PHASE II EXPANSION APPLICATION
JUNIPER RIDGE LANDFILL
VOLUME III
DESIGN REPORT

Prepared for

STATE OF MAINE BUREAU OF GENERAL SERVICES
as Owner
and
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November 2025

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PHASE II EXPANSION APPLICATION
JUNIPER RIDGE LANDFILL
VOLUME III
DESIGN REPORT

1.0 INTRODUCTION

This report describes the engineering design of the proposed Phase II Expansion of the Juniper Ridge Landfill (JRL) and presents the basis for design as required by the Maine Solid Waste Management Rules (Rules), 06-096 CMR 401, Sections 2.D, E, and F. The report discusses the site-specific factors considered during the design of the Phase II Expansion's liner, leak detection systems, underdrain systems, leachate collection, transport and storage systems, gas management systems, and cover systems. Also addressed in this report are the phasing of the Phase II Expansion development, the proposed stormwater management and erosion control plans, the geotechnical analysis, contaminant transport analyses, alternative liner design analysis, and construction details of the Phase II Expansion.

1.1 Project Description

The Phase II Expansion will be located north of and adjacent to the existing JRL within the approximately 780-acre parcel of land owned by the State of Maine and managed by the Bureau of General Services (BGS), as depicted in Figure 1-1. The site is operated by NEWSME Landfill Operations, LLC (NEWSME) under an Operating Services Agreement with BGS. Access to the site is by a paved, two-mile-long, private road from Route 16 (Bennoch Road) in Alton, Maine. The Phase II Expansion will expand the solid waste footprint by approximately 57 acres and will be developed in a series of cells similar to the existing landfill. Based on the current rates of filling, BGS and NEWSME project that construction of the first Phase II Expansion cell will need to be initiated during the 2027 construction season to be available for use in early 2028. The Phase II Expansion will provide approximately 11.9 million cubic yards of disposal capacity. The total Phase II Expansion facility site, including supporting site infrastructure (e.g., access roads, stormwater management ponds, additional leachate tanks, etc.) will comprise approximately 72 acres (see Figure 1-2).

The Phase II Expansion was designed to utilize the existing site conditions, limit potential adverse impacts to the surrounding environment, and allow the performance of the Phase II Expansion to be monitored separately from the existing facility. As with the initial expansion, the Phase II Expansion has been designed as a secure solid waste landfill with primary and secondary composite liners, a leak detection system, leachate and gas collection and transport systems, and intermediate and final cover systems. An underdrain system will be installed under approximately 36 acres of the Phase II Expansion to collect groundwater where the landfill base is located below the site's phreatic surface (water table). The Phase II Expansion will utilize existing site infrastructure such as the leachate storage tank, landfill gas treatment, Renewable Natural Gas (RNG) plant, and landfill gas flares. These design components, combined with the

site's low permeability native till soils, and hydrogeologic setting as described in Volume II, provides a facility that meets or exceeds the performance standards and siting criteria contained in Ch. 401.1.C of the Rules. Additional infrastructure to be constructed as part of the Phase II Expansion includes an additional leachate storage tank, a per- and polyfluoroalkyl substances (PFAS) leachate treatment plant, and extensions of the site access road, leachate force main, and electrical lines.

The Phase II Expansion has a maximum final top elevation of 385 feet-Mean Sea Level (ft-MSL) with 2.7 horizontal to 1 vertical outer sideslopes (see Figure 1-3). This final elevation is less than the maximum licensed elevation of the existing landfill facility (390 ft-MSL). Intermediate cover will be placed as portions of the landfill near interim or final design grades. The final cover will be placed once the waste has had time to compact and settle. The future covering sequence will include areas of both the Phase II Expansion and existing landfill cells. There is no change anticipated in the waste stream, which includes construction and demolition debris (CDD), front-end process residue, municipal solid waste ash, wood biomass ash, sludges, contaminated soil, oversized bulky waste, by-passed municipal solid waste, and other special wastes. The Phase II Expansion will only accept waste materials generated in the State of Maine as defined by State statutes. As is currently done, these materials will be commingled as necessary within the landfill to maximize in-place waste densities and assist with bulking of biosolids; thereby preserving and optimizing utilization of the State's landfill resource.

The Phase II Expansion will be developed in a phased approach over its anticipated 10- to 12-year life span. The Phase II Expansion will have five operational cells, each having about two years of capacity, at the projected usage rate of about 880,000 tons/year, based on an average of the last three years of waste acceptance. Cells 18, 21, and 22 will be located on the eastern side of the Phase II Expansion and Cells 19 and 20 will be located on the western side (see Figure 1-2). Cell 18 will have a permanent leachate pump station that will collect leachate from Cells 18 and 21. Cell 19 will have a permanent leachate pump station that will collect leachate from Cell 19 and the south side of Cell 20. Cell 20 will have a permanent leachate pump station that will collect leachate from the north side of Cell 20 and from Cell 22. Once completed, Phase II will have permanent pump stations in Cells 18, 19, and 20.

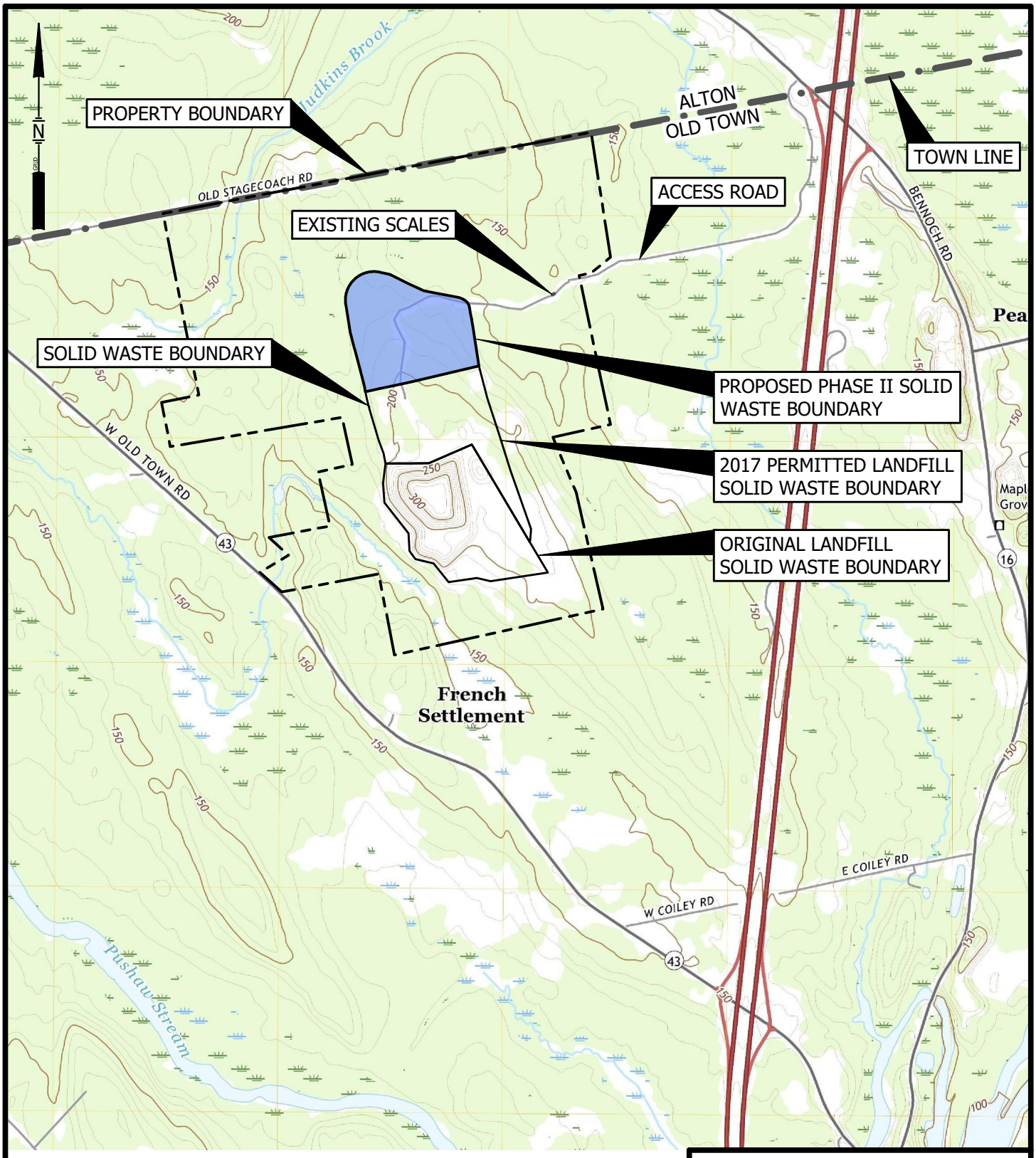
The leak detection system layout for the Phase II Expansion cells will mirror the leachate collection system layout, with leak detection pump stations in Cells 18, 19, and 20 that will remain active through the landfill operational and post-closure periods to allow the performance of each cell to be monitored individually.

A detailed discussion of the engineered components of the Phase II Expansion is contained in the remainder of this report. Appended to this report are engineering design drawings, waste characterization data, design calculations, and construction quality control and technical specifications for the Phase II Expansion.

1.2 Report Outline

This design report addresses the applicable submittal requirements of Ch. 401.2.D, E, and F of the Rules. The sections of this report and a general description of the items included in them are as follows:

- Section 2.0 of this report addresses the landfill design's compliance with the standards of Ch. 401.2.D (Design Standards for Landfills) including design standards for the liner system, travel time improvement allowances, base preparation below the liner system, leachate conveyance and storage structures, seismic impact zone, and phased operations;
- Section 3.0 presents information required by Ch. 401.2.F (Engineering Report) including stability, settlement assessments, stability and settlement monitoring, water balance, leachate management, gas management, cell development plans, a phased final cover proposal, waste storage and staging, waste characterization and design compatibility, surface water control plans, test pad, and special construction requirements;
- Section 4.0 provides a summary of the contaminant transport analysis performed for hypothetical failures of the Phase II Expansion's engineered systems;
- Section 5.0 provides a listing of the design drawings (plans, profiles, and details) prepared for this project and provided in Appendix A;
- Section 6.0 summarizes the Quality Assurance/Quality Control Plan (QA/QC Plan) that will be implemented during construction of the Phase II Expansion (included in Appendix B);
- Section 7.0 summarizes the construction contract bid documents that will be prepared during Phase II Expansion development (included in Appendix C);
- Section 8.0 addresses the proposed environmental monitoring program, which is described more completely in the Environmental Monitoring Plan (included in Appendix I of Volume IV of this report, Operations Manual);
- Section 9.0 summarizes the facility's Operations Manual (Volume IV); and
- Section 10.0 discusses the landfill construction procedures that will be followed during Phase II Expansion development.



BASEMAP ADAPTED FROM 7.5 MIN USGS TOPO QUADS
OLD TOWN, ME - 2024

FIGURE 1-1
SITE LOCATION MAP
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: SITELOC-EXPANSION LMN: NONE CTB: SME-STD.CTB JOB#: 240100.00 REV: 4/15/2025

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NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. BASE GRADES REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.
5. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.
6. SPECIAL FLOOD HAZARD ZONE PER FEMA PANEL 23019C1926D.

EXISTING SCALE HOUSE INFRASTRUCTURE AREA
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT (TYP)
BEDROCK OUTCROP (TYP)
END OF EXISTING LEACHATE FORCE MAIN
DETENTION POND 11R
PROPOSED SOLID WASTE LIMIT (TYP)
EXISTING OVERHEAD ELECTRIC LINE (TYP)
26'-WIDE PAVED ACCESS ROAD (TYP)
CELL 18 PUMP STATION
GRAVEL UTILITY ACCESS ROADS (TYP)
VERNAL POOL (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
CELL 14 PUMP STATION
CELL 13 PUMP STATION
CELL 12 PUMP STATION
PRIMARY ACCESS ROAD (TYP)
FORCE MAIN VAULT (TYP)
CATCH BASIN AND CULVERT (TYP)
PERMITTED TILL BORROW PIT
PERMITTED WOOD WASTE HANDLING AREA
DETENTION POND 10
DETENTION POND 9
WOOD STORAGE FACILITY 2 ACRE
1 ACRE
PROPERTY LINE (TYP)
PROPOSED WOOD STORAGE LOT
SUBSURFACE WASTEWATER DISPOSAL FIELD
APPROXIMATE LOCATION OF PROPOSED PFAS TREATMENT PLANT
MAINTENANCE BUILDINGS
RNG TREATMENT FACILITY POND
LFG TREATMENT FACILITY
WATER SUPPLY WELL
RENEWABLE NATURAL GAS (RNG) FACILITY
LFG FLARE LOCATION
LEACHATE STORAGE TANK PUMP STATION
LEACHATE STORAGE TANK 1
PROPOSED LEACHATE STORAGE TANK 2
PROPOSED LEACHATE STORAGE TANK
LIMIT OF BRI WETLANDS DELINEATION (TYP) SEE NOTE 2
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT (TYP)
DETENTION POND 14
RIPRAP DITCH (TYP)
DETENTION POND 11
RIPRAP CB INLET
CELL 11 PUMP STATION
PROPOSED GUARDRAIL (TYP)
PROPOSED LANDFILL BASE GRADES (TYP) SEE NOTE 4
PROPOSED CELL LIMITS (TYP)
LIMIT OF PHASE I EXPANSION LINER (TYP)
24" LFG HEADER (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
UTILITY MANHOLE (TYP)
DETENTION POND 6
CELL 8 PUMP STATION
EXISTING CELLS LINER LIMIT (TYP)
(2) 24" HDPE CULVERTS
PERMANENT LANDFILL ACCESS ROAD
100-YEAR FLOOD ZONE SPECIAL FLOOD HAZARD AREA (TYP) SEE NOTE 6
DETENTION POND 13
CELL 20 PUMP STATION
25-FOOT SETBACK FROM WOSS
FENCE (TYP)
8"x12" LEACHATE FORCEMAIN
PROPERTY LINE (TYP)
ELECTRICAL MANHOLE (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
DEED RESTRICTION (TYP)
CELL 19 PUMP STATION
DETENTION POND 12
CELL 17 BASE GRADES (SEE NOTE 5)
CELL 16 PUMP STATION
EXISTING EMH (TYP)
EXISTING FORCEMAIN VAULT (TYP)
CELL 15 PUMP STATION
RIPRAP DITCH (TYP)
EXISTING 24" DIA LANDFILL GAS PIPE
25-FOOT STREAM SETBACK
WATER LOADING RACK
DETENTION POND 1
8" GRAVITY SEWER IS ABANDONED
DETENTION POND 2
UNDERGROUND ELECTRIC (TYP)
LFG KNOCKOUT STRUCTURE AND VALVES
CELL 5 PUMP STATION
CELL 4 PUMP STATION
DETENTION POND 1A

200 0 400 FEE

DWG: BASE LMN: SITE-DEV-FIG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

FIGURE 1-2
SITE DEVELOPMENT PLAN
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

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NOTES:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLIGSA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014 AND 2015, AND BRI ENVIRONMENTAL IN 2024.
3. GRADES SHOWN REPRESENT THE TOP OF THE PROPOSED FINAL WASTE GRADES FOR THE PHASE II EXPANSION AT THE JUNIPER RIDGE LANDFILL

RNG TREATMENT FACILITY POND
DETENTION POND 9
APPROXIMATE LOCATION OF PROPOSED PFAS TREATMENT PLANT
LFG TREATMENT FACILITY
DETENTION POND 10
DETENTION POND 11R
DETENTION POND 14
DETENTION POND 13
RENEWABLE NATURAL GAS (RNG) FACILITY
LEACHATE STORAGE TANKS
FINAL LANDFILL ACCESS ROAD (TYP)
7.5% MIN (TYP)
10H:1V (TYP)
FINAL WASTE GRADES (TYP)
2.7H:1V (TYP)
DETENTION POND 6
DETENTION POND 12
DETENTION POND 2
DETENTION POND 1
DETENTION POND 1A (FORMER LEACHATE POND)

200 0 400 FEET

FIGURE 6-1
PROPOSED LANDFILL
FINAL WASTE GRADES
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: FINAL WASTE GRADES LMN: FWG CTB: SME-STD JOB#: 240101 REV: 11/6/2025

\\Server\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\FINAL WASTE GRADES.dwg, B_FIG 6-1, 11/6/2025 12:17:43 PM, sjm

2.0 DESIGN STANDARDS

Design of the Phase II Expansion's engineered systems fits the existing site conditions and limits the potential for adverse impacts to the surrounding environment during the facility's operational life, closure, and post-closure periods. The Phase II Expansion's engineered systems have been designed in accordance with the design standards of Ch. 401.2.D to achieve the performance standards of Ch. 401.1.C. The Phase II Expansion's construction will require excavation and filling of the on-site native till soils to provide uniformly sloping base grades. To minimize the disturbance of soil within 5 feet of bedrock at the site, excavation of areas with less than 5 feet to bedrock will be limited to grubbing of the site's uppermost vegetative and organic soil layers prior to placing soil fills or liner system components. The average native till soil thickness between the landfill base grade and bedrock will be approximately 22 feet with the depth ranging from approximately 0 to 50 feet. The liner system will be augmented where necessary to achieve the required travel time to sensitive receptors described in the Rules. An underdrain sand layer will be placed where the base grade is below the phreatic surface as described in Section 2.1.3.

2.1 Liner System Component Overview

The Phase II Expansion's liner system will consist of a leachate collection system, a composite primary liner, a leak detection system, and a composite secondary liner.

The leachate collection system will consist of the following components (from top to bottom):

- 12-inch-thick layer of sand (hydraulic conductivity (K) greater than or equal to $5x10^{-3}$ cm/sec and geometric mean greater to or equal to $1x10^{-2}$ cm/sec);
- 6-inch-diameter (or larger) perforated high density polyethylene (HDPE) collection piping; and
- Drainage geocomposite.

The composite primary liner will consist of the following components (from top to bottom):

- 80-mil high-density polyethylene (HDPE) textured geomembrane;
- Geosynthetic clay liner (GCL); and
- 12-inch-thick compacted soil layer (K less than or equal to $1x10^{-7}$ cm/sec).

The leak detection system will consist of the following components (from top to bottom):

- 12-inch-thick layer of sand (K greater than or equal $5x10^{-3}$ cm/sec);
- 6-inch-diameter perforated HDPE collection piping; and

- Drainage geocomposite.

The secondary liner will consist of the following components (from top to bottom):

- 60-mil HDPE textured geomembrane; and
- 12-inch-thick compacted soil layer (K less than $1x10^{-5}$ cm/sec and a geometric mean less than or equal to $1x10^{-6}$ cm/sec).

In areas where the native soil thickness between the grubbed surface and the interpreted bedrock is 5 feet or less (approximately 2.7 of the 57 acres), the secondary liner described above will be substituted with the augmented liner described below (from top to bottom):

- 60-mil HDPE textured geomembrane;
- GCL;
- 12-inch-thick compacted soil layer (K less than or equal to $1x10^{-7}$ cm/sec); and
- 12-inch-thick imported compacted soil layer (K less than or equal to $1x10^{-7}$ cm/sec).

The imported compacted soil layer above is used to increase travel time to sensitive receptors as discussed in Volume II of this application.

In areas where base grade of the cell will be below the phreatic surface, an underdrain system will be installed beneath the secondary liner consisting of (from top to bottom):

- 12-inch-thick layer of sand (K greater than or equal to $5x10^{-3}$ cm/sec); and
- 4-inch-diameter perforated HDPE collection piping.

The locations of the augmented secondary liner system and underdrain system are shown on Figure 2-1. The typical details for the primary and secondary liners are found on Drawing C-300 in Appendix A.

2.1.1 Primary and Secondary Liner Design Criteria

The soil portion of the secondary liner will have a K less than $1x10^{-5}$ cm/sec with a geometric mean less than or equal to $1x10^{-6}$ cm/sec (see alternative design analysis in Section 3.12). All other components of the primary and secondary liners will have a K of less than or equal to $1x10^{-7}$ cm/sec. The geomembranes used in the liner systems will meet the GRI GM-13 standards and the performance requirements contained in the site's construction technical specifications and QA/QC Plan included in Appendices C and B, respectively. A textured HDPE geomembrane will be used for both the primary and secondary liners.

The primary liner will be 80 mils thick, and the secondary liner will be 60 mils thick, with each geomembrane liner 20 mils thicker than required by the Rules.[1]

The GCL used in the liner system will consist of a sodium montmorillonite clay sandwiched between two geotextile fabrics. The specified average hydraulic conductivity for the GCL will be $5x10^{-9}$ cm/sec or less.

The soil used in the primary liner and areas of augmented secondary liner will consist of a recompacted barrier soil containing a minimum of 35 percent fines having a liquid limit greater than or equal to 20 and a plastic index greater than or equal to 8, but less than 30. The soil for the primary liner will be placed such that:

- The recompacted hydraulic conductivity is equal to or less than or equal to $1x10^{-7}$ cm/sec;
- The in-place density is equal to or greater than 90 percent maximum dry density as measured by ASTM D698 (standard proctor); and
- Compaction techniques using kneading action to remold the soil within 0 to 4 percent above its optimum moisture content as determined using ASTM D698.

The soil used in the secondary liner will consist of a recompacted barrier soil containing a minimum of 35 percent fines. The soil for the primary liner will be placed such that:

- The recompacted hydraulic conductivity will be less than $1x10^{-5}$ cm/sec with a geometric mean less than or equal to $1x10^{-6}$ cm/sec;
- The in-place density is equal to or greater than 90 percent of maximum dry density as measured by ASTM D698 (standard proctor); and
- Compaction techniques use kneading action to remold the soil within 0 to 4 percent of its optimum moisture content as determined using ASTM D698.

An alternative design analysis was conducted for the secondary soil liner in accordance with Ch. 401.2.E of the Rules and is described more fully in Section 3.1.2 of this report.

Soils for both the primary and secondary liners will be placed in a manner that produces a homogeneous layer that eliminates soil clods and preferential flow paths, protects the geomembrane from puncture, and reduces the soil's hydraulic conductivity to the maximum extent practicable. The soil liners will have a maximum stone size of less than or equal to 1 inch in the soil layer just below the GCL and less than or equal to ½ inch in the soil layer just below the HDPE geomembrane.

[1] Ch. 401.2.D of the Rules requires the primary and secondary geomembranes to have a nominal thickness of 60- and 40-mil, respectively.

2.1.2 Liner Improvement Allowances

Ch. 401.2.D.2 of the Rules identifies improvement allowance offsets associated with the containment system design that can be used in the calculation of the 6-year groundwater travel time to sensitive receptors performance standard specified in Ch. 401.1.C.1.c of the Rules. Volume II Section 7.0 of this application describes the travel time analysis conducted for the Phase II Expansion. The design of the Phase II Expansion incorporates the following feature and associated improvement allowance:

- Use of a composite secondary composite liner system with a leak detection system under the entire landfill (offset of three years); and
- Use of an imported soil layer in areas where the soil thickness between the landfill base and bedrock is less than 5 feet (offset 3.8 years).

2.1.3 Base Preparation Below Liner Systems

Base preparation below the liner systems of the Phase II Expansion will include clearing, grubbing, and grading the site to allow for positive drainage to the perimeter of the landfill for the underdrain, leak detection, and leachate collection systems. The landfill base preparation will include:

- Grading of the existing till soil to achieve the landfill base grades shown on the Site Base Grading Plan C-103 in Appendix A. In areas where fill is needed to achieve positive drainage, the fill will consist of a till soil placed in lifts of 12 inches or less and compacted to 90 percent of maximum dry density at a moisture content of 0 to 2 percent of optimum.
- In areas where the proposed base grades are below the phreatic surface, a groundwater underdrain system consisting of a 12-inch-thick layer of sand with 4-inch-diameter perforated collection piping will be installed. A total of approximately 36.2 acres under the Phase II Expansion will require an underdrain as shown on Figure 2-1. The underdrain sand will have a hydraulic conductivity of greater than or equal to $5x10^{-3}$ cm/sec; and
- Placement of one-foot of an imported soil layer in a 12-inch-thick lift and compacted to 90 percent of its maximum dry density at a moisture content of 0 to 4 percent above optimum, with a resulting maximum hydraulic conductivity of $1x10^{-7}$ cm/sec, will be constructed.

2.2 Leachate Conveyance Systems and Storage Structure Standards

Leachate is generated from precipitation that falls on the developed areas of the landfill and filters through the waste, or runs off the exposed waste in the active open operating area of the landfill. The Phase II Expansion's leachate conveyance systems are designed to handle these leachate sources along with any leak detection fluids and the landfill gas condensate. The landfill's leachate conveyance systems are designed in accordance with the standards identified in Ch. 401.2.D.4 and include engineered systems that collect, transport, and store leachate generated at the site.

These systems include:

- A leachate collection system designed to limit the leachate liquid depth (head) over the primary liner system to less than 12 inches during normal operating conditions, except in the leachate sumps;
- A leak detection system designed to detect leaks in the primary liner within 30 days. During the first several years after construction, this system will also collect and remove residual water accumulated in the system during construction, including from rain events and water expelled from the consolidation of the clay soils used in the construction of the primary liner;
- A gas condensate collection system designed to collect and remove condensation from the gas extraction and collection systems; and
- Pump stations that pump the liquids collected in the leachate, leak detection, and gas condensate systems. The gas condensate and leak detection systems will be pumped into the leachate collection system. Fluids collected in the leachate collection system will be pumped to one of two aboveground glass-lined leachate storage tanks.

2.2.1 Leachate Collection Systems

The leachate collection systems are designed to convey leachate by gravity to a collection sump at one (or two in the case of Cell 20) low points within each individual landfill cell. Primary components of each cell's leachate collection system include the following.

- 6- to 8-inch-diameter perforated HDPE collection piping;
- A 12-inch-thick layer of sand (K greater than or equal to $5x10^{-3}$ cm/sec with a geometric mean greater than or equal to $1x10^{-2}$ cm/sec);
- Filter stone and drainage stone covering the piping; and
- A drainage geocomposite.

The leachate collection system was designed to collect and convey leachate from the Phase II Expansion during the operating, closure, and post-closure periods. Leachate generation rates were estimated using U.S. Environmental Protection Agency's (U.S.EPA) Hydrogeologic Evaluation for Landfill Performance (HELP) model. The HELP model assumptions and results are discussed in Section 3.2 of this Report and the model printouts are included in Appendix D. Leachate head on the liner calculations along with leachate collection pipe sizing, spacing, and hydraulic capacity calculations for the various leachate collection components are contained in Appendix E. The piping systems are designed to withstand stresses due to dynamic and static loading conditions anticipated over the life of the landfill. Pipe strength calculations for buckling and deflection are contained in Appendix E-1.

The leachate collection system is designed so that the system's performance can be monitored and evaluated over the active and post-closure stages of the Phase II Expansion. The leachate level within the landfill cells will be monitored using pressure transducers located at the base of each cell. The leachate collection piping is designed to allow equipment access for routine cleaning, inspection, and maintenance of the primary collection pipe headers from the perimeter of the cells during the operating, closure, and post-closure periods for the Phase II Expansion. As required by Ch. 401, leachate collection HDPE piping will have a minimum diameter of 6 inches.

In addition, to minimize the potential clogging of leachate collection pipes and drainage geocomposite, the design of the leachate collection system incorporates filter design criteria for:

- Leachate collection sand to drainage geocomposite(geotextile portion);
- Leachate collection sand to leachate collection filter stone interface;
- Leachate collection filter stone to leachate collection drainage stone; and
- Leachate collection drainage stone to leachate collection pipe (perforation sizing).

The layout and typical details of the leachate collection system are shown on Drawings C-106, C-300, and C-301 contained in Appendix A. Soil filter design calculations and associated soil gradation selection criteria are contained in Appendix E-2. The drainage geocomposite has been sized to maintain the maximum head on the liner equal to the thickness of the geocomposite with factors of safety to account for reduction in transmissivity of the drainage geocomposite due to potential creep, intrusion of overlying soils, and chemical and biological clogging. These calculations are contained in Appendix E-5.

The initial layer of waste placed in the cell will be a five-foot layer of select waste that will serve as a soft layer to protect the liner from placement of other wastes in the landfill. This soft layer will also serve as a filter medium between subsequent waste stream components placed in the landfill and the sand of the leachate collection system. If the cell is expected to remain unused through a winter season, a frost layer consisting of a one-foot-thick layer of bark or other MEDEP-approved material will be placed over the leachate piping, similar to the current practice in the Phase I Expansion.

2.2.2 Leak Detection Systems

A leak detection system will underlie the Phase II Expansion's primary liner system. The leak detection system will consist of the following components (from top to bottom):

- Perforated HDPE 6- to 8-inch-diameter collection piping;
- A 12-inch-thick layer of drainage sand (K greater than or equal to $5x10^{-3}$ cm/sec);
- Drainage stone covering the pipe; and

- A drainage geocomposite.

The leak detection system is designed to detect a leak from the primary liner within 30 days during the active, closure, and post-closure life of the Phase II Expansion. The layout for the leak detection system is shown on Drawing C-105, with details shown on Drawings C-300 and C-301 in Appendix A. Similar to the leachate collection system, components of the leak detection system have been designed to withstand the stresses due to dynamic and static loading conditions expected over the life of the landfill. Leak detection design calculations are contained in Appendix E-4.

The fluids collected in the leak detection system will drain by gravity to individual leak detection pump stations located at the low point of Cells 18, 19, and 20 and will subsequently be pumped into that cell's leachate collection system. Cell 21 leak detection fluids will flow to the Cell 18 leak detection pump station; leak detection fluids from the south side of Cell 20 will flow to the Cell 19 leak detection pump station; and Cell 22 leak detection fluids will flow to the Cell 20 leak detection pump station. Each leak detection pump station is located below and adjacent to the leachate collection sumps and will have a carrier pipe/pump arrangement so leak detection fluids can be removed from a cell without penetrating the secondary liner. A flow meter and sampling port will be installed on the pump's discharge line to measure both the quantity and quality of the fluid removed from the permanent leak detection sumps. The location of leak detection sample sumps and pump stations are shown on Drawing C-105, contained in Appendix A. Details of the pump stations are shown on Drawings C-302 and C-303 in Appendix A.

Leak detection flows from Cell 20 (south side), Cell 21, and Cell 22 will pass through a dedicated leak detection sample sump so that leak detection fluids' water quality can be sampled should flows in leak detection pump stations exceed the Action Leakage Rates specified in the Leak Response Plan located in Volume IV Appendix P.

Similar to the leachate collection system previously described, the leak detection systems will meet the following standards:

- Leak detection pipes within the cell will have a minimum diameter of 6 inches and will be designed to allow equipment access for routine cleaning, inspection, and maintenance; and
- Interfaces between the leak detection system components will be designed as filters (i.e., sand to stone, sand to geosynthetic, etc.) to prevent clogging.

2.2.3 Landfill Gas Condensate System

The locations of condensate drains are shown on Drawing C-108 in Appendix A. Condensate traps will be provided at low points in the gas conveyance pipe to remove liquid. The traps consist of U-shaped tubes filled with liquid that provide a seal between the vacuum side of the system and the atmospheric pressure side of the system. Condensate collected in the traps will drain to a primary leachate collection system pipe.

Two temporary pump condensate knockout structures and two permanent condensate knockout structures are proposed for the Phase II Expansion to remove condensate from the 24-inch-diameter landfill gas headers, which will be located immediately adjacent to the landfill within the access road. Structures located outside the landfill limit of waste are designed to remove condensate that collects in the header pipes and pump it to the leachate cleanouts for cells with pump stations.

2.2.4 Leachate Transport System

The leachate transport systems for the Phase II Expansion will include three permanent internal cell pump stations, as well as dual-walled force mains located within the exterior edge of the access road. The three permanent pump stations are in the areas with the lowest base grades and will be used during both the active and post-closure periods of the Phase II Expansion.

Leachate pump stations will be internal cell pump stations that use a carrier pipe/pump and sump arrangement to remove leachate from the landfill cells without penetrating the liner system. Permanent pump stations constructed in Cells 18, 19, and 20 will have the same design as the existing landfill cells' pump stations (e.g., Cells 4, 5, 8, 14, and 16). These pump stations will use a dual carrier pipe and pump system and a valve pit located in a permanent structure. A control panel located adjacent to the valve pit within the pump station will control the flow of leachate from the sump area into a dual-contained HDPE force main.

The locations of leachate pump stations are shown on Drawing C-106, in Appendix A. Details of the permanent and temporary pump stations are shown on Drawings C-302 and C-303 in Appendix A.

The leachate sumps and pump systems were sized using the HydroCAD model to route stormwater flows within the active operating area of the landfill cells through the leachate sump and pumping system. During large storm events (e.g., 25-year, 24-hour storm events), the leachate generated within the active cell area will be temporarily stored within the cell until it is pumped out. For the cell with the largest open operating area, Cell 20, it will take about 35 hours after such an event to pump the stormwater flows to the leachate storage tank. The storage and pumping calculations for the sumps and force main are provided in Appendix E-6.

The following pumps have been selected for the Phase II Expansion's pump stations:

- Two 5-HP leachate pumps in the permanent pump stations; and
- One 1-HP leak detection pump in the leak detection pump stations.

Pump sizing calculations for the Phase II Expansion's leachate conveyance system for the permanent pump stations farthest from the leachate storage tank on each side of the landfill (i.e., Cells 18 and 20), are contained in Appendix E-6. Sample ports will be installed at the pump stations to allow sampling of

leachate and leak detection fluids. Continuous recording flow meters will be installed at the pump stations to measure leachate flows.

The force mains will be 6- by 10-inch SDR 17 dual-walled HDPE pipe. Tie-in vaults will be located at each of the connection points for the permanent pump stations in the lines as shown on Drawing C-106 in Appendix A. In-Line vaults will be installed on the force mains to provide pipeline cleaning access as shown on Drawing C-106. The proposed leachate transport systems will meet or exceed the design standards listed below. A hydraulic analysis of the performance of each force main using KY Pipe's modeling software is included in Appendix E-6.

- The components were designed to withstand stresses due to dynamic and static loading conditions expected over the life of the landfill.
- Leachate transport systems were designed so that their performance can be monitored and evaluated to ensure they are operating as designed.
- Leachate transport pipes were designed with a minimum diameter of 6 inches to allow equipment access for routine cleaning, inspection, and maintenance.
- Leachate transport systems were designed to convey the design flows from the leachate collection, gas condensate collection, and leak detection systems.
- Leachate transport systems were designed to provide for sampling and flow monitoring of leachate generated at the Phase II Expansion.
- Sample locations and sampling protocol have been designed to eliminate the need for confined space entry.
- Pressurized dual-walled leachate transport pipes located outside the solid waste boundary have been designed to allow leak testing during construction. Pressure transducers will be installed to allow monitoring while the pipe is in operation.

2.2.5 Leachate Storage Structures

The Public Benefit Determination issued by the MEDEP requires the operation of a PFAS treatment system for leachate from the JRL. To provide adequate pre-treatment storage of high leachate flows from rainfall events, a second 921,000-gallon glass-lined above-ground leachate storage tank will be installed next to the existing tank of the same size. The earthen berm surrounding the existing tank will be expanded to meet the site operating procedures and design criteria contained in Ch. 401.2.D.4.(b).[2] From this tank, leachate will be pumped to the PFAS treatment plant. After the PFAS removal, the treated leachate will be stored in a third leachate storage tank (size to be determined as part of PFAS treatment system final

[2] The conformance of the existing leachate storage tank with the requirements of Ch. 401.2.D.4.(b)(i-vi) was addressed with the issuance of Department Order #S-020700-WD-N-A. The conformance of the proposed storage tank with Ch. 401.2.D.4.(b)(i) is addressed in Section 3.3 of this application.

design) and subsequently removed via tanker truck and disposed of at the wastewater treatment plant (WWTP) for the Old Town Mill owned by ND Paper Old Town LLC, or other permitted wastewater treatment facilities.

Leachate storage tanks will be glass-fused-to-steel (GFS) tanks and will sit on a concrete foundation within secondary containment adjacent to the existing GFS leachate storage tank.

Within the tanks' circular concrete foundations will be a leak detection system overlying a tank secondary liner system. The tank secondary liner system will consist of a GCL overlying 6 inches of compacted till barrier soil. Above the tank secondary liner system will be a 12-inch-thick compacted sand layer and associated perforated pipes. The perforated PVC pipes will transition to solid PVC before exiting the concrete foundation wall. Threaded cap will be installed on the PVC pipe at the exterior of the tank to monitor for leakage.

To the exterior of the tanks will be an 8-foot-tall earthen containment berm with a 12-foot top width. The interior of the containment berm will serve as secondary containment for the leachate storage tanks within. The interior of the bermed area will have a liner system consisting of the following layers (from bottom to top):

- 6 inches of compacted till barrier soil;
- A geocomposite clay liner (GCL);
- 8 inches of sand;
- A 6-ounce nonwoven geotextile; and
- 4 inches of drainage stone.

In the southwest corner of the containment area will be a catch basin with a 12-inch-diameter HDPE discharge pipe and a gate valve with an indicator post. Water collected within the containment area will be conveyed to the catch basin and stored within the containment area until it is tested and discharged or collected and handled as leachate.

The available volume within the containment areas, excluding the volume that is occupied by other two tanks within the containment, exceeds 110 percent of the largest tank's volume.

2.3 Phase II Expansion's Location Relative to a Seismic Impact Zone

The Phase II Expansion is located in a seismic impact zone as defined by Section 400.1 of the Rules. The facility structures, including its liner systems, leachate collection systems, leachate transport systems, and surface water control systems have been designed to withstand the maximum horizontal acceleration in lithified earth material having a 90 percent probability of not being exceeded within 50 years (construction

and operational periods), or within 250 years (post-closure period). The stability assessment that addresses seismic loadings to the Phase II Expansion structures is contained in Section 3.1 of this Report.

2.4 Phased Operations

The Phase II Expansion is designed for phased operations with individual cell sizes based on the projected waste disposal rates and an approximate two-year cell life. The Phase II Expansion's phased operations will sequence waste and cover placement, control run-on and runoff, minimize leachate generation, protect the liner system, and maintain stability. The Phase II Expansion will be developed in a series of five cells, as described in Sections 1.1 and 3.5 of this document and in the Phase II Expansion's Cell Development Plans (see Volume IV Operations Manual, Appendix D).

LEGEND

12 CELL IDENTIFICATION

WETLAND DELINEATED

NOTES:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004 AND STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BASE GRADES IN PHASE II REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.

LIMIT OF BRI WETLANDS DELINEATION (TYP)

VERNAL POOL (TYP)

LIMIT OF PHASE II AUGMENTED LINER (TYP)

DETENTION POND 11R

250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT

EXISTING OVERHEAD ELECTRIC LINE (TYP)

PRIMARY ACCESS ROAD (TYP)

DETENTION POND 14

DETENTION POND 13

250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT

LIMIT OF PHASE I EXPANSION LINER (TYP)

LIMIT OF UNDERDRAIN AREA (TYP)

FENCE (TYP)

LIMIT OF PHASE II AUGMENTED LINER (TYP)

DEED RESTRICTION (TYP)

DETENTION POND 12

200 0 400 FEET

FIGURE 2-1
UNDERDRAIN AND
AUGMENTED LINER LOCATION
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: OM-SITE-DEV LMN: AUGM-LINR-LOC CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 8/6/2025

\\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\AcadFigures\OM-SITE-DEV.dwg, B_FIG 2-1, 8/6/2025 9:40:47 AM, sjm

3.0 LANDFILL SYSTEM DESIGN

The Phase II Expansion incorporates proven design methodologies and state-of-the-art technology. Tables 3-1 through 3-8 summarize the design selection, basis for engineering design, site-specific factors for the design, and the proposed construction procedures for the following engineered systems:

- Underdrain system (Table 3-1):
  - Underdrain system;
- Imported soil properties and improvement allowance systems (Table 3-2):
  - Imported soil layer,
  - Secondary liner with leak detection system, and
  - Augmented secondary liner system;
- Composite primary liner system (Table 3-3);
- Leachate collection and leachate transport systems (Table 3-4):
  - Leachate collection layer,
  - Gravity drain/sump pump system, and
  - Leachate transport system;
- Gas management systems (Table 3-5):
  - Horizontal collection trenches,
  - Vertical wells, and
  - Gas transport piping;
- Cover systems (Table 3-6):
  - Daily cover,
  - Intermediate cover, and
  - Final cover; and
- Potential failure modes and significance of failures in engineered systems (Table 3-7):
  - Underdrain system,
  - Augmented secondary liner systems,
  - Secondary liner and leak detection system,
  - Primary composite liner system,
  - Leachate collection systems,

- Leachate transport system – sump and pump,
- Gas collection, and
- Final cover.

The remainder of Section 3.0 provides the basis for the landfill system designs. Table 3-7 summarizes the engineered systems described above in terms of the design considerations, potential failure modes, and failure significance of the individual system components.

TABLE 3-1

UNDERDRAIN SYSTEM

System I.D.	System Components	Site-Specific Factors	Basis for Engineering Design	Proposed Construction Procedure
Underdrain system	• 12-inch-thick layer of drainage sand K >=5x10^{-3} cm\sec • 4-inch-diameter perforated HDPE pipe • Drainage stone	• Underdrain will be placed where the base grade cut is below the phreatic surface	• Gravity drainage to a location outside the developed area • Pipes sized based on assumed groundwater gradients	• Place perforated pipe network • Place stone around pipes • Place drainage sand

TABLE 3-2

IMPORTED SOIL LAYER AND IMPROVEMENT ALLOWANCE SYSTEMS

Item	Design Selection	Site-Specific Factors	Basis for Engineering Design	Proposed Construction Procedure
Imported Soil Layer	• 12-inch-thick compacted clay (K <= $1x10^{-7}$ cm/sec)	• This layer provides a uniform soil layer directly below the augmented secondary liner system.	• This layer provides a uniform layer of soil beneath the augmented secondary liner system, and enhances the liner system performance by retarding both flow and contaminant concentrations in the unlikely event of liner failure. • Increases travel time to site sensitive receptors by 3.8 years.	• Place barrier soil ○ 12-inch lifts ○ 90 percent max. dry-density ○ 0 to 4 percent above optimum moisture-content ○ K = $1x10^{-7}$ cm/sec ○ >35 percent fines ○ <3-inch diameter
Augmented Secondary Liner	• GCL • 12-inch-thick compacted barrier soil (K <= $1x10^{-7}$ cm/sec)	• The augmented liner will be placed where disturbance within 5 feet of the bedrock surface is anticipated.	• GCL replaces soil portion of secondary liner • Increases travel time to sensitive receptors.	• Place barrier soil ○ 12-inch lifts ○ 90 percent max. dry-density ○ 0 to 4 percent above optimum moisture-content ○ K = $1x10^{-7}$ cm/sec ○ >35 percent fines ○ <1-inch-diameter beneath GCL • Place GCL
Secondary Liner with Leak Detection System	• Leak detection system ○ Drainage Geocomposite ○ 6-inch-diameter perforated HDPE piping ○ Drainage stone over piping ○ 12-inch-thick layer of drainage sand K >=$5x10^{-3}$ cm\sec • 60-mil textured HDPE liner • 12-inch-thick compacted barrier soil (K <= $1x10^{-5}$ cm/sec, Geometric Mean K<=$1x10^{-6}$)	• The composite secondary liner will be placed under the entire 57-acre Phase II Expansion ○ The composite secondary liner and leak detection system provides the ability to monitor the performance of the primary liner ○ The thickness of the geomembrane is 20 mil thicker than required by Ch. 401.2.D.1.a	• Increases travel time to site sensitive receptors by three years (i.e., improvement allowance 3 yrs assuming approval of Alternative Liner System) ○ Provides the ability to monitor the primary liner performance ○ Can detect leaks from the primary liner system within 30 days ○ Can transmit flow associated with facility's action leakage rate ○ Provides a uniform bedding layer of soil beneath the secondary liner, and enhances the liner system's performance by retarding both flow and contaminant concentration in the unlikely event of liner failure	• Place barrier soil ○ 90 percent max. dry-density ○ 0 to 4 percent above optimum moisture-content ○ K <= $1x10^{-5}$ cm/sec, ○ Geometric Mean K <= $1x10^{-6}$ cm/sec ○ >35 percent fines ○ <1/2-inch diameter beneath HDPE liner • Place 60-mil textured HDPE liner • Place leak detection system ○ Drainage Geocomposite ○ Perforated pipe network ○ Stone around pipes ○ Drainage sand K >=$5x10^{-3}$ cm\sec

Note:
[1] The augmented liner replaces the soil portion of the secondary liner.

TABLE 3-3

COMPOSITE PRIMARY LINER SYSTEM

Engineered System	Design Selection	Site-Specific Factors	Basis for Engineering Design	Proposed Construction Procedure
Composite Primary Liner	• 80-mil textured HDPE liner • GCL • 12-inch-thick compacted barrier soil (K <= $1x10^{-7}$ cm/sec)	• Consistent with the Phase I primary liner system. • The thickness of the geomembrane is 20 mil thicker than required by Ch. 401.2.D.1.a	• Provide containment of waste materials and leachate • Uses proven technology for landfills (compacted soil, GCL, HDPE geomembranes) • Acceptable interface friction and internal friction angles between liner components • Standard placement of materials • Meets and exceeds design criteria of Ch. 401.2.D.1(a&b)	• Place barrier soil o 90 percent max. dry-density o 0 to 4 percent above optimum moisture-content o K = $1x10^{-7}$ cm/sec o >35 percent fines o 12-inch maximum lift thickness (per variance) o <1-inch diameter beneath GCL • Place GCL • Place 80-mil textured HDPE liner

TABLE 3-4

LEACHATE COLLECTION AND TRANSPORT SYSTEMS

Engineered System	Design Selection	Site-Specific Factors	Basis for Engineering Design	Proposed Construction Procedure
Leachate Collection Layer	• Drainage Geocomposite • 6- and 8-inch-diameter perforated HDPE piping • Drainage stone over piping • Filter stone over drainage stone • 12-inch-thick layer of drainage sand Kmin >=5x10^{-3} cm\sec, Kmin Geometric Mean >=1x10^{-2} cm\sec	• Cell layout and collection to provide positive drainage to the landfill perimeter and associated sump areas • Provides the ability to clean major leachate lines	• Collect and convey leachate to collection sumps • Minimize leachate head on liner system ○ Provide long-term monitoring, maintenance, inspection, and cleaning of collection piping • Provide soil filter (around piping) and geosynthetic filter (sand to geocomposite) to minimize clogging of collection system • Provide redundant design for collection system (pipe, drainage geocomposite, and drainage sand	• Place drainage geocomposite • Place perforated pipe network • Place stone around pipes • Place drainage sand
Gravity Drain/Sump and Pump System	• Riser pipe and inlet grates • Two 5-HP submersible pumps for permanent stations • Pump station/valve pit/control panel	• Provide ability to clean major leachate lines • Sumps located at low point of cells • Minimize pump stations by using gravity drainage from one cell to an adjacent cell whenever possible	• Provide redundant design for pumping system from sump and pump areas (2 pumps) • Design leachate sumps to temporarily hold stormwater flows from 25-year 24-hour storm	• Place stone in sump areas • Install riser pipes • Complete placement of stone • Place drainage sand • Install pump station • Install pump station valve pit and control panel
Dual-contained Force Main and Leachate Tanks	• 6”x10” dual containment pipe force main • Existing plus additional glass-lined above-ground storage tanks	• See site-specific factors for leachate collection system • Construct new tank next to existing leachate storage tank • Extend existing force main to new pump stations	• Provide for dual containment of pressurized leachate transport line. • Provide locations for leachate and leak detection sampling and flow monitoring that eliminate the need for confined space entry • Provide equipment access for routine cleaning, inspection, and maintenance • Place vaults so that no length of force main exceeds 500 feet	• Install new leachate storage tank • Increase secondary containment area to encompass both tanks • Install dual containment HDPE force main between the Phase II Expansion pump stations and existing landfill’s leachate collection system

TABLE 3-5

GAS MANAGEMENT SYSTEMS

Engineered System	Design Selection	Site-Specific Factors	Basis for Engineering Design	Proposed Construction Procedure
Horizontal Gas Collection Trenches	• HDPE perforated pipes bedded in stone	• Placed in waste during filling operations • Connected to transport piping	• Assists in controlling odor prior to capping • Allows for transport of gas to odor treatment or RNG facility	• Install in waste as waste filling occurs • Slope solid pipe at a minimum 2 percent • Slope perforated pipe at a minimum of 2 percent • As-built locations surveyed after installation
Vertical Gas Extraction Wells	• 8-Inch-diameter perforated PVC pipe screened section encased in stone or other porous media • Gas wells equipped with flow control valves	• Wells installed with 18 months of waste reaching interim cell grades • Spaced for 100-foot radius of influence • Stop 15 feet above liner	• Extracts landfill gas generated by the facility and assists in controlling odors and reducing greenhouse gas emissions	• Drill gas wells with 36-inch bucket auger • Install perforated PVC pipe and backfill annulus with porous media • Use solid PVC pipe within 15 feet of the surface and seal with a soil-bentonite mix to prevent air incursion into the gas well • Connect to gas transmission piping
Gas Collection Transport and Header Pipes	• Gas headers are 24-inch HDPE • Transport pipes are 6- to 12-inch HDPE • Flow control valves at landfill perimeter	• Headers located in perimeter berm and connected to existing headers • Transport pipes run up & down waste slope at perimeter of landfill • Condensate collection provided in transport and headers	• Headers sized for projected gas flow based on site-specific gas flow modeling	• Gas headers installed during berm construction • Gas transport pipes installed as waste is placed in cells

TABLE 3-6

COVER SYSTEMS

Engineered System	Design Selection	Site-Specific Factors	Basis for Engineering Design	Proposed Construction Procedure
Daily Cover	• 9-inch-thick soil layer or • 9-inch-thick layer of soil like material (i.e., ash, CDD process fines, short paper fiber, contaminated soil) or • Foam alternative daily cover	• The Facility utilizes a mixture of waste (alternative daily cover) and virgin soils for daily cover. • Foam is only used when conditions are generally above freezing	• Minimize odors • Minimize litter, dust, birds, other vectors	• Grade waste to drain • Place daily cover
Intermediate Cover	• 18-inch-thick layer of till with minimum of 35% fines) or • 40-mil geomembrane	• Typically use geomembrane on sideslopes, soil on top of landfill	• Minimize leachate generation • Minimize odors • Minimize litter, dust, other vectors	• Grade waste to drain • Place intermediate cover • Fertilize, seed, and mulch per MEDEP's BMPs (soil cover only)
Final Cover	• 18-inch-thick vegetative soil layer for growing grass • Drainage geocomposite • 40-mil textured LLDPE geomembrane • GCL • 12 inches barrier soil (K < 1x10-5 cm/sec) • 6-inch construction fines or sand bedding layer • Riprapped downspouts	• Final cover system for existing landfill cells • Gas collection system of existing landfill's cover system	• Minimize infiltration of precipitation into the landfill after closure and thereby reduce leachate production • Provide a cover system with minimal maintenance issues that promotes drainage, minimizes erosion, and minimizes the potential for disruption of continuity and function from settlement or subsidence	• Place and grade construction fines • Place barrier soil • Construct riprapped downspouts • Place GCL • Place 40-mil LLDPE Geomembrane • Place drainage geocomposite • Place vegetative soil • Fertilize, seed, and mulch per MEDEP's BMPs (soil cover only)

TABLE 3-7

POTENTIAL FAILURE MODES AND SIGNIFICANCE OF FAILURES IN ENGINEERED SYSTEMS

System I.D.	System Components	Design Considerations	Potential Failure Modes	Design Contingencies	Failure Significance
Underdrain system	• 12-inch-thick layer of sand • 4-inch-diameter perforated HDPE pipe • Drainage stone • Geotextiles (for separation)	• Pipe size • Pipe strength • Pipe spacing • Filter design (sand/stone) • Separation geotextile design	• Pipe clogging • Pipe collapse	• Use of conservative material specification (i.e., $K \geq 5x10^{-3}$ cm/sec) • Slope of base will provide positive drainage even with collapsed pipes • Pipe bedding with stone will provide drainage even if pipe is clogged or collapsed. • Pipe burial with semi-trench condition and compacted stone backfill will increase pipe strength and minimize collapse	• Performance of underdrain in short-term (i.e., protect bedrock, dewater site) will not be affected • Underdrain does not need to function once soil liner materials are suitably compacted and enough waste is placed in the landfill to prevent the liner system from floating
Augmented Secondary Liner Systems	• GCL (augmented only) • 12-inch-thick compacted barrier soil	• Interface friction angle • Internal friction angle • Anchor trench design • Connection details • GRI GCL-3 geomembrane standards • Hydraulic conductivity ($1x10^{-7}$ cm/sec min) • In-place density 90 percent maximum dry-density • Moisture-content 0 to 4 percent above optimum • Place in 12-inch lifts • Replace soil portion of secondary liner	• Installation damage during construction • Manufacturing defects • Premature hydration of GCL • Stability/settlement issues • Clods, voids, poor bonding of lifts • Freeze/thaw cracking • Desiccation cracking	• Strict construction QA/QC to provide proper installation and repairs to manufacturing or construction related defects • Proper timing of liner placement to avoid premature hydration of GCL • Use of proper anchor trench and cell development techniques to avoid stability issues with liner system	• Significance of failure is diminished due to the robust double composite liner system

TABLE 3-7 (cont'd)

System I.D.	System Components	Design Considerations	Potential Failure Modes	Design Contingencies	Failure Significance
Secondary Liner and Leak Detection System	• 6-inch-diameter perforated HDPE pipe • 12-inch-thick drainage sand layer • Drainage geocomposite • 60-mil textured HDPE liner • 12-inch-thick barrier soil layer	• Hydraulic conductivity ($1x10^{-5}$ cm/sec) max and ($1x10^{-6}$ cm/sec) max geometric mean. particle size 3", 35% fines, 90% maximum density, 0-4% moisture content, 12" lifts capacity and detection time, action leakage rate • GRI GM-13 geomembrane standards • Interface/internal friction angle • Pipe size, strength, spacing • Filter design and separation design • Connection details • Dynamic and static loading • Monitoring and maintenance	• Clogging • Settlement • Pipe collapse	• Use of redundant design components to collect and transport leachate (i.e., pipe and geocomposite) • Use of filter design criteria at critical material interfaces • Use of conservative material specifications and design factors of safety to account for nonperformance (i.e., K = $5x10^{-3}$ cm/sec sand) • Drainage slopes reduce clogging potential of system • Material testing to ensure conformance with specifications	• Significance of failure minimized by design conservatism and redundancy • Slope of liner system reduces the potential of system clogging • Pipe bedding with stone will provide drainage even if pipe is clogged or collapses • Pipe burial with semi-trench condition and compacted stone backfill will increase pipe strength and minimize likelihood of collapse

TABLE 3-7 (cont'd)

System I.D.	System Components	Design Considerations	Potential Failure Modes	Design Contingencies	Failure Significance
Primary Composite Liner System	• 80-mil textured HDPE liner • GCL • 12-inch-thick compacted barrier soil	• Hydraulic conductivity ($1x10^{-7}$ cm/sec) max. particle size 3", 35% fines, 90% maximum density, 0-4% moisture content, 9" lifts • GRI GM-13 geomembrane standards • Interface/internal friction angle • Anchor trench design • Connection details	• Installation damage during construction • Manufacturing defects • Premature hydration of GCL • Stability/settlement issues • Clods, voids, poor bonding of lifts • Freeze/thaw cracking • Desiccation cracking	• Strict construction QA/QC to provide proper installation and repairs to manufacturer's or construction related defects • Proper timing of liner placement to avoid premature hydration of GCL • Use of proper anchor trench and cell development techniques to avoid stability issues with liner system • Use of composite liner with intimate contact (HDPE/GCL) to minimize leakage if liner gets damaged during construction or operation • Use of composite secondary liner and leak detection system as secondary back-up to primary liner system • Liner leak location survey performed after installation of leachate collection system to locate any damage to liner and repair as needed.	• Significance of failure is greatly diminished due to redundant composite primary liner, composite secondary liner with leak detection layer, leak location testing, and back-up barrier soil/underdrain system

TABLE 3-7 (cont'd)

System I.D.	System Components	Design Considerations	Potential Failure Modes	Design Contingencies	Failure Significance
Leachate Collection Systems	• 12-inch-thick sand layer • 6- and 8-inch-diameter perforated HDPE pipe • Drainage Geocomposite	• Capacity/hydraulic head on liner system • Pipe size, strength, spacing • Filter design • Connection details • Hydraulic conductivity • Dynamic and static loading • Monitoring and maintenance	• Clogging of collection system components • Pipe collapse • Differential settlement causing misalignment of pipes • Freezing of pipes	• Use of redundant design means to collect and transport leachate (i.e., pipe and drainage geocomposite) • Use of filter design criteria at critical material interfaces • Use of conservative material specifications and design factors of safety to account for nonperformance (i.e., min $5x10^{-3}$ cm/sec sand with min geometric mean of $1x10^{-2}$ cm/sec) • Slopes of liner reduce clogging potential of system • Use of stone filter around pipe • Design that allows for pipe cleaning	• Significance of failure minimized by design conservatism and redundancy • Pipe bedding with stone will provide drainage even if pipe is clogged or collapsed. • Pipe burial with semi-trench condition and compacted stone backfill will increase pipe strength and minimize likelihood of collapse

Leachate Transport System – Sump and Pump	• HDPE dual containment force main (6x10")
	• Dual containment pipe leak detection
	• Pump station
	• Valve pit
	• Control panel
	• Electrical supply
	• Back-up power
	• Alarm system
	• Sump area
		• Capacity of sump area
		• Monitoring and maintenance
		• Longevity of components
		• Connection to existing transport line
		• Pump sizing (leachate, leak detection, and underdrain)
			• Clogging of sump area
			• Power outage (long-term)
			• Clogging of transport pipe
			• Pump failure
			• Leak in the force main
				• Redundant design of system including:
				  ○ Use of two sump pumps for leachate transport
				  ○ Use of back-up generator
				  ○ Use of dual-containment pipe
				• Pump leachate at minimum 2 feet per second to prevent clogging of transport pipe
				• Use of pressure gauges to detect leaks in force main
				• Use of flow meter to monitor performance of system
					• Significance of failure minimized by redundant design of system and ability to detect and respond to failures immediately

TABLE 3-7 (cont'd)

System I.D.	System Components	Design Considerations	Potential Failure Modes	Design Contingencies	Failure Significance
Gas Collection	• Sand/stone • HDPE pipe	• Capacity • Pipe size, strength, spacing	• Stability/settlement • Clogging • Pipe collapse	• Use of pipe strength design criteria and bedding installation methods to prevent pipe collapse • Install gas header pipes in perimeter berm to limit settlement of pipes • Install gas transport pipes up and down waste sideslopes to limit plugging of pipes	• Failure potential minimized by design contingencies • Significance of failure minimized by redundant design of system
Final Cover Systems	• 18-inch vegetative soil to protect geomembrane and grow grass • Drainage geocomposite • 40-mil textured LLDPE geomembrane • GCL • 12-inch-thick barrier soil layer ($K \leq 1x10^{-5}$ cm/sec) • 6-inch-thick construction fines or sand bedding layer • Riprapped downspouts	• Interface and internal friction angles • Long-term creep • Desiccation • Freeze/thaw	• Stability/settlement • Erosion	• Use of composite cover system to provide redundant barrier to precipitation infiltration • Use of material components designed to provide the maximum internal and interface friction angles to minimize stability issues • Use of strict post-closure maintenance to minimize erosion issues	• Failure potential minimized by design contingencies • Significance of failure minimized by redundant design of system

The design calculations, evaluations, and drawings that support the Phase II Expansion design are contained in Appendices A through J, including the following:

- Design drawings (Appendix A);
- HELP model output data and leachate generation (Appendix D);
- Pipe strength design (Appendix E-1);
- Soils/stone filter design (Appendix E-2);
- Underdrain Pipe Sizing and Spacing (Appendix E-3);
- Leak detection design (Appendix E-4);
- Leachate collection and underdrain pipe sizing and spacing design (Appendix E-5);
- Storage volume for leachate collection sumps and pump system and force main design (Appendix E-6);
- Leachate tank storage capacity (Appendix E-7);
- Geotechnical evaluation (Expansion and Cell 18) (Appendix F);
- Leachate quality/waste characterization (Appendix G);
- Waste compatibility test results (Appendix H);
- Landfill gas design report (Appendix I);
- Contaminant transport calculations (Appendix J); and
- Cell 18 Design Drawings (Appendix K).

3.1 Geotechnical Evaluation

The geotechnical monitoring plan for the Phase II Expansion is included in Volume IV, Appendix N, of this application.

The geotechnical evaluation for the proposed Phase II Expansion included assessments of stability and settlement, as required by Ch. 401 Sections 2.F(1) and 2.F(2), and development of a stability and settlement monitoring plan for the construction and operation periods, as per Ch. 401 Section 2.F(3). The geotechnical evaluation also included assessments of cover system stability and settlement, in accordance with Ch. 401 Sections 5.I(1) and 5.I(2).

The stability and settlement assessments are based on substantial field and laboratory data obtained from prior site-specific subsurface investigations, construction quality control and conformance testing, and instrumentation and performance monitoring. The available data effectively define the site's existing

geologic and hydrogeologic conditions and establish demonstrated geotechnical parameter values for the Phase II Expansion's foundation soils, liner system, waste mass, and cover system.

The stability and settlement assessments and the related monitoring plan are briefly summarized in the subsections below. The appended Geotechnical Evaluation Report (Appendix F) provides the details of the stability and settlement assessments, including the geotechnical input parameters, analysis methodologies, results, and conclusions. The planned stability and settlement monitoring for the proposed Phase II Expansion is included in the sitewide Geotechnical Monitoring Plan (GMP), which is provided as Appendix N of the facility's Operations Manual (Volume IV).

3.1.1 Stability Assessment (Foundation Soils, Liner System, and Waste Mass)

SME assessed the stability of the Phase II Expansion relative to potential failure planes that pass through or along the foundation soils, liner system components, and/or waste mass, as required by Chapter 401 Section 2.F(1) of the Rules. Factor(s) of safety (FOS) for the construction, operation, and post-closure periods were evaluated under both static and seismic loading conditions for a range of configurations associated with the proposed Phase II Expansion. The results of this assessment indicate FOS that meet or exceed the MEDEP's minimum recommended values, and that the proposed Phase II Expansion will be stable relative to potential failures that pass through or along the foundation soils, liner system, and/or waste mass.

The stability analyses were made using SLOPE/W (GeoStudio 2024), an industry-standard slope stability software, and a two-dimensional stability model developed based on the proposed configuration of the Phase II Expansion (at various periods of operation) and the extensive site-specific data described herein. SLOPE/W uses limit equilibrium methods to evaluate the stability of a mass tending to rotate or slide under the influence of gravity and other applied loads. Rotational or translational movement of the landfill is considered along a series of assumed potential failure planes, as described herein. SLOPE/W compares the forces that resist movement (e.g., shear strength) with those that can cause motion (e.g., gravity) to compute the associated FOS for each assumed failure plane. The minimum computed FOS is then compared to the MEDEP's recommended minimum FOS.

3.1.1.1 Static Stability Assessment

The results of the static stability analyses for the Phase II Expansion indicate that the minimum computed FOS for the construction and operation periods meet or exceed the MEDEP's recommended minimum FOS of 1.3. Similarly, the calculated minimum FOS for the post-closure period meets or exceeds the minimum acceptable FOS of 1.5, as required by the Rules.

3.1.1.2 Seismic Stability Assessment

The proposed Phase II Expansion is in a Seismic Impact Zone, as defined by Ch. 400 Section 1.ZZ. As such, SME assessed seismic stability using a "pseudo-static" approach, as presented in RCRA Subtitle D

(258) Seismic Design for Municipal Solid Waste Landfill Facilities (U.S.EPA, 1995), and the associated application of a site-specific seismic coefficient (k_s) for the SLOPE/W model. The seismic coefficient is used to impart a lateral load to the assumed rotational or translational failure mass (i.e., to the waste and/or soil) to represent the effect of seismic loading. The seismic coefficient is related to a site's peak ground acceleration (PGA) and seismic site classification. See Appendix F for additional discussion regarding selection of the seismic coefficient.

Ch. 401 Section 2.F(1)(b) indicates that seismic stability analyses are to be based on the maximum horizontal acceleration (i.e., PGA) in lithified earth material, having a 90 percent probability of not being exceeded within 50 years (construction and operational periods) or within 250 years (post-closure period). SME obtained the associated PGA values from the 2023 National Seismic Hazard Model and the USGS Earthquake Hazard Toolbox and then adjusted them, as appropriate, to account for the influence of the site soils, engineered components, and the waste mass, as required by Ch. 401 Section 2.F(1)(b).

The results of the seismic stability analyses performed for the Phase II Expansion indicate that the minimum computed FOS for the construction and operation periods meet or exceed the MEDEP's recommended minimum FOS of 1.1, and that the calculated minimum FOS for the post-closure period meets or exceeds the minimum acceptable FOS of 1.0, as required by the Rules. SME's seismic stability assessment also included evaluations of liquefaction potential, potential for strength loss due to cyclic loading, and permanent deformation. The results of the analyses indicate that the foundation soils and waste materials for the Phase II Expansion are not susceptible to liquefaction or cyclic strength loss and that any potential earthquake-induced deformations will be within allowable limits.

3.1.2 Settlement Assessment

SME performed a settlement assessment for the proposed Phase II Expansion, as required by Ch. 401 Sections 2.F(2) and 5.I(2), to:

- Quantify anticipated settlements of the landfill foundation soils and waste mass; and
- Evaluate the effect of those settlements on the liner and leachate management systems and the final cover system.

The settlement assessment was based on the proposed grading of the Phase II Expansion and the extensive site-specific data referenced herein.

3.1.2.1 Settlement of Foundation Soils (Liner & Leachate Management Systems)

SME calculated settlement of the foundation soils to assess any potential impacts to the liner and/or leachate management systems, as required by Ch. 401 Section 2.F(2). The available site-specific data indicate that the foundation soils beneath the footprint of the proposed Phase II Expansion consist of

dense to very dense glacial till of variable thickness. The glacial till has extremely low compressibility and is underlain by bedrock.

SME calculated settlement of the foundation soils (glacial till), and any associated subgrade fill (recompacted glacial till and/or imported granular fill), due to loads associated with the subsequent placement of the liner system, waste mass, and final cover. The settlement calculations were made using Hooke's Law and associated stress-strain formula, in which a soil's vertical strain (i.e., settlement) is directly proportional to changes in vertical stress, based on its modulus of elasticity (i.e., Young's modulus). The analysis indicates that the dense to very dense glacial till foundation soils will settle less than 2 inches due to the applied loads. As such, it is estimated that base grade slopes (i.e., liner and leachate management systems) will change less than 0.1 percent relative to the design slopes and that any strains in geosynthetics or PE pipe materials (due to changes in slope length) will be negligible. Therefore, settlement of the foundation soils is not expected to affect the integrity or performance of the landfill liner or leachate management systems.

3.1.2.2 Settlement of Waste Mass (Final Cover System)

SME calculated settlement of the waste mass to assess any potential impacts to the final cover system, as required by Ch. 401 Section 5.I(2). Site-specific data (and other published studies on solid waste) indicate that the JRL waste materials are highly compressible initially, and that the compression will occur relatively quickly during the operations period as the waste is placed to its full height. This initial primary settlement of the waste mass can be estimated using to Hooke's Law and stress-strain formula, as described above. Most of this primary settlement of the waste mass is expected to occur during the operational period, prior to construction of the final cover system.

Site-specific data indicate that the JRL waste materials will also undergo secondary compression (non-stress-based strain) due to compression and decomposition of the waste over time. SME established a site-specific secondary compression strain rate of 0.00004 (ft/ft)/day, based on review of over 10 years of topographic survey data from inactive areas of the existing landfill (SME, 2015). This strain rate equates to about 4.5 percent strain at 30 years (i.e., the time from when the cover is installed to the end of the post-closure period). This value was used to estimate settlement of the waste mass during the post-closure period. Settlements ranging from 0 to 10 feet are predicted at the end of the 30-year post-closure period; however, the settlement is projected to occur in a gradual manner, and the cover system's initial design slopes are sufficient to maintain positive drainage and meet or exceed the minimum allowable post-consolidation slopes of 5 percent, as required in Ch. 401 Section 5.G(4). Further, the calculated tensile strains of less than 1 percent are well below the maximum allowable strains recommended by geosynthetic manufacturers. As such, settlement of the waste is not expected to compromise the integrity or performance of the final cover system.

3.1.3 Stability and Settlement Monitoring Plan

SME developed a stability and settlement monitoring plan for the proposed Phase II Expansion, as required by Ch. 401 Section 2.F(3), based on the results of the stability and settlement assessments performed in accordance with Ch. 401 Sections 2.F(1) and 2.F(2), as described herein. Neither of these assessments identified any potential failure modes governed by the foundation soils. As such, no instrumentation is planned for the foundation soils beneath the footprint of the proposed Phase II Expansion. Further, the results of the required assessments indicate that the types and frequency of stability and settlement monitoring that have been employed at the JRL since 2010 are appropriate for the proposed Phase II Expansion.

Therefore, the stability and settlement monitoring (i.e., geotechnical monitoring) for the proposed Phase II Expansion will consist of four primary activities and associated reporting:

- Visual observations and inspections of the landfill relative to slope stability, settlement, and general condition;
- Review of annual topographic survey data;
- Review of waste types, quantities, placement locations, and filling sequences; and
- Review and evaluation of fluid levels measured within the leachate collection layer of selected waste cells.

The stability and settlement monitoring plan for the proposed Phase II Expansion is incorporated into and presented with the sitewide Geotechnical Monitoring Plan (GMP), which is provided as Appendix N of the facility's Operations Manual (Volume IV).

3.1.4 Stability Assessment (Cover System)

SME performed a stability assessment of the final cover system proposed for the Phase II Expansion, as required by Ch. 401 Section 5.I(1). This stability assessment considered potential failure planes that pass along and/or between the various layers of soil and geosynthetics intended for the cover system and focused on areas of the Phase II Expansion where the final outer sideslopes may be inclined as steep as 2.7 horizontal to 1 vertical (i.e., 20.3 degrees). The minimum FOS during the construction and post-closure periods were evaluated considering both static and seismic loading conditions, equipment loads/braking forces (during construction), and potential seepage forces (that may occur in the geocomposite drainage layer).

The cover system stability analyses were made using an in-house spreadsheet calculator following the methods published by Koerner and Soong, Geosynthetics International, 2005, "Analysis and Design of Veneer Cover Soils," and by various hand solutions. The calculated minimum FOS were then compared to the MEDEP's recommended minimum FOS. For each case, the calculated minimum FOS meet or exceed

the minimum acceptable FOS required by the Rules. Therefore, this stability assessment demonstrates that the grades and materials intended for the final cover will result in acceptable performance relative to cover system stability.

3.2 Water Balance Submission

SME used the U.S.EPA's HELP Model Version 3 to simulate leachate generation rates for the entire JRL, including the original landfill and both expansions. The most critical leachate generation conditions over the life of the Phase II Expansion were identified, and the modeling results under these conditions were used to design the leachate collection system. The HELP model simulation used the soils and geosynthetic properties representative of the proposed containment system components (i.e., liner and leachate collection systems) and climatological data for a 15-year period from 2008 through 2023. Daily precipitation data was obtained from a weather station in Bangor, Maine. Temperature and solar radiation data were synthetically generated by the HELP model using model coefficients for Bangor, Maine.

SME conducted HELP model simulations to estimate annual leachate generation rates. These conditions included:

- An open active waste filling condition assuming 10 feet of waste and no cover with a 2 percent slope (top of waste);
- An open active waste filling condition assuming 60 feet of waste and no cover with a 2 percent slope (top of waste);
- An open active waste filling condition assuming 60 feet of waste and no cover with a 33 percent slope (sideslopes);
- An 18-inch-thick interim soil cover; and
- An interim/final geomembrane cover.

An evaluation of annual leachate generation was conducted based on the landfill conditions described above, and assuming newly opened Cells 18-22 each with only 10 feet of waste placement. The results indicate that the average annual leachate generation during the operational life of the Phase II Expansion is projected to range from 16 million gallons per year to 27 million gallons per year.

The leachate generation rates calculated for these conditions were applied to the worst-case scenario, which is when the largest cell, Cell 20, is initially opened and filled with 10 feet of waste. Leachate generation rates for the entire landfill were calculated, including both impingement on the liner through the landfill and runoff from active waste filling areas. For the intermediate and final cover conditions, it was assumed that the runoff was clean surface water, so only impingement on the liner was included in calculating the leachate volume. A HELP model simulation was also run for the final cover condition. The

HELP model printouts and a summary sheet showing the estimated leachate generation rates over the anticipated life of the facility are included in Appendix D of this Report.

The estimated average daily leachate flow from the JRL facility when Cell 20 is initially opened is approximately 73,300 gallons per day (gpd), or approximately 26.4 million gallons per year (MGY). The average daily flow during the peak month, about 144,150 gpd, was used to size the leachate storage tank and leachate collection system drainage composite and pipe spacing, which were discussed in Section 2.4.1 of this Report.

3.3 Leachate Management

The leachate management conveyance, transport, and treatment systems selected for the Phase II Expansion are described in Section 2.4 of this Report. Leachate generated by the JRL will be pumped to either the existing on-site leachate storage tank or a second tank that will be added prior to waste disposal in Cell 18. Leachate will be pumped from these two pretreatment storage tanks into the PFAS treatment plant. After treatment, the leachate will be pumped to a post-treatment storage tank and then trucked to either the wastewater treatment plant at the Old Town Mill, which is currently owned by ND Paper, to the, or other permitted wastewater treatment facilities. On average, approximately 64,000 gpd of leachate were hauled from the JRL site in 2022, 2023, and 2024. During the peak leachate hauling month of the past two years, April 2024, this number increased to about 120,000 gpd. With the anticipated increase in leachate flows as a result of the Phase II Expansion (i.e., 73,300 gpd average and 144,150 gpd in the peak month) more leachate will need to be hauled from the site. The increase represents about three to four additional trucks per day if a peak month occurs when Cell 20 is initially opened.

There are no changes proposed to the waste types expected to be received in the Phase II Expansion cells; therefore, the quality of the leachate generated in the Phase II Expansion cells is expected to be consistent with the quality of the leachate currently generated at the site. Appendix G contains summary tables of the existing landfill's leachate testing results. A copy of the existing leachate disposal contract with ND Paper is contained in Appendix M of Volume I of the application.

Description of the design of the various components of the leachate collection and transport systems are provided in Section 2.4 of this report. The leachate and underdrain pipe sizing and spacing calculations are provided in Appendix E-3. The leachate generated at the facility will continue to be pumped to, and temporarily stored in, the existing and the additional proposed on-site aboveground leachate storage tanks. Each tank has a storage capacity of 921,000 gallons. The storage capacity of the tanks was designed for the most critical condition of leachate generation over the life of the Phase II Expansion, i.e., when Cell 20 is initially opened. The design considered the following:

- An initial static water level in the tank, consistent with common operational practices at the site;
- The estimated peak daily facility wide leachate generation rates; and

- The amount of additional leachate that would be generated from the largest open operating area for the Phase II Expansion (i.e., Cell 20) during a 25-year 24-hour storm event.

These calculations demonstrate that two 921,000-gallon storage tanks have the capacity to meet the storage capacity requirements of Ch. 401.2.D.4.b.(i). The calculations are provided in Appendix E-7. Design drawings for the proposed leachate conveyance systems are contained in Appendix A.

3.3.1 Action Leakage Rate/Leak Response Action Plan

A leak detection system is proposed for the Phase II Expansion to monitor the performance of the primary liner system as described in Section 2.2 of this Report. As described, this system will have the capability to measure both flow and water quality from the leak detection layer, which will allow NEWSME to determine if excessive leakage is occurring from the primary liner. This will be done by comparing the measured specific conductance to values calculated using selected Action Leakage Rates (ALR), leachate specific conductance, and baseline measurements. The methodology to implement this monitoring is contained in the Leak Response Action Plan (LRAP) contained in Appendix P of the Operations Manual, which is located in Volume IV of this application.

Design Liner Leakage Rates. The amount of leachate that could potentially leak through the primary liner depends on several factors, including the following:

- The number and size of holes or imperfections in the geomembrane;
- The head above the primary liner;
- The uniformity of contact between the geomembrane and underlying soil/GCL; and
- The hydraulic conductivity of the material in contact with the primary liner.

The ALRs of 20 gallons per acre per day (gpad) and 100 gpad are proposed for the Phase II Expansion. These values are the same as those approved for the previous expansion and conservatively consistent with U.S.EPA guidance.[3] The ALR represents the minimum rate of leakage that will trigger notification to the MEDEP by NEWSME of a concern with primary liner system. This notification will begin discussions between the MEDEP and NEWSME as to the possible need for a response action for the leakage. The steps in evaluating the ALRs and response actions are included in the LRAP for the Phases I and II Expansions in Volume IV, Appendix P.

3.3.2 Contingency Plan for Leachate Conveyance Failure Modes

The Phase II Expansion has been designed to allow for long-term access for maintenance and repair of the engineered components that make up the landfill's leachate conveyance system. The leachate collection

[3] Per 40 CFR § 265.302, "The action leakage rate is the maximum design flow rate that the leak detection system (LDS) can remove without the fluid head on the bottom liner exceeding 1 foot."

and conveyance systems have been designed using conservative values and redundant components so that the overall system will continue to function even if there are failures of one or more components within the system. Potential modes of failure of the Phase II Expansion engineered leachate conveyance systems were previously described in Table 3-7, and are listed below.

- Leachate Collection System

  Modes of failure for the proposed leachate transport systems include:

  - Clogging of collection system components;
  - Pipe collapse due to loading (static and live load conditions);
  - Misalignment due to differential settlement and thermal expansion/contraction; and
  - Freezing of the pipe.

  Contingencies built into the leachate collection system that address these potential failures include:

  - Use of conservative factors of safety in the design calculations that address potential clogging of drainage geocomposite and geotextiles;
  - Use of a leachate collection piping network, leachate collection drainage geocomposite, and drainage sand layer to collect and transmit leachate flows;
  - Use of conservative loading assumptions for calculating pipe strength;
  - Design of a two-layer stone filter between the sand layer and the perforated pipe to prevent clogging and serve as a conduit for leachate flow even in the event of a pipe failure;
  - Use of pressure transducers within each cell to monitor leachate collection and head on the liner; and
  - Design of the leachate collection piping layout to allow for cleaning.

Responses to performance issues in the leachate collection system will vary. Due to the redundancy and contingencies built into the design, nonperformance of any one component with the system will have limited impact on the function of the system and may not be obvious. If multiple non-performance modes were to occur, evidence of the problem would likely include seepage along the sideslopes and elevated readings at pressure transducer locations within the cell's leachate collection system. Because access to the base of the landfill is not practical after a significant depth of waste is placed, design of a system with redundancies (for instance geocomposite with overlying drainage sand and piping networks) reduces the potential of a system failure resulting from the failure of any individual component. Leachate collection piping will be cleaned periodically to maintain flow and prevent clogging.

- Leachate Transport System

  Modes of failure for the proposed leachate transport systems include:

  - Pump failure;
  - Leak in the force main;
  - Clogging of the sump area;
  - Clogging of the force main; or
  - Power outage.

  Contingencies built into the leachate transport system that address these potential modes of failure include the following:

  - Periodic maintenance, cleaning, and inspections of all transport lines;
  - Availability of back-up pumps and back-up generators at the landfill's sump and pump stations;
  - Ability to pump leachate directly from the landfill cell's sumps into haul trucks for transport to the wastewater treatment plant;
  - Use of continuous recording flow meters to detect significant changes in leachate flows that would indicate non-performance of the conveyance system;
  - Use of high-water alarm and loss of power alarms at the sump and pump areas;
  - Use of dual-containment piping for the force main to contain potential leaks from the inner carrier pipe;
  - Use of pressure gauges installed along the outer transport pipe of the dual-containment force main to indicate a leak in the force main's carrier pipe;
  - Use of valves within the leachate transport piping system to control flows from select locations of the transport system; and
  - Ability to visually inspect and to readily access the interior and exterior of the leachate storage structure to perform maintenance and make repairs, as necessary.

  The redundant nature of the leachate transport system's design will provide back-up and containment for many of the potential modes of non-performance. Some of the potential modes of non-performance could result in temporary build-up of leachate within the landfill cells which could result in the temporary build-up of head over the liner system. These issues can be addressed through routine maintenance, inspection, and cleaning of the various components of the transport system, or replacement of pumps, when necessary.

Due to the relative size and capacity of the nearby WWTP (i.e., Old Town Mill owned by ND Paper) in relation to the predicted leachate flows, there are no leachate disposal limitations associated with the

contracted treatment plant. A copy of the current leachate disposal contract for JRL leachate is contained in Volume I, Appendix L of the Phase II Expansion's Permit Application.

3.3.3 Leachate Conveyance Monitoring and Maintenance

The volume of leachate generated will be measured by flow meters located at each pump station. Leachate quality will be monitored in accordance with the site's Environmental Monitoring Plan contained in Volume IV, Appendix I of this application, which was developed to comply with the requirements of Ch. 405. Leachate samples will be routinely collected directly from the on-site storage tank and the leachate and leak detection pump stations.

The Phase II Expansion's leachate collection, leak detection, and leachate transport systems will be maintained, inspected, and cleaned periodically in accordance with the site's maintenance and inspection plan as described in Volume IV, Appendix O of this application. The leak detection system will be monitored in accordance with the LRAP contained in Volume IV, Appendix P.

3.4 Gas Management

The existing active landfill gas (LFG) extraction system will be expanded to collect the landfill gas generated by the Phase II Expansion. Landfill gas will be collected and conveyed to either the permitted on-site flare or the RNG facility. The LFG collection and control system will be designed to meet the applicable requirements in 40 CFR Part 60, Subpart XXX (New Source Performance Standards [NSPS]) for Municipal Solid Waste (MSW) Landfills and 40 CFR Part 63, Subpart AAAA (the National Emissions Standards for Hazardous Air Pollutants [NESHAP] for MSW Landfills). This, in combination with placement of intermediate and final cover over the landfill, will limit the potential for landfill gas migration from the facility. The details of the landfill gas management design for the Phase II Expansion is provided in the Landfill Gas Design Report prepared by Sanborn Head & Associates, Inc. contained in Appendix I. The Report addresses the overall landfill gas generation estimates, the proposed landfill gas extraction and conveyance systems, and the landfill gas system operations and maintenance.

3.5 Cell Development

NEWSME will construct and operate the Phase II Expansion sequentially, constructing and operating a series of five landfill cells. Each landfill cell is sized to have approximately two years of capacity, with construction of new cells anticipated to occur every two years. The cell development concept also incorporates a phased final cover construction over the existing and future JRL landfill cells. Cover construction will generally occur in years alternate to cell construction years. The actual timing for both cells and cover construction will depend on the capacity consumption estimates conducted annually, and the projection of when new cell disposal capacity will be needed.

3.5.1 Cell Development Plan

The cell development sequence has been established to allow NEWSME to continue to operate in the active landfill cell while the next cell is being constructed. The cell development sequence allows for phased intermediate and final cover placement to control leachate generation by diverting clean surface water runoff from the covered waste. Each landfill cell will have several similar attributes including:

- The landfill cells will be constructed on a firm base of compacted native till and imported barrier soils;
- Each cell base will be sloped to drain to the associated cell sump;
- The site access roads, surface water drainage control structures, leachate force main, and gas headers will be located in the north, east, and west perimeter berms; and
- The leak detection and leachate collection piping orientation allows access for cleaning.

Erosion and sedimentation control procedures that will be implemented for each cell are provided in the Erosion and Sedimentation Control Plan contained in Volume I, Appendix L of this application.

3.5.1.1 Cell 18 Development

Cell 18 abuts existing Cell 14 and will be the first Phase II Expansion cell developed. Cell 18 will have a 15.3-acre waste disposal area and will provide approximately 2.3 MCY of disposal capacity. The location and base grades for Cell 18 are shown on Figure 3-1.

Cell 18 construction will include the following:

- Installation of erosion control measures;
- Relocation of utility poles and perimeter fence;
- Construction of Detention Pond 11R to replace Detention Pond 11;
- Construction of Detention Pond 14;
- Excavation or filling of the cell area to base grades;
- Construction of an underdrain sand and piping layer;
- Construction of approximately 1,000 linear feet of the Phase II Expansion's eastern perimeter berm,
- Construction of approximately 1,700 linear feet of intermediate cell berms on the northern and western sides of the cell;
- Construction of a temporary cell berm in the northeast corner of the cell (to be removed as part of Cell 21 construction to allow leachate to flow from Cell 21 to the Cell 18 pump station);

- Construction of a temporary access road from the existing site access road into the northwest corner of the cell;
- Installation of the cell's secondary liner, leak detection system, primary liner, and leachate collection systems;
- Welding of the Cell 18 geomembrane liner systems to the geomembrane liner systems in the adjacent Cell 14;
- Construction of the cells' leachate collection and leak detection sump and pump systems;
- Extension of approximately 650 linear feet of the eastern perimeter leachate transport force main from existing sewer manhole #27 to the Cell 18 pump station; and
- Constructing approximately 640 linear feet of the 24-inch-diameter gas header pipe.

The base grades for Cell 18 generally slope northeasterly towards the permanent collection sump located in the northeast corner of the cell. Leachate and leak detection flows collected from Cell 18 will be pumped to the eastern perimeter force main.

Access to Cell 18 will be from the north side of the cell (see Figure 3-1) and from internal landfill access roads. The sequence of existing intermediate cover removal, waste placement, and installation of gas collection piping and intermediate cover are described in detail in the Operations Manual, Volume IV of this application. Once Cell 18 filling is complete, intermediate cover will be applied to the areas of Cell 18 shown on Figure 3-2. The year following Cell 18 construction, final cover will be placed over approximately 9.7 acres of the existing landfill cells at the location shown on Figure 3-1 (Stage 5 Final Cover).

3.5.1.2 Cell 19 Development

Cell 19 will abut future Cells 17 and 18 and be the second Phase II Expansion cell developed. Cell 19 will have an 11.2-acre waste disposal area and provide approximately 2.09 MCY of disposal capacity. The location and base grades for Cell 19 are shown on Figure 3-2.

Cell 19 construction will include the following:

- Installation of erosion control measures;
- Relocation and extension of overhead utilities;
- Construction of Detention Pond 12;
- Excavation or filling of the cell area to base grades;
- Construction of an underdrain sand and piping layer;

- Construction of approximately 900 linear feet of the Phase II Expansion's western perimeter berm;
- Construction of approximately 750 linear feet of intermediate cell berm on the northern side of the cell;
- Installation of the cell's underdrain, secondary liner, leak detection system, primary liner, and leachate collection system;
- Welding the Cell 19 geomembrane liner to the geomembrane liner systems in adjacent Cells 17 and 18;
- Construction of the Cell 19 pump station and collection sump;
- Extension of the western transport force main approximately 1,100 linear feet from the pump station to the Cell 19 leachate force main tie-in point at the northwest corner of future Cell 17; and
- Construction of approximately 1,200 linear feet of the 24-inch gas header.

Base grades of Cell 19 generally slope from the southwest and northeast of the cell toward the permanent collection sump in the northwest corner of the cell. Access to Cell 19 will be from the existing north side access road and from internal landfill access roads. The sequence of existing intermediate cover removal, waste placement, and installation of gas collection piping and intermediate cover at pre-determined intervals of the cell development will be the same as Cell 18, which is described in Volume IV of this application. Once Cell 19 filling is complete, intermediate cover will be applied to the area of Cell 19 shown on Figure 3-2. The year following Cell 19 construction, final cover will be placed over approximately 10.9 acres of the existing landfill cells at the location shown on Figure 3-2 (Stage 6 Final Cover).

3.5.1.3 Cell 20 Development

Cell 20 will abut the north side of future Cell 19 and be the third Phase II Expansion cell developed. Cell 20 will have a 16.9-acre waste disposal area and provide approximately 2.4 MCY of disposal capacity. The location and base grades for Cell 20 are shown on Figure 3-3.

Construction of Cell 20 will include the following:

- Installation of erosion and sedimentation control measures;
- Installation of overhead utilities;
- Installation of underground electrical and back-up power generator;
- Construction of Detention Pond 13;
- Excavation or filling of the cell area to base grades;

- Construction of an underdrain and piping layer;
- Construction of approximately 2,100 linear feet of the Phase II Expansion's perimeter berm on the northern and western sides of the cell;
- Installation of approximately 900 linear feet of intermediate cell berm on the eastern side of the cell;
- Installation of the cell's underdrain, secondary liner, leak detection system, primary liner, and leachate collection systems;
- Welding of the Cell 20 geomembrane liner systems to the adjacent Cell 19 liner systems;
- Construction of the leachate piping tie-in from Cell 20 to Cell 19 in the southwest corner of the cell;
- Construction of the Cell 20 pump station in the northeast corner of the cell;
- Extension of the western transport force main approximately 1,800 linear feet from pump station 20 to the Cell 19 leachate force main tie-in point at the northwest corner of future Cell 19;
- Removal of the temporary berm in the northwest corner of Cell 19 and tie in to the Cell 19 leachate collection piping; and
- Construction of approximately 1,750 linear feet of the 24-inch gas header.

The direction of flow along the base grade of Cell 20 is split diagonally from southeast to northwest due to the underlying bedrock. Leachate in the northeast half of the cell will flow to the Cell 20 pump station while leachate in the southwest half of the cell will flow to the southwest corner of the cell then to the Cell 19 pump station. Leachate collected in the Cell 20 pump station (northern half of Cell 20) will be pumped via the dual containment force main along the west perimeter berm of Cell 20.

Access to Cell 20 will be from both the east side of the cell from the existing access road, and the southern side of the cell from the interior landfill access road. As in previous cells, sequence of existing intermediate cover removal, waste placement, installation of gas collection piping and installation of intermediate cover at pre-determined intervals of the cell development will progress in much the same manner. Once Cell 20 filling is complete, intermediate cover will be applied to the area of Cell 20 shown on Figure 3-3. The year following Cell 20 construction, final cover will be placed over approximately 10.9 acres of the existing landfill cells at the location shown on Figure 3-3 (Stage 7 Final Cover). Additionally during the following year the remaining portion of the northern perimeter berm will be constructed (approximately 800 linear feet) along with construction of Detention Pond 14.

3.5.1.4 Cell 21 Development

Cell 21 will abut future Cells 18 and 20 and be the fourth Phase II Expansion cell developed. Cell 21 will have a 7.6-acre waste disposal area, provide approximately 2.35 MCY of disposal capacity below elevation 340. The location and base grades for Cell 21 are shown on Figure 3-4.

Cell 21 construction will include the following:

- Installation of erosion control measures;
- Excavation or filling of the cell area to base grades;
- Construction of an underdrain and piping layer;
- Construction of approximately 1,000 linear feet of intermediate cell berm on the northern side of the cell;
- Installation the cell's secondary liner, leak detection system, primary liner, and leachate collection systems;
- Welding of the Cell 21 geomembrane liner systems to adjacent Cells 18 and 20 geomembrane liner systems;
- Removal of the temporary berm in the northeast corner of Cell 18 and tie into the Cell 18 leachate collection piping; and
- Construction of approximately 200 linear feet of the 24-inch gas header.

Access to Cell 21 will be from the north access roads and from internal landfill access roads. As in the previous cells, the sequence of existing intermediate cover removal, waste placement, and installation of gas collection piping and installation of intermediate cover at pre-determined intervals of the cell development will progress in the same manner. Once Cell 21 filling is complete, intermediate cover will be applied to Cell 21 shown on Figure 3-4. The year following Cell 21 construction, final cover will be placed over approximately 15 acres of the existing landfill cells at the location shown on Figure 3-4 (Stage 8 Final Cover).

3.5.1.5 Cell 22 Development

Cell 22 will abut future Cells 20 and 21 and be the final Phase II Expansion cell developed. Cell 22 has a waste disposal area of approximately 5.6 acres and will provide approximately 1.76 MCY of disposal capacity below Elevation 340 feet. The location and base grades for Cell 22 are shown on Figure 3-5.

Construction of Cell 22 will include the following:

- Installation of erosion and sedimentation control measures;
- Excavation or filling of the cell area to base grades;

- Construction of an underdrain sand and piping layer;
- Installation of the cell's secondary liner, leak detection system, primary liner, and leachate collection systems;
- Welding of the Cell 22 geomembrane liner systems to adjacent Cells 20 and 21;
- Removal of the temporary berm in the northeast corner of Cell 20 and tie-in to the Cell 22 leachate collection piping; and
- Constructing approximately 1,300 linear feet of the 24-inch gas header.

Access to Cell 22 will be from the north of the cell from the facility's main access road and from internal landfill access roads. As in the previous cells, the sequence of existing intermediate cover removal, waste placement, and installation of gas collection piping and intermediate cover at predetermined intervals of the cell development will progress in the same manner. Once Cell 22 filling is complete, intermediate cover will be applied to the remainder of open active area of Cell 22 until final cover is placed. The year following Cell 21 construction, final cover will be placed over approximately 14.4 acres of the existing landfill cells at the location shown on Figure 3-5 (Stage 9 Final Cover).

3.5.1.6 Cell 18-22 (Elevations 340 to Final) Development

Upon completion of Cell 22 construction, there will be a large operation area on the top of the Phase II Expansion area. The Phase II Expansion area will be filled to Elevation 340. A waste filling access road to the top of the landfill will be constructed on the northwest corner of the Phase II Expansion as shown on Figure 3-6. This road will be used to place the final 40 vertical feet of waste within the expansion footprint. This final phase of filling will provide approximately 1.0 MCY of disposal capacity to the final waste grades of the Phase II Expansion area. Waste and final cover placement in the active area will be performed in a counterclockwise fashion starting from the southeast corner and progressing to the southwest corner of the area as shown on Figure 3-7.

3.6 Phased Final Cover System

The proposed final cover system for the Phase II Expansion will use similar engineered components (i.e., textured geomembrane), and earthen materials (i.e., barrier soil and vegetative cover soil) that will be used in the landfill cell construction. Placement of the proposed final cover system will comply with the similar material installation specifications, and quality control/quality assurance protocol as used for the cell construction. The final cover system proposed for the Phase II Expansion is as follows (top to bottom):

- 18 inches of a vegetative cover soil;
- Drainage geocomposite;
- 40-mil LLDPE textured geomembrane liner;

- 12 inches of compacted barrier soil layer; and
- 6 inches of construction fines or sand layer.

As the landfilling progresses and individual cells reach final grade, detailed design drawings and technical specifications will be prepared and submitted to the MEDEP for review and approval prior to the placement of each stage of final cover at the site. Figure 3-8 shows the proposed final development conditions of the Juniper Ridge Landfill including Phase II Expansion. The borrow source materials used for closure will be obtained from permitted sources. Estimated costs associated with closure construction and post-closure maintenance and care are included in Volume I, Section 3.2 of this Application.

3.7 Waste Storage, Staging, and Burn Areas

The Phase II Expansion will not require any waste storage, waste staging, or burn areas for wood waste or CDD. If necessary, on a temporary basis select areas of the existing landfill will be used as a storage area for the soft layer material that will be placed at the bottom of the Phase II Expansion cells as described in Section 2.4.1. The permitted wood waste handling area located to the east of the existing landfill will continue to be used during the operation of the Phase II Expansion.

3.8 Waste Characterization and Design Compatibility

The waste types and approximate percentages (by weight) proposed for disposal in the Phase II Expansion are the same types of wastes that have been placed in the existing JRL Phase I Expansion cells. The Phase II Expansion is based on an average annual waste intake of 880,000 tons per year as that was the average annual tonnage from 2021–2023. The percentage of each major waste type is listed below and is based on tonnages of each material received in 2023.

- Ash (1 percent);
- Miscellaneous waste[5] (2 percent);
- CDD process fines used for daily cover (6 percent);
- WWTP biosolids and miscellaneous sludge (8 percent);
- Oversized bulky waste (9 percent);
- Municipal solid waste bypass from incinerators (32 percent); and
- CDD (42 percent).

Table 3-8 is a summary of the wastes accepted at JRL during 2023. As part of this Application, NEWSME and BGS request MEDEP's approval for continuance and disposal of the same waste types that are currently approved for disposal in the existing landfill. The wastes proposed for disposal in the Phase II

Expansion have been previously determined to be non-hazardous by the MEDEP and are suitable for disposal at JRL.

TABLE 3-8

SUMMARY OF WASTES ACCEPTED AT JUNIPER RIDGE LANDFILL
REPORT YEAR 2023

Waste Description	Tons	Percent of Total
Burn Pile, Hot Loads, and Burnt Structure Ash	689	0. 1%
Catch Basin Grit & Street Sweepings	559	0.1%
CDD/MSW Processing Residue - Bulky Waste	78,673	9.4%
Recycled/Reused CDD Processing Residue - Fines	50,774	6.1%
Coal, Oil & Multifuel Boiler Ash	1,355	0.2%
Contaminated Soil & Debris	4,095	0.5%
Residue/Trash from Single Stream	8,239	1.0%
Industrial (Miscellaneous)	131	0.0%
Industrial WWTP Sludge	9,086	1.1%
Leather Scraps	51	0.0%
Lime Mud And Grit	1,168	0.1%
Mixed CDD	347,016	41.6%
Polyethylene & Cellulose Trimmings	145	0.0%
MSW Bypass	266,452	31.9%
MSW Incinerator Ash	2,619	0.3%
Municipal WWTP/POTW Sludge	57,090	6.8%
Non-Friable Asbestos	670	0.1%
Non-Hazardous Chemical Related	723	0.1%
Oil Spill Debris	2,191	0. 3%
Pulp Mill Waste	538	0. 1%
Sandblast Grit	244	0.0%
Water/Air Filtration Media	7	0.0%
Spoiled Foods	328	0.0%
Sulfur Scrubbing Residues	699	0.1%
Recycled/Reused Wood From CDD	248	0.0%
WWTP Grit Screenings	574	0.1%
Total	**834,364**	**100.0%**

Characterization of the JRL's waste stream and landfill leachate have been routinely performed as part of the operation of the existing landfill. As previously discussed, there are no proposed changes in the wastes accepted in the Phase II Expansion. Therefore, there are no significant changes expected for the characteristics of the solid waste streams planned for the Phase II Expansion. JRL's Waste Characterization and Acceptance Plan is contained in Appendix G of Volume IV of this Application; the plan describes the analytical testing that is required of waste generators to determine if a waste stream is compliant with the regulatory licenses and permits that the JRL operates under.

Operation of the existing landfill demonstrates the compatibility of the waste streams and the engineered systems for the landfill (e.g., liner and leachate collection systems). There have been no significant issues in terms of physical or chemical commingling of the various waste streams.

All of the proposed engineered components of the Phase II Expansion liner and cover systems (i.e., HDPE geomembrane, GCL, barrier soil, and HDPE piping) have been successfully used for constructing the existing JRL. All the materials proposed for use in the Phase II construction are routinely used at other solid waste disposal facilities throughout Maine. All of these materials are recognized by the MEDEP as state-of-the-art design components and in many cases are required by specification to meet the performance standards of the Rules. The MEDEP has agreed, based upon previous material testing results from JRL and other sites, that the synthetic components planned for the Phase II Expansion exhibit acceptable chemical resistance and do not require additional testing with respect to U.S.EPA's 9090 testing. Copies of material compatibility testing, and data on the suitability of the materials used in the Phase I Expansion construction, are contained in Appendix H.

3.9 Surface Water Control Plans

An Erosion and Sedimentation Control Plan meeting the requirements of Ch. 400.4.J, and a Stormwater Management Plan meeting the standards and submission requirements of Ch. 400.4.M are provided in Appendices J and K, respectively, of Volume I of this Application.

3.10 Test Pad Submissions

During base grade, liner, and final cover construction, the construction techniques used to compact the soils will be evaluated similarly to what has been done with the construction of the existing JRL cells to ensure conformance of the in-place soils with the requirements of Part 3.11.B.1.b of Section 02200 of the Project Specifications. The first 50,000 square feet of soils placed in the first cell or first cover area will be used as a test pad. The test pad program will consist of placing and compacting the barrier soil in one or two lifts, each with a compacted thickness of 12 inches. During placement and compaction, in-place moisture-density tests will be obtained at a frequency of 15 per acre per lift. The compaction equipment and number of passes will be noted in the field logs. In-place hydraulic conductivity test samples will be randomly collected from the test pad area with a total of seven hydraulic conductivity tests collected for each 12-inch-thick lift. The hydraulic conductivity tests will be performed on barrier soil samples representative of the top, middle, and bottom of each lift. These hydraulic conductivity tests will be sent to the laboratory and the hydraulic conductivity, density, and moisture content of the in-place barrier soil measured. On the sideslopes of the cell berms, where the barrier soil will be 24 inches thick, 24-inch-long Shelby tube samples of the clay barrier soil will be taken, and the sample will be cut longitudinally to visually evaluate the remolding and bonding of the clay layers. Pictures will be used to document the condition of the compacted clay. If it becomes necessary to locate a new borrow source, new test pads will be conducted for both liner and cap placement.

The data collected and testing results will be compiled and discussed with the construction stakeholders and upon concurrence that the construction techniques are appropriate to achieve the specified in-place properties of the barrier soil, the soil placement and compaction techniques will be employed for the

remainder of the project. The frequency of moisture testing and hydraulic conductivity testing will be consistent with the criteria found in Section 02200 of the Specifications for the remainder of the barrier soil construction.

3.11 Special Construction Requirements

In the areas shown on Figure 2-1, an augmented secondary liner will replace the soil portion of the secondary liner, this augmented secondary liner will consist of a 12-inch-thick layer of compacted clay barrier soil underlying a GCL. In addition to this augmented secondary liner system, an additional 12-inch layer of imported soil meeting the requirements of the clay barrier soil will be placed below the augmented secondary liner to meet the travel time requirements as described in Volume II of this Application. An underdrain system will be installed in areas where the base grade will be below the existing phreatic surface. This layer will facilitate dewatering of the site and thereby provide a firm base so that the base liner soils can be sufficiently compacted such that the in-place soils will meet the moisture, density, and hydraulic conductivity requirements for the project. The underdrain system will consist of a 12-inch-thick layer of drainage sand with 4-inch-diameter perforated pipes and will be installed in the locations shown on Drawing C-104 in Appendix A.

3.12 Alternative Design Analysis

Section 2 (D)(1) of the Rules – Design Standards for Landfills, describes the minimum liner system requirements for a licensed landfill. In summary, the minimum liner consists of a leachate collection system underlain by a composite liner, which consists of a 60-mil-thick geomembrane that is in turn directly underlain by a minimum 24-inch-thick layer of barrier soil. The Rules indicate the barrier soil will consist of compacted clay or well graded till that exhibits a hydraulic conductivity less than or equal to $1x10^{-7}$ centimeters/second (after installation). The Rules allow a geosynthetic clay liner (i.e., GCL) to be substituted for 12 inches of the soil barrier layer.

A number of subsurface investigations were performed in the Phase II Expansion area to characterize the native soil type and bedrock conditions (e.g., thickness, texture, and hydraulic conductivity). An analysis of groundwater travel time (to sensitive receptors) was completed for the Phase II Expansion area and identified several locations where the required minimum 6-year travel time would likely not be met without enhancement of the minimum liner requirements in the Design Standards as set forth in the Rules. Section 4.0 of this document presents the travel time analysis for the Phase II Expansion. The subsurface investigations also identified three areas in the Phase II Expansion area where the base of the landfill will not be separated from the underlying bedrock by at least 5 feet (as measured from the grubbed subgrade surface). The combined lateral extent of the near surface bedrock is approximately 0.5 acres (i.e., approximately 1.0 percent of the Phase II Expansion area). Figure 2-1 identifies the areas in the Phase II Expansion where bedrock is at or near the ground surface. For purposes of this section, the other portions

(i.e., approximately 2.7 acres) of the Phase II Expansion area are treated as requiring addition of imported materials to achieve the minimum 6-year travel time requirement.

To address areas where groundwater travel times to sensitive receptors are less than six years, the Rules allow the time of travel to be improved (i.e., extended) by inclusion of one or more additional barrier layers, inclusion of a leak detection system, implementation of engineered systems to improve groundwater and/or surface water quality, increased environmental monitoring, and/or managing groundwater such that it discharges into the waste deposit area. Table 1 of the Rules Section D (2) summarizes the methods to increase groundwater travel times and the time offsets available achieving the required 6-year travel time.

For the Phase II Expansion, NEWSME is proposing to utilize two different liner systems – one to address the needed time of travel improvement (i.e., approximately 54.3 acres of the Phase II Expansion area) and the other to address the shallow bedrock (i.e., approximately 2.7 acres of the Phase II Expansion area). Both of the proposed liner systems will utilize the same leachate collection system and the same primary liner system, but will include different secondary liner systems to comply with the Rules. The liner for the 54.3-acre portion of the Phase II Expansion area will be known as the Base Liner System and will have a top to bottom configuration as follows:

- 12 inches of Leachate Collection Sand;
- Leachate Collection Drainage Geocomposite;
- 80-mil Textured HDPE Geomembrane;
- Geosynthetic Clay Liner;
- 12 inches compacted barrier soil (maximum hydraulic conductivity (K) of $1x10^{-7}$ cm/sec);
- 12 inches Leak Detection Sand;
- Leak Detection Drainage Geocomposite;
- 60-mil Textured HDPE Geomembrane; and
- 12 inches compacted barrier soil (maximum K $1x10^{-5}$ cm/sec with a geometric mean less than or equal to $1x10^{-6}$ cm/sec).

NEWSME recognizes that the Base Liner System relies on time of travel offsets relative to the minimum design requirements and thus is considered by the Rules to be an alternate design. Section 3.12.1 presents a discussion of the Base Liner System design, which demonstrates the technical equivalency of Base Liner System.

The liner system for the 2.7-acre portion of the Phase II Expansion area (i.e., where bedrock is expected to be less than 5 feet below the bottom of waste) will be known as the Augmented Liner System and will have a top to bottom configuration as follows:

- 12 inches of Leachate Collection Sand;
- Leachate Collection Drainage Geocomposite;
- 80-mil Textured HDPE Geomembrane;
- Geosynthetic Clay Liner;
- 12 inches compacted barrier soil (maximum K of $1x10^{-7}$ cm/sec);
- 12 inches Leak Detection Sand;
- Leak Detection Drainage Geocomposite;
- 60-mil Textured HDPE Geomembrane;
- Geosynthetic Clay Liner;
- 12 inches compacted barrier soil (maximum K of $1x10^{-7}$ cm/sec); and
- 12 inches imported soil layer (maximum K of $1x10^{-7}$ cm/sec).

The Augmented Liner System will cover the areas of near surface bedrock plus some additional area to transition to the Base Liner System. Overall, the Augmented Liner System is expected to have an area of approximately 2.7 acres. The lateral limits of the Augmented Liner System are shown on Figure 2-1. The Augmented Liner System complies with the Rules. Specifically, the Augmented Liner System will include a primary and secondary liner system consisting of a textured geomembrane, GCL, and 12 inches of compacted barrier soil with a maximum K of $1x10^{-7}$ cm/sec. An additional 12-inch-thick imported soil layer with a maximum K of $1x10^{-7}$ cm/sec will be installed below the secondary liner system to provide additional travel time to the system.

3.12.1 Alternative Liner Design (Base Liner System)

To achieve the 6-year groundwater travel time with respect to the nearest sensitive receptor, NEWSME proposes to add a leak detection system and a secondary liner system to the Phase II Expansion Base Liner System to utilize the 3-year travel time offset as described in Table 1 of Rules Section 2(D)(2). Moreover, NEWSME's proposal is to utilize an alternative liner that is an improvement as compared to the required minimum(s) by increasing the thickness of the geomembrane in the primary liner system from 60 mils to 80 mils, increasing the thickness of the secondary geomembrane liner from 40 mils to 60 mils, and by substituting a GCL for 12 inches of the clay barrier layer associated with the primary liner system. To improve the performance of the proposed Base Liner System further, a drainage geocomposite will be added to the base of both the leachate collection sand and the leak detection sand. Finally, NEWSME proposes to reduce the thickness of the soil barrier underlying the secondary liner from 24 inches to 12

inches and use compacted till exhibiting a hydraulic conductivity of less than or equal to $1x10^{-5}$ cm/sec with a geometric mean less than or equal to $1x10^{-6}$ cm/sec cm/sec to construct the 12-inch barrier layer rather than clay with a lower hydraulic conductivity. NEWSME recognizes the till barrier soil is not an improvement of the minimum design standard, but has analyzed the proposed overall Base Liner System and has determined it is hydraulically superior to the overall system required by the Rules. The proposed alternate Base Liner System will also help to conserve scarce local clay sources.

The following table presents a comparison of the minimum liner system described in the Rules, which is needed to support the 3-year travel time offset, and the alternative Base Liner System proposed for the Phase II Expansion. The proposed alternative Base Liner System is considered an improvement with respect to the minimum design standard liner system for several reasons, which are discussed later in this document.

COMPARISON OF MINIMUM DESIGN STANDARD LINER SYSTEM AND PROPOSED ALTERNATIVE BASE LINER SYSTEM TO SUPPORT 3-YEAR TIME OF TRAVEL OFFSET

Layer Name (Top to Bottom)	Minimum Design Standard Liner System to Support 3 year Travel Time Offset	Alternative Base Liner System to Support 3-year Travel Time Offset
Leachate Collection System	12" Leachate Collection Sand	12" Leachate Collection Sand Drainage Geocomposite
Primary Liner System	60-mil HDPE geomembrane 24" Clay Barrier Soil with K of $1x10^{-7}$ cm/sec	80-mil HDPE geomembrane Geosynthetic Clay Liner 12" Clay Barrier Soil at $1x10^{-7}$ cm/sec
Leak Detection System	12" Leak Detection Sand	12" leak detection sand Drainage Geocomposite
Secondary Liner System	40-mil HDPE geomembrane 24" Clay Soil with K of $1x10^{-7}$ cm/sec or less	60-mil HDPE geomembrane 12" Till Soil with K $1x10^{-5}$ cm/sec and geometric mean K less than or equal to $1x10^{-6}$ cm/sec

Chapter 401, Section 2(E) – Alternative Design Process allows alternatives to the minimum design standards for landfills (i.e., Section 2(D)) to be proposed. As indicated, NEWSME proposes to use a landfill Base Liner System that is an improvement to the minimum design standard required by the Rules. Section 2(E) of the Rules lists six aspects of an alternative design which need to be addressed for use of an alternative design in lieu of the minimum design standards for landfills. Consideration of those six aspects for the proposed alternative Base Liner System is as follows.

(1) A discussion of the benefits of the proposed alternative technology.

The principal benefit of the proposed alternate Base Liner System is to remove the potential threat of leachate leaving the Phase II Expansion from reaching a sensitive receptor in less than six years. The alternative Base Liner System uses only soil and geosynthetic materials that have been successfully installed multiple times at JRL and as such the construction and QA/QC methods for use of those materials for the alternative Base Liner System are well

established. As shown in the liner comparison table above, both the primary and secondary geomembrane components for the Phase II Expansion will be thicker than the minimum thickness required. The added geomembrane thickness reduces the potential for puncture of the already puncture-resistant geomembranes required by the Design Standards for Landfills.

Geocomposite drainage layers will be included in the leachate collection system and in the leak detection system of the proposed alternative Base Liner System. The drainage geocomposite will underly the 12-inch-thick sand layers in both the leachate collection system and in the leak detection system. Inclusion of the drainage geocomposites will reduce the time for lateral drainage (and removal) of the leachate collected above the primary geomembrane and reduce the time for lateral drainage (and removal) of liquid collected in the leak detection system. Inclusion of the drainage geocomposites minimizes the hydraulic head on the associated underlying geomembranes to less than approximately ½ inch. The reduced hydraulic head causes the vertical gradient across the geomembrane(s) to be significantly decreased as compared to a hydraulic head equivalent to the thickness of the sand in the leachate collection or leak detection systems (i.e., 12 inches). Additionally, the (rapid) lateral drainage feature of geocomposites allows collected leachate and/or leakage to be quickly diverted to removal sumps/pumps that minimize the time for occurrence of hydraulic head on the underlying geomembrane(s).

2) *A discussion of the risks and drawbacks of the proposed alternative technology*.

The materials and methods used to construct the proposed alternative Base Liner System for the Phase II Expansion will be the same as those used at the JRL for the existing landfill liner systems. Both the primary and secondary geomembranes for the Phase II Expansion Base Liner System will consist of HDPE, of which more than 6.7 million square feet have been installed in both the original JRL and the Phase I Expansion. Similarly, more than 6.4 million square feet of drainage geocomposite and 4.4 million square feet of GCL have been installed at JRL without incident. The soil materials to be used for the leachate collection and leak detection systems are native materials that will come from nearby sand sources, which have been used extensively for construction of the leachate collection and leak detection systems for the original JRL Landfill and the Phase I Expansion at JRL. The compacted soil barrier supporting the secondary liner will have an increased hydraulic conductivity of $1x10^{-6}$ cm/sec (geometric mean) as compared to $1x10^{-7}$ cm/sec and a thickness of 12 inches. The increased thickness of the secondary geomembrane coupled with installing the underlying soil barrier consistent with Section 2(D)(1)(v) – Liner System Requirements (for compaction) is expected to create a condition conducive to very few, if any installation caused liner punctures that would allow leakage from the leak detection system to the environment. As noted in the discussion for aspect (*4*) below, the proposed Base Liner System will result in equal or superior hydraulic performance as compared to the minimum design standard liner as described in Chapter 401, Section 2(D) of the Rules.

(3) An assessment of similar applications of the proposed alternative technology.

The alternative technology (i.e., proposed Base Liner System) has been used at JRL and similar municipal solid waste landfills elsewhere in Maine. The materials and methods that will be used for the proposed Base Liner System alternative have been reviewed and accepted by MEDEP at JRL and other landfills and the proposed alternative is recognized as standard practice for overcoming shallow bedrock issues in landfill development areas.

(4) A demonstration that the alternative technology will provide equal or superior performance to the component it is proposed to replace, or that its inclusion within a system will result in equal or superior performance of that system.

The hydraulic performance of the minimum design standard liner system described in the Design Standards for Landfills was compared to the proposed Base Liner System for the Phase II Expansion using the Hydraulic Evaluation of Landfill Performance (HELP) model. HELP is a technically recognized, quasi-two-dimensional hydrologic model for estimating water movement into, across, through, and out of landfills. The HELP model analyses completed for comparing the two liner systems used recent weather records representative of the Bangor, Maine area and used soil and geomembrane geotechnical values consistent with similar materials already in-place at JRL. The results of the HELP model comparison of the proposed Base Liner System versus the minimum liner system described in the Design Standards for Landfills are summarized in the following table. The summary shows that the proposed Base Liner System is hydraulically superior to the minimum liner system as described in the Design Standards for Landfills. The HELP models completed for the comparison are presented as Appendix D.

HELP Model Comparison of Minimum Design Standard Liner System and Proposed Alternative Design Liner System to Support 3-year Time of Travel Offset

	Minimum Design Standard Liner System to Support 3-year Travel Time Offset	Alternative Design Liner System to Support 3-year Travel Time Offset
Modeled System Description	Waste Layer (10') Leachate Collection Sand (12") 60-mil HDPE geomembrane 24" Clay Barrier Soil with Max K of $1x10^{-7}$ cm/sec 12" Leak Detection Sand 40-mil HDPE geomembrane 24" Clay Soil with Max K of $1x10^{-7}$ cm/sec	Waste Layer (10') Leachate Collection Sand (12") Drainage Geocomposite 80-mil HDPE geomembrane 12" Clay Barrier Soil with Max K of $1x10^{-7}$ cm/sec GCL 12" Leak Detection Sand Drainage Geocomposite 60-mil HDPE geomembrane 12" Till Barrier Soil with Max K of $1x10^{-5}$ cm/sec and geometric mean less than or equal $1x10^{-6}$ cm/sec
Average Annual Leachate Drained into Leachate Collection System	363,962 gallons per acre per year	361,342 gallons per acre per year
Average Annual Leakage through Primary Liner	56.8 gallons per acre per year	0.07 gallons per acre per year
Average Annual Leachate Collected from Leak Detection System	55.0 gallons per acre per year	0.01 gallons per acre per year
Average Annual Leakage to Environment	0.21 gallons per acre per year	0.06 gallons per acre per year
Note: The HELP Model reports the calculated volume of leachate collected, leakage detected, and leakage from landfill liner systems on a per acre basis. HELP reports the volumes to the to the nearest 0.001 cubic foot (i.e., 0.007 gallons).		

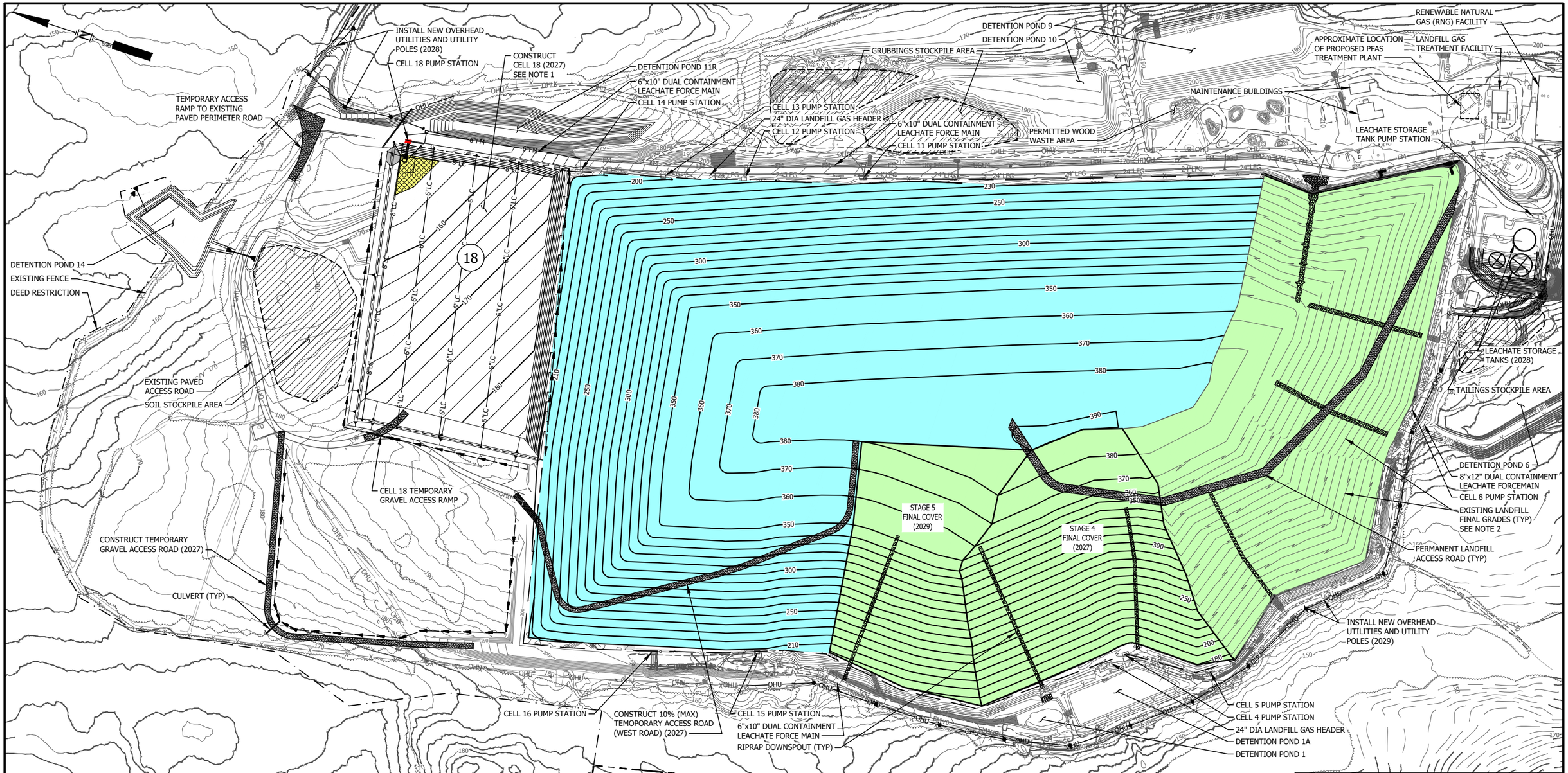
(5) An assessment of the feasibility of constructing the proposed alternative, including the ability to provide an adequate level of quality assurance and quality control. A demonstration of the feasibility of construction may be required.

Construction of the proposed Base Liner System will use the same materials and methods used for similar sections of liner already successfully constructed at JRL. Specifications for the material compositions and installation methods have been reviewed by MEDEP for each waste cell previously constructed at JRL. A QA/QC plan was developed for liner construction at JRL and will be implemented for the proposed Base Liner System construction associated with the Phase II Expansion. The feasibility of successful construction for the proposed liner system is good.

(6) An assessment of the likelihood that the proposed alternative will perform as designed through landfill operations, closure, and post-closure periods.

The proposed Base Liner System is expected to perform as designed throughout the duration of the life of the landfill operation, closure, and post-closure periods. The materials and methods planned for the proposed Base Liner System for Phase II Expansion have been time tested at JRL and have been shown to be successful. NEWSME has consistently supported

QA/QC efforts for previous liner installations at JRL and will do the same for the Phase II Expansion.



CAPACITY	2,300,000 CUBIC YARDS
OPEN CELL AREA	15.3 ACRES
OPEN SLOPE AREA	0 ACRES
INTERMEDIATE COVER	74.8 ACRES
FINAL COVER	47.2 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE COVER
- 18 — CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. GRADES SHOWN IN CELL REPRESENT CELL BASE GRADES PRIOR TO WASTE FILLING.
2. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-1
CELL 18 INITIAL CONDITIONS (2028-2029)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: C18-INITIAL CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

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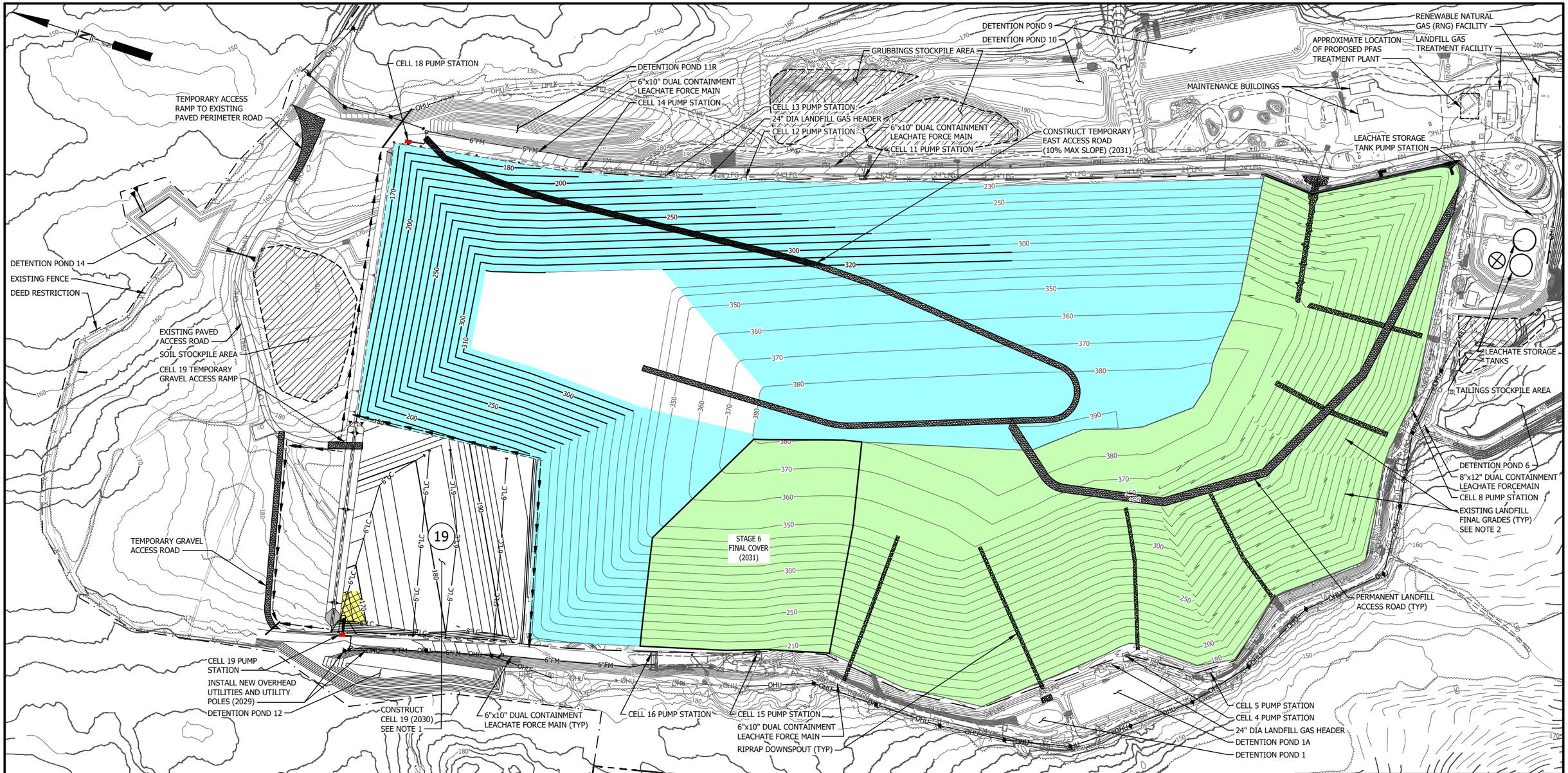

CAPACITY	2,090,000 CUBIC YARDS
OPEN CELL AREA	11.2 ACRES
OPEN SLOPE AREA	8.7 ACRES
INTERMEDIATE COVER	70.5 ACRES
FINAL COVER	58.1 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE COVER
- (19) CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. GRADES SHOWN IN CELL REPRESENT CELL BASE GRADES PRIOR TO WASTE FILLING.
2. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-2
CELL 19 INITIAL CONDITIONS/
CELL 18 OPERATIONAL FILLING CONDITIONS
(2030-2031)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: C19-INITIAL-C18-OWG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

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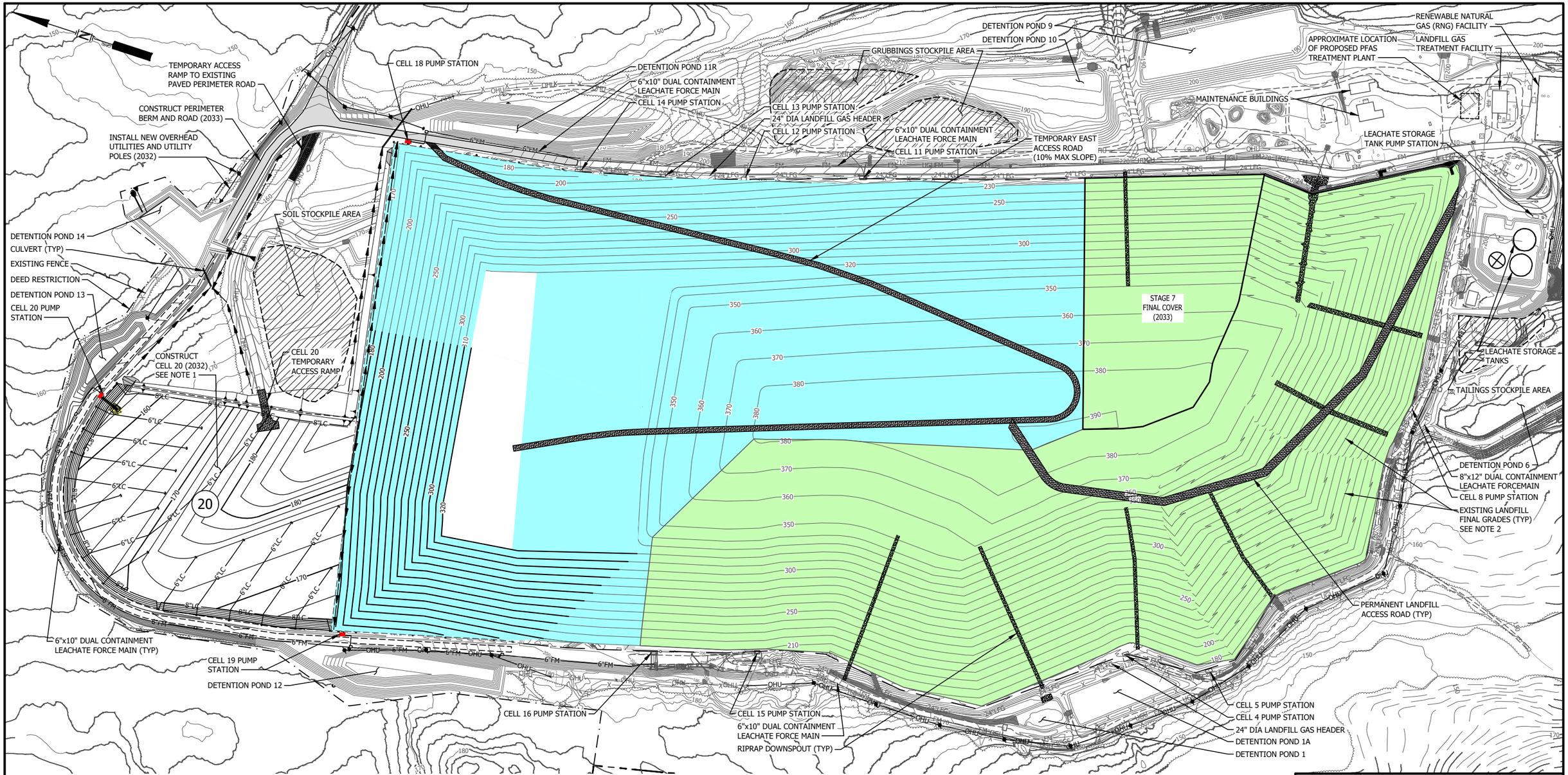

CAPACITY	2,400,000 CUBIC YARDS
OPEN CELL AREA	16.9 ACRES
OPEN SLOPE AREA	5.0 ACRES
INTERMEDIATE COVER	74.5 ACRES
FINAL COVER	69.0 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE COVER
- 20 — CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. GRADES SHOWN IN CELL REPRESENT CELL BASE GRADES PRIOR TO WASTE FILLING.
2. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-3
CELL 20 INITIAL CONDITIONS/
CELL 19 OPERATIONAL FILLING CONDITIONS
(2032-2033)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: C20-INITIAL-C19-OWG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

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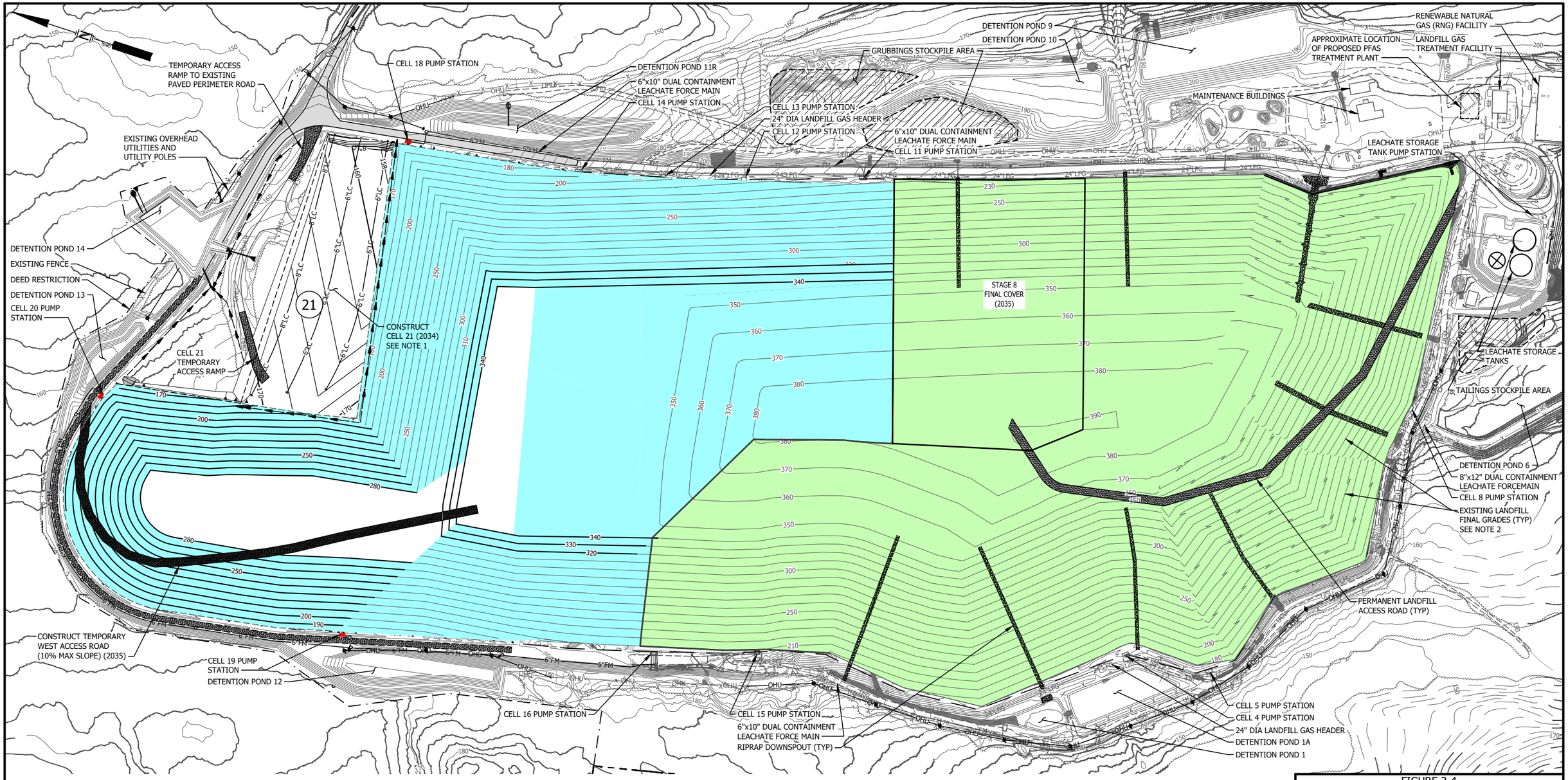

CAPACITY	2,350,000 CUBIC YARDS
OPEN CELL AREA	7.6 ACRES
OPEN SLOPE AREA	10.2 ACRES
INTERMEDIATE COVER	71.2 ACRES
FINAL COVER	84.0 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE COVER
- 21 — CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. GRADES SHOWN IN CELL REPRESENT CELL BASE GRADES PRIOR TO WASTE FILLING.
2. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-4
CELL 21 INITIAL CONDITIONS/
CELL 20 OPERATIONAL FILLING CONDITIONS
(2034-2035)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: C21-INITIAL-C20-OWG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

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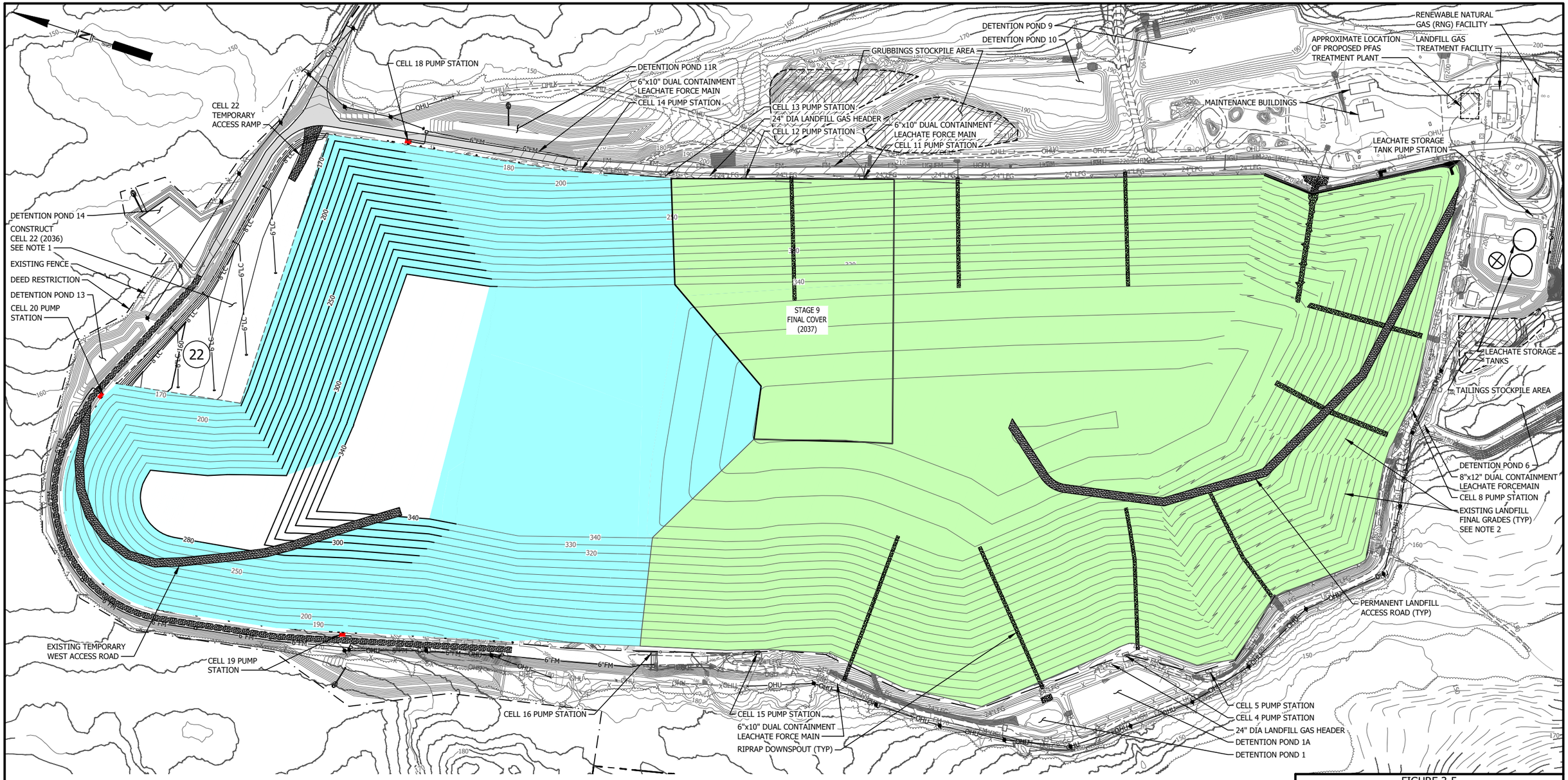

CAPACITY	1,760,000 CUBIC YARDS
OPEN CELL AREA	5.6 ACRES
OPEN SLOPE AREA	11.2 ACRES
INTERMEDIATE COVER	63.4 ACRES
FINAL COVER	98.4 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE COVER
- 22 — CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. GRADES SHOWN IN CELL REPRESENT CELL BASE GRADES PRIOR TO WASTE FILLING.
2. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-5
CELL 22 INITIAL CONDITIONS/
CELL 21 OPERATIONAL FILLING CONDITIONS
(2036-2037)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: C22-INITIAL-C21-OWG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/7/2025

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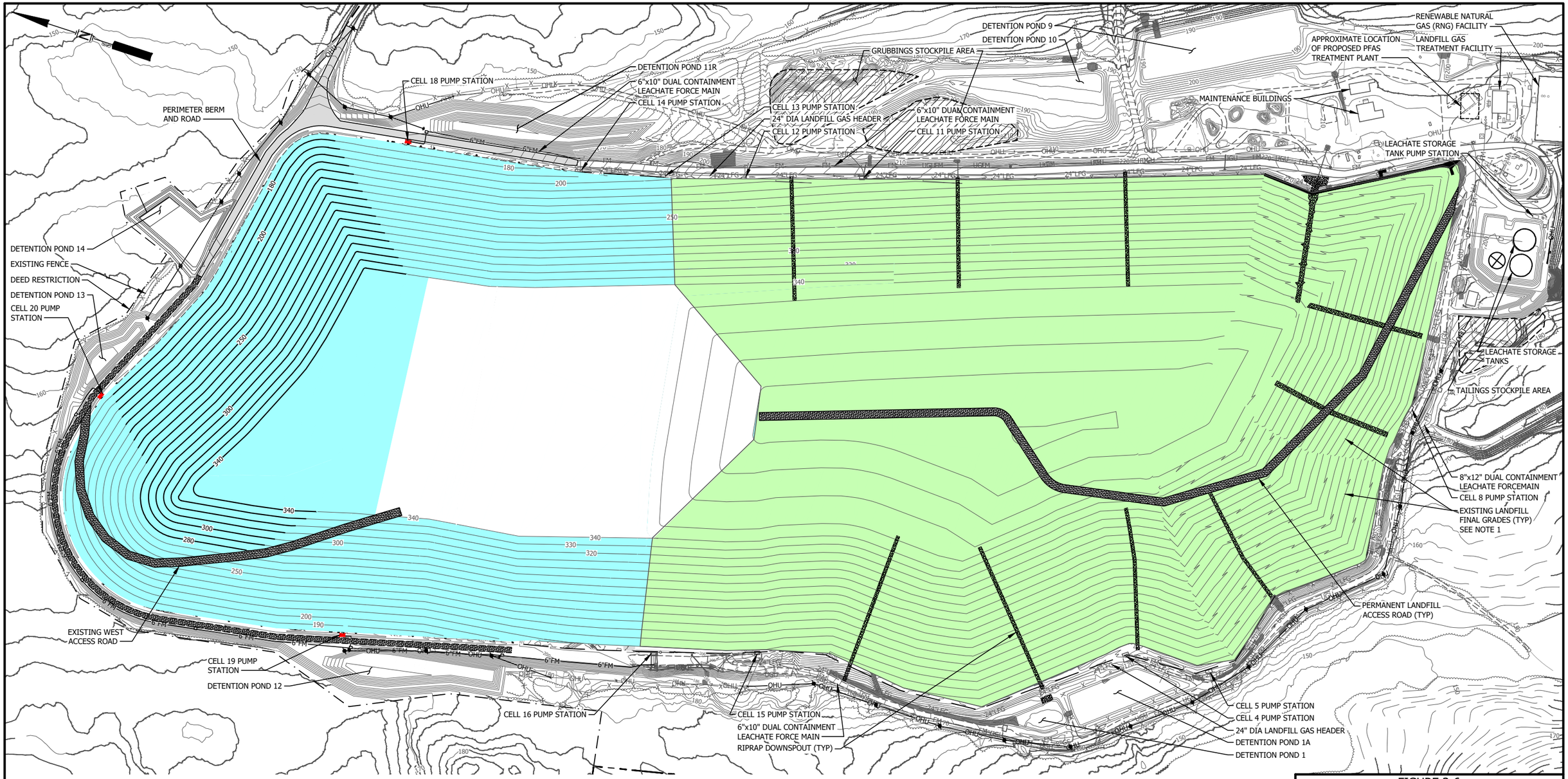

CAPACITY	1,000,000 CUBIC YARDS
OPEN CELL AREA	23.3 ACRES
INTERMEDIATE COVER	56.9 ACRES
FINAL COVER	98.4 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE COVER
- 18 — CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-6
CELL 22 OPERATIONAL FILLING CONDITIONS
(2038-2039)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: C22-OWG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

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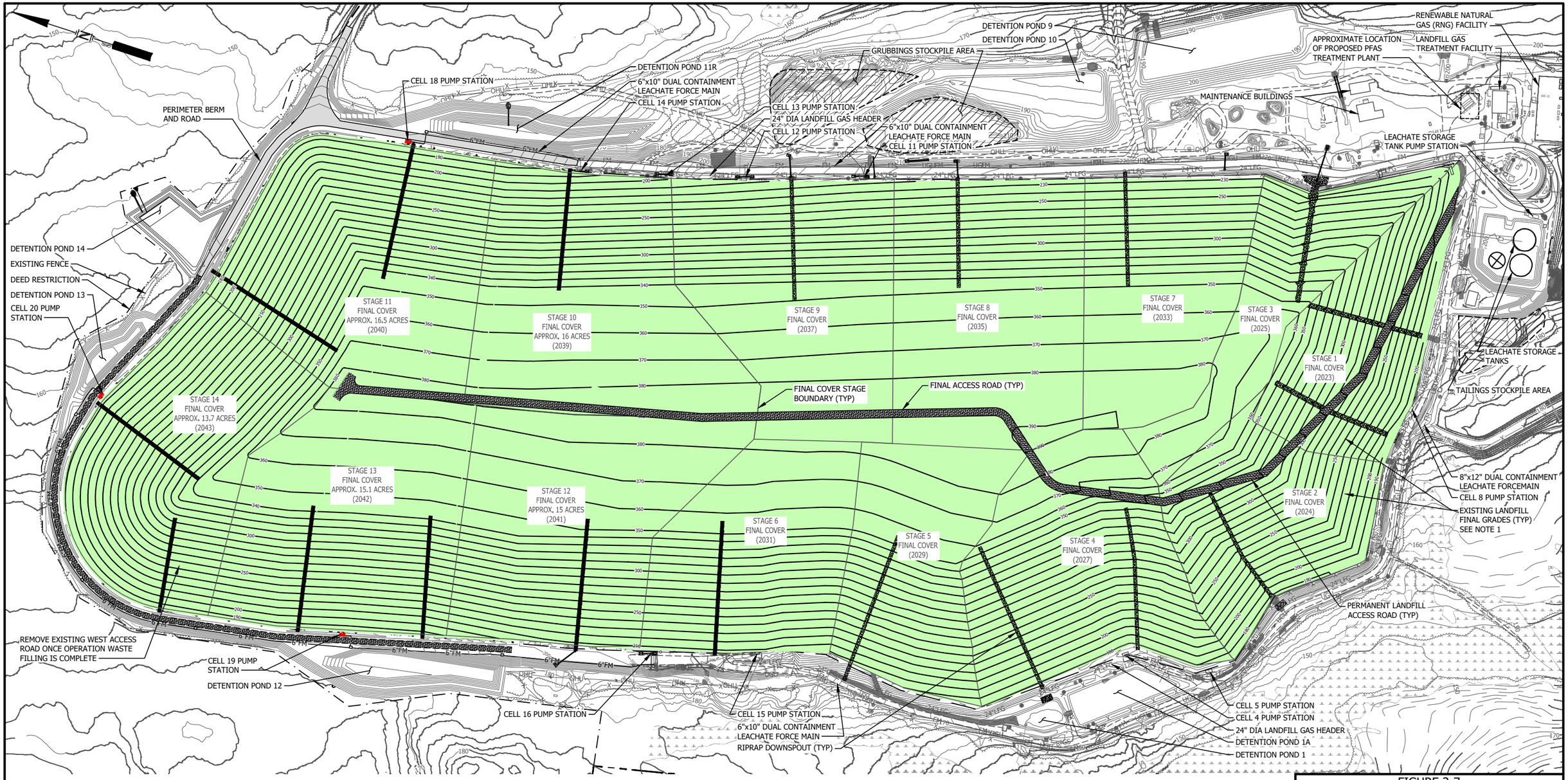

TOTAL EXPANSION CAPACITY	11,900,000 CUBIC YARDS
OPEN AREA	0 ACRES

NOTE: ALL AREAS ARE PLAN AREAS.

LEGEND

- AREAS OF FINAL COVER
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

DWG: CELL-DEV LMN: C18 TO C22-FINAL CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

FIGURE 3-7
CELLS 18 TO 22 OPERATIONAL WASTE GRADES
FINAL DEVELOPMENT CONDITIONS (2040-2043)
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

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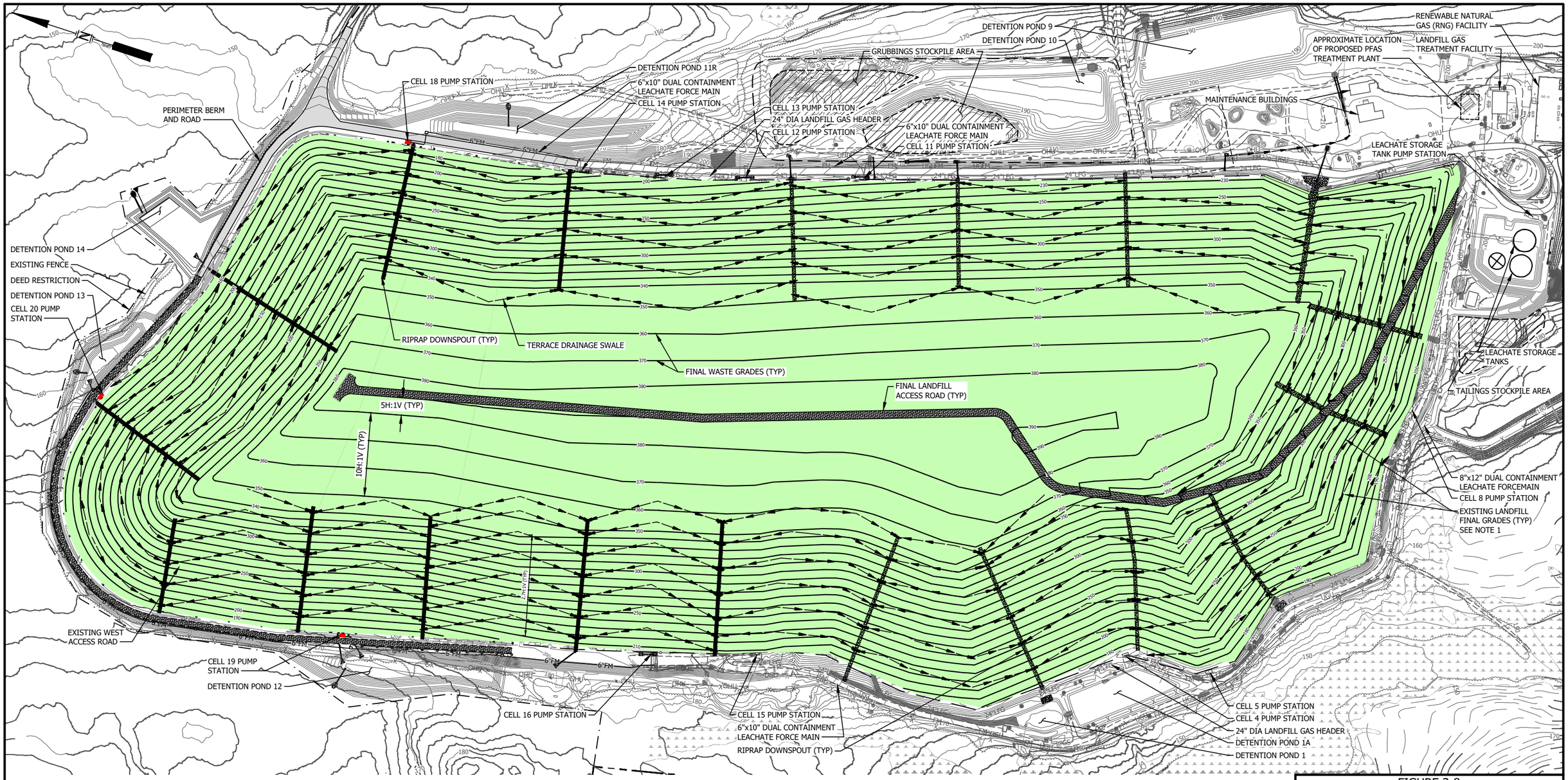

LEGEND

- AREAS OF FINAL COVER
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

FIGURE 3-8
PHASE II EXPANSION CELLS
FINAL DEVELOPMENT CONDITIONS
CELL DEVELOPMENT
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: CELL-DEV LMN: FINAL-DEV CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

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4.0 CONTAMINANT TRANSPORT ANALYSIS

This contaminant transport analysis provides an evaluation of the proposed Phase II Expansion for the Juniper Ridge Landfill (JRL) in Old Town, Maine and the adjacent area that could be affected during operation and after closure of the landfill, in the event of releases of landfill leachate to groundwater beyond the engineered leachate containment systems. This analysis has been completed in accordance with Section 401.2.G of the Maine Department of Environmental Protection (MEDEP) Maine Solid Waste Management Rules (MEDEP, 2015a).

This analysis assesses the potential for an unreasonable threat to identified potential sensitive receptors and to identify any operational or monitoring measures needed to ensure protection of the sensitive receptors (hereafter referred to as "receptors"). The potential for an unreasonable threat to a receptor is defined by the MEDEP "as an arrival time of less than six years from the landfill or less than three years from leachate storage structures and pump stations of a concentration of a pollutant which would result in contamination of that sensitive receptor" (MEDEP, 2015a). For this analysis, contamination of a sensitive receptor is taken to be the exceedance of a Maine Maximum Contaminant Level (MCL) for groundwater or the exceedance of a Maine Freshwater Criterion Continuous Concentration (MFCCC) for surface water.

The basis for the contaminant transport analysis includes substantial historical hydrogeologic investigations that are presented in detail in Volume II of the Application and historical JRL leachate quality monitoring. The following subsections and associated Appendices describe the methodology, leachate concentration assumptions, solute transport model input assumptions, potential leachate sources, potential receptors, transport model results, proposed monitoring locations to protect potential sensitive receptors, model sensitivity analysis, and conclusions.

4.1 Analysis and Modeling of Hypothetical Leakage

The analysis simulates the transport of leachate leakage travel through the landfill's underlying soil and/or bedrock until it reaches an identified potential receptor. Leakage is modeled first, assuming no engineered barriers exist (that is, no landfill liner at the base of the landfill) and, second, from the landfill liner at its design leakage rate. In this second case, the liner is present but is assumed to have some leakage which is a more realistic scenario than no liner at all. The absence of a liner beneath the entire landfill is unrealistic but is conceptually useful for examining potential groundwater flow paths away from the landfill to make sure all potential receptors are accounted for. Potential leakage from leachate storage tanks, pump stations and leachate pipelines are also examined. In addition to examining transport to potential sensitive receptors, transport to select monitoring wells was examined to evaluate their usefulness to detect leachate leakage from the landfill facility.

In order to evaluate assumed leakage through the underlying soils and/or bedrock, a groundwater solute transport model was used to simulate potential leachate concentrations in the groundwater from the assumed leaks. This equation was used to predict leachate analyte concentrations over time at each receptor. Because of the thorough characterization of groundwater flow paths at the Site and the relatively simple geometry of the hypothetical leak sources, an analytical solute transport equation was deemed reasonable and suitable. The selected groundwater solute transport equation readily accounts for leachate plume advection and dispersion, is relatively straight-forward to implement, is well documented, and is commonly used in such applications. A detailed discussion of the analytical model and input parameters is presented in Appendix J.

4.2 Selection of Leachate Concentrations

The contaminant at the potential contamination sources (e.g., landfill, leachate storage structures, and pump stations) is understood to be JRL leachate for the purpose of this analysis. Leachate from JRL is pumped to the on-site leachate storage tank. Samples of the JRL leachate are collected three times annually by SME from the leachate storage tank and chemically analyzed by a Maine certified laboratory for groundwater analytes specified in the JRL Environmental Monitoring Plan (EMP). During one of the rounds each year, the leachate samples are analyzed for a larger list of analytes listed in Appendix A of Chapter 405 of the Maine Solid Waste Management Rules (MEDEP, 2015b). JRL leachate samples associated with transport and the receiving wastewater treatment facilities are also collected quarterly by SME and chemically analyzed by a Maine certified laboratory.

To characterize potential groundwater contaminants, SME assessed all JRL leachate monitoring analytes with detections above their respective laboratory Practical Quantification Limits (PQLs) between 2020 and 2024 that are subject to an MCL and/or MFCCC. The JRL leachate quality data over this period is included in Appendix J.

Table 4-1 provides a summary of the ratios of maximum detected analyte concentrations (within the specified date range) to their respective MCLs and/or MFCCCs. Ratios of less than one indicates that the leachate concentration for that analyte is below the respective MCL or MFCCC criteria. The table shows that arsenic for groundwater and ammonia for surface water exceed their respective criteria by the greatest amount and are the most likely to be observed at a receptor. Accordingly, arsenic, for groundwater, and ammonia, for surface water, were assessed for the contaminant transport analyses at their respective maximum concentrations in the leachate quality data used for this assessment (see Appendix J). Although the analytical transport model uses a generic solute, the model results can be adjusted for a specific analyte, at any receptor, using the historical maximum concentrations given in Table 4-1. The time of travel to a receptor is essentially independent of any specific analyte because, as explained later, the model ignores chemical interactions that would decrease the analyte concentration as it moves through the soil and bedrock. It is important to note that the simulated analyte concentrations

at surface water receptors do not account for any dilution as groundwater enters the surface waters. This provides conservative results with respect to estimated surface water analyte concentration for comparison to MFCCCs.

TABLE 4-1

JRL LEACHATE SUMMARY
JANUARY 1, 2020 – DECEMBER 31, 2024

Analytes with MCLs					Analytes with MFCCCs			
Analyte	**Maximum Concentration Detected in 2020 Through 2024 (mg/L)**	**MCL (mg/L)**	**Concentration to MCL Ratio**		**Analyte**	**Maximum Concentration Detected in 2020 Through 2024 (mg/L)**	**MFCCC (mg/L)**	**Concentration to MFCCC Ratio**
Arsenic	0.53	0.01	53		Ammonia	880	1.4	629
Nitrate	260	10	26		Cyanide	0.73	0.0052	140
Antimony	0.059	0.006	9.8		Lead	0.051	0.00041	124
Thallium	0.01	0.002	5.0		Heptachlor Epoxide	0.00043	0.0000038	113
Cadmium	0.024	0.005	4.8		Cadmium	0.024	0.00022	109
Cyanide	0.73	0.2	3.7		Chloride	15,000	230	65
Lead	0.051	0.015	3.4		Endosulfan I	0.0023	0.000056	41
Chromium	0.31	0.1	3.1		Copper	0.082	0.00236	35
Methylene Chloride	0.015	0.005	0.3		Nickel	0.023	0.0134	17
Heptachlor Epoxide	0.00043	0.002	2.2		Selenium	0.085	0.005	17
Selenium	0.085	0.05	1.7		Aluminum	0.89	0.087	10
Benzene	0.0081	0.005	1.6		Iron	8.3	1	8.3
Vinyl Chloride	0.0022	0.002	1.1		Arsenic	0.53	0.15	3.5
Beryllium	0.0041	0.004	1.0		Zinc	0.054	0.0306	1.8
Barium	1.7	2	0.85		Mercury	0.0000774	0.00091	0.09
1,2-dichloroethane	0.0035	0.005	0.70		-	-	-	-
Toluene	0.078	1	0.08		-	-	-	-
Copper	0.082	1.3	0.06		-	-	-	-
Cis-1,2-dichloroethene	0.0033	0.07	0.05		-	-	-	-
Mercury	0.0000774	0.002	0.04		-	-	-	-
Trans-1,2-dichloroethene	0.0028	0.1	0.03		-	-	-	-
Ethylbenzene	0.013	0.7	0.02		-	-	-	-
1,4-dichlorobenzene	0.0012	0.075	0.02		-	-	-	-
Styrene	0.013	0.1	0.01		-	-	-	-

4.3 Potential Sensitive Receptors

Potential sensitive receptors surrounding the Phase II Expansion, as described in Section 6.0 in Volume II of this Application, are shown surrounding the Phase II Expansion solid waste boundary on Figure 4-1. These locations include the north property boundary (Receptor A), the start of a drainage feature that drains to Class B unnamed tributary to Judkins Brook east of the Phase II Expansion (Receptor B), the east property boundary (Receptor C), the west property boundary (Receptor D), the start of a drainage feature that drains to a Class B unnamed tributary to Pushaw Stream (Receptor E), the start of a drainage feature

that drains to Class B Judkins Brook (Receptor F), and the Class B unnamed tributary to Pushaw Stream (Receptor G). While Receptors B, D, E, and G are not Maine-classified waters (and, therefore, not receptors by definition), they are the approximate beginnings of drainage features that drain to Class B waters and were conservatively selected as direct influences on those Class B waters.

The contaminant transport analysis employs the principle that groundwater generally flows in a direction perpendicular to groundwater level equipotential contours, in a hydraulically downgradient direction. Based on the interpreted groundwater level equipotential contours shown on Figure 4-1, potential receptors at the nearest north and east property boundaries (i.e., Receptor A and Receptor C, respectively) can be eliminated from consideration of being influenced by the Phase II Expansion. Receptor A is located on the east side of a low-lying topographic ridgeline and groundwater at that location is not interpreted to be hydraulically downgradient from the Phase II Expansion. Groundwater at Receptor C is interpreted to be hydraulically downgradient of the previously permitted landfill boundary, not the currently proposed expansion. Receptor C was evaluated previously for the permitting of Cells 11 through 16 of the JRL (SME, 2015). Interpreted groundwater flow paths to Receptor A and Receptor C are shown on Figure 4-1. The leachate storage structures are located south of the Phase II Expansion and on the opposite side of the site. The potential receptor for the leachate storage structures, Receptor G, is the Class B unnamed tributary to Pushaw Stream located to the west of the permitted JRL. The interpreted groundwater flow paths to Receptors B, D, E, F, and G are described in the contaminant transport analyses results tables in Appendix J.

4.4 Potential Leachate Leakage Sources Used in the Transport Analyses

The locations of the Phase II Expansion solid waste boundary, the three proposed pump stations (i.e., the Cell 18 Pump Station, Cell 19 Pump Station, and Cell 20 Pump Station) along the perimeter of the Phase II Expansion, and the containment area for the existing and proposed leachate storage tanks at the south end of the JRL site are shown on Figure 4-1. These are the locations identified as potential leachate sources for the contaminant transport analysis. For the purpose of the transport analyses, all potential leachate releases are assumed to be continuous sources.

The lined Phase II Expansion area can be subdivided into two areas based on the groundwater flow divide located within the landfill expansion boundary (see Figure 4-1). Receptor B (described above in Section 4.3) is east of the groundwater flow divide and is evaluated based on leachate seepage into the till soils east of the groundwater flow divide (watershed area 40.2 acres). Potential Receptors D, E, and F are west of the groundwater flow divide and are evaluated based on the rate of leachate seepage into the till soils west of the groundwater flow divide (watershed area 16.4 acres).

Potential leachate from the three proposed pump stations along the perimeter of the Phase II Expansion are evaluated based on the leachate seepage into the till beneath the approximately 20-foot by 10-foot

base areas of the pump stations. Groundwater flows from the Cell 18 Pump Station and Cell 20 Pump Station toward Receptor B to the east. Groundwater flows from the Cell 19 Pump Station toward Receptors D, E, and F to the west.

Potential leakage from the leachate storage tank structures were evaluated based on the downward seepage of leachate into the till beneath the areas for the existing leachate storage tank and the proposed leachate storage tank. The area underlain by the tank's stone drainage layer, a geosynthetic clay liner, and compacted till, is approximately 55,580 square feet from the inside top edge of the containment berm.

The Phase II Expansion dual-containment leachate transport pipelines were also evaluated as potential leachate leakage sources. The dual-containment leachate transport pipelines are proposed to be constructed in 3-foot-wide trenches with clay dikes located every 150 feet within the trenches. The contaminant transport evaluation assumes that the two segments between the clay dikes of the dual-containment leachate transport pipes (i.e., 300 feet of pipeline) are leaking. Therefore, the evaluation for the trench is based on leachate seepage into the till along a 300-foot-long stretch of trench.

4.5 Contaminant Transport Analysis

Contaminant transport and travel times to potential receptors were based on groundwater flow paths between the Phase II Expansion solid waste boundary (and associated leachate transport and storage features) and the potential receptors. Due to the multiple variables that influence the time of travel of a contaminant in groundwater (e.g., distance, hydraulic gradient, soil type, and soil thickness), an assessment of groundwater travel times was also completed to identify areas within the Phase II Expansion that have a shorter travel time to a sensitive receptor despite having a greater horizontal distance (see Section 6.0 in Volume II of this Application). Travel times were evaluated based on 65-foot by 65-foot spaced nodes within the interior of the Phase II Expansion to identify these areas of shorter travel time to potential sensitive receptors. This approach helped to identify three areas within the Phase II Expansion where shallow bedrock (i.e., thin till) areas within the Phase II Expansion result in shorter travel times to sensitive receptors compared to from the Phase II Expansion boundary. Contaminant transport analyses were also completed within these three shallow bedrock areas (Areas 1, 2, and 3), which are identified on Figure 4-1. In such areas, as a safety factor, an additional one-foot thickness of imported soil (compacted clay) with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec over the till at proposed base grade elevations is added to increase the travel time. As described in Section 6.2 of Volume II of the Application, the calculated travel time through this imported soil layer is 3.8 years.

The MEDEP Maine Solid Waste Management Rules (MEDEP, 2015a) requires projection of the extent of quality of plumes and the concentrations of plumes and time of arrival at all identified sensitive receptors until steady-state is approached for the following Scenario A:

- Contaminant transport from the landfill, leachate storage structures, and pump stations assuming maximum operational leachate generation rates, quantities, and concentrations, and that no engineering barriers to contaminant transport exist. The purpose of this analysis is to verify that all potentially affected sensitive receptors of contaminants have been identified and to simulate concentrations over time of contaminants at identified sensitive receptors.

Using the contaminant transport simulation methodology described in this Section and Appendix J, contaminant transport simulations were completed for multiple Scenario A situations, or sub-scenarios. These sub-scenarios consist of 16 groundwater transport situations from the various potential contaminant sources to the various potential sensitive receptors. For each of these 16 sub-scenarios, calculations are provided for: (1) horizontal flow through till; and (2) vertical downward flow through glacial till and then horizontal flow through bedrock. Each scenario calculation is provided for both ammonia and arsenic to represent conservative estimates of MFCCC and MCL exceedances, respectively, at potential sensitive receptors (for the reasons discussed in Section 4.2). Descriptions of these contaminant transport scenarios are provided on Table J-1 in Appendix J.

The maximum operational leachate generation rate for the Phase II Expansion is based on the peak daily flow estimated from the HELP model analysis located in Appendix D, which is 28,650 gpd per acre. This value assumes 10 feet of waste during a 5.3-inch precipitation event and is based on the past 15 years of weather data. This assumes the waste is placed directly atop the till (i.e., no liner). However, based on the vertical hydraulic conductivity of the till, 9.07×10^{-4} ft/day, the maximum rate of downward vertical flow into the till is approximately 296 gpd per acre, which is significantly less than the HELP model results. This indicates that the natural till soils are incapable of transporting the amount of leachate estimated based on the HELP results. Under this hypothetical contaminant transport scenario, operational leachate generation for the Phase II Expansion in excess of the maximum rate of vertical flow into the till will be collected and pumped to the leachate storage tank, which is a standard operation procedure described in Volume IV of the Application.

All contaminant transport analyses completed for Scenario A assume leachate is infiltrating directly into the soil at the till's hydraulic capacity of 296 gpd/acre. Since the Phase II Expansion is positioned on two separate groundwater sheds (as discussed above), the east watershed received a total of approximately 11,877 gpd of leachate and the west watershed received approximately 4,855 gpd of leachate. Transport analyses were also completed for potential leaks from Phase II Expansion pump stations, the containment area for the leachate storage tanks, and from the Phase II Expansion dual-containment leachate transport pipes (see Figure 4-1 for locations). Analyses completed for contaminant transport from the Phase II Expansion pump stations assume leachate is infiltrating directly to the soil in the area beneath the pump stations (i.e., approximately 200 ft^2). This would result in approximately 1.36 gpd of leachate infiltrating into the till. Analyses completed for contaminant transport from the leachate storage tanks assume leachate is infiltrating directly to the soil in the area beneath the leachate storage tank containment area

of approximately 1.3 acres. This would result in approximately 377.1 gpd infiltrating the till soil. Analyses completed for contaminant transport from the Phase II Expansion dual-containment leachate transport pipelines assume leachate is infiltrating directly to the soil around a 300-foot-long segment of a 3-foot-wide trench (i.e., approximately 900 ft^2). This would result in approximately 6.11 gpd infiltrating into the till.

Results for the Scenario A contaminant transport simulations are presented in Table J-1 in Appendix J. These analyses all showed that arrival of a contaminant at concentrations exceeding an MCL for groundwater or MFCCC for surface water is greater than a six years from the Phase II Expansion and greater than three years from leachate storage structures and pump stations.

The MEDEP Maine Solid Waste Management Rules (MEDEP, 2015a) also requires projection of the extent of quality of plumes and the concentrations of plumes and time of arrival at all identified sensitive receptors until steady state is approached for the following Scenario B:

- Contaminant transport from the landfill and leachate storage structures using the design leakage rates and quantities. The analysis must include simulated concentration of contaminants at sensitive receptors and at the monitoring wells to assess the potential impact on ground and surface water quality in the event of discharge of pollutants outside engineered containment systems (MEDEP, 2015a).

Using the contaminant transport simulation methodology described in this Section and Appendix J, contaminant transport simulations were completed for multiple Scenario B situations, or sub-scenarios. These sub-scenarios consist of 17 groundwater transport situations from the various potential contaminant sources to the various potential sensitive receptors. As done for Scenario A calculations, for each of these 17 sub-scenarios, calculations are provided for: (1) horizontal flow through till; and (2) vertical downward flow through glacial till and then horizontal flow through bedrock. Each scenario calculation is provided for both ammonia and arsenic to represent conservative estimates of MFCCC and MCL exceedances, respectively, at potential sensitive receptors (for the reasons discussed in Section 4.2). Descriptions of these contaminant transport scenarios are provided on Table J-2 in Appendix J.

The liner's design leakage rate is estimated at 4.6 gpd per acre. This is significantly less that the maximum hydraulic capacity of the till used in Scenario A. This results in about 185 gpd leaking into the east groundwater shed beneath the landfill liner and approximately 75.5 gpd of leachate leaking into the west groundwater shed. In addition to the liner leakage, analyses were completed for the potential for leakage from the containment area for the leachate storage tanks.

Results for the Scenario B contaminant transport simulations are presented in Table J-2 in Appendix J. These analyses results all showed that arrival of a contaminant at concentrations exceeding an MCL for

groundwater or MFCCC for surface water is greater than a six years from the Phase II Expansion and greater than three years from leachate storage structures.

4.6 Proposed Phase II Expansion Monitoring Locations

Scenario B also includes analyte transport to existing and proposed monitoring wells to demonstrate that they are on the groundwater seepage pathways from the landfill. The Phase II Expansion groundwater monitoring locations proposed in the revised EMP in Volume IV of the Application are shown surrounding the proposed solid waste boundary on Figure 4-1. Well pairs are proposed at six new locations for the Phase II Expansion, which will be identified as OW-612A, OW-612B, OW-613A, OW-613B, OW-614A, OW-614B, OW-615A, OW-615B, OW-616A, OW-616B, OW-617A, and OW-617B. Each well pair will include a monitoring well screened in the till soil and a monitoring well screened in the upper bedrock. Existing piezometers P-04-12A and P-04-12B are proposed for monitoring bedrock and till groundwater, respectively, outside of the west perimeter of the Phase II Expansion. Existing open-borehole bedrock well PW-08-04 is proposed to be modified to an instrumented bedrock monitoring well (OW-08-04A), along with a new proximate monitoring well screened in the till (OW-08-04B). These wells will be used for monitoring the groundwater outside of the northwest perimeter of the Phase II Expansion. Existing monitoring wells MW-206 and P-206A, which are located south of the existing JRL on the ridge of the till drumlin and away from current and future JRL operations, will be considered background monitoring wells for both the existing JRL and the Phase II Expansion. Additional information on Phase II Expansion monitoring locations is included in Section 7.0 of Volume II of the Application and in the revised EMP in Volume IV of the Application. Existing wells within the Phase II Expansion solid waste boundary that will be abandoned are discussed in Section 7.1.3 of Volume II of the Application.

4.7 Sensitivity Analysis

A transport sensitivity analysis was completed for the scenario with the least groundwater travel time between a potential leachate source and a potential receptor. Scenario A – 4b (see Appendix J, Table J-3) has the shortest travel time to a receptor (i.e., the unnamed tributary to Class B Judkins Brook east of the Phase II Expansion). For this scenario, groundwater from a hypothetical leachate spill travels vertically downward through the till and then horizontally through bedrock to the receptor (see Figure 4-1). The model transport results for Scenario A – 4b estimate the arrival time of 11.6 years for an ammonia MFCCC exceedance at Receptor B and the arrival time of 14.8 years for an arsenic MCL exceedance at Receptor B.

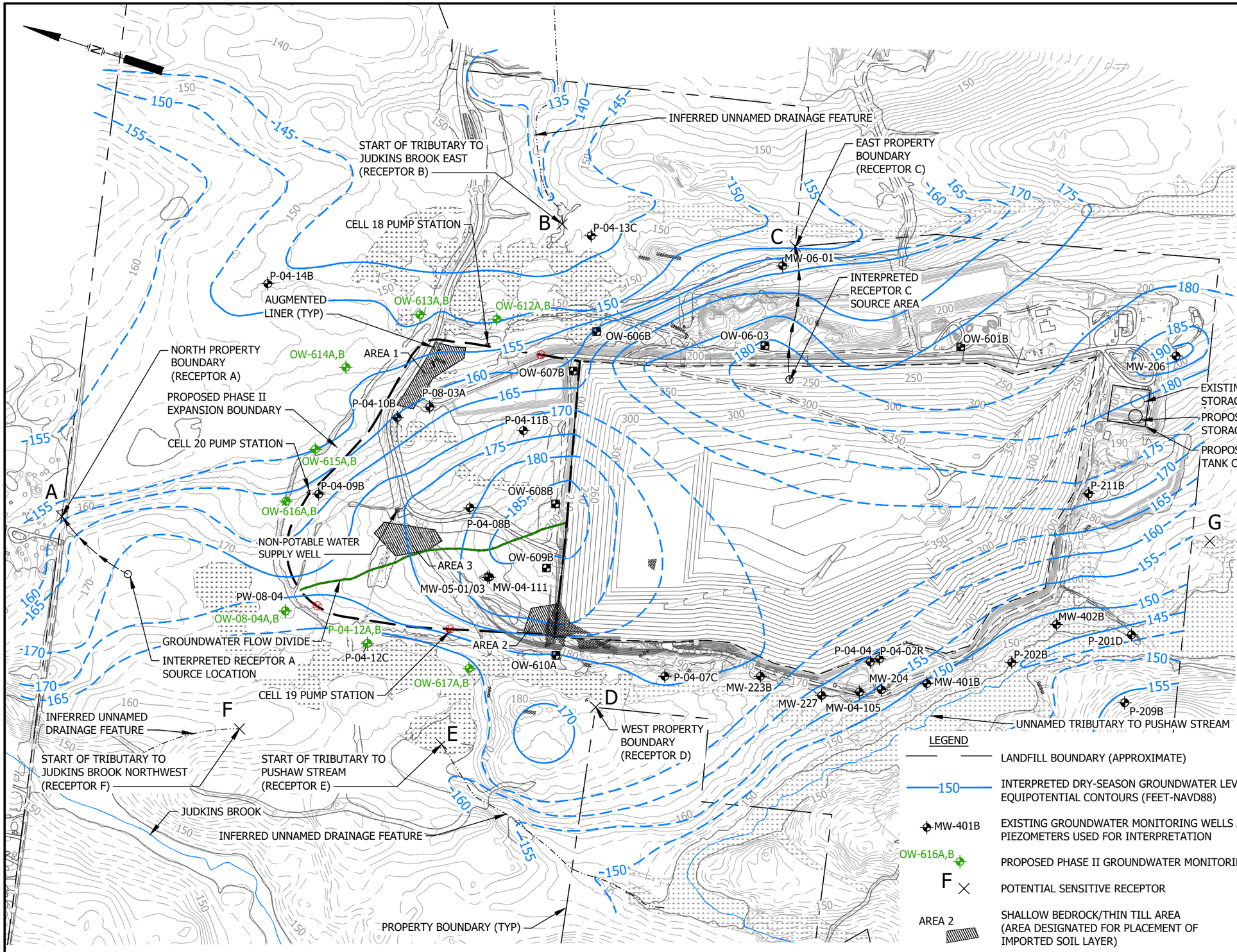
The sensitivity analysis includes 50 percent increase and decrease variations for five model input parameter values, which are shown in Table J-3 of Appendix J. The 50 percent variations for parameter values in the sensitivity analysis provides a quantification of uncertainty in the transport model results caused by the potential uncertainty of model input parameters. The sensitivity analysis results, shown in Table J-3, indicate that an uncertainty of a parameter value within 50 percent of the initially selected value

does not result in a change to the travel time conclusions (i.e., that all scenarios analyzed show that there will not be an arrival of an analyte concentration exceeding an MCL or MFCCC at a receptor within six years from the landfill or within three years from leachate storage structures and pump stations).

4.8 Conclusions

The contaminant transport analysis demonstrates that the Phase II Expansion complies with the requirements of Chapter 401.1.C.1.c and d and Chapter 401.2.G of the MEDEP Rules in the event of failure of engineered systems that contain leachate. The analyses presented herein support the conservative nature of the design of the Phase II Expansion and show that, even under hypothetical failure scenarios of leachate containment systems, sensitive receptors in the vicinity of the Expansion will not be unreasonably threatened. Considering the conservative nature of the design of the Phase II expansion, including the liner system (with leak detection), imported soil layer, underdrain monitoring and dual-containment of leachate transport pipes, combined with the proposed monitoring plan, the Phase II Expansion will not pose an unreasonable threat to sensitive receptors in the vicinity of the Site. The simulations demonstrate that the proposed monitoring locations and monitoring frequency (as described in the proposed EMP) will be sufficient to detect measurable changes in groundwater and surface water quality that may occur under potential failure scenarios. As demonstrated through extensive field investigations and analysis performed as part of the application process, the proposed landfill design combined with the natural setting sufficiently inhibits transport of leachate in the overburden groundwater system and underlying bedrock formation to receptors including on-site surface waters and off-site groundwater.

WELL IDENTIFICATION	GROUNDWATER LEVEL ELEVATION (FEET - NAVD88
	10/28/2024
MW-04-105	156.86
MW-04-111	184.76
MW-05-03	184.62
MW-06-01	163.82
MW-204	152.98
MW-206	193.87
MW-223B	166.77
MW-227	158.55
MW-401B	149.55
MW-402B	148.48
OW-06-03	180.53
OW-601B	176.25
OW-606B	161.78
OW-607B	160.77
OW-608B	189.97
OW-609B	184.14
OW-610A	169.84
P-04-02R	157.31
P-04-04	158.20
P-04-07C	171.41
P-04-08B	178.20
P-04-09B	162.21
P-04-10B	161.19
P-04-11B	<174.33
P-04-12C	163.29
P-04-13C	<142.78
P-04-14B	146.73
P-08-03B	<163.82
P-201D	144.20
P-202B	146.70
P-209B	155.81
P-211B	172.76



NOTES:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLIGSA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83.
2. WATER LEVEL ELEVATIONS AND INTERPRETED CONTOURS REPRESENT CONDITIONS RECORDED USING MANUAL WATER LEVEL MEASUREMENTS ON OCTOBER 28, 2024.
3. PIEZOMETERS P-209C, P-04-11B, P-04-13C, AND P-08-03B WERE DRY ON OCTOBER 28, 2024. PIEZOMETERS P-209B AND P-04-14B ARE NEAR SURFACE BEDROCK WELLS.

LEGEND

- LANDFILL BOUNDARY (APPROXIMATE)
- 150 — INTERPRETED DRY-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- MW-401B — EXISTING GROUNDWATER MONITORING WELLS AND PIEZOMETERS USED FOR INTERPRETATION
- OW-616A,B — PROPOSED PHASE II GROUNDWATER MONITORING WELL
- F — POTENTIAL SENSITIVE RECEPTOR
- AREA 2 — SHALLOW BEDROCK/THIN TILL AREA (AREA DESIGNATED FOR PLACEMENT OF IMPORTED SOIL LAYER)
- DUAL CONTAINMENT LEACHATE TRANSPORT PIPE SOURCE

FIGURE 4-1
CONTAMINANT TRANSPORT
GROUNDWATER ELEVATION MAP
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: GW LMN: GW-CONT CTB: SME-STD-HALF.CTB JOB#: 240102.05 REV: 8/6/2025

\\Server\cds\Casella\OldTownLandfillExpansion\Phase II Expansion\Acad\Figures\GW.dwg, B_FIG 4-1, 8/6/2025 9:46:06 AM, sjm

5.0 DESIGN DRAWINGS

Appendix A contains the plan, profile, and detail drawings that meet the requirements of Ch. 401.2.H. Drawings attached in Appendix A include the following:

- Cover Sheet;
- Symbols and Abbreviations;
- Anticipated Conditions Plan;
- Site Development Plan;
- Base Grading Plan;
- Underdrain Piping Plan;
- Leak Detection Piping Plan;
- Leachate Collection Piping Plan;
- Leachate Storage System Plan and Details;
- Gas Collection Piping Plan;
- Final Grades and Site Drainage Plan;
- Section Location Plan;
- Landfill Cross Sections; and
- Details of the Phase II Expansion's proposed engineered systems.

Other engineering drawings for the stormwater management/erosion control systems are attached to the Erosion Control and Stormwater Management Plans contained in Volume I of this Application.

Appendix K contains the plan, profile, and detail drawings for Cell 18 Construction. Drawings attached in Appendix K include the following:

- Cover Sheet;
- Symbols and Abbreviations;
- Existing Site Conditions Plan;
- Site Development Overview Plan;
- Base Grading Plan;
- Underdrain Piping Plan;

- Liner Layout Plan;
- Leak Detection Piping Plan;
- Leachate Collection Piping Plan;
- Cell 18 Access Plan;
- Force Main and Landfill Gas Piping Plan and Profile;
- Sections and Details; and
- Erosion Control Notes and Details.

6.0 QUALITY ASSURANCE PLAN

A QA/QC Plan was prepared for the Phase II Expansion to assure that the design specifications and performance requirements for all facility components are met during construction. The QA/QC Plan is included in Appendix B, and meets the requirements of Ch. 401.2.I and includes the following items:

- Construction Quality Assurance (CQA) measures to be implemented;
- Relationship between the QA/QC Plan, construction quality control, and the construction contract bid documents;
- Responsibility and authority of organizations and/or personnel involved in permitting, design, construction, and certification of construction of the landfill, including a construction problem resolution process that incorporates the roles and responsibilities of all parties, including owner, manufacturer, installer, designer, Quality Assurance (QA) personnel, contractor, and the MEDEP;
- Qualifications of the CQA personnel qualifications will meet the requirements of Ch. 401.3(B), including certification by Geosynthetic Institute's Construction Quality Assurance – Inspector's Certification Program (CQA-ICP);
- Inspections and tests to be performed to ensure that the construction and materials conform to contractual and regulatory requirements for each landfill component;
- Specifications regarding a leak location survey that will be completed on the primary geomembrane liner;
- Sampling activities, sample size, methods for determining sample locations, frequency of sampling, acceptance and rejection criteria, and methods for ensuring corrective measures are implemented;
- Recordkeeping and reporting requirements for CQA activities; and
- A list and description of all items requiring CQA certifications, including identification of the engineers responsible for the certifications.

7.0 CONSTRUCTION CONTRACT BID DOCUMENTS

Contract bid documents for the initial cell of the Phase II Expansion that will be constructed, Cell 18, will be submitted upon receipt of approval of this Application. Sample bid documents including technical specifications and a construction quality assurance manual are included in Appendices C and B, respectively. Prior to construction of any portion of the Phase II Expansion, detailed construction documents will be prepared, similar to those included in Appendix C and will include detailed engineering drawings, technical specifications, and QA/QC Plan. These documents will be prepared and submitted to the MEDEP for review and approval four months prior to the initiation of construction activities at the site, similar to what is currently required for approval of the Phase I Expansion cells. Included in Appendix F and K, respectively, are the geotechnical evaluation and design drawings for Cell 18, the first landfill cell to be constructed.

8.0 WATER QUALITY REPORT AND PROPOSED MONITORING PROGRAM

A water quality report and proposed monitoring program prepared for the Phase II Expansion are discussed and contained in Section 6.0 of Volume II and in Appendix I of Volume IV, respectively, of this application. These have been prepared in accordance with the requirements of Ch. 405.

9.0 OPERATIONS MANUAL

Volume IV of this Application consists of an Operations Manual prepared in accordance with Ch. 401.4.A.

10.0 LANDFILL CONSTRUCTION

During construction of the proposed Phase II Expansion, NEWSME will abide by the following regulatory requirements.

- Pre-Construction Conference. Prior to the construction of a cell or final closure cap at the Phase II Expansion, NEWSME will hold a pre-construction meeting with BGS, the contractor, NEWSME's engineer, and the MEDEP. The MEDEP will be given notice at least seven days prior to the pre-construction meeting.
- Quality Assurance/Quality Control Plan. A Quality Assurance/Quality Control Plan (QA/QC Plan) has been developed to monitor the quality of materials and procedures used in the Phase II Expansion construction. A copy of the plan is contained in Appendix B. The QA/QC Plan addresses personnel and procedures to be used during construction of the Phase II Expansion to monitor and document materials used to meet project specification. The QA/QC Plan identifies responsibilities of parties involved in the construction such as the owner, project manager, designer, geosynthetic manufacturer, and construction quality assurance personnel; the required construction documentation; and the QA/QC required for the material used in construction including soil components, geomembranes, geotextiles, drainage geocomposite, GCL, and piping. Specified material properties are contained in the project technical specifications in Appendix C.
- Liner Installation. Prior to installing any type of liner, NEWSME will evaluate the liner installation procedures and schedule relative to climatic conditions and other site factors such as base preparation, QA/QC Plan, and technical specifications to ensure the integrity of the installed liner system. HDPE geomembrane liners will only be installed between April 15 and November 1 and only when ambient temperatures exceed 32 degrees Fahrenheit. A cold weather installation plan will be prepared and submitted to the MEDEP for approval if liner installations are required during other times of the year.
- Changes From Approved Plans and Specifications. Prior to implementing any changes to the approved landfill design, leachate management systems, or project specifications, NEWSME will receive approval from the MEDEP through an amendment, minor revision, or change order approval. As provided in the Solid Waste Rules, the MEDEP will issue a response to the change order request within five working days or approval of the change order will be deemed automatically granted.
- Weekly Inspection Reports. NEWSME and NEWSME's consultants as well as the construction quality assurance team responsible for construction inspection at the site will keep daily and weekly construction inspection reports and provide copies of the reports to the MEDEP in a timely manner. Weekly reports will summarize daily reports and include: a summary of test results; a summary of submittals and actions taken; a summary of work progress; a list of upcoming work items for the next two weeks; punch list items as applicable; a summary of significant problems

encountered and how the problems were resolved; status of any change orders; and construction stability monitoring results, if applicable.

- Photographic Documentation. To provide photographic documentation, landfill construction photographs will be taken periodically. Copies of these photographs will be provided to the MEDEP upon request and will be contained in the final construction report.
- Record Drawings. Upon completion of landfill construction, record drawings will be prepared for the facility. Drawings will be sealed by a State of Maine Professional Engineer and will be submitted to the MEDEP within 45 days after the completion of the construction project.
- Final Construction Report and Commencement of Operations. Upon completion of each construction cell at the Phase II Expansion, NEWSME will submit a written request to the MEDEP to conduct an inspection of the completed construction activity for finding of compliance with the facility license. NEWSME will commence operations in the newly constructed areas of the Phase II Expansion upon MEDEP approval, or within ten working days after submitting the written request and after the MEDEP conducts or waives the need for a final construction inspection. Written certifications submitted to the MEDEP requesting inspection will be submitted as part of the final construction report. The final construction report will be prepared and submitted to the MEDEP within 45 days following completion of construction of each cell of the Phase II Expansion. A copy of the final construction report will be retained by NEWSME at their offices. The final construction report will provide written certification by the overseeing engineer that the project was completed in substantial compliance with approved plans and specifications. The report will include a summary of all testing data, a narrative describing the construction project, copies of representative photographs, and documentation of the project. The report will also include a tabulation of all problems encountered during construction and a description of how those problems were resolved, along with copies of the weekly inspection reports. Supporting documentation included in the final construction report will include laboratory test results, subgrade acceptance certification, manufacturer quality control certification, and quality assurance final reports for earthwork and geosynthetics.

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APPENDIX A

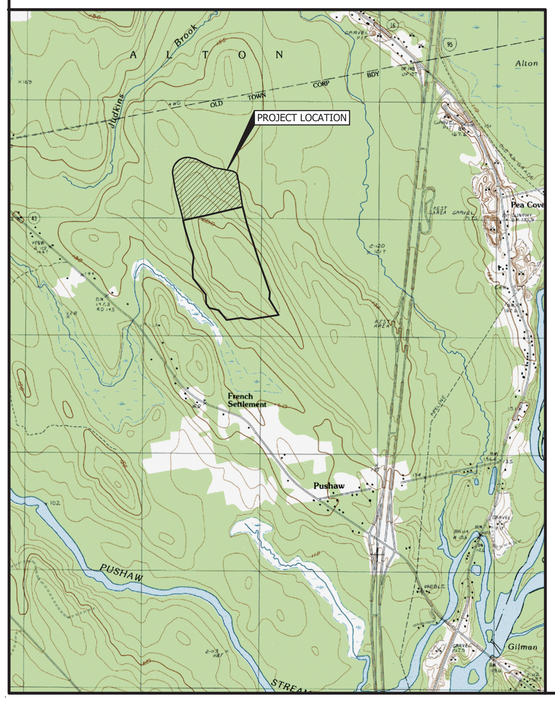
DESIGN DRAWINGS

SME
SEVEE & MAHER
ENGINEERS

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS, LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

TITLE	DWG NO
COVER SHEET	
SYMBOLS & ABBREVIATIONS	C-100
ANTICIPATED CONDITIONS PLAN	C-101
SITE DEVELOPMENT PLAN	C-102
BASE GRADING PLAN	C-103
UNDERDRAIN PLAN	C-104
LEAK DETECTION PIPING PLAN	C-105
LEACHATE COLLECTION PIPING PLAN	C-106
LEACHATE STORAGE SYSTEM PLAN AND DETAILS	C-107
GAS COLLECTION PIPING PLAN	C-108
FINAL GRADES AND SITE DRAINAGE PLAN	C-109
SECTION LOCATION PLAN	C-110
PROPOSED SECTIONS TRAVERSE	C-200
PROPOSED SECTIONS TRAVERSE	C-201
PROPOSED SECTIONS TRAVERSE	C-202
PROPOSED SECTIONS LONGITUDINAL	C-203
PROPOSED SECTIONS LONGITUDINAL	C-204
PROPOSED SECTIONS LONGITUDINAL	C-205
SECTIONS AND DETAILS	C-300
SECTIONS AND DETAILS	C-301
SECTIONS AND DETAILS	C-302
SECTIONS AND DETAILS	C-303
SECTIONS AND DETAILS	C-304
SECTIONS AND DETAILS	C-305
SECTIONS AND DETAILS	C-306
SECTIONS AND DETAILS	C-307
SECTIONS AND DETAILS	C-308
SECTIONS AND DETAILS	C-309
SECTIONS AND DETAILS	C-310
SECTIONS AND DETAILS	C-311

LOCATION MAP



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STATE OF MAINE
BRIAN D PIERCE
9601
11/1/2023
REGISTERED PROFESSIONAL ENGINEER

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SYMBOLS

EXISTING	PROPOSED		EXISTING	PROPOSED		EXISTING	PROPOSED	
		NORTH ARROW (GRID)			DRAINAGE COURSE (WITH DIRECTION)	G	G	UNDERGROUND GAS MAIN
DATE		NORTH ARROW (MAGNETIC)			EDGE OF WATER	UCC	UCC	UNDERGROUND COMMUNICATIONS LINE
25	25	CONTOUR LINES			STREAM	UGE	UGE	UNDERGROUND ELECTRICAL LINE
	INV 25.56	SPOT ELEVATION (INVERT ELEVATION)			WATER ELEVATION (GROUND OR SURFACE)	OHE	OHE	OVERHEAD ELECTRICAL LINE
		SURVEY BASELINE WITH TRIANGULATION OR INTERSECTION POINT			FENCE LINE (STOCKADE)	OT	OT	OVERHEAD TELEPHONE LINE
		PROPERTY LINE OR RIGHT-OF-WAY	X X	X X	FENCE LINE (METAL/CHAIN LINK)	SS	SS	SANITARY SEWER
		DEED RESTRICTION BOUNDARY			STONE WALL	FM	FM	FORCE MAIN
N35°-10'-10"W 251.17'	N35°-10'-10"W 251.17'	PROPERTY LINE W/ BEARING AND DISTANCE			RETAINING WALL	W	W	WATER MAIN
1	20	CELL DESIGNATION			GUARD RAIL	SD	SD	STORM DRAIN
		BOUNDARY LINE (State, County, Municipality)			BUILDING AND STRUCTURES	UD	UD	UNDERDRAIN
⊡	■	SURVEY MONUMENT		2 1 OR 2:1	SLOPE RATIO (HORIZONTAL TO VERTICAL)	LFG	LFG	LANDFILL GAS
		SURVEY CONTROL	TOP OF SLOPE	TOP OF SLOPE	SLOPES (WITH SLOPE RATIO)	LT	LT	LEACHATE TRANSPORT
○	●	PROPERTY PIN, DRILL HOLE, PK, OR STAKE			EDGE OF PAVEMENT	LC	LC	LEACHATE COLLECTION
		WOODS OR BRUSH LINE			EDGE OF GRAVEL	LD	LD	LEAK DETECTION
		INDIVIDUAL TREE			CONCRETE	GC	GC	GAS COLLECTION
		WETLAND DELINEATED	B-12 MW-12 P-12	B-12 MW-12 P-12	TEST BORING, MONITORING WELL, OR PIEZOMETER AND NUMBER	GT	GT	GAS TRANSPORT
		WETLAND PHOTO INTERPRETED	TP-12	TP-12	TEST PIT AND NUMBER	▷	▶	REDUCER
		WETLAND TO BE IMPACTED	SW-12	SW-12	SURFACE WATER SAMPLE LOCATION			MECHANICAL CAP OR PLUG
		WETLAND OF SPECIAL SIGNIFICANCE (WOSS)			GAS EXTRACTION WELL			COUPLING
		WOSS SETBACK (25-FOOT)	C	C	GAS CONDENSATE TRAP			BEND
		WOSS SETBACK (75-FOOT)	KO	KO	LFG KNOCKOUT			TEE
	●	VERNAL POOL			GAS WELL HEAD			PIPE TO BE ABANDONED
		VERNAL POOL SETBACK			GAS VENT CAPPED			RISER PIPE & INLET GRATE
		NRPA STREAM		⊘	CLEANOUT STRUCTURE			STORM GRATE
		BEDROCK OUTCROP		●	MANHOLE			DRAINAGE INLET STRUCTURE
	♦	SAMPLE SUMP			CATCH BASIN		■	UNDERDRAIN SUMP
		SLOPE INCLINOMETER			CULVERT		LF	LITTER FENCE
		VIBRATING WIRE SETTLEMENT CELL			RIPRAP		SF	SILTATION FENCE
		VERTICAL/HORIZONTAL DISPLACEMENT MONUMENT			WATER OR GAS VALVE		LOW	LIMIT OF WORK LINE
		VERTICAL DISPLACEMENT MONUMENT			HYDRANT		CLL	CLEARING LIMIT LINE
				W	WELL (MAROOKA SUPPLY WELL)			100-YEAR FLOODPLAIN
					AIR RELEASE VALVE			WETLAND
				E	ELECTRICAL MANHOLE (EMH)			WETLAND OF SPECIAL SIGNIFICANCE (WOSS)
					UTILITY POLE			
					LIGHT POLE			

GENERAL NOTES

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC., NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLIGSA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC, CUMBERLAND, MAINE.

   SITE CONTROL POINTS INFORMATION:

POINT #	NORTHING	EASTING	ELEVATION (FT)	DESCRIPTION
1000	478242.06	925376.38	167.99	WET WELL-PLUG
1001	477837.90	925672.66	160.12	MH13-PK
1002	479259.38	925158.27	185.65	LEDGE-PK
1003	479589.83	925157.64	205.01	MH30-PK
1004	479820.27	925097.15	205.01	MH33-PK
1006	478246.50	925365.28	167.62	VALVE PIT-PK
1007	477451.45	926203.11	165.62	MH14-PK
1010	480071.86	926904.09	206.29	MH26-PK
1011	479669.08	927037.61	215.20	MH25-PK
1012	478065.49	927548.96	216.94	MH22-PK
1013	477534.13	927485.35	203.30	MH19-PK
1014	480638.39	926747.66	185.91	MH27-PK

2. LOCATIONS OF EXISTING UNDERGROUND UTILITIES INCLUDING ELECTRICAL AND PIPING BASED ON FIELD SURVEY DURING CONSTRUCTION OF CELLS 1 THROUGH 16, FORMER LEACHATE POND AND LANDFILL GAS HEADER AND FLARE RE-LOCATIONS.

3. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, AND 2015, AND BRI ENVIRONMENTAL IN 2024.

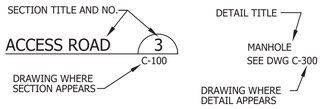
4. GRADES SHOWN WITHIN THE PERMITTED SOLID WASTE BOUNDARY REPRESENT ANTICIPATED GRADING AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.

5. LIMIT OF INTERMEDIATE GEOMEMBRANE COVER AND FINAL COVER SHOWN REPRESENTS ANTICIPATED SITE CONDITIONS AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.

TYPICAL ABBREVIATIONS:

ACCMP	ASPHALT COATED CMP
ACP	ASBESTOS CEMENT PIPE
AC	ACRE
AGG	AGGREGATE
ALUM	ALUMINUM
APPD	APPROVED
APPROX	APPROXIMATE
ARMH	AIR RELEASE MANHOLE
ASB	ASBESTOS
ASP	ASPHALT
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AZ	AZIMUTH
BCCMP	BITUMINOUS COATED CMP
BM	BENCH MARK
BIT	BITUMINOUS
BLDG	BUILDING
BOT	BOTTOM
BRG	BEARING
BV	BALL VALVE
CB	CATCH BASIN
CEN	CENTER
CEM LIN	CEMENT LINED
CMP	CORRUGATED METAL PIPE
CO	CLEAN OUT
CF	CUBIC FEET
CFS	CUBIC FEET PER SECOND
CI	CAST IRON
CL	CLASS
CONC	CONCRETE
CONST	CONSTRUCTION
CONTR	CONTRACTOR
CS	CURB STOP
CTR	CENTER
CU	COPPER
CY	CUBIC YARD
D	DEGREE OF CURVE
DBL	DOUBLE
DEG OR °	DEGREE
DEPT	DEPARTMENT
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DIST	DISTANCE
DN	DOWN
DR	DRAIN
DWG	DRAWING
EA	EACH
EG	EXISTING GROUND OR GRADE
ELEC	ELECTRIC
EL	ELEVATION
ELB	ELBOW
EOP	EDGE OF PAVEMENT
EQUIP	EQUIPMENT
EST	ESTIMATED
EXC	EXCAVATE
EXIST	EXISTING
FI	FIELD INLET
FG	FINISH GRADE
FBRGL	FIBERGLASS
FDN	FOUNDATION
FLEX	FLEXIBLE
FLG	FLANGE
FLR	FLOOR
FPS	FEET PER SECOND
FT OR '	FEET
FTG	FOOTING
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GPD	GALLONS PER DAY
GPM	GALLONS PER MINUTE
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
HP	HORSEPOWER
HYD	HYDRANT
ID	INSIDE DIAMETER
IN OR "	INCHES
INV	INVERT
INV EL	INVERT ELEVATION
LB	POUND
LC	LEACHATE COLLECTION
LD	LEAK DETECTION
LF	LINEAR FEET
LOC	LOCATION
LOW	LIMIT OF WORK
LT	LEACHATE TRANSPORT
MH	MANHOLE
MJ	MECHANICAL JOINT
MATL	MATERIAL
MAX	MAXIMUM
MFR	MANUFACTURE
MIN	MINIMUM
MISC	MISCELLANEOUS
MON	MONUMENT
NITC	NOT IN THIS CONTRACT
NTS	NOT TO SCALE
N/F	NOW OR FORMERLY
NO OR #	NUMBER
OC	ON CENTER
OD	OUTSIDE DIAMETER
PC	POINT OF CURVE
PD	PERIMETER DRAIN
PI	POINT OF INTERSECTION
PIV	POST INDICATOR VALVE
PT	POINT OF TANGENT
PERF	PERFORATED
PP	POWER POLE
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
QTY	QUANTITY
RCP	REINFORCED CONCRETE PIPE
ROW	RIGHT OF WAY
RAD	RADIUS
REQD	REQUIRED
RT	RIGHT
RTE	ROUTE
S	SLOPE
SCH	SCHEDULE
SF	SQUARE FEET
SFC	SLIPFORM CONCRETE CURB
SHT	SHEET
SMH	SANITARY MANHOLE
ST	STREET
STA	STATION
SY	SQUARE YARD
TAN	TANGENT
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPORARY
TYP	TYPICAL
UD	UNDERDRAIN
V	VOLTS
VA TEE	VALVE ANCHORING TEE
VERT	VERTICAL
VGC	VERTICAL GRANITE CURB
WG	WATER GATE
W/	WITH
W/O	WITHOUT
YD	YARD

VIEW MARKERS & IDENTIFICATION



REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE — BRIAN D. PERRY — 9600 — 11/11/2025 — REGISTERED PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SYMBOLS & ABBREVIATIONS

SME SEVEE & MAHER ENGINEERS
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DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 240101 DWG FILE SYMSHT

C-100

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NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. GRADES SHOWN WITHIN THE PERMITTED SOLID WASTE BOUNDARY REPRESENT ANTICIPATED GRADES AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.
5. SPECIAL FLOOD HAZARD ZONE A IS 100-YEAR FLOOD ZONE WITHOUT BASE FLOOD ELEVATION (BFE) PER MAP PANEL 23019C1926D, EFFECTIVE DATE 7/19/2023.

SITE CONTROL POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION (FT)	DESCRIPTION
1000	478242.06	925376.38	167.99	WET WELL-PLUG
1001	477837.90	925672.66	160.12	MH13-PK
1002	479259.38	925158.27	185.65	LEDGE-PK
1003	479589.83	925157.64	205.01	MH30-PK
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1007	477451.45	926203.11	165.62	MH14-PK
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1012	478065.49	927548.96	216.94	MH22-PK
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REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
9600
LICENSED PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

ANTICIPATED CONDITIONS PLAN

SME
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DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	EXCN
CTB:	SME-STD.CTB
JOB NO.	240101.00
DWG FILE	BASE
	C-101

N:\Projects\Casella\Old Town Landfill\Expansion\Phase II Expansion\Acad\Plans\BASE.dwg C-101 11/10/2025 11:42:03 AM, sjm

EXISTING SCALE HOUSE INFRASTRUCTURE AREA
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
BEDROCK OUTCROP (TYP)
SITE CONTROL POINT (TYP) SEE TABLE THIS DWG AND SEE NOTE 1 ON DWG C-100
LFG KNOCKOUT STRUCTURE (TYP)
END OF EXISTING LEACHATE FORCE MAIN
DETENTION POND 11R
PROPOSED SOLID WASTE LIMIT (TYP)
26'-WIDE PAVED ACCESS ROAD (TYP)
EXISTING OVERHEAD ELECTRIC LINE (TYP)
PERMITTED TILL BORROW PIT
PERMITTED WOOD WASTE HANDLING AREA
PROPOSED WOOD STORAGE LOT
SUBSURFACE WASTEWATER DISPOSAL FIELD
APPROXIMATE LOCATION OF PROPOSED PFAS TREATMENT PLANT
PROPERTY LINE (TYP)
VERNAL POOL (TYP)
GRAVEL UTILITY ACCESS ROADS (TYP)
OW-613A,B
OW-612A,B
LIMIT OF BRI WETLANDS DELINEATION (TYP) SEE NOTE 2
CELL 12 PUMP STATION
PRIMARY ACCESS ROAD (TYP)
DETENTION POND 10
DETENTION POND 9
MAINTENANCE BUILDINGS
RNG TREATMENT FACILITY POND
LFG TREATMENT FACILITY
WOOD STORAGE FACILITY 2 ACRE
WATER SUPPLY WELL
CELL 14 PUMP STATION
CELL 13 PUMP STATION
FORCE MAIN VAULT (TYP)
CATCH BASIN AND CULVERT (TYP)
1 ACRE
RENEWABLE NATURAL GAS (RNG) FACILITY
LFG FLARE LOCATION
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
DETENTION POND 14
OW-614A,B
#1010
#1011
#1012
CELL 11 PUMP STATION
RIPRAP DITCH (TYP)
RIPRAP CB INLET
LEACHATE STORAGE TANK PUMP STATION
LEACHATE STORAGE TANK 1
PROPOSED LEACHATE STORAGE TANK 2
REMOVE AND RELOCATE EXISTING FENCE
DETENTION POND 11
EXISTING DETENTION POND INFRASTRUCTURE TO BE REMOVED
CELL 18 PUMP STATION
EXISTING PAVED ACCESS ROAD TO BE REMOVED
#1013
PROPOSED LEACHATE STORAGE TANK 3
PROPOSED GUARDRAIL (TYP)
OW-615A,B
STAGE 3 FINAL COVER
24" LFG HEADER (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
EXISTING PAVED ACCESS ROAD TO BE REMOVED
PROPOSED LANDFILL BASE GRADES (TYP) SEE NOTE 4
PROPOSED CELL LIMITS (TYP)
100-YEAR FLOOD ZONE SPECIAL FLOOD HAZARD AREA (TYP) SEE NOTE 6
OW-616A,B
DETENTION POND 13
CELL 20 PUMP STATION
LIMIT OF PHASE I EXPANSION LINER (TYP)
STAGE 1 FINAL COVER
UTILITY MANHOLE (TYP)
DETENTION POND 6
CELL 8 PUMP STATION
EXISTING CELLS LINER LIMIT (TYP)
(2) 24" HDPE CULVERTS
PERMANENT LANDFILL ACCESS ROAD
FENCE (TYP)
EXISTING OVERHEAD UTILITIES TO BE REMOVED
STAGE 2 FINAL COVER
8"x12" LEACHATE FORCEMAIN
PROPERTY LINE (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
OW-08-04A,B
DEED RESTRICTION (TYP)
#1007
ELECTRICAL MANHOLE (TYP)
DETENTION POND 2
UNDERGROUND ELECTRIC (TYP)
P-04-12A,B
CELL 19 PUMP STATION
CELL 16 PUMP STATION
EXISTING EMH (TYP)
#1004
#1003
#1002
#1001
#1000
#1006
DETENTION POND 1A
LFG KNOCKOUT STRUCTURE AND VALVES
CELL 5 PUMP STATION
CELL 4 PUMP STATION
OW-617A,B
REMOVE AND RELOCATE EXISTING FENCE
PROPOSED FENCE (TYP)
DETENTION POND 12
CELL 17 BASE GRADES (SEE NOTE 5)
25-FOOT STREAM SETBACK
EXISTING FORCEMAIN VAULT (TYP)
CELL 15 PUMP STATION
RIPRAP DITCH (TYP)
EXISTING 24" DIA LANDFILL GAS PIPE
8" GRAVITY SEWER IS ABANDONED
WATER LOADING RACK
DETENTION POND 1

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. BASE GRADES REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.
5. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.
6. SPECIAL FLOOD HAZARD ZONE A IS ZONE WITHOUT BASE FLOOD ELEVATION (BFE) PER MAP PANEL 23019C1926D, EFFECTIVE DATE 7/19/2023.

100 0 200 400 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
9601
LICENSED
PROFESSIONAL ENGINEER
11/17/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SITE DEVELOPMENT PLAN

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	SITE-DEV
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-102

N:\Server\Projects\2024\Juniper Ridge\Engineering\Phase II Expansion\Autocad\Plans\BASE.dwg, C-102, 11/17/2025 11:42:21 AM, sjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. BASE GRADES REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.
5. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.

100-YEAR FLOOD ZONE
SPECIAL FLOOD
HAZARD AREA (TYP)
SEE NOTE 6 ON DWG C-101

GRAVEL UTILITY
ACCESS ROADS (TYP)

VERNAL POOL (TYP)

PROPOSED
FENCE (TYP)

DETENTION
POND 14

PROPOSED SOLID
WASTE LIMIT (TYP)

26'-WIDE PAVED
ACCESS ROAD (TYP)

END OF EXISTING
LEACHATE FORCE MAIN

DETENTION
POND 11R

250' SIGNIFICANT VERNAL POOL
CRITICAL TERRESTRIAL HABITAT

LFG KNOCKOUT
STRUCTURE (TYP)

EXISTING OVERHEAD
ELECTRIC LINE (TYP)

CELL 12 PUMP STATION

PRIMARY ACCESS ROAD (TYP)

CELL 11 PUMP STATION

CELL 13 PUMP STATION

CELL 14 PUMP STATION

EXISTING CATCH
BASIN AND CULVERT
TO BE REMOVED

LIMIT OF
AUGMENTED
LINER (TYP)

PROPOSED
GUARDRAIL (TYP)

250' SIGNIFICANT VERNAL POOL
CRITICAL TERRESTRIAL HABITAT

DETENTION
POND 13

C-300

PROPOSED LANDFILL
BASE GRADES (TYP)
SEE NOTE 4

PROPOSED CELL
LIMITS (TYP)

LIMIT OF PHASE I
EXPANSION LINER (TYP)

ANTICIPATED OPERATIONAL
WASTE GRADES (TYP)
SEE NOTE 4 ON DWG C-101

FENCE (TYP)

20'-WIDE GRAVEL
ACCESS ROAD (TYP)

DEED RESTRICTION (TYP)

LEAVE 12" OF NATIVE
SOIL IN PLACE ABOVE
BASE GRADE (TYP)
SEE NOTE 4

DETENTION
POND 12

25-FOOT STREAM SETBACK

CELL 17 BASE GRADES (TYP)
SEE NOTE 5

EXISTING
EMH (TYP)

EXISTING FORCEMAIN
VAULT (TYP)

CELL 16 PUMP
STATION

CELL 15 PUMP STATION

60 0 120 240 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN
PIERCE
9608
11/11/2025
LICENSED
PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

BASE GRADING PLAN

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/2025
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LMN:	BASEGRADE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-103

\\Server\cfs\Cwells\Old\Twin Law\MEExpansion\Phase II Expansion\Acad\Plans\BASE.dwg, C-103, 11/10/2025 11:42:47 AM, sjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. BASE GRADES REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.
5. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.

VERNAL POOL (TYP)
LEVEL SPREADER DP-14 SEE DWG C-309
PLUNGE POOL SEE DWG C-309
POND UNDERDRAIN SEE DWG C-309
DETENTION POND 14
CELL 22 UD PIPE 4" INV 156.5 (TEE) 4" INV 155.0 (OUTLET) (UD DISCHARGE TO 4' DIA OPEN BASIN)
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
DETENTION POND 13
POND UNDERDRAIN SEE DWG C-309
PIPE DAM (TYP) SEE DWG C-306
FENCE (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
DEED RESTRICTION (TYP)
GRAVEL UTILITY ACCESS ROADS (TYP)
PROPOSED SOLID WASTE LIMIT (TYP)
4-INCH UD DISCHARGE PIPE INV 152.7
4-INCH UD DISCHARGE PIPE S=0.005 '/'
26'-WIDE PAVED ACCESS ROAD (TYP)
PLUNGE POOL SEE DWG C-309
LEVEL SPREADER DP-11R SEE DWG C-308
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
4" DIA INV 162.0
LFG KNOCKOUT STRUCTURE (TYP)
DETENTION POND 11R
4-INCH UD DISCHARGE PIPE INV 153.5
4" DIA SDR 17 HDPE SOLID PIPE
EXISTING CELL 14 UNDERDRAIN OUTLET TO BE RELOCATED TO DAYLIGHT (OUTLET) IN DETNTION POND 11R INV 167.0 (EXISTING)
EXISTING 4" DIA UNDERDRAIN PIPING (TYP)
PROPOSED CELL LIMITS (TYP)
LIMIT OF UNDERDRAIN AREA (TYP)
PROPOSED LANDFILL BASE GRADES (TYP) SEE NOTE 4
END CAP (TYP)
CELL DIVIDER BERM (TYP)
LIMIT OF PHASE I EXPANSION LINER (TYP)
INTERMEDIATE BERM BASE LINER CONNECTION (TYP) SEE DWG C-303
4" DIA SDR 17 HDPE PERFORATED PIPE (TYP)
UNDERDRAIN PIPING (TYP) SEE DWG C-300
CELL 19 UD PIPE 4" INV 167.0 (CROSS) 4" INV 166.0 (OUTLET) (UD DISCHARGE DAYLIGHT)
DETENTION POND 12
POND UNDERDRAIN SEE DWG C-309
EXISTING OVERHEAD ELECTRIC LINE (TYP)
POND UNDERDRAIN SEE DWG C-309
CELL 13 PUMP STATION
CELL 14 PUMP STATION
CELL 12 PUMP STATION PRIMARY ACCESS ROAD (TYP)
CELL 17 BASE GRADE SEE NOTE 5
CELL 16 PUMP STATION
EXISTING EMH (TYP)
EXISTING FORCEMAIN VAULT (TYP)
C-300
C-301

60 0 120 240 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PERRY
9601
11/11/2025
LICENSED PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

UNDERDRAIN PLAN

SME
SEVEE & MAHER ENGINEERS
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Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	UNDERDRAIN
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-104

\\Server\vol\Data\Jobs\240\Civil\Landfill\Expansion\Phase II Expansion\Used Plans\BASE.dwg, C-104, 11/12/2025 3:22:59 PM, sjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
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3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
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5. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.

60 0 120 240 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PERRY
9601
PROFESSIONAL ENGINEER
11/7/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LEAK DETECTION PIPING PLAN

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
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Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LD-PIPE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-105

\\Server\dk\Castle\2DTown\Landfill\Expansion\Phase II Expansion\Xdoll\Plans\BASE.dwg, C-105, 11/7/2025 11:43:30 AM, sjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
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5. PIPE SDR RATING IS BASED ON OVERLYING WASTE DEPTH AT WHICH PIPE IS LOCATED. PIPE LATERALS LOCATED WITHIN CELL 18 AND PART OF CELL 21 WILL REQUIRE PIPE HDPE SDR 7.0 RATING
6. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.

PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 18 SEE DWG C-302
SMH #34 TIE-IN VAULT (TYP) SEE DWG C-307
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
EXISTING OVERHEAD ELECTRIC LINE (TYP)
VERNAL POOL (TYP)
26'-WIDE PAVED ACCESS ROAD (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
DETENTION POND 11R
CELL 12 PUMP STATION PRIMARY ACCESS ROAD (TYP)
CELL 13 PUMP STATION
SMH #27 CONNECTION AT EXISTING VAULT (TYP) SEE DWG C-307
CELL 14 PUMP STATION
6"x10" DUAL CONTAINMENT HDPE FORCE MAIN (TYP)
LEACHATE LEVEL TRANSDUCER AND CABLE (TYP)
DETENTION POND 14
6" DIA SDR 11 HDPE PERF LEACHATE COLLECTION LATERAL (TYP) SEE DWG C-300
PROPOSED GUARDRAIL (TYP)
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
6" AND 8" DIA SDR 7 HDPE PERF LEACHATE COLLECTION LATERAL SEE DWG C-300 SEE NOTE 5
DETENTION POND 13
PROPOSED CELL LIMITS (TYP)
PROPOSED LANDFILL BASE GRADES (TYP) SEE NOTE 4
PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 20
SMH #39 TIE-IN VAULT SEE DWG C-307
LIMIT OF PHASE I EXPANSION LINER (TYP)
6" AND 8" DIA SDR 11 HDPE PERF LEACHATE COLLECTION LATERAL (TYP) SEE DWG C-300 SEE NOTE 5
INTERMEDIATE BERM BASE LINER CONNECTION (TYP) SEE DWG C-303
FENCE (TYP)
HDPE PIPE END CAP (TYP)
LINER SYSTEM TIE-IN CONNECTION TO ADJACENT CELL (TYP) SEE DWG C-300
SMH #38 IN-LINE VAULT SEE DWG C-307
PROPOSED SOLID WASTE LIMIT (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
8" DIA SDR 17 HDPE PERF HEADER PIPE (TYP)
LEACHATE COLLECTION AND LEAK DETECTION CLEANOUTS (TYP) SEE DWG C-301
SMH #33 TIE-IN CONNECTION VAULT SEE DWG C-307
DEED RESTRICTION (TYP)
CELL 17 BASE GRADE SEE NOTE 6
CELL 16 PUMP STATION
EXISTING EMH (TYP)
EXISTING FORCEMAIN VAULT (TYP)
CLEARING LIMIT LINE (LIMIT OF WORK) (TYP)
SMH #37 IN-LINE VAULT SEE DWG C-307
PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 19
PIPING AT PERIMETER BERM (TYP) SEE DWG C-300
DETENTION POND 12
SMH #36 TIE-IN VAULT SEE DWG C-307
25-FOOT STREAM SETBACK
SMH #35 IN-LINE VAULT SEE DWG C-307
6"x10" DUAL CONTAINMENT HDPE FORCE MAIN (TYP)

60 0 120 240 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE BRIAN D. PIERCE 9601 LICENSED PROFESSIONAL ENGINEER 11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LEACHATE COLLECTION PIPING PLAN

SME SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LC-PIPE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-106

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SMH #19
SMH #17
12"/18" DUAL CONTAINMENT FORCE MAIN
PROPOSED CONTAINMENT AREA PERIMETER
EXISTING GRAVITY LEACHATE DRAIN PIPE
FUTURE PFAS POST-TREATMENT STORAGE TANK ±500,000 GALLONS (PRIOR TO EXPANSION)
FROM PFAS TREATMENT PLANT
SMH #18 MODIFICATION SEE DWG C-311
12"/16" DUAL CONTAINMENT FORCE MAIN
EXISTING 921,000 GALLON LEACHATE STORAGE TANK
TANK INLET SEE DWG C-310
TANK OUTLET SEE DWG C-310
LEACHATE STORAGE TANK FOUNDATION DRAIN CONNECT TO EXISTING TANK FOUNDATION DRAIN
EXISTING STORAGE BUILDING
RIPRAP DITCH (TYP) SEE DWG C-309
FUTURE POST TREATMENT LEACHATE PIPING (PRIOR TO EXPANSION)
DETENTION POND 6
LEACHATE STORAGE TANK SYSTEM SECTION SEE DWG C-310
(2) 24" DIA HDPE CULVERTS INV IN 192.0 INV OUT 189.0
RIPRAP OUTLET APRON (TYP) SEE DWG C-308
PROPOSED±921,000 GALLON LEACHATE STORAGE TANK
LEACHATE STORAGE TANK AREA CATCH BASIN INLET
12" DIA IPS HDPE STORM DRAIN OUTLET PIPE
INV OUT 197.5
BOLLARD (TYP)
POST INDICATOR VALVE
BOLLARD (TYP)
POST INDICATOR VALVE (CLOSED POSITION)
8"/12" DUAL CONTAINMENT FORCE MAIN
4" FOUNDATION DRAIN SOLID WALL CORRUGATED POLYETHYLENE PIPE
REMOVE EXISTING CATCH BASIN AND INSTALL END CAP ON 12" DRAIN CORE
ABANDON EXISTING 12" DRAIN LINE IN PLACE
8"/12" DUAL CONTAINMENT FORCE MAIN TO PFAS TREATMENT
8'x12' TANK DISCHARGE VALVE PIT SEE DWG C-311
8"/12" DUAL CONTAINMENT FORCE MAIN
6' DIA LOADING RACK VALVE PIT SEE DWG C-311
8"/12" DUAL CONTAINED HDPE LONG RADIUS ELBOW
CB-02 4' DIAMETER RIM 208.00 INV OUT 199.00
LEACHATE STORAGE TANK SYSTEM SECTION SEE DWG C-310
EXISTING PIPING TO LOADING RACK
LEACHATE STORAGE TANK PUMP STATION
8" SDR 11 HDPE PIPE
2" SDR 11 HDPE PIPE
DUAL CONTAINMENT PUMP STATION
8" SDR 11 HDPE PIPE
2"/4" DUAL CONTAINMENT FORCE MAIN
24"LFG
N
10 0 20 40 FEET

NOTE:
1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE BRIAN D PIERCE 9601 LICENSED PROFESSIONAL ENGINEER 11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LEACHATE STORAGE SYSTEM PLAN

SME SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LC-STOR
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-107

\\Warren\Civil\Data\Civil\Juniper\Engineering\Phase II Expansion\Final\Plan\BASE.dwg, C-107, 11/7/2025 11:44:17 AM, kjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. BASE GRADES REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.
5. PIPE SDR RATING IS BASED ON OVERLYING WASTE DEPTH AT WHICH PIPE IS LOCATED. PIPE LATERALS LOCATED WITHIN CELL 18 AND PART OF CELL 21 WILL REQUIRE PIPE HDPE SDR 7.0 RATING
6. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.
7. GAS COLLECTION PIPING FROM LFG SYSTEM DESIGN REPORT FOR THE PHASE II EXPANSION AT JUNIPER RIDGE LANDFILL, PREPARED BY SANBORN, HEAD & ASSOCIATES, INC., DATED NOVEMBER 2025.

GRAVEL UTILITY ACCESS ROADS (TYP)
VERNAL POOL (TYP)
CELL 18 CONDENSATE PUMP STATION (TEMPORARY)
PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 18
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
26'-WIDE PAVED ACCESS ROAD (TYP)
6"x10" DUAL CONTAINMENT HDPE FORCE MAIN (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
EXISTING OVERHEAD ELECTRIC LINE (TYP)
DETENTION POND 11R
CELL 14 PUMP STATION
CELL 13 PUMP STATION
CELL 12 PUMP STATION
PRIMARY ACCESS ROAD (TYP)
DETENTION POND 14
CELL 22 CONDENSATE PUMP STATION
PROPOSED GUARDRAIL (TYP)
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
DETENTION POND 13
CELL 20 CONDENSATE PUMP STATION (TEMPORARY)
PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 20
FENCE (TYP)
PROPOSED SOLID WASTE LIMIT (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
DEED RESTRICTION (TYP)
CLEARING LIMIT LINE (LIMIT OF WORK) (TYP)
PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 19
CELL 19 CONDENSATE PUMP STATION
DETENTION POND 12
25-FOOT STREAM SETBACK
CELL 17 BASE GRADE SEE NOTE 6
6"x10" DUAL CONTAINMENT HDPE FORCE MAIN (TYP)
CELL 16 PUMP STATION
PROPOSED LANDFILL FINISH WASTE GRADES (TYP) SEE NOTE 4

60 0 120 240 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE BRIAN D. PERRY 9600 PROFESSIONAL ENGINEER 11/12/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

GAS COLLECTION PIPING PLAN

SME SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	GC-PIPE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-108

\\Narwin\CAD\Cadd\COT\Twn\Land\RE\Expansion\Phase II Expansion\Xdoh\Plans\BASE.dwg, C-108, 11/7/2025 12:42:43 PM, sjm

DETENTION POND 10
OUTLET CONTROL
STRUCTURES TO REMAIN

DETENTION POND 10

EMERGENCY SPILLWAY (TYP)
SEE DWG C-309

CB 4G AND SD 4G
SEE DWG C-309

TOE DITCH
SEE DWG C-309

OUTLET CONTROL
STRUCTURE DP-11R
SEE DWG C-309

PLUNGE POOL
SEE DWG C-309

LEVEL SPREADER DP-11R
SEE DWG C-308

DETENTION POND 11R

CB 4H AND SD 4H
SEE DWG C-309

EXISTING
CULVERT PS-14

EXISTING
CULVERT PS-11B-2

EXISTING
CULVERT PS-13

EXISTING CB 4I
AND CULVERT 4I

EXISTING
CULVERT PS-11

EXISTING
CULVERT 4IA

EXISTING CB 4JA-3
AND SD 4JA-3

EXISTTING CULVERTS
4JB AND 4JC

EXISTING CB 4JA
AND SD 4JA

LEVEL SPREADER DP-14
SEE DWG C-309

EMERGENCY
SPILLWAY (TYP)
SEE DWG C-309

PLUNGE POOL
SEE DWG C-309

OUTLET CONTROL
STRUCTURE DP-14
SEE DWG C-309

DETENTION POND 14

CB 4D AND SD 4D
SEE DWG C-309

EMERGENCY
SPILLWAY (TYP)
SEE DWG C-309

DETENTION
POND 13

OUTLET CONTROL
STRUCTURE DP-13
SEE DWG C-309

LEVEL SPREADER
DP-13
SEE DWG C-308

PLUNGE POOL
SEE DWG C-309

CB 4C AND SD 4C
SEE DWG C-309

TOE DITCH
SEE DWG C-309

FINAL COVER RIPRAP
DOWNSPOUT (TYP)
SEE DWG C-309

FINAL COVER SURFACE
TERRACE (TYP)
SEE DWG C-309

FINAL LANDFILL
ACCESS ROAD (TYP)

FINAL WASTE GRADES (TYP)

7.5% MIN (TYP)

10H:1V (TYP)

2H:1V (TYP)

CB 2B AND SD 2B
SEE DWG C-309

CB 2E AND SD 2E
SEE DWG C-309

OUTLET CONTROL
STRUCTURE DP-12
SEE DWG C-309

LEVEL SPREADER DP-12
SEE DWG C-308

DETENTION POND 12

EMERGENCY SPILLWAY (TYP)
SEE DWG C-309

PLUNGE POOL
SEE DWG C-309

CB 2D AND SD 2D
SEE DWG C-309

EXISTING DITCH 2D
SEE DWG C-309

FINAL COVER SYSTEM
SEE DWG C-309

NOTE:
1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.

2. WETLAND BOUNDARIES DELINEATED BY BRI ENVIRONMENTAL IN 2024.

3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.

60 0 120 240 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D PIERCE
9608
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

FINAL GRADES AND SITE DRAINAGE PLAN

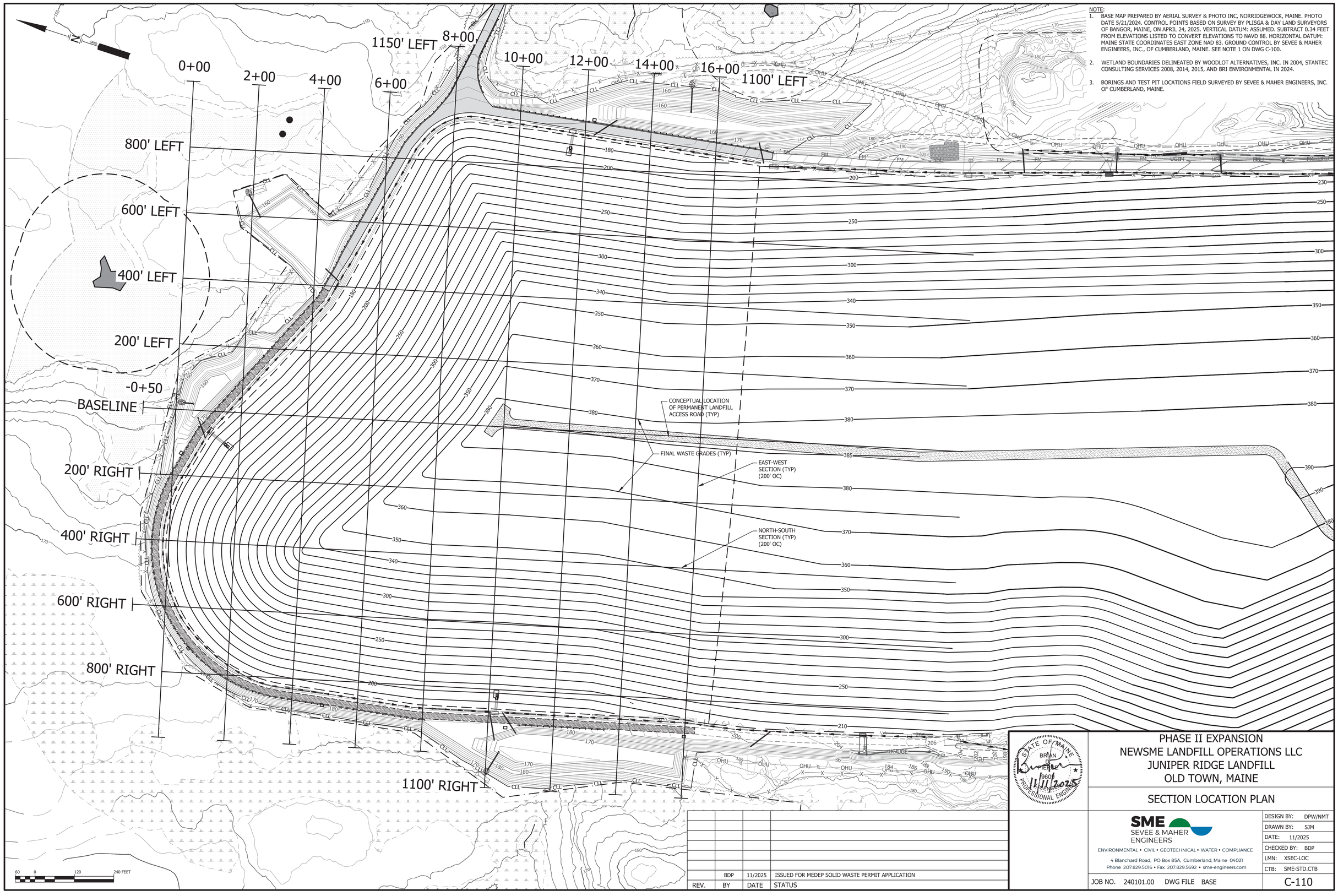
SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	FINAL-DRAIN
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-109

\\Server\Jobs\Casella\DAT\Twin Landfill\Expansion\Phase II Expansion\Acad\Plans\BASE.dwg C-109, 11/11/2025 10:07:24 AM, sjm



NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
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3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PERRY
9601
11/11/2025
PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTION LOCATION PLAN

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	XSEC-LOC
CTB:	SME-STD.CTB
JOB NO.	240101.00
DWG FILE	BASE

C-110

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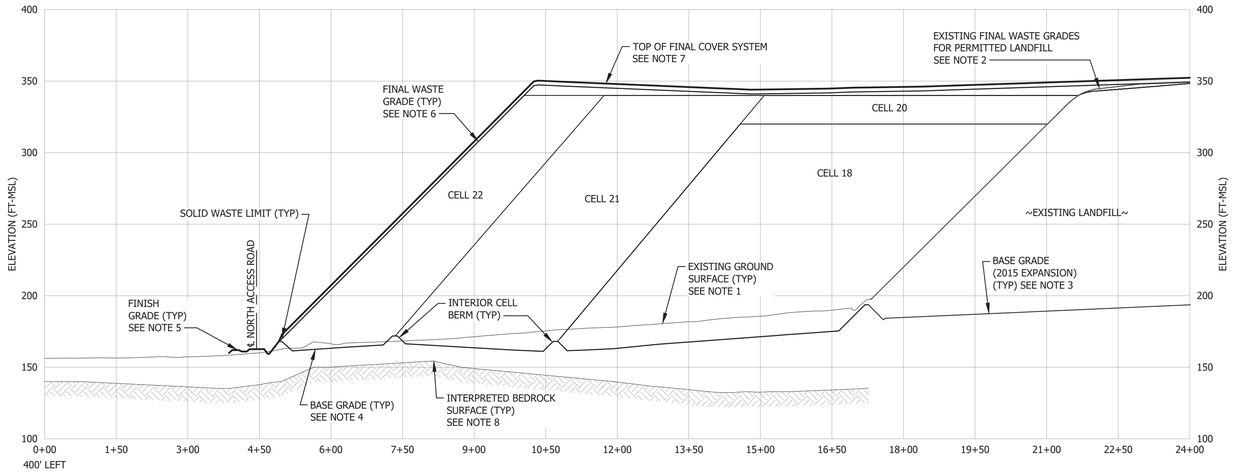

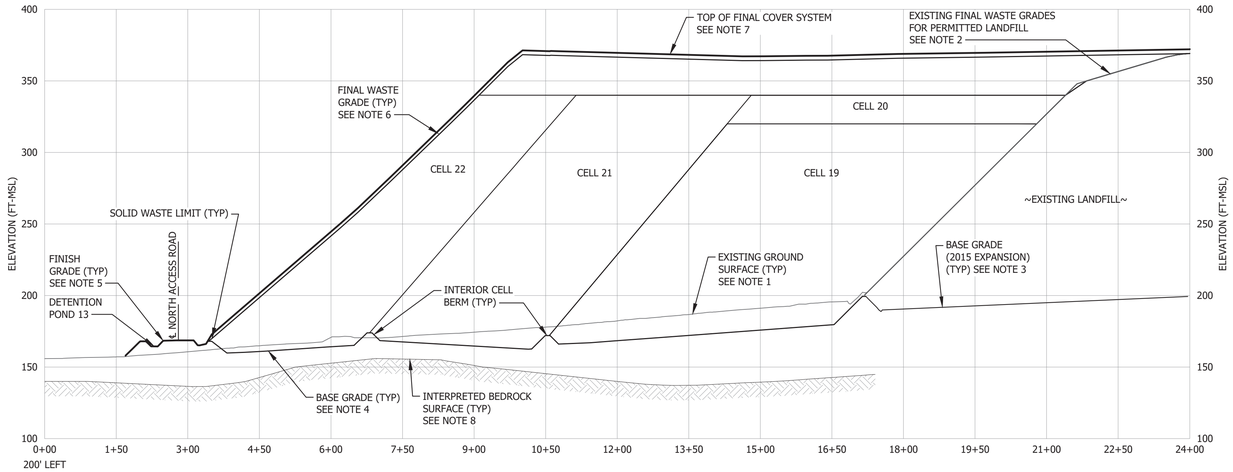

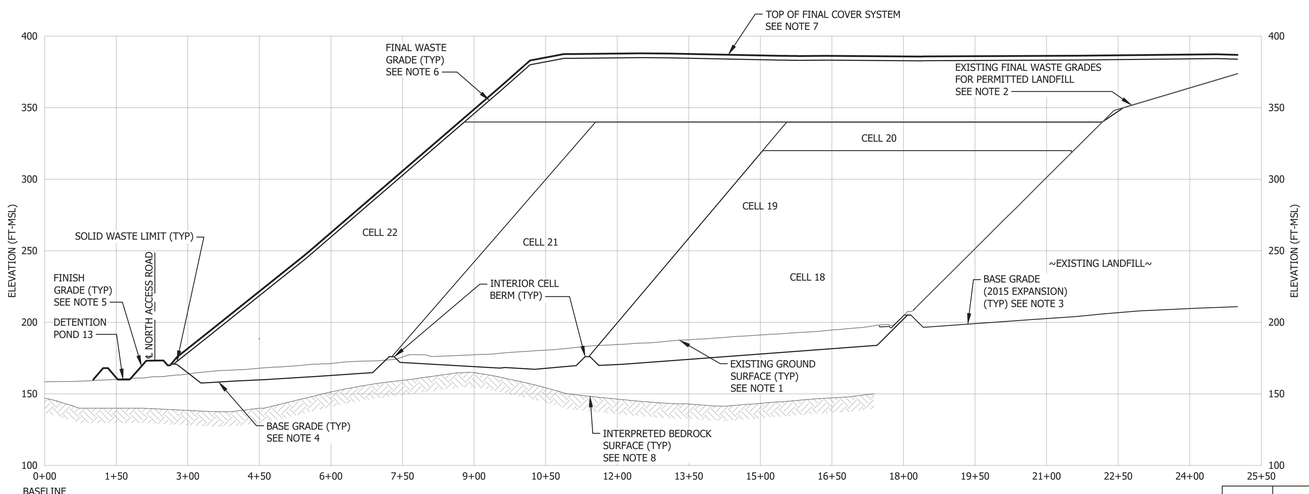

NOTES:

1. EXISTING GROUND SURFACE INTERPRETED FROM TOPOGRAPHIC BASE MAP PREPARED BY AERIAL SURVEY AND PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATED 5/21/2024.
2. GRADES SHOWN REPRESENT THE EXISTING PERMITTED LANDFILL FINAL WASTE GRADES (TOP OF WASTE).
3. GRADES SHOWN AT THE BOTTOM OF THE EXISTING LANDFILL REPRESENT THE DESIGN BASE GRADES OF THE EXISTING PERMITTED LANDFILL (2015 EXPANSION).
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6. FINAL WASTE GRADES SHOWN REPRESENT THE PROPOSED TOP OF WASTE ELEVATIONS FOR THE PHASE II LANDFILL EXPANSION.
7. TOP OF FINAL COVER SYSTEM GRADES REPRESENT THE FINAL ELEVATION OF THE PHASE II EXPANSION INCLUDING THE FINAL COVER SYSTEM AS SHOWN ON DWGS C-109 AND C-306.
8. BEDROCK SUFACE ELEVATION IS INTERPRETED FROM SECTION 4.3 VOLUME II SITE ASSESSMENT REPORT FOR JUNIPER RIDGE LANDFILL PHASE II EXPANSION, DATED NOVEMBER, 2025.

75 0 150 300 FEET (HORZ)
25 0 50 100 FEET(VERT)

STATE OF MAINE
BRIAN D. PIERCE
9601
LICENSED
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROPOSED SECTIONS TRANSVERSE

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB
JOB NO.	240101.00
DWG FILE	SECTIONS

C-200

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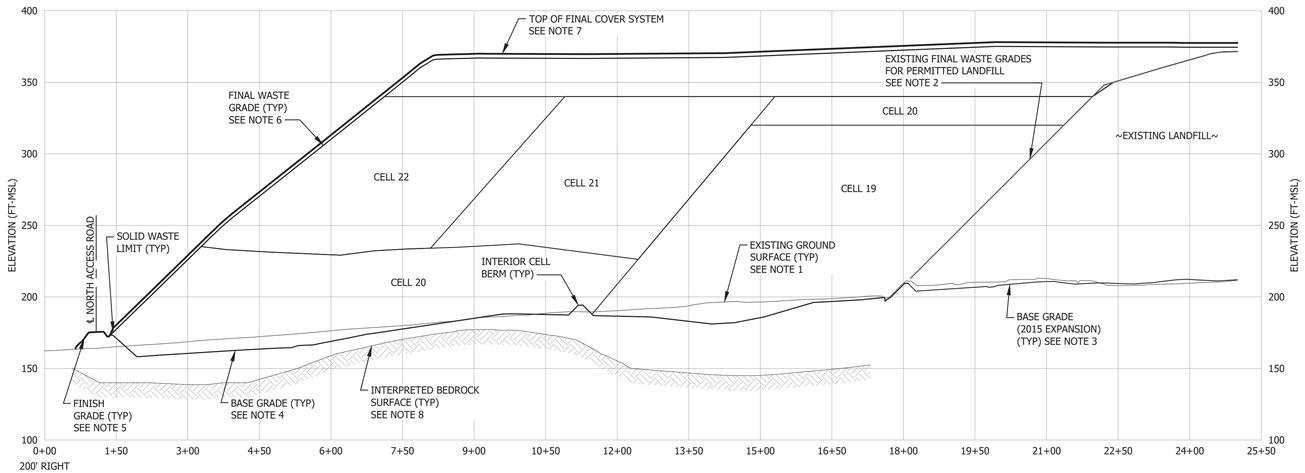

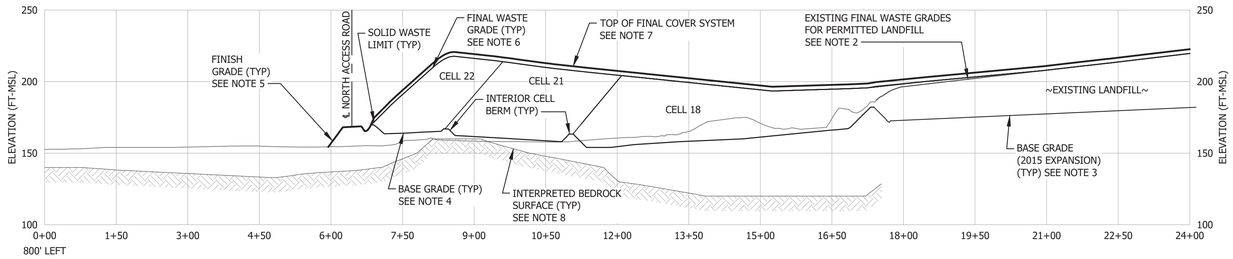

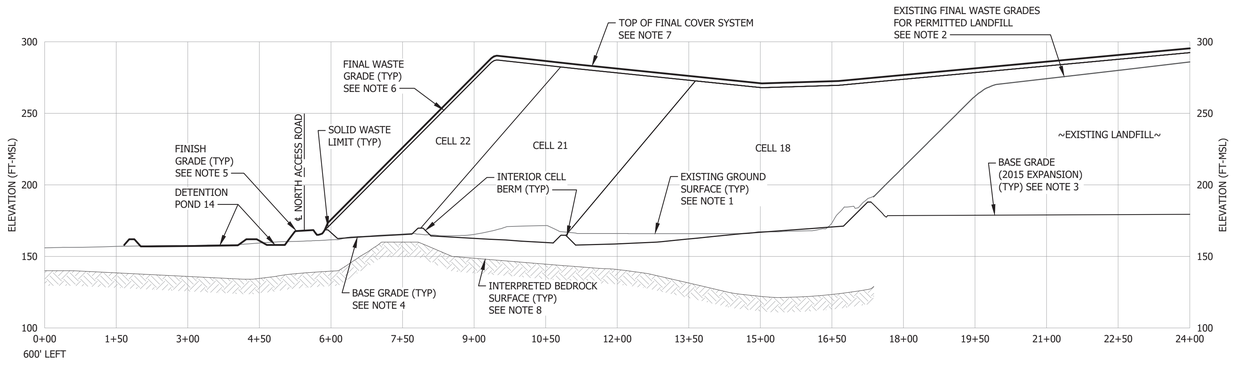

NOTES:

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6. FINAL WASTE GRADES SHOWN REPRESENT THE PROPOSED TOP OF WASTE ELEVATIONS FOR THE PHASE II LANDFILL EXPANSION.
7. TOP OF FINAL COVER SYSTEM GRADES REPRESENT THE FINAL ELEVATION OF THE PHASE II EXPANSION INCLUDING THE FINAL COVER SYSTEM AS SHOWN ON DWGS C-109 AND C-306.
8. BEDROCK SUFACE ELEVATION IS INTERPRETED FROM SECTION 4.3 VOLUME II SITE ASSESSMENT REPORT FOR JUNIPER RIDGE LANDFILL PHASE II EXPANSION, DATED NOVEMBER, 2025.

75 0 150 300 FEET (HORZ)
25 0 50 100 FEET(VERT)

STATE OF MAINE
BRIAN D. PERRY
9601
LICENSED
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROPOSED SECTIONS TRANSVERSE

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE SECTIONS

C-201

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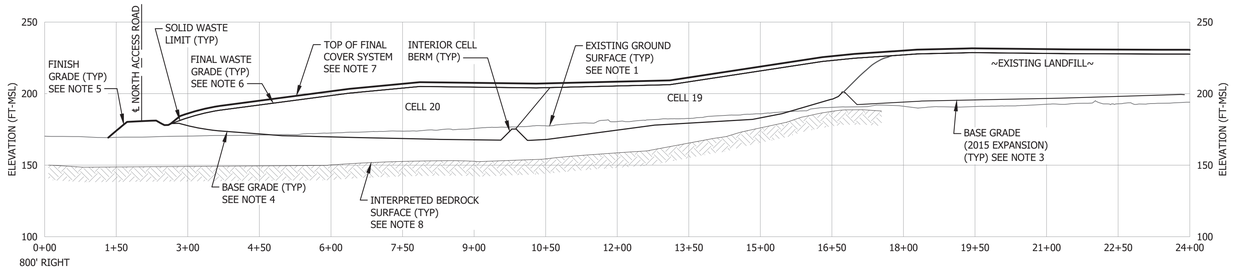

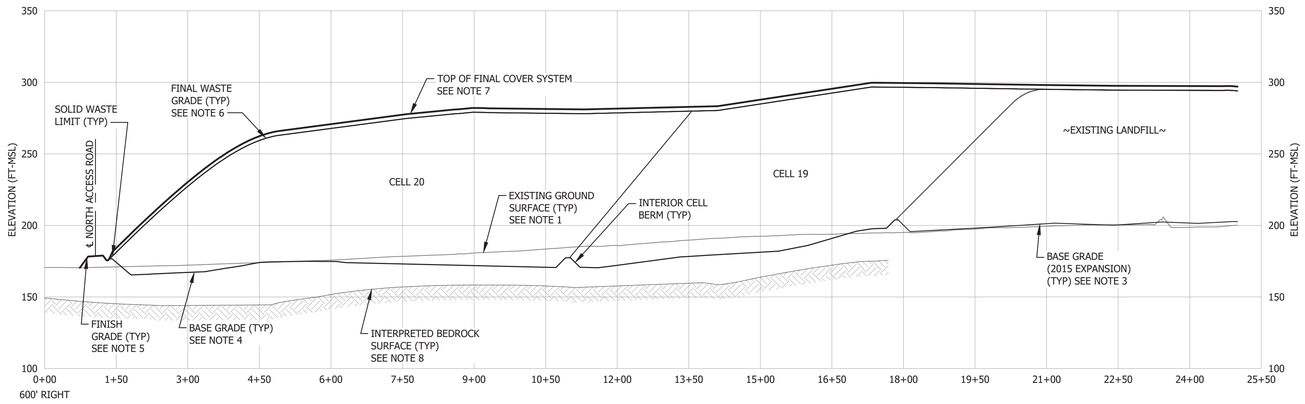

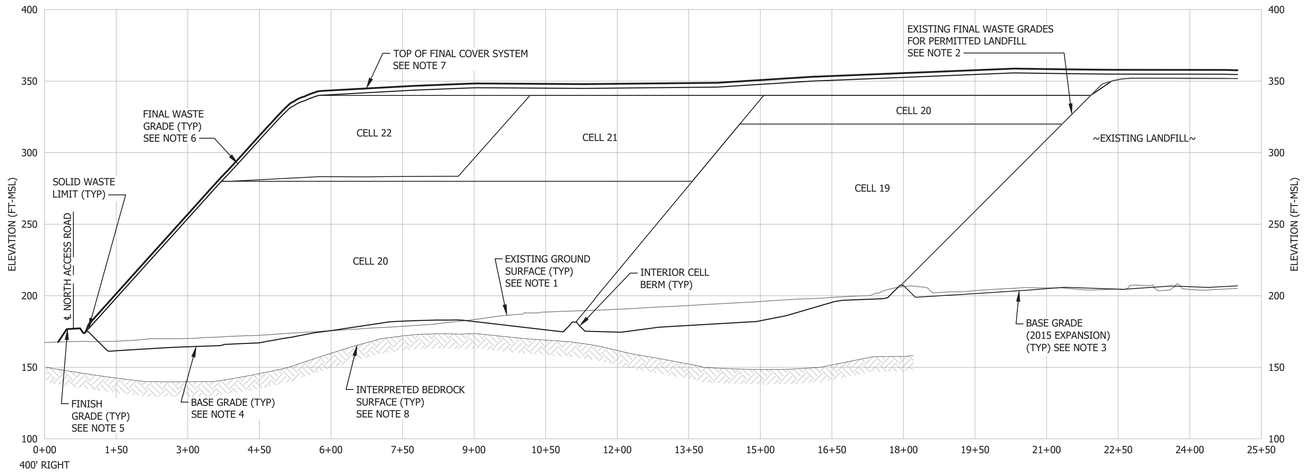

NOTES:

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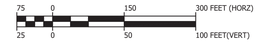
7. TOP OF FINAL COVER SYSTEM GRADES REPRESENT THE FINAL ELEVATION OF THE PHASE II EXPANSION INCLUDING THE FINAL COVER SYSTEM AS SHOWN ON DWGS C-109 AND C-306.
8. BEDROCK SUFACE ELEVATION IS INTERPRETED FROM SECTION 4.3 VOLUME II SITE ASSESSMENT REPORT FOR JUNIPER RIDGE LANDFILL PHASE II EXPANSION, DATED NOVEMBER, 2025.



PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROPOSED SECTIONS TRANSVERSE

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

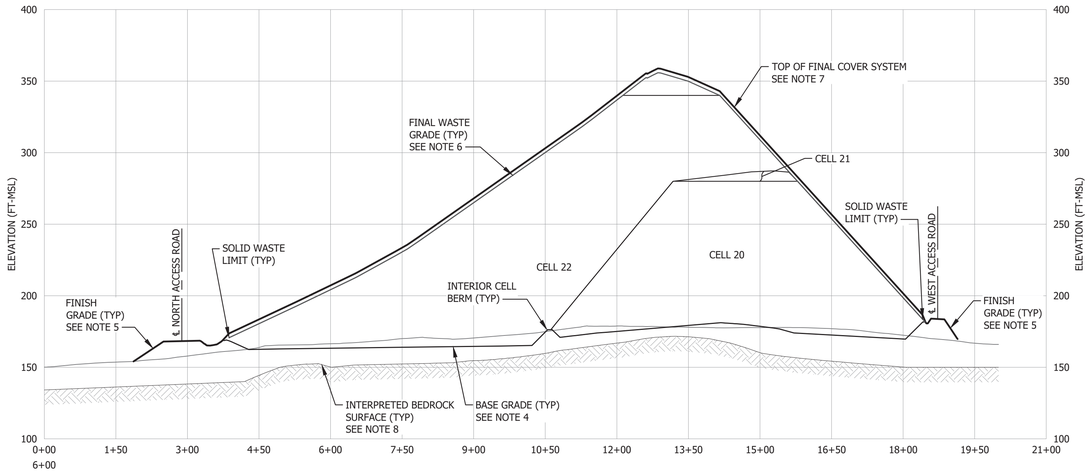
SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

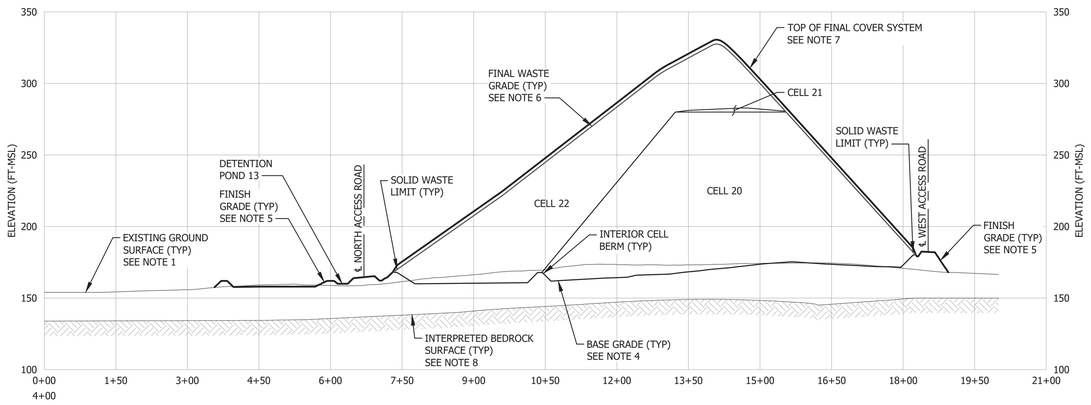
DESIGN BY:	DPW
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

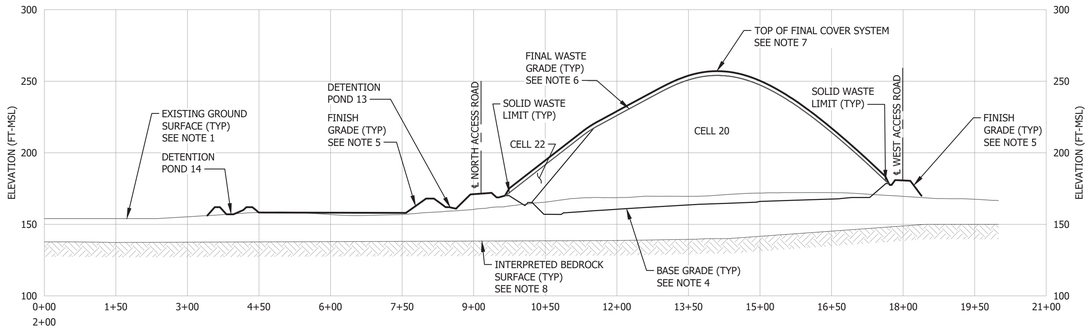
JOB NO. 240101.00 DWG FILE SECTIONS

C-202

\\Server\dfs\Data\JobToDo\JuniperRidgeExpansion\Phase II Expansion\Acad\Plans\SECTIONS.dwg, C-202, 11/10/2025 2:26:21 PM, sjm







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2. GRADES SHOWN REPRESENT THE EXISTING PERMITTED LANDFILL FINAL WASTE GRADES (TOP OF WASTE).
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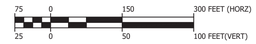
7. TOP OF FINAL COVER SYSTEM GRADES REPRESENT THE FINAL ELEVATION OF THE PHASE II EXPANSION INCLUDING THE FINAL COVER SYSTEM AS SHOWN ON DWGS C-109 AND C-306.
8. BEDROCK SUFACE ELEVATION IS INTERPRETED FROM SECTION 4.3 VOLUME II SITE ASSESSMENT REPORT FOR JUNIPER RIDGE LANDFILL PHASE II EXPANSION, DATED NOVEMBER, 2025.



REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROPOSED SECTIONS LONGITUDINAL

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE SECTIONS

C-203

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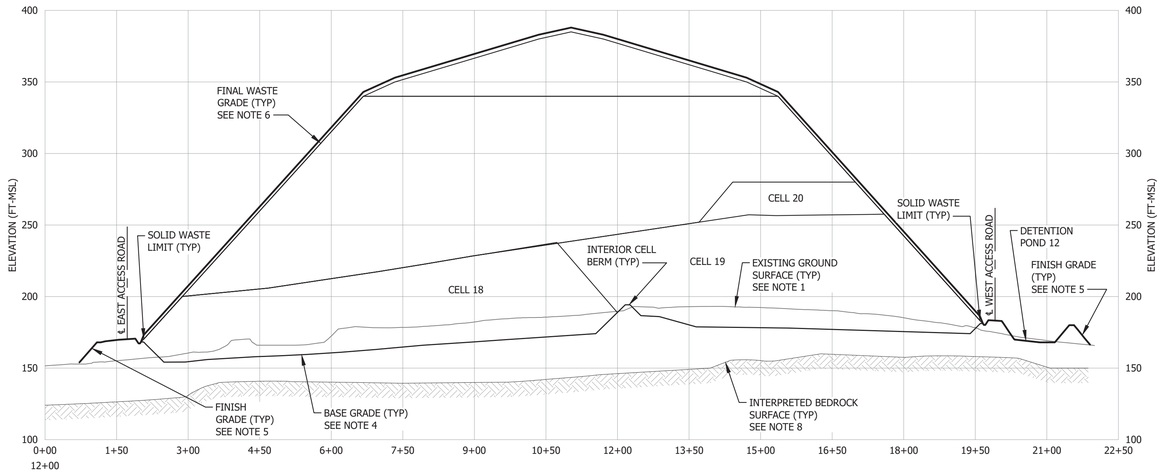

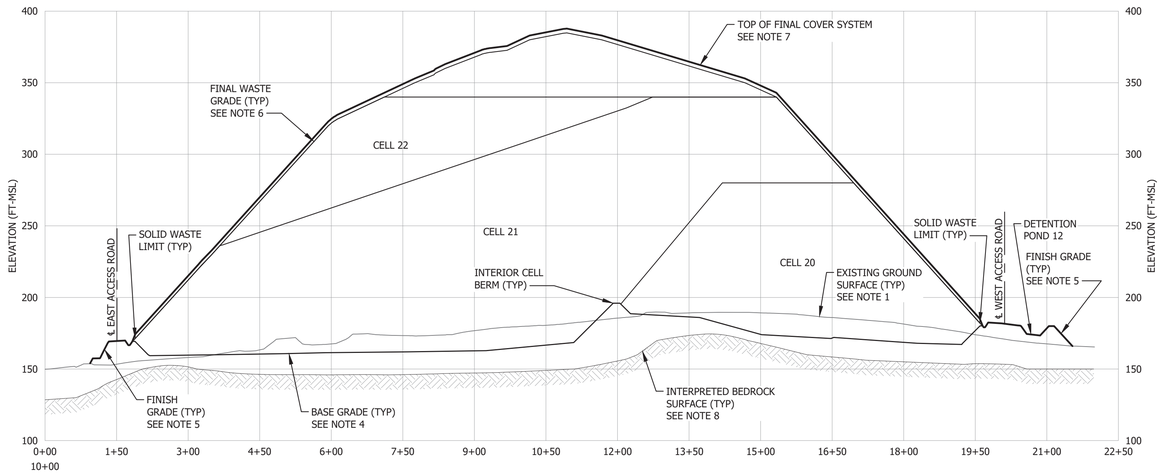

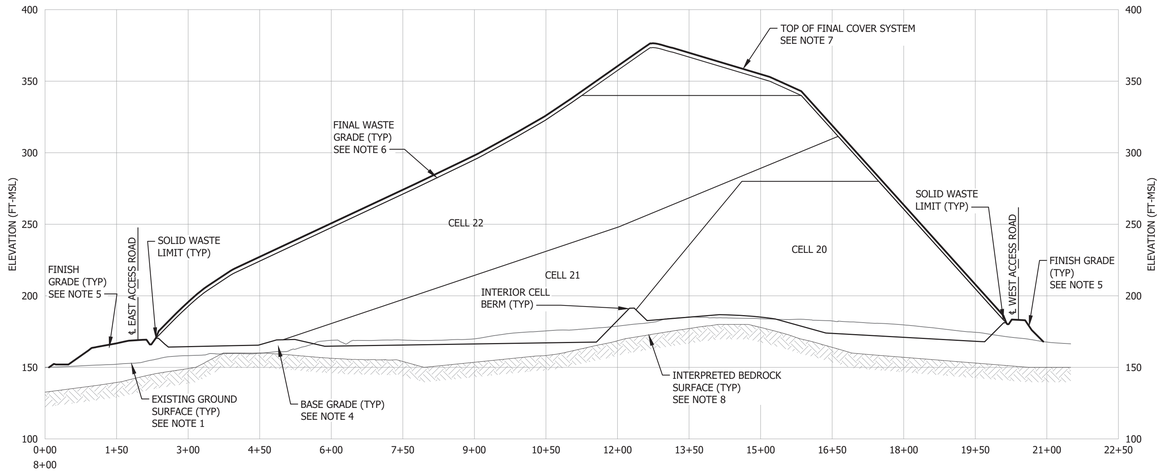

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75 0 150 300 FEET (HORZ)
25 0 50 100 FEET(VERT)

STATE OF MAINE
BRIAN D PIERCE
9601
11/17/2025
LICENSED PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROPOSED SECTIONS LONGITUDINAL

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB
JOB NO.	240101.00
DWG FILE	SECTIONS

C-204

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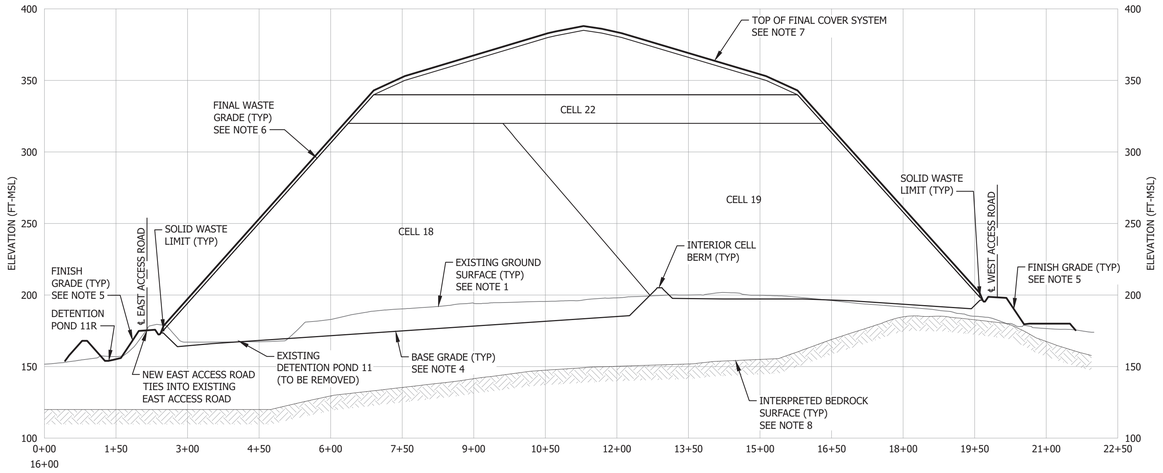

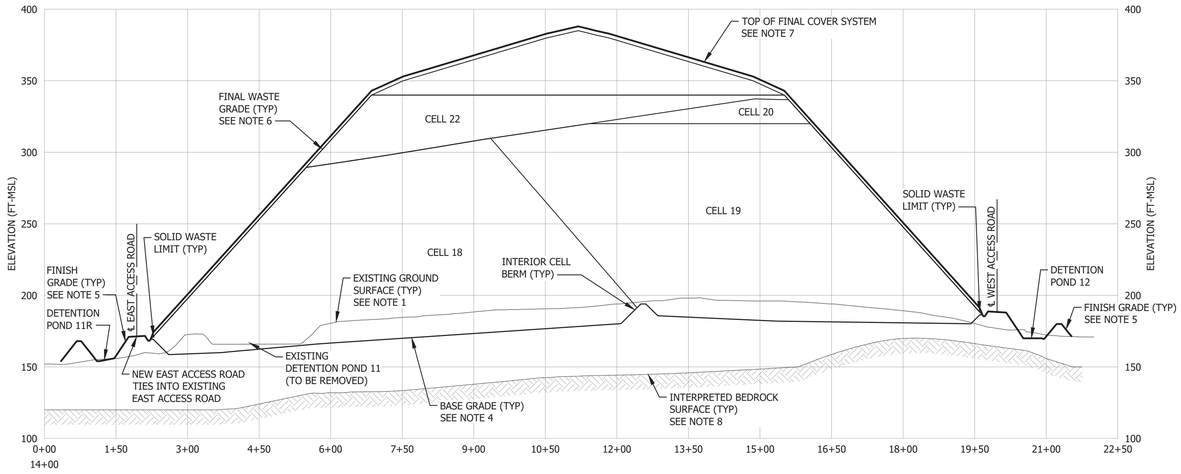

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25 0 150 300 FEET (HORZ)
25 0 50 100 FEET(VERT)

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
9608
11/11/2025
LICENSED PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROPOSED SECTIONS LONGITUDINAL

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE SECTIONS

C-205

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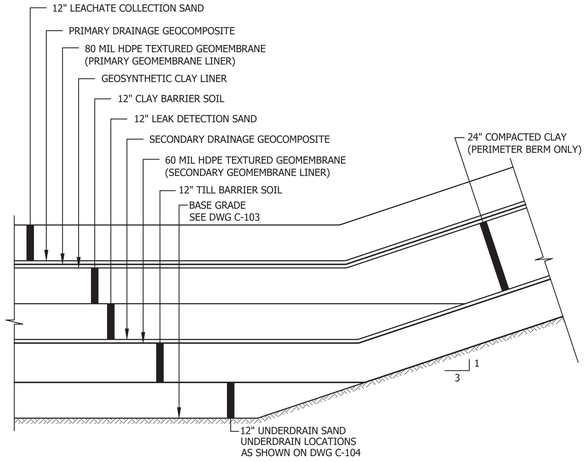
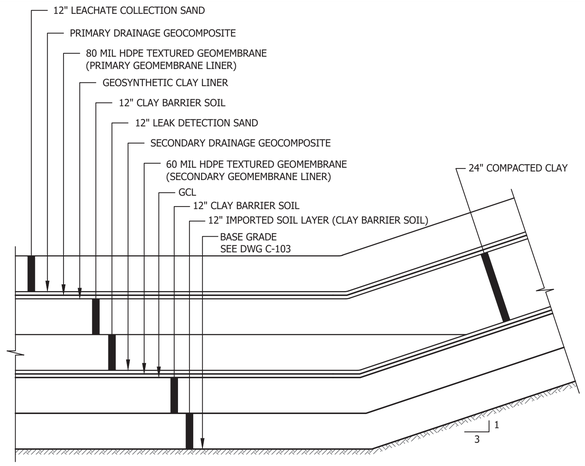
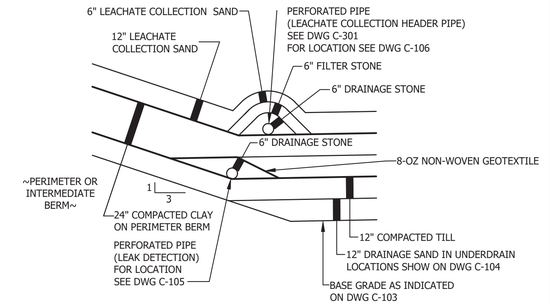


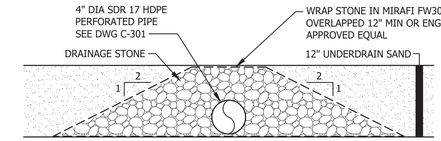
BASE LINER SYSTEM
NTS



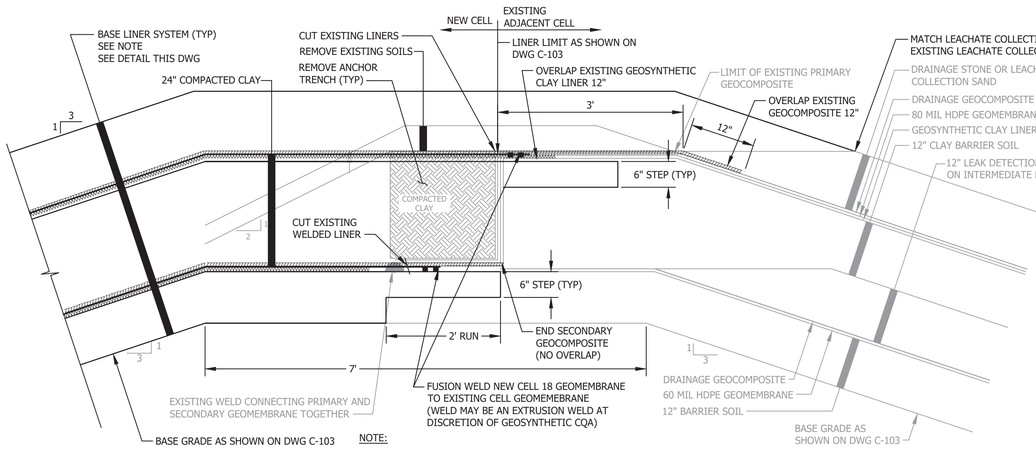
AUGMENTED LINER SYSTEM
NTS



PIPING AT PERIMETER BERM
NTS

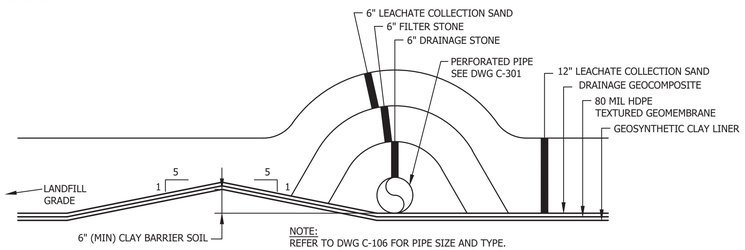


UNDERDRAIN PIPING
NTS



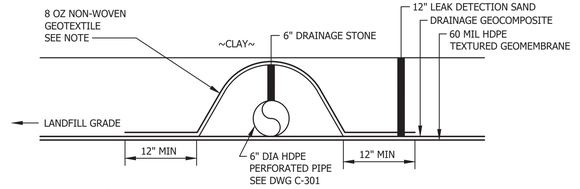
NOTE:
AREAS WITH BASE LINER SYSTEM DO NOT INCLUDE GCL UNDER THE SECONDARY GEOMEMBRANE OR THE CLAY BARRIER SOIL.

LINER SYSTEM TIE-IN CONNECTION TO ADJACENT CELLS
NTS



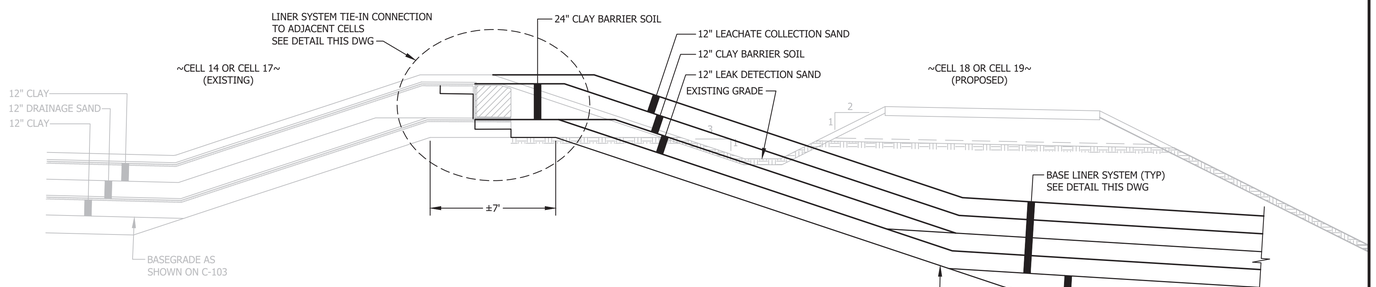
NOTE:
REFER TO DWG C-106 FOR PIPE SIZE AND TYPE.

LEACHATE COLLECTION LATERAL
NTS



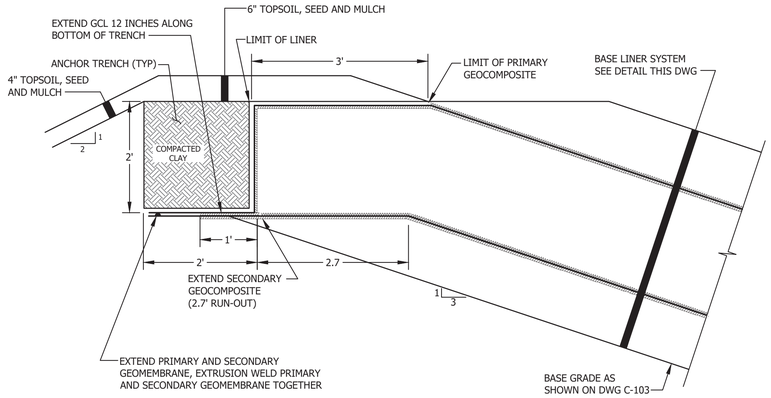
NOTE:
PLACE 8 OZ NON-WOVEN GEOTEXTILE OVER DRAINAGE STONE. EXTEND FABRIC ONE FOOT BEYOND LIMITS OF STONE ALONG THE ENTIRE LENGTH OF THE PIPE.

LEAK DETECTION LATERAL
NTS



LINER SYSTEM CONNECTION TO EXISTING CELLS (1)
NTS

C-102
C-103
C-104
C-105
C-106



ANCHOR TRENCH/LINER TERMINATION
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D PIERCE
9609
LICENSED
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER
ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LMN
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE DETAILS

C-300

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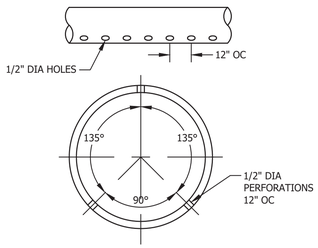
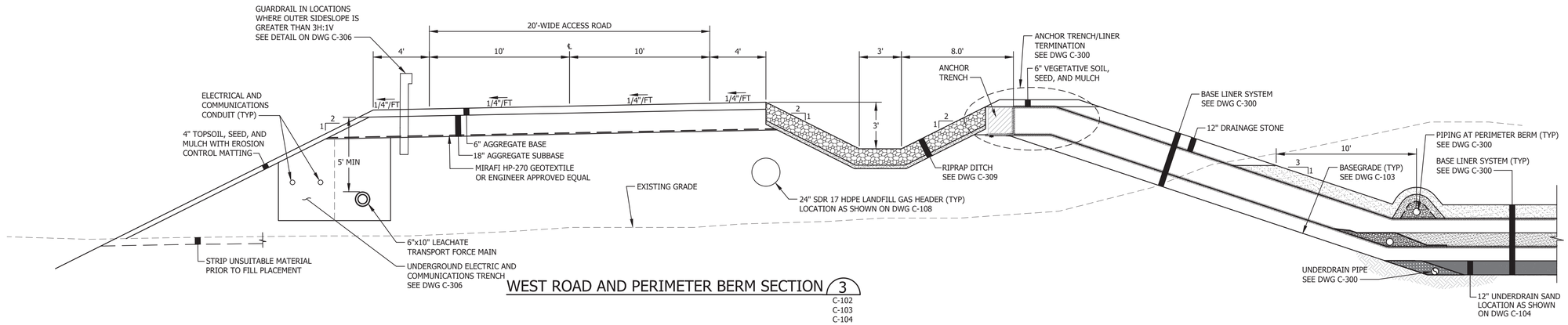


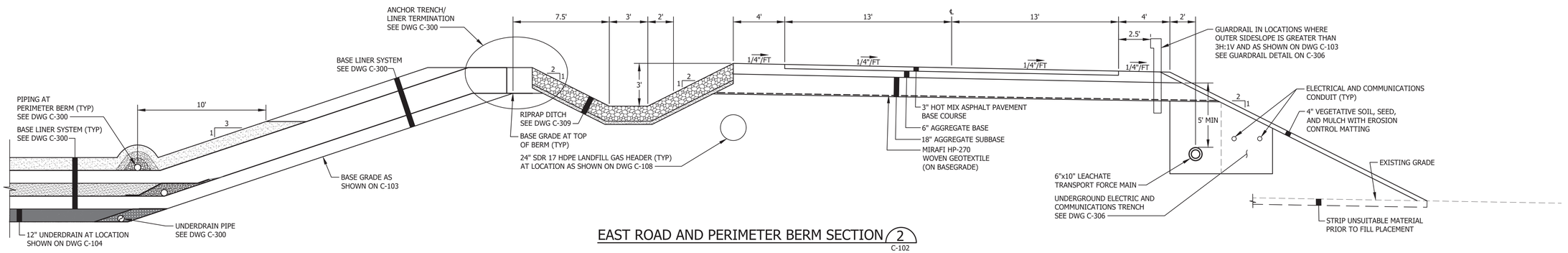
PERFORATED PIPE

NTS



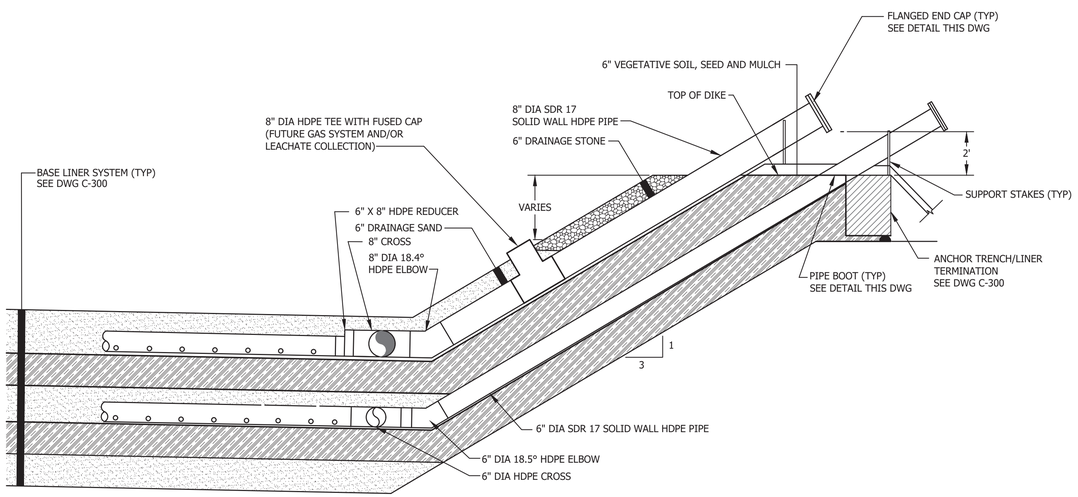
WEST ROAD AND PERIMETER BERM SECTION 3

C-102
C-103
C-104
C-105



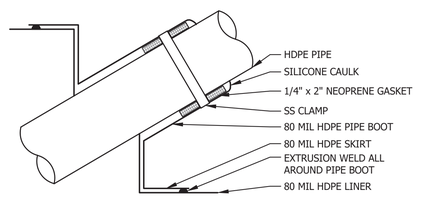
EAST ROAD AND PERIMETER BERM SECTION 2

C-102
C-103
C-104
C-105



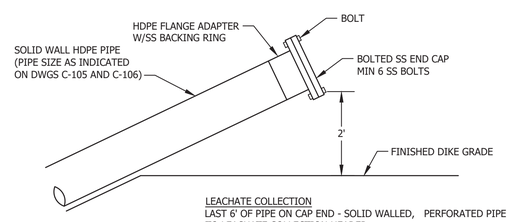
LEACHATE COLLECTION & LEAK DETECTION CLEANOUTS

NTS



PIPE BOOT

NTS



LEACHATE COLLECTION
LAST 6' OF PIPE ON CAP END - SOLID WALLED, PERFORATED PIPE
TO LEACHATE COLLECTION HEADER

LEAK DETECTION CLEANOUT
SOLID WALLED ENTIRE LENGTH TO HEADER

FLANGED END CAP

NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D PIERCE
9609
LICENSED
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

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DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/10/2025
CHECKED BY:	BDP
LMN:	LMN
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE DETAILS

C-301

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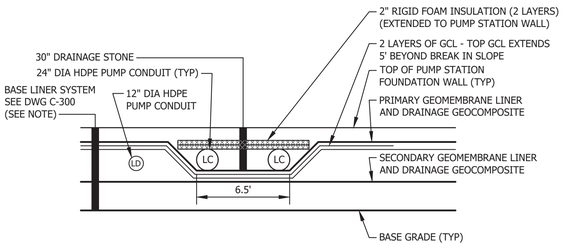
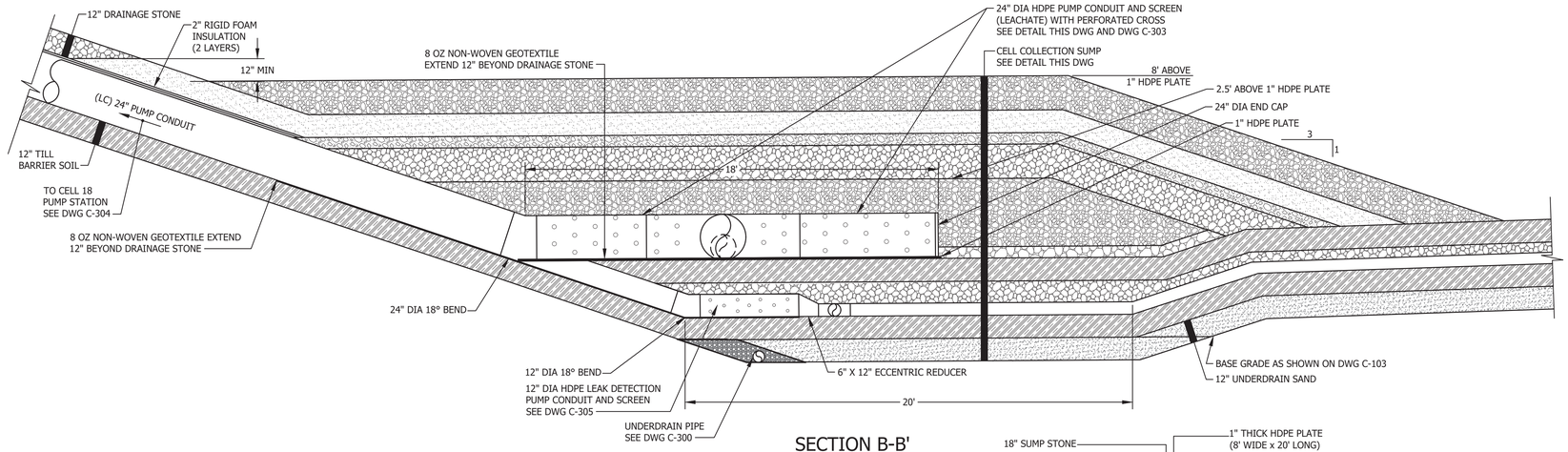


SECTION C-C'
NTS



SECTION B-B'
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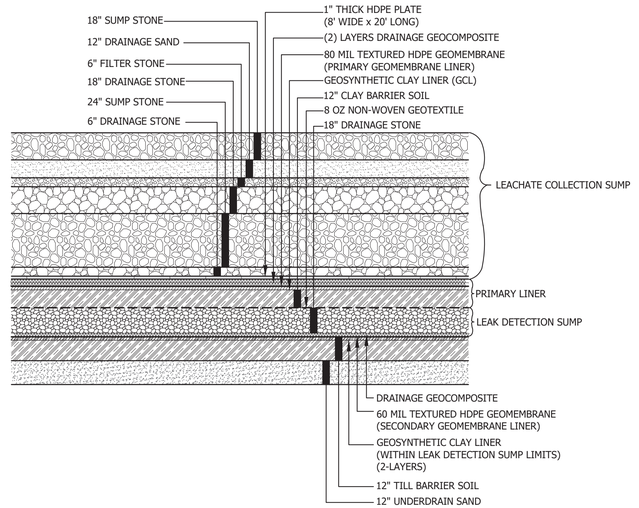

CELL COLLECTION SUMP
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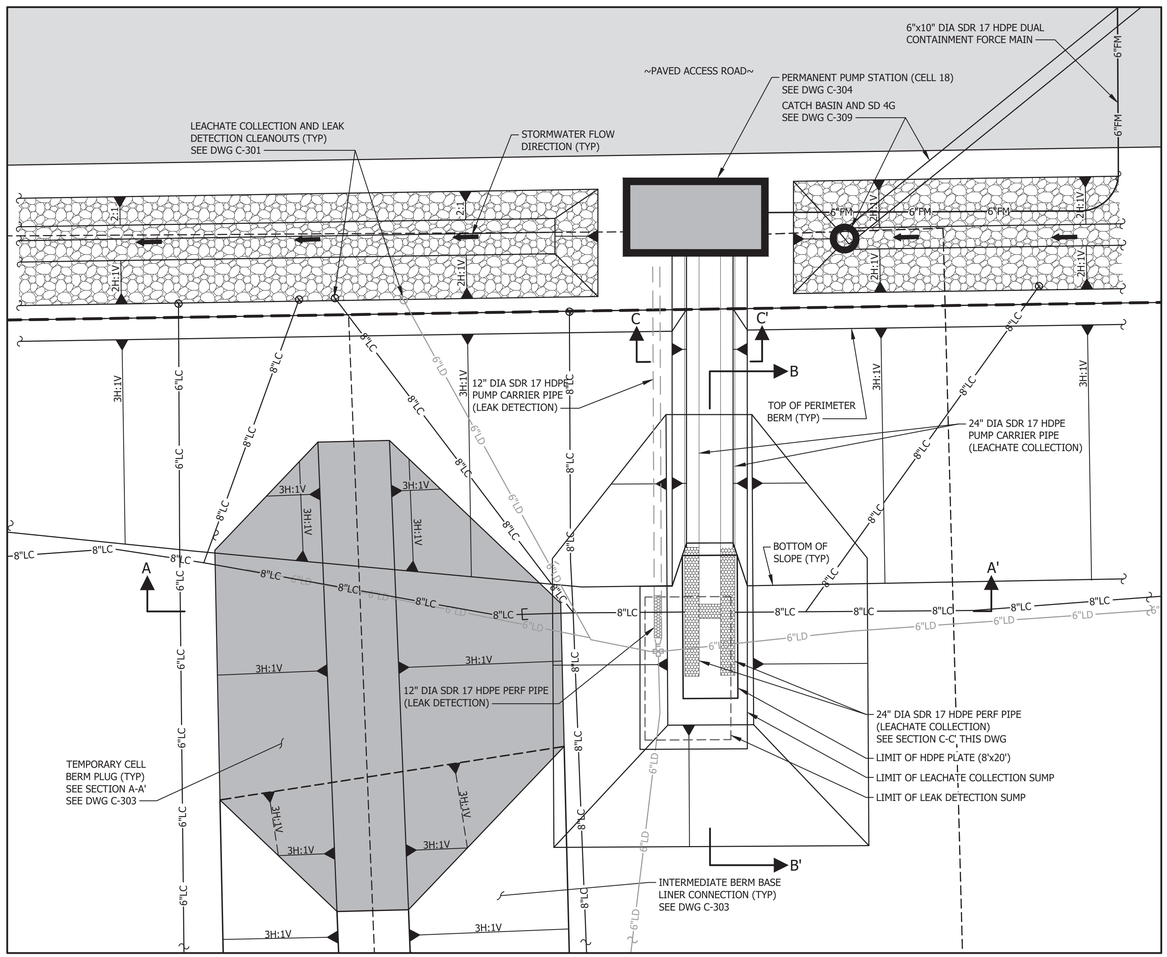

PERMANENT COLLECTION SUMP AREA AND PUMP STATION PLAN - CELL 18

5 0 10 20 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
9601
LICENSED
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

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DESIGN BY:	DPW/NMT
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DATE:	11/2025
CHECKED BY:	BDP
LMN:	PERM-PUMP
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE BASE

C-302

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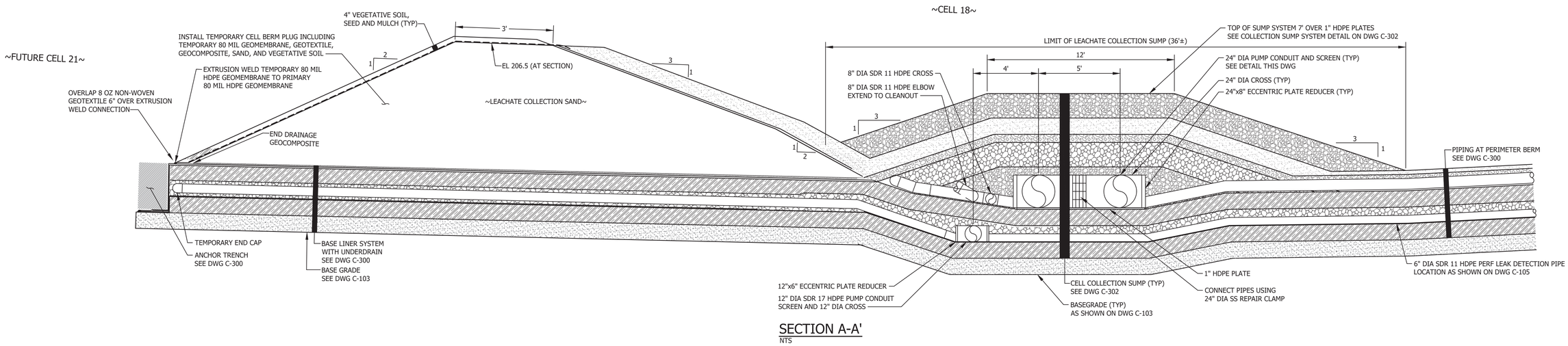

SECTION A-A'
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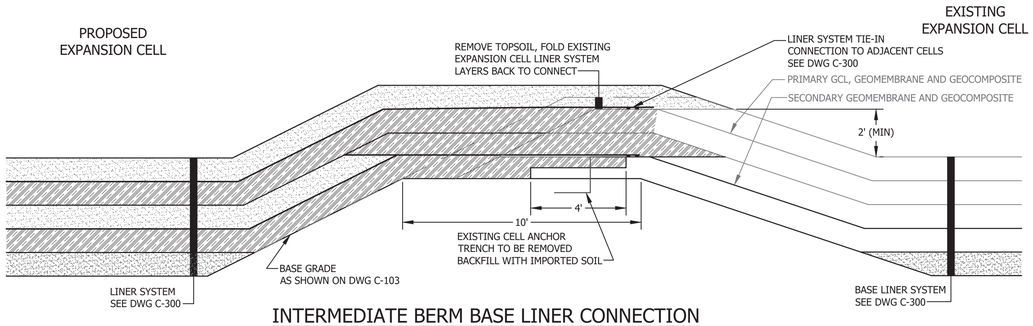

INTERMEDIATE BERM BASE LINER CONNECTION
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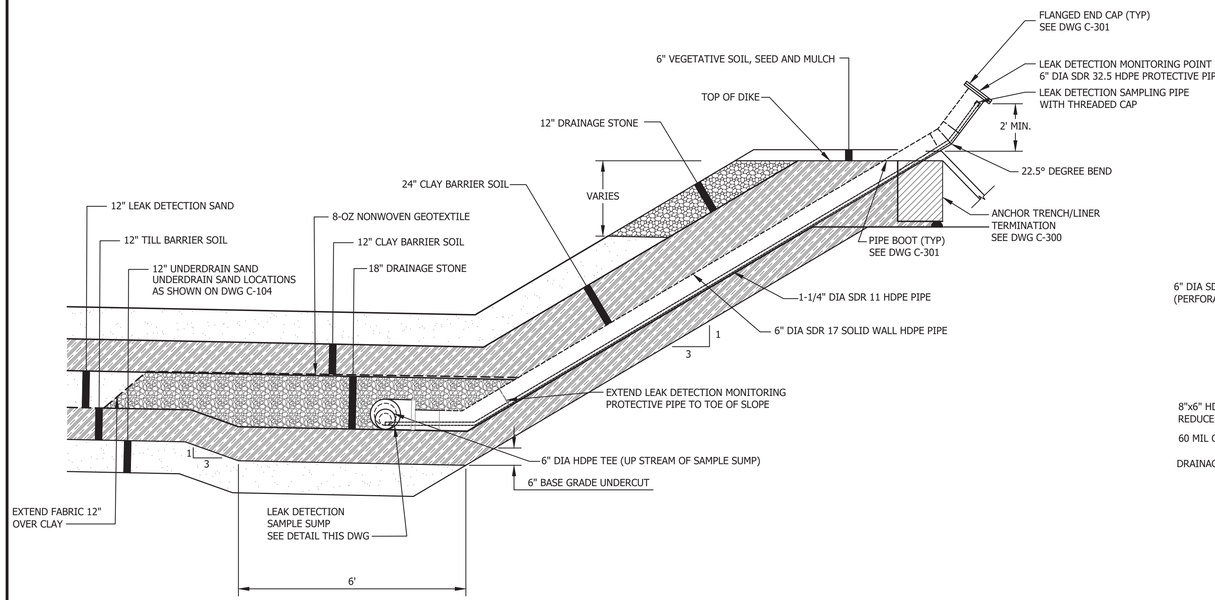
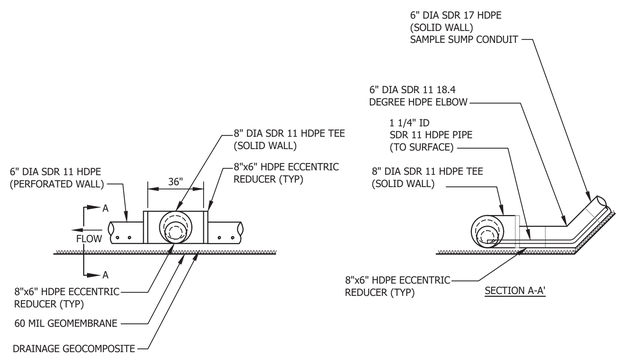


CELL 20, 21, AND 22 LEAK DETECTION SAMPLE SUMP
NTS



LEAK DETECTION SAMPLE SUMP
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE BRIAN D. EMERY 9601 11/11/2025 PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

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4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/11/2025
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LMN:	LMN
CTB:	SME-STD.CTB

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C-303

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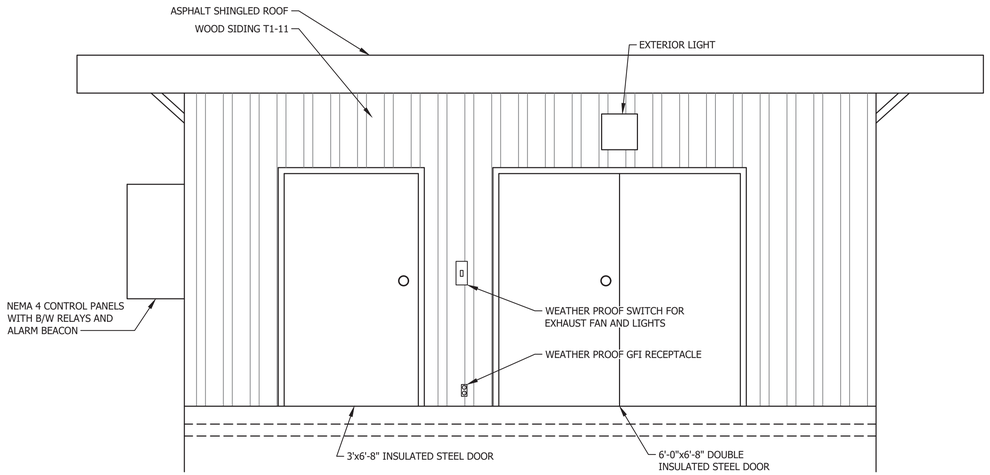

PERMANENT PUMP STATION (CELL 18) - FRONT ELEVATION
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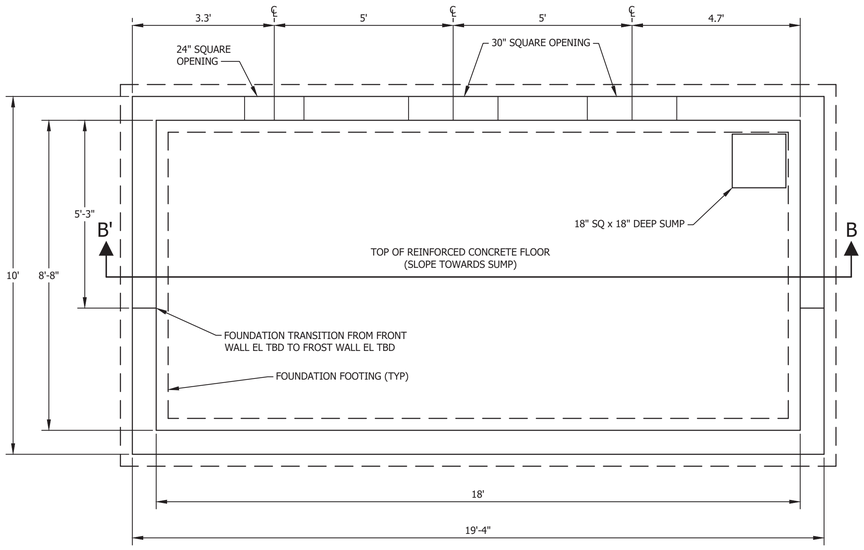
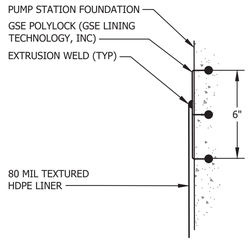


PLAN VIEW

PERMANENT PUMP STATION (CELL 18) - FOUNDATION PLAN
NTS



LINER TO BUILDING CONNECTION
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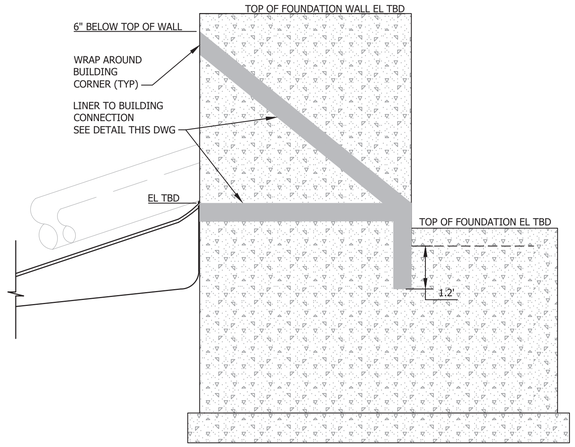
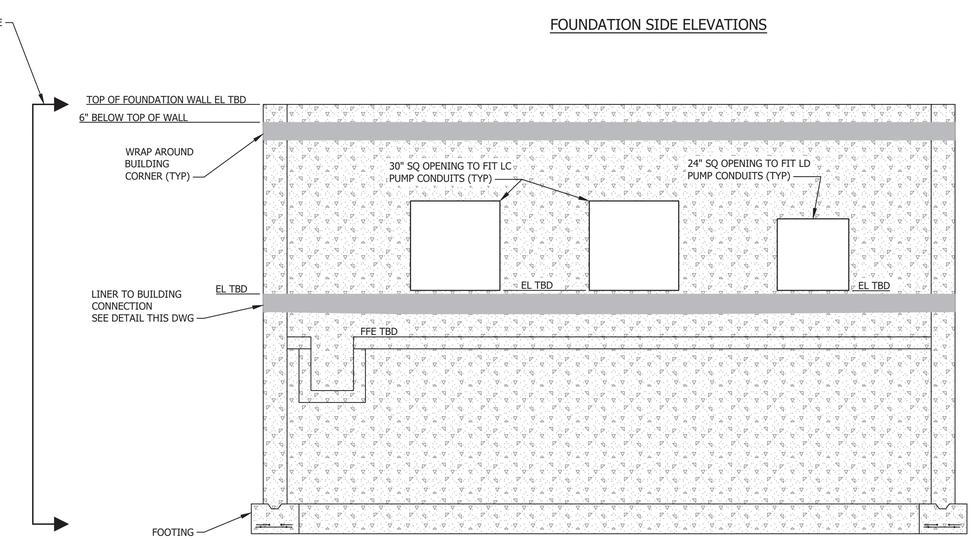


FOUNDATION SIDE ELEVATIONS



FOUNDATION REAR ELEVATION

LINER TO PERMANENT PUMP STATION CONNECTION
NTS

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	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D PIERCE
9601
11/11/2025
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PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
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C-304

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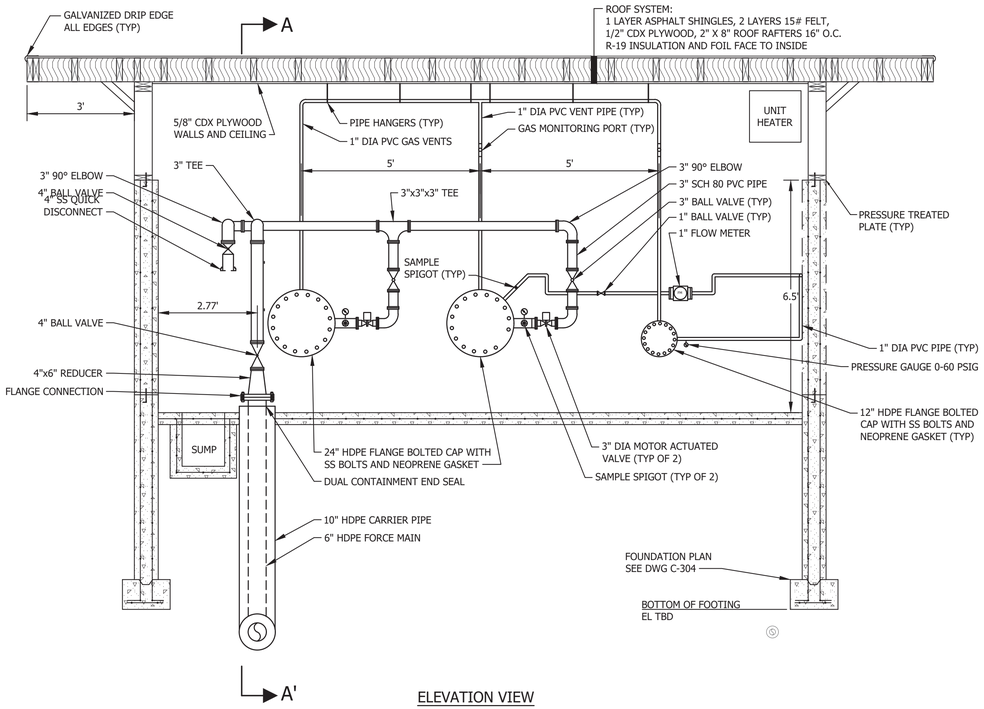
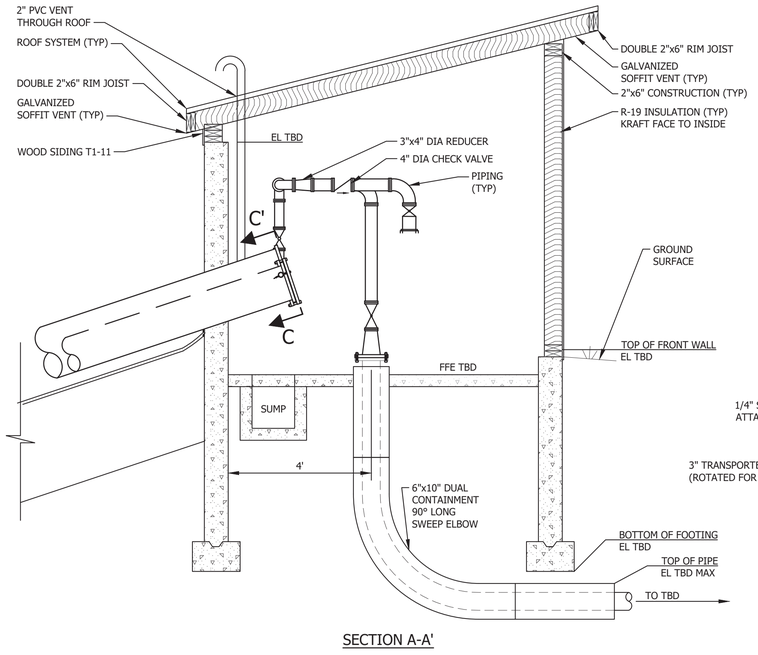
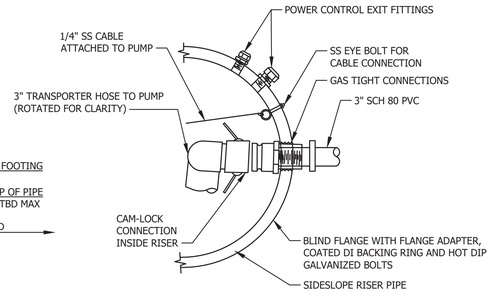


ELEVATION VIEW

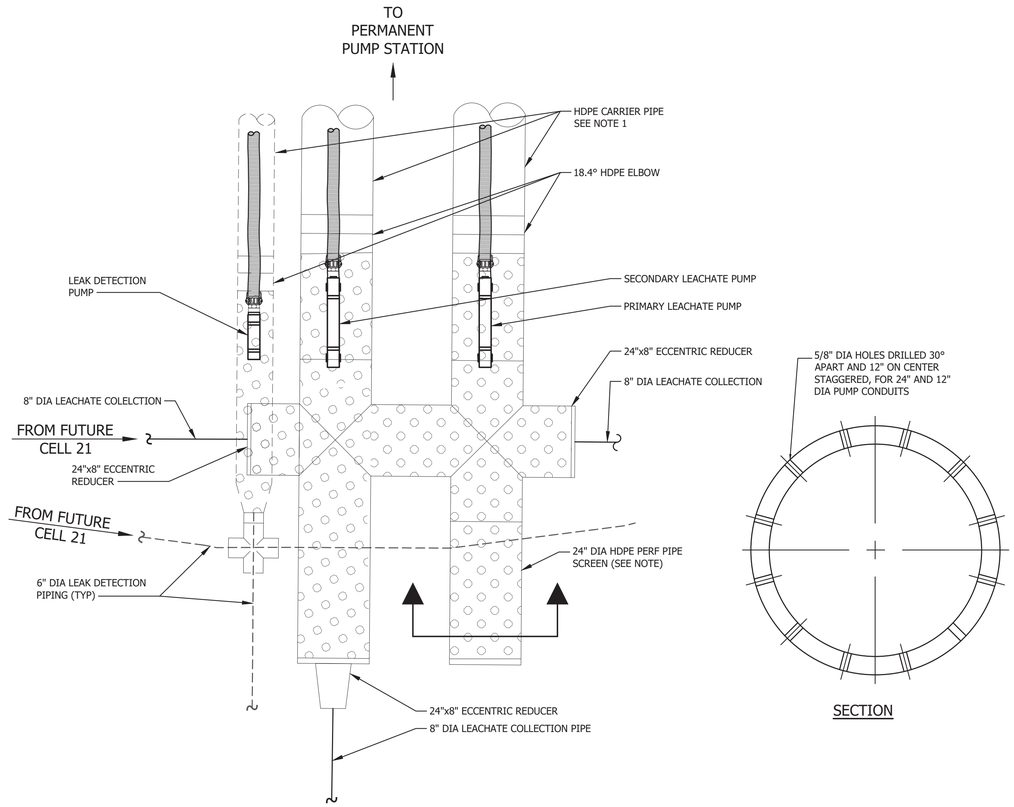


SECTION A-A'

PERMANENT PUMP STATION (CELL 18)
NTS



DISCHARGE CONNECTION - SECTION C-C'
NTS



SECTION

NOTES:
1. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF PUMP HDPE PUMP CONDUITS TO THE ENGINEER FOR REVIEW AND APPROVAL.
2. DIAMETER OF PUMP CONDUIT AND SCREEN IS 12" FOR LEAK DETECTION SYSTEM, 24" FOR PRIMARY LEACHATE COLLECTION SYSTEM AND SECONDARY LEACHATE COLLECTION SYSTEM.
3. PRIMARY AND SECONDARY LEACHATE PUMPS SHALL BE AT THE BOTTOM OF SUMP AND SIT HORIZONTALLY ON SUMP FLOOR. PRIMARY LEACHATE PUMP DISCHARGE HOSE IS 3-INCH DIAMETER.
4. LEAK DETECTION PUMP SHALL BE POSITIONED AT THE BOTTOM OF THE LEAK DETECTION SUMP AND SIT HORIZONTALLY ON SUMP FLOOR. LEAK DETECTION DISCHARGE HOSE IS 2-INCH DIAMETER.

HDPE PUMP CONDUIT AND SCREEN
NTS

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9601
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PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

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C-305

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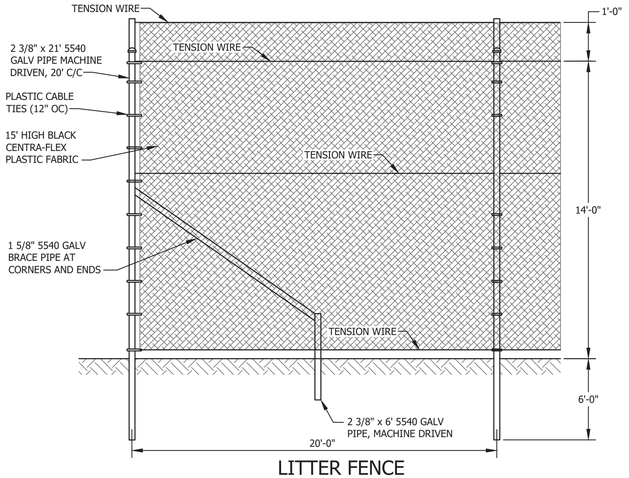
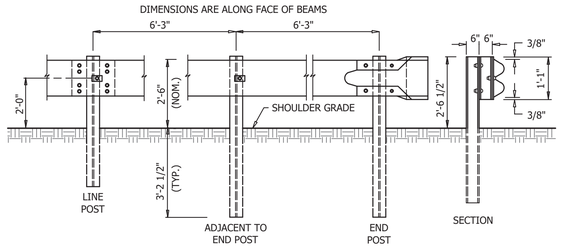
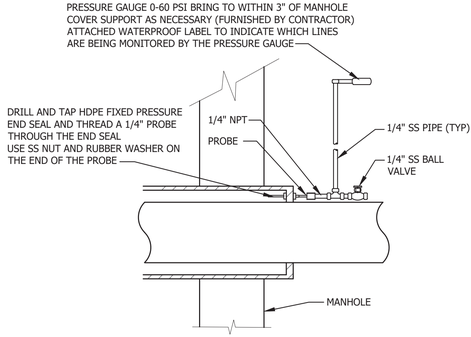


LITTER FENCE
NTS

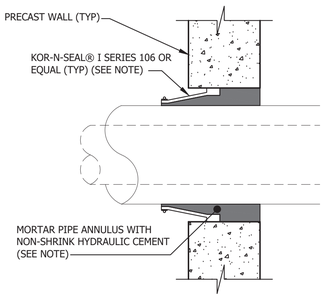


NOTES:
1. INTERMEDIATE POST SPACING SHALL BE 6'-3" UNLESS OTHERWISE SHOWN.
2. POST AND OFFSET BRACKETS SHALL BE 4"x 6" I-BEAM 8.5 OR 9.0 LBS/FT. LENGTH OF 5'-9" ATTACHED WITH 5/8" DIA HOT DIP GALVANIZED BOLTS WITH HEX NUTS.
3. ALL HOLES IN BEAM TO BE SHOP-PUNCHED PRIOR TO GALVANIZING.
4. RAIL PANELS AND END SECTIONS TO BE 12 GAUGE STEEL.
5. BACK-UP PLATE TO BE PLACED BEHIND RAIL ELEMENTS AT INTERMEDIATE STEEL POSTS (NON-SPLICE POSTS).
6. ALL PARTS SHALL CONFORM TO CURRENT MAINE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
7. WHEN GUARDRAIL IS CONSTRUCTED AT UP TO FOUR FEET FROM THE EDGE OF PAVEMENT, THE GUARDRAIL WILL BE SET FROM THE GRADE AT THE FACE OF RAIL.
8. END SECTIONS TO BE IN ACCORDANCE WITH MAINE DEPARTMENT OF TRANSPORTATION STANDARDS.
9. GUARDRAIL SET ON A RADIUS OF 150 FEET OR LESS TO BE CIRCULAR.

GUARDRAIL
NTS



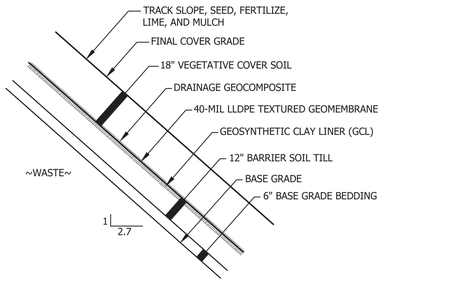
PRESSURE GAUGE AND TRANSMITTER
NTS



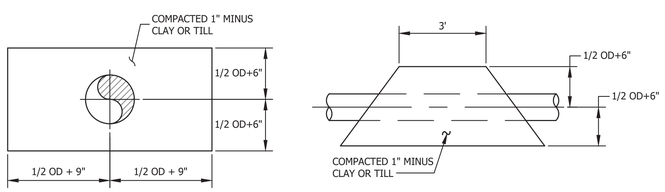
NOTE:

THE JOINTS FOR THE PIPES THROUGH PRECAST WALLS SHALL BE WEDGE STYLE KOR-N-SEAL® I SERIES 106 AS MANUFACTURED BY TRELLEBORG OR EQUAL. THE ANNULUS SHALL BE FILLED WITH NON-SHRINK HYDRAULIC CEMENT. THE CONTRACTOR SHALL FOLLOW THE MANUFACTURERS INSTRUCTIONS TO MIX AND APPLY THE CEMENT. THE FINAL PLUG SHALL YIELD A STRONG AND RIGID SEAL BETWEEN THE PIPE AND STRUCTURE. COMPLETE VACUUM TESTING PRIOR TO THE INSTALLATION OF CEMENT.

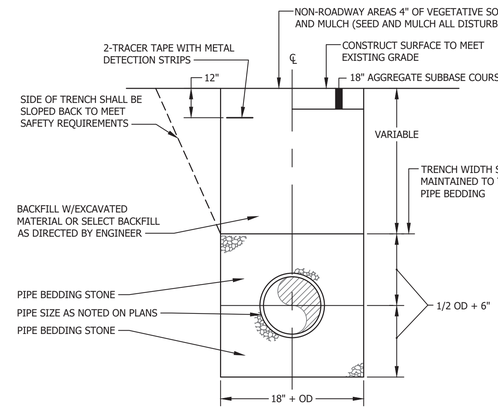
PRECAST WALL PENETRATION
NTS



FINAL COVER SYSTEM
NTS

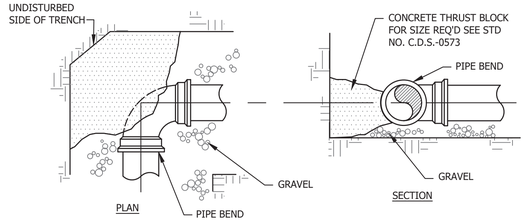


PIPE DAM
NTS

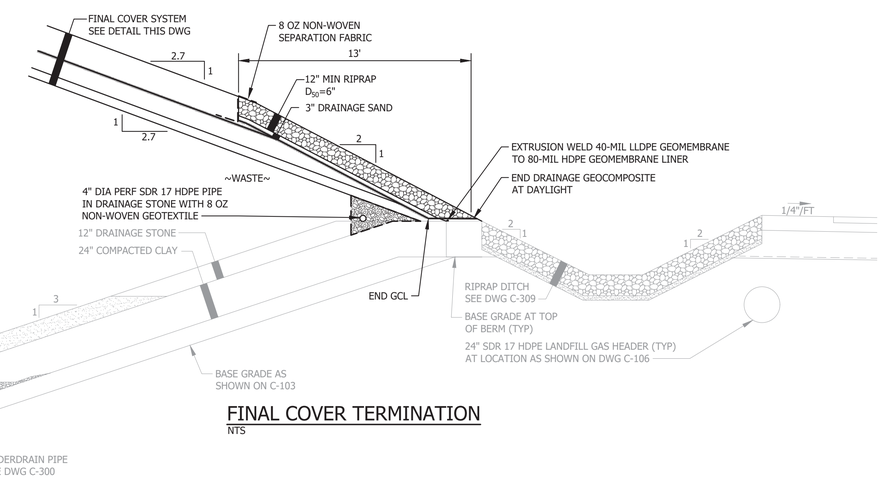


PIPE TRENCH
NTS

SIZE REQUIREMENTS FOR CONCRETE THRUST BLOCKS					
		BEARING ON UNDISTURBED SOIL (SQ FT)			
FITTINGS		90° BENDS	45° BENDS	TEES & PLUGS	HYDRANTS
PIPE SIZE	4"	2.0	1.0	1.0	N/A
	6"	3.0	2.0	2.0	6.0
	8"	5.0	3.0	4.0	N/A
	10"	7.0	4.0	5.0	N/A
	12"	10.0	6.0	7.0	N/A
	14"	13.0	7.0	10.0	N/A
	16"	17.0	9.0	12.0	N/A



TYPICAL THRUST BLOCK PLACEMENT ON BENDS
NTS



FINAL COVER TERMINATION
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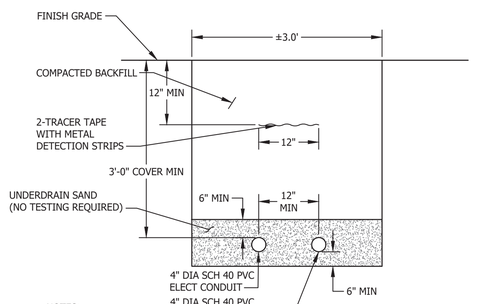
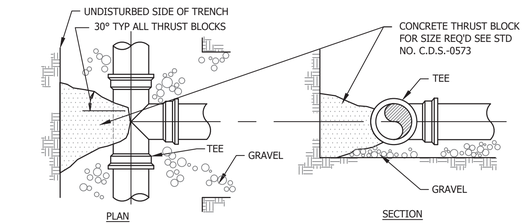


NOTES:
1. FROM POWER POLE TO PUMP STATION INSTALL TWO ELECTRICAL CONDUITS.
2. FROM PUMP STATION TO CLEANING/TIE-IN VAULT TWO ELECTRICAL CONDUITS AND ONE COMMUNICATION CONDUIT.
3. FIELD FIT AND MODIFY AS NECESSARY.

UNDERGROUND ELECTRIC AND COMMUNICATION TRENCH
NTS



TYPICAL THRUST BLOCK PLACEMENT ON TEES
NTS

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STATE OF MAINE — BRIAN D. PIERCE — 9608 — 11/11/2025 — LICENSED PROFESSIONAL ENGINEER

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

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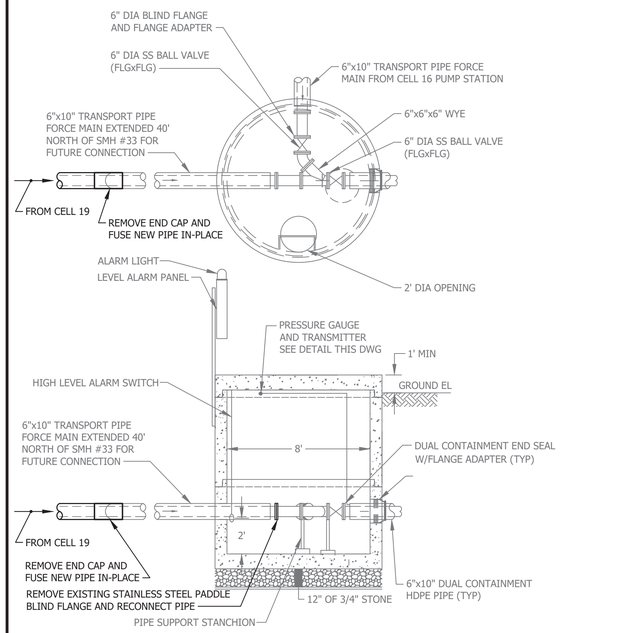
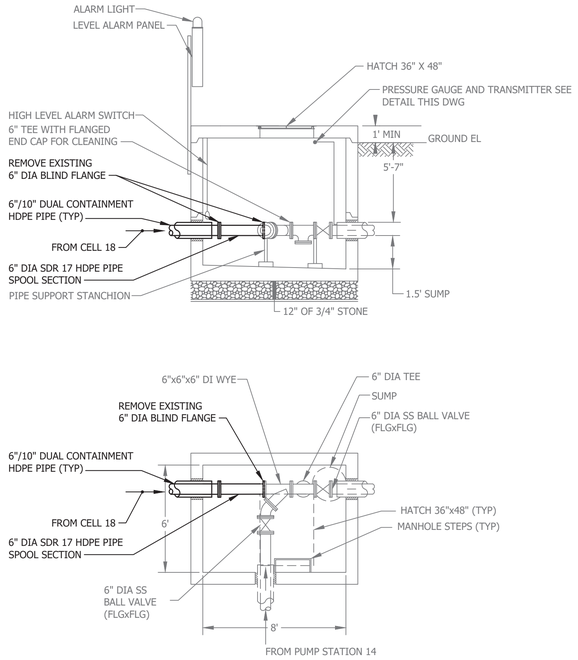


NOTE: ALL PIPE FITTINGS TO BE DUCTILE IRON UNLESS OTHERWISE NOTED.

SMH #33 CONNECTION
NTS



SMH #27 CONNECTION
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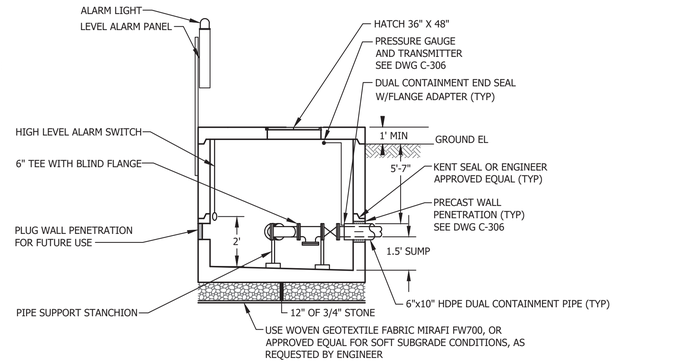
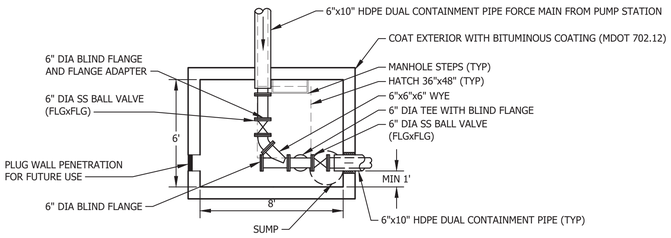
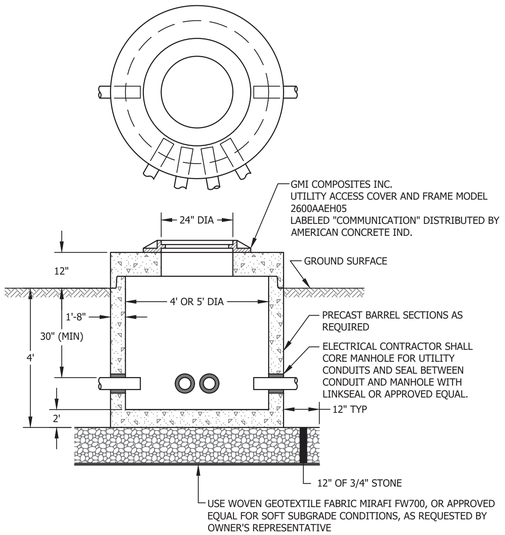




NOTE: ALL PIPE FITTINGS TO BE DUCTILE IRON UNLESS OTHERWISE NOTED.

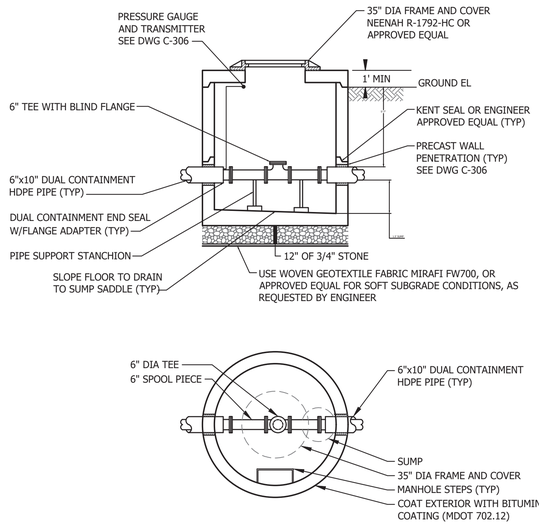
SMH TIE-IN VAULT (SMH #34, #36 & #39)
NTS



NOTES:

1. 4' DIA MANHOLE AS MANUFACTURED BY AMERICAN CONCRETE INDUSTRIES OR ENGINEER APPROVED EQUAL.
2. 4000 PSI CONCRETE AT 28 DAYS.
3. DESIGNED FOR H-20 WHEEL LOADING.
4. CONFORMS TO ASTM C-478 SPECIFICATIONS.
5. REINFORCED TO 0.12 IN SQ/LF.
6. SHIPLAP JOINTS SEALED WITH BUTYL RUBBER.
7. EXTERIOR COATED WITH ASPHALTIC PROTECTIVE DAMPROOFING.
8. BOTTOM MIN 5'-0" BELOW FINISH GRADE.
9. PRECAST CONCRETE VAULT MANUFACTURER TO PROVIDE ANTI-FLOATATION EXTENDED BASE SLAB AS NECESSARY. ANTI-FLOATATION DESIGN AND SHOP DRAWINGS SHALL BE PREPARED BY THE MANUFACTURER AND SUBMITTED TO THE ENGINEER FOR APPROVAL.

ELECTRIC AND COMMUNICATIONS MANHOLE (EMH)
NTS



NOTE: ALL PIPE FITTINGS TO BE DUCTILE IRON UNLESS OTHERWISE NOTED.

SMH IN-LINE VAULT (SMH #35, #37 & #38)
NTS

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BRIAN D. PIERCE
9601
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PROFESSIONAL ENGINEER
11/11/2025

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C-307

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A. GENERAL

1. All soil erosion and sediment control will be done in accordance with: (1) the Maine Erosion and Sediment Control Handbook: Best Management Practices, Maine Department of Environmental Protection (MEDEP), October 2016; (2) the project specific stormwater pollution prevention plan.

2. The site contractor (to be determined) will be responsible for the repair/replacement/maintenance of all erosion control measures until all disturbed areas are stabilized.

3. Disturbed areas will be permanently stabilized within 7 days of final grading. Disturbed areas not to be worked upon within 14 days of disturbance will be temporarily stabilized within 7 days of the disturbance.

4. In all areas, removal of trees, bushes and other vegetation, as well as disturbance of topsoil will be kept to a minimum while allowing proper site operations.

5. Any suitable topsoil will be stripped and stockpiled for reuse as directed by the owner. Topsoil will be stockpiled in a manner such that natural drainage is not obstructed and no off-site sediment damage will result. In any event, stockpiles will not be located within 100 feet of wetlands and will be at least 50 feet upgradient of the stockpile's perimeter silt fence. The sideslopes of the topsoil stockpile will not exceed 2:1. Silt fence will be installed around the perimeter of all topsoil stockpiles. Topsoil stockpiles will be surrounded with siltation fencing and will be temporarily seeded with Aroostook rye, annual or perennial ryegrass within 7 days of formation, or temporarily mulched.

B. TEMPORARY MEASURES

1. STABILIZED CONSTRUCTION ENTRANCE/EXIT

A crushed stone stabilized construction entrance/exit will be placed at any point of vehicular access to the site.

2. SILT FENCE

a. Silt fence will be installed prior to all construction activity, where soil disturbance may result in erosion. Silt fence will be erected at locations shown on the plans and/or downgradient of all construction activity.

b. Silt fences will be removed when they have served their useful purpose, but not before the upgradient areas have been permanently stabilized.

c. Silt fences will be inspected immediately after each rainfall and at least daily during prolonged rainfall. They will be inspected if there are any signs of erosion or sedimentation below them. Any required repairs will be made immediately. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind them, they will be replaced with a temporary crushed stone check dam.

d. Sediment deposits will be removed after each storm event if significant build-up has occurred or if deposits exceed half the height of the barrier.

3. STONE CHECK DAMS

Stone check dams will be installed in grass-lined swales and ditches during construction.

4. BARK MULCH SEDIMENT BARRIER

a. Where approved, bark mulch sediment barriers may be used as a substitute for silt fence. See the details in this drawing set for specifications.

b. Rock Filter Berms: To provide more filtering capacity or to act as a velocity check dam, a berm's center can be composed of clean crushed rock ranging in size from the french drain stone to riprap.

5. TEMPORARY SEEDING

Stabilize disturbed areas that will not be brought to final grade for a year or less and reduce problems associated with mud and dust production from exposed soil surface during construction with temporary vegetation.

6. TEMPORARY MULCHING

Use temporary mulch in the following locations and/or circumstances:

- In sensitive areas (within 100 feet of streams, wetlands and in lake watersheds) temporary mulch will be applied within 7 days of exposing spill or prior to any storm event.
- Apply temporary mulch within 14 days of disturbance or prior to any storm event in all other areas.
- Areas which have been temporarily or permanently seeded will be mulched immediately following seeding.
- Areas which cannot be seeded within the growing season will be mulched for over-winter protection and the area will be seeded at the beginning of the growing season.
- Mulch can be used in conjunction with tree, shrub, vine, and ground cover plantings.
- Mulch anchoring will be used on slopes greater than 5 percent in late fall (past September 1), and over-winter (September 1 - April 25).

The following materials may be used for temporary mulch:

a. Hay or Straw material shall be air-dried, free of seeds and coarse material. Apply 2-3 tons/acre or 3 bales (90-130 lbs per 1,000 sf).

b. Erosion Control Mix: It can be used as a stand-alone reinforcement:
- on slopes 2 horizontal to 1 vertical or less;
- on frozen ground or forested areas; and
- at the edge of gravel parking areas and areas under construction.

c. Erosion control mix alone is not suitable:
- on slopes with groundwater seepage;
- at low points with concentrated flows and in gullies;
- at the bottom of steep perimeter slopes exceeding 100 feet in length;
- below culvert outlet aprons; and around catch basins and closed storm systems.

d. Chemical Mulches and Soil Binders: Wide ranges of synthetic spray-on materials are marketed to protect the soil surface. These are emulsions that are mixed with water and applied to the soil. They may be used alone, but most often are used to hold wood fiber, hydro-mulches or straw to the soil surface.

e. Erosion Control Blankets and Mats: Mats are manufactured combinations of mulch and netting designed to retain soil moisture and modify soil temperature. During the growing season (April 25 to August 31) use mats indicated on drawings or North American Green (NAG) C125 BN (or mulch and netting) on:
- the base of grassed waterways;
- steep slopes (15 percent or greater); and
- any disturbed soil within 100 feet of lakes, streams, or wetlands.

During the late fall and winter (September 1 to April 25) use heavy grade mats indicated on drawings for NAG SC250 on all areas noted above plus use lighter grade mats NAG C125BN (or mulch and netting) on:
- sideslopes of grassed waterways; and
- moderate slopes (between 8 and 15 percent).

7. TEMPORARY DUST CONTROL

To prevent the blowing and movement of dust from exposed soil surfaces, and reduce the presence of dust, use water to control dusting by preserving the moisture level in the road surface materials. The use of calcium chloride or any other chemicals for dust control is prohibited

8. CONSTRUCTION DE-WATERING

a. Water from construction de-watering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams or site boundaries. Utilize temporary sediment basins, erosion control soil filter berms backed by staked hay bales, or other approved Best Management Practices (BMP's).

b. In sensitive areas near streams or ponds, discharge the water from the de-watering operation into a temporary sediment basin created by a surrounding filter berm of uncompacted erosion control mix immediately backed by staked hay bales (see the site details). Locate the temporary sediment basin at lease 100 feet from the nearest water body, such that the filtered water will flow through undisturbed vegetated soil areas prior to reaching the water body or property line.

A. PERMANENT MEASURES

1. Riprapped Aprons: All storm drain pipe outlets and the inlet and outlet of culverts will have riprap aprons to protect against scour and deterioration.

2. Topsoil, Seed, and Mulch: All areas disturbed during construction, but not subject to other restoration (paving, riprap, etc.) will be loamed, limed, fertilized, seeded, and mulched.

a. Seeded Preparation: Use stockpiled materials spread to the depths shown on the plans, if available. Approved topsoil substitutes may be used. Grade the site as needed.

b. Seeding will be completed by August 31 of each year. Late season seeding may be done between September 1 and April 25. Areas not seeded or which do not obtain satisfactory growth by August 31, will be seeded with Aroostook Rye or mulched. After November 1, or the first killing frost, disturbed areas will be seeded at double the specified application rates, mulched, and anchored.

PERMANENT SEEDING SPECIFICATIONS

Mixture:	Grassed areas (lbs/acre)
Tall Fescue	54
Creeping Red Fescue	25
Red Top	5
Ladino Clover	13
Annual Ryegrass	8
Birdsfoot Trefoil	5
Timothy	10

c. Mulch in accordance with specifications for temporary mulching.

d. If permanent vegetated stabilization cannot be established due to the season of the year, all exposed and disturbed areas not to undergo further disturbance are to have dormant seeding applied and be temporarily mulched to protect the site.

3. Ditches and Channels: All ditches on-site will be lined with North American Green S75 erosion control mesh (or an approved equal) upon installation of loam and seed.

B. WINTER CONSTRUCTION AND STABILIZATION

1. Winter excavation and earthwork will be completed so as to minimize exposed areas while satisfactorily completing the project. Limit exposed areas to those areas in which work is to occur during the following 15 days and that can be mulched in one day prior to any snow event. All areas will be considered denuded until the subbase gravel is installed in roadway areas or the areas of future loam and seed have been loamed, seeded, and mulched.

Install any added measures necessary to control erosion/sedimentation. The particular measure used will be dependent upon site conditions, the size of the area to be protected, and weather conditions.

To minimize areas without erosion control protection, continuation of earthwork operations on additional areas will not begin until the exposed soil surface on the area being worked has been stabilized.

2. Natural Resource Protection: During winter construction, or within 100-feet of a natural resource (i.e., wetland) a double-row of sediment barriers (i.e., silt fence backed with hay bales or erosion control mix) will be placed between any natural resource and the disturbed area. Projects crossing the natural resource will be protected a minimum distance of 100 feet on either side from the resource.

3. Sediment Barriers: During frozen conditions, sediment barriers may consist of erosion control mix berms or any other recognized sediment barriers as frozen soil prevents the proper installation of hay bales or silt fences.

4. Mulching: All areas will be considered to be denuded until seeded and mulched. Hay and straw mulch will be applied at a rate of twice the normal accepted rate.

Mulch will not be spread on top of snow.

After each day of final grading, the area will be properly stabilized with anchored hay or straw or erosion control matting.

Between the dates of September 1 and April 25, all mulch will be anchored by either mulch netting, emulsion chemical, tracking or wood cellulose fiber.

5. Soil Stockpiling: Stockpiles of soil or subsoil will be mulched for over-winter protection with hay or straw at twice the normal rate or with a 4-inch layer of erosion control mix. This will be done within 24 hours of stocking and re-established prior to any rainfall or snowfall. Any soil stockpiles shall not be placed (even covered with mulch) within 100 feet from any natural resources.

6. Seeding: Dormant seeding may be placed prior to the placement of mulch or erosion control blankets. If dormant seeding is used for the site, all disturbed areas will receive 4 inches of loam and seed at an application rate of three times the rate for permanent seeding. All areas seeded during the winter will be inspected in the spring for adequate catch. All areas insufficiently vegetated (less than 85 percent catch) will be revegetated by replacing loam, seed, and mulch.

If dormant seeding is not used for the site, all disturbed areas will be revegetated in the spring.

7. Maintenance: Maintenance measures will be applied as needed during the entire construction season. After each rainfall, snow storm, or period of thawing and runoff, the site contractor will perform a visual inspection of all installed erosion control measures and perform repairs as needed to ensure their continuous function.

Following the temporary and/or final seeding and mulching, the contractor will, in the spring, inspect and repair any damages and/or bare spots. An established vegetative cover means a minimum of 90 percent of areas vegetated with vigorous growth.

A. OVER-WINTER CONSTRUCTION EROSION CONTROL MEASURES

1. Stabilization of Disturbed Soil: By August 31, all disturbed soils on areas having a slope less than 15 percent will be seeded and mulched. If the contractor fails to stabilize these soils by this date, then the contractor shall stabilize the soil for late fall and winter, by using either temporary seeding or mulching.

2. Stabilization of Disturbed Slopes: All slopes to be vegetated will be completed by August 31. The owner will consider any area having a grade greater than 15 percent (6.5H:1V) to be a slope. Slopes not vegetated by August 31 will receive one of the following actions to stabilize the slope for late fall and winter:

a. Stabilize the soil with temporary vegetation and erosion control mesh.
b. Stabilize the slope with erosion control mix.
c. Stabilize the slope with stone riprap.

3. Stabilization of Ditches and Channels: All stone-lined ditches and channels to be used to convey runoff through the winter will be constructed and stabilized by November 15. Grass-lined ditches and channels will be complete by September 15. Grass-lined ditches not stabilized by September 15 shall be lined with either sod or riprap.

E. MAINTENANCE PLAN

1. Routine Maintenance: Inspection will be performed as outlined in the project's Erosion Control Plan. Inspection will be by a qualified person during wet weather to ensure that the facility performs as intended. Inspection priorities will include checking erosion controls for accumulation of sediments.

A. Housekeeping

1. Spill prevention. Controls must be used to prevent pollutants from being discharged from materials on site, including storage practices to minimize exposure of the materials to stormwater, and appropriate spill prevention, containment, and response planning and implementation.

2. Groundwater protection. During construction, liquid petroleum products and other hazardous materials with the potential to contaminate groundwater may not be stored or handled in areas of the site draining to an infiltration area. An "infiltration area" is any area of the site that by design or as a result of soils, topography and other relevant factors accumulates runoff that infiltrates into the soil. Dikes, berms, sumps, and other forms of secondary containment that prevent discharge to groundwater may be used to isolate portions of the site for the purposes of storage and handling of these materials.

3. Fugitive sediment and dust. Actions must be taken to ensure that activities do not result in noticeable erosion of soils or fugitive dust emissions during or after construction. Oil may not be used for dust control.

4. Debris and other materials. Litter, construction debris, and chemicals exposed to stormwater must be prevented from becoming a pollutant source.

5. Trench or foundation de-watering. Trench de-watering is the removal of water from trenches, foundations, coffer dams, ponds, and other areas within the construction area that retain water after excavation. In most cases the collected water is heavily silted and hinders correct and safe construction practices. The collected water must be removed from the ponded area, either through gravity or pumping, and must be spread through natural wooded buffers or removed to areas that are specifically designed to collect the maximum amount of sediment possible, like a cofferdam sedimentation basin. Avoid allowing the water to flow over disturbed areas of the site. Equivalent measures may be taken if approved by the department.

6. Non-stormwater discharges. Identify and prevent contamination by non-stormwater discharges.

7. Additional requirements. Additional requirements may be applied on a site-specific basis.

B. CONSTRUCTION SEQUENCE

It is anticipated that construction will commence upon receipt of all necessary permits and approvals. The following outlines the preliminary construction sequence:

a. Install silt fence and other temporary erosion control measures for the construction of Cell and accessory facilities such as berms, and service roads;

b. Construct upslope stormwater diversion berms, ditches, culvert outlets, and control structures:

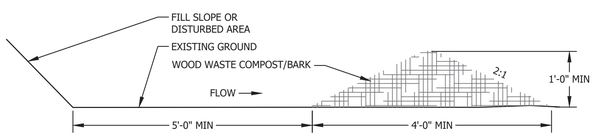
c. Perform stormwater upgrades;

d. Construct service road;

e. Construct Cell base grade;

f. Construct Cell liner system;

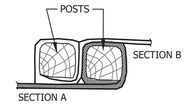
g. As permanent erosion control measures become stabilized, remove temporary measures (e.g., silt fence, stone check dams).



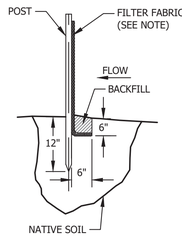
NOTE:
BARK MULCH SEDIMENT BARRIERS MAY BE USED AS AN ALTERNATE TO SILT FENCE WHEN APPROVED BY THE ENGINEER.

EROSION CONTROL MIX BERM
NTS

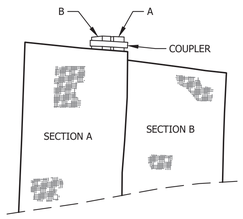
NOTE: SILTATION FENCE SHALL BE ENVIROFENCE AS MANF. BY MIRAFI INC., PROPEX SILT STOP AS MANF. BY AMOCO FABRICS CO. OR EQUAL



TOP VIEW

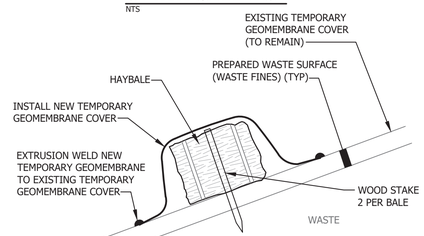


TOE-IN DETAIL

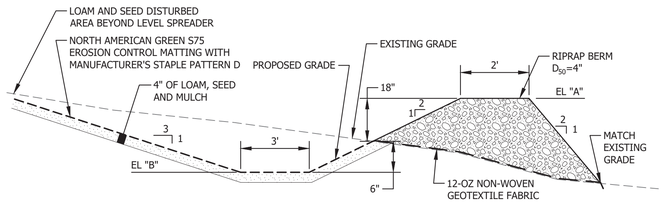


JOINING SECTIONS

SILTATION FENCE
NTS



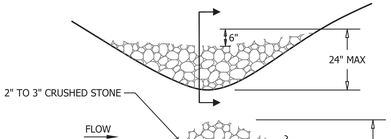
INTERMEDIATE COVER STORMWATER DIVERSION BERM
NTS



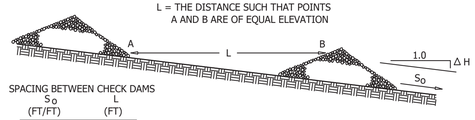
NOTES:
1. CONSTRUCT LEVEL LIP AND SPREADER ON ZERO PERCENT GRADE.
2. STORM RUNOFF CONVERTED TO SHEET FLOW SHALL OUTLET ONTO STABILIZED AREA. WATER SHALL NOT BE CHANNELIZED IMMEDIATELY BELOW POINT OF DISCHARGE.

LEVEL SPREADER NO.	EL "A"	EL "B"	LENGTH (FT)
DP-11R	151.5	150.0	15.0
DP-12	165.8	164.3	15.0
DP-13	158.0	156.5	15.0
DP-14	154.0	152.5	25.0

LEVEL SPREADER
NTS



SECTION

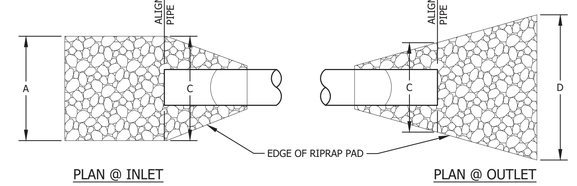


SPACING BETWEEN CHECK DAMS

So (FT/FT)	L (FT)
0.020	75
0.030	50
0.040	40
0.050	30
0.080	20
0.100	10

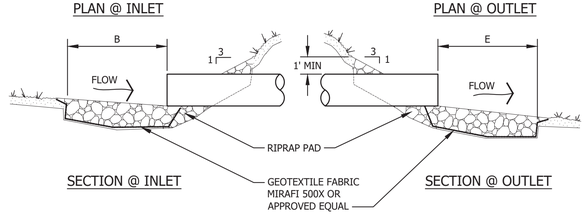
STONE CHECK DAM
NTS

CROSS SECTION



PLAN @ INLET

PLAN @ OUTLET



SECTION @ INLET

SECTION @ OUTLET

RIPRAP PAD MUST BE INSTALLED WITHIN 48 HOURS OF INSTALLING NEW PIPE OR CULVERT.

PIPE	PIPE DIA (IN)	C (FT)	D (FT)	E (FT)	PAD DEPTH (IN)	D50 (IN)
DP-11R	24	6	15	20	20	10
DP-12	24	6	15	20	20	10
DP-13	24	6	15	20	20	10
DP-14	24	6	15	20	20	10
SC-2D	24	6	15	20	20	10
UNDERDRAIN DISCHARGE STRUCTURE	4	4	4	4	8	4

PIPE INLET/OUTLET DETAILS
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. EMERY
9601
LICENSED
PROFESSIONAL ENGINEER
11/11/2025

PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	DPW/NMT
DRAWN BY:	SJM
DATE:	11/10/2025
CHECKED BY:	BDP
LMN:	LMN
CTB:	SME-STD.CTB

JOB NO. 240101.00 DWG FILE DETAILS

C-308

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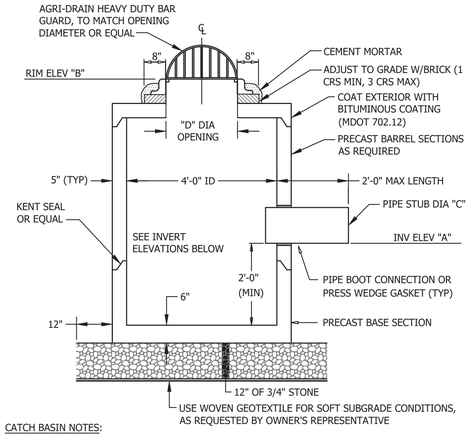


CATCH BASIN NOTES:

THE CONTRACTOR SHALL PROVIDE SUBMITTALS TO THE ENGINEER FOR APPROVAL. SUBMITTALS SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

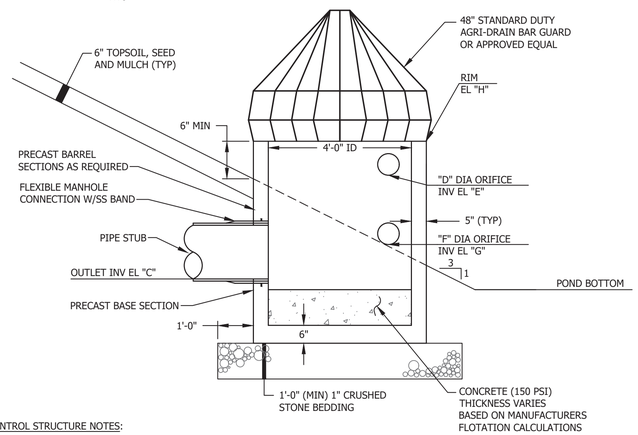
PRODUCT DATA: SUBMIT PRODUCT DATA FOR ALL MATERIALS USED ON THE JOB FOR REVIEW FOR LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND DESIGN CONCEPT EXPRESSED IN CONTRACT DOCUMENTS.

SHOP DRAWINGS: SUBMIT FOR REVIEW SHOP DRAWINGS OF ALL PRECAST UNITS. MANUFACTURER'S INFORMATION SHALL BE SUBMITTED FOR JOINT SEALANTS AND WATERPROOFING. MANUFACTURER SHALL PROVIDE ANTI-FLOTATION DESIGN SHOP DRAWINGS AND CALCULATIONS, INCLUDING ANY EXTENDED BASE SLABS AS NECESSARY, FOR PROPOSED MANHOLES. MANUFACTURER SHALL ASSUME GROUNDWATER LEVELS EQUAL TOP OF GROUND ELEVATIONS AND PROVIDE FOR A 1.2 FACTOR OF SAFETY AGAINST FLOTATION.

CATCH BASIN SCHEDULE A

CATCH BASIN DESIGNATION	PIPE INV EL	RIM EL	PIPE DIA	TOP OPENING
	"A" (FT)	"B" (FT)	"C" (IN)	DIA "D" (IN)
CB-2B	173.0	179.0	24	30
CB-2G	173.0	179.0	24	30
CB-2D	192.0	201.0	24	30
CB-4C	167.0	171.0	24	30
CB-4D	158.00	160.5	24	30
CB-4G	161.00	167.0	24	30
CB-4H	174.0	181.0	24	30

CATCH BASIN
NTS



OUTLET CONTROL STRUCTURE NOTES:

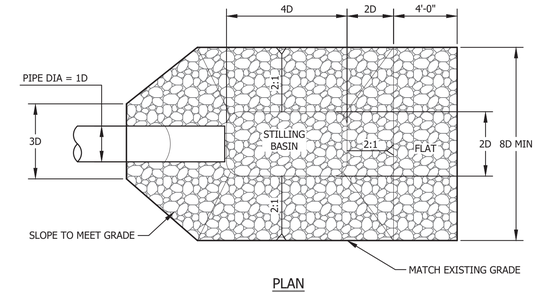
THE CONTRACTOR SHALL PROVIDE SUBMITTALS TO THE ENGINEER FOR APPROVAL. SUBMITTALS SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

PRODUCT DATA: SUBMIT PRODUCT DATA FOR ALL MATERIALS USED ON THE JOB FOR REVIEW FOR LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND DESIGN CONCEPT EXPRESSED IN CONTRACT DOCUMENTS.

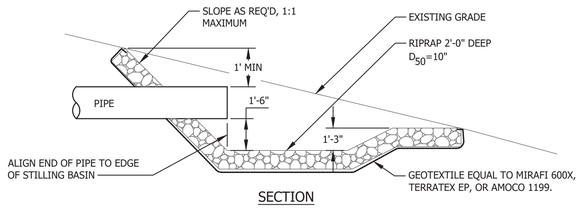
SHOP DRAWINGS: SUBMIT FOR REVIEW SHOP DRAWINGS OF ALL PRECAST UNITS. MANUFACTURER'S INFORMATION SHALL BE SUBMITTED FOR JOINT SEALANTS AND WATERPROOFING. MANUFACTURER SHALL PROVIDE ANTI-FLOTATION DESIGN SHOP DRAWINGS AND CALCULATIONS, INCLUDING ANY EXTENDED BASE SLABS AS NECESSARY, FOR PROPOSED MANHOLES. MANUFACTURER SHALL ASSUME GROUNDWATER LEVELS EQUAL TOP OF BERM ELEVATION AND PROVIDE FOR A 1.2 FACTOR OF SAFETY AGAINST FLOTATION.

STRUCTURE DESIGNATION	OUTLET INV EL	ORIFICE DIA	ORIFICE INV EL	ORIFICE DIA	ORIFICE INV EL	RIM EL	OUTLET (C) CULVERT	CULVERT	CULVERT SLOPE
	"C" (FT)	"D" (IN)	"E" (FT)	"F" (IN)	"G" (FT)	"H" (FT)	DIAMETER (IN)	LENGTH (FT)	(FT/FT)
DP-11R	155.3	6.0	159.0	4.0	156.50	161.00	24 (CORR PE)	55.00	0.02
DP-12	168.9	6.0	174.0	4.0	171.50	175.00	24 (CORR PE)	66.00	0.01
DP-13	160.3	6.0	163.0	4.0	160.50	163.80	24 (CORR PE)	30.00	0.04
DP-14	157.0	6.0	159.0	4.0	158.00	159.80	24 (CORR PE)	55.00	0.02

OUTLET CONTROL STRUCTURE
NTS



PLAN

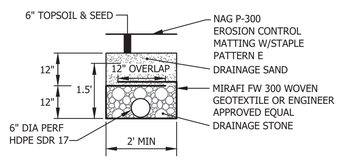


SECTION

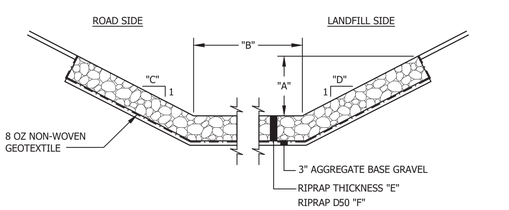
NOTES:

1. INSTALL SILT FENCE DOWNSTREAM PRIOR TO EXCAVATION.
2. LOAM AND SEED ALL AREAS DISTURBED BY CONSTRUCTION OF PLUNGE POOL.

STANDARD PLUNGE POOL
NTS



POND UNDERDRAIN
NTS

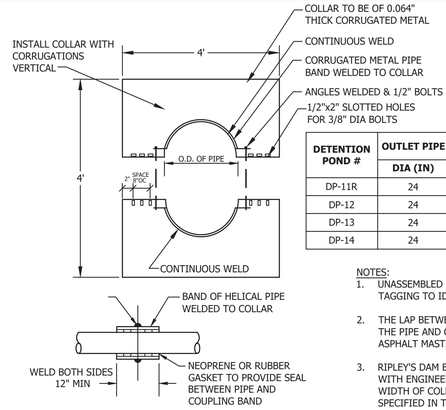


DITCH	A	B	C	D	E	F
	(FT)	(FT)			(IN)	(IN)
TOE DITCH	3	3	2	2	22	10
DITCH 2D	3	3	2	2	22	10

RIPRAP DITCH
NTS

STORM DRAIN	DIAMETER	MATERIAL	LENGTH	SLOPE	INV IN	INV OUT
	(in.)		(ft.)	(%)		
SD-2B	24	CORR PE	90.0	0.010	173.00	172.00
SD-2E	24	CORR PE	80.0	0.010	173.00	172.00
SD-2D	24	CORR PE	30.0	0.020	192.00	191.50
SD-4C	24	CORR PE	52.0	0.009	167.00	166.50
SD-4D	24	CORR PE	54.5	0.009	158.00	157.50
SD-4G	24	CORR PE	115.0	0.008	161.00	160.00
SD-4H	24	CORR PE	65.0	0.030	174.00	172.00

STORM DRAIN PIPES
NTS

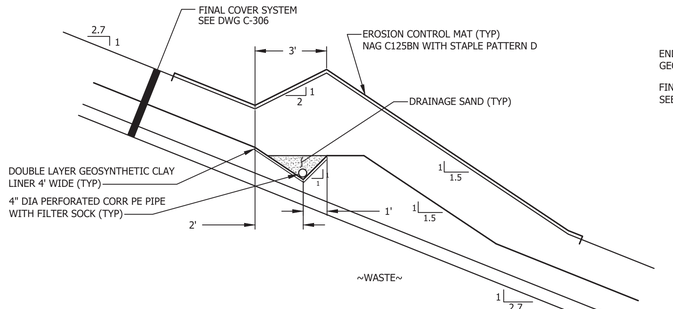


DETENTION POND #	OUTLET PIPE	PIPE LENGTH	SATURATED LENGTH	# OF	SPACING
	DIA (IN)	(FT)	(FT)	COLLARS	(FT)
DP-11R	24	55	46.2	2	15
DP-12	24	66	35.2	2	12
DP-13	24	30	42.5	2	14
DP-14	24	55	22.8	2	8

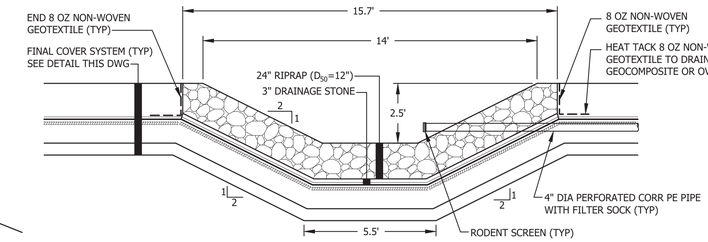
NOTES:

1. UNASSEMBLED COLLAR SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PARTS.
2. THE LAP BETWEEN THE TWO HALF SECTIONS AND BETWEEN THE PIPE AND CONNECTING BAND SHALL BE CAULKED WITH ASPHALT MASTIC AT TIME OF INSTALLATION.
3. RIPLEY'S DAM BY MCRIP MANUFACTURING MAY BE USED WITH ENGINEERS APPROVAL PROVIDING THAT LENGTH AND WIDTH OF COLLAR IS EQUAL TO OR GREATER THAN THAT SPECIFIED IN THE DETAIL.

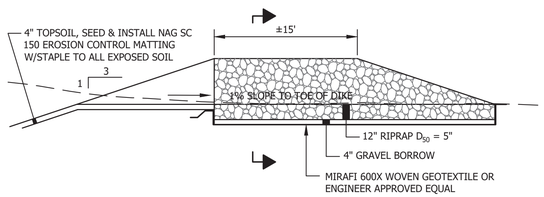
ANTI-SEEP COLLAR
NTS



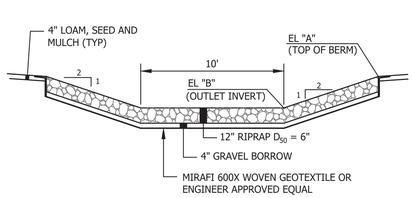
FINAL COVER SURFACE TERRACE
NTS



FINAL COVER RIPRAP DOWNSPOUT
NTS



ELEVATION



SECTION

STRUCTURE DESIGNATION	BOTTOM WIDTH (FT)	LENGTH (FT)	EL "A" (FT)	D_{50} (IN)	THICKNESS (IN)	EL "B" (FT)
DP-11R	10	±15	168.0	6	12	166.5
DP-12	10	±15	180.0	6	12	178.5
DP-13	10	±15	168.0	6	12	166.5
DP-14	10	±15	162.0	6	12	160.5

EMERGENCY SPILLWAY
NTS

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STATE OF MAINE — BRIAN D. PERRY — 9600 — LICENSED PROFESSIONAL ENGINEER — 11/11/2025

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NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

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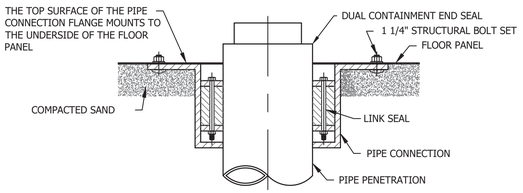
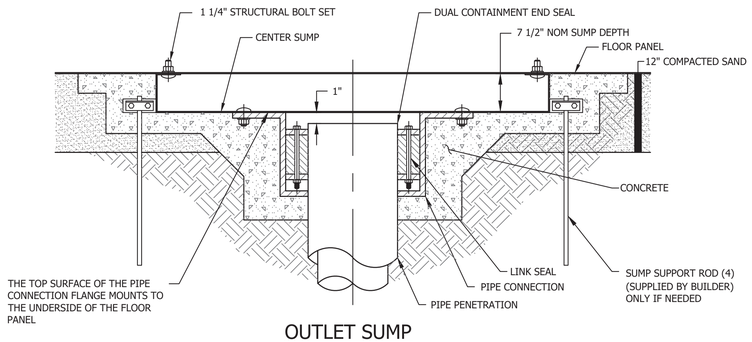


TANK INLET
NTS



OUTLET SUMP
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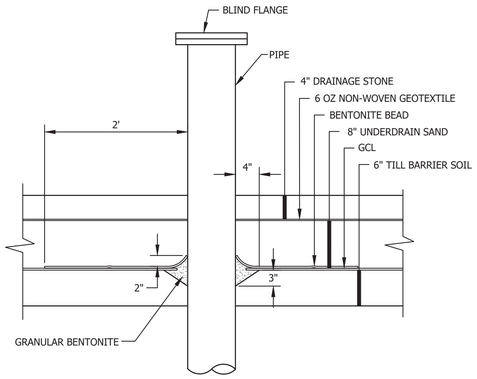

SECONDARY CONTAINMENT PENETRATION
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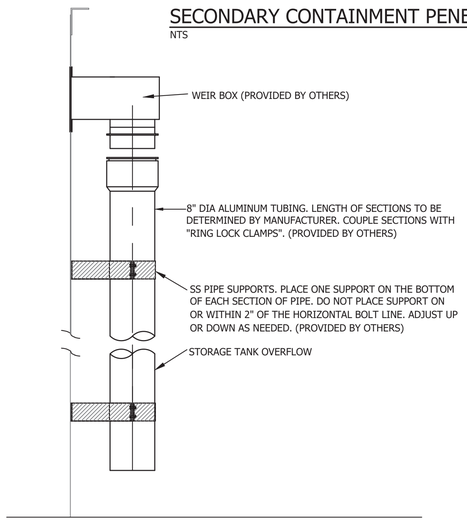

GRAVITY SEWER TERMINATION
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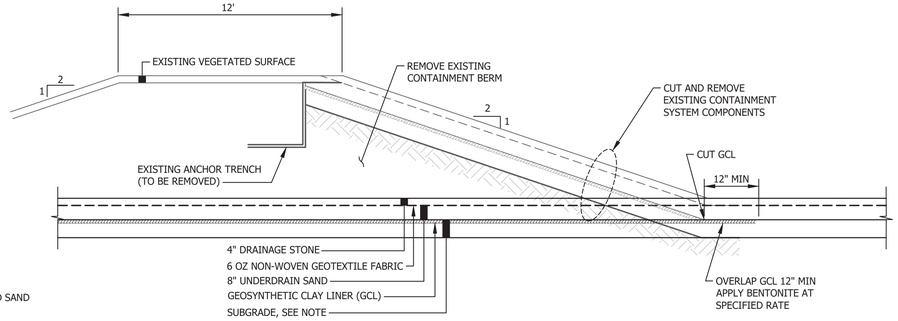
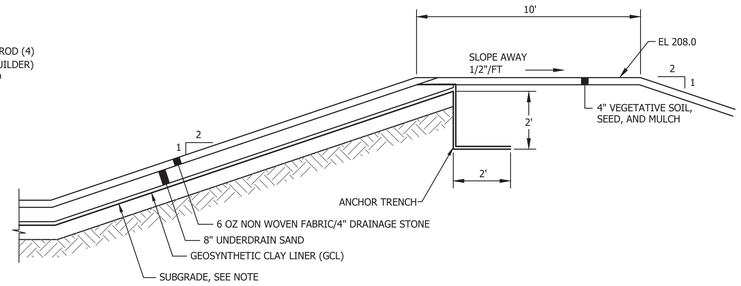


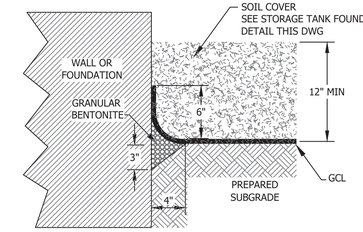
NOTE:
TOP 6 INCHES OF SUBGRADE TO BE SCARIFIED.
REMOVE ROCKS GREATER THAN 1" AND RECOMPACT.

CONTAINMENT AREA LINER CONNECTION
NTS

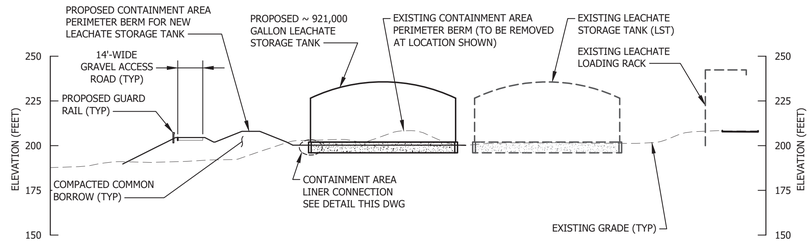


NOTE:
TOP 6 INCHES OF SUBGRADE TO BE SCARIFIED. REMOVE ROCKS GREATER THAN 1" AND RECOMPACT.

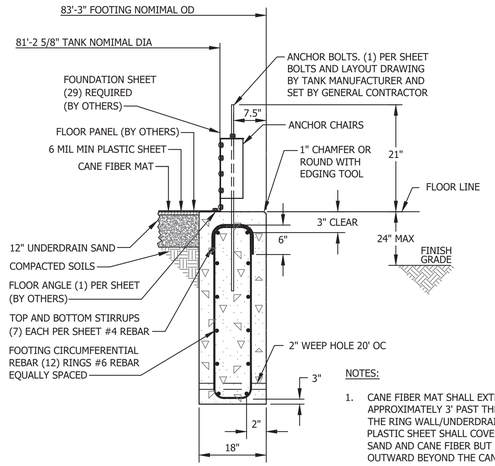
CONTAINMENT AREA AND PERIMETER BERM
NTS



GCL WALL SEAL
NTS

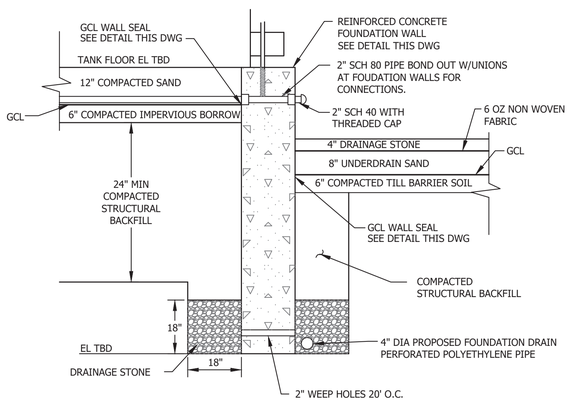


LEACHATE STORAGE SYSTEM SECTION
20 0 40 80 FEET (HORZ)
20 0 40 80 FEET (VERT)



NOTES:
1. CANE FIBER MAT SHALL EXTEND INWARD APPROXIMATELY 3' PAST THE INTERSECTION OF THE RING WALL/UNDERDRAIN SAND. SIX MIL PLASTIC SHEET SHALL COVER THE UNDERDRAIN SAND AND CANE FIBER BUT SHALL NOT EXTEND OUTWARD BEYOND THE CANE FIBER.
2. TANK INSTALLER TO FILLET INTERSECTION OF RING WALL/FLOOR ANGLE WITH TANK SEALANT.

REINFORCED CONCRETE FOUNDATION WALL
NTS



STORAGE TANK FOUNDATION
NTS

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STATE OF MAINE BRIAN D. PHELPS 9601 REGISTERED PROFESSIONAL ENGINEER 11/11/2025

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JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

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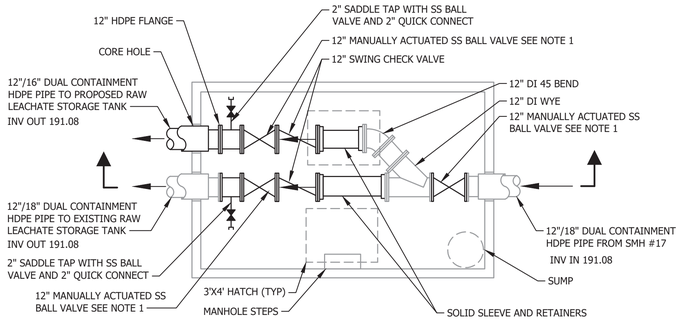
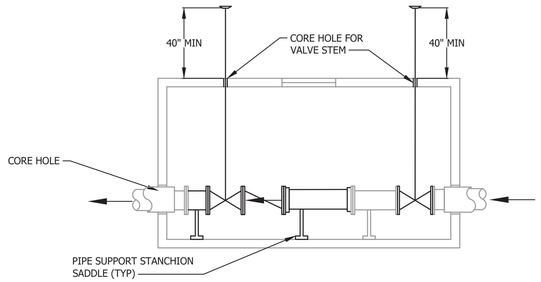


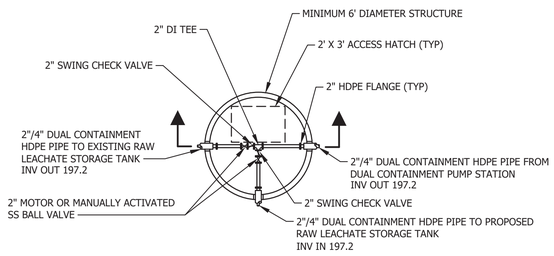
PLAN VIEW

NOTES:
1. BALL VALVE TO BE MANUALLY ACTUATED WITH HANDWHEEL AND EXTEND A MINIMUM OF 40" ABOVE THE STRUCTURE

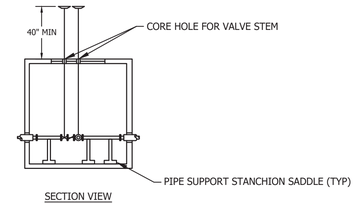


SECTION VIEW

SMH #18 MODIFICATIONS
NTS

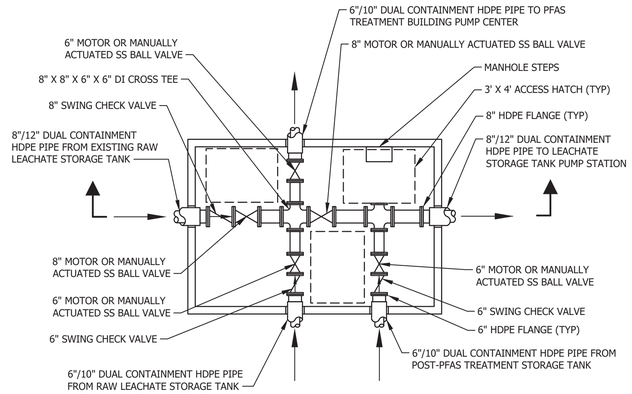


PLAN VIEW



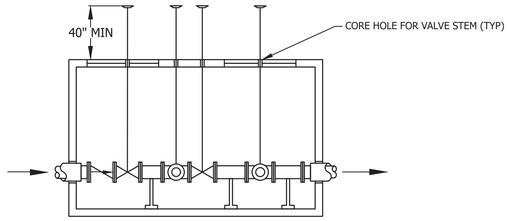
SECTION VIEW

LOADING RACK VALVE PIT
NTS



PLAN VIEW

NOTES:
1. DRAIN EXISTING LEACHATE STORAGE TANK PRIOR TO COMMENCING TIE-IN OPERATIONS
2. BYPASS LEACHATE PUMPING REQUIRED FROM EXISTING LEACHATE STORAGE TANK TO EXISTING LEACHATE STORAGE TANK PUMP STATION DURING TIE-IN OPERATIONS



SECTION VIEW

TANK DISCHARGE VALVE PIT
NTS

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BRIAN D PIERCE
9608
LICENSED PROFESSIONAL ENGINEER
11/11/2025

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NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

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APPENDIX B

QUALITY ASSURANCE/QUALITY CONTROL PLAN

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ENGINEERS

QUALITY ASSURANCE/ QUALITY CONTROL PLAN CELL 18 CONSTRUCTION JUNIPER RIDGE LANDFILL OLD TOWN, MAINE

Prepared for

NEWSME LANDFILL OPERATIONS, LLC
Old Town, Maine

November 2025

4 Blanchard Road
P.O. Box 85A
Cumberland, Maine 04021

Tel: 207.829.5016 sme-engineers.com

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QUALITY ASSURANCE/QUALITY CONTROL PLAN
CELL 18 CONSTRUCTION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

1.0 GENERAL

1.1 Scope

This Quality Assurance/Quality Control Plan (QAP) addresses the quality assurance and quality control of the installation of all facility components used by NEWSME Landfill Operations, LLC (NEWSME Operations) at the Juniper Ridge Landfill (JRL) in Old Town, Maine. Facility components included in this QAP include the following engineered systems: composite liner system, leachate collection system, leachate detection system, leachate transport system, leachate storage systems, leachate pump system, gas management systems, and stormwater management systems.

In the context of this plan, quality assurance refers to means and actions employed to assure conformity of the facility component production and installation with the project-specific QAP, drawings, specifications, and contractual and regulatory requirements. Quality assurance is provided by a party independent from production and installation. Quality control refers only to those actions taken to ensure that materials and workmanship meet the requirements of the plans and specifications. Quality control is provided by the manufacturers and installers of the various components of the facility and by compliance with applicable sections of the construction specifications contained in the contract documents.

The scope of this QAP applies to characterization of manufacturing, shipment, handling, and installation of facility components. This QAP does not address design guidelines, installation specifications, or selection of facility components. The technical specifications define the quality of materials and workmanship used on the construction of the facility.

The QAP is the means to assure the level of material and workmanship used in the construction of the facility components meets or exceeds the requirements of the design specifications and drawings. This QAP was developed based on U.S.EPA guidance included in "Construction Quality Assurance for Hazardous Waste Landfill Disposal Facilities", U.S.EPA/530-SW-86-031, October 1986, and "Quality Assurance and Quality Control for Waste Containment Facilities," U.S.EPA/600/R-93/182 September 1993.

1.2 Parties

The parties discussed in this section are associated with the ownership, design, manufacture, transportation, installation, and quality assurance of the facility components. The definitions, qualifications, and responsibilities of these parties are outlined in the following subsections.

1.2.1 Site Owner/Landfill Operator

1.2.1.1 Definitions

The Owner of the Juniper Ridge Landfill site is the State of Maine acting through the State Planning Office. The operator of the JRL is NEWSME Landfill Operations, LLC (NEWSME Operations). Funding for Cell 18 JRL Construction Project is by NEWSME Operations. The NEWSME Operations contact person for this project is Wayne Boyd.

1.2.2 Project Manager/Resident Project Representative.

1.2.2.1 Definitions

The Project Manager/Resident Project Representative (RPR) is the official representative of NEWSME Operations; in this plan, the term Project Manager/RPR shall apply equally to "Construction Coordinator," i.e., the individual responsible for coordinating construction and quality assurance activities for the project. Project Manager/RPR may also be referred to as the “Owner’s Representative” in other parts of these Bid Documents and Specifications.

1.2.2.2 Responsibilities

The Project manager is responsible for construction quality assurance activities. The Project Manager/RPR is responsible for the organization and implementation of the QAP for the project as outlined in Section 1.1 of this plan.

The Project Manager/RPR shall serve as communications coordinator for the project, initiating the resolution, pre-construction, and construction meetings outlined in Section 1.3. As communications coordinator, the Project Manager/RPR shall serve as a liaison between all parties involved in the project to ensure that communications are maintained.

The Project Manager/RPR shall also be responsible for proper resolution of all quality assurance issues that arise during construction.

1.2.2.3 Qualifications

The selection of the Project Manager/RPR is the direct responsibility of NEWSME Operations. Qualifications for this position include familiarity with the following:

1. Applicable QAPs.
2. General knowledge of the construction materials and techniques necessary to construct the facility.
3. Applicable regulatory requirements.
4. Company policies and procedures for project management.

1.2.3 Designer

1.2.3.1 Definitions

The Designer is the individual and/or firm responsible for the preparation of the design, including plans and project-specific technical specifications for the facility components and systems. The Designer may also be referred to as the "Engineer" in other parts of these Bid Documents and Specifications.

1.2.3.2 Responsibilities

The Designer is responsible for performing the engineering design and preparing the associated drawings and specifications for all the components of the landfill facility. The Designer is responsible for approving all design and specification changes and making design clarifications necessitated during construction of the landfill and associated facilities. The Designer may attend the resolution and pre-construction meetings outlined in Section 1.3 of this plan upon the request of the Project Manager/RPR.

1.2.3.3 Qualifications

The Designer shall be a qualified engineer, certified or licensed as required by regulation. The Designer shall be familiar with all the landfill components and applicable regulatory requirements.

1.2.3.4 Submittals

The Designer shall submit the project design drawings and specifications to NEWSME Operations. The Designer shall submit completed design clarification forms to NEWSME Operations in a timely manner upon request.

1.2.4 Construction Quality Assurance Agent and Quality Assurance Resident Engineer

1.2.4.1 Definitions

The Construction Quality Assurance Agent (CQA) is a firm independent from NEWSME Operations that shall be responsible for observing and documenting activities related to the quality assurance of all phases of the landfill and associated construction activities, on behalf of NEWSME Operations. The required staffing level will be a function of the Installer's schedule.

In this QAP the term Quality Assurance Resident Engineer (QARE) shall be used to designate the engineer in charge of the project-specific quality assurance work. In this QAP the terms "construction Quality Assurance Agent (CQA)" and "Quality Assurance Resident Engineer" are interchangeable. In some cases, the duties of the QARE described below may be shared by two individuals: a Quality Assurance Managing Engineer located at the headquarters of the CQA, and a Quality Assurance Resident Engineer located at the site. The personnel of the CQA also include Quality Assurance Monitors who are located at the site for construction observation and documentation. Construction Quality Assurance Agent and Quality Assurance Resident Engineers will also be described in this QAP by the specific tasks they oversee; specifically, Soils (i.e., Construction) QARE/CQA or Geosynthetic QARE/CQA.

1.2.4.2 Responsibilities

The QARE is responsible for observing and documenting activities related to the quality assurance of the production and installation of all landfill components. The QARE is responsible for implementation of the project QAP prepared by the Project Manager/RPR and coordination of the on-site and off-site materials testing program. The QARE is also responsible for issuing a final certification report, sealed by a registered professional engineer, as outlined in Section 2.0 of this QAP.

The specific duties of the QARE personnel are as follows:

1. The QARE:
    a. Reviews all design drawings and specifications.
    b. Reviews other site-specific documentation, including proposed layouts, and manufacturer's and installer's literature.
    c. Develops a site-specific addendum for quality assurance of materials and construction techniques (if necessary) with the assistance of the Project Manager/RPR.
    d. Administers the QAP, e.g., assigns and manages quality assurance personnel, reviews all field reports, and provides engineering review of all quality assurance related issues.
    e. Reviews changes to design drawings and specifications as issued by the Designer.
    f. Acts as the on-site (resident) representative of the Project Manager/RPR.
    g. Familiarizes Geosynthetic Quality Assurance Monitors with the site and the project QAP.
    h. Attends quality assurance related meetings, e.g., resolution, pre-construction, daily, weekly.
    i. Reviews Manufacturer and Installer certifications and documentation and makes appropriate recommendations.
    j. Reviews the Installer's personnel qualifications for conformance with those qualifications pre-approved for work on site.
    k. Manages the preparation of the as-built drawing(s).
    l. Provides on-site testing of soils for compaction, using Nuclear Methods.
    m. Sampling of on-site soils and other materials and coordinates testing.
    n. Reviews Geosynthetic Quality Assurance Monitor's daily reports, logs and photographs.
    o. Notes any on-site activities that could result in damage and/or delays.
    p. Reports to the Project Manager/RPR and logs any relevant observations reported by the Geosynthetic Quality Assurance Monitors in the daily report.
    q. Prepares his own daily report.
    r. Prepares the weekly report of construction activities.

s. Oversees the marking, packaging, and shipping of laboratory test samples.

t. Reviews the results of laboratory testing and makes appropriate recommendations.

u. Designates a qualified Quality Assurance Monitor to represent the QARE whenever he is absent from the site while operations are ongoing.

v. Reports any unapproved deviations from the QAP to the Project Manager/RPR.

w. Prepares the final certification report.

x. Verifies that the supporting soil has met requirements set in Section 4.3 and overburden soil placement requirements set in Section 4.4.

y. Complete geotechnical/monitoring program form, as presented in the site's Geotechnical Monitoring Plan.

2. The Quality Assurance Monitor:

a. Monitors, logs, photographs and/or documents all construction operations. Photographs shall be taken routinely and in critical areas of the installation sequence. These duties shall be assigned by the QARE.

b. Monitors the following operations for all construction activities.

(1) Material delivery.

(2) Unloading and on-site transport and storage.

(3) Sampling for conformance testing.

(4) Material placement.

(5) In-place conformance testing.

(6) Visual inspection by walkover.

(7) Construction stability.

c. Monitors and documents construction operations, including:

(1) Subgrade preparation, testing, and approval.

(2) Placement, testing, sampling, and approval of soil materials used to construct the landfill.

(3) Placement of geosynthetic materials that are not related to the landfill liner system.

(4) Installation and testing of piping systems and associated appurtenances.

(5) Installation and testing of pump stations and associated equipment.

(6) Installation and testing of the leachate storage and associated plumbing and equipment.

(7) Installation of the loading rack and loading arm.

1.2.4.3 Qualifications

The CQA shall be pre-qualified by NEWSME Operations. The CQA shall be experienced in quality assurance of landfill facilities. The CQA shall be experienced in the preparation of quality assurance documentation including: quality assurance forms, reports, certifications, and manuals.

The Quality Assurance Managing Engineer shall be a degreed engineer and be registered as a professional Engineer in the State of Maine. The Quality Assurance Resident Engineer shall be specifically experienced in the landfill construction techniques and shall be trained by the CQA in the duties of a QARE.

Quality Assurance Monitors shall be quality assurance personnel who have been specifically trained in the quality assurance of landfills.

The Geosynthetic Quality Assurance Monitor shall be certified by the National Institute for Certification in Engineering Technology (NICET), the Geosynthetic Institute's Construction Quality Assurance – Inspectors Certification Program (CQA-ICP) or equivalent or work under the direct supervision of a NICET or CQA-ICP certified professional.

1.2.4.4 Submittals

Pre-qualification: To be considered for pre-qualification, the CQA must provide the following information:

1. Corporate background and information.
2. Quality assurance capabilities:
    a. A summary of the firm's experience with landfill construction.
    b. A summary of the firm's experience in quality assurance, including installation quality assurance of similar landfill construction projects.
    c. A summary of quality assurance documentation and methods used by the firm, including sample quality assurance forms, reports, certifications, and manuals prepared by the firm.
    d. Resumes of key personnel.

Pre-installation: Prior to beginning work on a project, the CQA must provide the Project Manager/RPR with the following information:

1. Resumes of personnel to be involved in the project including QARE and Quality Assurance Monitors.
2. Proof of professional engineering registration for the engineer to be designated as the Quality Assurance Managing Engineer (QAME).
3. Proof of the required quality assurance experience of the quality assurance personnel.

1.2.5 Geosynthetic Manufacturer

1.2.5.1 Definitions

The Manufacturer is the firm responsible for production of any of the various geosynthetic liner system components outlined in this QAP.

1.2.5.2 Responsibilities

Each Manufacturer is responsible for the production of its geosynthetic product. In addition, each Manufacturer is responsible for the condition of the geosynthetic until the material is accepted by the Project Manager/RPR upon delivery. Each Manufacturer shall produce a consistent product meeting the project specifications. Each Manufacturer shall provide quality control documentation for its product as specified in this QAP.

1.2.5.3 Qualifications

Each Manufacturer shall be pre-qualified by NEWSME Operations. Each Manufacturer shall provide sufficient production capacity and qualified personnel to meet the demands of the project. Each Manufacturer shall have an internal quality control program for its product that meets the requirements presented in this QAP.

1.2.5.4 Submittals

Pre-qualification: A Manufacturer shall meet the following requirements and submit the following information to be considered for pre-qualification:

1. Corporate background and information.
2. Manufacturing capabilities:
    a. Information on plant size, equipment, personnel, number of shifts per day, and capacity per shift.
    b. Daily production quantity available for NEWSME Operations' facilities.
    c. A list of material properties including certified test results, to which are attached geosynthetic samples.
    d. A list of at least 15 completed landfill or surface impoundment facilities totaling the minimum area (see project specification) identified in the project specifications, for which the Manufacturer has manufactured a geosynthetic. For each facility, the following information shall be provided:
        (1) Name and purpose of facility, its location and date of installation.
        (2) Name of owner, project manager, designer, fabricator (if any) and installer.
        (3) Type of geosynthetic, surface area of geosynthetic manufactured.
        (4) Available information on the performance of the lining system and the facility.

3. The Manufacturer's quality control manual, including a description of the quality control laboratory facilities.
4. The origin (supplier's name and production plant) and identification (brand name and number) of resin used to manufacture the product.

Pre-installation: Prior to the installation of any geosynthetic material, a Manufacturer must submit to the Project Manager/RPR all quality control documentation required by the appropriate section of this QAP. This documentation shall be reviewed by the Geosynthetic Construction Quality Assurance Agent as outlined in Section 1.2.4 of this QAP before installation can begin.

1.2.6 Geosynthetic Installer

1.2.6.1 Definitions

The Geosynthetic Installer is the firm responsible for installation of the geosynthetics. The Installer may be affiliated with the Manufacturer.

The Superintendent is responsible for the Installer's field crew. The Superintendent shall represent the Installer at all site meetings and shall be responsible for acting as the Installer's spokesman on the project.

The Master Seamer shall be the most experienced seamer of the Installer's field crew. The Master Seamer shall provide direct supervision over less experienced seamers.

1.2.6.2 Responsibilities

The Geosynthetic Installer shall be responsible for field handling, storing, deploying, seaming, temporary restraining, and all other aspects of the geosynthetics installation. The Installer may also be responsible for transportation of these materials to the site and for anchor systems, if required by the project specifications. The Installer shall be responsible for submittal of the documentation listed in Section 1.2.6.4.

1.2.6.3 Qualifications

The Geosynthetic Installer shall be pre-qualified and approved by NEWSME Operations. The Installer shall be able to provide qualified personnel to meet the demands of the project. At a minimum, the Installer shall provide a Superintendent, Seamers, and a Master Seamer as described below.

The Superintendent must be qualified based on previously demonstrated experience, management ability, and authority. The Superintendent, unless otherwise approved by the Project Manager/RPR, shall have previously managed, at a minimum, two installation projects which entailed the installation of at least a combined total of 10,000,000 sq. ft of polyethylene geomembrane.

For geomembrane installation, all personnel performing seaming operations shall be qualified with not less than 500,000 sq. ft of polyethylene geomembrane seaming experience. The Master Seamer shall have experience seaming a minimum of 1,000,000 sq. ft of polyethylene geomembrane using the same type of seaming apparatus to be used at the site.

1.2.6.4 Submittals

Pre-qualification: To be considered for pre-qualification, the Geosynthetic Installer shall submit the following information unless waived by the CQA. The reason for waiving these requirements will be the CQA previous experience with the installer.

1. Corporate background and information.
2. Description of installation capabilities:
    a. Information on equipment (numbers and types) and personnel (number of superintendents, number of crews).
    b. Average daily production anticipated.
    c. Samples of field geomembrane seams and a list of minimum values for geomembrane seam properties.
3. A list of at least ten completed facilities, totaling a minimum of 10,000,000 sq. ft, for which the Installer has installed geosynthetics. For each installation, the following information shall be provided:
    a. Name and purpose of facility, its location, and date of installation.
    b. Name of owner, project manager, designer, manufacturer, fabricator (if any), and name of contact at the facility who can discuss the project.
    c. Name and qualifications of the Superintendent(s) of the Installer's crew(s).
    d. Type of geosynthetic and surface area installed.
    e. Type of seaming and type of seaming apparatus used.
    f. Duration of installation.
    g. Available information on the performance of the lining system and the facility.
4. The Geosynthetic Installer's quality control manual.
5. A copy of a letter of recommendation supplied by the geomembrane manufacturer.

Pre-installation: Prior to commencement of the installation, the Installer must submit to the Project Manager/RPR:

1. Resume of the Superintendent to be assigned to this project, including dates and duration of employment.
2. Resume of the Master Seamer to be assigned to this project, including dates and duration of employment.
3. A panel layout drawing showing the installation layout identifying field seams as well as any variance or additional details which deviate from the engineering drawings. The layout shall be adequate for use as a construction plan and shall include dimensions, details, etc.

4. Installation schedule.
5. A list of personnel performing field seaming operations along with pertinent experience information.
6. All geosynthetic quality control certificates as required by this QAP (unless submitted directly to the Project Manager/RPR by the Geosynthetic Manufacturer).
7. Certification that extrudate to be used is comprised of the same resin as the geomembrane to be used.

This documentation shall be reviewed by the Geosynthetic Construction Quality Assurance Agent, as outlined in Section 1.3.3 of this QAP, before installation of the geosynthetic can begin.

Installation: During the installation, the Installer shall be responsible for the submission of:

1. Quality control documentation recorded during installation.
2. Subgrade surface acceptance certificates for each area to be covered by the lining system, signed by the Geosynthetic Installer.

Completion: Upon completion of the installation, the Installer shall submit:

1. The warranty obtained from the Manufacturer.
2. The installation warranty.

1.2.7 Geosynthetic Quality Assurance Laboratory

1.2.7.1 Definitions

The Geosynthetic Quality Assurance Laboratory (QAL) is a firm, independent from the Geosynthetic Manufacturer(s) and Geosynthetic Installer, responsible for conducting tests on samples of geosynthetics taken from the site.

1.2.7.2 Responsibilities

The Geosynthetic QAL shall be responsible for conducting the appropriate laboratory tests as directed by the Geosynthetic QAE. The test procedures shall be done in accordance with the test methods outlined in this QAP and/or the project specifications. The Geosynthetic QAL shall be responsible for providing test results as outlined in Section 1.2.7.4.

1.2.7.3 Qualifications

The Geosynthetic QAL shall have experience in testing geosynthetics and be familiar with American Society for Testing and Materials (ASTM), Federal Test Method Standard (FTMS), National Sanitation Foundation (NSF), and other applicable test standards. The laboratory shall be GAI-2AP certified. The Geosynthetic QAL shall be capable of providing verbal results of destructive seam tests within 24 hours of receipt of test samples and shall maintain that standard throughout the installation. The Geosynthetic QAL shall be approved by the Project Manager/RPR or NEWSME Operations.

On-site laboratory facilities may be used by the Geosynthetic QAL, provided they are appropriately equipped and approved by the Geosynthetic QARE and the Project Manager/RPR.

1.2.7.4 Submittals

The Geosynthetic QAL shall submit destructive seam test results to the Geosynthetic QARE in written form within 48 hours of receipt of test samples unless otherwise specified by the Project Manager/RPR. Geomembrane destructive test results shall typically be provided verbally to the Geosynthetic QARE within 24 hours of receipt of test samples.

Written test results shall be in an easily readable format and include references to the standard test methods used.

1.2.8 Soils Quality Assurance Laboratory

1.2.8.1 Definitions

The Soils Quality Assurance Laboratory (SQAL) is a firm, independent from the contractor, responsible for conducting tests on construction soils materials taken from the site.

1.2.8.2 Responsibilities

The Soils QAL shall be responsible for conducting the appropriate laboratory tests as directed by the Soils QARE or CQA. The test procedures shall be done in accordance with the test methods outlined in this QAP and/or the project specifications. The Soils QAL shall be responsible for providing test results as outlined in Section 1.2.8.4.

1.2.8.3 Qualifications

The Soils QAL shall have experience in testing geosynthetics and be familiar with American Society for Testing and Materials (ASTM), Federal Test Method Standard (FTMS), and other applicable test standards. The Soils QAL shall be approved by the Project Manager/RPR and/or NEWSME Operations.

On-site laboratory facilities may be used by the Soils QAL, provided they are appropriately equipped and approved by the Soils QARE/CQA and the Project Manager/RPR.

1.2.8.4 Submittals

The Soils QAL shall submit soil test results to the Soils QARE in written form within 5 days of receipt of test samples unless otherwise specified by the Project Manager/RPR. Soil test results shall typically be provided verbally to the Soils QARE/CQA within 24 hours of receipt of test samples, or a time period as dictated by the testing requirements. Written test results shall be in an easily readable format and include references to the standard test methods used.

Written test results shall be in an easily readable format and include references to the standard test methods used.

1.3 Communication

To guarantee a high degree of quality during the construction process and assure a final product that meets all project specifications, clear, open channels of communication are essential. This section discusses appropriate lines of communication and describes all necessary meetings.

1.3.1 Lines of Communication

The Soils QARE/CQA and the Geosynthetic QARE shall be capable of direct communication with the Project Manager/RPR at all times. The project manager shall be capable of direct communications with NEWSME Operations and the MEDEP at all times.

1.3.2 Resolution Meeting

Following permit approval and the completion of the construction drawings and specifications for the project, a resolution meeting may be held. If a resolution meeting is required, it is recommended that the meeting be held prior to bidding the construction work and include the parties when involved, typically including the Project Manager/RPR, Designer, Soils QARE/CQA, Geosynthetic QARE, and a NEWSME Operations representative. If necessary, this meeting can be held in conjunction with the pre-construction meeting.

The purpose of this meeting is to establish lines of communication, review construction drawings and specifications for completeness and clarity, begin planning for coordination of tasks, anticipate any problems which might cause difficulties and delays in construction, and review the QAP. Aspects of the design shall be reviewed during this meeting so that clarification and/or design changes may be made before the construction work is bid. In addition, the guidelines regarding quality assurance testing and problem resolution must be known and accepted by all.

The meeting shall be documented by a person designated at the beginning of the meeting and minutes shall be transmitted to all parties.

1.3.3 Pre-Construction Meeting

A pre-construction meeting shall be held at the site prior to the start of earthwork and geosynthetic deployment. Typically, the meeting shall be attended by the Project Manager/RPR, Designer, Geosynthetic Installer, Soils QARE/CQA, Geosynthetic QARE, and a NEWSME Operations representative. NEWSME Operations or their agent shall notify the MEDEP of the pre-construction meeting 7 days prior to the meeting date so that an MEDEP representative may attend if desired.

Specific topics considered for this meeting include review of the project QAP for any problems or additions. In addition, the responsibilities of each party should be reviewed and understood clearly. The meeting shall be documented by a person designated at the beginning of the meeting and minutes shall be transmitted to all parties.

1.3.4 Progress Meetings

A weekly progress meeting shall be held between the Contractor, Soils QARE/CQA, Geosynthetic QARE, Geosynthetic Installer's Superintendent, Project Manager/RPR, and any other concerned parties. This meeting shall discuss current progress, planned activities for the next week, issues requiring resolution, and any new business or revisions to the work. The CQAs shall log any problems, decisions, or questions arising at this meeting in his weekly report. If any matter remains unresolved at the end of this meeting, the Project Manager/RPR shall be responsible for the resolution of the matter and the communication of the decision to the appropriate parties.

2.0 DOCUMENTATION

An effective QAP depends largely on identification of the construction activities that shall be monitored and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The QAREs/CQAs shall document that all requirements in the geosynthetic portions of the project QAP have been addressed and satisfied.

The QAREs/CQAs shall provide the Project Manager/RPR with signed descriptive remarks, data sheets, and checklists to verify that all monitoring activities have been carried out. The QAREs/CQAs shall also maintain at the job site a complete file of the documents which comprise the QAP, including plans and specifications, checklists, test procedures, daily logs, and other pertinent documents.

2.1 Daily Reports

2.1.1 Geosynthetics Quality Assurance

Each Geosynthetic Quality Assurance Monitor shall complete a daily report and/or logs on prescribed forms, outlining all monitoring activities for that day. The precise areas, panel numbers, seams completed and approved, and measures taken to protect unfinished areas overnight, shall be identified. Failed seams or other panel areas requiring remedial action shall be identified with regard to nature of action, required repair, and precise location. Repairs completed must also be identified. Any problems or concerns with regard to operations on-site should also be noted. This report must be completed at the end of each monitor's shift, prior to leaving the site, and submitted to the Geosynthetic QARE.

The Geosynthetic QARE shall review the daily reports submitted by the Geosynthetic Quality Assurance Monitors and incorporate a summary of their reports into the Geosynthetic QARE's daily report. Any matters requiring action by the Project Manager/RPR shall be identified. The report shall include a summary of the quantities of the geosynthetics installed that day. This report must be completed daily, summarizing the previous day's activities, and a copy submitted to the Project Manager/RPR at the beginning of the work day following the report date.

2.1.2 Construction Quality Assurance

Each Construction Quality Assurance Monitor shall complete a daily report and/or logs on prescribed forms outlining the monitoring activities undertaken for that day. The activities undertaken, materials used, location, time, testing done, samples taken, and test results obtained shall be documented. Failed areas shall be identified and the remedial action taken noted. Any problems and/or concerns regarding failed areas shall be noted. The monitor(s) shall also note the equipment used and the work force provided, and any subcontractors, during the daily operations. The report must be completed at the end of each monitor’s shift, prior to leaving the site, and submitted to the Soils QARE/CQA.

The Soils QARE/CQA will review daily reports submitted by the CQA monitor(s) and incorporate a summary of their reports into the Soils QARE’s/CQA’s daily report. Any actions requiring action by the Project

Manager/RPR shall be clearly identified. The report shall include a summary of quantities of materials installed that day. This report must be completed daily, summarizing the previous day's activities, and a copy submitted to the Project Manager/RPR at the beginning of the work day following the report date.

2.1.3 Report Forms and Installation Logs

Each Quality Assurance Monitor shall document construction activities as described above on the pertinent forms or logs attached to the end of this Section.

2.2 Testing Reports

2.2.1 Geosynthetics Testing Reports

The destructive test reports from all sources shall be collated by the Geosynthetic QARE. This includes field tests, Installer's laboratory tests (if performed), and Geosynthetic QAL tests. A summary list of test samples pass/fail results shall be prepared by the Geosynthetic QARE on an ongoing basis and submitted with the weekly progress reports.

2.2.2 Soils Testing Reports

The on-site testing and laboratory test reports from all sources shall be collected by the Soils QARE. This includes field tests and laboratory tests. A summary list of test samples of pass/fail results shall be prepared by the Soils QARE on an ongoing basis and submitted with weekly progress reports.

2.2.3 Miscellaneous Test Reports

On-site testing of pressure pipe, manholes, pump stations, leachate storage tank, and other equipment shall be reported on a separate Equipment Test Report Log. Test reports shall be submitted to the Soils QARE/CQA as the equipment is tested and shall be included in weekly progress reports.

2.3 Progress Reports

Progress reports shall be prepared by the CQAs/QAREs and submitted to the Project Manager/RPR. These reports shall be submitted every week, starting the first Friday of construction on-site. This report shall include: test results, submittals and action taken; summary of work progress; upcoming work items for the next two weeks; punch list items; summary of problems encountered and how the problems were resolved; change order status; and construction stability monitoring results, if applicable. Other items may include delays caused by weather conditions or material shortages. A copy of these progress reports shall be forwarded to the MEDEP within one week after the completion of each construction week.

All CQA's/QARE's daily reports for the period should be appended to each progress report.

2.4 Record Drawings

2.4.1 Geosynthetic Record Drawings

Record drawings shall be prepared by the Geosynthetic QARE. The Record drawings shall include, at a minimum, the following information for geomembrane.

1. Location, as accurate as possible, of each panel relative to the site benchmarks (furnished by the Project Manager/RPR).
2. Identification of the seams and panels with appropriate numbers or identification codes (see Section 5.4.1).
3. Location of patches and repairs.
4. Location of destructive testing samples.
5. Pertinent as-built details, such as penetrations and anchor trenches, etc.

The record drawings shall illustrate each layer of geomembrane, and, if necessary, another drawing shall identify problems or unusual conditions of the geotextile or geonet layers. In addition, applicable cross-sections shall show layouts of geonets, geotextiles or geogrids in sump areas or any other areas which are unusual or differ from the design drawings.

2.4.2 Construction Record Drawings

Record drawings shall be prepared by the CQA Agent. The record drawings will incorporate the record drawings prepared by the Geosynthetic and Soils QARE. The record drawings shall include the above, plus the following information:

1. Horizontal and vertical location of base grades, top of primary and secondary 12-inch clay layer, and top of primary and secondary HDPE geomembrane liner, relative to the site benchmarks (furnished by the Project Manager/RPR).
2. The contractor will record changes to pertinent details and supply this information to the Soils QARE/CQA. The Soils QARE/CQA will show changes to the details on the record drawings.
3. Horizontal and vertical location of all external landfill components such as: pump stations; force mains; manholes; culverts; roadways; electrical conduits; utilities; gas collection system piping; and leachate storage facilities. These shall be located relative to the site benchmarks.

Record drawings shall be stamped by a Maine registered professional engineer in employ of the CQA.

2.5 Final Certification Report

A final certification report shall be submitted to NEWSME Operations upon completion of the work. This report shall summarize the activities of the project and document the aspects of the quality assurance program performed. A copy of the report will be submitted to the MEDEP as part of the construction documentation report.
The final certification report shall include, at a minimum, the following information:

1. Parties and personnel involved with the project.
2. Certification, sealed and signed by a registered professional engineer.
3. Record drawings, sealed and signed by a registered professional engineer.
4. A narrative summary of the Geosynthetics QARE observation of the geosynthetic installation and handling activities, including placement of overburden soil.
5. A narrative summary of all phases of the landfill construction and associated facilities.
6. Copies of applicable specifications.
7. Written clarifications and interpretations of the specifications.
8. Change Orders to specifications.
9. Minutes from pertinent construction meetings.
10. Geosynthetics manufacturer's quality control documentation, certifications, warranties, and guarantees.
11. Copies of the following geosynthetics quality assurance records: conformance testing results; certificates of subgrade acceptance; temperature logs; panel deployment logs; trial seam logs; destructive testing results; non-destructive testing logs; repair logs and diagrams; and CQA daily and weekly reports.
12. Copies of the following site construction quality assurance records: field compaction testing results; soil material conformance testing results; submittals; pipe testing records; pump station testing records; leachate storage tank leak testing records; and CQA daily and weekly reports.
13. Copies of photographs taken to document the progression of site construction activities.

The report shall include written certification by the Geosynthetic QARE and the Quality Assurance Managing Engineer that the installation was completed in accordance with the project QAP except as noted to the Project Manager/RPR.

3.0 LINING SYSTEM ACCEPTANCE

3.1 Geosynthetic Lining System

Upon written recommendation by the Geosynthetic QARE, the Project Manager/RPR shall consider accepting the geosynthetic lining system. The conditions of acceptance are described below. The Installer and Manufacturer(s) will retain all ownership and responsibility for the geosynthetics in the lining system until acceptance by NEWSME Operations.

The geosynthetic lining system shall be accepted by NEWSME Operations when:

1. The installation of the lining system, or section thereof, is finished.
2. Verification of the adequacy of all seams and repairs, including associated testing, is completed.
3. All documentation of installation is completed.
4. The leak location survey has been performed on the primary geomembrane liner in accordance with ASTM D7007 (Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earth Materials), any leaks found have been repaired appropriately by the liner installer and a report documenting the results of the survey has been reviewed and approved by the Geosynthetic CQA Project Manager.
5. The Geosynthetic QARE is able to recommend acceptance.
6. The Owner and/or his Authorized Representative is satisfied that the geomembrane has been installed in accordance with the above Specifications.

The Geosynthetic QARE shall certify that the installation did proceed in accordance with the geosynthetic portions of the project QAP, except as noted to the Project Manager/RPR. This certification shall be provided in the final certification report as outlined in Section 2.5.

3.2 Landfill Facility Systems

Upon written recommendation by the CQA's Quality Assurance Managing Engineer, the Project Manager/RPR shall consider accepting the landfill systems. The conditions of acceptance are described below. The Contractor will retain all ownership and responsibility for the newly constructed landfill and associated facilities until acceptance by NEWSME Operations.

The landfill facility systems shall be accepted by NEWSME Operations when:

1. The installation of the landfill soil and geosynthetic lining system, landfill piping systems, pump stations, leachate transport and storage facilities, or sections thereof, are finished.

2. Verification of the adequacy of the materials placed, equipment supplied, facilities constructed, including all associated testing, is complete.
3. All documentation of installation is completed.
4. The CQA's Quality Assurance Managing Engineer is able to recommend acceptance.

The CQA's Quality Assurance Managing Engineer shall certify that installation has proceeded in accordance with the project QAP except as noted to the Project Manager/RPR. This certification shall be provided in the final certification report as outlined in Section 2.5.

4.0 SOIL COMPONENTS

4.1 Borrow Materials

Compacted Clay: For use in the imported soil and clay liner, must meet requirements for gradation, Atterberg limits, remolded hydrogeologic, and moisture content.

Drainage Sand: For use in the leak detection and leachate collection systems, must meet requirements for gradation and remolded hydraulic conductivity specified in Section 02200.

Leachate Collection Sump Stone: For use in the leachate collection system, must meet requirements for gradation.

Drainage Stone: For use in the underdrain and leachate collection systems, must meet requirements for gradation.

Access Road Base and Subbase Material: Must meet requirements for gradation.

Common Borrow: Must meet requirements as defined by Maine Department of Transportation (MDOT) Section 703.18.

Impervious Borrow: Must have greater than 35 percent by weight passing the No. 200 U.S. standard sieve.

Riprap: Must meet size requirements as defined by the specifications Section 02220.

The soils used in the construction of the Juniper Ridge Landfill (JRL) facility shall meet the CQC requirements outlined in the specifications. Changes in the materials must be approved by the Project Manager/RPR prior to placement.

Compacted clay used for imported soil layer and liner construction will come from an off-site clay pit and/or from any existing clay cover that is to be removed. The Soils QARE/CQA will be required to inspect and approve the use of the compacted clay for liner construction. The recycled clay must meet the clay borrow requirements as defined by the specifications.

The following quality control procedure is incorporated into the project specifications to assure that the clay borrow source(s) delivered to the site meets the project specifications and provides the data to define quality control acceptance criteria. The procedure is to use the individual moisture density curves and associated hydraulic conductivity test from clay borrow source testing program to guide the clay placement.

4.2 Material Delivery, Storage, and Processing

Material used in the construction of JRL facility will require proper handling in order to assure that the specified design properties are not compromised. The Soils QARE/CQA must observe hauling operations and inspect materials as they are delivered. Loads shall be periodically inspected to assure that contamination is not occurring. Truck dump bodies shall be in clean condition prior to a change of material being handled. Hauling personnel shall be informed by the Contractor of the need to clean dump bodies when appropriate. The Soils QARE/CQA may elect to obtain samples for quality assurance testing. Testing under these circumstances will be at the contractor's expense.

Storage of materials shall be in such a manner so that the material properties will remain uncompromised by contamination until they are used. The Soils QARE/CQA shall instruct the contractor of a storage location. The contractor is responsible for keeping materials from being contaminated. The contractor must take measures to assure stockpiled materials meet the specifications as they are installed. The Soils QARE/CQA may elect to obtain samples for quality assurance testing.

Processing of soil materials at the site may be necessary. Clay material stripped from existing landfill cover and to be used as liner material may require processing. Processing may entail removal of large stones or organic material. Other processing may include homogenization of clay by mixing and stockpiling and adjustment of clay moisture. The Soils QARE/CQA should monitor these activities and perform quality assurance testing as necessary.

4.3 Subgrade Preparation

Subgrades shall be properly prepared and compacted to the requirements outlined in Part 3.09 of Section 02200 of these specifications. The Soils QARE/CQA is responsible for inspection of the subgrade and identifying areas which will require further compaction. Testing will be done as needed to assure that the subgrade can adequately support the subsequent compacted liner materials. Water should be added or removed to assure optimum compaction effort.

Soil approved to be left in place shall be proofrolled prior to compacted clay placement. Proofrolling shall include a minimum of three passes of a heavy vibratory compactor. The type and weight of the compactor shall be approved by a qualified geotechnical engineer.

Unacceptable subgrade material is to be removed and replaced with a suitable compacted common borrow. Common borrow used to fill the subgrade is to be approved by the Soils QARE/CQA. Subgrade below any proposed geosynthetics shall be inspected by the Geosynthetic QARE and the installer. The Geosynthetic QARE will inform the contractor of subgrade deficiencies. The contractor will provide the necessary construction effort to alleviate any subgrade deficiencies. The Geosynthetic QARE and installer will re-inspect the subgrade. The installer will complete a Subgrade Acceptance form which documents the subgrade acceptance.

4.4 Placement, Remolding, and Compaction

4.4.1 Soil Material Placement

Placement of soil into a fill is to be done according to the specifications. For embankment and excavation fills, loose lift thicknesses shall not exceed 12 inches for material compacted by heavy compaction equipment and not more than 6 inches in loose depth for material compacted by hand-operated tampers. For compacted clay lifts, the loose lift thickness shall not exceed 9 inches, unless the results of the test pad program demonstrate a thickness of 12-inches is allowable. The Soils QARE/CQA will be responsible for implementation of compacted clay placement guidelines as set forth in these specifications. The CQA Monitor(s) will observe the placement of compacted clay in order to verify it is placed as required. The contractor is responsible for documentation of loose lift of clay thickness, drainage sand, and drainage stone as directed in the specifications. The contractor will provide this documentation to the Soils QARE/CQA on a weekly basis.

Placement of soil materials to compact will not be allowed in weather conditions that adversely affect material compaction. The contractor is responsible for protection of materials being placed and should take necessary measures to protect the materials.

Clay lifts to be installed up to old or previously placed clay lifts shall be matched-in by stepping the clay layers. Prior to placement of a new lift of soil, the surface of the previous compacted clay lift should be roughened to promote a good bond between new and old lifts. CQA Monitor shall inspect lift surface to assure the surface is properly prepared.

Extreme care is required when placing soil materials over geomembrane liner. Prior to the commencement of sand placement, the contractor must provide the Soils QARE/CQA with a written plan stating the sequence of sand placement over the geomembrane. The plan should state where the site will be accessed, placement of haul roads, how sand is spread, and the personnel and equipment that will be utilized. The minimum thickness of sand over the geomembrane for low ground pressure equipment shall be one foot. Minimum thickness for rubber-tired equipment is three feet. The Soils QARE/CQA will observe the hauling of fully loaded vehicles over three foot sand haul roads and may require additional sand over the liner if conditions warrant. The contractor is responsible for maintaining sand haul roads so that damage does not occur to the geomembrane and/or the underlying clay layer. The CQA Monitor(s) will observe vehicle operation on sand haul roads to assure the operation is smooth (without sudden stops, quick turns, or hopping).

Equipment used for placement of the 12-inch sand blanket over the geomembrane shall have a ground pressure of no more than 5 psi. Equipment shall have no cleats and is not allowed to make tight, sudden turns.

Sand placed on the sideslope shall be placed by working from the toe of the slope to the top of the slope. The CQA Monitor will observe spreading of sand on sideslopes to assure no damage is done to liner

materials and that liner materials are not slipping on the sideslopes. Equipment working on the sideslopes is not to make sudden stops, especially in the downhill direction.

Drainage stone placed within limits of the liner system shall be spread so that no damage occurs to the liner system. Stone placed over piping and lifts less than 18 inches in thickness shall be placed with an excavator, bucket loader, or similar type equipment. CQA Monitor will inspect drainage stone for contamination periodically, as lift is placed.

4.4.2 Remolding and Compaction

Proper remolding of soil materials is dependent upon the correct moisture content of the soil and the compaction effort. The Soils QARE/CQA will be responsible for being familiar with the soil properties being used for the soil components at the NEWSME Operations Landfill facility. Soils QARE/CQA shall have soils materials tested when their properties are in doubt. For the clay material, the soil moisture/density relationship will be defined from test results from borrow source or conformance testing. The Soils QARE/CQA should be directly involved with the test pad and be knowledgeable of soil materials and workability. The contractor shall be responsible for notifying the Soils QARE/CQA of any changes in soil materials or borrow source. The CQA Monitor shall observe clay or soil placement to assure material meets the requirements set forth by the specifications. The Soils QARE/CQA may elect to perform additional testing, beyond what is required by the specifications, in order to define the soil properties and determine their acceptability.

Prior to compaction of clay soils the contractor will supply the Soils QARE/CQA with a plan detailing where the soil materials will be obtained, how and where they are to be placed within the new phase, method of moisture adjustment, equipment to be used, and measures of protection from the weather elements. Remolding the clay begins after proper scarification of the existing surface, followed by clay placement as described in Section 4.4.1 of this section. The loose clay lift is then compacted. The equipment used and the number of passes required to meet the project specifications shall be determined at the beginning of the clay placement with a minimum of three passes. The CQA Monitor will observe the compactive effort and periodically document the number of passes taken on a given section of soil liner. The surface of the compacted clay will then be sealed by smooth roller. The CQA Monitor will measure the moisture/density by nuclear method, as outlined in Section 4.6.1.2 of this plan. Upon passing test results, the CQA Monitor will sample the clay, if necessary, and inform the contractor of the results. Non-passing test results will immediately be reported to the contractor. The contractor can request the area be retested or the area will be reworked by adjusting soil moisture and compactive effort. The CQA Monitor should observe these adjustment measures to assure that they are applied uniformly throughout the failed area. After reworking the soil lift, the CQA Monitor will retest the lift. If the moisture density tests pass, the CQA Monitor may sample the area for hydraulic conductivity if required and the contractor may resume normal lift construction. Non-passing results on the second trial suggest the material is deficient and must be removed and replaced with other suitable material. The area will be reworked until passing test results are obtained. The CQA Monitor shall document the efforts required to acquire passing test results in deficient areas.

The compaction requirements of other soil and subgrade materials used for construction of the JRL facility are outlined in the specifications. The CQA Monitor must document the testing of these materials. Deficient areas are to be reworked until passing test results are obtained. The CQA monitor will observe the placement of the clay layer to document that previous compacted clay lifts are scarified prior to placement of the next loose lift of clay. The CQA monitor will also document through visual observations that the clay clods are broken up as part of the compaction effort. The CQA will have the authority to require areas of the clay to be reworked if either inadequate lift bonding or lack of break-up of the clay clods is observed.

4.5 Protection

Soil materials used in the construction of the soil components of the landfill require protection to assure that the quality of the material remains within the specified requirements during and after placement into the system. The CQA shall review the contractor's planned measures to protect the soil components. Protection measures must address soils being stockpiled for subsequent use in the landfill, soils in the process of being placed, and soils already placed. At a minimum, protection measures shall address wet weather conditions, dry weather conditions (desiccation), freezing temperatures, and cross contamination of materials during and after placement. The contractor shall be responsible for implementing protection measures required to assure soil components remain in accordance to the specifications. The CQA shall oversee implementation of the protection measures.

4.6 Quality Assurance Testing and Documentation

4.6.1 Construction Quality Assurance (CQA) Agent Responsibilities

The CQA will direct the sampling and testing of all soil materials to be used in the construction of the landfill components. The CQA will observe and document borrow site material resources and on-site utilization of the soil materials. Duties shall include, but not be limited to, sampling, testing, observing, and documenting soil material utilization. The CQA shall also approve methods of construction and the equipment used to place and work the soil materials.

4.6.1.1 Quality Assurance Testing

The CQA shall implement the soil testing plan as defined by the construction specifications and the quality assurance manual. Borrow materials shall be sampled and tested by CQA at the required frequency as defined by the QAQC Plan and construction specifications. Tests performed on each soil component shall be approved by the CQA. Borrow materials from the point source shall be sampled and tested at frequency indicated on Table 2-1 of Section 02200 of the Specifications.

4.6.1.2 Quality Control Testing

Quality control testing of borrow materials to be used in the construction of the landfill shall be sampled and tested at the frequency indicated in Table 3-1 of Section 02200 of the project specification. Samples shall be obtained from stockpiles to be shipped to the site or from shipments

arriving on-site. The quality control testing of clay borrow shall be sampled, tested, and approved by the CQA at the required frequency as defined by this QAP and the construction technical specifications (ref. Table 3-1, Specification Section 02200).

4.6.1.3 Standard In-place Testing

The tests indicated on Table 3-2 of Section 02200 of the project Specifications shall be performed to document the clay barrier soil meets the specified in-place properties. This testing shall be performed by the CQA.

4.6.2 Sampling Procedures

4.6.2.1 Borrow Site Characterization

Sampling of a borrow site to be mined for soil components to be utilized in the construction of the landfill shall be overseen by the Soils QARE/CQA. The sample size and location shall be dependent upon the material being mined, the amount to be mined, and the frequency of Construction Quality Control (CQC) testing required. The sample size will be as directed by the CQC testing laboratory and as approved by the Soils QARE/CQA. The frequency of sampling shall be as indicated in Table 2-1 of Section 02200 of the project specifications, or as directed by the Soils QARE/CQA.

4.6.2.2 Construction Testing of Borrow Source Materials

Soil materials processed or unprocessed that are to be used as part of the landfill shall be sampled at stockpiles or from truck loads arriving on-site prior to being installed into the landfill. Samples shall be taken under direction of the Soils QARE/CQA. The frequency of sampling shall be as indicated in Table 3-1 of Section 02200 of the project specifications, or as directed by the Soils QARE/CQA. The sample size will be as directed by the CQC testing laboratory and as approved by the Soils QARE/CQA.

4.6.2.3 In-Place Construction Test Samples

Samples of soil materials placed as components of the landfill shall be sampled as directed by the Soils QARE/CQA. In-place sampling locations shall be chosen by establishing a 75-foot square grid pattern over each lift, sample location shall be randomly picked from the grid nodes. Sample grid patterns shall be staggered in each successive lift so that locations vary from lift to lift.

Should a failing test occur, the Soils QARE/CQA shall define the limit of the failing area by taking additional samples halfway between the passing test and the failing test. This procedure will be continued until the limits of the failing area are defined by passing test results.

Sampling or testing that requires penetration of in-place barrier soils will require the contractor to patch or fill the sample hole. The method of filling or patching of these holes shall be approved by the Soils QARE/CQA. The Soils QARE/CQA shall document such repairs.

4.6.3 Documentation

All observations, results of field tests performed on-site or off-site and laboratory tests, shall be recorded on suitable data record sheets. At a minimum, the inspection data record sheets shall include the following:

1. Description or title of the inspection activity.
2. Location of the inspection activity or location from which the sample was obtained.
3. Type of tests done or to be done.
4. Recorded observation or test date.
5. Results of the inspection or testing with reference to specifications.
6. Person involved in the inspection.
7. Signature of the CQA resident engineer and review by the CQA Project Manager.

Data record sheets to be utilized in the CQA program shall be approved by the CQA Project Manager.

5.0 GEOMEMBRANES

5.1 Quality Control Documentation

Prior to the installation of any geomembrane material, the Manufacturer or Installer shall provide the Project Manager/RPR with the following information:

1. The origin (resin supplier's name and resin production plant), identification (brand name and number), and production date of the resin.
2. Copies of the quality control certificates issued by the resin supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the geomembrane meets the specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the geomembrane manufactured for the project meets the project specifications.
5. A statement indicating that the amount of reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness and does not exceed 2 percent by weight.
6. A list of the materials which comprise the geomembrane, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.
7. A specification for the geomembrane which includes all properties contained in the specifications measured using the appropriate test methods.
8. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
9. Quality control certificates, signed by a responsible party employed by the Manufacturer. Each quality control certificate shall include roll identification numbers, sampling procedures, and results of quality control tests. At a minimum, results shall be given for those properties stated in Section 02771 Part 1.05.C of the project specifications:

   These quality control tests shall be performed in accordance with the test methods and frequency as specified in GRI GM 13 and Specification Section 02771 Part 1.05.C.

The Manufacturer shall identify all rolls of geomembranes with the following:

1. Manufacturer's name
2. Date of manufacture
3. Resin batch code
4. Product identification
5. Thickness
6. Roll number

7. Roll dimensions

5.1.1 Product Review

The Project Manager/RPR shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum properties meet the specifications.

5.2 Conformance Testing

Upon delivery of the rolls of geomembrane, the Geosynthetic QARE shall assure that conformance test samples are obtained for the geomembrane. These samples shall then be forwarded to the Geosynthetic QAL for testing to assure conformance to the specifications.

If the Project Manager/RPR desires, the Geosynthetic QARE or his agent, can perform the third-party conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

The conformance tests shall be performed in accordance with the test methods specified in Section 02771 Part 1.06 of the project specifications and consistent with GRI Test Method GM13.

5.2.1 Sampling Procedures

The rolls to be sampled shall be selected by the Geosynthetic QARE. Samples shall be taken across the entire width of the roll and shall not include the first 3 feet (1 m). Unless otherwise specified, samples shall be 3 feet (1 m) long by the roll width. The Geosynthetic QARE shall mark the machine direction on the samples with an arrow.

A lot consists of a group of materials which is manufactured from a specific batch of raw materials (e.g., HDPE resin, or bentonite clay). The manufacturer shall identify the consecutively numbered rolls of material, which are inclusive within a lot.

Unless otherwise specified, samples shall be obtained at one sample per 100,000 ft^2 (9,290 m^2) of geomembrane. Conformance tests shall be done on the samples and the results of tensile strength properties in the cross machine direction shall be utilized to establish the parent material strength.

5.2.2 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Geosynthetic QARE prior to the deployment of the geomembrane.

The Geosynthetic QARE shall examine all results from laboratory conformance testing and shall report any nonconformance to the Project Manager/RPR. The Geosynthetic QARE shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the Geosynthetic QAL incorrectly conducting the tests, the Manufacturer may request that the sample in question be retested by the Geosynthetic QAL with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Manufacturer. Alternatively, the Manufacturer may have the sample retested at two different approved independent laboratories at the expense of the Manufacturer. If both laboratories produce passing results, the material shall be accepted. If both laboratories do not produce passing results, then the original Geosynthetic QAL test results shall be accepted. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager/RPR.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out of specification and rejected. Alternatively, at the option of the Project Manager/RPR, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out of specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If the two additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

5.3 Subgrade Preparation

5.3.1 Surface Preparation

The earthwork contractor shall be responsible for preparing the supporting soil for placement of the geosynthetic layers. The Geomembrane will be deployed on top of prepared subgrade or Geosynthetic Clay Liner (GCL)

As indicated in Section 5.3.1.1 below, the Installer shall certify in writing that the sub-surface on which the geomembrane will be installed is acceptable. A certificate of acceptance shall be given by the Installer to the Geosynthetic QARE prior to commencement of geomembrane deployment in the area under consideration. The Project Manager/RPR shall be given a copy of this certificate by the Geosynthetic QARE.

After the supporting soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the Project Manager/RPR any change in the supporting soil condition that may require repair work. The Project Manager/RPR may consult with the Geosynthetic QARE regarding the need for repairs. If the Geosynthetic QARE concurs with Installer, the Project Manager/RPR shall assure that the supporting soil is repaired.

At any time before or during the geomembrane installation, the Geosynthetic QARE shall indicate to the Project Manager/RPR any locations which may not be adequately prepared for the geomembrane.

5.3.1.1 Clay Liner Surface Preparation

The earthwork contractor shall be responsible for preparing the supporting clay liner soils for placement of the secondary liner geomembrane.

Before the secondary liner geomembrane installation begins, the Geosynthetic CQA shall verify that:

1. All lines and grades are verified.
2. An Owner's Representative verify that the supporting soil meets the density specified in the project specifications.
3. The surface to be lined has been rolled, compacted, or handworked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.
4. The surface of the supporting soil does not contain stones which may be damaging to the geosynthetics.
5. There is no area excessively softened by high water content.

The Installer shall certify in writing that the surface on which the secondary liner geomembrane will be installed is acceptable. A certificate of acceptance shall be given by the Installer to the Geosynthetic CQA prior to commencement of geomembrane deployment in the area under consideration. The Project Manager shall be given a copy of this certificate by the Geosynthetic CQA.

After the supporting soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the Project Manager any change in the supporting soil condition that may require repair work. The Project Manager may consult with the Geosynthetic CQA regarding the need for repairs. If the Geosynthetic CQA concurs with Installer, the Project Manager shall assure that the supporting soil is repaired.

At any time before or during the secondary liner geomembrane installation, the Geosynthetic CQA shall indicate to the Project Manager any locations which may not be adequately prepared for the secondary liner geomembrane.

5.3.1.2 GCL Surface Preparation

The geosynthetic installer shall be responsible for preparing the GCL for installation of the overlying primary liner geomembrane.

Before the primary liner geomembrane installation begins, the Geosynthetic CQA shall verify that:

1. All GCL seams have been completed in accordance with the specifications.
2. Repairs to the GCL are complete and secure.
3. The GCL surface is free of large wrinkles and folds and lies flat to the underlying surface.
4. GCL panels have been identified and as-built information collected.

The Installer shall verbally verify with the Geosynthetic CQA that the surface on which the geomembrane will be installed is acceptable. At any time before or during the primary liner geomembrane installation, the Geosynthetic CQA shall indicate to the Installer any locations which may not be adequately prepared for the geomembrane. The Installer shall repair said areas to the satisfaction of the Geosynthetic CQA.

5.3.1.3 Drainage Geocomposite Surface Preparation

The geosynthetic installer shall be responsible for preparing the drainage geocomposite for installation of the overlying drainage sand layer.

Before the drainage sand layer installation begins, the Geosynthetic CQA shall verify that:

1. All drainage geocomposite seams have been completed in accordance with the specifications.
2. Repairs to the drainage geocomposite are complete and secure.
3. The drainage geocomposite surface is free of large wrinkles and folds and lies flat to the underlying surface.

The Installer shall verbally verify with the Geosynthetic CQA that the surface on which the geomembrane will be installed is acceptable. At any time before or during the primary liner geomembrane installation, the Geosynthetic CQA shall indicate to the Installer any locations which may not be adequately prepared for the geomembrane. The Installer shall repair said areas to the satisfaction of the Geosynthetic CQA.

5.3.1.4 Drainage Sand Surface Preparation

The earthwork contractor shall be responsible for preparing the supporting drainage sand for placement of the overlying compacted clay layer.

Before the compacted clay layer installation begins, the Geosynthetic CQA shall verify that:

1. All lines and grades are verified.
2. An Owner's Representative verify that the supporting soil meets all the drainage sand requirements specified in the project specifications.
3. The surface to be lined has been machine-graded or handworked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.
4. There is no area excessively softened by high water content.

5.3.2 Anchor Trench

The Geosynthetic QARE shall verify that the anchor trench has been constructed according to the design drawings and specifications.

If the anchor trench is excavated in a clay material susceptible to desiccation, the amount of trench open at any time should be minimized. The Geosynthetic QARE shall inform the Project Manager/RPR of any signs of significant desiccation associated with the anchor trench construction.

Slightly rounded corners shall be provided in the trench so as to avoid sharp bends in the geomembrane. Excessive amounts of loose soil shall not be allowed to underlie the geomembrane in the anchor trench.

The anchor trench shall be adequately drained to prevent ponding or softening of the adjacent soils while the trench is open. The anchor trench shall be backfilled and compacted as outlined in the project specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics. The Geosynthetic QARE shall observe the backfilling operation and advise the Project Manager/RPR of any problems. Any problems shall be documented by the Geosynthetic QARE in his daily report.

5.4 Geomembrane Deployment

5.4.1 Panel Nomenclature

A field panel is defined as a unit of geomembrane which is to be seamed in the field (i.e., a field panel is a roll or a portion of roll cut in the field).

It shall be the responsibility of the Geosynthetic QARE to assure that each field panel is given an identification code (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Project Manager/RPR, Installer and Geosynthetic QARE. This field panel identification code shall be as simple and logical as possible. In general, it is not appropriate to identify panels using roll numbers since roll numbers established in the manufacturing plant are usually cumbersome and are not related to location in the field. The Geosynthetic QARE shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code shall be used for all quality assurance records.

The Geosynthetic QARE shall verify that field panels are installed at the locations indicated on the Installer's layout plan, as approved by the Project Manager/RPR.

5.4.2 Panel Deployment Procedure

The Geosynthetic QARE shall review the panel deployment progress of the Installer (keeping in mind issues relating to wind, rain, geosynthetic clay liner hydration, and other site-specific conditions) and

advise the Project Manager/RPR on its compliance with the approved panel layout drawing and its suitability to the actual field conditions. Once approved, only the Project Manager/RPR can authorize changes to the panel deployment procedure. The Geosynthetic QARE shall verify that the condition of the supporting soil does not change detrimentally during installation.

The Geosynthetic QARE shall record the identification code, location, and date of installation of each field panel.

5.4.3 Deployment Weather Conditions

Geomembrane deployment shall not proceed at an ambient temperature below 32°F (0°C) or above 104°F (40°C) unless otherwise authorized, in writing, by the Project Manager/RPR. Geomembrane placement shall not be performed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds. Geomembrane deployment shall not be undertaken if weather conditions will preclude material seaming following deployment.

The Geosynthetic QARE shall verify that the above conditions are fulfilled. Ambient temperature shall be measured by the Geosynthetic QARE in the area in which the panels are to be deployed. The Geosynthetic QARE shall inform the Project Manager/RPR of any weather related problems which may not allow geomembrane placement to proceed.

5.4.4 Method of Deployment

Before the geomembrane is handled on-site, the Geosynthetic QARE shall verify that handling equipment to be used on the site is adequate and does not pose risk of damage to the geomembrane or underlying geosynthetic clay liner. During handling, the Geosynthetic QARE shall observe and verify that the Installer's personnel handle the geomembrane and geosynthetic clay liner with care.

The Geosynthetic QARE shall verify the following:

1. Any equipment used does not damage the geomembrane or geosynthetic clay liner by handling, trafficking, excessive heat, leakage of hydrocarbons, or other means.
2. The prepared surface underlying the geomembrane or geosynthetic clay liner has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane placement.
3. Any geosynthetic elements immediately underlying the geomembrane or geosynthetic clay liner are clean and free of debris.
4. All personnel do not smoke or wear damaging shoes while working on the geomembrane or geosynthetic clay liner, or engage in other activities which could damage the geomembrane or geosynthetic clay liner.

5. The method used to unroll the panels does not cause excessive scratches or crimps in the geomembrane and does not damage the supporting soil or geosynthetic clay liner.
6. The geomembrane or geosynthetic clay liner is not dragged over surfaces that may damage the panels. Rub sheets shall be used to prevent damage to geosynthetic materials if dragging is necessary.
7. The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels).
8. Adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the geomembrane, has been placed to prevent uplift by wind. In case of high winds, continuous loading, e.g., by sand bags, is recommended along edges of panels to minimize risk of wind flow under the panels.
9. Direct contact with the geomembrane is minimized and the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.
10. The method used to place the panels does not result in bridging.
11. That adequate field trial seams be run on seams that connect new geomembrane with existing geomembrane.

The Geosynthetic QARE shall inform the Project Manager/RPR if the above conditions are not fulfilled.

5.4.5 Damage and Defects

Upon delivery to the site, the Geosynthetic QARE shall conduct a surface observation of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. The Geosynthetic QARE shall advise the Project Manager/RPR, in writing, of any rolls or portions of rolls which should be rejected and removed from the site because they have severe flaws and/or minor repairable flaws.

The Geosynthetic QARE shall inspect each panel, after placement and prior to seaming, for damage and/or defects. The Geosynthetic QARE shall advise the Project Manager/RPR which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels, or portions of damaged panels, which have been rejected shall be marked and their removal from the work area recorded by the Geosynthetic QARE. Repairs shall be made using procedures described in Section 5.8.

5.4.6 Writing on the Liner

To avoid confusion, the Installer and the Geosynthetic QARE shall each use different colored markers that are readily visible for writing on the geomembrane. The markers used must be semi-permanent and compatible with the geomembrane.

5.5 Field Seaming

5.5.1 Seam Layout

Before installation begins, the Installer must provide the Project Manager/RPR and the Geosynthetic QARE with a panel layout drawing (i.e., a drawing of the facility to be lined showing all expected seams). The Geosynthetic QARE shall review the panel layout drawing and verify that it is consistent with accepted state-of-practice. No panels may be seamed without the written approval of the panel layout drawing by the Project Manager/RPR. In addition, panels not specifically shown on the panel layout drawing may not be used without the Project Manager/RPR's prior approval.

In general, seams should be oriented parallel to the line of maximum slope, i.e., oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam should be less than 5 feet (1.5 m) from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Project Manager/RPR.

A seam numbering system compatible with the panel numbering system shall be used by the Geosynthetic QARE.

5.5.2 Accepted Seaming Methods

Approved processes for field seaming are extrusion welding and fusion welding. Proposed alternate processes shall be documented and submitted by the Installer to the Project Manager/RPR for approval. Only apparatus which have been specifically approved by make and model shall be used. The Project Manager/RPR shall submit all documentation regarding seaming methods to be used to the Geosynthetic QARE for review.

5.5.2.1 Extrusion Process

The Geosynthetic QARE shall log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Project Manager/RPR.

The Geosynthetic QARE shall verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus decided upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. Prior to beginning a seam, the extruder is purged until all heat-degraded extrudate has been removed from the barrel.
4. Clean and dry welding rods or extrudate pellets are used.
5. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
6. Grinding shall be completed no more than 1 hour prior to seaming.

7. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
8. The geomembrane is protected from damage in heavily trafficked areas.
9. Exposed grinding marks adjacent to an extrusion weld shall be minimized. In no instance shall exposed grinding marks extend more than 1/4 inch from the seamed area.
10. In general, the geomembrane panels are aligned to have a nominal overlap of 3 inch (75 mm) for extrusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
11. No solvent or adhesive is used unless the product is approved in writing by the Project Manager/RPR prior to use (samples shall be submitted to the Project Manager/RPR for testing and evaluation).
12. The procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any temporary welding apparatus is controlled such that the geomembrane is not damaged or degraded.

5.5.2.2 Fusion Process

The Geosynthetic QARE shall log ambient, seaming apparatus, and geomembrane surface temperatures at appropriate intervals and report any noncompliances to the Project Manager/RPR.

The Geosynthetic QARE shall also verify that:

1. The Installer maintains on-site the number of spare operable seaming apparatus decided upon at the pre-construction meeting.
2. Equipment used for seaming is not likely to damage the geomembrane.
3. For cross seams, the edge of the cross seam is ground to an incline prior to welding.
4. The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.
5. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
6. The geomembrane is protected from damage in heavily trafficked areas.
7. A movable protective layer is used as required by the Installer directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets and prevent debris from collecting around the pressure rollers.
8. In general, the geomembrane panels are aligned to have a nominal overlap of 6 inches (152 mm) for fusion welding. In any event, the final overlap shall be sufficient to allow peel tests to be performed on the seam.
9. No solvent or adhesive is used unless the product is approved in writing by the Project Manager/RPR prior to use (samples shall be submitted to the Project Manager/RPR for testing and evaluation).

5.5.3 Seam Preparation

The Geosynthetic QARE shall verify that prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris or foreign material of any kind. If seam overlap grinding is required, the Geosynthetic QARE must assure that the process is completed according to the Manufacturer's instructions within one hour of the seaming operation and in a way that does not damage the geomembrane. The Geosynthetic QARE shall also verify that seams are aligned with the fewest possible number of wrinkles and "fishmouths".

Seaming operations to existing liner systems shall be done with care. Existing liner system shall be prepared by pressure wash to assure clean surface. Trial seams shall be done on all seams connecting new liner with existing liner systems.

5.5.4 Trial Seams

Trial seams shall be made on fragment pieces of geomembrane liner used on the project to verify that conditions are adequate for production seaming. Such trial seams shall be made at the beginning of each seaming period, or at least once each four hours, for each production seaming apparatus used that day. Also, an additional trial seam is required after any change of operator, equipment shutdown, significant idle time, or significant weather change. Additional trial seams due to idle time or weather are at the discretion of the Geosynthetic QARE. Each seamer shall make at least one trial seam each day. Trial seams shall be made under the same conditions as actual seams.

Trial seams shall be made on liner that will be used in production seaming, such as: new textured liner to new textured liner; new textured liner to existing textured liner; smooth liner to textured liner.

The trial seam shall be at least 4 feet (1.2 m) long by 1 foot (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.5.2.

Five samples shall be cut from the trial seam with a 1 inch (25 mm) wide die. The samples shall be cut by the Installer at locations selected randomly along the trial seam. The samples shall be tested in peel and shear using a field tensiometer. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. If a sample fails, the entire operation shall be repeated. If the additional sample fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved. The Geosynthetic QARE shall observe all trial seam procedures.

5.5.5 General Seaming Procedures

During general seaming, the Geosynthetic QARE shall be cognizant of the following:

1. For fusion welding, it may be necessary to place a movable protective layer of plastic directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture buildup between the sheets to be welded and prevent debris from collecting around the pressure rollers.
2. If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.
3. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 inches (152 mm) beyond the cut in all directions.
4. If seaming operations are carried out at night, adequate illumination shall be provided.
5. Seaming shall extend to the outside edge of panels placed in the anchor trench.
6. All cross seam tees should be extrusion welded to a minimum distance of 4 inches on each side of the tee.
7. No field seaming shall take place without the Master Seamer being present.

The Geosynthetic QARE shall verify that the above seaming procedures (or any other procedures agreed upon and indicated in the project manual) are followed and shall inform the Project Manager/RPR of any nonconformance.

5.5.6 Seaming Weather Conditions:

5.5.6.1 Normal Weather Conditions

The normal required weather conditions for seaming are as follows:

1. Ambient temperature between 32°F (0°C) and 104°F (40°C).
2. Dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.
3. No excessive winds.

The Geosynthetic QARE shall verify that these weather conditions are fulfilled and notify the Project Manager/RPR in writing if they are not. Ambient temperature shall be measured by the Geosynthetic QARE in the area in which the panels are to be placed. The Project Manager/RPR will then decide if the installation is to be stopped or special procedures used.

5.5.6.2 Cold Weather Conditions

To assure a quality installation, if seaming is conducted when the ambient temperature is below 32°F (0°C), the following conditions must be met:

1. Geomembrane surface temperatures shall be determined by the Geosynthetic QARE at intervals of at least once per 100 foot of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32°F (0°C).

2. Preheating may be waived by the Project Manager/RPR based on a recommendation from the Geosynthetic QARE, if the Installer demonstrates to the Geosynthetic QARE's satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
3. If preheating is required, the Geosynthetic QARE shall inspect all areas of geomembrane that have been preheated by a hot air device prior to seaming to assure that they have not been overheated.
4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
5. All preheating devices shall be approved prior to use by the Project Manager/RPR.
6. Additional destructive tests (as described in Section 5.7) shall be taken at an interval between 500 feet and 250 feet of seam length, at the discretion of the Geosynthetic QARE.
7. Sheet grinding may be performed before preheating, if applicable.
8. Trial seaming, as described in Section 5.5.4, shall be conducted under the same ambient temperature and preheating conditions as the actual seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 5°F from the initial trial seam test conditions.
9. All snow and ice shall be removed from the liner using plastic shovels. The Geosynthetic QARE will also have authority to suspend installation activities during severe weather conditions.

5.5.6.3 Warm Weather Conditions

At ambient temperatures above 104°F, no seaming of the geomembrane shall be permitted unless the Installer can demonstrate to the satisfaction of the Project Manager/RPR that geomembrane seam quality is not compromised.

Trial seaming, as described in Section 5.5.4, shall be conducted under the same ambient temperature conditions as the actual seams.

At the option of the Geosynthetic QARE, additional destructive tests (as described in Section 5.4) may be required for any suspect areas.

5.6 Nondestructive Seam Testing

5.6.1 Concept

The Installer shall nondestructively test field seams over their full length using a vacuum test unit, air pressure test (for double fusion seams only), or other approved method. Vacuum testing and air pressure testing are described in Sections 5.6.2 and 5.6.3, respectively. The purpose of nondestructive tests is to check the continuity of seams. It does not provide quantitative information on seam strength. Nondestructive testing shall be carried out as the seaming work progresses, not at the completion of field seaming. At a minimum of once every 4 hours of seaming and when operation has been suspended for

greater than one hour or if breakdown of seaming equipment occurs, weld samples will be tested in peel and shear in accordance with the destructive test requirements of the contract documents.

For all seams, the Geosynthetic QARE shall:

1. Observe nondestructive testing procedures.
2. Record location, data, test unit number, name of tester, and outcome of all testing.
3. Inform the Installer and Project Manager/RPR of any required repairs.

5.6.2 Vacuum Testing

The following procedures are applicable to vacuum testing.

1. The equipment shall consist of the following:
    a. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, a porthole or valve assembly, and a vacuum gauge.
    b. A pump assembly equipped with a pressure controller and pipe connections.
    c. A rubber pressure/vacuum hose with fittings and connections.
    d. A sudsy solution of soap and water.
    e. A bucket and wide paint brush, or other means of applying the sudsy solution.
2. The following procedures shall be followed:
    a. Energize the vacuum pump and reduce the tank pressure to approximately 3.0 to 8.0 psi gauge.
    b. Wet a strip of geomembrane approximately 12 inches by 48 inches (0.3 m x 1.2 m) with the soapy distilled water solution.
    c. Place the box over the wetted area.
    d. Close the bleed valve and open the vacuum valve.
    e. Assure that a leak-tight seal is created.
    f. For a period of not less than 15 seconds, apply vacuum and examine the geomembrane through the viewing window for the presence of soap bubbles.
    g. If no bubble appears after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches (76 mm) overlap, and repeat the process.
    h. All areas where soap bubbles appear shall be marked and repaired in accordance with Section 5.8.

5.6.3 Air Pressure Testing

The following procedures are applicable to double fusion welding which produces a double seam with an enclosed space.

1. The equipment shall consist of the following:
    a. An air pump (manual or motor driven), equipped with pressure gauge capable of generating and sustaining a pressure between 30 and 35 psi (206 and 241 kPa) and mounted on a cushion to protect the geomembrane.
    b. A rubber hose with fittings and connections.
    c. A sharp hollow needle, or other approved pressure feed device.
2. The following procedures shall be followed:
    a. Seal both ends of the seam to be tested.
    b. Insert needle or other approved pressure feed device into the air channel created by the fusion weld.
    c. Insert a protective cushion between the air pump and the geomembrane.
    d. Energize the air pump to a pressure between 30 and 35 psi (206 and 241 kPa), close valve, allow 2 minutes for pressure to stabilize, and sustain pressure for at least 5 minutes.
    e. If loss of pressure exceeds 2 psi (15 kPa) or does not stabilize, locate faulty area and repair in accordance with Section 5.8.
    f. Cut opposite end of tested seam area once testing is completed to verify continuity of the air channel. If air does not escape, locate blockage and retest unpressurized area. Seal the cut end of the air channel.
    g. Remove needle or other approved pressure feed device and seal.

5.6.4 Test Failure Procedures

The Installer shall complete any required repairs in accordance with Section 5.8. For repairs, the Geosynthetic QARE shall:

1. Observe the repair and testing of the repair.
2. Mark on the geomembrane that the repair has been made.
3. Document the repair procedures and test results.

5.7 Destructive Seam Testing

5.7.1 Concept

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

5.7.2 Location and Frequency

The Geosynthetic QARE shall select locations where seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

1. A minimum frequency of one test location per 1,000 feet of seam length performed by each welder. This minimum frequency is to be determined as an average taken throughout the entire facility.
2. Test locations shall be determined during seaming at the Geosynthetic QARE's discretion. Selection of such locations may be prompted by suspicion of overheating, contamination, offset welds, or any other potential cause of imperfect welding.

The Installer shall not be informed in advance of the locations where the seam samples will be taken.

5.7.3 Sampling Procedures

Samples shall be cut by the Installer at locations chosen by the Geosynthetic QARE as the seaming progresses so that laboratory test results are available before the geomembrane is covered by another material. The Geosynthetic QARE shall:

1. Observe sample cutting.
2. Assign a number to each sample and mark it accordingly.
3. Record sample location on layout drawing.
4. Record reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described in Section 5.8. The continuity of the new seams in the repaired area shall be tested according to the project specifications.

5.7.4 Sample Dimensions

At a given sampling location, one sample will be taken by the installer with minimum dimensions of seam width by 48 inches in length. Field seam testing shall be performed in accordance with Section 02771 on a total of five coupons. Two coupons shall be cut one end and three from the opposite end using a 1-inch

wide die with the seam centered parallel to the width of the coupon. If all coupons pass the field seam testing requirements as specified in Section 02771, a sample for laboratory testing is cut from the sample. The sample is cut into three parts and distributed as follows.

1. One portion to the Installer for optional laboratory testing, 12 inches x 12 inches (0.3 m x 0.3 m);
2. One portion for Geosynthetic QAL testing, 12 inches x 18 inches (0.3 m x 0.5 m); and
3. One portion to the Project Manager/RPR for archive storage, 12 inches x 12 inches (0.3 m x 0.3 m).

Final determination of the sample sizes shall be made at the pre-construction meeting.

5.7.5 Field Testing

The five 1-inch (25 mm) wide coupons mentioned in Section 5.7.4 shall be tested in the field using a tensiometer and shall not fail according to the criteria in the project specifications. The tensiometer shall be capable of maintaining a constant jaw separation rate of two inches per minute. If the test passes in accordance with this section, the sample qualifies for testing in the laboratory. If it fails, the seam should be repaired in accordance with Section 5.8. Final judgment regarding seam acceptability, based on the failure criteria, rests with the Geosynthetic QARE. Both tracks are to be tested in peel.

The Geosynthetic QARE shall witness all field tests and mark all samples and portions with their number. The Geosynthetic QARE shall also log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description and attach a copy to each sample portion.

5.7.6 Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, under the responsibility of the Geosynthetic QAL in a manner which will not damage the test sample. The Project Manager/RPR will be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetic QAL.

Testing shall include properties as defined in the specifications. The minimum acceptable values to be obtained in these tests are indicated in the specifications. At least 5 specimens shall be tested in each shear and peel. Specimens shall be selected alternately by test from the samples (i.e. peel, shear, peel, shear...).

The Geosynthetic QAL shall provide verbal test results no more than 24 hours after they receive the samples. The Geosynthetic QARE shall review laboratory test results as soon as they become available and make appropriate recommendations to the Project Manager/RPR.

5.7.7 Destructive Test Failure Procedures

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetic QAL, or by field tensiometer. The Installer has two options:

1. The Installer can repair the seam between any two passing test locations.
2. The Installer can trace the welding path to an intermediate location (at 10 feet (3 m) minimum from the point of the failed test in each direction) and take a sample with a 1 inch (25 mm) wide die for an additional field test at each location. If these additional samples pass the test, then full laboratory samples are taken. If these laboratory samples pass the tests, then the seam is repaired between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be repaired.

All acceptable repaired seams shall be bound by two locations from which samples passing laboratory destructive tests have been taken. Passing laboratory destructive tests of trial seam samples taken, as indicated in Section 5.5.4, may be used as a boundary for the failing seam. In cases exceeding 150 feet (50 m) of repaired seam, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with Section 5.8.

The Geosynthetic QARE shall document all actions taken in conjunction with destructive test failures.

5.8 Defects and Repairs

5.8.1 Identification

All seams and non-seam areas of the geomembrane shall be examined by the Geosynthetic QARE for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be cleaned by the Installer if the amount of dust or mud inhibits examination.

5.8.2 Evaluation

Each suspect location both in seam and non-seam areas shall be nondestructively tested using the methods described in Section 5.6 as appropriate. Each location which fails the nondestructive testing shall be marked by the Geosynthetic QARE and repaired by the Installer. Work shall not proceed with any materials which will cover locations which have been repaired until appropriate nondestructive and laboratory test results with passing values are available.

5.8.3 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Project Manager/RPR, Installer, and Geosynthetic QARE.

1. The repair procedures available include:

a. Patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.

b. Spot welding or seaming, used to repair small tears, pinholes, or other minor, localized flaws.

c. Capping, used to repair large lengths of failed seams at the discretion of the Geosynthetic CQA.

d. Removing bad seam and replacing with a strip of new material welded into place.

2. For any repair method, the following provisions shall be satisfied:

   a. Surfaces of the geomembrane which are to be repaired using extrusion methods shall be abraded no more than one hour prior to the repair. The extrudate shall cover all the grinding area.

   b. All surfaces shall be clean and dry at the time of the repair.

   c. All seaming equipment used in repairing procedures shall meet the requirements of the QAP.

   d. Patches or caps shall extend at least 6 inches (150 mm) beyond the edge of the defect and all corners of patches shall be rounded with a radius of approximately 3 inches (75 mm).

5.8.4 Repair Verification

Each repair shall be numbered and logged. Each repair shall be nondestructively tested using the methods described in Section 5.6 as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150 feet long may be of sufficient extent to require destructive test sampling, at the discretion of the Geosynthetic QARE. Failed tests indicate that the repair shall be redone and retested until a passing test results. The Geosynthetic QARE shall observe all nondestructive testing of repairs and shall record the number of each repair, date, and test outcome.

5.8.5 Large Wrinkles

When seaming of the geomembrane is completed, and prior to placing overlying materials, the Geosynthetic QARE shall indicate to the Project Manager/RPR which wrinkles should be cut and reseamed by the Installer. The number of wrinkles to be repaired should be kept to an absolute minimum. Therefore, wrinkles should be located during the coldest part of the installation process, while keeping in mind the forecasted weather to which the uncovered geomembrane may be exposed. Wrinkles are considered to be large when the geomembrane can be folded over onto itself. This is generally the case for a wrinkle that extends 12 inches from the subgrade. Seams produced while repairing wrinkles shall be tested as outlined above.

When placing overlying material on the geomembrane, every effort must be made to minimize wrinkle development. If possible, cover should be placed during the coolest weather available. In addition, small wrinkles should be isolated and covered as quickly as possible to prevent their growth. The placement of cover materials shall be observed by the Geosynthetic QARE to assure that wrinkle formation is minimized.

5.9 Geomembrane Protection

The quality assurance procedures indicated in this Section are intended only to assure that the installation of adjacent materials does not damage the geomembrane.

5.9.1 Soils

A copy of the specifications prepared by the Designer for placement of soils shall be given to the Geosynthetic QARE by the Project Manager/RPR. The Geosynthetic QARE shall verify that these specifications are consistent with the state-of-practice such as:

1. Placement of soils on the geomembrane shall not proceed at an ambient temperature below 32°F (0°C) nor above 104°F (40°C) unless otherwise specified.
2. Placement of soil on the geomembrane should be done during the coolest part of the day to minimize the development of wrinkles in the geomembrane.
3. A geotextile or other cushion approved by the Designer is generally required between aggregate and the geomembrane.
4. Equipment used for placing soil shall not be driven directly on the geomembrane.
5. A minimum thickness of 1 foot (0.3 m) of soil is specified between a light dozer (ground pressure of 5 psi (35 kPa) or lighter) and the geomembrane.
6. In any areas traversed by any vehicles other than low ground pressure vehicles approved by the Project Manager/RPR, the soil layer shall have a minimum thickness of 3 feet (0.9 m). This requirement may be waived if provisions are made to protect the geomembrane through an engineered design. Drivers shall proceed with caution when on the overlying soil and prevent spinning of tires or sharp turns.

The Geosynthetic QARE shall measure soil thickness and verify that the required thicknesses are present. The Geosynthetic QARE must also verify that final thicknesses are consistent with the design and verify that placement of the soil is done in such a manner that geomembrane damage is unlikely. The Geosynthetic QARE shall inform the Project Manager/RPR if the above conditions are not fulfilled.

5.9.2 Sumps and Appurtenances

A copy of the plans and specifications prepared by the Designer for appurtenances shall be given by the Project Manager/RPR to the Geosynthetic QARE. The Geosynthetic QARE shall review these plans and verify that:

1. Installation of the geomembrane in appurtenant areas and connection of geomembrane to appurtenances have been made according to specifications.

2. Extreme care is taken while welding around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas.
3. The geomembrane has not been visibly damaged while making connections to appurtenances.

The Geosynthetic QARE shall inform the Project Manager/RPR in writing if the above conditions are not fulfilled.

5.10 Leak Location Survey

The work shall be performed by a qualified independent testing firm that has performed surveys during the previous three years of at least 10,000,000 square feet of geomembrane covered by earth materials. This shall include at least three large scale projects consisting of at least two surveys of more than 875,000 square feet and one survey of 1,000,000 square feet. Leak Location Services, Inc. of San Antonio, Texas (Daren L. Laine, contact) is approved and is a qualified provider of these services.

5.10.1 Preparation

The following must be complete prior to the leak location service arriving on site.

- Install electrodes, if required, under the GCL prior to deployment.
- Uniformly wet the leachate collection sand with water to field capacity.
- Expose or leave exposed, the geomembrane located at the top of the anchor trench or along tie-in seams with adjacent cells for the duration of the leak survey.

5.10.2 Performance

The leak location equipment will be tested/calibrated to document the leak detection sensitivity. A 0.25-inch diameter hole will be used as an artificial leak to test equipment sensitivity. Once the leachate collection sand has been placed, a hole shall be dug through the sand and a hole made in the drainage geocomposite. Next, a drill or other suitable instrument shall be used to remove rather than displace the material (geomembrane) in the hole location. The geocomposite shall be replaced and the location marked and/or located relative to site benchmarks.

6.0 GEOTEXTILES

6.1 Quality Control Documentation

Prior to the installation of any geotextile, the Manufacturer or Installer shall provide the Project Manager/RPR with the following information:

1. The origin (resin supplier's name and resin production plant) and identification (brand name and number) of the resin used to manufacture the geotextile.
2. Copies of the quality control certificates issued by the resin supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the geotextile meets the Manufacturer's resin specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the geotextile manufactured for the project meets the project specifications.
5. A statement indicating that the reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness.
6. A list of the materials which comprise the geotextile, expressed in the following categories as percent by weight: base polymer, carbon black, other additives.
7. A specification for the geotextile which includes all properties contained in the project specifications measured using the appropriate test methods.
8. Written certification that minimum average roll values given in the specification are guaranteed by the Manufacturer.
9. For non-woven geotextiles, written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle free.
10. Quality control certificates, signed by a responsible party employed by the Manufacturer. The quality control certificates shall include roll identification numbers, sampling procedures, and results of quality control tests. At a minimum, results shall be given for those properties stated in Section 02272 Part 1.05(C) of the project specifications.

    Quality control tests shall be performed in accordance with the test methods specified in the project specifications for at least every 100,000 ft^2 of geotextile produced.

The Manufacturer shall identify all rolls of geotextiles with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

6.1.1 Product Review

The Project Manager/RPR shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum average roll properties meet the project specifications.

6.2 Conformance Testing

Upon delivery of the rolls of geotextiles, the Geosynthetic QARE shall assure that conformance test samples are obtained for the geotextile. These samples shall then be forwarded to the Geosynthetic QAL for testing to assure conformance to the project specifications.

If the Project Manager/RPR desires, the Geosynthetic QARE or his agent can perform the conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

The conformance tests shall be performed in accordance with the test methods indicated in Section 02272 Part 2.01.B of the project specifications. Other conformance tests may be required by the Project Manager/RPR.

6.2.1 Sampling Procedures

The rolls to be sampled shall be selected by the Geosynthetic QARE. Samples shall be taken across the entire width of the roll and shall not include the first complete revolution of fabric on the roll. Samples shall not be taken from any portion of a roll which has been subjected to excess pressure or stretching. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The Geosynthetic QARE shall mark the machine direction on the samples with an arrow. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the Geosynthetic QARE based on a review of all roll information including quality control documentation and manufacturing records.

Unless otherwise specified, samples shall be taken at a rate of one per lot, not to exceed one conformance test per 100,000 ft^2 (10,000 m^2) of geotextile.

6.2.2 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Geosynthetic QARE prior to the deployment of the geotextile.

The Geosynthetic QARE shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the Geosynthetic QAL incorrectly conducting the tests, the Manufacturer may request that the sample in question be retested by the Geosynthetic QAL with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Manufacturer. Alternatively, the Manufacturer may have the sample retested at two different approved independent laboratories at the expense of the Manufacturer. If both laboratories produce passing results, the material shall be accepted. If both laboratories do not produce passing results, then the original Geosynthetic QAL test results shall be accepted. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager/RPR.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out of specification and rejected. Alternatively, at the option of the Project Manager/RPR, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out of specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

6.3 Geotextile Deployment

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings. Wrappings shall be removed shortly before deployment.

The Geosynthetic QARE shall observe rolls upon delivery at the site and any deviation from the above requirements shall be reported to the Project Manager/RPR.
The Installer shall handle all geotextiles in such a manner as to assure they are not damaged in any way and the following shall be complied with:

1. On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.
2. In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during deployment and shall remain until replaced with cover material.
3. Geotextiles shall be cut using a geotextile cutter (hook blade) only. If in place, special care shall be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.
4. The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
5. During placement of geotextiles, care shall be taken not to entrap, in or beneath the geotextile, stones, excessive dust, or moisture that could damage the geomembrane, cause clogging of drains or filters, or hamper subsequent seaming.
6. A visual examination of the geotextile shall be carried out over the entire surface, after installation, to assure that no potentially harmful foreign objects, such as needles, are present.

The Geosynthetic QAL shall note any noncompliance and report it to the Project Manager/RPR.

6.4 Seaming Procedures

On slopes steeper than 10 horizontal:1 vertical, all geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped a minimum of 3 inches (75 mm) prior to seaming. In general, no horizontal seams shall be allowed on sideslopes (i.e., seams shall be along, not across, the slope), except as part of a patch.

On bottoms and slopes shallower than 10 (horizontal):1 (vertical), geotextiles shall be seamed as indicated above (preferred), or continuously thermally bonded with the written approval of the Project Manager/RPR.

The Installer shall pay particular attention at seams to assure that no earth cover material could be inadvertently inserted beneath the geotextile.

Any sewing shall be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. Sewing shall be done using machinery and stitch types specified in the project specifications or as approved in writing by the Project Manager/RPR.

6.5 Defects and Repairs

Any holes or tears in the geotextile shall be repaired as follows:

On slopes, a patch made from the same geotextile shall be sewn into place in accordance with the project specifications. Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile.

The Geosynthetic QARE shall observe any repair and report any noncompliance with the above requirements in writing to the Project Manager/RPR.

6.6 Geotextile Protection

All soil materials located on top of a geotextile shall be deployed in such a manner as to assure:

1. The geotextile and underlying lining materials are not damaged.
2. Minimal slippage of the geotextile on underlying layers occurs.
3. No excess tensile stresses occur in the geotextile.

Unless otherwise specified by the Geosynthetic QARE, all lifts of soil material shall be in conformance with the guidelines given in Section 5.9.1.

7.0 GEONETS (DRAINAGE GEOCOMPOSITE)

7.1 Quality Control Documentation

Prior to the installation of any geonet, the Manufacturer or Installer shall provide the Project Manager/RPR with the following information:

1. The origin (resin supplier's name and resin production plant), identification (brand name and number), and production date of the resin.
2. Copies of the quality control certificates issued by the resin supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the geonet meets the specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the geonet and drainage geocomposite manufactured for the project meets the project specifications.
5. A statement indicating that the amount of reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness and does not exceed 2 percent by weight.
6. A list of the materials which comprise the geonet, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.
7. A specification for the geonet which includes all properties contained in the specifications measured using the appropriate test methods.
8. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
9. Quality control certificates, signed by a responsible party employed by the Manufacturer. The quality control certificates shall include roll identification numbers, sampling procedures and results of quality control tests. At a minimum, results shall be given for those properties stated in Section 02272 Part 1.04 of the project specifications.

   Quality control tests shall be performed in accordance with the test methods specified in the specifications, for every 100,000 ft^2 of geonet produced.

The Manufacturer shall identify all rolls of drainage geocomposite with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

The Geosynthetic QARE shall review these documents and shall report any discrepancies with the above requirements to the Project Manager/RPR. The Geosynthetic QARE shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum properties meet the specifications.

7.2 Conformance Testing

Upon delivery of the rolls of geonet, the Geosynthetic QARE shall assure that conformance test samples are obtained for the geonet. These samples shall then be forwarded to the Geosynthetic QAL for testing to assure conformance to the specifications.

If the Project Manager/RPR desires, the Geosynthetic QARE or his agent, can perform the conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

The conformance tests shall be performed in accordance with the test methods indicated in Section 02272 Part 2.01.C.6 of the project specifications. Other conformance tests may be required by the Project Manager/RPR.

7.2.1 Sampling Procedures

The rolls to be sampled shall be selected by the Geosynthetic QARE. Samples shall be taken across the entire width of the roll and shall not be taken from any portion of a roll which has been subjected to excess pressure or stretching. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. The Geosynthetic QARE shall mark the machine direction on the samples with an arrow. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

If the Project Manager/RPR desires, the Geosynthetic QARE or his agent or his agent, can perform the third-party conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

A lot consists of a group of materials which is manufactured from a specific batch of raw materials (e.g., HDPE resin, or bentonite clay). The manufacturer shall identify the consecutively numbered rolls of material, which are inclusive within a lot.

Unless otherwise specified, samples shall be taken at a rate of one per lot, not less than one conformance test per 100,000 ft^2 (10,000 m^2) of geonet.

7.2.2 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Geosynthetic QARE prior to the deployment of the geotextile.

The Geosynthetic QARE shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the Geosynthetic QAL incorrectly conducting the tests, the Manufacturer may request that the sample in question be retested by the Geosynthetic QAL with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Manufacturer. Alternatively, the Manufacturer may have the sample retested at two different approved independent laboratories at the expense of the Manufacturer. If both laboratories produce passing results, the material shall be accepted. If both laboratories do not produce passing results, then the original Geosynthetic QAL test results shall be accepted. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager/RPR.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out of specification and rejected. Alternatively, at the option of the Project Manager/RPR, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out of specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

7.3 Geocomposite Deployment

During shipment and storage, the geocomposite shall be protected from inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions.

The Geosynthetic QARE shall observe rolls upon delivery at the site and any deviation from the above requirements shall be reported to the Project Manager/RPR.

The Installer shall handle all geocomposite in such a manner as to assure they are not damaged in any way and the following shall be complied with:

1. On slopes, the geocomposite shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geocomposite sheet in tension.
2. In the presence of wind, all geocomposite shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during deployment and shall remain until replaced with cover material.
3. Geocomposite shall be cut using a hook blade only. If in place, special care shall be taken to protect other materials from damage which could be caused by the cutting of the geocomposite.
4. The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.
5. During placement of geocomposite, care shall be taken not to entrap, in or beneath the geocomposite, stones, excessive dust, soil, or moisture that could damage the geomembrane, cause clogging of drains or filters, or hamper subsequent seaming.
6. A visual examination of the geocomposite shall be carried out over the entire surface, after installation, to assure that no potentially harmful foreign objects are present.

The Geosynthetic QAL shall note any noncompliance and report it to the Project Manager/RPR.

7.4 Seaming Procedures

Geonets shall be overlapped a minimum of 4 inches (75 mm) prior to tying. In general, no horizontal seams shall be allowed on sideslopes (i.e., seams shall be along, not across, the slope), except as part of a patch.

7.5 Seams and Overlaps

Adjacent geonet shall be joined according to construction drawings and specifications. At a minimum, the following requirements shall be met:

1. Adjacent rolls of geocomposite shall be overlapped by at least 4 inches (100 mm) at geonet joint and the overlying geotextile component shall be sewn together.
2. Geonet overlaps shall be secured by tying.
3. Tying can be achieved by plastic fasteners or polymer braid. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.
4. Tying shall be every 5 feet (1.5 m) along the slope, every 6 inches (0.15 m) in the anchor trench, and every 6 inches (0.15 m) along end-to-end seams on the base of the landfill.
5. In general, no horizontal seams shall be allowed on sideslopes.
6. In the corners of the sideslopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed geonet, from top to bottom of the slope.

7. When more than one layer of geonet is installed, joints shall be staggered.
8. The geotextiles that will have direct contact with soil shall be heat-sealed at geonet overlaps.

The Geosynthetic QARE shall note any noncompliance and report it to the Project Manager/RPR.

When several layers of geonet are stacked, care shall be taken to prevent strands of one layer from penetrating the channels of the next layer, thereby significantly reducing the transmissivity. This cannot happen if stacked geonet are placed in the same direction. A stacked geonet shall never be laid in perpendicular directions to the underlying geonet (unless otherwise specified by the Designer).

7.6 Defects and Repairs

Any holes or tears in the geocomposite shall be repaired by placing a patch extending 6 inches (0.15 m) beyond the edges of the hole or tear if the hole is greater than two inches. Any other holes or tears shall be patched that extends beyond the hole or tear by at least three times the largest dimension of the hole or tear. The patch shall be secured to the original geonet by tying every 6 inches (0.15 m) or heat bonding to geotextile component. Tying devices shall be as indicated in Section 7.5. If the hole or tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be repaired as follows:

1. On the base of the landfill, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Section 7.5.
2. On sideslopes, the damaged geocomposite shall be removed and replaced.

7.7 Geonet Protection

Soil should never be placed in direct contact with geocomposite. Soil materials near the geocomposite shall be placed in such a manner as to assure:

1. The geocomposite and underlying lining materials are not damaged.
2. Minimal slippage of the geocomposite on underlying layers occurs.
3. No excess tensile stresses occur in the geonet.

Unless otherwise specified by the Designer, all lifts of soil material shall be in conformance with the guidelines given in Section 4.0.

Any noncompliance shall be noted by the Geosynthetic QARE and reported to the Project Manager/RPR.

8.0 GEOSYNTHETIC CLAY LINERS (GCL)

8.1 Quality Control Documentation

Prior to the installation of any GCL, the Manufacturer or Installer shall provide the Project Manager/RPR with the following information:

1. The origin (bentonite and geotextile supplier's name and bentonite and geotextile production plant) and identification (brand name and number) of the bentonite and geotextile used to manufacture the GCL.
2. Copies of the quality control certificates issued by the bentonite and geotextile supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the bentonite and geotextile used to manufacture the GCL meets the Manufacturer's bentonite and geotextile specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the GCL manufactured for the project meets the project specifications.
5. A specification for the GCL which includes all properties contained in the project specifications measured using the appropriate test methods.
6. Written certification that minimum average roll values given in the specification are guaranteed by the Manufacturer.
7. For non-woven geotextiles, written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle free.
8. Quality control certificates, signed by a responsible party employed by the Manufacturer. The quality control certificates shall include roll identification numbers, sampling procedures and results of quality control tests. At a minimum, results shall be given for those properties stated in Section 02275 Part 2.01(A) of the project specifications.

   Quality control tests shall be performed in accordance with the test methods specified in the project specifications and consistent with GRI-GCL3, Standard Specification for Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs).

The Manufacturer shall identify all rolls of GCLs with the following:

1. Manufacturer's name
2. Product identification
3. Roll number
4. Roll dimensions

8.1.1 Product Review

The Project Manager/RPR shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls related to it.
4. Roll packages are appropriately labeled.
5. Certified minimum average roll properties meet the project specifications.

8.2 Conformance Testing

Upon delivery of the rolls of GCLs, the Project Manager/RPR shall assure that conformance test samples are obtained for the GCL. Samples shall be obtained for conformance testing at a frequency consistent with GRI-GCL3 Standards, with a minimum of 1 per lot. These samples shall then be forwarded to an independent laboratory for testing to assure conformance to the project specifications.

If the Project Manager/RPR desires, the Geosynthetic QARE or his agent can perform the conformance test sampling at the manufacturing plant. This may be advantageous in expediting the installation process for very large projects.

The conformance tests shall be performed in accordance with the test methods indicated in Section 02275 Part 1.06. Other conformance tests may be required by the Project Manager/RPR.

8.2.1 Sampling Procedures

The rolls to be sampled shall be selected by the Project Manager/RPR. Samples shall be taken across the entire width of the roll. Samples shall not be taken from any portion of a roll which has been subjected to excess pressure or stretching. Unless otherwise specified, samples shall be 3 ft (1 m) long by the roll width. All lots of material and the particular test sample that represents each lot should be defined before the samples are taken.

A lot consists of a group of materials which is manufactured from a specific batch of raw materials (e.g., HDPE resin, or bentonite clay). The manufacturer shall identify the consecutively numbered rolls of material, which are inclusive within a lot.

Unless otherwise specified, samples shall be taken at a rate of one per lot but not less than one conformance test per 100,000 ft^2 (4,645 m^2) of GCL.

8.2.2 Test Results

All conformance test results shall be reviewed and accepted or rejected by the Project Manager/RPR prior to the deployment of the GCL.

The Project Manager/RPR shall be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the independent laboratory incorrectly conducting the tests, the Manufacturer may request that the sample in question be retested by the independent laboratory with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Manufacturer. Alternatively, the Manufacturer may have the sample retested at two different approved independent laboratories at the expense of the Manufacturer. If both laboratories produce passing results, the material shall be accepted. If both laboratories do not produce passing results, then the original independent laboratory test results shall be accepted. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager/RPR.

If a test result is in nonconformance, all material from the lot represented by the failing test should be considered out of specification and rejected. Alternatively, at the option of the Project Manager/RPR, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all rolls in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out of specification material, additional samples must be taken from rolls that have roll numbers immediately adjacent to the roll that was sampled and failed. If both additional tests pass, the roll that represents the initial failed test and the roll manufactured immediately after that roll (next larger roll number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of rolls within the lot.

8.3 Subgrade Preparation

8.3.1 Surface Preparation

The earthwork contractor shall be responsible for preparing the supporting soil for GCL placement.

Before the GCL installation begins, the Geosynthetic QARE shall verify that:

1. All lines and grades are verified.
2. An Owner's Representative verify that the supporting soil meets the density specified in the project specifications.
3. The surface to be lined has been rolled, compacted, or handworked so as to be free of irregularities, protrusions, loose soil, and abrupt changes in grade.

4. The surface of the supporting soil does not contain stones which may be damaging to the geosynthetics.
5. There is no area excessively softened by high water content.

The Installer shall certify in writing that the surface on which the GCL will be installed is acceptable. A certificate of acceptance shall be given by the Installer to the Geosynthetic QARE prior to commencement of GCL deployment in the area under consideration. The Project Manager/RPR shall be given a copy of this certificate by the Geosynthetic QARE.

After the supporting soil has been accepted by the Installer, it is the Installer's responsibility to indicate to the Project Manager/RPR any change in the supporting soil condition that may require repair work. The Project Manager/RPR may consult with the Geosynthetic QARE regarding the need for repairs. If the Geosynthetic QARE concurs with Installer, the Project Manager/RPR shall assure that the supporting soil is repaired.

At any time before or during the GCL installation, the Geosynthetic QARE shall indicate to the Project Manager/RPR any locations which may not be adequately prepared for the GCL.

8.4 GCL Deployment

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. GCL rolls shall be shipped and stored in relatively opaque and watertight wrappings. Wrappings shall be removed shortly before deployment.

The Geosynthetic QARE shall observe rolls upon delivery at the site and any deviation from the above requirements shall be reported to the Project Manager/RPR.

The Installer shall handle all GCLs in such a manner as to assure they are not damaged in any way and the following shall be complied with:

1. On slopes, the GCLs shall be securely anchored and then rolled down the slope in such a manner as to continually keep the GCLs fully relaxed (but not wrinkled).
2. GCLs shall be cut using a utility knife or special (manufacturer) cutter only. If in place, special care shall be taken to protect other materials from damage which could be caused by the cutting of the GCLs.
3. The Installer shall take any necessary precautions to prevent damage to underlying layers during placement of the GCL.
4. A visual examination of the GCL shall be carried out over the entire surface, after installation, to assure that no potentially harmful foreign objects, such as needles, are present.

5. The Installer shall sign and submit subgrade surface acceptance certificates for each area to be covered by the GCL.
6. The Installer shall deploy no more GCL material than can be covered with geomembrane by the end of that working day; this shall be verified by the Project Manager/RPR.
7. The Installer shall use a core pipe to lift the GCL during deployment which does not bend excessively creating unacceptable tension in the GCL, this shall be verified by the Project Manager/RPR.
8. To prevent damage, the GCL panels should not be dragged along the subgrade surface.

8.5 Seaming Procedures

GCLs shall be overlapped a minimum of 6 inches prior to seaming. In general, no horizontal seams shall be allowed on sideslopes (i.e., seams shall be along, not across, the slope), except as part of a patch. The GCL shall be seamed with a minimum of ¼-pound (115 g/lf) of bentonite. Seams at the base of the slope shall be a minimum of 5 feet away from the toe of the slope.

The Geosynthetic QARE shall pay particular attention at seams to assure that no earth cover material could be inadvertently inserted beneath the GCL.

8.6 Defects and Repairs

Any holes or tears in the GCL shall be repaired as follows:

Place a bead of granular bentonite at the minimum rate of one-quarter pound per linear foot around the damaged area, cut a batch of new GCL to fit over the damaged area and extending a minimum of 6 inches beyond it, and carefully backfill.

Care shall be taken to remove any soil or other material which may have penetrated the damaged GCL.

8.7 GCL Protection

All soil materials located on top of a GCL shall be deployed in such a manner as to assure:

1. The GCL is not damaged.
2. Minimal slippage of the GCL on underlying layers occurs.
3. No excess tensile stresses occur in the GCL.

Unless otherwise specified by the Geosynthetic QARE, all lifts of soil material shall be in conformance with the guidelines given in Section 4.0.

8.8 Installation Documentation

The Project Manager/RPR shall prepare and submit the following information as part of the project documentation plan:

1. All conformance testing results.
2. All daily reports detailing the GCL deployment.
3. Subgrade surface acceptance certifications signed by the responsible parties.
4. A compilation of all CQA checklists completed during the installation.
5. All manufacturer's certifications and accompanying test data.
6. A description of deviations, if any, made to the original CQA plan during the installation.
7. The Geosynthetic QARE will accept the GCL prior to placement.

9.0 HDPE PIPE, FITTINGS AND APPURTENANCES

9.1 Quality Control Documentation

Prior to the installation of any pipe, fittings, and appurtenances at the landfill facilities, the contractor shall provide the Engineer with material submittals on the materials to be used in construction of the landfill facilities. Submittals shall be prepared according to the project specifications. The following information shall be available and will be provided to the Engineer or CQA upon request:

1. The origin (resin supplier's name and resin production plant), identification (brand name and number), and production date of the resin.
2. Copies of the quality control certificates issued by the resin supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the HDPE pipe and fittings meets the specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the HDPE pipe and fittings manufactured for the project meets the project specifications.
5. A statement indicating that the amount of reclaimed polymer added to the resin during manufacturing was done with appropriate cleanliness and does not exceed 2 percent by weight.
6. A list of the materials which comprise the HDPE pipe and fittings, expressed in the following categories as percent by weight: polyethylene, carbon black, other additives.
7. A specification for the pipe and fittings which includes all properties contained in the specifications measured using the appropriate test methods.
8. Written certification that minimum values given in the specification are guaranteed by the Manufacturer.
9. Quality control certificates, signed by a responsible party employed by the Manufacturer. The quality control certificates shall include pipe identification numbers, sampling procedures and results of quality control tests. At a minimum, results shall be given for:
    a. Density
    b. Melt flow index
    c. Carbon black content

    Quality control tests shall be performed in accordance with the test methods specified in the specifications, for every 1,000 ft of pipe produced.

The Manufacturer shall identify all pipe according to ASTM D 1248 and ASTM F 714.

The CQA shall review these documents, as requested, and shall report any discrepancies with the above requirements to the Project Manager/RPR. The CQA shall verify that:

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurements of properties by the Manufacturer are properly documented and that the test methods used are acceptable.
3. Quality control certificates have been provided at the specified frequency for pipe produced and that each certificate identifies the pipe related to it.
4. Pipe is appropriately labeled.
5. Certified minimum properties meet the specifications.

9.2 Conformance Testing

Upon delivery of the HDPE pipe, the CQA shall inspect the pipe and, based on the pipe condition and review of the manufacturer's certification documentation, may elect to sample the pipe for conformance testing. Conformance test samples shall be identified in a manner appropriate for the ASTM standard for HDPE pipe. These samples shall then be forwarded to the QAL for testing to assure conformance to the specifications.

If elected, the following conformance tests shall be performed on the pipe:

1. Physical dimensions by ASTM D 2122
2. Density by ASTM D 1505
3. Plate bearing test by ASTM D 2412
4. Impact resistance by ASTM D 2444

These conformance tests shall be performed in accordance with the test methods specified. Other conformance tests may be required by the Project Manager/RPR.

9.2.1 Sampling Procedures

A lot shall be defined as a group of consecutively numbered pipes from the same manufacturing line. Alternatively, a lot may be designated by the CQA based on a review of all pipe information including quality control documentation and manufacturing records.

Unless otherwise specified, samples shall be taken at a rate of one per lot, not less than one conformance test per 1,000 ft of HDPE pipe.

9.2.2 Test Results

All conformance test results must be reviewed and accepted or rejected by the CQA prior to installation of the pipe.

The CQA shall examine all results from laboratory conformance testing and shall report any nonconformance to the Project Manager/RPR. The CQA shall be responsible for checking that all test results meet or exceed the minimum property values listed in project specifications.

If the Manufacturer has reason to believe that failing tests may be the result of the QAL incorrectly conducting the tests, the Manufacturer may request that the sample in question be retested by the QAL with a technical representative of the Manufacturer present during the testing. This retesting shall be done at the expense of the Manufacturer. Alternatively, the Manufacturer may have the sample retested at two different NEWSME Operations approved independent laboratories at the expense of the manufacturer. If both laboratories produce passing results, the material shall be accepted. If both laboratories do not produce passing results, then the original QAL's test results shall be accepted. The use of these procedures for dealing with failed test results is subject to the approval of the Project Manager/RPR.

If a test result is in nonconformance, all material from the lot represented by the failing test shall be considered out of specification and rejected. Alternatively, at the option of the Project Manager/RPR, additional conformance test samples may be taken to "bracket" the portion of the lot not meeting specification (note that this procedure is valid only when all pipes in the lot are consecutively produced and numbered from one manufacturing line). To isolate the out of specification material, additional samples must be taken from pipes that have pipe numbers immediately adjacent to the pipe that was sampled and failed. If the two additional tests pass, the pipe that represents the initial failed test and the pipe manufactured immediately after that pipe (next larger pipe number) shall be rejected. If one or both of the additional tests fail, then the entire lot shall be rejected or the procedure repeated with two additional tests that bracket a greater number of pipes within the lot.

9.3 Pipe and Fitting Placement

The Installer shall handle all pipe in such a manner as to ensure it is not damaged in any way and the following shall be complied with:

1. HDPE pipe, fittings, and appurtenances shall be placed as shown in the Contract Drawings, specifications, and/or as directed by the CQA.
2. Piping placed within a trench shall be placed according to the contract drawings. Pipe bedding and backfill shall be done according to the specifications.

3. Pipe fittings shall be installed as shown on the contract drawings and as recommended by the pipe manufacturer and CQA.
4. Solid wall HDPE transport pipe and associated fittings shall be pressure leak tested according to general industry standards. The CQA is responsible for observing and documenting these tests. The installer is responsible for locating and repairing all leaks in such a manner that is acceptable to the CQA.

9.4 Pipe Seams and Fusion Techniques

Butt fusion welding shall be used to seam pipe lengths together and install pipe fittings. Welding shall be done by qualified personnel and according to manufacturer's instructions. The installer shall provide the CQA with documentation of the pipe welder's experience. The CQA shall observe and document welding operations as necessary to assure welding techniques are highest quality.

9.5 Repairs

Any damaged pipe shall be discarded. No repairs shall be allowed.

9.6 Manholes, Valves and Other Appurtenances

Manholes, valves and other appurtenances associated with the piping systems shall be constructed according to the contract drawings and specifications. All connections to piping and/or associated equipment shall be according to the contract drawings and the manufacturer's recommendations. All manholes, valves and other pipe connections shall be leak tested according to general industry standards. The installer is responsible for repair of faulty material and repairs required to provide a leakproof installation. The CQA is responsible for observing and documenting installation and testing necessary to assure installation techniques are highest quality.

9.7 Soil Materials Placement

All soil materials located on top of a pipe shall be placed in such a manner as to ensure:

1. The pipe and underlying materials are not damaged or dislocated.
2. The pipe structural integrity is not compromised.

Unless otherwise specified by the Designer, all lifts of soil material shall be in conformance with the guidelines given in Section 4.0.

Any noncompliance shall be noted by the CQA and reported to the Project Manager/RPR.

APPENDIX C

CONSTRUCTION SPECIFICATIONS

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BID DOCUMENTS
CELL 18 CONSTRUCTION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

Prepared for

NEWSME LANDFILL OPERATIONS, LLC
Old Town, Maine

November 2025

4 Blanchard Road
P.O. Box 85A
Cumberland, Maine 04021

Tel: 207.829.5016 sme-engineers.com

SME
SEVEE & MAHER
ENGINEERS

TABLE OF CONTENTS

Titles to divisions and paragraphs in these Specifications are introduced merely for convenience, and shall not be taken as a correct or complete segregation of the several units of material and labor. No responsibility, either direct, or implied, is assumed by the Engineer for omissions or duplications by the Contractor, or his subcontractors, due to real or alleged error in arrangement of the matter in these Contract Documents.

If any errors or omissions appear in the Drawings, Specifications, or other documents, the Contractor shall immediately notify the Engineer in writing of such omissions or errors.

A. BID AND CONTRACT DOCUMENTS

Section I	Invitation for Bids
Section II	Instructions to Bidders
Section III	Bid Forms and Bid Form Attachments
Section IV	Technical Specifications
Section V	Contract Drawings (Refer to Attachment 1)
Section VI	CQA Plan (Refer to Appendix B)
Section VII	Construction Agreement and Forms
Section VIII	Performance and Payment Bonds
Section IX	The Agreement Price – Fees, Charges, Rates and Additional Terms and Conditions

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Section 01012	Health and Safety Plan
Section 01025	Measurement and Payment
Section 01041	Project Coordination
Section 01060	Applicable Codes
Section 01211	Preconstruction Conference
Section 01300	Submittals
Section 01350	Engineer's Field Office
Section 01505	Mobilization
Section 01561	Cleaning
Section 01562	Dust Control
Section 01570	Traffic Control
Section 01600	Material and Equipment
Section 01700	Contract Closeout

DIVISION 2 **SITE WORK**

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Section 02016 Existing Utilities and Underground Structures
Section 02100 Site Preparation
Section 02200 Earthwork
Section 02220 Erosion Control
Section 02261 Riprap
Section 02272 Geotextiles and Drainage Geocomposite
Section 02275 Geosynthetic Clay Liner
Section 02450 Pipe Installation
Section 02451 Corrugated Pipe
Section 02466 Polyvinyl Chloride Pipe (Gravity Applications)
Section 02510 Hot Mix Asphalt Pavement
Section 02570 Catch Basins and Drainage Structures
Section 02732 Cell Pump Station and Force Main Meter and Valve Pit
Section 02771 Textured High Density Polyethylene (HDPE) Geomembrane Liner (60- and 80-mil)
Section 02772 Leak Location Survey
Section 02780 Interfacial Friction Angle Conformance Testing
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DIVISION **CONCRETE**

Section 03300 Cast-In-Place Concrete
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DIVISION 15 **MECHANICAL**

Section 15100 HDPE Pipe and Fittings
Section 15101 PVC Pipe and Fittings
Section 15110 Valves and Pipe Accessories
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APPENDICES

APPENDIX A PERMITS: APPENDIX A-1 MEDEP SOLID WASTE PERMIT
APPENDIX A-2 ARMY CORPS OF ENGINEERS PERMIT
APPENDIX A-3 CITY OF OLD TOWN PLANNING BOARD PERMIT

APPENDIX B QUALITY ASSURANCE/QUALITY CONTROL PLAN
APPENDIX C TEST PIT AND BORING LOGS
APPENDIX D ADDENDUMS

ATTACHMENT 1

CELL 18 DESIGN DRAWINGS

A. BID AND CONTRACT DOCUMENTS

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SECTION I

INVITATION FOR BIDS

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SECTION I
INVITATION FOR BIDS

I. INVITATION FOR BIDS

Three copies of your sealed proposals for Construction of Cell 18 at the Juniper Ridge Landfill Facility, will be received at the office of NEWSME Landfill Operations LLC (NEWSME Operations), Hampden, Maine, until **_____ on _____**, and at that time privately opened.

The work consists of the following:

Construction of Cell 18, including: mobilization, erosion control, dust control, site preparation including relocation of overhead utilities, removal of existing Detention Pond 11 infrastructure, abandonment of groundwater monitoring wells and piezometers, construction of the perimeter berm; establishment of Cell 18 base grades, installation of temporary hay bale berm across north slope of Cell 14, installation of underdrain system including one foot drainage sand, HDPE piping, and out letting of the Cells 12 through 14 underdrain system into Detention Pond 11R, installation of the secondary composite system including one foot of compacted till and 60-mil HDPE textured geomembrane; installation of the leak detection system including drainage geocomposite, HDPE piping, drainage sand, cleanouts, and sampling ports; installation of the primary composite liner system including one foot compacted clay layer, GCL, and 80-mil HDPE textured geomembrane; installation of the leachate collection system including; drainage geocomposite, HDPE pipe, drainage sand, filter stone, drainage stone, leachate collection sump and Cell 18 pump station including pumps, piping, instrumentation, and electrical work; construction of liner system tie-connections with existing Cell 14 liner systems; installation of temporary geomembrane lined berm for future Cell 21 connection, performing primary liner leak survey; extension of existing leachate transport force main and 24-inch landfill gas header, stormwater management including placement of vegetative soil and temporary and permanent erosion control measures; construction of Detention Pond 11R, construction of Detention Pond 14, and installation of stormwater ditches and pond outlet control structures; installation/relocation of chain link fence; installation of new litter fence; construction of Cell 18 landfill access ramp; construction of temporary gravel access ramp; as-built/record survey, restoration of existing site roadways and site cleanup.

NEWSME Landfill Operations will be supplying the geosynthetic clay liner, the 60- and 80-mil HDPE texture geomembranes, and the drainage geocomposite for the Cell 18 project.

All bids will remain subject to acceptance for 30 days after the actual date of the bid opening. Complete instructions for filing are included in the Information for Bidders.

NEWSME reserves the right to waive any informality in or to reject any or all proposals, or to accept any bid if deemed to be in the best interest of the Company to do so.

Juniper Ridge Landfill
Old Town, Maine

SECTION II

INSTRUCTIONS TO BIDDERS

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SECTION II

INSTRUCTIONS TO BIDDERS

1. PROPOSALS

A. Receipt and Opening of Bids

Sealed bids will be received until **_____ on _____** at the office of NEWSME Landfill Operations LLC (NEWSME Operations) at Pine Tree Landfill, 358 Emerson Mill Road, Hampden, Maine, or at the offices of Sevee & Maher Engineers, Inc. (SME) at 4 Blanchard Road, Cumberland, Maine, and then privately opened and read. Bids delivered to SME should be accompanied by a faxed version of the bid to Wayne Boyd at NEWSME Operations at (207) 862-2839. The faxed version must exactly match the delivered bid. The envelopes containing three copies of the bids must be sealed, addressed to Purchasing Department, Attn: Wayne Boyd, and designated as:

Cell 18 Construction
Juniper Ridge Landfill
Old Town, Maine 04468
fax (207) 862-2839
phone (207) 862-4200 ext. 224

NEWSME Operations will not consider any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. All bids will remain subject to acceptance for 30 days after the actual date of the bid opening.

B. Preparation of Bid

Each bid must be submitted on the prescribed form to these documents. All blank spaces in the form shall be filled, all copies shall be signed in ink in longhand, and all numbers shall be stated in writing and in figures. The complete form shall be without alterations, or erasures, and no changes shall be made in the phraseology of the form. All bid items shall be considered as a unit, and a bid on all items shall be required in order to be considered. Total base bid shall represent lump sum price to complete all work described by the bid documents. Unit price values shall be used to determine contractor's compensation for extra work not described or shown by the bid documents. Unit prices will not vary due to changes in quantities. Individual bid items may be deleted from the project scope at the discretion of NEWSME Operations. No additional payment of any type or for any reason will be made for items covered by a lump sum price, or adjustment be made for items covered by lump sum price as a result of item deletion. Conditional bids will not be accepted.

C. Bid Documents, Drawings, and Specifications

One set of bid documents, including Drawings and Specifications, will be issued by Sevee & Maher Engineers, Inc. (SME) (termed "the Engineer") to each invited Bidder only, for the purpose of preparing a bid. No partial sets will be issued, nor will drawings or specifications be issued to firms wishing to submit material, equipment or other

sub-bids to invited Bidders. The loaned sets of drawings and specifications shall be returned to the Engineer by unsuccessful Bidders, if so requested.

D. Bidder

(a) Shall carefully examine the documents, the Drawings and the Specifications, shall visit the site and fully inform himself as to all existing and controlling conditions and limitations including availability of materials and labor. A mandatory pre-bid conference for prospective bidders will be held on **_____ at Juniper Ridge Landfill Site**. The submission of a bid shall be a representation that he has inspected the site and has familiarized himself with all of the controlling conditions. The failure or omission of any Bidder to examine any form, instrument or document shall in no way relieve any Bidder from any obligation in respect to his bid.

(b) Shall notify the Engineer in writing if he finds discrepancies in, or omissions from, the Drawings and/or Specifications, or is in doubt as to their meanings. If an explanation is necessary, a reply will be made by an addendum issued to Bidders. No oral statement shall change the requirements of the Specifications or Drawings unless confirmed in writing.

(c) Shall state the lump sum price for which he will execute and complete each work package and the entire work in accordance with the Drawings, Specifications, and the requirements of the contract.

(d) Work extra to the contract requirements will be done, as outlined in the Bid Form (ref. Section C).

(e) Shall indicate in his bid the portions of the Contract work, if any, which will be subcontracted. The Bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a subcontract under this Contract must be acceptable to NEWSME Operations. A complete list of proposed subcontractors shall be included in the Contractor's bid.

(f) Shall state that he will complete the work of the contract in accordance with the Construction Schedule included as part of the Specifications.

(g) Shall sign his name in the space provided. If the bid is made by a partnership or corporation, the name and address of the partnership or corporation shall be shown, together with the names of the partners or the officers. A bid made by a partnership shall be acknowledged by one of the partners, a bid made by a corporation by one of the authorized officers thereof.

(h) If awarded the contract, will be required to furnish copies of Insurance Certificates endorsed to meet the requirements of the contract.

(i) Each Bidder is urged to submit his best possible price with his bid. Bids will be evaluated and the order placed on the basis of the set of prices received in each Bidder's bid. Adjustment of original bid prices will not be considered after receipt of bids, except as required to adjust for design or scope changes.

E. Owner Purchased Liner Materials

NEWSME Operations has purchased the geosynthetic clay liner, geomembrane and geocomposite for this project. These materials will be stockpiled on-site prior to the start of construction. The specific materials and amount supplied for the project are as follows:

Material	Installed Amount (sq. ft.)
Geomembrane 60 mil	
Geomembrane 80 mil	
Geosynthetic Clay Liner	
Leachate Collection Drainage Geocomposite	
Leak Detection Drainage Geocomposite	

The amount of material purchased was based on an Engineer estimate of total cell area covered with a contingency. If the contractor believes additional material is needed to complete the project they have to identify, in an attachment to the bid, the amount of additional material they believe is necessary to complete the project and the basis for that amount.

If, during construction, the Contractor determines that additional materials are required to complete the project, that material will be ordered by the Owner and paid for by the Contractor, including any associated costs for testing and shipping. The cost for any such additional materials above and beyond the amounts provided by the Owner will be deducted from the Contractor's final invoice.

The Contractor is responsible for monitoring the rate of material depletion as the work progresses and for identifying the need for any such additional materials as far in advance as possible to ensure work is unaffected by the need to obtain these materials.

F. Time of Completion

Bidder must agree to be substantially complete by **Month, Day, Year**. Construction of Cell 18 must be completed by this date and the cell must be ready for Maine Department of Environmental Protection approval. Completion of items outside of Cell 18 can occur after this date.

NEWSME Operations is in the process of securing all permits necessary to complete the project. The timing for obtaining these permits is unknown and thus a start date for on-site construction cannot be given at this time. NEWSME Operations' goal is to obtain all necessary permits to enable the Contractor to begin the on-site work as early as possible. NEWSME Operations will keep the Contractor informed of the progress made in the project permitting. NEWSME Operations requests that the Contractor provide NEWSME Operations with a Construction Schedule identifying the major construction items and a proposed start date to have the project completed by the dates described in the Bid Schedule.

G. Condition of Work

Each Bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful Bidder of his obligations to furnish all material, equipment, and labor necessary to carry out the provisions of his Contract. Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruptions of or interference with the work of any other Contractor. The Juniper Ridge Landfill is an active site receiving waste materials on a daily basis. It is the responsibility of the Contractor to coordinate with the Owner with regard to use of the premises, including haul routes and vehicular access.

H. Addenda and Interpretations

No interpretation of the meaning of the plans, specifications, or other pre-bid documents will be made to any Bidder orally. Every request for such interpretation should be in writing addressed to Sevee & Maher Engineers, Inc., P.O. Box 85A, Cumberland Center, Maine 04021, emailed to **(jrlcell18@smemaine.com)**, or faxed to (207) 829-5692, to be given consideration must be received at least five days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be mailed by certified mail with return receipt requested to all prospective bidders (at the respective addresses furnished for such purposes), faxed or e-mailed. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

I. Laws and Regulations

The Bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

J. Method of Award

If at the time this Contract is to be awarded, the lowest base bid submitted by a reasonable Bidder does not exceed the amount of funds then estimated by NEWSME Operations as available to finance the Contract, the Contract will be awarded on the base bid only. If such bid exceeds said amount, NEWSME Operations may reject all bids or may award the Contract, reducing the amount of unit price work to keep the overall Contract amount within the available funds. NEWSME Operations shall award to the Bidder it judges to be best qualified.

K. Bonds

The General Contractor is required to provide a Performance and Payment Bond for this project. Cost for Performance and Payment Bond shall be listed separately in the Bid Schedule. Appropriate sections of the Construction Agreement shall apply to these bonds. The Owner may, if requested, evaluate alternatives to purchasing/providing these Payment and Performance Bond.

L. Attachment to the Bid Form

The Bidder will attach to his bid form the following:

1. The name of the on-site supervisor(s) whom he proposes to supervise the work, together with a brief resume of past experience.

2. A list of similar projects the Bidder has completed, including the name, address, and telephone number of person familiar with the Bidder's performance.

3. A list of the equipment and personnel which he proposes to use and standard rate sheets.

4. A proposed construction schedule and manpower projection, as explained in Instructions to Bidders, Section F – Time of Completion.

5. Who the Bidder proposes to use as specialty subcontractors.

6. Performance Bond, Payment Bond, applicable sales and use taxes shall be included in the lump sum bid price, and the amount so included stated separately.

7. Separate quantity take-off for each bid line item.

M. Alternate Bids

The Bidder is requested to quote this work in strict conformity with this document. However, if for any reason (such as Bidder's method of cost accounting, a special small tool or equipment rental system, etc.) the Bidder wishes to submit an alternate bid, it may be considered.

END OF SECTION

SECTION III

BID FORMS AND BID FORM ATTACHMENTS

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SECTION III

BID FORM

BID FOR: CELL 18 CONSTRUCTION AT JUNIPER RIDGE LANDFILL FACILITY, OLD TOWN, MAINE

To: Wayne Boyd, General Manager
NEWSME Landfill Operations, LLC
358 Emerson Mill Road
Hampden, Maine 04444

Date:_____

Proposal of _____ (hereinafter called "Bidder"), a corporation, organized and existing under the laws of the State of _____ _____, a partnership or an individual* doing business as _____, to NEWSME Landfill Operations LLC (hereinafter called "NEWSME Operations").

Having carefully examined the Instructions to Bidders, the Form of Agreement, the General and Supplementary Conditions, the Bid and Contract Documents and Specifications entitled, Juniper Ridge Landfill Cell 18 Construction, Old Town, Maine and the contract drawings (Issued for Bid **Month Year**), project permits, and the Quality Assurance/Quality Control Plan, as well as the site upon which the work is to be performed, and all conditions affecting the prosecution of the work, including the availability of materials and labor:

The UNDERSIGNED proposes and agrees to furnish all materials, labor, equipment, and supervision and perform all operations required to complete the entire scope of work in accordance with the Contract Specifications and Drawings, and all applicable local State and Federal Regulations, within the time set forth therein, for the following prices listed below.

The estimated quantities of materials provided by the Engineer for each bid item are approximate quantities of in-place materials based upon the Engineer's interpretation of the Contract Drawings. This information is provided for informational purposes only and shall not be considered to represent the actual amount of material required to complete the Scope of Work (i.e., quantities of waste, shrinkage, compaction, overlap, anchor trench, and incidental materials are not included). The cost for each bid item shall be based upon the Bidder's own interpretation of the existing site conditions, Contract Drawings, and technical specifications, and shall include all materials and incidental items required to complete the Scope of Work.

Errors or omissions of the Engineer's estimated material quantity listed in the Bid Form shall not entitle the Bidder to any adjustment in the Lump Sum Contract price. The Bidder shall list their own material quantities used to prepare the Bid and notify the Owner/Engineer in writing of any significant discrepancies of in-place material quantities prior to submitting the Bid.

Bidder hereby agrees to commence work under this Contract on or before the dates specified in the proposed schedule, provided that NEWSME Operations has issued a Notice to Proceed, and complete work on or before the completion date specified in the Contract Documents.

The pricing contained in this proposal is good until _____.

1. BID ITEMS

A. Bidder agrees to perform all the work, including all incidental labor, materials, and equipment necessary for the satisfactory completion of the work and in full compliance with the contents and intent of the specifications and/or plans of the work, for the following prices listed below.

B. The Contract will be awarded based on the Lump Sum price for the total project. The Lump Sum price will become the contract price. To track costs associated with the project completion the Contractor is required to provide cost information for the individual bid items, that make up the lump sum price. For each item, the Contractor shall provide information on the unit price, and the Contractor's estimated quantities. The price for each item shall be the product of the Contractor's estimated quantities and unit prices. The Engineer's estimated quantities are provided for informational purposes only.

C. Interlineation, alteration or erasure may void the Bid. All prices shall be typewritten or written by hand in ink.

SECTION A

GENERAL CONTRACTOR'S BID VALUES

Item	Description	Engineer's Est. Quantity	Units	Contractor's Est. Quantity	Unit Price (1) ($)	Price ($)
1	Mobilization/Demobilization	1	LS			
2	Stormwater Management Features (Detention Pond 11R and 14, including Inlet and Outlet Structures and Underdrain Pipe)	1	LS			
3	Grubbing	1	LS			
4	Cell 18 Ber, Construction Area Cut to Fill, Place, and Compact	67,500	CY			
5	Cell 18 Base Area Cut to Stockpile	145,800	CY			
6	Supply and Install 1-foot of Drainage Sand for Underdrain System	24,500	CY			
7	Supply and Install 4-inch SDR 17 HDPE Underdrain Pipe	2,675	LF			
8	Supply and Install 1-foot of Compacted Till for Secondary Liner System	24,850	CY			
9	Install Owner Supplied 60-mil HDPE Textured Geomembrane Secondary Liner	670,640	SF			
10	Install Owner Supplied Leak Detection Drainage Geocomposite	670,640	SF			
11	Supply and install 1-foot of Drainage Sand for Leak Detection System	19,600	CY			
12	Supply and Install 6-inch SDR 7 HDPE Leak Detection Pipe	1,840	LF			
13	Supply and Install 6-inch SDR 11 HDPE Leak Detection Pipe	660	LF			
14	Supply and Install 1-foot Compacted Clay for Primary Liner System	30,200	CY			
15	Install Owner Supplied Geosynthetic Clay (GCL) for Primary Liner System	670,640	SF			
16	Install Owner Supplied 80-mil HDPE Textured Geomembrane for Primary Liner	670,700	SF			
17	Install Owner Supplied Leachate Collection Drainage Geocomposite	660,500	SF			
18	Supply and Install 1-foot of Drainage Sand for Leachate Collection System	24,500	CY			
19	Supply and install 6-inch SDR 7 HDPE Leachate Collection Pipe	3,060	LF			
20	Supply and install 8-inch SDR 7 HDPE Leachate Collection Pipe	1,655	LF			
21	Supply and Install Leachate and Leak Detection Sumps and Cell 18 Pump Station	1	LS			
22	Supply and Install Cell 18 Pump Station Building and Force Main	1	LS			
23	Supply and Install 6-Inch x 10-inch Dual Containment Force Main and Appurtenances	645	LF			
24	Supply and Install 24-Inch SDR 17 Landfill Gas Header Pipe	640	LF			

Item	Description	Engineer's Est. Quantity	Units	Contractor's Est. Quantity	Unit Price (1) ($)	Price ($)
25	Supply and Install 8-inch SDR 17 Landfill Gas Pipe	40	LF			
26	Supply and Install Landfill Gas Condensate Pump Station	1	LS			
27	Piezometer, Observation Well, and Monitoring Well Abandonment	1	LS			
28	Supply and install Erosion Control (including siltation fencing, hay bales, stone check dam, geotextile, seed and mulch)	1	LS			
29	Dewatering and Stormwater Control	1	LS			
30	Supply and Insall Chain-Link Fence	700	LF			
31	Supply and Install Litter Fence	2,260	LF			
32	Dust Control	1	LS			
33	Cell 18 Access Ramp Construction	1	LS			
34	Landfill Perimeter Access Roadway Construction (including guardrail)	1	LS			
35	Supply and Install SMH #34	1	LS			
36	Supply and Install Electrical Utility Manholes	1	LS			
37	Supply and Install Intermediate Cover Stormwater Diversion Berm	1,000	LF			
38	Leak Location Survey on Primary 80-mil HDPE Geomembrane	1	LS			
39	Construction/Record Survey	1	LS			
40	Electrical Sub-Contractor (Electrical and Communication Utilities)	1	LS			
					Sub-Total	
41	Sales and Use Tax	1	LS			
42	Performance and Payment Bond	1	LS			
					Sub-Total	
		Total Bid (Basis of Bid)				
	TOTAL AMOUNT OF BID: (ITEMS 1 THROUGH 42) – BASIS OF AWARD Contract is Lump Sum with progress payments based on work completed per Owner's survey. Total Amount of Bid in Words _____					
	Note (1) Unit Price based upon Contractor's Estimated Quantity					

SECTION B

EXTRA WORK UNIT PRICES

Changes in the Contract work shall be performed at the unit prices, described below. The unit prices are gross prices, including the Contractor's equipment, labor, supervision, and materials costs, entire mark-up, field or other costs, including general conditions, fringe benefits, overhead and profit.

Item Description	Units	Unit Price
Grubbing	Acre	
Clearing	Acre	
Common Excavation	C.Y.	
Excavation of Unsuitable Material	C.Y.	
Open Rock Excavation	C.Y.	
Trench Rock Excavation	C.Y.	
Aggregate Subbase Material	C.Y.	
Aggregate Base Material	C.Y.	
Clay Borrow Material	C.Y.	
Common Borrow Material	C.Y.	
Siltation Fence	L.F.	
Bark Mulch Sediment Barrier	L.F.	
Riprap	C.Y.	
Stone Check Dam	EA	
Erosion Control Blanket (NAG C125)	S.Y.	
Seed, Fertilizer, Lime, Mulch	Unit	
Topsoil	C.Y.	
Pipe Bedding Stone	C.Y.	
Drainage Stone	C.Y.	
Filter Stone	C.Y.	
Drainage Sand	C.Y.	
4-inch HDPE Pipe SDR 11.0 (Solid)	L.F.	
4-inch HDPE Pipe SDR 11.0 (Perforated)	L.F.	
6-inch HDPE Pipe SDR 17.0 (Solid)	L.F.	
6-inch HDPE Pipe SDR 11.0 (Perforated)	L.F.	
8-inch HDPE Pipe SDR 11.0 (Solid)	L.F.	
8-inch HDPE Pipe SDR 11.0 (Perforated)	L.F.	
12-inch HDPE Pipe SDR 17.0 (Solid)	L.F.	
12-inch HDPE Pipe SDR 17.0 (Perforated)	L.F.	
24-inch HDPE Pipe SDR 17.0	L.F.	
6-inch x10-inch Dual Containment HDPE Pipe SDR 17.0/SDR 21	L.F.	
24-inch Culvert	L.F.	
8-inch Ductile Iron Pipe	L.F.	
8-oz Non-Woven Geotextile	S.F.	
12-oz Non-Woven Geotextile	S.F.	
Mirafi HP-270 Woven Geotextile	S.F.	
Mirafi FW403 Woven Geotextile	S.F.	
Mirafi 500X Woven Geotextile	S.F.	
Litter Fence	L.F.	

1. Provide your expected start date with a Notice to Proceed on **Month Day, Year**.

2. The UNDERSIGNED proposes the following deviations from, and additions, supplements and exceptions to the Specifications, with applicable pricing, on which the Proposal is based, there are no others, and affirms that any provisions in this Proposal inconsistent with the provisions in the Specifications which are not here expressly described or referred to will be construed as though such inconsistent provisions had not been included in this Proposal.

3. The UNDERSIGNED agrees that any changes in the scope of work extra to the contract requirements for which method of payments has not been otherwise established in this Bid will be negotiated on a fixed lump sum basis, unit price basis or cost-plus-percentage basis, as selected by the Owner. When the fixed sum basis or unit price basis is selected for extra work, a breakdown of the sum will be provided as required by the Owner. When the cost-plus-percentage basis is selected for extra or for work performed under allowances, compensation will be paid as follows:

(a) An amount equal to the total sum of all Reimbursable Costs, as defined in the General Conditions of the Contract. A breakdown of the Reimbursable costs will be provided as required by the owner.

(b) Plus an amount equal to ____% of Reimbursable Costs, which amount shall be full compensation for all Overhead as defined in the General Conditions of the Contract.

(c) Plus an amount equal to _____% of the sum of Reimbursable Costs and Overhead, which amount shall be defined as “Fee". A breakdown of the fee will be provided as required by the Owner.

(d) Extra Work by subcontractors shall not be included in Reimbursable Costs, but shall be handled separately, as stipulated in Paragraph 5 of this Bid.

4. The UNDERSIGNED agrees that only the following portions on the work will be subcontracted, and that the names of subcontractors will be submitted prior to award of contract, in accordance with the General Conditions of the Contract.

_____

_____

_____

_____

_____

5. The UNDERSIGNED agrees that extra work performed by their subcontractors shall be invoiced in the same manner described for the Contractor's extra work, and that the Contractor will compensate the subcontractors accordingly and accept as full payment the invoiced cost plus a charge of _____% for the Contractor’s own services in handling the extra work performed by the subcontractors. All subcontract prices and fees shall be subject to the Owner's prior approval.

6. The UNDERSIGNED agrees to perform work of the Contract during over-time periods for purposes beyond the intent of the Contract, if requested and authorized to do so by the Engineer and be reimbursed for the additional cost as described in the General Conditions of the Contract.

7. The UNDERSIGNED agrees to execute a formal contract for the entire work on the Agreement form provided for that purpose, within ten days after receiving notification the contract has been awarded.

8. The UNDERSIGNED agrees to substantially complete the entire work of the contract in accordance with the Construction Schedule and/or completion dates included in the Specifications.

9. The UNDERSIGNED agrees that all applicable Federal, state and local sales and use taxes and cost of required insurance are included in the proposal as a separate bid item.

10. The UNDERSIGNED agrees in submitting this Bid that the right is reserved by the Owner to reject any or all Bids. It is agreed that this Bid may not be withdrawn for a period of thirty (30) days from the opening date thereof.

11. The UNDERSIGNED acknowledges the receipt of Addendums:

No.	Date	Signature

12. The UNDERSIGNED hereby declares as Bidder, that the only persons or parties interested in this Bid as Principals are those named herein; that this Bid is made without any connections with any other person or parties making a Bid for the same purpose; that this Bid is in all respects fair and without collusion or fraud.

13. The UNDERSIGNED agrees that if the Contract is awarded to them this Bid will be attached as Exhibit A and made a part of the executed Agreement.

_____
(Legal Name of Contracting Firm)

Signed By:_____

Name Typed:_____

Title: _____

Date:_____

Telephone Number:_____

SECTION IV

TECHNICAL SPECIFICATIONS

SME
SEVEE & MAHER
ENGINEERS

SECTION IV

TECHNICAL SPECIFICATIONS

The following Sections of the Technical Specifications for the Cell 18 Construction at Juniper Ridge Landfill are incorporated by this reference into this Section of the Contract Documents as fully as if reproduced in their entirety herein.

No.	Title
Section 01010	Summary of Work
Section 01012	Health and Safety Plan
Section 01025	Measurement and Payment
Section 01041	Project Coordination
Section 01060	Applicable Codes
Section 01211	Preconstruction Conference
Section 01300	Submittals
Section 01350	Engineer's Field Office
Section 01505	Mobilization
Section 01561	Cleaning
Section 01562	Dust Control
Section 01570	Traffic Control
Section 01600	Material and Equipment
Section 01700	Contract Closeout
Section 02015	Subsurface Information
Section 02016	Existing Utilities and Underground Structures
Section 02100	Site Preparation
Section 02200	Earthwork
Section 02220	Erosion Control
Section 02261	Riprap
Section 02272	Geotextiles and Drainage Geocomposite
Section 02275	Geosynthetic Clay Liner
Section 02450	Pipe Installation
Section 02451	Corrugated Pipe
Section 02466	Polyvinyl Chloride Pipe (Gravity Applications)
Section 02510	Hot Mix Asphalt Pavement
Section 02570	Catch Basing and Drainage Structures
Section 02732	Cell Pump Station and Force Main Meter and Valve Pit
Section 02771	Textured High Density Polyethylene (HDPE) Geomembrane Liner (60 and 80-Mil)
Section 02772	Leak Location Survey
Section 02780	Interfacial Friction Angle Conformance Testing
Section 02800	Seeding and Mulching
Section 03300	Cast-In-Place Concrete
Section 03420	Precast Concrete Structures
Section 15100	HDPE Pipe and Fittings
Section 15101	PVC Pipe and Fittings
Section 15110	Valves and Pipe Accessories
Section 15120	Hydrostatic and Low-Pressure Air Testing of Polyethylene Pipe

SECTION V

CONTRACT DRAWINGS
(REFER TO ATTACHMENT 1)

SME
SEVEE & MAHER
ENGINEERS

SECTION V

CONTRACT DRAWINGS

The following Contract Drawings entitled, "Cell 18 Construction at Juniper Ridge Landfill, NEWSME Landfill Operations LLC, Old Town, Maine", that were prepared by Engineer are incorporated by this reference into this Attachment as fully as if reproduced in their entirety herein.

Title	**Dwg No.**
Cover Sheet	
Symbols & Abbreviations	C-100
Existing Conditions Plan	C-101
Site Development Overview Plan	C-102
Base Grading Plan	C-103
Underdrain Piping Plan	C-104
Liner Layout Plan	C-105
Leak Detection Piping Plan	C-106
Leachate Collection Piping Plan	C-107
Cell 18 Access Plan	C-108
Leachate Transport and Landfill Gas Header Pipe Plan and Profile	C-200
Sections and Details	C-300
Sections and Details	C-301
Sections and Details	C-302
Sections and Details	C-303
Sections and Details	C-304
Sections and Details	C-305
Sections and Details	C-306
Sections and Details	C-307
Erosion Control Notes and Details	C-308
Erosion Control Notes and Details	C-309

SECTION VI

CQA PLAN
(REFER TO APPENDIX B)

SME
SEVEE & MAHER
ENGINEERS

SECTION VII

CONSTRUCTION AGREEMENT AND FORMS

SME
SEVEE & MAHER
ENGINEERS

CONSTRUCTION AGREEMENT BY AND BETWEEN

_____

AND

NEWSME Landfill Operations LLC
a subsidiary of Casella Waste Systems, Inc.

CONSTRUCTION
Juniper Ridge Landfill
Old Town, Maine
Cell 18 Construction

CONSTRUCTION AGREEMENT

THIS AGREEMENT is entered into as of this _____ day of _____, by and between _____, with an office in _____ (hereinafter referred to as "Contractor"), and NEWSME Landfill Operations, LLC, a subsidiary of Casella Waste Systems, Inc., with an office in Hampden, Maine (hereinafter referred to as "Owner").

RECITALS

WHEREAS, Owner desires to engage Contractor to provide various services and materials in connection with the Work (as defined herein) pursuant to the terms and conditions of this Agreement for Construction of **Cell 18** at the Juniper Ridge Landfill (hereinafter referred to as the "Site"); and

WHEREAS, Contractor desires to render those services and provide such materials as described herein and has the experience, staff, and resources to properly perform the Work.

NOW, THEREFORE, as consideration for the covenants, promises, and representations contained herein, other good and valuable consideration and intending to be legally bound hereby, Owner and Contractor agree as follows:

1. General Terms and Conditions

I. The Work, Consideration, Definitions, the Agreement Price and Agreement Time

Contractor agrees to provide all necessary and required labor, materials, services and equipment to perform the Work in accordance with the terms of this Agreement, and Owner shall pay to Contractor the Agreement Price (as defined herein) of $_____.— as adequate and complete consideration for proper performance of such Work.

A. The Work: Contractor shall undertake construction of **Cell 18** and associated work at the Site including providing all necessary and required labor, materials, tools, equipment, incidentals, excavation, dewatering, shoring, sheeting, bracing, traffic control, safety devices and services necessary and all related work pursuant to the Contract Documents including the Technical Specifications and the Contract Drawings (herein referred to as the "Work").

B. Terms Defined: The following terms, as they may occur in the Contract Documents, shall mutually be understood by Owner and Contractor to have the following meanings:

Wayne Boyd of Casella Waste Systems, Inc. is the Owner's **"Authorized Representative"** who has the authority to execute a Change Order on behalf of Owner.

"Bid and Contract Documents" or "Bid Package" shall mean bid documents entitled: Bid Documents, Cell 18 Construction, which were prepared by Owner and were previously sent to, received, reviewed and accepted by Contractor. The Bid and Contract Documents consist of the following:

Section Number	Title
I	Invitation for Bids
II	Instructions to Bidders
III	Bid Forms and Bid Form Attachments
IV	Technical Specifications
V	Contract Drawings
VI	CQA Plan
VII	Construction Agreement and Forms
VIII	Performance and Payment Bonds
IX	The Agreement Price - Fees, Charges, Rates, and Additional Terms and Conditions

"Bid Forms" shall mean Section III of the Bid and Contract Documents and attachments thereto.

"Bid Package" shall mean the Bid and Contract Documents as defined herein.

"Change Order" shall mean Owner's written form issued after execution of this Agreement by an Authorized Representative of Owner to Contractor authorizing an addition, deletion, or revision to the Work as contained in the Contract Documents, and/or an adjustment in the Agreement Price or Agreement Time. The form of Change Order to be used is attached hereto in Section VII of the Bid and Contract Documents.

"Construction Quality Assurance (CQA) Consultant" shall mean representatives of _____ who shall observe and document construction quality assurance activities and issue the project certification report (if applicable).

"Contract Documents" shall mean this Agreement and the documents attached thereto as referenced below:

Section Number	Title
I	Invitation for Bids
II	Instructions to Bidders
III	Bid Forms and Bid Form Attachments
IV	Technical Specifications
V	Contract Drawings
VI	CQA Plan
VII	Construction Agreement and Forms
VIII	Performance and Payment Bonds
IX	The Agreement Price - Fees, Charges, Rates, and Additional Terms and Conditions

"Contract Drawings" shall mean that portion of the Contract Documents which contains graphic illustrations with written representations thereon reflecting the character and scope of the Work (including plan sheets, details and sections). The set of Contract Drawings for the Work are entitled, "**Cell 18 Construction at Juniper Ridge Landfill NEWSME Landfill Operations, LLC, Old Town, Maine**" which were prepared by Engineer. No Work shall be performed and no materials shall be ordered, fabricated or installed unless and until Owner issues a Notice to Proceed to Contractor. References in the Bid and Contract Documents to "Construction Drawings" shall mean Contract Drawings.

"Contractor" shall mean _____, the party entering into this Agreement with Owner who shall perform the Work.

"Date of Completion" shall be the date of Substantial Completion of the Work as defined in this Agreement.

"Day" unless otherwise expressly defined in this Agreement, shall mean a calendar day beginning at midnight and continuing for twenty-four (24) hours until midnight of the following day. All days shall be considered consecutive unless otherwise indicated.

"Engineer" shall mean Sevee and Maher Engineers, Inc., the design engineer for the Work.

"Extra Work" shall mean an item of the Work not provided for in this Agreement as awarded but authorized by a Field or Change Order.

"Field Order" shall mean a written order issued by Owner that orders minor changes in the Work but which does not involve a change in the Agreement Price or the Agreement Time. The form of Field Order to be used in accordance with this Agreement is attached hereto in Section VII of the Bid and Contract Documents.

"Final Acceptance" shall be accomplished when the Work has passed Final Inspection, Substantial Completion (as defined herein) has occurred and Contractor receives a written Notice of Final Acceptance from Owner.

"Final Inspection" shall mean the last inspection of the Work by Owner.

"Final Payment" shall mean payment of the Agreement Price to Contractor by Owner for proper performance of the Work less amounts previously paid by Owner to Contractor less amounts not due to Contractor because of a change in the Scope of the Work less amounts withheld or applied by Owner pursuant to the terms and conditions of this Agreement or applicable law. Final Payment shall not be made to Contractor until and unless a Notice of Final Acceptance of the Work is sent by Owner and is received by Contractor.

"Notice to Proceed" shall mean a written notice sent by Owner to the Contractor indicating the date on which it is to commence performance of the Work.

"Owner" shall mean NEWSME Landfill Operations, LLC, a subsidiary of Casella Waste Systems, Inc., the party for whom the Work is to be performed.

"Payment Forms" shall mean application for payment forms (i.e. invoices), copies of which are attached hereto in Section VII of the Bid and Contract Documents, which must be completed by Contractor and submitted to Owner before payment may be made to Contractor hereunder.

"Site" shall be the location where the Work will be performed which is the Juniper Ridge Landfill as indicated previously in the Recitals to the Agreement and shall include all surface and subsurface conditions.

"Subcontractor" shall mean all materialmen, suppliers, vendors, agents and their respective employees and any other individual or entity, at any tier, providing goods and/or services to or on behalf of Contractor regarding performance of the Work.

"Substantial Completion" shall be the date, as determined by Owner, when the Work is sufficiently completed in accordance with the Contract Documents so that the Work can be utilized for the purpose for which it was intended by Owner.

"Superintendent" shall mean Contractor's employee who shall be in attendance at the Site; and who shall be a competent, full-time representative of Contractor; and who shall be the manager of Contractor's Work; and who shall meet all qualifications set forth in the CQA Plan (if included herein) and who shall have the authority to make decisions regarding the Work and sign Change Orders on behalf of Contractor.

"Facilities" shall mean all above-ground and below-ground pipelines, conduits, ducts, cables, wire, manholes, vaults, utilities, tanks, tunnels, attachments and any encasements containing such items that have been installed to furnish any services, facilities, utilities or materials including, but not limited to, the following: electricity; gases; water; steam; liquid petroleum products; telephone or other communications; cable television; sewage and drainage removal; and traffic or other control systems.

C. Agreement Time: Work shall commence within ten (10) days after the date referenced in a Notice to Proceed for commencement of the Work, and Substantial Completion shall occur _____ (herein referred to as the "Agreement Time").

D. Agreement Price: Owner shall pay compensation to Contractor that shall be the (fixed unit price) (a price guaranteed not to exceed the ceiling price) of _____ dollars ($_____) (herein referred to as the "Agreement Price").

2. Form and Intent of Contract Documents

For purposes of the Contract Documents, it shall be presumed that all materials, labor, equipment and services necessary and/or required to perform the Work or to fulfill the intent of the Contract Documents shall be performed, furnished and installed by Contractor regardless of whether they are expressly indicated in the Contract Documents. All Work shall be performed by Contractor unless expressly reflected in the Contract Documents as being performed by Owner or others.

3. Time Is of the Essence

In the performance and completion of the Work by Contractor, time shall be of the essence of this Agreement.

4. Payment

A. At the end of each month, Contractor shall submit itemized Payment Forms to Owner at the Site based upon the percentage of Work properly completed in accordance with the task breakdown on the Schedule and supported by receipts or vouchers showing payments for materials and labor, payments to Subcontractors and such other documentation as Owner may require in order to document Contractor's right to payment.

i. The percentage of Work properly completed in accordance with the Contract Documents shall be calculated on the basis of materials placed or installed (i.e. "in-place" Work).

ii. Measurement shall be the responsibility of Contractor subject to verification by Owner. Mutual agreement between Owner and Contractor on all measurements is required for each progress payment and Final Payment requested before such payment can be made.

iii. Contractor may request compensation for materials stored at the Site if the following conditions are satisfied:
   a. Materials are physically located within the Site boundary;

   b. Invoices from suppliers are presented as backup to a request for progress payment; and

   c. Materials stored at the Site are designated as relating to a specific item required by the Contract Documents.

B. For fixed unit price or time and materials Work to be performed pursuant to a Change Order hereto, Contractor shall include a brief description of the Extra Work performed together with a summary of actual units employed and/or hours worked by Contractor's employees, engaged directly in the Extra Work, by classification and the rate (and multiplier if applicable) allocated per task(s) as identified in the Schedule. Direct non-salary expenses, such as subcontracts and other direct costs and expenses, shall be itemized separately and allocated per task(s) as identified in the Schedule. In addition to the foregoing, Contractor shall submit to Owner copies of time sheets, expense reports, receipts, and other documentation necessary to substantiate each submission of Payment Forms to Owner's satisfaction.

C. Contractor shall submit its application for payment on Payment Forms supplied by Owner. Copies of these forms are provided in Section VII of the Bid and Contract Documents.

D. Within thirty (30) days following receipt and approval by Owner of Contractor's Payment Forms, Owner shall pay Contractor ninety percent (90%) of the Agreement Price for a proportionate amount of the Work which, to the best knowledge, information, and belief of Owner, has been completed in accordance with the Contract Documents, less the aggregate of all previous payments made for such Work.

E. Upon receipt of any payment from Owner hereunder, Contractor shall pay out of such monies received any amounts that are due to Subcontractors on account of such Subcontractor's work. Contractor shall require each Subcontractor to include in its invoice to Contractor the percentage actually retained by Contractor, if any. Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to its Subcontractors in a similar manner. Before any payment can be made to Contractor hereunder, Contractor shall provide a waiver and release fully executed by Contractor on a Waiver and Release Form and one executed by each Subcontractor on Waiver and Release Forms for Subcontractors, which are included in Section VII of the Bid and Contract Documents. In addition to, and not in limitation of, any terms or conditions of this Agreement, Contractor agrees that Owner may, in consultation with Contractor, and without obligation to do so, pay any Subcontractor (including, but not limited to, paying an amount which is made in settlement of any dispute involving Contractor and/or any Subcontractor) directly and deduct such amount from any amounts that are due to Contractor, thereby reducing the total amount owed (the total Agreement Price) to Contractor for performance of the Work. In addition, Contractor agrees to hold Owner harmless from all claims, lawsuits, costs, damages, expenses and liability for Owner's actions undertaken in accordance with the terms and conditions of this Paragraph.

F. The full amount of the Agreement Price less amounts previously paid by Owner to Contractor less amounts not due to Contractor because of a change in the Scope of the Work less amounts withheld or applied by Owner pursuant to the terms and conditions of this Agreement or applicable law will be paid to Contractor by Owner within thirty (30) days following Final Acceptance of the Work; however, as a condition precedent to Owner

making Final Payment, Contractor shall file with Owner all Waiver and Release Forms (Progress payment as well as Final Payment forms) for itself and its Subcontractors on forms provided by Owner in Section VII of the Bid and Contract Documents. Regardless of execution of any of the forms herein, Final Payment by Owner shall automatically constitute a waiver of all claims, liens and actions of any kind by Contractor against Owner arising out of this Agreement.

G. No payment shall be made for costs or expenses incurred by Contractor prior to issuance of a Notice to Proceed for the Work or after termination of this Agreement except as expressly provided herein.

H. If any items in any Payment Forms submitted by Contractor are disputed by Owner for any reason, including the lack of supporting documentation, Owner may temporarily delete the disputed item and pay the remaining amount of the Payment Forms. Owner shall promptly notify Contractor of the dispute and request clarification or remedial action. If any dispute is settled in Contractor's favor, Contractor shall include the settled amount on a subsequent regularly scheduled submission of Payment Forms or in a special submission of Payment Forms for the disputed item only.

I. 50% of the mobilization line item of _____dollars ($_____) of the Agreement Price in this instance, $_____ shall be paid to Contractor upon successful mobilization to the Site by Contractor.

5. Payments Withheld

A. Payments otherwise due to Contractor including, but not limited to, any and all retainage, may be applied by Owner against any amounts due or claimed to be due Owner from Contractor, its subsidiaries or affiliates or may be withheld by Owner on account of any of the following: work suspected by Owner to be defective and not remedied; claims filed, or reasonable evidence indicating probable filing of claims; breach of any term or condition of the Contract Documents by Contractor and/or its Subcontractors; failure of Contractor to make payments promptly to its Subcontractors (and for Subcontractors to make payment to their Subcontractors) for material, labor or other goods or services; refusal of Contractor to accept or make payment for any part of the Work; Contractor's failure to deliver Waiver and Release Forms for itself or its Subcontractors; or a reasonable doubt that the Work can be completed for the balance of the Agreement Price then unpaid and/or within the Agreement Time. If the foregoing causes are removed, then withheld payments shall promptly be made. If the said causes are not removed within a reasonable time, Owner may rectify the same at Contractor's sole cost and expense (at no cost to Owner), and/or Owner may terminate this Agreement for cause pursuant to the terms and conditions provided herein.

6. Construction Personnel and Activities

I. Supervision and Construction Procedures

A. Contractor shall supervise, manage, control and direct the Work, using the Contractor's best skill and attention.

B. Contractor shall be responsible to Owner for all acts and omissions of the Contractor's employees, Subcontractors and all other persons performing any of the Work for Contractor.

C. Contractor shall be responsible for inspection of portions of Work already performed under this Agreement to determine that such portions of the Work are in proper condition to receive subsequent Work at no cost to Owner.

D. Construction meetings shall be held at the Site weekly or at such other frequencies as agreed to by Owner and Contractor as arranged by Owner's Project Manager. The Superintendent and all of Contractor's personnel working at the Site (as appropriate) shall attend such meetings.

7. Independent Contractor

A. The Work shall be performed and furnished by Contractor as an independent contractor and under the sole supervision, management, direction and control of Contractor in accordance with the terms and conditions of this Agreement. Contractor shall not be an agent, employee, or representative of Owner for any purpose. Contractor shall have full control over its Subcontractors and employees as it may see fit to assist in performance of the Work, including, but not limited to, the hiring, firing, and supervision of any such employees of Contractor except for Owner's right of removal of employees or Subcontractors of Contractor expressly provided in this Agreement and/or permitted by applicable law.

B. Contractor further agrees that the MANNER, MEANS, METHODS, MANAGEMENT, PROCEDURES, SEQUENCES AND TECHNIQUES OF CONSTRUCTION SHALL BE UNDER THE SOLE CONTROL AND IS THE SOLE RESPONSIBILITY OF CONTRACTOR.

8. Contractor's Superintendent

A. Contractor shall keep its Superintendent in attendance at the Site until Final Acceptance of the Work.

B. The Superintendent shall thoroughly understand the Contract Documents and shall insure that all of Contractor's employees and/or Subcontractors understand the tasks to be performed pursuant to such documents. The Superintendent shall communicate all necessary and/or required information to Contractor's employees and Subcontractors.

C. The Superintendent shall keep a daily diary of the Work performed and shall transmit copies of such diary to Owner on a weekly or more frequent basis.

D. The Superintendent shall attend all pre-construction and construction meetings and have the authority to make decisions on behalf of Contractor regarding performance of the Work.

9. Subcontractors and Employees

A. Nothing contained in this Agreement shall create any contractual relationship between Owner and any Subcontractor of Contractor. Notwithstanding the foregoing, any Subcontractor that executes a Waiver and Release Form as provided in Section VII of the Bid and Contract Documents shall be bound by the terms and conditions contained therein to Owner and others as indicated such Waiver and Release.

B. Contractor shall temporarily defer, at no cost to Owner, the prosecution of any portion of the Work that may be necessary in the opinion of Owner for the proper advancement of the work of other contractors when such deferment can be accomplished without unreasonable interference with Contractor's Work.

C. Owner must approve of any Subcontractor selected by Contractor in writing prior to performance of any Work by such Subcontractor, although such approval does not create any contractual relationship between such Subcontractor and Owner nor does such approval relieve Contractor of any of its responsibilities or liability hereunder. Owner may require Contractor to change any Subcontractor regardless of Owner's previous approval of such Subcontractor.

D. Any part of the Work performed for Contractor by a Subcontractor shall be undertaken pursuant to a written subcontract between the Contractor and such Subcontractor, which shall be prepared on a form of subcontract satisfactory to Owner in all respects. Each such subcontract shall contain at a minimum provisions that:

i. Require that such work be performed in accordance with the terms and conditions of the Contract Documents and all laws and regulations and require that the Subcontractor be bound by the terms and conditions of these Contract Documents and to assume toward Contractor all the obligations and responsibilities which Contractor, by such Contract Documents, assumes toward Owner;

ii. Waive all rights the contracting parties may have against one another or that the Subcontractor may have against Owner for damages caused by fire or other perils covered by the insurance required in the Contract Documents;

iii. Require the Subcontractor to carry and maintain insurance coverage in accordance with the Contract Documents, and to file certificates of insurance and certified copies of policies for such coverage with Contractor;

iv. Require the Subcontractor to submit all Waiver and Release Forms for itself and its Subcontractors on forms provided in Section VII of the Bid and Contract Documents for Work completed by it and by its Subcontractors as a condition precedent to the disbursement of any progress payment next due and owing;

v. Require submission to Contractor or Subcontractor, as the case may be, of applications for payment on the Payment Forms provided in Section VII of the Bid and Contract Documents together with clearly-defined invoices and billings supporting all such applications under each subcontract to which Contractor or its Subcontractor is a party;

vi. Report, so far as practicable, unit prices, lump sums, actual costs and any other feasible method for use in the determination of costs for changes in the Work in accordance with the Contract Documents;

vii. Require each Subcontractor to furnish to Contractor, in a timely fashion, all information necessary for the preparation and submission of all reports, shop drawings and other submittals required herein;

viii. Require that each Subcontractor continue to perform under its subcontract in the event this Agreement is terminated and that Owner, at Owner's sole discretion, may take an assignment of said subcontract and request such Subcontractor to continue such performance;

ix. Require each Subcontractor to remove all debris created by its activities; and

x. If required by law, require each Subcontractor to submit evidence that it has a valid contractor's license, that it is an equal opportunity employer, and that it is in compliance with all related laws, statutes, regulations, rules, standards, orders and ordinances.

10. Operation and Maintenance Data

A. In addition to, but not in limitation of, the terms and conditions of the Contract Documents, Contractor shall deliver as applicable a minimum of three (3) complete bound instruction manuals to Owner for the materials and/or equipment incorporated into the Work. The purpose of such manuals shall be for the instruction of Owner's operating and maintenance personnel and to provide a positive source of information regarding the products, materials and/or equipment.

B. The bound instruction manuals shall include:

i. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and reassembly;

ii. Complete nomenclature of all parts of all equipment;

iii. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other pertinent data regarding procurement procedure;

iv. Copies of all guarantees and warranties; and

v. Manufacturers' bulletins, catalog cuts and descriptive data where pertinent clearly indicating the precise items included in the Work.

11. Owner's Equipment

From time to time during the course of the Work, Owner may have its on-site earthmoving equipment available for use in aiding Contractor to perform earthwork activities. Contractor may employ the equipment when Owner indicates its availability and desire to rent it to Contractor. Contractor and Owner shall agree on payment to Owner and other terms and conditions which are mutually agreeable to both parties as a Change Order to this Agreement for Contractor's use of such equipment. Notwithstanding the foregoing, such equipment shall be priced on a load count or hourly basis as indicated in the Change Order. The Change Order must be executed by both parties hereto prior to using any of such equipment for any earthwork activity.

12. Labor

Contractor, for itself, its employees and Subcontractors, agrees that in performance of the Work provided for in the Contract Documents:

A. Contractor shall take affirmative action to ensure that applicants are employed and treated during employment without regard to their sex, race, creed, color, or national origin;

B. Contractor shall cooperate with Owner in the conduct of all labor relations affecting the Work;

C. At Owner's request, Contractor shall provide a method of identifying its employees and checking such employees into and out of the Site. Such method must be satisfactory to Owner prior to its use at the Site and shall be provided at Contractor's sole cost and expense (at no cost to Owner);

D. Contractor shall employ at the Site only those employees who work in harmony with the employees of Owner and/or other contractors and have the requisite skills and abilities to perform the Work in a safe, good and workmanlike manner. Owner may, at any time, refuse

admittance to the Site or expel from the Site any employee of Contractor and/or its Subcontractor including, but not limited to, Contractor's Superintendent whose presence Owner, at Owner's sole discretion, considers undesirable and Contractor shall indemnify, defend and hold Owner harmless from all claims, lawsuits, compensation, costs, expenses (including, but not limited to, all reasonable attorneys' and other consultants' fees and charges) or damages related to Owner's refusal to admit such individual to or expulsion of such individual from the Site; and

E. Contractor acknowledges that it is Contractor's responsibility to hire all personnel for the proper and diligent prosecution of the Work and Contractor shall use its best efforts to maintain labor peace for the duration of the Work.

13. Owner's Project Manager

Owner's Project Manager may monitor all or a portion of the Work on behalf of Owner but such monitoring shall in no manner relieve Contractor of any of its obligations, liabilities or responsibilities under the Contract Documents including, but not limited to, supervision, direction, management and coordination of the Work and shall not be used as grounds for additional payment to Contractor. Under no circumstances shall Owner, its Project Manager or other such representatives of Owner be considered to be engaged in any form of construction management activities relating to the Work.

14. Cooperation Between Trades and Progress of the Work

A. Full cooperation between all trades engaged upon the premises is mandatory. This Section of the Agreement shall be distinctly understood to bind Contractor and all of its Subcontractors to properly coordinate their Work with that of other Contractors working at the Site, so that the Work may at all times proceed without interruption or delay and predetermined progress milestones contained within the Schedule are met.

B. Any loss, cost, delay, damage, or expense (including, but not limited to, all reasonable attorneys' fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges) caused by defective or improperly timed or coordinated Work shall be borne by the Contractor responsible therefore, unless such loss, cost, delay, damage or expense is caused by Owner or Engineer. All remedies to repair or replace defective or damaged work shall be affected by the responsible Contractor without interruption or delay to the Schedule.

C. If Contractor removes, alters, destroys, or defaces the property of Owner or the work of another contractor in the performance of the Work, Contractor shall promptly repair or replace the affected property or the Work to the satisfaction of Owner without interruption or delay to the Schedule at Contractor's sole cost and expense (including, but not limited to, all reasonable attorneys' fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges).

D. In the event of any dispute or controversy, Contractor for itself and its Subcontractors agrees that it will continue to prosecute the Work diligently to meet the Schedule within the Agreement Time pending resolution of any such dispute or controversy.

E. When Contractor repairs or replaces defective or damaged Work (in accordance with the terms or conditions of the Contract Documents, applicable law or otherwise) Contractor shall do so at Contractor's sole cost, expense, risk and account (at no cost to Owner). Contractor shall be solely responsible for all costs and expenses of investigation, construction, reconstruction and correction of the Work in accordance with the terms and conditions of the Contract Documents including, but not limited to, all reasonable attorneys'

fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges.

15. Technical Components of the Work

A. Contract Drawings and Technical Specifications

i. Contractor shall perform the Work in strict compliance with the Contract Documents, including, but not limited to, the Contract Drawings and the Technical Specifications.

ii. Contractor shall have available on the Site, at all times, one copy of the Contract Drawings and Technical Specifications, including all Addenda thereto. Contractor shall also maintain at the Site, one copy of all approved Shop Drawings, Change Orders, Field Orders, submittals and the Schedule.

iii. Owner reserves the right to make minor changes to or modifications of the Contract Drawings prior to or during performance of the Work which shall be reflected thereon. The Work shall conform to such revised drawings and to such other drawings relative thereto as may be furnished by Owner in explanation of details or reflecting minor modifications during construction, including such minor modifications as Owner may consider necessary on account of conditions discovered during performance of the Work.

B. Survey

i. Owner shall provide the initial survey indicating horizontal and vertical controls and/or reference points and benchmarks for the Site. Contractor shall, by its own engineer/surveyor (who shall be registered in the state where the Site is located) and instruments, make whatever measurements and alignments that are necessary to collect the survey information required in the Contract Documents to enable it to construct each element of the Work in the correct position required, corresponding to the horizontal and vertical controls and/or reference points and benchmarks established by Owner's survey. If any errors are found, Contractor shall notify Owner in writing and, unless otherwise notified by Owner in writing, shall not proceed until such errors are corrected. If Contractor does proceed without such correction having been made, such action shall be construed as its acceptance of such lines, grades, and elevations, and Contractor shall be responsible for the correctness of the same. If by reason of Contractor acting without Owner's notification for Contractor to proceed in light of errors found, and it is necessary to reconstruct any part of the Work, Contractor shall uncover, remove and reconstruct such Work in accordance with the Contract Documents at Contractor's sole expense, risk and account (at no cost to Owner).

ii. Contractor shall furnish all survey stakes, all batter boards, templates, and other devices necessary for laying out all parts of the Work. All stakes destroyed by Contractor shall be replaced by Contractor.

iii. Contractor shall record all survey data including all lines and grades and shall record all test data required by the Contract Documents. All survey and test data shall be made available to Owner on a weekly basis or at times otherwise requested by Owner.

C. Shop Drawings and Samples

i. Contractor shall submit to Owner all Shop Drawings prepared or to be used by Contractor in performing the Work at least fourteen (14) days prior to commencement of the Work (unless Owner requests an expedited schedule) for Owner's review and approval. Contractor shall also submit to Owner for review and approval, with such

promptness as to cause no delay in the Work, all samples required by the Contract Documents or as otherwise requested by Owner.

ii. After checking and verifying all field measurements and after complying with applicable procedures specified in the Contract Documents, Contractor shall submit all Shop Drawings to Owner which shall bear a stamp or specific written indication that Contractor has satisfied Contractor's responsibilities under the Contract Documents with respect to the review of the submission. The data shown on the Shop Drawings and the background information for the sample shall be complete with respect to quantities, dimensions, specified performance and design criteria, installation protocol, catalog numbers, materials and similar data to enable Owner to review the information as required.

iii. All samples shall be checked by and accompanied by a specific written indication from Contractor that Contractor has satisfied all of Contractor's responsibilities under the Contract Documents with respect to the review of the submission. The submission shall clearly identify the material, supplier, and pertinent data such as catalog numbers and the use for which the sample is intended.

iv. Before submission of each Shop Drawing or sample, Contractor shall have reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples which pertain to the Work, with all facets of the Work itself and with the terms and conditions of the Contract Documents to insure compatibility therewith.

v. At the time of each submission, Contractor shall give Owner specific written notice of each variation that the Shop Drawings or samples may exhibit from the Work as described in the Contract Documents. In addition, Contractor shall cause a specific notation for each such variation to be made on each Shop Drawing and background information for the sample submitted to Owner for review and approval.

vi. Owner and Engineer shall review and approve with reasonable promptness Shop Drawings and samples, but Owner's and Engineer's review and approval will be only to assist Contractor in interpreting the scope of the Work in accordance with Owner's business and operational objectives and shall not relieve Contractor from any responsibility or liability for errors or omissions in the Shop Drawings. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. Contractor shall make corrections required by Owner or Engineer and shall return the required number of corrected copies of Shop Drawings as indicated in the Technical Specifications. If no specific number is indicated, at least one (1) copy of such drawings will be submitted as required or requested by Owner new samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Owner or Engineer on previous submittals.

vii. Where a Shop Drawing or sample is to be provided hereunder, any related Work performed prior to Owner's and Engineer's review and approval of the pertinent submission will be at the sole risk, expense, account and responsibility of Contractor (at no cost or liability to Owner).

viii. All Shop Drawings, plans, drawings, specifications, and similar documents prepared by Contractor for the Work and any copies thereof shall be the sole property of Owner. Contractor shall deliver such documents to Owner at the completion of the Work or at times as may otherwise be requested by Owner.

D. All Shop Drawings shall become part of the Contract Documents after approval by Owner hereunder.

16. Substitutions

A. No item listed on the Contract Drawings, Contractor's Shop Drawings, or in the Technical Specifications by trade name or by name of manufacturer may be substituted without the prior approval of Owner. Owner reserves the sole right to accept or reject such Contractor's proposal for substitution. Contractor shall insure that any such substitution or refusal of substitution shall not cause delay or increased costs. For any substitutions, Owner and Engineer shall determine whether the substitute may be utilized and may make inquiries at Contractor's sole cost and expense to verify such claim.

B. At least fourteen (14) days prior to commencement of the Work, Contractor shall submit to Owner any proposals for substitutions, together with samples and complete data. Owner may consider but is under no obligation to consider such proposals. In either event, Owner shall render a decision to Contractor as promptly as possible. No substitutions may be made without the prior written consent of Owner evidenced by a Change Order and approved Shop Drawing.

C. All applications for substitutions shall be accompanied by a statement of credit or extra cost attributed to the substitution.

D. Contractor shall carefully verify and shall be fully responsible for determining that the materials and/or equipment it has proposed to provide and/or install are in accordance with and will fit into the confines indicated on the Contract Drawings, Contractor's Shop Drawings and/or the Technical Specifications.

E. Unless otherwise indicated, design of the Work is based upon the material or supplier's equipment named first in the list of manufacturers in the Technical Specifications contained herein. When other manufacturers are listed and are desired to be used by Owner, Contractor may be required to make modifications or adjustments, at Contractor's sole cost and expense, to coordinate the installation of the material and/or equipment with associated elements of the Work.

17. Reports

A. Contractor shall prepare and forward to Owner at least fourteen (14) days prior to commencement of the Work a materials and equipment report which shall include: a complete list of suppliers and/or fabricators; items to be purchased from and/or supplied by such suppliers and/or fabricators; time required for fabrication; and the scheduled delivery dates for each item to be purchased and/or supplied, leased or otherwise used for performance of the Work. As soon as available, Contractor shall furnish copies of purchase orders and other evidence of procurement to Owner.

B. Contractor shall prepare such additional reports as Owner may request.

C. During progress of the Work, Contractor shall keep at the Site, in good and legible form, a record of all work done differently from or in addition to that shown on the Contract Drawings. Such record shall clearly and accurately describe the "as-built" conditions and dimensions in sufficient detail and accuracy to enable Owner to prepare as-built drawings of the Work. Contractor shall submit the record to Owner as soon as possible; however, all such information must be submitted to Owner in good and acceptable form prior to Final Acceptance of the Work by Owner.

D. Contractor shall submit all other submittals to Owner and others in accordance with provisions of the Technical Specifications regarding the same.

18. Dewatering

A. In addition to, and not in limitation of, any terms or conditions contained in the Technical Specifications, all Work (including, but not limited to excavation and backfilling) shall be performed under workable and dry conditions. Contractor shall be solely responsible for all dewatering in performing the Work including, but not limited to, the following:

i. Preventing surface water and subsurface or groundwater from flowing into the excavations and flooding the Site and surrounding area; and

ii. Not allowing water to accumulate in excavations; and

iii. Providing and maintaining pumps, sumps, suction and discharge lines and other dewatering system components which are necessary to properly convey water away from excavations; and

iv. Conveying water removed from excavations to existing natural channels or otherwise providing proper and appropriate disposal of such water.

B. Dewatering devices shall provide adequate filtering to prevent the removal of fines from the soil.

C. The cost of such dewatering shall already be included in the Agreement Price.

19. Inspections, Examinations and Testing

A. Access to and Testing of the Work

i. Contractor shall provide Owner, Engineer, CQA Consultant, representatives of Owner, testing agencies and governmental agencies with jurisdictional interests with proper and safe access to the Work at reasonable times for their observation, inspection and testing.

ii. Contractor shall give Owner timely notice of readiness of the Work for all required inspections, tests or approvals so as not to delay the Schedule.

iii. If federal, state or local laws, regulations, ordinances, rules, standards, orders or requirements of any public body or court having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, Contractor shall assume full responsibility therefore, pay all costs in connection therewith and furnish Owner and CQA Consultant with the required certificates of inspection, testing or approval.

iv. Contractor shall be responsible for and shall pay all costs in connection with any inspection or testing by Owner of a supplier of materials or equipment proposed to be incorporated into the Work, or of materials or equipment submitted to Owner for approval prior to Contractor's purchase thereof for incorporation into the Work.

v. All inspections, tests or approvals, other than those undertaken directly by governmental authorities having jurisdiction, shall be performed by organizations acceptable to Owner.

vi. If any Work is covered contrary to the written or oral request of Owner, it must, if requested by Owner, be uncovered for observation and replaced at Contractor's sole expense, risk and account (at no cost to Owner). Any work undertaken by Contractor pursuant to this Paragraph must be undertaken in full compliance with the terms and conditions of the Contract Documents.

vii. If Owner considers it necessary or advisable that covered Work be observed by Owner, Engineer or CQA Consultant, or inspected or tested by others, for any reason, Contractor, at Owner's request, shall uncover, expose or otherwise make available for observation, inspection or testing as Owner may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is not in accordance with the Contract Documents, Contractor shall bear all costs and expenses (including, but not limited to, all reasonable attorneys' fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges) of such uncovering, exposure, observation, inspection, testing and of proper reconstruction of the Work to the standard necessary and/or required by the Contract Documents.

B. Inspection, Examination and Acknowledgment

i. CONTRACTOR REPRESENTS BY ITS EXECUTION OF THIS AGREEMENT THAT IT HAS HAD THE OPPORTUNITY TO INSPECT AND EXAMINE AND HAS THOROUGHLY INSPECTED AND EXAMINED THE SITE (WHERE OR UPON WHICH THE WORK IS TO BE PERFORMED), ALL APPLICABLE LAWS AND REGULATIONS, THE CONTRACT DOCUMENTS, SITE PERMIT CONDITIONS, DATA AND OTHER SUCH INFORMATION REFLECTING SURFACE AND SUBSURFACE CONDITIONS OF THE SITE EXISTING PRIOR TO PERFORMANCE OF THE WORK AND UNDER WHICH THE COMPLETED WORK SHALL OPERATE INCLUDING, BUT NOT LIMITED TO, ALL FACILITIES, THE CHARACTER, QUALITY AND QUANTITY OF MATERIAL REQUIRED, KIND OF EQUIPMENT AND FACILITIES NEEDED PRELIMINARY TO AND DURING PERFORMANCE OF THE WORK (OR IF IT HAS NOT DONE SO, WAIVES SUCH INSPECTION AND EXAMINATION AT ITS OWN RISK); THAT IT HAS OBTAINED AND CAREFULLY STUDIED (OR ASSUMES RESPONSIBILITY FOR OBTAINING AND CAREFULLY STUDYING) ALL SUCH EXAMINATIONS, INVESTIGATIONS, EXPLORATIONS, TESTS, REPORTS, DRAWINGS, STUDIES AND OTHER INFORMATION WHICH PERTAIN TO THE SURFACE, SUBSURFACE OR PHYSICAL CONDITIONS AT OR CONTIGUOUS TO THE SITE OR THAT OTHERWISE MAY AFFECT THE PROGRESS, PERFORMANCE, INSTALLATION, OPERATION OR FURNISHING OF THE WORK AS REQUIRED OR IS NECESSARY FOR THE PROPER PERFORMANCE OF THE WORK AT THE AGREEMENT PRICE, WITHIN THE AGREEMENT TIME AND IN ACCORDANCE WITH ALL OF THE TERMS AND CONDITIONS OF THE CONTRACT DOCUMENTS; THAT IT HAS A FULL UNDERSTANDING OF THE DIFFICULTIES AND CONDITIONS WHICH MAY BE ENCOUNTERED IN PERFORMING THE WORK AND AGREES THAT THE CONTRACT DOCUMENTS ARE ADEQUATE AND REASONABLE FOR CONTRACTOR'S PERFORMANCE OF SUCH WORK. CONTRACTOR'S FAILURE TO INSPECT AND/OR EXAMINE SUCH SITE AND THE CONTRACT DOCUMENTS RESULTING IN ITS SUBSEQUENT INABILITY TO PERFORM THE WORK HEREUNDER SHALL IN NO WAY RELIEVE IT OF THE OBLIGATIONS OF THIS AGREEMENT.

ii. Contractor is responsible for reviewing all available information, data, and the Contract Documents and shall confirm the location of each Facility that exists. Contractor shall take all precautions to avoid damage to all persons and property around such Facilities during performance of the Work. If Facilities must be moved to perform the Work, the cost for such moving shall already be included in the Agreement Price, otherwise, they shall be moved at Contractor's sole expense, risk and account (at no cost to Owner).

iii. Contractor agrees to advise fully all of its employees, Subcontractors and others working for Contractor at the Site, of any risks at the Site and of all necessary and/or required environmental, safety, and health procedures contained in any applicable federal, state and/or local law, regulation, ordinance, standard, rule or order (including, but not limited to all applicable OSHA requirements).

iv. Contractor acknowledges and is aware that the Site may contain residential, commercial, and/or industrial waste materials, and Contractor knowingly and voluntarily assumes all risk of injury and damage to Contractor and Contractor's property, employees, Subcontractors and others working for Contractor, caused by exposure to such waste materials while at the Site.

C. Surveys, Borings, Drawings, Studies, Test Results and Other Site Information

i. Owner shall not be responsible for furnishing surveys (except as expressly provided herein) or other information as to the physical characteristics of, legal limitations of, or utility locations for, the Site.

ii. Owner may, however, make available to Contractor, and if so Contractor is deemed to have studied the results of certain surveys, test borings, drawings, studies, test results and information that it has, if any, as to surface conditions, subsurface conditions and Site geology. Owner does not assume any responsibility whatsoever with respect to the completeness, sufficiency or accuracy of surveys or borings made; of the logs of test borings; of drawings, studies, or test results; of other investigations; or of the interpretations and conclusions made thereof; AND THERE IS NO WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, THAT THE CONDITIONS INDICATED BY SUCH SURVEYS, INVESTIGATIONS, BORINGS, LOGS, DRAWINGS, STUDIES OR INFORMATION ARE REPRESENTATIVE OF THOSE CONDITIONS EXISTING THROUGHOUT THE SITE, OR ANY PART THEREOF, OR THAT UNFORESEEN DEVELOPMENTS MAY NOT OCCUR except however, Contractor may rely on the survey for the Site which is given to Contractor by Owner and which sets the vertical and horizontal controls and identifies benchmarks for the Site.

iii. At Owner's request, Contractor shall make available to Owner the results of any Site investigation, test borings, drawings, analyses, studies, surveys, tests or other investigations conducted by or in possession of the Contractor or any of its agents or Subcontractors.

20. Compliance with Laws, Permits and Other Conditions

I. Compliance with Laws

A. In the performance of the Work hereunder, Contractor, its employees and Subcontractors agree to comply with all applicable federal, state, provincial, county and local laws, ordinances, lawful orders, rules, standards and regulations including, but not limited to, social security and income tax withholding laws, employment compensation laws, environmental, safety and health laws including those of the Occupational Safety and Health Act (OSHA) in existence at the time of execution of this Agreement and as thereafter enacted, amended and/or modified.

B. Contractor, its employees and Subcontractors represent and warrant that they have acquired and paid for all necessary work permits (to include all required documentation to allow personnel who are not United States citizens to legally work in the United States), licenses, certificates and other forms of documentation of personnel registration and training and that their personnel have received all necessary training required to perform

the Work. Contractor shall furnish copies of such documentation to Owner's Project Manager prior to commencement of performance of the Work.

C. Contractor shall be responsible for the payment of all sales, use, added value and all other federal, state and/or local taxes of any type that arise out of or are related to the Work including, but not limited to, any personal property, income, franchise, or business privilege tax assessed to the Contractor for conducting its operations and purchasing materials and/or equipment hereunder. All applicable taxes shall already be included in the Agreement Price.

D. Contractor shall not violate any applicable laws, regulations, ordinances, orders, rules or standards pertaining to wetlands.

E. To the fullest extent permitted by law, Contractor, on behalf of itself, its employees and its Subcontractors, agrees to indemnify, defend and hold Owner, its respective parent and/or subsidiary and/or affiliated compan(y)(ies), and their respective officers, directors, employees, agents and subcontractors harmless from any liability, penalties or damages which might be imposed by reason of an asserted or established violation of any federal, state, provincial, county and/or local law, ordinance, lawful order, rule, standard or regulation by Contractor, its employees or Subcontractors.

F. Contractor shall perform the Work in accordance with all applicable permits, certificates and licenses acquired by Owner.

II. Legal Restrictions and Waste Disposal Permit Conditions

Contractor shall not violate any zoning, setback, buffer or other locational aspects of applicable laws, codes or ordinances, or of any recorded covenants or permit conditions of any of Owner's waste disposal or other permits (including, but not limited to, those referenced in the project specifications). If Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, rules, regulations or permit conditions, Contractor shall notify Owner promptly in writing and any necessary changes shall be accomplished by appropriate modification to the Contract Documents.

III. Building Permits, Certificates and Licenses

A. Contractor shall procure all federal, state, county, local and all other applicable permits, certificates, bonds, licenses and inspections and shall give all applicable notices and pay for all applicable governmental charges and inspection fees as required for proper performance of the Work to be performed by Contractor as applicable. Contractor shall not initiate or perform any Work until copies of the appropriate permits, certificates, bonds, licenses and inspections (if necessary or required) that are required prior to performance of the Work are submitted to Owner.

IV. Standards, Specifications, and Codes

A. Where provisions of the Contract Documents refer to or wherever the Work performed under the Contract Documents relates to the specification of the AASHTO, AIA, ASTM, NSF or other specific standards and specifications, such specifications are made a part hereof to the extent which is indicated. Where standards, specifications, codes, etc., are referred to herein, it shall be understood that such reference is to the issue in effect at the time of Contractor's performance of the Work.

B. Abbreviations for the names or designation of recognized technical societies and industry standards in general use in the Technical Specifications include but are not limited to the following:

AASHTO	American Association of State Highway and Transportation Officials
AIA	American Institute of Architects
ASTM	American Society for Testing and Materials
NSF	National Sanitation Foundation

V. Material and Workmanship

A. All materials shall be new, free from rust or other foreign matter, and of the best quality of their respective kind. The types and sources of all materials shall be subject to Owner's approval. The Work in all respects shall be performed in a good and workmanlike manner and all Work shall be performed by persons skilled in the performance of their respective duties. Such materials and workmanship shall be free from negligence.

B. Owner is privileged to reject any materials having been obtained and installed at any time and any rejected material shall be removed and replaced with approved materials or repaired in accordance with the manufacturer's recommendations by Contractor, without delay, at Contractor's sole expense, risk and account (at no cost to Owner). All materials furnished and installed under these Contract Documents shall be of approved design and manufacture and shall be limited to products regularly produced, recommended, and guaranteed for service ratings in accordance with the manufacturer's catalog data or other comprehensive literature made available to the public and in effect at the time of execution of this Agreement. In addition to the foregoing, all materials and equipment must conform to and comply with all solid waste permit conditions for the Site.

VI. Standards of Quality

If the Contract Documents including, but not limited to, the Technical Specifications and/or Contract Drawings, describe materials, devices, or equipment as those which shall be similar and equal to certain materials, devices, or equipment designated by trade or manufacturer's name and Contractor desires to use such "equal," then Contractor shall be required to demonstrate to the satisfaction of Owner that the materials, devices, or equipment it proposes to furnish are in fact, similar or equal to the quality of those designated in such documents prior to Contractor placing an order therefore or incorporating such "equal" into the Work. In addition, Contractor shall comply with all provisions of the Contract Documents regarding substitutions.

21. Patents/Copyrights

A. If, during the course of performance of the Work by Contractor under this Agreement, or within a period of one (1) year thereafter, Contractor and/or any of the Contractor's employees or Subcontractors make any invention or discovery arising out of or resulting from the Work performed by Contractor or its Subcontractors pursuant to the Contract Documents, Contractor and/or its Subcontractors shall furnish Owner with full and complete information on such invention or discovery and shall, upon request of Owner and without further compensation, assign the entire right, title and interest thereto, together with all rights to patents thereon, to Owner; authorize Owner, to apply for Letters Patent for said discovery or invention in any and all countries in its own name or in any name at its election, and Contractor and its Subcontractors shall further, upon the request of Owner and at Owner's expense, execute and deliver, or procure the execution and delivery of, any and all rightful oaths, applications for patents and other papers and generally do all lawful acts for said Owner, its successors, assigns or legal representatives to obtain and enforce patent protection on said invention in all countries.

B. To the fullest extent permitted by law, Contractor shall indemnify, defend, and hold Owner, its parent and/or subsidiary and/or affiliated compan(y)(ies) and their respective officers, directors, employees, agents and subcontractors harmless from all costs and expenses (including, but not limited to, all reasonable attorneys' fees, professional engineering fees

and charges, sampling and testing fees, experts' fees and other consultants' fees and charges) and liability of any kind for or on account of infringement or claimed infringement of any patent or any patented or unpatented invention, article, material, or process manufactured or used in the performance of the Work, incorporated into the Work or occasioned by use of the Work by Owner or another.

22. Confidentiality

A. In connection with the Work to be performed under the Contract Documents, Owner may disclose to Contractor, or Contractor may have access to, through its representatives, confidential commercial information and technical data (including trade secrets in which Owner has proprietary rights) patentable as well as unpatentable (hereinafter "Information"). All such Information, howsoever disclosed, developed, or obtained by Contractor shall not be used or disclosed to others without Owner's prior written consent unless such information is in the public sector (through no fault or breach of any term or condition of the Contract Documents by Contractor). Upon completion of the Work, or upon earlier termination of this Agreement, Contractor shall return to Owner all such prints, drawings and documents of any kind supplied by Owner, together with all copies thereof made by or for Contractor and its Subcontractors.

B. Contractor shall not release Information or discuss the Work with news media, governmental agencies, or other interested parties at any time without the prior written consent of Owner.

C. Notwithstanding the provisions of this Section of the Agreement to the contrary, Information referred to in this Section of the Agreement may be disclosed to a court of competent jurisdiction if it is legally required to be disclosed. If such Information is requested to be disclosed by such court, Contractor shall provide Owner with written notice immediately of the request for disclosure so that Owner may enforce the provisions of this Agreement, seek an appropriate protective order and/or in Owner's sole discretion, waive Contractor's compliance with selected provisions of this Agreement concerning all or a portion of such Information.

23. Liability and Guarantee

I. Protection of the Work and Safety

A. Contractor shall maintain the Work, materials and/or equipment free from injury or damage from rain, wind, water, storms, frost and/or heat. If adverse weather makes it impossible to continue performing the Work in a safe manner, in spite of employing appropriate weather precautions, Contractor shall cease performance of the Work and notify Owner of such cessation.

B. Contractor shall not permit open fires on the Site except with the prior written permission of Owner and Contractor's adherence to all applicable laws, regulations, rules, standards and orders.

C. Contractor, at its own expense, risk and account (at no cost to Owner), shall repair, replace, and maintain in service any Facilities which are damaged, broken, or otherwise rendered inoperative by Contractor or any of its Subcontractors during performance of the Work. The method used by Contractor in repairing, replacing, or maintaining such Facilities shall be approved by Owner. However, Owner's approval does not in any way relieve Contractor of any of its obligations, liabilities, and responsibilities regarding the protection, repair, replacement or maintenance of such Facilities. Contractor shall be responsible for coordination of the Work with the owners of such Facilities.

D. Contractor shall take all necessary precautions for the safety of and shall provide protection to prevent damage, injury or loss to all subcontractors [including, but not limited to, all Subcontractors (as defined herein)], visitors, invitees, and licensees on the Site; employees performing the Work and other persons who may be affected thereby or in the vicinity thereof; the Work itself (including materials and equipment to be incorporated therein); and other property at the Site or adjacent thereto such as structures and Facilities not designated for removal, relocation or replacement in the course of construction. Contractor shall comply with all applicable provisions of federal, state, local, and municipal safety laws, regulations and building codes to prevent accidents or injuries to persons on, about, or adjacent to any area where the Work is being performed.

E. Contractor shall erect and properly maintain, at all times, as necessary and required by the conditions and progress of the Work, all barricades, warning signs, scaffolding, shoring, sheeting, bracing, hazard markings (suitably illuminated) and safeguards for the protection of workmen and the public.

F. Contractor shall provide such equipment and medical facilities as are necessary to supply first aid to anyone who may be injured in connection with the Work, and shall have the capability of immediate removal and hospitalization, if required.

G. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE MANNER, MANAGEMENT, MEANS, METHODS, SEQUENCES, PROCEDURES, AND TECHNIQUES NECESSARY TO PERFORM THE WORK IN A SAFE MANNER.

H. Contractor shall arrange and attend safety meetings with Owner in order to discuss any conditions at the Site perceived to be unsafe and/or any other matters relating to work safety. Meetings may be held at any time but not less frequently than weekly and may be part of the regularly scheduled construction meetings. An agenda shall be prepared for each meeting and an attendance sheet shall be signed by representatives of each party present at the meeting. Notwithstanding arranging and attending meetings, Contractor shall immediately notify Owner of any condition that is perceived to be unsafe.

II. Risk of Loss

Until Final Acceptance of the Work by Owner, all risk of loss, injury, theft, damage to or destruction of the Work including, but not limited to, materials and/or equipment contained therein (i.e. stored at the Site or incorporated into the Work) shall be borne by Contractor. Responsibility of Contractor shall extend to materials and/or equipment furnished or leased by Owner to Contractor under the terms and conditions of the Contract Documents. Contractor shall replace or repair all damaged and/or stolen work to the condition necessitated and/or required by the Contract Documents at Contractor's sole expense, risk and account at no cost to Owner.

III. Indemnification

A. To the fullest extent permitted by law, Contractor, for itself, its employees and Subcontractors shall indemnify, defend, and hold harmless Owner, its parent and/or affiliated and/or subsidiary compan(y)(ies), and their respective officers, directors, employees, agents, vendors and subcontractors from and against all claims, lawsuits, damages, losses and expenses, (including, but not limited to, all reasonable attorneys' fees, professional engineering fees, sampling and testing fees, experts' fees and other consultants' fees and charges) arising out of a breach of any terms or conditions of the Contract Documents by Contractor or its Subcontractors, errors or omissions of Contractor or its Subcontractors, or resulting from the performance of the Work; provided, that any such claim, damage, loss and/or expense resulting from performance of the Work (1) is

attributable to bodily injury, sickness, disease or death (including, but not limited to, injury or death to employees and/or Subcontractors of Contractor), or to injury to or destruction of property (including the loss of use resulting therefrom) or contamination of or adverse effects on the environment (including, but not limited to, property damage to employees and/or Subcontractors of Contractor) and (2) is caused in whole or in part by the negligence, willful misconduct or strict liability of Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

B. In all claims against Owner, any person or entity indemnified hereunder, any subcontractor of Owner, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation as provided herein shall not be limited in any way by any limitation on the amount or type of damages recoverable against Contractor, its employees or Subcontractors, regarding compensation or benefits payable by or for the Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The obligations contained in this Section of the Agreement shall survive termination of this Agreement.

IV. Guarantee

A. In addition to and not in substitution or limitation of specific warranties, if any, required by law, this Agreement or the Contract Documents, Contractor warrants and guarantees for a period of one (1) year from the date of Final Acceptance of the Work by Owner that the Work to be performed and the materials and equipment to be furnished under the Contract Documents shall all be free from negligence, any errors or omissions, defects in design work done by Contractor and shall be technically correct and accurate, shall be fit and sufficient for the purposes expressed herein; that all tasks to be performed as necessary and required by the Contract Documents shall be fully and completely performed pursuant to the Contract Documents; and that all materials, equipment and finished Work shall function in accordance with the letter and intent of the Contract Documents including, but not limited to, the Technical Specifications, the Contract Drawings and the warranty representations of Contractor.

B. In addition to, and not in limitation of, any remedy provided by law, in equity, the Contract Documents or other warranties, Contractor shall repair or replace any defective or negligently produced materials or workmanship which may develop during said one (1) year period, shall be responsible for all damages, costs and expenses (including, but not limited to, all reasonable attorneys' fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges) resulting from a breach of this warranty and guarantee by Contractor and/or its Subcontractors and Contractor shall be responsible for any damage to other work caused by the repairing of such defects, at Contractor's sole expense, risk and account (at no cost to Owner). Remedial work to be performed by Contractor shall include, but not be limited to, uncovering, removal, reinstallation, inspections and testing by Owner to determine the nature and extent of such defect. Such corrective or remedial work shall be undertaken in an expeditious fashion in accordance with a schedule developed by Owner, in Owner's sole discretion, even if additional costs are incurred in completing such work on any accelerated basis. Contractor shall be responsible for all such additional costs for accelerated work as indicated above. If requested by Owner, Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment used or to be used to repair such damage. Any such repairs or replacement and the affected Work shall be warranted by Contractor for an additional one (1) year period from the date of Final Acceptance by Owner of such repairs or replacement. At Owner's option, Owner may remedy any such defects or negligence and Contractor shall be liable for all reasonable costs arising therefrom including, but not limited to, all

reasonable attorneys' fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges.

C. Contractor shall secure and deliver to Owner written warranties and guarantees from its Subcontractors reflecting the date the warranty period begins and the date upon which such warranty ends. Contractor shall transfer all manufacturer's or dealer's warranties to Owner immediately upon purchase of any materials or equipment for incorporation into the Work. Contractor shall perform no modifications to the materials or equipment or otherwise void such warranties except with the prior written consent of Owner. Contractor is responsible for the warranty of all Work, whether performed by it or by its Subcontractors at any time.

D. The warranty and remedies provided herein shall survive termination of this Agreement. Contractor shall not be entitled to an extension of the Agreement Time because of any delay in performance of the Work attributable to Owner's exercise of its rights and remedies hereunder.

V. Limitation of Liability.

NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR SPECIAL, INCIDENTAL, EXEMPLARY, PUNITIVE OR CONSEQUENTIAL DAMAGES INCLUDING WITHOUT LIMITATION LOSS OF USE, LOSS OF PROFITS OR REVENUES, OR COST OF SUBSTITUTE OR RE-PERFORMED SERVICES, SUFFERED, ASSERTED OR ALLEGED BY EITHER PARTY OR ANY THIRD PARTY ARISING FROM OR RELATING TO THIS AGREEMENT, REGARDLESS OF WHETHER THOSE DAMAGES ARE CLAIMED UNDER CONTRACT, WARRANTY, INDEMNITY, TORT OR ANY OTHER THEORY AT LAW OR IN EQUITY.

24. Waivers and Releases

A. Waivers and Releases (Upon Progress Payment and Final Payment)
Contractor, for itself and its Subcontractors (including, but not limited to, all materialmen, suppliers and laborers) and for all other persons furnishing any goods or services pertaining to the Work, hereby agrees as a condition precedent to Contractor receiving any payment under this Agreement, to furnish to Owner good and sufficient waivers and releases on Waiver and Release Forms contained in Section VII of the Bid and Contract Documents for itself and to obtain and furnish to Owner similar waivers and releases from every Subcontractor (including, but not limited to, materialmen, suppliers and laborers) and all other persons furnishing goods and/or services pertaining to the Work on Waiver and Release Forms contained in Section VII of the Bid and Contract Documents for "Subcontractors". These fully executed Waiver and Release Forms must accompany all Payment Forms submitted by Contractor to Owner hereunder, and be in the form of “upon receipt of the requested amount” for the Waiver and Release forms to be valid.

B. Payments Directly to Subcontractors
Contractor agrees that Owner may, in consultation with Contractor, and without obligation to do so, pay any Subcontractor directly and deduct such amount from any amounts which are due to Contractor hereunder, thereby, reducing the total amount of the Agreement Price owed to Contractor for performance of the Work by the amount so paid to such Subcontractor. In addition, Contractor agrees to hold Owner harmless from all claims, lawsuits, costs, damages, expenses and liability for such actions taken by Owner in accordance with Section 24 of this Agreement.

25. Insurance and Performance and Payment Bonds

A. Insurance
Contractor shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of or result from Contractor's performance of the Work,

whether such Work is undertaken by Contractor or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

i. Claims under worker's or workmen's compensation, disability benefit, and/or other similar employee benefit acts;

ii. Claims for damages because of bodily injury, occupational sickness or disease, or death of its employees;

iii. Claims for damages because of bodily injury, sickness or disease, or death of any person who is not its employee;

iv. Claims for damages insured by usual personal injury liability coverage which are sustained i) by any person as a result of an injury directly or indirectly related to the employment of such person by Contractor, or ii) by any other person;

v. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom; and

vi. Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.

The insurance required by this Agreement shall be written for not less than the limits of liability specified as follows:

COVERAGE	REQUIREMENTS	MINIMUM AMOUNTS
Worker's Compensation	Statutory Worker's Compensation Coverage and Employers Liability.	Statutory Limit
Employers Liability	The employer's liability coverage shall not contain an exclusion for occupational disease.	$500,000 Employer's Liability
Comprehensive General Liability (Including Contractual Liability) Bodily Injury Property Damage	This coverage shall be written on an occurrence basis and include, but not be limited to premises-operations, blanket contractual, XCU, independent contractors, products-completed, operations, personal injury and broad form property damage. Form CG2010 or its equivalent must be attached to the certificate of insurance showing Owner listed as an Additional Insured on the General Liability policy.	$1,000,000 Each Occurrence $2,000,000 Aggregate
Comprehensive Automobile Liability (Owned, Hired, and Non-Owned Vehicles): Bodily Injury Property Damage	This coverage shall be written on an occurrence basis and include owned, hired, and non-owned vehicles.	$1,000,000 Combined Single Limit
Excess Umbrella Liability	This coverage shall be written on an occurrence basis.	$5,000,000 Each Occurrence $5,000,000 Aggregate
Contractor's Pollution Liability		$1,000,000 Each Occurrence $2,000,000 Aggregate

Limits required may be satisfied by primary policies plus umbrella/excess liability.

B. A Certificate of Insurance acceptable to Owner shall be filed with Owner prior to commencement of the Work. However, failure to obtain the required documents prior to the work beginning shall not waive the Contractor's obligation to provide them. Owner reserves the right to require complete, certified copies of all required insurance policies, including endorsements effective the coverage required by these specifications, at any time. In addition, Contractor shall insure that all coverage required above remain in full force and effect for five (5) years after the completion of the work.

C. If Contractor's insurance is canceled or amounts of coverage are reduced through aggregate erosion for any reason, Contractor shall immediately obtain new policies with the coverage stipulated herein. If Contractor fails to procure, maintain and/or pay for such insurance, Contractor agrees that Owner may, but is not obligated to, obtain such insurance on behalf

of and at the sole expense of Contractor and such costs and expenses may be withheld from amounts due the Contractor under this Agreement or may be paid to Owner directly within ten (10) calendar days after receipt of an invoice from Owner for the same. In addition, Contractor agrees to hold Owner harmless from all claims, lawsuits, costs, damages, expenses, and liability for such actions taken by Owner in accordance with this Agreement. Failure to obtain adequate insurance coverage shall not be a basis for an extension of the Agreement Time or adjustment of the Agreement Price.

D. Contractor shall name Owner as an additional insured (hereinafter referred to as the "Additional Insured") without limitation on all coverage listed in this Section of the Agreement, except for Worker's Compensation and Professional Liability coverage. All insurance carried by Contractor in accordance with this Section of the Agreement shall be endorsed to provide that:

i. The Additional Insured is included as an additional insured with the understanding that any obligation imposed upon the insured (including, without limitation, the responsibility of paying premiums) shall be the sole obligation of Contractor and not that of the Additional Insured or any other insured;

ii. The respective interest of the Additional Insured shall not be invalidated by any action or inaction of Contractor or any other person or entity or any non-disclosure or failure to notify. The Additional Insured shall remain an additional insured regardless of any breach or violation by Contractor or any other person of any warranties, declarations or terms or conditions contained in such policies;

iii. Contractor hereby grants to Owner a waiver of any right to subrogation which any insurer of said Contractor may acquire against Owner by virtue of the payment of any loss under such insurance. Contractor agrees to obtain any endorsement that may be necessary to affect this waiver of subrogation, but this provision applies regardless of whether or not Owner has received a waiver of subrogation endorsement from the insurer;

iv. Such insurance shall be primary without the right of contribution of any other insurance carried by or on behalf of the Additional Insured with respect to its respective interest as such in the Site and the Work;

v. If such insurance is canceled for any reason whatsoever including non-payment of premium or any substantial change is made in the coverage which affects a substantial interest of the Additional Insured, such cancellation or change shall not be effective as to the Additional Insured until thirty (30) days after receipt of written notice by the Additional Insured of such cancellation or change; and

vi. Any insurance carried by the Contractor in accordance with the provisions herein shall be endorsed to provide that inasmuch as the policy is written to cover more than one insured, all terms, conditions, insuring agreements and endorsements shall operate in the same manner as if there were a separate policy covering each insured.

vii. Any deductibles or self-insured retentions must be disclosed to and approved by Owner. If Contractor intends to charge Owner for such insurance premiums, they shall already be reflected in the Agreement Price.

viii. Each insurance policy required by this clause shall be endorsed to state that coverage shall not be cancelled by either party, except after thirty (30) days prior written notice has been provided to Owner.

ix. Contractor shall require and verify that all subcontractors maintain insurance, meeting all the requirements stated herein.

26. Performance and Payment Bonds

The Contractor shall provide a standard performance bond for the full amount of the Agreement Price.

27. The Work Schedule, Deliveries and Storage

I. Scheduling

A. Contractor shall be responsible for arranging and attending a meeting with Owner to develop a detailed work schedule herein referred to as "the Schedule" which shall be more detailed and descriptive than any schedule which may have been submitted to Owner prior to the execution of this Agreement.

B. The Schedule shall not exceed the Agreement Time unless agreed upon in writing by Owner and Contractor.

C. The Schedule shall be updated during the regularly scheduled construction meetings at the Site or at more frequent times as otherwise agreed to by Owner and Contractor. The update shall include the following items as well as any additional information necessary to make an accurate and informative report:

i. Actual start dates;

ii. Actual finish dates;

iii. Percentage of the Work completed (together with the number of units installed, if applicable);

iv. Whether the Work is on schedule, and if not, a statement as to how Contractor intends to get back on schedule (together with projected changes in the Schedule required for safe completion of the Work); and

v. The remaining duration of the Work in workdays (together with the number of units needed to be installed, if applicable).

D. The Schedule represents the work schedule of Contractor. Contractor accepts and agrees to abide by the Schedule as formulated herein. The Schedule supersedes all prior oral or written work schedules of any type created by Contractor or Owner for performance of the Work.

E. It shall be Contractor's responsibility to promptly notify Owner in writing of any delay which may jeopardize completion of the Work in accordance with the Schedule. If, at any time, it appears to Owner that the rate of progress of the Work is insufficient to ensure completion of the Work in accordance with the Agreement Time, Owner shall notify Contractor and Contractor shall take such steps as are necessary to insure safe completion of the Work within such Agreement Time. Any additional expenses and/or costs incurred by Contractor or charges made to Owner in excess of the Agreement Price in complying with Schedule milestones (including but not limited to those incurred for overtime or additional shifts) shall be paid solely by Contractor (at no cost to Owner).

II. Deliveries

All deliveries shall be coordinated with Owner which are not specifically addressed in the Contract Documents. Owner will work with Contractor in scheduling delivery of materials to the Site.

III. Storage and Unloading

Contractor shall be solely responsible for receiving, unloading, handling and storing all materials that are not owner supplied for the Work upon delivery at the Site at Contractor's sole cost, expense (including, but not limited to drayage), risk and account (at no additional cost to Owner). Unloading must be accomplished within the Shipper's "free period" and any demurrage charges resulting from failure to do so shall be at Contractor's sole expense, risk and account (at no cost to Owner). Contractor may store material, machinery, and equipment in an area designated by Owner. Contractor is required to coordinate and relocate materials as necessary at no cost to Owner. Owner's designation of a storage area shall in no way make Owner responsible for damage to, loss or theft of such materials, machinery, and/or equipment.

28. Delays, Unknown Conditions and Suspension of the Work

A. Force Majeure

If Contractor is delayed in the prosecution or completion of the Work due solely to Acts of God or fire, floods, insurrections, riots, epidemics, acts of governmental authorities, changes in law or abnormally or unusually severe weather which are beyond the control and without the fault or negligence of Contractor and which have a material adverse effect upon Contractor's ability to complete the Work within the Agreement Time, then the Agreement Time shall be extended for a period consistent with the time by which completion is delayed. Contractor shall use its best efforts to make up any time lost by such delays, if any. Contractor shall notify Owner of any such delay and the causes therefor in writing within five (5) working days after the delay commences, otherwise Contractor will be deemed to have waived any extension of time. Contractor shall accept any extension of time from Owner in full and complete satisfaction for any increased cost or expense resulting from such excusable delay. There shall be no payment or compensation of any kind (including, but not limited to, costs, expenses and charges for standby time) to Contractor for expenses or damages arising from delay. Delays caused by the Contractor, its Subcontractors or materialmen shall not be considered reasons for an extension of time.

B. Unknown Conditions

If conditions (including, but not limited to subsurface or otherwise concealed physical conditions) are encountered at the Site which are unknown physical conditions (prior to such conditions being encountered) of an unusual nature and which differ materially from those ordinarily found to exist and are not generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then written notice by Contractor shall be given to Owner promptly before such conditions are disturbed and in no event later than three (3) days after the first occurrence of each condition. Owner and Engineer will promptly investigate such conditions and, if they are unknown, unusual, differ materially from those conditions ordinarily found to exist and are not generally recognized as inherent in construction activities of the character provided for in the Contract Documents and cause a material increase or decrease in the Contractor's cost of, or time required for, performance of all or any part of the Work, Engineer will recommend to Owner an equitable adjustment in the Agreement Price, Agreement Time or both. If Engineer determines that the conditions at the Site are not unknown, unusual, and do not materially differ from those conditions ordinarily found to exist and are generally recognized as inherent in construction activities of the character provided for in the Contract Documents and that no change in the terms of the Contract Documents is justified, Engineer shall so notify Owner and Contractor in writing, stating the reasons therefore. Engineer's decision in this regard shall be final.

C. Suspension of the Work

i. Owner may, at any time and without cause, suspend the Work or any portion thereof upon giving notice to Contractor. Contractor shall strictly comply with Owner's notice and shall reasonably act to minimize the cost of such suspension. Any part of the Work not suspended shall continue to be prosecuted with full diligence by Contractor.

ii. Owner may, at any time, direct Contractor to resume the Work which was previously suspended and an equitable adjustment may be made to pay for Contractor's direct actual costs and the costs of Contractor's supplies and subcontractors, including cost of storage, demurrage, and other direct delay costs, incurred during the period of suspension and provide, if appropriate, adjustment of the Agreement Time in accordance with all other provisions of the Contract Documents relating thereto.

iii. Should Owner suspend the Work for in excess of six (6) months, and Owner and Contractor do not agree to mutually satisfactory terms to extend such suspension, such suspension shall cause this Agreement to be terminated in accordance with Section 29 of this Agreement.

iv. The right of Owner to stop the Work shall not give rise to any duty or obligation on the part of Owner to exercise this right for the benefit of Contractor or any other person or entity.

29. Agreement Termination

I. Owner's Right to Terminate for Cause

A. Owner may, without prejudice to any other right or remedy, and upon giving Contractor written notice, terminate this Agreement immediately and may (without liability being attributed to Owner) take possession of the premises and of all materials, tools, equipment, and accessories thereon and finish the Work by whatever method Owner may deem expedient for any of the following reasons:

i. Contractor is adjudged bankrupt;

ii. Contractor makes a general assignment for the benefit of its creditors;

iii. Contractor becomes insolvent;

iv. A receiver is appointed on account of Contractor's insolvency;

v. Contractor, at any time, refuses or fails to pursue the Work with due diligence; or to supply enough properly skilled workmen; or provide the proper quality and/or quantity of materials; or there is a reasonable doubt about whether the Contractor will be able to complete the Work in accordance with the Agreement Time and Agreement Price;

vi. Contractor fails to make prompt payment to Subcontractors or its workmen for material, equipment or labor;

vii. Contractor disregards any laws, regulations ordinances, permit conditions or rules of Owner; or

viii. Contractor breaches any of the terms or conditions of the Contract Documents (including, but not limited to, any provisions regarding the completion and submission of Waiver and Release Forms for Contractor and/or its Subcontractors).

B. Upon receipt of such termination notice, Contractor shall immediately discontinue the Work and deliver to Owner all permits, licenses, Contract and Shop Drawings, inspection reports, certifications or certificates obtained by Contractor relating in any way to any portion of the Work, together with a waiver and release fully executed by Contractor on a form provided by Owner in Section VII of the Contract Documents. Additionally, Contractor shall at the request of Owner, cancel any outstanding purchase orders or subcontracts or assign such purchase orders or subcontracts to Owner. Contractor shall not be entitled to receive any further payment from Owner for Work completed prior to the date of termination or any retainage until Final Acceptance of the Work pursuant to the provisions provided herein.

C. If after termination of Contractor's right to proceed for cause, it is determined that there was no cause or default to terminate Contractor therefore, the rights and obligations of the parties shall be the same as if the termination had been issued by Owner under Section 29(III) of this Agreement.

II. Remedies in the Event of Owner's Termination of Contractor for Cause

A. Promptly upon termination of Contractor by Owner for cause, Owner shall make a determination of the cost of finishing the Work. Owner may finish the Work by whatever method Owner deems expedient. If the unpaid balance of the Agreement Price exceeds the expense of finishing the Work, including compensation for additional engineering, managerial, and legal and administrative services, such excess shall be retained by Owner without any accounting to Contractor. If the expense of finishing the Work exceeds the unpaid balance of the Agreement Price, Contractor shall pay the difference immediately to Owner.

B. Contractor shall be liable for all costs and expenses incurred by Owner and others if Contractor is terminated by Owner for cause including, but not limited to, all reasonable attorneys' fees, professional engineering fees and charges, sampling and testing fees, experts' fees and other consultants' fees and charges. These remedies are in addition to, and not in limitation of, any remedies provided at law, in equity or otherwise pursuant to the Contract Documents of Owner.

III. Other Termination

Owner may, without prejudice to any other right or remedy, and upon giving Contractor prior written notice, unilaterally terminate this Agreement for any reason or no reason, in Owner's sole discretion. Upon receipt of such notice, Contractor shall immediately discontinue the Work unless the notice provides otherwise, and deliver to Owner all permits, licenses, certificates, drawings and all other work prepared or obtained by Contractor relating in any way to any portion of the Work, together with fully executed Waiver and Release Forms for itself and its Subcontractors. Additionally, Contractor shall, at the request of Owner, cancel any outstanding purchase orders or subcontracts or assign such purchase orders or subcontracts to Owner as requested by Owner. Owner shall pay to Contractor: i) that portion of the Agreement Price representing that portion of the Work satisfactorily completed prior to termination; ii) any direct and reasonable costs of demobilization, or termination charges associated with subcontractor and supplier demobilization and cancellation; iii) any other reasonable, necessary and direct expenses associated with such termination; and iv) a fee of seven percent (7%) calculated on items (ii) and (iii) above representing administrative costs incurred by Contractor and a reasonable profit thereon, less any amounts previously paid to or withheld by Contractor for such completed Work. No other amounts shall be payable to Contractor regarding such termination. In addition, the payments provided for herein shall be accepted by Contractor as its sole and exclusive compensation in the event of termination hereunder and in lieu of any and all liability of any nature whatsoever on the part of Owner.

30. The Premises and Completion of the Work

I. Substantial Completion, Final Inspection, Final Acceptance and Occupancy of the Work

A. When Contractor considers the entire Work or a designated portion thereof ready for its intended use, Contractor shall send notice to Owner certifying in writing that:

i. The Contract Documents have been reviewed; and,

ii. The Work has been inspected for compliance with the Contract Documents; and,

iii. After such inspection by Contractor, the Work has been completed in accordance with the Contract Documents; and,

iv. All equipment and systems constructed by Contractor hereunder have been tested in the presence of Owner and are operational; and

v. The Work is completed and ready for Final Inspection.

B. After receipt by Owner of such written certification that the Work is ready for Final Inspection Owner shall promptly make such Final Inspection.

C. If Owner determines that Substantial Completion i.e., the Work is sufficiently completed, in accordance with the Contract Documents, so that the Work can be utilized for the purpose for which it was intended by Owner, has not occurred, Owner will promptly notify Contractor in writing, listing the reasons for not granting Substantial Completion and:

i. Contractor shall take immediate steps to remedy the stated deficiencies and shall send a second written certification to Owner; and

ii. Owner shall reinspect the Work; and

iii. Failure by Owner to include any items on the list of reasons for not granting Substantial Completion does not relieve Contractor of the liability or responsibility of Contractor to complete all Work in a good and workmanlike manner and in accordance with the terms and conditions of the Contract Documents.

iv. If Owner determines that Substantial Completion has occurred, Owner shall issue a certificate of Substantial Completion.

v. Owner shall have the right to exclude Contractor from the Work after the date of Substantial Completion.

D. Owner may, if it finds it necessary, occupy or use a portion or portions of the Work prior to or after Substantial Completion thereof. Occupancy or use of a portion or portions of the Work shall not constitute acceptance of the Work by Owner or relieve Contractor of its obligations and/or liabilities hereunder.

E. After Substantial Completion **of all of the Work** has occurred, Contractor may make application for Final Acceptance to Owner. Such application may be made only if:

i. Substantial Completion (as defined herein) has occurred (i.e., all items of correction have been completed to the satisfaction of Owner, the Work has passed Final Inspection by Owner and Owner has issued a Certificate of Substantial Completion); and,

ii. Owner has received all maintenance and operating instructions for equipment and/or systems provided hereunder, schedules, guarantees, bonds, certificates of inspection, applicable certifications, Shop Drawings, record documents and other documents required to be prepared and/or delivered to Owner hereunder; and,

iii. Owner has received all fully executed Waiver and Release Forms (including Waiver and Release Forms for Final Payment) from the Contractor and all Subcontractors (as defined herein) on Waiver and Release Forms which are attached hereto in Section VII of the Bid and Contract Documents; and,

iv. Owner has received Payment Forms for all remaining amounts due and owing but yet unpaid for the Work.

F. If Contractor has complied with all of the terms and conditions contained in Sections 30 of this Agreement for all of the Work, Owner shall issue Final Acceptance to Contractor for that part of the Work which is in compliance with all of the above.

31. Use of the Premises

A. Contractor shall comply with and enforce the rules and requirements of Owner and all applicable laws, regulations, ordinances and permit conditions with reference to deliveries, storage of equipment and/or material, enclosures, barriers, signs, advertisements, smoking, and deportment of employees on the premises.

B. Contractor shall conduct its operations at the premises in such a manner as to cause a minimum of inconvenience or disturbance to or interference with the normal and uninterrupted utilization of existing premises, Facilities, business operations and services adjacent to or in the vicinity of the premises. Operations which could prevent access thereto, interrupt, restrict or otherwise infringe upon the utilization or business operation thereof, shall be coordinated with Owner prior to the initiation of such operations. Contractor shall assure free, convenient, unencumbered and direct access to properties neighboring the Site for owners of such properties and their respective tenants, agents, invitees and guests.

C. Facilities shall not be interrupted without approval from Owner as to time and duration. No Facilities serving existing Site operations shall be discontinued until new service connections are installed (unless temporary connections are made to serve such Site operations).

D. The Work shall be performed during daylight hours. Non-daylight work must be approved by Owner in writing.

E. All personal vehicles shall be parked at a location designated by Owner. Only essential work-related vehicles will be permitted on the Site.

F. All of Contractor's personnel including Subcontractors shall sign in and out daily at the Site, as required by Owner. Visitors, including delivery personnel, shall be escorted by Contractor's personnel while on Owner's property.

32. Housekeeping

A. Contractor shall maintain the Site, all roadways utilized to access the Site and all working areas in a reasonably clean and orderly condition. Contractor shall perform cleanups when

necessary or as ordered by Owner. In no event shall cleanups be performed less frequently than once per week.

B. Contractor shall leave all surfaces free from any contamination resulting from performance of the Work. Upon completion or termination of the Work, Contractor shall remove from the Site and from all public and private property, at its own expense, all temporary structures and Facilities, tools, excess construction materials, fences and scaffolding which remain from its performance of the Work or operations hereunder. All waste materials, rubbish and all other debris of any kind resulting from performance of the Work or operation hereunder shall be disposed of pursuant to the provisions of this Section of the Agreement and the Contract Documents.

C. Owner shall provide a container for collection of all construction and other waste produced by Contractor, its employees and Subcontractors. Contractor shall be responsible for collection and delivery of the waste to the container and shall be responsible for maintaining the waste in accordance with all safety laws, rules, regulations, standards, ordinances, orders, Site permit conditions and precautions. Contractor warrants that such waste shall not contain any hazardous, explosive, highly flammable, infectious, pathological, radioactive, toxic or illegal waste as defined under any applicable laws, regulations or operating permits. Owner shall dispose of such waste.

33. Temporary Facilities

Contractor shall provide and secure all such temporary facilities and utilities as necessary to complete the Work. Such facilities and utilities shall include, but are not limited to, the following:

A. Pumps and hoses required to convey all water;

B. Toilets and sanitary facilities;

C. Commercial electrical power, if available;

D. Compressed air;

E. Signs, barricades, warning lights, scaffolding, shoring, sheeting, bracing and all safety devices;

F. Field office(s) and phone service; and/or

G. Temporary storage buildings.

34. Miscellaneous Terms and Conditions

A. Separate Contracts
Separate contracts may be awarded for different parts of the Work and/or for various types of Work at the Site. Contractor shall afford other contractors and Owner (if applicable) working on the Site reasonable opportunities for the receipt and storage of their materials and equipment and shall coordinate its work with theirs at no cost to Owner.

B. Additional, Omitted, or Changed Work
i. Owner may authorize minor variations in the Work from the terms and conditions of the Contract Documents including, but not limited to, the Contract Drawings and Technical Specifications which do not involve an adjustment in the Agreement Price or the

Agreement Time and are consistent with the overall intent of the Contract Documents. Such authorization may be implemented by a Field Order issued to Contractor and will be binding on Contractor who shall perform the Work involved promptly. If Contractor believes that a Field Order from Owner justifies an increase in the Agreement Price or an extension of the Agreement Time, Contractor shall send a written notice to Owner requesting a Change Order described below within five (5) days after receipt by Contractor of such Field Order; otherwise, Contractor shall perform all work required by the Field Order promptly and no change in the Agreement Price nor Agreement Time shall be permitted.

ii. Owner, without invalidating the Agreement may, in its sole discretion, order changes in the Work or the Contract Documents within the general scope of this Agreement consisting of additions, deletions or other revisions, with the Agreement Price and the Period of Performance being adjusted accordingly. However, if Owner orders portions or all of the Work not to be performed, Owner shall do so in writing and Contractor shall delete such work as is indicated in the notice from the Work to be performed pursuant to this Agreement and shall reduce the Agreement Price and Period of Performance in proportion to such reduction. Notwithstanding any term or condition of this Agreement, a Change Order need not be executed to reflect Owner's deletion of Work from the scope of the Work but may be executed to reflect such change.

iii. Unless otherwise provided herein, a Change Order requested by Contractor shall be considered by Owner only if Contractor makes a request for a Change Order by sending written notice to Owner promptly but in no event later than five (5) days after the occurrence of the event giving rise to the request for a Change Order; otherwise, Contractor shall not have a right to submit a Change Order to Owner for such event and no change in the Agreement Price nor Agreement Time shall be permitted. The notice to Owner must state the specific nature of the request. No request by Contractor for a change in the Contract Documents or adjustment in the Agreement Price or Agreement Time will be valid if not submitted in accordance with this Paragraph.

iv. If Owner considers a Change Order to be acceptable, it shall be executed by Owner's Authorized Representative. If Contractor considers a Change Order to be acceptable, it shall be executed by Contractor's duly authorized representative or Superintendent. The form of Change Order to be used hereunder is provided in Section VII of the Bid and Contract Documents. Change Orders must be fully executed by both parties hereto prior to performance of the Extra Work which is the subject of the Change Order. Any changes in the terms or conditions of the Contract Documents as authorized by a Change Order fully executed by both parties hereto shall be performed under the applicable conditions of the Contract Documents (not modified by such Change Order). Changes that result in an increase in Agreement Price shall be calculated in accordance with the following methods:

a. Firm Lump Sum - If Owner requests, Contractor shall submit a written proposal covering the Extra Work on a firm lump sum basis. Owner shall review such proposal and upon mutual agreement, a Change Order to the Agreement shall be issued; and/or

b. Fixed Unit Prices - If Owner requests, and fixed unit prices are established in Section IX of the Bid and Contract Documents, then the increase in the Agreement Price shall be computed using such prices, except, however, these fixed unit prices shall apply only for quantities fluctuation of greater than 20 percent (20%) of the original quantity. Quantity fluctuation in excess of 20 percent (20%) will require a re-evaluation of the fixed unit prices. If the fixed unit prices are not established in the

Agreement or Contract Documents or such re-evaluation requires that different prices should apply, then Owner and Contractor shall negotiate and mutually agree upon fixed unit prices to apply to such changed work; and/or

c. Actual Cost - If Owner requests, Contractor shall perform the Extra Work covered by any increase in the Agreement Price on the basis of the actual cost incurred plus allowances for overhead and profit as provided herein.

v. The direct cost of labor to Contractor at the rates set forth in Section IX of the Bid and Contract Documents shall be used, or, if no rates are attached, the effective rates established by any applicable labor agreement, including any surcharges contained in such labor agreement for fringe benefits, payroll taxes, and insurance shall apply. Such labor costs shall include all classifications up to and including General Foremen, but shall not include Contractor's clerical and supervisory employees, regardless of classification. Contractor shall receive an allowance of ten percent (10%) total for overhead and profit on the costs described in this Paragraph;

vi. The actual cost of materials incorporated into the Extra Work shall be used. Contractor must receive written authorization from Owner to furnish such materials prior to incorporation of such materials into the Extra Work. Contractor must establish that it has endeavored to obtain such materials at the lowest available prices and shall verify the cost of all materials by submitting the actual invoice. Material usage shall be subject to verification by Owner. Contractor shall receive an allowance of ten percent (10%) total for overhead and profit on the costs described in this Paragraph;

vii. The actual cost for the Extra Work subcontracted by Contractor will be allowed only when each Subcontractor has been approved in writing by Owner before Contractor commences such Extra Work. Only the net cost to Contractor shall be considered a cost hereunder that may be billed to Owner, it being understood that, on any actual cost work by its Subcontractor(s), that allowances for tools, supplies, overhead, supervision and profit to the Subcontractor(s) shall not exceed ten percent (10%);

viii. The actual cost of equipment rented by Contractor from third parties not affiliated with Contractor at no more than published rates (i.e., Bluebook Equipment Rates) plus operating costs, less the applicable discount associated with the area where the Work is being performed shall be used. Contractor shall receive an allowance of ten percent (10%) total for overhead and profit on the costs described in this Paragraph; and

ix. The cost of rental of Contractor-owned equipment which shall include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance, depreciation, storage and insurance at rates which are attached hereto in Section IX of the Bid and Contract Documents shall be used. Such costs shall not exceed the rental rates as published in the most current Bluebook Equipment Rate Guide. If rates are not attached hereto, then the cost of such equipment shall be at actual cost not to exceed the rental rates published in the most current Bluebook Equipment Rate Guide. Hourly rental charges of equipment on the Site shall be on the basis of 1/176th of monthly rates. Operators of rental equipment shall be paid in accordance with the "labor" provisions of Section 34 of this Agreement.

x. For all purposes of the Contract Documents, the profit and overhead allowances provided herein shall be deemed complete compensation to Contractor for all cost attributed to or apportioned to the Extra Work. By way of illustration, overhead and profit shall be deemed to include, but not be limited to: Contractor's profit; cost of capital; supervision; clerical and non-manual labor; all tools having a replacement value

of less than $200; expendable supplies; warehousing costs; local transportation of material and labor; all expenses of Contractor prior to beginning the Extra Work; preparatory work performed by Contractor prior to beginning the Extra Work; Extra Work performed by Contractor which does not meet the standards to which the Work should be performed under the terms and conditions of the Contract Documents, including the cost of correcting or replacing such Extra Work, taxes on Contractor's income, profit, franchise, occupational license, or personal property; and fines or assessments against Contractor by any governmental authority.

xi. The compensation established herein for any change ordered by Owner shall be the sole and exclusive consideration for such change. Any increased overhead, extension of the Agreement Time, inefficiencies, and all other costs and profits are incorporated into the compensation established pursuant to this Section of the Agreement and are agreed upon by Contractor.

xii. If notice of any change affecting the Work or the provisions of the Contract Documents (including, but not limited to, the Agreement Price or Agreement Time) is required by the provisions of any bond to be given to a surety, the giving of any such notice shall be Contractor's responsibility, and the amount of each applicable bond shall be increased by any increase in the Agreement Price caused by such Change Order.

C. If a dispute arises, Owner and Contractor will attempt to settle any dispute arising out of or relating to this Agreement through cooperation and negotiation in good faith. Either party may initiate such negotiations at any time upon written request to the other. Either party may demand that the dispute be submitted to mediation, by written notice to the other party. When such a demand is made, the parties shall within ten (10) days jointly make arrangements for the mediation of the dispute within the State of Maine with a mutually agreeable party ("ADR Service Provider"), whose procedures for mediation of business disputes in effect on the date of the written demand for mediation shall govern the mediation in all respects, except as modified by written agreement of the parties.

35. Right to Audit

Owner shall have the right to audit all books, records and accounts of Contractor solely relating to the performance of the Work and for a period of two (2) years following Final Acceptance of the Work, during which time Contractor agrees to maintain such books, records and accounts at its own expense. Owner shall have full access to priced copies of all such records, accounts, purchase orders, invoices, equipment leases, subcontracts, time sheets and receipts of Contractor in order to verify the cost of the Work and any overhead and profit relating thereto.

36. Notice

Any notice required under this Agreement shall be given by and shall correspondingly be deemed received as follows: personal delivery (on the date of delivery); or, telecopy [on the date of transmission (if received during normal business hours)]; or, overnight express mail (on the day after delivery to a reputable overnight delivery service or the U.S Postal Service) or by registered or certified U.S. Mail, return receipt requested, (on the third day after being post-marked by the U.S. Postal Service); if addressed to the party to whom intended, and is sent with sufficient prepaid postage or delivery fees. Notice shall be given to the parties at the following addresses:

To Owner:

One copy of notice shall also be sent to the Engineering Department of Owner to the attention of Jeffrey Pelletier, Environmental Manager at:

Casella Waste Systems, Inc.
358 Emerson Mill Road
Hampden, ME 04444
Email: Jeffrey.Pelletier @casella.com

One copy of notice shall also be sent to the Legal Department of Owner to the attention of the General Counsel at: 25 Greens Hill Lane
Rutland, Vermont 05701
802-775-6198 (fax)

To Contractor:

Either party may change the location for receipt of notice hereunder by providing written notice to the other party as aforesaid.

37. Copies of Contract Documents Furnished to the Contractor

Upon execution of this Agreement, Owner may, if requested, provide one (1) copy of the Contract Documents to Contractor free of charge. Any additional copies shall be purchased for the cost of reproduction and handling.

38. Law and Severability

This Agreement is to be governed by the laws of the location of the Work. In the event that any provision(s) or portion of such provision(s) of the Contract Documents shall be void, unlawful or unenforceable, such provision(s) or portions thereof, shall be deemed stricken from the Contract Documents, but the Contract Documents shall not otherwise be affected and the remaining provisions, or portions thereof, shall continue in full force and effect.

39. Modification and Non-waiver

The parties agree that no change or modification to the Contract Documents, or any documents incorporated by reference herein or otherwise made a part of the Contract Documents, shall have any force or effect unless the change is in writing, dated and made a part of this Agreement. The execution of the change shall be authorized and signed in the same manner as this Agreement or as authorized by the Change Order provisions of this Agreement. In addition, any failure by Owner at any time or from time to time, to require the strict adherence to and performance of the terms or conditions of the Contract Documents shall not constitute a waiver by Owner nor impair Owner's right to enforce such terms or conditions or any other terms or conditions of the Contract Documents.

40. Assignment

A. Contractor may not assign or subcontract any portion of the Work, right to payment or any terms or conditions of the Contract Documents without the prior written approval of Owner. The parties agree that there are no third-party beneficiaries to this Agreement.

B. No assignment, transfer, or subcontract, even though consented to, shall relieve Contractor of its obligations, responsibilities and liability under the Contract Documents.

C. Should any assignee fail to perform the Work undertaken by it in a proper manner, Owner may, at Owner's option, require Contractor to terminate such assignment.

D. Owner may, in its sole discretion, freely assign this Agreement to any of its parent, subsidiary or affiliated companies or any other individual or entity.

41. Headings

All headings in this Agreement have been inserted for convenience of reference only and are not to be considered a part of this Agreement nor shall they in any way affect the interpretation of this Agreement.

42. Separate Counterparts and Telecopy

This Agreement may be executed in separate counterparts which shall collectively and separately be considered one and the same Agreement. No party shall be bound by this Agreement until Owner and Contractor have fully executed it. In addition, a telecopy or facsimile of this Agreement (including, but not limited to, executed signature pages) shall have the same legal force and effect as an original. If this Agreement is executed by telecopy or facsimile, originals of the executed Agreement shall be forwarded to both parties as soon as reasonably possible.

43. Remedies and Rights Not Exclusive

No remedies or rights herein conferred upon Owner are intended to be exclusive of any remedy or right provided by law, but each shall be cumulative and shall be in addition to every other remedy or right given hereunder or now or hereafter existing at law or in equity (including, but not limited to, the remedy of specific performance).

44. Approvals, Authorizations, Certifications, Reviews and/or Concurrences, etc. By Owner, Engineer or CQA Consultant

Any approvals, authorizations, certifications, reviews, observations, acceptances (including, but not limited to, Final Acceptance), progress payments, Final Payment, consents, inspections (including, but not limited to, Final Inspection), verifications, beliefs, monitoring, testing, opinions, indications of satisfaction, and/or concurrences by Owner, Engineer or CQA Consultant does not constitute acceptance, approval, certification nor assurance of completeness, quality, or accuracy concerning details, dimensions and quantities and shall not relieve Contractor of any obligations, responsibility or liability for Contractor's active or passive negligence, willful misconduct or strict liability, defects in workmanship, proper performance of the Work in a good and workmanlike manner, in accordance with the Contract Documents, and pursuant to the proper manner, means, methods, techniques, management, sequences and procedures of construction or safety nor shall such actions on Owner's part cause any liability or responsibility to be attributed to Owner. In addition, Contractor agrees to hold Owner indemnify, defend and hold harmless Owner from all claims, lawsuits, damages, costs, expenses (including, but not limited to, all reasonable attorneys', professional engineering, sampling and testing, experts' and other consultants' fees and charges) and liability for such actions taken by Owner as reflected in Section 34 of this Agreement.

45. Integration and Interpretation

This Agreement shall include the following documents which were previously sent to and received by Contractor in the Bid Package entitled “Bid Documents, Cell 18 Construction, Juniper Ridge Landfill, Old Town, Maine,” and which is incorporated by reference into this Agreement as fully as if set forth herein in their entirety:

A. Section Number Title

I	Invitation for Bid
II	Instructions to Bidders
III	Bid Forms and Bid Form Attachments
IV	Technical Specifications
V	Contract Drawings
VI	CQA Plan
VII	Construction Agreement and Forms
VIII	Performance and Payment Bonds
IX	The Agreement Price - Fees, Charges, Rates, and Additional Terms and Conditions

B. The various Contract Documents that constitute this Agreement shall, insofar as is possible, be so interpreted as to be consistent with one another. In the event of any conflict among the terms and conditions of the Contract Documents, this Agreement shall take precedence over all other documents.

C. If a discrepancy or inconsistency exists between the Contract Drawings and the Technical Specifications, Contractor shall notify Owner immediately for a resolution. Until a resolution is made by Owner, the Contract Drawings shall have precedence over the Technical Specifications (except as provided in paragraph "D" of this Section of the Agreement).

D. Among all Contract Documents (except for the Agreement which has precedence over all documents) the more stringent specifications shall have precedence over the less stringent specifications in such documents.

E. The document of the latest date shall govern unless such order of precedence is otherwise addressed in this Section of the Agreement.

F. All references in the Technical Specifications to "Industry Codes and Standards," or to "Manufacturer's Recommended Specifications," shall be deemed to refer to the latest editions or revisions of such "Standards" and "Specifications."

46. Entire Agreement and Binding Effect

This Agreement, including any Change Orders fully executed by both parties hereto and all documents incorporated by reference herein or specifically made a part of this Agreement as expressed herein, represents a negotiated agreement between and constitutes the entire agreement and understanding between Owner and Contractor. This Agreement shall supersede any prior written or oral negotiations, representations, agreements or understandings relating to the subject matter of the Contract Documents. In addition, this Agreement shall be binding upon all parties hereto, their heirs, successors, representatives and assigns.

_____	NEWSME LANDFILL OPERATIONS LLC
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____

SECTION VII

FORMS PACKAGE

CHANGE ORDER

CONTRACTOR:

_____

_____

_____

OWNER:

_____

_____

_____

SITE:

_____

_____

_____

PROJECT:

_____

_____

_____

CHANGE ORDER NUMBER: _____

DATE: _____

CONTRACT DESCRIPTION:

(Agreement) (Addendum) by and between

_____

and

_____

dated _____

as thereafter amended or changed pursuant to the terms of such Agreement (hereinafter referred to as the "Agreement") for the proper performance of all necessary, required and/or related Work to:

_____

_____

at the Site.

Contractor and Owner, intending to be legally bound hereby, agree to make the following changes to the Agreement:

I. Contractor shall provide all necessary and required labor, materials, tools, services, equipment, and incidentals to

_____

_____

_____

II. This Change Order shall incorporate by reference the terms and conditions of the Agreement as fully as if reproduced in its entirety herein.

III. Contractor shall obtain the necessary insurance coverage and Certificates of Insurance as required by the Agreement prior to performing any Work.

IV. All other terms and conditions of the Agreement shall remain the same.

V. Change Order Summary:

A. The original Agreement Price was $_____

B. Net change by previously authorized Change Orders $_____

C. The Agreement Price prior to this Change Order was $_____

D. The Agreement Price for this Change Order is $_____

E. The new Agreement Price of the Agreement (including this Change Order) is $_____

F. The Agreement Time for Substantial Completion of the Work required pursuant to the Agreement and this Change Order shall be _____, 20___(remain unchanged).

IN WITNESS WHEREOF, the parties hereto set forth their signatures as of the date first set forth above.

WITNESS:

By: _____

Printed Name: _____

CONTRACTOR:

By: _____

Printed Name: _____

Title: _____

WITNESS:

By: _____

Printed Name: _____

OWNER:

_____

CASELLA WASTE SYSTEMS, INC.

By: _____

Printed Name: _____

Title: _____

ATTACHMENT C-1

WAIVER AND RELEASE FORMS (CONTRACTOR)

WAIVER AND RELEASE FORM
(PROGRESS PAYMENT FOR CONTRACTOR)

Upon receipt of a progress payment in the sum of $_____ for labor, services, equipment, materials, permits, licenses and/or other goods or services (the "Goods and Services") provided to _____ (the "Owner") regarding the Work performed by _____ (the "Contractor") at _____ _____ as further set forth in an agreement between Owner and Contractor, dated _____, for _____as thereafter amended or modified (hereafter referred to as the "Agreement"), Contractor on behalf of itself, its employees, agents, subcontractors, vendors, materialmen and suppliers, at any tier, (hereafter collectively and individually referred to as the "Releasors") does hereby, to the fullest extent permitted by law and to the extent of receipt of the amount of the progress payment reflected above hereby, waives, releases and forever relinquishes, *pro tanto*, any and all: mechanics' liens; levies of any kind; attachment liens; judgment liens; execution liens; stop notices; bond rights; claims, lawsuits, losses, damages, costs and expenses (including, but not limited to, all attorneys', professional engineering, testing and sampling, experts' and other consultants' fees and charges) (hereafter collectively and individually referred to as the "Claims") which the Releasors had previously, have at the present time or may have in the future pertaining to the Goods and Services furnished or installed in connection with the Work (as defined in the Agreement) including, but not limited to, such Claims against or concerning the following: retainage or other funds not yet paid in accordance with the terms and conditions of the Agreement, land, buildings, structures, additions, improvements or personally constructed under the Agreement and/or arising out of the Work furnished or installed thereunder; and/or all other assets (hereafter collectively and individually referred to as the "Assets") of Owner its parent corporation, its subsidiar(y)(ies) and affiliated companies and their respective officers, directors, shareholders, agents, employees, representatives, subcontractors, their successors and assigns (hereafter collectively and individually referred to as the "Releasees").

In addition to, and not in limitation of, any term or condition contained in the Agreement, to the fullest extent permitted by law, Contractor shall indemnify, defend and hold Releasees harmless, from any Claims against Releasees or the Assets and shall fully satisfy of record any such Claims incurred by Releasees because of the Contractor's or any of the Releasors' performance of the Work and breach of any terms or conditions of the Agreement or this Waiver and Release, at Contractor's sole cost and expense (including, but not limited to, all recording, reasonable attorneys', professional engineering, experts' and other consultants' fees and charges). If Contractor fails to satisfy any such Claims of record within five (5) calendar days after Owner's request to Contractor to do so, Owner may, but is not obligated to, satisfy such Claims of record and charge all costs and expenses associated therewith (including, but not limited to, all reasonable attorneys', professional engineering, experts', recording and other consultants' fees and charges) to Contractor who shall be solely responsible to pay for such charges (at no cost to the Releasees).

This Waiver and Release Form covers a progress payment for the Goods and Services provided to Owner for Work performed through _____ only and does not cover any retention or Goods and Services furnished or installed after that date.

WITNESS: _____ **CONTRACTOR:**

By: _____ **By: _____**

Printed Name: _____ **Printed Name: _____**

WAIVER AND RELEASE FORM
(FINAL PAYMENT FOR CONTRACTOR)

Upon receipt of Final Payment in the sum of $_____ for labor, services, equipment, materials, permits, licenses and/or other goods or services (the "Goods and Services") provided to _____ (the "Owner") regarding the Work (as defined in the Agreement) performed by _____ (the "Contractor") at _____ _____, as further set forth in an agreement between Owner and Contractor, dated _____, for _____ _____ as thereafter amended or modified (the "Agreement"), Contractor on behalf of itself, its employees, agents, subcontractors, vendors, materialmen and suppliers, at any tier, (hereafter collectively and individually referred to as the "Releasors") does hereby to the fullest extent permitted by law:

A. Waive, release and forever relinquish any and all mechanics' liens; levies of any kind; attachment liens; judgment liens; execution liens; stop notices; bond rights; claims, lawsuits, losses, damages, costs and expenses (including, but not limited to, all attorneys', professional engineering, testing and sampling, experts' and other consultants' fees and charges) (hereafter collectively and individually referred to as the "Claims") which the Contractor had previously, has at the present time or may have in the future pertaining to such Goods and Services furnished or installed in connection with the Work (as defined in the Agreement) including, but not limited to, such Claims against or concerning the following: retainage or other funds not yet paid in accordance with the terms and conditions of the Agreement, land, buildings, structures, additions, improvements or personally constructed under the Agreement and/or arising out of the Work furnished or installed thereunder; and/or all other assets (hereafter collectively and individually referred to as the "Assets") of Owner, its parent corporation, its subsidiar(y)(ies) and affiliated companies and their respective officers, directors, shareholders, agents, employees, representatives, subcontractors, their successors and assigns (hereafter collectively and individually referred to as "Releasees"); and,

B. Warrant that there are no amounts or Claims owed by the Contractor or the Releasors to any person or entity which could become the basis for a Claim against Releasees and in addition to, but not in limitation of, any terms or conditions contained in the Agreement, shall indemnify, defend and hold Releasees harmless, from any and all Claims whatsoever arising at law or in equity, or otherwise which Releasors may have against Releasees or the Assets by reason of any matter, cause or thing whatsoever arising out of performance of the Work, the Agreement and/or this Waiver and Release. Contractor shall fully satisfy of record any such Claims against Releasees or the Assets at Contractor's sole cost and expense (including, but not limited to, recording, reasonable attorneys', professional engineering, experts' and other consultants' fees and charges). If Contractor fails to satisfy such Claim of record within five (5) calendar days after Owner's request to Contractor to do so, Owner may, but is not obligated to, satisfy such Claim of record and charge all costs and expenses associated therewith (including, but not limited to, all reasonable attorneys', professional engineering, experts', recording and other consultants' fees and charges) to Contractor who shall be solely responsible to pay for such charges (at no cost to Releasees).

WITNESS:

By: _____

Printed Name: _____

CONTRACTOR:

By: _____

Printed Name: _____

Title: _____

ATTACHMENT C-2

WAIVER AND RELEASE FORMS (SUBCONTRACTORS)

WAIVER AND RELEASE FORM
(PROGRESS PAYMENT FOR SUBCONTRACTOR)

Upon receipt of a progress payment in the sum of $_____ for all labor, services, equipment, rental, materials, permits, licenses and/or other goods or services (hereinafter the "Goods and Services") for _____ _____ (attach purchase order, agreement or scope of work and mark as Exhibit A) (hereafter referred to as the "Work") which is provided to _____ (the "Contractor") as part of the Work performed pursuant to an agreement between Contractor and _____ (the "Owner") dated _____, for _____ at _____ as thereafter amended or modified (the "Agreement"), the Undersigned on behalf of itself, its employees, agents, subcontractors, vendors, materialmen and suppliers, at any tier, (hereafter collectively and individually referred to as the "Subcontractor Releasors") does hereby, to the fullest extent permitted by law and to the extent of receipt of the amount of the progress payment reflected above hereby, waives, releases and forever relinquishes, *pro tanto*, any and all: mechanics' liens; levies of any kind; attachment liens; judgment liens; execution liens; stop notices; bond rights; claims, lawsuits, losses, damages, costs and expenses (including, but not limited to, all attorneys', professional engineering, testing and sampling, experts' and other consultants' fees and charges) (hereafter collectively and individually referred to as the "Claims") which the Subcontractor Releasors had previously, have at the present time or may have in the future pertaining to the Goods and Services furnished or installed in connection with the Work including, but not limited to, such Claims against or concerning the following: retainage or other funds not yet paid in accordance with the terms and conditions of the Agreement, land, buildings, structures, additions, improvements or personally constructed under the Agreement and/or arising out of the Work furnished or installed thereunder; and/or all other assets (hereafter collectively and individually referred to as the "Assets"), of Owner its parent corporation, its subsidiar(y)(ies) and affiliated companies and their respective officers, directors, shareholders, agents, employees, representatives, subcontractors, their successors and assigns (hereafter collectively and individually referred to as the "Releasees").

To the fullest extent permitted by law, the Undersigned shall indemnify, defend and hold the Releasees harmless, from any Claims against the Releasees or the Assets and shall fully satisfy of record any such Claims against the Releasees or the Assets at the Undersigned's sole cost and expense (including, but not limited to, all recording, reasonable attorneys', professional engineering, experts' and other consultants' fees and charges) arising out of performance of the Work and breach of any terms or conditions of this Waiver and Release by the Undersigned or the Subcontractor Releasors. If the Undersigned fails to satisfy any such Claims of record within five (5) calendar days after Owner's request to the Undersigned to do so, Owner may, but is not obligated to, satisfy such Claims of record and charge all costs and expenses associated therewith (including, but not limited to, all reasonable attorneys', professional engineering, experts', recording and other consultants' fees and charges) to the Undersigned who shall be solely responsible to pay for such charges (at no cost to the Releasees).

This Waiver and Release Form covers a progress payment for the Goods and Services provided to Contractor or Owner for the Work performed through _____ only and does not cover any retention or Goods and Services furnished or installed after that date.

WITNESS:

By: _____

Printed Name: _____

CONTRACTOR:

By: _____

Printed Name: _____

Title: _____

WAIVER AND RELEASE FORM
(FINAL PAYMENT FOR SUBCONTRACTOR)

Upon receipt of Final Payment in the sum of $_____ for all labor, services, equipment, rental, materials, permits, licenses and/or other goods or services (hereinafter the "Goods and Services") for _____ _____ (attach purchase order, agreement or scope of work and mark as Exhibit A) (hereafter referred to as the "Work") which is provided to _____ (the "Contractor") as part of the Work performed pursuant to an agreement between Contractor and _____ (the "Owner") dated _____, for _____ at _____ as thereafter amended or modified (the "Agreement"), the Undersigned on behalf of itself, its employees, agents, subcontractors, vendors, materialmen and suppliers, at any tier, (hereafter collectively and individually referred to as the "Subcontractor Releasors") does hereby to the fullest extent permitted by law:

A. Waive, release and forever relinquish any and all mechanics' liens; levies of any kind; attachment liens; judgment liens; execution liens; stop notices; bond rights; claims, lawsuits, losses, damages, costs and expenses (including, but not limited to, all attorneys', professional engineering, testing and sampling, experts' and other consultants' fees and charges) (hereafter collectively and individually referred to as the "Claims") which the Subcontractor Releasors had previously, have at the present time or may have in the future pertaining to such Goods and Services furnished or installed in connection with the Work including, but not limited to, such Claims against or concerning the following: retainage or other funds not yet paid in accordance with the terms and conditions of the Agreement, land, buildings, structures, additions, improvements or personally constructed under the Agreement and/or arising out of the Work furnished or installed thereunder; and/or all other assets (hereafter collectively and individually referred to as the "Assets") of Owner, its parent corporation, its subsidiar(y)(ies) and affiliated companies and their respective officers, directors, shareholders, agents, employees, representatives, subcontractors, their successors and assigns (hereafter collectively and individually referred to as "Releasees"); and,

B. Warrant that there are no amounts or Claims owed by the Subcontractor Releasors to any person or entity which could become the basis for a Claim against Releasees and shall indemnify, defend and hold Releasees harmless, from any and all Claims whatsoever arising at law or in equity, or otherwise which Subcontractor Releasors may have against Releasees or the Assets by reason of any matter, cause or thing whatsoever arising out of the Undersigned's or Subcontractor Releasors' performance of the Work or this Waiver and Release. The Undersigned shall fully satisfy of record any such Claims at the Undersigned's sole cost and expense (including, but not limited to, recording, reasonable attorneys', professional engineering, experts' and other consultants' fees and charges). If the Undersigned fails to satisfy such Claim of record within five (5) calendar days after Owner's request to the Undersigned to do so, Owner may, but is not obligated to, satisfy such Claim of record and charge all costs and expenses associated therewith (including, but not limited to, all reasonable attorneys', professional engineering, experts', recording and other consultants' fees and charges) to the Undersigned who shall be solely responsible to pay for such charges (at no cost to Releasees).

NOTICE OF AWARD

DESCRIPTION OF WORK: Construction of Cell 18 at the Juniper Ridge Landfill facility in Old Town, Maine.

To:

The Owner has considered the Bid submitted by you on _____, for the above described work in response to its Notice and Instructions to Bidders dated **Month Year**.

It is to the best interest of said Owner to accept your Bid in the amount of **(**$**_____.___)**; you are hereby notified that your Bid has been accepted

Dated this **__ day of _____**

NEWSME Landfill Operations, LLC
Owner

By:_____

Title:_____

ACCEPTANCE OF NOTICE

Receipt of the above Notice of
Award is hereby acknowledged this
_____ day of _____, 20__

By:_____

Title:_____

NOTICE TO PROCEED

DESCRIPTION OF WORK: Construction of Cell 18 at the Juniper Ridge Landfill facility in Old Town, Maine, including mobilization, erosion control, site preparation, placement of underdrain system, placement of secondary liner system, placement of leak detection system, placement of composite liner system, placement of leachate collection system, and stormwater management features as described at the Pre-Bid Meeting on **Month Day Year**, as described in the specifications, and as shown on Contract Drawings**.**

To:

The Owner has considered the Bid submitted by you dated _____ for the above described work in response to its Notice and Instructions to Bidders dated **Month Year**.

The total net dollar amount covered by this notice is $_____

Dated this __ day of _____

NEWSME LANDFILL OPERATIONS, LLC
Owner

By:_____

Title:_____

ACCEPTANCE OF NOTICE

Receipt of the above Notice of
Award is hereby acknowledged this
_____ day of _____, 20__

By:_____

Title:_____

SECTION VIII

PERFORMANCE AND PAYMENT BONDS
(NOT IN THIS CONTRACT)

SME
SEVEE & MAHER
ENGINEERS

SECTION IX

THE AGREEMENT PRICE – FEES, CHARGES, RATES AND ADDITIONAL TERMS AND CONDITIONS (SEE BID FORM AND CONTSTRUCTION AGREEMENT IN PREVIOUS SECTIONS)

SME
SEVEE & MAHER
ENGINEERS

B. TECHNICAL SPECIFICATIONS

SME
SEVEE & MAHER
ENGINEERS

DIVISION 1

GENERAL REQUIREMENTS

SME
SEVEE & MAHER
ENGINEERS

SECTION 01010

SUMMARY OF WORK

1.01 WORK COVERED BY CONTRACT DOCUMENTS: These Contract Documents define the requirements of the construction of Cell 18 at the Juniper Ridge Landfill site in Old Town, Maine. Work shall include furnishing all materials (including materials source testing as shown on the Project Drawings, equipment, labor, supervision, and performing all operations required to complete the work as shown on the Project Drawings contained herein, and as described in the site's Quality Assurance/Quality Control Plan and the Project Specifications contained herein, and as evidently necessary to complete the work. Work shall include, but not be limited to, the following items:

Construction. Provide the equipment, labor, tools, materials, and supervision necessary for the successful completion of the work as detailed in the Contract Documents. The work includes, but is not limited to:

- Site layout;
- Installation and maintenance of all required erosion control measures including dewatering in accordance with Maine Department of Environmental Protection Best Management Practices;
- Clear and grub area within limit of work;
- Excavation and grading of Cell 18 to base grade as shown on the Project Drawings;
- Place and compact fill for Cell 18 perimeter berm as shown on the Project Drawings;
- Placement of underdrain sand layer;
- Installation of underdrain pipe;
- Installation of the 1-foot layer of compacted till barrier soil for secondary liner system;
- Installation of the Cell 18 secondary 60-mil HDPE geomembrane;
- Installation of the Cell 18 leak detection system, including drainage geocomposite, HDPE pipe, drainage stone, drainage sand, cleanouts, sample sump, and sampling ports;
- Installation of Cell 18 primary composite liner system including the 1-foot layer of compacted clay soil, GCL, and 80-mil HDPE geomembrane;
- Installation of the leachate collection system including drainage geocomposite, HDPE pipe, drainage sand, filter stone, drainage stone, cleanouts, collection sump, and leachate level transducer;
- Installation of the Cell 18 pump station pumps, piping and instrumentation;
- Installation of the 6-inch x 10-inch dual containment force main pipe;
- Installation of the 24-inch diameter landfill gas header pipe;
- Installation of the 8-inch diameter landfill gas pipe;
- Installation of the landfill gas condensate pump station;
- Abandonment of piezometers, observation wells, and monitoring wells as shown on the Project Drawings;
- Installation of SMH #34 as shown on the Project Drawings;
- Installation of electrical utility manholes as shown on the Project Drawings;
- Construction of Cell 18 access ramp;
- Construction of Detention Pond 11R;
- Construction of Detention Pond 14;
- Construction of east access road as shown on the Project Drawings;
- Installation of guard rail in locations shown on the Project Drawings;
- Construction of stormwater management features shown on the Project Drawings;
- Installation of chain link fencing as shown on the Project Drawings;
- Installation of litter fencing as shown on the Project Drawings;
- Dust control as specified in the Project Specifications;

- Dewatering and stormwater control throughout the duration of the project in accordance with the Project Specifications;
- Loam, seed and mulch all areas required by Project Specifications and all areas disturbed during construction or as directed by on-site Owner's Representative;
- Performing third-party leak location survey (Cell 18 primary geomembrane liner);
- Performing layout and as-built survey by Professional Land Surveyor of finished work including, but not limited to the following locations: all pipe and conduit locations, location of the anchor trench and tie-in seams, all culvert inverts, all manhole inverts and rim elevations, and finish topography on a 50-foot grid, including toe and crests of berms or dikes;
- Retaining a qualified electrical sub-contractor to provide the electrical and communication services required for on-site infrastructure in the Cell 18 pump station, and installation of the leachate collection transducer;
- Providing the necessary labor, equipment, materials, and supervision to assist the geosynthetic installer as required, including, but not limited to:
    - Unloading and field storage of the liner materials in accordance with manufacturer's recommendations;
    - Handling and deployment of the liner materials in accordance with manufacturer's recommendations;
    - Excavation and backfill of all liner anchor trenches;
    - Furnishing leachate collection sand for use in sandbags of the geomembrane anchoring system;
    - Preparation of all liner subgrade materials including moisture control, picking stones and roots as directed by the Engineer or CQA agent to provide a smooth rolled surface to the tolerances required by the Engineer or CQA agent, and assist in cleaning of the geomembrane liners as necessary;
    - Coordination of work schedule to accommodate the liner installation, including weekend and holiday work as necessary, and allowing sufficient turnaround time for results of destructive seam testing (typically 24 hours) prior to placing additional material over the HDPE seams; and
    - Placement of a minimum three (3) feet of suitable material, approved by the Engineer or CQA agent, over the liner materials before traveling on the liner with equipment other than low-pressure equipment approved by the Engineer or CQA agent.
- Maintain, repair, replace and remove (as necessary) all erosion control measures including, but not limited to, siltation fence, hay bales and stone check dams at the site to control erosion and sedimentation as required by the Project Specifications or as directed by on-site Owner's Representative; and
- Clean-up of the site following successful Contract completion.

1.02 SCHEDULE OF WORK:

All phases of the project must be completed within the timeframe noted in Section A of the bid form. The Contractor is encouraged to perform construction activities during normal working hours. The Contractor shall provide a detailed construction schedule to the Owner prior to beginning construction activities on-site.

1.03 CONTRACTOR USE OF PREMISES:

The Juniper Ridge Landfill is an active facility that receives wastes on a daily basis. It will be the responsibility of the Contractor to coordinate with NEWSME Operations with regard to use of premises, including haul routes and vehicular access. All details must be established prior to the preconstruction conference and shall be presented to NEWSME Operations at or before the preconstruction conference. The Contractor shall coordinate all construction activities so as not to interfere with active landfilling operations.

The Contractor shall obey all traffic, noise, and dust control policies of the Juniper Ridge Landfill, including primary access roads. The Contractor shall minimize the use of equipment engine brakes at the intersection of Route 16 and the site access road.

1.04 PROTECTION OF PROJECT WHILE UNDER CONSTRUCTION:

A. The Contractor will be responsible for providing complete protection of the contract limits of the Project during construction from any acts of nature or man, such as, but not limited to, floods, wind damage, earth slides, and slope failures. Damage to the Project caused by such acts will not be sufficient cause to increase contract costs to the Owner.

B. The Contractor shall take every precaution to ensure that no siltation of stormwater drainage courses occur when working in those areas.

C. The Contractor shall protect existing on-site structures from damage during construction, including: monitoring wells, power lines, maintenance facility, liner systems of existing cells, existing leachate collection and transport systems and LFG infrastructure, etc.

D. The Contractor shall be responsible for all repairs required to correct damage made to existing on-site structures described above resulting from any construction activity. The Contractor shall also make the necessary repairs to the existing access roads upon completion of the contract work.

1.05 COMPLIANCE WITH ENVIRONMENTAL PERMITS:

A. The Contractor shall comply fully with: 1) Conditions of the MEDEP Board Order, MEDEP NRPA Permit By Rule Conditions, MEDEP Construction General Permit, and MEDEP "Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices"; 2) Conditions of the City of Old Town Solid Waste Facility Permit; 3) Department of the Army Permit No. NAE-1991-1909-M1; and 4.) Maine Construction General Permit.

B. From the hour of 6:00 am to 7:00 am, the Contractor shall limit equipment use within 60 feet of the western solid waste boundary (approximately 480 feet from the western property line) to equipment with a combined sound level of 77 dBA at 50 feet or less.

1.06 USE OF REGISTERED LAND SURVEYOR:

A. The Contractor will provide for the services of a Professional Land Surveyor (PLS) to lay out base grades and leachate collection and transport system structures. A letter from the PLS certifying that the proposed work has been laid out in accordance with the Contract Drawings will be issued to NEWSME upon completion of the survey work. In addition, the Contractor will retain the services of a PLS to provide all the necessary as-built survey information to the Engineer upon completion of the project. At a minimum, as-built survey information will be required for cell limits, all pipe inverts, and other areas of work as directed by the Owner's Authorized Representative. Permanent benchmarks have been established at the precast concrete valve pit near the leachate pond and at the Landfill's Maintenance Facility. The PLS shall verify existing project benchmarks and establish additional project benchmarks on all proposed concrete vaults and manholes for future use as survey control points.

1.07 SUMMARY OF OWNER-FURNISHED MATERIALS AND SERVICES

NEWSME Operations will furnish the following materials and services:

- Geomembrane, geosynthetic clay liner, and drainage geocomposite materials. See specific specification sections for additional details on the quantities and suppliers of these materials.
- Field quality control material testing described in the Contract Drawings, including borrow source construction testing and in-place construction testing. The Contractor is only

responsible for the borrow source (both on-site and off-site) characterization testing described on the Contract Drawings and for all failing tests performed by the Owner.

- All quality control/quality assurance tests and conformance tests associated with the secondary and primary geomembrane.
- Power for use by Contractor.

END OF SECTION

SECTION 01012

HEALTH AND SAFETY PLAN

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 DESCRIPTION: This work shall consist of preparation of a Health and Safety Plan, submitted prior to the commencement of construction, and statement of safe working procedures.

PART 2 EXECUTION

2.01 HEALTH AND SAFETY PLAN (HASP) REQUIREMENTS:

A. The HASP shall conform to guidance contained in "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" NIOSH/OSHA/USCG/U.S.EPA, October 1985 and 29 CFR 1910 (FR March 6, 1989).

B. The HASP will include, but not be limited to, the following:
   1. Identification of potential hazards
   2. Identification of a site Health and Safety Officer
   3. Air monitoring activities
   4. Personnel protective equipment requirements
   5. Emergency and contingency planning

PART 3 WORK PROCEDURES:

3.01 All work involving excavation below grade or otherwise involving a risk of worker exposure to landfill gases, leachate, or solid waste shall be performed in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations, U.S.EPA Health and Safety Regulations, the Owner's Site Safety Plan(s), and the Contractor's site Health and Safety Plan.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

1.01 RELATED DOCUMENTS: Contract Drawings, Section 01010 Summary of Work, and Bid Form.

1.02 WORK COVERED BY CONTRACT DOCUMENTS:

A. The Contractor shall furnish all labor, materials, tools, equipment, and supervision necessary for complete installation of the work covered by these Contract Documents.

B. Miscellaneous work items necessary to satisfactorily complete the project, and for which no separate payment item is included in the Contract, shall not be measured and paid for separately, but shall be considered as incidental to the Contract Bid Item.

C. The Contractor shall acquaint himself with all work associated with each payment item and shall have no claim for his unfamiliarity with the requirement of various items.

1.03 BASIS OF MEASUREMENT AND PAYMENT:

Item No. 1- Mobilization/Demobilization

Payment of this item requires that the Contractor shall furnish and/or deliver to the job site all labor, materials, equipment, and temporary support facilities, including, but not limited to, a field office, portable sanitary facilities, utilities, and equipment necessary to perform the required work. This pay item includes the protection of any existing site structures identified on the Project Drawings. This Item shall also include the demobilization/removal of above said items from the site at the completion of work. In addition, the Contractor shall prepare all required written plans and schedules including, but not limited to, initial and progress construction schedules, traffic sequencing plan, and subcontractor work plans.

Item No. 2 – Stormwater Management Features (Detention Pond 11R and 14, including Inlet and Outlet Structures and Underdrain Pipe

Payment of this item requires that the Contractor shall provide all labor, materials, and equipment to construct the stormwater controls within and outside of Cell 18 including new drainage ditches, culverts, level spreaders, and associated structures as identified on the Project Drawings. The Contractor shall perform a final cleaning of accumulated sediment from the structures of at the end of the project. The Detention Pond 11R and 14 work also includes stumping, grubbing, excavating, hauling, grading, supply and installation of the pond underdrain pipe, and constructing the outlet control structure. Excess soils from the Detention Pond 11R and 14 excavations shall be stockpiled. The stockpile shall be located as identified on the Project Drawings.

Item No. 3 – Grubbing

Payment of this item requires that the Contractor shall provide all labor, materials, and equipment to grub within the areas of work described on the Project Drawings for Cell 18. The work includes the removal of vegetative soil, hauling, stockpiling, and stabilization of the grubbing stockpile at the completion of hauling. The grubbing stockpile shall be located in the area depicted on the Project Drawings.

Item No. 4 – Cell 18 Berm Construction Area Cut to Fill, Place, and Compact

Payment of this item requires that the Contractor shall provide all labor, materials (including cut to fill), and equipment to cut, fill, place, and compact the Cell 18 Berm Area within the limits of fill as shown on the Project Drawings. The work shall be performed in accordance with the Project Drawings and Project Specifications.

Item No. 5 – Cell 18 Construction Area Cut to Stockpile

Payment of this item requires that the Contractor shall provide all labor, materials, equipment necessary to excavate the existing cell area to base grade shown on the Project drawings. This work also includes transport and stockpiling of excess cut to the dedicated soil stockpile area as shown on the Project Drawings. The work shall be performed in accordance with the Project Drawings and Project Specifications.

Item No. 6 – Supply and Install 1-foot of Drainage Sand for Underdrain System

Payment of this item requires that the Contractor provide all labor, material, and equipment to furnish and install one (1) foot of drainage sand for the underdrain sand layer as shown on the Contract Drawings. The work also includes the Contractor borrow source characterization testing in accordance with the Project Specifications.

Item No. 7 – Supply and Install 4-Inch SDR 17 HDPE Underdrain Pipe

Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the underdrain piping at the locations indicated on the Project Drawings. Material shall include perforated and non-perforated 4-inch diameter pipe including fittings, connections, and accompanying drainage stone. This item will also include Contractor borrow source characterization testing in accordance with the Project Specifications.

Item No. 8 – Supply and Install 1-foot of Compacted Till for Secondary Liner System

Payment of this item requires that the Contractor provide all labor, material, and equipment to furnish and install one (1) foot of compacted till for the secondary liner as shown on the Project Drawings. The work also includes Contractor borrow source characterization testing in accordance with the Project Specifications.

Item No. 9 – Install Owner Supplied 60-mil HDPE Textured Geomembrane Secondary Liner

Payment of this item requires that the Contractor provide all labor and equipment to install Owner-supplied 60-mil HDPE textured geomembrane in accordance with the Project Drawings and Specifications. The work also includes completing the tie-in seams with the Cell 14 liner system as shown on the Project Drawings.

Item No. 10 – Install Owner Supplied Leak Detection Drainage Geocomposite

Payment of this item requires that the Contractor provide all labor and equipment to install Owner-supplied leak detection drainage geocomposite in accordance with the Project Drawings and Specifications. The work also includes completing the tie-in seams with the Cell 14 liner system as indicated on the Project Drawings.

Item No. 11 – Supply and Install 1-foot of Drainage Sand for Leak Detection System

Payment of this item requires that the Contractor provide all labor, material, and equipment to furnish and install one (1) foot of drainage sand for the leak detection system as shown on the Project Drawings. The work also includes Contractor borrow source characterization testing in accordance with the Project Specifications.

Item No. 12 – Supply and Install 6-inch SDR 7 HDPE Leak Detection Pipe

Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the leak detection system piping and cleanouts at the locations indicated on the Project Drawings. Material shall include perforated and non-perforated 6-inch diameter pipe including fittings, connections, permanent cleanout labels, and accompanying separation fabric, drainage stone, and filter stone to cover the piping. This item will also include Contractor borrow source characterization testing associated with any materials used. The work shall be performed in accordance with the Project Drawings and Specifications.

Item No. 13 – Supply and Install 6-inch SDR 11 HDPE Leak Detection Pipe

Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the leak detection system piping and cleanouts at the locations indicated on the Project

Drawings. Material shall include perforated and non-perforated 6-inch diameter pipe including fittings, connections, permanent cleanout labels, and accompanying separation fabric, drainage stone, and filter stone to cover the piping. This item will also include Contractor borrow source characterization testing associated with any materials used. The work shall be performed in accordance with the Project Drawings and Specifications.

Item No. 14 – Supply and Install 1-foot of Compacted Clay for Primary Liner System
Payment of this item requires that the Contractor provide all labor, materials, and equipment to furnish and install one (1) foot of compacted clay for the primary liner as shown on the Project Drawings. The work includes Contractor borrow source characterization testing in accordance with the Project Specifications.

Item No. 15 – Install Owner Supplied Geosynthetic Clay Liner (GCL) for Primary Liner System
Payment of this item requires that the Contractor provide all labor and equipment to install the Owner-supplied GCL in accordance with the Project Drawings and Specifications. The work also includes constructing the tie-in seams with the Cell 14 liner system as indicated on the Project Drawings.

Item No. 16 – Install Owner Supplied 80-mil HDPE Textured Geomembrane Primary Liner
Payment of this item requires that the Contractor provide all labor and equipment to install the Owner-supplied 80-mil HDPE textured geomembrane in accordance with the Project Drawings and Specifications. The work also includes constructing the tie-in seams with Cell 14 liner system as indicated on the Project Drawings.

Item No. 17 – Install Owner Supplied Leachate Collection Drainage Geocomposite
Payment of this item requires that the Contractor provide all labor and equipment to install the Owner-supplied leachate collection drainage geocomposite in accordance with the Project Drawings and Specifications. The work also includes, but is not limited to, constructing the tie-in seams with Cell 14 liner system as indicated on the Project Drawings.

Item No. 18 – Supply and Install 1-foot of Drainage Sand for Leachate Collection System
Payment of this item requires that the Contractor provide all labor, materials, and equipment to furnish and install one (1) foot of drainage sand for leachate collection as shown on the Contract Drawings, and incidental items shall include all equipment, labor, tools, and materials necessary for the successful completion of the work. The work also includes borrow source testing in accordance with the Specifications.

Item No. 19 – Supply and Install 6-inch SDR 7 HDPE Leachate Collection Pipe
Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the leachate collection system piping at the locations indicated on the Project Drawings. Materials shall include perforated and non-perforated 6-inch diameter pipe including fittings, connections, and accompanying drainage stone and filter stone to cover the piping. This item will also include Contractor borrow source characterization testing associated with any soil materials used. The work shall be performed in accordance with the Project Drawings and Specifications.

Item No. 20 – Supply and Install 8-inch SDR 7 HDPE Leachate Collection Pipe
Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the leachate collection system piping and cleanouts at the locations indicated on the Project Drawings. Materials shall include perforated and non-perforated 8-inch diameter pipe including fittings, connections, and accompanying drainage stone and filter stone to cover the piping. This item will also include Contractor borrow source characterization testing associated with any soil materials used. The work shall be performed in accordance with the Project Drawings and Specifications.

Item No. 21 – Supply and Install Leachate and Leak Detection Sumps and Cell 18 Pump Station
Payment of this item requires that the Contractor provide all labor, materials, and equipment to furnish and install the Cell 18 pump station building, collection sump, and leachate collection layer

transducer as shown on the Project Drawings and described in the Project Specifications. The work includes, but is not limited to:

(1) Furnish and install a new leachate pump station building; all pumps, piping, fittings, and instrumentation within the new pump station.
(2) Furnish and install the leachate collection and leak detection sumps, including, but not limited to, sample sump base grade undercut, drainage stone, filter stone, pump conduit, HDPE plates, and insulation as shown on the Contract Drawings.
(3) Furnish and install the temporary Cell berm at the temporary sump to the grades shown on the Project Drawings including, but not limited to, drainage sand and the Owner-supplied geosynthetic materials.
(4) Furnish and install the leachate collection layer transducer at the location shown on the Project Drawings including, but not limited to, bedding sand and electrical conduit.
(5) Install, start up and test all electrical and communication infrastructure associated with the new temporary leachate pump station; and
(6) All other work and expense incidental thereto for which payment is not provided under other items.

Item No. 22 – Supply and Install Cell 18 Pump Station Building and Force Main Pipe

Payment of this item requires that the Contractor provide all labor, materials, and equipment to furnish and install the Cell 18 pump station building, control panel and 6-inch x 10-inch dual-containment HDPE force main pipe shown on the Project Drawings and described in the Project Specifications. The work includes setting up alarms at the control panel to monitor the existing landfill gas condensate knockout water level, the pump station building temperature, and the float switch located in the pump station building sump; integrating the control panel into the landfill's existing SCADA system; and connecting the force main from the Cell 18 Pump Station Building to the force main infrastructure as shown on the Project Drawings.

Item No. 23 – Supply and Install 6-inch x 10-inch Dual Containment Force Main and Appurtenances

Payment of this item requires that the Contractor provide all labor, materials, and equipment to furnish and install the 6-inch diameter x 10-inch diameter dual-containment SDR 17 HDPE force main and appurtenances at the locations indicated on the Project Drawings. Materials shall include 6-inch by 10-inch diameter dual-contained pipe, and accompanying backfill and bedding materials, geotextile, and Contractor borrow source Characterization testing and pipe pressure testing in accordance with the Project Drawings and Specifications.

Item No. 24 – Supply and Install 24-inch SDR 17 Landfill Gas Header Pipe

Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the 24-inch landfill gas header and header termination at the location indicated on the Project Drawings. Material shall include 24-inch diameter pipe, including fittings, connections, fabrications, insulation, pipe warning tape, marker post, borrow source testing and accompanying geotextile, backfill, and bedding materials in accordance with the Project Drawings and Specifications.

Item No. 25 – Supply and Install 8-inch SDR 17 Landfill Gas Pipe

Payment of this item requires the Contractor provide all labor, materials, and equipment to construct the 8-inch landfill gas piping and pipe termination at the location indicated on the Project Drawings. Material shall include 8-inch diameter pipe, including fittings, connections, fabrications, and accompanying backfill and bedding materials in accordance with the Project Drawings and Specifications.

Item No. 26 – Supply and Install Landfill Gas Condensate Pump Station

Payment of this item requires the Contractor provide all labor, materials, and equipment to install the precast landfill gas condensate pump station at the location indicated on the Project Drawings. Material shall include the correct diameter precast manhole and accompanying backfill and bedding materials in accordance with the Project Drawings and Specifications.

Item No. 27 – Piezometer, Observation Well, and Monitoring Well Abandonment
Payment of this item requires the Contractor retain the services of a competent drilling contractor, to provide all labor, materials, and equipment to abandon existing piezometers, observation wells, and monitoring wells at the location shown on the Project Drawings and in accordance with the Project Specifications.

Item No. 28 – Supply and Install Erosion Control (including siltation fencing, hay bales, stone check dam, geotextile, seed and mulch
Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct and maintain (for the duration of the Project) erosion and sediment control features in accordance with the Project Specifications. The work includes, but shall not be limited to, furnishing, installing and maintaining vegetative soil, hay bales, silt fence, riprap aprons, stone check dams, erosion control blankets, seed, fertilizer, lime, and mulch. The maintenance of the erosion and sediment control features shall be in accordance with the Project Drawings and Specifications, and in accordance with the MEDEP "Maine Erosion and Sediment Control Best Management Practices" and Maine Construction General Permit.

Item No. 29 – Dewatering and Stormwater Control
Payment of this item requires that the Contractor shall provide all labor, materials, and equipment necessary (for the duration of the Project) for the dewatering of excavations and the removal and/or diversion of surface water from the construction area. The Contractor shall maintain a dewatering and stormwater control system so that no sediment impacted waters are discharged beyond the project limits.

Item No. 30 – Supply and Install Chain-Link Fence
Payment of this item requires the Contractor provide all labor, materials, and equipment necessary to install chain-link fence, pedestrian gate, and sliding cantilevered gate at the locations shown on the Project Drawings.

Item No. 31 – Supply and Install Litter Fence
Payment of this item requires the Contractor provide all labor, materials, and equipment necessary to install litter fence at the locations shown on the Project Drawings.

Item No. 32 – Dust Control
Payment of this item requires the Contractor provide all labor, materials, and equipment for applying water or street sweeping for dust control in accordance with the Project Drawings, or as required by the Owner.

Item No. 33 – Cell 18 Access Ramp Construction
Payment of this item requires that the Contractor provide all labor, materials, and equipment to furnish and install the access road into Cell 18 as shown on the Project Drawings. The work also includes saw cutting and removal of existing pavement, regrading, and installation of the gravel aggregate base and subbase as shown on the Project Drawings.

Item No. 34 – Landfill Perimeter Access Roadway Construction (including guardrail)
Payment of this item requires that the Contractor provide all labor, materials, and equipment to construct the landfill access road at the locations shown on the Project Drawings. The work includes all roadway aggregate and bituminous pavement materials installed above subgrade and guardrails as shown on the Contract Drawings.

Item No. 35 – Supply and Install SMH #34
Payment of this item requires that the Contractor provide all labor, materials, and equipment to install precast SMH #34, appurtenances at the locations indicated on the Project Drawings. Materials shall include fittings, flow meter, valves, connections, fabrications, and accompanying

backfill and bedding materials, geotextile, and borrow source and pipe testing in accordance with the Project Drawings and Specifications.

Item No. 36 – Supply and Install Electrical Utility Manholes
Payment of this item requires the Contractor provide all labor, materials, and equipment to install the precast electric manholes at the location indicated on the Project Drawings. Material shall include the correct diameter precast electric manholes and accompanying backfill and bedding materials in accordance with the Project Drawings and Specifications.

Item No. 37 – Supply and Install Intermediate Cover Stormwater Diversion Berm
Payment of this item requires the Contractor provide all labor, materials, and equipment to install intermediate cover stormwater diversion berms in accordance with the Project Drawings and Specifications.

Item No. 38 – Leak Location Survey on Primary 80-mil HDPE Geomembrane
Payment of this item requires that the Contractor retain the services of Leak Location Services, Inc. of San Antonio Texas, to provide all labor, materials, and equipment to perform a leak location survey of the newly constructed Cell 18 80-mil HDPE geomembrane primary liner system. Work shall be performed as specified in Contract Specification 02772.

Item No. 39 – Construction/Record Survey
Payment of this item shall include all equipment, labor, materials, and equipment necessary for successful completion of the work. The location, both horizontal and vertical, of all piping and structures shall be recorded, along with the liner anchor trenches, at an interval of every 50 feet, except at changes in grades or corners where more detail will be required to define the location of the structure. The finished top of leachate collection sand grade shall be surveyed at 50-foot grid except at changes in grades or corners where more detail will be required to define the surface. The information must be provided on an Auto Cad drawing with information placed on separate layers.

Item No. 40 – Electrical Sub-Contractor (Electrical and Communication Utilities)
Payment of this item requires that the Contractor coordinate with an Electrical Sub-contractor to provide all labor, materials, and equipment to install the electrical and communication utilities required as shown on the Project Drawings and specified in the Project Specifications. This item includes electrical and communication work for the new Cell 18 pump station, the Cell 18 leachate level transducer, and installation of conduit including trenching, backfill, and bedding materials, electrical manholes, and communication manholes.

Item No. 41 – Sales and Use Tax
Payment of this item requires that the Contractor accurately record and document the applicable sales and use tax for materials used on this project. This information may be requested by the Owner or a State Agency during or upon completion of the project.

Item No. 42 – Performance and Payment Bond
Payment of this item requires that the Contractor provide a Performance and Payment Bond for the full amount of the Agreement Price.

1.04 METHOD OF MEASUREMENT AND BASIS OF PAYMENT (UNIT PRICES – ADD):
The following section describes the method of measurement and payment for work which may be necessary in addition to the work associated with the construction of the base bid item described herein and shown on the Contract Drawings. The additional work items shall only be undertaken upon written approval of the Engineer, and do not include any work items associated with or undertaken as a result of the construction of the base bid item.

A. Grubbing: Measurement of additional grubbing will be the actual additional acreage stripped as measured by horizontal dimensions determined by a field survey. Payment for the accepted quantities of additional clearing and grubbing will be at the unit price per acre.

B. Clearing: Measurement of additional clearing will be the actual additional acreage cleared as measured by horizontal dimensions determined by a field survey. Payment for the accepted quantities of additional clearing will be at the unit price per acre.

C. Common Excavation: Additional quantities of excavation of material will be measured by the number of cubic yards measured in its original position by cross-sectioning the area prior to and after excavation of the material. Volumes will be computed by the average end area method or by other methods generally recognized as conforming to good engineering practice. Payment for the accepted quantities of additional excavation of material will be at the unit price per cubic yard, including removal from the site and disposal, if necessary.

D. Excavation of Unsuitable Material: Additional excavation of unsuitable material will be measured by the number of cubic yards measured in its original position by cross-sectioning the area prior to and after excavation of the unsuitable material. Volumes will be computed by the average end area method or by other methods generally recognized as conforming to good engineering practice. Payment for the accepted quantities of additional excavation of unsuitable material will be at the unit price per cubic yard, including removal from the site and disposal, if necessary.

E. Open Rock Excavation: Open rock excavation shall be measured by cross-sectioning the ledge surface. The depth shall be between the sectioned surface and the proposed subgrade. Volumes will be computed by the average end area method or by other methods generally recognized as conforming to good engineering practice. All over-excavation shall be at the Contractor's expense. Any sections over-excavated shall be brought to grade with crushed stone or glacial till as directed by the Resident Project Representative. Horizontal limits will be as shown on the Contract Drawings or within two feet of proposed precast concrete structures.

   Rock excavation shall consist of removing hard igneous, metamorphic, and sedimentary rock which cannot be excavated without drilling and blasting or drilling and splitting, and all boulders having a volume of two (2) cubic yards or more. Rock excavation shall be performed mechanically with jackhammer or other excavation equipment. No blasting will be allowed on-site.

   Payment for the accepted quantities of open rock excavation will be at the unit price per cubic yard, including removal from the site and disposal, if necessary.

F. Trench Rock Excavation: Trench rock excavation shall be measured on the following basis: The depth will be the vertical distance from the bottom of the pipe bedding to the surface of the ledge, measured on the centerline of the pipe. The trench width shown on the Contract Drawings will be taken as the pay width. All over-excavation shall be at the Contractor's expense. Any areas over-excavated shall be brought to grade with crushed stone.

   Trench rock excavation shall consist of removing hard igneous, metamorphic, and sedimentary rock which cannot be excavated without drilling and blasting or drilling and splitting, and all boulders having a volume of two (2) cubic yards or more. Rock excavation shall be performed mechanically with jackhammer or other excavation equipment. No blasting will be allowed on-site.

   Payment for the accepted quantities of trench rock excavation will be at the unit price per cubic yard, including removal from the site and disposal, if necessary.

G. Aggregate Subbase Material: Additional aggregate subbase material to be used in the access road construction will be the number of cubic yards, in-place, based upon the length, width, and depth of the aggregate subbase material. Payment for the accepted quantities of additional aggregate subbase material will be at the unit price per cubic yard.

H. Aggregate Base Material: Additional aggregate base material to be used in the access road construction will be the number of cubic yards, in-place, based upon the length, width, and

depth of the aggregate base material. Payment for the accepted quantities of additional aggregate base material will be at the unit price per cubic yard.

I. Clay Borrow Material: Additional clay borrow material to be used during construction will be the number of cubic yards, in-place, based upon the length, width, and depth of the clay borrow material. Payment for the accepted quantities of additional clay borrow material will be at the unit price per cubic yard. Satisfactory completion of this work shall include placement of clay, compaction, testing, and other associated work.

J. Common Borrow Material: Additional common borrow material to be used during construction will be the number of cubic yards, in-place, based upon the length, width and depth of the common borrow material. Payment for the accepted quantities of additional common borrow material will be at the unit price per cubic yard.

K. Siltation Fence: Measurement for additional siltation fence shall be by the linear foot installed. The accepted quantity of siltation fence will be paid for at the contract unit price per linear foot, which shall be full compensation for furnishing, placing, maintaining, and removal of the item.

L. Bark Mulch Sediment Barrier: Measurement for additional bark mulch sediment barrier shall be by the linear foot installed. The accepted quantity of bark mulch sediment barrier will be paid for at the contract unit price per linear foot, which shall be full compensation for furnishing, placing, maintaining, and removal of the item.

M. Riprap: Additional quantities of riprap shall be the number of cubic yards, in-place, based upon the surface area and depth of the riprap. Payment for the accepted quantities of additional riprap will be at the unit price per cubic yard. Geotextile material shall be installed under riprap as shown on the Contract Drawings. The installation of geotextile shall be incidental to the riprap pay item and no additional payment will be made.

N. Stone Check Dam: Measurement for additional stone for stone check dams shall be per cubic yard of stone placed. The accepted quantity of stone will be paid for at the contract unit price per stone check dam which shall be full compensation for furnishing, placing, and maintaining (as necessary) the stone check dam.

O. Erosion Control Blanket (NAG C125): Measurement for additional erosion control blanket shall be by the square foot of blanket installed. The accepted quantity of erosion control blanket will be paid for at the contract unit price per square yard, which shall be full compensation for furnishing, placing, and maintaining the erosion control blanket.

P. Seed, Fertilizer, Lime, Mulch: The quantity of additional materials needed for seeding including seed, fertilizer, lime, and mulch will be based on field measurement upon establishment of a satisfactory vegetative cover. Additional seeding does not include seeding of areas disturbed as a result of the construction of the base bid item. Seeding includes soil preparation, seed placement, fertilizer, lime, mulch, and erosion control mesh (if required by the Resident Project Representative). Payment for accepted quantities of additional seeding will be based upon the price per unit (1,000 sq ft).

Q. Topsoil: If additional topsoil from on-site sources is required, the quantity shall be based on field measurement in-place. Payment for the accepted quantities of additional topsoil will be at the unit price per cubic yard.

R. Pipe Bedding Stone: Measurement for additional pipe bedding stone shall be per cubic yard of stone placed. The accepted quantity of stone will be paid for at the contract unit price per cubic yard which shall be full compensation for furnishing, placing, and maintaining (as necessary) the stone.

S. Drainage Stone: Measurement for additional drainage stone shall be per cubic yard of stone placed. The accepted quantity of stone will be paid for at the contract unit price per cubic yard

which shall be full compensation for furnishing, placing, and maintaining (as necessary) the stone.

T. Filter Stone: Measurement for additional filter stone shall be per cubic yard of stone placed. The accepted quantity of stone will be paid for at the contract unit price per cubic yard which shall be full compensation for furnishing, placing, and maintaining (as necessary) the stone.

U. Drainage Sand: Additional drainage sand used during construction will be the number of cubic yards in-place, based upon the length, width, and depth of the sand material. Payment for the accepted quantities of additional sand material will be at the unit price per cubic yard.

V. 4-inch HDPE Pipe (Solid and Perforated): Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

W. 6-inch HDPE Pipe (Solid and Perforated): Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

X. 8-inch HDPE Pipe (Solid and Perforated): Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

Y. 12-inch HDPE Pipe (Solid and Perforated): Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

Z. 24-inch HDPE Pipe (Solid and Perforated): Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

AA. 6-inch x 10-inch Dual-Containment HDPE Pipe: Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

BB. 24-inch HDPE Culverts: Measurement for additional culverts shall be along the centerline of the pipe. Payment for the accepted quantity of additional HDPE culverts will be made at the unit price per linear foot. Culvert pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

CC. 8-inch Ductile Iron Pipe: Measurement for additional pipe shall be along the centerline of the pipe. Payment for the accepted quantity of additional pipe will be made at the unit price per linear foot. Pipe pay items shall include all fittings and bedding materials. No other measurement and payment associated with this item shall be made.

DD. 8-oz Non-Woven Geotextile: Measurement for additional non-woven geotextile shall be by square foot of geotextile installed as shown on the Contract Drawings. The accepted quantity of geotextile will not include overlap, non-woven geotextile within the anchor trench, or waste, and will be paid for by the contract unit price per square foot. The unit price shall be for all labor, materials, materials testing, and equipment required to install the material. This work shall also include handling and storage of the material and any other associated work.

EE. 12-oz Non-Woven Geotextile: Measurement for additional non-woven geotextile shall be by square foot of geotextile installed as shown on the Contract Drawings. The accepted quantity

of geotextile will not include overlap, non-woven geotextile within the anchor trench, or waste, and will be paid for by the contract unit price per square foot. The unit price shall be for all labor, materials, materials testing, and equipment required to install the material. This work shall also include handling and storage of the material and any other associated work.

FF. Mirafi HP-270 Woven Geotextile: Measurement for additional woven geotextile shall be by square foot of geotextile installed as shown on the Contract Drawings. The accepted quantity of geotextile will not include overlap, woven geotextile within the anchor trench, or waste, and will be paid for by the contract unit price per square foot. The unit price shall be for all labor, materials, materials testing, and equipment required to install the material. This work shall also include handling and storage of the material and any other associated work.

GG. Mirafi 500X Woven Geotextile: Measurement for additional woven geotextile shall be by square foot of geotextile installed as shown on the Contract Drawings. The accepted quantity of geotextile will not include overlap, woven geotextile within the anchor trench, or waste, and will be paid for by the contract unit price per square foot. The unit price shall be for all labor, materials, materials testing, and equipment required to install the material. This work shall also include handling and storage of the material and any other associated work.

HH. Litter Fence: Measurement for additional litter fence shall be by the linear foot of fence installed. The accepted quantity of litter fence will be paid for at the contract unit price per linear foot, which shall be full compensation for furnishing and placing the litter fence.

1.05 BASIS OF MEASUREMENT AND PAYMENT (DEDUCTIONS):

A. Changes in the contract work which result in reduced work will be measured based on the information shown on the Contract Drawings and at the contract unit prices. Measurements and volumes will be computed based on methods generally recognized as conforming to good engineering practice and acceptable to both the Contractor and the Resident Project Representative.

B. Costs of any conformance or construction testing that fails to meet the Specifications contained herein shall be borne by the Contractor. The price shall include the cost of the failing test and any cost to resample the failing material, including any shipping and handling. The engineer on a monthly basis will forward a bill with a cost breakdown to the Contractor who shall apply these in the monthly requisition for payment as a deduction from the contract work. If the laboratory performing the tests is brought into question by the Contractor or any of his Sub-Contractors, and it is decided to send any further testing to a new laboratory, the Contractor shall bear the cost of all new testing that will be required to demonstrate conformance of a questionable material. These “new” costs shall not be applied to the monthly requisition for payment as a deduction.

C. The Owner shall not pay for any conformance testing beyond the initial testing required to approve a material for use on this project. The Owner shall also not pay for any conformance tests required on construction materials which are required because the Contractor chooses to supply construction materials from more lots than required to meet the square footage testing frequency contained in the Specifications. This does not relieve the requirement that representative samples of material used on the job be tested from each lot. The cost for this additional testing is the responsibility of the Contractor, and will be handled as described in 1.05.B.

1.06 UNIT PRICES: Changes in the contract work shall be performed at the unit prices indicated on the proposal. The unit prices are gross prices, including the Contractor's equipment, labor, supervision, and materials costs, entire mark-up, field or other costs, including general conditions, fringe benefits, overhead, and profit.

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 GENERAL:

The Contractor shall be responsible for the following:

A. Coordination of all work under the Contract.

B. Compliance with requirements of all public agencies having jurisdiction over construction.

C. Making arrangements, as necessary, for temporary electricity, heat, water, telephone, sanitary facilities, first aid facilities, fire protection, and storage of materials and supplies and for the timely delivery to the job site.

D. Assisting the Quality Assurance Resident Engineer (QARE) as necessary in the review of construction, obtaining material samples, the testing of materials, and construction layout surveys.

E. Maintaining up to date progress records, project schedule, and as-built drawings.

F. Maintaining the project site in a neat condition. Protect all existing structures, including monitoring wells, utility poles, buildings, liner, and leachate collection systems of existing cells, etc., from damage resulting from the Contractors (or their Subcontractors) work on-site.

G. Coordinating with all utilities, and notifying the appropriate owners when work is scheduled in areas that may affect existing utilities.

H. No extra payment shall be made to the Contractor for delays caused by lack of progress, defective workmanship, or rescheduling of work by other contractors, subcontractors, or equipment and material suppliers.

I. Coordinating the work of subcontractors, equipment, and material suppliers.

J. Verifying all field dimensions and notifying the QARE and Engineer in writing of any discrepancies. No additional payment will be allowed because of differences between field dimensions and those shown on the Contract Drawings without notifying the Engineer prior to performing the work.

K. Attendance of weekly progress meetings by Contractor's Superintendent. Meeting will be held in Contractor's construction office, or as indicated on the meeting agenda.

L. Providing a competent and authorized supervisory representative at each work location during all working hours who shall act as the agent of the Contractor. The supervisory representative shall be capable of reading and thoroughly understanding the Drawings and Specifications, with full authority to fulfill the Contractor's duties and responsibilities on the job. If, in the opinion of the Owner, the supervisory representative or any of his successors proves incompetent, not conscientious, or not industrious, then the Contractor shall replace the supervisory representative upon written request of the Owner.

M. The Contractor shall only employ competent individuals on the job. Whenever the Engineer or the Owner notifies the Contractor in writing that, in his opinion, any individual on the job, whether employed by the Contractor or any of the subcontractors imperils the safety of others or is incompetent, unfaithful, disorderly, or otherwise unsatisfactory, such individual shall be discharged from the Contract work and shall not be employed on it, except with the written consent of the Owner.

1.03 PRE-INSTALLATION CONFERENCES:

A. When required in individual specification section, convene a preinstallation conference at work site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Quality Assurance Resident Engineer and Engineer two weeks in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes, and distribute copies within two days after conference to participants, with two copies to Engineer.

E. Review conditions of installation, preparation and installation procedures, and coordination with related work.

1.04 PLAN PREPARATION

A. When required in the Contract Documents, prepare project plans and submit to the Engineer in the timeline indicated in the referenced document.

END OF SECTION

SECTION 01060

APPLICABLE CODES

PART 1 GENERAL

1.01 RELATED DOCUMENTS: All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this section.

1.02 GENERAL

A. Comply with current edition of all local, State, and federal codes applicable to the proposed construction including but not limited to the following.
   1. OSHA – National Occupational Safety and Health Act
   2. BOCA – Building Officials and Code Administrators –"National Building Code"
   3. Associated General Contractors of America – "Manual of Accident Prevention in Construction"
   4. ASTM – American Society for Testing Materials
   5. AASHTO – American Association of State Highway and Transportation Officials
   6. NFPA – National Fire Prevention Association
   7. Department of Environmental Protection, "Maine Erosion and Sediment Control Handbook for Construction: Best Management Practices"
   8. GRI Standards – Geosynthetic Research Institute
   9. MEDEP Solid Waste Management Regulations
   10. MEDEP Maine General Permit for Construction Rules
   11. MEDEP NRPA Permit-by-Rule Standard
   12. Town of Old Town Ordinances

END OF SECTION

SECTION 01211

PRE-CONSTRUCTION CONFERENCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Summary of Work: Section 01010

1.03 DESCRIPTION

A. Pre-construction Conference:
   1. After Award of Contract and prior to the Notice to Proceed, meet with NEWSME Landfill Operations LLC (NEWSME Operations), or its representative for a Pre-construction Conference.
   2. The purpose of this conference is to review the principle features of work and to address questions regarding the contract and work site.

B. Minimum Agenda:
   1. Review plans and specifications.
   2. Distribute and discuss.
      a. List of major subcontractors.
      b. Tentative construction schedules.
   3. Critical work sequencing.
   4. Relation and coordination of subcontractors.
   5. Owner supplied materials.
   6. Designation of responsible personnel.
   7. Protocol for processing field decisions and change orders.
   8. Submittal of shop drawings, project data, and submittals required by the technical specifications.
   9. Use of premises:
      a. Access restrictions.
      b. Office and storage areas.
      c. Owner's requirements.
      d. Ongoing landfill operations.
      e. Roadway maintenance.
   10. Payment and procurements of materials including tax exempt materials.
   11. Safety and first-aid procedures.
   12. Testing of materials.
   13. Estimates for partial payments.
   14. Environmental protection.
   15. Location for disposal of soil stockpile material.
   16. Odor control during construction.
   17. Hours of construction and applicable noise limits.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Quality Assurance/Quality Control Plan: Appendix B

B. Individual Material Specifications in Division 2, Division 3, and Division 15

1.03 SECTION INCLUDES:

A. Definitions

B. Submittal procedures

C. Construction progress schedule

D. Proposed products list

E. Product Data

F. Electronic CAD Files of Project Drawings

G. Shop drawings

H. Samples

I. Other Submittals

J. Test Reports

K. Certificates

L. Manufacturer's instructions

M. Contractor Review

N. Engineer Review

O. Tax Exempt Material

1.04 DEFINITIONS:

A. Action Submittals: Written and graphic information and physical samples that require the Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require the Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.05 SUBMITTAL PROCEDURES:

A. Transmit each submittal electronically to the Engineer at jrlcell18@smemaine.com on an Engineer accepted form.

B. No materials covered by submittals shall be stored on-site until submittal for material is approved by the Engineer. A Contractor's submittal that has "No Exception Taken" indicates that the Engineer is satisfied that the equipment or material submitted is in compliance with the specifications. Material delivered to and/or stored at the site prior to review by the Engineer shall be at the Contractor's risk.

C. No work of the General Contractor that requires submittals shall proceed until submittals have been reviewed and approved by the Engineer.

D. Sequentially number the transmittal forms. Re-submissions are to have original number with an alphabetic suffix.

E. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate to submittal.

F. Apply the Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the work and the Contract Documents.

G. Schedule submittals to expedite the project and deliver to the Engineer. Coordinate submission of related items. The Contractor may be obligated to provide submittals as dictated in the Contract between the Owner and the Contractor.

H. For each submittal for review, allow seven (7) days excluding delivery time to and from the Contractor.

I. Identify variations from the Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.

J. Provide space for Contractor and Engineer review stamps.

K. Revise and resubmit submittals as required, identifying all changes made since the previous submittal.

L. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

M. Submittals not requested will not be recognized or processed.

N. Incomplete Submittals: The Engineer will not review incomplete submittals. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of the Engineer.

1.06 CONSTRUCTION PROGRESS SCHEDULE:

A. The Contractor shall prepare and submit detailed progress schedules, schedule of values, shop drawings, and sample submittal schedules to the Engineer for approval in accordance with the General Conditions. The schedule shall be in bar graph form showing material delivery schedules and starting and completion dates for all phases of construction. Times of work shall be as indicated in the Contract or as approved by the Engineer and Owner.

B. If, in the opinion of the Engineer, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress, which may require him to increase the number of shifts, and/or overtime operations, days of work, and/or the amount of construction planned, and to submit for approval such supplementary schedule or schedules as necessary to demonstrate the manner in which the agreed rate to progress will be regained, all without additional cost to the Owner.

1.07 PRODUCT DATA:

A. Product Data: Action Submittal: Submit to the Engineer for review for assessing conformance with information given and design concept expressed in the Contract Documents.

B. If the Contractor proposes to use products which have properties different from what is required by the Specifications, the Contractor shall identify in the submittal, or subsequent written requests, which properties do not meet the Specifications and what specific alternate property is being proposed for the material. The Engineer will only consider alternatives presented in a written form. The Engineer shall review the proposal and determine if the proposed alternative property meets the design intent of the project. The Engineer's approval of an alternate property shall be in writing and only cover the specific property which the Contractor has requested the Engineer evaluate. Under no condition shall the Engineer's approval extend to other properties of the product in question. The Engineer may reject a Contractor request to evaluate an alternate property than specified in project specifications and drawings, without supplying reasoning for doing so.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

1.08 ELECTRONIC CAD FILES OF PROJECT DRAWINGS:

A. Contract Documents are included in portable document or paper format while CAD Files are offered to the Contractor as a convenience.

B. Electronic CAD Files of Project Drawings: May only be used to expedite production of Shop Drawings for the Project. Use for other Projects or purposes is not allowed.

C. Electronic CAD Files of Project Drawings: Distributed only under the following conditions:
   1. Use of files is solely at receiver's risk. The Engineer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions, and quantities set forth in the Contract Documents. In the event of ambiguity, discrepancy, or conflict between information on electronic media and that in the Contract Documents, notify the Engineer of the discrepancy and use the information in hard copy Drawings and Specifications.
   2. CAD files do not necessarily represent the latest Contract Documents, existing conditions, and as-built conditions. Receiver is responsible for determining and complying with these conditions and for incorporating addenda and modifications.
   3. User is responsible for removing information not normally provided on Shop Drawings and removing references to the Contract Documents. Shop Drawings submitted with information associated with other trades or with references to the Contract Documents will not be reviewed and will be immediately returned.
   4. Receiver shall not hold the Engineer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation, or use of this electronic information.
   5. Receiver shall understand that even though Engineer has computer virus scanning software to detect the presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media.
   6. Receiver shall not hold the Engineer responsible for such viruses or their consequences, and shall hold the Engineer harmless against costs, losses, or damage caused by the presence of computer viruses in files or media.

1.09 SHOP DRAWINGS:

A. Shop Drawings: Action Submittal: Submit to the Engineer for assessing conformance with information given and design concepts expressed in the Contract Documents. Shop Drawings shall be presented in clear and thorough manner.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a Professional Engineer responsible for designing components shown on Shop Drawings.
   1. Include signed and sealed calculations to support design.
   2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
   3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. Submit electronic submittals via email as PDF electronic files to the Engineer by email at jrlcell18@smemaine.com.

E. After review, distribute in accordance with procedures above.

1.10 SAMPLES:

A. Samples: Action Submittal: Submit to the Engineer for assessing conformance with information given and design concepts expressed in Contract Documents.

B. Include identification on each sample, with full project information.

C. Submit the number of samples specified in individual specification sections (three minimum) ; one of which will be retained by the Engineer.

D. Reviewed samples which may be used in the work are indicated in individual specification sections.

E. Samples will not be used for testing purposes unless specifically stated in individual Specification Sections.

1.11 OTHER SUBMITTALS:

A. Informational Submittal: Submit data for the Engineer's knowledge as the Owner’s Representative or for the Owner’s knowledge.

B. Submit information for assessing conformance with information given and design concept expressed in the Contract Documents.

1.12 TEST REPORTS:

A. Informational Submittal: Submit reports for the Engineer's knowledge as the Owner’s Representative or for the Owner’s knowledge.

B. Submit test reports for information for assessing conformance with information given and design concepts expressed in the Contract Documents.

1.13 CERTIFICATES:

A. Informational Submittal: Submit certification by manufacturer, installation/application Subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.14 MANUFACTURER'S INSTRUCTIONS:

A. Informational Submittal: Submit manufacturers installation instructions for the Engineer’s knowledge as Contract administrator or for the Owner’s knowledge.

B. When specified in individual specification sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing in quantities specified for Product Data.

C. Identify conflicts between manufacturer's instructions and the Contract Documents.

1.15 CONTRACTOR REVIEW:

A. Review for compliance with the Contract Documents and approve submittals before transmitting to the Engineer.

B. Contractor is responsible for:
   1. Determination and verification of materials including manufacturer's catalog numbers.
   2. Determination and verification of field measurements and field construction criteria.
   3. Checking and coordinating information in submittal with requirements of Work and of the Contract Documents.
   4. Determination of accuracy and completeness of dimensions and quantities.
   5. Confirmation and coordination of dimensions and field conditions at the Site.
   6. Construction means, techniques, sequences, and procedures.
   7. Safety precautions.
   8. Coordination and performance of Work of all trades.

C. Stamp, sign or initial, and date each submittal to certify compliance with the requirements of the Contract Documents.

D. Do not fabricate products or begin Work for which submittals are required until approved submittals have been received from the Engineer.

1.16 ENGINEER REVIEW:

A. Do not make "mass submittals" to the Engineer. "Mass submittals" are defined as six (6) or more submittals or items in one (1) day or 15 or more submittals or items in one week. If "mass submittals" are received, the Engineer's review time stated above will be extended as necessary to perform proper review. The Engineer will review "mass submittals" based on priority determined by the Engineer after consultation with the Owner.

B. Informational submittals and other similar data are for the Engineer's information, do not require the Engineer's responsive action, and will not be reviewed or returned with comment.

C. Submittals made by the Contractor that are not required by the Contract Documents may be returned without action.

D. Submittal approval does not authorize changes to the Contract requirements unless accompanied by a Change Order.

E. The Owner may withhold monies due to the Contractor to cover additional costs beyond the second submittal review.

1.17 TAX EXEMPT MATERIALS:

A. Materials purchased for the landfill liner system, leachate collection and leak detection system, leachate pump station, leachate force main, and landfill gas transport system are sales tax-exempt. Upon project completion the Contractor shall submit to the Owner an itemized list of all tax-exempt materials installed as part of the project. The list shall be submitted in an Excel format, include a description of all materials and identify where the materials are used. An example of the table to use for the submittal is provided below and the Contractor shall add additional rows under each category as needed.

EXAMPLE TABLE FOR TAX EXEMPT MATERIALS

Category	Material Purchased	Unit	Qty	Unit Cost	Total	Sales Tax
Liner System						
Leak Detection						
Leachate Collection						
Leachate Pump Station						
Leachate Force Main						
Landfill Gas Transport Systems						

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01350

ENGINEER'S FIELD OFFICE

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 DESCRIPTION:

A. Provide and maintain a field office for exclusive use of the Quality Assurance Resident Engineer (QARE) during the entire life of Contract. The field office and QARE shall not be disturbed, moved or interrupted without Engineer's approval. The building shall be a separate structure or part of a common structure (if approved by the Engineer), located outside of the hard hat area erected on a location approved by Owner and Engineer.

B. Construction Trailer:
   1. Portable or mobile buildings or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
   2. Structurally sound, secure, weathertight enclosures for office and storage spaces.
   3. Equip door to field office with a closer and a new secure lock and two keys.
   4. Area: Minimum 200 square feet.
   5. Provide lighting, electrical outlets, and automatic heating, cooling ventilating equipment to maintain 68 degrees F heating and 72 degrees F cooling.
   6. Windows: Minimum four, arranged for cross ventilation, minimum total area of 10 percent of floor area, with operable sash and insect screens. Supply sufficient drinking water from approved sources.

C. Furnishings:
   1. One flat top desk, 54x30 inch (minimum), with three drawers.
   2. One drafting table, 36x72 inch (minimum), with one equipment drawer.
   3. One standard four-drawer letter size metal filing cabinet with locks and two keys per lock.
   4. One swivel arm chair.
   5. Four folding chairs.
   6. One drafting stool.
   7. One tackboard, 36x30 inches (minimum).
   8. One large waste basket, approximate size: 15 to 20 gallons.
   9. One desk lamp.
   10. One drafting table lamp.
   11. One broom.
   12. One dust pan.
   13. Sufficient floor sweeping compound for the duration of the Work.
   14. Drinking Water: Provide a sufficient supply of potable water for the duration of the job.
   15. Portable toilet.
   16. Sufficient supply of toilet paper, hand sanitizer, and paper towels for the duration of the Work.
   17. Lockable closet, 36x48 inches (minimum), or other Engineer approved separate locking mechanism for storage of valuable items or required hazardous materials.

18. Wireless internet access with upload and download speeds in accordance with IEEE Standard 802.11ac.

END OF SECTION

SECTION 01505

MOBILIZATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Summary of Work: Section 01010

B. Project Coordination: Section 01041

1.03 GENERAL:

A. Mobilization shall include the obtaining of all permits, insurance, and bonds; moving onto the site any and all plants and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the work. Mobilization shall include but not be limited to the following items:
   1. Delivery to the site of all Contractors plant and equipment required for first month operations.
   2. Installing temporary construction power, communications, and lighting facilities as required.
   3. Identifying construction water supply.
   4. Providing a field office for the Contractor and the Engineer, complete with all needed furnishings and utility services.
   5. Providing on-site sanitary facilities and potable water facilities as specified.
   6. Arrangement for and erection of Contractor's work and storage yard.
   7. Submittal of all required insurance certificates and bonds.
   8. Obtaining all required permits.
   9. Posting all OSHA required notices and establishment safety programs.
   10. Having the Contractor's superintendent at the job site full time.
   11. Submittal of Preliminary Construction Schedule.
   12. Maintaining stormwater management log and records.
   13. Submittal of Borrow Source Testing Schedule.
   14. Submittal of materials and equipment which shall include: a complete list of suppliers and/or fabricators; items to be purchased from and/or supplied by such suppliers and/or fabricators; time required for fabrication; and scheduled delivery dates for each item to be purchased and/or supplied, leased or otherwise used for performance of the Work. This report shall be submitted for review at least 14 days prior to commencement of the Work.

B. Field Offices, Sheds, and Storage Areas:
   1. The Contractor will provide a temporary field office(s). The Contractor shall provide materials, equipment, and furnishings to adequately service the space.
   2. The Contractor will coordinate the office site location with the Owner and will fill and grade the site as necessary in order to provide drainage away from the building.
   3. Field office(s) shall be ready for occupancy before any onsite construction activities begin.

4. The office shall be a portable or mobile building constructed with the floor raised above ground and placed on a solid foundation. Steps and landings shall be provided at entrances. The building shall be structurally sound, secure, and weathertight.
5. The offices shall be provided with adequate insulation, lighting, safety devices, and environmental controls (heating and cooling). The offices shall also be provided with an adequate amount of secure storage space. The offices shall be furnished with, but not limited to, chair, drafting table, a desk, filing cabinet, and bookshelves.
6. The Contractor shall make available safety equipment, which shall include at minimum, high visibility reflective vests or shirts, safety toed shoes, hard hats and safety glasses.
7. Storage areas and sheds shall be provided as necessary. Location of storage areas and sheds shall be approved by the Owner.
8. The Contractor shall be responsible for maintaining office spaces, storage sheds, and storage areas in a neat and orderly manner.
9. At completion of work remove buildings, foundations, utility services, storage sheds, and storage areas. Areas shall be restored to pre-construction condition.
10. The Contractor shall provide a portable toilet, which will be provided with regular maintenance and cleaning.

END OF SECTION

SECTION 01561

CLEANING

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Summary of Work: Section 01010

B. Project Coordination: Section 01041

C. Cleaning for Specific Products or Work: Specification Section for that work

1.03 DESCRIPTION:

A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all sight-exposed surfaces; leave project area clean.

1.04 SAFETY REQUIREMENTS:

A. Standards: Maintain project in accordance with the following safety and insurance standards: Manual of Accident Prevention in Construction (AGC), all applicable requirements of the Occupational Safety and Health Administrations, and the Owner.

B. Conduct cleaning and disposal operations to comply with local, state and federal ordinances and laws, particularly anti-pollution laws.
   1. Do not burn or bury rubbish and waste materials on project site.
   2. Do not dispose of wastes in streams or waterways.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.01 DURING CONSTRUCTION:

A. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris, and rubbish.

B. Provide on-site containers for collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris and rubbish from site and legally dispose of in off-site or on-site areas approved by the Owner.

3.02 ADDITIONAL CLEANING REQUIRED

A. Pipe: Flush underdrain, leak detection, leachate collection, and leachate transport piping before final tie-in and remove debris from collection points as necessary.

B. Manholes: After pipe cleaning and prior to demobilization from the site, remove any debris and sediment from manhole structures.

C. Catch Basins: After pipe cleaning and prior to demobilization from the site, remove any debris and sediment from catch basins within or impacted by the project.

3.03 FINAL CLEANING:

A. Maintain cleaning until project is completed and occupied by Owner.

END OF SECTION

SECTION 01562

DUST CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Site Preparation: Section 02100

B. Earthwork: Section 02200

C. Health and Safety Plan: Section 01012

1.03 DESCRIPTION: This work shall consist of furnishing all labor, materials, and equipment for applying water, and/or street sweeping for dust control in conformity with the Contract Drawings and as specified herein, or as required by the Quality Assurance Resident Engineer (QARE).

PART 2 PRODUCTS

2.01 GENERAL: The water shall not be salt or brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

2.02 CALCIUM CHLORIDE: Contractor shall not use calcium chloride or other dust control chemicals unless granted permission to do so by the Engineer.

PART 3 EXECUTION

3.01 SPRINKLING: The Contractor shall apply water to roadways and work areas as needed to minimize dust or as instructed by the QARE. Water shall be applied by approved methods and with equipment including a tank with gauge equipped pressure pump and a nozzle-equipped spray bar. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

3.02 STREET SWEEPING: The Contractor shall sweep both internal and external paved roadways whenever instructed by the QARE. The Contractor will immediately clean any soil tracked off-site and take appropriate action to remove soil from vehicle tires prior to traveling on public roads.

END OF SECTION

SECTION 01570

TRAFFIC CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 DESCRIPTION: This work shall consist of furnishing all labor, material, and equipment for traffic control including: signs, barricades and channelization, lighting, flaggers, and other items necessary to effectively control vehicular and pedestrian traffic through the construction period at the intersection of Route 16 and the Juniper Ridge Landfill access road, and maintaining the ability of landfill traffic to continue to access the operating landfill area, the landfill gas treatment facility, and the leachate loading rack.

Traffic rules and routes within the Owner's Facility will be coordinated with the Owner and their designees.

PART 2 PRODUCTS

2.01 Materials used shall meet the requirements of the most current revisions of the Maine Department of Transportation Standard Specifications for Highways and Bridges and the Manual on Uniform Traffic Control Devices.

PART 3 EXECUTION

3.01 Installation of traffic control devices shall be in accordance with the most current revisions of the Maine Department of Transportation Standard Specifications for Highways and Bridges, and the Manual on Uniform Traffic Control Devices.

3.02 Maintain safe operating speeds of all construction equipment and delivery vehicles at all times including, but not limited to, 15 mph on the Juniper Ridge Landfill access roads, and 25 mph along the paved entranceway of the site between the site's entrance gate and Route 16.

3.03 Stage all construction equipment at the landfill site. There shall be no vehicle staging or parking on Route 16. The use of vehicle engine brakes is forbidden on Route 16 and the entrance road to the facility.

3.04 Coordinate construction activities with the ongoing operations at the Juniper Ridge Landfill.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawings) applies to the work specified under this contract.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED SECTIONS:

A. Section 01561: Cleaning

1.03 SECTION INCLUDES:

A. Closeout procedures

B. Final cleaning

C. Adjusting

D. Project record documents

E. Spare parts and maintenance materials

1.04 CLOSEOUT PROCEDURES:

A. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Engineer's inspection.

B. Review Engineer and Contractor project item punch list items.

C. Provide submittals to Engineer that are required by governing or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.05 FINAL CLEANING:

A. Execute final cleaning prior to final inspection.

B. Clean equipment and fixtures to a sanitary condition.

C. Clean or replace filters of operating equipment.

D. Clean debris from drainage systems.

E. Clean site, sweep paved areas, rake clean landscaped surfaces.

F. Remove waste and surplus materials, rubbish, and construction facilities from the site.

G. Flush underdrain and leachate collection piping upon final tie-in to existing piping systems and remove debris from manhole collection points as necessary.

1.06 ADJUSTING:

A. Adjust operating products and equipment to assure smooth and unhindered operation.

1.07 PROJECT RECORD DOCUMENTS:

A. Maintain on-site, one set of the following record documents; record actual revisions to the work:
   1. Contract Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separately from documents used for construction.

C. Record information concurrently with construction progress.

D. Specifications: Legibly mark and record at each product section a description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.

E. Record Documents and Shop Drawings: Survey the completed project and record the as-built coordinates and elevations of the containment dike corners, leak detection piping at 50-foot intervals and all fittings, leachate collection and transport piping at 50-foot intervals and all fittings, valves, culvert pipe inlets and outlets, and other points as directed by the Owner or Quality Assurance Resident Engineer. Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
   3. Field changes of dimension and detail.
   4. Details not on original Contract Drawings.

F. Delete Engineer title block seal from all documents.

G. Submit documents to Engineer with claim for final Application for Payment.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS:

A. Provide products, spare parts, maintenance, and extra materials in quantities as specified in individual specification sections.

B. Deliver to project site and place in location as directed; obtain receipt prior to final payment.

END OF SECTION

DIVISION 2

SITE WORK

SME
SEVEE & MAHER
ENGINEERS

SECTION 02015

SUBSURFACE INFORMATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

1.03 DESCRIPTION:

A. Subsurface explorations were performed at the locations shown on the Contract Drawings and a log of each exploration (boring logs and test pit logs) has been compiled for the purpose of guidance in the design and construction of the project facilities.

B. The logs do not indicate subsurface conditions except at the locations of the exploration (at the time explorations were made) and any interpretation the Contractor may make is their responsibility.

C. Subsurface investigations of the site were made by Sevee & Maher Engineers, Inc., or others (as indicated on the Contract Drawings and/or Logs). The logs present the opinion of the Engineer and shall not be interpreted to prescribe or dictate construction procedures or relieve the Contractor in any way of his responsibility for the construction. Logs of the explorations are contained in Appendix C of this document.

D. The approximate locations of the explorations made during this study are included on the Existing Conditions Plan. The locations were established by field survey (tape and compass) and/or ground survey (total station, global positioning system, or other).

E. The water levels shown on the log at the exploration are based on observations made by the field personnel at the time the explorations were made and may or may not represent the current groundwater surface at the explorations. They are presented only as an observation of the free-standing water surface in the exploration on the date noted.

F. The refusal depths shown at the exploration locations indicate only, that in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe, rod, or sampler was encountered to render further advance impossible or impractical by the procedures and equipment being used. Refusal may indicate bedrock surface, large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects, or a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

G. Additional exploration information may be available for areas outside the project area and can be requested by the Contractor.

END OF SECTION

SECTION 02016

EXISTING UTILITIES AND UNDERGROUND STRUCTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Site Preparation: Section 02100

B. Earthwork: Section 02200

C. Pipe Installation: Section 02450

1.03 DESCRIPTION:

A. The existing utilities shown on the Contract Drawings are shown diagrammatically and it is not to be inferred that the locations shown are precise.

B. Coordinate with DigSafe Systems, Inc and all applicable non-DigSafe utility owners prior to excavation, whether shown on the Contract Drawings or not.

C. The Contractor shall locate all utilities using a private utility location service if indicated in the Contract Documents.

D. The Contractor will be responsible for any and all damage to existing utilities caused by their efforts.

E. The Contractor will contact the affected utility, Engineer, and Owner as soon as any damage is uncovered.

F. If utilities are damaged, the utility shall make the determination as to who makes the necessary repairs. Repairs will be made to the satisfaction of the utility owner.

G. In areas where existing underground structures are shown or suspected, carefully uncover such structures to such extent as to enable the Quality Assurance Resident Engineer to determine what adjustments, if any, need to be made to accommodate the presence or removal of such structures.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 02015: Subsurface Information

B. Section 02200: Earthwork

C. Section 02220: Erosion Control

D. Section 02771: Textured Geomembrane

E. Appendix C: Test Pits and Boring Logs

1.03 DESCRIPTION OF WORK:

The Contractor shall be responsible for the following items;

A. Work specified in this section shall consist of furnishing all labor, materials, and equipment to prepare the site for subsequent improvements in conformity with the Contract Drawings, and as specified herein.

B. Site Preparation shall include, but is not limited to, the following:
   1. Protection of existing trees.
   2. Smoothing of existing ground surface in areas where topsoil is not removed.
   3. Verification of locations and elevations of all existing facilities within the limits of work and to be connected to.
   4. Protection of existing utilities.
   5. Confirming the location and elevation of benchmarks and control points shown on the Contract Drawings and reporting any inconsistencies to the Engineer immediately and prior to initiating earthwork activities.
   6. Protection of existing structures, buildings, and engineered systems (stormwater management facilities, monitoring wells, landfill gas wells, existing landfill intermediate cover, landfill infrastructure).
   7. Verification of existing utility locations and elevations:
      a The Contractor shall locate and verify the location and invert elevations at all connection points and utilities, as shown on the Contract Drawings. The Contractor shall notify the Engineer of any discrepancies. The Contractor shall be responsible for notifying and obtaining the services of Dig Safe and all applicable non-Dig Safe utility owners to locate existing utilities as necessary.
      b The existing utilities shown on the drawings are shown diagrammatically and are not to be inferred that the locations shown are precise.
      c Coordinate with all applicable utility owners prior to excavation in areas where it is reasonable to expect the presence of existing utilities, whether shown on the drawings or not.

d Accept responsibility for any and all damage to any existing utilities, caused by the Contractor's efforts.
e Contact the effected utility as soon as any damage is uncovered.
f The utility shall make the determination as to who makes the necessary repairs.
g In areas where existing underground structures are shown or suspected carefully uncover such structures to such extent as to enable the Engineer to determine what adjustments if any need to be made to accommodate the presence or removal of such structure.

1.04 JOB CONDITIONS:

The Contractor shall be responsible for the following items;

A. Protection of Existing Facilities: Provide protections necessary to prevent damage to existing facilities indicated to remain. Protect facilities on adjoining properties and on the Owner's property. Restore damaged facilities to their original condition, as acceptable to parties having jurisdiction.

B. Adjoining Property: Confine all operations to the property of the Owner. Protect abutting properties from construction activities at all times.

C. Salvageable Facilities: Carefully remove items indicated to be salvaged, and store on the Owner's premises where indicated, unless otherwise directed.

D. Maintain access to landfill operational cell, landfill gas treatment building, landfill gas flare, leachate storage facility, and leachate loading rack.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

The Contractor shall be responsible for the following items;

3.01 GENERAL:

A. The Contractor will establish limit of work lines as shown on the Contract Drawings, construction lines, and designate the trees, shrubs, plants, and other items to remain.

B. Alignment stakes, grade stakes, witness stakes, boundary markers, benchmarks, and tie points shall be preserved until such time as their usefulness has ceased and permission for their destruction is given by the Engineer.

C. Remove vegetation, facilities, or obstructions interfering with installation of new construction. Remove such items elsewhere on the site or premises as specifically indicated. Removal includes stumps and roots.

D. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

E. Mark and identify existing utilities to be connected into.

3.02 TOPSOIL STRIPPING:)

A. Topsoil is defined as friable silt loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, and large stones, and without weeds, roots, and other objectionable material.

B. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material.

C. Remove heavy growths of grass and brush from areas before stripping.

D. Stockpile topsoil on-site in storage piles where directed by Owner. Construct storage piles to freely drain surface water. Seed and mulch stockpiles, with temporary seed mixture in accordance with Contract Documents and the most recent version of the Maine Department of Environmental Protection Best Management Practices.

E. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.

F. Dispose of unsuitable material the same as waste material; herein specified

3.03 GRUBBING:)

A. Completely remove stumps, roots, heavy turf, and other debris. Disposal of stumps shall be by grinding or chipping and material shall remain on site for use as erosion control material.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 12-inch loose depth and thoroughly compact to a density equal to adjacent original ground.

C. Excavated soil shall be stockpiled within the facility's existing permitted till borrow pit or used in the outer fill of the perimeter berm.)

3.04 DEMOLITION: Not Applicable

3.05 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's Property: Except as otherwise provided, all wood, trash, and debris shall be removed and disposed of by the Contractor. Disposal may be deposited off-site in accordance with all applicable local, state, and federal rules, or on-site as directed by the Owner.

B. Wood Chipping: Wood chipping shall be done with approved equipment capable of reducing woody material to chips not over 1/4 inches in thickness nor over 8 inches long. Chips shall be distributed in a thin layer over the ground surface. Ground cover plants shall not be smothered and drainageways shall not be blocked.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawing), including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to work specified in this Section.

C. All work performed under this specification shall be performed in accordance with the most recent edition of the Maine Department of Environmental Protection's (MEDEP's) "Maine Erosion and Sediment Control Best Management Practices" (BMPs) and in accordance with the Maine Construction General Permit for the Project.

1.02 DESCRIPTION: This work shall consist of survey layout, excavation, filling, embankment construction, placement of landfill liner soils, and grading and shall include all hauling, compaction, necessary for construction of the project and disposal of all unsuitable material encountered.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Subsurface Information: Section 02015

B. Site Preparation: Section 02100

C. Erosion Control: Section 02220

D. Geotextiles and Drainage Geocomposite: Section 02272

E. Geosynthetic Clay Liner: Section 02275

F. Pipe Installation: Section 02450

G. Corrugated Culverts: Section 02451

H. Seeding and Mulching: Section 02800

1.04 REFERENCES

The publications listed below are part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American Association of State and Highway and Transportation Officials (AASHTO):
   1. AASHTO M145 Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
   2. AASHTO T 104 Soundness of Aggregates by Use of Sodium Sulfate of Magnesium Sulfate
   3. AASHTO T 289 Determining pH of Soil for Use in Corrosion Testing
   4. AASHTO T 236 Direct Shear Test of Soils Under Consolidated Drained Conditions

B. The American Society for Testing and Materials (ASTM):
   1. ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
   2. ASTM D6913 Laboratory Compaction Characteristics of Soil Using Standard Effort
   3. ASTM D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort

4. ASTM D2216 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
5. ASTM D2434 Standard Test Method for Permeability of Granular Soils (Constant-Head)
6. ASTM D4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
7. ASTM D5084 Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
8. ASTM D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
9. ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
10. ASTM D4373 Standard Test Method for Rapid Determination of Carbonate Content of Soils
11. ASTM D5519 Standard Test Methods for Particle Size Analysis of Natural and Man-made Riprap Materials
12. ASTM D420 Standard Guide for Site Characterization for Engineering Design and Construction Purposes
13. ASTM C702 Standard Practice for Reducing Samples of Aggregate to Testing Size
14. ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

C. OSHA Safety and Health Regulations for Construction, Subpart P Excavations 1926.652 (a-g).

1.05 QUALITY ASSURANCE

A. All work pertaining to this Section shall be done according to the requirements outlined in the Quality Assurance/Quality Control Plan (Appendix B).

B. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

C. Borrow Source Characterization Testing **(By Contractor)**:

1. The following borrow source characterization testing shall be performed on the materials used for the project's earthwork construction. The testing program will assure that borrow materials from on-site or off-site sources meet the requirements of this specification. Borrow source testing shall be performed prior to delivering off-site material to the site and prior to using on-site material for landfill construction. Changes in the borrow source and/or material properties shall be avoided. The Contractor shall employ a soils testing laboratory acceptable to the Engineer to perform soil testing of borrow source materials. Borrow source characterization will be performed in accordance with the MEDEP Solid Waste Management Rules, Chapter 401, Appendix A, or as directed by the Engineer.

   Borrow source characterization testing on soil materials shall be done at the following frequencies:

BORROW SOURCE CHARACTERIZATION TESTING

Borrow Material	Testing	Method	Frequency[1]
Sand[2]	Moisture Density[3]	ASTM D698	1/2,500 cy
	Remolded Hydraulic Conductivity	ASTM D2434	1/5,000 cy
	Grain Size	ASTM D6913	1/2,500 cy
	Calcium Carbonate[4] Content	ASTM D4373	1 per Source
Drainage Stone	Grain Size	ASTM D6913	1/2,500 cy
	Calcium Carbonate[4] Content	ASTM D4373	1 per Source
Filter Stone	Grain Size	ASTM D6913	1/2,500 cy
	Calcium Carbonate[4] Content	ASTM D4373	1 per Source
Sump Stone	Grain Size	ASTM D5519 Method A	1 per Type
	Calcium Carbonate[4] Content	ASTM D4373	1 per Source
Barrier Soil	Moisture Density	ASTM D698	1/2,500 cy
	Remolded Hydraulic Conductivity	ASTM D5084	1/5,000 cy
	Grain Size	ASTM D6913	1/2,500 cy
	Moisture Content	ASTM D 2216	1/500 cy
	Atterberg Limits (clay barrier soil only)	ASTM D 4318	1/2,500 cy
Common Borrow	Grain Size	ASTM D6913	1/2,500 cy
	Moisture/Density	ASTM D698	1/2,500 cy
Structural Backfill	Grain Size	ASTM D6913	1/2,500 cy
	Moisture/Density	ASTM D698	1/2,500 cy
Pipe Bedding	Grain Size	ASTM D6913	1/2,500 cy
Aggregate Base and Aggregate Subbase	Grain Size	ASTM D6913	1/2,500 cy
	Moisture/Density	ASTM D1557 (Paved Surfaces) or ASTM D698 (Gravel Surfaces)	1/2,500 cy

Notes:

1 Minimum of one test per source.

2 Sand material includes Underdrain, Leak Detection, and Leachate Collection system sand.

3 Underdrain and Leak Detection Sand layers only.

4 Equivalent methods can be used to determine calcium carbonate content, including Whole Rock Geochemistry ME XRF06 and ME ICP06. Historic testing of the source is sufficient provided material came from the same source.

1.06 SUBMITTALS:

A. The Contractor shall supply representative materials for testing as required by the Engineer. The Contractor shall schedule his operation and submissions so the Engineer has sufficient time to perform testing. Failing tests of materials quality, gradation, or field density will be charged to the Contractor and deducted from payments.

B. Test Reports: Submit borrow source test reports directly to the Engineer from the Contractor's testing subcontractor, with copy to the Contractor. If borrow source testing indicates a significant change in material index properties during construction, the in-place material testing specifications described herein shall be modified.

C. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.07 JOB CONDITIONS:

A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that

the Owner and/or the Engineer will not be responsible for interpretations or conclusions drawn therefrom by the Contractor. Data are made available for the convenience of the Contractor.

Additional test borings and other exploratory operations may be made by the Contractor at no cost to the Owner.

B. Existing Utilities: The Contractor shall contract the services of a private utility location service and/or Dig Safe to locate existing underground utilities in the areas of work, as necessary, or as required by law. In addition, the Contractor is required to collaborate with the Owner to gain supplementary information regarding the location of underground utilities at the site. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions. Cooperate with the Owner and utilities companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Utility Owner.

Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided.

Demolish and completely remove from the site any existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

C. Use of Explosives: Blasting at the Juniper Ridge Landfill site is not permitted.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights as necessary. Operate any required warning lights as recommended by authorities having jurisdiction. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. The Contractor shall comply with all applicable rules, procedures and regulations regarding safety as defined by all local, state, and federal agencies, including but not limited to, OWNER'S safety procedures, State of Maine Labor Department Rules, and the Occupational Safety and Health Act (OSHA) Regulations.

E. Work related to Owner supplied HDPE geomembrane and geosynthetic clay liner installation:

The Contractor shall provide the necessary labor, materials, equipment, and supervision to perform the following work in conjunction with the installation of the geomembrane liner, geosynthetic clay liner, and drainage geocomposite.

- Excavation and backfill of all liner anchor trenches;
- Preparation of all liner subgrade materials including moisture control, picking stones as directed by the Engineer or Quality Assurance Resident Engineer (QARE), providing a smooth rolled surface to the tolerances required by the Engineer or QARE;
- Coordination of work schedule to accommodate the geosynthetics installation including weekend and holiday work as necessary, and allowing sufficient turnaround time for results of destructive seam testing (typically 24 hours) prior to placing material over the geomembrane or geosynthetics;
- Placement of a minimum 3 feet of suitable material, approved by the Engineer or QARE agent, over the liner materials before traveling on the liner with equipment other than low-pressure equipment (5 pounds per square inch) approved by the Engineer or QARE; and
- All other conditions noted in Section 00110 "Summary of Work".

PART 2 - PRODUCTS

2.01 SOIL MATERIALS:

A. Roadways and Parking Lots:

1. Aggregate Subbase: Aggregate subbase shall be soil consisting of hard, durable particles that are free from vegetation, lumps, or balls of clay, and other deleterious substances. Aggregate subbase shall not contain particles of rock which will not pass the 6-inch square mesh sieve. The gradation of the portion passing a 3-inch sieve shall meet the grading requirements of the following table:

	Percent by Weight Passing
Sieve Designation	Square Mesh Sieve
1/4"	25-70
#40	0-30
#200	0- 7

(M.D.O.T. 703.06 b. Type D)

2. Aggregate Base: Shall be crushed rock or soil consisting of hard durable particles which are free from vegetation, organic matter, lumps or balls of clay, and other deleterious substances. The gradation of the base materials shall meet the grading requirements of the following table:

	Percent by Weight Passing
Sieve Designation	Square Mesh Sieve
2"	100
1/2"	45-70
1/4"	30-55
#40	0-20
#200	0- 5

(M.D.O.T. 703.06 a. Type A)

B. Structures:

1. Granular Backfill: Backfill placed within 5 feet of structures shall consist of a well graded sand free of vegetation, organic matter, lumps, or balls of clay and other deleterious substances. The gradation shall meet the grading requirements of the following table:

	Percent by Weight Passing
Sieve Designation	Square Mesh Sieve
3"	100
#40	0- 70
#200	0- 10

(M.D.O.T. 703.19)

C. Pipe Bedding Stone (Solid Wall Pipe): Stone shall be obtained from rock of uniform quality and shall consist of clean, angular fragments of quarried rock free from soft disintegrated pieces or other questionable matter. The material shall meet the following gradation requirements:

	Percent by Weight Passing
Sieve Designation	Square Mesh Sieve
¾"	100
½"	85 -100
3/8"	0 - 15

D. Landfill:

1. Clay Barrier Soil:
   a. Clay Barrier Soil Material shall contain a minimum of 35 percent fines (passing the #200 sieve) with a maximum particle size of less than or equal to 1 inch and have a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec. Clay Barrier soil shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1"	100
#40	90-100
#200	35-100*

*No. 200 sieve gradation is based on the percent passing the No. 4 sieve.

   b. The Clay barrier soil shall meet the following Atterberg limits (ASTM D4318)
      Liquid limit: $\geq$ 20
      Plasticity index: 8 $\leq$ P.I. $\leq$30
   c. The clay barrier soil shall be free of organic matter and deleterious materials.
2. Till Barrier Soil:
   a. Till Barrier Soil shall contain a minimum of 35 percent fines (passing the #200 sieve) and a maximum hydraulic conductivity of $1x10^{-5}$ cm/sec and a geometric mean less or equal to $1x10^{-6}$ cm/sec. The barrier soil shall be free of organic matter and deleterious materials.
   b. Till Barrier soil shall meet the following gradation requirements

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
3"	100
#200	35-100 *

*No. 200 sieve gradation is based on the percent passing the No. 4 sieve.

   Stones larger than 1/2" in diameter shall not be permissible immediately beneath a geomembrane liner.
3. Drainage Stone: Shall be screened and washed crushed stone free of organic matter, silt, or clay lumps, and deleterious material. The stone shall contain no more than 15 percent calcium carbonate as determined by ASTM D4373 or equivalent method approved by the Engineer (i.e., whole rock geochemistry methods). The material shall meet the following gradation requirements:
   a. Pipe Drainage Stone:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
2"	100
1-1/2"	80-100
1"	50- 85
1/2"	0- 50
#4	0- 15
#10	0- 5

b. Leachate Sump Stone will consist of durable screened and washed stone.

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
4”	100
2”	0

4. Filter Stone: Shall be screened and washed stone free of organic matter, silt, or clay lumps, and deleterious material. The stone shall contain no more than 15 percent calcium carbonate as determined by ASTM D4373 or equivalent method approved by Engineer (i.e., whole rock geochemistry methods). The material shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1”	100
No. 4	30-100
No. 20	0-20
No. 40	0-5

5. Underdrain Sand: Clean sand, free from organic matter, graded to meet the following criteria for the appropriate designation. The underdrain sand will have a minimum remolded hydraulic conductivity of $5.0x10^{-3}$ cm/sec (as determined by ASTM D2434). The underdrain sand shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1”	100
1/2”	80-100
#4	70 – 100
#20	35 – 80
#60	0-40
#100	0-15
#200	0- 10

6. Leak Detection Sand: Clean sand, free from organic matter, graded to meet the following criteria for the appropriate designation. The leak detection sand will have a minimum remolded hydraulic conductivity of $5.0x10^{-3}$ cm/sec (as determined by ASTM D2434).

   The leak detection sand shall meet the following gradation requirements:

Sieve Designation	Percent by Weight Passing Square Mesh Sieve
1”	100
1/2”	80 – 100
#4	70 – 100
#20	35 – 80
#60	0 – 40
#100	0 – 15
#200	0 – 7.5

7. Leachate Collection Sand: Clean sand, free from organic matter, graded to meet the following criteria for the appropriate designation. The leachate collection sand will have a minimum remolded hydraulic conductivity of $5.0x10^{-3}$ cm/sec. and a geometric mean

remolded hydraulic conductivity of greater than or equal to $1.0x10^{-2}$ cm/sec as determined by ASTM D2434.

The leachate collection sand shall meet the following gradation requirements:

	Percent by Weight Passing
Sieve Designation	Square Mesh Sieve
1”	100
1/2”	90-100
#4	70 – 100
#20	35 – 80
#60	0-40
#100	0-15
#200	0- 7.5

For all sand materials - An alternate gradation may be considered and approved by the Engineer provided the material meets the remolded hydraulic conductivity requirement, and has a gradation that allows it to meet the design filter criteria with the exception that the percent passing the #200 sieve shall not exceed 7.5 percent for leak detection and leachate collection sand or 10.0 percent for underdrain sand.

F. Miscellaneous Materials:
   1. Common Borrow: Shall be soil suitable for embankment construction. It shall be free of frozen material, perishable rubbish, peat, organic matter, large rock fragments, or other unsuitable material. AASHTO M145 Classifications A-1 through A-5 may be used. In embankments, the maximum aggregate size shall not exceed twelve (12) inch diameter. In the base grade, fill the maximum aggregate size shall not exceed a three (3) inch diameter. Use of other materials as common borrow is at the discretion of the Engineer and only in approved areas.
   2. Vegetative Soil: Shall be in accordance with Section 02800 – Seeding and Mulching.
   3. Riprap: Shall be in accordance with Section 02261 – Riprap.
   4. Frost Protection Layer: Suitable frost protection material shall include bark, wood chips, sawdust, municipal solid waste, and/or other materials approved by the Engineer, Owner, and the MEDEP.

2.02 ON-SITE MATERIAL

A. Material on the site is the property of NEWSME and may only be used with the approval of the Engineer and Owner. The Contractor will complete all borrow source testing requirements specified in Table 2-1, if they wish to use any on-site material.

B. Material not incorporated in the work because it is unsuitable will be stockpiled at a location determined by the Owner.
   1. Material designated to be saved by the Engineer or Owner will be stockpiled using MEDEP Erosion Control Best Management Practices (BMPs) for construction, at a location shown on the Drawings or designated by the Owner/Engineer.
   2. Unsuitable material shall consist of grubbings or materials that contain rock of a size that exceeds specifications, organic materials, frozen materials, or other materials of a deleterious nature as deemed by the Engineer.

PART 3 - EXECUTION

3.01 INSPECTION: Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Engineer, in writing of conditions detrimental to the proper and timely

completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 EXCAVATION: Excavation consists of removal and disposal of material encountered when establishing required grade elevations. All excavation shall be unclassified and shall include any and all material encountered. No extra compensation shall be allowed for excavation work covered by the bid proposal.

A. Excavation for Structures: Conform to elevations and dimensions shown within a vertical tolerance of one twentieth (0.05) of a foot and extending a sufficient horizontal distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

Excavation for footings and foundations shall extend to the depth necessary to remove all fill material above the native soils. When the footing and foundation grades extend into native soils, the native soil shall be excavated to the foundation grades specified on the plans.

In excavating for footings and foundations, take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave a solid base to place concrete.

Rock shattered due to drilling or ripping operations shall be removed. Excess rock excavation shall be filled with Class A or Class B concrete.

B. Excavation for Pavements: Conform to subgrade elevations and dimensions shown, within a vertical tolerance of one-tenth (0.1) of a foot.

C. Excavation for Trenches: Conform to elevations and dimensions within a vertical tolerance of one-tenth (0.1) of a foot. Excavate to the uniform width shown or required for the particular item to be installed. Provide adequate working space for compactive equipment.

Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations and provide suitable bedding as specified in paragraph 2.01.C.

Where rock is encountered, carry the excavation one half (0.5) of a foot below the required elevation and backfill with a one half (0.5) of a foot-thick layer of bedding stone or gravel prior to installing pipe.

Grade bottoms of trenches as indicated, notching under pipe joints to provide solid bearing for the entire body of the pipe.

Do not backfill trenches until authorized by the Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

D. Site Excavation: Conform to elevations and dimensions shown within a vertical tolerance of one-tenth (0.1) of a foot. During the excavation to base grade, excavating equipment and trucks are to be kept off the subgrade to minimize disturbance of the subgrade. Excavate to a depth to provide for any subsequent loam, sod, or other specified surface material.

E. Excavation of Unsuitable Material: Shall consist of the excavation and removal of all fill materials including loose, uncompacted soil materials, buried rubber tires and waste, buried vegetation and other organic or inorganic debris, and/or saturated and unsaturated mixtures of soils and organic matter not suitable for foundation or embankment material that may be encountered during the prosecution of the work, or as directed by the Engineer. The excavation shall extend to the limits and depth necessary to remove the unsuitable material as directed by the QARE.

3.03 STABILITY OF EXCAVATIONS: Slope sides of excavations to comply with. OSHA Safety and Health Regulations for Construction, Subpart P Excavations 1926.652 (a-g). Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

3.04 SHORING AND BRACING:

A. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, in good serviceable condition.

B. The Contractor shall have a competent person as defined in OSHA Safety and Health Regulations for Construction, Subpart C ,General Safety and Health Conditions, 1926.32 (f), on-site during all trenching, shoring and bracing work.

C. The Contractor shall prepare an excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed at the Project location

D. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

E. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

F. Design sheeting and shoring to be removed at completion of excavation work.

G. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

H. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section

J. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

3.05 MATERIAL STORAGE: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Seed and mulch stockpiles in accordance with MEDEP BMPs as necessary.

Locate and retain soil materials away from edge of excavations.

Dispose of excess soil material and waste materials as herein specified.

3.06 COLD WEATHER PROTECTION: Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F.

3.07 WINTER CONSTRUCTION OF EMBANKMENTS: Frozen material shall not be placed in the embankment or base grade layers. The construction of embankments and base grading may continue during cold weather only when all frozen material in the top of the area to be worked is moved to the waste storage area, or removed from the site, before placing additional material. Winter construction of the compacted barrier soil is prohibited.

Placement of soil fill shall be at the discretion of the Engineer when temperatures are below 30°F. Compaction shall be in accordance with the specified method of soil placement. When the prevailing temperatures are below 30°F, all soil material placed shall have a moisture content at the time of compaction equal to or less than the optimum moisture content.

3.08 CLOSING ABANDONED UNDERGROUND UTILITIES: Close open ends of abandoned underground utilities that are indicated to remain permanently with closures sufficiently strong to withstand pressures that may result after closure.

Close open ends of metallic conduit and pipe with threaded galvanized metal caps or plastic plugs, or other suitable method for the type of material and size of pipe, or as shown on the Contract Drawings. Do not use wood plugs.

Close open ends of plastic PVC pipe abandoned in-place with a permanent plastic PVC plug, or as shown on the Contract Drawings. Pipe end is to be backfilled with bedding sand.

Close open ends of concrete and masonry utilities with not less than 8-inch-thick brick masonry bulkheads, constructed to completely fill the opening.

Wet brick before laying. Lay brick in mortar so as to form a full bed with ends and side joints in one operation. Joints shall be more than three-eighths (3/8) inch wide. Protect fresh masonry from freezing or from rapid drying, as necessary, and maintain protection until mortar has set.

3.09 BACKFILL AND FILL:

A. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
   1. In excavations, use satisfactory excavated or borrow material.
   2. Under grassed areas, use satisfactory excavated or borrow material.
   3. In pipe trenches, use material specified in typical trench section.
   4. Landfill Base: Use satisfactory on-site excavated soil material, and/or borrow meeting the requirements of SWMR Ch. 401.2.D(3).

B. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance by Engineer of construction below finish grade including, but not limited to, damp proofing, waterproofing, and perimeter insulation.
   2. Inspection, testing, approval, and recording locations of underground utilities.
   3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Temporary sheet piling driven below bottom of structures shall be removed in a manner to prevent settlement of structures or utilities,.
   4. Removal of trash, debris, frozen and/or unsuitable materials.

C. Placement and Compaction: Place backfill and fill materials in layers not more than 12 inches compacted depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers, except for clay as noted below.

   Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

   Prior to the placement of the compacted clay layer, a test pad program shall be completed to demonstrate that the placement and compaction techniques used can achieve the required performance standards. The test pad shall: include an area of approximately 50,000 square feet within the cell, encompass the transition from landfill base to perimeter berm, and consist of placing and compacting the clay in a compacted thickness of 12 inches.

   During placement, in-place moisture/density tests will be obtained at an increased frequency of 15 per acre per lift. Provided the field test demonstrates an adequate compaction effort has been obtained through the entire lift thickness, the type of compaction (e.g., compaction equipment and number of passes) will be noted and shall be the method used for the remainder of the clay placement. In-place hydraulic conductivity tests will be randomly

collected at an elevated frequency of 8 per acre per lift for each one-foot lift. Laboratory hydraulic conductivity tests will be performed on clay samples representative of the top, middle, and bottom of each lift. These hydraulic conductivity tests will be sent to the laboratory and the hydraulic conductivity, density, and moisture content of the in-place clay measured.

If the field and laboratory tests confirm that this construction technique can achieve the project performance criteria, the area of the test pad covered with two 12-inch lifts will be tested to verify lift bonding. 3 samples shall be collected by pushing Shelby tubes through the entire 24" in-place thickness to verify the interface between the two lifts. The condition of the lift interface will be visually confirmed by sectioning the full depth core removed from the tubes, and taking photos of the samples.

The data collected and testing results will be compiled and discussed by the construction stakeholders and upon concurrence that the construction techniques are appropriate to achieve the specified in-place properties of the clay the technique will be employed for the remainder of the project.

Mating of new clay lifts with previously placed clay lifts shall be done by excavating the mating edge of the existing clay lifts in a stepped manner. Each step shall have a vertical height no greater than 12 inches and a horizontal width of 4 to 6 feet. The surface of each of the steps in the old clay layer shall be scarified to maximize bonding between the new and old sections.

Place backfill and fill materials evenly to required elevations, adjacent to structures. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.

Low ground-pressure dozers will be used during the placement of the leak detection sand and leachate collection sand above the geomembrane. The methodology of underdrain sand placement in this area will require approval of the QARE. Grading sand materials will utilize laser or GPS survey technology to eliminate the need for grade stakes. In addition, extra precaution will be taken with the equipment used for placement to avoid sudden turns, stops or starts that could disturb the underlying composite liner. No equipment will be allowed on the sideslopes when placing drainage stone on the slopes. The stone will be placed by an excavator or clamshell bucket. The stone will be graded with a smooth-bucket.

The Contractor shall insure that the surface upon which the secondary geomembrane is to be placed does not contains particles that will not pass through a ½" square mesh sieve.

Equipment such as low ground-pressure dozers and sheepsfoot drum rollers will be used during the placement and compaction of the clay liner. Grading of the clay material will utilize laser or GPS survey technology to eliminate the need for grade stakes. The type of equipment, operating speed, and number of passes to adequately compact the clay barrier soils shall be approved by the Engineer. In addition, extra precaution will be taken with the equipment used for placement and compaction to avoid sudden turns, stops or starts that could disturb the clay liner. The equipment used in compaction of materials placed above the geomembrane shall be approved by the Engineer. A smooth drum roller is to be used to seal the lifts.

At the completion of the clay liner and prior to the installation of the GCL, the clay surface shall be proof rolled with three passes of a smooth drummed roller.

Sealing the lifts will encourage runoff from storms, thus limiting development of excessively moist or wet lenses of soil within the barrier layer. The lift surface shall be scarified or otherwise roughened by tracking with a bulldozer prior to placing the next lift of material to promote good bonding between lifts.

Equipment used to construct the landfill shall be approved by the Engineer prior to or during the pre-construction meeting.

3.10 GRADING:

A. General: Uniformly grade areas within the limits of grading under this section, including adjacent transition areas. Smooth finish surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.11 COMPACTION:

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification.

B. Percentage of Maximum Density Requirements: Compact soil to within not less than the following percentages of maximum dry density (determined in accordance with ASTM D 698).

1. Landfill:
   a) Subgrades: Native soils approved to be left in place shall be proof rolled prior to the barrier soil or under drain sand placement. Proof rolling shall include a minimum of three passes of a heavy vibratory compactor. The type and weight of the compactor shall be approved by the Engineer. The Engineer shall recommend removal of any unsatisfactory fill or native material, approve compaction equipment, and observe the compaction effort.
   b) Barrier Soil: Compact barrier layer material to achieve the following properties:

In-Place Hydraulic Conductivity:	Clay Barrier soil $\leq 1x10^{-7}$ cm/sec at least 90 percent standard proctor density. Till Barrier soil < $1x10^{-6}$ cm/sec (geometric mean)
Moisture Content:	(0-4 percent above optimum for clay barrier soil and +/- 2% of optimum for till barrier soils)

   Compaction test frequency of the barrier soil material will be at 9/acre/lift.
   c) Embankments and Anchor Trench: Compact soil at least 90 percent of maximum dry density. Embankments compaction test frequency: 1 test/100 lf/lift. Anchor trench compaction test frequency at Engineer's discretion.
   d) Drainage Sand: Compact sand used for the underdrain and leak detection layers to at least 90 percent of maximum dry density. Compaction test frequency at 5/acre/lift.
2. Footings and Foundations:
   a. Footings founded on native sands: Compact subgrade with at least six complete passes of an approved vibratory plate.
   b. Compact each layer of granular fill material to at least 95 percent of standard proctor maximum dry density.
3. Structural Slabs: Compact each layer of granular fill material to at least 95 percent of standard proctor maximum dry density.
4. Adjacent to Structures: Within 5 feet of a structure, compact each layer of granular fill material to at least 92 percent of standard proctor maximum dry density.
5. Lawn or Unpaved Areas: Compact each layer backfill or fill material to at least 85 percent of standard proctor maximum dry density.

6. Pavements: Compact subgrade and each layer of gravel borrow, subbase material, and base material to at least 95 percent of modified proctor maximum dry density.
7. Pipe Trenches: Compact bedding material and each layer of backfill to six (6) inches over pipe to at least 90 percent of standard proctor maximum dry density.

C. Moisture Control: Where subgrade or a layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, in proper quantities to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to the specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.

The Contractor shall protect compacted barrier soil layers from desiccation during dry conditions, the barrier layers shall be kept in a moisture conditioned state as described above. Plans to control compacted clay layer desiccation shall be approved by the Project Manager.

3.12 BASE AND SUBBASE COURSES:

A. General: This work consists of placing aggregate base and subbase material, in layers of specified thickness, over subgrade surface.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Placing: Place subbase and base course material on prepared surfaces in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

When a compacted subbase course is shown to be 6 inches thick or less, place material in a single layer. When shown to be more than 6 inches thick, place material in equal layers, except no single layer shall be more than 12 inches or less than 3 inches in thickness when compacted.

3.13 VEGETATIVE SOIL:

A. General: This work consists of placing vegetative soil of the specified thickness on prepared subgrade in all areas disturbed by construction and not otherwise surfaced or covered by structures and shall be seeded and mulched in accordance with Section 02800 – Seeding and Mulching.

B. Material: Use suitable vegetative soil stripped from the site wherever possible.

C. Placing and Grading: Place vegetative soil to the specified thickness. Grade and rake soil to remove all foreign material and rocks over two (2) inches. Leave the surface uncompacted and track prior to seeding operations.

3.14 FIELD QUALITY CONTROL **(Testing Services by Owner)**:

Quality Control Testing During Construction: The Owner will perform quality control testing of materials used in the work (i.e., Borrow Source Construction Testing and in-place construction testing, in general accordance with the MEDEP Solid Waste Management Regulations Chapter 401 Appendix A). The Owner's Representative shall collect representative materials for testing.. The Contractor shall schedule his operation and submissions so the Owner's Representative has sufficient time to perform material quality control testing. Failing quality control tests of materials will be charged to the Contractor and deducted from payments. Quality control procedures outlined in the site's Quality Assurance/Quality Control Plan shall be implemented by the

Contractor during construction at the landfill. The Contractor will allow the Owner's testing service to examine and test subgrades and fill layers before further construction work is performed. Test results meeting the requirements of 3.11 herein, shall be obtained prior to placing additional materials.

A. Borrow Source Construction Testing: The following borrow source quality control testing of the barrier soils and granular drainage material shall be required as a minimum. Samples to be tested will be collected by the Owner's Representative. Samples will be taken in accordance with ASTM D420 and C702 from material that has arrived on site.

TABLE 3-1

BORROW SOURCE CONSTRUCTION TESTING

Material	Tests	Frequency
Barrier Soil	Moisture Density ASTM D698	1/2,500 cy
	Grain Size ASTM D422 (w/o hydrometer) or ASTM D6913	1/2,500 cy
	Moisture Content ASTM D2216	1/500 cy
Sand [1]	Moisture Density ASTM D698[2]	1/2,500 cy
	Grain Size ASTM D422 (w/o hydrometer) or ASTM D6913	1/1,000 cy
	Moisture Content ASTM D2216[2]	1/2500 cy
Drainage Stone	Grain Size ASTM D422 (w/o hydrometer) or ASTM D6913	1/500 cy
Filter Stone	Grain Size ASTM D422 (w/o hydrometer) or ASTM D6913	1/500 cy
Sump Stone	Grain Size ASTM D422 (w/o hydrometer) or ASTM D6913	1/500 cy

Notes:
1 Drainage Sand material includes Underdrain, Leak Detection, and Leachate Collection system sand.
2 Leak Detection and underdrain sand layer only.

B. In-Place Construction Testing: The following in-place construction quality control testing shall be performed.

TABLE 3-2

IN-PLACE CONSTRUCTION TESTING

Material	Tests	Frequency
Barrier Soils	Density ASTM D6938	9/acre/lift
	Moisture Content ASTM D6938	9/acre/lift
	Moisture Content ASTM D2216	1/acre/lift
	Undisturbed Hydraulic Conductivity ASTM D5084[2]	5/acre/lift
	Remolded Hydraulic Conductivity[3] ASTM D5084	5/acre/lift
	Thickness	5/acre/lift
	Lift Interface Bond and Remolding	5/acre/lift
Drainage Sand[1]	Density ASTM D6938[2]	5/acre/lift
	Thickness	5/acre/lift
	Constant Head Hydraulic Conductivity ASTM D2434	5/acre/lift
Embankments	Density ASTM D6938	1/100/LF/lift
Base Fill (Common Borrow)	Density ASTM D6938	9/acre/lift
	Moisture Content ASTM D6938	9/acre/lift

Notes:

[1] Drainage Sand material includes Underdrain, Leak Detection, and Leachate Collection systems. Underdrain and Leak Detection Sand layers only.

[2] Clay barrier soils only.

[3] Till barrier soils only.

Perform field density tests in accordance with ASTM D6938 (Nuclear Device), as applicable.

1. Measurement of Soil Thickness and Soil Characteristics:. The thickness of compacted till barrier soil, clay barrier soil and the drainage sand layers shall be recorded at the required frequency described below. The thickness of the aggregate subbase and base material shall be recorded once per 100 lineal feet of material placed.
2. The Owner's Representative shall identify test locations. The Contractor shall assist the Owner's Representative in obtaining the required samples. The Owner's Representative shall maintain daily logs of measurements of soil lifts soil characteristics and other observations. The thickness of the drainage and filter stone shall be recorded at 100-foot intervals.
3. Sampling clay barrier soil for hydraulic conductivity will entail collecting a sample with a thin-walled tube advanced into the entire depth of the compacted layer. The tube will be removed by slowly twisting the tube 360° while slowly pulling the tube from the compacted clay. Once successfully sampled, the tube ends shall be capped and taped. The tube shall be labeled with the site name, sample location, date, and time. Samples shall be transported vertically to the Owner's contracted testing laboratory. Samples will be tested for hydraulic conductivity according to ASTM D5084.
4. Deficient Areas of Work: Contractor placed subgrades and fills that are found deficient by inspection and/or failing quality control testing will be reworked. Subgrades and barrier soils that are below specified density or thickness, or outside the specified hydraulic conductivity range will be corrected at the Contractor's expense and the Contractor will reimburse the Owner for additional testing expenses. The Owner has the option of retesting the area in question prior to the Contractor taking corrective action. The deficient area is defined as the area encompassing half the distance from the failing point to surrounding sampling points which satisfactorily meet the testing requirements. The Contractor can elect to rework a rejected area; if it fails again the Contractor must remove the failing material and start anew with new material. The reworked area will be inspected and tested until the area is in conformance. An area which has been rejected

for nonconformance due to deficient specified thickness or grading requirements may be reworked by the Contractor until it meets the specification, provided this work does not cause the rejected block to deviate from the other requirements of conformance.

5. Barrier Soil Sample Holes: Holes formed in the compacted layer by the removal of thin-walled tube samples and moisture density testing, or for other testing or sampling, shall be backfilled by the Contractor to previous grade. The backfill will consist of either bentonite chips or compacted barrier soil such that the hydraulic conductivity requirements for the compacted clay layer are satisfied.

3.15 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

Control of compacted barrier soil layer desiccation shall be in accordance with Section 3.09.C.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations, desiccation, or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction. This work shall be performed at no additional cost to the Owner.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS:

Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of off-site in accordance with all local, state, and federal rules and regulations, or in areas designated by Owner/Engineer.

END OF SECTION

SECTION 02220

EROSION CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

C. The Project Site-Specific Maine Construction General Permit.

D. All work performed under this specification shall be performed in general accordance with the most recent edition of the Maine Department of Environmental Protection (MEDEP) Maine Erosion and Sediment Control Practices Best Management Practices.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Measurement and Payment: Section 01025

B. Project Coordination: Section 01041

C. Site Preparation: Section 02100

D. Earthwork: Section 02200

E. Riprap: Section 02261

F. Seeding and Mulching: Section 02800

1.03 DESCRIPTION OF WORK:

A. Prevention: Take every reasonable precaution and do whatever is necessary to avoid any erosion and to prevent sedimentation of rivers, streams, lakes, reservoirs, impoundments, and drainage ditches and swales.

B. Exposure: The exposure of uncompleted cut slopes, embankments, trench excavations, and site-graded areas shall be kept as short as possible. Initiate seeding and other erosion control measures on each segment as soon as reasonably possible.

C. Temporary Protection: Should it become necessary to suspend construction for seven days, shape all excavated and graded areas in such a manner that runoff will be intercepted and diverted to points where sediment control structures have been installed. Provide and maintain temporary erosion and sediment control measures, such as berms, dikes, slope drains, silt stops, sedimentation basins, sediment traps, mulching, temporary seeding, stone check dams, and filter berms until permanent drainage facilities or erosion control features have been completed and are operative. The Contractor shall provide temporary seeding, mulching, or other protective coverings to exposed earth surfaces and stockpiles outside of the landfill cell that are susceptible to erosion and which will be exposed to rain or wind elements for a period of greater than seven days.

D. Handling of Erodible Soils: Erodible soils placed or exposed during the work shall be so handled and treated as to minimize the possibility of its reaching any surface waters. Use diversion channels, dikes, sediment traps, or any other effective control measures.

E. Off-site Erosion Control: The requirements of this Section also apply to Project-related construction activities away from the Project site, such as at borrow pits, off-site storage areas, and haul and work roads.

F. Remedial Action: Should any protective measures employed indicate any deficiencies or erosion taking place, immediately repair erosion control measures or employ different techniques to correct the situation and to prevent subsequent erosion and sedimentation.

G. Discontinuation: Continue temporary erosion and sedimentation control measures until the permanent measures have been sufficiently established and are capable of controlling erosion and sedimentation on their own.

H. Permanent Seeding: At the completion of landfill construction activities, the Contractor shall provide permanent seeding, mulching, or other protective landscape coverings to exposed earth surfaces affected by construction activities, and as shown on the Contact Drawings, and as specified in Section 02800.

I. Inspection: The Contractor shall perform all inspections and documentation required by the project's MEDEP Maine General Construction Permit.

J. Maintenance and Repair: The Contractor shall be responsible for maintenance, and/or repair of all temporary and permanent erosion and sedimentation control measures during construction, including temporary or permanent erosion and sedimentation control measures installed by other subcontractors and used during this project. Inspections will be undertaken by the Contractor's qualified personnel to ensure that controls are correctly functioning, and that additional erosion control measures are installed if needed. Such inspections will occur bi-weekly and after each significant rainfall event (1 inch or more within a 24-hour period) during construction and until permanent erosion and sediment control measures have been properly installed and the site is stabilized. Sediment within sediment control structures shall be removed when the height of the sediment is greater than one-half the depth of the erosion control measure.

1.04 SEDIMENT CONTROL GUIDELINES:

A. Maine Erosion and Sediment Control BMPs (most recent version).

B. Maine Erosion and Sediment Control Practices Field Guide for Contractors (most recent version).

C. MEDEP Natural Resources Protection Act Permit by Rule Standards, Chapter 305.

D. MEDEP – Maine Construction General Permit requirements.

1.05 SUBMITTALS:

A. The Contractor shall furnish to the Engineer, in writing, his plan for dewatering excavations and diverting surface water before beginning the construction work for which the dewatering or diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

B. Manufacturer's product data sheets, material certifications, and standard manufacturing quality control test data for products listed in Part 2 of this specification.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Handle material in accordance with manufacturer's recommendations. Protect materials from deterioration during delivery, and while stored at the site.

1.07 JOB CONDITIONS: Contractor must examine the subgrade, verify the elevations, observe the conditions under which work is to be performed and notify the Engineer of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

Proceed with and complete the erosion and sedimentation work as rapidly as portions of the site become available, working within the required seasonal limitations.

A. Seeding Seasons: Unless variance is requested in writing and approved by the Engineer, seeding shall be done within the following dates:

Permanent Seeding: April 26 – September 15

Temporary Seeding: September 16 until April 25

Dormant Seeding: At the Contractor's risk, from September 16 until April 25

1.08 QUALITY CONTROL:

A. Source Quality Control:
   1. General: Ship erosion control materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to landscape materials.
   2. Analysis and Standards: Package standard products with the manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemist, wherever applicable or as further specified.
   3. Inspection: The Engineer reserves the right to request manufacturers materials (bags, tags, etc.) of any and all materials to confirm material quality and quantity.

B. Installation Quality Control:
   1. Provide at least one person who shall be present at all times during erosion control installation and who shall be thoroughly familiar with the types of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.
   2. Material manufacturers and vendors shall be reputable, qualified firms regularly engaged in producing the required types of materials.
   3. Protect and maintain all areas disturbed by the work, such that erosion is controlled and sediments are not allowed to flow into any watercourse, onto adjacent properties, or into storm drains.

PART 2 - MATERIALS AND PRODUCTS

2.01 GENERAL:

A. Materials incorporated in erosion control shall be specified in other sections or included herein.

2.02 GRUBBINGS:

A. The top 14 inches of soil removed from areas shown on the Drawings shall be segregated into piles, cleaned sufficiently, and reused in accordance with Section 02200, Earthwork. Any of this soil that is used as vegetative soil shall be tested by a qualified laboratory for the requirements listed for vegetative soil. If the quantity of stockpiled vegetative soil is insufficient, or quality is not in accordance with the requirements for vegetative soil, the Contractor shall provide additional new vegetative soil from an Engineer-approved off-site source as required to complete the work.

2.03 VEGETATIVE SOIL:

A. Vegetative Soil shall be as specified in Seeding and Mulching Specification Section 02800.

2.04 SILTATION FENCE:

A. Siltation fence shall be preassembled fence consisting of synthetic filter fabric reinforced with a supporting mesh and mounted on wood or metal stakes.

B. The fence shall be Envirofence as manufactured by Mirafi, Spun Bond as manufactured by Trevira, or Propex Silt Stop as manufactured by Amoco or approved equal.

2.05 RIPRAP STONE:

A. Riprap shall be as shown on the Drawings.

B. Bedding Stone: Material for bedding shall be drainage stone conforming to Specification 02200, Earthwork.

C. Riprap Geotextile: The nonwoven geotextile used in the construction of riprap-lined swales, the final cover downspout, plunge pool, and the gas collection trench shall meet Specification 02272.

2.06 STONE CHECK DAMS:

A. Stone for check dams shall consist of a mixture of angular stones having a particle size of between 2 and 6 inches and faced with 6 inches of drainage stone. The check dams shall be installed at locations as indicated on the Drawings and shall be constructed as detailed on the Drawings.

B. Exposed Stone: The exposed stones for the check dams shall be angular and as nearly rectangular in cross-section as practicable. Rounded stone will not be permitted. The stone shall consist of durable stones that will not disintegrate by exposure to the action of water or weather.

2.07 EROSION CONTROL MATTING:

A. Shall be placed on newly loamed and seeded areas as indicated on the Contract Drawings.

B. During fall and winter (see Section 1.07.A) use heavy-grade mats or as recommended by the Engineer on all channel bottoms and slopes greater than 4H:1V. Install mats according to manufacturer's recommendation.

2.08 MULCH:

A. Mulch shall be in accordance with Seeding and Mulching Specification Section 02800.

2.09 HAY BALES:

A. Rectangular-shaped bales of hay or straw weighing at least 40 lbs. free from primary noxious weed seeds and rough or woody materials.

2.10 EROSION CONTROL MIX:

A. Erosion Control Mix shall contain a well-graded mixture of particle-sizes and may contain rocks smaller than 4” diameter. Erosion control mix shall be free of refuse, physical contaminants, and material toxic to plant growth such as ash and yard scrapings. Large portions of silts, clays, or fine sands are not acceptable in the mix. The mix composition should meet the following standards:
   1. The organic matter content should be between 80% and 100% on a dry weight basis;

2. Particle size by weight should be 100% passing a 4-inch screen and 70% to 85% passing a 0.75” screen;
3. The organic portion needs to be fibrous and elongated;
4. Soluble salt content shall be < 4.0 mmhos/cm; and
5. The pH shall be between 5.0 and 8.0.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall provide for the diversion of clean surface water from the construction areas and install siltation and erosion control structures as shown on the Contract Drawings or as directed by the Engineer or QARE.

B. The Contractor shall provide all materials, equipment, and labor necessary (for the duration of the Contract) for the dewatering of excavations and the removal and/or diversion of surface water from the construction area, and installation of erosion and sedimentation control structures as shown on the Contract Drawings and according to these Specifications, and in accordance with the MEDEP BMPs. The Contractor shall maintain a dewatering and stormwater control system so that no sediment-impacted waters are discharged from the site.

C. The Contractor shall build all drains, dikes, and sediment basins, install all siltation fencing, mulches, grasses, seeding, ditches, channels, riprap, grading, and all other work necessary to control water pollution, surface runoff, and soil erosion.

D. The Contractor shall provide temporary seeding, mulching, or other protective coverings to exposed earth surfaces or stockpiles which will be exposed to rain or wind elements through the fall and winter seasons.

E. The Contractor shall maintain all facilities necessary to control water pollution, surface runoff, and soil erosion until permission is given by the Engineer to discontinue the use of the facilities.

F. It shall be the Contractor’s responsibility to restore any eroded or damaged surfaces to the design grade with approved material and to keep topsoiled areas in acceptable condition until a sufficient vegetated surface is established and accepted by the Engineer.

3.02 EROSION CONTROL PROVISIONS:

A. The discharge from pumping operations during dewatering operations shall be contained by a dike so constructed as to prevent siltation, and the area at the outlet pipe shall be protected against erosion by the construction of a riprap apron.

B. Prior to removal of sediment control dikes, all retained silt or other materials shall be removed and placed in areas not susceptible to erosion as directed by the Engineer, at no additional cost to the Owner.

3.03 REMOVAL OF TEMPORARY WORKS:

A. After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

3.04 PLACEMENT OF EROSION CONTROL BLANKET: Erosion control blanket shall be placed at locations indicated on Contract Drawings. The anchoring of the blanket shall be in accordance with manufacturer’s recommendations, as shown on the Contract Drawings, or as directed by the Engineer or QARE.

3.05 PLACEMENT OF RIPRAP: Placement of riprap shall be in accordance with Riprap Specification Section 02261.

3.06 MAINTENANCE AND ACCEPTANCE:

A. The Contractor shall be responsible for inspection and maintenance of all temporary erosion and sedimentation control measures during construction. Inspections will be undertaken by qualified personnel to ensure that controls are correctly functioning, and that additional erosion control measures are installed if needed. Such inspections will occur bi-weekly and after each significant rainfall event (1 inch or more within a 24-hour period) during construction until permanent erosion control measures have been properly installed and the site is stabilized. Trapped sediment shall be removed when the height of the sediment is greater than one-half the depth of the erosion control measure.

B. The Contractor shall continue to maintain erosion and sedimentation controls until vegetation is suitably established (Seeding and Mulching Specification Section 02800) and the Engineer deems the site stable, at which time all temporary erosion and sediment controls may be removed from the site.

END OF SECTION

SECTION 02261

RIPRAP

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. All work included in the Contract (Contract Documents, Specifications, and Drawing), including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Measurement and Payment: Section 01025

B. Project Coordination: Section 01041

C. Earthwork: Section 02200

D. Erosion Control: Section 02220

1.03 DESCRIPTION

A. Work specified in this Section shall consist of furnishing all labor, materials, and equipment to place a protective covering of riprap on the slopes of embankments, dikes, streambanks, channels, and stormwater outlets in conformity with the Contract Drawings and as specified herein.

PART 2 MATERIALS

2.01 TYPE OF STONE: Stones shall consist of sound, durable rock that is resistant to the action of water. Rough, unhewn quarry stone may be used. The stones shall be angular. The top and bottom surfaces of each stone shall be approximately parallel to each other and the sides approximately perpendicular to the bottom and top. Round or thin, flat stones will not be permitted. The maximum allowable length to width ratio will be 3:1.

A. Gradation of riprap shall be as indicated on the Contract Drawings and meet the following requirements:

1. Riprap D_0 = Minimum Stone Size = Average dimension which no stones are smaller than the designation. Minimum stone size shall have an average dimension of approximately 0.5 times the D_{50}size.
2. Riprap D_{50} = Average Stone Size = Size at which approximately 50 percent of the stones by volume shall have an average dimension larger than the designation.
3. Riprap D_{100} = Maximum Stone Size = Size at which no stones are larger than. Maximum stone size shall have an average dimension of two times the D_{50} designation.

2.02 STONE MATERIAL: The stones for riprap shall be angular and as nearly rectangular in cross-section as practicable. Rounded boulders or cobbles will not be permitted.

2.03 BEDDING MATERIAL: Material for bedding shall be aggregate base material conforming to Specification 02200, Earthwork.

2.04 GEOTEXTILE: A nonwoven geotextile conforming to Specification 02272, Geotextiles, shall be placed along the areas receiving riprap as shown on the Contract Drawings or as directed by the Engineer.

PART 3 EXECUTION

3.01 PLACEMENT OF RIPRAP: Riprap shall be placed full depth in one operation without special handwork and shall be placed approximately true to the required slope, line and grade and be uniform in appearance. The stones shall be laid in close contact with the longer axis perpendicular to the plane of the slope to stagger joints. Except when required to be grouted, the openings between the stones in all riprap shall be filled with spall, or rocks securely rammed into place.

3.02 The gradation of riprap shall be evaluated by the Quality Assurance Resident Engineer (QARE) or Engineer by visual inspection of the load before and/or after it is dumped. The QARE reserves the right to reject stone at the job site that is either in a stockpile, or in-place. Stone rejected at the job site or in-place shall be removed from the site at no additional cost to the Owner.

END OF SECTION

SECTION 02272

GEOTEXTILES AND DRAINAGE GEOCOMPOSITE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the project's Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Measurement and Payment: Section 01025

B. Project Coordination: Section 01041

C. Earthwork: Section 02200

D. Erosion Control: Section 02220

E. Polyethylene Piping: Section 02455

F. Textured Geomembrane (Project Specific Linear Low-Density Polyethylene (LLDPE) or High-Density Polyethylene (HDPE)): Section 02771

G. Interfacial Friction Angle Conformance Testing: Section 02780

H. HDPE Pipe and Fittings: Section 15100

1.03 REFERENCES:

A. ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastomer

B. ASTM D1505 Standard Test Method for Density of Plastics by Density-Gradient Technique

C. ASTM D4218 Standard Test Method for Determining Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique

D. ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus

E. ASTM D4491 Standard Test Method for Water Permeability of Geotextiles by Permittivity

F. ASTM D4533 Standard Test Method for Trapezoidal Tearing Strength of Geotextiles

G. ASTM D4595 Standard Test Method for Tensile Properties of Geotextiles by Wide-Width Strip Method

H. ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

I. ASTM D4716 Standard Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head

J. ASTM D4751 Standard Test Method for Determining Apparent Opening Size of Geotextile

K. ASTM D5035 Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

L. ASTM D5199 Standard Test Method for Measuring the Nominal Thickness of Geotextiles

M. ASTM D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

N. ASTM D5321 Standard Test Method for Determining Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

O. ASTM D6241 Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

P. ASTM D7005 Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites

1.04 DESCRIPTION:

A. Furnish and install woven and non-woven geotextiles whichever is called for at the locations and in the manner shown on the drawings or as described herein and in the QA/QC plan.

B. Install Owner-supplied drainage geocomposite as part of the Project liner system as shown on the drawings, described herein and in the QA/QC plan. The Geosynthetics Quality Assurance Engineer (GCARE) will coordinate with the Owner, Manufacturer, Quality Assurance Resident Engineer (QARE), and Engineer the review of manufactures documentation of experience and manufacturing quality control testing, and conformance testing for drainage geocomposite. This will not be the responsibility of the Contractor.

1.05 SUBMITTALS:

A. The Contractor shall submit product information to the Engineer prior to commencing the work.

B. If brand name materials other than those suggested in this Section are proposed for use, furnish certified copies of manufacturers' certifications and material sample as evidence that the material is similar and equal in strength, durability, and permeability.

C. Submit Quality Control documentation described in this specification, and the Quality Assurance/Quality Control Plan.

1.06 QUALITY CONTROL

A. The paragraphs below detail the Quality Control required for the drainage geocomposite. Other materials requiring a submittal from the manufacturer indicating the material meets or exceeds the material properties indicated in Section 2 of this specification.

B. Manufacturer's Experience: The manufacturer supplying the geosynthetic materials shall satisfactorily demonstrate previous experience by letter of certification. Certification shall indicate that the manufacturer has produced and has in service in similar applications for a period of not less than one (1) year, at least (10) million sq ft of geotextiles and drainage geocomposite (including geotextile and geonet) meeting these specifications.

C. Installer's Experience: The Installer proposing to install the drainage geocomposite shall satisfactorily demonstrate previous experience by letter of certification. Certification shall indicate the Installer's successful past installation of at least 5,000,000 sq ft of drainage geocomposite.

D. Prior to the installation of any drainage geocomposite , the Manufacturer shall provide the Project Manager with the following information:
   1. The origin (resin supplier's name and resin production plant) and identification (brand name and number) of the resin used to manufacture the material.
   2. Copies of the quality control certificates issued by the resin supplier (if required by the Engineer).

3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the geotextile meets the Manufacturer's resin specifications (if required by the Engineer).
4. Reports on quality control tests conducted by the Manufacturer to verify that the geotextile manufactured for the project meets the project specifications.
5. A list of the materials which comprise the material, expressed in the following categories as percent by weight: base polymer, carbon black, other additives.
6. A specification for the drainage geocomposite and its components which includes all properties contained in the project specifications measured using the appropriate test methods.
7. Written certification that minimum average roll values given in the specification are guaranteed by the Manufacturer.
8. For non-woven geotextiles, written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle free.
9. Quality control certificates, signed by a responsible party employed by the Manufacturer. The quality control certificates shall include roll identification numbers, sampling procedures and results of quality control tests. At a minimum, results shall be given for:

   Geotextile
   a. Fabric Weight
   b. Grab tensile/elongation
   c. Trapezoidal tear strength
   d. Puncture
   e. Apparent opening size
   f. Permittivity

   Geonet
   a. Density (Specific Gravity)
   b. Carbon black content
   c. Thickness
   d. Tensile strength
   e. Drainage Geocomposite
   f. Transmissivity
   g. Ply adhesion

   Quality control tests shall be performed in accordance with the test methods specified in Section 2.01A for at least every 200,000 ft^2 (20,000 m^2) of geotextile produced.

   The Manufacturer shall identify all rolls of geotextiles with the following:
   a. Manufacturer's name
   b. Product identification
   c. Roll number
   d. Roll dimensions

1.07 CONFORMANCE TESTING:

A. General: Drainage geocomposite will be sampled by the QARE, Engineer, or their agent(s), at the manufacturer or upon delivery to the site. The manufacturer will assist in collecting the samples.

B. As the material is manufactured, random samples of the drainage geocomposite and geotextile will be collected at the frequency specified below. The Engineer or their representative/agent will ship samples to the designated geosynthetic testing laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed

properties. The Engineer will provide shipping information and geosynthetic testing laboratory information at the time of award and prior to sampling.

C. Drainage geocomposite samples will be taken by cutting along the entire width and 3 feet from the end of a rolled or folded geosynthetic material. The sampling frequency will be one sample per every 100,000 square feet of respective material to be delivered with a minimum of once per lot, for testing, to assure conformance to the specification. A lot consists of a group of materials which is manufactured from a specific batch of raw materials (e.g., HDPE resin) and manufacturing run. The manufacturer shall identify the consecutively numbered rolls of material that are inclusive within a lot. It is not required that all rolls included in a lot be supplied to the project, as long as the specified certification test results are supplied by the manufacturer to bracket the rolls delivered to the project. Conformance tests shall be performed in accordance with the test methods specified in paragraph 2.01 herein.

D. Friction angle testing of interfaces containing drainage geocomposite shall be performed according to Section 02780 and at the frequency herein.

E. All conformance samples will be shipped to the laboratory a minimum of 21 days prior to the anticipated delivery unless an alternate time period is acceptable to the Engineer to assure that sampling and testing occur in a timely manner as to avoid construction delays. No materials will be delivered until acceptable test results are approved by the Engineer.

F. Any further testing required to assure conformance shall be the responsibility of the Contractor in accordance with Specification Section 01025. The testing laboratory and the results shall be acceptable to the Engineer.

G. Conformance Testing Requirements for geocomposite related materials shall include the following:
   1. Geotextile
      a. Fabric Weight
      b. Grab tensile/elongation
      c. Trapezoidal tear strength
      d. Puncture
   2. Drainage Geocomposite
      a. Transmissivity
      b. Ply Adhesion
      c. Geonet Tensile Strength
      d. Interfacial Friction Angle
      e. Geonet Thickness

PART 2 PRODUCTS

2.01 MATERIALS:

A. Non-Woven Geotextiles:
   1. Produced by heat bonding, needle punching or by the use of external adhesives.
   2. The network of fibers shall be bonded so the fibers will retain their dimensional stability.
   3. Fibers may be made from polypropylene or other materials as approved by the Engineer.
   4. Geotextile shall be resistant to rot, mildew, insects, salt water, rodents and any other biological and chemical substances commonly encountered in the ground.
   5. Non-Woven Geotextiles:
      a. 6-oz/sy: The geotextile used as a filter fabric and heat bonded to both sides of the HDPE drainage geonet shall meet the Minimum Average Roll Values (MARV) listed below.
      b. 8-oz/sy and 12-oz/sy: The geotextile used for as a protective layer below riprap or as indicated in the Contract Drawings and shall be Mirafi 180N (8-oz) and 1120N (12-

oz) or Engineer approved Equal and shall meet the following Minimum Average Roll Values listed below:

Property	Unit	Test Method	MARV		
Weight	oz/yd^2	ASTM D5261	6	8	12
Grab Strength	lbs	ASTM D4632	150	200	300
Trapezoid Tear Strength	lbs	ASTM D4533	55	75	115
Puncture Resistance	lbs	ASTM D6241	310	430	750
Apparent Opening Size (Max)	Std Sieve	ASTM D4751	70	60	100
Permittivity	Sec	ASTM D4491	1.5	0.2	0.2
UV Resistance	% min. 500 hr	ASTM D4355	70	50	50

B. Woven Geotextile Fabric (Filter/Separation Applications):
   1. Shall be a woven monofilament geotextile utilized for filtration/separation as shown on the Contract Drawings. Mirafi FW 402 or Engineer approved equal shall meet the minimum criteria listed below. Alternate products must be woven monofilament geotextile and Contractor shall submit a sample of the FW 402 and the requested product for consideration.
   2. Edges shall be selvaged to prevent raveling.

Property	Test Method	MARV
Grab Tensile Strength (lbs)	ASTM D4632	200
Grab Tensile Elongation (%)	ASTM D4632	10
Puncture Strength (lbs)	ASTM D6241	675
Trapezoid Tear (lbs)	ASTM D4533	75
Permittivity (sec^{-1})	ASTM D4491	0.9
Ultraviolet Stability (% for min. 500 hrs)	ASTM D4355	90
Apparent Opening Size (standard sieve – Maximum)	ASTM D4751	30

C. Woven Geotextile Fabric (Reinforcement/Separation Applications):
   1. Shall be a high-tenacity monofilament polypropylene yarns utilized for reinforcement/ separation as shown on the Contract Drawings. Mirafi HP270 or Engineer approved equal shall meet the minimum criteria listed below.
   2. Edges shall be selvaged to prevent raveling.

Property	Test Method	MARV
Grab Tensile Strength (lbs/ft)	ASTM D4595	2460
Grab Tensile Strength @ 5% strain (lbs/ft)	ASTM D4595	1200
Grab Tensile Strength (lbs)	ASTM D4632	260
Grab Tensile Elongation (%)	ASTM D4632	13
Puncture Strength (lbs)	ASTM D6241	1000
Permittivity (sec^{-1})	ASTM D4491	0.6
Apparent Opening Size (standard sieve - maximum)	ASTM D4751	30

D. Drainage Geocomposite:
   1. Fabric wrapped high density polyethylene (HDPE) geonet drainage media.
   2. Geonet: Two overlapping strands of HDPE.
   3. Geotextile fabric heat-bonded to both sides of geonet and conform to the properties listed in Subsection 2.01. Fabric shall be bonded to the geonet so that it lies flat on the geonet, free of wrinkles and folds.
   4. The geotextile shall be bonded to the geonet over 100 percent of the surface. Any material not meeting this requirement will be rejected for use on this project.
   5. Geotextile shall extend a minimum of 2 inches beyond the edge of the geonet. The fabric edge shall be true and even to the edge of the geonet.
   6. Drainage geocomposite conforming to the following properties:

Property	Unit	Test Method	Value
Specific Gravity (geonet)	gm/cm^3	ASTM D1505	0.94 min
Melt Flow Index (geonet)	gm/10 min.	ASTM D1238	0.1 - 1.0
Thickness (geonet)	mil	ASTM D5199	160 min / max 250
Percent Carbon Black (geonet)	%	ASTM D4218	2-3
Transmissivity	m^2/sec	ASTM D4716	See Note A.
Ply Adhesion	lbs/in	ASTM D7005	1.0 min
Tensile Strength at Yield MD (geonet)	lbs/in	ASTM D5035	45 min
Interface Friction Strength between Drainage Geocomposite and Overlying Soil Material	lbs/ft^2	ASTM D5321 (Procedure B)	See Specification Section 02780
Interface Friction Strength between Drainage Geocomposite and Underlying Geomembrane	lbs/ft^2	ASTM D5321 (Procedure A)	See Specification Section 02780

Notes:
The drainage geocomposite will have a minimum required transmissivity of (PROJECT SPECIFIC FOR EACH CELL) m^2/sec at a normal pressure of (PROJECT SPECIFIC FOR EACH CELL) psf and a gradient of (PROJECT SPECIFIC FOR EACH CELL
Where minimum required transmissivity is the flow rate of the geocomposite tested in accordance with ASTM D4716 for all manufacturers quality control and quality assurance conformance testing, with the following conditions:
- performed between textured geomembrane material and Ottawa Sand;
- test duration = 100 hours;
- performed at a normal pressure of (PROJECT SPECIFIC FOR EACH CELL) psf;
- tested at hydraulic gradient of (PROJECT SPECIFIC FOR EACH CELL); and
- oriented in the machine direction.

2.02 LABELING: The Manufacturer will identify all rolls of geotextiles and drainage geocomposite with the following:

A. Manufacturer's name

B. Product identification

C. Roll and lot number

D. Roll dimensions

E. Date of manufacture

2.03 TIES: Ties used to secure adjacent sheets of Geonet will be plastic fasteners or polymer braid and will meet the approval of the Engineer. Metallic ties will not be allowed. Ties will be yellow, white, or another color approved by the Engineer to facilitate inspection.

PART 3 EXECUTION

3.01 PREPARATION OF BASE FOR GEOTEXTILE/GEOCOMPOSITE: Subgrade surfaces shall be properly graded and compacted to the satisfaction of the QARE. All sharp or protruding objects shall be removed from the subgrade surface prior to fabric placement. Geotextile fabric shall not be placed until the subgrade preparation is completed and the subgrade surfaces have been inspected and approved by the QARE.

3.02 SHIPPING AND UNLOADING: The Contractor shall be responsible for unloading the materials and should refer to the manufacturer's manual prior to arrival of the material to ascertain the appropriateness of their unloading equipment and procedures. All unloading and on-site handling efforts will be appropriately supervised. Upon arrival on site verify manufacturer labels are on all rolls delivered to the project. A firmly affixed label attached to the selvage edge shall clearly state the manufacturer's name, product identification, roll number, roll lot number, roll dimensions, roll weight, and date of manufacture. All material lot and roll numbers will be recorded and compared to the packing list. In addition, each roll will also be visually inspected to determine if any of the materials have been damaged. Major damage suspected to have occurred during loading/unloading or transit will be reported immediately to the carrier and to manufacturer. The exact nature and extent of the damage will also be indicated on the bill of lading along with the specific lot and roll numbers of the damaged materials. Damaged materials shall not be utilized in the project unless approved by the Engineer.

The Contractor shall protect the geotextiles and geocomposite from mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Rolls of material shall be continuously and uniformly supported and stored away from high traffic areas on a smooth elevated level prepared surface free from large stones that could damage the geotextile. Chocks for rolls shall be kept readily accessible. Rolls shall be stacked no greater than three rolls high or to the height recommended by the manufacturer. Materials stored for longer than one month shall be covered by a tarp or similar item.

3.03 INSTALLATION:

A. Geotextile installation shall be in accordance with manufacturer's recommendations and shall include the following considerations:
   1. Place in the manner and at the locations shown on the drawings.
   2. At the time of installation, geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.
   3. Geotextile used for the roadway shall be sewn or overlapped to provide proper separation of soil materials.
   4. Roll Direction: Place long dimensions perpendicular to the sideslopes (i.e., up and down). Lay smooth and free of tension, stress, folds, wrinkles, or creases.
   5. Join adjacent panels of geocomposite geotextile with a sewn J-stitch along the entire length of the panels or provide a minimum 6-inch overlap of geotextile.
   6. Join adjacent panels of reinforcement geotextile and/or filter geotextile with either a 12-inch overlap or sewing as indicated in the paragraph above.

B. Drainage Geocomposite Placement:
   1. Place in the manner and at the locations shown on Drawings.
   2. At the time of installation, drainage net shall be rejected if it has defects, rips, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.
   3. Join adjacent sheets of geonet with plastic ties spaced at minimum of 5 feet on-center. Adjoining sheet ends shall be tied at 6 inches on-center or heat bonded if approved by the QARE.
   4. Place long dimensions perpendicular to the contours of the sideslopes (i.e., up and down). Lay smooth and free of tension, stress, folds, wrinkles, or creases.

5. Provide a minimum width of 2 in. of overlap for each joint of the geonet.
6. Heat tack seal or sew the overlapping geotextiles.
7. Place so that the upstream strip of geotextile will overlap the downstream strip.
8. No horizontal seams shall be placed closer than 20 feet from the top of slope or within 20 feet of a horizontal seam on adjacent panels.

C. Geocomposite Protection

The quality assurance procedures indicated in this Section are intended only to assure that the installation of adjacent materials does not damage the geocomposite. Soil materials placed on the geosynthetic material shall be placed in accordance with specifications in this Section and in Section 02200.

D. Soils
1. Placement of soils on the geocomposite shall not proceed at an ambient temperature below 32°F (0°C) nor above 104°F (40°C) unless otherwise approved by the Engineer.
2. Placement of soil on the geocomposite will be done in a manner that minimizes the development of wrinkles in the geocomposite.
3. Equipment used for placing soil shall not be driven directly on the geocomposite.
4. A minimum thickness of 1 foot of soil is specified between a light dozer (ground pressure of 5 psi or lighter) and the geocomposite along any travel ways. Grading of soil to final depth shall be done to limit the number of passes to achieve required depth.
5. Any areas traversed by any vehicles other than low ground pressure vehicles shall have a minimum thickness of 3 feet. The location of these areas shall be limited by the provisions in Section 02200. This requirement may be waived if provisions are made to protect the geomembrane through an engineered design. Drivers shall proceed with caution when on the overlying soil and prevent spinning of tires or sharp turns.
6. Vehicles traveling on soils overlying the geotextile should accelerate and decelerate slowly to prevent increased stresses on underlying interfaces.
7. Frozen soil shall not be placed on the geocomposite.

E. Protection of Geotextile and Drainage Net:
1. Upon delivery to the site, geotextiles shall be set up off the ground and be wrapped with a plastic tarp or stored inside a trailer or building to prevent dust clogging.
2. Exercise necessary care while transporting, storing, and installing the geotextile to prevent damaging it.
3. Protect geotextiles from prolonged direct exposure to sunlight.
4. Repair all damaged areas of the geotextile by placing another piece of geotextile of sufficient size to extend a minimum of 6 inches beyond the limits of the damage in all directions over the damaged area.
5. Do not leave geotextiles exposed more than thirty (30) days (or less if recommended by the manufacturer) without being covered by backfill unless a letter is provided by the material supplier indicating the material can be left exposed for a longer time period.
6. When required, sew overlaps and repairs to damaged geotextile using a portable machine to provide seam strengths of at least 90 percent of the filter fabric strength.

END OF SECTION

SECTION 02275

GEOSYNTHETIC CLAY LINER

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Measurement and Payment: Section 01025

B. Project Coordination: Section 01041

C. Earthwork: Section 02200

D. Geotextiles and Drainage Geocomposite: Section 02272

E. Textured High Density Polyethylene (HDPE) Geomembrane Liner (60- and 80-mil): Section 02771

F. Interfacial Friction Angle Conformance Testing: Section 02780

1.03 REFERENCES:

A. GRI GCL3 Test Methods, Required Properties, and Test Frequencies of Geosynthetic Clay Liners (GCLs)

B. ASTM D4873 Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples

C. ASTM D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

D. ASTM D5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners

E. ASTM D5891 Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners

F. ASTM D5993 Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners

G. ASTM D6768 Standard Test Method for Tensile Strength of Geosynthetic Clay Liners

H. ASTM D6496 Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners

I. ASTM D5887 Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter

J. ASTM D6243 Standard Test Method for Determining the Internal and Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method

1.04 DESCRIPTION:

A. Install Owner-supplied geosynthetic clay liner (GCL) and associated bags of bentonite powder needed for seaming as part of the cell's liner system as shown on the drawings, described herein and in the QA/QC manual. The Engineer will review of manufacturer's documentation of experience and manufacturing quality control testing and conformance testing for the GCL.

1.05 SUBMITTALS:

A. The Contractor shall submit, for review and acceptance, a layout drawing depicting the orientation of sheets and the direction of the overlap between sheets.

Installer's Experience: The Installer shall satisfactorily demonstrate previous experience by letter of certification. Certification shall indicate the Installer's successful past installation of at least 5,000,000 sq ft of GCL.

B. If requested by the Engineer, the Contractor shall submit a description of the method that will be utilized to deploy the GCL. The submittal shall also include a list of equipment that will be utilized during installation of the GCL.

C. Manufacturer Quality Control Documentation as specified in Section 1.06 below.

1.06 MANUFACTURER'S QUALITY CONTROL DOCUMENTATION:

A. Manufacturer Experience: Supply the following information on manufacturer's capabilities and experience supplying GCL to landfill and surface impoundment projects (if requested by the Engineer)
   1. Corporate background and information.
   2. Information on plant size, equipment, personnel, number of shifts per day, and capacity per shift.
   3. Daily production quantity available for this procurement.
   4. List of material properties including certified test results, to which are attached geosynthetic samples.
   5. The Manufacturer's quality control manual, including a description of the quality control laboratory facilities. Submit documentation of current laboratory accreditation by Geosynthetic Accreditation Institute-Laboratory Accreditation Program (GAI-LAP).
   6. The origin (supplier's name and production plant) and identification (brand name and number) of materials used to manufacture the product.
   7. Manufacturer supplying the GCL will demonstrate previous experience by letter of certification. Certification will indicate that the manufacturer has produced and has similar material in service in similar applications for a period of not less than one (1) year, at least ten (10) million square feet (ft^2) of GCL material, meeting these Specifications.

B. All required manufacturer's quality control certifications as described in GRI-GCL3 "Test Methods, Required Properties, and Test Frequencies of Geosynthetic Clay Liners (GCLs)," and in the Quality Assurance Quality Control Plan (Appendix B), including, but not limited to, the following:
   1. Verification that clay component of the finished product is greater than 75 percent montmorillonite clay;
   2. Verification that the proper mass per unit area of bentonite clay has been added to the finished product;
   3. Verification that the actual geotextiles used in the finished product meet the manufacturer's specification based on the minimum average roll value (MARV);
   4. Verification that needle-punched non-woven geotextiles have been inspected continuously for the presence of broken needles using an in-line metal detector; and
   5. Manufacturer's Quality Control Certification for the tests described in Table 2.01.A.

1.07 CONFORMANCE TESTING: To be obtained at the manufacturing facility by the Owner's Representative. The manufacturer will assist the Owner's Representative in collecting a sample:

A. As the material is manufactured, obtain random samples of the GCL at the specified frequency below. The Engineer/Owner or their designated representative will obtain samples of at the manufacturing facility and ship samples to Engineer/Owner's designated geosynthetic testing laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed properties. The Engineer/Owner will provide shipping information and geosynthetic testing laboratory information at the time of award and prior to sampling.

B. All conformance sampling will be shipped to the laboratory a minimum of 21 days prior to the anticipated delivery of material to the site unless an alternate time period is acceptable to the Engineer/Owner. No materials will be delivered to the site without the approval of the Engineer/Owner. In the event that the Engineer/Owner allows materials delivery to the site before testing is completed this will be done at the Engineer's/Owner's risk.

C. GCL samples will be taken by cutting along the entire width and 3 feet from the end of a roll. Samples will be obtained for the GCL at a rate of 1 test per 100,000 ft^2 of GCL with a minimum of once per lot, for testing, to assure conformance to the specification. Test samples should be identified by type, style, lot, and roll numbers. The machine direction should also be noted on the samples with a waterproof marker. A lot consists of a group of material which is manufactured from a specific batch (e.g., bentonite clay) of raw materials and within one manufacturing run. The manufacturer will identify the consecutively numbered rolls of material that are inclusive within a lot. It is not required that all rolls included in a lot be supplied to the project, as long as the specified certification test results are supplied by the manufacture to bracket the rolls delivered to the project. It is required that all GCL material will be furnished from consecutive manufacture runs of no more than three lots unless otherwise approved by the Engineer.

D. GCL Conformance testing by the Owner will be performed in accordance with the test methods below.

Material Property	Test Method
Hydraulic Conductivity	ASTM D5887
Bentonite mass per unit area	ASTM D5993
Tensile Strength	ASTM D6768
Peel Strength	ASTM D6496
Index Flux	ASTM D5887

Conformance testing will also include interfacial friction angle testing per ASTM D6243 for the following interfaces:

1. Between the 80-mil textured HDPE geomembrane and non-woven side of GCL;
2. GCL internal;
3. Between woven side of GCL and the clay barrier soil; and
4. Between the 60-mil textured HDPE geomembrane and the non-woven side of the GCL (cells with augmented liner only).

The interfacial friction angle tests shall be performed according to Section 02780.

PART 2 PRODUCTS

2.01 MATERIALS:

A. The GCL liner shall meet the following properties.

Material Property	Test Method	Required Values	Manufacturer's Test Frequency
Geotextile Mass/Unit Area	ASTM D5261	≥5.9 oz./sy	1 per 25,000 yd^2
Bentonite Swell Index	ASTM D5890	≥24 mL/2g min.	1 per 50 tons
Bentonite Fluid Loss	ASTM D5891	≥18 mL max.	1 per 50 tons
Bentonite Mass/Area	ASTM D5993	≥0.75 lb/ft^2 (3.6 kg/m^2)	1 per 5,000 yd^2
GCL Tensile Strength (Machine Direction)	ASTM D6768	≥23 lb/in	1 per 25,000 yd^2
GCL Peel Strength	ASTM D6496	≥2.1 lb/in	1 per 5,000 yd^2
GCL Index Flux	ASTM D5887	≤ $1x10^{-8}$ $m^3/m^2/sec$.	1 per 30,000 yd^2
GCL Hydraulic Conductivity	ASTM D5887	≤$5x10^{-9}$ cm/sec @ ≤5 psi confining stress	1 per 30,000 yd^2

B. In addition to the properties above, the GCL shall meet the hydrated internal shear strength and interface friction requirements listed in Specification Section 02780.

C. The geotextiles used in the manufacture of the GCL will be made up from polypropylene fibers. Any and all substitutions shall be approved by the Owner prior to their use.

D. The GCL will be manufactured by the mechanical bonding of the needle punch process to enhance the friction characteristics of the GCL and to maintain the integrity of the GCL under hydration. No glues or adhesives will be used in lieu of the needle punch process so as to retain these characteristics.

E. Needled GCLs are those which, by the process of a needling board (similar to that used in the manufacture of standard nonwoven geotextiles) have fibers of a nonwoven geotextile pushed through the bentonite clay core and integrated into the woven geotextile.

PART 3 EXECUTION

3.01 SHIPPING AND HANDLING:

A. Covering of the Rolls:
   1. Manufacturers should clearly stipulate the type of protective covering and the manner of cover placement. The covering should be verified as to its capability for safe storage and proper transportation of the product.
   2. The covering should be placed around the GCL in a workmanlike manner so as to effectively protect the product on all of its exposed surfaces and edges.
   3. The central core should be accessible for handling by forklift vehicles. Handling of the GCL during shipment (i.e., loading, transport, and unloading) shall be performed using techniques approved by the manufacturer.
   4. Clearly visible labels shall identify the name and address of the manufacturer, trademark, date of manufacture, location of manufacture, style, roll number, lot number, serial number, dimensions, and weight in accordance with ASTM D4873.

B. Storage at the Manufacturing Facility:
   1. GCLs should always be stored indoors until they are ready to be transported to the field site.

2. Handling of the GCL should be such that the protective wrapping is not damaged. If it is, it must be immediately rewrapped by machine or hand; in the case of minor tears it may be taped.
3. Placement and stacking of rolls should be done in a manner so as to prevent thinning of the product at points of contact with the storage frame or with one another and core damage.

C. Shipment:
1. The GCLs should be shipped by themselves with no other cargo that could damage them in transit during stops or while off-loading other materials.
2. Method of loading GCLs rolls, transporting them, and off-loading them at the job site should not cause any damage to the GCL, its core, or its protective wrapping.
3. Any protective wrapping that is damaged or stripped off the rolls should be repaired immediately or the roll should be moved to an enclosed facility until its repair can be made to the approval of the quality assurance personnel.
4. If any clay has been lost during transportation or from damage of any type, the outer layers of the GCL should be discarded until undamaged product is evidenced. The remaining roll must be wrapped in accordance with the manufacturer's original method to prevent hydration or further damage to the remaining roll.

D. Unloading: The Contractor shall be responsible for unloading the materials and should refer to the manufacturer's manual prior to arrival of the material to ascertain the appropriateness of their unloading equipment and procedures. All unloading and on-site handling efforts will be appropriately supervised. Upon arrival on site, verify manufacturer labels are on all rolls delivered to the project. A firmly affixed label attached to the selvage edge shall clearly state the manufacturer's name, product identification, material thickness, roll number, roll type, roll dimensions, and roll weight. All material lot and roll numbers will be recorded and compared to the packing list. In addition, each roll will be visually inspected to determine if any of the materials have been damaged. Major damage suspected to have occurred during loading/unloading or transit will be reported immediately to the carrier and to manufacturer. The exact nature and extent of the damage will also be indicated on the bill of lading along with the specific lot and roll numbers of the damaged materials. Damaged materials shall not be utilized in the project unless approved by the Engineer.

The Contractor shall protect the GCL from mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Rolls of material shall be continuously and uniformly supported and stored away from high traffic areas on a smooth elevated level prepared surface free from stones greater than ½-inch diameter (clean fine sand). Chocks for rolls shall be kept readily accessible. Rolls shall be stacked no greater than three rolls high or as recommended by the manufacturer. Stored materials shall be covered by a tarp or other methods as approved by the Engineer.

E. Storage at the Site:
1. Handling of the GCLs should be done in a competent manner such that damage does not occur to the product nor to its protective wrapping.
2. The location of temporary field storage should not be in areas where water can accumulate. The rolls should be stored on high, flat ground or elevated off the ground so as not to form a dam creating the ponding of water. It is recommended to construct a platform so that GCL rolls are continuously supported along their length. GCL stored outdoors should be covered completely by tarps or other protective materials.
3. The rolls should not be stacked so high as to cause thinning of the product at points of contact. Temporary storage (material delivered the same year it will be installed) may be stacked no higher than 3 rolls high while long term storage (overwinter or more) shall be no higher than one roll high unless otherwise approved by the Engineer. Furthermore, they shall be stacked in such a way that access for conformance testing is possible.

4. If outdoor storage of rolls is to be longer than a few weeks, particular care (e.g., using tarpaulins) should be taken to minimize moisture pick-up or accidental damage. For storage periods longer than one season, a temporary enclosure should be placed over the rolls that will protect them from rain, snow, wind, sun, runoff and snowmelt or they should be moved within an enclosed facility.

3.02 INSTALLATION:

A. General: The Contractor shall schedule a pre-installation conference as specified in Section 01041.

Installation of the GCL shall include the following considerations:

1. Exercise necessary care while transporting and installing the GCL to prevent damage.
2. Roll storage during installation shall meet the requirements of Paragraph 3.01.E.
3. The GCL shall be installed with the woven-coated side contacting the compacted clay barrier soil and the non-woven side contacting the textured geomembrane. Place in the manner and at the locations shown on the drawings.
4. Rolls shall be handled and deployed utilizing a 3-inch schedule 80 steel pipe through the core and slings or straps attached to the ends of the pipe (core pipe) or per manufacturers recommendations as approved by the Engineer. The core pipe shall be suspended from a spreader bar so that the edges of the GCL are not damaged by the suspending straps or chains.
5. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade to avoid damage to the bottom surface of the GCL that might change the frictional properties of the material. Material may be unrolled or a slip sheet or rub sheet shall be used to reduce friction damage during placement.
6. Work on the slopes shall be undertaken before work on the bottom to permit drainage in the event of rainfall. Panels may be pulled up from the bottom of the slope to the anchor trench or anchored first and the roll slowly lowered down the slope. Seams on a slope shall be perpendicular to the toe of the slope at all times. Seams at the base of the slope shall be a minimum of 5 feet away from the toe of the slope. Roll ends are not allowed within 50 feet of each other on adjacent panels.
7. Seam areas or runs shall be flat and clear of any large rocks, debris, or ruts. Contacting surfaces shall be clean and clear of dirt or native soil with all edges pulled tight to maximize contact and to smooth out any wrinkles or creases. Side seam overlaps shall be a minimum of 6 inches and butt seams shall have a minimum of 1-foot overlap as observed by the Quality Assurance Resident Engineer (QARE). A proper seam shall cover the lap line and leave the match line exposed.
8. Seams shall be augmented with granular bentonite to insure seam integrity. Granular bentonite shall be spread evenly from the panel edge to the lap line at a minimum rate of 1/4 pound per linear foot. This rate of application will be assured by using one 50-pound bag of granular bentonite (evenly spaced along the seam) per roll of GCL. Accessory bentonite shall be of the same type as the material within the GCL itself. Fasteners, anchor pins or adhesives may be used on seams to keep panels in place during backfill operations if necessary.
9. The Contractor shall only work on an area that can be completed in one working day. Completion shall be defined as the full installation of the GCL and placement of geomembrane to cover the GCL. Prior to deployment of the GCL, the subgrade (i.e. barrier soil) will be smooth rolled to provide a smooth surface free of debris, roots, and angular rocks. The GCL subgrade will be inspected and certified by the installers CQA personnel prior to placement of the GCL. Deployment of the GCL will be visually inspected to assure that no potentially harmful objects are present (e.g., stones, cutting blades, small tools, sandbags, etc.).

10. For any penetrations or structures the GCL will contact, a small notch shall be cut along the edge of the area. The GCL shall be brought up to the appurtenance and trimmed to fit snugly.
11. For protection and proper performance, the geomembrane shall be immediately placed over the GCL.
12. During the geomembrane installation, all care shall be taken to avoid sharp turns and any quick stops or starts so as to avoid pinching or moving the GCL. A rub sheet shall be placed between the GCL and geomembrane during deployment. GCL damage resulting from actions taken by the Contractor that are not in accordance with this specification shall be repaired to the satisfaction of the Engineer and in accordance with the Specifications. The Contractor shall be responsible for all costs associated with furnishing, testing, installing, and providing quality assurance and quality control during the installation of additional material as the result of damage caused by the Contractor or as a result of the Contractors actions.
13. Large rips or tears shall be repaired by placing a patch over the defect, with a minimum overlap of 6 inches on all edges. Accessory bentonite shall be placed between the patch and the repaired material at a rate of 1/4 pound per lineal foot of edge. Prematurely hydrated GCL shall be removed and replaced with new GCL in accordance with the repair procedures described above.
14. Overlap joints and seams shall be measured as a single layer of GCL.
15. Securely anchor GCL as shown on the Contract Drawings or as approved by the Engineer.
16. When applicable, soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum thickness of 1 foot of cover should be maintained between low-ground pressure equipment (vehicles with a ground pressure of 5-psi or less) and the GCL at all times during the covering process. This thickness recommendation does not apply to frequent traffic areas or roadways for which a minimum thickness of 3 feet is required.

END OF SECTION

SECTION 02450

PIPE INSTALLATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

C. RELATED WORK SPECIFIED ELSEWHERE:
1. Measurement and Payment: Section 01025
2. Project Coordination: Section 01041
3. Earthwork: Section 02200
4. Erosion Control: Section 02220
5. Corrugated Pipe: Section 024521
6. Manholes, Catch Basins, and Drainage Structures: Section 02570
7. Reinforced Concrete Pipe: Section 02612
8. HDPE Pipe and Fittings: Section 15100
9. PVC Pipe and Fittings: Section 15101
10. Ductile Iron Pipe and Accessories: Section 15102
11. Valves and Pipe Accessories: Section 15110
12. Pipe Pressure Testing: Section 15120

D. REFERENCES:
1. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
2. ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

1.02 DESCRIPTION OF WORK:

A. Work of this Section shall consist of furnishing all labor, materials, and equipment to install and test leachate transport piping. Only the appropriate portions of this section pertaining to the specific contract work identified in Section 01010 "Summary of Work", or as directed by the Engineer, will apply.

1.03 SUBMITTALS:

A. The Contractor shall furnish material specific submittals (indicated in other specifications) to the Engineer prior to commencing the work. Pipe of the same manufacturer shall be used for each pipe material throughout the project unless approved by the Engineer.

B. The Contractor shall submit to the Engineer a Construction Schedule for pipe installation.

PART 2 PRODUCTS

Not Applicable.

PART 3 EXECUTION

3.01 INSTALLATION:

A. All materials shall be stored and handled in accordance with the manufacturer's recommendations.

B. Excavate, backfill, and compact soils in accordance with Section 02200.

C. Pipe Grade Defined: Pipe grade shall be the invert of the pipe as shown on the Contract Drawings.

D. Pipe Jointing: All joints shall be made in a dry condition (trench, excavation, etc.) and in accordance with the manufacturer's recommendations and the best practices for the type of pipe installed.

E. Pipe Installation:
   1. Pipes shall be of the material, size, and length shown on the Contract Drawings.
   2. Accurately lay to the line and grades as indicated on the Contract Drawings.
   3. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions.
   4. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
   5. All pipe trenches shall be kept free of water during pipe laying and other related work. Pipe trenches shall continue to be dewatered until such time as it is safe to allow the water to rise in the excavation.
   6. Ensure pipes stay in correct position while being backfilled.
   7. Pipe testing shall be as indicated in specification Section 15120.
   8. Pipe Bedding and backfill: As specified in Section 02200.
   9. Securely attach each section to the adjoining section by the manufacturer approved method for the type of joint used. Pipe gaskets shall be lubed with joint lubricant prior to installation.
   10. Installation of the culvert shall be from downstream up with bell ends of pipes facing upstream unless approved by the Engineer.
   11. Installation of a culvert shall include pipe joints located at least 5-feet (horizontally) in from the point where fill height over the pipe exceeds 1 foot.
   12. When backfilling a trench, the backfill material placed under the pipe haunches must be thoroughly compacted. This compaction is referred to as "chinking" the pipe, and it is done by angling a shovel handle or spade end down – acting as a compactor rod – and under the pipe to hand–compact the fill directly beneath the pipe. This chinking should be done under the entire length of the pipe while backfilling the bottom half of the pipe.
   13. Complete tie-ins within the trench where possible to prevent overstressing of the pipe and connection.
   14. Notify Quality Assurance Resident Engineer (QARE) prior to pipe installation to allow time for QARE inspection.
   15. Bedrock, Rock and Other: If ledge rock, boulders, rubble, or large stone (greater than 1.5-inch-diameter) are encountered in the trench bottom, excavate a minimum of 6 inches below the pipe bottom and replace with proper pipe bedding material.
   16. Unsuitable Conditions: When trench conditions are unsuitable for pipe placement (i.e., quick, or unstable conditions or conditions that do not allow proper placement), the Contractor shall cease pipe placement and notify the QARE.

F. Pipe Cutting:
   1. Where required, sections of pipe may be cut to provide shorter sections of pipe necessary for the construction. The cutting of the pipe shall be done in accordance with the pipe manufacturer's recommendations.
   2. When permitted and allowed by the pipe manufacturer, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. Unless approved by the QARE, the cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

G. Valve Installation: All valves shall be installed in accordance with the specifications for the pipe to which they are to be connected. Valve joints shall be made up in accordance with the Contract Documents. The valves shall bear no stresses due to loads from the adjoining pipe. All valves shall be inspected before installation, and they shall be cleaned and well lubricated prior to installation in the pipeline.

H. Inspection: Pipe installation shall be subject to inspection by the QARE for quality, adherence to line and grade, jointing, and proper backfill. Any joint not satisfactory to the QARE shall be removed and remade to his satisfaction at the Contractor's expense. No pipe shall be backfilled until it has been approved by the QARE prior to backfilling, the contractor shall obtain as-built top of pipe coordinates and elevations at grade changes, fittings, and at least every 50 feet along the length of pipe. Pipe testing shall be performed by the Contractor and observed by the QARE with procedures and documentation in accordance with specification Section 15120.

3.02 PIPE INSULATION:

A. Exposed Condition: Install 2-inch-thick Foamglass insulation by Pittsburg Corning with flexible PITTWRAP insulation jacketing or Engineer approved equal.

B. Buried Trench Condition: Install 2-inch-thick x 4-ft-wide Styrofoam SM or XPS insulation as manufactured by Dow Chemical Co., or Engineer approved equal, between pipe and culvert or over pipe when noted on plans or as directed by the QARE. Install insulation over the pipe when there is less than 5 ft of cover between the top of pipe and final ground grade. Install 6 in. above the pipe unless otherwise shown on the Contract Drawings and provide 6-in. sand blanket above and below insulation.

3.03 SPECIAL REQUIREMENTS:

A. Flexible Pipe: In the case of the installation of polyvinyl chloride and HDPE pipe, strict adherence shall be made to the general pipe installation requirements noted in Section 3.01 D, so that the horizontal deflection in these pipes does not exceed 5.0 percent of the pipe diameter being installed or per manufacturers' recommendations and Engineer's approval.

B. Assembling Push-On Joints: Push-on joints shall be made up by first inserting the gasket into the groove of the bell and applying a thin film of special nontoxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe. The chamfered end of the plain pipe shall be inserted into the gasket and then pushed past it until it seats against the bottom of the socket.

C. Assembling Mechanical Joint Retainer Glands: Surfaces against which the gasket will come in contact shall be thoroughly brushed with a wire brush prior to assembly of the joint. The gasket shall be cleaned. The gasket, bell, and spigot shall be lubricated by being washed with soapy water. The gland and gasket, in that order, shall be slipped over the spigot, and the spigot shall be inserted into the bell until it is correctly seated. The gasket shall then be seated evenly in the bell at all points, centering the spigot, and the gland shall be pressed firmly against the gasket. After all bolts have been inserted and the nuts have been made finger-tight,

diametrically opposite nuts shall be progressively and uniformly tightened all around the joint to the proper tension by means of a torque wrench.

The correct range of torque is indicated below:

TORQUE RANGE VALUES

Range of torque	60 to 90 ft-lb

If effective sealing of the joint is not attained at the maximum torque indicated above, the joint shall be disassembled and thoroughly cleaned, then reassembled. Bolts shall not be overstressed to tighten a leaking joint. Set screws for retainer glands shall be torqued as recommended by the manufacturer.

3.04 ACCEPTANCE:

A. The Engineer reserves the right to accept the pipeline in sections after the satisfactory tests have been completed and approved and to make full use of any part or parts of the system after acceptance of those parts.

B. Until such time as the entire Contract has been accepted by the Engineer, the Contractor shall be held responsible to rectify any leaks, errors, or other poor workmanship which may be discovered and shall make any necessary repairs, alterations, or adjustments as may be required to properly complete the work.

END OF SECTION

SECTION 02451

CORRUGATED PIPE

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Measurement and Payment: Section 01025

B. Project Coordination: Section 01041

C. Earthwork: Section 02200

D. Erosion Control: Section 02220

E. Pipe Installation: Section 02450

1.03 REFERENCES:

A. AASHTO M36 Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains

B. AASHTO M232 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

C. AASHTO M 252 Standard Specification for Corrugated Polyethylene Drainage Pipe

D. AASHTO M274 Standard Specification for Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe

E. AASHTO M 294 Standard Specification for Corrugated Polyethylene Pipe, 12- to 60-inch Diameter

F. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

G. ASTM F667 Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

H. ASTM F2306 Standard Specification for 12 in. to 60 in. Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Non-Pressure Gravity-Flow Storm Sewer and Subsurface Drainage Applications

I. ASTM F2648 Standard Specification for 2 in. to 60 in. Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications

J. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

1.04 DESCRIPTION OF WORK:

A. Work Included: Provide and install corrugated metal pipes and/or corrugated HDPE culvert pipe of the type(s), size(s) and in the location(s) shown on the Contract Drawings and as specified herein.

B. Work Not Included: Temporary drainage devices used by the Contractor for construction purposes.

1.05 SUBMITTALS:

A. The Contractor shall submit the name of the manufacturer and manufacturer's specifications indicating that the pipe meets the requirements of Section 2.01 to the Engineer prior to commencing work. Pipe of the same manufacturer shall be used throughout the project unless otherwise approved by the Engineer.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Exercise care when handling corrugated pipe to prevent damage to pipe and finish.

B. Immediately remove damaged materials and replace at no additional cost to the Owner.

C. Store materials as recommended by the manufacturer and in a manner that does not damage the pipe.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Corrugated Polyethylene Pipe:
   1. Pipe shall be ADS Brand N12 WT pipe or Engineer approved equal.
   2. Pipe and fittings shall be by the same manufacturer unless approved by the Engineer.
   3. Pipe shall be corrugated exterior and smooth interior pipe. The product supplied under this specification shall be high density polyethylene corrugated exterior/smooth interior pipe. Four- through 10-inch diameters shall meet all the requirements of AASHTO M 252 Type S (watertight joints). Twelve- to 48-inch diameters shall conform to AASHTO M 294 Type S or ASTM F2648.
   4. Corrugated polyethylene pipe Joints and fittings shall be bell and spigot type meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306. Joints shall be watertight in accordance with the requirements of ASTM D3212, and gaskets shall meet the requirements of ASTM F477.

B. Perforated Corrugated Polyethylene Pipe:
   1. Pipe shall be ADS Brand N12 ST pipe or Engineer approved equal.
   2. Pipe and fittings shall be by the same manufacturer unless approved by the Engineer.
   3. Pipe shall be corrugated exterior and smooth interior pipe. The product supplied under this specification shall be high density polyethylene corrugated exterior/smooth interior pipe. Four- through 10-inch diameters shall meet all the requirements of AASHTO M 252 Type S (watertight) or Type SP (silt tight joints) (4- to 10-inch-diameter pipes) or AASHTO M294 Type S (watertight) or Type SP (silt tight joints) or ASTM F2306 (12- to 60-inch pipes).
   4. Perforations shall be located in the valleys of the corrugations, be circular or slotted and evenly spaced around the circumference and length of the pipe. The water inlet areas shall be no less than 0.945in2/ft for pipe diameters 4 inches through 10 inches

diameter, no less than 1.42 in2/ft for pipe diameters 12 inches through 18 inches diameter, and not less 1.89 in^2/ft for pipe diameters 24 inches and larger.

5. Corrugated polyethylene pipe Joints and fittings shall be bell and spigot type meeting the requirements of AASHTO M252, AASHTO M294, or ASTM F2306. Joints shall be soil tight and gaskets shall be in accordance with the requirements of ASTM F477.
6. Maximum slot dimensions for 4- and 6-inch-diameter pipe shall be 0.875-inches and 0.125 inches. Maximum slot dimensions for 8- and 10-inch-diameter pipe shall be 1.18 inches and 0.125 inches. Maximum hole diameter for pipes 12- to 24-inch-diameter pipes shall be 0.313 inches. Maximum hole diameter for pipes 30-inch to 60-inch-diameter pipes shall be 0.313 inches.

C. Corrugated Polyethylene Pipe (Single Wall – Perforated and Solid)
1. Pipe shall be ADS Single Wall pipe or Engineer approved equal.
2. Pipe and fittings shall be by the same manufacturer unless approved by the Engineer.
3. Pipe shall be corrugated exterior and interior pipe. The product supplied under this specification shall be single wall high density polyethylene corrugated exterior and interior pipe. Three- through 15-inch diameters shall meet all the requirements of ASTM F667.
4. Perforations and shall be the same as listed in 2.01.B above.
5. Corrugated polyethylene pipe joints and fittings shall meet the requirements of ASTM F667.

D. Aluminized Steel Corrugated Pipe.
1. Pipe shall be spiral-ribbed 16-gauge Aluminized Type II pipe meeting the requirements of AASHTO M36 using steel conforming to AASHTO M274.
2. Fittings and couplings shall be in accordance with AASHTO M36 and shall allow the use of O-ring gaskets.
3. O-Ring Gaskets: Gaskets shall be used in conjunction with coupling bands. The use of TC-40 type mastic will be required at the lap joint with O-ring gaskets.
4. Nuts and bolts shall conform to AASHTO M232.

PART 3 EXECUTION

3.01 INSTALLATION-

A. Pipe:
1. Pipe shall be of the material, size, and length shown on the Contract Drawings.
2. Accurately lay to the line and grades as indicated on the Contract Drawings.
3. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions.
4. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
5. All pipe trenches shall be kept free of water during pipe laying and other related work. Pipe trenches shall continue to be dewatered until such time as it is safe to allow the water to rise in the excavation.
6. Ensure pipes stays in correct position while being backfilled.
7. Pipe testing shall be as indicated in specification Section 15120.
8. Pipe Bedding and backfill: As specified in Section 02200.
9. Securely attach each section to the adjoining section by the manufacturer approved method for the type of joint used. Pipe gaskets shall be lubed with joint lubricant prior to installation.
10. Sections of Corrugated Pipe: Join by enclosing joints with coupling bands of the same material and manufacturer as the pipe unless approved by the Engineer.
11. Pipe grade shall be based on the pipe invert as shown on the Contract Drawings.

12. Installation of the culvert pipe shall be from downstream up with bell ends of pipes facing upstream unless approved by the Engineer.
13. Pipe joints shall be located at least 5 feet (horizontally) in from the point where fill height over the pipe exceeds 1 foot.
14. Elliptical Pipe: Placed so that major axes are within 5 degrees of the appropriate planes, horizontal or vertical as the case may be.
    When backfilling a trench, the backfill material placed under the pipe haunches must be thoroughly compacted. This compaction is referred to as “chinking” the pipe, and it is done by angling a shovel handle or spade end down – acting as a compactor rod – and under the pipe to hand–compact the fill directly beneath the pipe. This chinking should be done under the entire length of the pipe while backfilling the bottom half of the pipe.
15. Notify Quality Assurance Resident Engineer (QARE) prior to pipe installation to allow time for QARE inspection.
16. Bedrock, Rock and Other: If ledge rock, boulders, rubble, or large stone (greater than 1.5-inch-diameter) are encountered in the trench bottom, excavate a minimum of 6 inches below the pipe bottom and replace with proper pipe bedding material.
17. Unsuitable Conditions: When trench conditions are unsuitable for pipe placement (i.e., quick, or unstable conditions or conditions that don’t allow proper placement), the Contractor shall cease pipe placement and notify the QARE.

B. Fittings:
   1. Anti-seep collars or other non-standard fittings shall be installed as shown in the Contract Drawings.

3.02 INSPECTION:

A. Inspection of the pipe shall be made by the QARE after delivery. Pipe may be rejected by the QARE for failure to conform to any the following:
   1. Fractures or cracks sufficient to impair strength, durability, or serviceability of pipe;
   2. Defects indicating improper proportioning, mixing, and molding; or
   3. Damaged ends

B. Acceptance of fittings, stubs, or other specially fabricated pipe sections shall be based on visual inspection at the job site and documentation of conformance to these specifications.

C. Pipe installation shall be subject to inspection by the QARE for quality, adherence to line grade, jointing, and proper backfill.

D. Any joint not properly installed (as determined by the QARE) shall be removed and remade to his satisfaction at the Contractor's expense.

E. No pipe shall be backfilled until it has been approved by the QARE.

END OF SECTION

SECTION 02466

POLYVINYL CHLORIDE PIPE (GRAVITY APPLICATIONS)

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 DESCRIPTION: This work shall consist of furnishing and installation of 4-inch through 48-inch unplasticized polyvinyl chloride (PVC) pressure pipe with integral bell and spigot joints for the conveyance of liquids. This pipe shall meet the standards of AWWA standard C900 PVC Water Distribution Piping and shall be in conformity with the Contract Drawings and as specified herein.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Pipe Installation: Section 02450

C. Measurement and Payment: Section 01025

D. Project Coordination: Section 01041

1.04 REFERENCES:

1. ASTM D3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
2. ASTM D1784 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
3. ASTM D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
4. ASTM D2464 Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
5. ASTM D2467 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
6. ASTM D2564 Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
7. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
8. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
9. ASTM D3915 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Pressure Applications
10. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.05 SUBMITTALS:

A. The Contractor shall submit the name of the manufacturer of pipe and appurtenances to the Engineer prior to commencing work. Pipe of the same manufacturer shall be used throughout the project unless otherwise approved by the Engineer.

B. The Contractor shall submit to the Engineer a Construction Schedule for pipe installation.

C. The Contractor shall submit manufacturer's technical product data including installation instructions for piping joint and fittings. Chemical resistance data shall be provided at the request of the Engineer.

D. The Engineer may request that the manufacturer submit a certification that the products meet requirements in this specification.

1.06 PACKAGING DELIVERY AND HANDLING:

The pipe and fitting manufacturer shall package products for shipment in a manner suitable for transport by commercial carrier. When delivered, a receiving inspection shall be performed, and any shipping damage reported to the pipe and fittings manufacturer. Pipe and fittings shall be handled, installed, and tested in accordance with manufacturer's recommendations, and the requirements of this specification.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. Pipe and fittings shall be manufactured from a PVC compound which meets the requirement of Cell Classification 1245-B PVC as outlined in ASTM D1784.

B. Clean rework or recycled material generated by the manufacturer's own production may be used so long as the pipe or fitting produced meet all the requirements of this specification.

C. Dimension: Pipe Size shall be as indicated on the Contract Drawings. Fittings shall be of the same material and quality as the pipe on which they are installed.

PART 3 EXECUTION

3.01 PIPE HANDLING

PVC pipe and pipe fittings shall be handled according to manufacturer's recommendations. Under no circumstance shall pipe and pipe fittings be dropped or dumped.

3.02 PIPE JOINTING

A. All pipe shall be inspected for cuts, scratches, or other damage prior to installation. Pipe with imperfections shall not be incorporated into the work.

B. All joints shall be made in a dry area in accordance with the manufacturer's recommendations and the best practices for material and class of pipe installed. The ends of the pipe shall be wiped clean with a dry cloth before making each joint.

C. Bell ends of pipe shall be installed facing uphill.

D. Solvent cemented joints:
   1. Use a PVC cement which meets ASTM D2564.
   2. Cut pipe to desired length with pipe cutters, hack saw, or cross cut saw.
   3. Ream pipe both internally and externally to remove burrs and ragged edges.
   4. Before making solvent weld joint, be sure all joining surfaces are free of dirt, dust, water, and oil.
   5. The use of a primer before the application of PVC cement is recommended.
   6. Apply primer to both joining surfaces.
   7. Immediately apply a smooth coat of cement to the joining surfaces.

8. Immediately insert the spigot end into the bell end to the full depth of the socket.
9. Turn pipe 1/8 to 1/4 turn in the socket to ensure an even spread of cement.
10. Hold firmly in position for 15 seconds.
11. Allow joint to set according to cement manufacturer's instructions.

3.03 PIPE INSTALLATION AND TESTING

Install pipe in accordance with Section 02450 of these specifications.

3.04 PIPE SYSTEM IDENTIFICATION: All system components shall be identified in accordance with NEWSME standards. Pipe system components shall be labeled at all accessible structures. Pipe labeling shall include labels that identify the type of fluid in the pipe and the normal flow direction of fluid in the pipe network.

END OF SECTION

SECTION 02510

HOT MIX ASPHALT PAVEMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. The most recent version of the State of Maine, Department of Transportation, Standard Specifications (MDOT Specifications), including the most recent Special Provisions changes.

1.03 DESCRIPTION: Furnish all labor, materials, and equipment to install asphalt pavement in conformity with the Contract Drawings and as specified herein.

1.04 REFERENCES

The publications listed below are part of this Technical Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

Maine Department of Transportation Standard Specifications (most recent version)

A. Division 400 – Pavements

B. Division 401 – Hot Mix Asphalt Pavement

C. Division 409 – Bituminous Tack Coat

D. Division 702 – Bituminous Material

E. Division 703 – Aggregates

1.05 QUALITY ASSURANCE:

A. Qualifications of Hot Mix Asphalt Product: Use only materials which are furnished by a bulk hot mix a asphalt producer regularly engaged in production of hot-mix, hot-laid asphalt pavement.

B. Qualifications of Mixing Plant: Mixing plant shall be certified by State of Maine Department of Transportation.

C. Installer: Company specializing in performing work of this section.

D. Qualifications of Testing Agency: Use only recognized commercial testing laboratories with not less than 5 years of experience in conducting tests and evaluations of hot mix asphalt materials and design.

E. Obtain materials from same source throughout.

1.06 SUBMITTALS:

A. Mix Design: Provide the Engineer with an electronic copy of the job mix formula for each course used in the work.

B. Test Reports: Provide the Engineer with an electronic copy of each test described below at the frequency required in paragraph C.
   1. Aggregate Material: Submit laboratory test reports that confirm aggregates used in the hot mix asphalt conform to Section 703 of the MDOT Specifications.
   2. Submit laboratory test reports that asphalt material used in the hot mix asphalt mix conforms to Section 702 of the MDOT Specifications.
   3. In-Place, Compacted Hot Mixed Asphalt Pavement: Submit laboratory test reports of samples cut from the in-place, compacted pavement indicating the percentage of theoretical maximum density (TMD), based on laboratory specimens of the mix combined in the proportions of the job mix formula.

C. Frequency of Testing:
   1. Aggregate Material: Submit laboratory test reports of the stockpiled aggregates initially used in the mix and additional test reports for each change of source.
   2. Hot Mix Asphalt : Submit laboratory test reports for hot mix asphalt used in the initial mix and additional test reports for each change of source.
   3. In-Place, Compacted hot mix asphalt pavement Mix: Submit laboratory test reports at frequencies not less than one of the following:
      a. Every 300 tons placed.
      b. Each day's placement.
      c. Each course, each day's placement.
      d. In-place testing may be waived at the sole discretion of the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Aggregates: Conform to Section 703 of MDOT Specifications.

B. Hot Mix Asphalt Pavement: Conform to Section 702 of MDOT Specifications.

C. Tack Coat: Conform to Section 409 of MDOT Specifications

D. Mixes
   1. Hot Mix Asphalt Paving Mixtures: Designed in accordance with Section 400 of MDOT Specifications
   2. Base Course: HMA 19.0 millimeter (3/4-inch)
   3. Wearing Course: 12.5 millimeter (1/2-inch)

PART 3 EXECUTION

3.01 INSTALLATION:

A. Place, hot mixed asphalt pavement in conformance with Section 401 of MDOT Specifications.

B. Single Course Hot Mix Asphalt Paving:

   1. Install pavement in accordance with Maine Department of Transportation standards.

   2. Place hot mix asphalt pavement within 24 hours of applying primer or tack coat.

   3. Place hot mix asphalt pavement wearing course to thickness indicated on Contract Drawings.

4. Compact paving by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

C. Double Course Hot Mix Asphalt Paving:
1. Place hot mix asphalt pavement binder course within 24 hours of applying primer or tack coat.
2. Place binder course to thickness indicated on Contract Drawings.
3. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
4. Place wearing course to thickness indicated on Contract Drawings.
5. Compact each course by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

D FIELD QUALITY CONTROL

1. Hot Mix Asphalt Paving Mix Temperature: Measure temperature at time of placement.
2. Hot Mix Asphalt Paving Thickness: ASTM D3549; test one core sample from every 1,000 square yards compacted paving.
3. Hot Mix Paving Density: ASTM D2950 nuclear method; test one location for every 1,000 square yards compacted paving.
4. Field testing may be waived at the sole discretion of the Engineer.

D. TOLERANCES

1. Pavement in area of handicap accessible spaces shall have a maximum slope of 1:48 in any direction.
2. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
3. Scheduled Compacted Thickness: Within 1/4 inch.
4. Variation from Indicated Elevation: Within 1/2 inch

E. Pavement Repair:
1. Saw edges of existing pavement to provide a vertical bonding face as indicated on the Contract Drawings.
2. Grind surface course 12 inches on either side of repair.
3. Apply a tack coat to the ground edges.
4. Apply hot mix pavement of the same type and thickness of that being repaired.
5. Roller compact both surfaces, compacting the final wear course to meet existing pavement surfaces.

END OF SECTION

SECTION 02570

CATCH BASINS AND DRAINAGE STRUCTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Erosion Control: Section 02220

C. Pipe Installation: Section 02450

1.03 DESCRIPTION OF WORK: Work specified in this section shall consist of furnishing all labor, materials, and equipment to construct manholes or catch basins, in conformity with the contract drawings and as specified herein.

1.04 SUBMITTALS: The Contractor shall submit to the Engineer shop drawings of all precast units. Manufacturer's information shall be submitted for joint sealants and waterproofing. Manufacturer shall provide floatation design shop drawings and calculations, including anti-floatation extended base slabs as necessary, for proposed manholes. Manufacturer shall assume groundwater levels equal top of ground elevations and provide for a 1.2 floatation factor of safety.

PART 2 - MATERIALS

2.01 PRECAST CATCH BASIN SECTIONS AND DRAINAGE STRUCTURES: Precast sections shall be manufactured in accordance with the latest ASTM Specification Designation C-478. Precast catch basins and drainage structures shall be reinforced for H-20 loading (4,000 psi concrete).

2.02 MORTAR: Cement mortar shall be prepared in the following manner:

A. The cement shall be Type II. The mix shall be one (1) part cement to three (3) parts clean, well graded, hard, durable sand. Hydrated lime may be added to the mixture in an amount not to exceed 15% by weight of the cement. The amount of water shall be only the amount necessary to make a workable mix.

2.03 BRICK: Brick for manholes shall meet the latest AASHTO Specification Designation M-91

2.04 WATERPROOFING: Waterproofing for manholes, and Vaults shall be:

A. Asphalt conforming to ASTM Designation D-41, or

B. Cement base coating suitable for brush coat application.

2.05 FRAMES AND COVERS:

A. All castings shall be made of clean, even grain, gray cast iron. The castings shall be smooth, true to pattern and free from projections, sand holes, warp, and other defects which would interfere with the use of or impair the serviceability of the castings.

B. The horizontal surface of the cover seat and under surface of the cover which rests upon the cover seat shall be machined on all frames and cover intended for vehicular traffic. After machining it shall be impossible to rock any cover after it has been seated on its associated frame.

C. The iron used for castings shall conform to ASTM Designation A-48 for Class 30 gray iron.

D. Unless otherwise shown on the Drawings, all castings shall be coated with coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, not tacky and not brittle.

E. Manufacturer's name and catalog figure number must be cast on each frame and cover.

F. Catch basin grates shall be as shown on contract drawings or approved equal.

2.06 INLET GRATES:

A. Inlet grates shall be Heavy Duty Bar Guards manufactured by Agri Drain or equal.

B. Guards will be constructed of ½" steel rod and be protected by a powder coat finish.

PART 3 - EXECUTION

3.01 FABRICATION:

A. The tongue and groove of manhole, vault and catch basin sections shall be formed of concrete so as to receive a pre-molded bituminous seal. Sections shall be set so as to be vertical and in true alignment.

B. Each section of the precast manhole, vault and catch basin shall have two (2) lift points for the purpose of handling and installing.

C. Holes for pipes shall be cast in the base section so that there is a clear distance of 4-1/2-inch minimum between the inside bottom of the base section and the pipe invert, or as shown on the plans.

D. The joint for the pipe at the base section shall be a wedge style Kor-N-Seal series 106 boot as manufactured by Telleborg or equal.

3.02 INSTALLATION (As shown on the Contract Drawings):

A. General:
   1. The excavation shall be properly dewatered while placing bedding material and setting the base or placing concrete. Waterstop shall be used at the horizontal joint of cast-in-place manholes. Base shall be placed on a 6-inch layer of compacted stone bedding.
   2. Inlet and outlet stubs shall be connected and sealed as shown on the Drawings.
   3. Barrel sections and cones of the appropriate combination of heights shall then be placed, using manufacturer's recommended procedure for sealing the horizontal joints, and as shown on the Drawings or the remaining barrel of the manhole shall be cast above the base.
   4. A leakage test shall then be made as described in "Leakage Tests."
   5. Following satisfactory completion of the leakage test, the frame and cover shall be placed on the top or some other means of preventing accidental entry by unauthorized persons, children, animals, etc., until the Contractor is ready to make final adjustment to grade.

B. Waterproofing: The waterproofing of the exterior surfaces of manholes, vaults shall be one of the following methods:
   1. Bituminous Coating: After the concrete or cement plaster has set, two coats of an approved bituminous waterproofing material shall be applied to all outside surfaces of manholes. Waterproofing material shall be applied by brush or spray at approximate rate of 70 sq. ft./gal., in accordance with the manufacturer's instructions. Time shall be

allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first.

2. Cement Base Coating: Cement base coatings delivered in sealed containers shall be mixed in accordance with the manufacturer's recommendations and applied with a stiff brush in 2 coats. Each coat shall be applied at the rate of 2 lb. per sq. yd.

C. Frames and Covers: Frames shall be set on mortared brick courses true to grade and concentric with the opening. All voids beneath the bottom flange and in the brick courses shall be completely filled to make a watertight fit. A ring of mortar at least 1 inch thick shall be placed around the outside of the bottom flange, extending to the edge of the manhole all around its circumference. The bricks and mortar shall not extend beyond the top of precast concrete cone section.

D. Each pipe boot annulus shall be sealed with hydraulic cement as shown on the Contract Drawings.

3.03 VACUUM LEAKAGE TESTS:

A. General:
1. To be observed by the Engineer on an as needed basis.
2. A vacuum test made as described below. Manhole to pipe connection must be a flexible connector to perform this testing.

B. Preparation for Test:
1. After the manhole has been assembled in place, fill lifting holes and point with an approved non-shrinking mortar.
2. Perform test prior to placing the shelf and invert and before filling and pointing the horizontal joints, and before backfilling.
3. If the groundwater table has been allowed to rise above the bottom of the manhole, it must be lowered for the duration of the test.
4. Plug pipes and other openings into the manhole and the plugs braced to prevent blow out.

C. Test Procedure:
1. Test immediately after manhole assembly.
2. Use manhole vacuum test equipment equal to NPC Systems, Inc., Milford, New Hampshire.
3. Set tester in place.
4. Inflate compression band to seal base to structure.
5. Draw a vacuum of 10-in. Hg.
6. Close the valve.
7. Minimum test times for various manhole sizes. Less than 1 in/hg drop for the sizes listed below.

MH Depth (feet)	4’ Diameter MH	5’ Diameter MH	6’ Diameter MH
15 feet or less	50 sec.	1 min. 5 sec.	1 min. 20 sec.
15 to 30 feet	1 min. 20 sec.	1 min. 45 sec.	2 min. 10 sec.

8. If leakage occurs fill those points with non-shrink grout, allow to set and retest.
9. Rejected Manholes: Disassemble, reconstruct or replace as directed by the Engineer.

D. Backfilling: The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at his own risk, and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Resident Project Representative that the water table is below the bottom of the manhole throughout the test.

END OF SECTION

SECTION 02732

CELL PUMP STATION AND FORCE MAIN METER AND VALVE PIT

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

B. The requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 DESCRIPTION: The work of this Section includes furnishing all labor, materials, tools, and equipment necessary for the Cell 18 pump station and sample sumps and the pump station as shown on the Contract Drawings. The pump station system shall be complete with submersible pumps, motors, motor controls, electrical wiring and conduits, piping and valves, liquid level sensors, lift out assembly, structure, and other necessary appurtenances. The valve pit shall be complete with structure, valves, flow meters, and electrical wiring and conduits. Some of the electrical components of the pump stations will be supplied by the Owner-Approved Electrical Contractor (OAEC) as specified below. The OAEC will be responsible for the installation of supplied components.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Site Preparation: Section 02100

B. Earthwork: Section 02200

C. Erosion Control: Section 02220

D. Pipe Installation: Section 02450

E. Cast In-Place Concrete: Section 03300

1.04 DESIGN CRITERIA:

A. The materials and equipment covered by this specification are intended to be standard materials and equipment of proven ability. Equipment shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details for construction of the equipment.

B. To provide for continuity of the pump station's electrical and control systems with the owner's existing SCADA system, the electrical and control systems for the pump station will be supplied by the OAEC. A description of these systems is provided in this specification for the purpose of providing the supplier of pumps, level sensors, and associated piping and fittings with an indication of the type of electrical and control systems that will be used in this pump station. The control logic function and all other control components used in each control system shall be performed by solid-state components, which shall be standard catalog items of the manufacturer, with proven field performance. The manufacturer shall stock at least one module of each type used in each system. The modules shall be of a compatible, integrated control family with a full range of control/protective/alternation/telemetry capabilities and associated housings, enclosure system and appurtenances to perform a variety of functions as

required by this project and foreseeable expansion It is the intention of this specification to disallow non-standard, “one of a kind,” experimental, unproven combinations of equipment.

C. The level/pressure sensing equipment shall be standard products manufactured by the control supplier in order to assure proper system interconnections and reliable, long-term operation.

D. Equipment shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer’s recommendations and the Contract Documents. The specifications call attention to certain features but do not purport to cover all details entering into the construction of the equipment.

1.05 PRODUCT HANDLING: All materials and equipment shall be shipped, stored, handled, and installed in such a manner as not to degrade quality, serviceability, or appearance. The equipment shall be stored in a clean, dry location free from construction dust, precipitation, and excess moisture. If stored for more than two weeks, the equipment shall receive all maintenance considerations required by the manufacturer for proper storage of the equipment.

1.06 SUBMITTALS: Shop drawings, brochures, and samples shall be submitted for all items to be furnished in accordance with the provisions of the General Conditions . Submittals shall include at least the following:

A. Shop Drawings: A complete set of drawings shall be supplied to ensure successful installation and operation of the control system. The shop drawings shall consist of all of the following:
   1. Sufficient detail to evaluate compliance with these specifications.
   2. A detailed component list including manufacturer and catalog number.
   3. A custom wiring diagram for this specific application to facilitate and ensure accurate field connections to the control panel by electrical installation personnel.
   4. A description of operation for the control system.
   5. An enclosure dimension print.

B. Brochures and/or catalog cuts.

C. Performance curves.

D. Complete master wiring diagrams and elementary or control schematics, including required coordination with other electrical control devices operating in conjunction with the pumping station. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

1.07 Operation and Maintenance Manual for the equipment the mechanical equipment and components that area included in pump station construction.

1.08 Attention is directed to Part 2 of these Specifications wherein certain special mechanical and electrical equipment requirements are specified.

1.09 DESIGN CONDITIONS:

Pump Application	HP	Flow Rate (gpm)	TDH Range (ft)	SDR 17 Carrier Pipe Diameter (ft)
Leachate Pump	5	150	TBD	1.5 to 2
Leak Detection Pump	0.5	30	TBD	1

PART 2 PRODUCTS

2.01 LEACHATE COLLECTION PUMPS AND CARRIAGE SYSTEM:

A. Pumps:
   1. The contractor shall furnish and install one complete leachate transfer pumping system, including two pumps, as manufactured by Leachator or Engineer-approved equal.
   2. Pumps shall be of centrifugal, submersible design suitable for landfill leachate. The pump shall be coupled to a submersible motor that is non-overloading throughout the operating curve of the pump. Pump shall be supplied with a 300-series stainless steel strainer allowing up to a 1/4-" solids to pass.
   3. Leachate Pumps shall be Leachator™ LPS150MGST34050-02. Both pumps shall be supplied with 100 feet of jacketed power cable and rated for a minimum duty performance as specified above.
   4. Motor horsepower shall be as identified above, and shall operate on 460 volt, 3 phase, 60 hertz supply power.
   5. Major pump components shall be of high strength, lightweight aluminum alloy casting, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 300-series stainless steel construction. All exterior metal surfaces coming into contact with the liquid, other than stainless steel, shall be protected by a factory applied two-part epoxy coating. All O-rings shall be Viton.
   6. The cable entry seal design shall include specific torque requirements to ensure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal.
   7. The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber, NEMA B type. The stator windings and leads shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F).

B. The stator shall be heat-shrink fitted into the stator housing. The motor shall be designed for continuous duty handling pumped media with a temperature up to 40°C (104°F) and capable of up to 15 evenly spaced starts per hour.

C. The rotor bars and short circuit rings shall be made of cast aluminum. The motor and pump shall be designed and assembled by the same manufacturer.

D. The combined service factor (combined effect of voltage, frequency, and specific gravity) shall be a maximum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW, and efficiency. This chart shall also include data on starting and no-load characteristics.

E. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater to a depth of 65 feet without loss of watertight integrity.

F. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.
   1. The pump shaft shall rotate on two ball bearings, single row angular upper, and double row angular lower. Motor bearings shall be permanently grease lubricated.
   2. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal shall be tungsten carbide/tungsten carbide. The upper seal shall be tungsten carbide/tungsten carbide.
   3. Shaft shall be constructed of stainless-steel ANSI 431.

4. The Impeller shall be of 3 vane closed impeller constructed of high chrome alloy cast iron ASTM A532 Alloy IIIA, hardened for high wear resistance to 60 Rc hardness.

G. Carriage System:
   1. The pumps shall be mounted in a patented 300-series stainless steel carriage for use in 24-inch HDPE/SDR 17 riser pipes with a constant inside diameter and set at a 3 to 1 slope.
   2. The carriages shall provide a low center of gravity and all wheels shall remain in contact with the contour of the riser pipe. The wheels shall be constructed of non-corrosive material with self-lubricating qualities and must be able to travel over welding beads typically found in riser pipe fabrications.
   3. The level sensors shall be carriage mounted and capable of being removed or replaced without disassembly of the pump assembly.
   4. A safety/retrieval cable assembly with properly sized cable clips, snap hooks, and anchor eye bolt constructed of 300-series stainless steel shall be provided for each pump/carriage.

H. Discharge Hose:
   1. Discharge hose shall be 3-inch-diameter Nitrile Synthetic rubber construction flexible hose having a rated working pressure of 150 PSI and a temperature range of 2 to 93 degrees Celsius (35 to +200^{o}F.)
   2. Hose suitable for leachate service shall be provided in a length commensurate with the dimensional requirements of the application and field fit by installing contractor.

I. Discharge Hose Fittings:
   1. All hose fittings shall be 300-series stainless steel and shall be suitable for the application. All hose bands shall be hi-torque 300-series stainless construction.

J. Discharge Exit Fittings:
   1. A riser side exit disconnect fitting shall be provided that will allow quick connection/disconnection of the pump discharge hose from the riser exit, and allow the pump to be removed without interference of the stationary fittings. The exit arrangement shall thread through the riser pipe so as to provide a gas tight connection.
   2. All fittings shall be 300-series stainless steel construction.
   3. The exit connections will penetrate the riser wall approximately 6 inches, but no more than 18 inches, from the top of the riser pipe by means of 300-series stainless steel, male threaded exit nipple.

2.02 LEAK DETECTION PUMP:

A. Pumps: The leak detection pump shall be a Goulds, Series 13GS (0.5 hp, 230 volt, 3 phase motor) or engineer approved equal. Pumps shall be of centrifugal, submersible design suitable for landfill leachate. The pump shall be coupled to a submersible motor that is non-overloading throughout the operating curve of the pump. Pump shall be supplied with a 300-series stainless steel strainer allowing up to a 0.25" solids to pass. The pump shall be designed so that the shaft power required (BHP)/(kW) shall not exceed the motor rated output throughout the entire operating range of the pump performance curve.

B. All major parts of the pumping unit(s) including casing, impeller, motor cover, and intermediate brackets shall be manufactured from appropriate resins. The need for a protective coating shall not be required. All exposed fasteners shall be stainless steel and shall have stainless steel mating anchors integrally cast into the mating part. All units shall be furnished with an NPT discharge companion flange.

C. Impellers shall be of the multi-vane, semi-vortex, solids handling design and shall be slip fit to the shaft. The motor shaft shall be machined to provide a positive drive of the impeller. The pump casing shall incorporate an air relief valve.

D. All units shall be furnished with a dual inside mechanical shaft seal located completely out of the liquid, running in a separate oil filled chamber. The oil chamber shall be fitted with a device that shall provide positive lubrication of the top mechanical seal, (down to one third of the

standard oil level). The device shall not consume any additional electrical power. Units shall have silicon carbide seal faces. Mechanical seal hardware shall be stainless steel.

E. The pump motor(s) shall be 1 hp, 460 volt, 3 phase, and shall be NEMA MG-1, Design Type B or equivalent. Motor(s) shall be rated at full load amps. Motor(s) shall have a maximum service factor less than 1.15 and shall be rated for 20 starts per hour. Motor(s) shall be air filled, copper wound, class F insulated with built in thermal and over amperage protection. Motor shaft shall be 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. The bearings shall be single row, double shielded, C3, deep groove type ball bearings. Bearing seats shall be anodized steel or cast aluminum. Motor casing shall be 304 Stainless Steel.

F. The pump power cable shall be suitable for submersible pump applications. The cable entrance shall incorporate built in strain relief, limited tightening plate, and shall feature a vulcanized, one piece, combination three-way mechanical compression sealing/fatigue reducing boot The cable entrance assembly shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

G. Leak Detection Pump Carriage System: The specified pumps shall be mounted in a stainless steel or non-corrosive, durable carriage. The carriage shall be designed for sideslope riser leachate applications. The carriage must remain in contact with the inside diameter of the riser pipe to assure a straight path of travel of the pump to the base of the riser pipe and shall prevent the pump from twisting movement due to the starting torque of the motor. The carriage must easily remove the pump in the field should the pump require service. The pump and carriage shall be capable of entry into a lead 12-inch SDR 17 for pumps, riser pipe and must be able to travel over welding beads (0.625 inch) and perforations which are common to leachate collection riser pipe fabrication. A safety/retrieval cable of 1/4-inch stainless steel with required fittings shall be provided for each pump.

H. Pump Cord: Heavy-duty S.O.W. cord shall be used for all electrical connections from the pumps to the control panels.

I. Discharge Hose:
   1. Discharge hose shall be 2-inch diameter Nitrile Synthetic rubber construction flexible hose having a rated working pressure of 150 PSI and a temperature range of 2 to 93 degrees Celsius (35-200°F).
   2. Hose suitable for leachate service shall be provided in a length commensurate with the dimensional requirements of the application and field fitted by installing contractor.

2.03 CONTROL PANEL (SUPPLIED BY OAEC):

A. General: The pump manufacturer shall provide a completely self-contained duplex motor control panel and a simplex motor control panel. The control panel shall provide short circuit and overload protection for each pump. On the duplex leachate collection system an automatic alternator with manual override switch shall be provided to manually select the lead pump duty between the two pumps on successive cycles. The control panel shall conform to National Electrical Manufacturer's Association (NEMA), Joint Industry Council (JIC), and National Electrical Code (NEC) specifications, and shall be Underwriters' Laboratories (UL) listed. The panel shall be factory wired and tested. The control panel shall be mounted on a concrete slab located adjacent to and outside the pump station building.

B. Enclosures: The motor controls and circuit breakers shall be housed in NEMA 4X enclosures as shown on the Contract Plans. The enclosure shall be constructed of 14-gauge steel with continuous seam welds. The enclosure shall be provided with tamperproof double-door system consisting of a bland outer door and a second inner door on which all operating controls are located. The controls shall incorporate a "dead front" type of installation. Finish shall be baked enamel, white inside, gray outside. A padlock hasp shall be provided.

C. Phase Failure/Undervoltage Monitor: A phase-loss/unbalance/reversal and undervoltage protection assembly shall be provided with adjustable nominal voltage setting and three extractor type line voltage fuses. This device shall drop-out pumps if all phases drop below 90 percent or if one phase drops below 80 to 83 percent nominal voltage. This device shall have a 1/2-second drop-out delay and adjustable restoration time delay of up to five minutes.

D. Pump Circuit Breaker: A thermal magnetic molded case industrial type circuit breaker shall be supplied as branch circuit protection for each leachate pump. The circuit breaker must have a minimum ampere interrupting capacity of 14,000 symmetrical RMS amps at 480 VAC. Each circuit breaker toggle shall be operator accessible from the front of the dead front inner door. Each circuit breaker shall include an inner door interlocked, rotary type, padlock compatible operator handle.

E. Pump Motor Starters: A NEMA rated, full-voltage across the line magnetic motor starter with overload sensing in each phase to provide overcurrent and running protection shall be provided for each pump motor. Overcurrent protection shall be provided by accurately sized, replaceable, overload heater elements. Resetting of the overload shall be provided via an inner door-mounted reset pushbutton. 120 VAC control power shall be provided for the motor starter coil.

Pump	HP	CB Size	Controlled By
Leachate Primary	5	20 AMP	Leachate level sensing
Leachate Secondary	5	20 AMP	Leachate level sensing
Leak Detection	0.5	20 AMP	Liquid Level sensing

F. Pump Selector Switch: A door-mounted, 1-3/16" diameter "hand-off-auto" 3-position, rotary, oil tight, heavy duty type selector switch shall be furnished for each pump.

G. Pump Run Indicating Light: A door-mounted, 1-3/16" diameter oil tight type pilot light operated from a respective starter auxiliary contact, shall be furnished for each pump, to indicate a "pump running" condition. Each pilot light shall be transformer, press-to-test type with replaceable bulb.

H. Pump Running Time Meter: A door-mounted running time meter, measuring hours and tenths of hours of operation up to 99999.9 hours, shall be furnished for each pump. This shall be a 120-VAC device operating from the control voltage by an auxiliary contact of the motor starter.

I. Control Power Transformer: A 480/120 VAC transformer with primary fusing and secondary protection shall be provided for all 120 VAC powered devices, including the motor starter pilot circuits. The secondary side of the transformer shall be protected by the single pole circuit breaker described below.

J. Control Power Circuit Breaker: A control power circuit breaker shall be provided. The breaker shall be operable through the inner door of the control panel to provide a disconnect means and short circuit protection for any 120 VAC (or less) devices not powered from motor starter circuits.

K. Convenience Receptacle: An inner door-mounted, 120 VAC duplex, ground fault interrupter (GFI) type, convenience receptacle rated at 15 amperes shall be supplied for the operation of a trouble light, drill, etc. It shall be protected by a separate circuit breaker accessible from the inner door.

L. Condensation Protective Heater: A 100-Watt, 120 VAC, strip type, condensation protective heater, and high temperature cutout thermostat shall be supplied in the control panel.

M. Leachate Pump Liquid Level Pump/Alarm Controllers (2): This specification is intended to cover a complete and operational automatic pump and alarm control system that responds to the leachate level pressure excursions.
   1. Each system shall sense the liquid level and pressure over a calibrated range, display it on local display on the face of the controller.
   2. Each pump/alarm controller shall accept a single, level-proportional analog input signal (4-20 milli-amp) and provide level-differential automatic operation of the pump(s) and alarms.
   3. Each controller shall display the sensed control level on a display as manufactured by Precision Digital. The level shall be displayed in a 0 to 10-foot range or range as required, with 3-inch resolution.
   4. Each controller shall operate directly with the level sensing transducer. The controller shall include transducer excitation voltage regulation, signal spanning and offsetting and adjustable "quelling" (rate-of-change limiting).
   5. Each controller shall include abnormal level alarm annunciation circuitry with a front accessible alarm silence pushbutton and rear terminal block connection for an external audible alarm and silence pushbutton.
   6. It is the specific intention of this functional requirement that standard controllers will be employed with features as herein described and that they be a fully-integrated assembly. That is, the furnishing of similar functions using a multiplicity of setpoint modules, extensive relay/timer logic to accomplish control sequences or generic programmable logic controllers with custom software is specifically precluded by this specification and will not be acceptable.

N. Leachate Level Sensing Submersible Transducers: Each liquid level in the leachate and leak detection sumps shall be sensed by a submersible level transducer. In addition to these three transducers, the contractor shall supply one complete set of spare transducers with cable to the Owner. Each transducer shall be able to read in 0.1-ft increments and be a 3-wire type to operate from a supply voltage of 10.5 to 24 VDC and produce a 4-20 milli-amp instrumentation signal in direct proportion to the measured level excursion over a factory-calibrated range. Each transducer shall have internal and external transient protections. One complete set of spare transducers with cable shall be supplied to the project.
   1. Each transducer shall be of the solid-state head-pressure sensing type, suitable for continuous submergence and operation and shall be installed in accordance with manufacturer's instructions.
   2. Transducer housings shall be constructed of Type 316 stainless steel, with a bottom diaphragm measuring 7/8-inch-diameter of heavy-duty, limp, foul-free, molded Teflon (TM) bonded to a synthetic rubber back/seal.
   3. A hydraulic fill liquid behind the diaphragm shall transmit the sensed pressure to a solid-state variable-capacitance transducer element to convert the sensed pressure to a corresponding electrical value. The sensed media shall exert its pressure against the diaphragm which flexes minutely so as to vary the proximity between an internal ceramic diaphragm and a ceramic substrate to vary the capacitance of an electrical field created between the two surfaces. A stable, hybrid, operational amplifier assembly shall be incorporated in the transducer to excite and demodulate the sensing mechanism. The transducer shall incorporate laser-trimmed, temperature compensated, high quality components and construction to provide a precise, reliable, stable output signal directly proportional to the sensed pressure over a factory-calibrated range.
   4. Each transducer element shall incorporate high over-pressure protection and be designed to withstand intermittent over-pressures five times the full-scale range being sensed. Metallic diaphragms shall not be acceptable in that they are subject to damage or distortion. Sensing principles employing LVDTs, resistive or pneumatic elements shall not be acceptable.
   5. The internal pressure of each lower transducer assembly shall be relieved to atmospheric pressure through a heavy-duty urethane jacketed hose/cable assembly, and breather system mounted in the pump control panel. Each sealed breather system shall compensate for variations in barometric pressure and expansion and contraction of air

due to temperature changes and altitude as well as prevent fouling from moisture and other corrosive elements. Transducer levels shall be set as follows:

Leachate Collection Sump Pump:	
Primary Pump "On" Elevation	3 ft above sump floor.
Secondary Pump "On" Elevation	5 ft above sump floor.
Pumps "Off" Elevation	1 ft above sump floor.
Leak Detection Sump Pump:	
Pump "On" Elevation	2 ft above sump floor.
Pump "Off" Elevation	1 ft above sump floor.

6. Each transducer assembly shall be installed where directed by the Engineer and connected with other system elements and placed in successful operation. Each shall be provided with input power and output signal transient protection, associated control elements as specified herein and in accordance with manufacturer's instructions.
7. Each submersible level transducer shall be manufactured by KPSI, U.S. Filter/Consolidated Electric Company, Keller America, or an engineer approved equal.

O. Intrinsically Safe Transducer Control Modules (2): An intrinsically safe barrier shall be provided for each transducer and be mounted in the control panel. Each barrier shall have been tested, approved and labeled by an independent, 3rd party testing lab (i.e. UL, FM, CSA) with the specific submersible level transducer furnished for this application. Each barrier shall render the level sensing system suitable for use in Class 1, Division 1, Groups A, B, C, and D, Class 2, Division 1, Groups E, F and G, and Class 3, Division 1 hazardous locations.

P. Relays: Relays associated with the control apparatus shall be of the plug-in base type with transparent cover. Relays shall be provided with contacts rated for 10 amp, at 250 VAC. All relays shall be of the same manufacturer for all apparatus furnished.
1. This Specification does not apply to pre-manufactured modules which contain micro type relays to facilitate their operation.

Q. Local Alarm System: An enclosure top-mounted, alarm light including a high impact resistant, red Lexan lens shall be included. The alarm light shall operate on 120 VAC power and shall flash on a transducer abnormal level or pump cutout alarm condition. The alarm light shall include a latch-in circuit for an alarm condition, requiring manual reset via an inner door mounted, pushbutton.

R. Pump Cutout/Restore Logic: Logic shall be incorporated into the control to provide leachate cutout/restore based on the liquid level in the storage tank.
1. The pump cutout/restore logic shall include an inner door-mounted, 1-3/16-inch-diameter oil-tight-type pilot light to indicate a "pump cutout" condition. The pilot light shall be transformer, press-to-test type with replaceable bulb. The cutout logic shall also include an operator initiated, manual reset capability with inner door-mounted pushbutton, to allow the pumps to operate after the level in the storage tank has receded.

2.04 STATION WIRING (SUPPLIED BY OAEC):

A. The pumping station control panel wiring shall be in accordance with the National Electrical Code and as hereinafter specified. Control wiring shall be color coded. All job connections required to conveniently replace control components shall be made at approved type terminal blocks with engraved bakelite marker strips or similar approved means.

B. All wiring shall be of annealed 98 percent conductivity, soft drawn copper. Wire insulation shall be either Type THWN or Type XHHW. With the exception of control and signal leads, no wire smaller than No. 12 AWG, shall be used.

C. All wiring between the control panel and junction box shall be in watertight galvanized rigid steel conduit. Liquid tight flexible metal conduits shall be used for pump motor terminations. Where galvanized finish is removed for threading, a protective finish shall be applied.

D. Heavy-duty S.O.W. cord shall be used for all electrical connections from the pumps to the control panels.

2.05 FLOWMETER (SUPPLIED BY OAEC):

A. The flowmeters shall be MAG meters with instantaneous and cumulative reading capability as manufactured by Krohne America, Inc., Siemens or an engineer approved equal.

B. A digital display shall be located in the pump station control panel.

2.06 ATMOSPHERE MONITORING (SUPPLIED BY OAEC):

A. Infrared combustible gas monitor as manufactured by Honeywell, MSA, or engineer approved equal. Each unit shall have a NEMA 4X general purpose enclosure, mounted within the 7 to 30 VDC power supply (3-wire), 4-20 mA signal output, status LEDs and internal relays (3 alarm, 1 trouble). Each unit shall come with its own calibration kit and calibration gas. One controller shall be supplied for calibration and configuration.

PART 3 EXECUTION

3.01 INSTALLATION:

A. All materials and equipment shall be installed in a neat, workmanlike manner.

B. All wiring of the equipment shall be as specified in National Electrical Contractors Association Standard of Installation, and National Electrical Manufacturers Association WD1 and WD6.

C. Package Pumping Unit: Installation of the pumping station shall be done in accordance with written instructions provided by the manufacturer and as approved.

3.02 PAINTING: Shop painting and the surface preparation is a part of the work specified in this Section and shall be as specified in finish painting.

3.03 CLEANUP: Prior to startup and field testing, all foreign matter shall be removed from the pump chamber piping and pumps. Spillage of lubricants used in servicing the system shall be cleaned from all equipment and concrete surfaces.

3.04 INSPECTION AND TESTING: Each entire package pumping system shall be field tested as a system using clean fresh water prior to the acceptance of the station. The pumps shall be operated continuously at the design conditions for at least 15 minutes. All systems, controls, and sequences shall be operated and demonstrated as operating as approved. The Contractor shall perform all tests and shall be responsible for all necessary temporary connections, testing equipment, and utilities and shall provide and dispose of all water used.

A. Field Test: When the pumping facility is complete and ready for operation, the station shall be inspected and tested for compliance to the Contract Documents. Test of equipment shall be made by the Contractor in the presence of the Engineer, electrical sub-contractor, equipment manufacturer and the Owner. The equipment tests shall include, but will not be limited to the following:
   1. Pumps and motors: Pumps shall be run at design conditions. A determination shall be made of the pumping capacity. Performance of the pumps shall meet the specified criteria when field tested.
   2. Electrical: Readings shall be made of the voltage and amperage draw and recorded on the manufacturers start up form. This form should be kept by the Engineer, Contractor, and Owner for future reference.

3. Controls: Control primary elements shall be tested to determine satisfactory performance for starting and stopping at the proper liquid levels. Pump sequence and alarm functions will also be tested.
4. Equipment: Equipment shall be operated to determine that the pump is located in the correct position in the riser assembly. A check will be conducted to ensure that there is no overloading of the pump or any overheating in any of the controls. A check will be conducted for any abnormal vibration that may be evident in the discharge plumbing. Pump will be raised and reset to ensure correct placement in riser pipe.
5. Inspection: An inspection of all mechanical and electrical equipment, controls, piping, valves, fittings, brackets, mountings, seals, conduit, painting, and component features shall be made while the station is being tested to determine performance and compliance with design requirements and the specification.
6. Structure: The station shall be inspected for performance, structural soundness, and water tightness.
7. Repairs, adjustments, and replacement: The contractor shall make any and all necessary repairs, adjustments and replace any component parts until performance has been demonstrated to the satisfaction of the Engineer. The contractor shall bear the cost of any repair, adjustment, and replacement.
8. The leak detection pump and controls manufacturer must submit to the Engineer for review a full synopsis outlining occasions where the pump assembly has been:
    a. Run without damage
    b. Operated under conditions whereby solids have been passed through the pump assembly without degrading the pump performance or damaging the pump or motor assembly.

END OF SECTION

SECTION 02771

TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE LINER
(60 AND 80 MIL)

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan (QA/QC) shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Project Coordination: Section 01041

B. Earthwork: Section 02200

C. Geotextiles and Drainage Geocomposite: Section 02272

D. Geosynthetic Clay Liner: Section 02275

E. Interfacial Friction Angle Conformance Testing: Section 02780

1.03 REFERENCES

A. Geosynthetics Research Institute (GRI) GM13 Test Methods, Test Properties and Testing Frequencies for Hight Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

B. ASTM D1004 Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

C. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.

D. ASTM D792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

E. ASTM D4218 Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

F. ASTM D4833 Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

G. ASTM D5397 Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.

H. ASTM D5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.

I. ASTM D5885 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.

J. ASTM D5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes.

K. ASTM D6392 Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

L. ASTM D6693 Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.

M. ASTM D7466 Standard Test Method for Measuring the Asperity Height of Textured Geomembrane.

N. ASTM D8117 Standard Test Method for Oxidative Induction Tiem of Polyolefin Geosynthetics by Differential Scanning Calorimetry.

1.04 DESCRIPTION OF WORK:

A. Install Owner-supplied textured geomembrane as part of the Cell 18 liner system as shown on the Drawings, described herein and in the QA/QC manual. 80-mil textured HDPE geomembrane shall be installed as part of the primary liner system and 60-mil textured HDPE geomembrane shall be installed as part of the secondary liner system. The CQA will coordinate with the Owner to review the manufactures experience, manufacturing quality control testing, and conformance testing for textured geomembrane. This will not be the responsibility of the Contractor. The amount of high-density polyethylene geomembrane supplied to the project is as follows:
   1. 80-mil textured HDPE: (to be determined) SF
   2. 60-mil textured HDPE: (to be determined) SF

1.05 MANUFACTURER SUBMITTALS:

A. Manufacturing capabilities:
   1. Daily production quantity available for this procurement.
   2. Quality control procedures for manufacturing, including documentation of current laboratory accreditation by Geosynthetic Accreditation Institute-Laboratory Accreditation Program (GAI-LAP).
   3. List of material properties including certified test results.
   4. Representative samples of the specified geomembrane.

B. A list of at least ten completed facilities, totaling a minimum of 10,000,000 ft^2, for which the Manufacturer has manufactured a geomembrane meeting the requirements of these Specifications. For each facility, the following information will be provided:
   1. Name and purpose of facility, its location and date of installation.
   2. Name of Owner, Project Manager, Designer, Fabricator (if any), and Installer.
   3. Thickness of geomembrane, surface area of geomembrane manufactured.
   4. Available information on the performance of the lining system and the facility.

C. Origin (resin supplier's name, resin production plan) and identification (brand name, number) of the resin.

D. Sheet Quality: Submit the following information regarding sheet quality and properties:
   1. A material properties sheet including, at a minimum, all specified properties, measured using test methods indicated in the specifications at the frequencies shown (Section 2).
   2. A list and description of materials other than the base polymer which comprise the geomembrane.
   3. Sheet thickness will be monitored continuously during manufacture and will be nominal thickness $\pm$10 percent across the sheet.
   4. A written certification that property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

E. Roll Quality: Prior to shipment, provide a quality control certificate for each roll of geomembrane. The quality control certificate will be signed by a responsible party employed by the Geomembrane Manufacturer, such as the Production Manager. The Quality Control Certificate will include:
   1. Roll numbers and identification.
   2. Documentation certifying the geomembrane was continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, foreign materials, tears, punctures, and blisters.

3. Sampling results of quality control testing: Random sampling will be performed by the Manufacturer throughout the production run at the frequencies indicated below for each of the listed properties for the geomembrane to be delivered to the site. Value(s) must meet the requirements specified in Table 1 of Section 2.01.

Test	Test Designation	Frequency
Thickness	ASTM D5994	1 per toll
Density	ASTM D1505/792	1 per 100,000 lbs
Asperity Height	ASTM D7466	1 per 2 rolls
Break Strength	ASTM D6693 Type IV	1 per 20,000 lbs
Break Strain	ASTM D6693 Type IV	1 per 20,000 lbs
Yield Strength	ASTM D6693 Type IV	1 per 20,000 lbs
Yield Strain	ASTM D6693 Type IV	1 per 20,000 lbs
Tear Strength	ASTM D1004	1 per 45,000 lbs
Puncture Resistance	ASTM D4833	1 per 45,000 lbs
Stress Crack Resistance	ASTM D5397	Per GRI GM10
Carbon Black Content	ASTM D4218	1 per 20,000 lbs
Dispersion	ASTM D5596	1 per 45,000 lbs
Oxidative Induction Time (OIT)		
Standard OIT	ASTM D8117	1 per 200,000 lbs
High Pressure OIT	ASTM D5885	1 per 200,000 lbs
Oven Aging at 85°C		
Standard OIT	ASTM D8117	1 per formulation
High Pressure OIT	ASTM D5885	1 per formulation
UV Resistance		
High Pressure OIT	ASTM D5885	1 per formulation

4. The Resin Manufacturer will provide certification to the Geomembrane Sheet Manufacturer that the resin meets or exceeds the specifications for Density, Environmental Stress Crack, and Melt Index.
5. Sheet thickness shall be monitored continuously during manufacture and shall be nominal thickness $\pm$10 percent across the sheet.
6. Rolls not satisfying the specifications will be rejected. The Manufacturer will provide certification of testing as described in Part 2.

F. Resin Quality: Upon notice of award/selection, submit the following qualification information regarding resin quality.

1. A copy of the Quality Control Certificates issued by the Resin supplier.
2. Reports on the tests conducted by the Manufacturer to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the considered facility. These tests should include for HDPE resins, density, percent carbon black and percent carbon dispersion according to the methods outlined in this section.
3. A statement of origin and identification of raw materials used.
4. Documentation demonstrating the chemical compatibility of the materials to withstand leachate generated by municipal solid waste and other applicable waste materials.

G. Interface friction strength: The Manufacturer will supply materials which conform with the peak and large displacement interface friction angle or equivalent interface strength as presented in Table 2 of Part 2.01.

1.06 QUALITY CONTROL DOCUMENTATION: (Furnished by Liner Manufacturer and Liner Installer

A. Manufacturer's Experience: The Manufacturer supplying the geomembrane shall be GRI certified and shall satisfactorily demonstrate previous experience by letter of certification. Certification shall indicate that the Manufacturer has produced, and has in service in similar applications for a period of not less than two (2) years, at least 10,000,000 ft^2 of HDPE material meeting these Specifications.

B. Installer's Experience: The Installer proposing to install the liner shall satisfactorily demonstrate previous experience by letter of certification. Certification shall indicate the Installer's successful past installation of at least 10,000,000 ft^2 of HDPE geomembrane lining.

C. Installation shall be performed under the direction of a single installation supervisor who shall remain on site and be in responsible charge throughout the liner installation, including subgrade acceptance, liner layout, seaming, testing and repairs, and all other activities contracted for with the Installer. The installation supervisor shall have supervised the installation of at least 10,000,000 ft^2 of polyethylene geomembrane. Actual seaming shall be performed under the direction of a master seamer who may be the same person as the installation supervisor, and who has a minimum of 1,000,000 ft^2 polyethylene geomembrane seaming experience using the same type of seaming apparatus as that specified in this project. No seaming may be done by any individual with less than 500,000 ft^2 of polyethylene geomembrane seaming experience. The installation supervisor or master seamer must be on site whenever seaming is being performed.

1.07 CONFORMANCE TESTING (to be obtained/performed at the manufacturing facility by or in the presence of the Owner's representative. The Manufacturer will assist the Owner's representative in collecting a sample):

A. Obtain samples of the geomembrane at the specified frequency noted in Section 1.06.B. The Owner's representative will ship samples to Owner's designated geosynthetic testing laboratory for testing to ensure conformance to both the design specifications and the list of guaranteed properties. Owner will provide shipping information and geosynthetic testing laboratory information at the time of award and prior to sampling.

B. Geomembrane samples will be taken by cutting along the entire width roll. Unless otherwise specified, samples will be a minimum 3.0 feet long by the full roll width. Clearly mark the machine direction on the samples with an arrow. Geomembrane samples will be taken at a minimum rate of one per 100,000 ft^2 or with a minimum of once per lot.

C. All conformance sampling will be shipped to the laboratory a minimum of 21 days prior to the anticipated delivery unless an alternate time period is acceptable to the Owner. No materials will be delivered until acceptable test results are approved by the Engineer.

D. Geomembrane Conformance testing will be performed for the frictional properties noted in Specification Section 02780 Interfacial Friction Angle Conformance Testing.

1.08 SPECIAL PRODUCT WARRANTY: (Furnished by Liner Installer)

A. The Manufacturer warrants the HDPE geomembrane liner which is manufactured, sold as first quality, and installed with technical assistance and/or by an approved installation contractor (1) is furnished free of manufacturing defects in workmanship or material for a period of one year from the time of delivery with the basis for judgment of defects being the applicable product specifications in effect at the time the order was placed unless modified by mutual written agreement; (2) will not develop cracks/holes which go completely through the membrane due to the effects of normal service for a period of ten (10) years from the date of delivery; (3) immune to chemical attack and degradation by chemicals, specified in the Manufacturer's chemical resistance literature, as compatible with, and as not having an

adverse effect on the geomembrane; and (4) resistant to specific chemicals when tested for them by the Manufacturer at the request of the Owner. "Normal service" does not include physical damage caused by acts of God, casualty, or catastrophe such as (but not limited to) earthquakes, fire, explosion, floods, lightning, piercing hail, tornadoes, corrosive air pollution, mechanical abuse by machinery, equipment, people or animals, or excessive flexures, pressures or stress from any source other than faulty installation.

B. Should defects or weathering degradation within the scope of the above warranty occur, the manufacturer will refund to the purchaser-user the pro-rata part for the unexpired term of the warranty of the purchaser-user's original cost of such product or will supply repair or replacement materials at the then-current price. In the event the manufacturer supplies repair or replacement materials, against the then-current price, the manufacturer will credit the lesser of (1) the pro-rata part of the original sales price of the material so repaired or replaced for the unelapsed period of the warranty, or (2) the pro-rata part of the then-current price of the material so repaired or replaced to the unelapsed period of the warranty. The warranty will continue in effect on the repaired or replaced material for the unelapsed term of the original warranty.

C. To enable the Manufacturer's technical staff to properly determine the cause of any alleged defect and to take appropriate steps to effect timely corrective measures if such defect is within the warranty, any claim for alleged breach of warranty will be made and presented in writing to manufacturer within thirty (30) days after the alleged defect was first noticed.

PART 2 PRODUCTS (Furnished by Owner)

2.01 TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE:

A. The materials will be first quality products designed and manufactured specifically for the purposes of this work, and which have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes. The materials supplied will be manufactured from a maximum of three consecutive lots (resin batches). If the materials supplied cannot be from three consecutive lots, the Manufacturer is responsible for all costs associated with the additional conformance testing required.

B. Description of 60-mil HDPE Material: The geomembrane will be a textured high density polyethylene (HDPE) of 60-mil thickness containing no additives, fillers or extenders. Carbon black 2 to 3 percent will be added to the resin for ultraviolet resistance. The lining material will be manufactured a minimum of 20 feet seamless widths, and have the following physical characteristics:

TABLE 1

Test	Test Designation	Requirement
Thickness	ASTM D5994	54-66 mils nominal
Density	ASTM D1505/792	0.940 g/cubic cm (max.)
Asperity Height	ASTM D7466	16 mil (min. avg.)
Break Strength	ASTM D6693 Type IV	90 lb/in (min. avg.)
Break Strain	ASTM D6693 Type IV	100% (min. avg.)
Yield Strength	ASTM D6693 Type IV	126 lb/in (min. avg.)
Yield Strain	ASTM D6693 Type IV	12% (min. avg.)
Tear Resistance	ASTM D1004	42 lb (min. avg.)
Puncture Resistance	ASTM D4833	90 lbs (min. avg.)
Stress Crack Resistance	ASTM D5397	500 hr.
Carbon Black Content	ASTM D4218	2 to 3%
Dispersion	ASTM D5596	A1 or A2
Oxidative Induction Time (OIT)		
Standard OIT	ASTM D8117	100 minutes (min. avg.)
High Pressure OIT	ASTM D5885	400 minutes (min. avg.)
Oven Aging at 85°C		
Standard OIT	ASTM D8117	55% retained at 90 days (min. avg.)
High Pressure OIT	ASTM D5885	80% retained at 90 days (min. avg.)
UV Resistance		
High Pressure OIT	ASTM D5885	50% retained after 1600 hrs. (min. avg.)
Interface Friction Angle (per specification section 02780)		

In addition, the 60-mil geomembrane will be produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter, and will not have striations, roughness, pinholes or bubbles on the surface.

A. Description of 80-mil HDPE Material: The geomembrane will be a textured high density polyethylene (HDPE) of 80-mil thickness containing no additives, fillers or extenders. Carbon black 2 to 3 percent will be added to the resin for ultraviolet resistance. The lining material will be manufactured a minimum of 20 feet seamless widths, and have the following physical characteristics:

TABLE 2

Test	Test Designation	Requirement
Thickness	ASTM D5994	-5% nominal min. avg. -10% for individual for 8 out of 10 -15% for individual for any of the 10
Density	ASTM D1505 Type IV ASTM D792 Type IV	0.940 g/cc (max)
Asperity Height	ASTM D7466	16-mil (min. average)
Break Strength	ASTM D6693 Type IV	min. 120 lb per in. width
Break Strain	ASTM D6693 Type IV	min. 100%
Yield Strength	ASTM D6693 Type IV	min. 168 lb per in. width
Yield Strain	ASTM D6693 Type IV	min. 12%
Tear Resistance	ASTM D1004	min. 56 lb
Puncture Resistance	ASTM D4833	min. 120 lb
Stress Crack Resistance	ASTM D5397	500 hrs
Carbon Black Content	ASTM D4218	2 to 3%
Carbon Black Dispersion	ASTM D5596	A1 or A2
Ultraviolet Resistance	ASTM D5885	min. 50% retained @ 1600 hrs (min
Oxidative Induction Time Standard High Pressure	 ASTM D8117 ASTM D5885	 100 min. 400 min.
Oven Aging at 85°C Standard OIT High Pressure OIT	ASTM D5721 ASTM D8117 ASTM D5885	55% retained at 90 days 80% retained at 90 days
Interfacial Friction Angle Between drainage geocomposite and geomembrane	ASTM D5321 (see Section 02780)	See Section 02780
Between geosynthetic clay liner (non-woven side) and geomembrane	ASTM D6243	See Section 02780

In addition, the 80-mil geomembrane shall be produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter, and shall not have striations, roughness, pinholes or bubbles on the surface

B. Required Interface Friction Angle: Interfacial Friction Angle Conformance Testing shall be in accordance with Specification Section 02780.

C. Factory Bonded Seam: Calendered HDPE sheeting may not be fabricated into large sections at the factory.

D. Extrusion Joining Resin: Resin for extrusion joining sheets will be HDPE produced from the same material as the sheet resin. Physical properties will be the same as those of the resin used in the manufacture of the HDPE geomembrane liner. The resin will be supplied in black and/or natural color. Natural resin will be colored black through addition of 2.0 to 3.0 percent master batch colorant before use.

E. Documentation: Prior to delivery of the geomembranes to the job site, provide the Owner with a written certification that the product to be delivered was extruded from the specified resin. The Manufacturer will provide clear and concise quality control certificates for each batch of resin and each shift's production of geomembrane, and will follow the quality control testing program as described above. These quality control certificates will be signed by responsible parties employed by the Manufacturer, and will be supplied to the Owner. No geomembrane will be permitted to be delivered until the Owner has in his possession such certification. The Manufacturer will permit conformance test sampling by an independent party to be performed at the manufacturing plant prior to shipment if requested.

F. Roll Identification: Each roll will have permanently affixed both inside and outside the roll the following information: name of manufacturer; date of manufacture; resin batch code; actual thickness; roll number; roll length; and roll width. Unlabeled rolls will not be used and will be returned to the manufacturer at the manufacturer's expense.

G. All welding material will be supplied by the Manufacturer in twenty-pound spools and will be delivered in the original sealed containers, each with an indelible label bearing the brand name, Manufacturer's mark number and complete directions as to proper storage.

2.02 MISCELLANEOUS MATERIALS: (Furnished by Installer)

A. Pipe Boots, Vents, and Patches: All such devices shall be of the same material as the lining or a compatible approved equal.

B. Mechanical Fastenings: Mechanical fastenings shall be of the material, size, and type as detailed on the plans or approved shop drawings

PART 3 EXECUTION

3.01 GENERAL: The Contractor shall schedule a pre-installation conference as specified in Section 01041. During installation of the geomembrane, the Installer shall label each sheet immediately after deployment, with the roll number, panel number, and date it was installed.

3.02 SHIPPING AND HANDLING: The Contractor shall be responsible for unloading the materials and should refer to the Manufacturer's recommendations prior to arrival of the material to ascertain the appropriateness of their unloading equipment and procedures. All unloading and on-site handling efforts will be appropriately supervised. Upon arrival on site verify manufacturer labels are on all rolls delivered to the project. A firmly affixed label attached to the selvage edge, shall clearly state the manufacturer's name, product identification, material thickness, roll number, roll type, roll dimensions, and roll weight. All material lot and roll numbers will be recorded and compared to the packing list. In addition, each roll will also be visually inspected to determine if any of the materials have been damaged. Major damage suspected to have occurred during loading/unloading or transit will be reported immediately to the carrier and to Manufacturer. The exact nature and extent of the damage will also be indicated on the bill of lading along with the specific lot and roll numbers of the damaged materials. Damaged materials shall not be utilized in the project unless approved by the Engineer.

A. The Contractor shall protect the geomembrane from mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Rolls of material shall be continuously and uniformly supported and stored away from high traffic areas on a smooth elevated level prepared surface free from stones greater than ½-inch diameter (clean fine sand). Chocks for rolls shall be kept readily accessible. Rolls shall be stacked no greater than three rolls high. Materials stored overwinter shall be covered with a tarp.

3.03 SURFACE PREPARATION:

A. Conditions: Surfaces to be lined shall be smooth and free of all angular rocks, stones greater than ½-inch, sticks, roots, sharp objects or debris of any kind. The surface shall provide a firm, unyielding foundation. No standing water or excessive moisture shall be allowed.

B. Acceptance: The Installer shall certify that the surface to be lined is acceptable. No geomembrane shall be placed on subgrade deemed unsuitable by the Installer, Engineer, or the Geosynthetic Quality Assurance Resident Engineer (QARE).

3.04 ANCHOR TRENCH: Excavation, backfill and compaction of the anchor trench will be the responsibility of the General Contractor. The anchor trench shall be excavated along the lines

shown on the design drawings. The length of open trench should not exceed the amount of liner to be placed in a two (2) day period unless approval has been provided by the QARE.

A. The anchor trench may be partially backfilled during geomembrane panel placement; however, the anchor trench shall not be compacted until the geomembrane has experienced sufficient expansion/contraction cycles. Compaction of the anchor trench backfill shall be performed using manually operated compaction equipment. Backfill shall be placed in lifts not greater than 12 inches in loose thickness and shall be compacted to at least 90 percent of the maximum dry density according to ASTM D698. This backfill shall be compacted 1-inch minus till borrow. Borrow shall be placed at, or 4 percent above optimum moisture content. The QARE shall approve backfill material prior to anchor trench placement and must be notified prior to compaction.

3.05 FIELD SEAMS: The Geosynthetic QARE can, at its sole discretion, not allow any individual seamer or seaming equipment to be used for the project, based on observations made in the field. The Geosynthetic QARE will notify the Contractor of the individual or seaming equipment which may not be used on the project and the reason or steps necessary to demonstrate the person or equipment acceptance on the job. The Contractor shall have no recourse for this decision against the Owner, Engineer, or other parties.

A. Horizontal seams shall be allowed on the sideslopes but must be spaced a minimum of 20 feet apart on adjacent panels.

B. Layout: Overlap panels in shingle style from high to low elevation. Minimum panel length shall be 40 feet except as approved by the Geosynthetics QARE.

C. Preparation: All areas which are to become seam interfaces shall be cleaned of dust and dirt. When extrusion joining is required, the slick surfaces of the HDPE sheet which are to become seam interfaces shall be prepared by sanding or grinding (perpendicular to the seam) to a depth of less than 0.005 in. before joining the sheets. Field joints shall not take place unless the sheet is dry.

D. Seaming Methods: Installer shall submit to the Owner prior to construction a list of the seaming equipment and testing equipment, including manufacturer and model number to be used on-site. Field seams shall be made by overlapping adjacent sheets the appropriate amount and using one of the following seaming techniques:

1. Hot Air/Hot Wedge: Hot air/hot wedge technique shall be made by either a nozzle which directs hot air between the sheets or a hot metal surface in contact between the sheets. Each seaming unit must include a thermometer giving the temperature of the machine at the nozzle or metal surface. The seaming unit shall maintain a recordable temperature determined by on-site conditions and shall not vary more than, 50°F above, or below the recommended seaming temperature. The adjacent geomembrane sheets shall be overlapped 6 inches. The overlapped sheets are then pressed together by mechanical means. Seaming equipment that makes a split hot wedge seam will be the preferred method of seaming; single hot wedge seaming will be allowed only with the approval of the QARE.
2. Extrusion Bonding: Extrusion and fusion bonding will be limited to areas where hot wedge cannot be used, such as pipe boots, T-seams, and to any necessary repairs. The use of extrusion and fusion bonding as the primary seaming method will be allowed only with the approval of the QARE. The adjacent sheets to be seamed shall be overlapped a minimum of 3 inches. The joining procedure shall consist of softening the liner material by heated air. The temperature of the air impinging on the sheet for this purpose shall range from, 420°F to 680°F. The exact temperature used shall be determined by the installation supervisor. Directly following the application of heat, a one and one-half inch minimum width strip of the same high density polyethylene resin from which the sheet is made shall be extruded between the overlapped sheets. The temperature of the resin as it emerges from the extrusion die shall range from, 428°F to 536°F. The overlapped sheets shall be firmly pressed together by mechanical means to form the extrusion joint.

3. Fusion Bonding: Extrusion and fusion bonding will be limited to areas where hot wedge cannot be used, such as pipe boots, and to any necessary repairs. The major seaming of the liner will be done with hot wedge. Fusion bonding shall be by means of a homogeneous overlap extrusion fusion process which provides continuous dynamic integration of the extrudate bead with the lining material. The composition of the extrudate shall be identical to the lining material. The seaming unit shall be capable of continuously monitoring and controlling the temperature of the extrudate and the zone of contact where the machine is actually fusing the lining material. Temperature of the extrudate shall range from, 428°F to 536°F.

E. Cross-Seams (Butt Seam): Seaming of geomembrane at new/new geomembrane that has become soiled shall be properly prepared prior to seaming. No seaming will take place on dirty or soiled geomembrane. The installer shall trial weld representative samples taken from the seaming area. Passing trial welds shall be attained in accordance with Section 3.08.B.

F. Seaming Wrinkles: Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle, back into the panel so as to affect a flat overlap. The cut fishmouths or wrinkles shall be seamed as well as possible, and shall then be patched with an oval or round patch extending a minimum of 6 inches beyond the cut in all directions.

G. Repairs: Any required repair of scratches >5 percent of the sheet thickness and small holes in the liner surface shall be made with the extrusion hand welder. Liner material shall be cleaned of all dirt, dust and other foreign material, all smooth HDPE surfaces roughened, air heated to the prescribed temperature, and a strip of HDPE resin extruded over the hole to produce an extruded welded repair.

H. Quality of Workmanship: All joints, on completion of the work, shall be tightly bonded. Any lining surface showing injury due to crimping, scuffing, penetration by foreign objects, scratching by welding equipment, or distress from rough subgrade shall, as directed by the Engineer, be replaced or covered and sealed with an additional layer of HDPE of the proper size. The Installer shall inspect the final installation and any defects shall be repaired and tested until satisfactory.

I. No seaming shall be allowed if the Geosynthetic QARE is not on-site.

3.06 PIPE BOOTS, VENTS, MECHANICAL FASTENINGS, and PATCHES: The geomembrane shall be installed around any pipes, concrete structures or other penetrations through the geomembrane in accordance with the detailed Specifications shown on the Drawings. Prior to the start of construction, the Installer may provide, for the approval of the Owner, alternate installation methods or details to successfully perform geomembrane termination.

A. All clamps, bolts, nuts, gaskets or other materials used to secure the geomembrane shall be compatible with and have a lifespan at least equal to that of the geomembrane.

B. Care shall be taken to protect the underside of the geomembrane from damage due to settling at any under bedding to concrete transition.

C. Extreme care shall be taken while welding around any penetration or similar structure since destructive testing is not likely to be possible in such areas. All seaming in these areas shall be performed by the Installer's Master Seamer and the operations shall be observed on a full-time basis by the Geosynthetic QARE. Nondestructive tests of both the skirt and sleeve of the pipe boot shall be performed as described in Section 3.08.B of this specification.

3.07 SEAMING WEATHER CONDITIONS:

A. Normal Weather Conditions: The normal required weather conditions for seaming are as follows:
   1. Ambient temperature between 32°F (0°C) and 104°F (40°C).
   2. Dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.
   3. No excessive winds.

B. The Geosynthetic QARE shall verify that these weather conditions are fulfilled and notify the Engineer in writing if they are not. Ambient temperature shall be measured by the Geosynthetic QARE in the area in which the panels are to be placed. The Geosynthetic QARE will then decide if the installation is to be stopped or special procedures used.

C. Cold Weather Conditions: To assure a quality installation, if seaming is conducted when the ambient temperature is below 32°F (0°C), the following conditions must be met:
   1. Geomembrane surface temperatures shall be determined by the Geosynthetic QARE at intervals of at least once per 100 foot of seam length to determine if preheating is required. For extrusion welding, preheating is required if the surface temperature of the geomembrane is below 32°F (0°C).
   2. Preheating may be waived by the Geosynthetic QARE, if the Installer demonstrates to the Geosynthetic QARE's satisfaction that welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
   3. If preheating is required, the Geosynthetic QARE shall inspect all areas of geomembrane that have been preheated by a hot air device prior to seaming, to assure that they have not been overheated.
   4. Care shall be taken to confirm that the surface temperatures are not lowered below the minimum surface temperatures specified for welding due to winds or other adverse conditions. It may be necessary to provide wind protection for the seam area.
   5. All preheating devices shall be approved prior to use by the Project Manager.
   6. Additional destructive tests (as described in Section 5.5.6.2 of the Quality Assurance Plan (QAP)) shall be taken at an interval between 500 feet and 250 feet of seam length, at the direction of the Geosynthetic QARE.
   7. Sheet grinding may be performed before preheating, if applicable.
   8. Trial seaming, as described in the QAP, shall be conducted under the same ambient temperature and preheating conditions as the actual seams. Under cold weather conditions, new trial seams shall be conducted if the ambient temperature drops by more than 5°F from the initial trial seam test conditions.
   9. All snow and ice shall be removed from the liner using plastic shovels. The QARE will also have authority to suspend installation activities during severe weather conditions.

D. Warm Weather Conditions: At ambient temperatures above 104°F, no seaming of the geomembrane shall be permitted unless the Installer can demonstrate to the satisfaction of the Project Manager that geomembrane seam quality is not compromised.

E. Trial seaming, as described in Section 5.5.4 of the QAP, shall be conducted under the same ambient temperature conditions as the actual seams.

F. At the option of the Geosynthetic QARE, additional destructive tests (as described in the QAP) may be required for any suspect areas.

3.08 QUALITY CONTROL DURING INSTALLATION:

A. Site Test Equipment: The Installer shall maintain on site, in good working order, the following items:

B. Field Tensiometer: The tensiometer shall be motor driven and have jaws capable of traveling at a measured rate of 2 in./min. The tensiometer shall be equipped with a gauge which measures the force in unit pounds exerted between the jaws.

C. Vacuum Box: The vacuum box shall consist of a rigid housing with a transparent viewing window on top and a soft, closed- cell neoprene gasket attached to the bottom of the housing. The housing shall be equipped with a bleed valve. A separate vacuum source shall be connected to the vacuum box such that a negative pressure can be created and maintained between 4 and 8 psi. The vacuum box shall be equipped with a vacuum gauge capable of registering a minimum of 10 psi in increments of ¾ psi. A sudsy solution consisting of soap and distilled water shall be dispensed on the seam immediately ahead of the vacuum box.

D. Air Pressure Test Equipment: This method shall apply only when the split hot wedge seaming method is used. Equipment shall consist of an air pump capable of generating and maintaining a positive pressure of between 30 and 40 psi. A manometer capable of reading up to 40 psi attached to a needle or nipple shall be used to pressurize the air channel in the seam.

E. Alternative testing methods shall be submitted to the Owner or his Authorized Representative for approval prior to commencement of testing.

F. Non-Destructive Testing:
   1. Test Seams: Test trial seams shall be made at a minimum every 4 hours to verify that adequate conditions exist for field seaming to proceed. Each seamer shall produce a test seam at the beginning of each shift. In addition, if a seaming operation has been suspended for more than 1 hour or if a breakdown of the seaming equipment occurs, a test seam shall be produced prior to resumption of seaming operations.
   2. Test seams shall be made in the field on pieces of the approved geomembrane. Each test seam shall be at least 4 ft long by 1 ft wide and with sufficient overlap for peel testing in the field tensiometer.
   3. Five samples, 1 in. wide shall be taken across the seam using an approved template. The samples shall be tested in the field tensiometer, three in peel and two in shear and shall meet the requirements of Section 3.08.C.
   4. If the seam fails to pass, the seaming apparatus shall not be used for field seaming until any deficiencies have been corrected. This shall be verified by the production and successful testing of two consecutive test seams.
   5. Vacuum Testing: All extrusion welded and solid fusion welded seams shall be evaluated using vacuum box testing in accordance with test method ASTM D5641. Any seam overlap will be trimmed prior to testing.
      (a) A sudsy solution shall be applied to the test section and the vacuum box placed over the section. The bleed valve is then closed and the vacuum valve opened. Once a tight seal has been established (4 to 8 psi), the test section shall be visually examined for a period of not less than 15 seconds to determine whether bubbling of the soapy solution is occurring. The vacuum box is then moved and the process is repeated on the next adjacent section. A minimum 3 in. overlap shall be provided between all test sections.
      (b) All locations where bubbling of the sudsy solution was observed shall be clearly marked for repairs with a high visibility marker and recorded by number on field test reports. Any failed portion of seam shall be repaired by cap strip in accordance with Section 3.08.D.

G. Air Pressure Testing: All hot air/hot wedge seams shall be evaluated using air pressure testing. The seam shall be sealed off at one end and air passed through insuring an open passage. Once the seam is proven continuous the second end of the seam shall be sealed. If a seam end will be an integral part of the geomembrane the sealing shall be done in such a way that it does not harm the geomembrane. The seam should be pressurized to 30-35 psi. The feed valve shall be closed and the pressure sustained for a period of not less than 5 minutes. If a pressure loss of greater than 2 psi is observed or if the required pressure cannot be reached then the seam shall be rejected.

H. All faulty areas along the seam shall be identified and repaired by cap strip in accordance with Section 3.08.D. Vacuum testing shall be allowed on split wedge welds only when the faulty area cannot be isolated using air pressure testing. Any overlapping material must be removed

prior to vacuum testing. All holes created during air pressure testing shall be sealed on completion of the test and vacuum tested.

I. All seams shall be non-destructively tested by the Installer over their full length to verify the integrity of the seam. Non-destructive testing shall be performed concurrently with field seaming. Prefabricated field seams which will be inaccessible after installation, such as those under structures or fastened to penetrations, shall be tested prior to final installation. All non-destructive testing shall be observed and documented by the Geosynthetic QARE.

J. Approved non-destructive testing procedure is as above. Alternate procedures shall be submitted for approval to the Geosynthetic QARE prior to the commencement of non-destructive testing.

K. Geomembrane Penetrations: Accessible pipe boot seems for all geomembrane penetrations shall be vacuum tested as described above. Areas not accessible to vacuum testing shall be non-destructively tested using an electric spark test. The electric spark test shall employ a continuous length of 24-gauge copper wire, placed under the geomembrane seam within 1/4-inch of the edge. A portable pulse-type detector, equipped with a brush-type electrode, charged with a low amperage current of 20,000 to 30,000 volts, will be advanced along the seam at approximately 20 to 30 feet per minute. Seam defects are detected when a spark arks from the sire to the electrode, closing the circuit and sounding an audible alarm. All seam defects shall be repaired and retested as described herein. Alternative testing methods shall be submitted to the Geosynthetic QARE and the MEDEP for approval prior to commencement of testing.

L. Destructive Testing:
   1. Destructive testing of field seams shall be performed at selected locations in order to verify the criteria given in section "Test Seams". All sampling and testing shall be done concurrently with field seaming so that verification of field seam properties is made as the work progresses and corrective action implemented.
   2. Test samples shall be taken at an average frequency of one test location per 1,000 ft of seam for dual-wedge seams and one test per 500 ft of seam for extrusion seams. A minimum of one test sample shall be taken from each seam that connects to existing geomembrane liner. More frequent sampling shall be performed at the discretion of the Geosynthetic QARE based on field trial welds, destructive seam test results, weather conditions, inspection of seams, and overall seaming performance. Sample locations shall be determined by the Geosynthetics QARE. The Installer shall not be informed in advance of the locations where the seam samples will be taken.
   3. The Geosynthetic QARE may increase the amount of destructive testing based on the results of previous testing. Additional samples may also be required when the Geosynthetic QARE has reason to suspect the presence of excess crystallinity, contamination, faulty seaming equipment or any other reason affecting seam quality.
   4. The test sample shall measure approximately 12 in. wide by 48 in. long with seam centered lengthwise along the sample. Five one-in. wide coupon strips shall be cut using an approved template from the ends of the sample. These coupons shall be tested by the Installer in the field tensiometer in both peel and shear in accordance with section "Test Seams". The remainder of the sample shall be cut into two 12-in. lengths, and one 18-in. length. The 18-inch sample shall be taken by the Geosynthetic QARE for independent laboratory testing; of the remaining two, one shall be given to the Installer for his own records or testing, and one shall be kept by the Owner for permanent record.
   5. Samples shall be cut by the Installer under the direction of the Geosynthetic QARE. Each sample shall be indelibly numbered and identified. The sample number and location shall be recorded by the Installer on the panel layout drawing and on the sheet where the sample was taken.
   6. The results of laboratory testing shall be made available to the Installer by the Geosynthetic QARE not more than 48 hours after the samples have been received by the testing facility. The results of laboratory testing shall determine the acceptability of a seam. Laboratory testing shall be performed in accordance with the methods given in ASTM D6693 and ASTM D6392 and meet the following criteria:

Test	Test Designation	Requirement
Bonded seam strength (shear)	ASTM D6392 and ASTM D6693	4 of 5 coupons must be greater than 90% of parent material strength with none less than 70% of parent material strength* and have an acceptable mode of rupture
Peel adhesion (both tracks)	ASTM D6392 and ASTM D6693	4 of 5 coupons on each side of the weld must be greater than 60% of parent material strength* or 70% of the specified value, whichever is greater, with none less than 50% of parent material strength* and have an acceptable mode of rupture

Note:

* Parent material strength shall be defined as the maximum yield tensile strength value in the cross-machine direction of the manufacturers roll certification testing for all the geomembrane rolls delivered the site and the conformance test results. The Geosynthetic QARE is responsible for reviewing both the conformance and roll certification test results to determine the parent material strength value. The Geosynthetic QARE Project Manager and the MEDEP shall approve the parent material strength value.

7. Tests for peel adhesion and Shear shall be in a free condition (not 90° or 180°). Acceptable Locus of break codes for the specimen rupture mode shall be the following:

   For Dual Wedge Seams: BRK, SE1, SIP and AD-BRK $\leq$ 25 percent adhesion failure;

   For Extrusion Welds: SE1, SE2, SE3, BRK1, BRK2, HT, SIP, AD-WLD if strength is achieved, AD-BRK $\leq$ 25 percent adhesion failure.
8. Any seam that fails laboratory testing shall be repaired in accordance with section 3.08(D). The costs of repairing and retesting areas which failed destructive tests shall be the responsibility of the Installer.
9. The area from which the destructive test sample was taken shall be repaired without delay in accordance with the procedures given in section 3.08.D.

M. Inspection and Acceptance: As the work progresses, the Geosynthetic QARE shall document all locations requiring repair work and shall verify and document that all repairs have been successfully made by the Installer.
   1. A field seam shall only be considered acceptable when bounded by two destructive test locations which have passed laboratory testing and applicable non-destructive testing. The following procedures shall apply in the event that a seam fails laboratory testing:
      a. The Installer may reconstruct the seam with cap strips between the previous passing test location and the next passing test location (up to a maximum 75 feet) and retest, or;
      b. The Installer may elect to trace the extent of an unacceptable seam to some intermediate location. This shall involve taking 1-in. template-cut cross-sections from the seam at a minimum distance of 10 ft in both directions from the failed test location. These samples shall be tested in the field tensiometer in both shear and peel in accordance with section "Test Seams". If one or both of these samples fail the field test, tracing along the seam shall continue at minimum 10-ft increments until a passing result is recorded in both directions from the failed test location. At these locations large samples shall be cut for laboratory testing as in section "Destructive Testing". If laboratory testing verifies the acceptability of the seam at these locations, the Installer shall reconstruct the seam (with cap strips) between the two passing test locations. If laboratory testing shows the seam to be unacceptable, the Installer shall further trace the unacceptable seam until acceptable test results are recorded in both directions.
   2. Reconstructed seams shall be capped by cutting out the unacceptable seam, at least 6 inches each side of the seam and a minimum 6" beyond the defect, and patching with an acceptable material.

3. Reconstructed seams less than 150 ft in length shall be non-destructively tested in accordance with section "Non-Destructive Testing (3.08.B)". Reconstructed seams greater than 150 ft in length shall be destructively tested in accordance with section "Destructive Testing (3.08.C)."
4. The entire geomembrane surface shall be examined by the Geosynthetic QARE to confirm that it is free of any defects, holes, blisters, undispersed raw materials, or contamination by foreign matter. The geomembrane surface shall be cleaned by the Installer, if required so that it is free of dust, mud, debris or any other material which may inhibit a thorough examination of the surface. Any suspect areas shall be clearly marked by the Geosynthetic QARE and non-destructively tested in accordance with section "Test Seams."

N. Overburden: The Geosynthetic QARE shall monitor all overburden soils over the geomembrane and drainage geocomposite. The Geosynthetic QARE shall identify any large wrinkles which may have been built into the geomembrane. Any such wrinkle not built in to accommodate thermal contraction of the geomembrane prior to placement of the overburden shall be cut, repaired and tested by the Installer.
1. The Geosynthetic QARE shall identify any slope toe, declivity, or other surface transitions which might result in bridging of the geomembrane during placement of the overburden. Any such area shall be cut, repaired and tested by the Installer.
2. Equipment used for placing and compacting the overburden soil shall not be driven directly on the geomembrane. Such equipment shall be closely monitored during placement of the overlying soil to ensure that no damage occurs.
3. A minimum thickness of 1 ft of cover shall be maintained between the geomembrane and light earth moving equipment. Such equipment shall have a maximum ground pressure of 5 psi. Turning of any equipment shall be allowed on the initial 1 ft of cover. A minimum thickness of 3 feet of cover shall be maintained between the geomembrane and all rubber-tired earthmoving equipment.
4. In all cases, the placement of overburden shall be done with caution and in a manner which is least likely to cause wrinkles in, or damage to, the geomembrane.
5. For grades greater than 5% percent, all soil shall be placed in an upslope direction. Pushing soil downhill over slopes from 2% to 5% shall be allowed by the Geosynthetic QARE only after the Contractor has demonstrated they can do so without forming excessive wrinkles in the geomembrane or overlying geocomposite.

3.09 COMPLETION OF WORK

A. The installation of the geomembrane shall be considered totally complete when:
1. The installation of the cell liner system, or section thereof, is finished.
2. Verification of the adequacy of all seams and repairs, including associated testing, is completed.
3. All documentation of installation is completed.
4. The Geosynthetic QARE is able to recommend acceptance.
5. The Owner and/or their Representative is satisfied that the geomembrane has been installed in accordance with the above Specifications.

END OF SECTION

SECTION 02772

LEAK LOCATION SURVEY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Geomembrane Liner: Section 02771

C. Drainage Geocomposite: Section 02272

1.03 REFERENCES

A. ASTM D7007 Standard Practices for Electrical Methods for Locating Leaks in Geomembrane Covered with Water or Earthen Materials.

1.04 DESCRIPTION:

A. Leak Detection Survey to be performed by Leak Location Services, Inc. of San Antonio Texas or as approved by the Owner and Engineer.

B. Leak Detection Survey shall be performed on the primary geomembrane liner in accordance with ASTM D7007.

C. The Contractor shall furnish all labor, material, and equipment to support the Leak Survey crew, including line surveys, water, water truck with a driver, hose, electrical (110VAC. 5A) source/supply, a supervised crew that will prepare the soils for the leak survey, and any repairs of the geomembrane.

D. The leak location contractor shall furnish all labor, materials and equipment to perform the leak survey and any necessary reporting.

1.05 SUBMITTALS:

A. Leak location contractor shall submit: a location plan and or profile of proposed electrode placement; a drawing showing any necessary points to be surveyed prior to arriving on site; any necessary additional requirements; and a proposed schedule beginning at arrival on site.

1.06 QUALITY CONTROL PERFORMANCE TEST:

A. After excavating the leachate collection sand and removing a 2-foot diameter circle of drainage geocomposite, a test hole with a diameter of 0.25 inches shall be made in the geomembrane. A drill or other suitable instrument shall be used to remove rather than displace the material in the hole. The drill bit must be reciprocated within the hole to remove burrs from the edges or bottom side of the test hole. The test hole must be made in an area where the geomembrane has intimate contact with the supporting sub-grade or GCL.

B. If electrodes are installed under the geomembrane (not necessary in single liner systems), the test hole shall be placed at the farthest position away from any electrode, but at least 50 feet from the edge of the geomembrane.

C. The Contractor will survey and document the location of the test hole relative to site benchmarks. Leak location measurements shall be made and recorded along closely spaced parallel lines in the vicinity of the test hole. This data shall be analyzed to determine the leak detection distance for detecting the 0.25-inch test hole.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

A. Preparation: Any electrodes to be installed under the geomembrane shall be installed prior to the geomembrane. Leaks must be filled with moisture or earth material to be detected. To accomplish this, the following must occur at least 24 hours prior to the start of the survey:

   Uniformly wet the earth materials covering the geomembrane with water to field capacity. All leachate collection sand or stone shall be kept a minimum of 5 feet from the anchor trench for the duration of the Leak Test and there shall be a dry area located between the sand/stone and the edge of the geomembrane. The drainage inlet structures shall be constructed after the completion of the leak location survey to avoid masking of a potential leak signal. Any metal materials that will potentially interfere (mask a potential leak) with the leak survey including liner battens, couplings shall be insulated prior to the leak survey.

B. Leak Survey: The leak location data shall be taken on survey lines spaced no farther apart than twice the leak detection distance determined for a 0.25 inch diameter leak in the performance test. The measurement electrode spacing shall be no less than that used for the performance test. The spacing between measurements shall be no more than that used for the performance test.

   Data shall be recorded, plotted and analyzed for leak signals. The positions for these leak signals shall be located and the leaks excavated and repaired by the liner installer at the contractor's expense. Additional leak location survey data shall be collected near the located leak after the leak is repaired and electrically isolated to ensure no additional leaks are present. The survey data shall be repeated on the two closest survey lines for a distance extending at least 20 feet before and beyond the leak signal. If another leak signal is detected, this process shall be repeated until no additional leaks are detected.

C. Reporting: The daily results of the work shall be communicated to the owner's representative. A list of locations of the leaks found will be submitted to the Owners Representative after completion of the field work and before the survey personnel leave the site. A report documenting the electrical leak location surveys shall be submitted within 14 days of the completion of each leak survey. The reports shall document the methodology used to locate and repair the leaks, a description of the size and nature of the liner defect, and a diagram of the cell showing the approximate leak locations.

END OF SECTION

SECTION 02780

INTERFACE FRICTION ANGLE CONFORMANCE TESTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. The requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Project Coordination: Section 01041

B. Earthwork: Section 02200

C. Geotextiles and Drainage Geocomposite: Section 02272

D. Geosynthetic Clay Liner: Section 02275

E. Textured Geomembrane High-Density Polyethylene (HDPE)): Section 02771

1.03 REFERENCES:

A. ASTM D5321 Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

B. ASTM D6243 Standard Test Method for Determining the Internal and Interface Shear Strength of Geosynthetic Clay Liner by the Direct Shear Method

1.04 DESCRIPTION OF WORK: The work in this Section includes all labor, materials, tools, and equipment necessary to perform conformance interfacial friction angle testing for the following interfaces:

A. Drainage Sand and drainage geocomposite

B. HDPE textured geomembrane and primary drainage geocomposite

C. HDPE textured geomembrane and GCL

D. HDPE textured geomembrane and Till barrier soil

E. GCL and clay barrier soil

F. GCL internal

1.05 QUALITY CONTROL (furnished by Geosynthetic Laboratory):

A. Geosynthetics Quality Conformance Laboratory (QCL) Experience. The testing laboratory performing the interfacial friction angle conformance testing shall be accredited by the Geosynthetics Accreditation Institute for interfacial friction angle testing and shall have satisfactorily demonstrated previous experience by letter of certification. Certification shall indicate the testing laboratory's experience with the materials to be tested and any limitations the materials may evoke on the testing program.

B. Test Method. The Geosynthetics QCL shall perform the required interfacial friction angle testing in accordance with ASTM D5321 (for non-GCL interface shear testing) and ASTM D6243 (for GCL interface testing).

C. Test Reports. The Geosynthetics QCL shall provide test results to the project manager within three weeks of receipt of test samples. Test results shall be in the form of figures that present shear force versus displacement and shear stress versus normal stress. Both the peak strength and the large displacement strength shall be plotted. The laboratory shall report any influences or conditions that may have affected the test results. The laboratory shall indicate the correlation coefficient of the best fit lines drawn through the strength data, and the resulting peak strength and large displacement strength values for adhesion and friction angle.

PART 2 MATERIALS AND TESTING CONDITIONS

2.01 MATERIAL SAMPLING:

A. Materials to be tested shall be obtained from materials that will be placed into service at the Juniper Ridge Landfill site.

B. Sample size shall be determined by the *Geosynthetic QCL requirements.*

C. Soil components used in the laboratory testing shall be obtained from the borrow source or from soil stockpiles to be utilized in the construction of the soil components of the landfill.

D. Sample and testing frequency for geosynthetics components shall be as indicated below. Test frequency represents minimum number of tests. Additional tests may be required at the discretion of the CQA project manager.

Interface	Testing Frequency
Drainage sand/drainage geocomposite	2 tests
80-mil HDPE textured geomembrane/primary drainage geocomposite	2 tests
80-mil HDPE textured geomembrane/GCL	2 tests
60-mil HDPE textured geomembrane/compacted till barrier soil	2 tests
60-mil HDPE textured geomembrane/Secondary drainage geocomposite	2 tests
GCL/compacted clay barrier soil	2 tests
GCL internal	1 test

2.02 TESTING CONDITIONS:

A. The following testing conditions shall be utilized for interfacial friction angle testing:
   1. Use 12-inch by 12-inch-square direct shear apparatus as defined by Test Method ASTM D5321 (for non-GCL interface shear testing) and ASTM D6243 (for GCL interface testing).
   2. Test specimens shall be fully secured to the direct shear apparatus to prevent premature slippage.
   3. Test all geosynthetics in the direction parallel to the length of the roll (machine direction).
   4. Orient surface texturing of geomembrane so that the machine direction is tested parallel to the movement direction of the direct shear testing apparatus.
   5. Soil components shall be remolded into the testing apparatus according to the project earthwork specification Section 02200.
   6. Tests shall be run wet (flooded box).
   7. Asperity measurements shall be taken on the textured geomembrane sample specimens prior to and after direct shear testing at eight locations and the average value reported.
   8. The seating pressure, seating time, normal pressure(s), consolidation time and strain rate for each interface to be tested shall be as indicated below:

TABLE 3.1

Interface	Consolidation Time After Application of Normal Pressure (hrs)	Shear Force Displacement Rate (in/min.)	Seating Stress (psi)	Soak Time Prior to Application of Normal Stress (hrs)
Drainage Sand and Drainage geocomposite	4	0.2	N/A	1
HDPE textured geomembrane and drainage geocomposite	4	0.2	N/A	N/A
HDPE textured geomembrane and GCL (nonwoven geotextile)	24	0.004	1	24[1]
HDPE textured geomembrane and compacted till barrier soil	24	0.004	1	48
GCL (woven geotextile side) and compacted clay barrier soil	24[1]	0.004	1	24[1]
GCL internal	24	0.004	1	48

Notes:

[1] Interface tests with GCL component shall be soaked 24 hours at 1 psi seating stress and consolidated under normal load 24 hours prior to shearing. Conditioning of the interface specimens shall be done in the shear box prior to conducting the shear test.

[2] All tests shall be run out to 20 percent strain in the shear displacement direction. The large-displacement strengths shall be defined as the strength occurring at maximum horizontal test strain.

PART 3 REQUIREMENTS

3.01 The geosynthetic materials tested shall demonstrate their adequacy for use in the construction of the landfill by meeting or exceeding the following minimum requirements:

A. The interfaces listed in 2.01.D shall have shear test results for peak strength and large displacement strength that plot above the "average minimum strength envelope" as defined by Table 3.2 and Table 3.3.

TABLE 3.2

Normal Stress (psf)	Peak Shear Stress (psf)	Large Displacement Shear Stress (psf)
1,440	634	425
4,320	1,672	914
7,200	2,603	1,275
16,000	3,855	1,608

B. The internal GCL shear strengths listed below shall have test results for peak strength and large displacement strength that plot above the "average minimum strength envelope" as defined by Table 3.3.

TABLE 3.3

Normal Stress (psf)	Peak Shear Stress (psf)	Large Displacement Shear Stress (psf)
1,440	1,500	430
4,320	2,695	870
7,200	4,000	1,000
16,000	5,929	1,125

B. The large-displacement shear strengths shall be defined as the strength occurring at the maximum horizontal capacity of the testing device in the shear-displacement direction or as recommended by the Geosynthetics QCL.

C. Provide photographs of the test box at completion of testing. Photographs must specifically show geosynthetic grippers and possible pull-out. Also provide photographs of both sides of each geosynthetic and label direction of movement:

3.02 REVIEW OF TEST RESULTS: The Engineer shall review all test reports to determine if the test results meet the minimum requirements stated above.

3.03 RETESTING: The Contractor, Installer, and the Manufacturer may elect to retest failed tests. Testing may be done at the same laboratory or an independent laboratory. A minimum of two tests for each failure shall be completed with a determination of acceptability made by the Engineer. The testing laboratory shall be approved by the Engineer, and be GAI/LAP accredited, and the testing conditions shall be in accordance with ASTM D5321 (for non-GCL interface shear testing) and ASTM D6243 (for GCL interface testing). Testing shall be done at contractor's, installer's, or manufacturer's expense. Test results shall be reviewed by the Engineer.

END OF SECTION

SECTION 02800

SEEDING AND MULCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan and Erosion and Sediment Control Plan shall apply to the work specified in this Section.

C. All work performed under this specification shall be performed in accordance with the Maine Department of Environmental Protection (MEDEP) Maine Erosion and Sediment Control Best Management Practices (BMPs) (most recent version).

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Erosion Control: Section 02220

C. Erosion and Sedimentation Control Details as shown on the Contract Drawings

D. Contract Drawings; Erosion and Sedimentation Control Detail Sheet

1.03 DESCRIPTION OF WORK: Work specified in this section shall consist of furnishing all labor, materials, and equipment to perform seeding and mulching work in conformity with the contract drawings and as specified herein**.** Vegetative soil shall receive seed, fertilizer, lime, and mulch per these specifications**.**

1.04 QUALITY CONTROL:

A. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: The Contractor shall employ a testing laboratory acceptable to Engineer to perform off-site soil testing of materials at point of source which are contractor supplied. The Contractor shall perform the following analysis on vegetative soil used for landfill construction.

1.05 QUALITY ASSURANCE: If subcontracted, subcontract the seeding work to a single firm specializing in landscape work or as approved by the Engineer.

A. Source Quality Control:
   1. General: Ship landscape materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to landscape materials.
   2. Analysis and Standards: Package standard products with manufacturers certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agricultural Chemists, wherever applicable or as further specified.
   3. The vegetative soil may not be obtained from properties where biosolids were applied.
   4. Grass Seed: All seed shall be certified as to mixture, germination, and purity, as being in conformity with the following requirements:

a. Each variety of seed shall have a percentage of germination of not less than 80, a percentage of purity of not less than 85, and shall have not more than one percent of weed content.
b. All seed shall be from the same or previous year's crop unless recent tests by an approved testing agency demonstrate that older seed meets the above requirements.

5. Inspection: The Engineer reserves the right to inspect any plant materials either at the place of growth or at the site before planting, for compliance with requirements for name, variety, size, and quality.

1.06 SUBMITTALS:

A. Certification: For information only, submit certificates of inspection as required by governmental authorities, and manufacturer's or vendors analysis for soil amendments and fertilizer materials**.** Submit other data substantiating that materials comply with specified requirements at the request of the Engineer.
1. Submit seed vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species at the request of the Engineer**.**

B. Vegetative Soil Source: Before delivery of vegetative soil, the Contractor shall provide a submittal that includes the location of the proposed source, names and addresses of owners, depth to be stripped, crops grown during past two years. The source may not be a former biosolids application site.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer**.** Protect materials from deterioration during delivery, and while stored at the site.

1.08 JOB CONDITIONS: Contractor must examine the subgrade, verify the elevations, observe the conditions under which work is to be performed and notify the Engineers of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

A. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the required seasonal limitations**.**

B. Seeding Seasons: Unless variance is requested in writing and approved by the Engineer, seeding shall be done within the following dates:
1. Permanent Seeding: April 26 – September 15
2. Temporary Seeding: September 16 – April 25
3. Dormant Seeding: November 16 – April 25

PART 2 PRODUCTS

2.01 SOIL

A. Vegetative Soil: Vegetative Soil shall be free of particles in excess of 3-inches in the largest dimension, loose, friable and shall be free from refuse, large stones, clods, roots, or other undesirable foreign matter. It shall be reasonably free of weeds, roots, or rhizomes.

B. Vegetative Soil Testing:
Submit representative soil samples of vegetative soil to qualified soil testing laboratory for standard soil analysis (Nitrogen, Potassium, and Phosphorus) to ascertain what amendments may be necessary to obtain proper tilth, nutrient characteristics, and pH

balance in accordance with the following. Provide amendments as necessary at rates indicated on the soil test in accordance with the following criteria:

pH range: 6.0 to 7.5.
Phosphorus/Potassium: Low to Medium range
Soluble Salt: Not greater than 500 ppm

2.02 SOIL AMENDMENTS:

A. Soil Amendments per agronomic soil testing or as follows:
   1. Lime:
      a. Agricultural Ground Limestone: Agricultural ground limestone shall containing not less than 80% of total carbonates, ground so that not less than 100% passes a 10-mesh sieve, not less than 90% passes a 20-mesh sieve, and not less than 50% passes a 100-mesh sieve. Agricultural limestone may be shipped in containers or in bulk. Packaged material shall be delivered in the manufacturers standard containers. The containers shall be new and so constructed to assure safe arrival at the site. The net weight of the content shall not exceed 100-pounds per container. The manufacturers name, a guaranteed analysis, and net weight shall appear on each container. Bulk shipments shall be accompanied by certificates stating manufacturers name, weight, and guaranteed analysis.
      b. Liquid Lime: Liquid lime may be substituted for agricultural limestone when seeding hydraulically. Lime shall be water soluble and contain Elemental Calcium at 19-percent and have Nitrogen 15.5% of which 1% is from Ammoniacal Nitrogen and 14.5% is from Nitrate Nitrogen. Liquid lime shall be delivered in unopen containers. The containers shall include the manufacturers name, guaranteed analysis, and quantity.

   2. Fertilizer: Fertilizer shall contain available elements in conformity with the standards of the Association of Official Agricultural Chemists**.** The fertilizer shall be furnished in unopened bags and shall indicate the weight, contents and guarantee analysis shown thereon or on a securely attached tag, as applicable**.** The selection of fertilizer shall be based on the minimum phosphorus required by the soil as determined by the chemical analysis of soil samples**.** The Contractor shall be responsible for sampling and testing vegetative soil to determine amount of phosphorus required for vegetative growth.
      a. Granular fertilizer shall be a commercial grade fertilizer with percentages recommended by Soil Testing or containing the following percentages of available nutrients by weight:

Nitrogen	23 percent (at least 50 percent slow release)
Phosphoric Acid	As determined by Soil Testing
Potassium	12 percent (40 percent from potassium magnesium sulfate)
Iron	1 percent from iron sulphate

      b. Water soluble fertilizer shall be completely soluble in water, without chlorides or carbonates, containing a color or dye, and contain the following percentages of available nutrients by weight.

Nitrogen	20 percent
Phosphoric Acid	as Determined by Soil Testing
Potassium	20 percent

      c. The Engineer may approve the use of other fertilizers providing they are applied in an acceptable form and meet the total nutrient quantities required for the site.

2.03 GRASS MATERIAL:

A. Grass Seed: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America**.** Provide seed of the

grass species, proportions, and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified**.** Apply seed of the specified mixture and at the rate indicated on the Contract Drawings.

2.04 MISCELLANEOUS LANDSCAPE MATERIALS:

A. Mulch for Seeded Areas:
   1. Hay or straw mulch shall be used in all mulch applications unless otherwise approved by the Engineer. Hay and straw mulch shall consist of long fibered hay or straw, reasonably free from noxious weeds and other undesirable material**.** No material shall be used which is too wet, decayed, or compacted as to inhibit even and uniform spreading**.** No chopped hay, grass clippings, or other short fibered material shall be used unless directed. Application rate shall be as indicated on the Contract Drawings.
   2. Cellulose fiber mulch shall consist of wood, recycled paper (35-percent maximum), or humus cellulose fiber containing no materials which will inhibit seed germination or plant growth**.** Sufficient non-toxic water-soluble green dye shall be added to provide a definite color contrast to the ground surface to aid in even distribution**.** Cellulose fiber mulch shall be supplied in moisture resistant, sealed bags marked with the manufacturer's name, the air-dry weight, and composition of the contents. Cellulose fiber mulch shall not be applied after August 15.

B. Mulch Binder: Material for mulch binder shall be a commercially developed product for the tacking of hay or straw. Binder shall be free of refuse, physical contaminants, materials toxic to plant growth or asphalt. Paper fiber mulch may be used as a binder at a rate of 5 lb/unit and shall be dyed green. Paper fiber mulch shall be applied hydraulically or Engineer approved equal.

PART 3 - EXECUTION

3.01 SEEDING:

A. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage.

B. Rates of Application: Rates of application for limestone, fertilizer, and grass seed shall be in accordance with the Contract Drawings.

C. The hydraulic spray method shall be used for seeding all areas unless alternative methods are approved by the Engineer.

D. Seed, Lime, Fertilizer:
   1. All seed, lime, and fertilizer shall be mixed on-site in the presence of the Quality Assurance Resident Engineer (QARE) and bag tags shall be given to the QARE to confirm that the proper amounts of each are added to the soil.
   2. The Contractor shall apply seed, fertilizer, lime, mulch, and tack in the following order:
      a. Apply seed, lime, fertilizer per hydraulic spray method to tracked slopes as indicated below.
      b. Apply hay or straw mulch as indicated below.
      c. Apply mulch binder per hydraulic spray method as indicated below.

E. Application Procedure:
   1. Hydraulic Spray Method: The hydraulic spray method of sowing seed shall be done with an approved machine operated by a competent crew**.** Seed and fertilizing materials shall be mixed with water in the tank of the machine and kept thoroughly agitated so the materials are uniformly mixed and suspended in the water at all times during operation**.** The spraying equipment must be designed and operated to distribute seed and fertilizing materials evenly and uniformly on the designated areas at the required rates**.** If the Engineer finds the application uneven or otherwise unsatisfactory, he may require the

hydraulic spray method to be abandoned and the balance of the work done as specified under another method.

F. Mulching:
   1. Hay or straw mulch shall be spread evenly and uniformly over any designated areas or as directed by the QARE in the field so to avoid damage to seeded areas**.** Unless otherwise directed, mulch shall be applied at the rate of 2 to 3 tons per acre or 3 bales (90 to 130 lbs) per 1,000 square feet**.** Mulch shall cover the ground surface but heavy application of mulch shall be avoided**.** Lumps and thick mulch material shall be thinned.
   2. Unless otherwise authorized, the mulch shall be anchored in place by uniformly applying an acceptable mulch binder at a rate recommended by the manufacturer**.** Application of a concentrated stream of mulch binder will not be allowed**.** Other methods of anchoring mulch may be used subject to the approval.
   3. Cellulose fiber mulch shall be applied as waterborne slurry. The cellulose fiber and water shall be thoroughly mixed and sprayed on the area to be covered so as to form a uniform mat of mulch at the rate of not less than 60 pounds of mulch material per 1,000 square feet unit of area.

   4. Cellulose fiber mulch may be mixed with the proper quantities of seed, fertilizer, and agricultural limestone as required, or may be applied separately the next day after seeding.

G. Erosion Control Blanket:
   1. Erosion control blanket shall be placed at locations indicated on Contract Drawings. The anchoring of the blanket shall be as indicated by the manufacturer or as shown on the Contract Drawings.

3.02 MAINTENANCE AND ACCEPTANCE:

A. Seeded Areas:
   1. Maintain seeded areas by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, acceptable grass growth, free of eroded or bare areas.
   2. Permanent Seeding, April 26 to September 15, Inclusive: The Contractor shall maintain each seeded area until acceptance of the individual area**.** Maintenance shall consist of providing protection by erecting necessary signs and barriers and by repairing damaged areas as directed**.** Damaged areas and areas which do not produce a satisfactory stand of grass shall be repaired to re-establish the condition and grade of the area prior to the original seeding and then re-fertilized, reseeded, and re-mulched as specified to produce satisfactory results.
   3. Areas fertilized and seeded by the hydraulic method will be accepted only upon attainment of a reasonable thick uniform stand of not less than 90 percent coverage of permanent grasses, free from sizeable thin or bare spots.
   4. Temporary and Dormant Seeding, September 16 to April 25, Inclusive: Areas not seeded or which do not obtain satisfactory growth by September 16, will be seeded with Winter Rye or mulched at rates previously specified herein**.** After November 1, or the first killing frost (whichever comes first), disturbed areas shall receive dormant seeding (at double the regular seeding rate) in accordance with MEDEP BMPs and the Contract Drawings.
   5. Seeded areas will be accepted only upon attainment of a reasonably thick, uniform stand of not less than 90 percent coverage of permanent grasses, free from sizable thin or bare spots.

3.03 CLEANUP AND PROTECTION: During landscape work, store materials and equipment where directed**.** Keep pavements clean and work area in an orderly condition.

A. Protect landscape work and materials from damage due to landscape operation, operations by other contractors, and trades and trespassers**.** Maintain protection during installation and maintenance periods**.** Treat, repair, or replace damaged landscape work as directed.

3.04 RESTORATION: All paved, sod covered, or planted areas, structures, and substructures not specifically provided for in the contract disturbed by the Contractor during the execution of the work shall be restored by the Contractor, in a manner satisfactory to the Engineer, to their original conditions at no additional cost to the Owner.

END OF SECTION

DIVISION 3

CONCRETE

SME
SEVEE & MAHER
ENGINEERS

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Precast Concrete Structures: Section 02570

C. Leachate Collection Pump Station: Section 02732

1.03 REFERENCES

A. ACI 117 Specifications for Tolerances for Concrete Construction and Materials

B. ASTM A82 Standard Specifications for Steel Wire, Plain, for Concrete Reinforcement

C. ASTM C33 Standard Specification for Concrete Aggregate

D. ASTM C94 Standard Specification for Ready Mix Cement

E. ASTM C231 Standard Test Method for Air Content of Freshly Mixed Concrete by Pressure Method

F. ASTM C143 Standard Method for Determining Slump of Hydraulic-Cement Concrete

G. ASTM C150 Standard Specification of Portland Cement

H. ASTM A615 Standard Specifications for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

1.04 DESCRIPTION:

A. Furnish and install cast in place concrete shown on the Drawings and specified herein.

1.05 SUBMITTALS

A. The Contractor shall submit the concrete mix design to use for the project.

1.06 QUALITY ASSURANCE:

A. All concrete shall conform to applicable requirements of the ACI Standards for design and construction of concrete work.

B. All concrete shall be minimum 3,000 psi at 28 days unless otherwise specified.

1.07 SHOP DRAWINGS:

A. Provide Shop Drawings in accordance with Section 01300.

1.08 TESTING:

A. Sampling and testing will be at the discretion of the Owner and Engineer.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Concrete:
   1. Cement:
      a. Portland cement conforming to ASTM C150, as revised, Type II.
      b. Use an air entraining admixture conforming to ASTM C260.
      c. Maximum Water-Cementitious Materials Ratio-0.45
   2. Aggregate:
      a. Conform to ASTM C33, as revised.
      b. Sand: Medium with a fineness modulus of 2.3 to 3.1.
      c. Coarse Aggregate: Not to exceed 1-1/2 inches for mass concrete and 3/4 inch for reinforced slabs.
   3. Water: Potable supply.
   4. Mixed Concrete:
      a. Slump limit per ASTM C143 of 2 to 4 inches before adding high-range water-water-reducing agents or plasticizing admixture plus or minus 1 inch.
      b. Air Content: 5-7 percent per ASTM C231 except troweled finished floor not to exceed 3 percent.
   5. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

B. Reinforcing Steel:
   1. As herein used, designates the bars, and rods incorporated in the concrete, but does not include any structural shapes.
   2. Fabrication and placing of all reinforcing steel shall conform to the requirements of the American Concrete Institute, "Building Code Requirements for Reinforced Concrete" (ACI-318).
   3. Reinforcing Steel: Round, deformed steel bars of the intermediate grade Billet Steel with deformations to ASTM Specification A615.
   4. Wire: Conform to the requirements of the "Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement," ASTM Specification A82.
   5. Bars: Cold bent and accurately formed to the dimensions indicated on the Drawings.
   6. Stirrups and Ties:
      a. Bent around a pin having a diameter not less than two times the minimum thickness of the bar.
      b. Bends for Other Bars: Make around a pin having a diameter not less than six (6) times the minimum thickness of the bar.
      c. Do not straighten or re-bend in a manner that will injure the material.
      d. Bars with kinks, or bends not shown on the drawings, shall not be used.
      e. Heating of any bars will be permitted only when the entire operation is approved by the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Forms:
1. Design, furnish and erect as necessary to install concrete.
2. Of sufficient strength and rigidity to resist, without bulging, the weight of the concrete, and smooth and free of all irregularities.
3. Form material: Suitable for forms and adequate to retain the concrete to the designed dimensions; tied, clamped, and bolted together as necessary, to prevent the leakage of mortar.
4. Falsework: Rigidly braced against lateral movement, in such a manner that accurate alignment will be assured.
5. Provide for all openings, beams, rebates, chases, slabs, etc., as may be required.
6. Set all sleeves, inserts, etc., for other trades as furnished by them, and in the locations designated by them, and hold by substantial templates.
7. Properly treat with form coating.
8. Forms for Exposed Concrete: Surfaces equal in smoothness to metal or new plywood and joints tightly fitted.
9. Construct all wall forms with clean-out panels, suitably located along the base.
10. Thoroughly clean of foreign material just prior to the placement of concrete.
11. Fit all external corners of exposed concrete with 3/4-inch chamfer strips, except where specifically dimensioned on the drawings.
12. Remove only when approved by the Engineer, and only when the concrete has obtained at least 60 percent of the design strength and is also sufficient strength to support its own weight and the live loads to be placed thereon including backfill.
13. Repair any damage caused by removal of forms.

B. Placement of Reinforcing Steel:
1. When delivered to the job site, pile on wood blocking off the ground and away from earthwork or trenching operations, and cover if necessary to prevent rusting or splashing with mud.
2. Before being positioned, remove loose mill and rust scale and any coatings, including ice, which would destroy or reduce bond with the concrete.
3. Where there is delay in depositing concrete, reinspect, and clean when necessary.
4. Placement of Bars: In accordance with the "Recommended Practice for Placing Reinforcing Bars," as published by the Concrete Reinforcing Steel Institute.
5. Accurately position and secure against displacement by using annealed iron wire ties, or suitable clips, and support by suitable approved metal supports, bolsters, chains, spacers, or hangers.
6. Methods of Support: Approved prior to placement of reinforcing steel.
7. Brick supports for reinforcement in slabs laid on grade: Not permitted.
8. Maximum spacing of ties at intersections: Sixteen (16) inches.
9. Splices: Lap splice with bars placed in contact and wire securely. Minimum overlap of splices shall be 40 times the diameter of the bars.
10. Proposed splices not shown on the drawings. Obtain the Engineer's approval as to location and character of the splices.
11. Avoid splices at points of maximum stress, and if approved at those locations, lap-weld or form as otherwise directed.

C. Depositing Concrete:
1. Do not place until forms and reinforcing are inspected by the Engineer, but such does not constitute a review of structural adequacy of the forms which shall be the responsibility of the Contractor.

2. Place mass concrete where it is to remain immediately after mixing, in no case later than 40 minutes after mixing, distributing it over the area to be covered in layers as directed by the Engineer.
3. Take special care to spade and otherwise thoroughly work the concrete at and near the base of the walls.
4. Work along faces of forms to give a smooth surface, free from voids, or loose aggregate.
5. Limited vibrating may be permitted under the supervision of the Engineer.
6. No segregation will be allowed.
7. Provide spouts or suitable openings in forms where required.
8. Conduct vibration by internal type mechanical vibrators operated only by experienced employees.
9. Thoroughly rod and tamp about embedded materials to secure proper adhesion and to avoid displacement of such materials.

D. Curing:
1. Accomplish by keeping the work wet and covering the concrete surfaces, after stripping and finishing, with wet burlap or some other similar material which will hold water.
2. Keep wet continuously for at least seven (7) days.
3. At no time during these 7 days expose directly to the sun and wind.
4. Accomplish to the complete satisfaction of the Quality Assurance Resident Engineer (QARE).

E. Protection:
1. Heat water and/or aggregate and/or the concrete and/or protect against freezing, to the satisfaction of the Engineer.
2. Do not place on a subgrade that is frozen or contains frozen materials.
3. After being deposited in the forms, keep at a temperature of 50°F, or more, for at least five (5) days.

3.02 INSPECTION

A. Notify the QARE of form stripping so as to inspect the concrete work before any sealing, finishing, or backfill are allowed.

B. Replace all defective concrete work with suitable work or repair to the satisfaction of the QARE.

END OF SECTION

SECTION 03420

PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings, general provisions of Contract, and supplementary general conditions apply to the work specified under this section.

B. The requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Erosion Control: Section 02220

C. Pipe Installation: Section 02450

D. Cast-in-Place Concrete: Section 03300

1.03 DESCRIPTION OF WORK: Work specified in this section shall consist of furnishing all labor, materials, and equipment to construct manholes or catch basins, in conformity with the contract drawings and as specified herein.

1.04 REFERENCES:

A. ASTM A48 Standard Specifications for Gray Cast Iron Castings

B. ASTM C32 Standard specification for Sewer Manhole Brick (Made from Clay or Shale)

C. ASTM C478. Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

D. ASTM C858 Standard Specification for Underground Precast Concrete Utility Structures

E. ASTM C990 Standard Specification for Joints of Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

F. ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure

G. ASTM D41 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

1.05 SUBMITTALS: The Contractor shall submit to the Engineer electronic copies of shop drawings of all precast units. Manufacturer's information shall be submitted for joint sealants and waterproofing. Manufacturer shall provide anti-floatation design shop drawings and calculations, including any extended base slabs as necessary, for proposed manholes. Manufacturer shall assume groundwater levels equal top of ground elevations and provide for a 1.2 factor of safety against floatation.

PART 2 MATERIALS

2.01 PRECAST MANHOLE AND CATCH BASIN SECTIONS: Precast sections shall be manufactured in accordance with the latest ASTM C478 Standard Specification for Circular Precast Reinforced

Concrete Manhole Sections. Precast manholes and catch basins shall be manufactured with a minimum of 4,000 psi concrete and reinforced for H-20 loading.

2.02 PRECAST VAULTS OR UTILITY STRUCTURES: Precast vaults and utility structures shall be manufactured in accordance with the latest version of ASTM C858 Standard Specification for Precast Concrete Utility Structures.

2.03 MORTAR: Cement mortar shall be prepared in the following manner:

A. The cement shall be Type II. The mix shall be one (1) part cement to three (3) parts clean, well graded, hard, durable sand. Hydrated lime may be added to the mixture in an amount not to exceed 15% by weight of the cement. The amount of water shall be only the amount necessary to make a workable mix.

2.04 BRICK: Brick for manholes shall meet the latest version of ASTM C32 Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).

2.05 PRECAST DRYWELL: Precast drywell shall be an American Concrete No. 246160 or Engineer approved equal. No cover is required.

2.06 WATERPROOFING: Waterproofing for manholes shall be either of the following:

A. Asphalt conforming to ASTM D41.

B. Cement base coating suitable for brush coat application.

2.07 FRAMES AND COVERS:

A. All castings shall be made of clean, even grain, gray cast iron. The castings shall be smooth, true to pattern and free from projections, sand holes, warp, and other defects which would interfere with the use of, or impair the serviceability of the castings.

B. The horizontal surface of the cover seat and under surface of the cover which rests upon the cover seat shall be machined on all frames and cover intended for vehicular traffic. After machining it shall be impossible to rock any cover after it has been seated on its associated frame.

C. The iron used for castings shall conform to ASTM A48 for Class 35 gray iron (or greater).

D. Unless otherwise shown on the Drawings, all castings shall be coated with bituminous coating.

E. Manufacturer's name and catalog figure number must be cast on each frame and cover. The work SEWER or STORM must be stamped on the manhole covers as appropriate.

F. Catch basin grates shall be as shown on Contract Drawings or approved equal.

2.08 BUTYL SEALANT

A. Butyl sealant used to seal precast concrete structures including manholes, catch basins and pump stations shall meet , the latest version of ASTM C990.

B. Each manhole, catch basin or pump station shall utilize two (2) strips of sealant between sections.

C. Butyl Sealant shall be as indicated on the Contract Drawings or approved equal.

PART 3 EXECUTION

3.01 FABRICATION:

A. The tongue and groove of manhole and catch basin sections shall be formed of concrete so as to receive a premolded butyl joint sealer. Sections shall be set so as to be vertical and in true alignment.

B. Each section of the precast manhole and catch basin shall have two (2) holes for the purpose of handling and installing. These holes shall be tapered and shall be plugged with mortar after installation.

C. Holes for pipes shall be cast in the base section so that there is a clear distance of 4-1/2" minimum between the inside bottom of the base section and the pipe invert.

D. The joint for the pipe at the base section shall be as indicated on the Contract Drawings or shall consist of (a) rubber gasket anchoring rings cast into the concrete base and hard rubber wedge driven in to compress the gasket around the pipe: or (b) flexible rubber sleeve cast into the base section; or other joint as approved by the Engineer

3.02 INSTALLATION:

A. General:
   1. The excavation shall be properly dewatered while placing bedding material and setting the base or placing concrete. Water stops shall be used at the horizontal joint of cast-in-place manholes and catch basins.
   2. Inlet and outlet stubs shall be connected and sealed as shown on the Drawings.
   3. Barrel sections and cones of the appropriate combination of heights shall then be placed, using manufacturer's recommended procedure for sealing the horizontal joints, and as shown on the Contract Drawings.
   4. A leakage test shall then be made as described in "Leakage Tests."
   5. Following satisfactory completion of the leakage test, the frame and cover shall be placed on the top or some other means of preventing accidental entry by unauthorized persons, children, animals, etc., until the Contractor is ready to make final adjustment to grade.

B. Waterproofing: The waterproofing of the exterior surfaces of manholes shall be one of the following methods:
   1. Bituminous Coating: After the concrete or cement plaster has set, two coats of an approved bituminous waterproofing material shall be applied to all outside surfaces of manholes. Waterproofing material shall be applied by brush or spray at approximate rate of 70 sq. ft./gal., in accordance with the manufacturer's instructions. Time shall be allowed between coats to permit sufficient drying so that the application of the second coat has no effect on the first.
   2. Cement Base Coating: Cement base coatings delivered in sealed containers shall be mixed in accordance with the manufacturer's recommendations and applied with a stiff brush in 2 coats. Each coat shall be applied at the rate of 2 lb. per sq. yd.

C. Frames and Covers: Frames shall be set on mortared brick courses true to grade and concentric with the opening. All voids beneath the bottom flange and in the brick courses shall be completely filled to make a watertight fit. a ring of mortar at least 1 inch thick shall be placed around the outside of the bottom flange, extending to the edge of the manhole all around its circumference. The bricks and mortar shall not extend beyond the top of precast concrete cone section.

3.03 ALTER EXISTING MANHOLE, CATCH BASIN, OR PUMP STATION: When altering existing catch basins, manholes or pump stations, the structure shall be dismantled sufficiently to allow reconstruction in accordance with the applicable requirements as shown on the Drawings for

complete pump station and manholes. Each altered manhole or pump station shall be cleaned of all accumulated silt, debris, or foreign matter prior to final acceptance of work.

3.04 VACUUM LEAKAGE TESTS:

A. General:
   1. To be observed by the Engineer on each sewer manhole.
   2. A vacuum test made as described below. Manhole to pipe connection must be a flexible connector to perform this testing.

B. Preparation for Test:
   1. After the manhole has been assembled in place, fill lifting holes and point with an approved non-shrinking mortar.
   2. Perform test prior to placing the shelf and invert and before filling and pointing the horizontal joints, and before backfilling.
   3. If the groundwater table has been allowed to rise above the bottom of the manhole, it must be lowered for the duration of the test.
   4. Plug pipes and other openings into the manhole and the plugs braced to prevent blow out.

C. Test Procedure:
   Vacuum Testing shall be in accordance with ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
   1. Use manhole vacuum test equipment equal to NPC Systems, Inc., Milford, New Hampshire or Engineer approved equal.
   2. Set tester in place.
   3. Inflate compression band to seal base to structure.
   4. Draw a vacuum of 10-in. Hg.
   5. Close the valve.
   6. Acceptable test: pressure drop of as much as 1 in. Hg is allowable in the time listed on the attached table.
   7. If leakage occurs fill those points with non-shrink grout, allow to set and retest.
   8. Rejected Manholes: Disassemble, reconstruct, or replace as directed by the Engineer.

D. Backfilling: The test may be conducted either before or after backfilling around the manhole. However, if the Contractor elects to backfill prior to testing, for any reason, it shall be at his own risk and it shall be incumbent upon the Contractor to determine the reason for any failure of the test. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorption, etc., i.e., it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, the Contractor shall take any steps necessary to assure the Quality Assurance Resident Engineer that the water table is below the bottom of the manhole throughout the test.

END OF SECTION

MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS
30 TO 120 IN. IN SECONDS

Depth (ft)	Diameter (inch)																
	30	33	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
	Time, in seconds																
<4	6	7	7	9	10	12	13	15	16	18	19	21	23	24	25	27	29
6	9	10	11	13	15	18	20	22	25	26	29	31	34	36	38	41	43
8	11	12	14	17	20	23	26	29	33	35	38	41	45	48	51	54	57
10	14	15	18	21	25	29	33	36	41	44	48	52	56	60	63	67	71
12	17	18	21	25	30	35	39	43	49	53	57	62	67	71	76	81	85
14	20	21	25	30	35	41	46	51	57	62	67	72	78	83	89	94	100
16	22	24	29	34	40	46	52	58	67	70	76	83	89	95	101	108	114
18	25	27	32	38	45	52	59	65	73	79	86	93	100	107	114	121	128
20	28	30	35	42	50	53	65	72	81	88	95	103	111	119	126	135	142
22	31	33	39	46	55	64	72	79	89	97	105	114	122	131	139	148	156
24	33	36	42	51	59	64	78	87	97	106	114	124	133	143	152	161	170
26	36	39	46	56	64	75	85	94	105	114	124	134	144	155	164	175	185
28	39	42	49	59	69	81	91	101	113	123	133	145	155	167	177	188	199
30	42	45	53	63	74	87	98	108	121	132	143	155	166	178	189	202	213

DIVISION 15

MECHANICAL

SME
SEVEE & MAHER
ENGINEERS

SECTION 15100

HDPE PIPE AND FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. The requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.01 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Pipe Installation: Section 02450

C. Valves and Pipe Accessories: Section 15110

1.03 REFERENCES:

1. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
2. ASTM D638 Standard Test Method for Tensile Properties of Plastics
3. ASTM D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30C and 30C with a Vitreous Silica Dilatometer.
4. ASTM D790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
5. ASTM D1238 Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastomer
6. ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique
7. ASTM D1598 Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
8. ASTM D1603 Standard Test Method for Carbon Black Content in Olefin Plastics
9. ASTM D2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
10. ASTM D2657 Guideline for Polyolefin Thermoplastic Butt Fusion Heat Welding"
11. ASTM D2837 Method for Obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials
12. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
13. ASTM F1248 Standard Test Method for Determination of Environmental Stress Crack Resistance of Polyethylene Pipe (Withdrawn)
14. ASTM F1473 Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins
15. Plastic Pipe Institute Technical Release 4 (PPI TR-4)

1.04 DESCRIPTION OF WORK:

A. Work of this Section shall consist of furnishing all labor, materials, and equipment to install and test leachate collection, leachate transport, leak detection, and underdrain pipes as shown on the Contract Drawings. Only the appropriate portions of this section pertaining to the specific contract work identified in Section 01010 "Summary of Work", or as directed by the Engineer, will apply.

1.05 SUBMITTALS:

A. The Contractor shall furnish the name of the pipe and fittings manufacturer, to the Engineer prior to commencing the work. Pipe of the same manufacturer shall be used throughout the project.

B. The Contractor shall submit to the Engineer a Construction Schedule for pipe installation.

C. The Contractor shall submit manufacturer's technical product data including chemical resistance data and installation instructions for piping joints and fittings.

D. The Contractor shall submit the Quality Control Documentation as specified in Section 9 of the Quality Assurance/Quality Control (QA/QC) Plan, and, if required, a certificate from the pipe manufacturer certifying the product meets the requirements of this specification.

E. The Contractor shall submit to the Engineer documentation demonstrating the pipe welding technicians are certified by the Manufacturer to weld HDPE pipe. The Contractor shall provide the Engineer with butt-fusion procedures, pressures, and temperature for each size and class of pipe used. These procedures, pressures, and temperatures shall be used consistently throughout the project in accordance with the pipe manufacturer’s recommendations.

1.06 MANUFACTURER'S QUALITY ASSURANCE:

A. The pipe and fittings manufacturer shall have an established QA/QC program responsible for inspecting and testing incoming materials and outgoing product. At a minimum incoming polyethylene materials shall be inspected and tested for density per ASTM D1505, melt flow rate per ASTM D1238, and contamination. All incoming materials shall be certified by the supplier.

B. The pipe and fittings manufacturer shall have an established QA program responsible for assuring the long term performance of materials and products. Representative samples of PE materials shall be tested against the physical property requirements of this specification. Each extrusion line and molding machine shall be qualified to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D1598.

C. All outgoing products shall be inspected for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut. QC shall perform tests for density, melt flow rate, carbon content, and carbon dispersion. All fabricated fittings shall be inspected for fusion quality and alignment. The pipe and fitting manufacturer shall maintain internal QA/QC records, and shall provide QA/QC information upon request of the Engineer.

1.07 PACKAGING DELIVERY AND HANDLING:

The pipe and fitting manufacturer shall package products for shipment in a manner suitable for safe transport by commercial carrier. When delivered, a receiving inspection shall be performed, and any shipping damage reported to the pipe and fittings manufacturer. Pipe and fittings shall be handled, installed, and tested in accordance with manufacturer's recommendations, and the requirements of this specification.

PART 2 PRODUCTS

2.01 HDPE PIPE AND FITTINGS

A. Physical Properties:

Property	Unit	Test Method	Value
Material Listing	-	PPI TR-4	PE 4710
Cell Classification	-	ASTM D3350	PE 445574C
Density	g/cm^3	ASTM D1505	0.941 to 0.955
Melt Index	g/10 min	ASTM D1238	<0.15
Flexural Modulus	psi	ASTM D790	>110,000 and < 160,000
Tensile Strength (yield)	psi	ASTM D638	3,000-3,500
Slow Crack Growth Resistance	hours	ASTM F1473	100
Hydrostatic Design Basis	psi	ASTM D2837	1,600 @ 23° C
UV Stabilizer	% Carbon Black	ASTM D1603	2 to 3
Elastic Modulus	psi	ASTM D638	110,000 to <160,000
Thermal Expansion	1/° F	ASTM D696	8×10^{-5}
Molecular Weight Category	-	-	Extra High

B. General:

1. Materials used to manufacture pipe, fittings, and centralizers supplied under this specification shall be high density, extra high molecular weight polyethylene pipe. The pipe and fittings shall be designated PE 4710 using the cell classification system per ASTM D3350. The pipe and fittings shall be made from the same resin base that meets this specification, and provides a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined by ASTM D2837.
2. The HDPE pipe and fittings shall be produced by the same manufacturer, from identical materials that meet the requirements of this specification. Exceptions shall be pre-approved by the Engineer.
3. Density of base resin shall be within the limits of 0.941 to 0.955, ASTM D1505 (Test Methods).
4. The HDPE pipe manufactured from materials meeting the specifications of this section shall have an Environmental Stress Crack Resistance of no failures in 10,000 hours (ESCR: Fo >10,000) when tested in accordance with ASTM F1248.
5. Outside diameter of pipe shall conform to International Standard Organization (ISO) recommendations for outside diameters (IPS pipe size).
6. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.
7. Perforated pipe shall be provided as indicated on the Contract Drawings. Perforations shall be oriented as shown on the Contract Drawings.
8. HDPE Fittings, molded or fabricated, shall have the same pressure rating and strength as the pipe to which joining is intended. At the point of fusion, the outside diameter and minimum wall thickness of the fitting shall match the outside diameter and minimum wall thickness specifications of ASTM F714 for the same size pipe to which it is joined. Dual-wall containment fittings shall be fabricated by the manufacturer of the pipe. The manufacturer shall de-rate the fittings used for this project, as necessary. Bends, tees, and wyes shall be manufactured by mitered fabrication and shall meet the pressure rating of the piping system (100 psi). The manufacturer shall have written specifications for all standard mitered fittings establishing QC criteria and tolerances. All dual-wall containment fittings shall have a QC label as approved by the manufacturer. Fitting markings shall include a production code from which the location and date of manufacture can be determined. Upon request, the manufacturer shall provide an explanation of his production code.
9. Centralizers shall be used to support the dual-wall conductor pipe inside the containment pipe and maintain the specified annulus between the conductor pipe and containment pipe in both dual-wall containment fittings and pipe runs. The centralizers shall allow for

the passage of fluid flow in the event of conductor pipe failure. Centralizers shall be attached to both the conductor and the containment pipe. Centralizers shall be spaced as recommended by the pipe manufacturer. Spacing of the pipes and centralizers shall be described in the manufacturer's submittal and approved by the Owner's Representative.

10. Marking: Each standard and random length of pipe and fitting in compliance with this standard shall be clearly marked with the following information:
    a. ASTM Standard Designation
    b. Pipe Size
    c. Class and Profile Number
    d. Production Code
    e. Dimension Ratio
11. Dimensions: Pipe Size and DR Rating shall be as shown below:

4" Underdrain Pipe – Perforated	SDR 17
4" Underdrain Pipe – Solid	SDR 17
6" Leachate Detection Pipe – Perforated	SDR 7
6" Leachate Detection Pipe – Solid	SDR 17
6" Leachate Detection Pipe – Perforated	SDR 11
8" Leachate Detection Pipe – Solid	SDR 11
6" Leachate Detection Monitoring Point – Solid	SDR 32.5
12" Leachate Detection Riser and Sump Pipe	SDR 17
6" Leachate Collection Pipe – Perforated	SDR 7
8" Leachate Collection Pipe – Perforated	SDR 7
8" Leachate Collection Pipe – Perforated	SDR 17
8" Leachate Collection Pipe – Solid	SDR 17
24" Leachate Collection Riser Pipe	SDR 17
24" Leachate Collection Sump Pipe	SDR 17
6x10" Dual-Containment Force Main	SDR 17/SDR 17

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL:

A. Pipe may be rejected for failure to conform to Specifications for the following:
    1. Fractures or cracks sufficient to impair strength, durability or serviceability of pipe.
    2. Defects indicating improper proportioning, mixing, or molding.
    3. Damaged ends.
    4. Contractor shall provide a pyrometer to record and verify the temperature of heating plate surface (at min of three locations) once every two hours. Maintain records of these temperature measurements including, temperature, date, time and fusing technician, for the duration of the project. Provide the Engineer with a copy of the temperature measurements.

B. Acceptance of fittings, stubs, or other specifically fabricated pipe sections (e.g., butt-fusion joints) shall be based on visual inspection at the job site and documentation of conformance to these Specifications.

C. Prior to backfilling, the contractor shall obtain as-built top of pipe coordinates and elevations as grade changes, fittings, and at least every 50 feet along the length of pipe.

3.02 PIPE JOINTING

A. All materials shall be stored and handled in accordance with the manufacturer's recommendations.

B. All joints shall be made in a dry trench or area that is protected from adverse weather or dust, and in accordance with the manufacturer's recommendations and the best practices for class

of pipe installed. The ends of the pipe shall be wiped clean with a dry cloth before making each joint.

C. Butt Fusion Joints:
   1. Pipes: Join to one another and to HDPE fittings by thermal butt-fusion in accordance with ASTM D2657 (Reapproved 2023). Dual-wall containment piping systems shall be manufactured to allow for simultaneous joining with conventional fusion equipment without the use of an annular heating iron.
   2. The tensile strength at yield of the butt-fusion joints shall not be less than the pipe.
   3. The Contractor shall utilize fusion equipment approved by the pipe manufacturer and personnel trained by the pipe manufacturer representative for all fusion welding.

D. Flange Jointing:
   1. Use when connecting or transitioning to flanged steel pipe in manholes or pump stations
   2. Connect slip-on type 316 stainless steel backup flanges and nuts and bolts to flange adapters
   3. Butt fuse fabricated flange adapters to pipe.
   4. Observe the following in connection of flanged joints:
      a. Align flanges or flange valve connection to provide tight seal. Provide gaskets if needed to achieve seal for flanged connections.
   5. Make Flanged connections according to Section 02450.

E. Electro-Fusion Joints:
   1. Electro-fusion couplings shall be installed per manufacturer's specifications.
   2. Joints using electro-fusion couplings shall be performed in the trench so as not to overstress the joint and achieve proper alignment.

F. Stainless Steel Repair Clamp Joints:
   1. Stainless steel repair clamps shall be installed per manufacturer's specifications.
   2. Joints using stainless steel repair clamps shall be performed on connections to existing leachate collection pipes when conditions have been determined to be too wet for electro-fusion coupling installation. Connections shall be in the trench so as not to overstress the joint and achieve proper alignment.

G. General Fusion Procedures Dual Containment Pipe:
   1. Several important parameters need to be considered when fusing:
      a. Temperature: The required temperature for fusing is recommended to be 500°F, ±10° (260°C, ±6°). Should the temperature be less than that specified, then additional heating time must be allowed. The manufacturer's policy is to provide two 2-foot (0.6m) segments of pipe to allow a test fusion which ensures the proper fusion parameters are being utilized.
      b. Airborne Contaminants: Airborne contaminants can settle on the polyethylene material, heating plate, and cutter. The fusion operator should use extreme care to ensure that all airborne contaminants are removed prior to the facing operation.
      c. Cleaning of Pipe Ends: It is extremely important to remove all dirt, mud, grit, oil, water, etc. from the pipe ends. Any contamination can and will transfer to the faces of the heating iron and face plate. Avoid wiping the pipe areas after the facing operation. If shavings or other debris must be removed, use only a clean cotton cloth, as contaminated rags or use of solvents can leave harmful deposits on the fusion zone.
      d. Chip Removal: Due to the fact that the annular space between the conductor and containment pipe allows limited area for the facing ribbons, the annular cavity shall be monitored to ensure that chips do not build up and prevent proper facing. Remove all ribbons and chips from the annular and conductor cavities prior to heating the pipe ends.
      e. Machine Clearances: The end user will take due care to ensure that clearance between obstructions and the fusion joint are sufficient to allow use of their particular machine. The varying conventional fusion machines available will require different amounts of clearance space to perform the required fusion. If any questions exist in this area, contact the manufacturer's technical services department.

f. The heating iron configuration needs to be reviewed to ensure adequate surface area exists to heat both the inner and outer pipe. Some fusion machines do not encompass the range of inner and outer pipe diameters that are available.
g. Maintenance of the fusion machine is the operator's responsibility. It is recommended the heating iron temperature for the entire surface be checked at a minimum, on a daily basis with a pyrometer for uniform temperature.
h. The fusion pressure should be calculated by using the recommended interface pressure of 75 psi (0.52 MPa) multiplied by the interfacial areas of the inner and outer pipes combined. The Contractor shall provide a calculation for proposed fusion pressure performed in accordance with the pipe manufacturer's recommendations.

H. Pipe Cutting:
1. Dual containment pipe is manufactured to specific lengths. Due to the extreme importance of the conductor being centralized in the containment pipe, field cutting and fitting is not recommended. In the event that the end user cannot exactly specify the required length, the manufacturer should be alerted to this fact so that they can offer special lengths that may be required to allow the final tie-in. The feature should be recognized at the job onset in order to prevent final tie-in delays.
2. When permitted, sections of pipe may be cut to provide shorter sections of pipe necessary for the construction. The cutting of the pipe shall be done in accordance with the pipe manufacturer's recommendations and subject to the approval of the Engineer. Pipe cutting of dual-containment pipe shall be performed at the risk of the Contractor and shall not relieve the Contractor from obtaining proper fusion of the piping system.
3. When permitted, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

I. Inspection: Pipe installation shall be subject to inspection by the Engineer for quality, adherence to line and grade, jointing, and proper backfill. Any joint not satisfactory to the Engineer shall be removed and remade to his satisfaction at the Contractor's expense. No pipe shall be backfilled until it has been approved by the Engineer.

3.03 PIPE INSTALLATION

A. Install pipe according to Section 02450 of these specifications for trench conditions.

B. Contractor shall label all cleanouts as directed by the Owner.

END OF SECTION

SECTION 15101

PVC PIPE AND FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. The requirements set forth by the Quality Assurance/Quality Control Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Earthwork: Section 02200

B. Pipe Installation: Section 02450

C. Leachate Collection Pump Station: Section 02732

D. Valves and Pipe Accessories: Section 15110

E. Pipe Pressure Testing: Section 15120

1.03 REFERENCES:

1. ASTM D1784 Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
2. ASTM D1785 Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
3. ASTM D2464 Standard Specification for Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
4. ASTM D2467 Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
5. ASTM D2564 Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
6. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
7. ASTM D3034 Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
8. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
9. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.04 DESCRIPTION OF WORK:

A. Work of this Section shall consist of furnishing all labor, materials, and equipment to install and test PVC pipes as shown on the Contract Drawings and described herein. Only the appropriate portions of this section pertaining to the specific contract work identified in Section 01010 "Summary of Work" or as directed by the Engineer, will apply.

1.05 SUBMITTALS:

A. The Contractor shall furnish the name of the pipe and fittings manufacturer, to the Owner's Representative prior to commencing the work. Pipe of the same manufacturer shall be used throughout the project unless approved by Engineer.

B. The Contractor shall submit to the Engineer a Construction Schedule for pipe installation.

C. The Contractor shall submit manufacturer's technical product data including chemical resistance data and installation instructions for piping joints and fittings.

D. The Contractor shall submit the Quality Control Documentation as specified in Section 10 of the QA/QC Plan.

1.06 PACKAGING DELIVERY AND HANDLING:

The pipe and fitting manufacturer shall package products for shipment in a manner suitable for safe transport by commercial carrier. When delivered, a receiving inspection shall be performed, and any shipping damage reported to the pipe and fittings manufacturer. Pipe and fittings shall be handled, installed and tested in accordance with manufacturer's recommendations, and the requirements of this specification.

PART 2 PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Cell Classification 12454-B PVC as outlined in ASTM D1784. Pipe and fittings materials shall be specially formulated with sufficient ultraviolet (UV) screeners to provide for longer term outdoor exposure with no deleterious effects.

B. Clean rework or recycle material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of this specification.

C. Dimensions: Pipe Size and DR/SCH Rating shall be as shown on the Drawings.

PART 3 EXECUTION

3.01 PIPE HANDLING

PVC pipe and pipe fittings shall be handled according to manufacturer’s recommendations. Under no circumstance shall Pipe and pipe fittings be dropped or dumped.

3.02 PIPE JOINTING

A. All pipes shall be inspected for cuts, scratches, or other damage prior to installation. Pipe with imperfections shall not be incorporated into the work.

B. All joints shall be made n accordance with the manufacturer's recommendations and the best practices for material and class of pipe installed. The ends of the pipe shall be wiped clean with a dry cloth before making each joint.

C. Bell ends of pipe shall be installed upstream.

D. Solvent cemented joints:
   1. Use a grade of PVC cement which meets ASTM D2564.
   2. Cut pipe to desired length with pipe cutters, hack saw or crosscut saw.
   3. Ream pipe both internally and externally to remove burrs and ragged edges.

4. Before making solvent weld joint be sure all joining surfaces are free of dirt, dust, water, and oil.
5. Use a primer before the application of PVC cement.
6. Apply primer to both joining surfaces.
7. Immediately apply a smooth coat of cement to the joining surfaces.
8. Immediately insert the spigot end into the bell end to the full depth of the socket.
9. Turn pipe 1/8 to 1/4 turn in the socket to insure an even spread of cement.
10. Hold firmly in position for 15 seconds.
11. Allow joint to set according to cement manufacturer’s instructions.

E. Pipe Cutting:
1. Where required, sections of pipe may be cut to provide shorter sections of pipe necessary for the construction. The cutting of the PVC pipe shall be done in accordance with the pipe manufacturer's recommendations and subject to the approval of the Engineer.
2. In general, the PVC pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

3.03 PIPE INSTALLATION AND TESTING

Install and test pipe in accordance with Section 02450 of these specifications.

END OF SECTION

SECTION 15110

VALVES AND PIPE ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. The requirements set forth by the Quality Assurance/Quality Control (QA/QC) Plan shall apply to the work specified in this Section.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Pipe Installation: Section 02450

B. Leachate Collection Pump Station Section 02732

C. Manholes, Catch Basins, and Drainage Structures: Section 02570

D. HDPE Pipe and Fittings: Section 15100

E. PVC Pipe and Fittings: Section 15101

F. Pipe Pressure Testing: Section 15120

1.03 REFERENCE:

A. ASTM A536 Standard Specification for Ductile Iron Castings

B. ASTM A126 Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

C. ASTM A743 Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application"

1.04 DESCRIPTION OF WORK:

A. Work of this Section shall consist of furnishing all labor, materials, and equipment to install valves, fittings, and other appurtenances. Only the appropriate portions of this section pertaining to the specific contract work identified in Section 01010 "Summary of Work", or as directed by the Engineer, will apply.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

1.05 SUBMITTALS:

A. Product Data: Submit Manufacturers shop drawings, technical product data, installation instructions and catalog information for each valve fitting or accessory.

B. The Contractor shall submit the Quality Control Documentation as specified in the QA/QC Plan.

C. Manufacturer's Installation Instructions: Submit hanging or support methods and joining procedures.

PART 2 PRODUCTS

2.01 BALL VALVES:

A. General: Provide ball valves for the pipe size as indicated on Contract Drawings.

B. Description:
   1. Valves for sizes 4" diameter to 8" diameter shall be KTM Model EB100, full bore, metaltite seats as manufactured by Tyco International. Valves for size 12" diameter shall be KTM Model EO1100 as manufactured by Tyco International.
   2. The ball shall be 316, stainless steel.
   3. Seals and O-rings shall be constructed of Viton® where possible and applicable.
   4. Flanges shall be drilled according to ANSI B16.5, Class 150.

2.02 PLUG VALVES:

A. General: Provide plug valves for the pipe size as indicated on the Contract Drawings.

B. Description:
   1. Plug valves shall be PEC Eccentric Plug Valves as manufactured by DeZURIK. The valve shall have a cast iron body with a stainless-steel plug.
   2. The plug shall be 316, stainless steel. The body can be either cast iron or stainless steel provided it meets the pressure requirement.
   3. Seals and O-rings shall be constructed of Viton® where possible and applicable.
   4. Flanges shall be drilled according to ANSI B16.5, Class 150.

2.03 CHECK VALVES:

A. General: Provide check valves for the pipe size as indicated on the Contract Drawings.

B. Description:
   1. Check valve shall be a rubber flapper swing check valve as manufactured by APCO and be capable of 100 psi operating pressure.
   2. The flapper material shall be Viton A®.
   3. The body shall be stainless steel and the inside shall be unlined.
   4. Check valves shall be equipped with a backflow device.
   5. The flanges shall be drilled according to ANSI B16.5, Class 150.

2.04 RESILIENT SEATED GATE VALVES:

A. Resilient seated Gate Valves shall be ductile iron body, bronze mounted, with 18-8, 304 stainless steel bolts, resilient wedge gate with two-inch operating nut and a PIV single flange (lug) connection. Valves shall conform in every respect to AWWA C509 Valve shall be MJ-PIV, F-Series Resilient Wedge Valve as Manufactured by Clow or approved equal. Valves shall open left.

B. Valves shall be provided with “O” rings. The design of the valve shall be such that the seal plate can be fitted with new “O” rings while the valve is under pressure in a fully open position.

C. Valves shall have a 100 percent solids thermoset or fusion bonded epoxy protective coating, holiday-free in the waterway, which shall meet all requirements of AWWA C550. The epoxy coating shall not impart taste or odor to the water. The coating shall be a product acceptable to the National Sanitation Foundation (NSF) for use in potable water and shall be so listed in the most current NSF summary of approved products under ANSI/NSF Standard 61. The coating shall be applied and cured in strict conformance with the coating manufacturer’s cautions and instructions. The coatings shall be applied by the valve manufacturer under controlled factory conditions and field application is strictly prohibited.

2.05 PIV INDICATOR POST:

A. Indicator post shall be used to actuate and indicate the closed or open status of remotely installed PIV valves.

B. Indicator post and any necessary extensions shall be supplied and installed as shown on the contract drawings. Indicator post supplied shall open in the same direction as the valve and indicate as such. All bolts shall be 316, stainless steel.

2.06 FITTINGS:

A. Fittings shall be flanged ductile iron. All fittings shall be cement lined and coated as specified hereinbefore for ductile iron pipe. Fittings greater than 12 inches shall conform to ANSI A21.10 (AWWA C110) and fittings 12 inches or less shall conform to ANSI A21.11 (AWWA C111). Compact fittings shall be Class 150 conforming to ANSI A21.53 (AWWA C153) and shall be cement lined in compliance with AWWA C104 for fittings 12 inches or less. Compact fittings greater than 12 inches are not acceptable. Fittings shall come complete with gaskets, and 316 stainless steel bolts.

B. Plugs, caps, and blind flanges shall be stainless steel and shall conform to the weights and dimensions shown and be provided complete with all necessary gaskets and 316 stainless steel bolts.

C. All fasteners (nuts and bolts) shall be 316, stainless steel, and shall be the correct size and dimensions for the size flanges and size of pipe.

D. Leachate collection and leak detection Pump Station fittings shall be schedule 80 PVC. All exposed fasteners (nuts and bolts) used for leachate collection and leak detection cleanouts shall be hot dip galvanized and shall be the correct size and dimensions for the size flanges and size of pipe.

2.07 CONCRETE:

A. Concrete used for any purpose such as, but not limited to, thrust restraints, encasements, and chimneys shall have a minimum compressive strength of 3000 psi and conform to the specifications contained in Section 03300, Cast-in-Place Concrete.

2.08 STAINLESS STEEL REPAIR CLAMPS:

A. Repair clamps shall be as manufactured by Romac Industries.

2.09 PRESSURE TRANSMITTERS:

A. Pressure transmitters shall be installed to monitor the interstitial space of the dual containment system. They shall have an operating pressure range from 0 to 150 psi. The pressure transmitters shall be MBS 33, Cable type, 4-20 mA output, as manufactured by Danfoss.

B. The interstitial space shall be accessed by installing a threaded insert through the end termination or side wall of the containment pipe inside the manhole. The pressure transmitter shall be installed into this threaded insert or a coupling. This shall be done on the lowest end elevation of the pipe run.

C. Threaded connections shall be installed using Teflon tape, or approved sealant.

2.10 PRESSURE GAUGE:

A. Pressure gauges shall be furnished and installed as shown on the contract drawings.

B. Pressure shall be transmitted to the gauge by a (diaphragm seal) completely sealed fluid so as no leachate is in contact with the gauge. Fluid shall be a 50 percent mixture of ethylene glycol and water. Pressure gauges shall be protected from excessive line pressures by a stainless-steel ball valve installed between the pressure sensor and the pressure gauge.

C. Pressure gauges shall be pressure type with an appropriate operating range and a 4-1/2-inch dial. Gauges shall be ½ inch bourdon tube type and calibrated in psi and the dial shall so indicate. Gauges accuracy of plus or minus ½ percent. Pressure ranges shall be 0 PSIG to 150 PSIG unless otherwise indicated.

2.11 PRESSURE TRANSDUCER:

A. Pressure transducers shall be installed in the leachate collection sand layer of the Cell 6 liner system to measure the pressure head acting on the Geomembrane in the location shown on the contract drawings.

B. The pressure transducers shall have an operating pressure range from 0-5 psig and shall be Esterline's Series 700 4-20mA Open Face Model (Part Number 700-140-0005).

C. The pressure transducers shall be accessorized with the Esterline Option-009 Surge Protection Kit and the Series 810 Vent Filter (Part Number 810) or an Engineer approved equal.

PART 3 EXECUTION

3.01 GENERAL:

A. All materials shall be stored and handled in accordance with the manufacturer's recommendations.

B. Verify piping system is ready for installation.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Install valves with stems upright or horizontal, not inverted.

E. Install valves as shown on contract drawings for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Valves and Fittings shall be braced against movement by installation of yoke and stanchions as applicable.

G. Inspection: Pipe installation shall be subject to inspection by the Engineer for quality, adherence to line and grade, jointing, and proper backfill. Any joint not satisfactory to the Engineer shall be removed and remade to his satisfaction at the Contractor's expense. No pipe shall be backfilled until it has been approved by the Engineer.

END OF SECTION

SECTION 15120

HYDROSTATIC AND LOW-PRESSURE AIR TESTING OF POLYETHYLENE PIPE

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this Section.

B. Requirements set forth by the Quality Assurance/Quality Control (QA/QC) Plan shall apply to the work specified in this Section.

1.02 RELATED WORK ELSEWHERE

A. Measurement and Payment: Section 01025

B. Project Coordination: Section 01041

C. Earthwork: Section 02200

D. Pipe Installation: Section 02450

E. Manholes, Catch Basins, and Drainage Structures: Section 02570

F. HDPE Pipe and Fittings: Section 15100

G. Valves and Pipe Accessories: Section 15110

1.03 REFERENCE:

A. ASTM F2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure

B. ASTM F1417 Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low Pressure Air

C. Chevron Phillips Performance Pipe Technical Note 802 Leak Testing of Polyethylene Pipe for Municipal and Industrial Applications

1.04 DESCRIPTON OF WORK

A. The work of this section includes the furnishing of all labor, tools, equipment, and materials and performing all operations necessary to pressure test pipe associated with the Project.
   1. For dual-containment HDPE force main pipes, hydrostatic pressure testing shall be performed on the carrier pipe (inner pipe) and low-pressure air testing shall be performed on the containment pipe (outer pipe).
   2. For single-wall force main pipes, hydrostatic pressure testing shall be performed on the pipe.
   3. For single-wall gravity drain HDPE pipes, low pressure air or hydrostatic testing may be performed on polyethylene pipes (as chosen by the Contractor).

B. The work of this section shall be coordinated with the Quality Assurance Resident Engineer (QARE). Where conflicts appear between these specifications and ASTM F2164, Technical Note 802, or ASTM F1417 the more stringent requirement shall apply. All hydrostatic and low-pressure air testing shall be done by the Contractor in the presence of the QARE.

PART 2 PRODUCTS

2.01 MATERIALS

A. The temporary pump connections shall be made up of components compatible with test pressures.

B. The Contractor shall provide all necessary equipment (i.e., pumps, flanges, valves, bracing, bulkheads, gauges, etc.) to perform either hydrostatic or low-pressure air tests.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall conduct a hydrostatic or low-pressure air testing on HDPE pipes as indicated in above Section 1.04A. Alternative industry standard leak tests may be considered if submitted to and approved by the Engineer.

B. It shall be the responsibility of the Contractor to ensure that appropriate health and safety precautions are observed before, during, and after hydrostatic or air testing of piping systems. Always take precautions to eliminate hazards to persons near lines being tested. For the entire duration of the procedure only persons conducting the test or inspecting the system being tested will be allowed near the section under test. Persons near the testing should be fully aware of the hazards of field testing. All other persons shall be kept at a safe distance. Test sections shall be supervised at all times during testing. No one shall be allowed in manholes or in the potential path of expelled equipment during testing.

C. Restraint Against Movement: The Contractor shall take all measures necessary to ensure that all parts of the section and testing equipment (test balls, plugs, end caps, etc.) are restrained against movement should failure occur.

D. Leakage at a joint provides proof that the joint is defective and may fail at any moment. If leakage is observed from a joint, move away immediately and depressurize the test section.

E. Hydrostatic and low-pressure air tests shall be conducted in the presence of the QARE.

3.02 PREPARATION OF THE LINE (HYDROSTATIC AND AIR TESTING – ALL PIPES)

A. Pre-Test Preparation:
   1. Before testing all heat-fusion joints shall be completely cooled and mechanical joints shall be completely assembled with all necessary seals and fasteners installed and tightened.
   2. Flushing, pigging, or other means of cleaning may be required before testing to remove dirt and debris from the pipeline that may damage valves, regulators, etc.
   3. Allow concrete supports and anchors (when used) in the test section to cure until they develop sufficient strength to withstand test pressures and thrust forces.
   4. Restrain all portions of the test section against movement. Temporarily remove, restrain, or isolate expansion joints and expansion compensators before testing.
   5. Isolate the section of pipe to be tested with suitable test plugs or caps.
   6. Trench shall be dewatered to an elevation below the pipe invert during testing.

3.03 HYDROSTATIC PRESSURE TEST OF CARRIER PIPE (INNER PIPE OF DUAL CONTAINMENT FORCEMAIN OR SINGLE WALL FORCEMAIN)

A. Hydrostatic pressure test equipment shall be placed in the elevation of the lowest point of the pipe in the test section and shall be connected to the elevation of the test gauge as directed by the QARE. (Note: one vertical foot of water equals 0.422 psi)

B. Test Section: Testing may be conducted on the entire system or on sections of the system. The test size is determined by the capacity of the filling and pressurizing equipment. Equipment that has inadequate capacity may not be able to complete the test within allowable testing time limits.

C. Test Temperature: Polyethylene piping materials are typically pressure rated at 73 F. At higher temperatures, reduce pressure ratings and test pressures may be required. Engineer may adjust based on higher or lower temperatures.

D. Maximum Test Pressure: The maximum test pressure shall be 1.5 times the system design pressure. Items with lower pressure ratings shall be isolated from those of higher-pressure ratings and tested separately. A listing of the system design pressure of the project pipelines is included below.

Pipe Section	SDR Rating	Pressure Rating	Diameter (inches)	System Design Pressure (psi)	Maximum Test Pressure (psi)
TBD	TBD	TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD	TBD	TBD

E. Primary Testing Procedure: This testing procedure is based on ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
   1. Test Duration: Test duration is dependent on test pressure as indicated in the paragraphs below:
      a. When test pressure is between system design pressure and 1.5 times system design pressure the test duration (including pressurization, stabilization, holding time, and depressurization) should not exceed 8 hours.
      b. Before pressure is applied the Contractor shall do the following:
         i. Examine test equipment and all connections to ensure they are in proper operating condition,
         ii. Isolated components are vented to atmosphere, and
         iii. Disconnect or isolate and vent all low-pressure filling lines and systems.
   2. Filling: Fill the test section slowly. Before applying the specified test pressure, air shall be completely expelled from the pipes and valves. After all air has been expelled, the blowoffs can be closed, and the test pressure applied.
   3. Temperature Equalization: Allow test section and liquid to equalize to a common temperature.
   4. Pressurizing – Initial Expansion Phase: When the test section is filled with water and air is purged, gradually increase pressure in the test section to the required test pressure.
      a. If pressure can't be attained or it takes unreasonably long to reach test pressure there is likely excessive leakage, entrapped air, open valving, or equipment testing failure. Discontinue pressurizing and correct issue before continuing.
      b. Add makeup water as needed to maintain maximum test pressure for 4 hours.
   5. Test Phase
      a. Reduce test pressure by 10-psi and monitor pressure for 1 hour. Do not increase pressure or add makeup water.
   6. Pass/Fail Criteria
      a. The test passes if no visual leakage is observed and pressure during the test phase remains steady (within 5% of test phase pressure) for 1 hour test phase period.

7. Retesting
   a. If retesting is necessary, depressurize the test section and correct faults or leaks in the test section.
   b. The pipe shall be depressurized and allowed to "relax" for 8-hours prior to retesting.
8. Record Keeping
   a. The Contractor shall record the following testing information and give a copy to the QARE after testing:
      i. Date
      ii. Person Conducting Test
      iii. Test Liquid
      iv. Backflow Prevention Devices (if used)
      v. Weather Condition and Ambient Temperature
      vi. Test Pressure and Time (Begin and End)
      vii. Test Gauge Type
      viii. Test Gauge Locations
      ix. Test Gauge Calibration Record
      x. Description of test section (length, elevations, site location, and components)
      xi. Description of issues, failures, and corrective actions as necessary

F. Alternate Hydrostatic Testing Procedure: This alternate test procedure consists of two steps. The first step is the initial expansion, and the second step is the test phase. This procedure is based on Chevron Phillips Performance Pipe Technical Note 802 – Leak Testing of Polyethylene Pipe for Municipal and Industrial Applications.
   1. Initial Expansion Phase: During the initial expansion of the pipe under test, sufficient make-up water must be added to the system at hourly intervals for three hours to maintain the test pressure. After about four hours, initial expansion should be complete, and the actual test can start.
   2. Test Phase: When the test is to begin, the pipe is full of water and is subjected to a constant hydrostatic test pressure. The test phase should not exceed three hours, after which time any water deficiency must be replaced and measured. Add and measure the amount of make-up water required to return to the test pressure and compare this to the maximum allowance shown below.

Nominal Pipe Size (inches)	U.S. Gals/100 feet of Pipe[2]			Nominal Pipe Size (inches)	U.S. Gals/100 feet of Pipe[2]		
	1-Hour	2-Hour	3-Hour		1-Hour	2-Hour	3-Hour
2	0.07	0.10	0.16	20	2.80	5.50	8.00
3	0.10	0.15	0.025	22	3.50	7.00	10.50
4	0.13	0.25	0.40	24	4.50	8.90	13.30
5	0.21	0.41	0.62	28	5.50	11.10	16.80
6	0.30	0.60	0.90	30	6.30	12.70	19.20
8	0.50	1.00	1.50	32	7.00	14.30	21.50
10	0.80	1.30	2.10	36	9.00	18.00	27.00
12	1.10	2.30	3.40	42	12.00	23.10	35.30
14	1.40	2.80	4.20	48	15.00	27.00	43.00
16	1.70	3.30	5.00	54	22.00	31.40	51.70
18	2.00	4.30	6.50				

3.04 LOW PRESSURE AIR TEST – CONTAINMENT PIPE (OUTER PIPE OF DUAL WALL PIPE OR GRAVITY PIPE)

A. Contractor shall be responsible for furnishing all labor, materials, and equipment so that such tests can be performed at the times and locations the Engineer and/or QARE deems necessary.

B. Low Pressure Testing Equipment: For making low-pressure air tests, the Contractor shall use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The following testing equipment will be required to perform the work:
   1. Mechanical or Pneumatic Plugs.
   2. Portable Air Compressor with the following:
      a. Calibration
      b. Oil-free air source
      c. Singular control panel containing the following:
         i. Main shut off valve
         ii. Pressure regulating valve
         iii. 9-psi pressure relief valve
         iv. Input pressure gauge
         v. Continuous monitoring pressure gauge with the following
            1) Pressure gauge measuring from 0 to 10 psi
            2) 0.1 psi increments
            3) Accuracy of 0.04 psi
   3. Timer capable of measuring to 0.1 seconds.

C. Low Pressure Testing Setup:
   1. See procedures in Section 3.04.B above.
   2. One plug shall have an inlet tap or other provision for connecting an air hose to the portable air source.
   3. Connect the air hose to the inlet tap and portable air source and control equipment as indicated in Section 3.04.B above.

D. Low Pressure Air Testing Procedures:
   1. Pressurization Phase: Low-pressure shall be introduced slowly into the sealed line until the internal air pressure reaches 4.0 psig.
   2. Stabilization Phase: After the 4.0 psig pressure is obtained, regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psig for at least 2 minutes. The pressure may drop slightly while the pipe reaches equilibrium but should not drop below 3.5 psig.
   3. Test Phase: After equilibrium has been obtained as indicated above, determine the rate of air loss by Time Pressure Drop method indicated below.
   4. Time Pressure Drop Method:
      a. Add air until the internal pressure of the test section is raised to 4.0 psig and the test section is stabilized as indicated above. Disconnect the air supply and reduce pressure to 3.5 psig before starting the test.
      b. Either determine the time required for a 0.5 psig pressure drop or a 1.0 psig pressure drop and compare this interval to the minimum time for the pipe diameter and length indicated in the attached tables.
      c. Pass or Fail Criteria: Tests shall be considered passing if the air loss is less than or equal to the specified leakage rate (0.5 psig or 1.0 psig) indicated in the appropriate table above. Sections of pipeline that do not meet these criteria fail and cannot be accepted. When pipeline consists of more than one diameter pipe the test time shall be that of the largest allowable pipe in the section.
      d. Test Completion: Upon test completion slowly open the bleeder valve and allow air to escape. Caps and plugs shall not be removed until air pressure in the test section has been reduced to atmospheric pressure.
   5. Retesting. Retesting of any pipe section is allowed provided that the Contractor identifies the location of the leakage and repairs the pipe or adjusts the testing equipment as

appropriate. If the pipe section fails the test, segmented testing may be utilized to find the location of the leak. Once leaks are located, they should be repaired and retested per this practice.

6. Record Keeping
    a. The Contractor shall record the following testing information and give a copy to the QARE after testing:
        i. Date
        ii. Name of the person conducting test
        iii. Weather condition and ambient temperature
        iv. Tested pipe location, length, diameter, and components.
        v. Test pressure and time (start and end)
        vi. Control panel calibration record
        vii. Description of issues, failures, and corrective actions as necessary

3.05 ACCEPTANCE:

A. The Engineer reserves the right to accept the pipeline in sections after the satisfactory tests have been made and approved, and to make full use of any part or parts of the system after acceptance of those parts.

B. Until such time as the entire Contract has been accepted by the Engineer, the Contractor shall be held responsible to rectify any leaks, errors, or other poor workmanship which may be discovered and shall make any necessary repairs, alterations, or adjustments as may be required to properly complete the work.

END OF SECTION

MINIMUM TIME FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE FOR q = 0.0015

Pipe Diameter (in)	Minimum Time (mins)	Length for Minimum Time (ft)	Time for Longer Length (s)	Specification Time for Length (L) Shown (mins)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:06	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102.33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15

Notes:
1. See Practice UNI-B-6.
2. Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 inches in diameter.

MINIMUM TIME FOR A 0.5-PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE FOR Q = 0.0015

Pipe Diameter (in)	Minimum Time (mins)	Length for Minimum Time (ft)	Time for Longer Length (s)	Specification Time for Length (L) Shown (mins)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6:837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	61:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	36:37	44:31	53:25	62:19	71:13	80:07

Notes:

1. Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 inches in diameter.

APPENDIX A

PERMITS (PROVIDED UNDER SEPARATE COVER):

A-1 MEDEP SOLID WASTE PERMIT
A-2 ARMY CORPS OF ENGINEERS PERMIT
A-3 CITY OF OLD TOWN PLANNING BOARD PERMIT

SME
SEVEE & MAHER
ENGINEERS

APPENDIX A-1

MEDEP SOLID WASTE PERMIT

SME
SEVEE & MAHER
ENGINEERS

APPENDIX A-2

ARMY CORPS OF ENGINEERS PERMIT

SME
SEVEE & MAHER
ENGINEERS

APPENDIX A-3

CITY OF OLD TOWN PLANNING BOARD PERMIT

SME
SEVEE & MAHER
ENGINEERS

APPENDIX B

QUALITY ASSURANCE/QUALITY CONTROL PLAN

Refer to Volume III Design Report -
Appendix B

SME
SEVEE & MAHER
ENGINEERS

APPENDIX C

TEST PIT AND BORING LOGS
(PROVIDED UNDER SEPARATE COVER)

SME
SEVEE & MAHER
ENGINEERS

APPENDIX D

ADDENDUMS
(PROVIDED UNDER SEPARATE COVER)

SME
SEVEE & MAHER
ENGINEERS

ATTACHMENT 1

CELL 18 DESIGN DRAWINGS

Refer to Volume III Design Report –
Appendix K

SME
SEVEE & MAHER
ENGINEERS

APPENDIX D

HELP MODEL

SME
SEVEE & MAHER
ENGINEERS

D-1

AVERAGE ANNUAL LEACHATE GENERATION ANALYSIS

SME
SEVEE & MAHER
ENGINEERS

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PH II EXPANSION AVERAGE ANNUAL LEACHATE GENERATION EVALUATION

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: DPW
Date: 6/4/2025
Checked By: BDP
Date: 6/5/2025

OBJECTIVE

Evaluate the anticipted average annual leachate generation during each year of the Phase II Expansion Cells operations.

DESIGN CRITERIA

1. Average annual leachate generation is based on the predicted leachate quantity estimate from HELP model that includes one 25-year rain event and 15-years of hydrologic data.
2. Development (Cell Construction, Closure, Operations, et.c) follows, proposed Cell Development Concept.

DESIGN ASSUMPTIONS

1. Cell 18 Initial Waste Filling Operations assumes all existing permitted landfill cells (1-17) are fully developed to final waste grade and have either final cover or intermediate final cover installed.
2. Waste and cover conditions reflect those shown on the Cell Development plans included in Section 3 of The Design Report and Appendix D of Volume IV.
3. One new closure area (open receiving final waste regrading) is included during the intial waste filling operation of each new landfill expansion cell. This coincides with NEWSME's plan of performing a final closure every other year during the Phase II Expansion.
4. Intial waste filling condition assumes a 10' thick average waste deposit with a waste surface of 2% slope in operational open waste areas.
5. Waste fill at one year after cell construction assumes a 60-foot thick waste fill condition.
6. Closure area sideslope waste filling condition assumes a 60' thick sideslope waste deposit with a waste surface area of 33%.
7. Intermediate soil cover areas are assumed to be installed on the "flat top" area of waste deposits and are assumed to be 165' thick waste deposits with a surface slope of 5%.
8. Base Flow calculated using the average annual impingement rate into the leachate collection system (see Attached HELP Model).

ANALYSIS

1. **See HELP Model Output Summary Table for summary of Base Flows from each anticipated landfill condition.**

2. **See Average Annual Leachate Genetation Summary Table Below:**

Juniper Ridge Landfill Estimated Annual Leachate Generation				
			Predicted Average Annual Leachate Generation (Gallons)	
Year	Developed Landfill Base Area (Acres)	Predicted Landfill Final Cover Area (Acres)	Annual	Cumulative
2027	122.0	40.0	10,446,289	10,446,289
2028	137.3	40.0	19,454,236	29,900,525
2029	137.3	51.0	16,256,060	46,156,584
2030	148.5	51.0	20,244,158	66,400,742
2031	148.5	61.9	22,296,247	88,696,989
2032	165.4	61.9	26,382,526	115,079,515
2033	165.4	72.9	19,879,325	134,958,840
2034	173.0	72.8	23,704,341	158,663,181
2035	173.0	87.8	21,917,120	180,580,301
2036	178.6	87.9	23,425,047	204,005,348
2037	178.6	102.3	22,055,876	226,061,224
2038	178.6	102.3	15,889,889	241,951,113
2039	178.6	102.3	19,582,026	261,533,139
2040	178.6	118.3	17,876,929	279,410,068
2041	178.6	134.8	11,943,414	291,353,482
2042	178.6	149.8	9,174,456	300,527,937
2043	178.6	164.9	8,003,523	308,531,460
2044	178.6	178.6	-	308,531,460

AVERAGE ANNUAL LEACHATE GENERATION PER ACRE HELP MODEL SUMMARY

HELP MODEL INPUT FOR 10' Open Waste Condition with 2% Surface Slope

LAYER INFORMATION									GEOMEMBRANE		
NO.	TYPE	DESCRIPTION	DESCRIPTION	THICKNESS (INCHES)	SOIL TEXTURE NO	SAT. HYD CONDUCTIVITY (CM/SEC)	DRAIN LENGTH (FEET)	DRAIN SLOPE (%)	PIN HOLE DENSITY (#/ACRE)	INSTALL DEFECTS (#/ACRE)	PLACEMENT QUALITY
1	1	VERTICAL PERCOLATION	WASTE	120	18	1.00E-03					
2	1	LATERAL DRAINAGE	LEACHATE COLLECTION SAND	12		1.00E-02					
3	2	LATERAL DRAINAGE	LEACHATE COLLECTION COMPOSITE	0.25	34	3.30E+01	150	3			
4	4	GEOMEMBRANE LINER	PRIMARY LINER GEOMEMBRANE	0.08	35	2.00E-13			1	3	3

HELP MODEL INPUT FOR 60' Open Waste Condition with 33% Surface Slope

LAYER INFORMATION									GEOMEMBRANE		
NO.	TYPE	DESCRIPTION	DESCRIPTION	THICKNESS (INCHES)	SOIL TEXTURE NO	SAT. HYD CONDUCTIVITY (CM/SEC)	DRAIN LENGTH (FEET)	DRAIN SLOPE (%)	PIN HOLE DENSITY (#/ACRE)	INSTALL DEFECTS (#/ACRE)	PLACEMENT QUALITY
1	1	VERTICAL PERCOLATION	WASTE	120	18	1.00E-03					
2	1	LATERAL DRAINAGE	LEACHATE COLLECTION SAND	12		1.00E-02					
3	2	LATERAL DRAINAGE	LEACHATE COLLECTION COMPOSITE	0.25	34	3.30E+01	150	3			
4	4	GEOMEMBRANE LINER	PRIMARY LINER GEOMEMBRANE	0.08	35	2.00E-13			1	3	3

HELP MODEL INPUT FOR 165' Waste Fill Condition with Intermediate Soil Cover 5% Surface Slope

LAYER INFORMATION									GEOMEMBRANE		
NO.	TYPE	DESCRIPTION	DESCRIPTION	THICKNESS (INCHES)	SOIL TEXTURE NO	SAT. HYD CONDUCTIVITY (CM/SEC)	DRAIN LENGTH (FEET)	DRAIN SLOPE (%)	PIN HOLE DENSITY (#/ACRE)	INSTALL DEFECTS (#/ACRE)	PLACEMENT QUALITY
1	1	VERTICAL PERCOLATION	INTERMEDIAE SOIL COVER	18	18	4.00E-05					
2	1	VERTICAL PERCOLATION	WASTE	1980	18	1.00E-03					
3	2	LATERAL DRAINAGE	LEACHATE COLLECTION SAND	12		1.00E-02					
4	2	LATERAL DRAINAGE	LEACHATE COLLECTION COMPOSITE	0.25	34	3.30E+01	220	3			
5	4	GEOMEMBRANE LINER	PRIMARY LINER GEOMEMBRANE	0.08	35	2.00E-13			1	3	3

SUMMARY OF HELP MODEL RESULTS

	10' Open Waste (2% Slope)		60' Open Waste (33%)		165' Waste Fill w/ Intermediate Soil Cover (5% Slope)	
	Cubic Feet/Acre/Year	Gallons/Acre/Year	Cubic Feet/Acre/Year	Gallons/Acre/Year	Cubic Feet/Acre/Year	Gallons/Acre/Year
Average Annual Leachate Drained into Leachate Collection System	78,699.445	588,711	78,091.727	584,165	35,825.117	267,990

2027 Average Annual Leachate Generation Analysis (Cells 1-17 Fully Developed and Covered with Intermediate or Final Cover Conditions)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	2,221,560	32.8%	40.00	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	653,400	12.3%	15.00	35,825.00	537,375.00	4,020,102.38	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	2,439,360	45.9%	56.00	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
165' (5% Slope)	479,160	9.0%	11.00	78,091.00	859,001.00	6,426,186.48	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals			**122.00**		**1,396,376.00**	**10,446,288.86**			

2028 Average Annual Leachate Generation Analysis (Cell 18 Initial Waste Filling Conditions with 11 Acre Stage 5 Closure Area Waste Fill Regrade)

Inactive Landfill (Cells 1-17)	Area (SF)	% Area	Area (acre)	Leachate Gen/Acre (CF/Year)	Leachate (CF)/yr	Leachate (Gal)/yr	From Help Model Runs Average Annual Generation in the Drainage Layer		
Final Landfill Cover	2,221,560	29.1%	40.00	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	653,400	10.9%	15.00	35,825.00	537,375.00	4,020,102.38	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	2,439,360	40.8%	56.00	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33% Slope) Stage 5 Final Closure	479,160	8.0%	11.00	78,091.00	859,001.00	6,426,186.48	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
10' (2% Slope)(Cell 18)	666,468	11.1%	15.30	78,700.00	1,204,110.00	9,007,946.91	78700	CF	10' thick initial waste deposit with 2% cross slope grade
Totals		**100%**	**137.30**		**2,600,486.00**	**19,454,235.77**			

2029 Average Annual Leachate Generation Analysis (Cell 18 Operational Waste Filling Conditions with Stage 5 Final Closure Complete)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	2,221,560	37.1%	51.00	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	553,212	9.2%	12.70	35,825.00	454,977.50	3,403,686.68	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	2,247,696	37.6%	51.60	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33%) Cell 14 Sideslope Fill Overlap	291,852	4.9%	6.70	78,091.00	523,209.70	3,914,131.77	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
60' Thick Waste Deposit	666,468	11.1%	15.30	78,091.00	1,194,792.30	8,938,241.20	78091	CF	60' thick waste deposit
Totals		**95%**	**137.30**		**2,172,979.50**	**16,256,059.64**			

2030 Average Annual Leachate Generation Analysis (Cell 19 Initial Waste Filling Conditions with 10.9 Acre Stage 6 Final Closure Area Waste Fill Regrade)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	2,221,560	34.3%	51.00	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	357,542	5.5%	8.21	35,825.00	294,052.85	2,199,809.37	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	2,548,260	39.4%	58.50	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33% Slope) Stage 6 Final Closure	474,804	7.3%	10.90	78,091.00	851,191.90	6,367,766.60	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
10' (2% Slope)(Cell 19)	487,872	7.5%	11.20	78,700.00	881,440.00	6,594,052.64	78700	CF	10' thick initial waste deposit with 2% cross slope grade
165' (5% Slope) (Cell 18 and Overlap)	378,972	5.9%	8.70	78,091.00	679,391.70	5,082,529.31	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals		**100%**	**148.51**		**2,706,076.45**	**20,244,157.92**			

2031 Average Annual Leachate Generation Analysis (Cell 19 Operational Waste Filling Conditions with Stage 6 Final Closure Complete)										
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	2,696,364	41.7%	61.90	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	357,542	5.5%	8.21	35,825.00	294,052.85	2,199,809.37	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,916,640	29.6%	44.00	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33%) Cell 17 Fill Overlap	474,804	7.3%	10.90	78,091.00	851,191.90	6,367,766.60	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
60' Thick Waste Deposit	487,872	7.5%	11.20	78,091.00	874,619.20	6,543,026.24	78091	CF	60' thick waste deposit
165' (5% Slope) (Cell 18 and Overlap)	378,972	8.3%	12.30	78,091.00	960,519.30	7,185,644.88	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals		**100%**	**148.51**		**2,980,383.25**	**22,296,247.09**			

2032 Average Annual Leachate Generation Analysis (Cell 20 Initial Waste Filling Conditions with 11 Acre Stage 7 Final Closure Area Waste Fill Regrade)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	2,696,285	37.4%	61.90	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	876,682	12.2%	20.13	35,825.00	721,008.55	5,393,865.00	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,266,470	17.6%	29.07	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33% Slope) Stage 7 Final Closure	479,160	6.6%	11.00	78,091.00	859,001.00	6,426,186.48	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
10' (2% Slope)(Cell 20 North)	404,000	5.6%	9.27	78,700.00	729,908.17	5,460,443.04	78700	CF	10' thick initial waste deposit with 2% cross slope grade
10 (2% Slope)(Cell 20 South)	332,350	4.6%	7.63	78,700.00	600,457.87	4,492,025.36	78700	CF	10' thick initial waste deposit with 2% cross slope grade
Interim Soil Cover (Cell 19)	130,071	1.8%	2.99	35,825.00	106,974.14	800,273.55	35825	CF	165' thick waste deposit covered with impermeable soil layer
60' (33% Slope)(Cell 19)	206,840	2.9%	4.75	78,091.00	370,806.76	2,774,005.37	78091	CF	60' thick average waste deposit with 33% sideslope grade
Interim Soil Cover (Cell 18)	168,340	2.3%	3.86	35,825.00	138,447.67	1,035,727.02	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area (Cell 18 and Cell 19)	646,513	9.0%	14.84	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
Totals		**100%**	**165.44**		**859,456.22**	**26,382,525.81**			

2033 Average Annual Leachate Generation Analysis (Cell 20 Operational Waste Filling Conditions with Stage 7 Final Closure Complete)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	3,175,445	44.1%	72.90	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	876,682	12.2%	20.13	35,825.00	721,008.55	5,393,865.00	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,266,470	17.6%	29.07	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
60' Thick Waste Deposit (Cell 20 North)	404,000	5.6%	9.27	78,091.00	724,259.96	5,418,188.79	78091	CF	60' thick waste deposit
60' Thick Waste Deposit (Cell 20 South)	332,350	4.6%	7.63	78,091.00	595,811.38	4,457,264.96	78091	CF	60' thick waste deposit
Interim Soil Cover (Cell 19)	130,071	1.8%	2.99	35,825.00	106,974.14	800,273.55	35825	CF	165' thick waste deposit covered with impermeable soil layer
60' (Cell 19)	206,840	2.9%	4.75	78,091.00	370,806.76	2,774,005.37	78091	CF	60' thick average waste deposit with 33% sideslope grade
Interim Soil Cover (Cell 18)	168,340	2.3%	3.86	35,825.00	138,447.67	1,035,727.02	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area (Cell 18 and Cell 19)	646,513	9.0%	14.84	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
Totals		**100%**	**165.44**		**859,456.22**	**19,879,324.67**			

2034 Average Annual Leachate Generation Analysis (Cell 21 Initial Waste Filling Conditions with 15 Acre Stage 8 Final Closure Area Waste Fill Regrade)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	3,171,168	42.1%	72.80	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	732,699	9.7%	16.82	35,825.00	602,592.78	4,507,996.62	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	2,204,136	29.2%	50.60	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33% Slope) Stage 8 Final Closure	653,400	8.7%	15.00	78,091.00	1,171,365.00	8,762,981.57	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
10' (2% Slope)(Cell 21)	331,056	4.4%	7.60	78,700.00	598,120.00	4,474,535.72	78700	CF	10' thick initial waste deposit with 2% cross slope grade
165' (5% Slope) (Cells 18, 19, 20, and Overlap)	444,312	5.9%	10.20	78,091.00	796,528.20	5,958,827.46	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals		**100%**	**173.02**		**3,168,605.98**	**23,704,341.37**			

2035 Average Annual Leachate Generation Analysis (Cell 21 Operational Waste Filling Conditions with Stage 8 Final Closure Complete)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	3,824,568	50.7%	87.80	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	732,699	9.7%	16.82	35,825.00	602,592.78	4,507,996.62	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,681,416	22.3%	38.60	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
60' Thick Waste Deposit (Cell 21)	331,056	4.4%	7.60	78,091.00	593,491.60	4,439,910.66	78091	CF	60' thick waste deposit
60 Thick Waste Deposit (Cell 18 and Cell 20 Overlap Sideslope)	522,720	6.9%	12.00	78,091.00	937,092.00	7,010,385.25	78091	CF	60' thick waste deposit
165' (5% Slope) (Cells 18, 19, 20, and Overlap)	444,312	5.9%	10.20	78,091.00	796,528.20	5,958,827.46	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals		**100%**	**173.02**		**2,929,704.58**	**21,917,119.99**			

2036 Average Annual Leachate Generation Analysis (Cell 22 Initial Waste Filling Conditions with 14.4 Acre Stage 9 Final Closure Area Waste Fill Regrade)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	3,828,924	49.2%	87.90	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	840,708	10.8%	19.30	35,825.00	691,422.50	5,172,531.72	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,751,112	22.5%	40.20	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' (33% Slope) Stage 9 Final Closure	627,264	8.1%	14.40	78,091.00	1,124,510.40	8,412,462.30	78091	CF	60' thick average waste deposit with 33% sideslope grade
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
10' (2% Slope)(Cell 22)	243,936	3.1%	5.60	78,700.00	440,720.00	3,297,026.32	78700	CF	10' thick initial waste deposit with 2% cross slope grade
165' (5% Slope) (Cells 18, 19, 20 , 21 and Overlap)	487,872	6.3%	11.20	78,091.00	874,619.20	6,543,026.24	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals		**100%**	**178.60**		**3,131,272.10**	**23,425,046.58**			

2037 Average Annual Leachate Generation Analysis (Cell 22 Operational Waste Filling Conditions with Stage 9 Final Closure Complete)									
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	4,456,188	57.3%	102.30	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	840,708	10.8%	19.30	35,825.00	691,422.50	5,172,531.72	35825	CF	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,224,036	15.7%	28.10	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**			
60' Thick Waste Deposit (Cell 22)	243,936	3.1%	5.60	78,091.00	437,309.60	3,271,513.12	78091	CF	60' thick waste deposit
60 Thick Waste Deposit (Cell 20 and Cell 21 Overlap Sideslope)	527,076	6.8%	12.10	78,091.00	944,901.10	7,068,805.13	78091	CF	60' thick waste deposit
165' (5% Slope) (Cells 18, 19, 20 , 21 and Overlap)	487,872	6.3%	11.20	78,091.00	874,619.20	6,543,026.24	78091	CF	165' thick average waste deposit with 5% sideslope grade
Totals		**100%**	**178.60**		**2,948,252.40**	**22,055,876.20**			

2038 Average Annual Leachate Generation Analysis (Cells 18-22 Elevation 340 to Final Waste Filling Conditions)

Inactive Landfill (Cells 1-17)	Area (SF)	% Area	Area (acre)	Leachate Gen/Acre (CF/Year)	Leachate (CF)/yr	Leachate (Gal)/yr
Final Landfill Cover	4,451,832	57.2%	102.20	-	-	-
60' (33%)	566,280	7.3%	13.00	78,091.00	1,015,183.00	7,594,584.02
Interim Plastic Cover Area	296,208	3.8%	6.80	-	-	-
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**
Interim Plastic Cover Area	1,646,568	21.2%	37.80	-	-	-
165' (5%)	448,668	5.8%	10.30	78,091.00	804,337.30	6,017,247.34
Interim Soil Cover	370,260	4.8%	8.50	35,825.00	304,512.50	2,278,058.01
Totals		**100%**	**178.60**		**2,124,032.80**	**15,889,889.38**

From Help Model Runs Average Annual Generation in the Drainage Layer

0	CF	Final cover (impermeable soil with geosynthetics)
78091	CF	60' thick average waste deposit with 33% sideslope grade
0	CF	Temporary plastic cover (impermeable geosynthetic)
0	CF	Temporary plastic cover (impermeable geosynthetic)
78091	CF	165' thick average waste deposit with 5% sideslope grade
35825	CF	165' thick waste deposit covered with impermeable soil layer

2039 Average Annual Leachate Generation Analysis (Cells 18-22 Elevation 340 to Final Waste Filling Conditions with Stage 10 Final Closure Area Waste Fill Regrade)

Landfill Area	Area (SF)	% Area	Area (acre)	Leachate Gen/Acre (CF/Year)	Leachate (CF)/yr	Leachate (Gal)/yr
Final Landfill Cover	4,451,832	57.2%	102.20	-	-	-
60' (33%)	841,579	10.8%	19.32	78,091.00	1,508,718.12	11,286,720.26
Interim Plastic Cover Area	135,036	1.7%	3.10	-	-	-
Interim Plastic Cover Area	1,532,385.0	19.7%	35.18	-	-	-
165' (5%)	448,668	5.8%	10.30	78,091.00	804,337.30	6,017,247.34
Interim Soil Cover	370,260	4.8%	8.50	35,825.00	304,512.50	2,278,058.01
Totals		**100%**	**178.60**		**2,617,567.92**	**19,582,025.61**

From Help Model Runs Average Annual Generation in the Drainage Layer

0	CF	Final cover (impermeable soil with geosynthetics)
78091	CF	60' thick average waste deposit with 33% sideslope grade
0	CF	Temporary plastic cover (impermeable geosynthetic)
0	CF	Temporary plastic cover (impermeable geosynthetic)
78091	CF	165' thick average waste deposit with 5% sideslope grade
35825	CF	165' thick waste deposit covered with impermeable soil layer

2040 Average Annual Leachate Generation Analysis (Cells 18-22 Stage 10 Complete with Stage 11 Final Closure Area Waste Fill Regrade)										
Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	5,148,792	66.2%	118.20	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
60' (33%)	264,627	3.4%	6.08	78,091.00	474,402.83	3,549,007.53	78091	CF	60' thick average waste deposit with 33% sideslope grade
Interim Plastic Cover Area	135,036	1.7%	3.10	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
Interim Plastic Cover Area	1,032,933.0	13.3%	23.71	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
165' (5%)	238,075	3.1%	5.47	78,091.00	426,801.74	3,192,903.78	78091	CF	165' thick average waste deposit with 5% sideslope grade
60' Thick Waste Deposit (Stage 11 Final Cover Area)	718,740	9.2%	16.50	78,091.00	1,288,501.50	9,639,279.72	78091	CF	60' thick waste deposit
Interim Soil Cover	243,107	3.1%	5.58	35,825.00	199,938.21	1,495,737.72	35825	CF	165' thick waste deposit covered with impermeable soil layer
Totals		**100%**	**178.60**		**2,389,644.27**	**17,876,928.76**			

2041 Average Annual Leachate Generation Analysis (Cells 18-22 Stage 11 Complete with Stage 12 Final Closure Area Waste Fill Regrade)										
Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	5,867,532	75.4%	134.70	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Plastic Cover Area	889,185.0	11.4%	20.41	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
165' (5%)	125,617	1.6%	2.88	78,091.00	225,196.45	1,684,694.61	78091	CF	165' thick average waste deposit with 5% sideslope grade
60' Thick Waste Deposit (Stage 12 Final Cover Area)	653,400	8.4%	15.00	78,091.00	1,171,365.00	8,762,981.57	78091	CF	60' thick waste deposit
Interim Soil Cover	243,107	3.1%	5.58	35,825.00	199,938.21	1,495,737.72	35825	CF	165' thick waste deposit covered with impermeable soil layer
Totals		**100%**	**178.60**		**1,596,499.65**	**11,943,413.89**			

2042 Average Annual Leachate Generation Analysis (Cells 18-22 Stage 12 Complete with Stage 13 Final Closure Area Waste Fill Regrade)									
Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/Year)**	**Leachate (CF)/yr**	**Leachate (Gal)/yr**	**From Help Model Runs Average Annual Generation in the Drainage Layer**		
Final Landfill Cover	6,520,932	83.8%	149.70	-	-	-	0	CF	Final cover (impermeable soil with geosynthetics)
Interim Plastic Cover Area	541,678.0	7.0%	12.44	-	-	-	0	CF	Temporary plastic cover (impermeable geosynthetic)
60' Thick Waste Deposit (Stage 13 Final Cover Area)	657,756	8.5%	15.10	78,091.00	1,179,174.10	8,821,401.44	78091	CF	60' thick waste deposit
Interim Soil Cover	57,383	0.7%	1.32	35,825.00	47,193.43	353,054.08	35825	CF	165' thick waste deposit covered with impermeable soil layer
Totals		**100%**	**178.60**		**1,226,367.53**	**9,174,455.52**			

2043 Average Annual Leachate Generation Analysis (Cells 18-22 Stage 13 Complete with Stage 14 Final Closure Area Waste Fill Regrade)

Landfill Area	Area (SF)	% Area	Area (acre)	Leachate Gen/Acre (CF/Year)	Leachate (CF)/yr	Leachate (Gal)/yr
Final Landfill Cover	7,183,044	92.3%	164.90	-	-	-
60' Thick Waste Deposit (Stage 14 Final Cover Area)	596,772	7.7%	13.70	78,091.00	1,069,846.70	8,003,523.16
Totals		**100%**	**178.60**		**1,069,846.70**	**8,003,523.16**

From Help Model Runs Average Annual Generation in the Drainage Layer

0	CF	Final cover (impermeable soil with geosynthetics)
78091	CF	60' thick waste deposit

2044 Average Annual Leachate Generation Analysis (Cells 18-22 Stage 13 Complete with Stage 14 Final Closure Area Waste Fill Regrade)

Landfill Area	Area (SF)	% Area	Area (acre)	Leachate Gen/Acre (CF/Year)	Leachate (CF)/yr	Leachate (Gal)/yr
Final Landfill Cover	7,779,816	100.0%	178.60	-	-	-
Totals		**100%**	**178.60**		**-**	**-**

From Help Model Runs Average Annual Generation in the Drainage Layer

0 CF Final cover (impermeable soil with geosynthetics)

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**                                                                              **
**                                                                              **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                  **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                      **
**                     USAE WATERWAYS EXPERIMENT STATION                        **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                              **
**                                                                              **
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PRECIPITATION DATA FILE:    c:\JRL\ph2exp\NEWJRL4A.D4
TEMPERATURE DATA FILE:      c:\JRL\ph2exp\NEWJRL7.D7
SOLAR RADIATION DATA FILE:  c:\JRL\ph2exp\NEWJRL13.D13
EVAPOTRANSPIRATION DATA:    c:\JRL\ph2exp\DATA11.D11
SOIL AND DESIGN DATA FILE:  c:\JRL\ph2exp\10W_NR.D10
OUTPUT DATA FILE:           c:\JRL\ph2exp\10W_NR.OUT


TIME:  13:25     DATE:   9/23/2024


**********************************************************************************

     TITLE:  CASELLA - JUNIPER RIDGE EXPANSION - OPEN (10'WASTE)

**********************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  18
          THICKNESS                     =    120.00   INCHES
          POROSITY                      =      0.6710 VOL/VOL
          FIELD CAPACITY                =      0.2920 VOL/VOL
          WILTING POINT                 =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2985 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC

                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   1
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4170 VOL/VOL
          FIELD CAPACITY                =      0.0450 VOL/VOL
          WILTING POINT                 =      0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0826 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999978000E-02 CM/SEC
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LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0103	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	400.0	FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3897	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 55.0, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	55.50	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.119	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.368	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	46.896	INCHES
TOTAL INITIAL WATER	=	52.943	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM BANGOR MAINE

STATION LATITUDE	=	44.80 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	134
END OF GROWING SEASON (JULIAN DATE)	=	263
EVAPORATIVE ZONE DEPTH	=	8.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2009

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.77	2.47	1.68	3.99	3.94	8.10
	5.61	2.69	1.32	5.42	4.22	3.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.519	0.387	0.485	2.385	3.856	4.380
	5.442	1.583	1.906	1.332	0.397	0.260
LATERAL DRAINAGE COLLECTED	0.0756	0.0408	0.5952	8.0718	4.7442	0.2811
FROM LAYER 3	3.5468	0.2261	0.5681	0.7176	2.7155	0.2299
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.001	0.007	0.004	0.000
TOP OF LAYER 4	0.003	0.000	0.001	0.001	0.002	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.002	0.005	0.002	0.000
HEAD ON TOP OF LAYER 4	0.002	0.000	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.73	162369.891	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.933	83248.602	51.27
DRAINAGE COLLECTED FROM LAYER 3	21.8127	79180.211	48.77
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003689	13.391	0.01
CHANGE IN WATER STORAGE	-0.020	-72.283	-0.04
SOIL WATER AT START OF YEAR	51.576	187221.047	
SOIL WATER AT END OF YEAR	51.556	187148.766	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.52
SNOW WATER AT END OF YEAR	6.047	21949.807	13.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.026	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.47	2.19	4.68	2.24	1.73	4.38
	2.15	1.89	5.73	5.83	4.75	5.47
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.517	0.371	0.582	1.657	2.197	3.242
	3.255	1.775	2.610	1.560	0.520	0.346
LATERAL DRAINAGE COLLECTED	0.0760	0.0410	0.0342	11.0939	5.5196	0.3130
FROM LAYER 3	0.0932	0.0516	1.2176	1.9790	2.8312	2.6988
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.010	0.005	0.000
TOP OF LAYER 4	0.000	0.000	0.001	0.002	0.003	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.007	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.001	0.001	0.002	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.51	161571.312	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.632	67632.477	41.86
DRAINAGE COLLECTED FROM LAYER 3	25.9492	94195.437	58.30
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003396	12.326	0.01
CHANGE IN WATER STORAGE	-0.074	-268.962	-0.17
SOIL WATER AT START OF YEAR	51.556	187148.766	
SOIL WATER AT END OF YEAR	51.218	185920.234	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.59
SNOW WATER AT END OF YEAR	6.311	22909.367	14.18
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.66	2.19	4.50	5.26	3.51	2.79
	2.10	8.32	2.79	5.16	2.19	3.85
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.449	0.450	0.631	0.755	4.469	2.299
	2.114	5.231	2.596	1.261	0.864	0.337
LATERAL DRAINAGE COLLECTED	0.1526	0.0599	0.0418	6.3121	10.5458	1.4832
FROM LAYER 3	0.1168	0.1700	2.0899	1.0508	2.6652	1.2150
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0002	0.0002	0.0002	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.006	0.009	0.001
TOP OF LAYER 4	0.000	0.000	0.002	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.009	0.006	0.001
HEAD ON TOP OF LAYER 4	0.000	0.000	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.32	160881.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.456	77885.383	48.41
DRAINAGE COLLECTED FROM LAYER 3	25.9031	94028.336	58.45
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003098	11.245	0.01
CHANGE IN WATER STORAGE	-3.042	-11043.353	-6.86
SOIL WATER AT START OF YEAR	51.218	185920.234	
SOIL WATER AT END OF YEAR	50.685	183984.875	
SNOW WATER AT START OF YEAR	6.311	22909.367	14.24
SNOW WATER AT END OF YEAR	3.802	13801.376	8.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.054	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.95	1.55	1.40	3.99	5.12	7.10
	0.58	2.60	6.33	6.96	1.13	1.13
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.506	0.418	0.532	1.794	4.602	4.203
	1.620	2.032	2.450	1.240	0.732	0.352
LATERAL DRAINAGE COLLECTED	0.1239	0.0557	0.0723	2.7157	6.0283	2.5555
FROM LAYER 3	1.5425	0.3133	1.7027	1.3195	4.4062	1.5800
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.002	0.005	0.002
TOP OF LAYER 4	0.001	0.000	0.002	0.001	0.004	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.002	0.002	0.001
HEAD ON TOP OF LAYER 4	0.001	0.000	0.002	0.001	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.84	144619.172	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.480	74342.016	51.41
DRAINAGE COLLECTED FROM LAYER 3	22.4156	81368.711	56.26
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002817	10.224	0.01
CHANGE IN WATER STORAGE	-3.058	-11101.735	-7.68
SOIL WATER AT START OF YEAR	50.685	183984.875	
SOIL WATER AT END OF YEAR	50.650	183858.937	
SNOW WATER AT START OF YEAR	3.802	13801.376	9.54
SNOW WATER AT END OF YEAR	0.778	2825.582	1.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.048	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2013

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.87	2.04	2.05	1.77	4.55	5.46
	3.74	4.69	7.17	1.02	3.76	2.93
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.331	0.496	0.517	0.450	4.283	4.463
	3.962	4.049	2.929	1.205	0.429	0.196
LATERAL DRAINAGE COLLECTED	0.1158	0.0523	0.0352	1.5231	3.6804	1.4520
FROM LAYER 3	0.3914	0.5184	2.3893	2.4193	0.1399	0.0640
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.003	0.001
TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.001	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.001	0.002	0.002	0.000	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2013

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.05	145381.469	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	23.310	84616.117	58.20
DRAINAGE COLLECTED FROM LAYER 3	12.7813	46395.941	31.91
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0009		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002578	9.359	0.01
CHANGE IN WATER STORAGE	3.956	14360.099	9.88
SOIL WATER AT START OF YEAR	50.650	183858.937	
SOIL WATER AT END OF YEAR	49.126	178328.078	
SNOW WATER AT START OF YEAR	0.778	2825.582	1.94
SNOW WATER AT END OF YEAR	6.258	22716.549	15.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.048	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2014

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.18	1.99	3.65	2.28	3.31	3.59
	6.78	2.96	0.89	6.85	3.21	5.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.336	0.311	0.492	1.941	3.582	3.599
	4.623	3.372	0.632	1.657	0.885	0.290
LATERAL DRAINAGE COLLECTED	0.2535	1.3512	0.8392	6.1803	4.8212	0.2570
FROM LAYER 3	1.4354	0.4846	0.0899	0.1304	3.5709	2.6000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.001	0.001	0.006	0.004	0.000
TOP OF LAYER 4	0.001	0.000	0.000	0.000	0.003	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.005	0.002	0.000
HEAD ON TOP OF LAYER 4	0.002	0.000	0.000	0.000	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2014

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.719	78839.578	49.45
DRAINAGE COLLECTED FROM LAYER 3	22.0136	79909.367	50.12
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002360	8.568	0.01
CHANGE IN WATER STORAGE	0.185	672.112	0.42
SOIL WATER AT START OF YEAR	49.126	178328.078	
SOIL WATER AT END OF YEAR	55.569	201716.734	
SNOW WATER AT START OF YEAR	6.258	22716.549	14.25
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2015

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.69	2.20	1.45	2.39	2.32	4.90
	1.16	2.63	6.89	2.58	2.26	4.06
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.281	0.282	0.531	0.731	2.489	4.589
	1.928	2.942	1.388	1.813	0.991	0.876
LATERAL DRAINAGE COLLECTED	1.6656	0.9136	0.2857	2.7519	5.6722	0.8422
FROM LAYER 3	0.1149	0.0590	0.0375	2.9952	1.9127	1.6738
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.002	0.005	0.001
TOP OF LAYER 4	0.000	0.000	0.000	0.003	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.002	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.002	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2015

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.53	128973.898	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.840	68388.609	53.03
DRAINAGE COLLECTED FROM LAYER 3	18.9243	68695.383	53.26
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002293	8.322	0.01
CHANGE IN WATER STORAGE	-2.236	-8118.434	-6.29
SOIL WATER AT START OF YEAR	55.569	201716.734	
SOIL WATER AT END OF YEAR	52.643	191092.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.690	2505.669	1.94
ANNUAL WATER BUDGET BALANCE	0.0000	0.004	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2016

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.38	3.89	3.27	2.58	2.09	2.85
	2.69	2.24	1.23	3.20	4.16	3.77
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.552	0.224	0.437	1.459	2.330	2.618
	2.757	2.379	0.650	1.317	1.034	0.420
LATERAL DRAINAGE COLLECTED	2.0105	0.2475	2.8372	3.3556	4.5201	0.2365
FROM LAYER 3	0.0795	0.0460	0.0309	0.0230	1.0923	3.2253
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.002	0.003	0.004	0.000
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.001	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.002	0.003	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2016

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.508	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	16.178	58726.711	47.10
DRAINAGE COLLECTED FROM LAYER 3	17.7043	64266.770	51.54
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000002	0.006	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002186	7.935	0.01
CHANGE IN WATER STORAGE	0.465	1689.107	1.35
SOIL WATER AT START OF YEAR	52.643	191092.625	
SOIL WATER AT END OF YEAR	52.817	191725.734	
SNOW WATER AT START OF YEAR	0.690	2505.669	2.01
SNOW WATER AT END OF YEAR	0.981	3561.676	2.86
ANNUAL WATER BUDGET BALANCE	0.0000	-0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2017

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.63	2.26	2.07	3.98	6.36	4.32
	1.91	1.64	2.69	5.59	3.05	3.83
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.408	0.345	0.459	2.206	4.561	4.180
	2.464	1.728	2.549	1.079	0.989	0.502
LATERAL DRAINAGE COLLECTED	1.3224	0.6733	3.0063	3.0852	3.8773	2.2470
FROM LAYER 3	0.1431	0.0630	0.1772	0.1402	2.0687	3.2821
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.003	0.003	0.003	0.002
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.001	0.002	0.003	0.002	0.002
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2017

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.33	150027.906	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.471	77940.023	51.95
DRAINAGE COLLECTED FROM LAYER 3	20.0859	72911.695	48.60
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002017	7.323	0.00
CHANGE IN WATER STORAGE	-0.229	-831.131	-0.55
SOIL WATER AT START OF YEAR	52.817	191725.734	
SOIL WATER AT END OF YEAR	51.425	186671.562	
SNOW WATER AT START OF YEAR	0.981	3561.676	2.37
SNOW WATER AT END OF YEAR	2.145	7784.717	5.19
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2018

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.53	2.99	2.18	4.77	2.37	5.42
	2.48	2.73	2.63	4.66	7.00	4.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.346	0.355	0.501	1.121	3.377	4.198
	3.524	2.596	1.669	1.754	0.796	0.301
LATERAL DRAINAGE COLLECTED	1.4692	3.2633	2.4790	2.0299	6.0302	1.1024
FROM LAYER 3	0.1706	0.0721	0.0405	0.5787	3.3569	4.5664
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.002	0.005	0.001
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.003	0.004
STD. DEVIATION OF DAILY	0.001	0.001	0.002	0.001	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.001	0.003	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2018

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.99	170573.687	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.538	74551.227	43.71
DRAINAGE COLLECTED FROM LAYER 3	25.1595	91328.859	53.54
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001938	7.033	0.00
CHANGE IN WATER STORAGE	1.291	4686.625	2.75
SOIL WATER AT START OF YEAR	51.425	186671.562	
SOIL WATER AT END OF YEAR	54.124	196470.453	
SNOW WATER AT START OF YEAR	2.145	7784.717	4.56
SNOW WATER AT END OF YEAR	0.736	2672.444	1.57
ANNUAL WATER BUDGET BALANCE	0.0000	-0.055	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2019

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.15	1.83	1.94	5.53	4.43	5.33
	4.46	7.54	2.81	5.80	3.97	3.21
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.429	0.397	0.421	1.788	4.885	4.132
	5.681	3.839	3.016	2.099	0.712	0.416
LATERAL DRAINAGE COLLECTED	0.9406	3.1960	0.9177	3.6640	6.0980	1.0709
FROM LAYER 3	0.5035	1.2725	1.2553	0.5162	2.4442	3.3497
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002
LAYER 10	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.001	0.003	0.005	0.001
TOP OF LAYER 4	0.000	0.001	0.001	0.000	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.002	0.001	0.002	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.001	0.001	0.001	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2019

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.00	188759.953	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.816	100971.445	53.49
DRAINAGE COLLECTED FROM LAYER 3	25.2286	91579.969	48.52
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001799	6.529	0.00
CHANGE IN WATER STORAGE	-1.046	-3797.904	-2.01
SOIL WATER AT START OF YEAR	54.124	196470.453	
SOIL WATER AT END OF YEAR	53.453	194035.734	
SNOW WATER AT START OF YEAR	0.736	2672.444	1.42
SNOW WATER AT END OF YEAR	0.361	1309.265	0.69
ANNUAL WATER BUDGET BALANCE	0.0000	-0.084	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2020

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.42	1.65	2.27	4.78	2.22	2.08
	4.21	3.55	0.28	4.40	5.22	4.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.432	0.284	0.251	2.952	2.721	0.599
	4.113	3.121	1.251	1.143	1.075	0.533
LATERAL DRAINAGE COLLECTED	0.6240	1.2995	1.7121	4.5474	3.1239	0.1663
FROM LAYER 3	0.0688	0.5199	0.2245	0.0947	2.2473	4.1806
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
LAYER 10	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.004	0.003	0.000
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.002	0.004
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.003	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.001	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2020

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.60	136488.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.475	67063.930	49.14
DRAINAGE COLLECTED FROM LAYER 3	18.8090	68276.719	50.02
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001704	6.184	0.00
CHANGE IN WATER STORAGE	0.314	1141.135	0.84
SOIL WATER AT START OF YEAR	53.453	194035.734	
SOIL WATER AT END OF YEAR	54.128	196486.125	
SNOW WATER AT START OF YEAR	0.361	1309.265	0.96
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.062	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2021

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.99	1.76	3.63	1.82	0.97
	7.67	1.78	9.42	4.45	3.44	2.53
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.465	0.522	0.243	2.568	2.653	1.320
	4.148	1.967	3.287	2.062	1.027	0.562
LATERAL DRAINAGE COLLECTED	2.2686	0.1290	0.2804	3.8365	1.8100	0.1204
FROM LAYER 3	1.5897	1.4349	1.1491	3.9648	1.6960	2.7694
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.003	0.002	0.000
TOP OF LAYER 4	0.001	0.001	0.001	0.003	0.002	0.002
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.003	0.002	0.000
HEAD ON TOP OF LAYER 4	0.002	0.001	0.002	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2021

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.85	148285.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.824	75592.148	50.98
DRAINAGE COLLECTED FROM LAYER 3	21.0488	76407.125	51.53
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000002	0.006	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001641	5.957	0.00
CHANGE IN WATER STORAGE	-1.025	-3719.729	-2.51
SOIL WATER AT START OF YEAR	54.128	196486.125	
SOIL WATER AT END OF YEAR	52.556	190780.016	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.547	1986.390	1.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.99	3.81	3.24	4.96	2.11	1.49
	2.44	4.32	4.78	8.87	5.28	4.09
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.416	0.339	0.116	3.079	2.687	1.933
	2.684	3.304	2.756	2.121	1.128	0.564
LATERAL DRAINAGE COLLECTED	1.8350	0.1098	2.6368	5.1104	3.7949	0.2010
FROM LAYER 3	0.0752	0.0842	0.1985	2.0199	5.2541	3.9349
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.002	0.005	0.003	0.000
TOP OF LAYER 4	0.000	0.000	0.000	0.002	0.005	0.003
STD. DEVIATION OF DAILY	0.002	0.000	0.002	0.002	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.002	0.002	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2022

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.38	175619.437	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.125	76685.398	43.67
DRAINAGE COLLECTED FROM LAYER 3	25.2548	91675.016	52.20
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000002	0.006	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001592	5.779	0.00
CHANGE IN WATER STORAGE	1.998	7253.171	4.13
SOIL WATER AT START OF YEAR	52.556	190780.016	
SOIL WATER AT END OF YEAR	55.102	200019.578	
SNOW WATER AT START OF YEAR	0.547	1986.390	1.13
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.063	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.82	1.17	1.72	1.89	2.95	5.84
	3.98	6.22	3.54	6.55	2.60	7.00
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.470	0.428	0.364	2.451	3.324	5.143
	4.312	3.246	2.834	2.136	0.948	0.788
LATERAL DRAINAGE COLLECTED	4.1146	0.4088	1.7977	4.2445	1.6470	0.2197
FROM LAYER 3	0.1342	1.1840	0.9189	1.9582	2.9310	2.5552
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.000	0.002	0.004	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.002	0.003	0.002
STD. DEVIATION OF DAILY	0.002	0.000	0.001	0.002	0.001	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.001	0.001	0.001	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.28	178886.422	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.443	95989.648	53.66
DRAINAGE COLLECTED FROM LAYER 3	22.1136	80272.211	44.87
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001508	5.475	0.00
CHANGE IN WATER STORAGE	0.721	2619.033	1.46
SOIL WATER AT START OF YEAR	55.102	200019.578	
SOIL WATER AT END OF YEAR	55.823	202638.609	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.46	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.03	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.823	3.468	3.393
	3.508	2.878	2.168	1.585	0.835	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.808	0.928	1.341
	1.246	1.019	0.861	0.390	0.234	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.1365	0.7895	1.1714	4.5682	4.7942	0.8365
	0.6670	0.4333	0.8060	1.3272	2.6221	2.5283
STD. DEVIATIONS	1.1400	1.0885	1.1287	2.5124	2.1362	0.7970
	0.9783	0.4811	0.7978	1.1941	1.2547	1.3468
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

TOTALS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0010	0.0008	0.0010	0.0041	0.0041	0.0007
	0.0006	0.0004	0.0007	0.0011	0.0023	0.0022
STD. DEVIATIONS	0.0010	0.0010	0.0010	0.0022	0.0018	0.0007
	0.0008	0.0004	0.0007	0.0010	0.0011	0.0012

DAILY AVERAGE HEAD ON TOP OF LAYER 9

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.91 (5.063)	155770.6	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	21.349 (2.9846)	77498.23	49.752
LATERAL DRAINAGE COLLECTED FROM LAYER 3	21.68029 (3.66613)	78699.445	50.52267
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 4	0.002 (0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00000 (0.00000)	0.004	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00000 (0.00000)	0.005	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00231 (0.00068)	8.377	0.00538
CHANGE IN WATER STORAGE	-0.120 (1.8473)	-435.48	-0.280

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	1.05507	3829.92017
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 4	0.028	
MAXIMUM HEAD ON TOP OF LAYER 4	0.056	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	1.7 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00000	0.00003
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 9	0.000	
MAXIMUM HEAD ON TOP OF LAYER 9	0.004	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000011	0.04003
SNOW WATER	11.92	43258.5078
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6710	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770	

Maximum heads are computed using McEnroe's equations.

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	39.2059	0.3267
2	1.8831	0.1569
3	0.0100	0.0401
4	0.0000	0.0000
5	0.1800	0.7500
6	4.6800	0.3900
7	0.5400	0.0450
8	0.0020	0.0100
9	0.0000	0.0000
10	4.6423	0.3869
SNOW WATER	0.000	

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**                                                                              **
**                                                                              **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                  **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                      **
**                     USAE WATERWAYS EXPERIMENT STATION                        **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                              **
**                                                                              **
**********************************************************************************
**********************************************************************************


PRECIPITATION DATA FILE:    c:\JRL\ph2exp\NEWJRL4A.D4
TEMPERATURE DATA FILE:      c:\JRL\ph2exp\NEWJRL7.D7
SOLAR RADIATION DATA FILE:  c:\JRL\ph2exp\NEWJRL13.D13
EVAPOTRANSPIRATION DATA:    c:\JRL\ph2exp\DATA11.D11
SOIL AND DESIGN DATA FILE:  c:\JRL\ph2exp\60W_SSNR.D10
OUTPUT DATA FILE:           c:\JRL\ph2exp\60W_SSNR.OUT


TIME:  13:25     DATE:   9/23/2024


**********************************************************************************

     TITLE:  CASELLA - JUNIPER RIDGE EXPANSION - OPEN (60'WASTE)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =    720.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
          WILTING POINT                =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2931 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   1
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4170 VOL/VOL
          FIELD CAPACITY               =      0.0450 VOL/VOL
          WILTING POINT                =      0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0863 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999978000E-02 CM/SEC
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LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0104	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	400.0	FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3897	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 55.0, A SURFACE SLOPE OF 33.% AND A SLOPE LENGTH OF 180. FEET.

SCS RUNOFF CURVE NUMBER	=	61.50	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.119	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.368	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	222.141	INCHES
TOTAL INITIAL WATER	=	228.188	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM BANGOR MAINE

STATION LATITUDE	=	44.80 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	134
END OF GROWING SEASON (JULIAN DATE)	=	263
EVAPORATIVE ZONE DEPTH	=	8.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2009

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.77	2.47	1.68	3.99	3.94	8.10
	5.61	2.69	1.32	5.42	4.22	3.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.519	0.387	0.485	2.385	3.856	4.380
	5.442	1.583	1.906	1.332	0.397	0.260
LATERAL DRAINAGE COLLECTED	0.0991	0.0480	0.0438	1.3870	3.8072	3.1930
FROM LAYER 3	3.4476	3.4058	2.5644	0.6713	2.1974	0.9471
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.003	0.003
TOP OF LAYER 4	0.003	0.003	0.002	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 4	0.001	0.000	0.001	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.73	162369.891	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.933	83248.602	51.27
DRAINAGE COLLECTED FROM LAYER 3	21.8118	79177.016	48.76
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003725	13.523	0.01
CHANGE IN WATER STORAGE	-0.019	-69.237	-0.04
SOIL WATER AT START OF YEAR	226.821	823359.250	
SOIL WATER AT END OF YEAR	226.802	823290.000	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.52
SNOW WATER AT END OF YEAR	6.047	21949.807	13.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.47	2.19	4.68	2.24	1.73	4.38
	2.15	1.89	5.73	5.83	4.75	5.47
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.517	0.371	0.582	1.657	2.197	3.242
	3.255	1.775	2.610	1.560	0.520	0.346
LATERAL DRAINAGE COLLECTED	0.1000	0.0483	0.0375	0.9054	4.7916	4.0678
FROM LAYER 3	3.6174	3.2199	1.0939	1.8032	1.0007	3.3587
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.004	0.004
TOP OF LAYER 4	0.003	0.003	0.001	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.51	161571.312	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.632	67632.477	41.86
DRAINAGE COLLECTED FROM LAYER 3	24.0442	87280.539	54.02
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003362	12.205	0.01
CHANGE IN WATER STORAGE	1.831	6646.059	4.11
SOIL WATER AT START OF YEAR	226.802	823290.000	
SOIL WATER AT END OF YEAR	228.368	828976.500	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.59
SNOW WATER AT END OF YEAR	6.311	22909.367	14.18
ANNUAL WATER BUDGET BALANCE	0.0000	0.022	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.66	2.19	4.50	5.26	3.51	2.79
	2.10	8.32	2.79	5.16	2.19	3.85
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.449	0.450	0.631	0.755	4.469	2.299
	2.114	5.231	2.596	1.261	0.864	0.337
LATERAL DRAINAGE COLLECTED	1.9635	0.1351	0.0667	0.1565	3.8710	4.5434
FROM LAYER 3	3.9960	3.0194	2.2164	1.9191	2.1424	2.7350
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003
LAYER 10	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.000	0.003	0.004
TOP OF LAYER 4	0.003	0.003	0.002	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.32	160881.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.456	77885.383	48.41
DRAINAGE COLLECTED FROM LAYER 3	26.7646	97155.469	60.39
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.010	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.006	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003137	11.386	0.01
CHANGE IN WATER STORAGE	-3.904	-14170.639	-8.81
SOIL WATER AT START OF YEAR	228.368	828976.500	
SOIL WATER AT END OF YEAR	226.974	823913.875	
SNOW WATER AT START OF YEAR	6.311	22909.367	14.24
SNOW WATER AT END OF YEAR	3.802	13801.376	8.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.044	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.95	1.55	1.40	3.99	5.12	7.10
	0.58	2.60	6.33	6.96	1.13	1.13
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.506	0.418	0.532	1.794	4.602	4.203
	1.620	2.032	2.450	1.240	0.732	0.352
LATERAL DRAINAGE COLLECTED	1.1192	0.1009	0.0907	1.1432	2.3745	3.0062
FROM LAYER 3	2.8414	2.8799	2.0598	1.3827	1.9443	3.3049
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.001	0.002	0.003
TOP OF LAYER 4	0.002	0.002	0.002	0.001	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.84	144619.172	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.480	74342.016	51.41
DRAINAGE COLLECTED FROM LAYER 3	22.2477	80759.305	55.84
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002834	10.287	0.01
CHANGE IN WATER STORAGE	-2.890	-10492.355	-7.26
SOIL WATER AT START OF YEAR	226.974	823913.875	
SOIL WATER AT END OF YEAR	227.107	824397.312	
SNOW WATER AT START OF YEAR	3.802	13801.376	9.54
SNOW WATER AT END OF YEAR	0.778	2825.582	1.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.085	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2013

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.87	2.04	2.05	1.77	4.55	5.46
	3.74	4.69	7.17	1.02	3.76	2.93
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.331	0.496	0.517	0.450	4.283	4.463
	3.962	4.049	2.929	1.205	0.429	0.196
LATERAL DRAINAGE COLLECTED	1.2655	0.1034	0.0539	1.2623	2.5012	2.0153
FROM LAYER 3	1.2622	0.5552	0.7561	3.2124	0.9125	0.1014
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.001	0.002	0.002
TOP OF LAYER 4	0.001	0.000	0.001	0.003	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.000	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2013

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.05	145381.469	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	23.310	84616.117	58.20
DRAINAGE COLLECTED FROM LAYER 3	14.0015	50825.281	34.96
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0010		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002579	9.362	0.01
CHANGE IN WATER STORAGE	2.736	9930.732	6.83
SOIL WATER AT START OF YEAR	227.107	824397.312	
SOIL WATER AT END OF YEAR	224.363	814437.062	
SNOW WATER AT START OF YEAR	0.778	2825.582	1.94
SNOW WATER AT END OF YEAR	6.258	22716.549	15.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2014

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.18	1.99	3.65	2.28	3.31	3.59
	6.78	2.96	0.89	6.85	3.21	5.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.336	0.311	0.492	1.941	3.582	3.599
	4.623	3.372	0.632	1.657	0.885	0.290
LATERAL DRAINAGE COLLECTED	0.0812	1.5252	0.7915	0.8970	3.9964	3.4269
FROM LAYER 3	2.5417	2.2810	0.1645	0.1501	1.5060	2.3469
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.001	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.002	0.002	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.000	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.001	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2014

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.719	78839.578	49.45
DRAINAGE COLLECTED FROM LAYER 3	19.7084	71541.398	44.87
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002368	8.595	0.01
CHANGE IN WATER STORAGE	2.490	9040.080	5.67
SOIL WATER AT START OF YEAR	224.363	814437.062	
SOIL WATER AT END OF YEAR	233.111	846193.687	
SNOW WATER AT START OF YEAR	6.258	22716.549	14.25
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.087	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2015

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.69	2.20	1.45	2.39	2.32	4.90
	1.16	2.63	6.89	2.58	2.26	4.06
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.281	0.282	0.531	0.731	2.489	4.589
	1.928	2.942	1.388	1.813	0.991	0.876
LATERAL DRAINAGE COLLECTED	2.2727	2.4745	0.4494	0.9880	2.7374	3.3139
FROM LAYER 3	2.1775	0.1591	0.0652	1.4226	2.2772	1.5617
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.000	0.001	0.002	0.003
TOP OF LAYER 4	0.002	0.000	0.000	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.001	0.001	0.000
HEAD ON TOP OF LAYER 4	0.001	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2015

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.53	128973.898	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.840	68388.609	53.03
DRAINAGE COLLECTED FROM LAYER 3	19.8992	72233.961	56.01
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002267	8.230	0.01
CHANGE IN WATER STORAGE	-3.211	-11657.014	-9.04
SOIL WATER AT START OF YEAR	233.111	846193.687	
SOIL WATER AT END OF YEAR	229.210	832031.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.690	2505.669	1.94
ANNUAL WATER BUDGET BALANCE	0.0000	0.102	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2016

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.38	3.89	3.27	2.58	2.09	2.85
	2.69	2.24	1.23	3.20	4.16	3.77
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.552	0.224	0.437	1.459	2.330	2.618
	2.757	2.379	0.650	1.317	1.034	0.420
LATERAL DRAINAGE COLLECTED	2.3181	1.2165	1.6262	1.1100	3.6477	3.2073
FROM LAYER 3	1.3848	0.1153	0.0552	0.0357	1.0092	1.9944
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.001	0.000	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.001	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2016

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.508	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	16.178	58726.711	47.10
DRAINAGE COLLECTED FROM LAYER 3	17.7205	64325.336	51.59
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002152	7.812	0.01
CHANGE IN WATER STORAGE	0.449	1630.616	1.31
SOIL WATER AT START OF YEAR	229.210	832031.000	
SOIL WATER AT END OF YEAR	229.368	832605.625	
SNOW WATER AT START OF YEAR	0.690	2505.669	2.01
SNOW WATER AT END OF YEAR	0.981	3561.676	2.86
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2017

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.63	2.26	2.07	3.98	6.36	4.32
	1.91	1.64	2.69	5.59	3.05	3.83
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.408	0.345	0.459	2.206	4.561	4.180
	2.464	1.728	2.549	1.079	0.989	0.502
LATERAL DRAINAGE COLLECTED	2.6187	0.7283	1.6696	1.2262	1.9245	3.5470
FROM LAYER 3	3.2770	0.6530	0.2733	0.1587	0.8220	1.9283
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.001	0.001	0.002	0.003
TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2017

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.33	150027.906	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.471	77940.023	51.95
DRAINAGE COLLECTED FROM LAYER 3	18.8266	68340.562	45.55
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002026	7.354	0.00
CHANGE IN WATER STORAGE	1.030	3739.990	2.49
SOIL WATER AT START OF YEAR	229.368	832605.625	
SOIL WATER AT END OF YEAR	229.235	832122.562	
SNOW WATER AT START OF YEAR	0.981	3561.676	2.37
SNOW WATER AT END OF YEAR	2.145	7784.717	5.19
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2018

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.53	2.99	2.18	4.77	2.37	5.42
	2.48	2.73	2.63	4.66	7.00	4.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.346	0.355	0.501	1.121	3.377	4.198
	3.524	2.596	1.669	1.754	0.796	0.301
LATERAL DRAINAGE COLLECTED	2.5343	2.3982	1.7913	1.4790	2.6962	3.6350
FROM LAYER 3	3.2124	1.3328	0.1075	0.5737	0.9689	2.5690
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.002	0.001	0.002	0.003
TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2018

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.99	170573.687	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.538	74551.227	43.71
DRAINAGE COLLECTED FROM LAYER 3	23.2982	84572.422	49.58
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001935	7.024	0.00
CHANGE IN WATER STORAGE	3.152	11443.011	6.71
SOIL WATER AT START OF YEAR	229.235	832122.562	
SOIL WATER AT END OF YEAR	233.796	848677.812	
SNOW WATER AT START OF YEAR	2.145	7784.717	4.56
SNOW WATER AT END OF YEAR	0.736	2672.444	1.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2019

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.15	1.83	1.94	5.53	4.43	5.33
	4.46	7.54	2.81	5.80	3.97	3.21
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.429	0.397	0.421	1.788	4.885	4.132
	5.681	3.839	3.016	2.099	0.712	0.416
LATERAL DRAINAGE COLLECTED	3.3238	2.1942	2.4465	1.3330	2.9072	3.5674
FROM LAYER 3	2.9244	2.5158	2.0926	0.5827	1.2654	2.2202
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.002	0.001	0.003	0.003
TOP OF LAYER 4	0.003	0.002	0.002	0.001	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2019

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.00	188759.953	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.816	100971.445	53.49
DRAINAGE COLLECTED FROM LAYER 3	27.3733	99364.969	52.64
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001852	6.723	0.00
CHANGE IN WATER STORAGE	-3.191	-11583.134	-6.14
SOIL WATER AT START OF YEAR	233.796	848677.812	
SOIL WATER AT END OF YEAR	230.980	838457.875	
SNOW WATER AT START OF YEAR	0.736	2672.444	1.42
SNOW WATER AT END OF YEAR	0.361	1309.265	0.69
ANNUAL WATER BUDGET BALANCE	0.0000	-0.050	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2020

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.42	1.65	2.27	4.78	2.22	2.08
	4.21	3.55	0.28	4.40	5.22	4.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.432	0.284	0.251	2.952	2.721	0.599
	4.113	3.121	1.251	1.143	1.075	0.533
LATERAL DRAINAGE COLLECTED	2.8185	1.4157	1.2528	1.3911	3.5841	3.0069
FROM LAYER 3	0.3034	0.6098	0.2298	0.0727	2.1588	1.2512
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001
LAYER 10	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.001
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2020

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.60	136488.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.475	67063.930	49.14
DRAINAGE COLLECTED FROM LAYER 3	18.0947	65683.656	48.12
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001714	6.220	0.00
CHANGE IN WATER STORAGE	1.029	3734.162	2.74
SOIL WATER AT START OF YEAR	230.980	838457.875	
SOIL WATER AT END OF YEAR	232.370	843501.312	
SNOW WATER AT START OF YEAR	0.361	1309.265	0.96
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.059	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2021

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.99	1.76	3.63	1.82	0.97
	7.67	1.78	9.42	4.45	3.44	2.53
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.465	0.522	0.243	2.568	2.653	1.320
	4.148	1.967	3.287	2.062	1.027	0.562
LATERAL DRAINAGE COLLECTED	3.3997	1.8787	0.4189	1.5030	3.2512	0.9470
FROM LAYER 3	0.7861	2.2473	0.6293	2.4609	1.8326	1.2878
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.000	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.001	0.000	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2021

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.85	148285.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.824	75592.148	50.98
DRAINAGE COLLECTED FROM LAYER 3	20.6424	74931.953	50.53
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001618	5.872	0.00
CHANGE IN WATER STORAGE	-0.618	-2244.474	-1.51
SOIL WATER AT START OF YEAR	232.370	843501.312	
SOIL WATER AT END OF YEAR	231.204	839270.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.547	1986.390	1.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.99	3.81	3.24	4.96	2.11	1.49
	2.44	4.32	4.78	8.87	5.28	4.09
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.416	0.339	0.116	3.079	2.687	1.933
	2.684	3.304	2.756	2.121	1.128	0.564
LATERAL DRAINAGE COLLECTED	3.3661	1.8633	1.2091	1.1000	3.7471	3.3508
FROM LAYER 3	2.3444	0.2446	0.2599	1.4110	1.8316	1.9038
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.002	0.000	0.000	0.001	0.002	0.002
STD. DEVIATION OF DAILY	0.000	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.001	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2022

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.38	175619.437	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.125	76685.398	43.67
DRAINAGE COLLECTED FROM LAYER 3	22.6318	82153.312	46.78
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001575	5.718	0.00
CHANGE IN WATER STORAGE	4.621	16774.943	9.55
SOIL WATER AT START OF YEAR	231.204	839270.437	
SOIL WATER AT END OF YEAR	236.372	858031.750	
SNOW WATER AT START OF YEAR	0.547	1986.390	1.13
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.82	1.17	1.72	1.89	2.95	5.84
	3.98	6.22	3.54	6.55	2.60	7.00
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.470	0.428	0.364	2.451	3.324	5.143
	4.312	3.246	2.834	2.136	0.948	0.788
LATERAL DRAINAGE COLLECTED	3.5029	2.4144	2.2483	2.2734	3.7254	2.9782
FROM LAYER 3	1.3949	0.7678	1.3925	1.6492	2.3823	0.8989
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.002	0.002	0.003	0.003
TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.28	178886.422	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.443	95989.648	53.66
DRAINAGE COLLECTED FROM LAYER 3	25.6283	93030.594	52.01
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001492	5.417	0.00
CHANGE IN WATER STORAGE	-2.793	-10139.252	-5.67
SOIL WATER AT START OF YEAR	236.372	858031.750	
SOIL WATER AT END OF YEAR	233.579	847892.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.46	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.03	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.823	3.468	3.393
	3.508	2.878	2.168	1.585	0.835	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.808	0.928	1.341
	1.246	1.019	0.861	0.390	0.234	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	2.0522	1.2363	0.9464	1.2103	3.3042	3.1871
	2.3674	1.6004	0.9307	1.1671	1.6168	1.8940
STD. DEVIATIONS	1.2401	0.9628	0.8577	0.4430	0.7606	0.8320
	1.1154	1.2279	0.9048	0.9524	0.5708	0.9108
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 9

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

TOTALS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0018	0.0012	0.0008	0.0011	0.0029	0.0028
	0.0020	0.0014	0.0008	0.0010	0.0014	0.0016
STD. DEVIATIONS	0.0011	0.0009	0.0007	0.0004	0.0007	0.0007
	0.0010	0.0011	0.0008	0.0008	0.0005	0.0008

DAILY AVERAGE HEAD ON TOP OF LAYER 9

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.91 (5.063)	155770.6	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	21.349 (2.9846)	77498.23	49.752
LATERAL DRAINAGE COLLECTED FROM LAYER 3	21.51287 (3.65140)	78091.727	50.13253
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 4	0.002 (0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00000 (0.00000)	0.005	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00000 (0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00231 (0.00069)	8.382	0.00538
CHANGE IN WATER STORAGE	0.047 (2.7110)	172.23	0.111

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.19147	695.05389
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 4	0.005	
MAXIMUM HEAD ON TOP OF LAYER 4	0.012	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00000	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000000	0.00001
AVERAGE HEAD ON TOP OF LAYER 9	0.000	
MAXIMUM HEAD ON TOP OF LAYER 9	0.003	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000011	0.04010
SNOW WATER	11.92	43258.5078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6710
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	217.1553	0.3016
2	1.6951	0.1413
3	0.0046	0.0185
4	0.0000	0.0000
5	0.1800	0.7500
6	4.6800	0.3900
7	0.5400	0.0450
8	0.0020	0.0100
9	0.0000	0.0000
10	4.6423	0.3869
SNOW WATER	0.000	

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    c:\JRL\ph2exp\NEWJRL4.D4
TEMPERATURE DATA FILE:      c:\JRL\ph2exp\NEWJRL7.D7
SOLAR RADIATION DATA FILE:  c:\JRL\ph2exp\NEWJRL13.D13
EVAPOTRANSPIRATION DATA:    c:\JRL\ph2exp\DATA11.D11
SOIL AND DESIGN DATA FILE:  c:\JRL\ph2exp\165W_TSC.D10
OUTPUT DATA FILE:           c:\JRL\ph2exp\165W_TSC.OUT

TIME:  11:30     DATE:   9/23/2024

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     TITLE:  CASELLA - JUNIPER RIDGE EXPANSION - soil cover(165ft_Waste)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  12
          THICKNESS                    =     18.00   INCHES
          POROSITY                     =      0.4710 VOL/VOL
          FIELD CAPACITY               =      0.3420 VOL/VOL
          WILTING POINT                =      0.2100 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3781 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.419999997000E-04 CM/SEC

                                LAYER  2
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =   1980.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
          WILTING POINT                =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2920 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC
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LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0933	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0112	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	220.0	FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	400.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3898	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 74.0, A SURFACE SLOPE OF 10.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	75.40	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.385	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	3.768	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.680	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	596.167	INCHES
TOTAL INITIAL WATER	=	602.214	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM BANGOR MAINE

STATION LATITUDE	=	44.80	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	134	
END OF GROWING SEASON (JULIAN DATE)	=	263	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2009

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.77	2.47	1.68	3.99	3.94	8.10
	5.61	2.69	1.32	5.42	4.22	3.52
RUNOFF	0.272	0.087	8.044	3.582	0.000	2.640
	0.000	0.602	0.000	0.107	0.392	0.000
EVAPOTRANSPIRATION	0.519	0.387	0.485	2.378	3.429	4.429
	5.043	1.405	1.367	1.343	0.397	0.260
LATERAL DRAINAGE COLLECTED	0.1521	0.0598	0.0417	0.0922	1.1728	0.1805
FROM LAYER 4	1.3285	0.2294	0.4937	0.3022	1.4400	2.0693
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003
LAYER 11	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.002	0.000	0.001	0.000	0.002	0.003
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.001	0.000	0.001	0.000	0.002	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.73	162369.891	100.00
RUNOFF	15.728	57090.980	35.16
EVAPOTRANSPIRATION	21.441	77831.625	47.93
DRAINAGE COLLECTED FROM LAYER 4	7.5622	27450.787	16.91
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0008		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.003500	12.703	0.01
CHANGE IN WATER STORAGE	-0.005	-16.395	-0.01
SOIL WATER AT START OF YEAR	600.847	2181075.250	
SOIL WATER AT END OF YEAR	600.843	2181058.750	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.52
SNOW WATER AT END OF YEAR	6.047	21949.807	13.52
ANNUAL WATER BUDGET BALANCE	0.0001	0.193	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.47	2.19	4.68	2.24	1.73	4.38
	2.15	1.89	5.73	5.83	4.75	5.47
RUNOFF	0.000	0.000	10.661	5.321	0.000	0.007
	0.000	0.000	1.815	0.165	0.082	0.000
EVAPOTRANSPIRATION	0.517	0.371	0.582	1.653	1.751	3.092
	2.922	1.806	2.612	1.562	0.520	0.346
LATERAL DRAINAGE COLLECTED	0.1537	0.0601	0.0419	0.0203	0.5915	0.2064
FROM LAYER 4	0.3368	0.1272	0.3952	0.6987	0.5641	2.6269
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002
LAYER 11	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.001	0.001	0.001	0.003
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.51	161571.312	100.00
RUNOFF	18.051	65526.352	40.56
EVAPOTRANSPIRATION	17.735	64376.516	39.84
DRAINAGE COLLECTED FROM LAYER 4	5.8229	21137.271	13.08
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0006		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.003165	11.490	0.01
CHANGE IN WATER STORAGE	2.898	10519.772	6.51
SOIL WATER AT START OF YEAR	600.843	2181058.750	
SOIL WATER AT END OF YEAR	603.476	2190619.000	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.59
SNOW WATER AT END OF YEAR	6.311	22909.367	14.18
ANNUAL WATER BUDGET BALANCE	0.0000	-0.097	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.66	2.19	4.50	5.26	3.51	2.79
	2.10	8.32	2.79	5.16	2.19	3.85
RUNOFF	0.000	0.000	1.398	16.313	0.000	0.000
	0.000	0.445	0.000	0.016	0.000	0.000
EVAPOTRANSPIRATION	0.449	0.450	0.631	0.736	3.804	2.376
	2.048	5.186	2.610	1.262	0.865	0.337
LATERAL DRAINAGE COLLECTED	2.5982	0.1983	0.0785	0.0410	0.6445	0.3653
FROM LAYER 4	0.1257	0.3827	1.3428	0.8512	1.1780	2.1406
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003
LAYER 11	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.002	0.001	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.32	160881.562	100.00
RUNOFF	18.173	65969.016	41.00
EVAPOTRANSPIRATION	20.753	75333.953	46.83
DRAINAGE COLLECTED FROM LAYER 4	9.9470	36107.445	22.44
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0011		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002990	10.854	0.01
CHANGE IN WATER STORAGE	-4.556	-16539.920	-10.28
SOIL WATER AT START OF YEAR	603.476	2190619.000	
SOIL WATER AT END OF YEAR	601.429	2183187.000	
SNOW WATER AT START OF YEAR	6.311	22909.367	14.24
SNOW WATER AT END OF YEAR	3.802	13801.376	8.58
ANNUAL WATER BUDGET BALANCE	0.0001	0.206	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.95	1.55	1.40	3.99	5.12	7.10
	0.58	2.60	6.33	6.96	1.13	1.13
RUNOFF	0.528	0.000	4.933	1.663	0.043	1.185
	0.000	0.048	1.133	1.187	0.000	0.000
EVAPOTRANSPIRATION	0.506	0.418	0.532	1.794	4.234	3.789
	1.147	1.706	2.218	1.240	0.733	0.352
LATERAL DRAINAGE COLLECTED	1.3101	0.1080	0.0578	0.0433	0.4796	2.1761
FROM LAYER 4	1.8404	0.8633	1.2392	1.1833	0.7991	2.8745
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0002	0.0003	0.0002	0.0002	0.0002
LAYER 11	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.000	0.001	0.003
TOP OF LAYER 5	0.002	0.001	0.002	0.002	0.001	0.004
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 5	0.001	0.002	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.84	144619.172	100.00
RUNOFF	10.721	38916.234	26.91
EVAPOTRANSPIRATION	18.669	67766.891	46.86
DRAINAGE COLLECTED FROM LAYER 4	12.9748	47098.617	32.57
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002851	10.348	0.01
CHANGE IN WATER STORAGE	-2.527	-9172.536	-6.34
SOIL WATER AT START OF YEAR	601.429	2183187.000	
SOIL WATER AT END OF YEAR	601.926	2184990.250	
SNOW WATER AT START OF YEAR	3.802	13801.376	9.54
SNOW WATER AT END OF YEAR	0.778	2825.582	1.95
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.384	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2013

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.87	2.04	2.05	1.77	4.55	5.46
	3.74	4.69	7.17	1.02	3.76	2.93
RUNOFF	0.127	0.380	2.864	1.506	0.049	0.049
	0.000	0.174	2.299	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.331	0.496	0.517	0.450	3.846	3.738
	3.735	3.513	2.943	0.810	0.429	0.196
LATERAL DRAINAGE COLLECTED	1.9008	0.1337	0.0664	0.0387	0.4950	0.8023
FROM LAYER 4	1.5161	0.8407	0.3597	2.4799	0.2668	0.0818
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.000	0.001	0.001
TOP OF LAYER 5	0.002	0.001	0.000	0.003	0.000	0.000
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 5	0.001	0.001	0.000	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2013

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.05	145381.469	100.00
RUNOFF	7.449	27038.979	18.60
EVAPOTRANSPIRATION	21.004	76243.930	52.44
DRAINAGE COLLECTED FROM LAYER 4	8.9818	32603.986	22.43
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0010		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002562	9.301	0.01
CHANGE IN WATER STORAGE	2.613	9485.291	6.52
SOIL WATER AT START OF YEAR	601.926	2184990.250	
SOIL WATER AT END OF YEAR	599.059	2174584.750	
SNOW WATER AT START OF YEAR	0.778	2825.582	1.94
SNOW WATER AT END OF YEAR	6.258	22716.549	15.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.022	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2014

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.18	1.99	3.65	2.28	3.31	3.59
	6.78	2.96	0.89	6.85	3.21	5.23
RUNOFF	4.648	0.512	3.379	4.736	0.000	0.000
	0.949	0.000	0.000	0.745	0.000	4.045
EVAPOTRANSPIRATION	0.336	0.311	0.492	1.938	3.205	3.373
	3.976	2.966	0.643	1.667	0.886	0.290
LATERAL DRAINAGE COLLECTED	0.0466	0.0293	0.0248	0.0130	0.6661	0.2975
FROM LAYER 4	0.2927	1.4641	0.2592	0.3085	0.7711	1.7773
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.002	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2014

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.562	100.00
RUNOFF	19.013	69017.797	43.29
EVAPOTRANSPIRATION	20.084	72905.437	45.73
DRAINAGE COLLECTED FROM LAYER 4	5.9502	21599.123	13.55
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0006		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002373	8.614	0.01
CHANGE IN WATER STORAGE	-1.130	-4101.720	-2.57
SOIL WATER AT START OF YEAR	599.059	2174584.750	
SOIL WATER AT END OF YEAR	604.187	2193199.500	
SNOW WATER AT START OF YEAR	6.258	22716.549	14.25
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.313	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2015

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.69	2.20	1.45	2.39	2.32	4.90
	1.16	2.63	6.89	2.58	2.26	4.06
RUNOFF	0.867	0.000	2.369	4.089	0.000	0.013
	0.000	0.000	3.798	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.281	0.282	0.531	0.723	2.090	4.279
	1.482	2.939	1.294	1.819	0.990	0.878
LATERAL DRAINAGE COLLECTED	2.8852	0.2559	0.0856	0.0436	0.5930	0.2964
FROM LAYER 4	0.4947	0.1163	0.1184	0.5161	0.8421	0.8907
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.001	0.000	0.000	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2015

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.53	128973.898	100.00
RUNOFF	11.136	40422.434	31.34
EVAPOTRANSPIRATION	17.587	63841.730	49.50
DRAINAGE COLLECTED FROM LAYER 4	7.1379	25910.723	20.09
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0008		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002182	7.920	0.01
CHANGE IN WATER STORAGE	-0.333	-1208.744	-0.94
SOIL WATER AT START OF YEAR	604.187	2193199.500	
SOIL WATER AT END OF YEAR	603.164	2189485.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.690	2505.669	1.94
ANNUAL WATER BUDGET BALANCE	0.0000	-0.170	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2016

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.38	3.89	3.27	2.58	2.09	2.85
	2.69	2.24	1.23	3.20	4.16	3.77
RUNOFF	1.752	3.522	2.786	2.482	0.000	0.000
	0.000	0.000	0.000	0.000	0.001	1.088
EVAPOTRANSPIRATION	0.552	0.223	0.437	1.319	1.797	2.705
	3.063	2.019	0.647	1.332	1.039	0.421
LATERAL DRAINAGE COLLECTED	1.6750	1.2977	0.1205	0.0403	0.6879	0.1215
FROM LAYER 4	0.0599	0.0386	0.0271	0.0327	0.6840	1.1622
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2016

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.508	100.00
RUNOFF	11.631	42220.090	33.86
EVAPOTRANSPIRATION	15.555	56463.582	45.28
DRAINAGE COLLECTED FROM LAYER 4	5.9474	21588.902	17.31
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0006		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002126	7.718	0.01
CHANGE IN WATER STORAGE	1.215	4410.167	3.54
SOIL WATER AT START OF YEAR	603.164	2189485.000	
SOIL WATER AT END OF YEAR	604.088	2192839.250	
SNOW WATER AT START OF YEAR	0.690	2505.669	2.01
SNOW WATER AT END OF YEAR	0.981	3561.676	2.86
ANNUAL WATER BUDGET BALANCE	0.0000	0.045	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2017

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.63	2.26	2.07	3.98	6.36	4.32
	1.91	1.64	2.69	5.59	3.05	3.83
RUNOFF	2.844	2.998	1.419	2.086	0.443	0.000
	0.000	0.000	0.001	1.363	0.000	0.006
EVAPOTRANSPIRATION	0.408	0.345	0.458	2.207	4.364	4.024
	2.547	1.706	1.982	1.115	0.988	0.502
LATERAL DRAINAGE COLLECTED	2.9962	0.3136	0.0904	0.0291	0.9126	1.8339
FROM LAYER 4	0.1707	0.0679	0.2897	0.3720	0.5546	1.0279
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
LAYER 11	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.000	0.000	0.000	0.001	0.002
TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 5	0.000	0.000	0.001	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2017

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.33	150027.906	100.00
RUNOFF	11.159	40507.996	27.00
EVAPOTRANSPIRATION	20.647	74949.992	49.96
DRAINAGE COLLECTED FROM LAYER 4	8.6587	31431.002	20.95
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0009		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002009	7.291	0.00
CHANGE IN WATER STORAGE	0.863	3131.870	2.09
SOIL WATER AT START OF YEAR	604.088	2192839.250	
SOIL WATER AT END OF YEAR	603.787	2191748.000	
SNOW WATER AT START OF YEAR	0.981	3561.676	2.37
SNOW WATER AT END OF YEAR	2.145	7784.717	5.19
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.248	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2018

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.53	2.99	2.18	4.77	2.37	5.42
	7.38	2.73	2.63	4.66	7.00	4.23
RUNOFF	6.430	2.491	1.838	2.558	0.000	0.074
	3.282	0.000	0.044	0.010	0.607	1.571
EVAPOTRANSPIRATION	0.346	0.355	0.502	1.121	3.073	4.153
	3.465	2.781	1.146	1.758	0.797	0.301
LATERAL DRAINAGE COLLECTED	3.0777	0.4775	0.0980	0.0548	1.0230	1.1144
FROM LAYER 4	0.5846	1.1738	0.0997	0.6005	0.7805	1.2910
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0001	0.0002	0.0002	0.0002	0.0001	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.001	0.000	0.000	0.001	0.001
TOP OF LAYER 5	0.001	0.001	0.000	0.001	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.000	0.001	0.002
HEAD ON TOP OF LAYER 5	0.001	0.002	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2018

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.89	188360.672	100.00
RUNOFF	18.905	68624.398	36.43
EVAPOTRANSPIRATION	19.798	71866.492	38.15
DRAINAGE COLLECTED FROM LAYER 4	10.3755	37663.160	20.00
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0011		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001920	6.969	0.00
CHANGE IN WATER STORAGE	2.810	10199.573	5.41
SOIL WATER AT START OF YEAR	603.787	2191748.000	
SOIL WATER AT END OF YEAR	608.005	2207060.000	
SNOW WATER AT START OF YEAR	2.145	7784.717	4.13
SNOW WATER AT END OF YEAR	0.736	2672.444	1.42
ANNUAL WATER BUDGET BALANCE	0.0000	0.072	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2019

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.15	1.83	1.94	5.53	4.43	5.33
	4.46	7.54	2.81	5.80	3.97	3.21
RUNOFF	3.858	0.619	3.806	2.063	0.000	0.125
	0.000	1.480	0.000	0.232	0.048	1.662
EVAPOTRANSPIRATION	0.429	0.397	0.421	1.789	4.845	3.652
	5.169	4.030	2.757	2.100	0.713	0.416
LATERAL DRAINAGE COLLECTED	3.1817	2.7707	1.0652	0.1193	1.2163	1.5731
FROM LAYER 4	0.8515	0.6313	0.7851	0.5918	0.7961	1.5032
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.004	0.001	0.000	0.002	0.002
TOP OF LAYER 5	0.001	0.001	0.001	0.001	0.001	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.002	0.000	0.002	0.002
HEAD ON TOP OF LAYER 5	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2019

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.00	188759.953	100.00
RUNOFF	13.894	50436.719	26.72
EVAPOTRANSPIRATION	26.717	96980.898	51.38
DRAINAGE COLLECTED FROM LAYER 4	15.0853	54759.664	29.01
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0016		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001855	6.733	0.00
CHANGE IN WATER STORAGE	-3.698	-13424.111	-7.11
SOIL WATER AT START OF YEAR	608.005	2207060.000	
SOIL WATER AT END OF YEAR	604.683	2194999.000	
SNOW WATER AT START OF YEAR	0.736	2672.444	1.42
SNOW WATER AT END OF YEAR	0.361	1309.265	0.69
ANNUAL WATER BUDGET BALANCE	0.0000	0.048	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2020

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.42	1.65	2.27	4.78	2.22	2.08
	4.21	3.55	0.28	4.40	5.22	4.52
RUNOFF	2.265	1.327	1.983	1.362	0.000	0.000
	0.442	0.270	0.000	0.135	0.202	1.053
EVAPOTRANSPIRATION	0.432	0.284	0.251	2.819	2.301	0.619
	4.127	2.726	0.779	1.152	1.077	0.533
LATERAL DRAINAGE COLLECTED	3.1234	0.6111	0.0979	0.1360	2.1938	0.2115
FROM LAYER 4	0.1320	0.4223	0.3504	0.1128	1.6674	0.7405
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
LAYER 11	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.001	0.000	0.000	0.003	0.000
TOP OF LAYER 5	0.000	0.001	0.000	0.000	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2020

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.60	136488.031	100.00
RUNOFF	9.038	32807.461	24.04
EVAPOTRANSPIRATION	17.101	62075.695	45.48
DRAINAGE COLLECTED FROM LAYER 4	9.7991	35570.578	26.06
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0010		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001694	6.151	0.00
CHANGE IN WATER STORAGE	1.661	6028.280	4.42
SOIL WATER AT START OF YEAR	604.683	2194999.000	
SOIL WATER AT END OF YEAR	606.704	2202336.500	
SNOW WATER AT START OF YEAR	0.361	1309.265	0.96
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.134	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2021

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.99	1.76	3.63	1.82	0.97
	7.67	1.78	9.42	4.45	3.44	2.53
RUNOFF	0.812	0.719	2.148	1.098	0.000	0.000
	2.364	0.000	2.441	1.380	0.000	0.000
EVAPOTRANSPIRATION	0.465	0.522	0.243	2.153	2.266	1.163
	3.616	1.912	3.292	1.809	1.026	0.561
LATERAL DRAINAGE COLLECTED	2.9150	2.6709	0.2949	0.5351	0.5298	0.1494
FROM LAYER 4	0.2605	1.1787	0.1694	1.6209	1.6623	0.7180
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001
LAYER 11	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.004	0.000	0.001	0.001	0.000
TOP OF LAYER 5	0.000	0.001	0.000	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.001	0.000	0.000
HEAD ON TOP OF LAYER 5	0.001	0.002	0.001	0.001	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2021

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.85	148285.516	100.00
RUNOFF	10.962	39792.113	26.83
EVAPOTRANSPIRATION	19.029	69073.656	46.58
DRAINAGE COLLECTED FROM LAYER 4	12.7049	46118.781	31.10
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001628	5.911	0.00
CHANGE IN WATER STORAGE	-1.847	-6705.093	-4.52
SOIL WATER AT START OF YEAR	606.704	2202336.500	
SOIL WATER AT END OF YEAR	604.310	2193645.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.547	1986.390	1.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.141	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.99	3.81	3.24	4.96	2.11	1.49
	2.44	4.32	4.78	8.87	5.28	4.09
RUNOFF	0.005	5.178	3.705	0.178	0.000	0.000
	0.000	0.483	0.186	2.556	0.279	0.006
EVAPOTRANSPIRATION	0.416	0.339	0.116	3.067	2.311	1.905
	2.410	3.216	2.282	2.025	1.130	0.564
LATERAL DRAINAGE COLLECTED	2.5801	1.4024	0.1303	0.1996	2.1244	0.4002
FROM LAYER 4	0.0731	0.3026	0.3370	0.8786	0.7209	0.8926
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 11	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.000	0.000	0.003	0.001
TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.000	0.000	0.002	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2022

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.38	175619.437	100.00
RUNOFF	12.576	45651.855	25.99
EVAPOTRANSPIRATION	19.781	71805.211	40.89
DRAINAGE COLLECTED FROM LAYER 4	10.0418	36451.695	20.76
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0011		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001535	5.573	0.00
CHANGE IN WATER STORAGE	5.979	21705.209	12.36
SOIL WATER AT START OF YEAR	604.310	2193645.000	
SOIL WATER AT END OF YEAR	610.837	2217336.750	
SNOW WATER AT START OF YEAR	0.547	1986.390	1.13
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.113	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.82	1.17	1.72	1.89	2.95	5.84
	3.98	6.22	3.54	6.55	2.60	7.00
RUNOFF	2.429	1.432	2.783	0.602	0.008	0.000
	0.000	2.084	0.371	2.141	0.000	1.886
EVAPOTRANSPIRATION	0.470	0.428	0.364	1.935	3.009	4.896
	3.586	3.144	2.439	1.791	0.954	0.789
LATERAL DRAINAGE COLLECTED	2.2149	2.9482	3.1271	2.1053	1.2195	0.4082
FROM LAYER 4	0.5171	0.7067	0.2756	1.3500	1.5815	0.5940
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 11	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.004	0.004	0.003	0.002	0.001
TOP OF LAYER 5	0.001	0.001	0.000	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 5	0.000	0.001	0.000	0.001	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.28	178886.422	100.00
RUNOFF	13.737	49864.211	27.87
EVAPOTRANSPIRATION	23.804	86409.898	48.30
DRAINAGE COLLECTED FROM LAYER 4	17.0482	61885.008	34.59
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0018		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001530	5.555	0.00
CHANGE IN WATER STORAGE	-5.311	-19278.172	-10.78
SOIL WATER AT START OF YEAR	610.837	2217336.750	
SOIL WATER AT END OF YEAR	605.526	2198058.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.087	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.79	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.24	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	1.789	1.284	3.608	3.309	0.036	0.273
	0.469	0.372	0.806	0.669	0.107	0.754
STD. DEVIATIONS	1.960	1.576	2.568	3.891	0.114	0.721
	1.006	0.618	1.216	0.855	0.185	1.162
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.739	3.088	3.213
	3.222	2.737	1.934	1.519	0.836	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.760	0.986	1.237
	1.166	1.026	0.883	0.372	0.235	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	2.0540	0.8892	0.3614	0.2341	0.9700	0.6758
	0.5723	0.5697	0.4361	0.7933	0.9539	1.3594
STD. DEVIATIONS	1.1452	1.0736	0.8073	0.5339	0.5493	0.6762
	0.5641	0.4549	0.3917	0.6470	0.4413	0.7935
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0026	0.0012	0.0005	0.0003	0.0012	0.0009
	0.0007	0.0007	0.0006	0.0010	0.0012	0.0017
STD. DEVIATIONS	0.0014	0.0015	0.0010	0.0007	0.0007	0.0009
	0.0007	0.0006	0.0005	0.0008	0.0006	0.0010

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES		CU. FEET	PERCENT
PRECIPITATION	43.24	(5.486)	156956.3	100.00
RUNOFF	13.478	(3.7171)	48925.78	31.172
EVAPOTRANSPIRATION	19.980	(2.7462)	72528.36	46.209
LATERAL DRAINAGE COLLECTED FROM LAYER 4	9.86918	(3.36872)	35825.117	22.82489
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.008	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	0.00000	(0.00000)	0.005	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 10	0.000	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00226	(0.00063)	8.209	0.00523
CHANGE IN WATER STORAGE	-0.091	(3.1345)	-331.10	-0.211

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	3.861	14014.4824
DRAINAGE COLLECTED FROM LAYER 4	0.16112	584.85968
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 5	0.006	
MAXIMUM HEAD ON TOP OF LAYER 5	0.012	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	6.3 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.00000	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	
MAXIMUM HEAD ON TOP OF LAYER 10	0.004	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000011	0.04064
SNOW WATER	11.92	43258.5078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4707
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2100

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	7.2050	0.4003
2	582.3653	0.2941
3	1.2274	0.1023
4	0.0025	0.0102
5	0.0000	0.0000
6	0.1800	0.7500
7	4.6800	0.3900
8	0.5400	0.0450
9	0.0020	0.0100
10	0.0000	0.0000
11	4.6435	0.3870
SNOW WATER	0.000	

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D-2

ALTERNATIVE LINER ANALYSIS

SME
SEVEE & MAHER
ENGINEERS

ALTERNATIVE DESIGN - HELP MODEL SUMMARY

HELP MODEL INPUT FOR MINIMUM DESIGN STANDARD LINER SYSTEM TO SUPPORT 3-YEARS TRAVEL TIME OFFSET (1-ACRE AREA)

LAYER INFORMATION									GEOMEMBRANE		
NO.	TYPE	DESCRIPTION	DESCRIPTION	THICKNESS (INCHES)	SOIL TEXTURE NO	SAT. HYD CONDUCTIVITY (CM/SEC)	DRAIN LENGTH (FEET)	DRAIN SLOPE (%)	PIN HOLE DENSITY (#/ACRE)	INSTALL DEFECTS (#/ACRE)	PLACEMENT QUALITY
1	1	VERTICAL PERCOLATION	WASTE	120	18	1.00E-03					
2	2	LATERAL DRAINAGE	LEACHATE COLLECTION SAND	12		5.00E-03	50	2			
3	4	GEOMEMBRANE LINER	PRIMARY LINER GEOMEMBRANE	0.06	35	2.00E-13			1	3	3
4	3	BARRIER SOIL LINER	PRIMARY LINER SOIL	24	16	1.00E-07					
5	2	LATERAL DRAINAGE LAYER	LEAK DETECTION SAND	12		5.00E-03	400	2			
6	4	GEOMEMBRANE LINER	SECONDARY LINER GEOMEMBRANE	0.04	35	2.00E-13			1	3	3
7	3	BARRIER SOIL LINER	SECONDARY LINER SOIL	24	16	1.00E-07					
8	1	VERTICAL PERCOLATION	NATIVE SOIL	24		8.50E-06					

HELP MODEL INPUT FOR ALTERNATIVE DESIGN LINER SYSTEM TO SUPPORT 3-YEARS TRAVEL TIME OFFSET (1-ACRE AREA)

LAYER INFORMATION									GEOMEMBRANE		
NO.	TYPE	DESCRIPTION	DESCRIPTION	THICKNESS (INCHES)	SOIL TEXTURE NO	SAT. HYD CONDUCTIVITY (CM/SEC)	DRAIN LENGTH (FEET)	DRAIN SLOPE (%)	PIN HOLE DENSITY (#/ACRE)	INSTALL DEFECTS (#/ACRE)	PLACEMENT QUALITY
1	1	VERTICAL PERCOLATION	WASTE	120	18	1.00E-03					
2	2	LATERAL DRAINAGE	LEACHATE COLLECTION SAND	12		1.00E-02					
3	2	LATERAL DRAINAGE	LEACHATE COLLECTION COMPOSITE	0.25	34	3.30E+01	125	2			
4	4	GEOMEMBRANE LINER	PRIMARY LINER GEOMEMBRANE	0.08	35	2.00E-13			1	3	3
5	3	BARRIER (GCL)	PRIMARY LINER GCL	0.24		5.00E-09					
NM*			PRIMARY LINER SOIL	12		1.00E-07					
6	2	LATERAL DRAINAGE	LEAK DETECTION SAND	12		5.00E-03					
7	2	LATERAL DRAINAGE	LEAK DETECTION COMPOSITE	0.2		1.00E+01	400	2			
8	4	GEOMEMBRANE LINER	SECONDARY LINER GEOMEMBRANE	0.06	35	2.00E-13			1	3	3
9	3	BARRIER SOIL LINER	SECONDARY LINER SOIL	12		1.00E-05					
10	1	VERTICAL PERCOLATION	NATIVE SOIL	24		8.50E-06					

Note: NM" = Not Modeled. Primary Liner Soil Barrier layer was not inlcuded in HELP Model for this option as the GCL restricts the flow (conservative assumption).

SUMMARY OF HELP MODEL RESULTS

	Regulation Liner		Alternative Liner	
	Cubic Feet/Acre/Year	Gallons/Acre/Year	Cubic Feet/Acre/Year	Gallons/Acre/Year
Average Annual Leachate Drained into Leachate Collection System	80,151.09	599,570	79,832.020	597,183
Average Annual Leakage through Primary Liner	4.490	33.59	0.009	0.07
Average Annual Leachate Collected by Leak Detection System	4.367	32.67	0.001	0.01
Average Annual Leakage to native soil below liner	0.021	0.16	0.008	0.06

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\newjrl4.D4
TEMPERATURE DATA FILE:      C:\newjrl7.D7
SOLAR RADIATION DATA FILE:  C:\newjrl13.D13
EVAPOTRANSPIRATION DATA:    C:\data11.D11
SOIL AND DESIGN DATA FILE:  C:\mindes8.D10
OUTPUT DATA FILE:           C:\mindes8.OUT



TIME:  14:30     DATE:  10/30/2025



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     TITLE:  MINIMUM DESIGN STANDARD LINER SYSTEM

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
               COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.



                                  LAYER  1
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                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  18
           THICKNESS                     =    120.00   INCHES
```

POROSITY	=	0.6710 VOL/VOL
FIELD CAPACITY	=	0.2920 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2984 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4370 VOL/VOL
FIELD CAPACITY	=	0.0620 VOL/VOL
WILTING POINT	=	0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0663 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999989000E-02 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	20.0 FEET

LAYER 3

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 4

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES

POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4370 VOL/VOL
FIELD CAPACITY	=	0.0620 VOL/VOL
WILTING POINT	=	0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0620 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999989000E-02 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	400.0 FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.04 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES

POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4640 VOL/VOL
FIELD CAPACITY	=	0.3100 VOL/VOL
WILTING POINT	=	0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.850000015000E-05 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	55.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.101	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.368	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.281	INCHES
TOTAL INITIAL WATER	=	71.328	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BANGOR MAINE

STATION LATITUDE	=	44.80 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	134
END OF GROWING SEASON (JULIAN DATE)	=	263
EVAPORATIVE ZONE DEPTH	=	8.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.79	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.24	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.818	3.413	3.379
	3.530	2.871	2.122	1.579	0.835	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.804	0.955	1.327
	1.263	1.021	0.884	0.398	0.234	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 2						
TOTALS	1.3240	0.7818	1.0852	3.9125	5.2336	1.2106
	0.8104	0.5962	0.7576	1.3944	2.4141	2.5598
STD. DEVIATIONS	1.1887	0.9468	0.9897	2.1954	2.3257	0.8439
	1.0182	0.5822	0.6809	1.1219	1.0828	1.2676
PERCOLATION/LEAKAGE THROUGH LAYER 4						
TOTALS	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001
	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
	0.0001	0.0000	0.0000	0.0001	0.0000	0.0001
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 3

AVERAGES	1.3032	0.8775	1.1084	3.2152	4.0565	1.2653
	0.8001	0.6269	0.8149	1.3879	2.3702	2.3782
STD. DEVIATIONS	1.0731	0.9895	0.9709	1.2161	1.1933	0.7998
	0.9348	0.5770	0.7098	1.0086	0.8773	1.0551

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0023	0.0022	0.0021	0.0022	0.0026	0.0027
	0.0025	0.0024	0.0022	0.0021	0.0022	0.0023
STD. DEVIATIONS	0.0005	0.0005	0.0005	0.0005	0.0004	0.0003
	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES	CU. FEET	PERCENT

PRECIPITATION	43.24	(5.486)	156956.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	21.238	(2.9723)	77093.34	49.118
LATERAL DRAINAGE COLLECTED FROM LAYER 2	22.08019	(4.16156)	80151.094	51.06585
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00124	(0.00020)	4.499	0.00287
AVERAGE HEAD ON TOP OF LAYER 3	1.684	(0.282)		
LATERAL DRAINAGE COLLECTED FROM LAYER 5	0.00120	(0.00015)	4.367	0.00278
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00001	(0.00000)	0.021	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.002	(0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.081	(1.9895)	-292.43	-0.186

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 2	0.73886	2682.05347
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000019	0.07040
AVERAGE HEAD ON TOP OF LAYER 3	10.750	

MAXIMUM HEAD ON TOP OF LAYER 3		12.755	
LOCATION OF MAXIMUM HEAD IN LAYER 2 (DISTANCE FROM DRAIN)		15.1 FEET	
DRAINAGE COLLECTED FROM LAYER 5		0.00000	0.01756
PERCOLATION/LEAKAGE THROUGH LAYER 7		0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 6		0.003	
MAXIMUM HEAD ON TOP OF LAYER 6		0.007	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)		0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 8		0.000000	0.00000
SNOW WATER		11.92	43258.5078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6710
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	39.0724	0.3256
2	2.3662	0.1972

3	0.0000	0.0000
4	10.2480	0.4270
5	0.7450	0.0621
6	0.0000	0.0000
7	10.2480	0.4270
8	7.4399	0.3100
SNOW WATER	0.000	

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\newjrl4.D4
TEMPERATURE DATA FILE:      C:\newjrl7.D7
SOLAR RADIATION DATA FILE:  C:\newjrl13.D13
EVAPOTRANSPIRATION DATA:    C:\data11.D11
SOIL AND DESIGN DATA FILE:  C:\ALTDES6.D10
OUTPUT DATA FILE:           C:\ALTDES6.OUT



TIME:  13:57     DATE:  10/30/2025



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     TITLE:  ALTERNATIVE DESIGN LINER SYSTEM

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
               COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.



                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  18
           THICKNESS                     =    120.00   INCHES
```

POROSITY	=	0.6710	VOL/VOL
FIELD CAPACITY	=	0.2920	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2984	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 2

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.0620	VOL/VOL
WILTING POINT	=	0.0240	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1035	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0104	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	125.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL

INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY = 1.00 HOLES/ACRE
FML INSTALLATION DEFECTS = 3.00 HOLES/ACRE
FML PLACEMENT QUALITY = 3 - GOOD

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0
THICKNESS = 0.24 INCHES
POROSITY = 0.7500 VOL/VOL
FIELD CAPACITY = 0.7470 VOL/VOL
WILTING POINT = 0.4000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.7500 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.499999997000E-08 CM/SEC

LAYER 6

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0
THICKNESS = 12.00 INCHES
POROSITY = 0.4370 VOL/VOL
FIELD CAPACITY = 0.0620 VOL/VOL
WILTING POINT = 0.0240 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0620 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.499999989000E-02 CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20
THICKNESS = 0.20 INCHES
POROSITY = 0.8500 VOL/VOL
FIELD CAPACITY = 0.0100 VOL/VOL
WILTING POINT = 0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 10.0000000000 CM/SEC

SLOPE = 2.00 PERCENT
DRAINAGE LENGTH = 400.0 FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS = 0.06 INCHES
POROSITY = 0.0000 VOL/VOL
FIELD CAPACITY = 0.0000 VOL/VOL
WILTING POINT = 0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY = 1.00 HOLES/ACRE
FML INSTALLATION DEFECTS = 3.00 HOLES/ACRE
FML PLACEMENT QUALITY = 3 - GOOD

LAYER 9

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS = 12.00 INCHES
POROSITY = 0.4270 VOL/VOL
FIELD CAPACITY = 0.4180 VOL/VOL
WILTING POINT = 0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.999999997000E-06 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS = 24.00 INCHES
POROSITY = 0.4640 VOL/VOL
FIELD CAPACITY = 0.3100 VOL/VOL
WILTING POINT = 0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.850000015000E-05 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	55.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.099	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.368	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	50.537	INCHES
TOTAL INITIAL WATER	=	56.584	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BANGOR MAINE

STATION LATITUDE	=	44.80	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	134	
END OF GROWING SEASON (JULIAN DATE)	=	263	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC

2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.79	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.24	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION

TOTALS	0.430	0.374	0.437	1.823	3.475	3.392
	3.533	2.884	2.140	1.585	0.835	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.808	0.928	1.339
	1.253	1.018	0.884	0.389	0.234	0.192

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	1.1548	0.7973	1.1557	4.5477	4.8054	0.8555
	0.8737	0.5202	0.8059	1.3348	2.6070	2.5340
STD. DEVIATIONS	1.1499	1.0805	1.1181	2.5072	2.1270	0.7966
	1.1587	0.5183	0.7807	1.1725	1.2625	1.3316

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 9

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0012	0.0009	0.0012	0.0051	0.0052	0.0010
	0.0009	0.0006	0.0009	0.0014	0.0029	0.0027
STD. DEVIATIONS	0.0012	0.0013	0.0012	0.0028	0.0023	0.0009
	0.0012	0.0006	0.0009	0.0013	0.0014	0.0014

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES		CU. FEET	PERCENT
PRECIPITATION	43.24	(5.486)	156956.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	21.360	(2.9838)	77534.98	49.399
LATERAL DRAINAGE COLLECTED FROM LAYER 3	21.99229	(4.16097)	79832.023	50.86256
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 4	0.002	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 7	0.00000	(0.00000)	0.001	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00000	(0.00000)	0.008	0.00001

AVERAGE HEAD ON TOP OF LAYER 8	0.000 (	0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (	0.00000)	0.000	0.00000
CHANGE IN WATER STORAGE	-0.113 (	1.8349)	-410.63	-0.262

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	1.05727	3837.88770
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00007
AVERAGE HEAD ON TOP OF LAYER 4	0.035	
MAXIMUM HEAD ON TOP OF LAYER 4	0.070	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	1.4 FEET	
DRAINAGE COLLECTED FROM LAYER 7	0.00000	0.00004
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.000	
MAXIMUM HEAD ON TOP OF LAYER 8	0.006	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00000
SNOW WATER	11.92	43258.5078

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.6710

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0770

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	39.1979	0.3266
2	2.1879	0.1823
3	0.0116	0.0465
4	0.0000	0.0000
5	0.1800	0.7500
6	0.7440	0.0620
7	0.0020	0.0100
8	0.0000	0.0000
9	5.1240	0.4270
10	7.4399	0.3100
SNOW WATER	0.000	

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APPENDIX E

DESIGN CALCULATIONS

SME
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E-1

PIPE STRENGTH

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ENGINEERS

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Cumberland, ME 04021
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smemaine.com

PIPE STRENGTH CALCULATION - LEAK DETECTION

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/8/2025

OBJECTIVE

Determine the pipe strength of 6-inch diameter perforated HDPE leak detection pipe.
Evaluation for worst case (thickest waste deposit) for the leak detection header pipe (SDR 11)

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	6.625	in	Outside Diameter	
DR	17.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.39	in	Minimum wall thickness	
A_{perf} =	0.6	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	4.7	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	4.1	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.3	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	19.4		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions **(assumes LC pipe directly over LD pipe system)**

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_d	100	pcf	Unit weight of sand
γ_r	100	pcf	Unit weight of stone
γ_c	100	pcf	Unit weight of clay
H_s	3	ft	Depth of cover system
H_w	36.0	ft	Depth of waste **(Cell 20 worst case if using SDR 11 pipe)**
H_d	1	ft	Depth of sand
H_r	1.5	ft	Depth of stone drainage layer
H_c	1	ft	Depth of clay
H_t =	42.5	ft	Total depth
W_{avg} =	89.1	pcf	Average Weight $W_{avg} = W_s*H_s/H_t+W_w*H_w/H_t+W_d*H_d/Ht+W_r*H_r/H_t+W_c*H_c/Ht$
P_E =	26.3	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure

1) CALCULATE COMPRESSIVE STRESS

$VAF=0.88-0.71(S_A-1/S_A+2.5)$ Vertical Arching Factor

$S_A=1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	3.14	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A=	1.65		
VAF=	0.78		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 2,942 psf radial directed earth pressure (for deep fills)
20.4 psi

$S=P_{RD}*DR$ = 347 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code [1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is withing the allowable compressive stress: 255 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)
μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.
E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor
E 28,000 psi Apparent modulus of pipe
I = 0.0033 in^4/in Pipe moment of inertia
R_F= 5,800

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles [21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 1.2 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 1.75 Deformation factor (see below)

Pipe deflection = **2.1** **percent** **Ok; Not to exceed 7.5% for design**

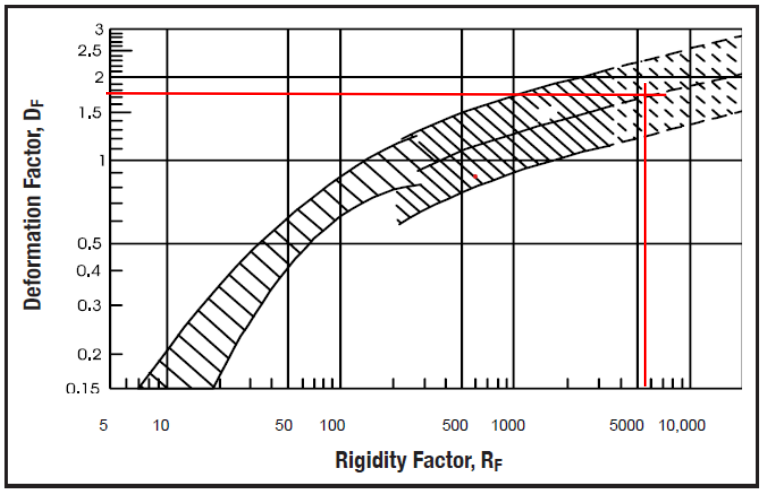

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{C} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{C}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0033	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	=Es/(1-μ)
D_M =	6.3	in	Mean pipe diameter = OD - T_{eff}

P_{CR}= 213 psi

Safety Factor= Pcr/PE = 8.1 2≤ SF Guidelines for HDPE pipe in deep fills.

CONCLUSION

6-inch HDPE leak detection pipe is suitable for use in landfill construction.

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smemaine.com

PIPE STRENGTH CALCULATION - LEAK DETECTION

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 6-inch diameter perforated HDPE leak detection pipe.
Evaluation for worst case (thickest waste deposit) for the leak detection lateral pipes (SDR 7).

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	6.625	in	Outside Diameter	
DR	7.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.95	in	Minimum wall thickness	
A_{perf} =	1.4	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	11.4	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	9.9	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.8	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	8.0		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions **(assumes LC pipe directly over LD pipe system)**

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_d	100	pcf	Unit weight of sand
γ_r	100	pcf	Unit weight of stone
γ_c	100	pcf	Unit weight of clay
H_s	3	ft	Depth of cover system
H_w	210.0	ft	Depth of waste **(Cell 18)**
H_d	0.5	ft	Depth of sand
H_r	1.5	ft	Depth of stone drainage layer
H_c	1	ft	Depth of clay
H_t =	216.0	ft	Total depth
W_{avg} =	85.8	pcf	Average Weight
P_E =	128.6	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure

$W_{avg} = W_s*H_s/H_t+W_w*H_w/H_t+W_d*H_d/Ht+W_r*H_r/H_t+W_c*H_c/Ht$

1) CALCULATE COMPRESSIVE STRESS

$VAF=0.88-0.71(S_A-1/S_A+2.5)$ Vertical Arching Factor

$S_A=1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	2.90	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A=	0.63		
VAF=	0.97		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 17,877 psf radial directed earth pressure (for deep fills)
124.1 psi

$S=P_{RD}*DR$ = 869 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code [1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress: 869 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)
μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.
E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor
E 28,000 psi Apparent modulus of pipe
I = 0.0473 in^4/in Pipe moment of inertia
R_F= 300

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles [21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 5.9 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 0.95 Deformation factor (see below)

Pipe deflection = **5.6** **percent** **Ok; Not to exceed 7.5% for design**

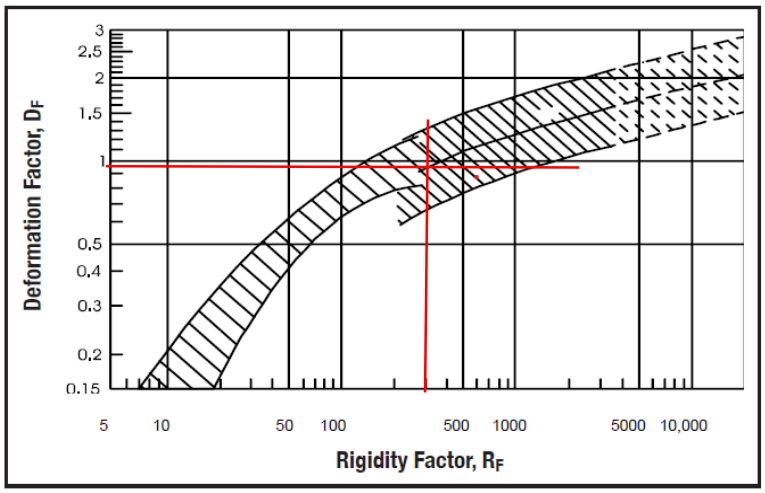

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{Q} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{Q}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0473	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	=Es/(1-μ)
D_M =	5.8	in	Mean pipe diameter = OD - T_{eff}
P_{CR}=	561	psi	

Safety Factor= Pcr/PE = 4.4 2≤ SF Guidelines for HDPE pipe in deep fills.

CONCLUSION

6-inch HDPE leak detection pipe is suitable for use in landfill construction.

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PIPE STRENGTH CALCULATION - LEACHATE COLLECTION (8-INCH DIAMETER)

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 8-inch diameter perforated HDPE leachate collection pipe.
Evaluation for worst case (standard waste deposit) for the leachate collection header pipes (SDR 11).

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	8.625	in	Outside Diameter	
DR	11.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.78	in	Minimum wall thickness	
A_{perf} =	1.2	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	9.4	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	8.2	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.7	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	12.6		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_d	100	pcf	Unit weight of sand
γ_r	100	pcf	Unit weight of stone
H_s	3	ft	Depth of cover system
H_w	134.0	ft	Depth of waste
H_d	0.5	ft	Depth of sand
H_r	1	ft	Depth of stone drainage layer
H_t =	138.5	ft	Total depth
W_{avg} =	86.0	pcf	Average Weight
P_E =	82.7	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure

$W_{avg} = W_s*H_s/H_t + W_w*H_w/H_t + W_d*H_d/H_t + W_r*H_r/H_t$

1) CALCULATE COMPRESSIVE STRESS

$VAF = 0.88 - 0.71(S_A - 1/S_A + 2.5)$ Vertical Arching Factor

$S_A = 1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	3.97	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A =	1.03		
VAF =	0.87		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort: Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 10,403 psf radial directed earth pressure (for deep fills)
72.2 psi

$S=P_{RD}*DR$ = 623 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code[1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress:623 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)
μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.
E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor
E 28,000 psi Apparent modulus of pipe
I = 0.0269 in^4/in Pipe moment of inertia
R_F= 1,400

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles[21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 3.8 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 1.4 Deformation factor (see below)

Pipe deflection = 5.3 percent **Ok; Not to exceed 7.5% for design**

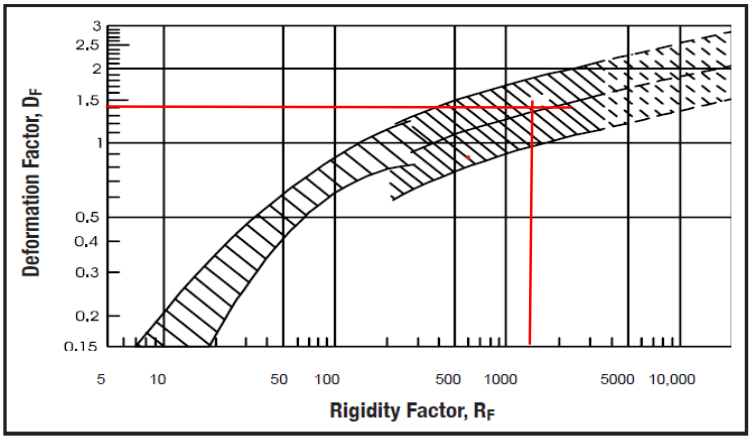

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{C} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{C}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0269	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	=Es/(1-μ)
D_M =	7.9	in	Mean pipe diameter = OD - T_{eff}

P_{CR}= 339 psi

Safety Factor= Pcr/PE = 4.1 2≤ SF Guidelines for HDPE pipe in deep fills.

CONCLUSION

8-inch HDPE leachate collection pipe is suitable for use in landfill construction.

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PIPE STRENGTH CALCULATION - LEACHATE COLLECTION (8-INCH DIAMETER)

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 8-inch diameter perforated HDPE leachate collection pipe.
Evaluation for worst case (thickest waste deposit) for the leachate collection header pipes (SDR 7).

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	8.625	in	Outside Diameter	
DR	7.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	1.23	in	Minimum wall thickness	
A_{perf} =	1.8	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	14.8	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	12.9	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	1.1	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	8.0		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil	
γ_w	85	pcf	Unit weight of waste	
γ_d	100	pcf	Unit weight of sand	
γ_r	100	pcf	Unit weight of stone	
H_s	3	ft	Depth of cover system	
H_w	210.0	ft	Depth of waste	**(Largest Waste Thickness for Cell 21 and Cell 18)**
H_d	0.5	ft	Depth of sand	
H_r	1	ft	Depth of stone drainage layer	
H_t =	214.5	ft	Total depth	
W_{avg} =	85.7	pcf	Average Weight	$W_{avg}=W_s*H_s/H_t+W_w*H_w/H_t+W_d*H_d/H_t+W_r*H_r/H_t$
P_E =	127.6	psi	Earth pressure	
P_{ATM} =	14.7	psi	Atmospheric Pressure	

1) CALCULATE COMPRESSIVE STRESS

$VAF=0.88-0.71(S_A-1/S_A+2.5)$ Vertical Arching Factor

$S_A=1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	3.77	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A=	0.63		
VAF=	0.97		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 17,733 psf radial directed earth pressure (for deep fills)
123.1 psi

$S=P_{RD}*DR$ = 1062 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code[1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress: 1062 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)

μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.

E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor

E 28,000 psi Apparent modulus of pipe

I = 0.1044 in^4/in Pipe moment of inertia

R_F= 300

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles[21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 5.9 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 0.95 Deformation factor (see below)

Pipe deflection = 5.6 percent **Ok; Not to exceed 7.5% for design**

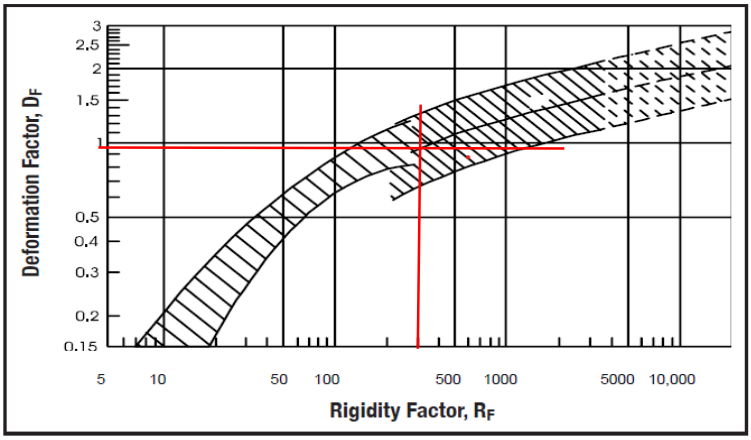

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{Q} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{Q}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.1044	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	=Es/(1-μ)
D_M =	7.5	in	Mean pipe diameter = OD - T_{eff}

P_{CR}= 561 psi

Safety Factor= Pcr/PE = 4.4 2≤ SF Guidelines for HDPE pipe in deep fills.

CONCLUSION

8-inch HDPE leachate collection pipe is suitable for use in landfill construction.

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PIPE STRENGTH CALCULATION - LEACHATE COLLECTION (6-INCH DIAMETER)

Project Name: Juniper Ridge Landfill Phase II Expansic
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 6-inch diameter perforated HDPE leachate collection pipe.
Evaluation for worst case (standard waste deposit) for the leachate collection lateral pipes (SDR 11).

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	6.625	in	Outside Diameter	
DR	11.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.60	in	Minimum wall thickness	
A_{perf} =	0.9	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	7.2	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	6.3	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.5	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	12.6		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_d	100	pcf	Unit weight of sand
γ_r	100	pcf	Unit weight of stone
H_s	3	ft	Depth of cover system
H_w	181.0	ft	Depth of waste
H_d	0.5	ft	Depth of sand
H_r	1	ft	Depth of stone drainage layer
H_t =	185.5	ft	Total depth
W_{avg} =	85.8	pcf	Average Weight
P_E =	110.5	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure

$W_{avg} = W_s*H_s/H_t + W_w*H_w/H_t + W_d*H_d/H_t + W_r*H_r/H_t$

1) CALCULATE COMPRESSIVE STRESS

$VAF = 0.88 - 0.71(S_A - 1/S_A + 2.5)$ Vertical Arching Factor

$S_A = 1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	3.05	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A =	1.03		
VAF =	0.87		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 13,892 psf radial directed earth pressure (for deep fills)
96.5 psi

$S=P_{RD}*DR$ = 639 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code [1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress: 639 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)
μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.
E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor
E 28,000 psi Apparent modulus of pipe
I = 0.0122 in^4/in Pipe moment of inertia
R_F= 1,400

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles [21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 5.1 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 1.35 Deformation factor (see below)

Pipe deflection = 6.8 percent **Ok; Not to exceed 7.5% for design**

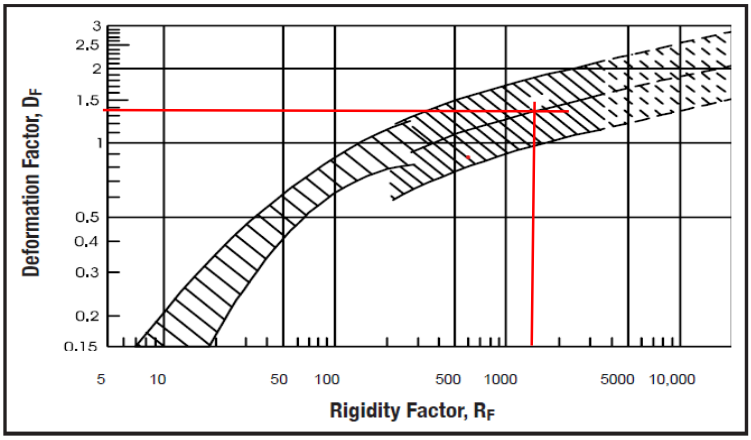

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{Q} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{Q}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0122	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	$=Es/(1-\mu)$
D_M =	6.1	in	Mean pipe diameter = OD - T_{eff}

P_{CR}= 339 psi

Safety Factor= Pcr/PE = 3.1 2≤ SF ≤4 Guidelines for HDPE pipe in deep fills.

CONCLUSION

6-inch HDPE leachate collection pipe is suitable for use in landfill construction.

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PIPE STRENGTH CALCULATION - LEACHATE COLLECTION (6-INCH DIAMETER)

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 6-inch diameter perforated HDPE leachate collection pipe.
Evaluation for worst case (thickest waste deposit) for the leachate collection lateral pipes (SDR 7).

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	6.625	in	Outside Diameter	
DR	7.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.95	in	Minimum wall thickness	
A_{perf} =	1.4	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	11.4	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	9.9	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.8	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	8.0		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil	
γ_w	85	pcf	Unit weight of waste	
γ_d	100	pcf	Unit weight of sand	
γ_r	100	pcf	Unit weight of stone	
H_s	3	ft	Depth of cover system	
H_w	207.0	ft	Depth of waste	**(Largest Waste Thickness for Cell 21 and Cell 18)**
H_d	0.5	ft	Depth of sand	
H_r	1	ft	Depth of stone drainage layer	
H_t =	211.5	ft	Total depth	
W_{avg} =	85.7	pcf	Average Weight	$W_{avg}=W_s*H_s/H_t+W_w*H_w/H_t+W_d*H_d/H_t+W_r*H_r/H_t$
P_E =	125.8	psi	Earth pressure	
P_{ATM} =	14.7	psi	Atmospheric Pressure	

1) CALCULATE COMPRESSIVE STRESS

$VAF=0.88-0.71(S_A-1/S_A+2.5)$ Vertical Arching Factor

$S_A=1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	2.90	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A=	0.63		
VAF=	0.97		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 17,487 psf radial directed earth pressure (for deep fills)
121.4 psi

$S=P_{RD}*DR$ = 805 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code (1)					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress: 805 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)

μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.

E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor

E 28,000 psi Apparent modulus of pipe

I = 0.0473 in^4/in Pipe moment of inertia

R_F= 300

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles (21))

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 5.8 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 0.95 Deformation factor (see below)

Pipe deflection = 5.5 percent **Ok; Not to exceed 7.5% for design**

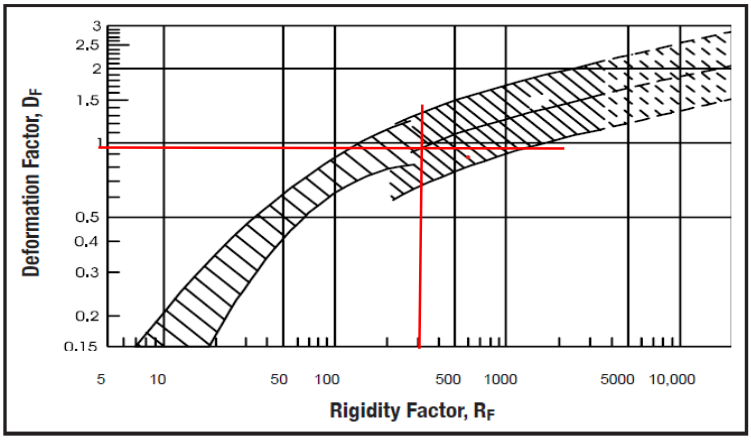

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{C} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{C}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0473	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	=Es/(1-μ)
D_M =	5.8	in	Mean pipe diameter = OD - T_{eff}

P_{CR}= 561 psi

Safety Factor= Pcr/PE = 4.5 2≤ SF Guidelines for HDPE pipe in deep fills.

CONCLUSION

6-inch HDPE leachate collection pipe is suitable for use in landfill construction.

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PIPE STRENGTH CALCULATION - LEACHATE COLLECTION (8-INCH DIAMETER)

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 8-inch diameter perforated HDPE leachate collection pipe.
Evaluation for worst case (shallow waste deposit) for the leachate collection perimeter berm toe header pipes (SDR 17).

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	8.625	in	Outside Diameter	
DR	17.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.51	in	Minimum wall thickness	
A_{perf} =	0.8	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	6.1	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	5.3	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.4	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	19.4		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_d	100	pcf	Unit weight of sand
γ_r	100	pcf	Unit weight of stone
H_s	3	ft	Depth of cover system
H_w	32.0	ft	Depth of waste
H_d	0.5	ft	Depth of sand
H_r	1	ft	Depth of stone drainage layer
H_t =	36.5	ft	Total depth
W_{avg} =	88.9	pcf	Average Weight
P_E =	22.5	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure

$W_{avg} = W_s*H_s/H_t + W_w*H_w/H_t + W_d*H_d/H_t + W_r*H_r/H_t$

1) CALCULATE COMPRESSIVE STRESS

$VAF = 0.88 - 0.71(S_A - 1/S_A + 2.5)$ Vertical Arching Factor

$S_A = 1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	4.09	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A =	1.65		
VAF =	0.77		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort: Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 2,496 psf radial directed earth pressure (for deep fills)
17.3 psi

$S=P_{RD}*DR$ = 150 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code [1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress: 150 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)

μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.

E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor

E 28,000 psi Apparent modulus of pipe

I = 0.0073 in^4/in Pipe moment of inertia

R_F= 5,800

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles [21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s= 1.0 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 1.75 Deformation factor (see below)

Pipe deflection = 1.8 percent **Ok; Not to exceed 7.5% for design**

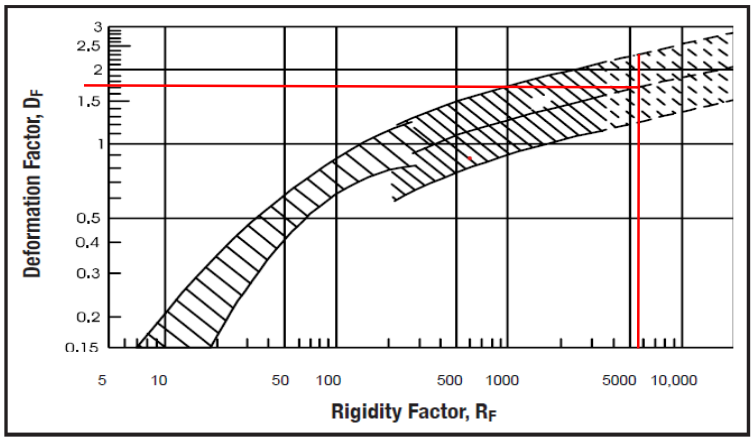

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{C} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{C}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0073	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	$=Es/(1-\mu)$
D_M =	8.2	in	Mean pipe diameter = OD - T_{eff}
P_{CR}=	213	psi	

Safety Factor= Pcr/PE = 9.4 2≤ SF Guidelines for HDPE pipe in deep fills.

CONCLUSION

8-inch HDPE leachate collection pipe is suitable for use in landfill construction.

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PIPE STRENGTH CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: DPW
Date: 11/3/2025
Checked By: BDP
Date: 11/5/2025

OBJECTIVE

Determine the pipe strength of 4-inch diameter perforated HDPE underdrain pipe.

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013
2. MCG Geotechnical Engineering Large Scale Constrained Modulus test 2/8/2010

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	4.500	in	Outside Diameter	
DR	11.0		Dimension Ratio	
N_{perf}	3.0		Perforations per ft	
D_{perf}	0.50	in	Perforation diameter	
T_{min} =	0.41	in	Minimum wall thickness	
A_{perf} =	0.6	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	4.9	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	4.3	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.4	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	12.6		Effective DR	$DR_{eff}=OD/T_{eff}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_d	100	pcf	Unit weight of sand
γ_r	100	pcf	Unit weight of clay
γ_f	125	pcf	Unit weght of till
H_s	3	ft	Depth of cover system
H_w	169.0	ft	Depth of waste
H_r	1	ft	Depth of clay
H_d	4.83	ft	Depth of sand
H_f	1	ft	Depth of till
H_t =	178.8	ft	Total depth
W_{avg} =	86.4	pcf	Average Weight
P_E =	107.3	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure

$W_{avg} = W_s*H_s/H_t + W_w*H_w/H_t + W_r*H_r/H_t$

1) CALCULATE COMPRESSIVE STRESS

$VAF = 0.88 - 0.71(S_A - 1/S_A + 2.5)$ Vertical Arching Factor

$S_A = 1.43*Ms*r_{CENT}/Et$ Hoop Thrust Stiffness Ratio

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
r_{CENT} =	2.07	in	Radius to centroidal axis of pipe
E	28,000	psi	Apparent modulus of elasticity of pipe material (see Table B.1.1 below)
S_A =	1.03		
VAF =	0.87		

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

$P_{RD}=VAF*W_{avg}*H_t$ = 13,488 psf radial directed earth pressure (for deep fills)
93.7 psi

$S=P_{RD}*DR$ = 1030 psi compressive stress

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code [1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

Compressive stress is less than allowable compressive stress: 884 psi ≤ 1,150 psi

2) CALCULATE: RING DEFLECTION

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$ secant modulus of soil (psi)
μ 0.35 Poisson's Ratio(see table 3-13 below); Conservative as pipe is bed in stone.
E_s= 2,181 psi Secant modulus of soil

$R_F=12E_s(DR_{eff}-1)^3/E$ Rigidity factor
E 28,000 psi Apparent modulus of pipe
I = 0.0038 in^4/in Pipe moment of inertia
R_F= 1,400

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles [21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

ANALYSIS (CONT'D)

Soil strain = $\epsilon_s = W_{avg} * H_t / 144 * E_s$

ϵ_s = 4.9 percent

Pipe deflection = $\epsilon_s * D_F$

D_F 1.3 Deformation factor (see below)

Pipe deflection = 6.4 percent **Ok; Not to exceed 7.5% for design**

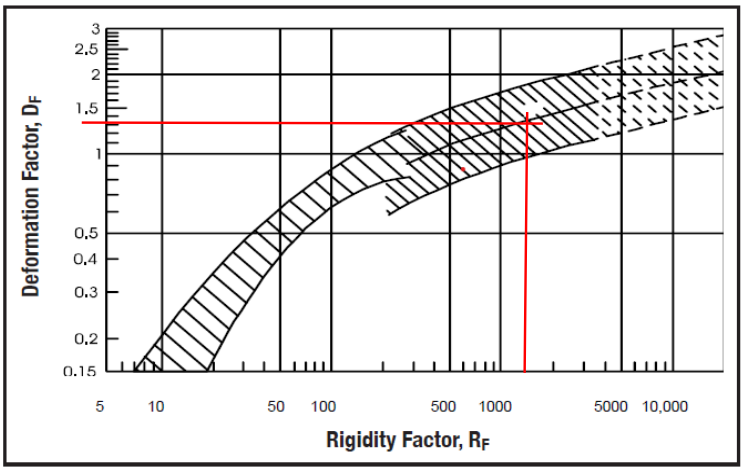

Figure 3-6 Watkins-Gaube Graph

3) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

$P_{CR} = 2.4 * \mathcal{Q} * R_H * (E*I)^{0.3333} (Es^*)^{0.66667} / D_M$

$\mathcal{Q}$	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
I =	0.0038	in^4/in	Pipe moment of inertia = $Teff^3/12$
Es	2,181	psi	Secant modulus
Es* =	3,355	psi	=Es/(1-μ)
D_M =	4.1	in	Mean pipe diameter = OD - T_{eff}
P_{CR}=	339	psi	

Safety Factor= Pcr/PE = 3.2 2≤ SF ≤4 Guidelines for HDPE pipe in deep fills.

CONCLUSION

1. 4-inch HDPE underdrain pipe is suitable for use in landfill construction.
2. Underdrain strength calculation performed assuming intermediate waste conditions (waste top elevation of 340).
3. Underdrain function is no longer necessary after the liner system is constructed and sufficient waste has been placed in the landfill to keep the liner system from floating due to groundwater.

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PIPE STRENGTH CALCULATION - LEAK DETECTION PUMP CONDUIT

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 12-inch diameter perforated HDPE leak detection temporary sump pipe.

REFERENCES

1. Chevron Phillips Chemical Company LC, Plexco Engineering Manual, 2003, Chapter 7 Buried Pipe Design.

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	12.750	in	Outside Diameter	
DR	11.0		Dimension Ratio	
N_{perf}	12.0		Perforations per ft	
D_{perf}	0.63	in	Perforation diameter	
T_{min} =	1.16	in	Minimum wall thickness	
A_{perf} =	8.7	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	13.9	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	5.2	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.43	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	29.3		Effective DR	$DR_{eff}=OD/T_{eff}$
D_m =	11.5	in	Mean Pipe Diameter	$D_m=OD-1.06*T_{min}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil	
γ_w	85	pcf	Unit weight of waste	
γ_r	100	pcf	Unit weight of stone	
γ_d	100	pcf	Unit weight of sand	
γ_c	100	pcf	Unit weight of clay	
H_s	3	ft	Depth of cover system	
H_w	28.0	ft	Depth of waste	
H_r	6	ft	Depth of stone drainage layer	
H_d	1	ft	Depth of sand layer	
H_c	1	ft	Depth of clay layer	
H_t =	39.0	ft	Total depth	
H' =	1.0	ft	Depth of water over pipe	
W_{avg} =	91.2	pcf	Average Weight	$W_{avg} = W_s*H_s/H_t + W_w*H_w/H_t + W_r*H_r/H_t$
P_E =	24.7	psi	Earth pressure	
P_{ATM} =	14.7	psi	Atmospheric Pressure	
Es	3,000	psi	Backfill Soil Modulus for 90 percent compaction in crushed stone	
K	0.10		Bedding Factor	
E_{stm}	100,000	psi	Short Term Modulus	
E_{ltm}	23,000	psi	Long Term Modulus	
D=	1.5		Deflection Lag Factor	
R=	0.992		Buoyancy Reduction Factor	R = 1 - 0.33*H'/H)
N=	2.0		Assumed safety factor	

1) CALCULATE CONSTRAINED BUCKLING

$$\gamma_{WT} = \frac{\gamma_w D_w + \gamma_S D_s}{H}$$ Weighted soil/total depth

γ_{WT} = 91 lbf/ft^3

Moment of Inertia $$I = \frac{t_{eff}{}^3}{12}$$ I = 0.007 in^3

Constrained Buckling $$B = \frac{1}{1 + 4e^{(-0.065*Ht)}}$$ B= 0.759

Critical Wall Pressure $$P_{wc} = \left(\sqrt{RBE_S E_{ltm} \frac{I}{D_m{}^3}}\right)\left(\frac{5.65}{N}\right)$$ P_{wc} = 43.1 psi

Safety Factor Against Buckling $$SF = \frac{P_{WC}}{H\gamma_{WT}}$$ SF = 1.74

Mean Pipe Radius $$R_M = \frac{OD - tmir}{2}$$ R_M = 5.80 in

Pipe Stiffness $$PS = \frac{I * E_{stm}}{0.149 R_M^3}$$ PS = 23.6 psi

ANALYSIS (CONT'D)

Load on Pipe $W = H * OD * \gamma_{WT}$ W = 315 lbf/in

Deflection $x = \frac{K * D * W}{0.149PS + 0.61E_s}$ x = 0.25 in

Percent Deflection % Deflection$= \frac{x}{OD}100$ % Deflection = 2.0%

CONCLUSION

The 12-inch perimeter HDPE pipe is suitable for use as the leak detection pump conduit in shallow fill.

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PIPE STRENGTH CALCULATION - LEACHATE COLLECTION SUMP CONDUIT

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 24-inch diameter perforated HDPE leachate collection sump conduit pipe.

REFERENCES

1. Chevron Phillips Chemical Company LC, Plexco Engineering Manual, 2003, Chapter 7 Buried Pipe Design.

ASSUMPTIONS

N/A

ANALYSIS

Pipe Data

OD	24.000	in	Outside Diameter	
DR	11.0		Dimension Ratio	
N_{perf}	12.0		Perforations per ft	
D_{perf}	0.63	in	Perforation diameter	
T_{min} =	2.18	in	Minimum wall thickness	
A_{perf} =	16.4	in^2	Area of perforations	$A_{perf}=D_{perf}*T_{min}*N_{perf}$
A_{pipe} =	26.2	in^2	Area of pipe (per 12-inch length)	Wall area without perforations
A_{eff} =	9.8	in^2	Effective area of pipe	$A_{eff}=A_{pipe}-A_{perf}$
T_{eff} =	0.82	in	Effective wall thickness	$T_{eff}=A_{eff}/12$
DR_{eff} =	29.3		Effective DR	$DR_{eff}=OD/T_{eff}$
D_m =	21.7	in	Mean Pipe Diameter	$D_m=OD-1.06*T_{min}$

ANALYSIS (CONT'D)

Burial Conditions

γ_s	125	pcf	Unit weight of cover soil
γ_w	85	pcf	Unit weight of waste
γ_r	100	pcf	Unit weight of stone
γ_d	100	pcf	Unit weight of sand
H_s	3	ft	Depth of cover system
H_w	28.0	ft	Depth of waste
H_r	5.5	ft	Depth of stone drainage layer
H_d	1	ft	Depth of sand
H_t =	37.5	ft	Total depth
H' =	1.0	ft	Depth of water over pipe
W_{avg} =	90.8	pcf	Average Weight $W_{avg} = W_s*H_s/H_t + W_w*H_w/H_t + W_r*H_r/H_t$
P_E =	23.6	psi	Earth pressure
P_{ATM} =	14.7	psi	Atmospheric Pressure
Es	3,000	psi	Backfill Soil Modulus for 90 percent compaction in crushed stone
K	0.10		Bedding Factor
E_{stm}	100,000	psi	Short Term Modulus
E_{ltm}	23,000	psi	Long Term Modulus
D=	1.5		Deflection Lag Factor
R=	0.991		Buoyancy Reduction Factor R = 1 - 0.33*H'/H)
N=	2.0		Assumed safety factor

1) CALCULATE CONSTRAINED BUCKLING

$$\gamma_{WT} = \frac{\gamma_w D_w + \gamma_S D_s}{H}$$ Weighted soil/waste unit weight

γ_{WT} = 91 lbf/ft^3

Moment of Inertia $$I = \frac{t_{eff}{}^3}{12}$$ I = 0.046 in^3

Constrained Buckling $$B = \frac{1}{1 + 4e^{(-0.065*Ht)}}$$ B= 0.741

Critical Wall Pressure $$P_{wc} = \left(\sqrt{RBE_S E_{ltm} \frac{I}{D_m{}^3}}\right)\left(\frac{5.65}{N}\right)$$ P_{wc} = 42.5 psi

Safety Factor Against Buckling $$SF = \frac{P_{WC}}{H\gamma_{WT}}$$ SF = 1.80

Mean Pipe Radius $$R_M = \frac{OD - tmin}{2}$$ R_M = 10.91 in

Pipe Stiffness $$PS = \frac{I * E_{stm}}{0.149 R_M^3}$$ PS = 23.6 psi

ANALYSIS (CONT'D)

Load on Pipe $W = H * OD * \gamma_{WT}$ W = 568 lbf/in

Deflection $x = \frac{K * D * W}{0.149PS + 0.61E_s}$ x = 0.46 in

Percent Deflection % Deflection$= \frac{x}{OD}100$ % Deflection = 1.9%

CONCLUSION

The 24-inch perimeter HDPE pipe is suitable for use as the leachate collection pump conduit in shallow fill.

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PIPE STRENGTH CALCULATION - FORCE MAIN

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 5/8/2025
Checked By: DPW
Date: 5/13/2025

OBJECTIVE

Determine the pipe strength of 6-inch solid HDPE force main under a live load.

REFERENCES

1. Plastic Pipe Institute Second Edition Handbook-2013.

ASSUMPTIONS

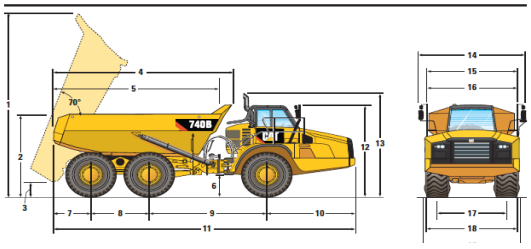
1. Max live load expected from CAT 740 articulated dump truck
2. Calculate earth loads on force main with 6 ft burial depth and 40T off road truck

ANALYSIS

1) CALCULATE EARTH LOADING

Operating Weights		
Front Axle – Empty	20 664 kg	45,556 lb
Center Axle – Empty	7229 kg	15,937 lb
Rear Axle – Empty	6499 kg	14,328 lb
Total – Empty	34 393 kg	75,824 lb
Front Axle – Rated Load	5211 kg	11,488 lb
Center Axle – Rated Load	17 186 kg	37,889 lb
Rear Axle – Rated Load	17 186 kg	37,889 lb
Total – Rated Load	39 582 kg	87,263 lb
Front Axle – Loaded	25 875 kg	57,045 lb
Center Axle – Loaded	24 415 kg	53,826 lb
Rear Axle – Loaded	23 685 kg	52,216 lb
Total – Loaded	73 975 kg	163,087 lb

Dimensions



	mm	ft
1	7092	23.4
2	3239	10.6
3	697	2.3
4	6288	20.6
5*	5734	18.8
6	577	1.8
7	1458	4.7
8	1966	6.4
9	4246	13.9
10	3330	10.9

	mm	ft
11	11 000	36.1
12	3745	12.3
13**	4039	13.3
14	4160	13.6
15***	3770	12.4
16	3418	11.2
17	2687	8.8
18	3430	11.2
19****	3520	11.5

ANALYSIS (CONT'D)

9/6/2017 Goodyear Off-The-Road (OTR) / Earthmover Tires - Tire Details & Specifications

Tire Specs | Loads and Inflations

Rim Width & Flange	Min. Dual Spacing (in)	Overall Width (in)	Overall Diameter (in)	Load Sect. & Growth (in)	Static Load Radius (in)	Revolutions per Mi	Gross Contact Area (in^2)	Tire Vol. (gal)	Tread Depth ($^1/_{32}$in)	TMPH (2S)	TMPH (4S)	TMPH (6S)
25.00-3.5		30.4	75.7	33.6	33	278	583	325	72		90	85

The Timoshenko Equation gives the soil pressure at a point directly under a disturbed surface load, neglecting any pavement. The equation can be used to find the pressure directly under a single wheel load.

$$P_L = \frac{I_f W_w}{a_C}\left(1 - \frac{H^3}{(r_T^2 + H^2)^{1.5}}\right) \qquad r_T = \sqrt{\frac{a_C}{\pi}}$$

Wheel load on top of pipe

I_f	3	off road truck		Impact Factor (Conservative)
W_W	57,045	lbs	See above	Wheel load
a_c	4.04	ft^2	See above	Contact Area
H	6	ft		Depth of cover
r_T =	1.13	ft		Equivalent radius
P_L =	2,174	PSF		Vertical soil pressure due to live load

Wheel load from opposite side

The Boussinesq Equation gives the pressure at any point in a soil mass under a concentrated surface load. The Boussinesq Equation may be used to find the pressure transmitted from a wheel load to a point that is not along the line of action of the load. Pavement effects are neglected.

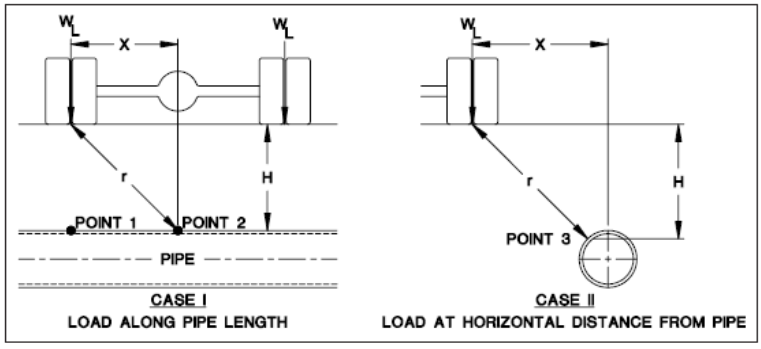


Figure 3-4 Illustration of Boussinesq Point Loading

ANALYSIS (CONT'D)

$$P_L = \frac{3 I_f W_w H^3}{2\pi r^5}$$ Boussinesq Equation

$$r = \sqrt{X^2 + H^2}$$ Distance from the point of load application to pipe crown (ft)

X 4.4 ft See diagram above
r = 7.44 ft

P_L = 774 PSF

Total load	2,948	PSF

2) CALCULATE RING DEFLECTION USING THE SPANGLER'S MODIFIED IOWA FORMULA FOR SOLID WALL PE PIPE

$$\frac{\Delta X}{D_M} = \frac{1}{144}\left(\frac{K_{BED} L_{DL} P_E + K_{BED} P_L}{\frac{2E}{3}\left(\frac{1}{DR-1}\right)^3 + 0.061 F_S E'} \right)$$

B_D	36	in	Trench width
K_{BED}	0.1		Bedding Factor (typically 0.1)
L_{DL}	1		Deflection lag factor
P_E	750	psf	Vertical soil pressure due to earth load
P_L	2,948	psf	Vertical soil pressure due to live load
E	28,000	psi	Apparent modulus of elasticity of pipe material
E'	3,000	psi	Modulus of soil reaction
F_S	1		Soil support factor
DR	17		Dimension Ratio
D_M =	6.24	in	Mean Diameter
Z =	0.2535	in	Centroid of wall section
t_{min}	0.507	in	Minimum wall thickness
DI	5.798	in	Pipe inside diameter
DO	6.625	in	Pipe outside diameter

$\Delta X/D_M$ =	1.4%	OKAY <6.0 %

As noted in Table 3-11.

ANALYSIS (CONT'D)

TABLE 3-7
Values of E' for Pipe Embedment (See Howard [8])

Soil Type-pipe Embedment Material (Unified Classification System)[1]	E' for Degree of Embedment Compaction, lb/in²			
	Dumped	Slight, <85% Proctor, <40% Relative Density	Moderate, 85%-95% Proctor, 40%-70% Relative Density	High, >95% Proctor, >70% Relative Density
Fine-grained Soils (LL > 50)[2] Soils with medium to high plasticity; CH, MH, CH-MH	No data available: consult a competent soils engineer, otherwise, use E' = 0.			
Fine-grained Soils (LL < 50) Soils with medium to no plasticity, CL, ML, ML-CL, with less than 25% coarse grained particles.	50	200	400	1000
Fine-grained Soils (LL < 50) Soils with medium to no plasticity, CL, ML, ML-CL, with more than 25% coarse grained particles; Coarse-grained Soils with Fines, GM, GC, SM, SC[3] containing more than 12% fines.	100	400	1000	2000
Coarse-grained soils with Little or No Fines GW, GP, SW, SP[3] containing less than 12% fines	200	1000	2000	3000
Crushed Rock	1000	3000	3000	3000
Accuracy in Terms of Percentage Deflection[4]	±2%	±2%	±1%	±0.5%

[1] ASTM D-2487, USBR Designation E-3
[2] LL = Liquid Limit
[3] Or any borderline soil beginning with one of these symbols (i.e., GM-GC, GC-SC).
[4] For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note: Values applicable only for fills less than 50 ft (15 m). Table does not include any safety factor. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If embedment falls on the borderline between two compaction categories, select lower E' value, or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/cu ft (598,000 J/m²) (ASTM D-698, AASHTO T-99, USBR Designation E-11). 1 psi = 6.9 KPa.

TABLE 3-11
Safe Deflection Limits for Pressurized Pipe

DR or SDR	Safe Deflection as % of Diameter
32.5	7.5
26	7.5
21	7.5
17	6.0
13.5	6.0
11	5.0
9	4.0
7.3	3.0

*Based on Long-Term Design Deflection of Buried Pressurized Pipe given in ASTM F1962.

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

ANALYSIS (CONT'D)

TABLE 3-9
Values of E'_N, Native Soil Modulus of Soil Reaction, Howard [3]

Native In Situ Soils				
Granular		Cohesive		
Std. Pentration ASTM D1586 Blows/ft	Description	Unconfined Compressive Strength (TSF)	Description	E'_N (psi)
> 0 - 1	very, very loose	> 0 - 0.125	very, very soft	50
1 - 2	very loose	0.125 - 0.25	very soft	200
2 - 4	very loose	0.25 - 0.50	soft	700
4 - 8	loose	0.50 - 1.00	medium	1,500
8 - 15	slightly compact	1.00 - 2.00	stiff	3,000
15 - 30	compact	2.00 - 4.00	very stiff	5,000
30 - 50	dense	4.00 - 6.00	hard	10,000
> 50	very dense	> 6.00	very hard	20,000
Rock	–	–	–	50,000

TABLE 3-10
Soil Support Factor, F_S

E'_N/E'	B_d/D_O 1.5	B_d/D_O 2.0	B_d/D_O 2.5	B_d/D_O 3.0	B_d/D_O 4.0	B_d/D_O 5.0
0.1	0.15	0.30	0.60	0.80	0.90	1.00
0.2	0.30	0.45	0.70	0.85	0.92	1.00
0.4	0.50	0.60	0.80	0.90	0.95	1.00
0.6	0.70	0.80	0.90	0.95	1.00	1.00
0.8	0.85	0.90	0.95	0.98	1.00	1.00
1.0	1.00	1.00	1.00	1.00	1.00	1.00
1.5	1.30	1.15	1.10	1.05	1.00	1.00
2.0	1.50	1.30	1.15	1.10	1.05	1.00
3.0	1.75	1.45	1.30	1.20	1.08	1.00
5.0	2.00	1.60	1.40	1.25	1.10	1.00

ANALYSIS (CONT'D)

3) CALCULATE COMPRESSIVE RING THRUST

Crushing occurs when the compressive stress in the wall exceeds the compressive yield stress of the pipe material. Equation 3-13 and 3-14 give the compressive stress resulting from earth and live load pressure for conventional extruded DR pipe and for ASTM F894 profile PE pipe.

Pipe wall compressive stress = (3-13) $S = \frac{(P_E + P_L)\,DR}{288}$ (3-14) $S = \frac{(P_E + P_L)\,D_O}{288A}$

S=	218.3	psi	Using equation 3-13.

The compressive stress is well below the allowable limit of 1,150 psi for the PE4710 material.

4) CALCULATE: CRITICAL CONSTRAINED BUCKLING PRESSURE

PCR=2.4*Ɑ*RH*(EI)^.3333(Es*)^.66667/D_M =critical constrained buckling pressure (psi)

Ɑ	0.55		Calibration factor, 0.55 for granular soils
R_H	1		Geometry factor, 1 for granular soils
E	28,000	psi	Apparent modulus of elasticity of pipe material
I =	0.0007	in^4/in	Pipe moment of inertia

$E_s=M_s((1+\mu)(1-2\mu)/(1-\mu))$

M_s =	3,500	psi	One dimensional soil modulus (See Table 2 below, conservative for 3/4" pipe bedding)
μ=	0.35		Poisson's Ratio(see table 3-13); Conservative as pipe is bed in stone.
E_s =	2,181		Secant modulus
E_{s*} =	3,355		=Es/(1-μ)

Pcr= 129.8 psi

PE= 25.7 psi Earth pressure plus live load

Safety Factor= P_{cr}/PE = 5.1 Safety factor of 2.5 is typical.

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles[21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

Table 2. Summary of Constrained Modulus Results (lb/in2)

Sample	Vendor Description	Compaction Effort: Low (hand placement)	Medium (raining particles)	High (hand tamping)
MS-1	1/2 in Granite	4000	7000	10000
MS-2	3/4 in Granite	3500	7000	8500
MS-3	1-1/2 in Granite	2000	3500	5000
MS-4	3/4 in Limestone	2000	3500	5500
MS-5	3/4 in Quartzite	3500	5500	7500
	Range	2000 - 4000	3500 - 7000	5000 - 10000

CONCLUSION

6-inch x 10-inch dual contained HDPE pipe is suitable for use as a force main subject to live loads.

E-2

SOIL FILTER AND GEOTEXTILE

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Geotextile Filter Design - Leak Detection Pipe

Project Name: Juniper Ridge Landfill Cell 18
Project Location: Old Town, Maine
Project No.: 240104
By: PCM
Date: 6/13/2024
Checked By: TJM
Date: 3/27/2025

OBJECTIVE

Evaluate suitability of 6-oz non-woven 85 mil geotextile as a filter in leak detection sand drainage layer.

REFERENCES

Mirafi TenCate Geotextile Filter Design, Application, and Product Selection Guide.
Koerner, R. M. (2016). Designing with Geosynthetics (6th ed., Vol. 1, pp. 108–115, Geotextile Functions And Mechanisms), Xlibris Corporation.

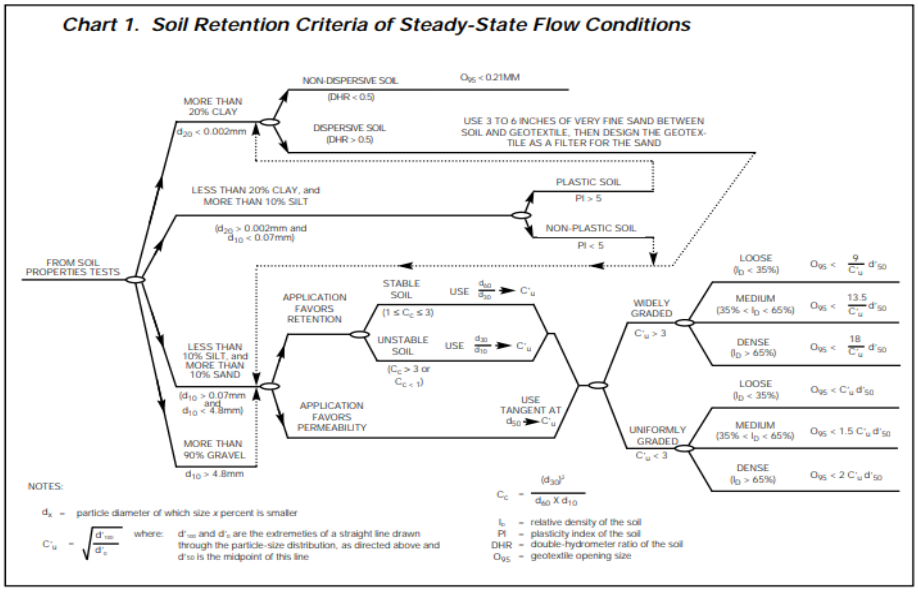
ASSUMPTIONS

Calculation is for soil material that is less than 10 percent silt (0.07 mm) and more than 10 percent sand (4.8 mm). (Koener 2016)

ANALYSIS

	Value entered from existing data
	Value Calculated
	Value Determined from entered data
	Value from Formula Entered Based on Gradation and Compaction

1. Evaluate Soil/Geotextile Suitability for Soil Retention (Koerner, 2016) as Indicated in Chart 1 Below.



SOIL GRADATION INFORMATION (See Attached Soil Gradation)

		Units	
d_{10}=	0.13	mm	Particle diameter where 10 percent is finer (See Attached Soil Gradation)
d_{30}=	0.30	mm	Particle diameter where 30 percent is finer (See Attached Soil Gradation)
d_{60}=	0.55	mm	Particle diameter where 60 percent is finer (See Attached Soil Gradation)
Cc=	1.26		Coefficient of curvature
d'_{100}=	1.04	mm	Upper most extreme of a straight line drawn through the particle size distribution
d'_{0}=	0.18	mm	Lower most extreme of a straight line drawn through the particle size distribution
d'_{50}=	0.46	mm	Midpoint of that line

Equations Used:

$$C_c = \frac{(d_{30})^2}{d_{60} x d_{10}}$$

$$C'_u = (d'_{100}/d'_0)^{1/2}$$

Application favors Retention
Stable Soil
Use straight line through d60 and d30 to get C'u

C'u= 2.40 Coefficient of Curvature

*Determine C'_u value from attached soil gradation and above soil gradation information.

Gradation	Uniformly Graded

Assumed Soil Relative Density =	0.95	Percent	
Maximum Geotextile Opening (095, Dense Soil) =	**2.21**	mm	
Specified O95=	0.212	mm	Std Sieve = 70

Geotextile meets Retention Requirements

US Mesh #	mm
30	0.60
40	0.40
50	0.30
60	0.25
70	0.21
80	0.18
100	0.15

2. Evaluate Hydraulic Conductivity Requirements (per Mirafi Requirements)

Equations Used: **kg= is*ks**

ks=	0.005	cm/s	Minimum Specified Soil Hydraulic Conductivity
is=	1.5		Hydraulic Gradient in the Soil (See Table 1 below)

Table 1. Typical Hydraulic Gradients[a]

Drainage Applications	Typical Hydraulic Gradient
Channel Lining	1.0
Standard Dewatering Trench	1.0
Vertical Wall Drain	1.5
Pavement Edge Drain	1.0
Landfill LCDRS	1.5
Landfill LCRS	1.5
Landfill SWCRS	1.5
Shoreline Protection	
Current Exposure	1.0[b]
Wave Exposure	10[b]
Dams	10[b]
Liquid Impoundments	10[b]

[a] Table developed after Giroud, 1988.
[b] Critical applications may require designing with higher gradients than those given.

Kg_d≥	0.008	cm/s	Minimum Designed Geotextile Permeability
Kg_r=	0.075	cm/s	Minimum Required Geotextile Hydraulic Conductivity (assuming FS of 10)
Kg_m=	0.3	cm/s	Manufacturer Specified Geotextile Hydraulic Conductivity

Geotextile Meets Hydraulic Conductivity Requirements

CONCLUSION

Specified geotextile meets the soil retention and hydraulic conductivity requirements specified above.

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PERFORATED PIPE & SOIL FILTER

Project Name: Juniper Ridge Landfill Cell 18
Project Location: Old Town, Maine
Project No.: 240104
By: PCM
Date: 11/12/2024
Checked By: TJM
Date: 3/27/2025

OBJECTIVE

Evaluate suitability of materials in contact with perforated piping.

REFERENCES

1. Cedergen, Drainage of Highway and Airfield Pavements, 1974

DESIGN PROCEDURE:

Use the following design criteria to determine suitablility of perforation size/stone size suitability:

1. D_{85} (pipe stone)/ Hole Dia. > 1.0 (to prevent intrusion of soil particles into the piping)

ANALYSIS

Drainage Stone to Perforated Pipe

Soil Material=	Drainage Stone			
Soil Gradation=	See Attached Gradation Curve			
D_{85}(stone)=	25.4	to	40	mm
Hole Dia.=	0.5	in.=	12.7	mm
Criteria 1:	2.00	>	1	**PASS**

Sump Stone to Pump Conduit Pipe

Soil Material=	Sump Stone			
Soil Gradation=	See Attached Gradation Curve			
D_{85}(stone)=	100	mm		
Hole Dia.=	0.625	in.=	15.875	mm
Criteria 1:	6.30	>	1	**PASS**

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SOIL FILTER DESIGN

Project Name: Juniper Ridge Landfill Cell 18
Project Location: Old Town, Maine
Project No.: 240104
By: PCM
Date: 11/12/2024
Checked By: TJM
Date: 3/27/2025

OBJECTIVE

Evaluate Filter Properties of Specified Soils.

REFERENCES

1. Cedergen, Drainage of Highway and Airfield Pavements, 1974.

DESIGN PROCEDURE:

Use the following design criteria to determine suitability of soil filter material:

1. D_{15}(filter)/5 < D_{85} (soil) (to prevent intrusion of fines)
2. D_{50}(filter)/25 < D_{50} (soil) (to assure uniformity of grading and prevent gap-graded materials)

ANALYSIS

Drainage Sand (as soil) to Filter Stone (as filter)

Soil Material=	Drainage Sand			
Soil Gradation=	See Attached Gradation Curve			
D_{85}(soil)=	1	to	10	mm
D_{50}(soil)=	0.34	to	2	mm
Filter Material=	Filter Stone			
Filter Gradation=	See Attached Gradation Curve			
D_{15}(filter)=	0.75	to	2.75	mm
D_{50}(filter)=	2.1	to	8.5	mm
Criteria 1:	0.55	<	2	**PASS**
Criteria 2:	0.34	<	0.35	**PASS**

Filter Stone (as soil) to Drainage Stone (as filter)

Soil Material=	Filter Stone			
Soil Gradation=	See Attached Gradation Curve			
D_{85}(soil)=	4	to	18	mm
D_{50}(soil)=	2.1	to	8.5	mm
Filter Material=	Drainage Stone			
Filter Gradation=	See Attached Gradation Curve			
D_{15}(filter)=	5	to	17	mm
D_{50}(filter)=	13	to	27	mm
Criteria 1:	3.4	<	4	**PASS**
Criteria 2:	1.08	<	2.1	**PASS**

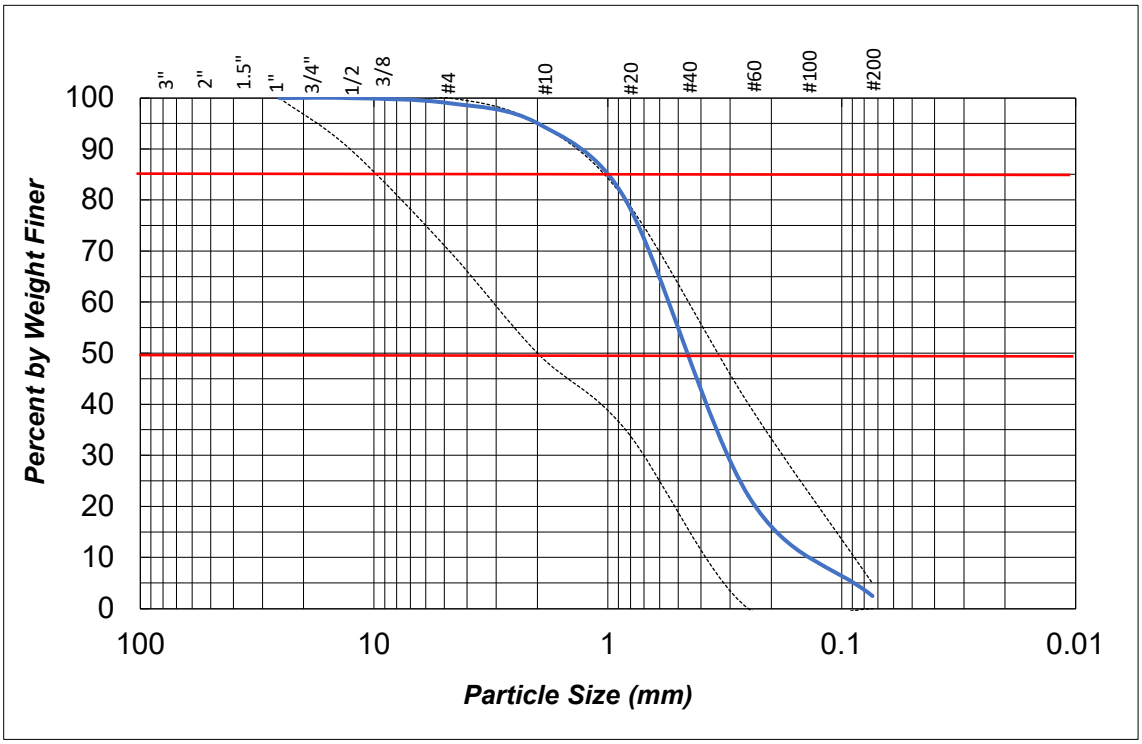
ANALYSIS (CONT'D)

Drainage Stone (as soil) to Sump Stone (as filter)				
Soil Material=	Drainage Stone			
Soil Gradation=	See Attached Gradation Curve			
D_{85}(soil)=	25.4	to	40	mm
D_{50}(soil)=	13	to	27	mm
Filter Material=	Sump Stone			
Filter Gradation=	See Attached Gradation Curve			
D_{15}(filter)=			80	mm
D_{50}(filter)=			90	mm
Criteria 1:	16	<	25.4	**PASS**
Criteria 2:	3.6	<	13	**PASS**

PROJECT: Cell 18 PROJECT No.: 240104

SOIL TYPE: LC Sand

U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	SPECIFICATION (%) MIN	MAX	Test Results
3	76.2			
2	50.8			
1.5	38.1			
1	25.4	100	100	**100**
3/4	19.1			
1/2	12.7	90	100	**100**
3/8	9.5			
#4	4.76	70	100	**99**
#10	2.0	50	95	**95**
#20	0.84	35	80	**80**
#40	0.42			
#60	0.25	0	40	**22**
#100	0.149			
#200	0.074	0	5	**2.5**

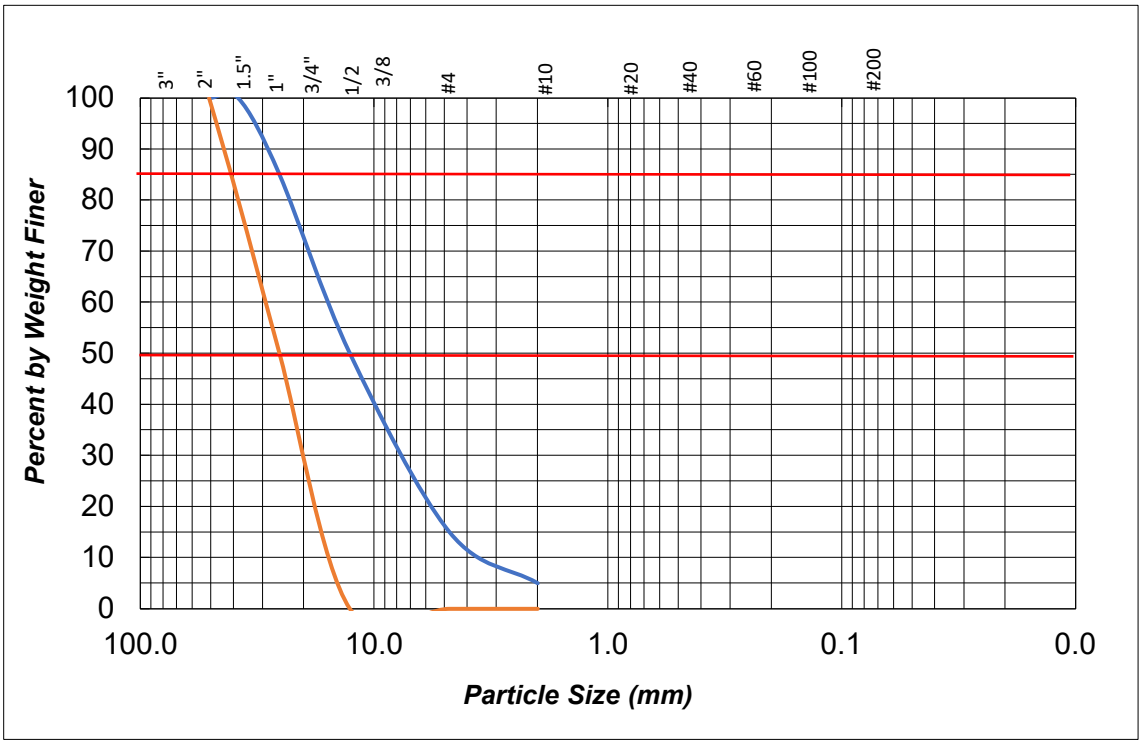


PROJECT: Cell 18 PROJECT No.: 240104

SOIL TYPE: Drainage Stone

TJM

U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	SPECIFICATION (%) MIN	SPECIFICATION (%) MAX	Test Results
3	76.2			
2	50.8	100	100	
1.5	38.1	80	100	
1	25.4	50	85	
3/4	19.1			
1/2	12.7	0	50	
3/8	9.5			
#4	4.76	0	15	
#10	2.0	0	5	
#20	0.84			
#40	0.42			
#60	0.25			
#100	0.149			
#200	0.074			

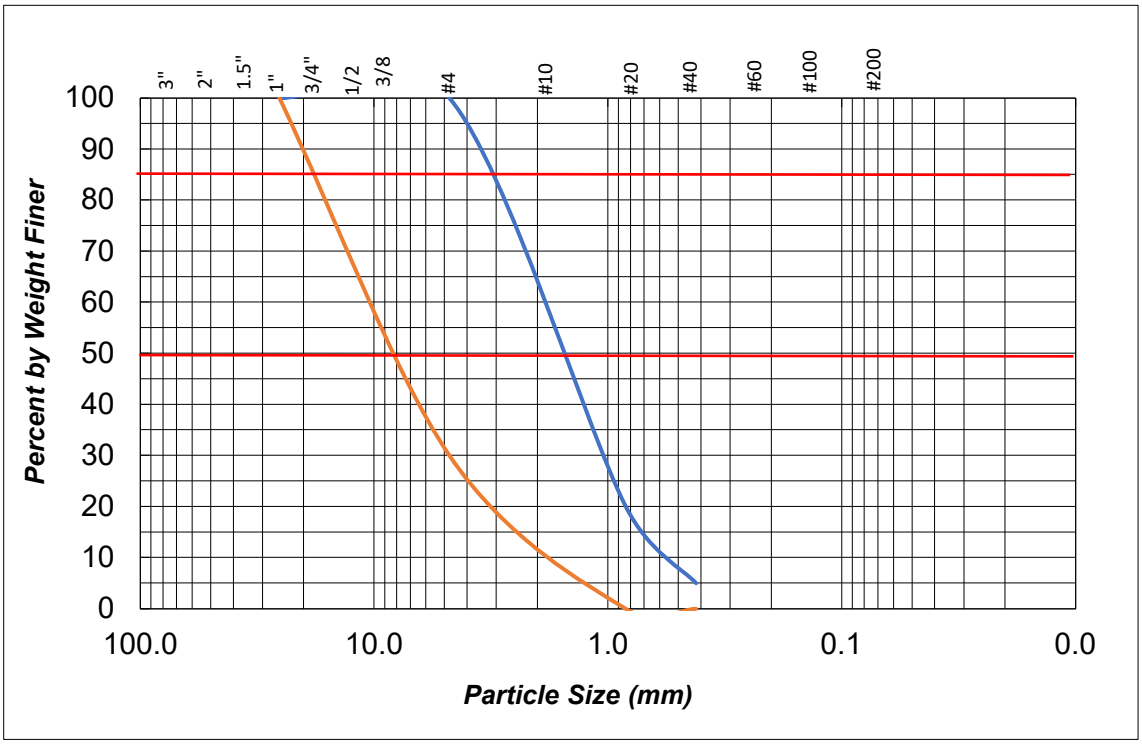


PROJECT: Cell 18 PROJECT No.: 240104

SOIL TYPE: Filter Stone

TJM

U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	SPECIFICATION (%) MIN	MAX	Test Results
3	76.2			
2	50.8			
1.5	38.1			
1	25.4	100	100	
3/4	19.1			
1/2	12.7			
3/8	9.5			
#4	4.76	30	100	
#10	2.0			
#20	0.84	0	20	
#40	0.42	0	5	
#60	0.25			
#100	0.149			
#200	0.074			

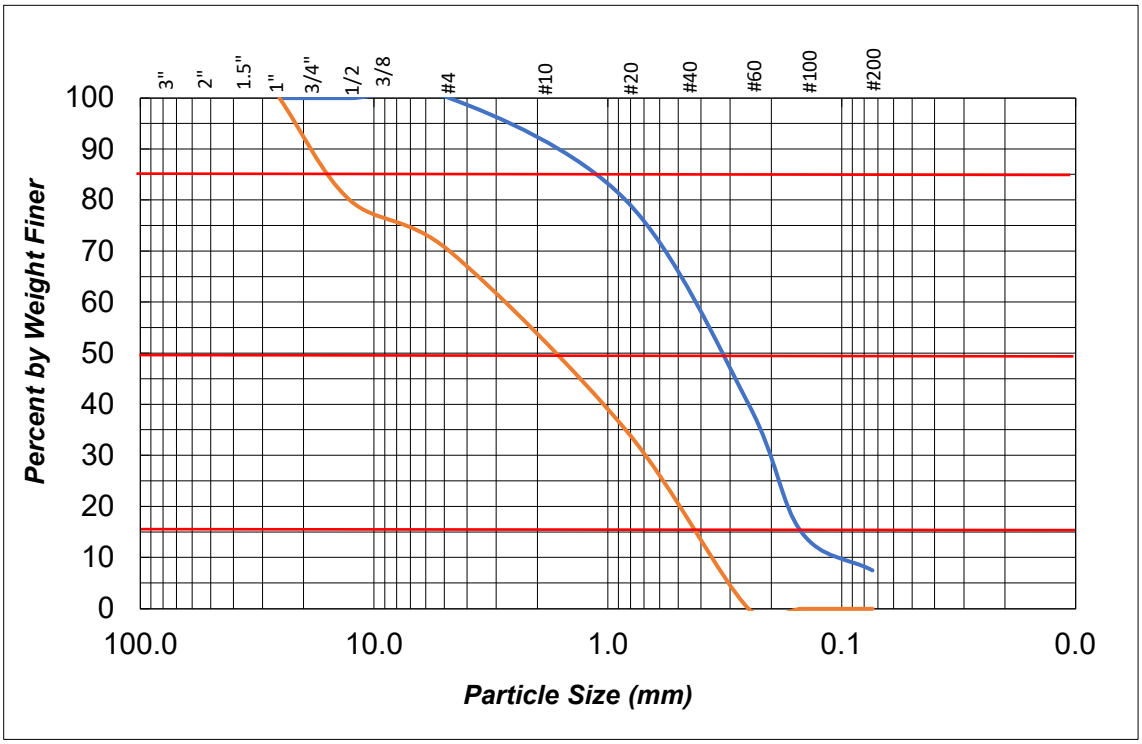


PROJECT: Cell 18 PROJECT No.: 240104

SOIL TYPE: Sand

TJM

		SPECIFICATION (%)		
U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	MIN	MAX	Test Results
3	76.2			
2	50.8			
1.5	38.1			
1	25.4	100	100	
3/4	19.1			
1/2	12.7	80	100	
3/8	9.5			
#4	4.76	70	100	
#10	2.0			
#20	0.84	35	80	
#40	0.42			
#60	0.25	0	40	
#100	0.149	0	15	
#200	0.074	0	7.5	



E-3

UNDERDRAIN PIPE SIZING AND SPACING

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 18
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 11/4/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine spacing of underdrain piping in underdrain system.

DESIGN CRITERIA

1. Space underdrain piping so that underdrain sand flow capacity is not exceeded.

ANALYSIS

1. Determine when flow from till will exceed the capacity of the proposed underdrain sand.

$Q=KiA$

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{sand} = Horizontal Hydraulic Conductivity of underdrain sand =	5.00E-03	cm/sec
	9.84E-03	ft/min
i_{sand}= Hydraulic Gradient of underdrain sand =	0.033	ft/ft (min Base grade Slope)
A_{sand} =Width x Thickness of UD Sand =	1	ft^2
(Assuming Saturation)		
Q_{sand} = calculated flow capacity of underdrain sand =	3.25E-04	ft^3/min

3. Determine quantity of groundwater expressed from exisitng till :

Per unit width of collection pipe (w = 1ft)

$Q=Ki(LxW)$

K_{till} = Horizontal Hydraulic Conductivity of existing till =	1.00E-05	cm/sec
	1.97E-05	ft/min
i_{till}= Hydraulic Gradient of overburden soil =	0.038	ft/ft (typical high pre-construction overburden phreatic slope)
W = Till Width	1	ft
Q_{till} =Q_{sand} =	3.25E-04	ft^3/min
Solve for L		
$L=(Q_{sand})/(K_{till}*i_{till}*L)$		
L=	434	ft (Spacing of collection pipe measured along base gradient)

CONCLUSION

The proposed underdrain pipe spacing will not exceed the sand flow capacity.

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 18
Project Location: Old Town, Maine
Project No.: 240101
By: DPW
Date: 11/3/2025
Checked By: BDP
Date: 11/3/2025.

OBJECTIVE

Determine anticapated uderdrain flow from Cell 18.

DESIGN CRITERIA

1. Evaluate pipe sizing necessary to carry anticitpated flows.

ANALYSIS

1. Determine flow from till into proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{till} = Horizontal Hydraulic Conductivity of existing till = 1.00E-05 cm/sec
1.97E-05 ft/min
i_{till}= Hydraulic Gradient of overburden soil = 0.038 ft/ft (typical high pre-construction overburden phreatic slope)

	AREA (sf)	K-till (ft/min)	*i* -till	Q (cfs)	Q (gpm)	
CELL 18	520,300	1.97E-05	0.038	0.0065	2.9	< 20 gpm Capacity of discharge pipe.

CONCLUSION

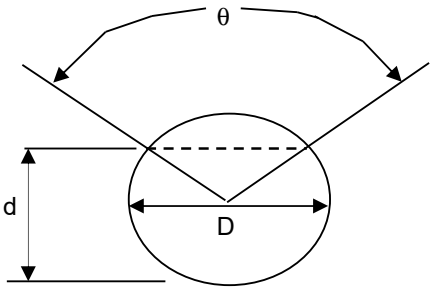
The Underdrain Discharge Pipe Capacity is > the estimated Cell 18 Underdrain Flow

ft^3/min

SEVEE && MAHER ENGINEERS, INC.

UNDERDRAIN DISCHARGE PIPE CAPACITY

CELL 18		Location:	OLD TOWN, MAINE
By: PCM		Date: 10/1/2024	
Chk. By: BDP		Date: 11/6/2024	mdo version 12.8.00



INPUT

D=	3.63	inches
d=	1.82	inches
n=	0.015	mannings coeff
θ=	179.7	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.04	0.48	0.08	1.25	0.05	20

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

ft^3/min

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cells 19 and 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: DPW
Date: 4/22/2025

OBJECTIVE

Determine anticapated uderdrain flow from Cells 19

DESIGN CRITERIA

1. Evaluate pipe sizing necessary to carry anticitpated flows.

ANALYSIS

1. Determine when flow from till will exceed the capacity of the proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe in steep base grade (9.7%) area

K_{sand} = Horizontal Hydraulic Conductivity of underdrain sand =	5.00E-03	cm/sec
	9.84E-03	ft/min
i_{sand}= Hydraulic Gradient of underdrain sand =	0.097	ft/ft (min Base grade Slope)
A_{sand} =Width x Thickness of UD Sand =	1	ft^2
(Assuming Saturation)		
Q_{sand} = calculated flow capacity of underdrain sand =	9.55E-04	ft^3/min

3. Determine quantity of groundwater expressed from exisitng till :

Per unit width of collection pipe (w = 1ft)

Q=Ki(LxW)

K_{till} = Horizontal Hydraulic Conductivity of existing till =	1.00E-05	cm/sec
	1.97E-05	ft/min
i_{till}= Hydraulic Gradient of overburden soil =	0.028	ft/ft (typical high pre-construction overburden phreatic slope)
W = Till Width	1	ft
Q_{till} =Q_{sand} =	9.55E-04	ft^3/min
Solve for L		
$L=(Q_{sand})/(K_{till}*i_{till}*L)$		
L=	1732	ft (Spacing of collection pipe measured along base gradient)

4. Determine the Capacity of the Underdrain Sand per unit width of collection pipe in shallow (2%) base grade area

K_{sand} = Horizontal Hydraulic Conductivity of underdrain sand =	5.00E-03	cm/sec
	9.84E-03	ft/min
i_{sand}= Hydraulic Gradient of underdrain sand =	0.02	ft/ft (min Base grade Slope)
A_{sand} =Width x Thickness of UD Sand =	1	ft^2
(Assuming Saturation)		
Q_{sand} = calculated flow capacity of underdrain sand =	1.97E-04	ft^3/min

5. Determine quantity of groundwater expressed from exisitng till :

Per unit width of collection pipe (w = 1ft)

Q=Ki(LxW)

K_{till} = Horizontal Hydraulic Conductivity of existing till =	1.00E-05	cm/sec
	1.97E-05	ft/min
i_{till}= Hydraulic Gradient of overburden soil =	0.035	ft/ft (typical high pre-construction overburden phreatic slope)
W = Till Width	1	ft
Q_{till} =Q_{sand} =	1.97E-04	ft^3/min
Solve for L		
$L=(Q_{sand})/(K_{till}*i_{till}*L)$		
L=	286	ft (Spacing of collection pipe measured along base gradient)

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cells 19 and 20
Project Location: Old Town, Maine

PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cells 19 and 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: DPW
Date: 4/22/2025

ANALYSIS CONT'D

6. Determine the Capacity of the Underdrain Sand per unit width of collection pipe in shallow (5%) base grade area

K_{sand} = Horizontal Hydraulic Conductivity of underdrain sand =	5.00E-03	cm/sec
	9.84E-03	ft/min
i_{sand}= Hydraulic Gradient of underdrain sand =	0.05	ft/ft (min Base grade Slope)
A_{sand} =Width x Thickness of UD Sand =	1	ft^2
(Assuming Saturation)		
Q_{sand} = calculated flow capacity of underdrain sand =	4.92E-04	ft^3/min

7. Determine quantity of groundwater expressed from exisitng till :

Per unit width of collection pipe (w = 1ft)

Q=Ki(LxW)

K_{till} = Horizontal Hydraulic Conductivity of existing till =	1.00E-05	cm/sec
	1.97E-05	ft/min
i_{till}= Hydraulic Gradient of overburden soil =	0.035	ft/ft (typical high pre-construction overburden phreatic slope)
W = Till Width	1	ft
Q_{till} =Q_{sand} =	4.92E-04	ft^3/min
Solve for L		
$L=(Q_{sand})/(K_{till}*i_{till}*L)$		
L=	714	ft (Spacing of collection pipe measured along base gradient)

CONCLUSION

The proposed underdrain pipe spacing will not exceed the sand flow capacity.

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 19 and 20
Project Location: Old Town, Maine
Project No.: 240101
By: DPW
Date: 11/3/2025
Checked By: BDP
Date: 11/3/2025

OBJECTIVE

Determine anticapated uderdrain flow from Cell 19 and 20.

DESIGN CRITERIA

1. Evaluate pipe sizing necessary to carry anticitpated flows.

ANALYSIS

1. Determine flow from till into proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{till} = Horizontal Hydraulic Conductivity of existing till = 1.00E-05 cm/sec
1.97E-05 ft/min
i_{till}= Hydraulic Gradient of overburden soil = 0.038 ft/ft (typical high pre-construction overburden phreatic slope)

	AREA (sf)	K-till (ft/min)	*i* -till	Q (cfs)	Q (gpm)	
CELL 19+20	152,400	1.97E-05	0.028	0.0014	0.6	
CELL 19+20	351,500	1.97E-05	0.035	0.0040	1.8	
			Total =	0.01	2.44	< 18 gpm Capacity of discharge pipe.

CONCLUSION

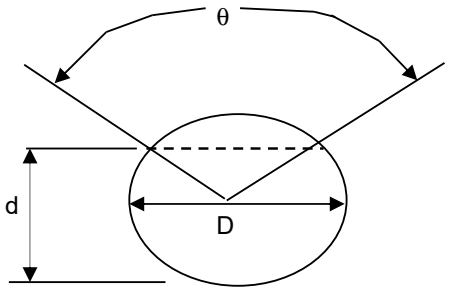
The Underdrain Discharge Pipe Capacity is > the estimated Cell 19 and Cell 20 Underdrain Flows

SEVEE && MAHER ENGINEERS, INC.

UNDERDRAIN DISCHARGE PIPE CAPACITY

CELL 19		Location:	OLD TOWN, MAINE
By: PCM		Date:	3/3/2025
Chk. By: DPW		Date:	4/22/2025

mdo version 12.8.00



INPUT

D=	3.63	inches
d=	1.82	inches
n=	0.015	mannings coeff
θ=	179.7	degrees
S=	0.004	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.04	0.48	0.08	1.12	0.04	18

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 21
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 10/1/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine spacing of underdrain piping in underdrain system.

DESIGN CRITERIA

1. Space underdrain piping so that underdrain sand flow capacity is not exceeded.

ANALYSIS

1. Determine when flow from till will exceed the capacity of the proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{sand} = Horizontal Hydraulic Conductivity of underdrain sand =	5.00E-03	cm/sec
	9.84E-03	ft/min
i_{sand}= Hydraulic Gradient of underdrain sand =	0.02	ft/ft (min Base grade Slope)
A_{sand} =Width x Thickness of UD Sand =	1	ft^2
(Assuming Saturation)		
Q_{sand} = calculated flow capacity of underdrain sand =	1.97E-04	ft^3/min

3. Determine quantity of groundwater expressed from exisitng till :

Per unit width of collection pipe (w = 1ft)

Q=Ki(LxW)

K_{till} = Horizontal Hydraulic Conductivity of existing till =	1.00E-05	cm/sec
	1.97E-05	ft/min
i_{till}= Hydraulic Gradient of overburden soil =	0.027	ft/ft (typical high pre-construction overburden phreatic slope)
W = Till Width	1	ft
Q_{till} =Q_{sand} =	1.97E-04	ft^3/min
Solve for L		
$L=(Q_{sand})/(K_{till}*i_{till}*L)$		
L=	370	ft (Spacing of collection pipe measured along base gradient)
		Longest Travel length = 329' < 370' spacing is okay.

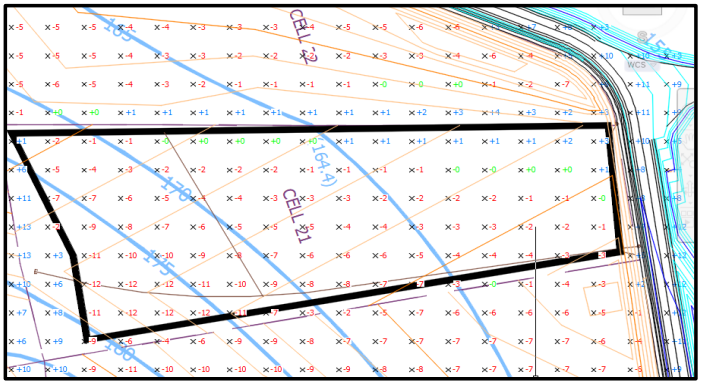
CONCLUSION

The proposed underdrain pipe spacing will not exceed the sand flow capacity.

Slope Report- Groundwater Gradient Tue Oct 22 09:46:22 2024

Surface: \\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Carlson\SURFACES\20241008-POTENT-2024-bwb.tin

Horizontal Area: 330,790.7 sq ft, 7.594 acres
Slope Area: 330,932.7 sq ft, 7.597 acres
Average Elevation: 168.80
Average Slope: 2.76%



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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 21
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 10/1/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Determine anticapated uderdrain flow from Cell 21 + Cell 18.

DESIGN CRITERIA

1. Evaluate pipe sizing necessary to carry anticitpated flows.

ANALYSIS

1. Determine flow from till into proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{till} = Horizontal Hydraulic Conductivity of existing till = 1.00E-05 cm/sec
1.97E-05 ft/min
i_{till}= Hydraulic Gradient of overburden soil = 0.027 ft/ft (typical high pre-construction overburden phreatic slope)

	AREA (sf)	K-till (ft/min)	*i* -till	Q (cfs)	Q (gpm)	
CELL 18	520,300	1.97E-05	0.033	0.0056	2.5	
CELL 21	331,000	1.97E-05	0.027	0.0029	1.3	
					3.8	*< 20 gpm Capacity of discharge pipe.

CONCLUSION

The Underdrain Discharge Pipe Capacity (20 gpm) is > the estimated Cell 18 + Cell 21 Underdrain Flow (3.8 gpm)

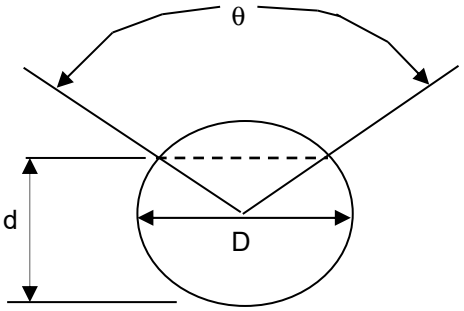
UNDERDRAIN DISCHARGE PIPE CAPACITY

CELL 21 Location: OLD TOWN, MAINE

By: PCM Date: 10/1/2024

Chk. By: BDP Date: 11/6/2024

mdo version 12.8.00



INPUT

D=	3.63	inches
d=	1.82	inches
n=	0.015	mannings coeff
θ=	179.7	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.04	0.48	0.08	1.25	0.05	20

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 22
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: DPW
Date: 4/22/2025

OBJECTIVE

To determine spacing of underdrain piping in underdrain system.

DESIGN CRITERIA

1. Space underdrain piping so that underdrain sand flow capacity is not exceeded.

ANALYSIS

1. Determine when flow from till will exceed the capacity of the proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{sand} = Horizontal Hydraulic Conductivity of underdrain sand =	5.00E-03	cm/sec
	9.84E-03	ft/min
i_{sand}= Hydraulic Gradient of underdrain sand =	0.02	ft/ft (min Base grade Slope)
A_{sand} =Width x Thickness of UD Sand =	1	ft^2
(Assuming Saturation)		
Q_{sand} = calculated flow capacity of underdrain sand =	1.97E-04	ft^3/min

3. Determine quantity of groundwater expressed from exisitng till :

Per unit width of collection pipe (w = 1ft)

Q=Ki(LxW)

K_{till} = Horizontal Hydraulic Conductivity of existing till =	1.00E-05	cm/sec
	1.97E-05	ft/min
i_{till}= Hydraulic Gradient of overburden soil =	0.021	ft/ft (typical high pre-construction overburden phreatic slope)
W = Till Width	1	ft
Q_{till} =Q_{sand} =	1.97E-04	ft^3/min
Solve for L		
$L=(Q_{sand})/(K_{till}*i_{till}*L)$		
L=	476	ft (Spacing of collection pipe measured along base gradient)
		Longest travel path to pipe is 340', Spacing is okay

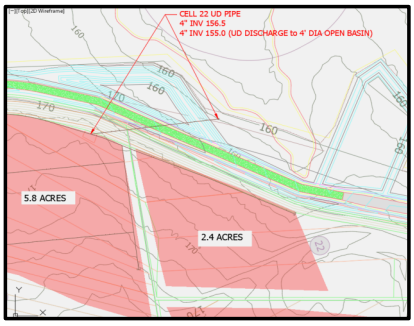
CONCLUSION

The proposed underdrain pipe spacing will not exceed the sand flow capacity.

Slope Report Tue Oct 22 11:13:21 2024

Surface: \\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Carlson\SURFACES\20241008-POTENT-2024-bwb.tin

Horizontal Area: 306,879.8 sq ft, 7.045 acres
Slope Area: 306,950.1 sq ft, 7.047 acres
Average Elevation: 163.71
Average Slope: 2.07%



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PIPE SPACING CALCULATION - UNDERDRAIN

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 22
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: DPW
Date: 4/22/2025

OBJECTIVE

Determine anticapated uderdrain flow from Cell 20 + 22.

DESIGN CRITERIA

1. Evaluate pipe sizing necessary to carry anticitpated flows.

ANALYSIS

1. Determine flow from till into proposed underdrain sand.

Q=KiA

2. Determine the Capacity of the Underdrain Sand per unit width of collection pipe

K_{till} = Horizontal Hydraulic Conductivity of existing till = 1.00E-05 cm/sec
1.97E-05 ft/min
i_{till}= Hydraulic Gradient of overburden soil = 0.021 ft/ft (typical high pre-construction overburden phreatic slope)

	AREA (sf)	K-till (ft/min)	*i* -till	Q (cfs)	Q (gpm)
CELL 20	254,500	1.97E-05	0.02	0.0017	0.8
CELL 22	104,400	1.97E-05	0.021	0.0007	0.3
					1.1

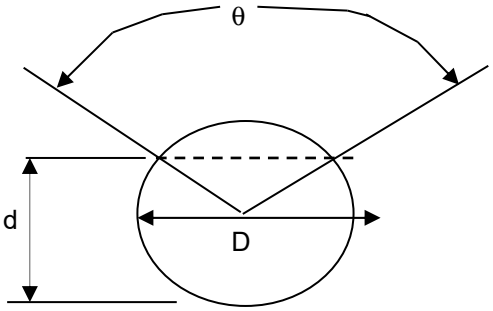
*< 20 gpm Capacity of discharge pipe.

CONCLUSION

The Underdrain Discharge Pipe Capacity (20 gpm) is > the estimated Cell 20 + Cell 22 Underdrain Flow (1.1 gpm)

UNDERDRAIN DISCHARGE PIPE CAPACITY

CELL 22		Location:	OLD TOWN, MAINE	
By: PCM		Date:	3/3/2025	
Chk. By: DPW		Date:	4/22/2025	mdo version 12.8.00



INPUT

D=	3.63	inches
d=	1.82	inches
n=	0.015	mannings coeff
θ=	179.7	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.04	0.48	0.08	1.25	0.05	20

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

E-4

LEAK DETECTION PIPE SIZING AND SPACING

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 18
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/25/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992.
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 18).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 4.7% (minimum)
4. Compressive load strength is 15,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 18 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE} =	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

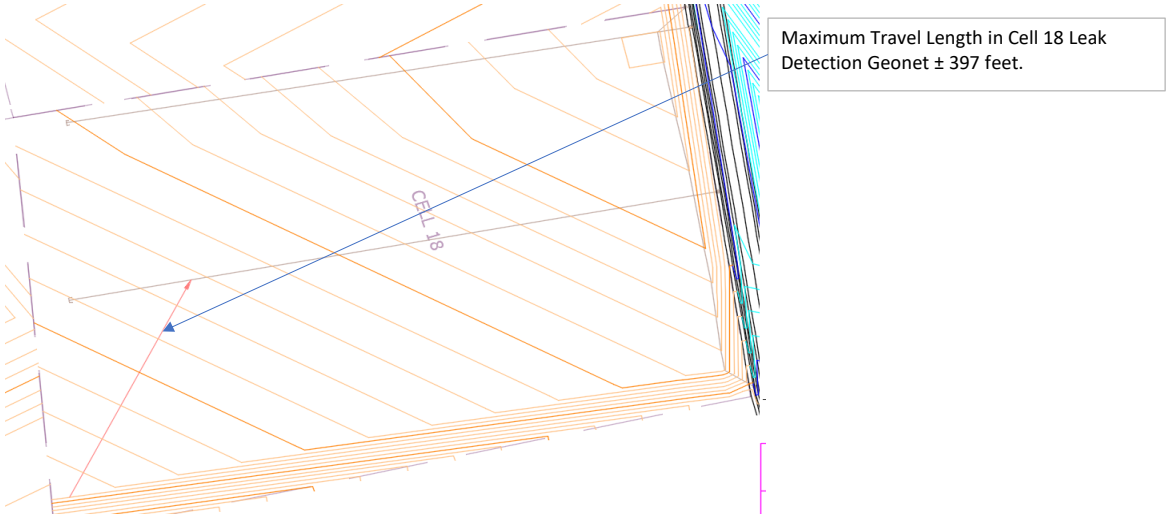
T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 18 LD Conditions

i =	0.047	ft/ft	LF Gradient
L =	397	ft	Longest flow length to Cell 18 LD pipe measured on drawing
L =	121.04	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

ANALYSIS (CONT'D)



Maximum Travel Length in Cell 18 Leak Detection Geonet ± 397 feet.

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

$T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) =$ m^2/sec

$T_{req} = 2.249E-05$ m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

$k_{req} =$ 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

$t_L =$	581584.1	sec	Travel time in geocomposite only.
	9693.1	min	Pipe travel time is insignificant.
	161.6	hrs	
	6.7	days	< 30 days, Okay.

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/25/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992.
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 19).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 2.0%.
4. Compressive load strength is 10,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 19 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE} =	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

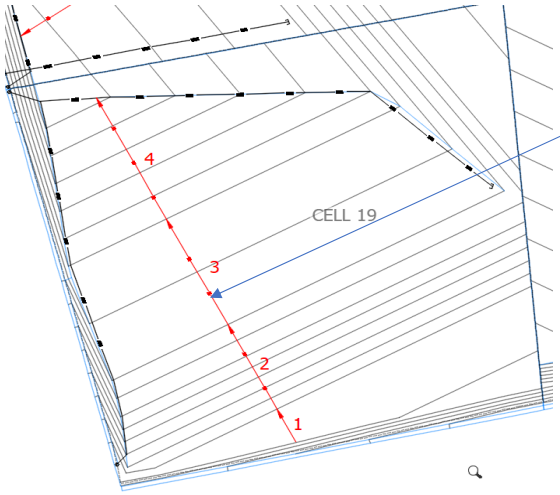
T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 19 LD Conditions

i =	0.02	ft/ft	LF Gradient	
L =	263	ft	Longest flow length to Cell 19 LD pipe measured on drawing along given grade	(63+200)
L =	80.18	m	Flow Path Length in meters	
t_g =	250	mil	Thickness of LD drain	
	0.0064	m		
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)	

ANALYSIS (CONT'D)



Maximum Travel Length in Cell 19 Leak Detection Geonet at three different

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

$T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) =$ m^2/sec

$T_{req} = 2.249E-05$ m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

$k_{req} =$ 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

$t_L =$	905410.7	sec	Travel time in geocomposite only.
	15090.2	min	Pipe travel time is insignificant.
	251.5	hrs	
	10.5	days	Legs 1+3 travel time

Travel Time in Geocomposite = (Leg 1 +Leg 3) + Leg 2 + Leg 4
= 10.5 + 1.4 + 3.7 days
= 15.6 days **< 30 days, Okay.**

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/25/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 19).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 8.8%
4. Compressive load strength is 10,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 19 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE} =	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 19 LD Conditions

i =	0.088	ft/ft	LF Gradient
L =	160	ft	Longest flow length to Cell 19 LD pipe measured on drawing along given grade
L =	48.78	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) = m^2/sec

T_{req} = 2.249E-05 m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

k_{req} = 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

t_L =	125186.4	sec	Travel time in geocomposite only.
	2086.4	min	Pipe travel time is insignificant.
	34.8	hrs	
	1.4	days	Leg 2 travel time

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/25/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 19).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 5.0% .
4. Compressive load strength is 15,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 19 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE}=	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 19 LD Conditions

i =	0.05	ft/ft	LF Gradient
L =	230	ft	Longest flow length to Cell 19 LD pipe measured on drawing along given grade
L =	70.12	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) = m^2/sec

T_{req} = 2.249E-05 m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

k_{req} = 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

t_L =	316721.6	sec	Travel time in geocomposite only.
	5278.7	min	Pipe travel time is insignificant.
	88.0	hrs	
	3.7	days	Leg 4 travel time

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992.
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 20).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 2%
4. Compressive load strength is 15,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 20 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE} =	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

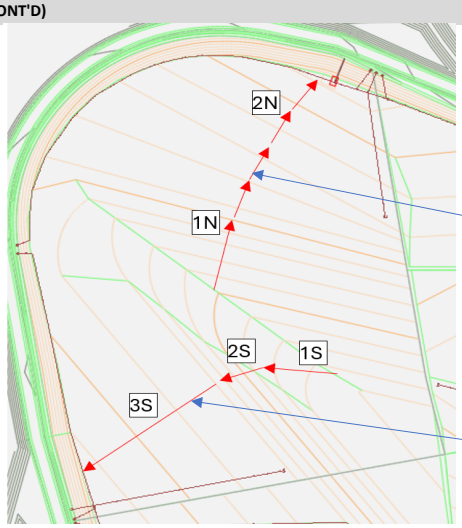
T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 20 LD Conditions

i =	0.02	ft/ft	LF Gradient
L =	472	ft	Longest flow length to Cell 20 LD pipe measured on drawing along given grade
L =	143.90	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

ANALYSIS (CONT'D)



Travel time in geocomposite is shorter in this path than in the southern part of this

Maximum Travel Length in Cell 20 Leak Detection Geonet ± 472 feet along 2 percent grade (Leg 1S + Leg 3S) and 126 feet along 10 percent grade(Leg 2S).

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

$T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) =$ m^2/sec

$T_{req} = 2.249E-05$ m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

$k_{req} =$ 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

$t_L =$	1624919.5	sec	Travel time in geocomposite only.
	27082.0	min	Pipe travel time is insignificant.
	451.4	hrs	
	18.8	days	Leg 1S + Leg 3S Travel Time

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 20).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 10%
4. Compressive load strength is 15,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 20 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE}=	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 20 LD Conditions

i =	0.1	ft/ft	LF Gradient
L =	126	ft	Longest flow length to Cell 20 LD pipe measured on drawing along given grade
L =	38.41	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) = m^2/sec

T_{req} = 2.249E-05 m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

k_{req} = 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

t_L =	86754.2	sec	Travel time in geocomposite only.
	1445.9	min	Pipe travel time is insignificant.
	24.1	hrs	
	1.0	days	Leg 2 Travel Time

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 21
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/25/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992.
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 21).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 2% (minimum)
4. Compressive load strength is 15,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 21 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE} =	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

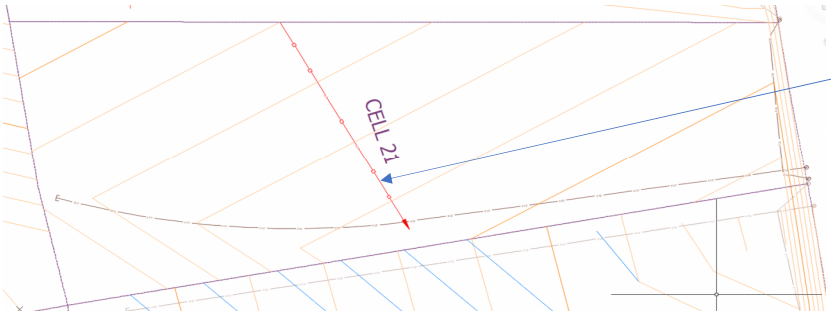
T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 21 LD Conditions

i =	0.02	ft/ft	LF Gradient
L =	350	ft	Longest flow length to Cell 21 LD pipe measured on drawing along given grade
L =	106.71	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

ANALYSIS (CONT'D)



Maximum Travel Length in Cell 21 Leak Detection Geonet ± 350 feet along 2 percent grade.

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

$T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) =$ m^2/sec

$T_{req} =$ 2.249E-05 m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

$k_{req} =$ 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

$t_L =$	1204919.1	sec	Travel time in geocomposite only.
	20082.0	min	Pipe travel time is insignificant.
	334.7	hrs	
	13.9	days	< 30 days, Okay.

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LEAK DETECTION SYSTEM DESIGN

Project Name: Juniper Ridge Landfill Cell 22
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

Evaluate the length of time required for a leak to be detected under the worst case design conditions.

REFERENCES

1. Giroud J.P. et. al., Rate of Leakage Though a Composite Liner Due to Geomembrane Defects, Geotextiles and Geomembranes, p 1-28, 1992.
2. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

1. Longest Leak Detection travel path as shown on sketch below (Cell 22).
2. Liner System is as shown below:
   80-mil HDPE Geomembrane
   GCL
   12-inch Compacted Clay
   12-inches Drainage Sand with 6-inch diameter HDPE piping
   Drainage Geocomposite
   60-mil HDPE Geomembrane
3. Gradient along geocomposite is 2% (minimum)
4. Compressive load strength is 15,000 lbs/ft^2

ANALYSIS

Determine Geocomposite Flow Properties:

Geocomposite Transmissivity (T) per Cell 22 specification.

T_{250} = 9.65E-05 m^2/sec

Geocomposite Reduction Factors (2.)

RF_{IN} =	1.0	Reduction Factor for Intrusion(Under Conformance Test Conditions)
RF_{CR} =	1.1	Reduction Factor for Creep (Based on Manufacturers Testing)
RF_{CC} =	1.3	Reduction Factor for Chemical Clogging
RF_{BC} =	1.5	Reduction Factor for Biological Clogging
RF_{DE} =	2.0	Reduction Factor for Design

Reduced Geocomposite Transmissivity (T_{250RED}) = T_{250} / (RF_{IN} x RF_{CR} x RF_{CC} x RF_{BC} x RF_{DE})

T_{250RED} = 2.249E-05 m^2/sec

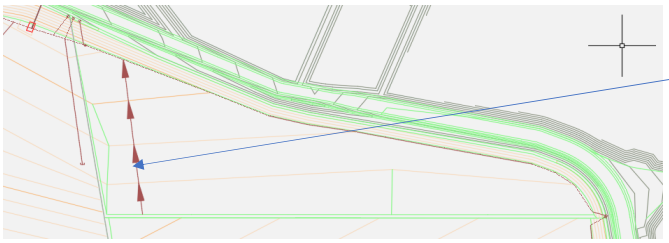
T_{250RED} = Design Value

System Design: 250 mil Geonet / Drainage Geocomposite

Cell 22 LD Conditions

i =	0.02	ft/ft	LF Gradient
L =	346	ft	Longest flow length to Cell 22 LD pipe measured on drawing along given grade
L =	105.49	m	Flow Path Length in meters
t_g =	250	mil	Thickness of LD drain
	0.0064	m	
n =	0.8	unitless	Porosity of drain (Per Skaps Industries Tech. Support)

ANALYSIS (CONT'D)



Maximum Travel Length in Cell 22 Leak Detection Geonet ± 346 feet along 2 percent grade.

SOLVE FOR TRAVEL TIME (LEAK DETECTION TIME) IN DRAINAGE GEOCOMPOSITE TO NEAREST PIPE

Leak Detection Time:

$T_{req} = T_{250}/(RF_{CR}*RF_{CC}*RF_{BC}*RF_{DE}) =$ m^2/sec

$T_{req} = 2.249E-05$ m^2/sec Design value (Reduced Specified Value) .

$k_{req} = T_{req}/t_g$ m/sec permeability of drain

$k_{req} =$ 3.542E-03 m/sec

$t_L = (n*L)/(k_{req}*i)$

$t_L =$	1191148.6	sec	Travel time in geocomposite only.
	19852.5	min	Pipe travel time is insignificant.
	330.9	hrs	
	13.8	days	< 30 days, Okay.

E-5

LEACHATE COLLECTION PIPE SIZING AND SPACING

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 18
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/11/2024
Checked By: BDP
Date: 11/6/20204

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	1.8328	degrees	Slope of the Landfill Base Between Pipes (3.2 percent)
	0.03198839	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor:(3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$ *ψDesign=* 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$ K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max}\cdot(2\cdot\cos(\beta))}{\left[\sqrt{\left(4\cdot\frac{e}{K}\right)+\tan(\beta)^2}-\tan(\beta)\right]}$$ L = 206 ft OK, MORE THAN LONGEST PATH LAID OUT= 195

CONCLUSION

The proposed Cell 18 leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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LEACHATE COLLECTION PIPE SIZING

Project Name: Juniper Ridge Landfill Cell 18
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/18/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate sizing of leachate collection lateral and header piping.

REFERENCES

N/A

ASSUMPTIONS

1. Size pipes appropriately to allow peak daily infiltration into waste and runoff over open waste assuming 10-feet of waste to header collection pipe. Assume largest open area header and add runoff from Stage 1 Cell Development slope with 40' vertical open waste. See HELP Model output Appendix D.
   Infiltration in/acre = 0.31402 (See HELP output in Appendix D, 10' Open Waste Condition with 100% Runoff; peak daily drainage collected
   Runoff in/acre = 3.764 per acre from layer 3 and peak daily runoff per acre over open area to header)
2. Minimum pipe size is 6" nominal (ID) to allow for proper cleaning.
3. For leachate collection laterals assume largest area contributing to a single leachate lateral and pipe slope (2%) as design condition.
4. For leachate header pipes assume largest area contributing to a leachate header during initial conditions and minimum pipe slope (2%) as design condition. Assume amount infiltrating is accounted for in sizing (Conservative because flow is delayed)
5. Assume pipe flow using Manning's Equation with HDPE pipe n= 0.012.

ANALYSIS

LEACHATE COLLECTION LATERAL AND HEADER ANALYSIS
Determine maximum amount of leachate to a lateral

Equation: Q=KA
Q= Flow to Pipe (ft^3/sec)
K= Infiltration through Waste (ft/sec)
A= Area contributing to flow (ft^2)

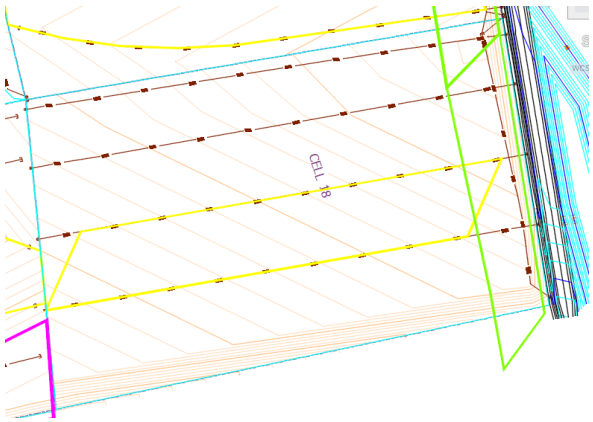
Convert Help Model Infiltration (in/day) to ft/sec.

Infiltration to Lateral =	0.31402	in/day/acre
	3.03E-07	ft/sec/acre
Runoff to Header =	3.764	in/day/acre
	3.63E-06	ft/sec/acre

ANALYSIS (CONT'D)

Multiply above rates by the contributing area to determine Q.

$A_{laterals}$ =	136,344	ft^2
$A_{headers}$ =	663,000.0	ft^2
	15.2	ACRES
$A_{runoff\ to\ Header}$ =	70,000	ft^2
	1.6	ACRES



Q_{Total} = Total Flow to Header = Infiltration + Runoff

$Q_{laterals}$ =	136,344	ft^2	x	3.029E-07	ft/sec	=	0.041	ft^3/sec
$Q_{Infilt\ to\ Header}$ =	663,000	ft^2	x	3.029E-07	ft/sec	=	0.201	ft^3/sec
$Q_{runoff\ to\ Header}$ =	70,000	ft^2	x	3.630E-06	ft/sec	=	0.254	ft^3/sec
$Q_{HeaderTotal}$ =							0.455	ft^3/sec

Determine maximum flow (Q_{max}) in 6-inch diameter and 8-inch diameter HDPE pipes using Manning's Equation.

OD =	6	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	5.349	inches (EJP Reference Manual)
	0.45	feet
Slope =	0.02	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.63	ft^3/sec (See attached printout)

OD =	8	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	6.963	inches (EJP Reference Manual)
	0.58	feet
Slope =	0.02	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	1.3	ft^3/sec (See attached printout)

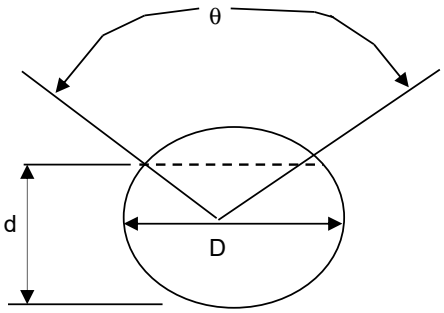
CONCLUSION

The maximum calculated flow (Q_{max}) for the header and lateral is greater than maximum total flow (Qtotal) anticipated from infiltration and runoff to the lateral and header; therefore the leachate collection header and lateral pipe sizing is appropriate.

LEACHATE COLLECTION 6-INCH LATERAL DISCHARGE PIPE CAPACITY

CELL 18		Location:	OLD TOWN, MAINE
By: PCM		Date:	9/18/2024
Chk. By: BDP		Date:	11/6/2024

mdo version 12.8.00



INPUT

D=	5.349	inches
d=	5.349	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.02	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

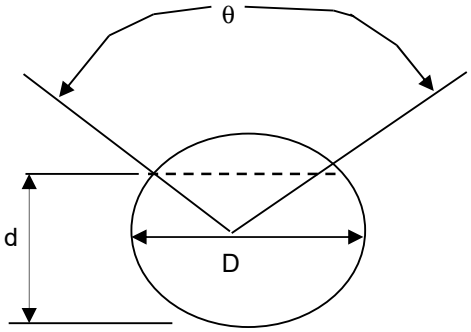
Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.16	1.40	0.11	4.06	0.63	284

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

LEACHATE COLLECTION 8-INCH HEADER DISCHARGE PIPE CAPACITY

CELL 18		Location:	OLD TOWN, MAINE
By: PCM	Date:	9/18/2024	
Chk. By: BDP	Date:	11/6/2024	mdo version 12.8.00



INPUT

D=	6.963	inches
d=	6.963	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.02	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.26	1.82	0.15	4.83	1.28	574

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/11/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	1.1458	degrees	Slope of the Landfill Base Between Pipes (2.0 percent)
	0.01999798	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging
Based on project specifiction

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$ *ψDesign=* 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$ K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$ L = 129 ft OK, Spacing of pipes in Cell 19 will be less than 126' (<129') in area where grade is 2% or greater

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/11/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	2.57657	degrees	Slope of the Landfill Base Between Pipes (4.5 percent)
	0.04496963	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging
Based on project specifiction

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$ *ψDesign=* 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$ K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$ L = 289 ft OK, Spacing of pipes in Cell 19 will be less than 266' (<289') in area where grade is 4.5% or greater

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/11/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	3.8331	degrees	Slope of the Landfill Base Between Pipes (6.7 percent)
	0.06690022	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging
Based on project specifiction

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$ *ψDesign=* 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$ K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$ L = 429 ft OK, Spacing of pipes in Cell 19 will be less than 230' (<<429') in area where grade is 6.7% or greater

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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LEACHATE COLLECTION PIPE SIZING

Project Name: Juniper Ridge Landfill Cell 19
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/18/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate sizing of leachate collection lateral and header piping.

REFERENCES

N/A

ASSUMPTIONS

1. Size pipes appropriately to allow peak daily infiltration into waste and runoff over open waste assuming 10-feet of waste to header collection pipe. Assume largest open area header and add runoff from Stage 1 Cell Development slope with 40' vertical open waste. See HELP Model output Appendix D.
   Infiltration in/acı 0.31402 (See HELP output in Appendix D, 10' Open Waste Condition with 100% Runoff; peak daily drainage collected per
   Runoff in/acre = 3.764 acre from layer 3 and peak daily runoff per acre over open area to header)
2. Minimum pipe size is 6" nominal (ID) to allow for proper cleaning.
3. For leachate collection laterals assume largest area contributing to a single leachate lateral (115,000 ft^2 in Cell 19) and pipe slope (0.5%) as design condition.
4. For leachate header pipes assume largest area contributing to a leachate header (area in and into Cell 19)and minimum pipe slope (0.5%) as design condition. Assume amount infiltrating is accounted for in sizing (Consevative in that this flow is delayed).
5. Assume pipe flow using Manning's Equation with HDPE pipe n= 0.012.

ANALYSIS

LEACHATE COLLECTION LATERAL AND HEADER ANALYSIS

Determine maximum amount of leachate to a lateral

Equation: Q=KA
Q= Flow to Pipe (ft^3/sec)
K= Infiltration through Waste (ft/sec)
A= Area contributing to flow (ft^2)

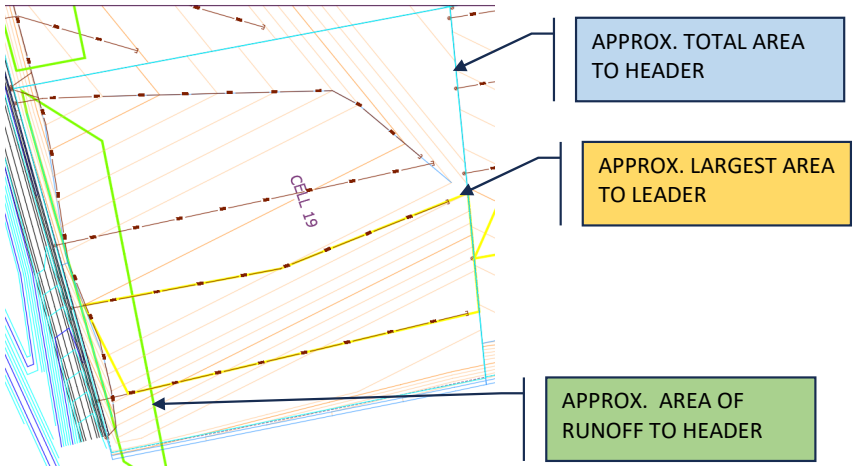
Convert Help Model Infiltration (in/day) to ft/sec.

Infiltration to Lateral =	0.31402	in/day/acre
	3.03E-07	ft/sec/acre
Runoff to Header =	3.764	in/day/acre
	3.63E-06	ft/sec/acre

ANALYSIS (CONT'D)

Multiply above rates by the contributing area to determine Q.

$A_{laterals}$ =	115,000	ft^2
$A_{headers}$ =	11.1	Acres
	483,000	ft^2
$A_{runoff\ to\ Header}$ =	62,000	ft^2



Q_{Total} = Total Flow to Header = Infiltration + Runoff

$Q_{laterals}$ =	115,000	ft^2	x	3.029E-07	ft/sec	=	0.035	ft^3/sec
$Q_{Infilt\ to\ Header}$ =	483,000	ft^2	x	3.029E-07	ft/sec	=	0.146	ft^3/sec
$Q_{runoff\ to\ Header}$ =	62,000	ft^2	x	3.630E-06	ft/sec	=	0.225	ft^3/sec
$Q_{HeaderTotal}$ =							0.371	ft^3/sec

Determine maximum flow (Q_{max}) in 6-inch diameter and 8-inch diameter HDPE pipes using Manning's Equation.

OD =	6	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	5.349	inches (EJP Reference Manual)
	0.45	feet
Slope =	0.005	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.32	ft^3/sec (See attached printout)

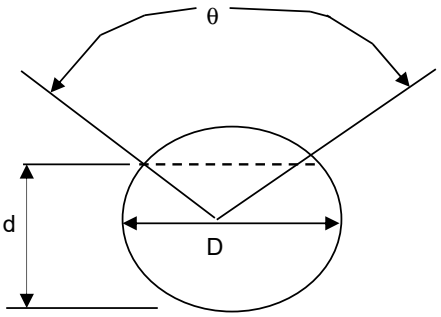
OD =	8	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	6.963	inches (EJP Reference Manual)
	0.58	feet
Slope =	0.01	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.9	ft^3/sec (See attached printout)

CONCLUSION

The maximum calculated flow (Q_{max}) for the header and lateral is greater than or equal to the maximum total flow (Qtotal) anticipated from infiltration and runoff to the lateral and header; therefore the leachate collection header and lateral pipe sizing is appropriate.

LEACHATE COLLECTION 6-INCH LATERAL DISCHARGE PIPE CAPACITY

CELL 19		Location:	OLD TOWN, MAINE	
By: PCM		Date:	9/19/2024	
Chk. By: BDP		Date:	11/6/2024	mdo version 12.8.00



INPUT

D=	5.349	inches
d=	5.349	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

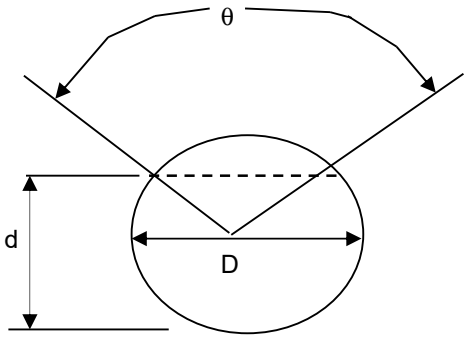
Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.16	1.40	0.11	2.03	0.32	142

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

LEACHATE COLLECTION 6-INCH LATERAL DISCHARGE PIPE CAPACITY

CELL 19		Location:	OLD TOWN, MAINE
By: PCM	Date:	9/19/2024	
Chk. By: BDP	Date:	11/6/2024	mdo version 12.8.00



INPUT

D=	6.963	inches
d=	6.963	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.01	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.26	1.82	0.15	3.42	0.90	406

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	1.1458	degrees	Slope of the Landfill Base Between Pipes (2.0 percent)
	0.01999798	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor:

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$

ψDesign= 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$

K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$

L = 129 ft OK, Spacing of pipes in Cell 20 will be less than 128' in area where grade is 2% or greater

CONCLUSION

The proposed leachate collection pipe spacing of 129 feet is less than the maximum pipe spacing calculated.

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	1.66111	degrees	Slope of the Landfill Base Between Pipes (2.9 percent)
	0.02899184	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor:

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$

ψDesign= 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$

K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$

L = 187 ft OK, Spacing of pipes in Cell 20 will be less than 143' in area where grade is 2.9% or greater

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	2.86241	degrees	Slope of the Landfill Base Between Pipes (5.0 percent)
	0.04995848	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$

ψDesign= 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$

K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$

L = 321 ft OK, Spacing of pipes in Cell 20 will be less than 207' in area where grade is 5% or greater

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	3.27049	degrees	Slope of the Landfill Base Between Pipes (5.7 percent)
	0.05708082	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$

ψDesign= 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$

K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$

L = 366 ft OK, Spacing of pipes in Cell 20 will be less than 207' (<<366') in area where grade is 5.7% or greater

CONCLUSION

The proposed leachate collection pipe spacing of 244 feet is less than the maximum pipe spacing calculated.

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LEACHATE COLLECTION PIPE SIZING

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 20
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 3/3/2025
Checked By: BDP
Date: 4/18/2025

OBJECTIVE

Evaluate sizing of leachate collection lateral and header piping.

REFERENCES

N/A

ASSUMPTIONS

1. Size pipes appropriately to allow peak daily infiltration into waste and runoff over open waste assuming 10-feet of waste to header collection pipe. Assume largest open area header and add runoff from Stage 1 Cell Development slope with 40' vertical open waste. See HELP Model output Appendix D.
   Infiltration in/acre = 0.31402 (See HELP output in Appendix D, 10' Open Waste Condition with 100% Runoff; peak daily drainage collected
   Runoff in/acre = 3.764 per acre from layer 3 and peak daily runoff per acre over open area to header)
2. Minimum pipe size is 6" nominal (ID) to allow for proper cleaning.
3. For leachate collection laterals assume largest area contributing to a single leachate lateral and pipe slope (2%) as design condition.
4. For leachate header pipes assume largest area contributing to a leachate header.
   and minimum pipe slope (0.5%) as design condition. Assume ammunt infiltrating is delayed and is not accounted for in sizing.
5. Assume pipe flow using Manning's Equation with HDPE pipe n= 0.012.

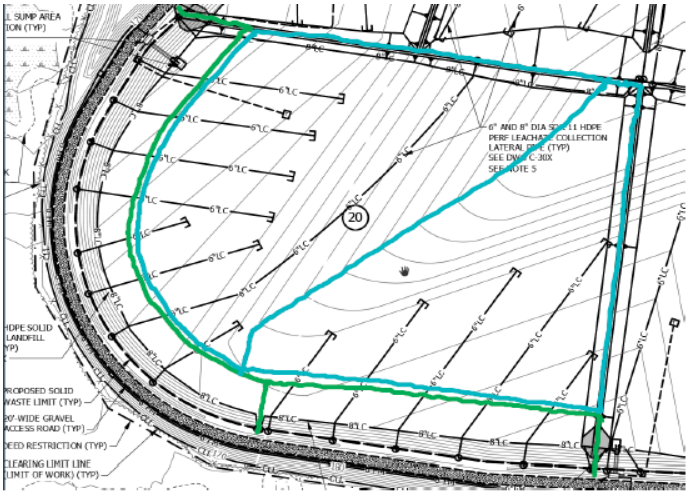
ANALYSIS

LEACHATE COLLECTION LATERAL AND HEADER ANALYSIS
Determine maximum amount of leachate to a lateral

Equation: Q=KA
Q= Flow to Pipe (ft^3/sec)
K= Infiltration through Waste (ft/sec)
A= Area contributing to flow (ft^2)

Convert Help Model Infiltration (in/day) to ft/sec.

Infiltration to Lateral =	0.31402	in/day/acre
	3.03E-07	ft/sec/acre
Runoff to Header =	3.764	in/day/acre
	3.63E-06	ft/sec/acre



ANALYSIS (CONT'D)

Multiply above rates by the contributing area to determine Q.

$A_{laterals}$ =	91,200	ft^2
$A_{headers}$ =	416,000.0	ft^2
	9.6	ACRES
$A_{runoff\ to\ Header}$ =	104,000	ft^2
	2.4	ACRES

Q_{Total} = Total Flow to Header = Infiltration + Runoff

$Q_{laterals}$ =	91,200	ft^2	x	3.029E-07	ft/sec	=	0.028	ft^3/sec
$Q_{Infilt\ to\ Header}$ =	416,000	ft^2	x	3.029E-07	ft/sec	=	0.126	ft^3/sec
$Q_{runoff\ to\ Header}$ =	104,000	ft^2	x	3.630E-06	ft/sec	=	0.378	ft^3/sec
$Q_{HeaderTotal}$ =							0.504	ft^3/sec

Determine maximum flow (Q_{max}) in 6-inch diameter and 8-inch diameter HDPE pipes using Manning's Equation.

OD =	6	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	5.349	inches (EJP Reference Manual)
	0.45	feet
Slope =	0.014	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.53	ft^3/sec (See attached printout)

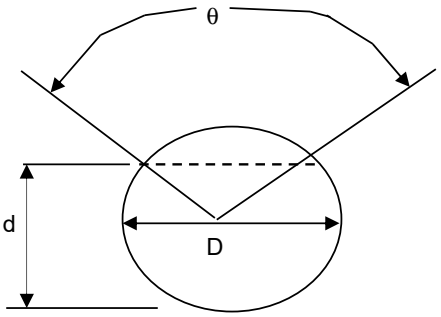
OD =	8	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	6.963	inches (EJP Reference Manual)
	0.58	feet
Slope =	0.005	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.64	ft^3/sec (See attached printout)

CONCLUSION

The maximum calculated flow (Q_{max}) for the header and lateral is greater than or equal to the maximum total flow (Qtotal) anticipated from infiltration and runoff to the lateral and header; therefore the leachate collection header and lateral pipe sizing is appropriate.

LEACHATE COLLECTION 6-INCH LATERAL DISCHARGE PIPE CAPACITY

CELL 20		Location:	OLD TOWN, MAINE	
By: PCM		Date:	3/3/2025	
Chk. By: BDP		Date:	4/18/2025	mdo version 12.8.00



INPUT

D=	5.349	inches
d=	5.349	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.014	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

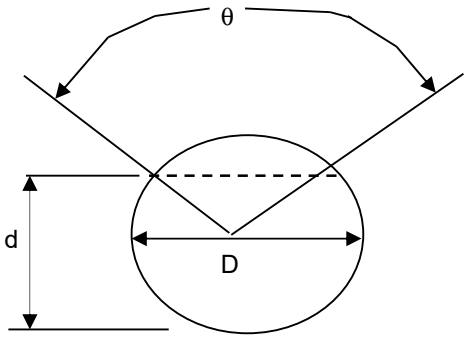
Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.16	1.40	0.11	3.39	0.53	238

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

LEACHATE COLLECTION 8-INCH HEADER DISCHARGE PIPE CAPACITY

	CELL 20		Location:	OLD TOWN, MAINE	
By:	PCM	Date:	3/3/2025		
Chk. By:	BDP	Date:	4/18/2025	mdo version 12.8.00	



INPUT

D=	6.963	inches
d=	6.963	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.26	1.82	0.15	2.42	0.64	287

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 21
Project Location: Old Town, Maine
Project No.: 24101
By: PCM
Date: 9/11/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Designing with Geosynthetics GSI GSI White Paper #4 Reduction Factors (RFs) Used in Geosynthetic Design
   Reduction Factors are equal to those used in current cells.

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	1.14576	degrees	Slope of the Landfill Base Between Pipes (2.0 percent)
	0.01999728	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$ *ψDesign=* 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$ K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$ L = 129 ft OK, MORE THAN LONGEST PATH LAID OUT= 129 feet

CONCLUSION

The proposed Cell 21 leachate collection pipe spacing of 129 (max.) feet is less than or equal to the maximum pipe spacing calculated.

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LEACHATE COLLECTION PIPE SIZING

Project Name: Juniper Ridge Landfill Cell 21
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/18/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

Evaluate sizing of leachate collection lateral and header piping.

REFERENCES

N/A

ASSUMPTIONS

1. Size pipes appropriately to allow peak daily infiltration into waste and runoff over open waste assuming 10-feet of waste to header collection pipe. Assume largest open area header and add runoff from Stage 1 Cell Development slope with 40' vertical open waste. See HELP Model output Appendix D.
   Infiltration in/acre = 0.31402 (See HELP output in Appendix D, 10' Open Waste Condition with 100% Runoff; peak daily drainage
   Runoff in/acre = 3.764 collected per acre from layer 3 and peak daily runoff per acre over open area to header)
2. Minimum pipe size is 6" nominal (ID) to allow for proper cleaning.
3. For leachate collection laterals assume largest area contributing to a single leachate lateral and pipe slope (0.8%) as design condition.
4. For leachate header pipes assume largest area contributing to a leachate header and minimum pipe slope (0.5%) as design condition. Assume amount infiltrating is accounted for in sizing. This is conservative because this volume is delayed.
5. Assume pipe flow using Manning's Equation with HDPE pipe n= 0.012.

ANALYSIS

LEACHATE COLLECTION LATERAL AND HEADER ANALYSIS

Determine maximum amount of leachate to a lateral

Equation: $Q=KA$

Q= Flow to Pipe (ft^3/sec)

K= Infiltration through Waste (ft/sec)

A= Area contributing to flow (ft^2)

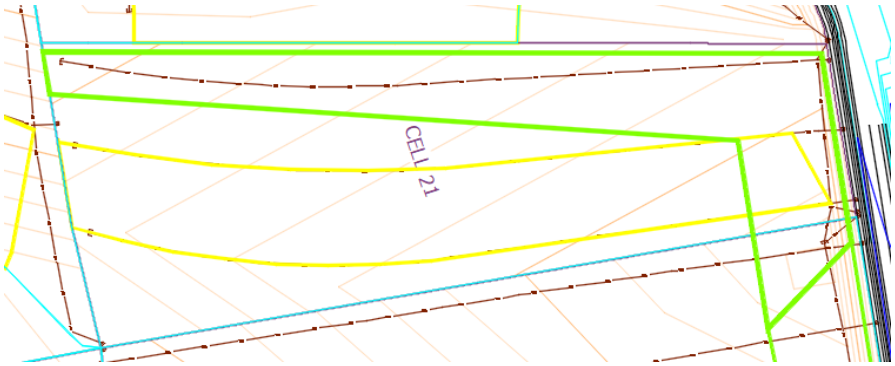
Convert Help Model Infiltration (in/day) to ft/sec.

Infiltration to Lateral =	0.31402	in/day/acre
	3.03E-07	ft/sec/acre
Runoff to Header =	3.764	in/day/acre
	3.63E-06	ft/sec/acre

ANALYSIS (CONT'D)

Multiply above rates by the contributing area to determine Q.

$A_{laterals}$ =	114,000	ft^2
$A_{headers}$ =	331,000.0	ft^2
	7.6	ACRES
$A_{runoff\ to\ Header}$ =	117,000	ft^2
	2.7	ACRES



Q_{Total} = Total Flow to Header = Infiltration + Runoff

$Q_{laterals}$ =	114,000	ft^2	x	3.029E-07	ft/sec	=	0.035	ft^3/sec
$Q_{Infilt\ to\ Header}$ =	331,000	ft^2	x	3.029E-07	ft/sec	=	0.100	ft^3/sec
$Q_{runoff\ to\ Header}$ =	117,000	ft^2	x	3.630E-06	ft/sec	=	0.425	ft^3/sec
$Q_{HeaderTotal}$ =							0.525	ft^3/sec

Determine maximum flow (Q_{max}) in 6-inch diameter and 8-inch diameter HDPE pipes using Manning's Equation.

OD =	6	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	5.349	inches (EJP Reference Manual)
	0.45	feet
Slope =	0.008	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.40	ft^3/sec (See attached printout)

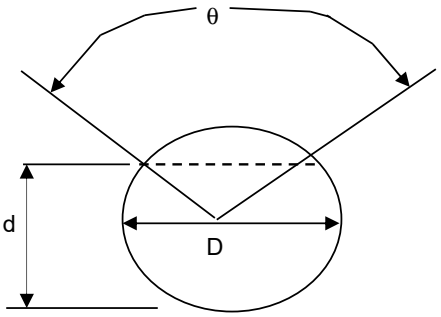
OD =	8	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	6.963	inches (EJP Reference Manual)
	0.58	feet
Slope =	0.02	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	1.3	ft^3/sec (See attached printout)

CONCLUSION

The maximum calculated flow (Q_{max}) for the header and lateral is greater than maximum total flow (Qtotal) anticipated from infiltration and runoff to the lateral and header; therefore the leachate collection header and lateral pipe sizing is appropriate.

LEACHATE COLLECTION 6-INCH LATERAL DISCHARGE PIPE CAPACITY

CELL 18		Location:	OLD TOWN, MAINE	
By: PCM		Date:	9/18/2024	
Chk. By: BDP		Date:	11/6/2024	mdo version 12.8.00



INPUT

D=	5.349	inches
d=	5.349	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.008	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

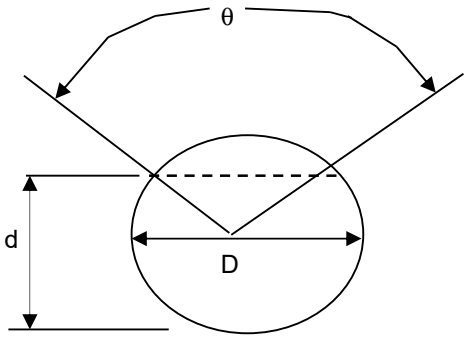
Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.16	1.40	0.11	2.56	0.40	180

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

LEACHATE COLLECTION 8-INCH HEADER DISCHARGE PIPE CAPACITY

CELL 18		Location:	OLD TOWN, MAINE
By: PCM	Date:	9/18/2024	
Chk. By: BDP	Date:	11/6/2024	mdo version 12.8.00



INPUT

D=	6.963	inches
d=	6.963	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.02	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.26	1.82	0.15	4.83	1.28	574

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 22
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 4/30/2025
Checked By: DPW
Date: 5/7/2025

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	1.3169	degrees	Slope of the Landfill Base Between Pipes (2.3 percent)
	0.02298424	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$

ψDesign= 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$

K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$

L = 148 ft OK, Spacing of pipes in Cell 22 will be 123' (<148') in area where grade is 2.3%

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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PIPE SPACING CALCULATION - LEACHATE COLLECTION

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 22
Project Location: Old Town, Maine
Project No.: 240101
By: PCM
Date: 9/11/2024
Checked By: BDP
Date: 11/6/2024

OBJECTIVE

To determine necessary leachate collection pipe spacing while maintaining maximum head on the liner to the thickness of the drainage net (geonet).

REFERENCES

1. Giroud ET Al., 1993
2. Design of Lateral Drainage Systems, Richardson 1999
3. Reduction Factors are equal to those used in current cells and as approved in previous permit application.
   Juniper Ridge Landfill Expansion (#S-020700-WD-BI-N and #L-19015-TG-D-N) June 1, 2017

ASSUMPTIONS

N/A

ANALYSIS

ψSpec=	3.20E-04	m^2/sec	Transmissivity Required in Drainage Geocomposite Specifications
K=	unknown	unitless	Permeability of Drainage Geocomposite
L=	unknown	m	Spacing between pipe laterals (measured along slope)
t=	0.3048	m	Leachate Collection Sand Thickness (12 inches)
e=	2.6191	in/month	(See HELP output in Appendix C, 10' Open Waste Condition; max average monthly lateral drainage
	2.5314E-08	m/sec	collected from layer 3)
β=	4.42478	degrees	Slope of the Landfill Base Between Pipes (7.7 percent)
	0.07722698	radians	
T_{max}=	0.25	inches	Geonet Thickness
	0.0064	m	

1. Solve for Design Transmissivity:

Apply Reduction Factor: (3)

RFtotal = Design Drainage Factor x Intrusion x Creep x Biological Clogging x Chemical Clogging

Design Drainage Factor =	3
Intrusion =	1
Creep =	1.1
Biological Clogging =	1.4
Chemical Clogging =	1.4
RF_{Total} =	6.5

$$Design\ Transmissivity = \varphi_{Design} = \frac{\varphi_{Spec}}{RF_{Total}}$$

ψDesign= 4.95E-05 m^2/sec

2. Solve for K:

$$K = \frac{\varphi_{Design}}{T_{Max}}$$

K= 7.79E-03 m/s

3. Solve for Pipe Spacing L:

$$L := \frac{T_{max} \cdot (2 \cdot \cos(\beta))}{\left[\sqrt{\left(4 \cdot \frac{e}{K}\right) + \tan(\beta)^2} - \tan(\beta)\right]}$$

L = 495 ft OK, Spacing of pipes in Cell 22 will be less than 495' (<<495') in area where grade is 7.7% or greater

CONCLUSION

The proposed leachate collection pipe spacing is less than the maximum pipe spacing calculated.

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LEACHATE COLLECTION PIPE SIZING

Project Name: Juniper Ridge Landfill Ph II Expansion Cell 22
Project Location: Old Town, Maine
Project No.: 240101
By: TJM
Date: 4/30/2025
Checked By: DPW
Date: 5/7/2025

OBJECTIVE

Evaluate sizing of leachate collection lateral and header piping.

REFERENCES

N/A

ASSUMPTIONS

ASSUMPTIONS

1. Size pipes appropriately to allow peak daily infiltration into waste and runoff over open waste assuming 10-feet of waste to header collection pipe. Assume largest open area header and add runoff from Stage 1 Cell Development slope with 40' vertical open waste. See HELP Model output Appendix D.
   Infiltration in/acre = 0.31402
   Runoff in/acre = 3.764
   (See HELP output in Appendix D, 10' Open Waste Condition with 100% Runoff; peak daily drainage collected per acre from layer 3 and peak daily runoff per acre over open area to header)
2. Minimum pipe size is 6" nominal (ID) to allow for proper cleaning.
3. For leachate collection laterals assume largest area contributing to a single leachate lateral and pipe slope (2.3%) as design condition.
4. For leachate header pipes assume largest area contributing to a leachate header.
   and minimum pipe slope (0.5%) as design condition. Assume ammount infiltrating is delayed and is not accounted for in sizing.
5. Assume pipe flow using Manning's Equation with HDPE pipe n= 0.012.

ANALYSIS

LEACHATE COLLECTION LATERAL AND HEADER ANALYSIS
Determine maximum amount of leachate to a lateral

Equation: Q=KA
Q= Flow to Pipe (ft^3/sec)
K= Infiltration through Waste (ft/sec)
A= Area contributing to flow (ft^2)

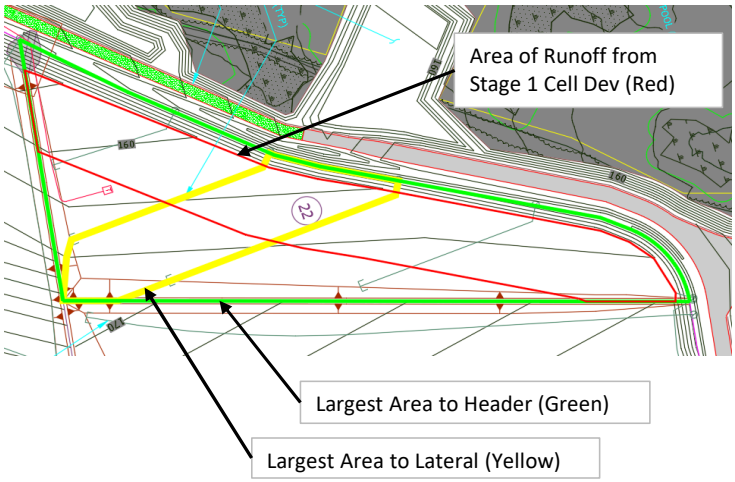
Convert Help Model Infiltration (in/day) to ft/sec.

Infiltration to Lateral =	0.31402	in/day/acre
	3.03E-07	ft/sec/acre
Runoff to Header =	3.764	in/day
	3.6304E-06	ft/sec

ANALYSIS (CONT'D)

Multiply above rates by the contributing area to determine Q.

$A_{laterals}$ =	60,610	ft^2
$A_{headers}$ =	5.6	Acres
	244,000	ft^2
$A_{runoff\ to\ Header}$ =	126,000	ft^2



Q_{Total} = Total Flow to Header = Infiltration + Runoff

$Q_{laterals}$ =	60,610	ft^2	x	3.029E-07	ft/sec	=	0.018	ft^3/sec
$Q_{Infilt\ to\ Header}$ =	244,000	ft^2	x	3.029E-07	ft/sec	=	0.074	ft^3/sec
$Q_{runoff\ to\ Header}$ =	126,000	ft^2	x	3.630E-06	ft/sec	=	0.457	ft^3/sec
$Q_{Header\ Total}$ =							0.531	ft^3/sec

Determine maximum flow (Q_{max}) in 6-inch diameter and 8-inch diameter HDPE pipes using Manning's Equation.

OD =	6	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	5.349	inches (EJP Reference Manual)
	0.45	feet
Slope =	0.019	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.62	ft^3/sec (See attached printout)

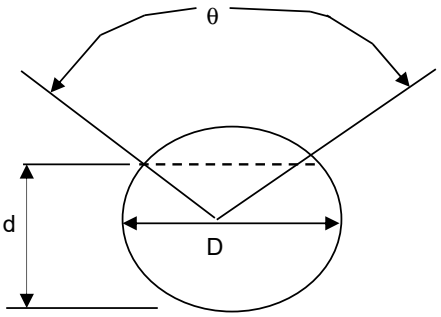
OD =	8	inches (EJP Reference Manual)
SDR =	11	unitless
ID =	6.963	inches (EJP Reference Manual)
	0.58	feet
Slope =	0.005	ft/ft (minimum design slope)
n =	0.012	unitless
Qmax =	0.81	ft^3/sec (See attached printout)

CONCLUSION

The maximum calculated flow (Q_{max}) for the header and lateral is greater than or equal to the maximum total flow (Qtotal) anticipated from infiltration and runoff to the lateral and header; therefore the leachate collection header and lateral pipe sizing is appropriate.

LEACHATE COLLECTION 6-INCH LATERAL DISCHARGE PIPE CAPACITY

CELL 22		Location:	OLD TOWN, MAINE	
By: TJM		Date:	4/30/2025	
Chk. By: BDP		Date:	5/7/2025	mdo version 12.8.00



INPUT

D=	5.349	inches
d=	5.349	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.019	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

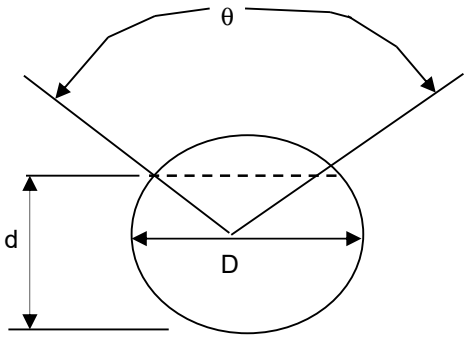
Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.16	1.40	0.11	3.95	0.62	277

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

LEACHATE COLLECTION 8-INCH HEADER DISCHARGE PIPE CAPACITY

CELL 22		Location:	OLD TOWN, MAINE
By: TJM	Date:	4/30/2025	
Chk. By: BDP	Date:	5/7/2025	mdo version 12.8.00



INPUT

D=	6.963	inches
d=	6.963	inches
n=	0.012	mannings coeff
θ=	0.0	degrees
S=	0.008	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation					
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs	flow, GPM
0.26	1.82	0.15	3.06	0.81	363

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

E-6

STORAGE VOLUME FOR LEACHATE COLLECTION SUMPS

SME
SEVEE & MAHER
ENGINEERS

Landfill Open (Cell 18)

Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM

Subcat Reach Pond Link

Routing Diagram for Leachate Collection Sump Analysis
Prepared by Sevee & Maher Engineers, Printed 6/13/2025
HydroCAD® 10.20-6a s/n 01260 © 2024 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Yr. Storm Event(AMC2)	Type III 24-hr		Default	24.00	1	4.80	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
15.300	55	Open Waste (10' Thick Cell 18 Open) At 5% (Cell 18)
3.000	65	Open Waste (Cell 14 Overlap) At 33% (Cell 18)
18.300	**57**	**TOTAL AREA**

Time span=0.00-120.00 hrs, dt=0.50 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Cell 18: Landfill Open (Cell Runoff Area=18.300 ac 0.00% Impervious Runoff Depth=1.00"
Tc=15.0 min CN=57 Runoff=8.93 cfs 1.525 af

Pond PS-18: Cell 18 Sump (Permanent PS) Peak Elev=163.73' Storage=52,369 cf Inflow=8.93 cfs 1.525 af
Outflow=0.31 cfs 1.525 af

Total Runoff Area = 18.300 ac Runoff Volume = 1.525 af Average Runoff Depth = 1.00"
100.00% Pervious = 18.300 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment Cell 18: Landfill Open (Cell 18)

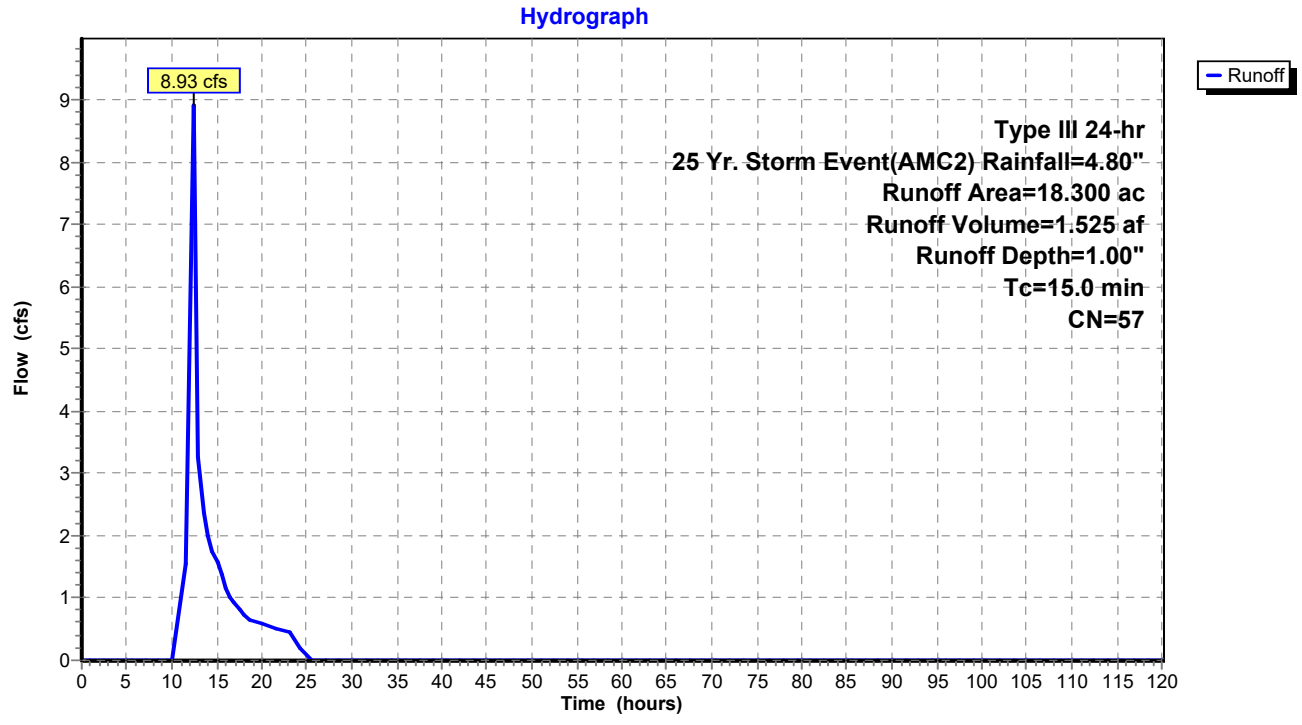
Runoff = 8.93 cfs @ 12.47 hrs, Volume= 1.525 af, Depth= 1.00"
Routed to Pond PS-18 : Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	15.300	55	Open Waste (10' Thick Cell 18 Open) At 5%
*	3.000	65	Open Waste (Cell 14 Overlap) At 33%
	18.300	57	Weighted Average
	18.300		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Subcatchment Cell 18: Landfill Open (Cell 18)



Hydrograph for Subcatchment Cell 18: Landfill Open (Cell 18)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	1.00	0.00
0.50	0.02	0.00	0.00	26.50	4.80	1.00	0.00
1.00	0.05	0.00	0.00	27.00	4.80	1.00	0.00
1.50	0.07	0.00	0.00	27.50	4.80	1.00	0.00
2.00	0.10	0.00	0.00	28.00	4.80	1.00	0.00
2.50	0.12	0.00	0.00	28.50	4.80	1.00	0.00
3.00	0.15	0.00	0.00	29.00	4.80	1.00	0.00
3.50	0.18	0.00	0.00	29.50	4.80	1.00	0.00
4.00	0.21	0.00	0.00	30.00	4.80	1.00	0.00
4.50	0.24	0.00	0.00	30.50	4.80	1.00	0.00
5.00	0.27	0.00	0.00	31.00	4.80	1.00	0.00
5.50	0.31	0.00	0.00	31.50	4.80	1.00	0.00
6.00	0.35	0.00	0.00	32.00	4.80	1.00	0.00
6.50	0.39	0.00	0.00	32.50	4.80	1.00	0.00
7.00	0.43	0.00	0.00	33.00	4.80	1.00	0.00
7.50	0.49	0.00	0.00	33.50	4.80	1.00	0.00
8.00	0.55	0.00	0.00	34.00	4.80	1.00	0.00
8.50	0.62	0.00	0.00	34.50	4.80	1.00	0.00
9.00	0.70	0.00	0.00	35.00	4.80	1.00	0.00
9.50	0.80	0.00	0.00	35.50	4.80	1.00	0.00
10.00	0.91	0.00	0.00	36.00	4.80	1.00	0.00
10.50	1.04	0.00	0.00	36.50	4.80	1.00	0.00
11.00	1.20	0.00	0.00	37.00	4.80	1.00	0.00
11.50	1.43	0.00	0.00	37.50	4.80	1.00	0.00
12.00	2.40	0.09	4.64	38.00	4.80	1.00	0.00
12.50	3.37	0.37	**8.90**	38.50	4.80	1.00	0.00
13.00	3.60	0.45	3.27	39.00	4.80	1.00	0.00
13.50	3.76	0.52	2.36	39.50	4.80	1.00	0.00
14.00	3.89	0.57	2.01	40.00	4.80	1.00	0.00
14.50	4.00	0.62	1.75	40.50	4.80	1.00	0.00
15.00	4.10	0.66	1.57	41.00	4.80	1.00	0.00
15.50	4.18	0.70	1.37	41.50	4.80	1.00	0.00
16.00	4.25	0.73	1.17	42.00	4.80	1.00	0.00
16.50	4.31	0.76	1.02	42.50	4.80	1.00	0.00
17.00	4.37	0.78	0.93	43.00	4.80	1.00	0.00
17.50	4.41	0.81	0.83	43.50	4.80	1.00	0.00
18.00	4.45	0.83	0.73	44.00	4.80	1.00	0.00
18.50	4.49	0.85	0.67	44.50	4.80	1.00	0.00
19.00	4.53	0.86	0.64	45.00	4.80	1.00	0.00
19.50	4.56	0.88	0.61	45.50	4.80	1.00	0.00
20.00	4.59	0.90	0.59	46.00	4.80	1.00	0.00
20.50	4.62	0.91	0.56	46.50	4.80	1.00	0.00
21.00	4.65	0.93	0.54	47.00	4.80	1.00	0.00
21.50	4.68	0.94	0.52	47.50	4.80	1.00	0.00
22.00	4.71	0.95	0.49	48.00	4.80	1.00	0.00
22.50	4.73	0.97	0.47	48.50	4.80	1.00	0.00
23.00	4.76	0.98	0.45	49.00	4.80	1.00	0.00
23.50	4.78	0.99	0.42	49.50	4.80	1.00	0.00
24.00	**4.80**	**1.00**	0.36	50.00	4.80	1.00	0.00
24.50	4.80	1.00	0.03	50.50	4.80	1.00	0.00
25.00	4.80	1.00	0.00	51.00	4.80	1.00	0.00
25.50	4.80	1.00	0.00	51.50	4.80	1.00	0.00

Hydrograph for Subcatchment Cell 18: Landfill Open (Cell 18) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	1.00	0.00	78.00	4.80	1.00	0.00
52.50	4.80	1.00	0.00	78.50	4.80	1.00	0.00
53.00	4.80	1.00	0.00	79.00	4.80	1.00	0.00
53.50	4.80	1.00	0.00	79.50	4.80	1.00	0.00
54.00	4.80	1.00	0.00	80.00	4.80	1.00	0.00
54.50	4.80	1.00	0.00	80.50	4.80	1.00	0.00
55.00	4.80	1.00	0.00	81.00	4.80	1.00	0.00
55.50	4.80	1.00	0.00	81.50	4.80	1.00	0.00
56.00	4.80	1.00	0.00	82.00	4.80	1.00	0.00
56.50	4.80	1.00	0.00	82.50	4.80	1.00	0.00
57.00	4.80	1.00	0.00	83.00	4.80	1.00	0.00
57.50	4.80	1.00	0.00	83.50	4.80	1.00	0.00
58.00	4.80	1.00	0.00	84.00	4.80	1.00	0.00
58.50	4.80	1.00	0.00	84.50	4.80	1.00	0.00
59.00	4.80	1.00	0.00	85.00	4.80	1.00	0.00
59.50	4.80	1.00	0.00	85.50	4.80	1.00	0.00
60.00	4.80	1.00	0.00	86.00	4.80	1.00	0.00
60.50	4.80	1.00	0.00	86.50	4.80	1.00	0.00
61.00	4.80	1.00	0.00	87.00	4.80	1.00	0.00
61.50	4.80	1.00	0.00	87.50	4.80	1.00	0.00
62.00	4.80	1.00	0.00	88.00	4.80	1.00	0.00
62.50	4.80	1.00	0.00	88.50	4.80	1.00	0.00
63.00	4.80	1.00	0.00	89.00	4.80	1.00	0.00
63.50	4.80	1.00	0.00	89.50	4.80	1.00	0.00
64.00	4.80	1.00	0.00	90.00	4.80	1.00	0.00
64.50	4.80	1.00	0.00	90.50	4.80	1.00	0.00
65.00	4.80	1.00	0.00	91.00	4.80	1.00	0.00
65.50	4.80	1.00	0.00	91.50	4.80	1.00	0.00
66.00	4.80	1.00	0.00	92.00	4.80	1.00	0.00
66.50	4.80	1.00	0.00	92.50	4.80	1.00	0.00
67.00	4.80	1.00	0.00	93.00	4.80	1.00	0.00
67.50	4.80	1.00	0.00	93.50	4.80	1.00	0.00
68.00	4.80	1.00	0.00	94.00	4.80	1.00	0.00
68.50	4.80	1.00	0.00	94.50	4.80	1.00	0.00
69.00	4.80	1.00	0.00	95.00	4.80	1.00	0.00
69.50	4.80	1.00	0.00	95.50	4.80	1.00	0.00
70.00	4.80	1.00	0.00	96.00	4.80	1.00	0.00
70.50	4.80	1.00	0.00	96.50	4.80	1.00	0.00
71.00	4.80	1.00	0.00	97.00	4.80	1.00	0.00
71.50	4.80	1.00	0.00	97.50	4.80	1.00	0.00
72.00	4.80	1.00	0.00	98.00	4.80	1.00	0.00
72.50	4.80	1.00	0.00	98.50	4.80	1.00	0.00
73.00	4.80	1.00	0.00	99.00	4.80	1.00	0.00
73.50	4.80	1.00	0.00	99.50	4.80	1.00	0.00
74.00	4.80	1.00	0.00	100.00	4.80	1.00	0.00
74.50	4.80	1.00	0.00	100.50	4.80	1.00	0.00
75.00	4.80	1.00	0.00	101.00	4.80	1.00	0.00
75.50	4.80	1.00	0.00	101.50	4.80	1.00	0.00
76.00	4.80	1.00	0.00	102.00	4.80	1.00	0.00
76.50	4.80	1.00	0.00	102.50	4.80	1.00	0.00
77.00	4.80	1.00	0.00	103.00	4.80	1.00	0.00
77.50	4.80	1.00	0.00	103.50	4.80	1.00	0.00

Hydrograph for Subcatchment Cell 18: Landfill Open (Cell 18) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	1.00	0.00
104.50	4.80	1.00	0.00
105.00	4.80	1.00	0.00
105.50	4.80	1.00	0.00
106.00	4.80	1.00	0.00
106.50	4.80	1.00	0.00
107.00	4.80	1.00	0.00
107.50	4.80	1.00	0.00
108.00	4.80	1.00	0.00
108.50	4.80	1.00	0.00
109.00	4.80	1.00	0.00
109.50	4.80	1.00	0.00
110.00	4.80	1.00	0.00
110.50	4.80	1.00	0.00
111.00	4.80	1.00	0.00
111.50	4.80	1.00	0.00
112.00	4.80	1.00	0.00
112.50	4.80	1.00	0.00
113.00	4.80	1.00	0.00
113.50	4.80	1.00	0.00
114.00	4.80	1.00	0.00
114.50	4.80	1.00	0.00
115.00	4.80	1.00	0.00
115.50	4.80	1.00	0.00
116.00	4.80	1.00	0.00
116.50	4.80	1.00	0.00
117.00	4.80	1.00	0.00
117.50	4.80	1.00	0.00
118.00	4.80	1.00	0.00
118.50	4.80	1.00	0.00
119.00	4.80	1.00	0.00
119.50	4.80	1.00	0.00
120.00	4.80	1.00	0.00

Summary for Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM

Inflow Area = 18.300 ac, 0.00% Impervious, Inflow Depth = 1.00" for 25 Yr. Storm Event(AMC2) event
Inflow = 8.93 cfs @ 12.47 hrs, Volume= 1.525 af
Outflow = 0.31 cfs @ 12.00 hrs, Volume= 1.525 af, Atten= 97%, Lag= 0.0 min
Primary = 0.31 cfs @ 12.00 hrs, Volume= 1.525 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Peak Elev= 163.73' @ 23.95 hrs Surf.Area= 60,939 sf Storage= 52,369 cf
Flood Elev= 167.00' Surf.Area= 128,396 sf Storage= 179,547 cf

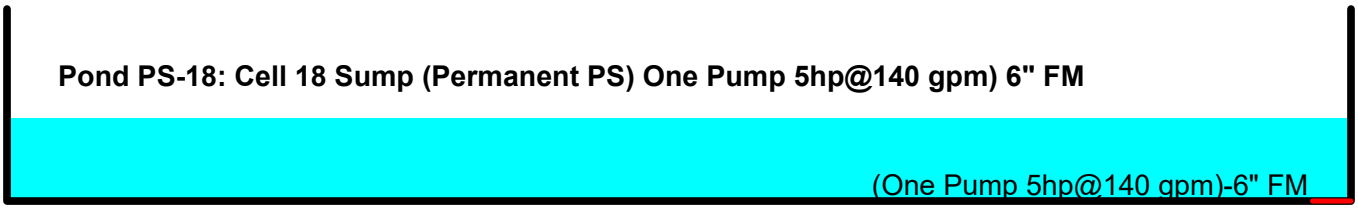
Plug-Flow detention time= 1,589.2 min calculated for 1.518 af (100% of inflow)
Center-of-Mass det. time= 1,595.0 min (2,492.2 - 897.1)

Volume	Invert	Avail.Storage	Storage Description
#1	159.00'	365,751 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

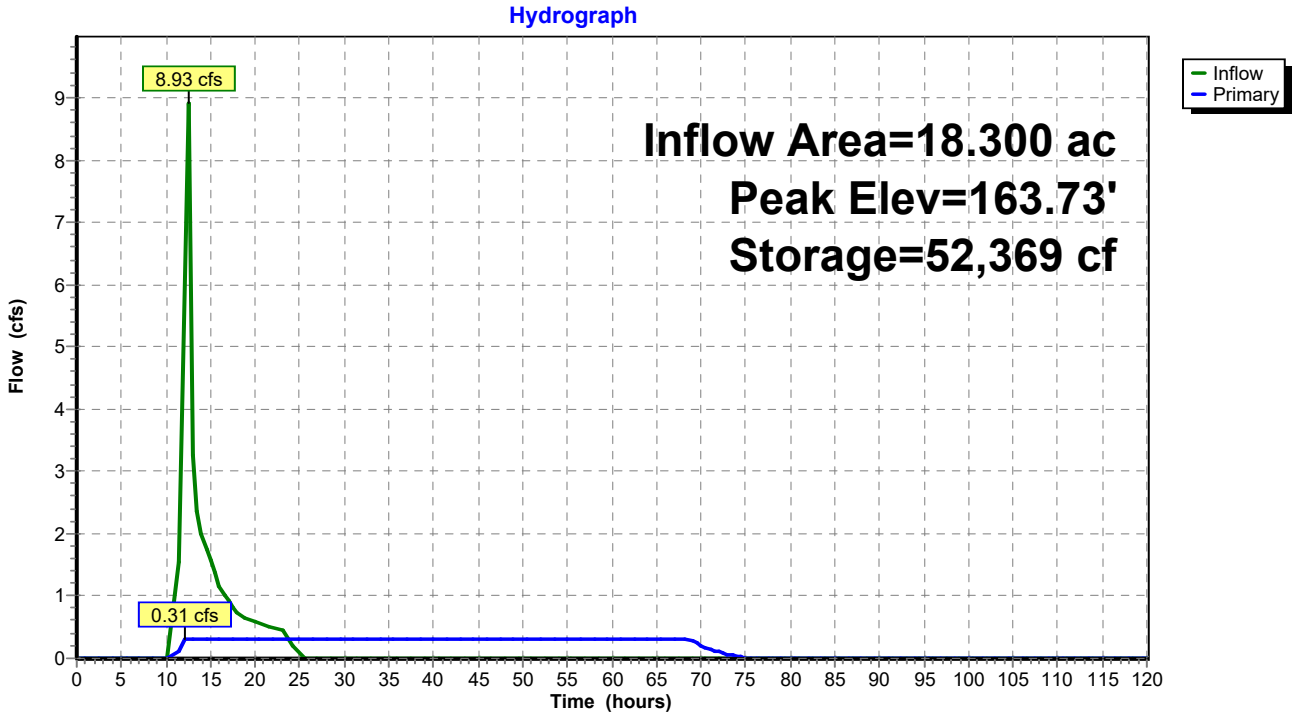
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
159.00	2,645	0.0	0	0
161.00	23,739	40.0	10,554	10,554
163.00	42,852	40.0	26,636	37,190
165.00	92,322	40.0	54,070	91,260
167.00	128,396	40.0	88,287	179,547
169.00	162,991	40.0	116,555	296,102
170.00	185,254	40.0	69,649	365,751

Device	Routing	Invert	Outlet Devices
#1	Primary	159.00'	**(One Pump 5hp@140 gpm)-6" FM** Head (feet) 0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 Disch. (cfs) 0.000 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310

Primary OutFlow Max=0.31 cfs @ 12.00 hrs HW=160.13' (Free Discharge)
↑—**1=(One Pump 5hp@140 gpm)-6" FM** (Custom Controls 0.31 cfs)



Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM



Hydrograph for Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	159.00	0.00
0.50	0.00	0	159.00	0.00
1.00	0.00	0	159.00	0.00
1.50	0.00	0	159.00	0.00
2.00	0.00	0	159.00	0.00
2.50	0.00	0	159.00	0.00
3.00	0.00	0	159.00	0.00
3.50	0.00	0	159.00	0.00
4.00	0.00	0	159.00	0.00
4.50	0.00	0	159.00	0.00
5.00	0.00	0	159.00	0.00
5.50	0.00	0	159.00	0.00
6.00	0.00	0	159.00	0.00
6.50	0.00	0	159.00	0.00
7.00	0.00	0	159.00	0.00
7.50	0.00	0	159.00	0.00
8.00	0.00	0	159.00	0.00
8.50	0.00	0	159.00	0.00
9.00	0.00	0	159.00	0.00
9.50	0.00	0	159.00	0.00
10.00	0.00	0	159.00	0.00
10.50	0.00	0	159.00	0.00
11.00	0.00	0	159.00	0.00
11.50	0.00	2	159.00	0.00
12.00	4.64	3,903	160.13	**0.31**
12.50	**8.90**	15,533	161.48	0.31
13.00	3.27	25,933	162.29	0.31
13.50	2.36	30,444	162.59	0.31
14.00	2.01	33,817	162.80	0.31
14.50	1.75	36,641	162.97	0.31
15.00	1.57	39,069	163.11	0.31
15.50	1.37	41,159	163.22	0.31
16.00	1.17	42,888	163.31	0.31
16.50	1.02	44,296	163.37	0.31
17.00	0.93	45,488	163.43	0.31
17.50	0.83	46,509	163.48	0.31
18.00	0.73	47,356	163.52	0.31
18.50	0.67	48,060	163.55	0.31
19.00	0.64	48,684	163.57	0.31
19.50	0.61	49,256	163.60	0.31
20.00	0.59	49,777	163.62	0.31
20.50	0.56	50,250	163.64	0.31
21.00	0.54	50,680	163.66	0.31
21.50	0.52	51,071	163.68	0.31
22.00	0.49	51,421	163.69	0.31
22.50	0.47	51,730	163.70	0.31
23.00	0.45	51,997	163.72	0.31
23.50	0.42	52,222	163.73	0.31
24.00	0.36	**52,368**	**163.73**	0.31
24.50	0.03	52,157	163.72	0.31
25.00	0.00	51,623	163.70	0.31
25.50	0.00	51,065	163.68	0.31

Hydrograph for Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.00	50,507	163.65	0.31
26.50	0.00	49,949	163.63	0.31
27.00	0.00	49,391	163.61	0.31
27.50	0.00	48,833	163.58	0.31
28.00	0.00	48,275	163.56	0.31
28.50	0.00	47,717	163.53	0.31
29.00	0.00	47,159	163.51	0.31
29.50	0.00	46,601	163.48	0.31
30.00	0.00	46,043	163.46	0.31
30.50	0.00	45,485	163.43	0.31
31.00	0.00	44,927	163.40	0.31
31.50	0.00	44,369	163.38	0.31
32.00	0.00	43,811	163.35	0.31
32.50	0.00	43,253	163.32	0.31
33.00	0.00	42,695	163.30	0.31
33.50	0.00	42,137	163.27	0.31
34.00	0.00	41,579	163.24	0.31
34.50	0.00	41,021	163.21	0.31
35.00	0.00	40,463	163.18	0.31
35.50	0.00	39,905	163.15	0.31
36.00	0.00	39,347	163.12	0.31
36.50	0.00	38,789	163.09	0.31
37.00	0.00	38,231	163.06	0.31
37.50	0.00	37,673	163.03	0.31
38.00	0.00	37,115	163.00	0.31
38.50	0.00	36,557	162.96	0.31
39.00	0.00	35,999	162.93	0.31
39.50	0.00	35,441	162.90	0.31
40.00	0.00	34,883	162.86	0.31
40.50	0.00	34,325	162.83	0.31
41.00	0.00	33,767	162.80	0.31
41.50	0.00	33,209	162.76	0.31
42.00	0.00	32,651	162.73	0.31
42.50	0.00	32,093	162.69	0.31
43.00	0.00	31,535	162.66	0.31
43.50	0.00	30,977	162.62	0.31
44.00	0.00	30,419	162.59	0.31
44.50	0.00	29,861	162.55	0.31
45.00	0.00	29,303	162.51	0.31
45.50	0.00	28,745	162.48	0.31
46.00	0.00	28,187	162.44	0.31
46.50	0.00	27,629	162.40	0.31
47.00	0.00	27,071	162.36	0.31
47.50	0.00	26,513	162.33	0.31
48.00	0.00	25,955	162.29	0.31
48.50	0.00	25,397	162.25	0.31
49.00	0.00	24,839	162.21	0.31
49.50	0.00	24,281	162.17	0.31
50.00	0.00	23,723	162.13	0.31
50.50	0.00	23,165	162.09	0.31
51.00	0.00	22,607	162.05	0.31
51.50	0.00	22,049	162.01	0.31

Hydrograph for Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM (continued)

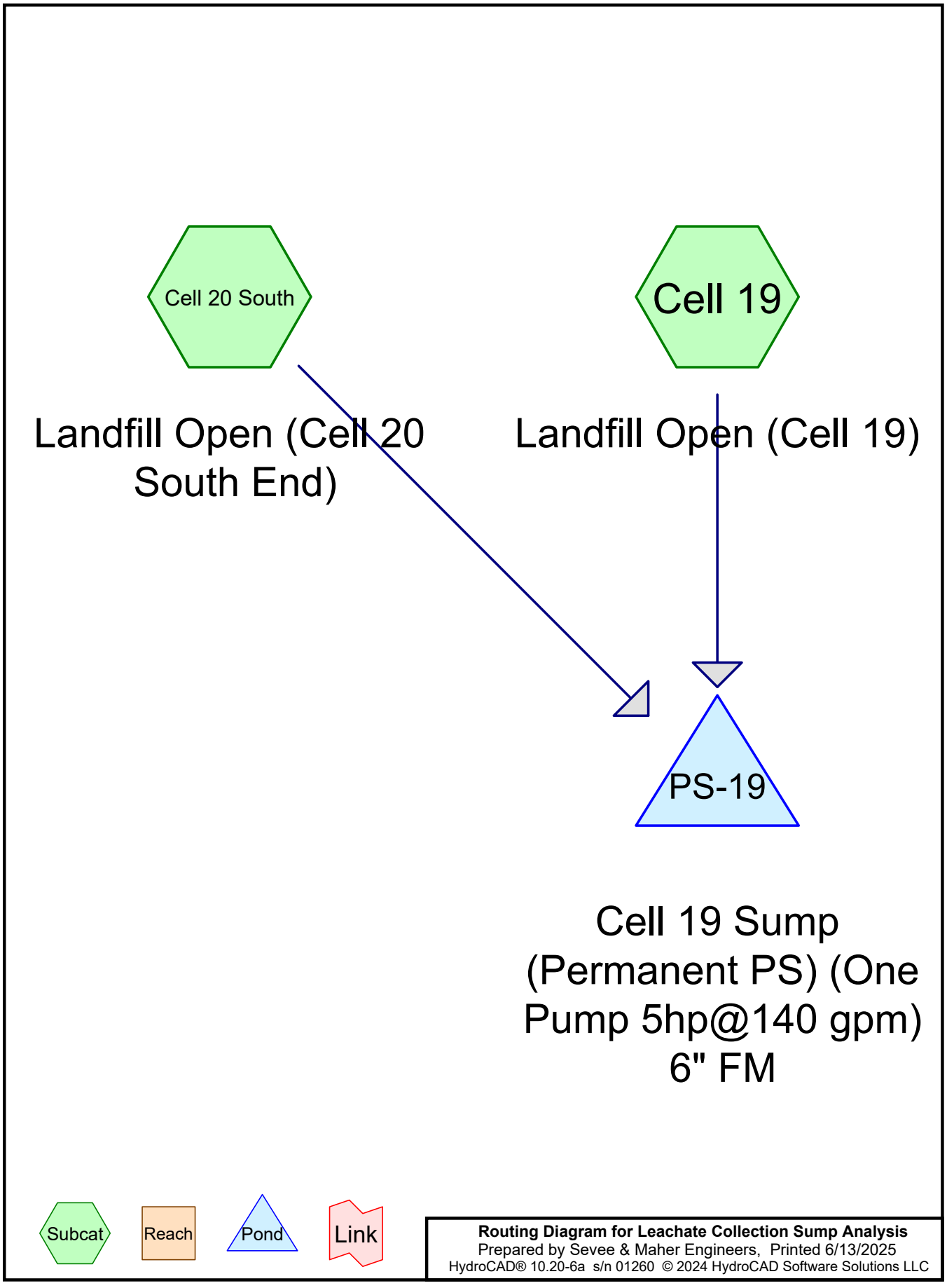
Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.00	21,491	161.96	0.31
52.50	0.00	20,933	161.92	0.31
53.00	0.00	20,375	161.88	0.31
53.50	0.00	19,817	161.83	0.31
54.00	0.00	19,259	161.79	0.31
54.50	0.00	18,701	161.75	0.31
55.00	0.00	18,143	161.70	0.31
55.50	0.00	17,585	161.65	0.31
56.00	0.00	17,027	161.61	0.31
56.50	0.00	16,469	161.56	0.31
57.00	0.00	15,911	161.51	0.31
57.50	0.00	15,353	161.46	0.31
58.00	0.00	14,795	161.41	0.31
58.50	0.00	14,237	161.36	0.31
59.00	0.00	13,679	161.31	0.31
59.50	0.00	13,121	161.26	0.31
60.00	0.00	12,563	161.20	0.31
60.50	0.00	12,005	161.15	0.31
61.00	0.00	11,447	161.09	0.31
61.50	0.00	10,889	161.03	0.31
62.00	0.00	10,331	160.98	0.31
62.50	0.00	9,773	160.92	0.31
63.00	0.00	9,215	160.85	0.31
63.50	0.00	8,657	160.79	0.31
64.00	0.00	8,099	160.72	0.31
64.50	0.00	7,541	160.66	0.31
65.00	0.00	6,983	160.59	0.31
65.50	0.00	6,425	160.51	0.31
66.00	0.00	5,867	160.44	0.31
66.50	0.00	5,309	160.35	0.31
67.00	0.00	4,751	160.27	0.31
67.50	0.00	4,193	160.18	0.31
68.00	0.00	3,635	160.09	0.31
68.50	0.00	3,082	159.98	0.30
69.00	0.00	2,562	159.88	0.27
69.50	0.00	2,100	159.78	0.24
70.00	0.00	1,693	159.68	0.21
70.50	0.00	1,341	159.58	0.18
71.00	0.00	1,041	159.49	0.15
71.50	0.00	789	159.41	0.13
72.00	0.00	583	159.33	0.10
72.50	0.00	418	159.26	0.08
73.00	0.00	292	159.20	0.06
73.50	0.00	198	159.14	0.04
74.00	0.00	130	159.10	0.03
74.50	0.00	84	159.07	0.02
75.00	0.00	54	159.04	0.01
75.50	0.00	35	159.03	0.01
76.00	0.00	22	159.02	0.01
76.50	0.00	14	159.01	0.00
77.00	0.00	9	159.01	0.00
77.50	0.00	6	159.00	0.00

Hydrograph for Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
78.00	0.00	4	159.00	0.00
78.50	0.00	2	159.00	0.00
79.00	0.00	2	159.00	0.00
79.50	0.00	1	159.00	0.00
80.00	0.00	1	159.00	0.00
80.50	0.00	0	159.00	0.00
81.00	0.00	0	159.00	0.00
81.50	0.00	0	159.00	0.00
82.00	0.00	0	159.00	0.00
82.50	0.00	0	159.00	0.00
83.00	0.00	0	159.00	0.00
83.50	0.00	0	159.00	0.00
84.00	0.00	0	159.00	0.00
84.50	0.00	0	159.00	0.00
85.00	0.00	0	159.00	0.00
85.50	0.00	0	159.00	0.00
86.00	0.00	0	159.00	0.00
86.50	0.00	0	159.00	0.00
87.00	0.00	0	159.00	0.00
87.50	0.00	0	159.00	0.00
88.00	0.00	0	159.00	0.00
88.50	0.00	0	159.00	0.00
89.00	0.00	0	159.00	0.00
89.50	0.00	0	159.00	0.00
90.00	0.00	0	159.00	0.00
90.50	0.00	0	159.00	0.00
91.00	0.00	0	159.00	0.00
91.50	0.00	0	159.00	0.00
92.00	0.00	0	159.00	0.00
92.50	0.00	0	159.00	0.00
93.00	0.00	0	159.00	0.00
93.50	0.00	0	159.00	0.00
94.00	0.00	0	159.00	0.00
94.50	0.00	0	159.00	0.00
95.00	0.00	0	159.00	0.00
95.50	0.00	0	159.00	0.00
96.00	0.00	0	159.00	0.00
96.50	0.00	0	159.00	0.00
97.00	0.00	0	159.00	0.00
97.50	0.00	0	159.00	0.00
98.00	0.00	0	159.00	0.00
98.50	0.00	0	159.00	0.00
99.00	0.00	0	159.00	0.00
99.50	0.00	0	159.00	0.00
100.00	0.00	0	159.00	0.00
100.50	0.00	0	159.00	0.00
101.00	0.00	0	159.00	0.00
101.50	0.00	0	159.00	0.00
102.00	0.00	0	159.00	0.00
102.50	0.00	0	159.00	0.00
103.00	0.00	0	159.00	0.00
103.50	0.00	0	159.00	0.00

Hydrograph for Pond PS-18: Cell 18 Sump (Permanent PS) One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
104.00	0.00	0	159.00	0.00
104.50	0.00	0	159.00	0.00
105.00	0.00	0	159.00	0.00
105.50	0.00	0	159.00	0.00
106.00	0.00	0	159.00	0.00
106.50	0.00	0	159.00	0.00
107.00	0.00	0	159.00	0.00
107.50	0.00	0	159.00	0.00
108.00	0.00	0	159.00	0.00
108.50	0.00	0	159.00	0.00
109.00	0.00	0	159.00	0.00
109.50	0.00	0	159.00	0.00
110.00	0.00	0	159.00	0.00
110.50	0.00	0	159.00	0.00
111.00	0.00	0	159.00	0.00
111.50	0.00	0	159.00	0.00
112.00	0.00	0	159.00	0.00
112.50	0.00	0	159.00	0.00
113.00	0.00	0	159.00	0.00
113.50	0.00	0	159.00	0.00
114.00	0.00	0	159.00	0.00
114.50	0.00	0	159.00	0.00
115.00	0.00	0	159.00	0.00
115.50	0.00	0	159.00	0.00
116.00	0.00	0	159.00	0.00
116.50	0.00	0	159.00	0.00
117.00	0.00	0	159.00	0.00
117.50	0.00	0	159.00	0.00
118.00	0.00	0	159.00	0.00
118.50	0.00	0	159.00	0.00
119.00	0.00	0	159.00	0.00
119.50	0.00	0	159.00	0.00
120.00	0.00	0	159.00	0.00



Routing Diagram for Leachate Collection Sump Analysis
Prepared by Sevee & Maher Engineers, Printed 6/13/2025
HydroCAD® 10.20-6a s/n 01260 © 2024 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Yr. Storm Event(AMC2)	Type III 24-hr		Default	24.00	1	4.80	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.630	55	OPEN WASTE AT 2 PERCENT GRADE (Cell 20 South)
4.750	55	OPEN WASTE AT 33 PERCENT GRADE (Cell 19)
12.380	**55**	**TOTAL AREA**

Time span=0.00-120.00 hrs, dt=0.50 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Cell 19: Landfill Open (Cell Runoff Area=4.750 ac 0.00% Impervious Runoff Depth=0.88"
Tc=15.0 min CN=55 Runoff=2.00 cfs 0.349 af

Subcatchment Cell 20 South: Landfill Open Runoff Area=7.630 ac 0.00% Impervious Runoff Depth=0.88"
Tc=15.0 min CN=55 Runoff=3.21 cfs 0.561 af

Pond PS-19: Cell 19 Sump (Permanent PS) Peak Elev=174.85' Storage=32,976 cf Inflow=5.28 cfs 1.607 af
Outflow=0.31 cfs 1.324 af

Total Runoff Area = 12.380 ac Runoff Volume = 0.910 af Average Runoff Depth = 0.88"
100.00% Pervious = 12.380 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment Cell 19: Landfill Open (Cell 19)

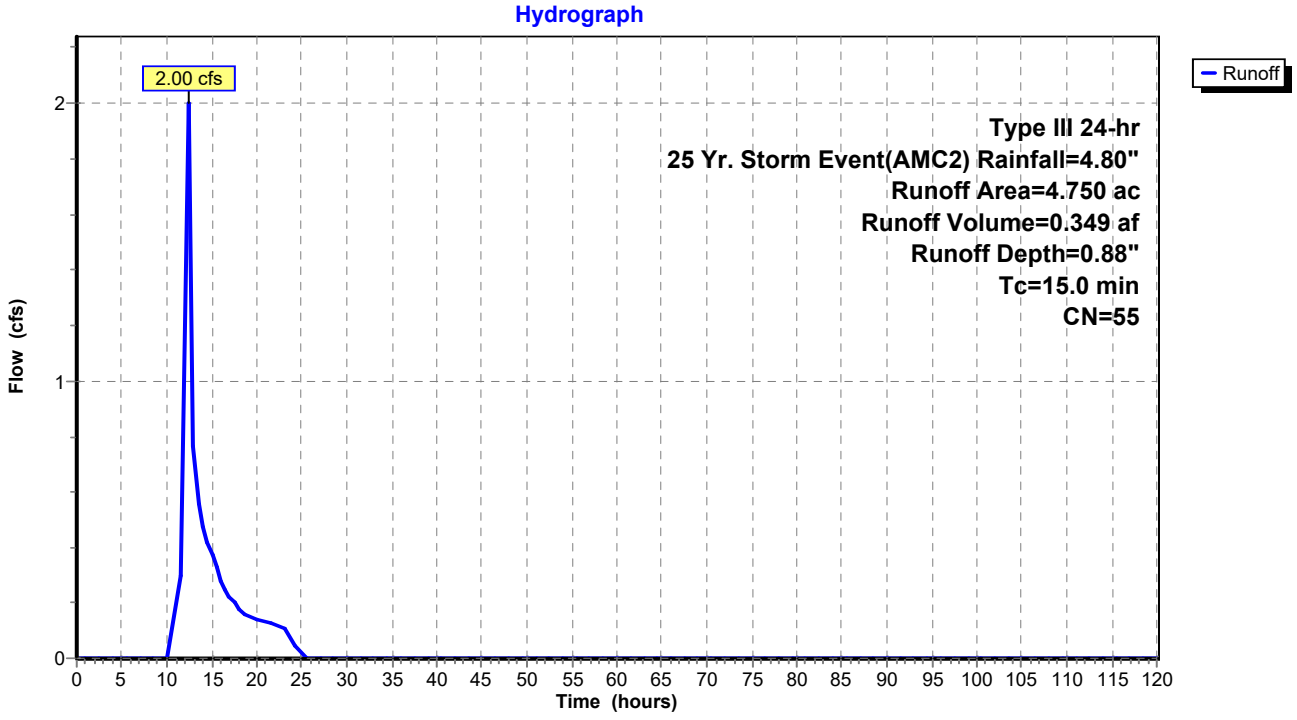
Runoff = 2.00 cfs @ 12.49 hrs, Volume= 0.349 af, Depth= 0.88"
Routed to Pond PS-19 : Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	4.750	55	OPEN WASTE AT 33 PERCENT GRADE
	4.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Subcatchment Cell 19: Landfill Open (Cell 19)



Hydrograph for Subcatchment Cell 19: Landfill Open (Cell 19)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	0.89	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**2.00**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	0.76	39.00	4.80	0.88	0.00
13.50	3.76	0.44	0.55	39.50	4.80	0.88	0.00
14.00	3.89	0.49	0.47	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.41	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.37	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.33	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.28	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.24	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.22	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.20	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.18	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.16	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.15	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.15	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.14	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.13	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.13	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.12	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.12	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.11	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.11	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.10	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.09	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.01	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 19: Landfill Open (Cell 19) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 19: Landfill Open (Cell 19) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End)

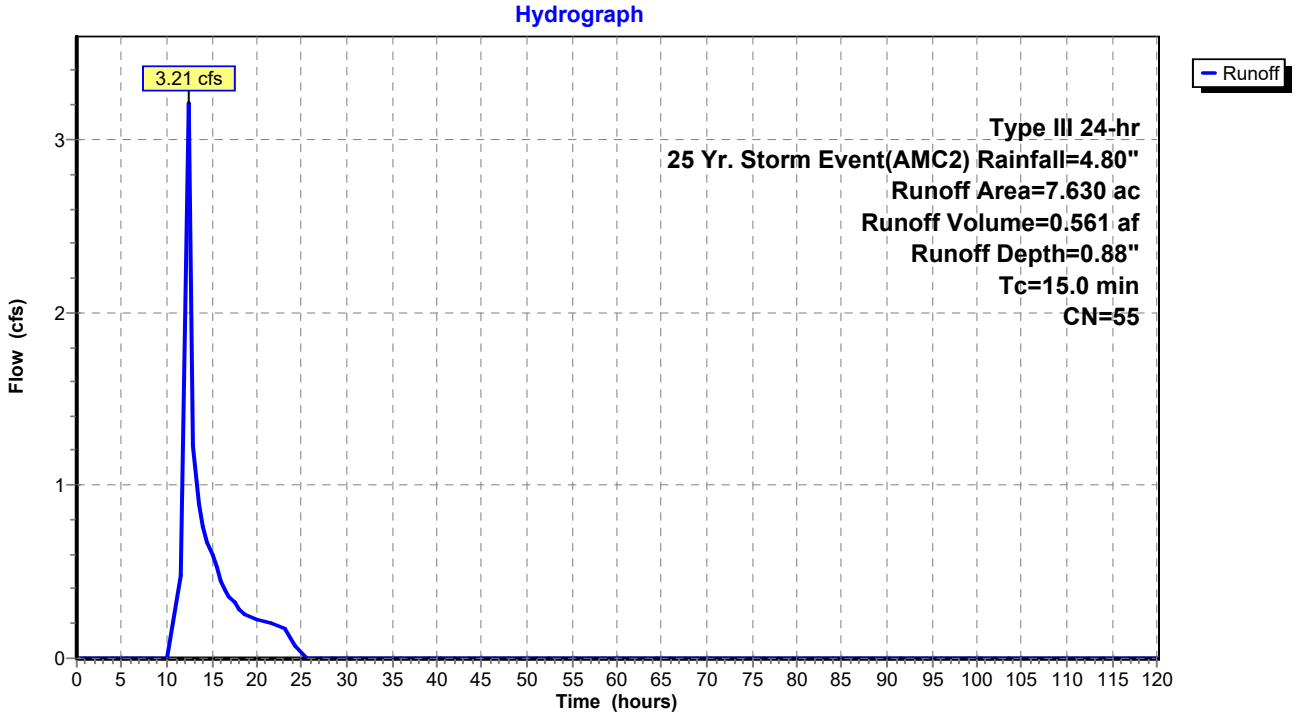
Runoff = 3.21 cfs @ 12.49 hrs, Volume= 0.561 af, Depth= 0.88"
Routed to Pond PS-19 : Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	7.630	55	OPEN WASTE AT 2 PERCENT GRADE
	7.630		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Subcatchment Cell 20 South: Landfill Open (Cell 20 South End)



Hydrograph for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	1.44	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**3.21**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	1.23	39.00	4.80	0.88	0.00
13.50	3.76	0.44	0.89	39.50	4.80	0.88	0.00
14.00	3.89	0.49	0.76	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.67	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.60	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.53	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.45	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.39	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.36	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.32	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.28	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.26	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.25	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.24	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.23	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.22	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.21	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.20	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.19	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.18	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.17	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.16	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.14	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.01	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Inflow Area = 12.380 ac, 0.00% Impervious, Inflow Depth > 1.56" for 25 Yr. Storm Event(AMC2) event
Inflow = 5.28 cfs @ 12.49 hrs, Volume= 1.607 af, Incl. 0.07 cfs Base Flow
Outflow = 0.31 cfs @ 13.00 hrs, Volume= 1.324 af, Atten= 94%, Lag= 30.8 min
Primary = 0.31 cfs @ 13.00 hrs, Volume= 1.324 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Peak Elev= 174.85' @ 23.77 hrs Surf.Area= 74,119 sf Storage= 32,976 cf
Flood Elev= 184.00' Surf.Area= 406,617 sf Storage= 815,299 cf

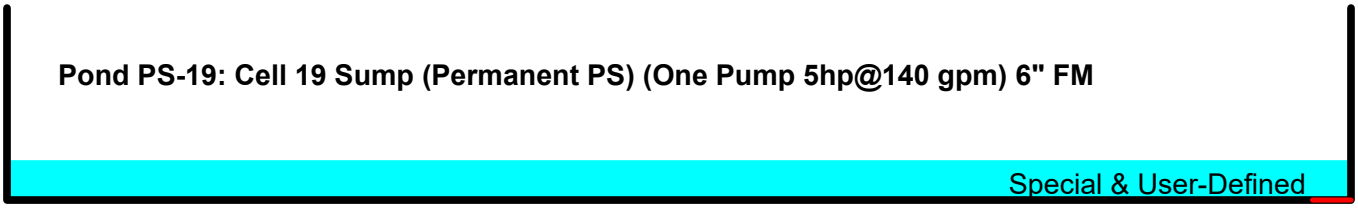
Plug-Flow detention time= 1,559.3 min calculated for 1.323 af (82% of inflow)
Center-of-Mass det. time= 769.1 min (2,842.9 - 2,073.9)

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	815,299 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

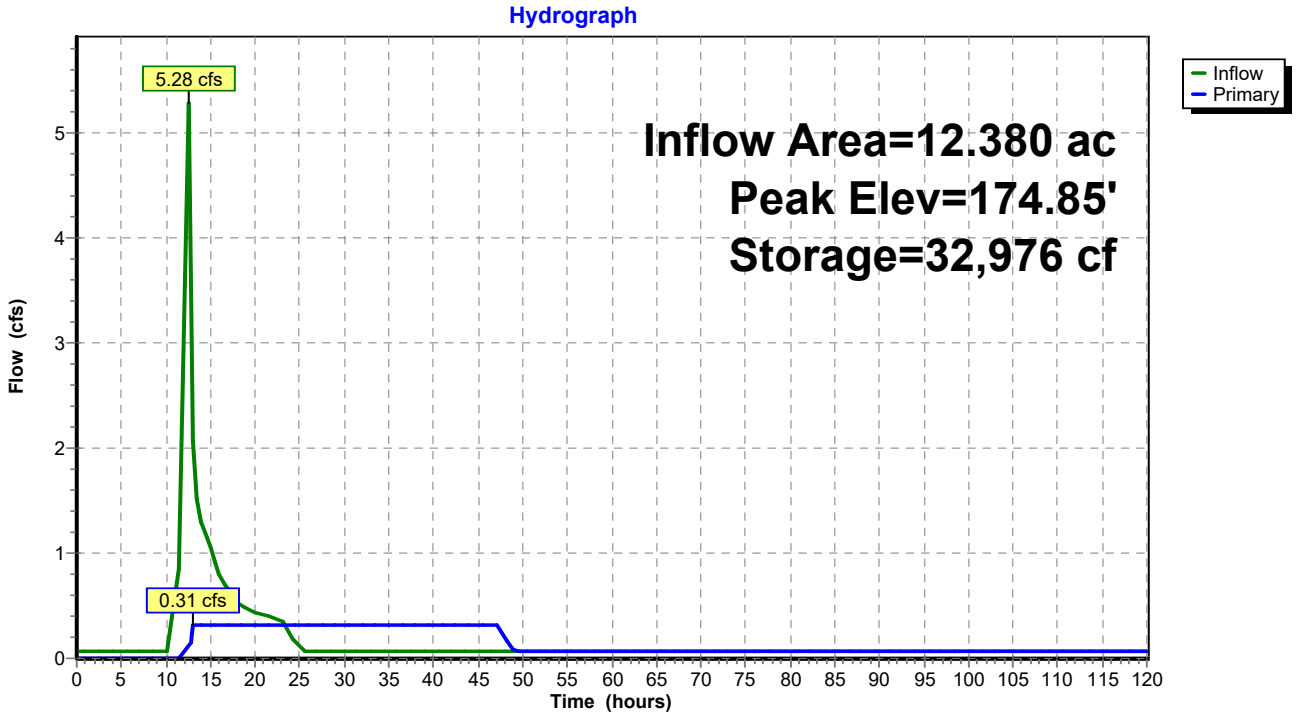
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
173.00	15,206	0.0	0	0
175.00	79,040	40.0	37,698	37,698
177.00	197,277	40.0	110,527	148,225
179.00	344,163	40.0	216,576	364,801
181.00	385,849	40.0	292,005	656,806
182.00	406,617	40.0	158,493	815,299

Device	Routing	Invert	Outlet Devices
#1	Primary	173.00'	**Special & User-Defined** Head (feet) 0.00 0.99 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 Disch. (cfs) 0.000 0.000 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310

Primary OutFlow Max=0.31 cfs @ 13.00 hrs HW=174.29' (Free Discharge)
↑—**1=Special & User-Defined** (Custom Controls 0.31 cfs)



Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM



Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.07	63	173.01	0.00
0.50	0.07	189	173.03	0.00
1.00	0.07	315	173.05	0.00
1.50	0.07	441	173.07	0.00
2.00	0.07	567	173.08	0.00
2.50	0.07	693	173.10	0.00
3.00	0.07	819	173.12	0.00
3.50	0.07	945	173.13	0.00
4.00	0.07	1,071	173.15	0.00
4.50	0.07	1,197	173.17	0.00
5.00	0.07	1,323	173.18	0.00
5.50	0.07	1,449	173.20	0.00
6.00	0.07	1,575	173.21	0.00
6.50	0.07	1,701	173.23	0.00
7.00	0.07	1,827	173.24	0.00
7.50	0.07	1,953	173.25	0.00
8.00	0.07	2,079	173.27	0.00
8.50	0.07	2,205	173.28	0.00
9.00	0.07	2,331	173.29	0.00
9.50	0.07	2,457	173.30	0.00
10.00	0.07	2,583	173.32	0.00
10.50	0.07	2,709	173.33	0.00
11.00	0.07	2,835	173.34	0.00
11.50	0.07	2,961	173.35	0.00
12.00	2.40	5,184	173.54	0.00
12.50	**5.28**	12,097	173.98	0.00
13.00	2.06	18,425	174.29	**0.31**
13.50	1.52	21,085	174.40	0.31
14.00	1.31	23,069	174.48	0.31
14.50	1.15	24,724	174.55	0.31
15.00	1.04	26,141	174.60	0.31
15.50	0.92	27,353	174.65	0.31
16.00	0.80	28,343	174.68	0.31
16.50	0.71	29,137	174.71	0.31
17.00	0.65	29,797	174.74	0.31
17.50	0.59	30,351	174.76	0.31
18.00	0.53	30,798	174.77	0.31
18.50	0.49	31,156	174.78	0.31
19.00	0.47	31,464	174.79	0.31
19.50	0.46	31,741	174.80	0.31
20.00	0.44	31,986	174.81	0.31
20.50	0.42	32,201	174.82	0.31
21.00	0.41	32,390	174.83	0.31
21.50	0.39	32,554	174.83	0.31
22.00	0.38	32,693	174.84	0.31
22.50	0.37	32,806	174.84	0.31
23.00	0.35	32,894	174.84	0.31
23.50	0.34	32,955	174.84	0.31
24.00	0.30	**32,966**	**174.85**	0.31
24.50	0.09	32,753	174.84	0.31
25.00	0.07	32,336	174.82	0.31
25.50	0.07	31,904	174.81	0.31

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.07	31,472	174.79	0.31
26.50	0.07	31,040	174.78	0.31
27.00	0.07	30,608	174.76	0.31
27.50	0.07	30,176	174.75	0.31
28.00	0.07	29,744	174.73	0.31
28.50	0.07	29,312	174.72	0.31
29.00	0.07	28,880	174.70	0.31
29.50	0.07	28,448	174.69	0.31
30.00	0.07	28,016	174.67	0.31
30.50	0.07	27,584	174.66	0.31
31.00	0.07	27,152	174.64	0.31
31.50	0.07	26,720	174.62	0.31
32.00	0.07	26,288	174.61	0.31
32.50	0.07	25,856	174.59	0.31
33.00	0.07	25,424	174.57	0.31
33.50	0.07	24,992	174.56	0.31
34.00	0.07	24,560	174.54	0.31
34.50	0.07	24,128	174.52	0.31
35.00	0.07	23,696	174.51	0.31
35.50	0.07	23,264	174.49	0.31
36.00	0.07	22,832	174.47	0.31
36.50	0.07	22,400	174.46	0.31
37.00	0.07	21,968	174.44	0.31
37.50	0.07	21,536	174.42	0.31
38.00	0.07	21,104	174.40	0.31
38.50	0.07	20,672	174.38	0.31
39.00	0.07	20,240	174.37	0.31
39.50	0.07	19,808	174.35	0.31
40.00	0.07	19,376	174.33	0.31
40.50	0.07	18,944	174.31	0.31
41.00	0.07	18,512	174.29	0.31
41.50	0.07	18,080	174.27	0.31
42.00	0.07	17,648	174.25	0.31
42.50	0.07	17,216	174.23	0.31
43.00	0.07	16,784	174.21	0.31
43.50	0.07	16,352	174.19	0.31
44.00	0.07	15,920	174.17	0.31
44.50	0.07	15,488	174.15	0.31
45.00	0.07	15,056	174.13	0.31
45.50	0.07	14,624	174.11	0.31
46.00	0.07	14,192	174.09	0.31
46.50	0.07	13,760	174.07	0.31
47.00	0.07	13,328	174.04	0.31
47.50	0.07	12,896	174.02	0.31
48.00	0.07	12,465	174.00	0.31
48.50	0.07	12,292	173.99	0.02
49.00	0.07	12,326	173.99	0.08
49.50	0.07	12,319	173.99	0.07
50.00	0.07	12,321	173.99	0.07
50.50	0.07	12,320	173.99	0.07
51.00	0.07	12,320	173.99	0.07
51.50	0.07	12,320	173.99	0.07

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.07	12,320	173.99	0.07
52.50	0.07	12,320	173.99	0.07
53.00	0.07	12,320	173.99	0.07
53.50	0.07	12,320	173.99	0.07
54.00	0.07	12,320	173.99	0.07
54.50	0.07	12,320	173.99	0.07
55.00	0.07	12,320	173.99	0.07
55.50	0.07	12,320	173.99	0.07
56.00	0.07	12,320	173.99	0.07
56.50	0.07	12,320	173.99	0.07
57.00	0.07	12,320	173.99	0.07
57.50	0.07	12,320	173.99	0.07
58.00	0.07	12,320	173.99	0.07
58.50	0.07	12,320	173.99	0.07
59.00	0.07	12,320	173.99	0.07
59.50	0.07	12,320	173.99	0.07
60.00	0.07	12,320	173.99	0.07
60.50	0.07	12,320	173.99	0.07
61.00	0.07	12,320	173.99	0.07
61.50	0.07	12,320	173.99	0.07
62.00	0.07	12,320	173.99	0.07
62.50	0.07	12,320	173.99	0.07
63.00	0.07	12,320	173.99	0.07
63.50	0.07	12,320	173.99	0.07
64.00	0.07	12,320	173.99	0.07
64.50	0.07	12,320	173.99	0.07
65.00	0.07	12,320	173.99	0.07
65.50	0.07	12,320	173.99	0.07
66.00	0.07	12,320	173.99	0.07
66.50	0.07	12,320	173.99	0.07
67.00	0.07	12,320	173.99	0.07
67.50	0.07	12,320	173.99	0.07
68.00	0.07	12,320	173.99	0.07
68.50	0.07	12,320	173.99	0.07
69.00	0.07	12,320	173.99	0.07
69.50	0.07	12,320	173.99	0.07
70.00	0.07	12,320	173.99	0.07
70.50	0.07	12,320	173.99	0.07
71.00	0.07	12,320	173.99	0.07
71.50	0.07	12,320	173.99	0.07
72.00	0.07	12,320	173.99	0.07
72.50	0.07	12,320	173.99	0.07
73.00	0.07	12,320	173.99	0.07
73.50	0.07	12,320	173.99	0.07
74.00	0.07	12,320	173.99	0.07
74.50	0.07	12,320	173.99	0.07
75.00	0.07	12,320	173.99	0.07
75.50	0.07	12,320	173.99	0.07
76.00	0.07	12,320	173.99	0.07
76.50	0.07	12,320	173.99	0.07
77.00	0.07	12,320	173.99	0.07
77.50	0.07	12,320	173.99	0.07

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
78.00	0.07	12,320	173.99	0.07
78.50	0.07	12,320	173.99	0.07
79.00	0.07	12,320	173.99	0.07
79.50	0.07	12,320	173.99	0.07
80.00	0.07	12,320	173.99	0.07
80.50	0.07	12,320	173.99	0.07
81.00	0.07	12,320	173.99	0.07
81.50	0.07	12,320	173.99	0.07
82.00	0.07	12,320	173.99	0.07
82.50	0.07	12,320	173.99	0.07
83.00	0.07	12,320	173.99	0.07
83.50	0.07	12,320	173.99	0.07
84.00	0.07	12,320	173.99	0.07
84.50	0.07	12,320	173.99	0.07
85.00	0.07	12,320	173.99	0.07
85.50	0.07	12,320	173.99	0.07
86.00	0.07	12,320	173.99	0.07
86.50	0.07	12,320	173.99	0.07
87.00	0.07	12,320	173.99	0.07
87.50	0.07	12,320	173.99	0.07
88.00	0.07	12,320	173.99	0.07
88.50	0.07	12,320	173.99	0.07
89.00	0.07	12,320	173.99	0.07
89.50	0.07	12,320	173.99	0.07
90.00	0.07	12,320	173.99	0.07
90.50	0.07	12,320	173.99	0.07
91.00	0.07	12,320	173.99	0.07
91.50	0.07	12,320	173.99	0.07
92.00	0.07	12,320	173.99	0.07
92.50	0.07	12,320	173.99	0.07
93.00	0.07	12,320	173.99	0.07
93.50	0.07	12,320	173.99	0.07
94.00	0.07	12,320	173.99	0.07
94.50	0.07	12,320	173.99	0.07
95.00	0.07	12,320	173.99	0.07
95.50	0.07	12,320	173.99	0.07
96.00	0.07	12,320	173.99	0.07
96.50	0.07	12,320	173.99	0.07
97.00	0.07	12,320	173.99	0.07
97.50	0.07	12,320	173.99	0.07
98.00	0.07	12,320	173.99	0.07
98.50	0.07	12,320	173.99	0.07
99.00	0.07	12,320	173.99	0.07
99.50	0.07	12,320	173.99	0.07
100.00	0.07	12,320	173.99	0.07
100.50	0.07	12,320	173.99	0.07
101.00	0.07	12,320	173.99	0.07
101.50	0.07	12,320	173.99	0.07
102.00	0.07	12,320	173.99	0.07
102.50	0.07	12,320	173.99	0.07
103.00	0.07	12,320	173.99	0.07
103.50	0.07	12,320	173.99	0.07

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
104.00	0.07	12,320	173.99	0.07
104.50	0.07	12,320	173.99	0.07
105.00	0.07	12,320	173.99	0.07
105.50	0.07	12,320	173.99	0.07
106.00	0.07	12,320	173.99	0.07
106.50	0.07	12,320	173.99	0.07
107.00	0.07	12,320	173.99	0.07
107.50	0.07	12,320	173.99	0.07
108.00	0.07	12,320	173.99	0.07
108.50	0.07	12,320	173.99	0.07
109.00	0.07	12,320	173.99	0.07
109.50	0.07	12,320	173.99	0.07
110.00	0.07	12,320	173.99	0.07
110.50	0.07	12,320	173.99	0.07
111.00	0.07	12,320	173.99	0.07
111.50	0.07	12,320	173.99	0.07
112.00	0.07	12,320	173.99	0.07
112.50	0.07	12,320	173.99	0.07
113.00	0.07	12,320	173.99	0.07
113.50	0.07	12,320	173.99	0.07
114.00	0.07	12,320	173.99	0.07
114.50	0.07	12,320	173.99	0.07
115.00	0.07	12,320	173.99	0.07
115.50	0.07	12,320	173.99	0.07
116.00	0.07	12,320	173.99	0.07
116.50	0.07	12,320	173.99	0.07
117.00	0.07	12,320	173.99	0.07
117.50	0.07	12,320	173.99	0.07
118.00	0.07	12,320	173.99	0.07
118.50	0.07	12,320	173.99	0.07
119.00	0.07	12,320	173.99	0.07
119.50	0.07	12,320	173.99	0.07
120.00	0.07	12,320	173.99	0.07

Landfill Open (Cell 20 North End)

Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Subcat Reach Pond Link

Routing Diagram for Leachate Collection Sump Analysis
Prepared by Sevee & Maher Engineers, Printed 6/13/2025
HydroCAD® 10.20-6a s/n 01260 © 2024 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Yr. Storm Event(AMC2)	Type III 24-hr		Default	24.00	1	4.80	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
9.270	55	OPEN WASTE AT 2 PERCENT GRADE (Cell 20 North)
9.270	**55**	**TOTAL AREA**

Time span=0.00-120.00 hrs, dt=0.50 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment Cell 20 North: Landfill Open Runoff Area=9.270 ac 0.00% Impervious Runoff Depth=0.88"
Tc=15.0 min CN=55 Runoff=3.90 cfs 0.681 af

Pond PS-20: Cell 20 Sump (Permanent PS) Peak Elev=168.76' Storage=22,477 cf Inflow=3.96 cfs 1.279 af
Outflow=0.31 cfs 1.063 af

Total Runoff Area = 9.270 ac Runoff Volume = 0.681 af Average Runoff Depth = 0.88"
100.00% Pervious = 9.270 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End)

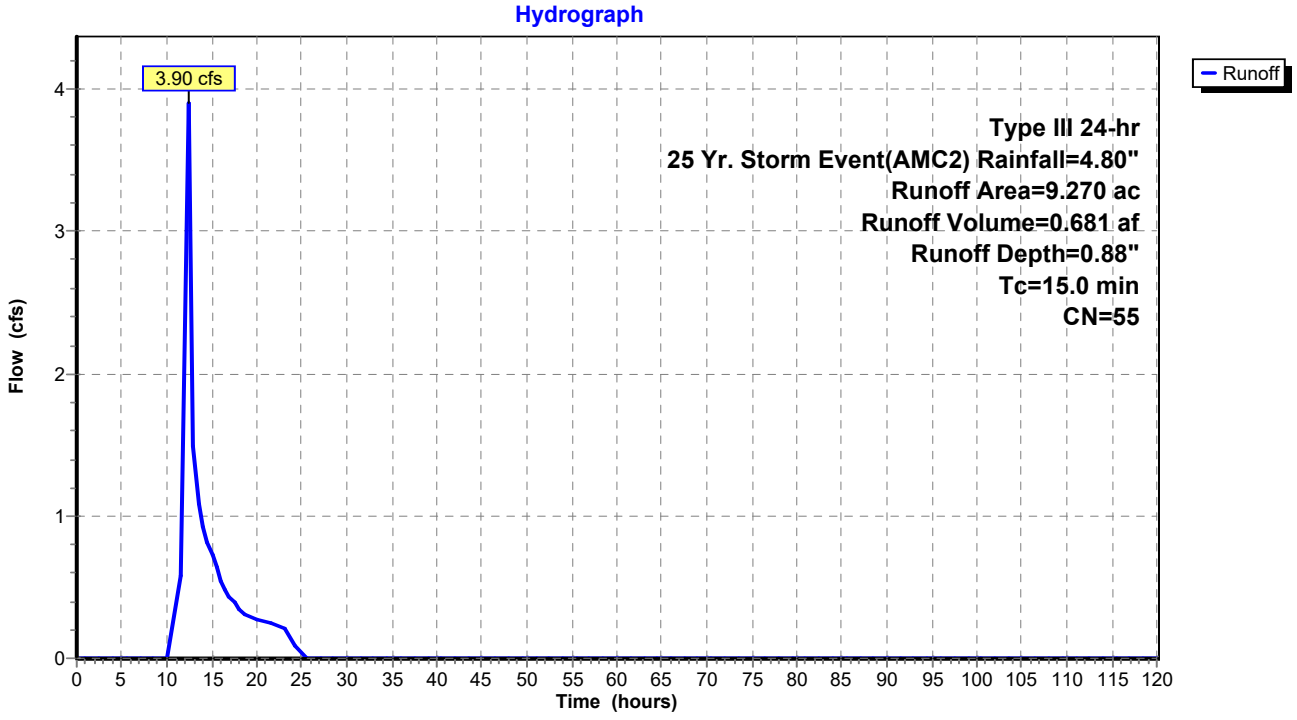
Runoff = 3.90 cfs @ 12.49 hrs, Volume= 0.681 af, Depth= 0.88"
Routed to Pond PS-20 : Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	9.270	55	OPEN WASTE AT 2 PERCENT GRADE
	9.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Subcatchment Cell 20 North: Landfill Open (Cell 20 North End)



Hydrograph for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	1.74	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**3.90**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	1.49	39.00	4.80	0.88	0.00
13.50	3.76	0.44	1.08	39.50	4.80	0.88	0.00
14.00	3.89	0.49	0.93	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.81	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.73	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.64	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.54	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.48	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.43	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.39	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.34	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.31	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.30	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.29	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.27	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.26	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.25	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.24	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.23	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.22	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.21	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.20	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.17	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.01	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Inflow Area = 9.270 ac, 0.00% Impervious, Inflow Depth > 1.66" for 25 Yr. Storm Event(AMC2) event
Inflow = 3.96 cfs @ 12.49 hrs, Volume= 1.279 af, Incl. 0.06 cfs Base Flow
Outflow = 0.31 cfs @ 13.00 hrs, Volume= 1.063 af, Atten= 92%, Lag= 30.8 min
Primary = 0.31 cfs @ 13.00 hrs, Volume= 1.063 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Peak Elev= 168.76' @ 21.15 hrs Surf.Area= 50,891 sf Storage= 22,477 cf
Flood Elev= 171.00' Surf.Area= 118,863 sf Storage= 97,636 cf

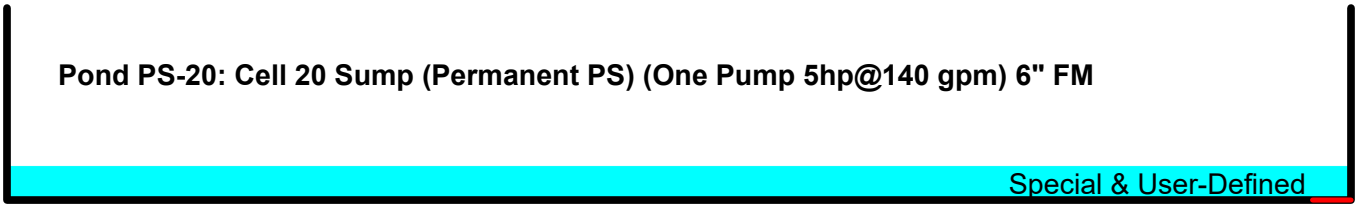
Plug-Flow detention time= 1,367.6 min calculated for 1.062 af (83% of inflow)
Center-of-Mass det. time= 600.7 min (2,764.7 - 2,164.0)

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	582,271 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

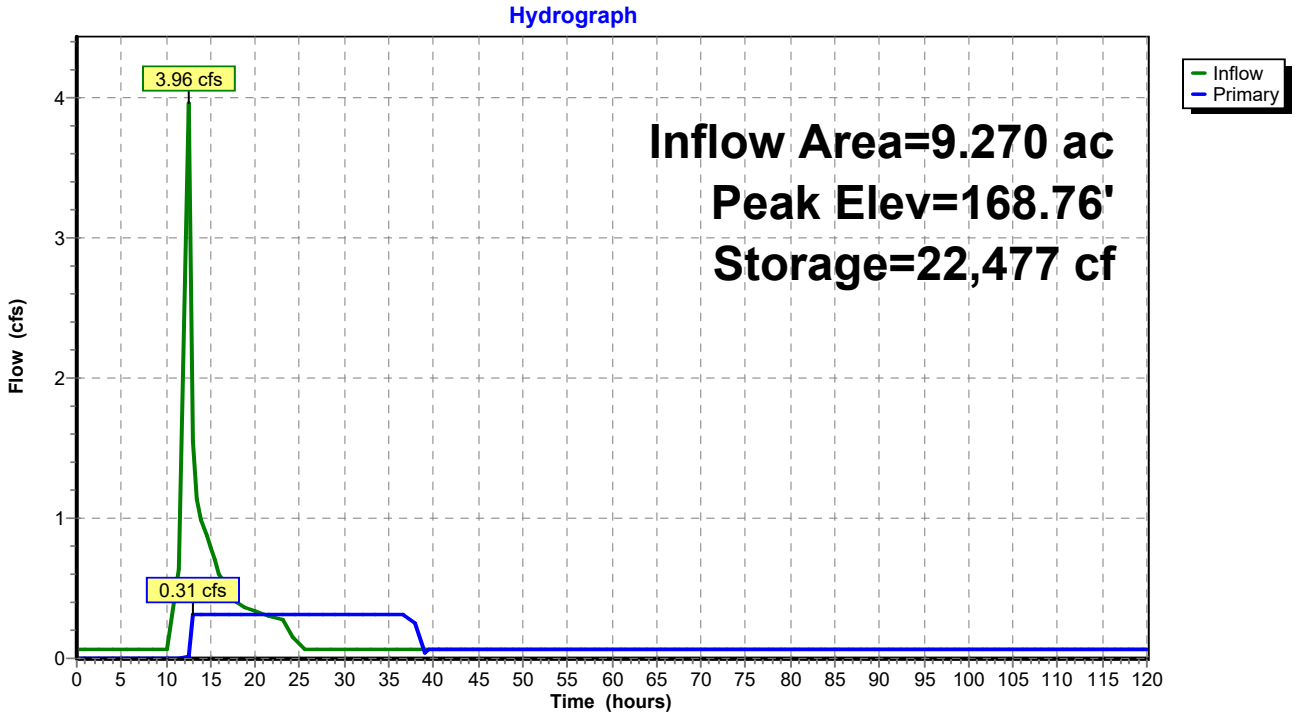
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	13,031	0.0	0	0
169.00	56,098	40.0	27,652	27,652
171.00	118,863	40.0	69,984	97,636
173.00	178,022	40.0	118,754	216,390
175.00	233,538	40.0	164,624	381,014
177.00	269,604	40.0	201,257	582,271

Device	Routing	Invert	Outlet Devices
#1	Primary	167.00'	**Special & User-Defined** Head (feet) 0.00 0.99 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 Disch. (cfs) 0.000 0.000 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310

Primary OutFlow Max=0.31 cfs @ 13.00 hrs HW=168.30' (Free Discharge)
↑—**1=Special & User-Defined** (Custom Controls 0.31 cfs)



Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM



Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.06	54	167.01	0.00
0.50	0.06	162	167.03	0.00
1.00	0.06	270	167.05	0.00
1.50	0.06	378	167.07	0.00
2.00	0.06	486	167.09	0.00
2.50	0.06	594	167.10	0.00
3.00	0.06	702	167.12	0.00
3.50	0.06	810	167.14	0.00
4.00	0.06	918	167.15	0.00
4.50	0.06	1,026	167.17	0.00
5.00	0.06	1,134	167.19	0.00
5.50	0.06	1,242	167.20	0.00
6.00	0.06	1,350	167.22	0.00
6.50	0.06	1,458	167.23	0.00
7.00	0.06	1,566	167.25	0.00
7.50	0.06	1,674	167.26	0.00
8.00	0.06	1,782	167.28	0.00
8.50	0.06	1,890	167.29	0.00
9.00	0.06	1,998	167.31	0.00
9.50	0.06	2,106	167.32	0.00
10.00	0.06	2,214	167.33	0.00
10.50	0.06	2,322	167.35	0.00
11.00	0.06	2,430	167.36	0.00
11.50	0.06	2,538	167.37	0.00
12.00	1.80	4,216	167.55	0.00
12.50	**3.96**	9,390	167.99	0.02
13.00	1.55	14,055	168.30	**0.31**
13.50	1.14	15,920	168.41	0.31
14.00	0.99	17,279	168.49	0.31
14.50	0.87	18,392	168.55	0.31
15.00	0.79	19,326	168.60	0.31
15.50	0.70	20,107	168.64	0.31
16.00	0.60	20,722	168.67	0.31
16.50	0.54	21,190	168.69	0.31
17.00	0.49	21,557	168.71	0.31
17.50	0.45	21,846	168.73	0.31
18.00	0.40	22,054	168.74	0.31
18.50	0.37	22,196	168.74	0.31
19.00	0.36	22,300	168.75	0.31
19.50	0.35	22,381	168.75	0.31
20.00	0.33	22,438	168.76	0.31
20.50	0.32	22,472	168.76	0.31
21.00	0.31	**22,487**	**168.76**	0.31
21.50	0.30	22,483	168.76	0.31
22.00	0.29	22,461	168.76	0.31
22.50	0.28	22,419	168.75	0.31
23.00	0.27	22,358	168.75	0.31
23.50	0.26	22,277	168.75	0.31
24.00	0.23	22,159	168.74	0.31
24.50	0.07	21,873	168.73	0.31
25.00	0.06	21,435	168.71	0.31
25.50	0.06	20,985	168.68	0.31

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.06	20,535	168.66	0.31
26.50	0.06	20,085	168.64	0.31
27.00	0.06	19,635	168.61	0.31
27.50	0.06	19,185	168.59	0.31
28.00	0.06	18,735	168.57	0.31
28.50	0.06	18,285	168.54	0.31
29.00	0.06	17,835	168.52	0.31
29.50	0.06	17,385	168.49	0.31
30.00	0.06	16,935	168.47	0.31
30.50	0.06	16,485	168.44	0.31
31.00	0.06	16,035	168.42	0.31
31.50	0.06	15,585	168.39	0.31
32.00	0.06	15,135	168.36	0.31
32.50	0.06	14,685	168.34	0.31
33.00	0.06	14,235	168.31	0.31
33.50	0.06	13,785	168.28	0.31
34.00	0.06	13,335	168.25	0.31
34.50	0.06	12,885	168.23	0.31
35.00	0.06	12,435	168.20	0.31
35.50	0.06	11,985	168.17	0.31
36.00	0.06	11,535	168.14	0.31
36.50	0.06	11,085	168.11	0.31
37.00	0.06	10,635	168.08	0.31
37.50	0.06	10,185	168.05	0.31
38.00	0.06	9,735	168.02	0.31
38.50	0.06	9,442	167.99	0.14
39.00	0.06	9,397	167.99	0.03
39.50	0.06	9,412	167.99	0.07
40.00	0.06	9,407	167.99	0.06
40.50	0.06	9,408	167.99	0.06
41.00	0.06	9,408	167.99	0.06
41.50	0.06	9,408	167.99	0.06
42.00	0.06	9,408	167.99	0.06
42.50	0.06	9,408	167.99	0.06
43.00	0.06	9,408	167.99	0.06
43.50	0.06	9,408	167.99	0.06
44.00	0.06	9,408	167.99	0.06
44.50	0.06	9,408	167.99	0.06
45.00	0.06	9,408	167.99	0.06
45.50	0.06	9,408	167.99	0.06
46.00	0.06	9,408	167.99	0.06
46.50	0.06	9,408	167.99	0.06
47.00	0.06	9,408	167.99	0.06
47.50	0.06	9,408	167.99	0.06
48.00	0.06	9,408	167.99	0.06
48.50	0.06	9,408	167.99	0.06
49.00	0.06	9,408	167.99	0.06
49.50	0.06	9,408	167.99	0.06
50.00	0.06	9,408	167.99	0.06
50.50	0.06	9,408	167.99	0.06
51.00	0.06	9,408	167.99	0.06
51.50	0.06	9,408	167.99	0.06

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.06	9,408	167.99	0.06
52.50	0.06	9,408	167.99	0.06
53.00	0.06	9,408	167.99	0.06
53.50	0.06	9,408	167.99	0.06
54.00	0.06	9,408	167.99	0.06
54.50	0.06	9,408	167.99	0.06
55.00	0.06	9,408	167.99	0.06
55.50	0.06	9,408	167.99	0.06
56.00	0.06	9,408	167.99	0.06
56.50	0.06	9,408	167.99	0.06
57.00	0.06	9,408	167.99	0.06
57.50	0.06	9,408	167.99	0.06
58.00	0.06	9,408	167.99	0.06
58.50	0.06	9,408	167.99	0.06
59.00	0.06	9,408	167.99	0.06
59.50	0.06	9,408	167.99	0.06
60.00	0.06	9,408	167.99	0.06
60.50	0.06	9,408	167.99	0.06
61.00	0.06	9,408	167.99	0.06
61.50	0.06	9,408	167.99	0.06
62.00	0.06	9,408	167.99	0.06
62.50	0.06	9,408	167.99	0.06
63.00	0.06	9,408	167.99	0.06
63.50	0.06	9,408	167.99	0.06
64.00	0.06	9,408	167.99	0.06
64.50	0.06	9,408	167.99	0.06
65.00	0.06	9,408	167.99	0.06
65.50	0.06	9,408	167.99	0.06
66.00	0.06	9,408	167.99	0.06
66.50	0.06	9,408	167.99	0.06
67.00	0.06	9,408	167.99	0.06
67.50	0.06	9,408	167.99	0.06
68.00	0.06	9,408	167.99	0.06
68.50	0.06	9,408	167.99	0.06
69.00	0.06	9,408	167.99	0.06
69.50	0.06	9,408	167.99	0.06
70.00	0.06	9,408	167.99	0.06
70.50	0.06	9,408	167.99	0.06
71.00	0.06	9,408	167.99	0.06
71.50	0.06	9,408	167.99	0.06
72.00	0.06	9,408	167.99	0.06
72.50	0.06	9,408	167.99	0.06
73.00	0.06	9,408	167.99	0.06
73.50	0.06	9,408	167.99	0.06
74.00	0.06	9,408	167.99	0.06
74.50	0.06	9,408	167.99	0.06
75.00	0.06	9,408	167.99	0.06
75.50	0.06	9,408	167.99	0.06
76.00	0.06	9,408	167.99	0.06
76.50	0.06	9,408	167.99	0.06
77.00	0.06	9,408	167.99	0.06
77.50	0.06	9,408	167.99	0.06

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
78.00	0.06	9,408	167.99	0.06
78.50	0.06	9,408	167.99	0.06
79.00	0.06	9,408	167.99	0.06
79.50	0.06	9,408	167.99	0.06
80.00	0.06	9,408	167.99	0.06
80.50	0.06	9,408	167.99	0.06
81.00	0.06	9,408	167.99	0.06
81.50	0.06	9,408	167.99	0.06
82.00	0.06	9,408	167.99	0.06
82.50	0.06	9,408	167.99	0.06
83.00	0.06	9,408	167.99	0.06
83.50	0.06	9,408	167.99	0.06
84.00	0.06	9,408	167.99	0.06
84.50	0.06	9,408	167.99	0.06
85.00	0.06	9,408	167.99	0.06
85.50	0.06	9,408	167.99	0.06
86.00	0.06	9,408	167.99	0.06
86.50	0.06	9,408	167.99	0.06
87.00	0.06	9,408	167.99	0.06
87.50	0.06	9,408	167.99	0.06
88.00	0.06	9,408	167.99	0.06
88.50	0.06	9,408	167.99	0.06
89.00	0.06	9,408	167.99	0.06
89.50	0.06	9,408	167.99	0.06
90.00	0.06	9,408	167.99	0.06
90.50	0.06	9,408	167.99	0.06
91.00	0.06	9,408	167.99	0.06
91.50	0.06	9,408	167.99	0.06
92.00	0.06	9,408	167.99	0.06
92.50	0.06	9,408	167.99	0.06
93.00	0.06	9,408	167.99	0.06
93.50	0.06	9,408	167.99	0.06
94.00	0.06	9,408	167.99	0.06
94.50	0.06	9,408	167.99	0.06
95.00	0.06	9,408	167.99	0.06
95.50	0.06	9,408	167.99	0.06
96.00	0.06	9,408	167.99	0.06
96.50	0.06	9,408	167.99	0.06
97.00	0.06	9,408	167.99	0.06
97.50	0.06	9,408	167.99	0.06
98.00	0.06	9,408	167.99	0.06
98.50	0.06	9,408	167.99	0.06
99.00	0.06	9,408	167.99	0.06
99.50	0.06	9,408	167.99	0.06
100.00	0.06	9,408	167.99	0.06
100.50	0.06	9,408	167.99	0.06
101.00	0.06	9,408	167.99	0.06
101.50	0.06	9,408	167.99	0.06
102.00	0.06	9,408	167.99	0.06
102.50	0.06	9,408	167.99	0.06
103.00	0.06	9,408	167.99	0.06
103.50	0.06	9,408	167.99	0.06

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (One Pump 5hp@140 gpm) 6" FM (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
104.00	0.06	9,408	167.99	0.06
104.50	0.06	9,408	167.99	0.06
105.00	0.06	9,408	167.99	0.06
105.50	0.06	9,408	167.99	0.06
106.00	0.06	9,408	167.99	0.06
106.50	0.06	9,408	167.99	0.06
107.00	0.06	9,408	167.99	0.06
107.50	0.06	9,408	167.99	0.06
108.00	0.06	9,408	167.99	0.06
108.50	0.06	9,408	167.99	0.06
109.00	0.06	9,408	167.99	0.06
109.50	0.06	9,408	167.99	0.06
110.00	0.06	9,408	167.99	0.06
110.50	0.06	9,408	167.99	0.06
111.00	0.06	9,408	167.99	0.06
111.50	0.06	9,408	167.99	0.06
112.00	0.06	9,408	167.99	0.06
112.50	0.06	9,408	167.99	0.06
113.00	0.06	9,408	167.99	0.06
113.50	0.06	9,408	167.99	0.06
114.00	0.06	9,408	167.99	0.06
114.50	0.06	9,408	167.99	0.06
115.00	0.06	9,408	167.99	0.06
115.50	0.06	9,408	167.99	0.06
116.00	0.06	9,408	167.99	0.06
116.50	0.06	9,408	167.99	0.06
117.00	0.06	9,408	167.99	0.06
117.50	0.06	9,408	167.99	0.06
118.00	0.06	9,408	167.99	0.06
118.50	0.06	9,408	167.99	0.06
119.00	0.06	9,408	167.99	0.06
119.50	0.06	9,408	167.99	0.06
120.00	0.06	9,408	167.99	0.06

E-7

LEACHATE TANK STORAGE CAPACITY

SME
SEVEE & MAHER
ENGINEERS

SME
SEVEE & MAHER
ENGINEERS
4 Blanchard Road, P.O. Box 85A
Cumberland, ME 04021
Tel: 207.829.5016 / Fax: 207.829.5692
smemaine.com

PH II EXPANSION LEACHATE GENERATION AND TANK CAPACITY EVALUATION

Project Name: Juniper Ridge Landfill Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: DPW
Date: 4/4/2025
Checked By: BDP
Date: 4/8/2025

OBJECTIVE

Evaluate the leachate generation during the Phase II Expansion and calculate the required design storage capacity per Chapter 401D.4.b.(i).

DESIGN CRITERIA

1. Design Storage Capacity must be based on the predicted leachate quantity under the most critical conditions anticipated over the life of the landfill including:
   A. Storm Flow from 25-year 24-hour storm event storm during wet period of analysis. (See Attached HydroCAD analysis)
   B. Base Flow estimate from HELP model that includes one 25-year rain event and 15-years of hydrologic data. (See Attached HELP Model Analysis)
2. Additional storage equal to 25% of the Design Storage Capacity determined above.
3. Must consider leachate management limitations relating to trasnporation and disposal.

DESIGN ASSUMPTIONS

1. Condition with the highest combined Storm and Base flow is the initial devlopment of Cell 20 with conditions indicated below and as shown on attached figure.
   A. Final Cover on approximately 58 Acreas of existing landfill
   B. Intermediate soil cover on approximately 20.1 acres of the top of the existing landfill
   C. Intermediate geomembrane cover on approximately 21.9 acres of the existing landfill
   D. Intermediate soil cover on approximately 6.8 acres of the top of the existing landfill
   E. Intermediate geomembrane cover on approximately 14.8 acres of the existing landfill
   F. Open Waste in Cell 19 (60-foot waste thickness) is approximately 4.7 acres
   G. Open Waste (10-foot thickness) in Cell 20 is 16.9 acres
   H. Open Waste on Stage 7 Final Cover regrade area (60-foot waste thickness) is 11 acres
2. An average waste surface of 2% slope in operational open waste areas. Sideslope waste surface areas are assumed to be 33%.
3. Base Flow calculated using the largest monthly impingement rate (see Attached HELP Model).
4. Storm Flow from the operational areas (Cells 19, 20, and Stage 7 Closure) includes 25-year 24-hour storm event (4.8 inches) which is included in the attached HydroCAD model.
5. Cell 19 and 20 pumping rate assumed to be 140 gpm (per pump station) applied in the HydroCAD model to determine storm pumping duration.
6. Tank liquid level at start of analys is assumed to be 7-feet which is the average leachate level observed from four years of leachate records (2020 to 2024)

ANALYSIS

1. Start Volume at 7-feet height = 270,610 gallons

2. Base Flow calculated to be:

   144,150 gal/day x 36 hour pumping duration / 24 hours/day = 216,225 gallons

3. Storm Flow from the following (See Attached HydroCAD):
   A. Cell 19 and Cell 20 = 1.591 Acre-ft x 325,851 gallons/Acre-ft = 518,429
   B. Stage 7 Regrade = 0.809 Acre-ft x 325,851 gallons/Acre-ft = 263,613
   C. Total Storm Flow = 782,042 gallons

5. Design Storage = Base Flow + Strom Flow = 998,267 gallons

6. 25% Additional Capacity per Rules = 249,567 gallons

7. Exising Tank Capacity = 920,275 gallons

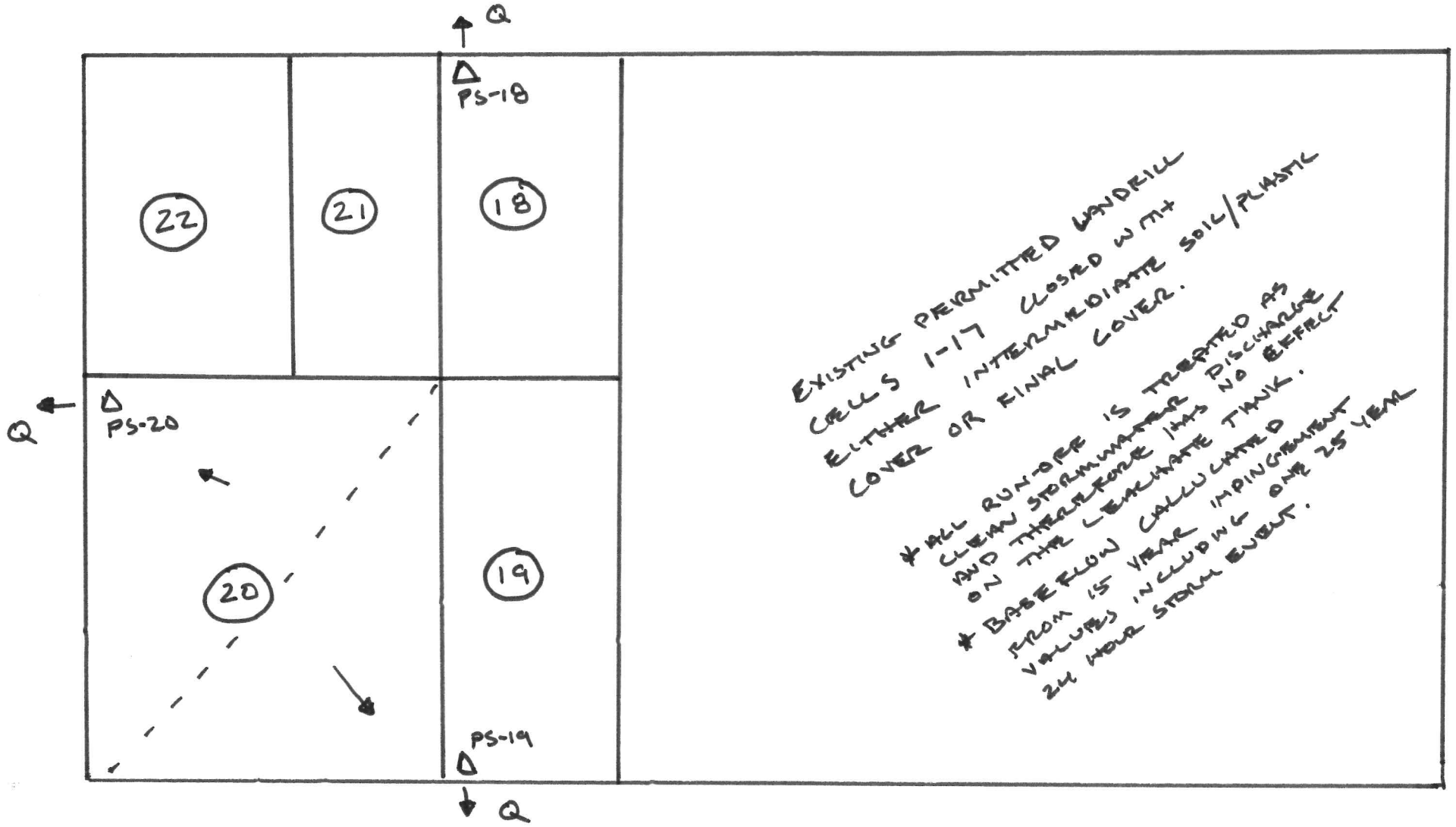
8. Additional Tank Capacity Required (Start Volume + Desing Storage - Existing Tank Capacity) = 598,169 gallons

9. Proposed Tank Capacity = 921,000 gallons > 598,169 gallons therefore we have adequate storage.

LEACHATE TANK SIZING & GENERATION SCHEMATIC

* EXPANSION CELLS BASEFLOW ARE CALCULATED FROM PEAK MONTHLY IMPINGEMENT (HELP MODEL)
* INCLUDED A 25 YEAR STORM EVENT (HCAD MODEL)
* EXISTING CLOSED/ACTIVE LANDFILL BASEFLOW FROM PEAK MONTHLY IMPINGEMENT (HELP) MODEL
* THE EXISTING LANDFILL BASEFLOW INCLUDES A 25 YEAR STORM EVENT IN THE BASE FLOW CALCULATION.

NOTE: CELLS 21 & 22 NOT INCLUDED AS AT THE TIME OF THEIR DEVELOPMENT THE LEACHATE GENERATION AT THE TANK WILL BE LESS THAN CELL 20'S INITIAL CONDITION (WITH 10-FEET OF WASTE ACROSS THE CELLS BASE).



EXISTING PERMITTED LANDFILL CELLS 1-17 CLOSED WITH EITHER INTERMEDIATE SOIL/PLASTIC COVER OR FINAL COVER.

* ALL RUN-OFF IS TREATED AS CLEAN STORMWATER AND THEREFORE HAS NO DISCHARGE ON THE LEACHATE TANK.
* BASEFLOW CALCULATED FROM 15 YEAR IMPINGEMENT VALUES INCLUDING ONE 25 YEAR 24 HOUR STORM EVENT.

≈6.85 ACRES OF INTERMEDIATE SOIL COVER ON PH II EXPANSION

≈14.84 ACRES OF INTERMEDIATE PLASTIC COVER ON PH II EXPANSION

(CELL 20N)
≈9.27 ACRES OF OPE WASTE
10' (2" SLOPE) CONDITION
ON PH II EXPANSION

≈32.87 ACRES OF INTERMEDIATE PLASTIC COVER ON THE EXISTING PH I EXPANSION

≈20.1 ACRES OF INTERMEDIATE SOIL COVER ON EXISTING PH I EXPANSION

≈11 ACRES OF EITHER FINAL/INTERMEDIATE PLASTIC COVER OR 60' OPEN WASTE 33% SLOPE CONDITION

STAGE 7 FINAL COVER (2033)

≈58 ACRES OF FINAL COVER ALL ON THE EXISTING PERMIT PH I EXPANSION

(CELL 20S)
≈7.63 ACRES OF OPEN WASTE
10' (2% SLOPE) CONDITION
ON PH II EXPANSION

≈4.75 ACRES OF OPEN WASTE
60' (33% SLOPE) CONDITION
ON PH II EXPANSION

18

19

20

LEGEND

- AREAS OF FINAL COVER
- AREAS OF INTERMEDIATE GEOMEMBRANE COVER
- AREAS OF INTERMEDIATE SOIL COVER
- AREAS OF ACTIVE WASTE FILLING CONDITIONS

- 20 — CELL DESIGNATION
- CLEAN STORMWATER DITCH
- CLEAN STORMWATER CATCH BASIN
- PERMANENT LEACHATE COLLECTION AND LEAK DETECTION PUMP STATIONS
- COLLECTION SUMP
- FORCEMAIN VAULT
- LC — LEACHATE COLLECTION PIPING
- FM — LEACHATE TRANSPORT FORCEMAIN

NOTES

1. GRADES SHOWN IN CELL REPRESENT CELL BASE GRADES PRIOR TO WASTE FILLING.
2. FINAL GRADES REPRESENT TOP OF WASTE.

175 0 350

WORST CASE
LEACHATE GENERATION CONDITION
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: LEACHATE-GEN-COND LMN: WORSE CASE LEACHATE CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 8/11/2025

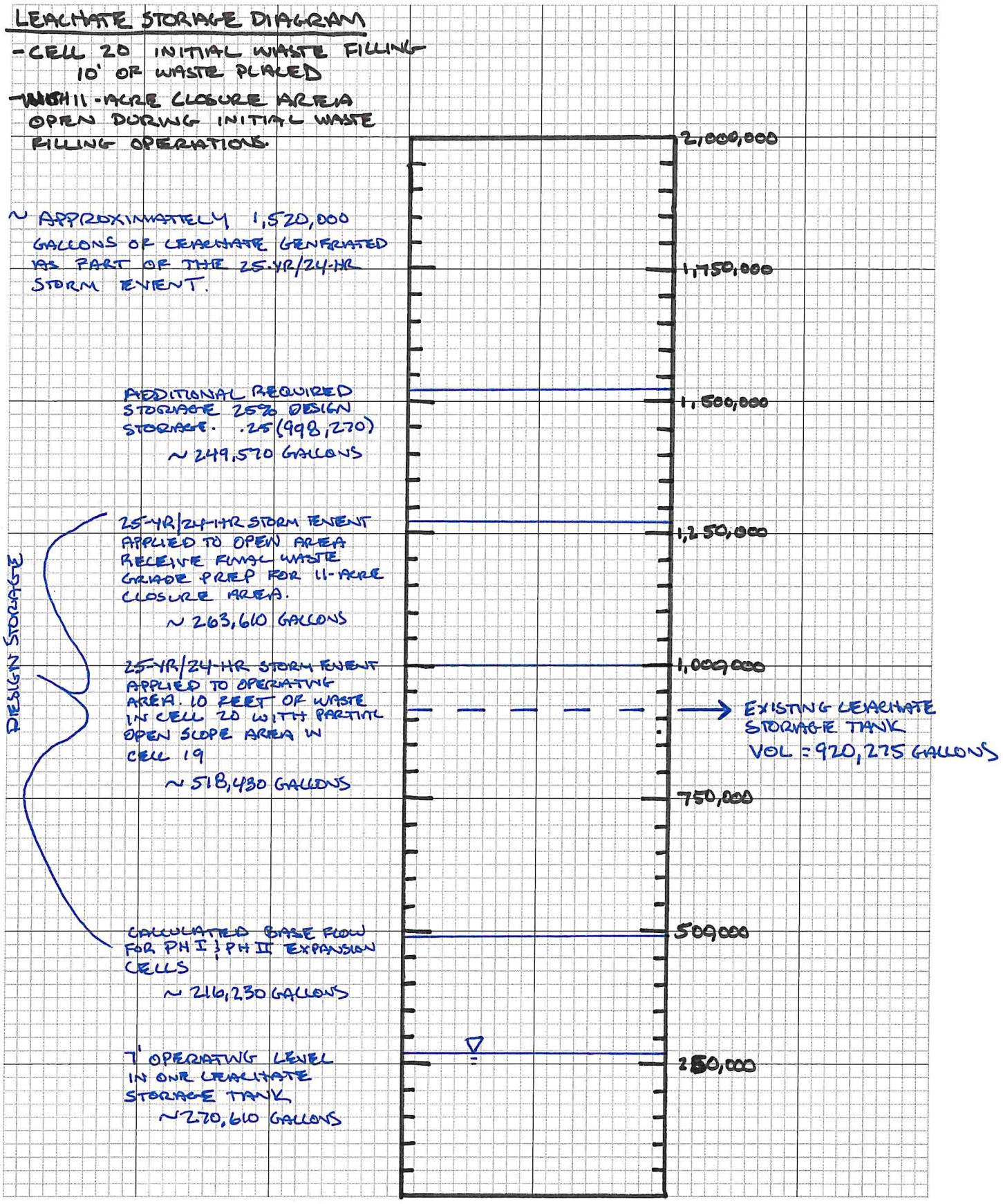
\\Server\ds\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\LEACHATE-GEN-COND.dwg, B_FIG, 8/11/2025 3:03:59 PM, sjm

Task 1: Daily Average of the Largest Monthly Flow At the Beginning of Cell 20 (Assumes 11 acre closure area)							From HELP Model Runs Peak Monly Generation in the Drainage Layer		
Inactive Landfill (Cells 1-17)	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (gal)/month**	**Leachate (gal)/day**	Largest ave. month (Inches/Acre)	Largest ave. month (Feet/Acre)	
Final Landfill Cover	2,530,757	35.1%	58.10	-	-	-	0	0.0000	Final cover (impermeable soil with geosynthetics)
Interim Soil Cover Area	876,682	12.2%	20.13	3,521.10	530,142.03	17,671.40	0.97	0.0808	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area	1,431,998	19.9%	32.87	-	-	-	0	0.0000	Temporary plastic cover (impermeable geosynthetic)
60' (33% Slope) Stage 7 Final Closure	479,160	6.6%	11.00	11,994.25	987,018.50	32,900.62	3.3042	0.2754	60' thick average waste deposit with 33% sideslope grade
			122.10			**50,572.02**			
Active Landfill Area	**Area (SF)**	**% Area**	**Area (acre)**	**Leachate Gen/Acre (CF/month)**	**Leachate (CF)/yr**				
10' (2% Slope) (Cell 20 North)	404,000	5.6%	9.27	17,402.95	1,207,468.81	40,248.96	4.7942	0.3995	10' thick initial waste deposit with 2% cross slope grade
10 (2% Slope) (Cell 20 South)	332,350	4.6%	7.63	17,402.95	993,322.42	33,110.75	4.7942	0.3995	10' thick initial waste deposit with 2% cross slope grade
Interim Soil Cover (Cell 19)	130,071	1.8%	2.99	3,521.10	78,655.78	2,621.86	0.97	0.0808	165' thick waste deposit covered with impermeable soil layer
60' (33% Slope) (Cell 19)	206,840	2.9%	4.75	11,994.25	426,068.34	14,202.28	3.3042	0.2754	60' thick average waste deposit with 33% sideslope grade
Interim Soil Cover (Cell 18)	168,340	2.3%	3.86	3,521.10	101,797.58	3,393.25	0.97	0.0808	165' thick waste deposit covered with impermeable soil layer
Interim Plastic Cover Area (Cell 18 and Cell 19)	646,513	9.0%	14.84	-	-	-	0	0.0000	Temporary plastic cover (impermeable geosynthetic)
Totals	**6,727,551**		**165.44**		**4,324,473.46**	**144,149.12**	Input as Base Flow in Tank Volume Calculation		

PROJECT	COMP. BY	JOB NO.
JUNIPER RIDGE LANDFILL PHASE II EXPANSION LEACHATE GENERATION	DPW	240101.00
	CHK. BY	DATE
	BDP	4/9/2025

LEACHATE STORAGE DIAGRAM

- CELL 20 INITIAL WASTE FILLING
  10' OF WASTE PLACED
- WITH 11-ACRE CLOSURE AREA OPEN DURING INITIAL WASTE FILLING OPERATIONS.



SME
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4 Blanchard Road, P.O. Box 85A
Cumberland, ME 04021
Tel: 207.829.5016 / Fax: 207.829.5692
smemaine.com

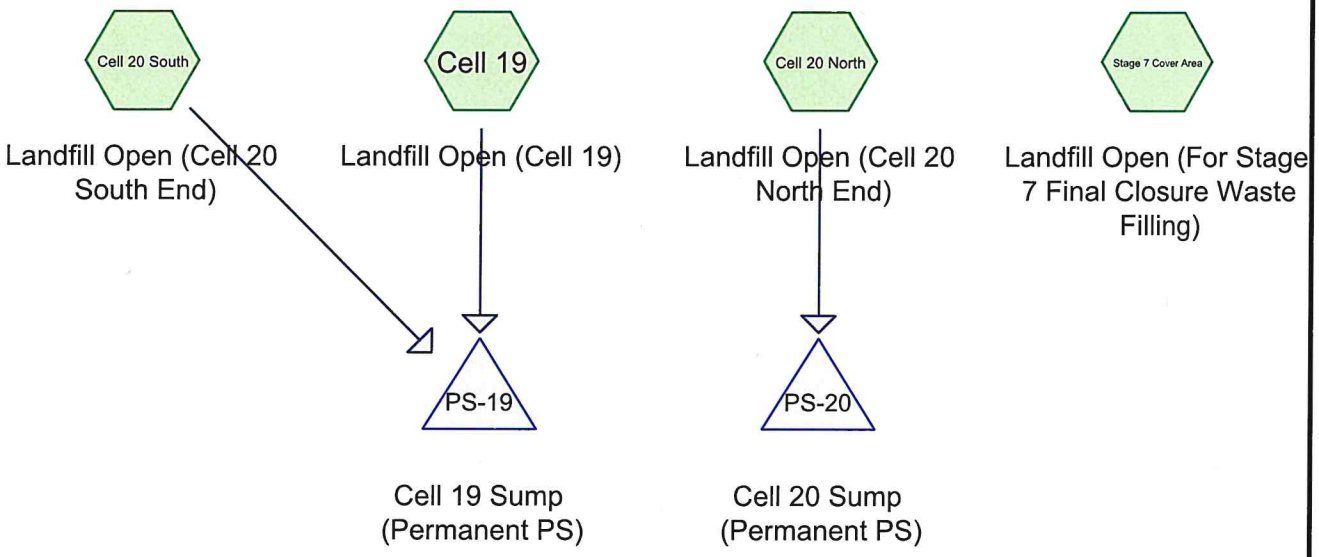
LEACHATE STORAGE TANK EVALUATION

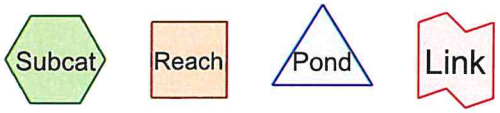
Project Name: JRL Phase II Expansion
Project Location: Old Town, Maine
Project No.: 240101
By: DPW
Date: 4/8/2025
Checked By: BDP
Date: 4/9/2025

Analysis

Tank Diameter (ft)	=	81
Tank Height (ft)	=	23.8
Total Tank Capacity (gallons)	=	921,000
Capacity per Foot (gallons)	=	38,667

Depth (ft)	Capacity	Cumulative Capactiy	Remaining Capacity at Water Depth
1	38,667	38,667	909,448
2	38,667	77,334	870,781
3	38,667	116,001	832,114
4	38,667	154,668	793,447
5	38,667	193,335	754,780
6	38,667	232,002	716,113
7	38,667	270,669	677,446
8	38,667	309,336	638,779
9	38,667	348,003	600,112
10	38,667	386,670	561,445
11	38,667	425,337	522,778
12	38,667	464,004	484,111
13	38,667	502,671	445,444
14	38,667	541,338	406,777
15	38,667	580,005	368,110
16	38,667	618,672	329,443
17	38,667	657,339	290,776
18	38,667	696,006	252,109
19	38,667	734,673	213,442
20	38,667	773,340	174,775
21	38,667	812,007	136,108
22	38,667	850,674	97,441
23	38,667	889,341	58,774
24	38,667	928,008	20,107
24.52	20,107	948,115	-





Routing Diagram for Sump-Design-20250210
Prepared by Sevee & Maher Engineers, Printed 4/10/2025
HydroCAD® 10.20-6a s/n 01260 © 2024 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 Yr. Storm Event(AMC2)	Type III 24-hr		Default	24.00	1	4.80	2

Summary for Subcatchment Cell 19: Landfill Open (Cell 19)

Runoff = 2.00 cfs @ 12.49 hrs, Volume= 0.349 af, Depth= 0.88"
Routed to Pond PS-19 : Cell 19 Sump (Permanent PS)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	4.750	55	OPEN WASTE AT 33 PERCENT GRADE
	4.750		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Hydrograph for Subcatchment Cell 19: Landfill Open (Cell 19)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	0.89	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**2.00**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	0.76	39.00	4.80	0.88	0.00
13.50	3.76	0.44	0.55	39.50	4.80	0.88	0.00
14.00	3.89	0.49	0.47	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.41	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.37	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.33	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.28	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.24	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.22	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.20	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.18	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.16	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.15	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.15	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.14	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.13	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.13	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.12	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.12	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.11	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.11	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.10	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.09	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.01	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 19: Landfill Open (Cell 19) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 19: Landfill Open (Cell 19) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End)

Runoff = 3.90 cfs @ 12.49 hrs, Volume= 0.681 af, Depth= 0.88"
Routed to Pond PS-20 : Cell 20 Sump (Permanent PS)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	9.270	55	OPEN WASTE AT 2 PERCENT GRADE
	9.270		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Hydrograph for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	1.74	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**3.90**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	1.49	39.00	4.80	0.88	0.00
13.50	3.76	0.44	1.08	39.50	4.80	0.88	0.00
14.00	3.89	0.49	0.93	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.81	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.73	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.64	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.54	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.48	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.43	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.39	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.34	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.31	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.30	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.29	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.27	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.26	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.25	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.24	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.23	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.22	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.21	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.20	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.17	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.01	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 North: Landfill Open (Cell 20 North End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End)

Runoff = 3.21 cfs @ 12.49 hrs, Volume= 0.561 af, Depth= 0.88"
Routed to Pond PS-19 : Cell 19 Sump (Permanent PS)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	7.630	55	OPEN WASTE AT 2 PERCENT GRADE
	7.630		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Time of Conc. (Conservative)**

Hydrograph for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	1.44	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**3.21**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	1.23	39.00	4.80	0.88	0.00
13.50	3.76	0.44	0.89	39.50	4.80	0.88	0.00
14.00	3.89	0.49	0.76	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.67	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.60	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.53	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.45	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.39	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.36	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.32	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.28	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.26	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.25	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.24	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.23	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.22	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.21	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.20	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.19	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.18	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.17	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.16	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.14	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.01	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Hydrograph for Subcatchment Cell 20 South: Landfill Open (Cell 20 South End) (continued)

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Subcatchment Stage 7 Cover Area: Landfill Open (For Stage 7 Final Closure Waste Fil

Runoff = 4.63 cfs @ 12.49 hrs, Volume= 0.809 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Type III 24-hr 25 Yr. Storm Event(AMC2) Rainfall=4.80"

	Area (ac)	CN	Description
*	11.000	55	OPEN WASTE AT 33 PERCENT SLOPE
	11.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry, Segment**

Hydrograph for Subcatchment Stage 7 Cover Area: Landfill Open (For Stage 7 Final Closure Waste Fillin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	4.80	0.88	0.00
0.50	0.02	0.00	0.00	26.50	4.80	0.88	0.00
1.00	0.05	0.00	0.00	27.00	4.80	0.88	0.00
1.50	0.07	0.00	0.00	27.50	4.80	0.88	0.00
2.00	0.10	0.00	0.00	28.00	4.80	0.88	0.00
2.50	0.12	0.00	0.00	28.50	4.80	0.88	0.00
3.00	0.15	0.00	0.00	29.00	4.80	0.88	0.00
3.50	0.18	0.00	0.00	29.50	4.80	0.88	0.00
4.00	0.21	0.00	0.00	30.00	4.80	0.88	0.00
4.50	0.24	0.00	0.00	30.50	4.80	0.88	0.00
5.00	0.27	0.00	0.00	31.00	4.80	0.88	0.00
5.50	0.31	0.00	0.00	31.50	4.80	0.88	0.00
6.00	0.35	0.00	0.00	32.00	4.80	0.88	0.00
6.50	0.39	0.00	0.00	32.50	4.80	0.88	0.00
7.00	0.43	0.00	0.00	33.00	4.80	0.88	0.00
7.50	0.49	0.00	0.00	33.50	4.80	0.88	0.00
8.00	0.55	0.00	0.00	34.00	4.80	0.88	0.00
8.50	0.62	0.00	0.00	34.50	4.80	0.88	0.00
9.00	0.70	0.00	0.00	35.00	4.80	0.88	0.00
9.50	0.80	0.00	0.00	35.50	4.80	0.88	0.00
10.00	0.91	0.00	0.00	36.00	4.80	0.88	0.00
10.50	1.04	0.00	0.00	36.50	4.80	0.88	0.00
11.00	1.20	0.00	0.00	37.00	4.80	0.88	0.00
11.50	1.43	0.00	0.00	37.50	4.80	0.88	0.00
12.00	2.40	0.07	2.07	38.00	4.80	0.88	0.00
12.50	3.37	0.30	**4.63**	38.50	4.80	0.88	0.00
13.00	3.60	0.38	1.77	39.00	4.80	0.88	0.00
13.50	3.76	0.44	1.28	39.50	4.80	0.88	0.00
14.00	3.89	0.49	1.10	40.00	4.80	0.88	0.00
14.50	4.00	0.53	0.96	40.50	4.80	0.88	0.00
15.00	4.10	0.57	0.86	41.00	4.80	0.88	0.00
15.50	4.18	0.60	0.76	41.50	4.80	0.88	0.00
16.00	4.25	0.63	0.65	42.00	4.80	0.88	0.00
16.50	4.31	0.66	0.56	42.50	4.80	0.88	0.00
17.00	4.37	0.68	0.51	43.00	4.80	0.88	0.00
17.50	4.41	0.70	0.46	43.50	4.80	0.88	0.00
18.00	4.45	0.72	0.41	44.00	4.80	0.88	0.00
18.50	4.49	0.74	0.37	44.50	4.80	0.88	0.00
19.00	4.53	0.75	0.36	45.00	4.80	0.88	0.00
19.50	4.56	0.77	0.34	45.50	4.80	0.88	0.00
20.00	4.59	0.79	0.33	46.00	4.80	0.88	0.00
20.50	4.62	0.80	0.31	46.50	4.80	0.88	0.00
21.00	4.65	0.81	0.30	47.00	4.80	0.88	0.00
21.50	4.68	0.83	0.29	47.50	4.80	0.88	0.00
22.00	4.71	0.84	0.28	48.00	4.80	0.88	0.00
22.50	4.73	0.85	0.26	48.50	4.80	0.88	0.00
23.00	4.76	0.86	0.25	49.00	4.80	0.88	0.00
23.50	4.78	0.87	0.24	49.50	4.80	0.88	0.00
24.00	**4.80**	**0.88**	0.20	50.00	4.80	0.88	0.00
24.50	4.80	0.88	0.02	50.50	4.80	0.88	0.00
25.00	4.80	0.88	0.00	51.00	4.80	0.88	0.00
25.50	4.80	0.88	0.00	51.50	4.80	0.88	0.00

Irograph for Subcatchment Stage 7 Cover Area: Landfill Open (For Stage 7 Final Closure Waste Filling) (cor

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
52.00	4.80	0.88	0.00	78.00	4.80	0.88	0.00
52.50	4.80	0.88	0.00	78.50	4.80	0.88	0.00
53.00	4.80	0.88	0.00	79.00	4.80	0.88	0.00
53.50	4.80	0.88	0.00	79.50	4.80	0.88	0.00
54.00	4.80	0.88	0.00	80.00	4.80	0.88	0.00
54.50	4.80	0.88	0.00	80.50	4.80	0.88	0.00
55.00	4.80	0.88	0.00	81.00	4.80	0.88	0.00
55.50	4.80	0.88	0.00	81.50	4.80	0.88	0.00
56.00	4.80	0.88	0.00	82.00	4.80	0.88	0.00
56.50	4.80	0.88	0.00	82.50	4.80	0.88	0.00
57.00	4.80	0.88	0.00	83.00	4.80	0.88	0.00
57.50	4.80	0.88	0.00	83.50	4.80	0.88	0.00
58.00	4.80	0.88	0.00	84.00	4.80	0.88	0.00
58.50	4.80	0.88	0.00	84.50	4.80	0.88	0.00
59.00	4.80	0.88	0.00	85.00	4.80	0.88	0.00
59.50	4.80	0.88	0.00	85.50	4.80	0.88	0.00
60.00	4.80	0.88	0.00	86.00	4.80	0.88	0.00
60.50	4.80	0.88	0.00	86.50	4.80	0.88	0.00
61.00	4.80	0.88	0.00	87.00	4.80	0.88	0.00
61.50	4.80	0.88	0.00	87.50	4.80	0.88	0.00
62.00	4.80	0.88	0.00	88.00	4.80	0.88	0.00
62.50	4.80	0.88	0.00	88.50	4.80	0.88	0.00
63.00	4.80	0.88	0.00	89.00	4.80	0.88	0.00
63.50	4.80	0.88	0.00	89.50	4.80	0.88	0.00
64.00	4.80	0.88	0.00	90.00	4.80	0.88	0.00
64.50	4.80	0.88	0.00	90.50	4.80	0.88	0.00
65.00	4.80	0.88	0.00	91.00	4.80	0.88	0.00
65.50	4.80	0.88	0.00	91.50	4.80	0.88	0.00
66.00	4.80	0.88	0.00	92.00	4.80	0.88	0.00
66.50	4.80	0.88	0.00	92.50	4.80	0.88	0.00
67.00	4.80	0.88	0.00	93.00	4.80	0.88	0.00
67.50	4.80	0.88	0.00	93.50	4.80	0.88	0.00
68.00	4.80	0.88	0.00	94.00	4.80	0.88	0.00
68.50	4.80	0.88	0.00	94.50	4.80	0.88	0.00
69.00	4.80	0.88	0.00	95.00	4.80	0.88	0.00
69.50	4.80	0.88	0.00	95.50	4.80	0.88	0.00
70.00	4.80	0.88	0.00	96.00	4.80	0.88	0.00
70.50	4.80	0.88	0.00	96.50	4.80	0.88	0.00
71.00	4.80	0.88	0.00	97.00	4.80	0.88	0.00
71.50	4.80	0.88	0.00	97.50	4.80	0.88	0.00
72.00	4.80	0.88	0.00	98.00	4.80	0.88	0.00
72.50	4.80	0.88	0.00	98.50	4.80	0.88	0.00
73.00	4.80	0.88	0.00	99.00	4.80	0.88	0.00
73.50	4.80	0.88	0.00	99.50	4.80	0.88	0.00
74.00	4.80	0.88	0.00	100.00	4.80	0.88	0.00
74.50	4.80	0.88	0.00	100.50	4.80	0.88	0.00
75.00	4.80	0.88	0.00	101.00	4.80	0.88	0.00
75.50	4.80	0.88	0.00	101.50	4.80	0.88	0.00
76.00	4.80	0.88	0.00	102.00	4.80	0.88	0.00
76.50	4.80	0.88	0.00	102.50	4.80	0.88	0.00
77.00	4.80	0.88	0.00	103.00	4.80	0.88	0.00
77.50	4.80	0.88	0.00	103.50	4.80	0.88	0.00

Irograph for Subcatchment Stage 7 Cover Area: Landfill Open (For Stage 7 Final Closure Waste Filling) (cor

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
104.00	4.80	0.88	0.00
104.50	4.80	0.88	0.00
105.00	4.80	0.88	0.00
105.50	4.80	0.88	0.00
106.00	4.80	0.88	0.00
106.50	4.80	0.88	0.00
107.00	4.80	0.88	0.00
107.50	4.80	0.88	0.00
108.00	4.80	0.88	0.00
108.50	4.80	0.88	0.00
109.00	4.80	0.88	0.00
109.50	4.80	0.88	0.00
110.00	4.80	0.88	0.00
110.50	4.80	0.88	0.00
111.00	4.80	0.88	0.00
111.50	4.80	0.88	0.00
112.00	4.80	0.88	0.00
112.50	4.80	0.88	0.00
113.00	4.80	0.88	0.00
113.50	4.80	0.88	0.00
114.00	4.80	0.88	0.00
114.50	4.80	0.88	0.00
115.00	4.80	0.88	0.00
115.50	4.80	0.88	0.00
116.00	4.80	0.88	0.00
116.50	4.80	0.88	0.00
117.00	4.80	0.88	0.00
117.50	4.80	0.88	0.00
118.00	4.80	0.88	0.00
118.50	4.80	0.88	0.00
119.00	4.80	0.88	0.00
119.50	4.80	0.88	0.00
120.00	4.80	0.88	0.00

Summary for Pond PS-19: Cell 19 Sump (Permanent PS)

Inflow Area = 12.380 ac, 0.00% Impervious, Inflow Depth > 1.56" for 25 Yr. Storm Event(AMC2) event
Inflow = 5.28 cfs @ 12.49 hrs, Volume= 1.607 af, Incl. 0.07 cfs Base Flow
Outflow = 0.31 cfs @ 13.00 hrs, Volume= 1.324 af, Atten= 94%, Lag= 30.8 min
Primary = 0.31 cfs @ 13.00 hrs, Volume= 1.324 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Peak Elev= 174.85' @ 23.77 hrs Surf.Area= 74,119 sf Storage= 32,976 cf
Flood Elev= 184.00' Surf.Area= 406,617 sf Storage= 815,299 cf

Plug-Flow detention time= 1,559.3 min calculated for 1.323 af (82% of inflow)
Center-of-Mass det. time= 769.1 min (2,842.9 - 2,073.9)

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	815,299 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
173.00	15,206	0.0	0	0
175.00	79,040	40.0	37,698	37,698
177.00	197,277	40.0	110,527	148,225
179.00	344,163	40.0	216,576	364,801
181.00	385,849	40.0	292,005	656,806
182.00	406,617	40.0	158,493	815,299

Device	Routing	Invert	Outlet Devices
#1	Primary	173.00'	**Special & User-Defined** Head (feet) 0.00 0.99 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 Disch. (cfs) 0.000 0.000 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310

Primary OutFlow Max=0.31 cfs @ 13.00 hrs HW=174.29' (Free Discharge)
↑**1=Special & User-Defined** (Custom Controls 0.31 cfs)

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)	
0.00	0.07	63	173.01	0.00	
0.50	0.07	189	173.03	0.00	
1.00	0.07	315	173.05	0.00	
1.50	0.07	441	173.07	0.00	
2.00	0.07	567	173.08	0.00	
2.50	0.07	693	173.10	0.00	
3.00	0.07	819	173.12	0.00	
3.50	0.07	945	173.13	0.00	
4.00	0.07	1,071	173.15	0.00	
4.50	0.07	1,197	173.17	0.00	
5.00	0.07	1,323	173.18	0.00	
5.50	0.07	1,449	173.20	0.00	
6.00	0.07	1,575	173.21	0.00	
6.50	0.07	1,701	173.23	0.00	
7.00	0.07	1,827	173.24	0.00	
7.50	0.07	1,953	173.25	0.00	
8.00	0.07	2,079	173.27	0.00	
8.50	0.07	2,205	173.28	0.00	
9.00	0.07	2,331	173.29	0.00	
9.50	0.07	2,457	173.30	0.00	
10.00	0.07	2,583	173.32	0.00	
10.50	0.07	2,709	173.33	0.00	
11.00	0.07	2,835	173.34	0.00	
11.50	0.07	2,961	173.35	0.00	
12.00	2.40	5,184	173.54	0.00	
12.50	**5.28**	12,097	173.98	0.00	
13.00	2.06	18,425	174.29	**0.31**	Pump ON
13.50	1.52	21,085	174.40	0.31	
14.00	1.31	23,069	174.48	0.31	
14.50	1.15	24,724	174.55	0.31	
15.00	1.04	26,141	174.60	0.31	
15.50	0.92	27,353	174.65	0.31	
16.00	0.80	28,343	174.68	0.31	
16.50	0.71	29,137	174.71	0.31	
17.00	0.65	29,797	174.74	0.31	
17.50	0.59	30,351	174.76	0.31	
18.00	0.53	30,798	174.77	0.31	
18.50	0.49	31,156	174.78	0.31	
19.00	0.47	31,464	174.79	0.31	
19.50	0.46	31,741	174.80	0.31	
20.00	0.44	31,986	174.81	0.31	
20.50	0.42	32,201	174.82	0.31	
21.00	0.41	32,390	174.83	0.31	
21.50	0.39	32,554	174.83	0.31	
22.00	0.38	32,693	174.84	0.31	
22.50	0.37	32,806	174.84	0.31	
23.00	0.35	32,894	174.84	0.31	
23.50	0.34	32,955	174.84	0.31	
24.00	0.30	**32,966**	**174.85**	0.31	
24.50	0.09	32,753	174.84	0.31	
25.00	0.07	32,336	174.82	0.31	
25.50	0.07	31,904	174.81	0.31	

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.07	31,472	174.79	0.31
26.50	0.07	31,040	174.78	0.31
27.00	0.07	30,608	174.76	0.31
27.50	0.07	30,176	174.75	0.31
28.00	0.07	29,744	174.73	0.31
28.50	0.07	29,312	174.72	0.31
29.00	0.07	28,880	174.70	0.31
29.50	0.07	28,448	174.69	0.31
30.00	0.07	28,016	174.67	0.31
30.50	0.07	27,584	174.66	0.31
31.00	0.07	27,152	174.64	0.31
31.50	0.07	26,720	174.62	0.31
32.00	0.07	26,288	174.61	0.31
32.50	0.07	25,856	174.59	0.31
33.00	0.07	25,424	174.57	0.31
33.50	0.07	24,992	174.56	0.31
34.00	0.07	24,560	174.54	0.31
34.50	0.07	24,128	174.52	0.31
35.00	0.07	23,696	174.51	0.31
35.50	0.07	23,264	174.49	0.31
36.00	0.07	22,832	174.47	0.31
36.50	0.07	22,400	174.46	0.31
37.00	0.07	21,968	174.44	0.31
37.50	0.07	21,536	174.42	0.31
38.00	0.07	21,104	174.40	0.31
38.50	0.07	20,672	174.38	0.31
39.00	0.07	20,240	174.37	0.31
39.50	0.07	19,808	174.35	0.31
40.00	0.07	19,376	174.33	0.31
40.50	0.07	18,944	174.31	0.31
41.00	0.07	18,512	174.29	0.31
41.50	0.07	18,080	174.27	0.31
42.00	0.07	17,648	174.25	0.31
42.50	0.07	17,216	174.23	0.31
43.00	0.07	16,784	174.21	0.31
43.50	0.07	16,352	174.19	0.31
44.00	0.07	15,920	174.17	0.31
44.50	0.07	15,488	174.15	0.31
45.00	0.07	15,056	174.13	0.31
45.50	0.07	14,624	174.11	0.31
46.00	0.07	14,192	174.09	0.31
46.50	0.07	13,760	174.07	0.31
47.00	0.07	13,328	174.04	0.31
47.50	0.07	12,896	174.02	0.31
48.00	0.07	12,465	174.00	0.31
48.50	0.07	12,292	173.99	0.02
49.00	0.07	12,326	173.99	0.08
49.50	0.07	12,319	173.99	0.07
50.00	0.07	12,321	173.99	0.07
50.50	0.07	12,320	173.99	0.07
51.00	0.07	12,320	173.99	0.07
51.50	0.07	12,320	173.99	0.07

PUMP OFF (SUMP RETURNING TO BASE FLOW)

49-13 = 36 HOURS

ASSUME 36 HR PUMP DURATION TO DRAW A 25-YR/24-HR STORM.

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.07	12,320	173.99	0.07
52.50	0.07	12,320	173.99	0.07
53.00	0.07	12,320	173.99	0.07
53.50	0.07	12,320	173.99	0.07
54.00	0.07	12,320	173.99	0.07
54.50	0.07	12,320	173.99	0.07
55.00	0.07	12,320	173.99	0.07
55.50	0.07	12,320	173.99	0.07
56.00	0.07	12,320	173.99	0.07
56.50	0.07	12,320	173.99	0.07
57.00	0.07	12,320	173.99	0.07
57.50	0.07	12,320	173.99	0.07
58.00	0.07	12,320	173.99	0.07
58.50	0.07	12,320	173.99	0.07
59.00	0.07	12,320	173.99	0.07
59.50	0.07	12,320	173.99	0.07
60.00	0.07	12,320	173.99	0.07
60.50	0.07	12,320	173.99	0.07
61.00	0.07	12,320	173.99	0.07
61.50	0.07	12,320	173.99	0.07
62.00	0.07	12,320	173.99	0.07
62.50	0.07	12,320	173.99	0.07
63.00	0.07	12,320	173.99	0.07
63.50	0.07	12,320	173.99	0.07
64.00	0.07	12,320	173.99	0.07
64.50	0.07	12,320	173.99	0.07
65.00	0.07	12,320	173.99	0.07
65.50	0.07	12,320	173.99	0.07
66.00	0.07	12,320	173.99	0.07
66.50	0.07	12,320	173.99	0.07
67.00	0.07	12,320	173.99	0.07
67.50	0.07	12,320	173.99	0.07
68.00	0.07	12,320	173.99	0.07
68.50	0.07	12,320	173.99	0.07
69.00	0.07	12,320	173.99	0.07
69.50	0.07	12,320	173.99	0.07
70.00	0.07	12,320	173.99	0.07
70.50	0.07	12,320	173.99	0.07
71.00	0.07	12,320	173.99	0.07
71.50	0.07	12,320	173.99	0.07
72.00	0.07	12,320	173.99	0.07
72.50	0.07	12,320	173.99	0.07
73.00	0.07	12,320	173.99	0.07
73.50	0.07	12,320	173.99	0.07
74.00	0.07	12,320	173.99	0.07
74.50	0.07	12,320	173.99	0.07
75.00	0.07	12,320	173.99	0.07
75.50	0.07	12,320	173.99	0.07
76.00	0.07	12,320	173.99	0.07
76.50	0.07	12,320	173.99	0.07
77.00	0.07	12,320	173.99	0.07
77.50	0.07	12,320	173.99	0.07

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
78.00	0.07	12,320	173.99	0.07
78.50	0.07	12,320	173.99	0.07
79.00	0.07	12,320	173.99	0.07
79.50	0.07	12,320	173.99	0.07
80.00	0.07	12,320	173.99	0.07
80.50	0.07	12,320	173.99	0.07
81.00	0.07	12,320	173.99	0.07
81.50	0.07	12,320	173.99	0.07
82.00	0.07	12,320	173.99	0.07
82.50	0.07	12,320	173.99	0.07
83.00	0.07	12,320	173.99	0.07
83.50	0.07	12,320	173.99	0.07
84.00	0.07	12,320	173.99	0.07
84.50	0.07	12,320	173.99	0.07
85.00	0.07	12,320	173.99	0.07
85.50	0.07	12,320	173.99	0.07
86.00	0.07	12,320	173.99	0.07
86.50	0.07	12,320	173.99	0.07
87.00	0.07	12,320	173.99	0.07
87.50	0.07	12,320	173.99	0.07
88.00	0.07	12,320	173.99	0.07
88.50	0.07	12,320	173.99	0.07
89.00	0.07	12,320	173.99	0.07
89.50	0.07	12,320	173.99	0.07
90.00	0.07	12,320	173.99	0.07
90.50	0.07	12,320	173.99	0.07
91.00	0.07	12,320	173.99	0.07
91.50	0.07	12,320	173.99	0.07
92.00	0.07	12,320	173.99	0.07
92.50	0.07	12,320	173.99	0.07
93.00	0.07	12,320	173.99	0.07
93.50	0.07	12,320	173.99	0.07
94.00	0.07	12,320	173.99	0.07
94.50	0.07	12,320	173.99	0.07
95.00	0.07	12,320	173.99	0.07
95.50	0.07	12,320	173.99	0.07
96.00	0.07	12,320	173.99	0.07
96.50	0.07	12,320	173.99	0.07
97.00	0.07	12,320	173.99	0.07
97.50	0.07	12,320	173.99	0.07
98.00	0.07	12,320	173.99	0.07
98.50	0.07	12,320	173.99	0.07
99.00	0.07	12,320	173.99	0.07
99.50	0.07	12,320	173.99	0.07
100.00	0.07	12,320	173.99	0.07
100.50	0.07	12,320	173.99	0.07
101.00	0.07	12,320	173.99	0.07
101.50	0.07	12,320	173.99	0.07
102.00	0.07	12,320	173.99	0.07
102.50	0.07	12,320	173.99	0.07
103.00	0.07	12,320	173.99	0.07
103.50	0.07	12,320	173.99	0.07

Hydrograph for Pond PS-19: Cell 19 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
104.00	0.07	12,320	173.99	0.07
104.50	0.07	12,320	173.99	0.07
105.00	0.07	12,320	173.99	0.07
105.50	0.07	12,320	173.99	0.07
106.00	0.07	12,320	173.99	0.07
106.50	0.07	12,320	173.99	0.07
107.00	0.07	12,320	173.99	0.07
107.50	0.07	12,320	173.99	0.07
108.00	0.07	12,320	173.99	0.07
108.50	0.07	12,320	173.99	0.07
109.00	0.07	12,320	173.99	0.07
109.50	0.07	12,320	173.99	0.07
110.00	0.07	12,320	173.99	0.07
110.50	0.07	12,320	173.99	0.07
111.00	0.07	12,320	173.99	0.07
111.50	0.07	12,320	173.99	0.07
112.00	0.07	12,320	173.99	0.07
112.50	0.07	12,320	173.99	0.07
113.00	0.07	12,320	173.99	0.07
113.50	0.07	12,320	173.99	0.07
114.00	0.07	12,320	173.99	0.07
114.50	0.07	12,320	173.99	0.07
115.00	0.07	12,320	173.99	0.07
115.50	0.07	12,320	173.99	0.07
116.00	0.07	12,320	173.99	0.07
116.50	0.07	12,320	173.99	0.07
117.00	0.07	12,320	173.99	0.07
117.50	0.07	12,320	173.99	0.07
118.00	0.07	12,320	173.99	0.07
118.50	0.07	12,320	173.99	0.07
119.00	0.07	12,320	173.99	0.07
119.50	0.07	12,320	173.99	0.07
120.00	0.07	12,320	173.99	0.07

Summary for Pond PS-20: Cell 20 Sump (Permanent PS)

Inflow Area = 9.270 ac, 0.00% Impervious, Inflow Depth > 1.66" for 25 Yr. Storm Event(AMC2) event
Inflow = 3.96 cfs @ 12.49 hrs, Volume= 1.279 af, Incl. 0.06 cfs Base Flow
Outflow = 0.31 cfs @ 13.00 hrs, Volume= 1.063 af, Atten= 92%, Lag= 30.8 min
Primary = 0.31 cfs @ 13.00 hrs, Volume= 1.063 af

Routing by Stor-Ind method, Time Span= 0.00-120.00 hrs, dt= 0.50 hrs
Peak Elev= 168.76' @ 21.15 hrs Surf.Area= 50,891 sf Storage= 22,477 cf
Flood Elev= 171.00' Surf.Area= 118,863 sf Storage= 97,636 cf

Plug-Flow detention time= 1,367.6 min calculated for 1.062 af (83% of inflow)
Center-of-Mass det. time= 600.7 min (2,764.7 - 2,164.0)

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	582,271 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
167.00	13,031	0.0	0	0
169.00	56,098	40.0	27,652	27,652
171.00	118,863	40.0	69,984	97,636
173.00	178,022	40.0	118,754	216,390
175.00	233,538	40.0	164,624	381,014
177.00	269,604	40.0	201,257	582,271

Device	Routing	Invert	Outlet Devices
#1	Primary	167.00'	**Special & User-Defined** Head (feet) 0.00 0.99 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 Disch. (cfs) 0.000 0.000 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310 0.310

Primary OutFlow Max=0.31 cfs @ 13.00 hrs HW=168.30' (Free Discharge)
↑—**1=Special & User-Defined** (Custom Controls 0.31 cfs)

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)	
0.00	0.06	54	167.01	0.00	
0.50	0.06	162	167.03	0.00	
1.00	0.06	270	167.05	0.00	
1.50	0.06	378	167.07	0.00	
2.00	0.06	486	167.09	0.00	
2.50	0.06	594	167.10	0.00	
3.00	0.06	702	167.12	0.00	
3.50	0.06	810	167.14	0.00	
4.00	0.06	918	167.15	0.00	
4.50	0.06	1,026	167.17	0.00	
5.00	0.06	1,134	167.19	0.00	
5.50	0.06	1,242	167.20	0.00	
6.00	0.06	1,350	167.22	0.00	
6.50	0.06	1,458	167.23	0.00	
7.00	0.06	1,566	167.25	0.00	
7.50	0.06	1,674	167.26	0.00	
8.00	0.06	1,782	167.28	0.00	
8.50	0.06	1,890	167.29	0.00	
9.00	0.06	1,998	167.31	0.00	
9.50	0.06	2,106	167.32	0.00	
10.00	0.06	2,214	167.33	0.00	
10.50	0.06	2,322	167.35	0.00	
11.00	0.06	2,430	167.36	0.00	
11.50	0.06	2,538	167.37	0.00	
12.00	1.80	4,216	167.55	0.00	
12.50	**3.96**	9,390	167.99	0.02	
13.00	1.55	14,055	168.30	**0.31**	PUMP ON
13.50	1.14	15,920	168.41	0.31	
14.00	0.99	17,279	168.49	0.31	
14.50	0.87	18,392	168.55	0.31	
15.00	0.79	19,326	168.60	0.31	
15.50	0.70	20,107	168.64	0.31	
16.00	0.60	20,722	168.67	0.31	
16.50	0.54	21,190	168.69	0.31	
17.00	0.49	21,557	168.71	0.31	
17.50	0.45	21,846	168.73	0.31	
18.00	0.40	22,054	168.74	0.31	
18.50	0.37	22,196	168.74	0.31	
19.00	0.36	22,300	168.75	0.31	
19.50	0.35	22,381	168.75	0.31	
20.00	0.33	22,438	168.76	0.31	
20.50	0.32	22,472	168.76	0.31	
21.00	0.31	**22,487**	**168.76**	0.31	
21.50	0.30	22,483	168.76	0.31	
22.00	0.29	22,461	168.76	0.31	
22.50	0.28	22,419	168.75	0.31	
23.00	0.27	22,358	168.75	0.31	
23.50	0.26	22,277	168.75	0.31	
24.00	0.23	22,159	168.74	0.31	
24.50	0.07	21,873	168.73	0.31	
25.00	0.06	21,435	168.71	0.31	
25.50	0.06	20,985	168.68	0.31	

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
26.00	0.06	20,535	168.66	0.31
26.50	0.06	20,085	168.64	0.31
27.00	0.06	19,635	168.61	0.31
27.50	0.06	19,185	168.59	0.31
28.00	0.06	18,735	168.57	0.31
28.50	0.06	18,285	168.54	0.31
29.00	0.06	17,835	168.52	0.31
29.50	0.06	17,385	168.49	0.31
30.00	0.06	16,935	168.47	0.31
30.50	0.06	16,485	168.44	0.31
31.00	0.06	16,035	168.42	0.31
31.50	0.06	15,585	168.39	0.31
32.00	0.06	15,135	168.36	0.31
32.50	0.06	14,685	168.34	0.31
33.00	0.06	14,235	168.31	0.31
33.50	0.06	13,785	168.28	0.31
34.00	0.06	13,335	168.25	0.31
34.50	0.06	12,885	168.23	0.31
35.00	0.06	12,435	168.20	0.31
35.50	0.06	11,985	168.17	0.31
36.00	0.06	11,535	168.14	0.31
36.50	0.06	11,085	168.11	0.31
37.00	0.06	10,635	168.08	0.31
37.50	0.06	10,185	168.05	0.31
38.00	0.06	9,735	168.02	0.31
38.50	0.06	9,442	167.99	0.14
39.00	0.06	9,397	167.99	0.03
39.50	0.06	9,412	167.99	0.07
40.00	0.06	9,407	167.99	0.06
40.50	0.06	9,408	167.99	0.06
41.00	0.06	9,408	167.99	0.06
41.50	0.06	9,408	167.99	0.06
42.00	0.06	9,408	167.99	0.06
42.50	0.06	9,408	167.99	0.06
43.00	0.06	9,408	167.99	0.06
43.50	0.06	9,408	167.99	0.06
44.00	0.06	9,408	167.99	0.06
44.50	0.06	9,408	167.99	0.06
45.00	0.06	9,408	167.99	0.06
45.50	0.06	9,408	167.99	0.06
46.00	0.06	9,408	167.99	0.06
46.50	0.06	9,408	167.99	0.06
47.00	0.06	9,408	167.99	0.06
47.50	0.06	9,408	167.99	0.06
48.00	0.06	9,408	167.99	0.06
48.50	0.06	9,408	167.99	0.06
49.00	0.06	9,408	167.99	0.06
49.50	0.06	9,408	167.99	0.06
50.00	0.06	9,408	167.99	0.06
50.50	0.06	9,408	167.99	0.06
51.00	0.06	9,408	167.99	0.06
51.50	0.06	9,408	167.99	0.06

PUMP OFF
39 - 13 = 26
26 HRS TO DRAIN 25-YR/24-HR STORM EVENT.

* LESS THAN THE TOTAL PUMP DURATION OF CELL 19 SUMP. THEREFORE USE 36 HRS AS PUMPING DURATION.

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.06	9,408	167.99	0.06
52.50	0.06	9,408	167.99	0.06
53.00	0.06	9,408	167.99	0.06
53.50	0.06	9,408	167.99	0.06
54.00	0.06	9,408	167.99	0.06
54.50	0.06	9,408	167.99	0.06
55.00	0.06	9,408	167.99	0.06
55.50	0.06	9,408	167.99	0.06
56.00	0.06	9,408	167.99	0.06
56.50	0.06	9,408	167.99	0.06
57.00	0.06	9,408	167.99	0.06
57.50	0.06	9,408	167.99	0.06
58.00	0.06	9,408	167.99	0.06
58.50	0.06	9,408	167.99	0.06
59.00	0.06	9,408	167.99	0.06
59.50	0.06	9,408	167.99	0.06
60.00	0.06	9,408	167.99	0.06
60.50	0.06	9,408	167.99	0.06
61.00	0.06	9,408	167.99	0.06
61.50	0.06	9,408	167.99	0.06
62.00	0.06	9,408	167.99	0.06
62.50	0.06	9,408	167.99	0.06
63.00	0.06	9,408	167.99	0.06
63.50	0.06	9,408	167.99	0.06
64.00	0.06	9,408	167.99	0.06
64.50	0.06	9,408	167.99	0.06
65.00	0.06	9,408	167.99	0.06
65.50	0.06	9,408	167.99	0.06
66.00	0.06	9,408	167.99	0.06
66.50	0.06	9,408	167.99	0.06
67.00	0.06	9,408	167.99	0.06
67.50	0.06	9,408	167.99	0.06
68.00	0.06	9,408	167.99	0.06
68.50	0.06	9,408	167.99	0.06
69.00	0.06	9,408	167.99	0.06
69.50	0.06	9,408	167.99	0.06
70.00	0.06	9,408	167.99	0.06
70.50	0.06	9,408	167.99	0.06
71.00	0.06	9,408	167.99	0.06
71.50	0.06	9,408	167.99	0.06
72.00	0.06	9,408	167.99	0.06
72.50	0.06	9,408	167.99	0.06
73.00	0.06	9,408	167.99	0.06
73.50	0.06	9,408	167.99	0.06
74.00	0.06	9,408	167.99	0.06
74.50	0.06	9,408	167.99	0.06
75.00	0.06	9,408	167.99	0.06
75.50	0.06	9,408	167.99	0.06
76.00	0.06	9,408	167.99	0.06
76.50	0.06	9,408	167.99	0.06
77.00	0.06	9,408	167.99	0.06
77.50	0.06	9,408	167.99	0.06

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
78.00	0.06	9,408	167.99	0.06
78.50	0.06	9,408	167.99	0.06
79.00	0.06	9,408	167.99	0.06
79.50	0.06	9,408	167.99	0.06
80.00	0.06	9,408	167.99	0.06
80.50	0.06	9,408	167.99	0.06
81.00	0.06	9,408	167.99	0.06
81.50	0.06	9,408	167.99	0.06
82.00	0.06	9,408	167.99	0.06
82.50	0.06	9,408	167.99	0.06
83.00	0.06	9,408	167.99	0.06
83.50	0.06	9,408	167.99	0.06
84.00	0.06	9,408	167.99	0.06
84.50	0.06	9,408	167.99	0.06
85.00	0.06	9,408	167.99	0.06
85.50	0.06	9,408	167.99	0.06
86.00	0.06	9,408	167.99	0.06
86.50	0.06	9,408	167.99	0.06
87.00	0.06	9,408	167.99	0.06
87.50	0.06	9,408	167.99	0.06
88.00	0.06	9,408	167.99	0.06
88.50	0.06	9,408	167.99	0.06
89.00	0.06	9,408	167.99	0.06
89.50	0.06	9,408	167.99	0.06
90.00	0.06	9,408	167.99	0.06
90.50	0.06	9,408	167.99	0.06
91.00	0.06	9,408	167.99	0.06
91.50	0.06	9,408	167.99	0.06
92.00	0.06	9,408	167.99	0.06
92.50	0.06	9,408	167.99	0.06
93.00	0.06	9,408	167.99	0.06
93.50	0.06	9,408	167.99	0.06
94.00	0.06	9,408	167.99	0.06
94.50	0.06	9,408	167.99	0.06
95.00	0.06	9,408	167.99	0.06
95.50	0.06	9,408	167.99	0.06
96.00	0.06	9,408	167.99	0.06
96.50	0.06	9,408	167.99	0.06
97.00	0.06	9,408	167.99	0.06
97.50	0.06	9,408	167.99	0.06
98.00	0.06	9,408	167.99	0.06
98.50	0.06	9,408	167.99	0.06
99.00	0.06	9,408	167.99	0.06
99.50	0.06	9,408	167.99	0.06
100.00	0.06	9,408	167.99	0.06
100.50	0.06	9,408	167.99	0.06
101.00	0.06	9,408	167.99	0.06
101.50	0.06	9,408	167.99	0.06
102.00	0.06	9,408	167.99	0.06
102.50	0.06	9,408	167.99	0.06
103.00	0.06	9,408	167.99	0.06
103.50	0.06	9,408	167.99	0.06

Hydrograph for Pond PS-20: Cell 20 Sump (Permanent PS) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
104.00	0.06	9,408	167.99	0.06
104.50	0.06	9,408	167.99	0.06
105.00	0.06	9,408	167.99	0.06
105.50	0.06	9,408	167.99	0.06
106.00	0.06	9,408	167.99	0.06
106.50	0.06	9,408	167.99	0.06
107.00	0.06	9,408	167.99	0.06
107.50	0.06	9,408	167.99	0.06
108.00	0.06	9,408	167.99	0.06
108.50	0.06	9,408	167.99	0.06
109.00	0.06	9,408	167.99	0.06
109.50	0.06	9,408	167.99	0.06
110.00	0.06	9,408	167.99	0.06
110.50	0.06	9,408	167.99	0.06
111.00	0.06	9,408	167.99	0.06
111.50	0.06	9,408	167.99	0.06
112.00	0.06	9,408	167.99	0.06
112.50	0.06	9,408	167.99	0.06
113.00	0.06	9,408	167.99	0.06
113.50	0.06	9,408	167.99	0.06
114.00	0.06	9,408	167.99	0.06
114.50	0.06	9,408	167.99	0.06
115.00	0.06	9,408	167.99	0.06
115.50	0.06	9,408	167.99	0.06
116.00	0.06	9,408	167.99	0.06
116.50	0.06	9,408	167.99	0.06
117.00	0.06	9,408	167.99	0.06
117.50	0.06	9,408	167.99	0.06
118.00	0.06	9,408	167.99	0.06
118.50	0.06	9,408	167.99	0.06
119.00	0.06	9,408	167.99	0.06
119.50	0.06	9,408	167.99	0.06
120.00	0.06	9,408	167.99	0.06

```
**********************************************************************************
**********************************************************************************
**                                                                              **
**                                                                              **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                  **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                      **
**                     USAE WATERWAYS EXPERIMENT STATION                        **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                              **
**                                                                              **
**********************************************************************************
**********************************************************************************



PRECIPITATION DATA FILE:    c:\JRL\ph2exp\NEWJRL4A.D4
TEMPERATURE DATA FILE:      c:\JRL\ph2exp\NEWJRL7.D7
SOLAR RADIATION DATA FILE:  c:\JRL\ph2exp\NEWJRL13.D13
EVAPOTRANSPIRATION DATA:    c:\JRL\ph2exp\DATA11.D11
SOIL AND DESIGN DATA FILE:  c:\JRL\ph2exp\10W_NR.D10
OUTPUT DATA FILE:           c:\JRL\ph2exp\10W_NR.OUT


TIME:  13:25     DATE:   9/23/2024


**********************************************************************************

     TITLE:  CASELLA - JUNIPER RIDGE EXPANSION - OPEN (10'WASTE)

**********************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  18
          THICKNESS                     =    120.00   INCHES
          POROSITY                      =      0.6710 VOL/VOL
          FIELD CAPACITY                =      0.2920 VOL/VOL
          WILTING POINT                 =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2985 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC

                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   1
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4170 VOL/VOL
          FIELD CAPACITY                =      0.0450 VOL/VOL
          WILTING POINT                 =      0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0826 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999978000E-02 CM/SEC
```

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0103	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	400.0	FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3897	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 55.0, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	55.50	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.119	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.368	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	46.896	INCHES
TOTAL INITIAL WATER	=	52.943	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM BANGOR MAINE

STATION LATITUDE	=	44.80 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	134
END OF GROWING SEASON (JULIAN DATE)	=	263
EVAPORATIVE ZONE DEPTH	=	8.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2009

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.77	2.47	1.68	3.99	3.94	8.10
	5.61	2.69	1.32	5.42	4.22	3.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.519	0.387	0.485	2.385	3.856	4.380
	5.442	1.583	1.906	1.332	0.397	0.260
LATERAL DRAINAGE COLLECTED	0.0756	0.0408	0.5952	8.0718	4.7442	0.2811
FROM LAYER 3	3.5468	0.2261	0.5681	0.7176	2.7155	0.2299
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.001	0.007	0.004	0.000
TOP OF LAYER 4	0.003	0.000	0.001	0.001	0.002	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.002	0.005	0.002	0.000
HEAD ON TOP OF LAYER 4	0.002	0.000	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.73	162369.891	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.933	83248.602	51.27
DRAINAGE COLLECTED FROM LAYER 3	21.8127	79180.211	48.77
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003689	13.391	0.01
CHANGE IN WATER STORAGE	-0.020	-72.283	-0.04
SOIL WATER AT START OF YEAR	51.576	187221.047	
SOIL WATER AT END OF YEAR	51.556	187148.766	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.52
SNOW WATER AT END OF YEAR	6.047	21949.807	13.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.026	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.47	2.19	4.68	2.24	1.73	4.38
	2.15	1.89	5.73	5.83	4.75	5.47
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.517	0.371	0.582	1.657	2.197	3.242
	3.255	1.775	2.610	1.560	0.520	0.346
LATERAL DRAINAGE COLLECTED	0.0760	0.0410	0.0342	11.0939	5.5196	0.3130
FROM LAYER 3	0.0932	0.0516	1.2176	1.9790	2.8312	2.6988
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.010	0.005	0.000
TOP OF LAYER 4	0.000	0.000	0.001	0.002	0.003	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.007	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.001	0.001	0.002	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.51	161571.312	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.632	67632.477	41.86
DRAINAGE COLLECTED FROM LAYER 3	25.9492	94195.437	58.30
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003396	12.326	0.01
CHANGE IN WATER STORAGE	-0.074	-268.962	-0.17
SOIL WATER AT START OF YEAR	51.556	187148.766	
SOIL WATER AT END OF YEAR	51.218	185920.234	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.59
SNOW WATER AT END OF YEAR	6.311	22909.367	14.18
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.66	2.19	4.50	5.26	3.51	2.79
	2.10	8.32	2.79	5.16	2.19	3.85
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.449	0.450	0.631	0.755	4.469	2.299
	2.114	5.231	2.596	1.261	0.864	0.337
LATERAL DRAINAGE COLLECTED	0.1526	0.0599	0.0418	6.3121	10.5458	1.4832
FROM LAYER 3	0.1168	0.1700	2.0899	1.0508	2.6652	1.2150
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0002	0.0002	0.0002	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.006	0.009	0.001
TOP OF LAYER 4	0.000	0.000	0.002	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.009	0.006	0.001
HEAD ON TOP OF LAYER 4	0.000	0.000	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.32	160881.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.456	77885.383	48.41
DRAINAGE COLLECTED FROM LAYER 3	25.9031	94028.336	58.45
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003098	11.245	0.01
CHANGE IN WATER STORAGE	-3.042	-11043.353	-6.86
SOIL WATER AT START OF YEAR	51.218	185920.234	
SOIL WATER AT END OF YEAR	50.685	183984.875	
SNOW WATER AT START OF YEAR	6.311	22909.367	14.24
SNOW WATER AT END OF YEAR	3.802	13801.376	8.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.054	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.95	1.55	1.40	3.99	5.12	7.10
	0.58	2.60	6.33	6.96	1.13	1.13
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.506	0.418	0.532	1.794	4.602	4.203
	1.620	2.032	2.450	1.240	0.732	0.352
LATERAL DRAINAGE COLLECTED	0.1239	0.0557	0.0723	2.7157	6.0283	2.5555
FROM LAYER 3	1.5425	0.3133	1.7027	1.3195	4.4062	1.5800
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.002	0.005	0.002
TOP OF LAYER 4	0.001	0.000	0.002	0.001	0.004	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.002	0.002	0.001
HEAD ON TOP OF LAYER 4	0.001	0.000	0.002	0.001	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.84	144619.172	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.480	74342.016	51.41
DRAINAGE COLLECTED FROM LAYER 3	22.4156	81368.711	56.26
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002817	10.224	0.01
CHANGE IN WATER STORAGE	-3.058	-11101.735	-7.68
SOIL WATER AT START OF YEAR	50.685	183984.875	
SOIL WATER AT END OF YEAR	50.650	183858.937	
SNOW WATER AT START OF YEAR	3.802	13801.376	9.54
SNOW WATER AT END OF YEAR	0.778	2825.582	1.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.048	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2013

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.87	2.04	2.05	1.77	4.55	5.46
	3.74	4.69	7.17	1.02	3.76	2.93
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.331	0.496	0.517	0.450	4.283	4.463
	3.962	4.049	2.929	1.205	0.429	0.196
LATERAL DRAINAGE COLLECTED	0.1158	0.0523	0.0352	1.5231	3.6804	1.4520
FROM LAYER 3	0.3914	0.5184	2.3893	2.4193	0.1399	0.0640
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.003	0.001
TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.001	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.001	0.002	0.002	0.000	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2013

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.05	145381.469	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	23.310	84616.117	58.20
DRAINAGE COLLECTED FROM LAYER 3	12.7813	46395.941	31.91
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0009		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002578	9.359	0.01
CHANGE IN WATER STORAGE	3.956	14360.099	9.88
SOIL WATER AT START OF YEAR	50.650	183858.937	
SOIL WATER AT END OF YEAR	49.126	178328.078	
SNOW WATER AT START OF YEAR	0.778	2825.582	1.94
SNOW WATER AT END OF YEAR	6.258	22716.549	15.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.048	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2014

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.18	1.99	3.65	2.28	3.31	3.59
	6.78	2.96	0.89	6.85	3.21	5.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.336	0.311	0.492	1.941	3.582	3.599
	4.623	3.372	0.632	1.657	0.885	0.290
LATERAL DRAINAGE COLLECTED	0.2535	1.3512	0.8392	6.1803	4.8212	0.2570
FROM LAYER 3	1.4354	0.4846	0.0899	0.1304	3.5709	2.6000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.001	0.001	0.006	0.004	0.000
TOP OF LAYER 4	0.001	0.000	0.000	0.000	0.003	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.005	0.002	0.000
HEAD ON TOP OF LAYER 4	0.002	0.000	0.000	0.000	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2014

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.719	78839.578	49.45
DRAINAGE COLLECTED FROM LAYER 3	22.0136	79909.367	50.12
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002360	8.568	0.01
CHANGE IN WATER STORAGE	0.185	672.112	0.42
SOIL WATER AT START OF YEAR	49.126	178328.078	
SOIL WATER AT END OF YEAR	55.569	201716.734	
SNOW WATER AT START OF YEAR	6.258	22716.549	14.25
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2015

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.69	2.20	1.45	2.39	2.32	4.90
	1.16	2.63	6.89	2.58	2.26	4.06
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.281	0.282	0.531	0.731	2.489	4.589
	1.928	2.942	1.388	1.813	0.991	0.876
LATERAL DRAINAGE COLLECTED	1.6656	0.9136	0.2857	2.7519	5.6722	0.8422
FROM LAYER 3	0.1149	0.0590	0.0375	2.9952	1.9127	1.6738
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.002	0.005	0.001
TOP OF LAYER 4	0.000	0.000	0.000	0.003	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.002	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.002	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2015

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.53	128973.898	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.840	68388.609	53.03
DRAINAGE COLLECTED FROM LAYER 3	18.9243	68695.383	53.26
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002293	8.322	0.01
CHANGE IN WATER STORAGE	-2.236	-8118.434	-6.29
SOIL WATER AT START OF YEAR	55.569	201716.734	
SOIL WATER AT END OF YEAR	52.643	191092.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.690	2505.669	1.94
ANNUAL WATER BUDGET BALANCE	0.0000	0.004	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2016

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.38	3.89	3.27	2.58	2.09	2.85
	2.69	2.24	1.23	3.20	4.16	3.77
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.552	0.224	0.437	1.459	2.330	2.618
	2.757	2.379	0.650	1.317	1.034	0.420
LATERAL DRAINAGE COLLECTED	2.0105	0.2475	2.8372	3.3556	4.5201	0.2365
FROM LAYER 3	0.0795	0.0460	0.0309	0.0230	1.0923	3.2253
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.002	0.003	0.004	0.000
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.001	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.002	0.003	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2016

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.508	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	16.178	58726.711	47.10
DRAINAGE COLLECTED FROM LAYER 3	17.7043	64266.770	51.54
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000002	0.006	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002186	7.935	0.01
CHANGE IN WATER STORAGE	0.465	1689.107	1.35
SOIL WATER AT START OF YEAR	52.643	191092.625	
SOIL WATER AT END OF YEAR	52.817	191725.734	
SNOW WATER AT START OF YEAR	0.690	2505.669	2.01
SNOW WATER AT END OF YEAR	0.981	3561.676	2.86
ANNUAL WATER BUDGET BALANCE	0.0000	-0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2017

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.63	2.26	2.07	3.98	6.36	4.32
	1.91	1.64	2.69	5.59	3.05	3.83
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.408	0.345	0.459	2.206	4.561	4.180
	2.464	1.728	2.549	1.079	0.989	0.502
LATERAL DRAINAGE COLLECTED	1.3224	0.6733	3.0063	3.0852	3.8773	2.2470
FROM LAYER 3	0.1431	0.0630	0.1772	0.1402	2.0687	3.2821
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.003	0.003	0.003	0.002
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.001	0.002	0.003	0.002	0.002
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2017

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.33	150027.906	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.471	77940.023	51.95
DRAINAGE COLLECTED FROM LAYER 3	20.0859	72911.695	48.60
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002017	7.323	0.00
CHANGE IN WATER STORAGE	-0.229	-831.131	-0.55
SOIL WATER AT START OF YEAR	52.817	191725.734	
SOIL WATER AT END OF YEAR	51.425	186671.562	
SNOW WATER AT START OF YEAR	0.981	3561.676	2.37
SNOW WATER AT END OF YEAR	2.145	7784.717	5.19
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2018

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.53	2.99	2.18	4.77	2.37	5.42
	2.48	2.73	2.63	4.66	7.00	4.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.346	0.355	0.501	1.121	3.377	4.198
	3.524	2.596	1.669	1.754	0.796	0.301
LATERAL DRAINAGE COLLECTED	1.4692	3.2633	2.4790	2.0299	6.0302	1.1024
FROM LAYER 3	0.1706	0.0721	0.0405	0.5787	3.3569	4.5664
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.002	0.005	0.001
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.003	0.004
STD. DEVIATION OF DAILY	0.001	0.001	0.002	0.001	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.001	0.003	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2018

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.99	170573.687	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.538	74551.227	43.71
DRAINAGE COLLECTED FROM LAYER 3	25.1595	91328.859	53.54
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001938	7.033	0.00
CHANGE IN WATER STORAGE	1.291	4686.625	2.75
SOIL WATER AT START OF YEAR	51.425	186671.562	
SOIL WATER AT END OF YEAR	54.124	196470.453	
SNOW WATER AT START OF YEAR	2.145	7784.717	4.56
SNOW WATER AT END OF YEAR	0.736	2672.444	1.57
ANNUAL WATER BUDGET BALANCE	0.0000	-0.055	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2019

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.15	1.83	1.94	5.53	4.43	5.33
	4.46	7.54	2.81	5.80	3.97	3.21
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.429	0.397	0.421	1.788	4.885	4.132
	5.681	3.839	3.016	2.099	0.712	0.416
LATERAL DRAINAGE COLLECTED	0.9406	3.1960	0.9177	3.6640	6.0980	1.0709
FROM LAYER 3	0.5035	1.2725	1.2553	0.5162	2.4442	3.3497
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002
LAYER 10	0.0001	0.0001	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.001	0.003	0.005	0.001
TOP OF LAYER 4	0.000	0.001	0.001	0.000	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.002	0.001	0.002	0.002	0.001
HEAD ON TOP OF LAYER 4	0.000	0.001	0.001	0.001	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2019

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.00	188759.953	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.816	100971.445	53.49
DRAINAGE COLLECTED FROM LAYER 3	25.2286	91579.969	48.52
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001799	6.529	0.00
CHANGE IN WATER STORAGE	-1.046	-3797.904	-2.01
SOIL WATER AT START OF YEAR	54.124	196470.453	
SOIL WATER AT END OF YEAR	53.453	194035.734	
SNOW WATER AT START OF YEAR	0.736	2672.444	1.42
SNOW WATER AT END OF YEAR	0.361	1309.265	0.69
ANNUAL WATER BUDGET BALANCE	0.0000	-0.084	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2020

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.42	1.65	2.27	4.78	2.22	2.08
	4.21	3.55	0.28	4.40	5.22	4.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.432	0.284	0.251	2.952	2.721	0.599
	4.113	3.121	1.251	1.143	1.075	0.533
LATERAL DRAINAGE COLLECTED	0.6240	1.2995	1.7121	4.5474	3.1239	0.1663
FROM LAYER 3	0.0688	0.5199	0.2245	0.0947	2.2473	4.1806
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001
LAYER 10	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.004	0.003	0.000
TOP OF LAYER 4	0.000	0.000	0.000	0.000	0.002	0.004
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.003	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.001	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2020

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.60	136488.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.475	67063.930	49.14
DRAINAGE COLLECTED FROM LAYER 3	18.8090	68276.719	50.02
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001704	6.184	0.00
CHANGE IN WATER STORAGE	0.314	1141.135	0.84
SOIL WATER AT START OF YEAR	53.453	194035.734	
SOIL WATER AT END OF YEAR	54.128	196486.125	
SNOW WATER AT START OF YEAR	0.361	1309.265	0.96
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.062	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2021

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.99	1.76	3.63	1.82	0.97
	7.67	1.78	9.42	4.45	3.44	2.53
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.465	0.522	0.243	2.568	2.653	1.320
	4.148	1.967	3.287	2.062	1.027	0.562
LATERAL DRAINAGE COLLECTED	2.2686	0.1290	0.2804	3.8365	1.8100	0.1204
FROM LAYER 3	1.5897	1.4349	1.1491	3.9648	1.6960	2.7694
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.003	0.002	0.000
TOP OF LAYER 4	0.001	0.001	0.001	0.003	0.002	0.002
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.003	0.002	0.000
HEAD ON TOP OF LAYER 4	0.002	0.001	0.002	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2021

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.85	148285.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.824	75592.148	50.98
DRAINAGE COLLECTED FROM LAYER 3	21.0488	76407.125	51.53
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000002	0.006	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001641	5.957	0.00
CHANGE IN WATER STORAGE	-1.025	-3719.729	-2.51
SOIL WATER AT START OF YEAR	54.128	196486.125	
SOIL WATER AT END OF YEAR	52.556	190780.016	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.547	1986.390	1.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.99	3.81	3.24	4.96	2.11	1.49
	2.44	4.32	4.78	8.87	5.28	4.09
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.416	0.339	0.116	3.079	2.687	1.933
	2.684	3.304	2.756	2.121	1.128	0.564
LATERAL DRAINAGE COLLECTED	1.8350	0.1098	2.6368	5.1104	3.7949	0.2010
FROM LAYER 3	0.0752	0.0842	0.1985	2.0199	5.2541	3.9349
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.002	0.005	0.003	0.000
TOP OF LAYER 4	0.000	0.000	0.000	0.002	0.005	0.003
STD. DEVIATION OF DAILY	0.002	0.000	0.002	0.002	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.000	0.002	0.002	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2022

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.38	175619.437	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.125	76685.398	43.67
DRAINAGE COLLECTED FROM LAYER 3	25.2548	91675.016	52.20
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.003	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000002	0.006	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001592	5.779	0.00
CHANGE IN WATER STORAGE	1.998	7253.171	4.13
SOIL WATER AT START OF YEAR	52.556	190780.016	
SOIL WATER AT END OF YEAR	55.102	200019.578	
SNOW WATER AT START OF YEAR	0.547	1986.390	1.13
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.063	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.82	1.17	1.72	1.89	2.95	5.84
	3.98	6.22	3.54	6.55	2.60	7.00
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.470	0.428	0.364	2.451	3.324	5.143
	4.312	3.246	2.834	2.136	0.948	0.788
LATERAL DRAINAGE COLLECTED	4.1146	0.4088	1.7977	4.2445	1.6470	0.2197
FROM LAYER 3	0.1342	1.1840	0.9189	1.9582	2.9310	2.5552
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.000	0.002	0.004	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.002	0.003	0.002
STD. DEVIATION OF DAILY	0.002	0.000	0.001	0.002	0.001	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.001	0.001	0.001	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.28	178886.422	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.443	95989.648	53.66
DRAINAGE COLLECTED FROM LAYER 3	22.1136	80272.211	44.87
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.004	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.005	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001508	5.475	0.00
CHANGE IN WATER STORAGE	0.721	2619.033	1.46
SOIL WATER AT START OF YEAR	55.102	200019.578	
SOIL WATER AT END OF YEAR	55.823	202638.609	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.46	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.03	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.823	3.468	3.393
	3.508	2.878	2.168	1.585	0.835	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.808	0.928	1.341
	1.246	1.019	0.861	0.390	0.234	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.1365	0.7895	1.1714	4.5682	4.7942	0.8365
	0.6670	0.4333	0.8060	1.3272	2.6221	2.5283
STD. DEVIATIONS	1.1400	1.0885	1.1287	2.5124	2.1362	0.7970
	0.9783	0.4811	0.7978	1.1941	1.2547	1.3468
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 9						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

TOTALS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0010	0.0008	0.0010	0.0041	0.0041	0.0007
	0.0006	0.0004	0.0007	0.0011	0.0023	0.0022
STD. DEVIATIONS	0.0010	0.0010	0.0010	0.0022	0.0018	0.0007
	0.0008	0.0004	0.0007	0.0010	0.0011	0.0012

DAILY AVERAGE HEAD ON TOP OF LAYER 9

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.91 (5.063)	155770.6	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	21.349 (2.9846)	77498.23	49.752
LATERAL DRAINAGE COLLECTED FROM LAYER 3	21.68029 (3.66613)	78699.445	50.52267
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 4	0.002 (0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00000 (0.00000)	0.004	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00000 (0.00000)	0.005	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00231 (0.00068)	8.377	0.00538
CHANGE IN WATER STORAGE	-0.120 (1.8473)	-435.48	-0.280

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	1.05507	3829.92017
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 4	0.028	
MAXIMUM HEAD ON TOP OF LAYER 4	0.056	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	1.7 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00000	0.00003
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 9	0.000	
MAXIMUM HEAD ON TOP OF LAYER 9	0.004	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000011	0.04003
SNOW WATER	11.92	43258.5078
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6710	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770	

Maximum heads are computed using McEnroe's equations.

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	39.2059	0.3267
2	1.8831	0.1569
3	0.0100	0.0401
4	0.0000	0.0000
5	0.1800	0.7500
6	4.6800	0.3900
7	0.5400	0.0450
8	0.0020	0.0100
9	0.0000	0.0000
10	4.6423	0.3869
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)               **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                  **
**                     USAE WATERWAYS EXPERIMENT STATION                    **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:    c:\JRL\ph2exp\NEWJRL4A.D4
TEMPERATURE DATA FILE:      c:\JRL\ph2exp\NEWJRL7.D7
SOLAR RADIATION DATA FILE:  c:\JRL\ph2exp\NEWJRL13.D13
EVAPOTRANSPIRATION DATA:    c:\JRL\ph2exp\DATA11.D11
SOIL AND DESIGN DATA FILE:  c:\JRL\ph2exp\60W_SSNR.D10
OUTPUT DATA FILE:           c:\JRL\ph2exp\60W_SSNR.OUT


TIME:  13:25     DATE:   9/23/2024


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     TITLE:  CASELLA - JUNIPER RIDGE EXPANSION - OPEN (60'WASTE)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  18
          THICKNESS                    =    720.00   INCHES
          POROSITY                     =      0.6710 VOL/VOL
          FIELD CAPACITY               =      0.2920 VOL/VOL
          WILTING POINT                =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2931 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   1
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4170 VOL/VOL
          FIELD CAPACITY               =      0.0450 VOL/VOL
          WILTING POINT                =      0.0180 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0863 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999978000E-02 CM/SEC
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LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0104	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	150.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	400.0	FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3897	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 55.0, A SURFACE SLOPE OF 33.% AND A SLOPE LENGTH OF 180. FEET.

SCS RUNOFF CURVE NUMBER	=	61.50	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.119	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	5.368	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.616	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	222.141	INCHES
TOTAL INITIAL WATER	=	228.188	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM BANGOR MAINE

STATION LATITUDE	=	44.80 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	134
END OF GROWING SEASON (JULIAN DATE)	=	263
EVAPORATIVE ZONE DEPTH	=	8.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2009

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.77	2.47	1.68	3.99	3.94	8.10
	5.61	2.69	1.32	5.42	4.22	3.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.519	0.387	0.485	2.385	3.856	4.380
	5.442	1.583	1.906	1.332	0.397	0.260
LATERAL DRAINAGE COLLECTED	0.0991	0.0480	0.0438	1.3870	3.8072	3.1930
FROM LAYER 3	3.4476	3.4058	2.5644	0.6713	2.1974	0.9471
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.003	0.003
TOP OF LAYER 4	0.003	0.003	0.002	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 4	0.001	0.000	0.001	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.73	162369.891	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	22.933	83248.602	51.27
DRAINAGE COLLECTED FROM LAYER 3	21.8118	79177.016	48.76
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003725	13.523	0.01
CHANGE IN WATER STORAGE	-0.019	-69.237	-0.04
SOIL WATER AT START OF YEAR	226.821	823359.250	
SOIL WATER AT END OF YEAR	226.802	823290.000	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.52
SNOW WATER AT END OF YEAR	6.047	21949.807	13.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.47	2.19	4.68	2.24	1.73	4.38
	2.15	1.89	5.73	5.83	4.75	5.47
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.517	0.371	0.582	1.657	2.197	3.242
	3.255	1.775	2.610	1.560	0.520	0.346
LATERAL DRAINAGE COLLECTED	0.1000	0.0483	0.0375	0.9054	4.7916	4.0678
FROM LAYER 3	3.6174	3.2199	1.0939	1.8032	1.0007	3.3587
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003
LAYER 10	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.001	0.004	0.004
TOP OF LAYER 4	0.003	0.003	0.001	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.51	161571.312	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.632	67632.477	41.86
DRAINAGE COLLECTED FROM LAYER 3	24.0442	87280.539	54.02
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003362	12.205	0.01
CHANGE IN WATER STORAGE	1.831	6646.059	4.11
SOIL WATER AT START OF YEAR	226.802	823290.000	
SOIL WATER AT END OF YEAR	228.368	828976.500	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.59
SNOW WATER AT END OF YEAR	6.311	22909.367	14.18
ANNUAL WATER BUDGET BALANCE	0.0000	0.022	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.66	2.19	4.50	5.26	3.51	2.79
	2.10	8.32	2.79	5.16	2.19	3.85
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.449	0.450	0.631	0.755	4.469	2.299
	2.114	5.231	2.596	1.261	0.864	0.337
LATERAL DRAINAGE COLLECTED	1.9635	0.1351	0.0667	0.1565	3.8710	4.5434
FROM LAYER 3	3.9960	3.0194	2.2164	1.9191	2.1424	2.7350
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003
LAYER 10	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.000	0.003	0.004
TOP OF LAYER 4	0.003	0.003	0.002	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.32	160881.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.456	77885.383	48.41
DRAINAGE COLLECTED FROM LAYER 3	26.7646	97155.469	60.39
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.010	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.006	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.003137	11.386	0.01
CHANGE IN WATER STORAGE	-3.904	-14170.639	-8.81
SOIL WATER AT START OF YEAR	228.368	828976.500	
SOIL WATER AT END OF YEAR	226.974	823913.875	
SNOW WATER AT START OF YEAR	6.311	22909.367	14.24
SNOW WATER AT END OF YEAR	3.802	13801.376	8.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.044	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.95	1.55	1.40	3.99	5.12	7.10
	0.58	2.60	6.33	6.96	1.13	1.13
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.506	0.418	0.532	1.794	4.602	4.203
	1.620	2.032	2.450	1.240	0.732	0.352
LATERAL DRAINAGE COLLECTED	1.1192	0.1009	0.0907	1.1432	2.3745	3.0062
FROM LAYER 3	2.8414	2.8799	2.0598	1.3827	1.9443	3.3049
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.001	0.002	0.003
TOP OF LAYER 4	0.002	0.002	0.002	0.001	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.84	144619.172	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.480	74342.016	51.41
DRAINAGE COLLECTED FROM LAYER 3	22.2477	80759.305	55.84
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0016		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002834	10.287	0.01
CHANGE IN WATER STORAGE	-2.890	-10492.355	-7.26
SOIL WATER AT START OF YEAR	226.974	823913.875	
SOIL WATER AT END OF YEAR	227.107	824397.312	
SNOW WATER AT START OF YEAR	3.802	13801.376	9.54
SNOW WATER AT END OF YEAR	0.778	2825.582	1.95
ANNUAL WATER BUDGET BALANCE	0.0000	-0.085	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2013

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.87	2.04	2.05	1.77	4.55	5.46
	3.74	4.69	7.17	1.02	3.76	2.93
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.331	0.496	0.517	0.450	4.283	4.463
	3.962	4.049	2.929	1.205	0.429	0.196
LATERAL DRAINAGE COLLECTED	1.2655	0.1034	0.0539	1.2623	2.5012	2.0153
FROM LAYER 3	1.2622	0.5552	0.7561	3.2124	0.9125	0.1014
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.001	0.002	0.002
TOP OF LAYER 4	0.001	0.000	0.001	0.003	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.000	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2013

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.05	145381.469	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	23.310	84616.117	58.20
DRAINAGE COLLECTED FROM LAYER 3	14.0015	50825.281	34.96
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0010		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002579	9.362	0.01
CHANGE IN WATER STORAGE	2.736	9930.732	6.83
SOIL WATER AT START OF YEAR	227.107	824397.312	
SOIL WATER AT END OF YEAR	224.363	814437.062	
SNOW WATER AT START OF YEAR	0.778	2825.582	1.94
SNOW WATER AT END OF YEAR	6.258	22716.549	15.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2014

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.18	1.99	3.65	2.28	3.31	3.59
	6.78	2.96	0.89	6.85	3.21	5.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.336	0.311	0.492	1.941	3.582	3.599
	4.623	3.372	0.632	1.657	0.885	0.290
LATERAL DRAINAGE COLLECTED	0.0812	1.5252	0.7915	0.8970	3.9964	3.4269
FROM LAYER 3	2.5417	2.2810	0.1645	0.1501	1.5060	2.3469
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.001	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.002	0.002	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.000	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.001	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2014

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.562	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.719	78839.578	49.45
DRAINAGE COLLECTED FROM LAYER 3	19.7084	71541.398	44.87
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002368	8.595	0.01
CHANGE IN WATER STORAGE	2.490	9040.080	5.67
SOIL WATER AT START OF YEAR	224.363	814437.062	
SOIL WATER AT END OF YEAR	233.111	846193.687	
SNOW WATER AT START OF YEAR	6.258	22716.549	14.25
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.087	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2015

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.69	2.20	1.45	2.39	2.32	4.90
	1.16	2.63	6.89	2.58	2.26	4.06
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.281	0.282	0.531	0.731	2.489	4.589
	1.928	2.942	1.388	1.813	0.991	0.876
LATERAL DRAINAGE COLLECTED	2.2727	2.4745	0.4494	0.9880	2.7374	3.3139
FROM LAYER 3	2.1775	0.1591	0.0652	1.4226	2.2772	1.5617
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.000	0.001	0.002	0.003
TOP OF LAYER 4	0.002	0.000	0.000	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.001	0.001	0.000
HEAD ON TOP OF LAYER 4	0.001	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2015

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.53	128973.898	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.840	68388.609	53.03
DRAINAGE COLLECTED FROM LAYER 3	19.8992	72233.961	56.01
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002267	8.230	0.01
CHANGE IN WATER STORAGE	-3.211	-11657.014	-9.04
SOIL WATER AT START OF YEAR	233.111	846193.687	
SOIL WATER AT END OF YEAR	229.210	832031.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.690	2505.669	1.94
ANNUAL WATER BUDGET BALANCE	0.0000	0.102	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2016

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.38	3.89	3.27	2.58	2.09	2.85
	2.69	2.24	1.23	3.20	4.16	3.77
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.552	0.224	0.437	1.459	2.330	2.618
	2.757	2.379	0.650	1.317	1.034	0.420
LATERAL DRAINAGE COLLECTED	2.3181	1.2165	1.6262	1.1100	3.6477	3.2073
FROM LAYER 3	1.3848	0.1153	0.0552	0.0357	1.0092	1.9944
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.001	0.000	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.001	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2016

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.508	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	16.178	58726.711	47.10
DRAINAGE COLLECTED FROM LAYER 3	17.7205	64325.336	51.59
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002152	7.812	0.01
CHANGE IN WATER STORAGE	0.449	1630.616	1.31
SOIL WATER AT START OF YEAR	229.210	832031.000	
SOIL WATER AT END OF YEAR	229.368	832605.625	
SNOW WATER AT START OF YEAR	0.690	2505.669	2.01
SNOW WATER AT END OF YEAR	0.981	3561.676	2.86
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2017

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.63	2.26	2.07	3.98	6.36	4.32
	1.91	1.64	2.69	5.59	3.05	3.83
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.408	0.345	0.459	2.206	4.561	4.180
	2.464	1.728	2.549	1.079	0.989	0.502
LATERAL DRAINAGE COLLECTED	2.6187	0.7283	1.6696	1.2262	1.9245	3.5470
FROM LAYER 3	3.2770	0.6530	0.2733	0.1587	0.8220	1.9283
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.001	0.001	0.002	0.003
TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2017

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.33	150027.906	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.471	77940.023	51.95
DRAINAGE COLLECTED FROM LAYER 3	18.8266	68340.562	45.55
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.002026	7.354	0.00
CHANGE IN WATER STORAGE	1.030	3739.990	2.49
SOIL WATER AT START OF YEAR	229.368	832605.625	
SOIL WATER AT END OF YEAR	229.235	832122.562	
SNOW WATER AT START OF YEAR	0.981	3561.676	2.37
SNOW WATER AT END OF YEAR	2.145	7784.717	5.19
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2018

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.53	2.99	2.18	4.77	2.37	5.42
	2.48	2.73	2.63	4.66	7.00	4.23
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.346	0.355	0.501	1.121	3.377	4.198
	3.524	2.596	1.669	1.754	0.796	0.301
LATERAL DRAINAGE COLLECTED	2.5343	2.3982	1.7913	1.4790	2.6962	3.6350
FROM LAYER 3	3.2124	1.3328	0.1075	0.5737	0.9689	2.5690
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.002	0.001	0.002	0.003
TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.002	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2018

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.99	170573.687	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.538	74551.227	43.71
DRAINAGE COLLECTED FROM LAYER 3	23.2982	84572.422	49.58
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001935	7.024	0.00
CHANGE IN WATER STORAGE	3.152	11443.011	6.71
SOIL WATER AT START OF YEAR	229.235	832122.562	
SOIL WATER AT END OF YEAR	233.796	848677.812	
SNOW WATER AT START OF YEAR	2.145	7784.717	4.56
SNOW WATER AT END OF YEAR	0.736	2672.444	1.57
ANNUAL WATER BUDGET BALANCE	0.0000	0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2019

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.15	1.83	1.94	5.53	4.43	5.33
	4.46	7.54	2.81	5.80	3.97	3.21
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.429	0.397	0.421	1.788	4.885	4.132
	5.681	3.839	3.016	2.099	0.712	0.416
LATERAL DRAINAGE COLLECTED	3.3238	2.1942	2.4465	1.3330	2.9072	3.5674
FROM LAYER 3	2.9244	2.5158	2.0926	0.5827	1.2654	2.2202
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002
LAYER 10	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.002	0.001	0.003	0.003
TOP OF LAYER 4	0.003	0.002	0.002	0.001	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2019

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.00	188759.953	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	27.816	100971.445	53.49
DRAINAGE COLLECTED FROM LAYER 3	27.3733	99364.969	52.64
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001852	6.723	0.00
CHANGE IN WATER STORAGE	-3.191	-11583.134	-6.14
SOIL WATER AT START OF YEAR	233.796	848677.812	
SOIL WATER AT END OF YEAR	230.980	838457.875	
SNOW WATER AT START OF YEAR	0.736	2672.444	1.42
SNOW WATER AT END OF YEAR	0.361	1309.265	0.69
ANNUAL WATER BUDGET BALANCE	0.0000	-0.050	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2020

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.42	1.65	2.27	4.78	2.22	2.08
	4.21	3.55	0.28	4.40	5.22	4.52
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.432	0.284	0.251	2.952	2.721	0.599
	4.113	3.121	1.251	1.143	1.075	0.533
LATERAL DRAINAGE COLLECTED	2.8185	1.4157	1.2528	1.3911	3.5841	3.0069
FROM LAYER 3	0.3034	0.6098	0.2298	0.0727	2.1588	1.2512
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001
LAYER 10	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.001
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2020

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.60	136488.031	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	18.475	67063.930	49.14
DRAINAGE COLLECTED FROM LAYER 3	18.0947	65683.656	48.12
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0013		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001714	6.220	0.00
CHANGE IN WATER STORAGE	1.029	3734.162	2.74
SOIL WATER AT START OF YEAR	230.980	838457.875	
SOIL WATER AT END OF YEAR	232.370	843501.312	
SNOW WATER AT START OF YEAR	0.361	1309.265	0.96
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.059	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2021

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.99	1.76	3.63	1.82	0.97
	7.67	1.78	9.42	4.45	3.44	2.53
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.465	0.522	0.243	2.568	2.653	1.320
	4.148	1.967	3.287	2.062	1.027	0.562
LATERAL DRAINAGE COLLECTED	3.3997	1.8787	0.4189	1.5030	3.2512	0.9470
FROM LAYER 3	0.7861	2.2473	0.6293	2.4609	1.8326	1.2878
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.000	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.001	0.000	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2021

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.85	148285.516	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	20.824	75592.148	50.98
DRAINAGE COLLECTED FROM LAYER 3	20.6424	74931.953	50.53
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0015		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001618	5.872	0.00
CHANGE IN WATER STORAGE	-0.618	-2244.474	-1.51
SOIL WATER AT START OF YEAR	232.370	843501.312	
SOIL WATER AT END OF YEAR	231.204	839270.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.547	1986.390	1.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.99	3.81	3.24	4.96	2.11	1.49
	2.44	4.32	4.78	8.87	5.28	4.09
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.416	0.339	0.116	3.079	2.687	1.933
	2.684	3.304	2.756	2.121	1.128	0.564
LATERAL DRAINAGE COLLECTED	3.3661	1.8633	1.2091	1.1000	3.7471	3.3508
FROM LAYER 3	2.3444	0.2446	0.2599	1.4110	1.8316	1.9038
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.001	0.001	0.003	0.003
TOP OF LAYER 4	0.002	0.000	0.000	0.001	0.002	0.002
STD. DEVIATION OF DAILY	0.000	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.001	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2022

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.38	175619.437	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	21.125	76685.398	43.67
DRAINAGE COLLECTED FROM LAYER 3	22.6318	82153.312	46.78
PERC./LEAKAGE THROUGH LAYER 5	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001575	5.718	0.00
CHANGE IN WATER STORAGE	4.621	16774.943	9.55
SOIL WATER AT START OF YEAR	231.204	839270.437	
SOIL WATER AT END OF YEAR	236.372	858031.750	
SNOW WATER AT START OF YEAR	0.547	1986.390	1.13
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.82	1.17	1.72	1.89	2.95	5.84
	3.98	6.22	3.54	6.55	2.60	7.00
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.470	0.428	0.364	2.451	3.324	5.143
	4.312	3.246	2.834	2.136	0.948	0.788
LATERAL DRAINAGE COLLECTED	3.5029	2.4144	2.2483	2.2734	3.7254	2.9782
FROM LAYER 3	1.3949	0.7678	1.3925	1.6492	2.3823	0.8989
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 10	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.002	0.002	0.003	0.003
TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.002	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.001	0.001	0.000	0.001
HEAD ON TOP OF LAYER 4	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 9	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.28	178886.422	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.443	95989.648	53.66
DRAINAGE COLLECTED FROM LAYER 3	25.6283	93030.594	52.01
PERC./LEAKAGE THROUGH LAYER 5	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0019		
DRAINAGE COLLECTED FROM LAYER 8	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 9	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 9	0.0000		
PERC./LEAKAGE THROUGH LAYER 10	0.001492	5.417	0.00
CHANGE IN WATER STORAGE	-2.793	-10139.252	-5.67
SOIL WATER AT START OF YEAR	236.372	858031.750	
SOIL WATER AT END OF YEAR	233.579	847892.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.46	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.03	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.823	3.468	3.393
	3.508	2.878	2.168	1.585	0.835	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.808	0.928	1.341
	1.246	1.019	0.861	0.390	0.234	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	2.0522	1.2363	0.9464	1.2103	3.3042	3.1871
	2.3674	1.6004	0.9307	1.1671	1.6168	1.8940
STD. DEVIATIONS	1.2401	0.9628	0.8577	0.4430	0.7606	0.8320
	1.1154	1.2279	0.9048	0.9524	0.5708	0.9108
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 9

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 10

TOTALS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0018	0.0012	0.0008	0.0011	0.0029	0.0028
	0.0020	0.0014	0.0008	0.0010	0.0014	0.0016
STD. DEVIATIONS	0.0011	0.0009	0.0007	0.0004	0.0007	0.0007
	0.0010	0.0011	0.0008	0.0008	0.0005	0.0008

DAILY AVERAGE HEAD ON TOP OF LAYER 9

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.91 (5.063)	155770.6	100.00
RUNOFF	0.000 (0.0000)	0.00	0.000
EVAPOTRANSPIRATION	21.349 (2.9846)	77498.23	49.752
LATERAL DRAINAGE COLLECTED FROM LAYER 3	21.51287 (3.65140)	78091.727	50.13253
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 4	0.002 (0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.00000 (0.00000)	0.005	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.00000 (0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00231 (0.00069)	8.382	0.00538
CHANGE IN WATER STORAGE	0.047 (2.7110)	172.23	0.111

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PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.19147	695.05389
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 4	0.005	
MAXIMUM HEAD ON TOP OF LAYER 4	0.012	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 8	0.00000	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 9	0.000000	0.00001
AVERAGE HEAD ON TOP OF LAYER 9	0.000	
MAXIMUM HEAD ON TOP OF LAYER 9	0.003	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000011	0.04010
SNOW WATER	11.92	43258.5078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.6710
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0770

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	217.1553	0.3016
2	1.6951	0.1413
3	0.0046	0.0185
4	0.0000	0.0000
5	0.1800	0.7500
6	4.6800	0.3900
7	0.5400	0.0450
8	0.0020	0.0100
9	0.0000	0.0000
10	4.6423	0.3869
SNOW WATER	0.000	

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**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    c:\JRL\ph2exp\NEWJRL4.D4
TEMPERATURE DATA FILE:      c:\JRL\ph2exp\NEWJRL7.D7
SOLAR RADIATION DATA FILE:  c:\JRL\ph2exp\NEWJRL13.D13
EVAPOTRANSPIRATION DATA:    c:\JRL\ph2exp\DATA11.D11
SOIL AND DESIGN DATA FILE:  c:\JRL\ph2exp\165W_TSC.D10
OUTPUT DATA FILE:           c:\JRL\ph2exp\165W_TSC.OUT

TIME:  11:30     DATE:   9/23/2024

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     TITLE:  CASELLA - JUNIPER RIDGE EXPANSION - soil cover(165ft_Waste)

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  12
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4710 VOL/VOL
          FIELD CAPACITY                =      0.3420 VOL/VOL
          WILTING POINT                 =      0.2100 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3781 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.419999997000E-04 CM/SEC

                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  18
          THICKNESS                     =   1980.00   INCHES
          POROSITY                      =      0.6710 VOL/VOL
          FIELD CAPACITY                =      0.2920 VOL/VOL
          WILTING POINT                 =      0.0770 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2920 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC
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LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0933	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 34

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0112	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	33.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	220.0	FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.08	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.24	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999997000E-08	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3900	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 1

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999978000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 20

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	10.0000000000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	400.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	1.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	3.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4100	VOL/VOL
FIELD CAPACITY	=	0.3900	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3898	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 74.0, A SURFACE SLOPE OF 10.% AND A SLOPE LENGTH OF 300. FEET.

SCS RUNOFF CURVE NUMBER	=	75.40	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.385	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	3.768	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.680	INCHES
INITIAL SNOW WATER	=	6.047	INCHES
INITIAL WATER IN LAYER MATERIALS	=	596.167	INCHES
TOTAL INITIAL WATER	=	602.214	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM BANGOR MAINE

STATION LATITUDE	=	44.80	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	134	
END OF GROWING SEASON (JULIAN DATE)	=	263	
EVAPORATIVE ZONE DEPTH	=	8.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	8.70	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	72.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	76.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
2.99	2.28	2.52	3.60	3.26	4.31
3.46	3.72	3.90	5.16	3.75	4.12

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
20.00	21.90	31.20	43.40	55.00	62.80
69.90	68.80	61.00	49.60	37.00	26.70

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BANGOR MAINE
AND STATION LATITUDE = 44.80 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2009

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.77	2.47	1.68	3.99	3.94	8.10
	5.61	2.69	1.32	5.42	4.22	3.52
RUNOFF	0.272	0.087	8.044	3.582	0.000	2.640
	0.000	0.602	0.000	0.107	0.392	0.000
EVAPOTRANSPIRATION	0.519	0.387	0.485	2.378	3.429	4.429
	5.043	1.405	1.367	1.343	0.397	0.260
LATERAL DRAINAGE COLLECTED	0.1521	0.0598	0.0417	0.0922	1.1728	0.1805
FROM LAYER 4	1.3285	0.2294	0.4937	0.3022	1.4400	2.0693
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003
LAYER 11	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.002	0.000	0.001	0.000	0.002	0.003
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.001	0.000	0.001	0.000	0.002	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2009

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.73	162369.891	100.00
RUNOFF	15.728	57090.980	35.16
EVAPOTRANSPIRATION	21.441	77831.625	47.93
DRAINAGE COLLECTED FROM LAYER 4	7.5622	27450.787	16.91
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0008		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.003500	12.703	0.01
CHANGE IN WATER STORAGE	-0.005	-16.395	-0.01
SOIL WATER AT START OF YEAR	600.847	2181075.250	
SOIL WATER AT END OF YEAR	600.843	2181058.750	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.52
SNOW WATER AT END OF YEAR	6.047	21949.807	13.52
ANNUAL WATER BUDGET BALANCE	0.0001	0.193	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2010

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.47	2.19	4.68	2.24	1.73	4.38
	2.15	1.89	5.73	5.83	4.75	5.47
RUNOFF	0.000	0.000	10.661	5.321	0.000	0.007
	0.000	0.000	1.815	0.165	0.082	0.000
EVAPOTRANSPIRATION	0.517	0.371	0.582	1.653	1.751	3.092
	2.922	1.806	2.612	1.562	0.520	0.346
LATERAL DRAINAGE COLLECTED	0.1537	0.0601	0.0419	0.0203	0.5915	0.2064
FROM LAYER 4	0.3368	0.1272	0.3952	0.6987	0.5641	2.6269
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002
LAYER 11	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.001	0.001	0.001	0.003
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2010

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.51	161571.312	100.00
RUNOFF	18.051	65526.352	40.56
EVAPOTRANSPIRATION	17.735	64376.516	39.84
DRAINAGE COLLECTED FROM LAYER 4	5.8229	21137.271	13.08
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0006		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.003165	11.490	0.01
CHANGE IN WATER STORAGE	2.898	10519.772	6.51
SOIL WATER AT START OF YEAR	600.843	2181058.750	
SOIL WATER AT END OF YEAR	603.476	2190619.000	
SNOW WATER AT START OF YEAR	6.047	21949.807	13.59
SNOW WATER AT END OF YEAR	6.311	22909.367	14.18
ANNUAL WATER BUDGET BALANCE	0.0000	-0.097	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2011

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.66	2.19	4.50	5.26	3.51	2.79
	2.10	8.32	2.79	5.16	2.19	3.85
RUNOFF	0.000	0.000	1.398	16.313	0.000	0.000
	0.000	0.445	0.000	0.016	0.000	0.000
EVAPOTRANSPIRATION	0.449	0.450	0.631	0.736	3.804	2.376
	2.048	5.186	2.610	1.262	0.865	0.337
LATERAL DRAINAGE COLLECTED	2.5982	0.1983	0.0785	0.0410	0.6445	0.3653
FROM LAYER 4	0.1257	0.3827	1.3428	0.8512	1.1780	2.1406
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003
LAYER 11	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.002	0.001	0.002	0.003
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2011

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.32	160881.562	100.00
RUNOFF	18.173	65969.016	41.00
EVAPOTRANSPIRATION	20.753	75333.953	46.83
DRAINAGE COLLECTED FROM LAYER 4	9.9470	36107.445	22.44
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0011		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002990	10.854	0.01
CHANGE IN WATER STORAGE	-4.556	-16539.920	-10.28
SOIL WATER AT START OF YEAR	603.476	2190619.000	
SOIL WATER AT END OF YEAR	601.429	2183187.000	
SNOW WATER AT START OF YEAR	6.311	22909.367	14.24
SNOW WATER AT END OF YEAR	3.802	13801.376	8.58
ANNUAL WATER BUDGET BALANCE	0.0001	0.206	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2012

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.95	1.55	1.40	3.99	5.12	7.10
	0.58	2.60	6.33	6.96	1.13	1.13
RUNOFF	0.528	0.000	4.933	1.663	0.043	1.185
	0.000	0.048	1.133	1.187	0.000	0.000
EVAPOTRANSPIRATION	0.506	0.418	0.532	1.794	4.234	3.789
	1.147	1.706	2.218	1.240	0.733	0.352
LATERAL DRAINAGE COLLECTED	1.3101	0.1080	0.0578	0.0433	0.4796	2.1761
FROM LAYER 4	1.8404	0.8633	1.2392	1.1833	0.7991	2.8745
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0003	0.0002	0.0003	0.0002	0.0002	0.0002
LAYER 11	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.000	0.001	0.003
TOP OF LAYER 5	0.002	0.001	0.002	0.002	0.001	0.004
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 5	0.001	0.002	0.001	0.001	0.001	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2012

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.84	144619.172	100.00
RUNOFF	10.721	38916.234	26.91
EVAPOTRANSPIRATION	18.669	67766.891	46.86
DRAINAGE COLLECTED FROM LAYER 4	12.9748	47098.617	32.57
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002851	10.348	0.01
CHANGE IN WATER STORAGE	-2.527	-9172.536	-6.34
SOIL WATER AT START OF YEAR	601.429	2183187.000	
SOIL WATER AT END OF YEAR	601.926	2184990.250	
SNOW WATER AT START OF YEAR	3.802	13801.376	9.54
SNOW WATER AT END OF YEAR	0.778	2825.582	1.95
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.384	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2013

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	0.87	2.04	2.05	1.77	4.55	5.46
	3.74	4.69	7.17	1.02	3.76	2.93
RUNOFF	0.127	0.380	2.864	1.506	0.049	0.049
	0.000	0.174	2.299	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.331	0.496	0.517	0.450	3.846	3.738
	3.735	3.513	2.943	0.810	0.429	0.196
LATERAL DRAINAGE COLLECTED	1.9008	0.1337	0.0664	0.0387	0.4950	0.8023
FROM LAYER 4	1.5161	0.8407	0.3597	2.4799	0.2668	0.0818
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.000	0.000	0.000	0.001	0.001
TOP OF LAYER 5	0.002	0.001	0.000	0.003	0.000	0.000
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 5	0.001	0.001	0.000	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2013

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.05	145381.469	100.00
RUNOFF	7.449	27038.979	18.60
EVAPOTRANSPIRATION	21.004	76243.930	52.44
DRAINAGE COLLECTED FROM LAYER 4	8.9818	32603.986	22.43
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0010		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002562	9.301	0.01
CHANGE IN WATER STORAGE	2.613	9485.291	6.52
SOIL WATER AT START OF YEAR	601.926	2184990.250	
SOIL WATER AT END OF YEAR	599.059	2174584.750	
SNOW WATER AT START OF YEAR	0.778	2825.582	1.94
SNOW WATER AT END OF YEAR	6.258	22716.549	15.63
ANNUAL WATER BUDGET BALANCE	0.0000	-0.022	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2014

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.18	1.99	3.65	2.28	3.31	3.59
	6.78	2.96	0.89	6.85	3.21	5.23
RUNOFF	4.648	0.512	3.379	4.736	0.000	0.000
	0.949	0.000	0.000	0.745	0.000	4.045
EVAPOTRANSPIRATION	0.336	0.311	0.492	1.938	3.205	3.373
	3.976	2.966	0.643	1.667	0.886	0.290
LATERAL DRAINAGE COLLECTED	0.0466	0.0293	0.0248	0.0130	0.6661	0.2975
FROM LAYER 4	0.2927	1.4641	0.2592	0.3085	0.7711	1.7773
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.002	0.000	0.000	0.001	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.001	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2014

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.92	159429.562	100.00
RUNOFF	19.013	69017.797	43.29
EVAPOTRANSPIRATION	20.084	72905.437	45.73
DRAINAGE COLLECTED FROM LAYER 4	5.9502	21599.123	13.55
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0006		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002373	8.614	0.01
CHANGE IN WATER STORAGE	-1.130	-4101.720	-2.57
SOIL WATER AT START OF YEAR	599.059	2174584.750	
SOIL WATER AT END OF YEAR	604.187	2193199.500	
SNOW WATER AT START OF YEAR	6.258	22716.549	14.25
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0001	0.313	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2015

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.69	2.20	1.45	2.39	2.32	4.90
	1.16	2.63	6.89	2.58	2.26	4.06
RUNOFF	0.867	0.000	2.369	4.089	0.000	0.013
	0.000	0.000	3.798	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.281	0.282	0.531	0.723	2.090	4.279
	1.482	2.939	1.294	1.819	0.990	0.878
LATERAL DRAINAGE COLLECTED	2.8852	0.2559	0.0856	0.0436	0.5930	0.2964
FROM LAYER 4	0.4947	0.1163	0.1184	0.5161	0.8421	0.8907
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.000	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.001	0.000	0.000	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2015

	INCHES	CU. FEET	PERCENT
PRECIPITATION	35.53	128973.898	100.00
RUNOFF	11.136	40422.434	31.34
EVAPOTRANSPIRATION	17.587	63841.730	49.50
DRAINAGE COLLECTED FROM LAYER 4	7.1379	25910.723	20.09
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0008		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002182	7.920	0.01
CHANGE IN WATER STORAGE	-0.333	-1208.744	-0.94
SOIL WATER AT START OF YEAR	604.187	2193199.500	
SOIL WATER AT END OF YEAR	603.164	2189485.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.690	2505.669	1.94
ANNUAL WATER BUDGET BALANCE	0.0000	-0.170	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2016

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.38	3.89	3.27	2.58	2.09	2.85
	2.69	2.24	1.23	3.20	4.16	3.77
RUNOFF	1.752	3.522	2.786	2.482	0.000	0.000
	0.000	0.000	0.000	0.000	0.001	1.088
EVAPOTRANSPIRATION	0.552	0.223	0.437	1.319	1.797	2.705
	3.063	2.019	0.647	1.332	1.039	0.421
LATERAL DRAINAGE COLLECTED	1.6750	1.2977	0.1205	0.0403	0.6879	0.1215
FROM LAYER 4	0.0599	0.0386	0.0271	0.0327	0.6840	1.1622
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.000	0.000	0.001	0.000
TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2016

	INCHES	CU. FEET	PERCENT
PRECIPITATION	34.35	124690.508	100.00
RUNOFF	11.631	42220.090	33.86
EVAPOTRANSPIRATION	15.555	56463.582	45.28
DRAINAGE COLLECTED FROM LAYER 4	5.9474	21588.902	17.31
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0006		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002126	7.718	0.01
CHANGE IN WATER STORAGE	1.215	4410.167	3.54
SOIL WATER AT START OF YEAR	603.164	2189485.000	
SOIL WATER AT END OF YEAR	604.088	2192839.250	
SNOW WATER AT START OF YEAR	0.690	2505.669	2.01
SNOW WATER AT END OF YEAR	0.981	3561.676	2.86
ANNUAL WATER BUDGET BALANCE	0.0000	0.045	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2017

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.63	2.26	2.07	3.98	6.36	4.32
	1.91	1.64	2.69	5.59	3.05	3.83
RUNOFF	2.844	2.998	1.419	2.086	0.443	0.000
	0.000	0.000	0.001	1.363	0.000	0.006
EVAPOTRANSPIRATION	0.408	0.345	0.458	2.207	4.364	4.024
	2.547	1.706	1.982	1.115	0.988	0.502
LATERAL DRAINAGE COLLECTED	2.9962	0.3136	0.0904	0.0291	0.9126	1.8339
FROM LAYER 4	0.1707	0.0679	0.2897	0.3720	0.5546	1.0279
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
LAYER 11	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.000	0.000	0.000	0.001	0.002
TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.001	0.001
HEAD ON TOP OF LAYER 5	0.000	0.000	0.001	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2017

	INCHES	CU. FEET	PERCENT
PRECIPITATION	41.33	150027.906	100.00
RUNOFF	11.159	40507.996	27.00
EVAPOTRANSPIRATION	20.647	74949.992	49.96
DRAINAGE COLLECTED FROM LAYER 4	8.6587	31431.002	20.95
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0009		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.002009	7.291	0.00
CHANGE IN WATER STORAGE	0.863	3131.870	2.09
SOIL WATER AT START OF YEAR	604.088	2192839.250	
SOIL WATER AT END OF YEAR	603.787	2191748.000	
SNOW WATER AT START OF YEAR	0.981	3561.676	2.37
SNOW WATER AT END OF YEAR	2.145	7784.717	5.19
ANNUAL WATER BUDGET BALANCE	-0.0001	-0.248	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2018

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.53	2.99	2.18	4.77	2.37	5.42
	7.38	2.73	2.63	4.66	7.00	4.23
RUNOFF	6.430	2.491	1.838	2.558	0.000	0.074
	3.282	0.000	0.044	0.010	0.607	1.571
EVAPOTRANSPIRATION	0.346	0.355	0.502	1.121	3.073	4.153
	3.465	2.781	1.146	1.758	0.797	0.301
LATERAL DRAINAGE COLLECTED	3.0777	0.4775	0.0980	0.0548	1.0230	1.1144
FROM LAYER 4	0.5846	1.1738	0.0997	0.6005	0.7805	1.2910
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0001	0.0002	0.0002	0.0002	0.0001	0.0002

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.001	0.000	0.000	0.001	0.001
TOP OF LAYER 5	0.001	0.001	0.000	0.001	0.001	0.002
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.000	0.001	0.002
HEAD ON TOP OF LAYER 5	0.001	0.002	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2018

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.89	188360.672	100.00
RUNOFF	18.905	68624.398	36.43
EVAPOTRANSPIRATION	19.798	71866.492	38.15
DRAINAGE COLLECTED FROM LAYER 4	10.3755	37663.160	20.00
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0011		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001920	6.969	0.00
CHANGE IN WATER STORAGE	2.810	10199.573	5.41
SOIL WATER AT START OF YEAR	603.787	2191748.000	
SOIL WATER AT END OF YEAR	608.005	2207060.000	
SNOW WATER AT START OF YEAR	2.145	7784.717	4.13
SNOW WATER AT END OF YEAR	0.736	2672.444	1.42
ANNUAL WATER BUDGET BALANCE	0.0000	0.072	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2019

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.15	1.83	1.94	5.53	4.43	5.33
	4.46	7.54	2.81	5.80	3.97	3.21
RUNOFF	3.858	0.619	3.806	2.063	0.000	0.125
	0.000	1.480	0.000	0.232	0.048	1.662
EVAPOTRANSPIRATION	0.429	0.397	0.421	1.789	4.845	3.652
	5.169	4.030	2.757	2.100	0.713	0.416
LATERAL DRAINAGE COLLECTED	3.1817	2.7707	1.0652	0.1193	1.2163	1.5731
FROM LAYER 4	0.8515	0.6313	0.7851	0.5918	0.7961	1.5032
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
LAYER 11	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.004	0.001	0.000	0.002	0.002
TOP OF LAYER 5	0.001	0.001	0.001	0.001	0.001	0.002
STD. DEVIATION OF DAILY	0.000	0.000	0.002	0.000	0.002	0.002
HEAD ON TOP OF LAYER 5	0.001	0.001	0.001	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2019

	INCHES	CU. FEET	PERCENT
PRECIPITATION	52.00	188759.953	100.00
RUNOFF	13.894	50436.719	26.72
EVAPOTRANSPIRATION	26.717	96980.898	51.38
DRAINAGE COLLECTED FROM LAYER 4	15.0853	54759.664	29.01
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0016		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001855	6.733	0.00
CHANGE IN WATER STORAGE	-3.698	-13424.111	-7.11
SOIL WATER AT START OF YEAR	608.005	2207060.000	
SOIL WATER AT END OF YEAR	604.683	2194999.000	
SNOW WATER AT START OF YEAR	0.736	2672.444	1.42
SNOW WATER AT END OF YEAR	0.361	1309.265	0.69
ANNUAL WATER BUDGET BALANCE	0.0000	0.048	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2020

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.42	1.65	2.27	4.78	2.22	2.08
	4.21	3.55	0.28	4.40	5.22	4.52
RUNOFF	2.265	1.327	1.983	1.362	0.000	0.000
	0.442	0.270	0.000	0.135	0.202	1.053
EVAPOTRANSPIRATION	0.432	0.284	0.251	2.819	2.301	0.619
	4.127	2.726	0.779	1.152	1.077	0.533
LATERAL DRAINAGE COLLECTED	3.1234	0.6111	0.0979	0.1360	2.1938	0.2115
FROM LAYER 4	0.1320	0.4223	0.3504	0.1128	1.6674	0.7405
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
LAYER 11	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.001	0.000	0.000	0.003	0.000
TOP OF LAYER 5	0.000	0.001	0.000	0.000	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.000	0.001	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.000	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2020

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.60	136488.031	100.00
RUNOFF	9.038	32807.461	24.04
EVAPOTRANSPIRATION	17.101	62075.695	45.48
DRAINAGE COLLECTED FROM LAYER 4	9.7991	35570.578	26.06
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0010		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001694	6.151	0.00
CHANGE IN WATER STORAGE	1.661	6028.280	4.42
SOIL WATER AT START OF YEAR	604.683	2194999.000	
SOIL WATER AT END OF YEAR	606.704	2202336.500	
SNOW WATER AT START OF YEAR	0.361	1309.265	0.96
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.134	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2021

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.39	1.99	1.76	3.63	1.82	0.97
	7.67	1.78	9.42	4.45	3.44	2.53
RUNOFF	0.812	0.719	2.148	1.098	0.000	0.000
	2.364	0.000	2.441	1.380	0.000	0.000
EVAPOTRANSPIRATION	0.465	0.522	0.243	2.153	2.266	1.163
	3.616	1.912	3.292	1.809	1.026	0.561
LATERAL DRAINAGE COLLECTED	2.9150	2.6709	0.2949	0.5351	0.5298	0.1494
FROM LAYER 4	0.2605	1.1787	0.1694	1.6209	1.6623	0.7180
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0002	0.0001	0.0002	0.0001	0.0001	0.0001
LAYER 11	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.004	0.004	0.000	0.001	0.001	0.000
TOP OF LAYER 5	0.000	0.001	0.000	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.000	0.001	0.000	0.001	0.000	0.000
HEAD ON TOP OF LAYER 5	0.001	0.002	0.001	0.001	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2021

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.85	148285.516	100.00
RUNOFF	10.962	39792.113	26.83
EVAPOTRANSPIRATION	19.029	69073.656	46.58
DRAINAGE COLLECTED FROM LAYER 4	12.7049	46118.781	31.10
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0014		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001628	5.911	0.00
CHANGE IN WATER STORAGE	-1.847	-6705.093	-4.52
SOIL WATER AT START OF YEAR	606.704	2202336.500	
SOIL WATER AT END OF YEAR	604.310	2193645.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.547	1986.390	1.34
ANNUAL WATER BUDGET BALANCE	0.0000	0.141	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2022

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.99	3.81	3.24	4.96	2.11	1.49
	2.44	4.32	4.78	8.87	5.28	4.09
RUNOFF	0.005	5.178	3.705	0.178	0.000	0.000
	0.000	0.483	0.186	2.556	0.279	0.006
EVAPOTRANSPIRATION	0.416	0.339	0.116	3.067	2.311	1.905
	2.410	3.216	2.282	2.025	1.130	0.564
LATERAL DRAINAGE COLLECTED	2.5801	1.4024	0.1303	0.1996	2.1244	0.4002
FROM LAYER 4	0.0731	0.3026	0.3370	0.8786	0.7209	0.8926
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 11	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.002	0.000	0.000	0.003	0.001
TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.000	0.000	0.002	0.000
HEAD ON TOP OF LAYER 5	0.000	0.000	0.000	0.001	0.001	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2022

	INCHES	CU. FEET	PERCENT
PRECIPITATION	48.38	175619.437	100.00
RUNOFF	12.576	45651.855	25.99
EVAPOTRANSPIRATION	19.781	71805.211	40.89
DRAINAGE COLLECTED FROM LAYER 4	10.0418	36451.695	20.76
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.008	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0011		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001535	5.573	0.00
CHANGE IN WATER STORAGE	5.979	21705.209	12.36
SOIL WATER AT START OF YEAR	604.310	2193645.000	
SOIL WATER AT END OF YEAR	610.837	2217336.750	
SNOW WATER AT START OF YEAR	0.547	1986.390	1.13
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.113	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	5.82	1.17	1.72	1.89	2.95	5.84
	3.98	6.22	3.54	6.55	2.60	7.00
RUNOFF	2.429	1.432	2.783	0.602	0.008	0.000
	0.000	2.084	0.371	2.141	0.000	1.886
EVAPOTRANSPIRATION	0.470	0.428	0.364	1.935	3.009	4.896
	3.586	3.144	2.439	1.791	0.954	0.789
LATERAL DRAINAGE COLLECTED	2.2149	2.9482	3.1271	2.1053	1.2195	0.4082
FROM LAYER 4	0.5171	0.7067	0.2756	1.3500	1.5815	0.5940
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
LAYER 11	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.004	0.004	0.003	0.002	0.001
TOP OF LAYER 5	0.001	0.001	0.000	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.002	0.000	0.000	0.001	0.001	0.001
HEAD ON TOP OF LAYER 5	0.000	0.001	0.000	0.001	0.002	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.28	178886.422	100.00
RUNOFF	13.737	49864.211	27.87
EVAPOTRANSPIRATION	23.804	86409.898	48.30
DRAINAGE COLLECTED FROM LAYER 4	17.0482	61885.008	34.59
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 5	0.0018		
DRAINAGE COLLECTED FROM LAYER 9	0.0000	0.005	0.00
PERC./LEAKAGE THROUGH LAYER 10	0.000001	0.004	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0000		
PERC./LEAKAGE THROUGH LAYER 11	0.001530	5.555	0.00
CHANGE IN WATER STORAGE	-5.311	-19278.172	-10.78
SOIL WATER AT START OF YEAR	610.837	2217336.750	
SOIL WATER AT END OF YEAR	605.526	2198058.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.087	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2009 THROUGH 2023

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.99	2.28	2.52	3.60	3.26	4.31
	3.79	3.72	3.90	5.16	3.75	3.96
STD. DEVIATIONS	1.51	0.76	1.08	1.31	1.38	2.03
	2.24	2.10	2.70	1.92	1.47	1.35
RUNOFF						
TOTALS	1.789	1.284	3.608	3.309	0.036	0.273
	0.469	0.372	0.806	0.669	0.107	0.754
STD. DEVIATIONS	1.960	1.576	2.568	3.891	0.114	0.721
	1.006	0.618	1.216	0.855	0.185	1.162
EVAPOTRANSPIRATION						
TOTALS	0.430	0.374	0.437	1.739	3.088	3.213
	3.222	2.737	1.934	1.519	0.836	0.450
STD. DEVIATIONS	0.079	0.082	0.140	0.760	0.986	1.237
	1.166	1.026	0.883	0.372	0.235	0.192
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	2.0540	0.8892	0.3614	0.2341	0.9700	0.6758
	0.5723	0.5697	0.4361	0.7933	0.9539	1.3594
STD. DEVIATIONS	1.1452	1.0736	0.8073	0.5339	0.5493	0.6762
	0.5641	0.4549	0.3917	0.6470	0.4413	0.7935
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 11

TOTALS	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0026	0.0012	0.0005	0.0003	0.0012	0.0009
	0.0007	0.0007	0.0006	0.0010	0.0012	0.0017
STD. DEVIATIONS	0.0014	0.0015	0.0010	0.0007	0.0007	0.0009
	0.0007	0.0006	0.0005	0.0008	0.0006	0.0010

DAILY AVERAGE HEAD ON TOP OF LAYER 10

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2009 THROUGH 2023

	INCHES	CU. FEET	PERCENT
PRECIPITATION	43.24 (5.486)	156956.3	100.00
RUNOFF	13.478 (3.7171)	48925.78	31.172
EVAPOTRANSPIRATION	19.980 (2.7462)	72528.36	46.209
LATERAL DRAINAGE COLLECTED FROM LAYER 4	9.86918 (3.36872)	35825.117	22.82489
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.008	0.00001
AVERAGE HEAD ON TOP OF LAYER 5	0.001 (0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 9	0.00000 (0.00000)	0.005	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (0.00000)	0.004	0.00000
AVERAGE HEAD ON TOP OF LAYER 10	0.000 (0.000)		
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.00226 (0.00063)	8.209	0.00523
CHANGE IN WATER STORAGE	-0.091 (3.1345)	-331.10	-0.211

****

PEAK DAILY VALUES FOR YEARS 2009 THROUGH 2023

	(INCHES)	(CU. FT.)
PRECIPITATION	5.27	19130.100
RUNOFF	3.861	14014.4824
DRAINAGE COLLECTED FROM LAYER 4	0.16112	584.85968
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 5	0.006	
MAXIMUM HEAD ON TOP OF LAYER 5	0.012	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	6.3 FEET	
DRAINAGE COLLECTED FROM LAYER 9	0.00000	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	
MAXIMUM HEAD ON TOP OF LAYER 10	0.004	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 11	0.000011	0.04064
SNOW WATER	11.92	43258.5078

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4707
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.2100

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 2023

LAYER	(INCHES)	(VOL/VOL)
1	7.2050	0.4003
2	582.3653	0.2941
3	1.2274	0.1023
4	0.0025	0.0102
5	0.0000	0.0000
6	0.1800	0.7500
7	4.6800	0.3900
8	0.5400	0.0450
9	0.0020	0.0100
10	0.0000	0.0000
11	4.6435	0.3870
SNOW WATER	0.000	

****
****

APPENDIX F

GEOTECHNICAL EVALUATION REPORT

SME
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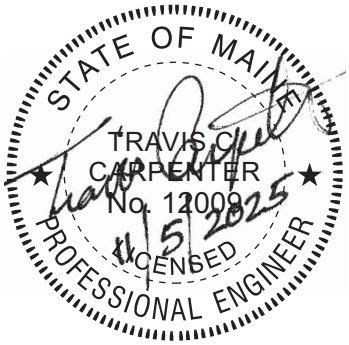
ENGINEERS

PHASE II EXPANSION APPLICATION
JUNIPER RIDGE LANDFILL
VOLUME III
GEOTECHNICAL EVALUATION REPORT

Prepared for

STATE OF MAINE BUREAU OF GENERAL SERVICES
as Owner
and
NEWSME LANDFILL OPERATIONS, LLC
as Operator



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ENGINEERS

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PHASE II EXPANSION APPLICATION
JUNIPER RIDGE LANDFILL
VOLUME III
GEOTECHNICAL EVALUATION REPORT

1.0 INTRODUCTION

This Geotechnical Evaluation Report (Report) describes the geotechnical analyses performed to support the proposed Phase II Expansion of the Juniper Ridge Landfill (JRL, or the landfill) located in Old Town, Maine. This geotechnical evaluation included assessments of landfill stability and settlement, as required by Chapter 401 Sections 2.F.(1) and 2.F.(2), and development of a stability and settlement monitoring plan for the construction and operation periods, as per Chapter 401 Section 2.F.(3). This evaluation also included assessments of cover system stability and settlement, in accordance with Chapter 401 Sections 5.I.(1) and 5.I.(2).

The stability and settlement assessments are based on substantial field and laboratory data obtained from prior site-specific subsurface investigations (as detailed in Volume II of this Application), construction quality control and conformance testing, and historical instrumentation and performance monitoring. The available data effectively define the site's existing geologic and hydrogeologic conditions and establish demonstrated geotechnical parameters for the Phase II Expansion's foundation soils, liner system, waste mass, and cover system.

This geotechnical evaluation demonstrates that the design of the Phase II Expansion will:

- Provide acceptable factors of safety (FOS) with respect to slope stability of the foundation soils, liner system, and waste mass throughout the construction, operation, and closure/post-closure periods for both static and seismic loading conditions;
- Maintain the integrity and performance of the liner and leachate management systems as well as the final cover system at the maximum predicted settlements; and
- Result in acceptable FOS relative to the stability of the final cover system during the closure/ post-closure periods for both static and seismic loading conditions.

This Report is organized and presented as follows:

- Section 2.0 summarizes project information pertinent to the stability and settlement assessments, including the proposed expansion geometry; existing foundation soil, bedrock, and

groundwater conditions; proposed features and components of the expansion; and the expected waste stream;

- Section 3.0 identifies the geotechnical input parameters selected for the stability and settlement assessments, including material properties (i.e., unit weight, shear strength, compressibility) for the foundation soils, liner system, waste mass, and cover system; piezometric conditions within and beneath the expansion area; and seismic loading conditions;
- Section 4.0 describes the stability assessment performed considering potential failure planes which pass through or along the foundation soils, liner system, and/or waste mass, as required by Chapter 401 Sections 401.2.F.(1);
- Section 5.0 presents the settlement assessment completed to predict total and differential settlement of the liner/leachate management systems and the final cover system, as per Chapter 401 Sections 2.F.(2) and 5.I.(2);
- Section 6.0 summarizes the stability and settlement monitoring plan for the construction and operation periods, as required by Chapter 401 Section 2.F.(3);
- Section 7.0 describes the cover system stability assessment performed to address the requirements of Chapter 401 Sections 5.I.(1); and
- Section 8.0 reviews the conclusions drawn and recommendations made, based on the results of this geotechnical evaluation.

2.0 PROJECT INFORMATION

The Phase II Expansion will be located to the north and adjacent to the existing JRL within an approximately 780-acre parcel of land owned by the State of Maine and managed by the Bureau of General Services (BGS), as shown in Figure 2-1. The site is operated by NEWSME Landfill Operations, LLC (NEWSME) under an Operating Services Agreement with BGS.

The Phase II Expansion will expand JRL's solid waste footprint by about 57 acres and provide approximately 11.9 million cubic yards (MCY) of additional disposal capacity. The Phase II Expansion will be developed in a phased approach over its anticipated 10- to 12-year life span. It will consist of five new landfill cells, (i.e., Cells 18 through 22), as shown in Figure 2-2. Each new cell is sized to provide about two years of capacity, at a projected usage rate of approximately 880,000 tons/year.

The Phase II Expansion has been designed as a secure solid waste landfill with primary and secondary composite liners, a leak detection system, leachate and gas collection and transport systems, and intermediate and final cover systems.

The following subsections summarize project information pertinent to the stability and settlement assessments, including:

- The proposed expansion geometry, including the footprint, base grades, and final grades;
- Subsurface conditions within the footprint of the expansion, including overburden soil type(s) and thicknesses, top of bedrock elevations, and groundwater depths/elevations; and
- Proposed features and components of the expansion, including base grade preparations, perimeter (and interior) berms, liner system(s), waste mass, and final cover system.

2.1 Proposed Expansion Geometry

The footprint of the Phase II Expansion is depicted in Figure 2-1. Figure 2-2 indicates the individual cells and the proposed base grades within that footprint. The base grade slopes range from about 2 to 10 percent, although the steepest liner slopes are generally askew (30 to 45 degrees) and not parallel to steepest perimeter sideslopes/final waste grades. Figure 2-3 depicts the proposed final waste grades for the Phase II Expansion, including a maximum waste elevation of 385 feet and maximum 2.7 horizontal (H) to 1 vertical (V) (37 percent) perimeter sideslopes.

2.2 Existing Subsurface Conditions

Numerous subsurface investigations and explorations have been performed to characterize the soil, bedrock, and groundwater conditions at the site, including the Phase II Expansion area. The exploration types and locations are depicted in Figure 2-4. Figure 2-4 also shows the locations of two interpretive subsurface profiles developed based on the findings from the various subsurface explorations and associated wells/piezometers. The subsurface profiles are illustrated in Figure 2-5.

The findings and results of the various subsurface investigations are detailed in the Site Assessment Report (SAR) (i.e., Volume II of this Application) and are briefly summarized in the following subsections.

2.2.1 Overburden Soil(s)

Site investigations indicate that the footprint of the Phase II Expansion is underlain by dense to very dense fine-grained glacial till. Thin, isolated lenses of "washed" glacial till were also found, typically just above bedrock. The glacial till is directly underlain by bedrock (see Subsection 2.2.2 below). Marine clay was encountered atop the glacial till in localized areas beyond the Phase II Expansion boundary.

An interpreted overburden soil thickness map was developed based on the bedrock depths/elevations observed in test pits and soil borings. As shown in Figure 2-6, the thickness of the overburden soils ranges from approximately 0.5 feet to 50 feet across the Phase II Expansion area. The average glacial till thickness between the landfill base grades and bedrock surface will be approximately 22 feet. Approximately 1 percent (i.e., 0.5 acres) of the Phase II Expansion footprint has an existing soil thickness of less than five feet between landfill base grades and the interpreted bedrock surface.

2.2.2 Bedrock

Figure 2-7 presents the interpreted bedrock surface topography using data collected from outcrops, test pits, and borings. Bedrock outcrops are present in localized areas at/near the northeastern and southwestern corners of the Phase II Expansion, as shown in Figures 2-6 and 2-7. Bedrock elevations within the Phase II Expansion vary from a high of approximately 180 to 190 feet in the southwestern corner to a low of about 120 feet near the southeastern corner. The bedrock elevation contours depicted in Figure 2-7 are for illustrative purposes only. Localized variations from the interpretations may exist.

2.2.3 Groundwater

Periodic groundwater level measurements have been obtained throughout the development history of this Site using the numerous wells and piezometers. Water levels have been measured in the Phase II Expansion area since approximately 2004. The wet- and dry-season overburden groundwater elevations presented herein are based on groundwater level measurements made around the Phase II Expansion

from March through October of 2024. Figure 2-8 illustrates the interpreted wet- and dry-season overburden groundwater elevation contours.

During the 2024 wet season (March 2024), the depth to groundwater varied from approximately 1 to 18 feet below the existing ground surface (bgs) with an average depth of about 5 feet-bgs. The groundwater depths were within 10 feet-bgs in all but one of the monitoring locations (OW-607B). During the 2024 dry season (October 2024), the groundwater depths ranged from approximately 5 to 20 feet-bgs with an average of about 11 feet-bgs. The deepest groundwater depths during both the wet and dry seasons were generally found near the northern boundary of the existing JRL, where groundwater elevations have decreased as a result of cut-off of recharge from precipitation (SME, 2024).

2.3 Proposed Expansion Features and Components

The primary features and components of the Phase II Expansion are summarized in the following subsections.

2.3.1 Base Grade Preparation, Underdrains, and Perimeter/Interior Berms

Base grade preparation below the liner systems of the Phase II Expansion will include clearing, grubbing, and grading of the site to allow for positive drainage to the perimeter of the landfill for the underdrain, leak detection, and leachate collection systems. The base grade preparation will include:

- Grading of the existing glacial till soil to achieve the proposed base grades (see Figure 2-2). In areas where subgrade fill is needed, the fill will consist of re-worked (from the site) and/or imported glacial till placed in lifts of 12 inches or less and compacted to at least 90 percent of its maximum dry density (MDD);
- To minimize the disturbance of soil within 5 feet of bedrock, grading in areas with less than 5 feet of existing overburden soil will be limited to grubbing of the uppermost vegetative and organic soil layers prior to placing subgrade fill and/or barrier soils;
- Installation of an underdrain system to collect groundwater in areas where the proposed base grades extend below the existing phreatic surface (overburden groundwater contours). The underdrain system will consist of a 12-inch-thick layer of sand with 4-inch-diameter perforated collection piping and will be installed under approximately 36 acres of the Phase II Expansion, as shown in Figure 2-9; and
- Construction of perimeter (and interior) berms, where indicated, with common borrow consisting of re-worked (from the site) and/or imported glacial till placed in lifts of 12 inches or less and compacted to at least 90 percent of its MDD.

2.3.2 Liner System

The Phase II Expansion's liner system (from top to bottom) consists of a leachate collection system, a composite primary liner, a leak detection system, and a composite secondary liner.

The leachate collection system will consist of the following components (from top to bottom):

- 12-inch-thick layer of sand;
- 6-inch-diameter (or larger) perforated high density polyethylene (HDPE) collection piping; and
- Drainage geocomposite.

The composite primary liner will consist of the following components (from top to bottom):

- 80-mil HDPE textured geomembrane;
- Geosynthetic clay liner (GCL); and
- 12-inch-thick layer of clay barrier soil (permeability less than or equal to $1x10^{-7}$ cm/sec).

The leak detection system will consist of the following components (from top to bottom):

- 12-inch-thick layer of sand;
- 6-inch-diameter perforated HDPE collection piping; and
- Drainage geocomposite.

The secondary liner will consist of the following components (from top to bottom):

- 60-mil HDPE textured geomembrane; and
- 12-inch-thick compacted soil layer (permeability less than $1x10^{-5}$ cm/sec and a geometric mean less than or equal to $1x10^{-6}$ cm/sec).

In areas where the native soil thickness between the grubbed surface and the interpreted top of bedrock is 5 feet or less (approximately 2.7 of the 57 acres), the secondary liner described above will be substituted with an augmented liner, as described below (from top to bottom):

- 60-mil HDPE textured geomembrane;
- GCL;

- 12-inch-thick layer of compacted clay barrier soil (permeability less than or equal to $1x10^{-7}$ cm/sec); and
- 12-inch-thick layer of imported clay barrier soil (permeability less than or equal to $1x10^{-7}$ cm/sec).

The locations of the augmented liner system are shown on Figure 2-9.

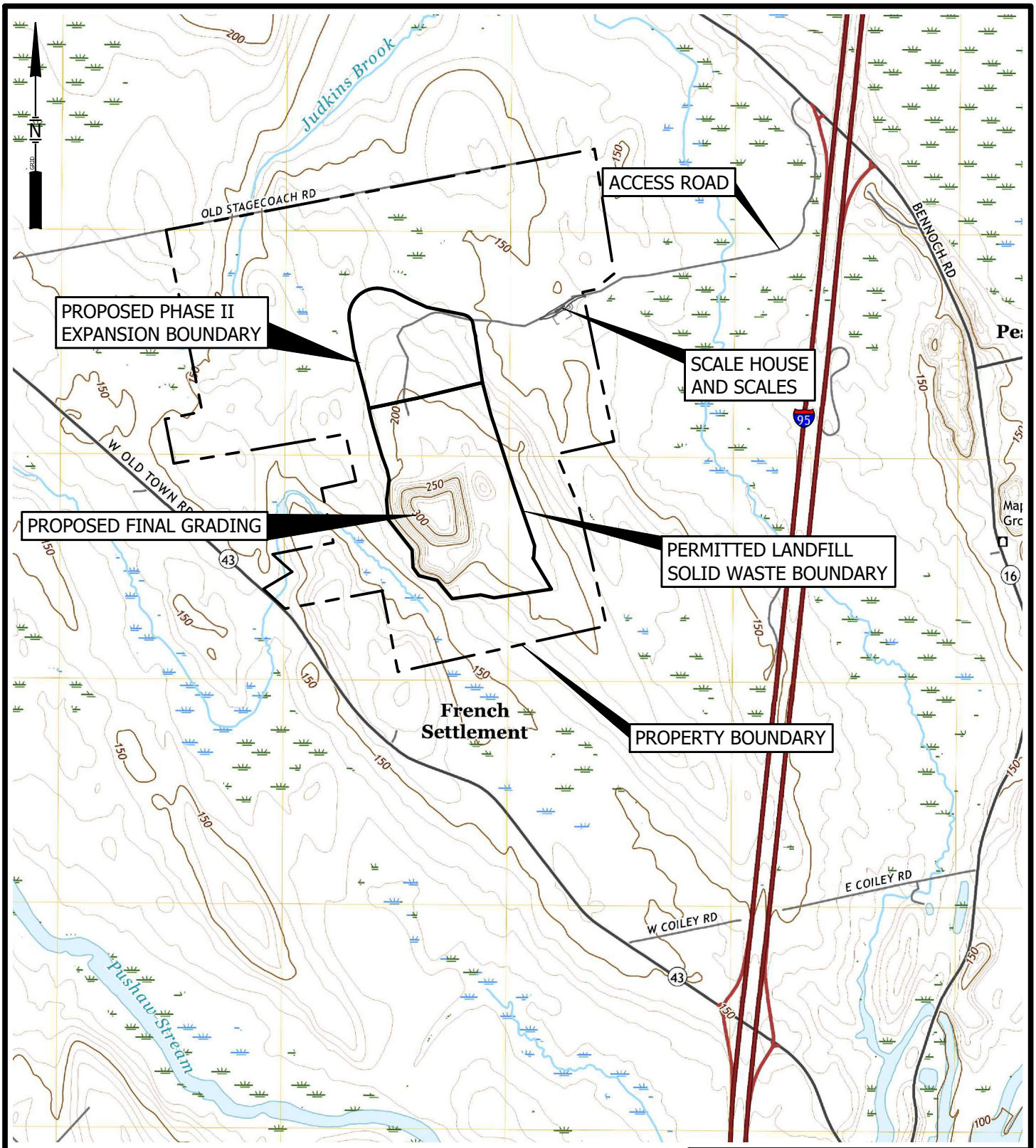
2.3.3 Waste Mass

The Phase II Expansion will receive similar types of waste as those received in the current landfill cells. The waste stream will include construction and demolition debris (CDD), front-end process residue, municipal solid waste ash, wood biomass ash, sludges, contaminated soil, oversized bulky waste, bypass municipal solid waste, and other special wastes. As is currently done, these materials will be commingled in accordance with the current Operations Manual (NEWSME, 2024) and spread and compacted in 2-foot-thick (maximum) horizontal lifts to maximize in-place waste densities and assist with the bulking of biosolids. Each of these waste streams has been disposed previously at JRL, and their geotechnical characteristics have been well documented in previous geotechnical evaluations performed for the landfill and by the geotechnical community.

2.3.4 Final Cover System

The proposed final cover system will consist of the following layers/materials (from top to bottom):

- 18 inches of vegetative cover soil (VCS);
- Drainage geocomposite;
- 40-mil linear low-density polyethylene (LLDPE) textured geomembrane liner;
- GCL;
- 12 inches of compacted barrier soil; and
- 6 inches of construction fines or sand layer.



BASE MAP ADAPTED FROM 7.5 MIN
USGS TOPOGRAPHIC QUADRANGLE
OLD TOWN, MAINE - 2021
GREENBUSH, MAINE - 2021

1000 0 2000 FEET

DWG: SITELOC LMN: USGS MAP CTB: SME-STD REV: 8/12/2025

FIGURE 2-1
SITE LOCATION MAP
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

\\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\SITELOC.dwg, FIG 2-1, 8/12/2025 2:18:19 PM, sjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. BASE GRADES REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.
5. CELL 17 BASE GRADES REPRESENT PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE LINER SYSTEM WITHIN THE LANDFILL LINER LIMITS. CELL 17 BASE GRADE SHOWN OUTSIDE THE LANDFILL REPRESENT THE PREPARED SUBGRADE PRIOR TO CONSTRUCTING THE ACCESS ROAD. CELL 17 HAS NOT BEEN CONSTRUCTED AT THE TIME THESE DRAWINGS WERE PREPARED.
6. SPECIAL FLOOD HAZARD ZONE PER FEMA PANEL 23019C1926D.

EXISTING SCALE HOUSE INFRASTRUCTURE AREA
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT (TYP)
BEDROCK OUTCROP (TYP)
END OF EXISTING LEACHATE FORCE MAIN
DETENTION POND 11R
PROPOSED SOLID WASTE LIMIT (TYP)
26'-WIDE PAVED ACCESS ROAD (TYP)
CELL 18 PUMP STATION
EXISTING OVERHEAD ELECTRIC LINE (TYP)
PERMITTED TILL BORROW PIT
PERMITTED WOOD WASTE HANDLING AREA
PROPERTY LINE (TYP)
PROPOSED WOOD STORAGE LOT
SUBSURFACE WASTEWATER DISPOSAL FIELD
APPROXIMATE LOCATION OF PROPOSED PFAS TREATMENT PLANT
RNG TREATMENT FACILITY POND
LFG TREATMENT FACILITY
MAINTENANCE BUILDINGS
DETENTION POND 9
WOOD STORAGE FACILITY 2 ACRE
WATER SUPPLY WELL
GRAVEL UTILITY ACCESS ROADS (TYP)
VERNAL POOL (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
CELL 14 PUMP STATION
CELL 13 PUMP STATION
CELL 12 PUMP STATION
PRIMARY ACCESS ROAD (TYP)
FORCE MAIN VAULT (TYP)
CATCH BASIN AND CULVERT (TYP)
DETENTION POND 10
1 ACRE
RENEWABLE NATURAL GAS (RNG) FACILITY
LFG FLARE LOCATION
LIMIT OF BRI WETLANDS DELINEATION (TYP) SEE NOTE 2
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT (TYP)
DETENTION POND 14
RIPRAP DITCH (TYP)
DETENTION POND 11
RIPRAP CB INLET
CELL 11 PUMP STATION
LEACHATE STORAGE TANK PUMP STATION
LEACHATE STORAGE TANK 1
PROPOSED LEACHATE STORAGE TANK 2
PROPOSED LEACHATE STORAGE TANK
PROPOSED GUARDRAIL (TYP)
24" LFG HEADER (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
UTILITY MANHOLE (TYP)
DETENTION POND 6
100-YEAR FLOOD ZONE SPECIAL FLOOD HAZARD AREA (TYP) SEE NOTE 6
DETENTION POND 13
CELL 20 PUMP STATION
PROPOSED LANDFILL BASE GRADES (TYP) SEE NOTE 4
PROPOSED CELL LIMITS (TYP)
LIMIT OF PHASE I EXPANSION LINER (TYP)
CELL 8 PUMP STATION
EXISTING CELLS LINER LIMIT (TYP)
(2) 24" HDPE CULVERTS
PERMANENT LANDFILL ACCESS ROAD
25-FOOT SETBACK FROM WOSS FENCE (TYP)
8"x12" LEACHATE FORCEMAIN
PROPERTY LINE (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
ELECTRICAL MANHOLE (TYP)
DEED RESTRICTION (TYP)
DETENTION POND 2
UNDERGROUND ELECTRIC (TYP)
CELL 19 PUMP STATION
DETENTION POND 12
CELL 16 PUMP STATION
EXISTING EMH (TYP)
EXISTING FORCEMAIN VAULT (TYP)
CELL 17 BASE GRADES (SEE NOTE 5)
DETENTION POND 1A
LFG KNOCKOUT STRUCTURE AND VALVES
CELL 5 PUMP STATION
CELL 4 PUMP STATION
CELL 15 PUMP STATION
RIPRAP DITCH (TYP)
EXISTING 24" DIA LANDFILL GAS PIPE
8" GRAVITY SEWER IS ABANDONED
25-FOOT STREAM SETBACK
WATER LOADING RACK
DETENTION POND 1

200 0 400 FEE

FIGURE 2-2
SITE DEVELOPMENT PLAN
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: BASE LMN: SITE-DEV-FIG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

\\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Plans\BASE.dwg, B_FIG 2-2, 11/6/2025 12:15:55 PM, sjm

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. SPECIAL FLOOD HAZARD ZONE PER FEMA PANEL 23019C1926D.

EXISTING SCALE HOUSE INFRASTRUCTURE AREA
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
BEDROCK OUTCROP (TYP)
PROPERTY LINE (TYP)
END OF EXISTING LEACHATE FORCE MAIN
DETENTION POND 11R
PROPOSED SOLID WASTE LIMIT (TYP)
26'-WIDE PAVED ACCESS ROAD (TYP)
CELL 18 PUMP STATION
EXISTING OVERHEAD ELECTRIC LINE (TYP)
PERMITTED TILL BORROW PIT
PERMITTED WOOD WASTE HANDLING AREA
PROPOSED WOOD STORAGE LOT
SUBSURFACE WASTEWATER DISPOSAL FIELD
APPROXIMATE LOCATION OF PROPOSED PFAS TREATMENT PLANT
DETENTION POND 9
MAINTENANCE BUILDINGS
RNG TREATMENT FACILITY POND
LFG TREATMENT FACILITY
WOOD STORAGE FACILITY
WATER SUPPLY WELL
GRAVEL UTILITY ACCESS ROADS (TYP)
VERNAL POOL (TYP)
LIMIT OF BRI WETLANDS DELINEATION (TYP) SEE NOTE 2
LFG KNOCKOUT STRUCTURE (TYP)
CELL 14 PUMP STATION
CELL 13 PUMP STATION
CELL 12 PUMP STATION
PRIMARY ACCESS ROAD (TYP)
DETENTION POND 10
FORCE MAIN VAULT (TYP)
CATCH BASIN AND CULVERT (TYP)
RENEWABLE NATURAL GAS (RNG) FACILITY
LFG FLARE LOCATION
LEACHATE STORAGE TANK PUMP STATION
LEACHATE STORAGE TANK 1
PROPOSED LEACHATE STORAGE TANK 2
PROPOSED LEACHATE STORAGE TANK
250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT
DETENTION POND 14
CELL 11 PUMP STATION
RIPRAP DOWNSPOUT (TYP)
PROPOSED GUARDRAIL (TYP)
24" LFG HEADER (TYP)
LFG KNOCKOUT STRUCTURE (TYP)
UTILITY MANHOLE (TYP)
DETENTION POND 6
100-YEAR FLOOD ZONE SPECIAL FLOOD HAZARD AREA (TYP) SEE NOTE 3
DETENTION POND 13
CELL 20 PUMP STATION
FINAL LANDFILL ACCESS ROAD (TYP)
7.5% MIN (TYP)
10H:1V (TYP)
CELL 8 PUMP STATION
EXISTING CELLS LINER LIMIT (TYP)
(2) 24" HDPE CULVERTS
PERMANENT LANDFILL ACCESS ROAD
FINAL WASTE GRADES (TYP)
FENCE (TYP)
2.7H:1V (TYP)
8"x12" LEACHATE FORCEMAIN
PROPERTY LINE (TYP)
20'-WIDE GRAVEL ACCESS ROAD (TYP)
DEED RESTRICTION (TYP)
ELECTRICAL MANHOLE (TYP)
UNDERGROUND ELECTRIC (TYP)
DETENTION POND 2
LFG KNOCKOUT STRUCTURE AND VALVES
CELL 19 PUMP STATION
DETENTION POND 12
CELL 16 PUMP STATION
EXISTING EMH (TYP)
EXISTING FORCEMAIN VAULT (TYP)
CELL 5 PUMP STATION
CELL 4 PUMP STATION
DETENTION POND 1A (FORMER LEACHATE POND)
CELL 15 PUMP STATION
RIPRAP DITCH (TYP)
EXISTING 24" DIA LANDFILL GAS PIPE
8" GRAVITY SEWER IS ABANDONED
25-FOOT STREAM SETBACK
WATER LOADING RACK
DETENTION POND 1

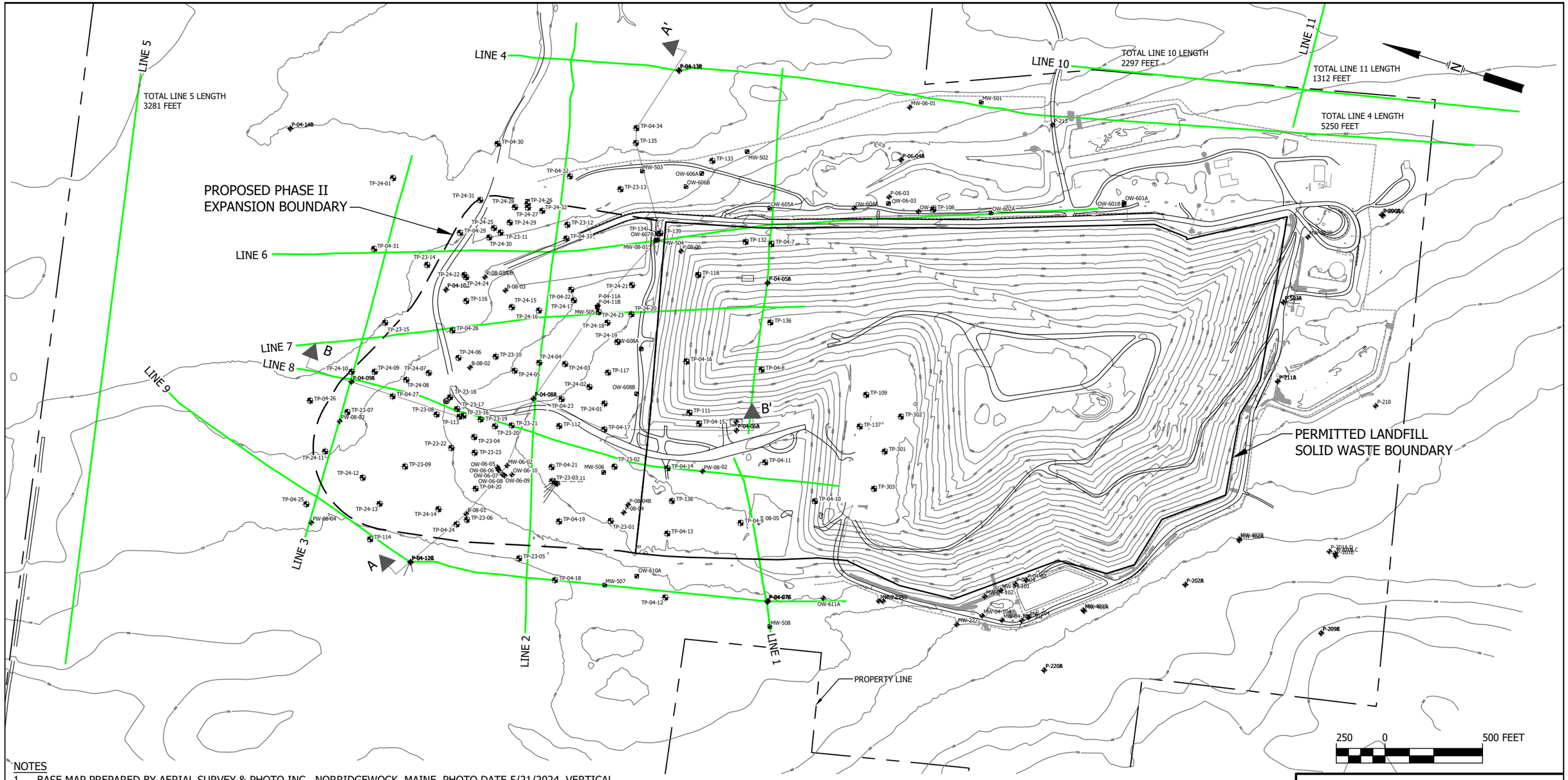
200 0 400 FEET

DWG: BASE LMN: FWG-FIG CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 11/6/2025

FIGURE 2-3
FINAL GRADING PLAN
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

\\Server\cds\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Plans\BASE.dwg, B_FIG 2-3, 11/6/2025 12:15:16 PM, sjm



NOTES

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC., NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. VERTICAL DATUM: BRASS PLUG AT FORMER LEACHATE POND PUMP STATION. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC, CUMBERLAND, MAINE.
2. REMAINDER OF BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC., NORRIDGEWOCK, MAINE. PHOTO DATE 6/24/21. VERTICAL DATUM: BRASS PLUG AT FORMER LEACHATE POND PUMP STATION. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS,INC, CUMBERLAND, MAINE.
3. PROPERTY LINE LOCATIONS ARE A RESULT OF FIELD SURVEY PERFORMED BY HERRICK AND SALSBURY, INC. LAND SURVEYORS, ELLSWORTH, MAINE FOR TRYTON TREE FARM PROJECT, PATTEN CORPORATION-DOWNEAST, OLD TOWN, MAINE, FEBRUARY 23, 1988, REVISED APRIL 7, 1988.
4. LOCATIONS OF EXPLORATIONS ARE APPROXIMATE.
5. DRAWING SHOULD NOT BE USED FOR DESIGN, QUANTITY TAKE-OFFS, GRADES, SURVEY ETC.

LEGEND

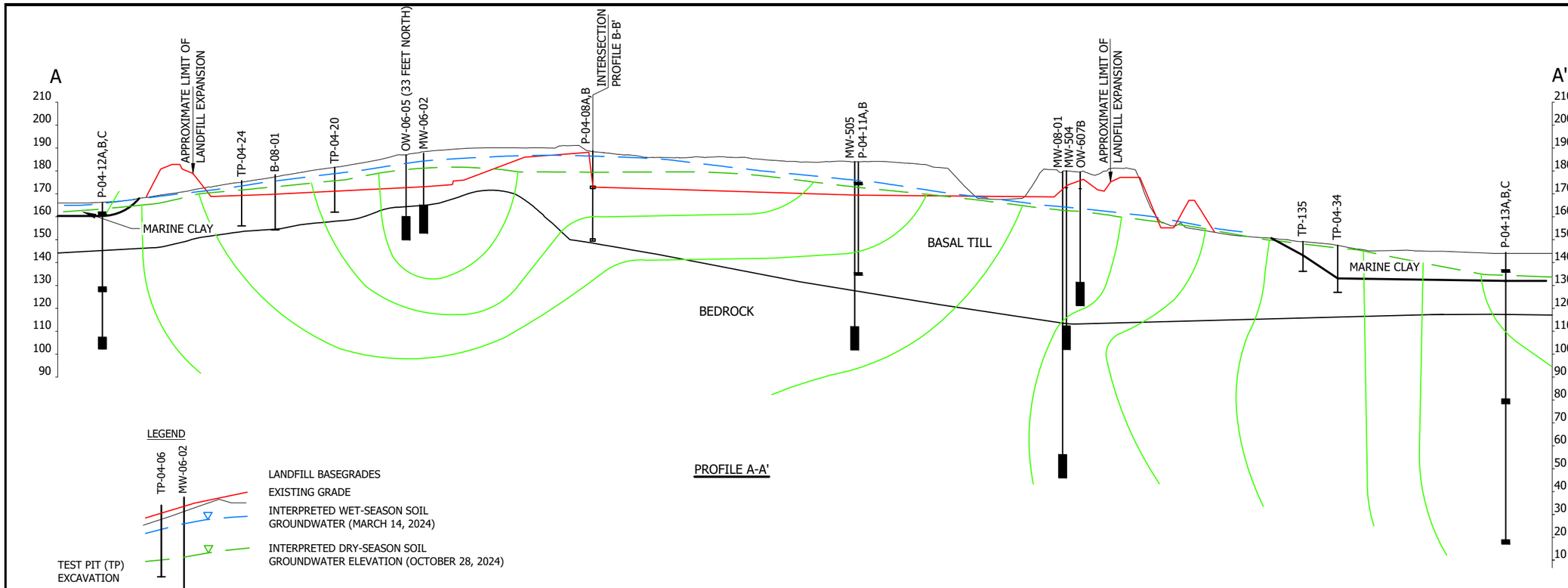
TP-23-05	TEST PIT LOCATION
P-220B	PIEZOMETER LOCATION
MW-06-02	MONITORING WELL LOCATION
OW-06-05	OBSERVATION WELL LOCATION
PW-08-01	AIR ROTARY BORING
LINE 1	EARTH RESISTIVITY AND VLF-EM SURVEY LINES AND DESIGNATIONS
A A'	INTERPRETED GEOLOGIC PROFILE LOCATION

FIGURE 2-4
SITE INVESTIGATION MAP
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: FIGURES LMN: SITE-INVESTIGATION CTB: SME-STD-HALF REV: 8/6/2025

\\Server\cds\Casella\OldTownLandfillExpansion\Phase II Expansion\Acad\Figures\FIGURES.dwg, B_FIG 2-4, 8/6/2025 1:46:48 PM, sjm



PROFILE A-A'

LEGEND

TP-04-06 MW-06-02

LANDFILL BASEGRADES

EXISTING GRADE

INTERPRETED WET-SEASON SOIL GROUNDWATER (MARCH 14, 2024)

INTERPRETED DRY-SEASON SOIL GROUNDWATER ELEVATION (OCTOBER 28, 2024)

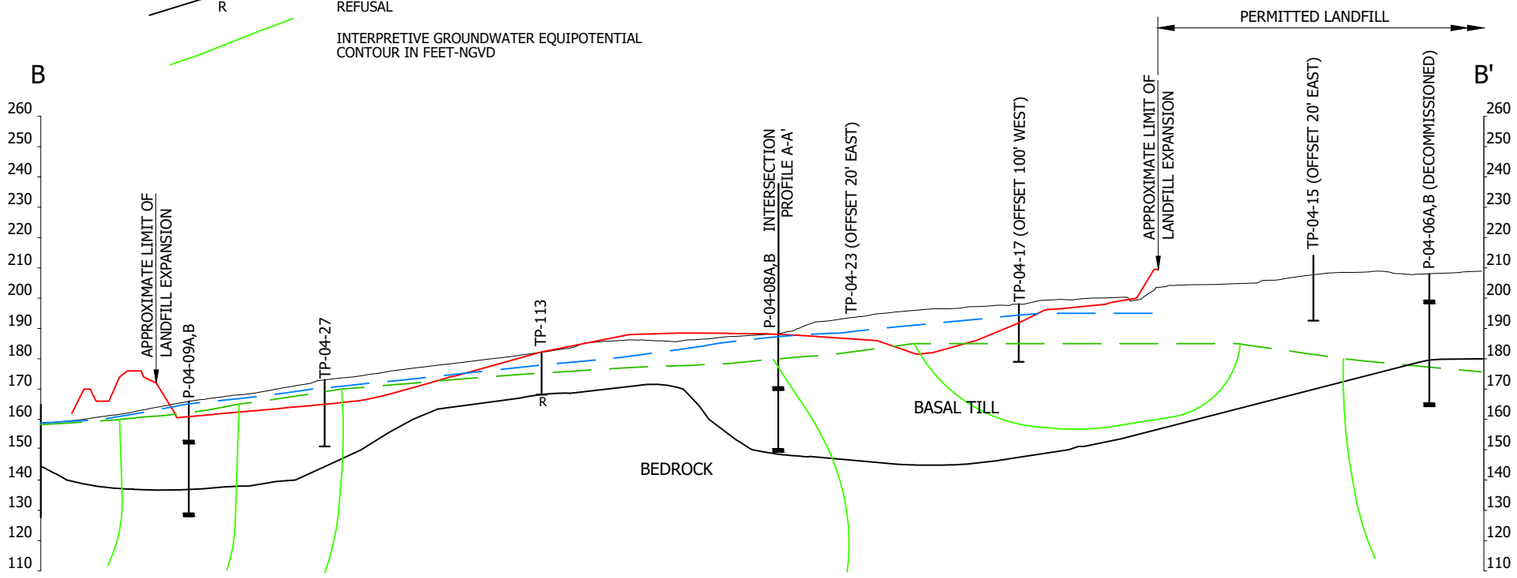
TEST PIT (TP) EXCAVATION

PIEZOMETER (P)/MONITORING WELL (MW) SCREEN INTERVAL

INTERPRETED BEDROCK SURFACE

R REFUSAL

INTERPRETIVE GROUNDWATER EQUIPOTENTIAL CONTOUR IN FEET-NGVD



PROFILE B-B'

GEOLOGIC LEGEND

MARINE CLAY - SOFT TO STIFF - GRAY TO BROWNISH GRAY SILTY CLAY WITH OCCASIONAL DISCONTINUOUS FINE SAND LENSES

BASAL TILL - VERY DENSE - COBBLY GRAVELLY SANDY SILTY-CLAY TO VERY SILTY SAND WITH FEW BOULDERS. RARE DISCONTINUOUS AND THIN (I.E.LESS THAN FEW INCHES THICK) SAND LENSES. RANDOMLY FISSILE THROUGHOUT. UPPER FEW FEET WEATHERED AND FRACTURED DUE TO FROST ACTION. TYPICALLY BROWNISH IN COLOR NEAR GROUND SURFACE AND JUST ABOVE BEDROCK. OCCASIONALLY GRAY IN DEEPER SOIL AREAS. BECOMING INTERBEDDED WITH SAND LENSES NEAR BEDROCK SURFACE IN SOME PLACES.

BEDROCK - INTERBEDDED METASILTSTONE, METAGRAYWACKE AND PHYLLITE. OCCASIONAL FRACTURES, TYPICALLY UNWEATHERED, BUT OCCASIONAL WEATHERED ZONES.

NOTES

1. GEOLOGIC UNITS ARE SHOWN SCHEMATICALLY. FIGURE SHOULD NOT BE USED FOR ENGINEERING DESIGN,QUANTITY TAKE-OFFS, GRADES, ETC.

2. THE GEOLOGIC UNITS REPRESENT AN INTERPRETATION OF THE TEST PIT AND BORING RESULTS. CONDITIONS MAY VARY FROM THAT SHOWN BETWEEN THE EXPLORATIONS. BOUNDARIES BETWEEN VARIOUS GEOLOGIC UNITS MAY VARY FROM THAT SHOWN AND MAY BE GRADATIONAL.

3. GROUND SURFACE TOPOGRAPHY FROM TOPOGRAPHIC MAP CREATED FROM MAY 21, 2024 AERIAL SURVEY.

4. VERTICAL EXAGGERATION OF PROFILES IS 10 TO 1.

5. SEE FIGURE 2-4 FOR PROFILE LOCATIONS.

125 0 250 500 FEET (HORZ)

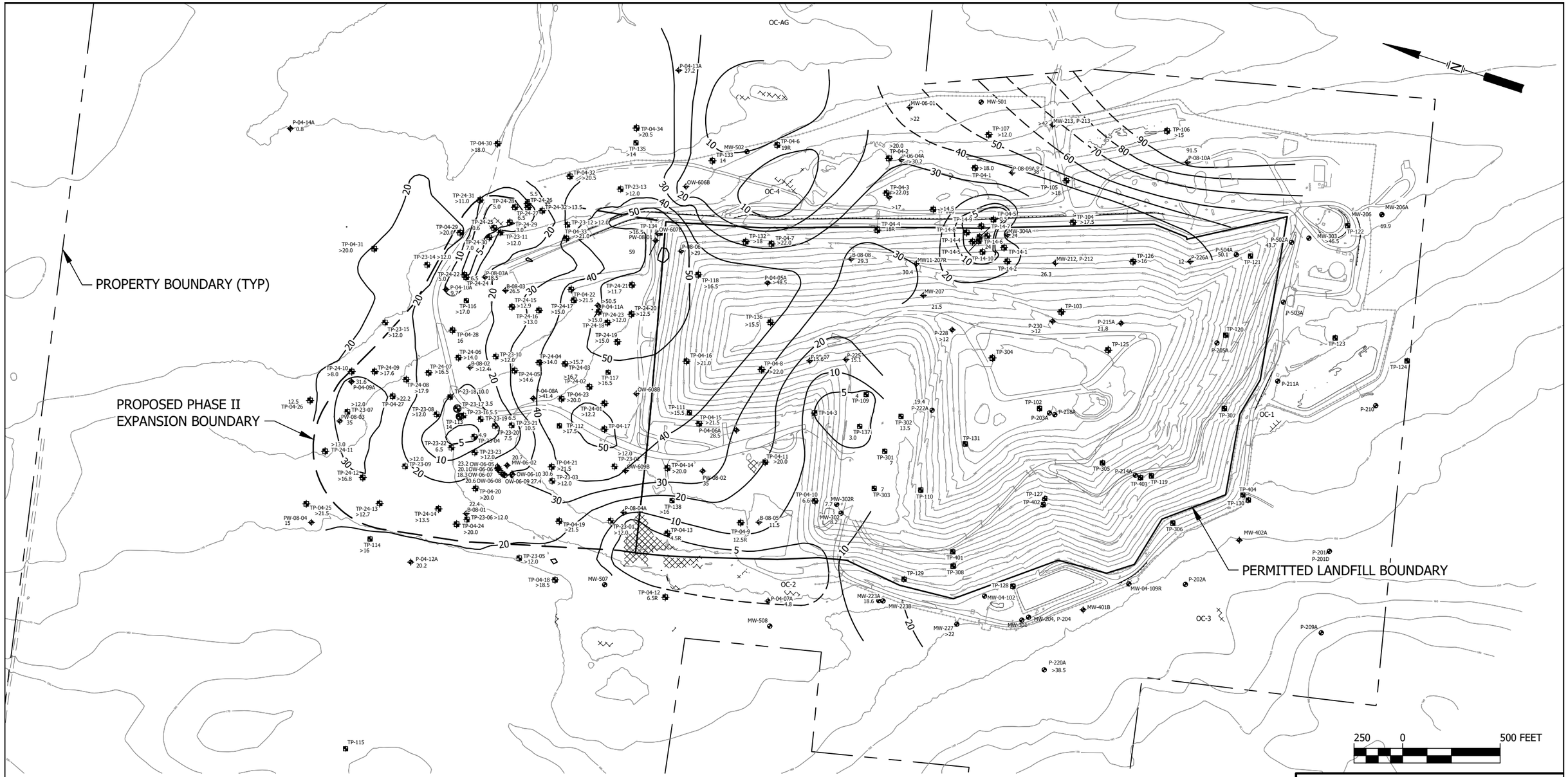
25 0 50 100 VEET (VERT)

FIGURE 2-5
INTERPRETED SUBSURFACE PROFILES
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: P-SECTION-HYDROGEO LMN: GEO-PROF-2025 CTB: SME-STD REV: 8/12/2025

\\Server\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\P-SECTION-HYDROGEO.dwg, B_FIG 2-5, 8/12/2025 6:18:51 PM, sjm



NOTES

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLIGSA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83.
2. PROPERTY LINE LOCATIONS ARE A RESULT OF FIELD SURVEY PERFORMED BY HERRICK AND SALSBURY, INC. LAND SURVEYORS, ELLSWORTH, MAINE FOR TRYTON TREE FARM PROJECT, PATTEN CORPORATION-DOWNEAST, OLD TOWN, MAINE, FEBRUARY 23, 1988, REVISED APRIL 7, 1988.
3. LOCATIONS OF EXPLORATIONS ARE APPROXIMATE.
4. INTERPRETATION OF SOIL ISOPACH CONTOURS BASED ON BORINGS, TEST PITS, SURFACE RESISTIVITY SURVEY AND OUTCROP OBSERVATIONS. ACTUAL CONFIGURATION SOIL THICKNESS MAY VARY FROM THAT SHOWN.
5. DRAWING SHOULD NOT BE USED FOR DESIGN, QUANTITY TAKE-OFFS, GRADES, SURVEY ETC.

LEGEND

TP-303 7	TEST PIT LOCATION WITH SOIL THICKNESS IN FEET
MW-207 21.5	BORING LOCATION WITH SOIL THICKNESS IN FEET
	BEDROCK OUTCROP (OUTCROPS WITH FRACTURE MEASUREMENTS ARE DESIGNATED OC-1 THRU OC-4 AND OC-AG)
10	INTERPRETED SOIL THICKNESS ISOPACH CONTOURS IN FEET

FIGURE 2-6
INTERPRETED
OVERBURDEN SOIL THICKNESS
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: FIGURES LMN: OVERBURDEN CTB: SME-STD-HALF REV: 8/6/2025

\\Serverfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\FIGURES.dwg, B_FIG 2-6, 8/6/2025 1:51:07 PM, sjm

LINE 5

LINE 4

LINE 10

LINE 11

LINE 6

PROPERTY LINE (TYP)

PROPOSED PHASE II
EXPANSION BOUNDARY

LINE 7

LINE 8

LINE 9

LINE 3

LINE 2

LINE 1

OC-AG

OC-4

OC-2

OC-1

OC-3

N

250 0 500 FEET

NOTES

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLIGSA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83.
2. PROPERTY LINE LOCATIONS ARE A RESULT OF FIELD SURVEY PERFORMED BY HERRICK AND SALSBURY, INC. LAND SURVEYORS, ELLSWORTH, MAINE FOR TRYTON TREE FARM PROJECT, PATTEN CORPORATION-DOWNEAST, OLD TOWN, MAINE, FEBRUARY 23, 1988, REVISED APRIL 7, 1988.
3. LOCATIONS OF EXPLORATIONS ARE APPROXIMATE.
4. INTERPRETATION OF BEDROCK ELEVATION CONTOURS BASED ON BORINGS, TEST PITS, SURFACE RESISTIVITY SURVEY AND OUTCROP OBSERVATIONS. ACTUAL CONFIGURATION OF BEDROCK SURFACE MAY VARY FROM THAT SHOWN.
5. DRAWING SHOULD NOT BE USED FOR DESIGN, QUANTITY TAKE-OFFS, GRADES, SURVEY ETC.

DWG: FIGURES LMN: BEDROCK CTB: SME-STD-HALF REV: 8/6/2025

LEGEND

80 — INTERPRETED BEDROCK SURFACE CONTOUR ELEVATION IN FEET-NGVD

LINE 2 — EARTH RESISTIVITY AND VLF-EM SURVEY LINE

LOW-ALTITUDE PHOTO LINEAMENTS (SEVEE & MAHER 1991, UPDATED 2008)

BEDDING (——) AND FRACTURE (– –) ORIENTATIONS MEASURED AT OUTCROPS; (LOCATION APPROXIMATE)

BEDROCK OUTCROPS (OUTCROPS WITH FRACTURE MEASUREMENTS ARE DESIGNATED OC-1 THRU OC-4 AND OC-AG)

TP-303 198 — TEST PIT LOCATION WITH ELEVATION OF BEDROCK SURFACE IN FEET-NGVD ("R" SUFFIX INDICATES BACKHOE REFUSAL)

MW-204 81.2 — BORING LOCATION WITH ELEVATION OF BEDROCK SURFACE IN FEET-NGVD ("R" SUFFIX INDICATES DRILLER REFUSAL)

FRACTURE STRIKE ROSE DIAGRAM FROM DOWNHOLE GEOPHYSICAL LOGGING. (NEG, 2009a)

FIGURE 2-7
INTERPRETED TOP OF BEDROCK ELEVATION CONTOURS
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

\\Server\cds\Caselia\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\FIGURES.dwg, B_FIG 2-7, 8/6/2025 1:53:10 PM, sjm

WELL IDENTIFICATION	GROUNDWATER LEVEL ELEVATION (FEET - NAVD88)	
	3/14/2024	10/28/2024
MW-04-105	-	156.86
MW-04-111	-	184.76
MW-05-01	191.02	-
MW-05-03	-	184.62
MW-06-01	-	163.82
MW-204	-	152.98
MW-206	-	193.87
MW-223B	-	166.77
MW-227	-	158.55
MW-401B	-	149.55
MW-402B	-	148.48
OW-06-03	-	180.53
OW-601B	-	176.25
OW-606B	-	161.78
OW-607B	162.72	160.77
OW-608B	194.55	189.97
OW-609B	197.09	184.14
OW-610A	174.51	169.84
P-04-02R	-	157.31
P-04-04	-	158.20
P-04-07C	172.91	171.41
P-04-08B	187.29	178.20
P-04-09B	165.45	162.21
P-04-10B	-	161.19
P-04-11B	175.01	<174.33
P-04-12C	165.64	163.29
P-04-13C	-	<142.78
P-04-14B	-	146.73
P-08-03B	-	<163.82
P-201D	-	144.20
P-202B	-	146.70
P-209B	-	155.81
P-211B	-	172.76

NOTES:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024.
2. WATER LEVEL ELEVATIONS AND INTERPRETED CONTOURS REPRESENT CONDITIONS RECORDED USING MANUAL WATER LEVEL MEASUREMENTS ON THE RESPECTIVE DATES SHOWN.
3. PIEZOMETERS P-209C, P-04-11B, P-04-13C, AND P-08-03B WERE DRY ON OCTOBER 28, 2024. PIEZOMETERS P-209B AND P-04-14B ARENEAR SURFACE BEDROCK WELLS.

LEGEND

- LANDFILL BOUNDARY (APPROXIMATE)
- 150 INTERPRETED DRY-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- 150 INTERPRETED WET-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- MW-401B EXISTING GROUNDWATER MONITORING WELLS AND PIEZOMETERS USED FOR INTERPRETATION

300 0 600 FEET

FIGURE 2-8
INTERPRETED OVERBURDEN GROUNDWATER ELEVATION CONTOURS
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER ENGINEERS

DWG: GW LMN: GW-OB CTB: SME-STD-HALF.CTB JOB#: 240102.05 REV: 8/6/2025

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LEGEND

12 CELL IDENTIFICATION

WETLAND DELINEATED

NOTES:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004 AND STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BASE GRADES IN PHASE II REPRESENT THE PREPARED SUBGRADE SURFACE BELOW THE UNDERDRAIN OR AUGMENTED LAYER. IN LOCATIONS THAT ARE NOT IDENTIFIED TO RECEIVE UNDERDRAIN OR AUGMENTED LINER, ONE FOOT OF NATIVE SOILS SHALL REMAIN IN PLACE ABOVE THE BASE GRADE. THE BASE LINER SYSTEM SHALL BE CONSTRUCTED ON THE RESULTING GRADE ABOVE THE UNDERDRAIN, AUGMENTED LINER, OR ONE FOOT OF NATIVE SOILS.

LIMIT OF BRI WETLANDS DELINEATION (TYP)

VERNAL POOL (TYP)

LIMIT OF PHASE II AUGMENTED LINER (TYP)

DETENTION POND 11R

250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT

EXISTING OVERHEAD ELECTRIC LINE (TYP)

PRIMARY ACCESS ROAD (TYP)

DETENTION POND 14

DETENTION POND 13

250' SIGNIFICANT VERNAL POOL CRITICAL TERRESTRIAL HABITAT

LIMIT OF PHASE I EXPANSION LINER (TYP)

LIMIT OF UNDERDRAIN AREA (TYP)

FENCE (TYP)

LIMIT OF PHASE II AUGMENTED LINER (TYP)

DEED RESTRICTION (TYP)

DETENTION POND 12

200 0 400 FEET

FIGURE 2-9
UNDERDRAIN AND
AUGMENTED LINER LOCATIONS
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: OM-SITE-DEV LMN: AUGM-LINR-LOC CTB: SME-STD-HALF.CTB JOB#: 240101 REV: 8/6/2025

\\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\OM-SITE-DEV.dwg, B_FIG 2-9, 8/6/2025 1:56:46 PM, sjm

3.0 GEOTECHNICAL INPUT PARAMETERS FOR STABILITY & SETTLEMENT ASSESSMENTS

Key input parameters for the assessment of slope stability and settlement of the proposed Phase II Expansion area include:

- Geotechnical properties of the foundation materials, liner system, waste mass, and cover system;
- Piezometric conditions (i.e., groundwater and leachate levels) within and beneath the expansion area; and
- Seismic loads that could potentially be imparted by the design earthquake.

The stability and settlement assessments described herein are based on the geotechnical input parameters presented in this Section. The geotechnical input parameters/engineering properties are based on substantial field and laboratory data obtained from prior site-specific subsurface investigations (as detailed in Volume II of this Application), construction quality control and conformance testing of similar geosynthetic materials and interfaces, historical instrumentation and performance monitoring, and published geotechnical literature.

The available data effectively define the site's existing geologic and hydrogeologic conditions and establish demonstrated geotechnical material properties for the Phase II Expansion's foundation soils, liner system, waste mass, and cover system.

3.1 Material Properties

The material properties selected for the stability and settlement assessments are based on data collected from previous field investigations and laboratory testing of the foundation soils, liner system, waste mass, and cover system; historical instrumentation and performance monitoring; and published geotechnical literature. The selected material properties are consistent with those used in prior site-specific assessments of stability and settlement (REW, 2005c; SME, 2015b; SME, 2024). The associated material properties are summarized in Table 3-1.

TABLE 3-1

SUMMARY OF MATERIAL PROPERTIES

Material	Unit Weight (pcf)	Effective Friction Angle (degrees)	Effective Cohesion (psf)	Load-Related Compression (Primary) (psf)	Non-Load-Related Consolidation Strain (Secondary)
Cover System[1,6]	125	30	0	N/A[8]	N/A[8]
Solid Waste[2,6]	74	32	0	E = 100,000	AWSR = 0.000004[9]
High-Strength Solid Waste[3,6]	74	>36	0	E = 200,000	AWSR = 0.000004[9]
Liner System[4,6]	120	See Note 4		N/A[8]	N/A[8]
Subgrade Fill / Perimeter Berms[5,6]	128	34	250	E = 1,440,000	N/A[8]
Gravel Roads[6]	130	34	0	N/A[8]	N/A[8]
Foundation Soil (Native Glacial Till)[6]	132	38	1000	E = 2,880,000	N/A[8]
Bedrock[6]	Impenetrable[7]			N/A[10]	N/A[10]

Notes:

1 Cover System properties applied for the Stability Assessment of the Foundation Soils, Liner System, & Waste Mass (Section 4.0). See Section 7.0 for Cover System interface friction properties used for the Stability Assessment of the Cover System.

2 "Solid Waste" represents the current and future JRL waste streams.

3 "High-Strength Solid Waste" represents selected waste capable of maintaining a 45-degree (1H:1V) slope angle.

4 Material properties for base liner system consist of minimum specified peak and large-displacement interface shear strength envelopes for the Phase II Expansion, as presented (and demonstrated from prior/historical interface strength testing associated with the construction of JRL Cell 16) in Attachment 1A.

5 Re-worked/compacted glacial till fill. Assumed lower unit weight, friction angle, and cohesion compared to intact native glacial till.

6 The selected material properties are generally consistent with prior site-specific assessments of stability and settlement (REW, 2005c; SME, 2015b; SME, 2024).

7 SLOPE/W terminology. Forces potential "failure" plains into overburden soils and/or along the soil-bedrock interface.

8 Layers are relatively thin and compacted during construction, making compressibility de minimis.

9 SME calculated a site-specific waste strain rate of 0.000004 (ft/ft)/day, which reduces to 4.5 percent strain at 30 years (i.e., the time from when the cover is installed to the end of the post-closure period), based on review of historical instrumentation, monitoring, and topographic data (see Attachment 1B).

10 Bedrock is assumed to be incompressible.

Abbreviations:

AWSR = Average Waste Strain Rate, average strain per day by the end of the post-closure period, (at 30-years = 4.5% strain).

E = Elastic modulus (i.e., Young's modulus of elasticity), pounds per square foot per unit of strain.

N/A = Not Applicable.

pcf = pounds per cubic foot.

psf = pounds per square foot.

Note that for the purposes of this assessment, no high-strength waste was used in the slope stability analyses described herein. High-strength waste is commonly used at/near perimeter sideslopes and for final grading/subgrade filling prior to construction of the final cover system, in accordance with the current Operations Manual (NEWSME, 2024); however, modeling of high-strength waste as part of this assessment could have caused an unconservative bias with respect to the FOS calculations.

3.2 Piezometric Conditions

Two potentiometric surfaces were used in the stability assessment (Section 4.0) as follows:

- Any groundwater/pore pressure in base grade "cut" areas will remain below the liner due to the proposed underdrain system. As such, the potentiometric surface in the foundation materials (i.e., below the liner system) will be limited to no higher than the bottom of the base liner. As a conservative assumption, SME assumed that the potentiometric surface beneath the proposed Phase II Expansion area is coincident with the bottom of the liner system, and that it approaches existing ground surface at/beyond the perimeter berms; and
- The liner system includes a leachate collection layer as described herein. Leachate in the landfill will be collected and controlled by the leachate collection system, which will maintain the level of leachate within the liner system. A second potentiometric surface coincident with the top of the liner system was conservatively applied in the slope stability assessment.

3.3 Seismic Loading Conditions

JRL is in a Seismic Impact Zone, as defined by Chapter 400 Section 1.Zz of the Rules (MEDEP, 2015). Therefore, seismic stability analyses were performed as described herein. SME assessed seismic stability using a "pseudo-static" approach, as presented in "RCRA Subtitle D (258) Seismic Design for Municipal Solid Waste Landfill Facilities" (United States Environmental Protection Agency [U.S.EPA], 1995), and the associated application of a site-specific seismic coefficient (C_s) to the seismic stability analyses described herein. The seismic coefficient is used to impart a lateral load to the assumed failure mass to represent the effects of seismic loading. For this evaluation, different seismic coefficients were developed for the post-closure (i.e., long-term) condition and the construction and operation (i.e., short-term) conditions, as described herein.

The seismic coefficient is related to a site's peak ground acceleration (PGA), seismic site classification, and waste height. Chapter 401 Section 2.F(1)(b) of the Rules indicates that seismic stability analyses are to be based on the maximum horizontal acceleration (i.e., PGA) in lithified earth material, having a 90 percent probability of not being exceeded within 250 years (post-closure period) or within 50 years (construction and operational periods). SME obtained the associated PGA values for the site from the 2023 National Seismic Hazard Model (USGS, 2023) and the USGS Earthquake Hazard Toolbox (USGS, 2024) and then adjusted them, as appropriate, to account for the influence of the site soils, engineered components, and the waste mass, as required by Chapter 401 Section 2.F(1)(b) of the Rules.

The reported PGA for lithified earth material having a 90 percent probability of not being exceeded within 250 years (post-closure period) ranges from 0.18g to 0.19g for seismic site classifications A, B, and B-C. The same range of 0.18g to 0.19g is reported for site classifications C, D, and E. The reported PGA

for lithified earth material having a 90 percent probability of not being exceeded within 50 years (construction and operation periods) is 0.06g for site classifications A, B, and B-C, and ranges from 0.06g to 0.07g for site classifications C, D, and E. The associated seismic hazard maps and output from the USGS Earthquake Hazard Toolbox are provided in Attachment 1C for reference.

SME selected 0.19g and 0.07g as the design PGAs at the base of the landfill for the post-closure and construction/operation periods, respectively. These base of landfill PGAs propagate upward through the waste deposit and are assumed to amplify (or potentially dampen) depending on the waste thickness and its density and seismic site classification (based on shear wave velocity). Review of the preliminary design drawings suggest future waste thicknesses of up to 215 feet in this area of the landfill. The site classification and/or shear wave velocity of the existing waste is not known; however, various researchers suggest that municipal solid waste (MSW) is typically characterized as soft to medium stiff soil (relative to seismic site classification) (Thusyanthan et. all, 2004).

Research by Singh and Sun (1995) has resulted in charts relating PGA at the base of the landfill to maximum accelerations at the top of the landfill, based on waste thickness and a seismic site classification ranging from soft to medium stiff. Interpretation of Singh and Sun's charts (see Attachment 1C) indicate maximum accelerations at the top of 100-foot and 200-foot waste deposits to be 0.28g and 0.16g, respectively, for a base of landfill PGA of 0.19g (post-closure period). Note the apparent dampening associated with the 200-foot waste thickness. The same charts indicate maximum accelerations at the top of 100-foot and 200-foot waste deposits of 0.12g and 0.06g, respectively, for a base of landfill PGA of 0.06g (operation and construction periods). Based on this information, SME conservatively selected 0.28g and 0.12g as the maximum top of landfill accelerations for the post-closure and construction/operation periods, respectively.

The pseudo-static stability methods presented in "RCRA Subtitle D (258) Seismic Design for Municipal Solid Waste Landfill Facilities" (U.S.EPA, 1995) allow the estimated peak accelerations to be reduced by a factor of 50 percent, based on studies by Hynes and Franklin (1984), to account for the time brevity of the peak acceleration during a typical earthquake event. Accordingly, SME selected seismic coefficients, C_s, of 0.14g and 0.06g for the post-closure and construction/operation periods, respectively, to apply in the seismic stability analyses.

4.0 STABILITY ASSESSMENT (FOUNDATION SOILS, LINER SYSTEM, & WASTE MASS)

SME assessed the stability of the Phase II Expansion relative to potential failure planes that pass through or along the foundation soils, liner system components, and/or waste mass, as required by Chapter 401 Section 2.F(1) of the Rules. Factor(s) of safety (FOS) for the construction/operation and post-closure periods were evaluated under both static and seismic loading conditions for a range of configurations associated with the proposed Phase II Expansion. The results of this assessment indicate FOS that meet or exceed the MEDEP's minimum recommended values, and that the proposed Phase II Expansion will be stable relative to potential failures that pass through or along the foundation soils, liner system, and/or waste mass.

Future stability assessments will be performed as part of the detailed design of each cell to confirm construction and operational phase stability and the results of this current stability assessment.

4.1 Selected Cross-Sections

SME reviewed existing subsurface conditions and the proposed features and components of the Phase II Expansion, as described herein, to select and develop three cross-sections for slope stability analysis. The selected cross-sections reflect potential worst-case operational and/or post-closure conditions relative to perimeter sideslope angles, waste thicknesses, foundation soil conditions, and/or liner slope angles.

- Cross-Section A-A' is aligned perpendicular to the western perimeter sideslope. Cross-Section A-A' was selected for analysis because it is perpendicular to a steep (2.7H:1V) and relatively tall (170 feet) perimeter sideslope, passes through the areas of proposed maximum waste height/elevation (El. 385 feet), includes an area of relatively steep liner slope (approximately 10 percent), and passes through a sedimentation basin at/along the western toe of the expansion;
- Cross-Section B-B' is aligned perpendicular to the northern perimeter sideslope. Cross-Section B-B' was selected for analysis because it is perpendicular to the steepest (2.7H:1V) and tallest (approximately 210 feet) perimeter sideslope, passes through areas with the proposed maximum waste height/elevation (El. 385 feet), and passes through a sedimentation basin at/along the northern toe of the expansion; and
- Cross-Section C-C' is perpendicular to the eastern perimeter sideslope. Cross-Section C-C' was selected because it is perpendicular to a steep (2.7H:1V) and relatively tall (170 feet) perimeter sideslope, passes through the area of maximum waste height/elevation (El. 385 feet), and passes through a sedimentation basin at/along the eastern toe.

The cross-section locations are depicted in Figures 4-1 and 4.2. The overall geometry and subsurface profile/internal geometry of Cross-Sections A-A', B-B', and C-C' are presented in Attachments 2A, 2B, and 2C, respectively.

4.2 Acceptance Criteria

Table 4-1 presents the minimum required FOS for the proposed Phase II Expansion to be considered stable, per Chapter 401 Sections 2.F(1) of the Rules. Stability was assessed based on the results of analyses performed using peak interface strengths and comparison of the calculated minimum FOS to the MEDEP's minimum required FOS.

TABLE 4-1

MEDEP MINIMUM REQUIRED FACTORS OF SAFETY RELATIVE TO SLOPE STABILITY (FOUNDATION SOILS, LINER SYSTEM, & WASTE MASS)

Period	Condition	Minimum Required FOS
Post-Closure (Long-Term)	Static	1.5
Post-Closure (Long-Term)	Seismic[1]	1.0[1]
Construction/Operation (Short-Term)	Static	1.3
Construction/Operation (Short-Term)	Seismic[2]	1.1[2]

Notes:

1 Based on application of a seismic coefficient developed based on the site-specific bedrock PGA having a 90% probability of not being exceeded in 250 years modified to account for the influence of overburden soils, engineered components, and waste mass.

2 Based on application of a seismic coefficient developed based on the site-specific bedrock PGA having a 90% probability of not being exceeded in 50 years modified to account for the influence of overburden soils, engineered components, and waste mass.

4.3 Analysis Methodology

The stability analyses were made using SLOPE/W (GeoStudio 2024), an industry-standard slope stability software program distributed by Seequent, and two-dimensional stability models (i.e., cross-sections) developed based on the proposed configuration of the Phase II Expansion and the extensive site-specific data described herein.

The analyses were performed using the Spencer Method, which is a limit equilibrium analysis that uses the method of slices and satisfies both force and moment equilibrium in its solutions. Limit equilibrium methods investigate the equilibrium of a soil mass tending to rotate or slide under the influence of gravity and other applied loads. Rotational and/or translational movement of the landfill is considered along a series of assumed or known potential "failure" planes. Limit equilibrium methods compare the forces, moments, and/or stresses that resist movement (e.g., shear strength) with those that can cause motion (e.g., gravity, pore-pressure, seismic, external applied loads). The output of the analysis is a FOS,

that is defined as the ratio of the shear strength (resisting force) to the shear stress (driving force) required for equilibrium.

SLOPE/W applies the selected limit equilibrium method to analyze potential failure surfaces and compute the associated FOS. For this assessment, thousands of potential failure surfaces were analyzed to calculate the minimum FOS for each loading condition. Surficial sloughing or other failure surfaces estimated to be non-critical were not used to represent the critical failure surface or define the minimum FOS. The minimum computed FOS was then compared to the MEDEP's recommended minimum FOS.

For this assessment, SME performed both static (i.e., non-earthquake) and seismic (i.e., earthquake) slope stability analyses for the loads resulting from the proposed grading/configuration shown in Figures 4-1 and 4-2. SME assessed the stability of the proposed Phase II Expansion relative to potential failure planes that pass through or along the foundation soils, liner system components, and/or waste mass. Circular-shaped (i.e., rotational) and block-shaped (i.e., translatory) potential failure surfaces were considered.

The seismic analyses consisted of a pseudo-static approach in which a horizontal force is applied to the static model to simulate earthquake-induced ground motion. The pseudo-static analysis followed the approach outlined in U.S. Environmental Protection Agency's (U.S.EPA) Subtitle D – Design Guidance (U.S.EPA, 1995). Based on the work of Hynes and Franklin (1984), a seismic coefficient equal to one-half the maximum ground acceleration (i.e., the peak ground acceleration, PGA) at the base of the landfill is applied to represent the horizontal force in a pseudo-static analysis. If the resulting seismic (i.e., pseudo-static) FOS is greater than or equal to 1.0, any earthquake-induced cover, waste/embankment, and/or liner deformations will be less than 12 inches (Hynes and Franklin, 1984). Six to 12 inches of seismically induced downslope displacement is generally considered tolerable in the design of landfill liners (Seed and Bonaparte, 1992).

4.4 SLOPE/W Model Development

Development of the SLOPE/W model for each cross-section included the following primary steps:

1. Defined overall external geometry/configuration (Section 2.1);
2. Defined subsurface profile and internal geometry (Sections 2.2 and 2.3);
3. Assigned material properties (i.e., unit weight and shear strength parameters) to the foundation soils, subgrade fill/perimeter berm materials, liner system, waste mass, and cover system, based on review of prior stability analyses, investigation data, empirical correlations, and/or engineering judgment (Section 3.1);

4. Defined piezometric conditions (i.e., groundwater and leachate levels) within the foundation soil(s) and waste mass (Section 3.2);
5. Defined and apply seismic loads, as applicable, which the landfill could potentially be subjected to as defined by the Rules (Section 3.3); and
6. Evaluated potential failure planes/slip surfaces that pass through or along the foundation soils, liner system components, and/or waste mass for both static (i.e., non-earthquake) and seismic (i.e., earthquake) loading conditions.

4.5 Analysis & Results

The lowest calculated FOS for potential failure planes/slip surfaces through the foundation materials, liner system, and/or waste mass are tabulated for each cross section in Table 4-2. The associated SLOPE/W output sheets for Cross-Sections A-A', B-B', and C-C' are provided in Attachments 2A, 2B, and 2C, respectively.

TABLE 4-2

SUMMARY OF MINIMUM CALCULATED SLOPE STABILITY FACTORS OF SAFETY RELATIVE TO SLOPE STABILITY

Post-Closure Period					
		Static Factors of Safety			
Slip Surface Location	Surface Shape	MEDEP Required Minimum	A-A'	B-B'	C-C'
Waste	Circular	1.5	1.70	1.69	1.71
Liner	Composite		1.69	1.60	1.67
Liner	Block		1.68	1.58	1.64
Foundation	Circular		2.24	2.09	2.56
		Seismic Factors of Safety			
Slip Surface Location	Surface Shape	MEDEP Required Minimum	A-A'	B-B'	C-C'
Waste	Circular	1.0	1.17	1.16	1.18
Liner	Block		1.12	1.05	1.10
Foundation	Circular		1.53	1.47	1.79
Construction/Operation Period					
		Static Factors of Safety			
Slip Surface Location	Surface Shape	MEDEP Required Minimum	A-A'	B-B'	C-C'
Waste	Circular	1.3	1.28	1.28	1.28
Liner	Block		1.33	1.32	1.33
		Seismic Factors of Safety			
Slip Surface Location	Surface Shape	MEDEP Required Minimum	A-A'	B-B'	C-C'
Waste	Circular	1.1	1.11	1.10	1.10
Liner	Block		1.14	1.13	1.14

Each slope stability FOS was calculated to be equal to or greater than the minimum values required by the Rules.

4.6 Seismic Liquefaction & Deformation Analyses

The seismic stability assessment included an evaluation of liquefaction potential (i.e., a liquefaction analysis) and an evaluation of potential deformation (i.e., a deformation analysis) due to earthquake-induced loading, as required by the Rules. The results of a prior site-specific liquefaction analysis (SME, 2015b) indicate that the site soils/foundation soil (i.e., dense glacial till) that underlie the existing landfill, and the Phase II Expansion area, are not susceptible to liquefaction during an earthquake. The prior site-specific liquefaction analysis is provided in Attachment 2D. Similarly, the results of a prior site-specific seismic deformation analysis (SME, 2015b) show that the liner and cover systems would deform less than 1 inch should earthquake conditions occur, which is well below the 6 to 12 inches of displacement that is generally considered acceptable for landfill liner and cover systems (Seed and Bonaparte, 1992). Therefore, seismic deformations will not compromise the liner (or final cover) systems. The prior site-specific deformation analysis is provided as Attachment 2E.

4.7 Discussion, Conclusions, & Recommendations

The results of this assessment indicate FOS that meet or exceed the MEDEP's minimum recommended values, and that the proposed Phase II Expansion will be stable relative to potential failures that pass through or along the foundation soils, liner system, and/or waste mass. Furthermore, each of the seismic slope stability factors of safety in Table 4-2 was calculated to be greater than 1.0, and as such, a seismic deformation analysis was not required; however, the results of a prior site-specific seismic deformation analysis (SME, 2015b) are provided for reference (Attachment 2E). Seismic factors of safety greater than 1.0 imply that earthquake-related deformations will be less than one foot, which is considered acceptable for solid waste landfills subjected to seismic loadings (U.S.EPA, 1995).

PHASE 2 EXPANSION
SOLID WASTE BOUNDARY

NON-POTABLE WATER
SUPPLY WELL

P-04-10B
P-08-03A
P-04-11B
P-04-09B
P-04-08B
MW-05-01/03
MW-04-111
P-04-12C
P-04-07C
OW-606B
OW-607B
OW-608B
OW-609B
OW-610A

A
A'
B
B'
C
C'

21
18
14
13
12
20
19
17
16
15

NOTES:
1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024.
2. WATER LEVEL ELEVATIONS AND INTERPRETED CONTOURS REPRESENT CONDITIONS RECORDED USING MANUAL WATER LEVEL MEASUREMENTS ON THE RESPECTIVE DATES SHOWN.
3. PIEZOMETERS P-209C, P-04-11B, P-04-13C, AND P-08-03B WERE DRY ON OCTOBER 28, 2024. PIEZOMETERS P-209B AND P-04-14B ARENEAR SURFACE BEDROCK WELLS.

LEGEND

- LANDFILL BOUNDARY (APPROXIMATE)
- 150 — INTERPRETED DRY-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- 150 — INTERPRETED WET-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- 180 — INTERPRETED BEDROCK SURFACE CONTOUR ELEVATION IN FEET-NGVD
- MW-401B — EXISTING GROUNDWATER MONITORING WELLS AND PIEZOMETERS USED FOR INTERPRETATION
- EVALUATED SLOPE STABILITY CROSS SECTION

125 0 250 FEET

FIGURE 4-1
CROSS-SECTION LOCATION PLAN
(FINAL GRADES)
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: GW LMN: GEOTECH-BG CTB: SME-STD-HALF.CTB JOB#: 240102.05 REV: 4/2/2025

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PHASE 2 EXPANSION
SOLID WASTE BOUNDARY

NON-POTABLE WATER
SUPPLY WELL

P-04-10B
P-08-03A
P-04-11B
P-04-09B
P-04-03B
MW-05-01/03
MW-04-111
P-04-12C
P-04-07C

OW-606B
OW-607B
OW-608B
OW-609B
OW-610A

A
A'
B
B'
C
C'

22
21
18
20
19
14
13
12
17
16
15

NOTES:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024.
2. WATER LEVEL ELEVATIONS AND INTERPRETED CONTOURS REPRESENT CONDITIONS RECORDED USING MANUAL WATER LEVEL MEASUREMENTS ON THE RESPECTIVE DATES SHOWN.
3. PIEZOMETERS P-209C, P-04-11B, P-04-13C, AND P-08-03B WERE DRY ON OCTOBER 28, 2024. PIEZOMETERS P-209B AND P-04-14B ARE NEAR SURFACE BEDROCK WELLS.

LEGEND

- LANDFILL BOUNDARY (APPROXIMATE)
- 150 — INTERPRETED DRY-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- 150 — INTERPRETED WET-SEASON GROUNDWATER LEVEL EQUIPOTENTIAL CONTOURS (FEET-NAVD88)
- 180 — INTERPRETED BEDROCK SURFACE CONTOUR (ELEVATION IN FEET-NGVD)
- MW-401B — EXISTING GROUNDWATER MONITORING WELLS AND PIEZOMETERS USED FOR INTERPRETATION
- EVALUATED SLOPE STABILITY CROSS SECTION

125 0 250 FEET

FIGURE 4-2
CROSS-SECTION LOCATION PLAN
(BASE GRADES)
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: GW LMN: GEOTECH-BG CTB: SME-STD-HALF.CTB JOB#: 240102.05 REV: 4/2/2025

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5.0 SETTLEMENT ASSESSMENTS

SME performed settlement assessments for the proposed Phase II Expansion, as required by Ch. 401 Sections 2.F(2) and 5.I(2), to:

- Quantify the anticipated settlements of the landfill foundation soils and waste mass; and
- Evaluate the effect of those settlements on the liner and leachate management systems, and the final cover system, respectively.

The assessments were based on the proposed grading of the Phase II Expansion and the extensive site-specific data referenced herein.

5.1 Settlement of Foundation Soils (Liner & Leachate Management Systems)

SME calculated settlement of the foundation soils to assess any potential impacts to the liner and/or leachate management systems, as required by Ch. 401 Section 2.F(2). The available site-specific data indicate that the foundation soils beneath the footprint of the proposed Phase II Expansion consist of dense to very dense glacial till of variable thickness. The glacial till has extremely low compressibility and is underlain by bedrock.

SME calculated settlement of the foundation soils (glacial till), and any associated subgrade fill (recompacted glacial till and/or imported granular fill), due to loads associated with the subsequent placement of the liner system, waste mass, and final cover. Most of the loading is attributable to the significant height/thickness of the waste mass in most areas. The settlement calculations were made using Hooke's Law and associated stress-strain formula, in which a soil's vertical strain (i.e., settlement) is directly proportional to changes in vertical stress, based on its modulus of elasticity (i.e., Young's modulus).

5.1.1 Inputs and Assumptions

Findings from prior site-specific investigations, as described herein, indicate that the overburden soil (i.e., foundation soil) beneath the Phase II Expansion area consists of dense glacial till that varies in thickness from approximately 0.5 to 50 feet. The average thickness of the glacial till foundation soil (between the landfill base grades and the top of bedrock surface) will be approximately 22 feet. Published geotechnical literature indicates that dense glacial till exhibits an elastic modulus, E, of 200,000 pounds per square inch (psi) (which is equivalent to 2,880,000 psf, as shown in Table 3-1) or more. For reworked and recompacted glacial till, SME assumed that the elastic modulus would be reduced by half (i.e., E = 1,440,000 psf, as shown in Table 3-1). The greater a soil's elastic modulus is, the more resistant the material is to strain (i.e., settlement) induced by an increase in stress (i.e., mass

landfill waste). Published literature indicates that bedrock typically bedrock exhibits an elastic modulus of 1,000,000 psi (144,000,000 psf) or more, which means that bedrock is essentially incompressible relative to landfill loads. Table 3-1 summarizes the assumed compressibility characteristics of each primary landfill material/system.

5.1.2 Analysis and Results

SME calculated the settlement of the foundation soils at several points across the Phase II Expansion area. The analysis point locations are indicated on figures provided in Attachment 3A. Those same figures also depict top of bedrock elevation contours, proposed base grades (and associated foundation soil thickness), groundwater elevation contours, and proposed final waste grades (and associated waste thickness).

SME developed a spreadsheet calculator to calculate settlement of the foundation soil due to the applied loads (waste) at each settlement analysis point, based on the various material thicknesses and compressibility parameters described herein. The location, existing ground surface elevation, top of bedrock elevation, groundwater elevation, proposed base grade, and proposed final grade are the primary inputs into the calculator, along with the assumed material unit weights and compressibility parameters summarized in Table 3-1. The spreadsheet calculations for foundation soils (liner and leachate management systems) are provided in Attachment 3B.

The analysis indicates that the dense to very dense glacial till foundation soils will settle less than 2 inches due to the applied loads. As such, it is estimated that base grade slopes (i.e., liner and leachate management systems) will change less than 0.1 percent relative to the design slopes and that any strains in geosynthetics or polyethylene (PE) pipe materials (due to changes in slope length) will be negligible. Therefore, any settlement of the foundation soils is not expected to affect the integrity or performance of the landfill liner or leachate management systems.

5.2 Settlement of the Waste Mass (Cover System)

SME calculated settlement of the waste mass to assess any potential impacts to the final cover system, as required by Ch. 401 Section 5.I(2). Site-specific data (and other published studies on solid waste) indicate that the JRL waste materials are highly compressible initially, and that the compression will occur relatively quickly during the operations period as the waste is placed to its full height. This initial primary settlement of the waste mass can be estimated using to Hooke's Law and stress-strain formula, as described above. Most of this primary settlement of the waste mass is expected to occur during the operational period, prior to construction of the final cover system.

5.2.1 Inputs and Assumptions

Prior site-specific analyses of waste settlement due to loading (due to self-weight of the waste mass) have assumed an elastic modulus, E, of 100,000 psf for the waste mass, as shown in Table 3-1). Site-specific landfill monitoring and survey data indicate that the JRL waste materials will also undergo secondary compression (non-stress-based strain) due to compression and decomposition of the waste over time. SME established a site-specific secondary compression strain rate of 0.000004 (ft/ft)/day, based on review of over 10 years of topographic survey data from inactive areas of the existing landfill (SME, 2015b). That prior evaluation of secondary compression (non-stress based strain) is provided in Attachment 1B. This strain rate equates to about 4.5 percent strain at 30 years (i.e., the time from when the cover is installed to the end of the post-closure period). This value was used to estimate settlement of the waste mass during the post-closure period.

5.2.2 Analysis and Results

SME calculated the settlement of the waste mass at several points across the Phase II Expansion area. The analysis point locations are indicated on figures provided in Attachment 3A. Those same figures also depict top of bedrock elevation contours, proposed base grades (and associated foundation soil thickness), groundwater elevation contours, and proposed final waste grades (and associated waste thickness).

SME developed a spreadsheet calculator to calculate settlement of the waste mass due to its self-weight (stress-based primary consolidation) and strain-based (secondary consolidation) loads at each settlement analysis point, based on the various material thicknesses and compressibility parameters described herein. The spreadsheet calculations for the waste mass (and the potential impact on the cover system) are provided in Attachment 3C.

Settlements ranging from 0 to 10 feet are predicted at the end of the 30-year post-closure period; however, the settlement is projected to occur in a gradual manner, and the cover system's initial design slopes are sufficient to maintain positive drainage and meet or exceed the minimum allowable post-consolidation slopes of 5 percent, as required in Ch. 401 Section 5.G(4). Further, the calculated tensile strains of less than 1 percent are below the maximum allowable strains recommended by geosynthetic manufacturers. As such, settlement of the waste is not expected to compromise the integrity or performance of the final cover system.

6.0 STABILITY AND SETTLEMENT MONITORING PLAN

SME developed a stability and settlement monitoring plan for the proposed Phase II Expansion, as required by Ch. 401 Section 2.F(3), based on the results of the stability and settlement assessments performed in accordance with Ch. 401 Sections 2.F(1) and 2.F(2), as described herein. Neither assessment identified any potential failure modes governed by the foundation soils. As such, no instrumentation is planned for the foundation soils beneath the footprint of the proposed Phase II Expansion. Further, the results of the required assessments indicate that the types and frequency of stability and settlement monitoring that have been employed at JRL since 2010 are appropriate for the proposed Phase II Expansion.

Therefore, the stability and settlement monitoring (i.e., geotechnical monitoring) for the proposed Phase II Expansion will consist of four primary activities and associated reporting:

- Visual observations and inspections of the landfill relative to slope stability, settlement, and general condition;
- Review of annual topographic survey data;
- Review of waste types, quantities, placement locations, and filling sequences; and
- Review and evaluation of fluid levels measured within the leachate collection layer of selected waste cells.

The stability and settlement monitoring plan for the proposed Phase II Expansion is incorporated into and presented with the sitewide Geotechnical Monitoring Plan (GMP), which is provided as Appendix N of the facility's Operations Manual (Volume IV).

7.0 STABILITY ASSESSMENT (COVER SYSTEM)

SME performed a stability assessment of the final cover system proposed for the Phase II Expansion, as required by Ch. 401 Section 5.I(1). This stability assessment considered potential failure planes that pass along and/or between the various layers of soil and geosynthetics intended for the cover system and focused on areas of the Phase II Expansion where the final perimeter sideslopes may be inclined as steep as 2.7 horizontal to 1 vertical (i.e., 20.3 degrees). The minimum FOS during the construction and post-closure periods were evaluated considering both static and seismic loading conditions, equipment loads/braking forces (during construction), and potential seepage forces (that may occur in the geocomposite drainage layer). This Section describes the geotechnical analyses performed. SME completed similar site-specific evaluations of cover system stability for the Stage 1 final cover (SME, 2022), Stage 2 final cover (SME, 2023), and Stage 3 final cover (SME, 2025).

This cover system stability assessment is based on substantial field and laboratory data obtained from prior site-specific construction quality control (CQC) and conformance testing from construction of the Stage 1 and Stage 2 final covers (refer to Attachments 4A and 4B). The results of the analyses presented herein demonstrate that the layout, grading, and materials intended for the Phase II Expansion's final cover will result in acceptable geotechnical performance in terms of slope stability.

7.1 Cover System Description

The Phase II Expansion's final cover area will be installed atop waste materials to be placed in future Cells 18, 19, 20, 21, and 22. The final cover grading and drainage features are shown in Figure 7-1. The final cover for the Phase II Expansion will include areas that range in slope from a maximum of 2.7H:1V (37 percent) along the perimeter slopes to a minimum of 13.3H:1V (7.5 percent) at the top of the landfill. The Phase II Expansion's final cover system will consist of the following layers (from the top down):

- 18 inches of vegetative cover soil (VCS, or cover soil);
- A drainage geocomposite;
- A 40-mil-thick LLDPE textured (on both sides) geomembrane;
- A GCL;
- 12 inches of compacted barrier soil; and
- 6 inches of construction fines or sand as a base grade bedding layer, which will separate the cover components from the underlying waste materials.

Figure 7-2 depicts a cross-section of the Phase II Expansion's final cover. Construction of the Phase II Expansion's final cover will involve shaping and grading of the future waste. Where necessary, additional solid waste and high-strength solid waste will be placed and compacted in accordance with the facility's Operations Plan to achieve the design base grades (cover system base grades). Subsequently, the base grade bedding layer will be placed to support and facilitate construction of the compacted barrier soil (glacial till) layer. The barrier layer will consist of 1-inch minus glacial till with a maximum hydraulic conductivity of $1x10^{-5}$ centimeters (cm)/second(sec). The GCL will be placed atop the barrier layer and then covered with a 40-mil LLDPE textured geomembrane. A drainage geocomposite will be installed atop the geomembrane to provide infiltration drainage and pore pressure relief for the cover soil, which will consist of 18 inches of vegetative soil with a maximum hydraulic conductivity of $1x10^{-5}$ cm/sec at the time of placement.

The Phase II Expansion's final cover will include 4-inch-diameter perforated HDPE underdrain pipes spaced at approximately 75-foot horizontal intervals and positioned above the geomembrane. The underdrain pipes will collect infiltration seepage from the drainage geocomposite and discharge it to a riprap-lined downspout or swale. The underdrain pipe spacing was established by preliminary drainage design calculations using the maximum allowable hydraulic conductivity of the cover soil (i.e., maximum infiltration) and the minimum specified transmissivity of the drainage geocomposite. The hydraulic conductivity of the cover soil and the transmissivity of the drainage geocomposite will both be confirmed via conformance testing prior to and during construction.

The Phase II Expansion's final cover will include surface terraces to collect precipitation runoff. These surface terraces will also likely be spaced at approximately 75-foot horizontal intervals on the 2.7H:1V sideslopes. The surface terraces will be cross-slope oriented and pitched to drain to central downspouts that will convey the runoff to the landfill perimeter. Figure 7-3 depicts the layout of the sideslope surface terraces relative to one another. Figure 7-4 shows a typical sideslope surface terrace and associated cover system underdrain.

7.2 Cover System Stability Assessment

SME performed a stability assessment of the proposed Phase II Expansion's final cover. The stability assessment considered potential failure planes that pass along and/or between the various layers of soil and geosynthetics intended for the cover system. SME calculated the minimum FOS for the cover construction and post-closure periods considering both static and seismic conditions and the associated loads/forces due to gravity, earthquake-related ground motions, construction equipment, and potential seepage.

7.2.1 Acceptance Criteria

Table 7-1 presents the minimum required FOS for the final cover to be considered stable, per Chapter 401 Sections 2.F(1) and 5.I(1) of the Maine Department of Environmental Protection's (MEDEP's) "Maine Solid Waste Management Rules" (Rules) (MEDEP, 2015). Stability was assessed based on the results of analyses performed using peak interface strengths, as recommended by Stark and Choi (2004), and comparison of the calculated minimum FOS to the MEDEP's minimum required FOS.

TABLE 7-1

MEDEP MINIMUM REQUIRED FACTORS OF SAFETY RELATIVE TO COVER SYSTEM STABILITY

Period	Condition	Minimum Required FOS
Post-Closure (Long-Term)	Static	1.5
Post-Closure (Long-Term)	Seismic[1]	1.0[1]
Construction (Short-Term)	Static	1.3
Construction (Short-Term)	Seismic[2]	1.1[2]

Notes:

1 Based on application of a seismic coefficient developed based on the site-specific bedrock PGA having a 90% probability of not being exceeded in 250 years modified to account for the influence of overburden soils, engineered components, and waste mass.

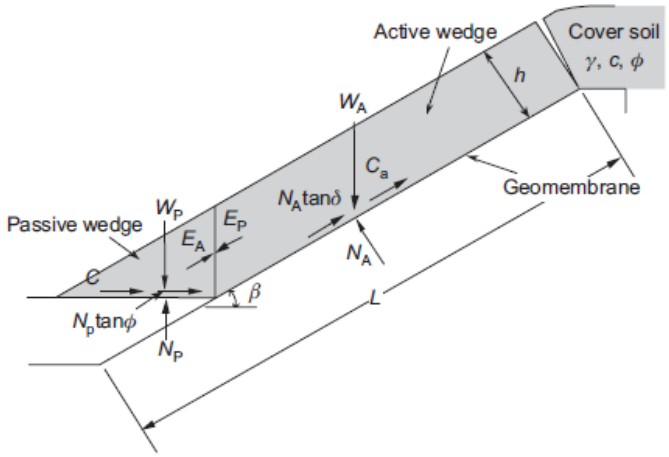
2 Based on application of a seismic coefficient developed based on the site-specific bedrock PGA having a 90% probability of not being exceeded in 50 years modified to account for the influence of overburden soils, engineered components, and waste mass.

7.2.2 Analysis Methodology

The cover system stability analyses were made using an in-house spreadsheet calculator developed based on industry-standard limit equilibrium methods presented and published in "Analysis and Design of Veneer Cover Soils" (Koerner & Soong, 2005). The method considers the equilibrium of a mass under the influence of gravity and other applied loads. The potential failure mechanism is downslope sliding along one or more cover system components due to insufficient component shear strength or insufficient shear strength at the interface between two adjacent components. The potential sliding mass is represented as a two-dimensional "two-part wedge" (with both active and passive components) or a two-dimensional "infinite slope" (with no passive resistance component due to the length of slope relative to the cover thickness and geometry of the "toe"), as illustrated in Figures 7-5 and 7-6.

FIGURE 7-5

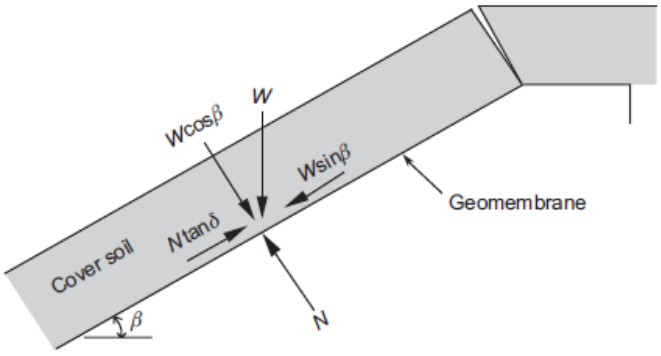
LIMIT EQUILIBRIUM FORCES ASSOCIATED WITH A FINITE LENGTH SLOPE



From Koerner & Soong, 2005.

FIGURE 7-6

LIMIT EQUILIBRIUM FORCES ASSOCIATED WITH AN INFINITE SLOPE



From Koerner & Soong, 2005.

The method and SME's associated in-house spreadsheet evaluate the FOS of the cover system relative to slope stability by summing forces parallel to the slope and comparing the forces that resist sliding (e.g., internal and/or frictional shear strength) with those forces that tend to cause sliding (e.g., gravity, construction equipment, seismic loading, or potential seepage/pore pressure), where:

$$FOS = \frac{\Sigma \text{ Resisting Forces}}{\Sigma \text{ Driving Forces}}$$

The calculated minimum FOS (based on analyses performed using peak interface strengths, as described herein) are then compared to the MEDEP's minimum required FOS. It should be noted that SME's spreadsheet calculator does not include any resistance generated by anchorage of, or tension in, the geosynthetic materials.

7.2.3 Geotechnical Parameters

Geotechnical parameters necessary for the evaluation of the proposed Phase II Expansion's final cover include the strength and density of the cover system soil layers, the strengths of the various cover system interfaces, and the strength and density of the underlying waste materials.

The Phase II Expansion's final cover will involve a buildup of multiple soil and geosynthetic layers (see Figure 7-2). Each layer and the layer-to-layer interfaces present potential planes of weakness relative to slope stability. The layer, or interface, with the lowest shear strength will control the overall slope stability of the cover system.

7.2.3.1 Cover System Soils and Underlying Waste Materials

Table 7-2 summarizes the relevant geotechnical parameters associated with each of the cover system's soil layers, as well as the underlying waste materials.

TABLE 7-2

COVER SYSTEM SOILS AND UNDERLYING WASTE MATERIALS

Soil / Material	Moist Density (pcf)	Saturated Density (pcf)	Friction Angle[1] (degrees)	Cohesion[1] (psf)
Vegetative Cover Soil	126	132	32	0
Compacted Glacial Till	125	135	>34	0
Base Grade Bedding Sand	115	125	>32	0
Construction Fines[2]	80	90	>32	0
Solid Waste[3]	74	74	>32	0
High Strength Solid Waste[4]	74	74	>36	0

Notes:

1 Soil parameters are similar to those used in the "Updated Geotechnical Stability Analysis" (REW, 2005) and are based on values in public technical literature, historical data from previous JRL geotechnical evaluations, and an understanding of how the vegetative cover soil will be placed.

2 Construction fines density values based on results of ASTM D 698 testing. Construction fines friction angle based on prior interface friction testing of fines against compacted glacial till.

3 Solid waste represents the waste placed prior to construction of the Phase II Expansion's final cover.

4 High strength solid waste represents selected waste that can sustain a 45-degree (1H:1V) slope angle. For the Phase II Expansion's final cover, high strength solid waste will be used where subgrade fill is required to achieve the design base grades (cover system base grades).

7.3.3.2 Cover System Interfaces

Table 7-3 summarizes relevant geotechnical parameters associated with each of the cover system's soil-to-geosynthetic and geosynthetic-to-geosynthetic interfaces. Table 7-3 reflects the minimum interface shear strengths specified in project Specification Section 02780 (i.e., Interfacial Friction Angle Conformance Testing), which is required prior to and during construction of the Phase II Expansion's final cover. The interface strengths assumed for this stability assessment have been confirmed by prior project-specific interface friction testing performed for both the Stage 1 and Stage 2 final covers. The prior project-specific test results are provided in Attachments 3B and 3C, respectively.

TABLE 7-3

COVER SYSTEM INTERFACE SHEAR STRENGTHS

Interface	Required Minimum Peak Strength[1,2]		Required Minimum Large Displacement Strength[1]	
	Normal Stress (psf)	Shear Stress (psf)	Normal Stress (psf)	Shear Stress (psf)
Vegetative Cover Soil to Drainage Geocomposite	100	89	100	56
	200	138	200	93
	400	235	400	165
Drainage Geocomposite to Textured Geomembrane	100	89	100	56
	200	138	200	93
	400	235	400	165
Textured Geomembrane to GCL[2]	100	89	100	56
	200	138	200	93
	400	235	400	165
GCL[2] to Compacted Glacial Till	100	89	100	56
	200	138	200	93
	400	235	400	165

Notes:

1 The required minimum peak and large displacement strengths are based on the minimum peak and large displacement strength envelopes specified in the Specification Section 02780.

2 The internal peak shear strength of the GCL shall exhibit a shear strength of at least 500 psf at a normal loading stress of 200 psf, as required by Specification Section 02780.

7.2.4 Loading Conditions

This stability assessment considers both static and seismic conditions during the construction and post-closure periods and the associated loads/forces due to gravity, earthquake-related ground motions, construction equipment, and potential seepage, as applicable.

7.2.4.1 Forces Due to Gravity Loading

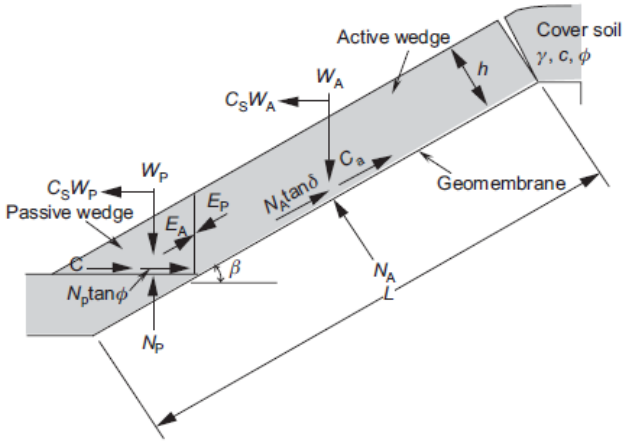
Figure 7-5 illustrates the "base" loading condition for a finite-length slope at angle β, with a uniformly thick cover soil (or a layered cover system) placed atop impervious geomembrane and/or GCL materials. This condition involves an active wedge on the slope, a passive wedge at the toe, and assumes a tension crack at the crest.

7.2.4.2 Forces Due to Seismic Loading

JRL is in a Seismic Impact Zone, as defined by Chapter 400 Section 1.ZZ of the Rules (MEDEP, 2015). As such, SME assessed seismic stability using a "pseudo-static" approach, as presented in "RCRA Subtitle D (258) Seismic Design for Municipal Solid Waste Landfill Facilities" (U.S.EPA, 1995), and the associated application of a site-specific seismic coefficient (C_s) to the seismic stability analyses. The seismic coefficient is used to impart a lateral load to the assumed sliding failure mass (i.e., the cover soil) to represent the effects of seismic loading, as illustrated in Figure 7-7. For this evaluation, different seismic coefficients were developed for the post-closure (i.e., long-term) condition and the construction (i.e., short-term) condition, as described herein.

FIGURE 7-7

ADDITION OF SEISMIC COEFFICIENT, C_S, TO LIMIT EQUILIBRIUM ANALYSIS



From Koerner & Soong, 2005.

The seismic coefficient is related to a site's peak ground acceleration (PGA), seismic site classification, and waste height. Chapter 401 Section 2.F(1)(b) of the Rules indicates that seismic stability analyses are to be based on the maximum horizontal acceleration (i.e., PGA) in lithified earth material, having a 90 percent probability of not being exceeded within 250 years (post-closure period) or within 50 years (construction and operational periods). SME obtained the associated PGA values for the site from the 2023 National Seismic Hazard Model (USGS, 2023) and the USGS Earthquake Hazard Toolbox (USGS, 2024) and then adjusted them, as appropriate, to account for

the influence of the site soils, engineered components, and the waste mass, as required by Chapter 401 Section 2.F(1)(b) of the Rules.

The reported PGA for lithified earth material having a 90 percent probability of not being exceeded within 250 years (post-closure period) ranges from 0.18g to 0.19g for seismic site classifications A, B, and B-C. The same range of 0.18g to 0.19g is reported for site classifications C, D, and E. The reported PGA for lithified earth material having a 90 percent probability of not being exceeded within 50 years (construction period) is 0.06g for site classifications A, B, and B-C, and ranges from 0.06g to 0.07g for site classifications C, D, and E. Output from the USGS Earthquake Hazard Toolbox is provided in Attachment 3C for reference.

SME selected 0.19g and 0.07g as the design PGAs at the base of the landfill for the post-closure and operation/construction periods, respectively. These base of landfill PGAs propagate upward through the waste deposit and are assumed to amplify (or potentially dampen) depending on the waste thickness and its density and seismic site classification (based on shear wave velocity). Review of preliminary design drawings suggest future waste thicknesses of up to 215 feet in this area of the landfill. The site classification and/or shear wave velocity of the existing waste is not known; however, various researchers suggest that municipal solid waste (MSW) is typically characterized as soft to medium stiff soil (relative to seismic site classification) (Thusyanthan et. all, 2004).

Research by Singh and Sun (1995) has resulted in charts relating PGA at the base of the landfill to maximum accelerations at the top of the landfill, based on waste thickness and a seismic site classification ranging from soft to medium stiff. Interpretation of Singh and Sun's charts (see Attachment 3C) indicate maximum accelerations at the top of 100-foot and 200-foot waste deposits to be 0.28g and 0.16g, respectively, for a base of landfill PGA of 0.19g (post-closure period). Note the apparent dampening associated with the 200-foot waste thickness. The same charts indicate maximum accelerations at the top of 100-foot and 200-foot waste deposits of 0.12g and 0.06g, respectively, for a base of landfill PGA of 0.06g (operation and construction periods). Based on this information, SME conservatively selected 0.28g and 0.12g as the maximum top of landfill accelerations for the post-closure and operation/construction periods, respectively. The pseudo-static stability methods presented in "RCRA Subtitle D (258) Seismic Design for Municipal Solid Waste Landfill Facilities" (USEPA, 1995) allow the estimated peak accelerations to be reduced by a factor of 50 percent to account for the time brevity of the peak acceleration during a typical earthquake event. Accordingly, SME selected seismic coefficients, C_s, of 0.14g and 0.06g for the post-closure and construction periods, respectively, to apply in the seismic stability analyses.

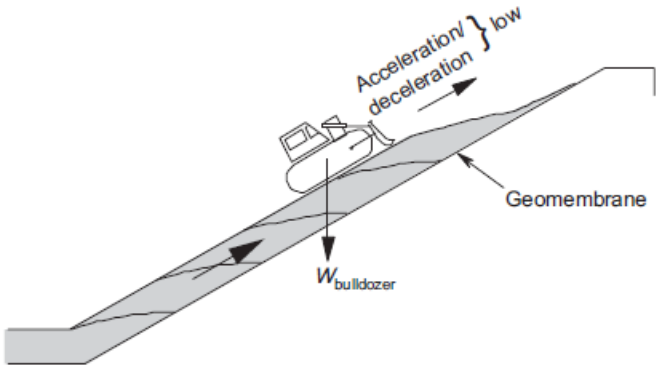
7.2.4.3 Forces Due to Equipment Loading

The placement of cover soil atop geosynthetics on a slope should proceed from the toe up to the crest (i.e., fill materials should be placed in the upslope direction) (Koerner and Soong, 2005). For

this construction (i.e., short-term) loading condition, the equipment live load is added to the base gravitational loading condition, as depicted in Figures 7-8 and 7-9.

FIGURE 7-8

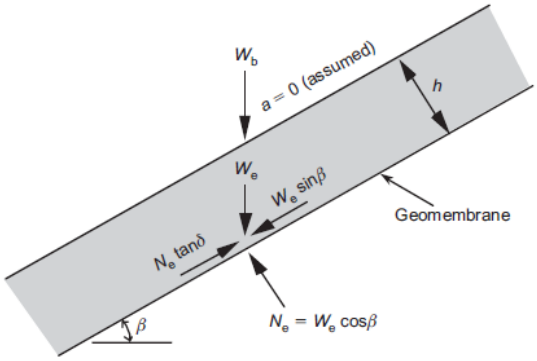
CONSTRUCTION EQUIPMENT PLACING FILL IN UPSLOPE DIRECTION



From Koerner & Soong, 2005.

FIGURE 7-9

ADDITION OF CONSTRUCTION EQUIPMENT LOAD TO LIMIT EQUILIBRIUM ANALYSIS



From Koerner & Soong, 2005.

For the purposes of this evaluation, SME has assumed that the cover soils will be placed using a Caterpillar (Cat) D6 or D6 XE with an operating weight of 48,500 to 49,100 pounds, a track shoe width of 2 feet, and a track length of about 9.7 feet. Cat D6 technical specifications are provided in Attachment 3D.

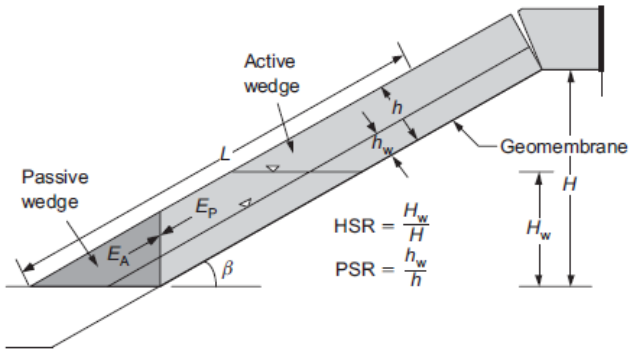
7.2.4.4 Consideration of Seepage Forces

The Phase II Expansion's final cover includes a drainage geocomposite to collect and transmit precipitation that infiltrates through the low-permeability cover soils. The cover design also incorporates surface terraces (on the 2.7H:1V sideslopes) and underdrain pipes spaced at approximately 75-foot intervals (on the 2.7H:1V sideslopes). The underdrains are designed to collect

and remove water from the drainage geocomposite at the specified intervals to maintain adequate drainage capacity within the composite and prevent the build-up of water or seepage within the cover soil. As such, the stability analyses described and performed herein assume no phreatic surface or seepage forces develop in the cover. However, in the unlikely event that the design capacity of drainage geocomposite becomes reduced (e.g., due to clogging or freezing), water can build-up in the cover soil as shown in Figure 7-10.

FIGURE 7-10

ILLUSTRATION OF POTENTIAL SEEPAGE BUILD-UP



From Koerner & Soong, 2005.

Therefore, SME analyzed the Phase II Expansion's final cover considering the potential for seepage forces to develop to highlight the importance of the drainage geocomposite, inclusion of underdrains at the specified intervals, and the specified conformance testing to confirm the hydraulic conductivity of the cover soil and transmissivity of the drainage geocomposite.

7.2.5 Analysis and Results

SME calculated the minimum FOS for the construction and post-closure periods considering both static and seismic conditions and the associated loads/forces due to gravity, construction equipment, earthquake-related ground motions, and potential seepage. The analyses used the geotechnical parameters presented in Tables 7-2 and 7-3 and applied forces due to gravity, seismic, construction equipment, and seepage, as applicable, as described in Sections 7.2.4.1, 7.2.4.2, 7.2.4.3, and 7.2.4.4, respectively.

Table 7-4 summarizes the interface slope stability FOS values calculated with respect to the Phase II Expansion's final cover slope angle, slope lengths, and applied forces described herein. The associated spreadsheet calculations are provided in Attachments 3E and 3F.

TABLE 7-4

CALCULATED SLOPE STABILITY FOS – COVER SYSTEM INTERFACES
(FINITE SLOPE LENGTHS)

Input Parameters	Cover System Slope					
	Peak Interface Strengths			Large Displacement Interface Strengths		
Slope Angle, H : V (horizontal to vertical)	**2.7H : 1V**	**-**	**Target FOS**	**2.7H : 1V**	**-**	**Target FOS**
Slope Angle, deg	20.3	-	-	20.3	-	-
Slope Length (plan view), feet	75	-	-	75	-	-
Slope Length (actual), feet	80	-	-	80	-	-
Cover Soil Unit Weight (moist), pcf	126	-	-	126	-	-
Cover Soil Unit Weight (saturated), pcf	132	-	-	132	-	-
Interface Friction Angle (geosynthetics), deg	26	-	-	20	-	-
Interface Adhesion (geosynthetics), psf	40	-	-	20	-	-
Slope Stability Conditions Analyzed	**Slope Stability Factor of Safety Peak Interface Strengths**			**Slope Stability Factor of Safety Large Displacement Strengths**		
Post-Closure, Gravity Forces (moist soil)	1.99	-	1.5	1.36	-	Na[1]
Post-Closure, Gravity Forces (saturated soil)	1.97	-	1.5	1.35	-	Na[1]
Post-Closure, Gravity Forces w/Seismic Forces	1.38	-	1.0	Na[1]	-	Na[1]
Construction, Gravity Forces w/Seismic Forces	1.68	-	1.1	Na[1]	-	Na[1]
Construction, Gravity Forces w/Equip. Forces	1.69	-	1.3	Na[1]	-	Na[1]

Notes:
[1] N_a = Not applicable to large-displacement interface conditions.

Table 7-5 summarizes the slope stability FOS values calculated for cover system soils via the "infinite slope" method, as described herein. This method yields a conservative lower bound estimate of the slope stability FOS for potential failure planes passing through the cover soil, barrier layer, or base grade bedding layer, in lieu of a planar failure along a soil-to-geosynthetic or geosynthetic-to-geosynthetic interface. The associated "infinite slope" spreadsheet calculations are provided in Attachment 3G.

TABLE 7-5

CALCULATED SLOPE STABILITY FOS – COVER SYSTEM SOILS
("INFINITE" SLOPE LENGTHS)

Input Parameters	Cover System Slope		
	Peak Internal Strengths		
Slope Angle, H : V (horizontal to vertical)	**2.7H : 1V**	**-**	**Target FOS**
Slope Angle, deg	20.3	-	-
Slope Stability Conditions Analyzed	**Infinite Slope Factor of Safety**		
Cover Soil (Vegetative Cover Soil) Internal Friction Angle = 32 deg	1.69	-	1.5
Barrier Layer (Compacted Glacial Till) Internal Friction Angle = 34 deg	1.82	-	1.5
Base Grade Bedding Layer (Sand or Waste Processing Fines) Internal Friction Angle = 32 deg	1.69	-	1.5

The Phase II Expansion's final cover was also analyzed relative to the unlikely development of a phreatic surface in the cover soil (i.e., the layer above the drainage geocomposite). That analysis considered seepage forces representative of water levels equivalent to 25 percent, 50 percent, 75 percent, and 100 percent of the slope's height above the toe (i.e., the horizontal submergence ratio, HSR, indicated in Figure 7-10) and the cover soil's thickness (i.e., the parallel submergence ratio, PSR, as shown in Figure 7-10). The results are summarized in Table 7-6. The results of this analysis demonstrate the importance of the drainage geocomposite, the inclusion of underdrains at the specified intervals (to prevent saturation of the drainage geocomposite), and the specified conformance testing to confirm that the hydraulic conductivity of the cover soil and transmissivity of the drainage geocomposite meet project specifications. The associated spreadsheet calculations are provided in Attachment 3H.

TABLE 7-6

CALCULATED SLOPE STABILITY FOS – CONSIDERING SEEPAGE FORCES (FINITE SLOPE LENGTHS)

Input Parameters	Cover System Slope					
	Peak Interface Strengths			Peak Interface Strengths		
Slope Angle, H : V (horizontal to vertical)	**2.7H : 1V (HSR)**	**2.7H : 1V (PSR)**	**Target FOS**	**10H : 1V (HSR)**	**10H : 1V (PSR)**	**Target FOS**
Slope Angle, deg	20.3	20.3	-	-	-	-
Slope Length (plan view), feet	75	75	-	-	-	-
Slope Length (actual), feet	80	80	-	-	-	-
Cover Soil Unit Weight (moist), pcf	126	126	-	-	-	-
Cover Soil Unit Weight (saturated), pcf	132	132	-	-	-	-
Interface Friction Angle (geosynthetics), deg	26	26	-	-	-	-
Interface Adhesion (geosynthetics), psf	40	40	-	-	-	-
Slope Stability Conditions Analyzed	**Slope Stability Factor of Safety Peak Interface Strengths**			**Slope Stability Factor of Safety Peak Interface Strengths**		
Post-Closure, Gravity Forces (saturated soil) w/Seepage Forces (25% HSR or PSR)	1.25	1.22	-	-	-	-
Post-Closure, Gravity Forces (saturated soil) w/Seepage Forces (50% HSR or PSR)	1.09	1.07	-	-	-	-
Post-Closure, Gravity Forces (saturated soil) w/Seepage Forces (75% HSR or PSR)	0.93	0.92	-	-	-	-
Post-Closure, Gravity Forces (saturated soil) w/Seepage Forces (100% HSR or PSR)	0.77	0.77	-	-	-	-

7.3 Discussion and Recommendations

SME completed a stability assessment for the proposed Phase II Expansion's final cover. The assessment considered potential failure planes that pass along and/or between the various layers of soil and geosynthetics intended for the cover system. In conducting the slope stability analyses, it was considered that the geotechnical properties of the cover materials, bedding layers, and waste materials (to achieve design base grades) to be used for construction of the Phase II Expansion's final cover will be

consistent with the geotechnical parameters indicated in Tables 7-2 and 7-3. The associated geotechnical parameters are based on substantial field and laboratory data obtained from prior site-specific investigations and CQC and conformance testing performed during construction of the Stage 1 and Stage 2 final covers. Conformance testing will be performed prior to and during construction of the Phase II Expansion's final cover to ensure that the proposed cover materials and construction methods are consistent with the geotechnical parameters assumed and indicated herein.

The calculated minimum FOS values for post-closure (i.e., long-term) static conditions (i.e., gravitational loading) and peak interface strength conditions exceeded 1.5, which is the minimum FOS required by the Rules for post-closure conditions. The results of the seismic stability analyses indicate that the minimum computed FOS for the post-closure and construction periods exceed the MEDEP's required minimum FOS of 1.0 and 1.1, respectively, for the corresponding periods. Seismic FOS values greater than 1.0 imply that earthquake-related deformations will be less than one foot, which is considered acceptable for solid waste landfills experiencing earthquake induced movements (U.S.EPA, 1995). The calculated minimum FOS values for construction (i.e., short-term) static conditions considering forces due equipment loading exceeded 1.3, minimum FOS required by the Rules for construction conditions. Note that the technical guidance advises against pushing soil in a downhill direction when above geosynthetic layers to avoid potential equipment induced slippage along the geosynthetic interface(s) (Koerner & Soong, 2005).

SME also analyzed the Phase II Expansion's final cover relative to the unlikely development of a phreatic surface in the cover soil. That analysis considered seepage forces representative of water levels equivalent to 25 percent, 50 percent, 75 percent, and 100 percent of the slope's height (horizontal seepage) and the cover soil's thickness (parallel seepage). As expected, as the water levels in the cover soil increase, the calculated slope stability factors of safety decrease. These results highlight the importance of the drainage geocomposite, the inclusion of underdrains at the specified intervals (to prevent saturation of the drainage geocomposite), and the specified conformance testing to confirm the hydraulic conductivity of the cover soil and transmissivity of the drainage geocomposite.

The results of the analyses presented herein demonstrate that the layout, grading, and materials intended for the Phase II Expansion's final cover will result in acceptable geotechnical performance in terms of slope stability. This cover stability assessment was prepared specifically for the proposed Phase II Expansion at the Juniper Ridge Landfill. In the event any changes to the Phase II Expansion's final cover configuration/grading, cover materials, or material properties are contemplated, SME recommends it be notified so that revisions to this assessment can be made, if warranted.

DETENTION POND 10 OUTLET CONTROL STRUCTURES TO REMAIN

DETENTION POND 10

OUTLET CONTROL STRUCTURE DP-11R

CB 4G AND SD 4G

TOE DITCH

DETENTION POND 11R

CB 4H AND SD 4H

EXISTING CULVERT PS-14

EXISTING CULVERT PS-11B-2

EXISTING CULVERT PS-13

EXISTING CB 4I AND CULVERT 4I

EXISTING CULVERT PS-11

EXISTING CULVERT 4IA

EXISTING CB 4JA-3 AND SD 4JA-3

EXISTTING CULVERTS 4JB AND 4JC

EXISTING CB 4JA AND SD 4JA

OUTLET CONTROL STRUCTURE DP-14

DETENTION POND 14

CB 4D AND SD 4D

DETENTION POND 13

OUTLET CONTROL STRUCTURE DP-13

CB 4C AND SD 4C

FINAL COVER RIPRAP DOWNSPOUT (TYP)

SIDESLOPE SURFACE TERRACE (TYP) SEE FIGURE 6-4

FINAL LANDFILL ACCESS ROAD (TYP)

7.5% MIN (TYP)

10H:1V (TYP)

FINAL WASTE GRADES (TYP)

2.7H:1V (TYP)

TOE DITCH

CB 2B AND SD 2B

CB 2E AND SD 2E

OUTLET CONTROL STRUCTURE DP-12

DETENTION POND 12

CB 2D AND SD 2D

EXISTING DITCH 2D

FINAL COVER SYSTEM SEE FIGURE 6-2

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
2. WETLAND BOUNDARIES DELINEATED BY BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.

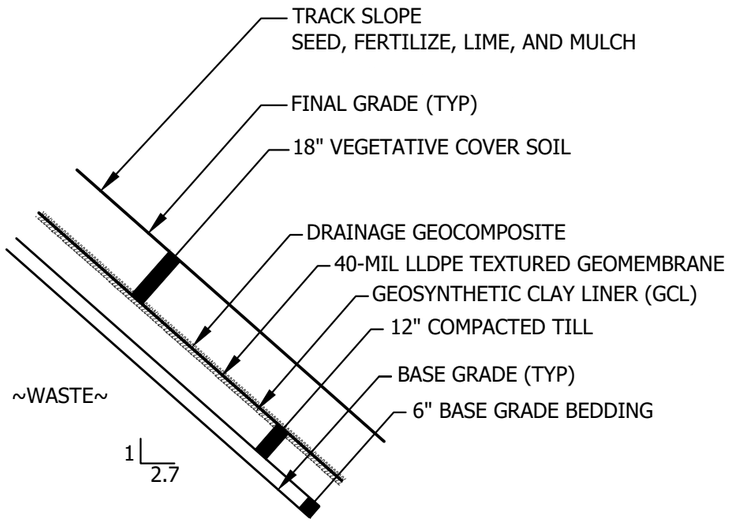
60 0 120 240 FEET

DWG: BASE LMN: FINAL-DRAIN-FIG 7-1 CTB: SME-STD.CTB JOB#: 240101 REV: 8/12/2025

FIGURE 7-1
FINAL COVER GRADING AND DRAINAGE FEATURES
PHASE II EXPANSION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

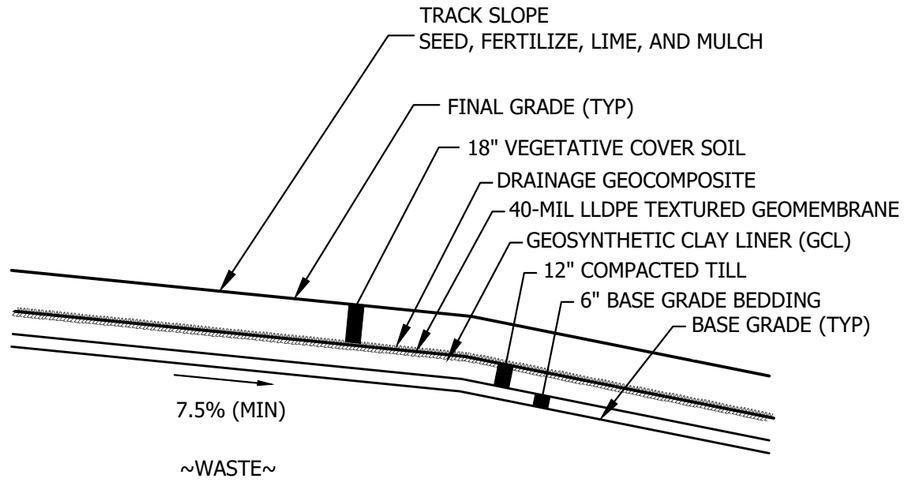
SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

\\Newnet\Sh\Clients\JCW\Town Landfill\Expansion\Phase II Expansion\Acad\Plans\BASE.dwg 10/7/1, 8/12/2025 6:22:59 PM, kjm



FINAL COVER SYSTEM ON SIDESLOPES

NTS



FINAL COVER SYSTEM AT TOP OF LANDFILL

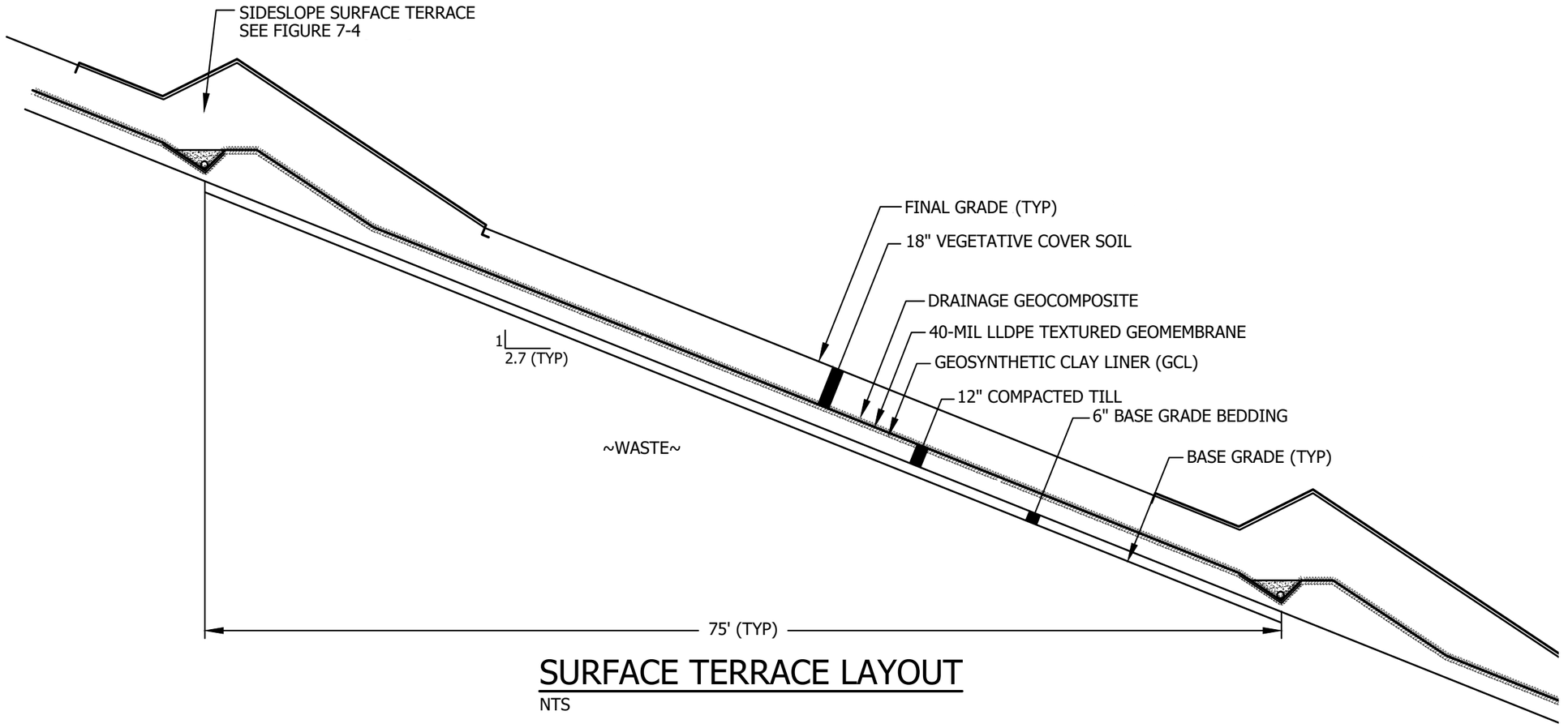
NTS

FIGURE 7-2
FINAL COVER CROSS-SECTIONS
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
NEWSME LANDFILL OPERATIONS LLC
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: DETAILS LMN: NONE CTB: SME-STD.CTB JOB#: 240101 REV: 8/12/2025

\\Serverdc\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\DETAILS.dwg, B_FIG 7-2, 8/12/2025 6:24:50 PM, sjm



SURFACE TERRACE LAYOUT

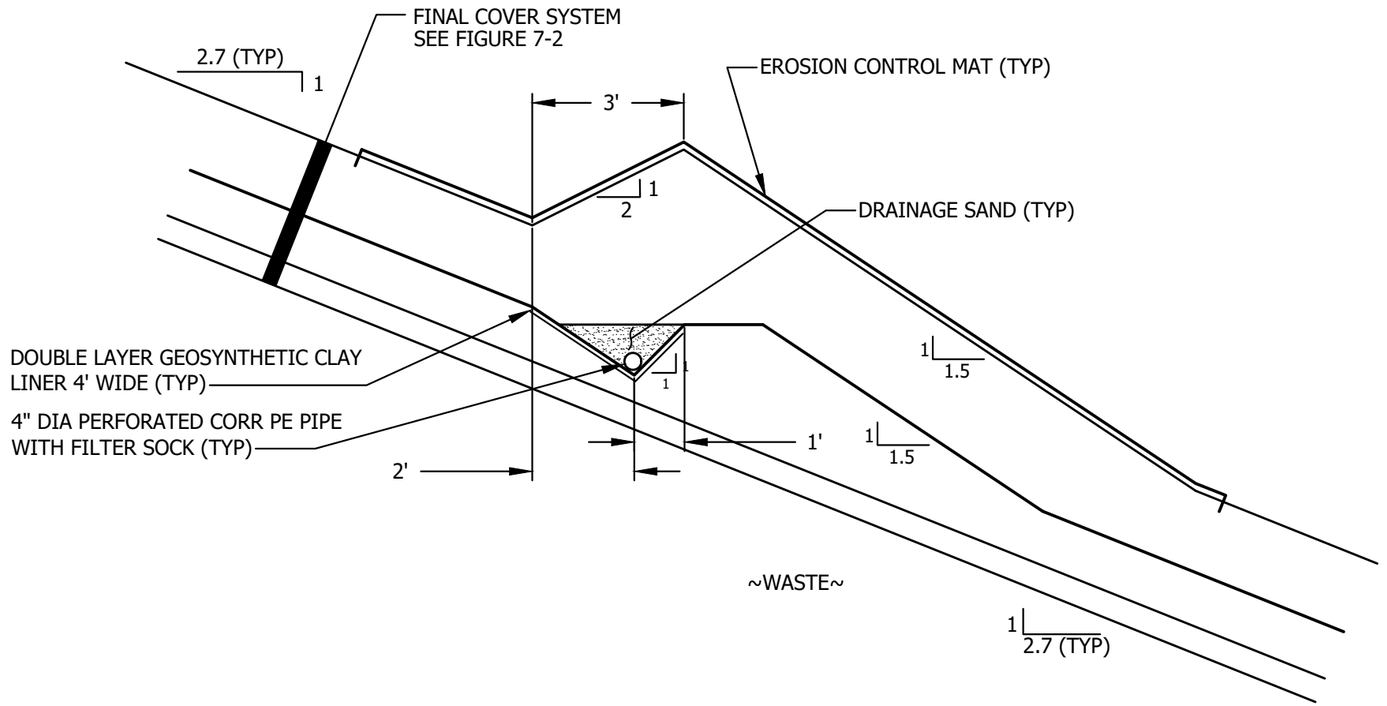
NTS

FIGURE 7-3
SURFACE TERRACE LAYOUT
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
NEWSME LANDFILL OPERATIONS LLC
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: DETAILS LMN: NONE CTB: SME-STD.CTB JOB#: 240101 REV: 8/12/2025

\\Nserver\cfs\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad Figures\DETAILS.dwg, B_FIG 7-3, 8/12/2025 6:25:09 PM, sjm



SIDESLOPE SURFACE TERRACE

NTS

FIGURE 7-4
SIDELSOPE SURFACE TERRACE
PHASE II EXPANSION
JUNIPER RIDGE LANDFILL
NEWSME LANDFILL OPERATIONS LLC
OLD TOWN, MAINE

SME
SEVEE & MAHER
ENGINEERS

DWG: DETAILS LMN: NONE CTB: SME-STD.CTB JOB#: 240101 REV: 8/12/2025

\\Server\cds\Casella\OldTownLandfill\Expansion\Phase II Expansion\Acad\Figures\DETAILS.dwg, B_FIG 7-4, 8/12/2025 6:26:11 PM, sjm

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Based on interpretation of available data, previous field and laboratory testing, and the slope stability and settlement assessments completed for the proposed Phase II Expansion as described in this Report, SME reached the following conclusions:

- The calculated static and seismic slope stability FOS meet or exceed the MEDEP's minimum recommended values, and indicate that the proposed Phase II Expansion will be stable relative to potential failures that pass through or along the foundation soils, liner system, and/or waste mass;
- Settlement of the foundation soils (due to loading of the overlying waste mass) is expected to be negligible and not of sufficient size to adversely affect the performance of the liner or leachate management systems;
- Settlement of the waste mass will occur during and following waste placement. Most of the primary settlement is expected to occur during the operational period, prior to construction of the final cover system. Post-closure secondary compression (non-stress-based strain) due to compression and decomposition of the waste over time will result in up to 10 feet of settlement of the waste mass at the end of the 30-year post-closure period; however, the settlement is projected to occur in a gradual manner, and the cover system's initial design slopes are sufficient to maintain positive drainage and meet or exceed the minimum allowable post-consolidation slopes of 5 percent, as required in Ch. 401 Section 5.G(4). Further, the calculated tensile strains of less than 1 percent are well below the maximum allowable strains recommended by geosynthetic manufacturers. As such, settlement of the waste is not expected to compromise the integrity or performance of the final cover system; and
- The calculated static and seismic slope stability FOS for the final cover system meet or exceed the MEDEP's minimum recommended values and demonstrate that the layout, grading, and materials intended for the Phase II Expansion's final cover will result in acceptable geotechnical performance in terms of slope stability.

8.2 Recommendations

The following recommendations are offered:

- During the initial stages of construction, excavation to base grade will extend below the existing groundwater table in some areas. This will induce groundwater seepage into excavations, which must be controlled to provide for a stable excavation and subgrade and during construction of the underdrain system and to facilitate adequate compaction of the soil portion of the liner

system located above the underdrain system. It will be important to properly dewater and provide adequate drainage for any groundwater seepage into the excavation;

- During operations, stable landfill sideslopes can be maintained without impending threats of static or seismic instability, provided the waste streams delivered to the landfill remain the same or similar to those described herein, and the filling practices described in the landfill operations manual are followed. Excessive waste lift thicknesses and areas of concentrated waste filling should be avoided as both conditions can cause undesirable stress imbalances within the waste mass and/or liner system, which could lead to localized instability of the waste; and
- A portion of the waste stream includes wastewater treatment plant (WWTP) sludge, which at times can be wet and low in shear strength. The operations manual requires that the landfill operator avoid the placement of any wet sludge near the exterior sideslopes of the final landfill configuration. The operations manual requires that unmixed sludge be placed at least 50 feet away from an active cell's exterior sideslope and that sludge mixed with high-strength waste (e.g., CDD) will not be placed within 25 feet from an exterior (i.e., final) sideslope. Mixtures of wet and/or low-strength waste with high strength waste should be of consistency such that landfill compaction equipment can travel over and densify the mixed waste after it has been placed. Only high strength should be placed within 25 feet of the exterior sideslopes as per the operations manual.

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ATTACHMENT 1

GEOTECHNICAL INPUT PARAMETERS

1A SPECIFIED LINER SYSTEM SHEAR STRENGTHS (AND INTERFACE TEST RESULTS FROM CELL 16)

1B ESTIMATED POST-CLOSURE WASTE SETTLEMENT COEFFICIENT (STRAIN RATE)

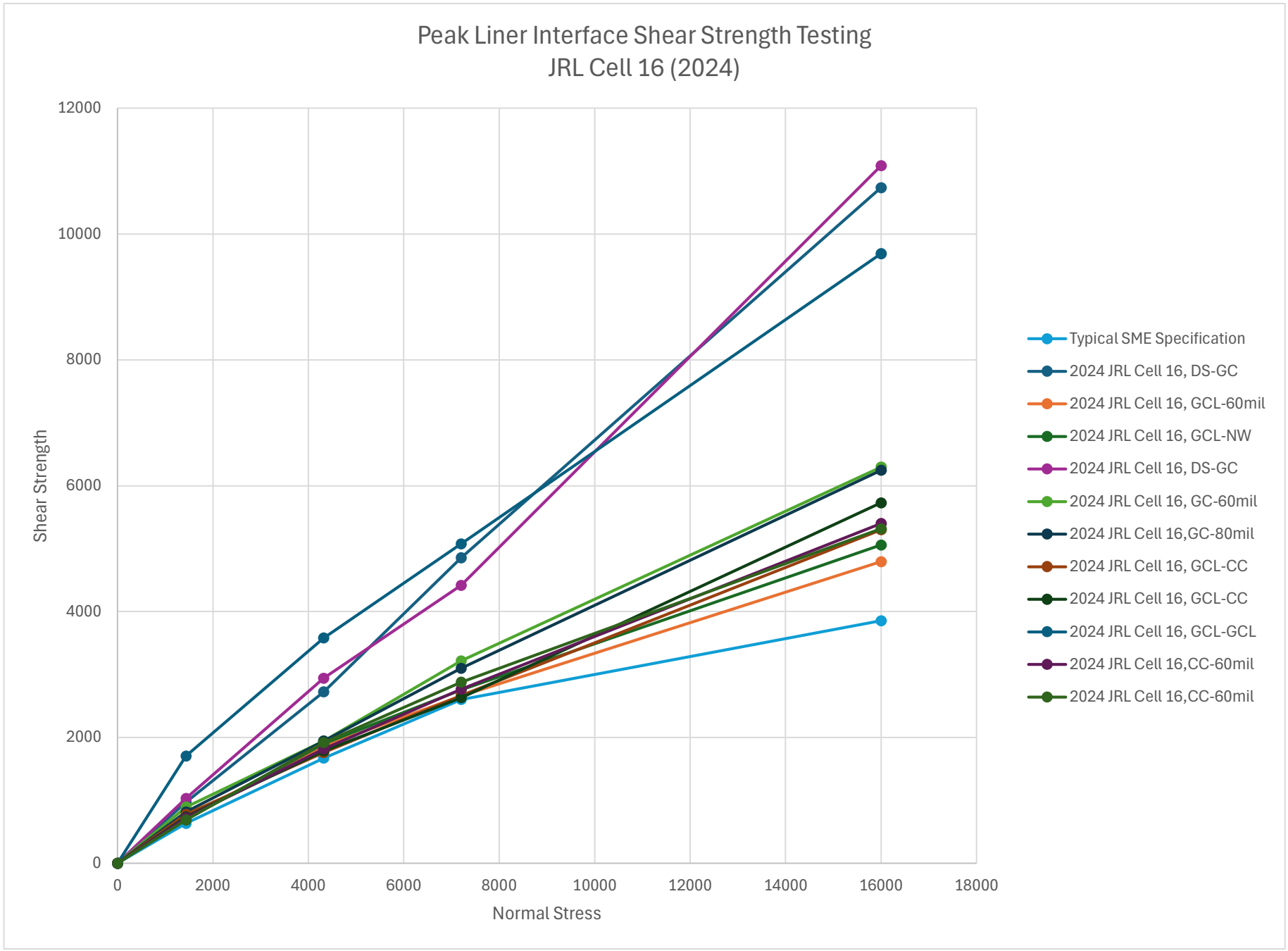
1C SEISMIC HAZARD MAPS/DATA

SME
SEVEE & MAHER
ENGINEERS

1A

SPECIFIED LINER SYSTEM SHEAR STRENGTHS (AND INTERFACE TEST RESULTS FROM CELL 16)

SME
SEVEE & MAHER
ENGINEERS


Peak Liner Interface Shear Strength Testing
JRL Cell 16 (2024)
Shear Strength
Normal Stress
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
Typical SME Specification
2024 JRL Cell 16, DS-GC
2024 JRL Cell 16, GCL-60mil
2024 JRL Cell 16, GCL-NW
2024 JRL Cell 16, DS-GC
2024 JRL Cell 16, GC-60mil
2024 JRL Cell 16,GC-80mil
2024 JRL Cell 16, GCL-CC
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2024 JRL Cell 16,CC-60mil
2024 JRL Cell 16,CC-60mil

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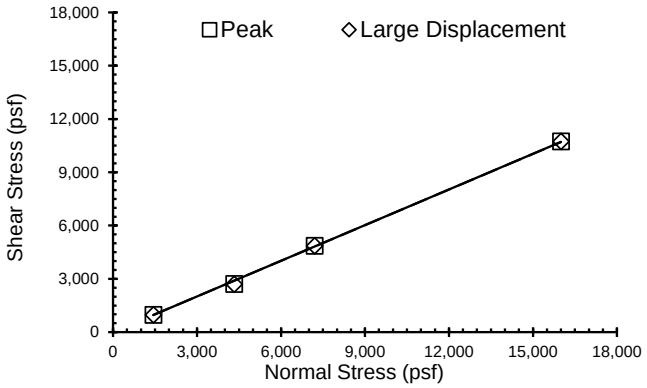
REVIEWED
By Darren Ward at 1:52 pm, Apr 02, 2024

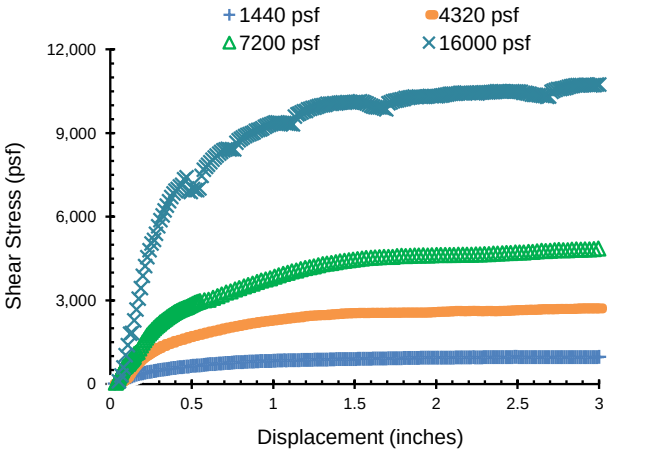
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-1
Richard S. Lacey, P.E. 4/2/2024
Analysis & Quality Review/Date

Drainage Sand vs.
SKAPS TN250-2-6 DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	33.8	33.8
Y-intercept or Adhesion	psf	0	0
Minimum Secant Angle	Degrees	32.2	32.1

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Drainage Sand	
	(Tamped in place at 3.8% m.c.)	
Lower Box	SKAPS TN250-2-6 DS Geocomposite	
	R# 0140191020025	
Conditioning	Interface soaked at 1 psi for 1 hour. Normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	10
Bearing Slide Resistance		lbs	22	49	76	114
Peak	Shear Stress	psf	970	2,723	4,855	10,737
	Secant Angle	deg.	34.0	32.2	34.0	33.9
Large Displacement	Shear Stress	psf	970	2,705	4,855	10,737
	Secant Angle	deg.	34.0	32.1	34.0	33.9

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

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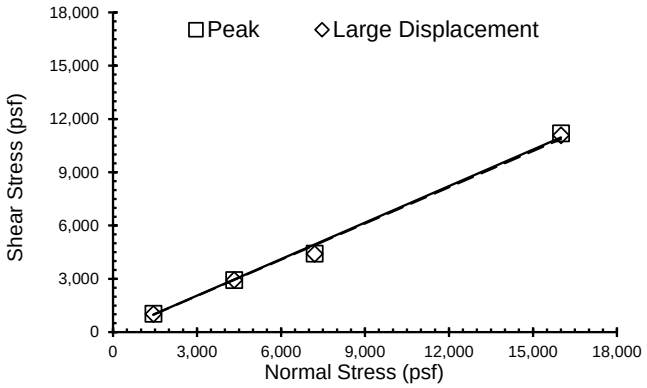
REVIEWED
By Darren Ward at 1:52 pm, Apr 02, 2024

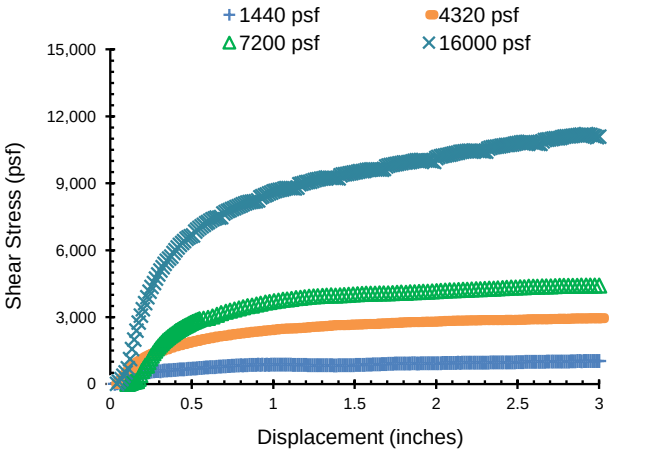
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-2
Richard S. Lacey, P.E. 4/2/2024
Analysis & Quality Review/Date

Drainage Sand vs.
SKAPS TN160-2-6 DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	34.4	34.2
Y-intercept or Adhesion	psf	0	0
Minimum Secant Angle	Degrees	31.5	31.5

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Drainage Sand	
	(Tamped in place at 3.8% m.c.)	
Lower Box	SKAPS TN160-2-6 DS Geocomposite	
	R# 0140191010020	
Conditioning	Interface soaked at 1 psi for 1 hour. Normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	10
Bearing Slide Resistance		lbs	22	49	76	114
Peak	Shear Stress	psf	1,030	2,941	4,416	11,197
	Secant Angle	deg.	35.6	34.2	31.5	35.0
Large Displacement	Shear Stress	psf	1,028	2,941	4,414	11,084
	Secant Angle	deg.	35.5	34.2	31.5	34.7

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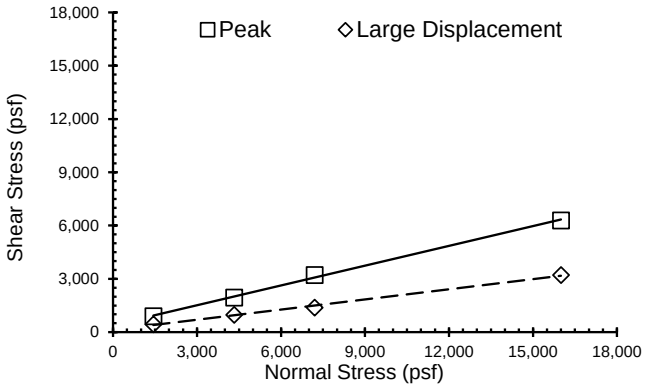
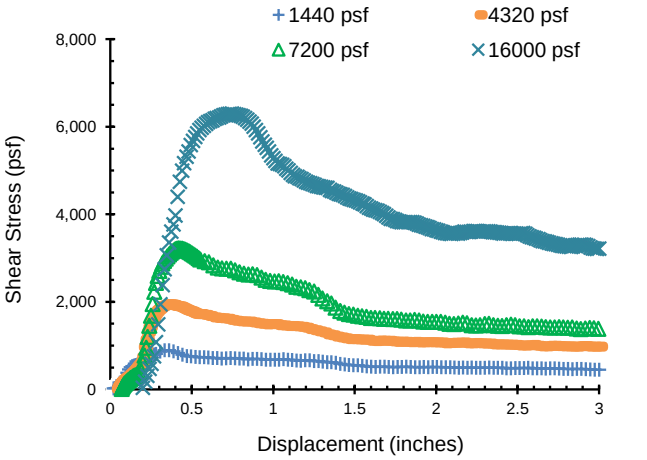
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-3
Richard S. Lacey, P.E. 6/28/2024
Analysis & Quality Review/Date

SKAPS TN160-2-6 DS Geocomposite vs. AGRU 60mil DS HDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	20.4	10.8
Y-intercept or Adhesion	psf	398	126
Minimum Secant Angle	Degrees	21.5	10.9

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	SKAPS TN160-2-6 DS Geocomposite	
	R# 0140191010020	
Lower Box	AGRU 60mil DS HDPE Microspike	
	(dull side against geocomposite)	
	R# GTD0134390025	
Conditioning	Interface soaked and loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred between the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	894	1,942	3,217	6,296
	Secant Angle	deg.	31.8	24.2	24.1	21.5
Large Displacement	Shear Stress	psf	450	971	1,385	3,213
	Secant Angle	deg.	17.3	12.7	10.9	11.4
Asperity Height, Avg. of 5 Meas.		mils	31	31	32	31

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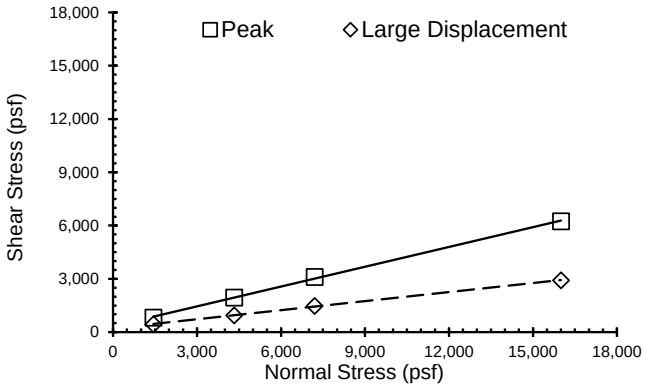
By TJM at 1:49 pm, Jun 28, 2024

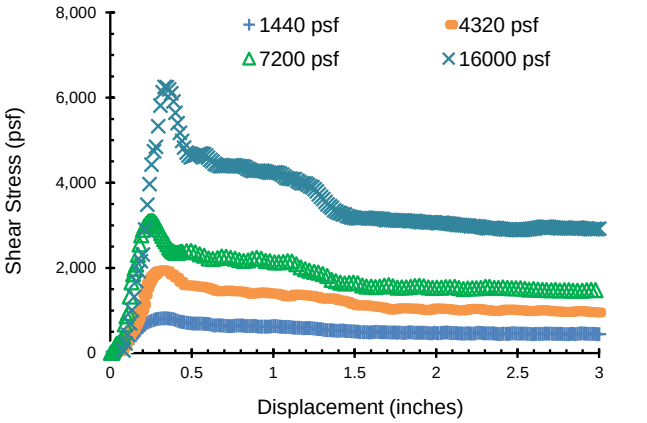
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-4
Richard S. Lacey, P.E. 6/28/2024
Analysis & Quality Review/Date

SKAPS TN250-2-6 DS Geocomposite vs. AGRU 80mil DS HDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	20.4	9.6
Y-intercept or Adhesion	psf	336	215
Minimum Secant Angle	Degrees	21.3	10.3

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	SKAPS TN250-2-6 DS Geocomposite	
	R# 0140191020025	
Lower Box	AGRU 80mil DS HDPE Microspike	
	(shiny side against geocomposite)	
	R# GTD0134380022	
Conditioning	Interface soaked and loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred between the interface at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	816	1,942	3,100	6,246
	Secant Angle	deg.	29.5	24.2	23.3	21.3
Large Displacement	Shear Stress	psf	441	946	1,475	2,921
	Secant Angle	deg.	17.0	12.4	11.6	10.3
Asperity Height, Avg. of 5 Meas.		mils	32	32	33	33

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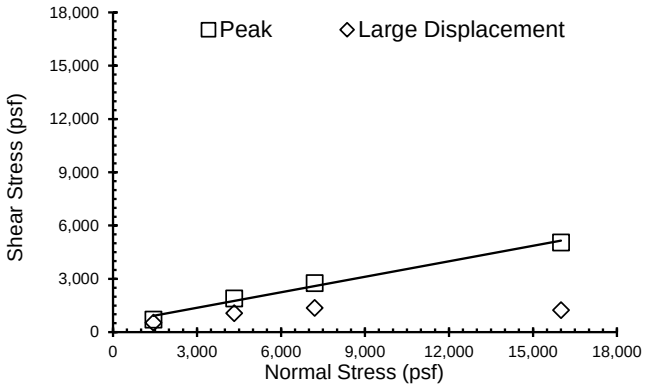
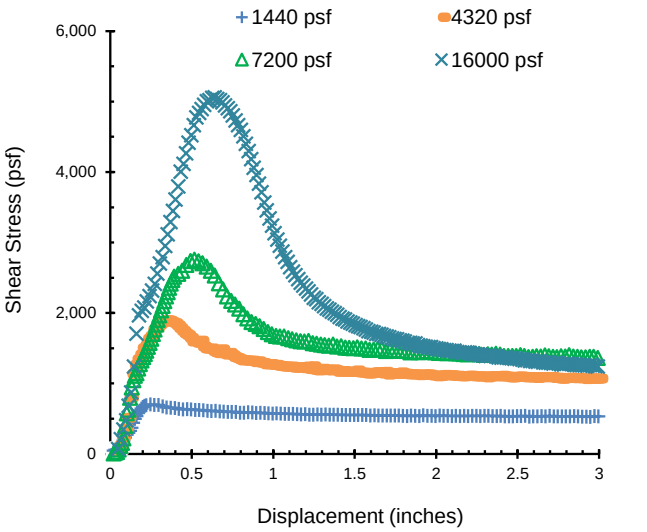
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-5
Richard S. Lacey, P.E. 6/25/2024
Analysis & Quality Review/Date

Solmax Bentoliner NS Peel GCL vs. AGRU 80mil DS HDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	16.2	Multiple Shearing Modes *Refer to the per-normal-stress secant angles*
Y-intercept or Adhesion	psf	497	
Minimum Secant Angle	Degrees	17.5	4.4

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax Bentoliner NS Peel GCL (non-woven side against HDPE)	
	R# 2335-139743	
Lower Box	AGRU 80mil DS HDPE Microspike	
	(dull side against GCL)	
	R# GTD0134380012	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

At 1,440 psf, 4,320 psf & 7,200 psf normal stresses, shearing occurred at the interface. At 16,000 psf normal stress, the GCL sheared internally.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	702	1,898	2,755	5,058
	Secant Angle	deg.	26.0	23.7	20.9	17.5
Large Displacement	Shear Stress	psf	533	1,066	1,363	1,239
	Secant Angle	deg.	20.3	13.9	10.7	4.4
Asperity Height, Avg. of 5 Meas.		mils	31	31	31	30

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By Darren Ward at 4:10 pm, Jun 26, 2024

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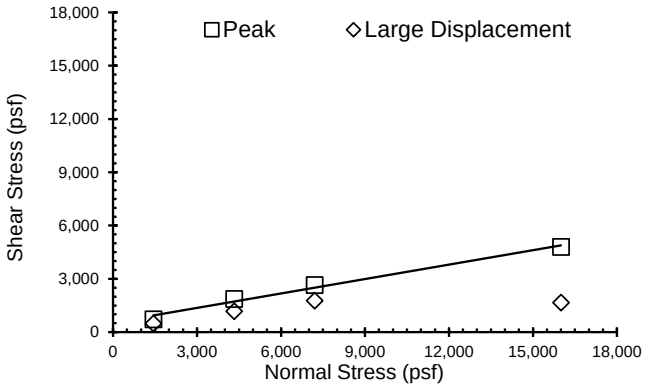
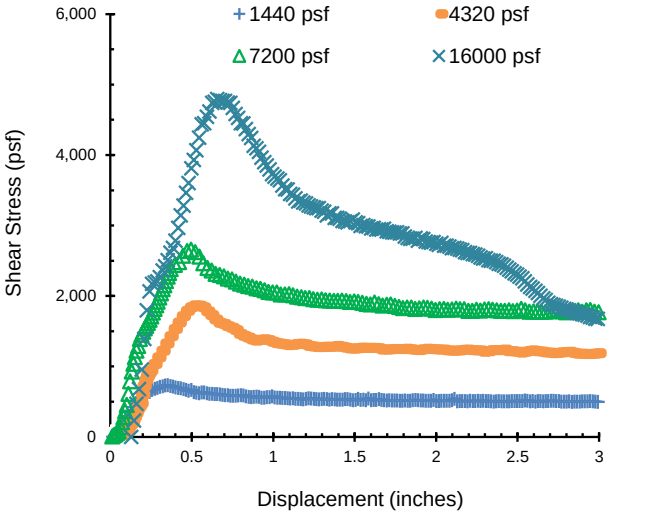
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-6
Richard S. Lacey, P.E. 6/25/2024
Analysis & Quality Review/Date

Solmax Bentoliner NS Peel GCL vs. AGRU 60mil DS HDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	15.2	Multiple Shearing Modes *Refer to the per-normal-stress secant angles*
Y-intercept or Adhesion	psf	551	
Minimum Secant Angle	Degrees	16.7	6.0

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax Bentoliner NS Peel GCL (non-woven side against HDPE)	
	R# 2335-139743	
Lower Box	AGRU 60mil DS HDPE Microspike	
	(shiny side against GCL)	
	R# GTD0134390025	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

At 1,440 psf, 4,320 psf & 7,200 psf normal stresses, shearing occurred at the interface. At 16,000 psf normal stress, the GCL sheared internally.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	731	1,864	2,658	4,793
	Secant Angle	deg.	26.9	23.3	20.3	16.7
Large Displacement	Shear Stress	psf	495	1,184	1,768	1,672
	Secant Angle	deg.	19.0	15.3	13.8	6.0
Asperity Height, Avg. of 5 Meas.		mils	32	32	33	32

RECEIVED
By Darren Ward at 9:03 am, Jun 26, 2024

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By Darren Ward at 4:11 pm, Jun 26, 2024

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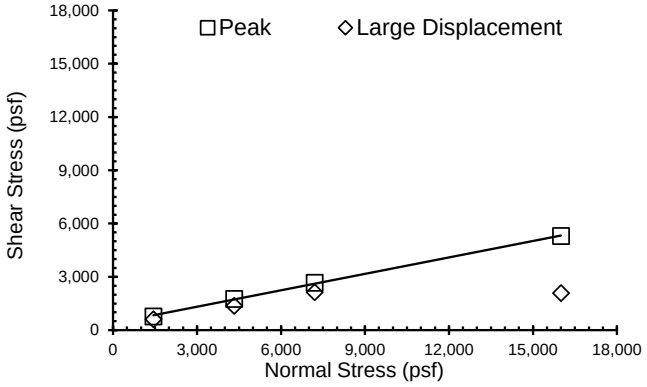
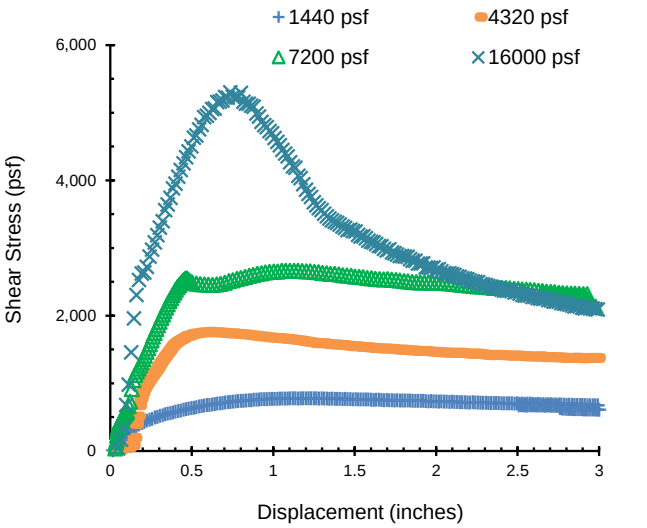
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-7
Richard S. Lacey, P.E. 6/25/2024
Analysis & Quality Review/Date

Solmax Bentoliner NSL Peel 35 GCL vs. Compacted Clay





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	17.1	Multiple Shearing Modes *Refer to the per-normal-stress secant angles*
Y-intercept or Adhesion	psf	392	
Minimum Secant Angle	Degrees	18.3	7.4

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax Bentoliner NSL Peel 35 GCL (woven side against HDPE)	
	R# 2335-139743	
Lower Box	Compacted Clay	
	ω = 26.8%, γ_d = 94.5 pcf	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

At 1,440 , 4,320 & 7,200 psf normal stresses, shearing occurred at the interface. At 16,000 psf normal stress, the GCL sheared internally.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	778	1,759	2,663	5,300
	Secant Angle	deg.	28.4	22.2	20.3	18.3
Large Displacement	Shear Stress	psf	610	1,372	2,133	2,091
	Secant Angle	deg.	23.0	17.6	16.5	7.4

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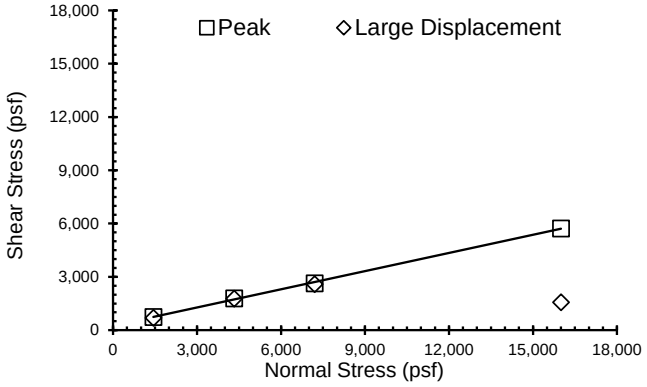
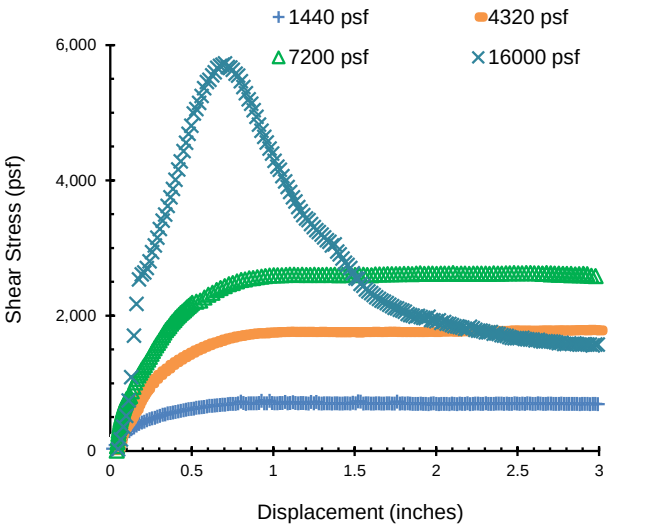
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-8
Richard S. Lacey, P.E. 6/25/2024
Analysis & Quality Review/Date

Solmax Bentoliner NSL Peel 35 GCL vs. Compacted Clay





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	18.8	Multiple Shearing Modes *Refer to the per-normal-stress secant angles*
Y-intercept or Adhesion	psf	252	
Minimum Secant Angle	Degrees	19.7	5.6

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax Bentoliner NSL Peel 35 GCL (woven side against HDPE)	
	R# 2335-139867	
Lower Box	Compacted Clay	
	ω = 26.8%, γ_d = 94.5 pcf	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

At 1,440 psf & 4,320 psf normal stresses, shearing occurred between the interface. At 7,200 psf & 16,000 psf normal stresses, the GCL sheared internally.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	740	1,786	2,630	5,727
	Secant Angle	deg.	27.2	22.5	20.1	19.7
Large Displacement	Shear Stress	psf	690	1,781	2,585	1,573
	Secant Angle	deg.	25.6	22.4	19.8	5.6

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By Darren Ward at 9:04 am, Jun 26, 2024

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By Darren Ward at 4:12 pm, Jun 26, 2024

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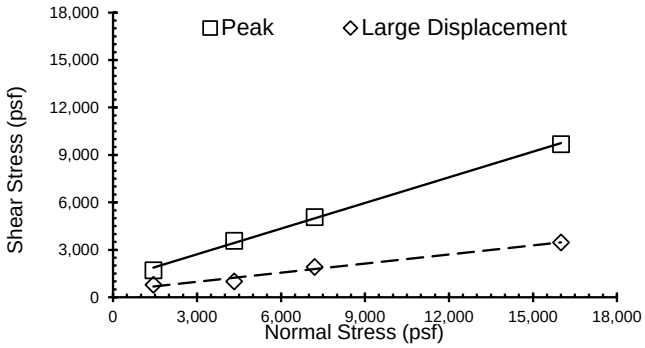
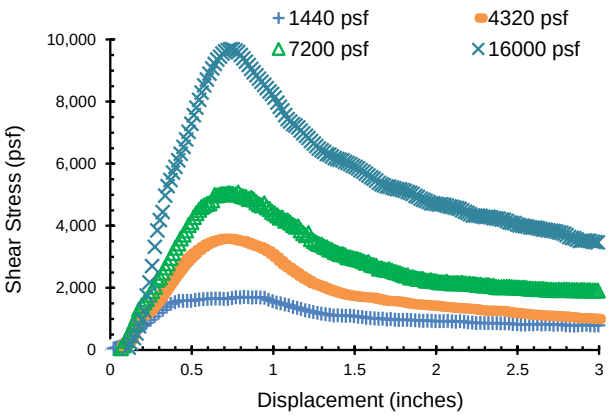
Internal Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-9
Richard S. Lacey, P.E. 6/25/2024
Analysis & Quality Review/Date

Solmax Bentoliner NS Peel 35 GCL vs. GCL Internal Shear





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	28.4	10.9
Y-intercept or Adhesion	psf	1,095	404
Minimum Secant Angle	Degrees	31.2	12.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
	Terrafix Bentofix NSL GCL Internal Shear R# 2335-139743	
Conditioning	GCL hydrated at 1 psi for 48 hours in the box. Interface soaked, loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

The GCL sheared internally at all stresses.

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	1,703	3,581	5,075	9,686
	Secant Angle	deg.	49.8	39.7	35.2	31.2
Large Displacement	Shear Stress	psf	792	996	1,914	3,468
	Secant Angle	deg.	28.8	13.0	14.9	12.2

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By Darren Ward at 9:05 am, Jun 26, 2024

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By Darren Ward at 4:12 pm, Jun 26, 2024

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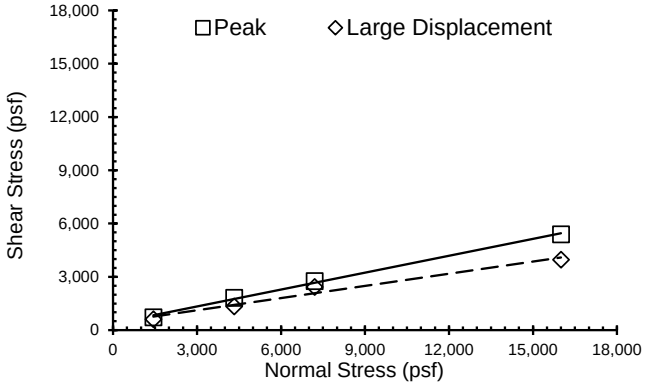
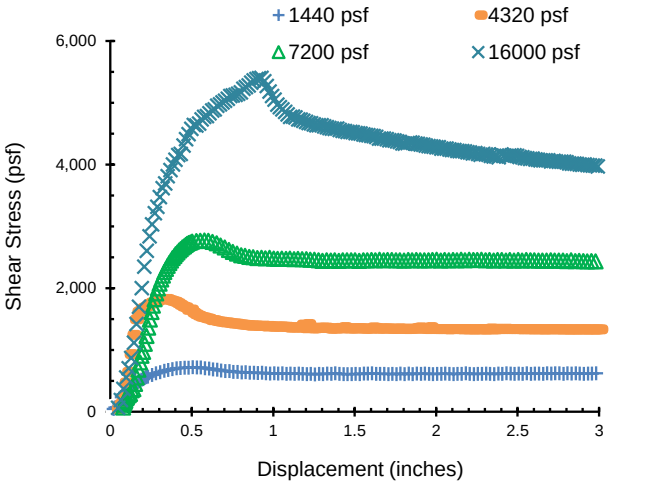
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-10
Richard S. Lacey, P.E. 6/28/2024
Analysis & Quality Review/Date

Compacted Clay vs.
AGRU 60mil HDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	17.6	12.9
Y-intercept or Adhesion	psf	381	432
Minimum Secant Angle	Degrees	18.6	13.9

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Compacted Clay	
	ω = 26.8%, γ_d = 94.5 pcf	
Lower Box	AGRU 60mil HDPE Microspike	
	(shiny side against clay)	
	ω = 26.8%, γ_d = 94.5 pcf	
Conditioning	Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	721	1,818	2,768	5,400
	Secant Angle	deg.	26.6	22.8	21.0	18.6
Large Displacement	Shear Stress	psf	620	1,329	2,430	3,967
	Secant Angle	deg.	23.3	17.1	18.7	13.9
Asperity Height, Avg. of 5 Meas.		mils	32	33	33	32

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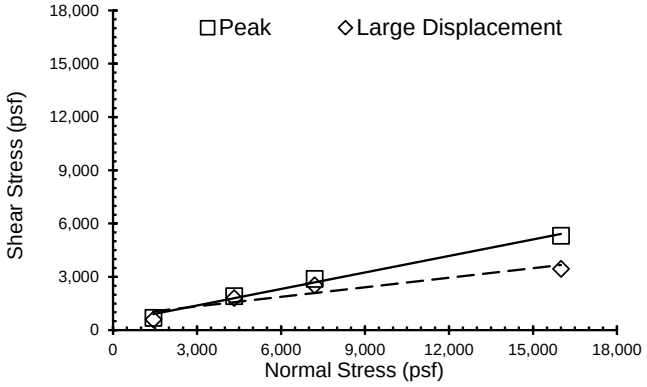
By TJM at 2:34 pm, Jun 28, 2024

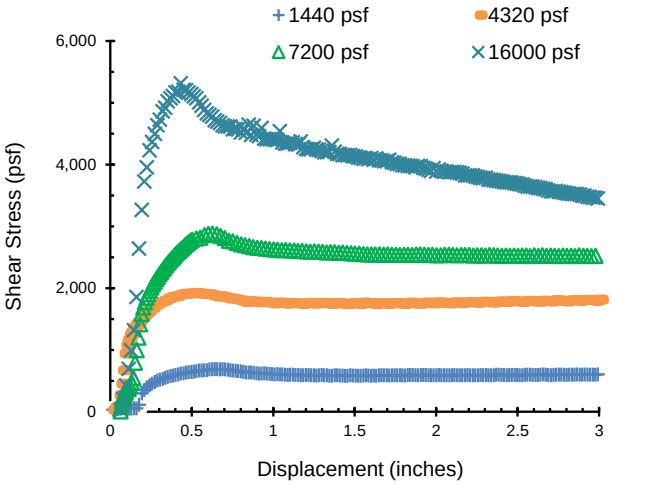
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Cell 16

TRI Log #: IF24009-11
Richard S. Lacey, P.E. 6/28/2024
Analysis & Quality Review/Date

Compacted Clay vs.
AGRU 60mil HDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	17.2	10.2
Y-intercept or Adhesion	psf	456	799
Minimum Secant Angle	Degrees	18.4	12.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Compacted Clay	
	ω = 26.8%, γ_d = 94.5 pcf	
Lower Box	AGRU 60mil HDPE Microspike	
	(shiny side against clay)	
	ω = 26.8%, γ_d = 94.5 pcf	
Conditioning	Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Specimen No.		-	1	2	3	4
Normal Stress		psf	1,440	4,320	7,200	16,000
Box Edge Dimension		in	12	12	12	12
Bearing Slide Resistance		lbs	22	49	76	160
Peak	Shear Stress	psf	687	1,919	2,880	5,315
	Secant Angle	deg.	25.5	24.0	21.8	18.4
Large Displacement	Shear Stress	psf	603	1,813	2,521	3,448
	Secant Angle	deg.	22.7	22.8	19.3	12.2
Asperity Height, Avg. of 5 Meas.		mils	32	32	32	33

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

1B

ESTIMATED POST-CLOSURE WASTE SETTLEMENT COEFFICIENT (STRAIN RATE)

SME
SEVEE & MAHER
ENGINEERS

SME
Sevee & Maher Engineers, Inc.

ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE

14101
20150522memo

MEMO TO: Project File

FROM: Brian Johnson, P.E.

DATE: May 22, 2015

SUBJECT: **DETERMINATION OF SITE SPECIFIC POST-FILLING SETTLEMENT COEFFICIENTS JUNIPER RIDGE LANDFILL, OLD TOWN, MAINE**

Sevee & Maher Engineers, Inc. (SME) has completed an evaluation of landfill settlement derived from aerial survey topography to estimate post-filling settlement coefficients specific to the in-place waste at the Juniper Ridge Landfill in Old Town, Maine. The evaluation utilized various locations (i.e., points) on the surface of the existing waste mass where waste thicknesses ranging from 30 feet, to more than 50 feet are present which had not been subjected to additional waste placement for several years, and where sufficient topographic survey(s) had been completed to allow settlement at various times to be calculated. The point locations were selected such that, primarily post-filling settlement (i.e. consolidation and decomposition) of the waste at the point of interest was occurring. The evaluation established a settlement coefficient representative of the in-place waste at JRL used to estimate post-filling waste settlement relative to post-closure cover performance.

POINT SELECTION

Fourteen points (identified as 1 through 14) were used in this evaluation and are located as shown on Figure 1. Table 1 summarizes the base data for each point. The bottom of waste elevation at each point was determined as the top of the leachate collection sand and is based on record drawings from the construction of each cell.

DATES OF TOPOGRAPHIC SURVEYS

Twenty-nine topographic surveys beginning 1/27/2006 and ending 7/31/2014 were used for the settlement evaluation. The survey dates corresponding to when the maximum waste elevation and maximum waste thickness occurred at each point are included in Table 1. Surveys subsequent to the date of maximum waste elevation were used to determine elevations (and hence waste thickness) at each point as the landfill surface settled. The calculated waste thicknesses following the date of maximum thickness are summarized in Table 2. Note that the settlement at Point 12 was evaluated over two distinct time intervals, because two maximum fill elevations occurred at that location (i.e., a filling followed by

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additional waste placement). Not all points were evaluated for each survey because in some cases settlements were minimal based on the comparison of the aerial surveys.

TABLE 1

POINTS USED IN EVALUATION OF SITE SPECIFIC SETTLEMENT FACTORS

Point Number	Cell	Northing	Easting	Bottom of Waste Elevation	Maximum Waste Elevation	Maximum Waste Thickness	Date When Maximum Waste Thickness was Surveyed
		Site Coordinates		feet	feet	feet	
1	1	925577	478460	173.3	200.5	27.2	4/29/2009
2	1	925697	478546	181.5	255	73.5	4/29/2006
3	1	925655	479117	210.5	257.6	47.1	10/31/2008
4	1	925704	478989	202.5	320.5	118	10/31/2008
5	2	925888	479134	213.5	250.5	37.0	4/26/2007
6	2	925949	478988	209.5	307	97.5	10/31/2007
9	3a	926175	479232	215.5	252	36.5	10/29/2007
10	3a	926182	479077	213.5	306.5	93.0	10/31/2008
11	3b	926344	479304	218	251	33.0	10/29/2007
12a	3b	926351	479161	216	258.5	84.5	10/29/2007
12b	3b	926351	479161	216	300.5	42.5	10/30/2013
7	4	925771	478291	174.5	212.5	84.5	10/30/2009
8	4	925929	478291	179.6	261	38.0	11/2/2011
13	5	925800	477958	165	210.5	81.4	11/2/2011
14	5	925935	478057	171.2	263.5	45.5	11/2/2011

TABLE 2

SUMMARY OF WASTE THICKNESSES

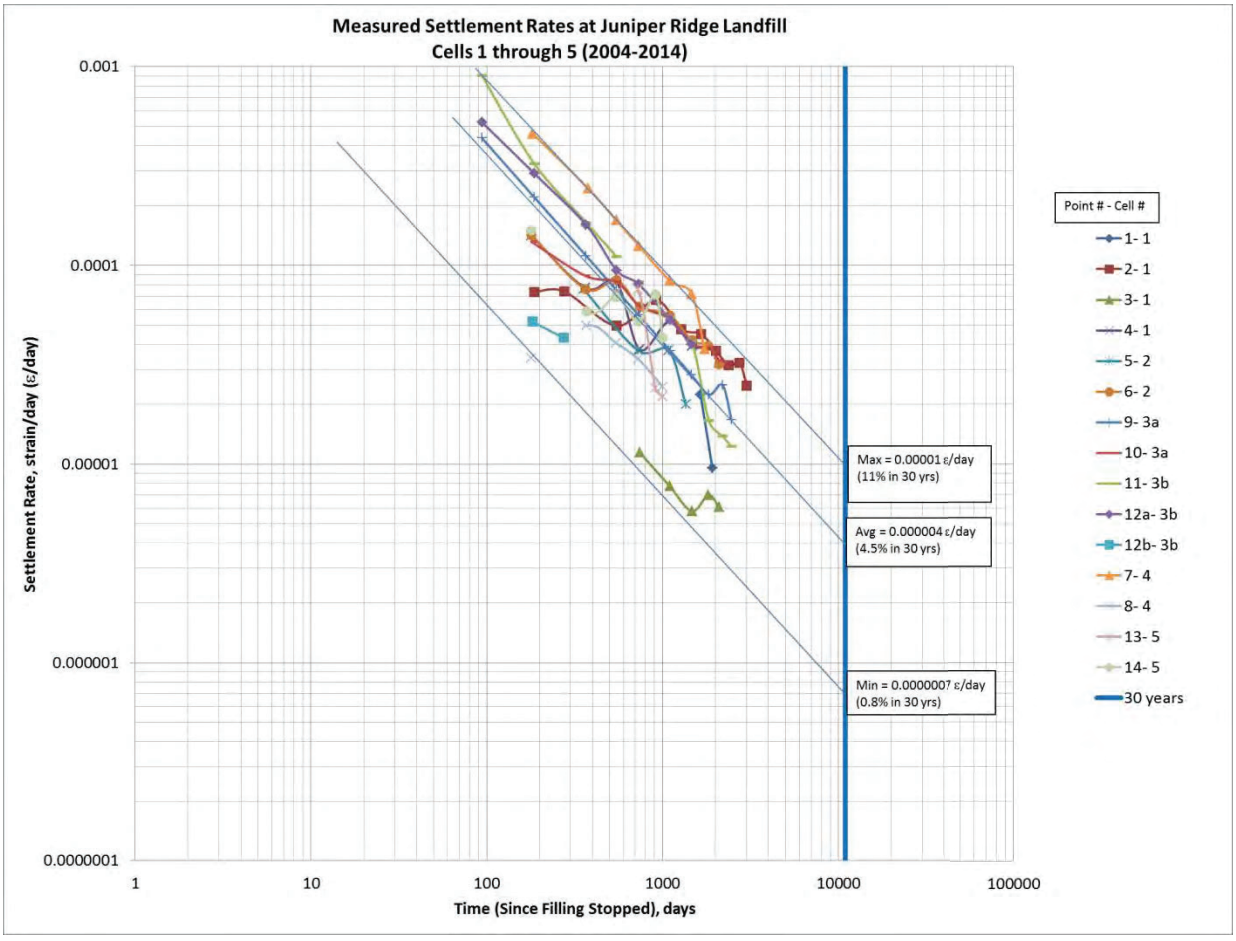
Point ID	1/27/2006	4/29/2006	7/31/2006	11/1/2006	1/30/2007	4/26/2007	7/31/2007	10/29/2007	1/31/2008	5/2/2008	10/31/2008	4/29/2009	10/30/2009	5/1/2010	11/12/2010	4/29/2011	11/2/2011	4/30/2012	11/6/2012	4/30/2013	10/30/2013	4/30/2014	7/31/2014
1				25.7				25.7			25.7	27.2	27.2	27.2	27.2		27.2		27.2		26.2		26.7
2	54	73.5	73.5	72.5	72			71.5			69		69		68		68		68		67		68
3	41	43	42.5	43.5	42.5			43			47.1		47.1		46.7		46.7		46.7		46.5		46.5
4	52	52.5	60.5	68	58.5	58	58.5	70.5	56.5	86.5	118	115	114.7	112.7	114.7		111.2		111.2		109.7		110
5				33	36	37	37	37	36	36	36	35.8	36		37		36		36		35.5		36
6				52.5				64.5	57.5	67.5	97.5	95	94.8	93	93		91.5		91.5		90.5		91
9						22.5	29.5	36.5	35	35	35	35	35		35		35		35		34.5		35
10						31		68	72	72	93	90.8	90	88.8	88.7		87.5		87.5		86.5		86.5
11					7	18.5	24.3	33	30.2	31	31	31	31		31		31		32		32		32
12a					6.5	23.5	31.5	42.5	40.4	40.2	40	40.3	40		40		40						
12b																			75	77	84.5	83.7	83.5
7												30.5	38	34.8	34.5	34.5	34.5		34.5		34		35.5
8										7.9	5.4	48.9	60.9		65.4	68.4	81.4	80.9	79.9	79.6	79.4		79.4
13												2	2	36	46	45.5	45.5	45.5	45.5	43.7	43	44.5	44.5
14												2.8	1.3	17.3	72.8	73.3	92.3	89.8	90.3	88.8	88.8	86.3	88.3

Notes:
1. Cells Shaded Blue are when the Maximum Waste Elevation Occurred.

STRAIN RATE

The strain rate per day (ε/day) was calculated for each point, using the date on which the maximum waste thickness occurred (Tables 1 and 2) as the start of settlement, as summarized in Figure 2. Figure 2 shows that the post-filling settlement decreases with time on a log-log basis. The log-log relationship between settlements is consistent with classical settlement theory when stress based consolidation and decomposition are combined. Using the site specific data in Figure 2, an average strain rate of 0.000004 ε/day in 30-years was developed, which equates to 4.5% ε in 30 years.

FIGURE 2


Measured Settlement Rates at Juniper Ridge Landfill
Cells 1 through 5 (2004-2014)
Settlement Rate, strain/day (ε/day)
0.001
0.0001
0.00001
0.000001
0.0000001
1
10
100
1000
10000
100000
Time (Since Filling Stopped), days
Max = 0.00001 ε/day
(11% in 30 yrs)
Avg = 0.000004 ε/day
(4.5% in 30 yrs)
Min = 0.0000007 ε/day
(0.8% in 30 yrs)
Point # - Cell #
1- 1
2- 1
3- 1
4- 1
5- 2
6- 2
9- 3a
10- 3a
11- 3b
12a- 3b
12b- 3b
7- 4
8- 4
13- 5
14- 5
30 years

CONCLUSIONS

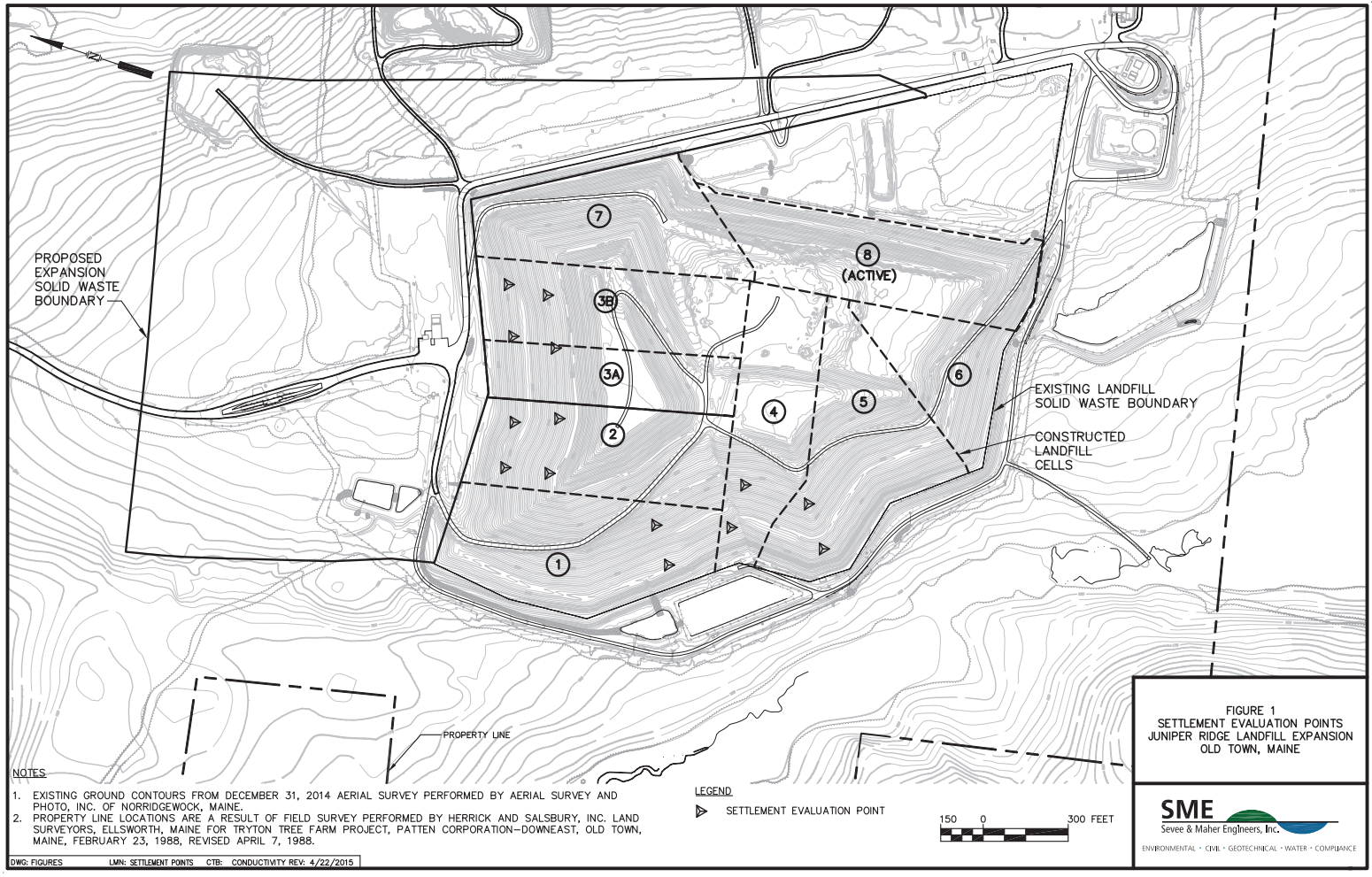
Based on the above described evaluation, the settlement of the waste at JRL 30-years after maximum fill heights are achieved (i.e., settlement after final cover is installed) can be estimated using Equation 1.

$$S_{30\text{-years}} = H * \varepsilon_{30\text{-years}} \qquad \text{(Equation 1)}$$

Where,

$S_{30\text{-years}}$ = Settlement after 30-years (feet);

H $\varepsilon_{30\text{-years}}$ = 4.5%.



NOTES

1. EXISTING GROUND CONTOURS FROM DECEMBER 31, 2014 AERIAL SURVEY PERFORMED BY AERIAL SURVEY AND PHOTO, INC. OF NORRIDGEWOCK, MAINE.
2. PROPERTY LINE LOCATIONS ARE A RESULT OF FIELD SURVEY PERFORMED BY HERRICK AND SALSBURY, INC. LAND SURVEYORS, ELLSWORTH, MAINE FOR TRYTON TREE FARM PROJECT, PATTEN CORPORATION–DOWNEAST, OLD TOWN, MAINE, FEBRUARY 23, 1988, REVISED APRIL 7, 1988.

LEGEND

▷ SETTLEMENT EVALUATION POINT

150 0 300 FEET

DWG: FIGURES LMN: SETTLEMENT POINTS CTB: CONDUCTIVITY REV: 4/22/2015

FIGURE 1
SETTLEMENT EVALUATION POINTS
JUNIPER RIDGE LANDFILL EXPANSION
OLD TOWN, MAINE

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\\Nserver\cts\Casella\Old Town Land\fill\Expansion\0.35MCY-Expansion\Acad\Figures\FIGURES.dwg, 4/22/2015 1:29:53 PM, pat

1C

SEISMIC HAZARD MAPS/DATA

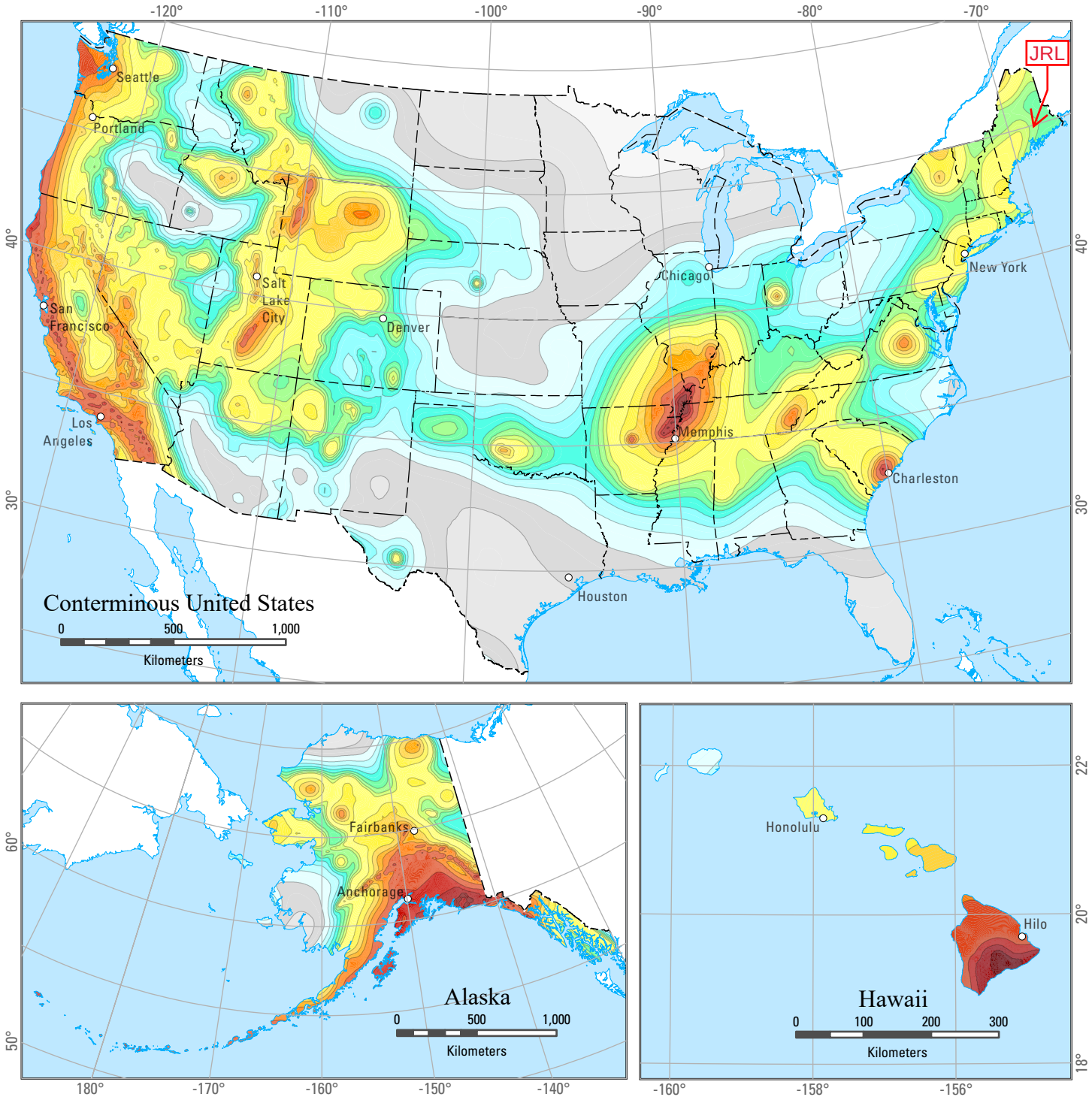
SME
SEVEE & MAHER
ENGINEERS

Google Maps

juniper ridge landfill

44.98078, -68.71986

Imagery ©2024 Airbus, CNES / Airbus, Maxar Technologies, USDA/FPAC/GEO, Map data ©2024 500 ft

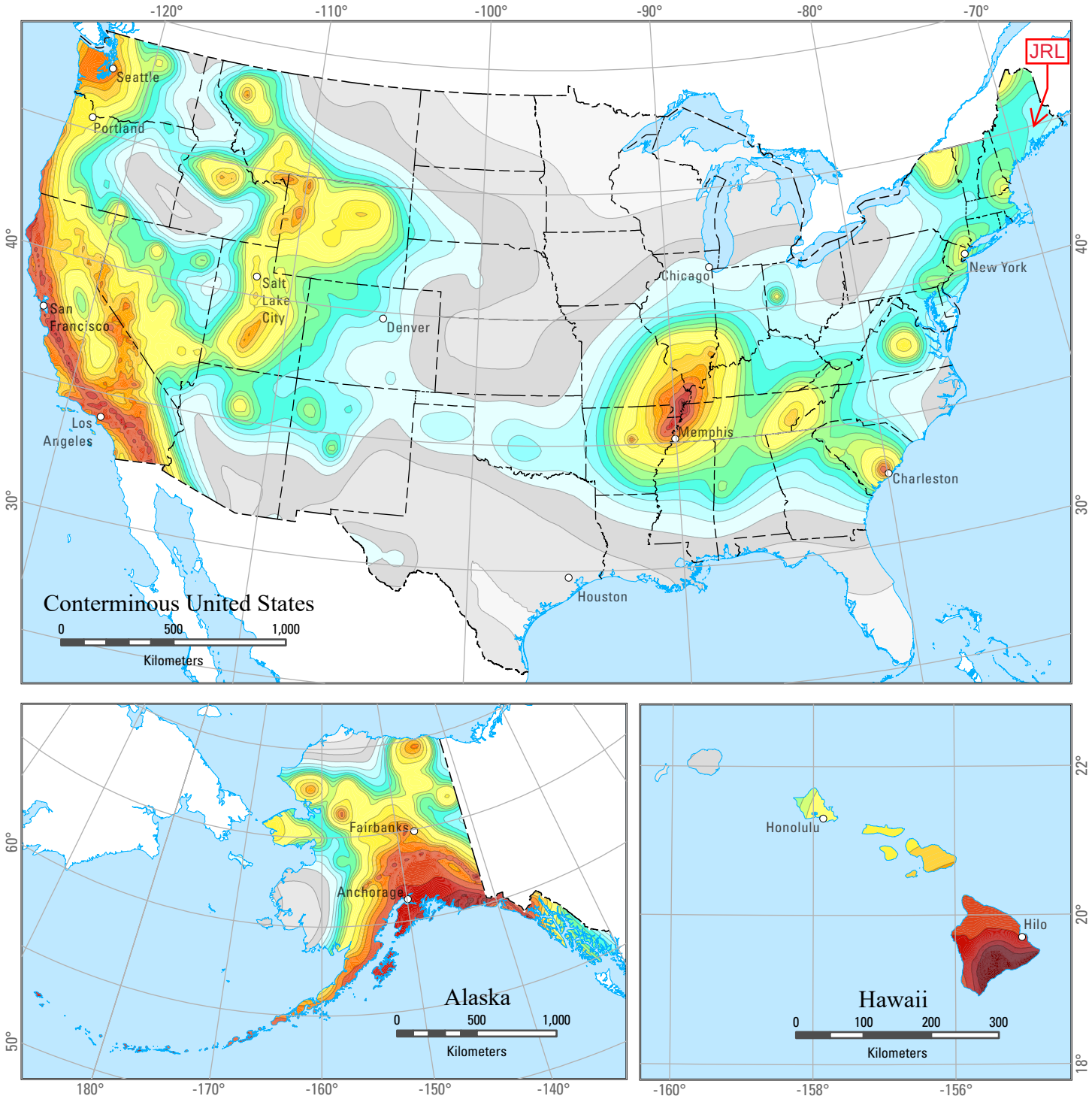


Peak ground acceleration *(g)*

0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16 0.18 0.2 0.3 0.4 0.5 0.6 0.8 1.2 1.6 2

2023 National Seismic Hazard Model for the United States

Peak horizontal acceleration
with a 2% probability of exceedance in 50 years
NEHRP site class B/C (V_{S30} = 760 m/s)



Peak ground acceleration *(g)*

0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.1 0.15 0.2 0.25 0.3 0.4 0.6 0.8 1

2023 National Seismic Hazard Model for the United States

Peak horizontal acceleration
with a 10% probability of exceedance in 50 years
NEHRP site class B/C (V_{S30} = 760 m/s)

Site Lat / Long: 44.9808, -68.7199
Site Class: A

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA(
50 (40% in 25)	0.008736	0.499212	0.008894	0.010879	0.012816	0.016155	0.017048	0.017221	0.017414	0.016436	0.014764	0.012938	0.0
100 (40% in 50)	0.01722	0.995577	0.017728	0.022256	0.026398	0.032504	0.033666	0.033319	0.032642	0.028596	0.025857	0.023928	0.0
200 (40% in 100)	0.029914	1.830332	0.032654	0.042198	0.050219	0.058727	0.059424	0.05803	0.055638	0.050684	0.042786	0.039617	0.0
225 (20% in 50)	0.034292	1.986087	0.035773	0.046182	0.054927	0.06354	0.064079	0.062531	0.059892	0.054745	0.048626	0.042375	0.0
475 (10% in 50)	0.059051	3.725794	0.06179	0.080696	0.095804	0.117798	0.116509	0.111507	0.098294	0.089445	0.079927	0.072561	0.0
975 (5% in 50)	0.095326	6.103616	0.100132	0.14215	0.168886	0.194261	0.188886	0.178719	0.162421	0.137999	0.123339	0.111578	0.0
1033 (7% in 75)	0.098262	6.303808	0.108987	0.147676	0.175377	0.200744	0.195077	0.18465	0.167957	0.141776	0.126987	0.115088	0.0
2475 (2% in 50)	0.180007	10.955505	0.192445	0.261753	0.310082	0.369828	0.348518	0.308908	0.276337	0.24006	0.202717	0.18328	0.1
10000 (1% in 100)	0.424206	21.896288	0.456443	0.631381	0.786998	0.874023	0.801134	0.689803	0.592462	0.474081	0.416026	0.367132	0.2

Site Lat / Long: 44.9808, -68.7199
Site Class: B

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA(
50 (40% in 25)	0.008963	0.514496	0.009647	0.01107	0.012968	0.016314	0.018708	0.019533	0.021013	0.017001	0.015312	0.01411	0.0
100 (40% in 50)	0.01771	1.029421	0.018223	0.022663	0.026716	0.032812	0.03729	0.038362	0.03794	0.031149	0.026736	0.024711	0.0
200 (40% in 100)	0.030659	1.883021	0.033699	0.04303	0.050838	0.059131	0.065029	0.069296	0.063841	0.052657	0.046621	0.04085	0.0
225 (20% in 50)	0.035338	2.039601	0.03683	0.047018	0.055545	0.063939	0.074726	0.075722	0.07259	0.056759	0.050606	0.043632	0.0
475 (10% in 50)	0.0606	3.843255	0.06335	0.081875	0.096609	0.118397	0.128542	0.128474	0.121031	0.09263	0.083078	0.075345	0.0
975 (5% in 50)	0.097572	6.284579	0.102383	0.144469	0.170333	0.19484	0.206912	0.204359	0.189401	0.142966	0.128304	0.115961	0.0
1033 (7% in 75)	0.100513	6.48648	0.112194	0.14999	0.176812	0.201301	0.213191	0.210442	0.195111	0.146789	0.132005	0.119519	0.0
2475 (2% in 50)	0.184733	11.337288	0.197165	0.265053	0.311981	0.370477	0.38752	0.373793	0.3176	0.25104	0.210724	0.190359	0.1
10000 (1% in 100)	0.434807	22.515908	0.467089	0.675112	0.792639	0.874216	0.888871	0.833142	0.6845	0.491883	0.434489	0.383559	0.2

Site Lat / Long: 44.9808, -68.7199
Site Class: B-C

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA0P4	SA0P5
50 (40% in 25)	0.009028	0.517988	0.009738	0.011777	0.014063	0.017823	0.022129	0.023477	0.024027	0.019152	0.016709	0.014986	0.01187	0.010
100 (40% in 50)	0.017851	1.037133	0.018366	0.022791	0.027291	0.03615	0.041531	0.042903	0.042621	0.035776	0.028892	0.026062	0.021666	0.017
200 (40% in 100)	0.032585	1.895025	0.034006	0.043302	0.052081	0.06434	0.077299	0.079082	0.076541	0.059773	0.051246	0.042922	0.036153	0.030
225 (20% in 50)	0.035647	2.05179	0.037142	0.047294	0.05681	0.074023	0.084047	0.085687	0.082805	0.063992	0.055308	0.048782	0.038855	0.033
475 (10% in 50)	0.061075	3.870057	0.063828	0.08229	0.103938	0.129734	0.142878	0.143796	0.136696	0.110701	0.090294	0.079833	0.062798	0.054
975 (5% in 50)	0.098285	6.325866	0.108896	0.145345	0.17444	0.211981	0.243665	0.241809	0.212987	0.171837	0.139197	0.122723	0.095857	0.083
1033 (7% in 75)	0.10123	6.528154	0.113214	0.150869	0.180935	0.218533	0.252732	0.250559	0.21885	0.177277	0.142977	0.126331	0.103021	0.085
2475 (2% in 50)	0.186296	11.424524	0.198725	0.266392	0.318235	0.407973	0.434107	0.423276	0.380722	0.286289	0.241199	0.200662	0.163717	0.134
10000 (1% in 100)	0.438504	22.658491	0.470796	0.679779	0.813437	0.959853	0.994706	0.944754	0.813878	0.596824	0.470233	0.405985	0.308529	0.262

Site Lat / Long: 44.9808, -68.7199
Site Class: C

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA(
50 (40% in 25)	0.010195	0.578395	0.01043	0.012473	0.014767	0.018527	0.02331	0.025252	0.026268	0.023267	0.019343	0.017788	0.0
100 (40% in 50)	0.018855	1.169502	0.019375	0.023804	0.028321	0.037589	0.043279	0.048562	0.049166	0.040703	0.035917	0.032355	0.0
200 (40% in 100)	0.034518	2.220628	0.035958	0.045248	0.054051	0.069964	0.08069	0.084451	0.083444	0.071113	0.059685	0.053935	0.0
225 (20% in 50)	0.037572	2.445037	0.039088	0.049231	0.058772	0.076748	0.087439	0.091091	0.089773	0.077077	0.063856	0.057971	0.0
475 (10% in 50)	0.063541	4.319205	0.066333	0.089703	0.107281	0.133098	0.147283	0.16016	0.146664	0.125941	0.109707	0.093676	0.0
975 (5% in 50)	0.101098	7.00789	0.112796	0.149039	0.177874	0.215421	0.250237	0.254909	0.239831	0.193642	0.168967	0.143157	0.1
1033 (7% in 75)	0.109981	7.623027	0.117008	0.154458	0.184242	0.234246	0.259114	0.263524	0.247936	0.199143	0.174268	0.146886	0.1
2475 (2% in 50)	0.188768	12.830378	0.201271	0.268517	0.319176	0.408027	0.43738	0.436987	0.40354	0.31659	0.277909	0.245232	0.1
10000 (1% in 100)	0.428552	26.394187	0.461	0.631057	0.784859	0.925254	0.966995	0.943471	0.837718	0.648712	0.557154	0.464822	0.3

Site Lat / Long: 44.9808, -68.7199
Site Class: C-D

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA(
50 (40% in 25)	0.010646	0.670516	0.010883	0.012615	0.014572	0.018144	0.02298	0.02597	0.027863	0.027108	0.025065	0.02345	0.0
100 (40% in 50)	0.019495	1.27768	0.020019	0.023957	0.027938	0.036615	0.042631	0.049883	0.052349	0.049816	0.04313	0.040416	0.0
200 (40% in 100)	0.035676	2.450414	0.03713	0.045351	0.052967	0.064577	0.078821	0.086	0.087837	0.082916	0.075642	0.0695	0.0
225 (20% in 50)	0.038714	2.677126	0.040245	0.049298	0.057625	0.074132	0.085456	0.092587	0.09416	0.088999	0.081579	0.075276	0.0
475 (10% in 50)	0.064846	4.663209	0.067668	0.089161	0.104022	0.128184	0.143247	0.161517	0.160992	0.14309	0.131674	0.121587	0.1
975 (5% in 50)	0.102247	8.017081	0.114299	0.147017	0.17143	0.206277	0.238575	0.253711	0.247658	0.217362	0.200063	0.184333	0.1
1033 (7% in 75)	0.111357	8.301185	0.118411	0.152324	0.177639	0.212546	0.247116	0.262038	0.255529	0.233947	0.205454	0.189556	0.1
2475 (2% in 50)	0.187989	13.788989	0.200539	0.262529	0.305443	0.380704	0.411539	0.426693	0.407093	0.369547	0.320496	0.29544	0.2
10000 (1% in 100)	0.413293	28.124353	0.445744	0.604683	0.695604	0.829827	0.869799	0.879194	0.805389	0.689748	0.626044	0.568732	0.4

Site Lat / Long: 44.9808, -68.7199
Site Class: D

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA0P4	SA0P5
50 (40% in 25)	0.011033	0.696937	0.011271	0.013109	0.015177	0.018812	0.023901	0.026973	0.03091	0.030976	0.028006	0.026381	0.023099	0.019
100 (40% in 50)	0.020051	1.313829	0.021706	0.024684	0.028839	0.037992	0.043966	0.05182	0.055308	0.05446	0.051164	0.047373	0.039732	0.035
200 (40% in 100)	0.036703	2.514753	0.03817	0.046768	0.054734	0.070126	0.081272	0.088508	0.091837	0.089442	0.084169	0.077975	0.064623	0.058
225 (20% in 50)	0.039732	2.739885	0.041277	0.050716	0.059396	0.076777	0.087889	0.095063	0.098145	0.095541	0.090145	0.083781	0.07307	0.062
475 (10% in 50)	0.066073	4.980293	0.06892	0.091701	0.107202	0.131558	0.146117	0.164902	0.167213	0.159922	0.143352	0.133129	0.116802	0.104
975 (5% in 50)	0.108953	8.081295	0.115917	0.15001	0.175146	0.20999	0.241659	0.255615	0.253455	0.239939	0.21497	0.199041	0.174563	0.156
1033 (7% in 75)	0.112875	8.360357	0.119958	0.155261	0.181279	0.216183	0.249982	0.263685	0.261071	0.247236	0.220306	0.204198	0.179503	0.161
2475 (2% in 50)	0.188148	13.738187	0.20074	0.265026	0.308248	0.382655	0.409269	0.42142	0.407076	0.381181	0.353145	0.311705	0.274561	0.248
10000 (1% in 100)	0.403659	27.443748	0.43611	0.601356	0.688298	0.808409	0.832409	0.830092	0.734861	0.681604	0.63156	0.575317	0.481645	0.442

Site Lat / Long: 44.9808, -68.7199
Site Class: D-E

Response Spectra Data

Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA(
50 (40% in 25)	0.011126	0.702155	0.011365	0.013229	0.015314	0.018913	0.023896	0.026801	0.029363	0.03122	0.028593	0.028013	0.0
100 (40% in 50)	0.020156	1.315816	0.021847	0.024834	0.029011	0.038127	0.043853	0.051209	0.05498	0.054515	0.052019	0.050423	0.0
200 (40% in 100)	0.036787	2.497984	0.038257	0.046958	0.054951	0.070143	0.080638	0.087069	0.090725	0.088821	0.084685	0.081786	0.0
225 (20% in 50)	0.039795	2.719275	0.041343	0.050888	0.059593	0.076743	0.087179	0.093515	0.096917	0.094798	0.090538	0.087515	0.0
475 (10% in 50)	0.065887	4.657941	0.068744	0.09166	0.107124	0.130893	0.144209	0.159874	0.16243	0.155884	0.142166	0.136937	0.1
975 (5% in 50)	0.102682	7.828063	0.114718	0.149236	0.174111	0.207782	0.235102	0.244942	0.242663	0.220898	0.209982	0.201394	0.1
1033 (7% in 75)	0.111605	8.09712	0.118686	0.154423	0.18016	0.213873	0.243159	0.252662	0.249881	0.236806	0.215068	0.206347	0.1
2475 (2% in 50)	0.184417	13.149891	0.197001	0.262099	0.304276	0.372808	0.392937	0.397378	0.381943	0.356753	0.322294	0.307874	0.2
10000 (1% in 100)	0.386924	25.473383	0.419204	0.586894	0.667952	0.735403	0.738926	0.721735	0.670728	0.617249	0.571183	0.537132	0.4

Site Lat / Long: 44.9808, -68.7199
Site Class: E

Response Spectra Data

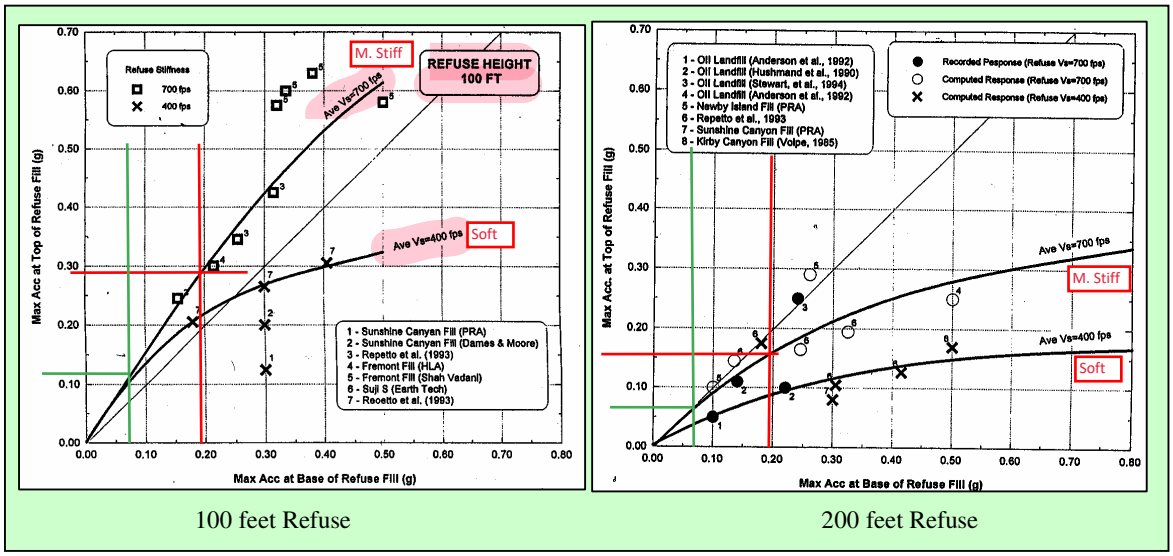
Export Response Spectra as CSV

IMT	PGA	PGV	SA0P01	SA0P02	SA0P03	SA0P05	SA0P075	SA0P1	SA0P15	SA0P2	SA0P25	SA0P3	SA(
50 (40% in 25)	0.011204	0.707942	0.011443	0.013329	0.015427	0.019	0.023911	0.026698	0.030901	0.031508	0.028944	0.028825	0.0
100 (40% in 50)	0.020257	1.320692	0.021986	0.026328	0.029169	0.038273	0.043819	0.050852	0.054852	0.054764	0.052507	0.051851	0.0
200 (40% in 100)	0.036935	2.494639	0.038407	0.047191	0.055214	0.070317	0.080352	0.086235	0.09017	0.08877	0.084922	0.083395	0.0
225 (20% in 50)	0.039934	2.713519	0.041485	0.051115	0.059849	0.076894	0.086854	0.092618	0.096296	0.094678	0.090697	0.089059	0.0
475 (10% in 50)	0.06596	4.62219	0.068823	0.091943	0.107419	0.130809	0.143266	0.157014	0.15986	0.147894	0.14128	0.13804	0.1
975 (5% in 50)	0.102535	7.689387	0.114466	0.149316	0.174102	0.207032	0.231774	0.238941	0.236787	0.217468	0.20669	0.200901	0.1
1033 (7% in 75)	0.111316	7.952193	0.118399	0.154475	0.180112	0.213073	0.239687	0.24646	0.243775	0.231691	0.211619	0.205709	0.1
2475 (2% in 50)	0.183085	12.812137	0.195669	0.261369	0.303076	0.368609	0.38455	0.384084	0.36832	0.344328	0.313171	0.302689	0.2
10000 (1% in 100)	0.379859	23.450148	0.41206	0.581445	0.659694	0.721434	0.716243	0.689383	0.636668	0.584348	0.5377	0.511283	0.4

From Thusyanthan et. all, 2004, after Singh and Sun, 1995.

The acceleration values obtained either from probabilistic acceleration maps or by site-specific acceleration determination represent the free-field ground motion at a rock outcrop. This does not necessarily represent the free-field soil acceleration at the landfill site. Soil conditions at the landfill site will influence the ground accelerations experienced by the landfill. Simplified and detailed procedures are available for determining the effect of local soil conditions on earthquake ground motions. The simplified approach is mainly based on charts, which were developed from recorded site responses in past earthquakes and analytical studies. The detailed seismic site response analyses are performed by numerical computer codes. The simplified approach for evaluating the influence of soil conditions on the amplification potential of peak ground acceleration (PGA) was first introduced by Seed and Idriss [16].This chart was later modified by Idriss [17] after the 1989 Loma Prieta earthquake. Since the shear wave velocity of MSW appear to be mainly between that of soft and medium stiff soil. Kavazajian and Matasovic [18] suggested that the soft soil curve by Idriss [17] can also be used to evaluate the peak acceleration at the top of a landfill. Singh and Sun [19], using published data, field data and computed response, produced charts of maximum surface acceleration (top or crest of a landfill) against maximum acceleration at the base of a landfill for 30 m (100 feet) and 60 m (200 feet) height waste with shear wave velocities of 122 m/s (700 fps) and 213 m/s (400 fps)-Figure 5.

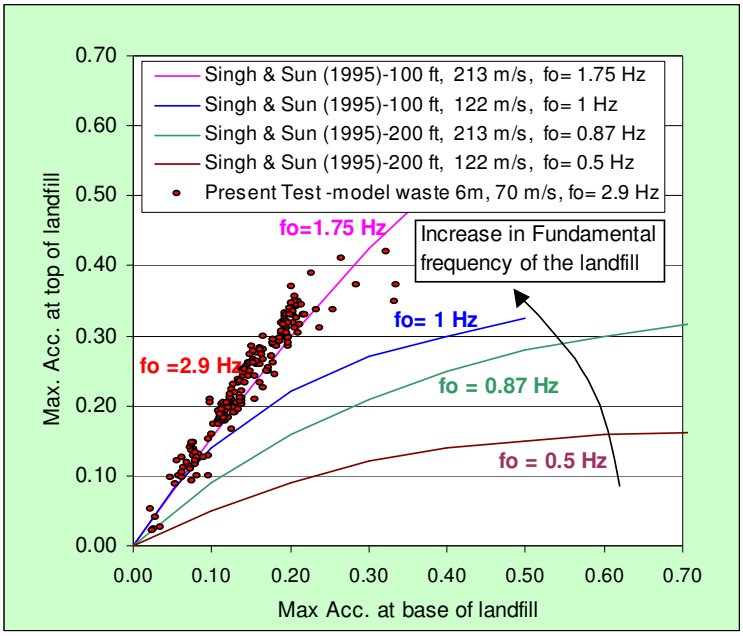
The acceleration records obtained in the present dynamic centrifuge test can be used to understand the amplification characteristics of MSW landfills. The prototype peak acceleration in the sand (Acc.12) and in the model waste (Acc.4) against the prototype peak acceleration of the base(Acc.9) for each earthquake cycle for all the 7 earthquakes have been plotted along with the results from Kavazanjian and Matasovic [18] and Singh and Sun [19] in Figure.6. The results of Kavazanjian and Matasovic [18] include the soft soil site amplification curve along with the observed response of OII landfill and the results of non-linear site response analyses. Singh and Sun [19] suggested that the amplification developed by Harder [20] for earth dams may be viewed as the upper bound on the amplification of free-field PGA at the top of landfills, which is also included in Figure 6.



100 feet Refuse 200 feet Refuse

Figure 5. Approximate relationship between acceleration at base and crest of a landfill, Singh and Sun [19]

From Thusyanthan et. all, 2004, after Singh and Sun, 1995.



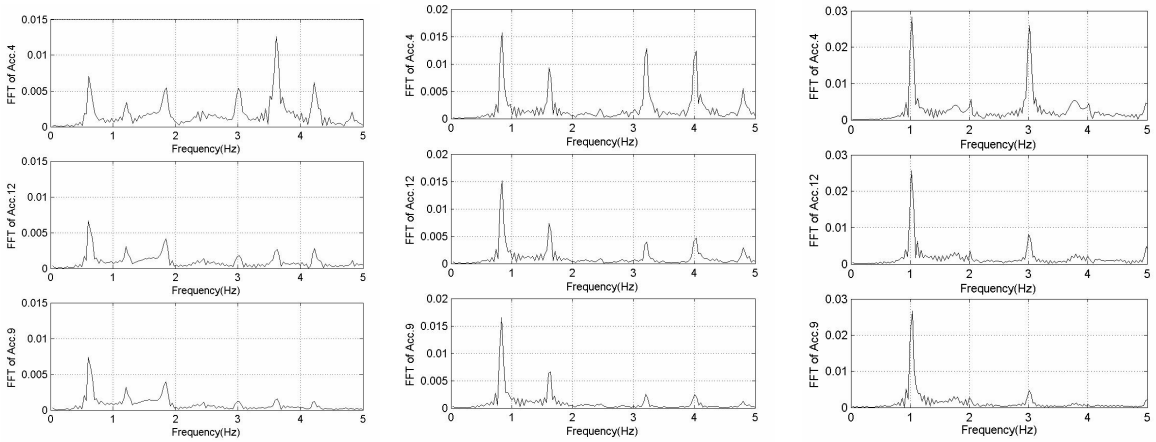
content is mainly between 1 Hz to 5 Hz. Further centrifuge tests can be used to validate this simplified chart.

This chart provides a good initial estimate of a MSW landfill response. A more formal numerical analysis can be carried out for design purposes.

Figure 7. Dynamic centrifuge data and Singh and Sun (1995) proposed curves showing the influence of fundamental frequency (f_o) of the waste fill on the curves.

Frequency analysis

Figure 8 shows the Fast Fourier Transform(FFT) of the acceleration signals Acc.9 (base), Acc.12 (sand surface) and Acc.4 (waste surface) for earthquakes 1, 2 and 3. It is clear from Figure 8 that higher harmonics that are near the fundamental frequency of the waste (2.9 Hz) are amplified in the model waste.



Earthquake 1 (0.6 Hz) **Earthquake 2 (0.8 Hz)** **Earthquake 3 (1 Hz)**

Figure 8. Fast Fourier Transform of acceleration signals from Earthquake 1,2 and 3.

ATTACHMENT 2

STABILITY ASSESSMENT – FOUNDATION SOILS, LINER SYSTEM, AND WASTE MASS

2A SLOPE/W OUTPUT – CROSS-SECTION A-A'
2B SLOPE/W OUTPUT – CROSS-SECTION B-B'
2C SLOPE/W OUTPUT – CROSS-SECTION C-C'
2D SEISMIC LIQUEFACTION ANALYSIS
2E SEISMIC DEFORMATION ANALYSIS

SME
SEVEE & MAHER
ENGINEERS

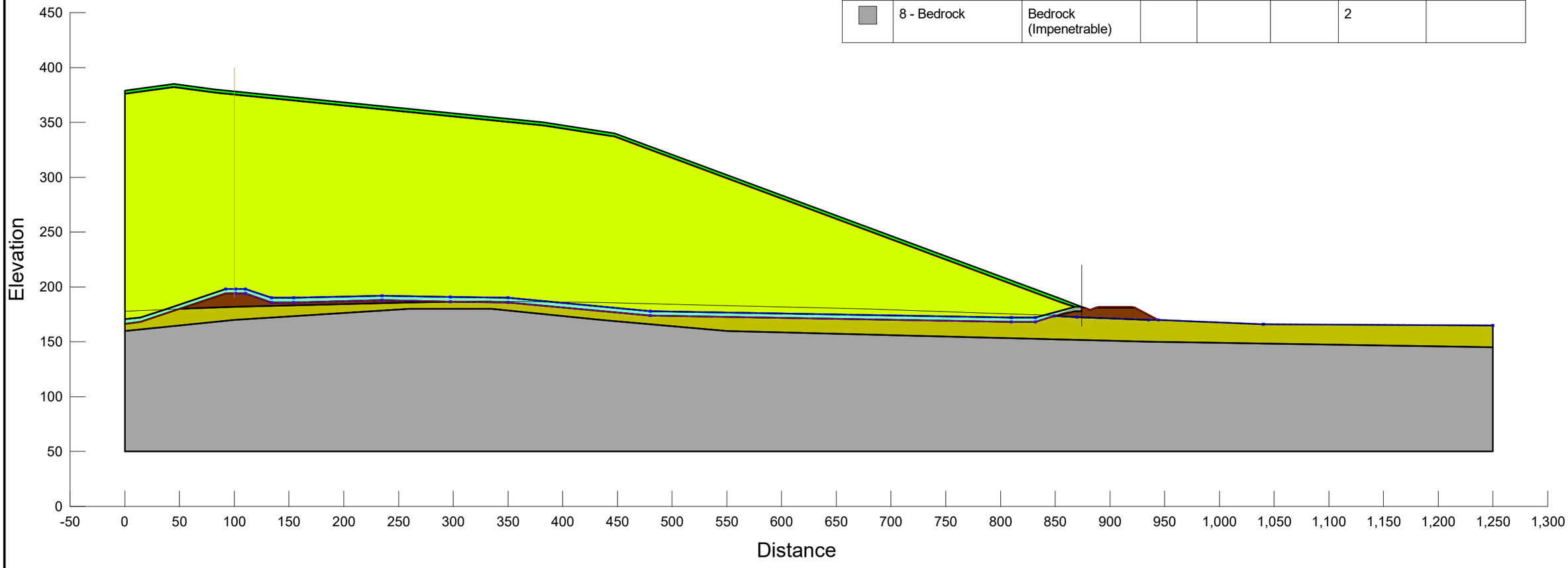
2A

SLOPE/W OUTPUT – CROSS-SECTION A-A'

SME
SEVEE & MAHER
ENGINEERS

File Name: JRL_Phase-II-Expansion_Section_A-A'_West_Rev.gsz
Date: 08/13/2025
Name: 1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.:

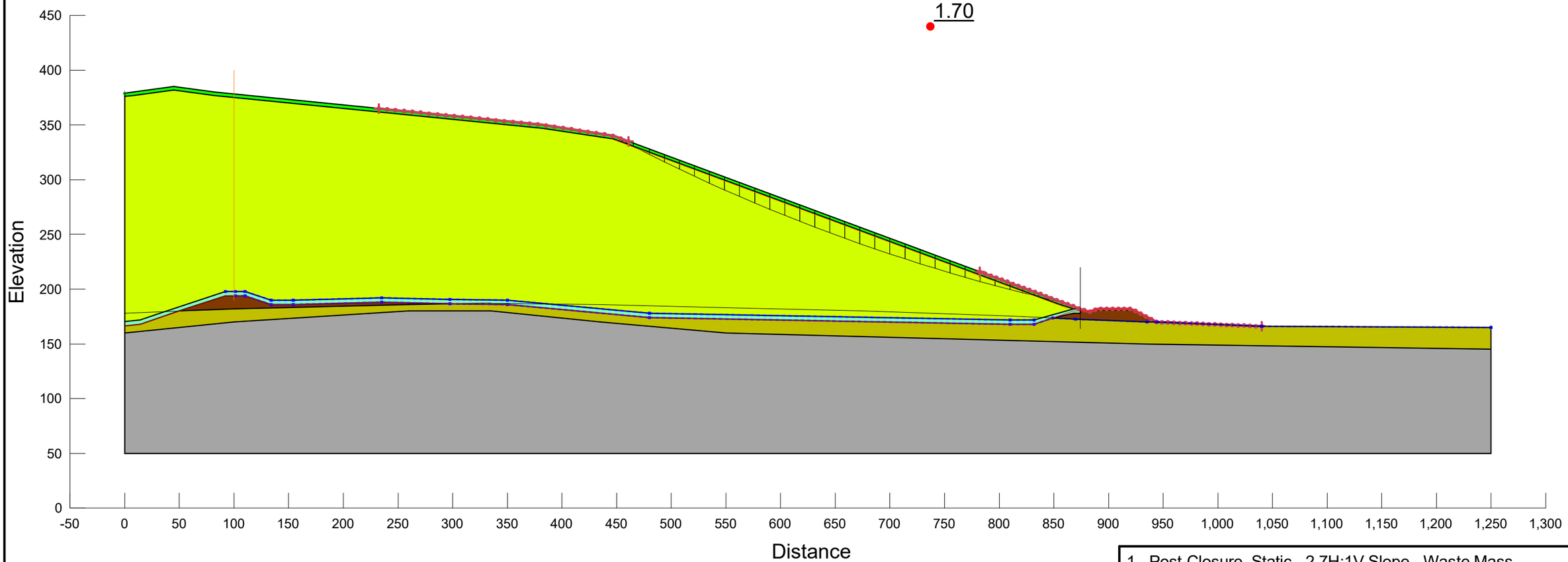
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass	
JRL_Phase-II-Expansion_Section_A-A'_West_Rev.gsz	
08/13/2025	1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass
Analysis Type: Spencer
Slope Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.:

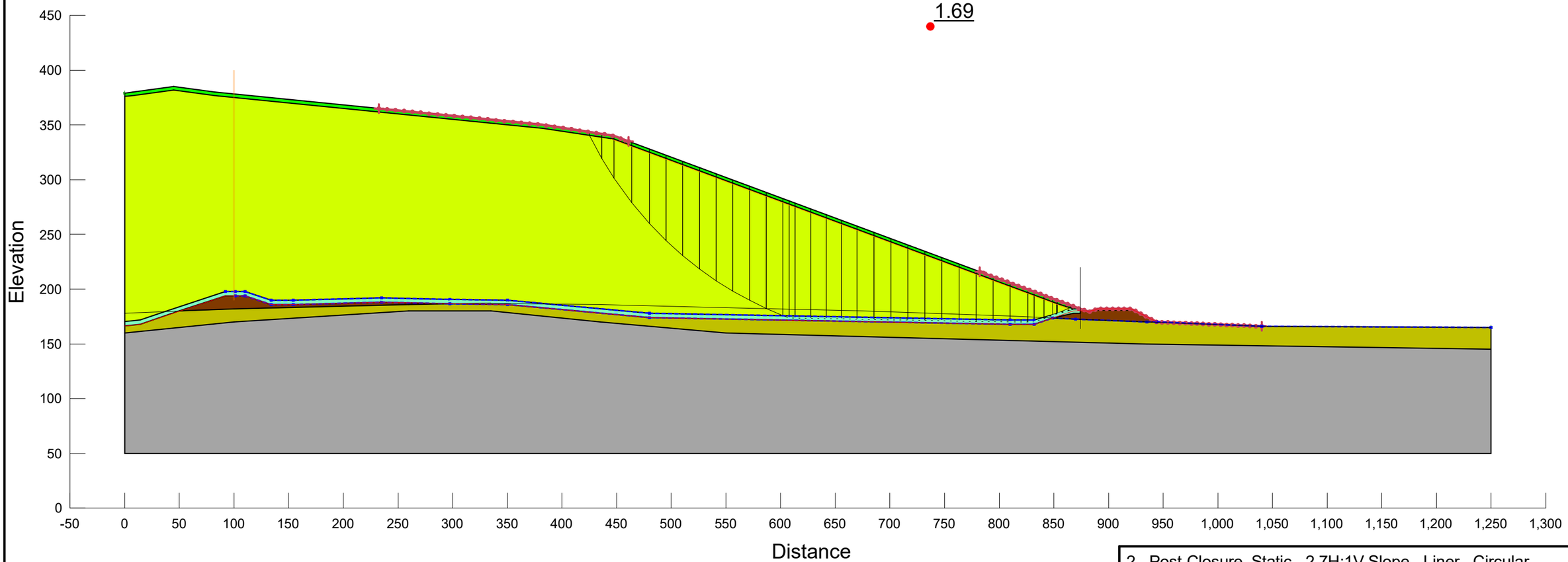
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 2 - Post-Closure, Static - 2.7H:1V Slope - Liner - Circular
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.:

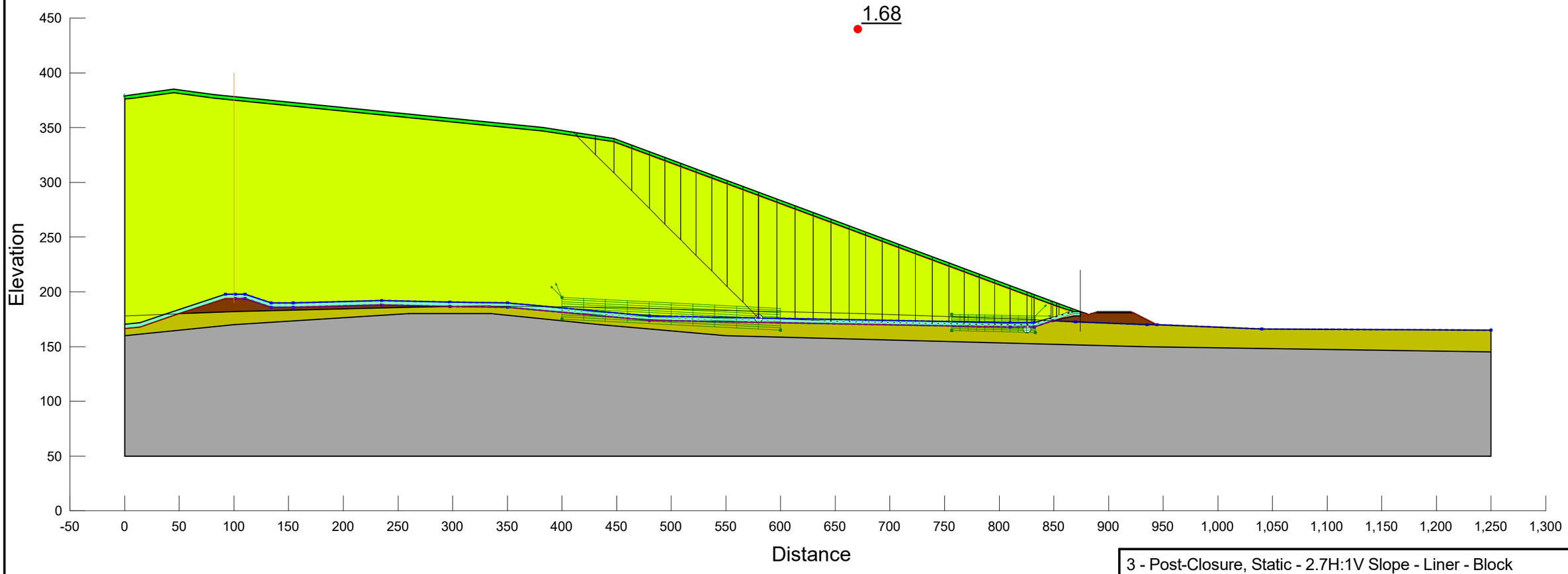
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



2 - Post-Closure, Static - 2.7H:1V Slope - Liner - Circular
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 3 - Post-Closure, Static - 2.7H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.:

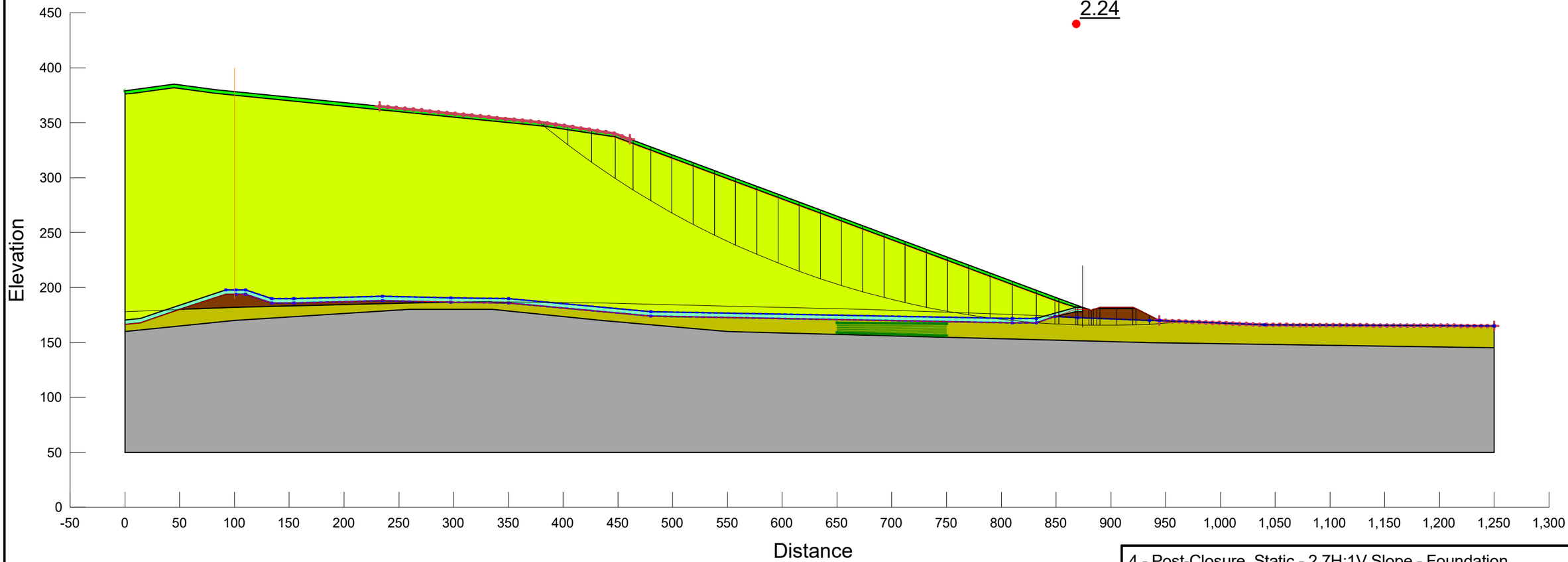
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



3 - Post-Closure, Static - 2.7H:1V Slope - Liner - Block
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 4 - Post-Closure, Static - 2.7H:1V Slope - Foundation
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.:

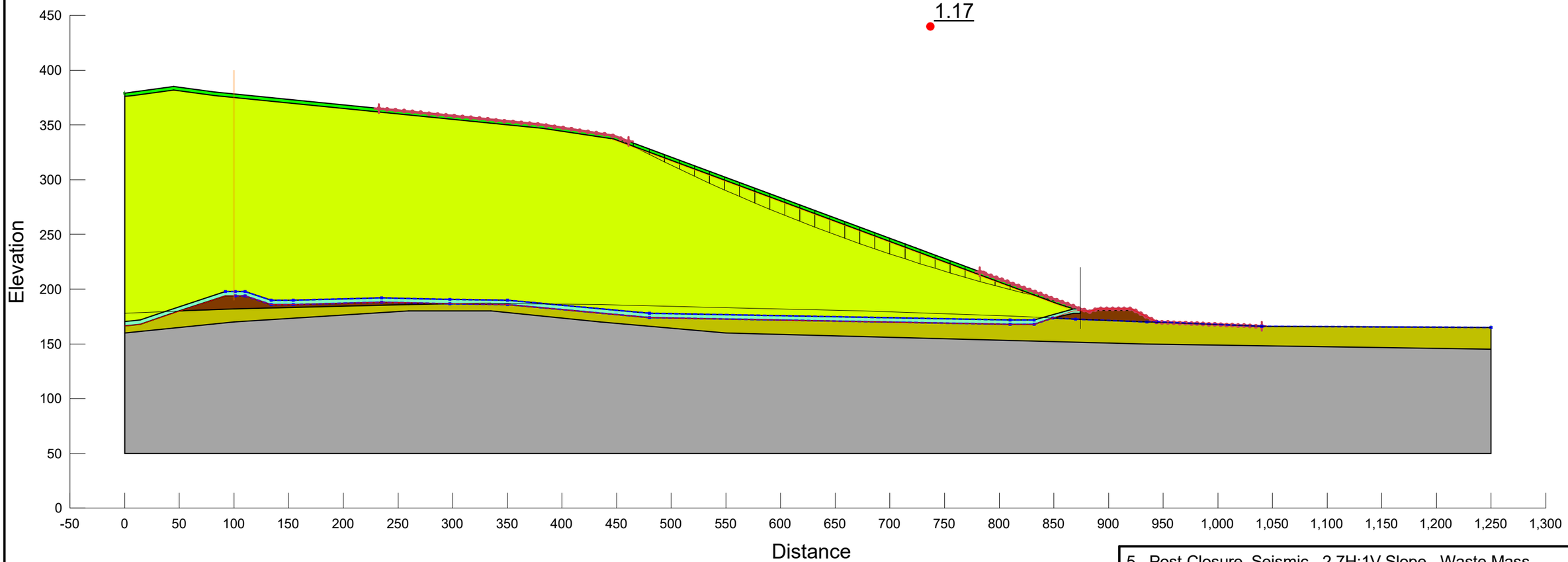
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



4 - Post-Closure, Static - 2.7H:1V Slope - Foundation	
JRL_Phase-II-Expansion_Section_A-A'_West.gsz	
08/13/2025	1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 5 - Post-Closure, Seismic - 2.7H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	

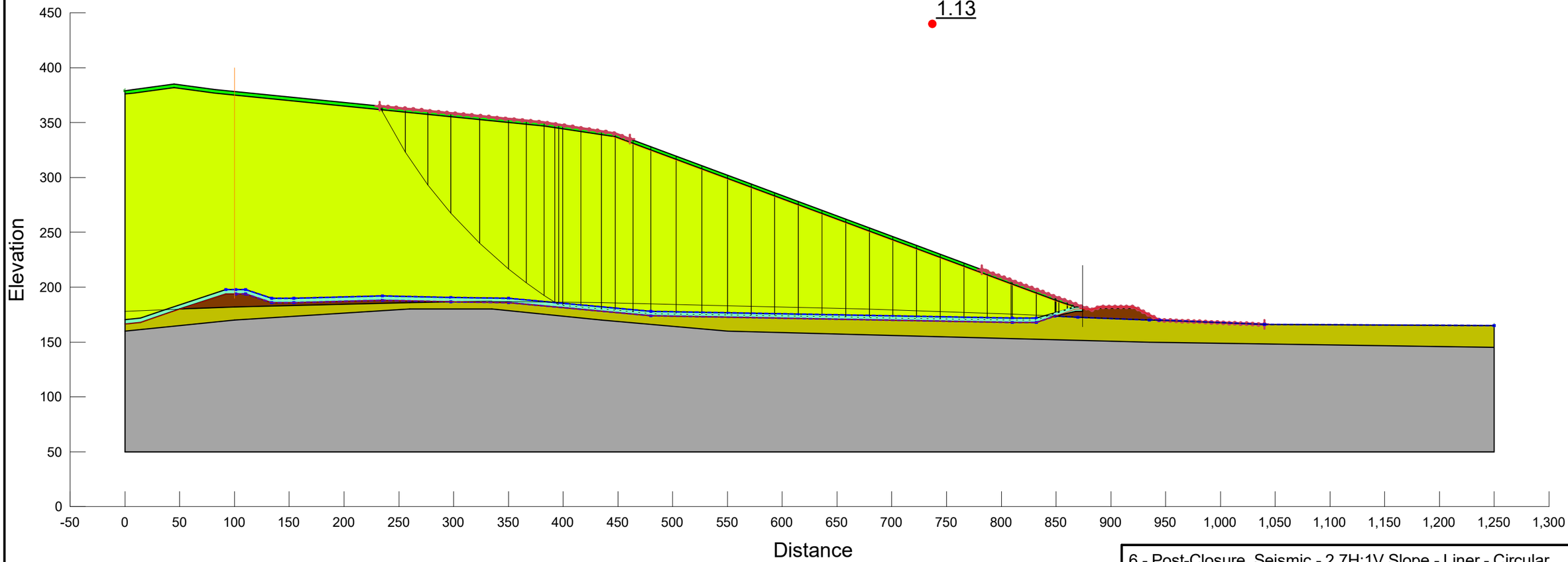


5 - Post-Closure, Seismic - 2.7H:1V Slope - Waste Mass
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 6 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Circular
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	

1.13

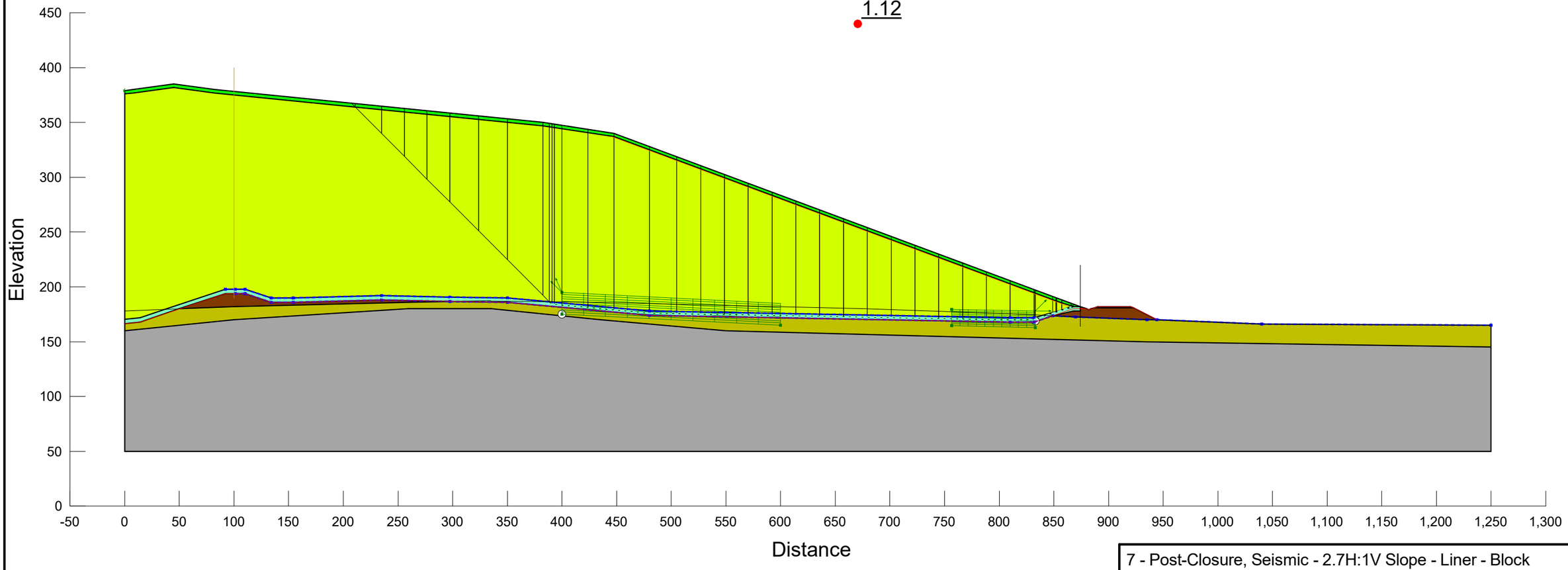


6 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Circular
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 7 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	

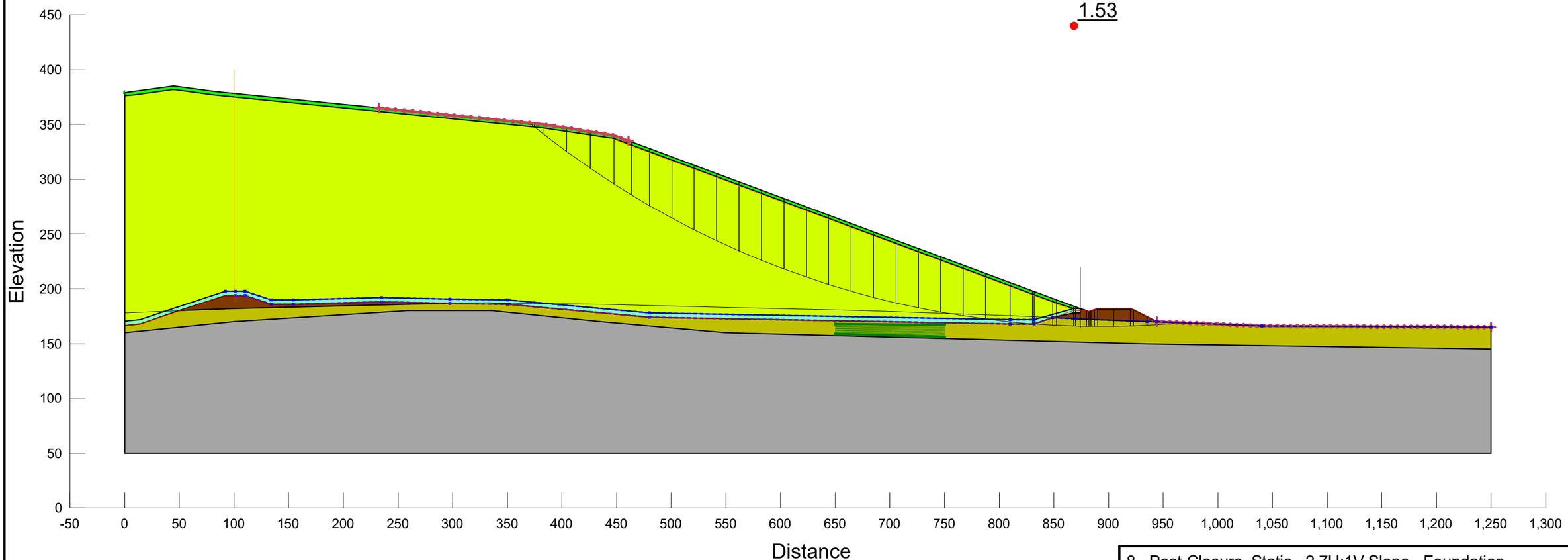
1.12



7 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Block
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/13/2025
Name: 8 - Post-Closure, Static - 2.7H:1V Slope - Foundation
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.: 0.14

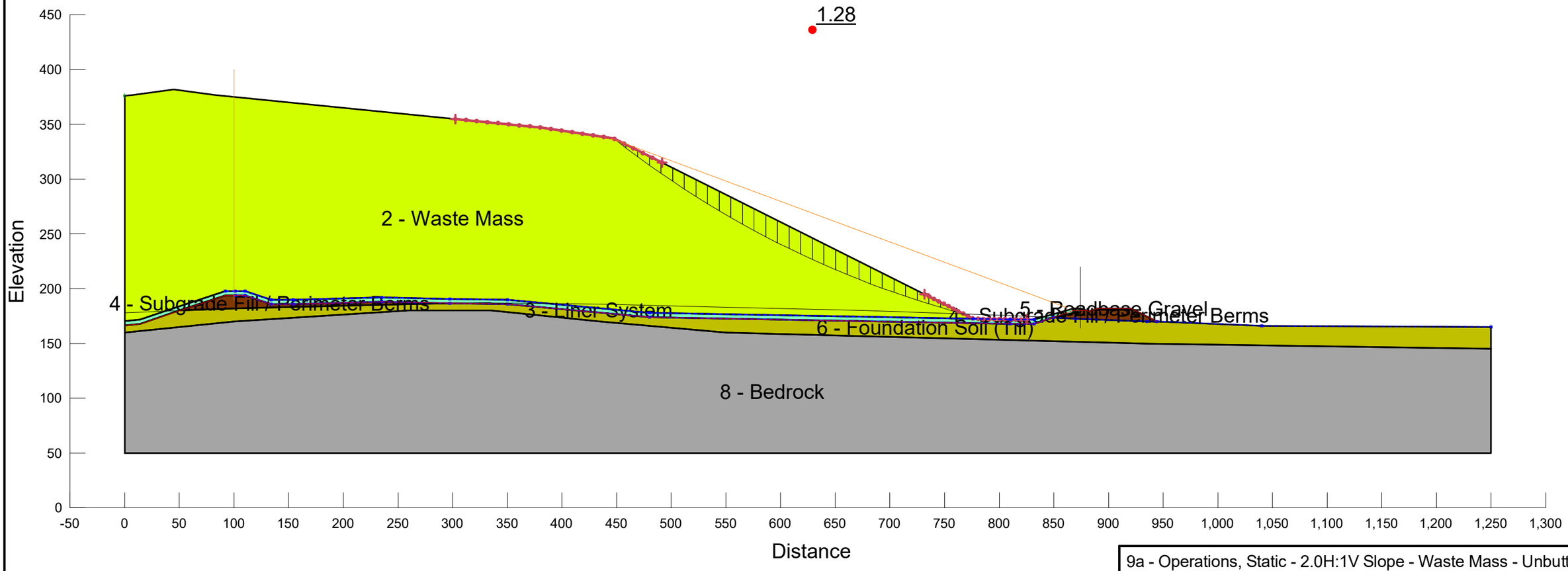
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30		
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



8 - Post-Closure, Static - 2.7H:1V Slope - Foundation
JRL_Phase-II-Expansion_Section_A-A'_West.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West_Ops.gsz
Date: 08/13/2025
Name: 9a - Operations, Static - 2.0H:1V Slope - Waste Mass - Unbuttressed
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

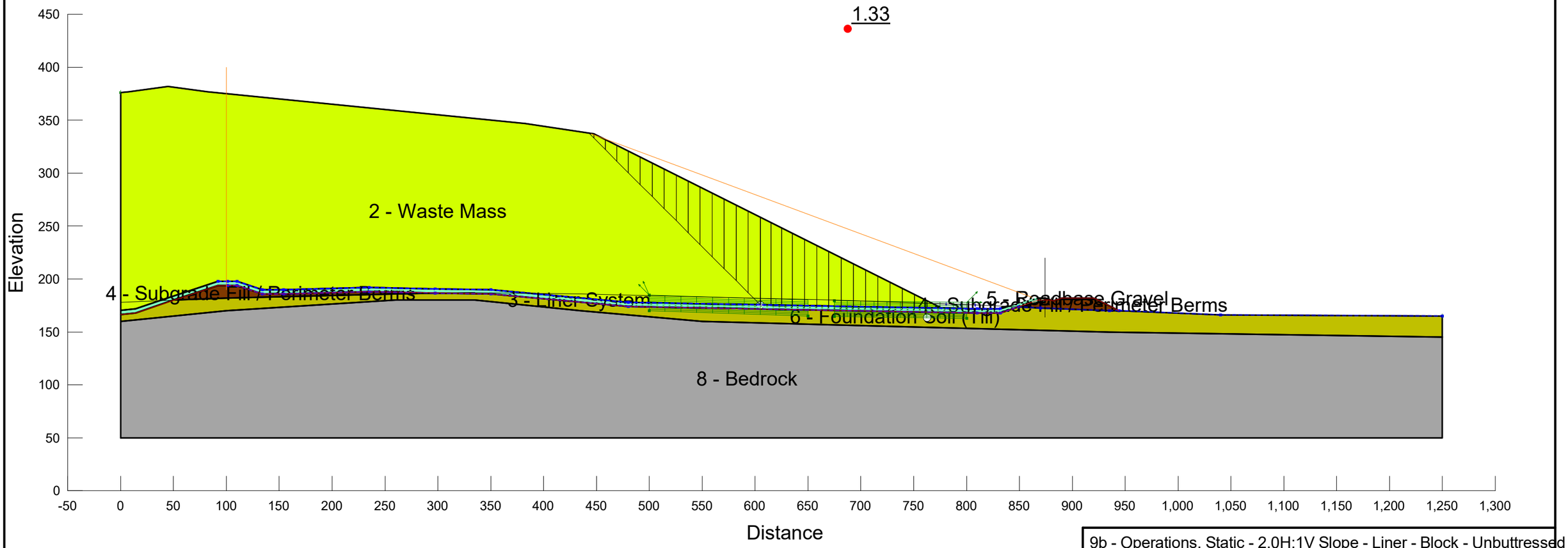
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



9a - Operations, Static - 2.0H:1V Slope - Waste Mass - Unbuttressed
JRL_Phase-II-Expansion_Section_A-A'_West_Ops.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West_Ops.gsz
Date: 08/13/2025
Name: 9b - Operations, Static - 2.0H:1V Slope - Liner - Block - Unbuttressed
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

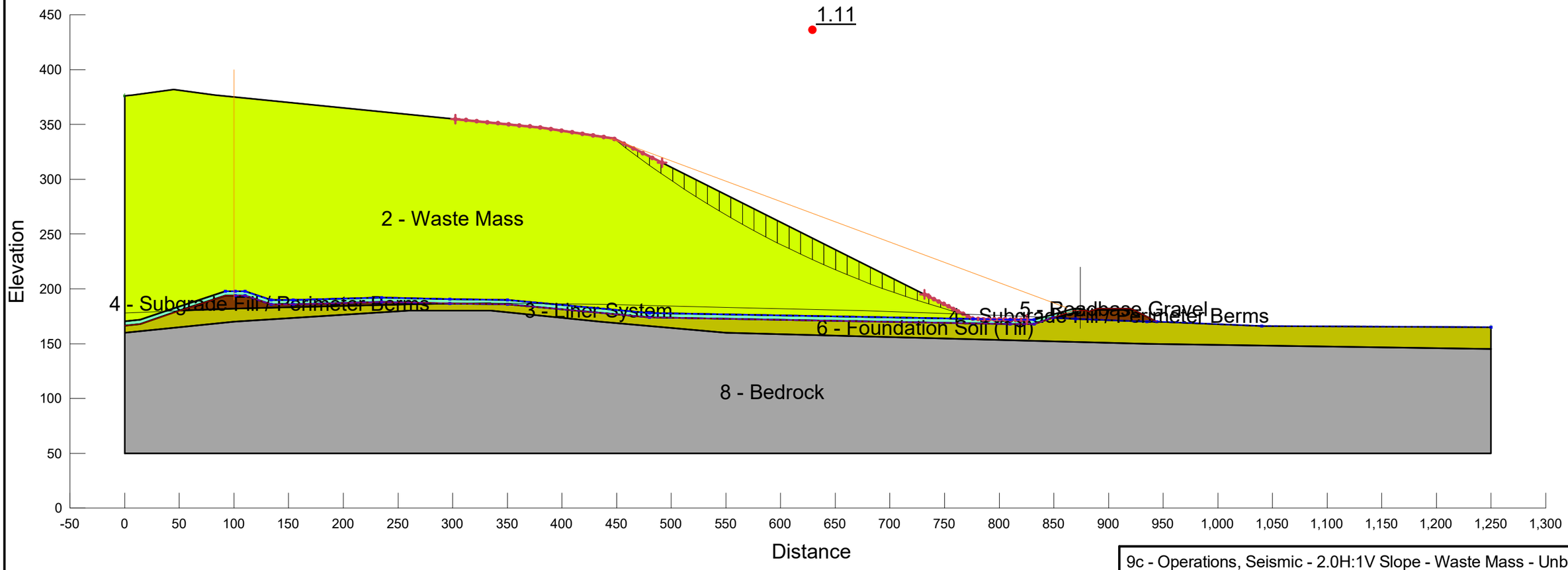
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



9b - Operations, Static - 2.0H:1V Slope - Liner - Block - Unbuttressed
JRL_Phase-II-Expansion_Section_A-A'_West_Ops.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West_Ops.gsz
Date: 08/13/2025
Name: 9c - Operations, Seismic - 2.0H:1V Slope - Waste Mass - Unbuttressed
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.06

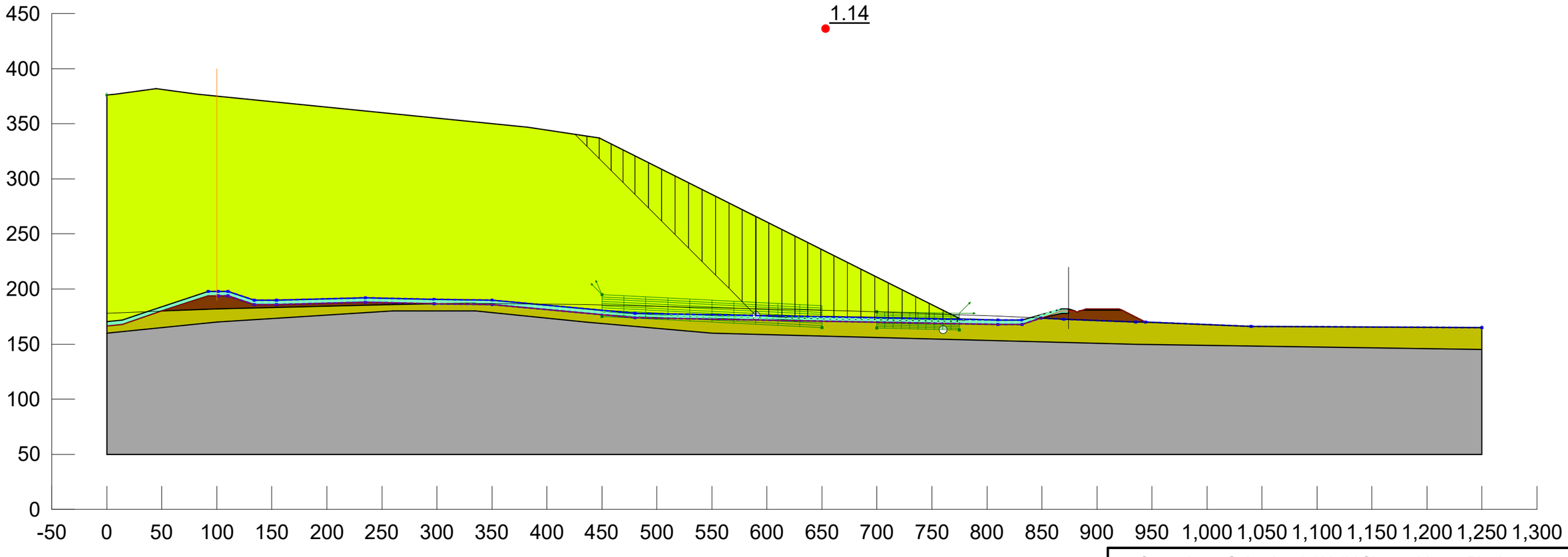
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



9c - Operations, Seismic - 2.0H:1V Slope - Waste Mass - Unbuttressed
JRL_Phase-II-Expansion_Section_A-A'_West_Ops.gsz
08/13/2025 1:1,100

File Name: JRL_Phase-II-Expansion_Section_A-A'_West.gsz
Date: 08/14/2025
Name: 7 - Operations, Seismic - 2.0H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 15 ft
Horz Seismic Coef.: 0.06

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	1	
	3 - Liner System	Shear/Normal Fn.	120			1	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	2	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	2	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	2	
	8 - Bedrock	Bedrock (Impenetrable)				2	



7 - Operations, Seismic - 2.0H:1V Slope - Liner - Block	
JRL_Phase-II-Expansion_Section_A-A'_West.gsz	
08/14/2025	1:1,100

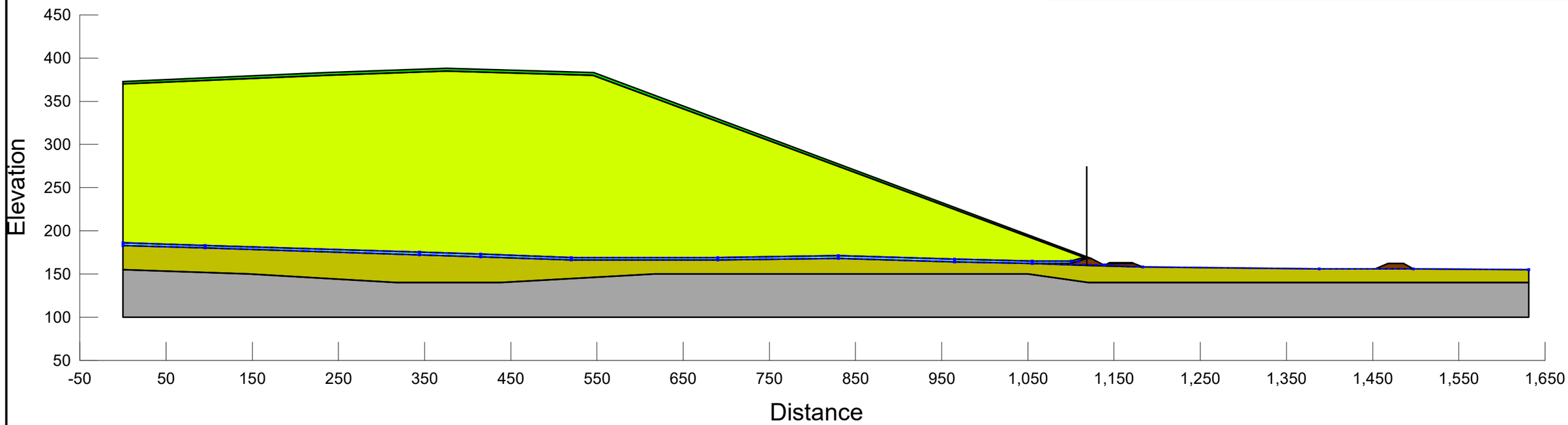
2B

SLOPE/W OUTPUT – CROSS-SECTION B-B'

SME
SEVEE & MAHER
ENGINEERS

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

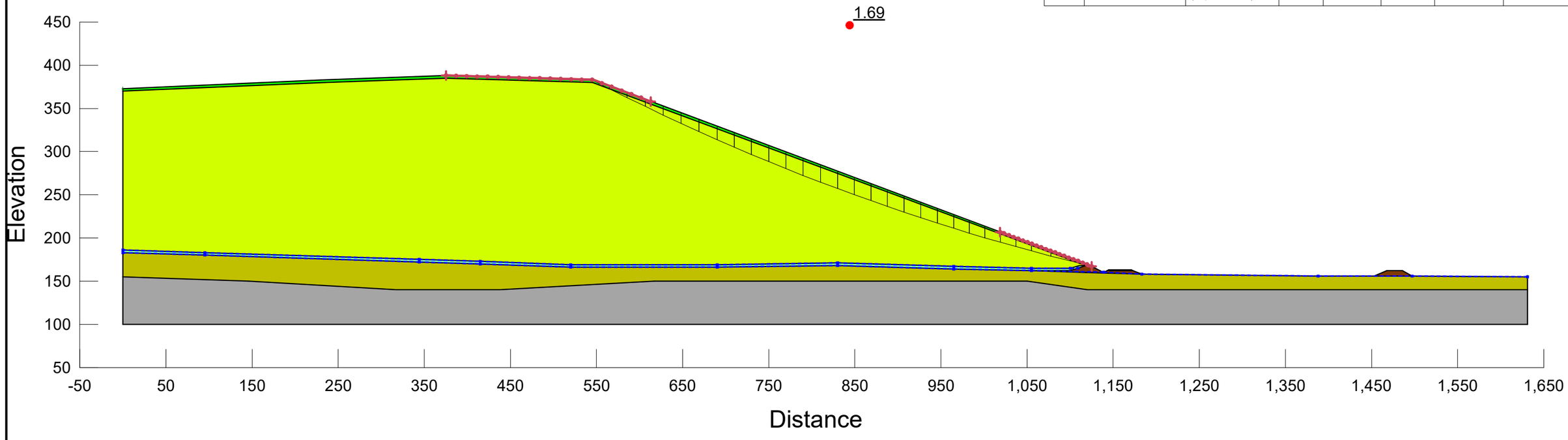
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

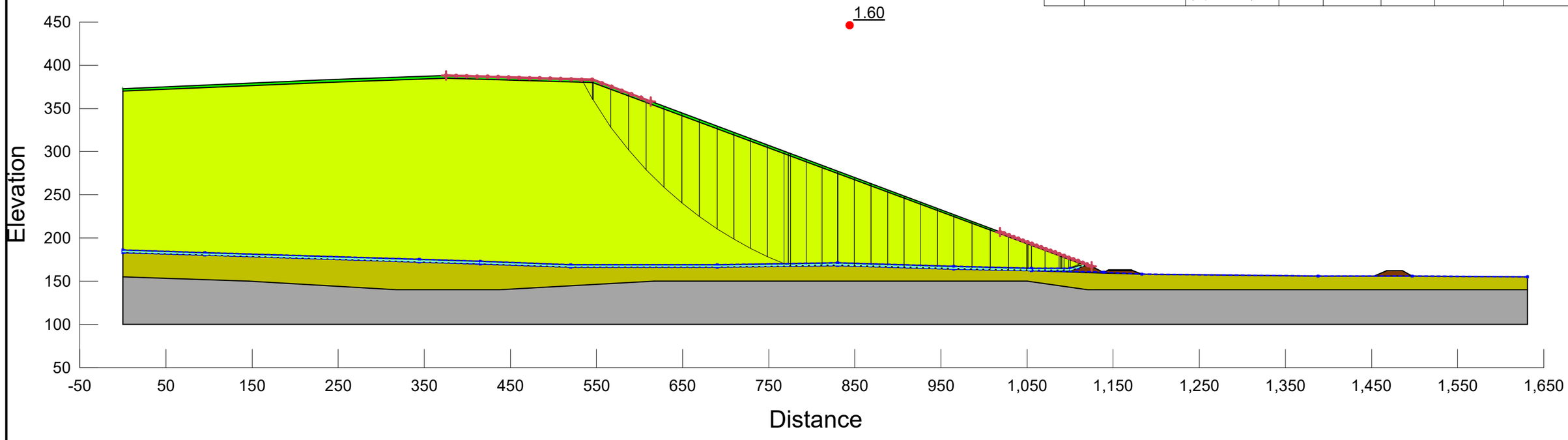
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



1 - Post-Closure, Static - 2.7H:1V Slope - Waste Mass	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 2 - Post-Closure, Static - 2.7H:1V Slope - Liner - Circular
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

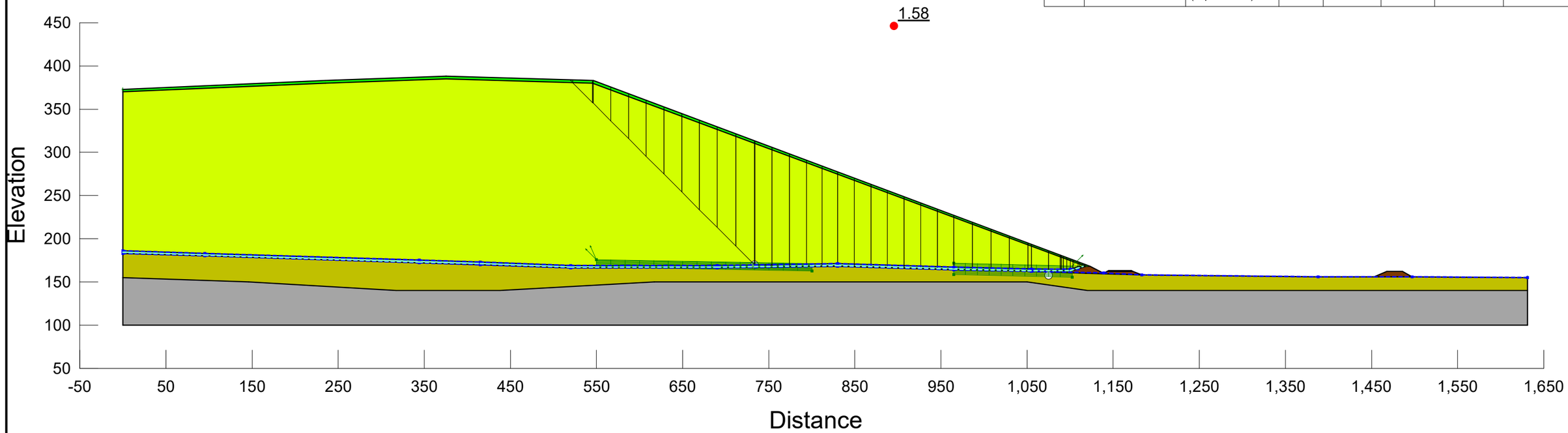
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



2 - Post-Closure, Static - 2.7H:1V Slope - Liner - Circular	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 3 - Post-Closure, Static - 2.7H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

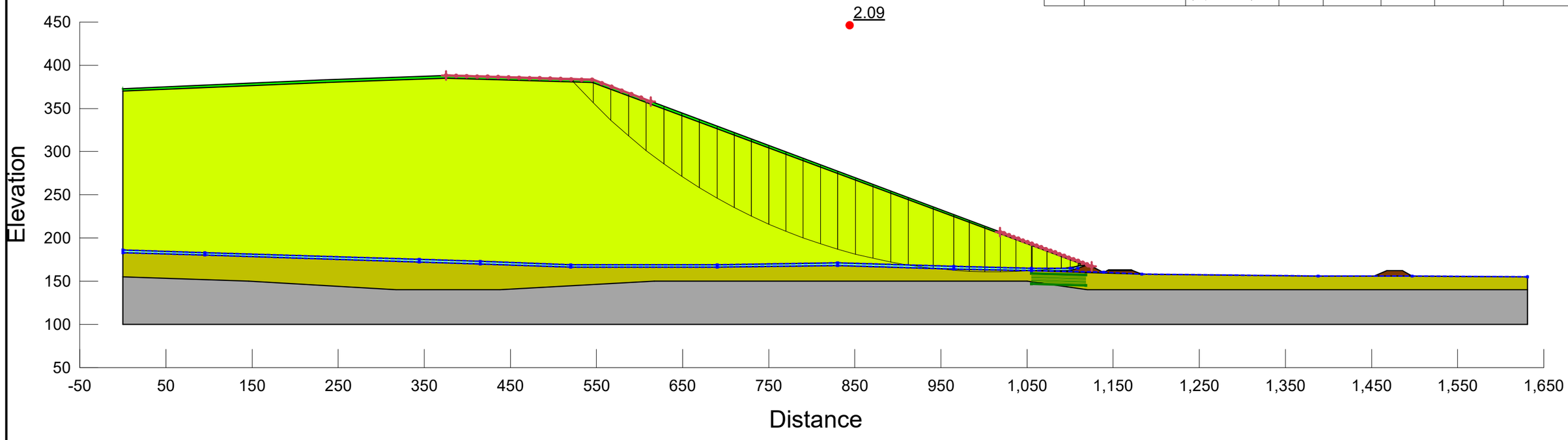
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



3 - Post-Closure, Static - 2.7H:1V Slope - Liner - Block	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 4 - Post-Closure, Static - 2.7H:1V Slope - Foundation
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

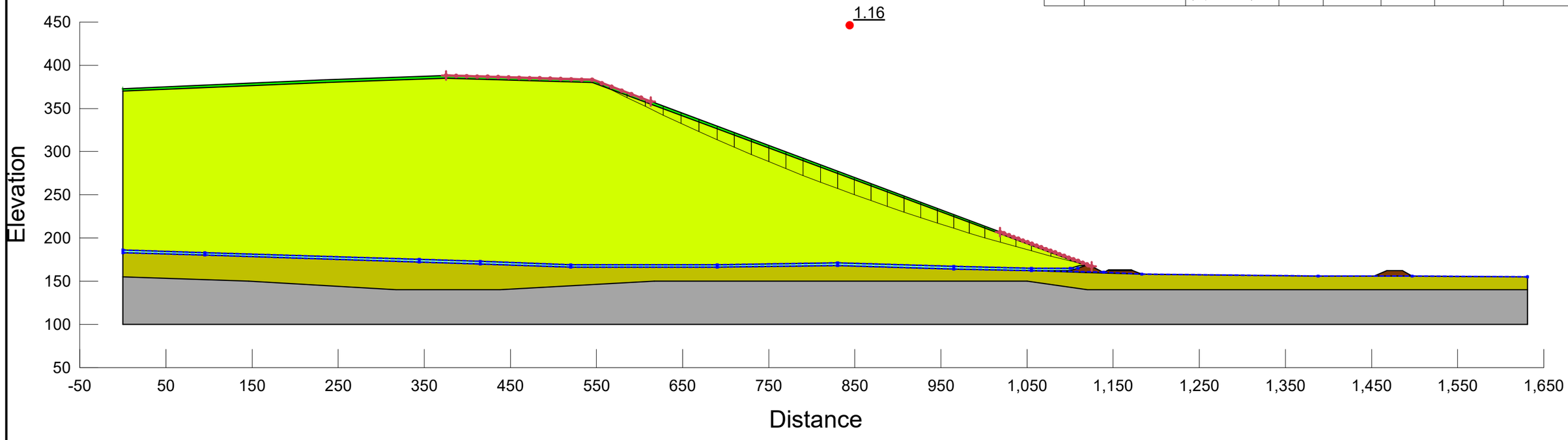
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



4 - Post-Closure, Static - 2.7H:1V Slope - Foundation	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 5 - Post-Closure, Seismic - 2.7H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

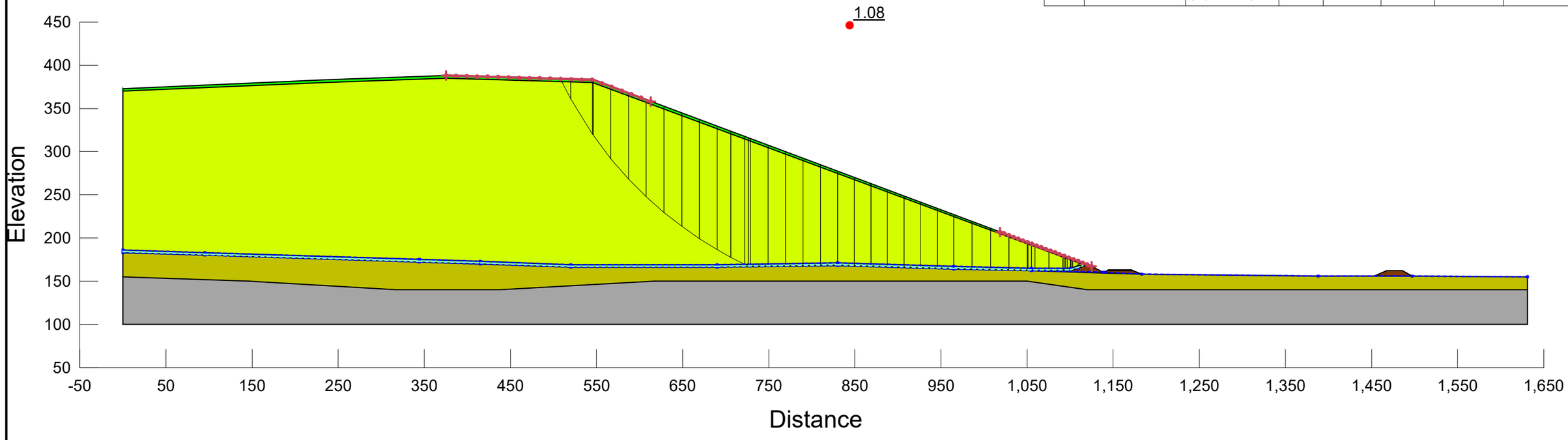
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



5 - Post-Closure, Seismic - 2.7H:1V Slope - Waste Mass	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 6 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Circular
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

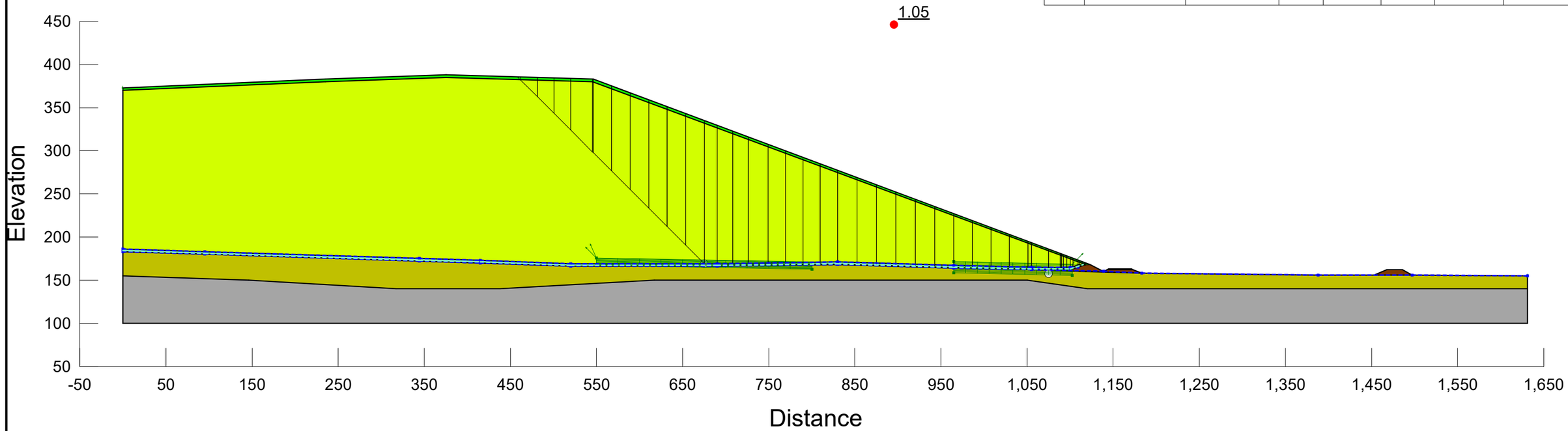
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



6 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Circular	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 7 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

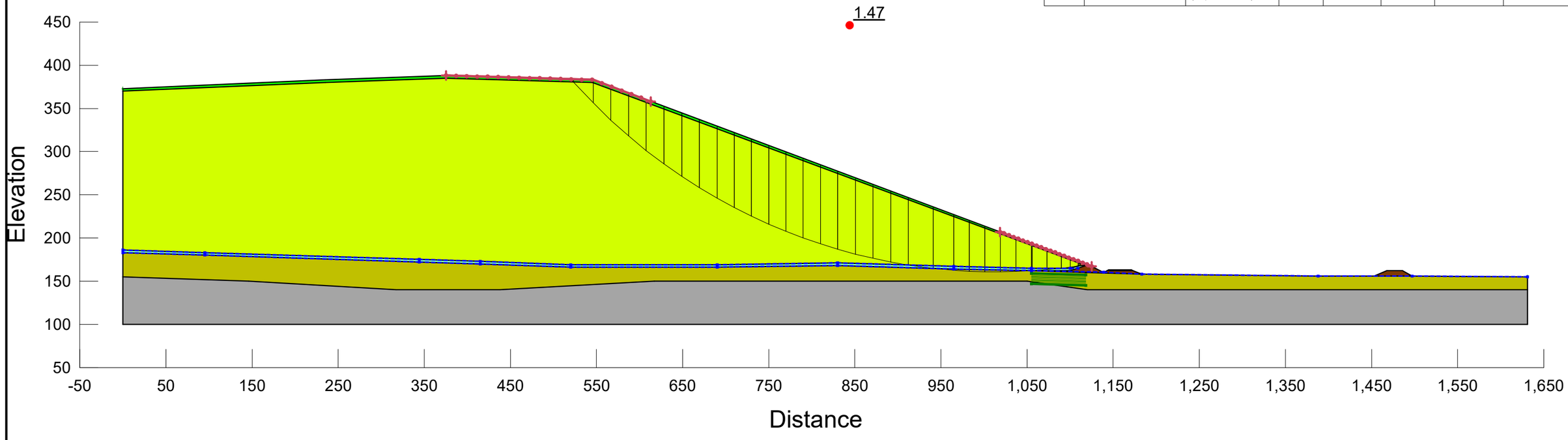
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



7 - Post-Closure, Seismic - 2.7H:1V Slope - Liner - Block	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 8 - Post-Closure, Seismic - 2.7H:1V Slope - Foundation
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

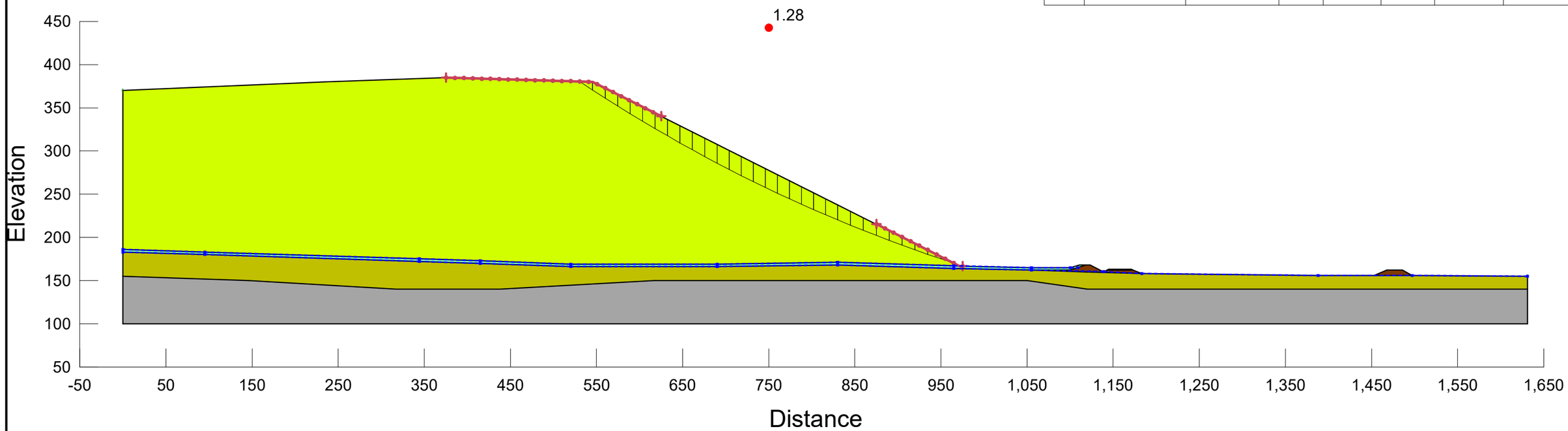
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



8 - Post-Closure, Seismic - 2.7H:1V Slope - Foundation	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 1 - Operations, Static - 2.0H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

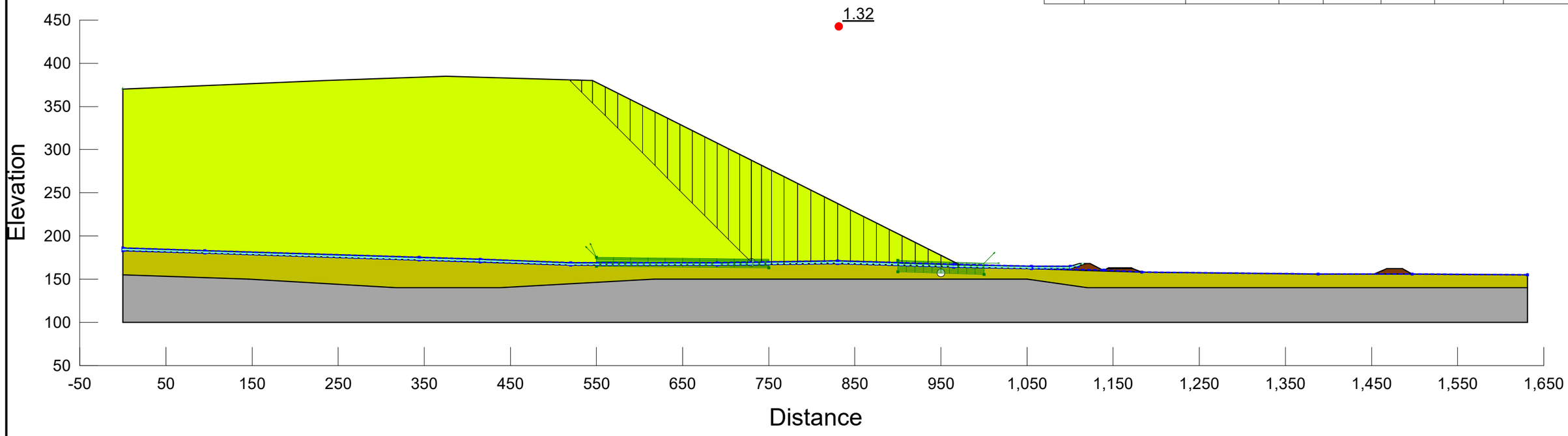
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



1 - Operations, Static - 2.0H:1V Slope - Waste Mass	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 3 - Operations, Static - 2.0H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

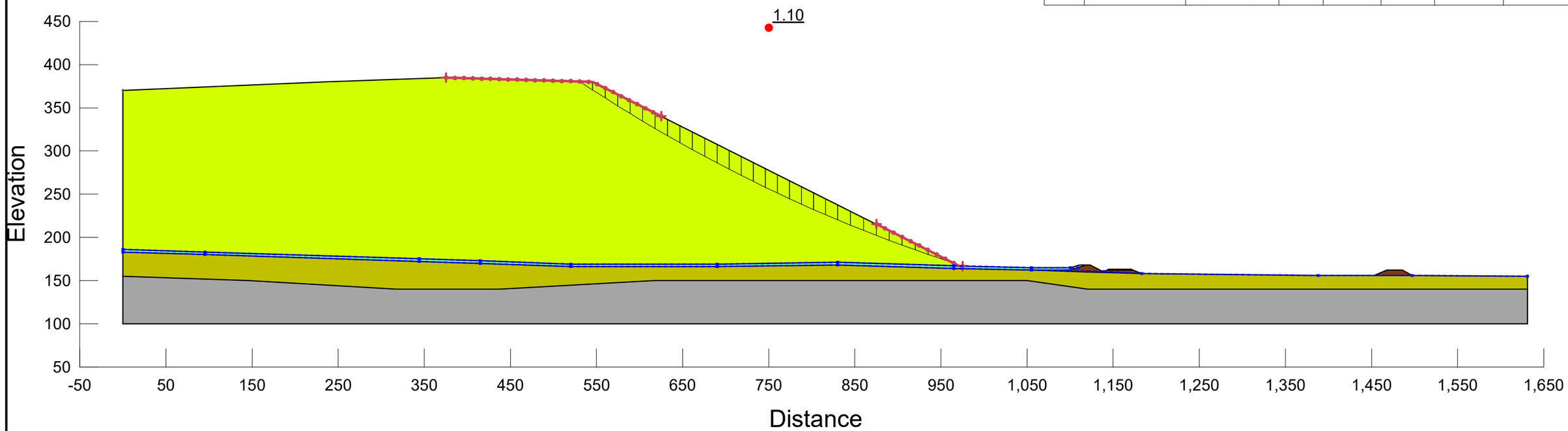
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



3 - Operations, Static - 2.0H:1V Slope - Liner - Block	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 5 - Operations, Seismic - 2.0H:1V Slope - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.06

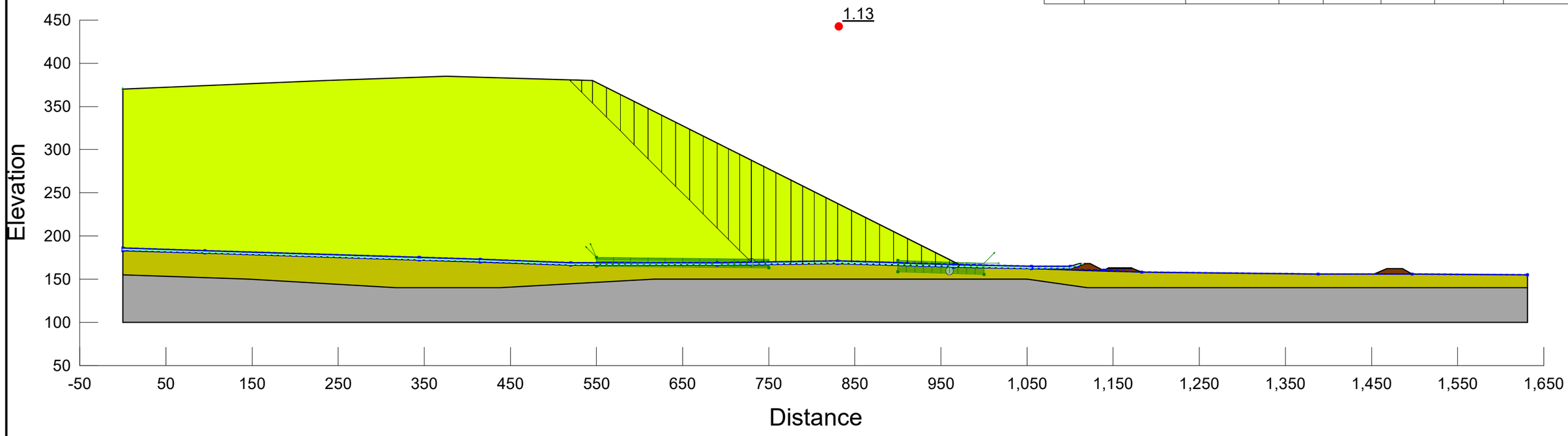
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



5 - Operations, Seismic - 2.0H:1V Slope - Waste Mass	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

File Name: JRL_Phase-II-Expansion_Section_B-B'_North.gsz
Date: 08/13/2025
Name: 7 - Operations, Seismic - 2.0H:1V Slope - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.06

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



7 - Operations, Seismic - 2.0H:1V Slope - Liner - Block	
JRL_Phase-II-Expansion_Section_B-B'_North.gsz	
08/13/2025	1:1,375

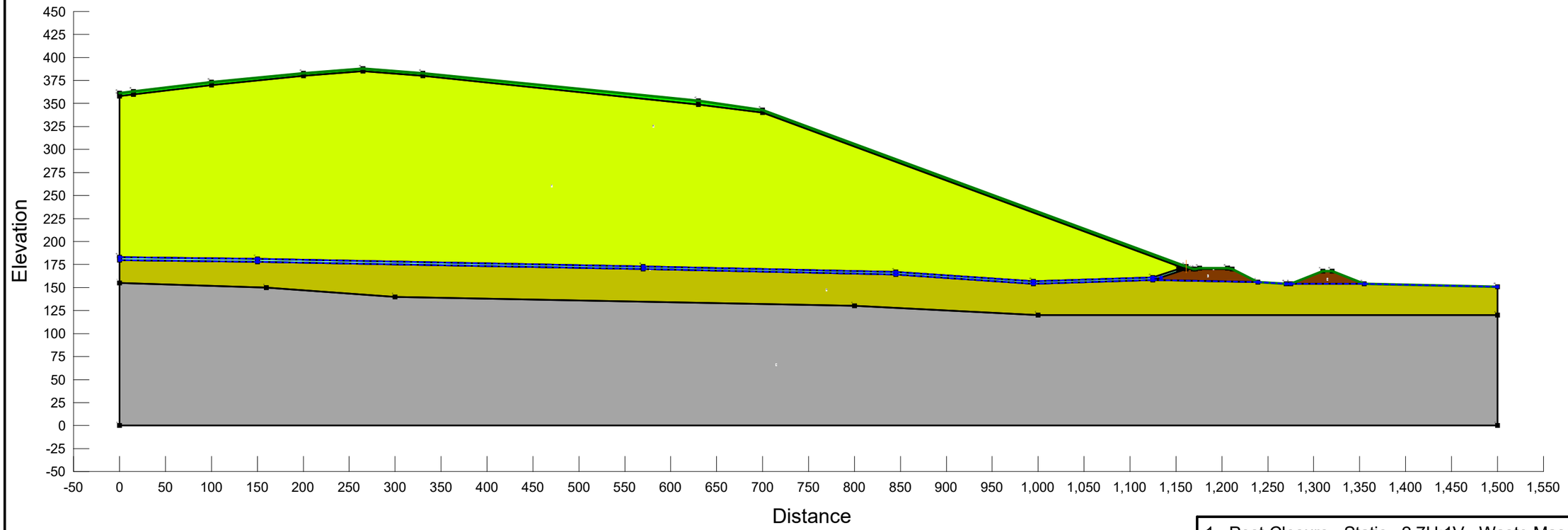
2C

SLOPE/W OUTPUT – CROSS-SECTION C-C'

SME
SEVEE & MAHER
ENGINEERS

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 1 - Post-Closure - Static - 2.7H:1V - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

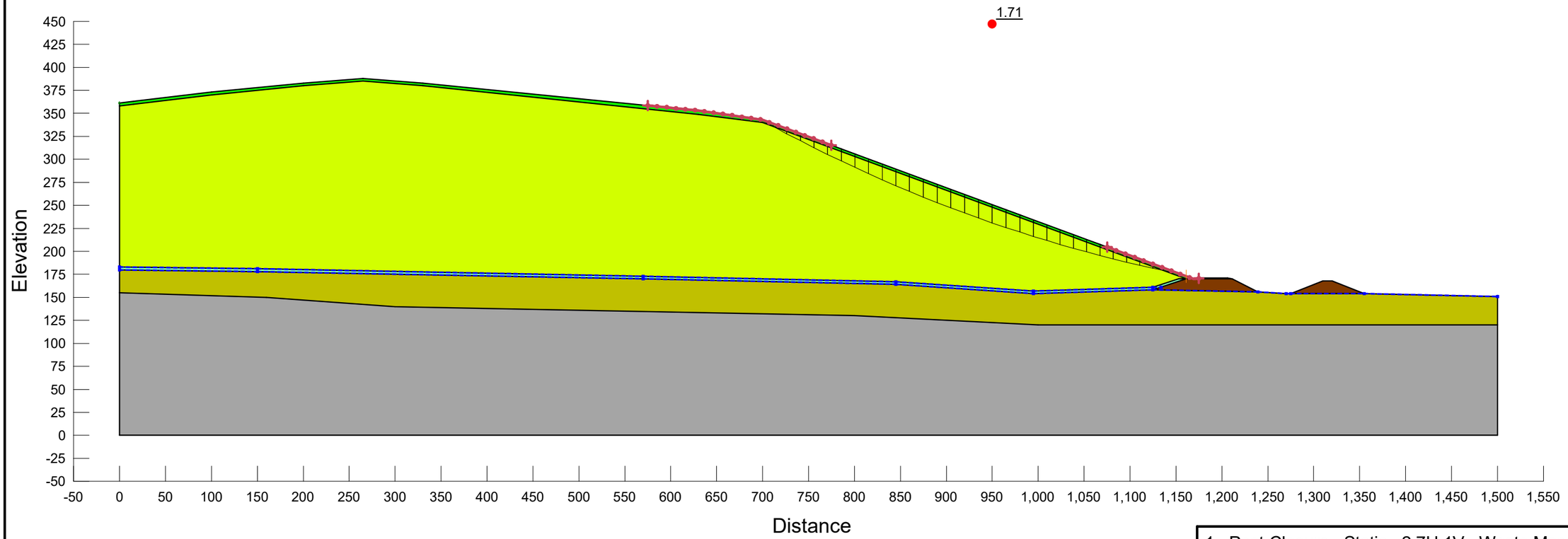
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



1 - Post-Closure - Static - 2.7H:1V - Waste Mass
JRL_Phase-II-Expansion_Section_C-C'_East.gsz
08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 1 - Post-Closure - Static - 2.7H:1V - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



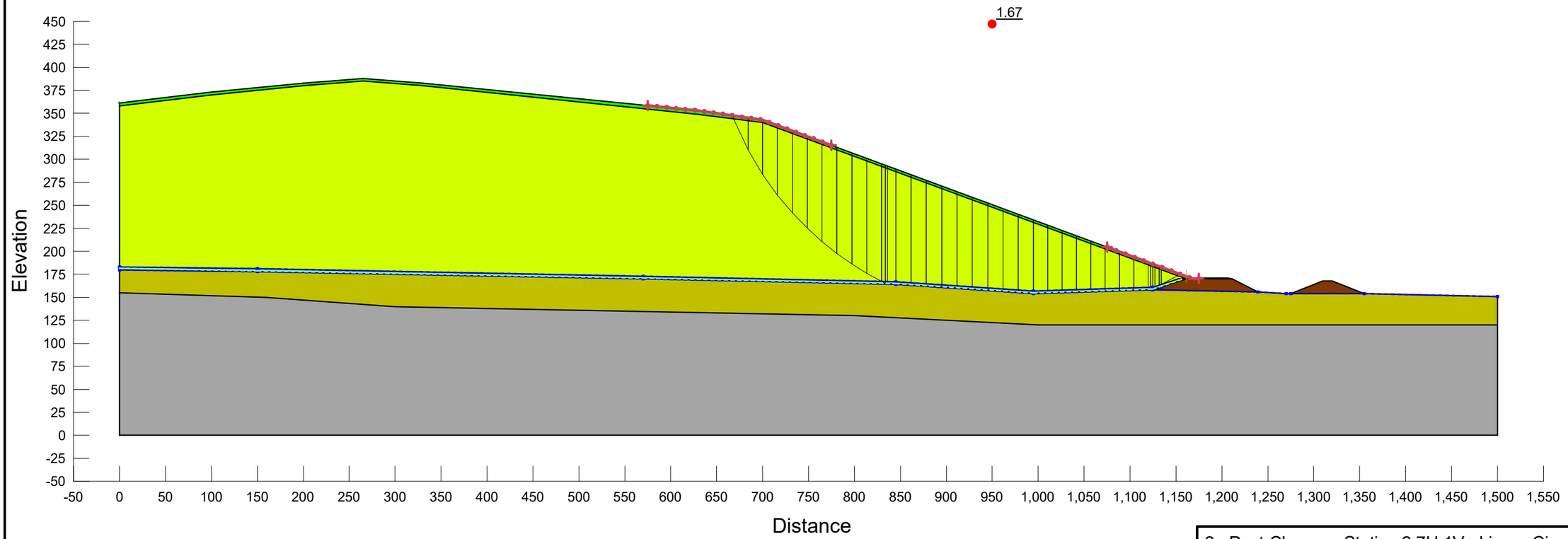
1 - Post-Closure - Static - 2.7H:1V - Waste Mass

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 2 - Post-Closure - Static - 2.7H:1V - Liner - Circular
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



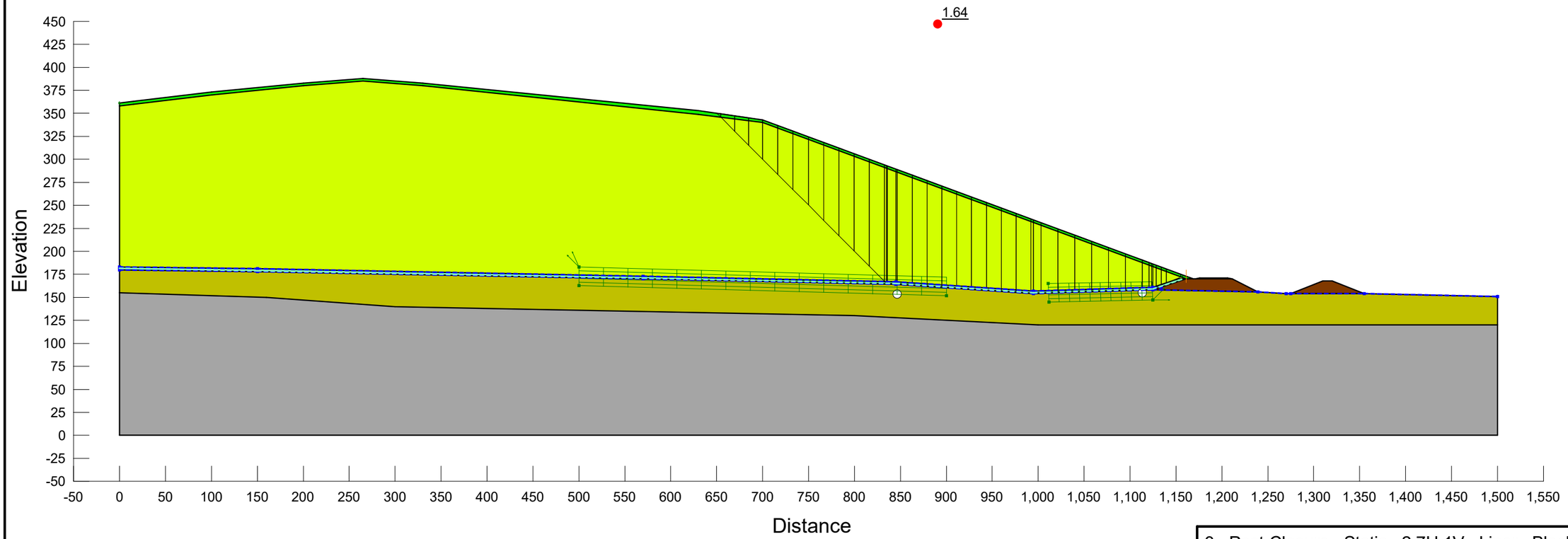
2 - Post-Closure - Static - 2.7H:1V - Liner - Circular

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 3 - Post-Closure - Static - 2.7H:1V - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



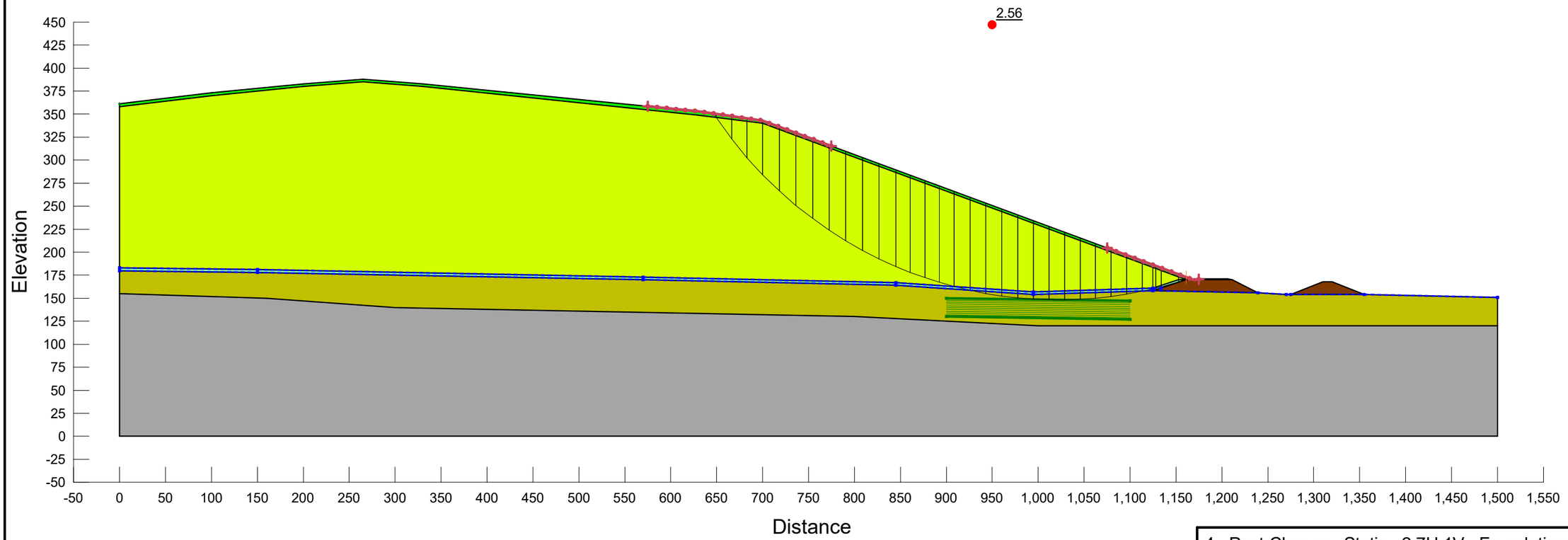
3 - Post-Closure - Static - 2.7H:1V - Liner - Block

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 4 - Post-Closure - Static - 2.7H:1V - Foundation
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.:

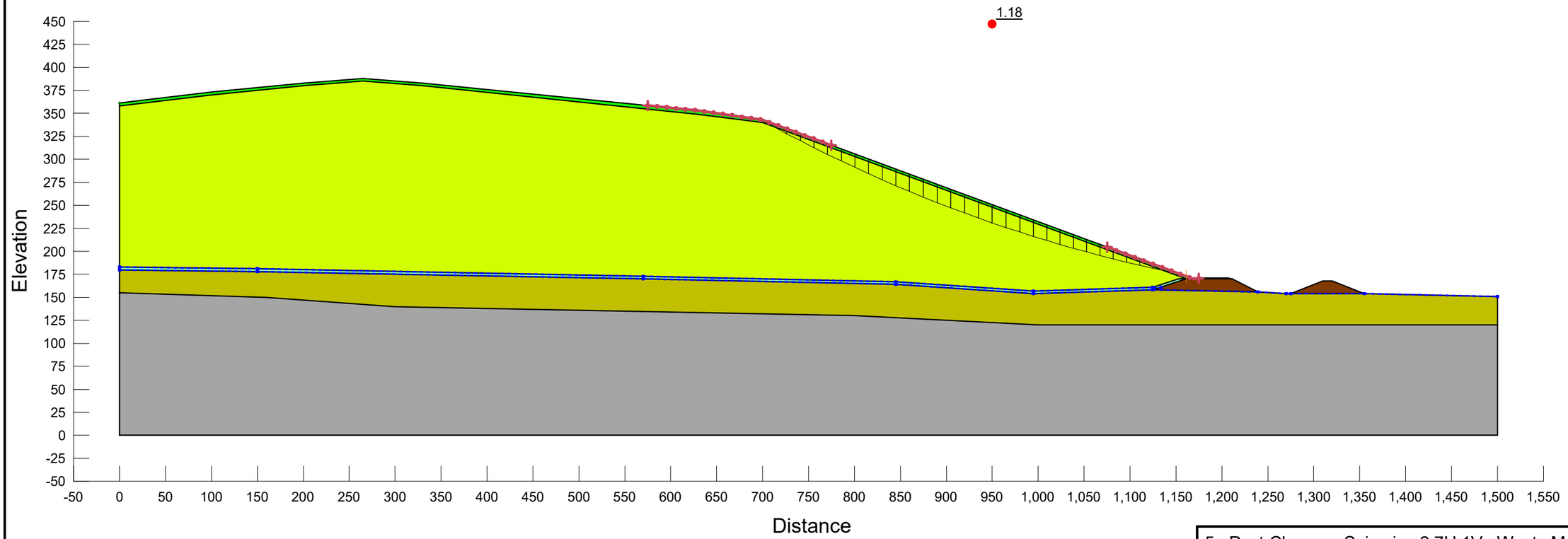
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



4 - Post-Closure - Static - 2.7H:1V - Foundation
JRL_Phase-II-Expansion_Section_C-C'_East.gsz
08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 5 - Post-Closure - Seismic - 2.7H:1V - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

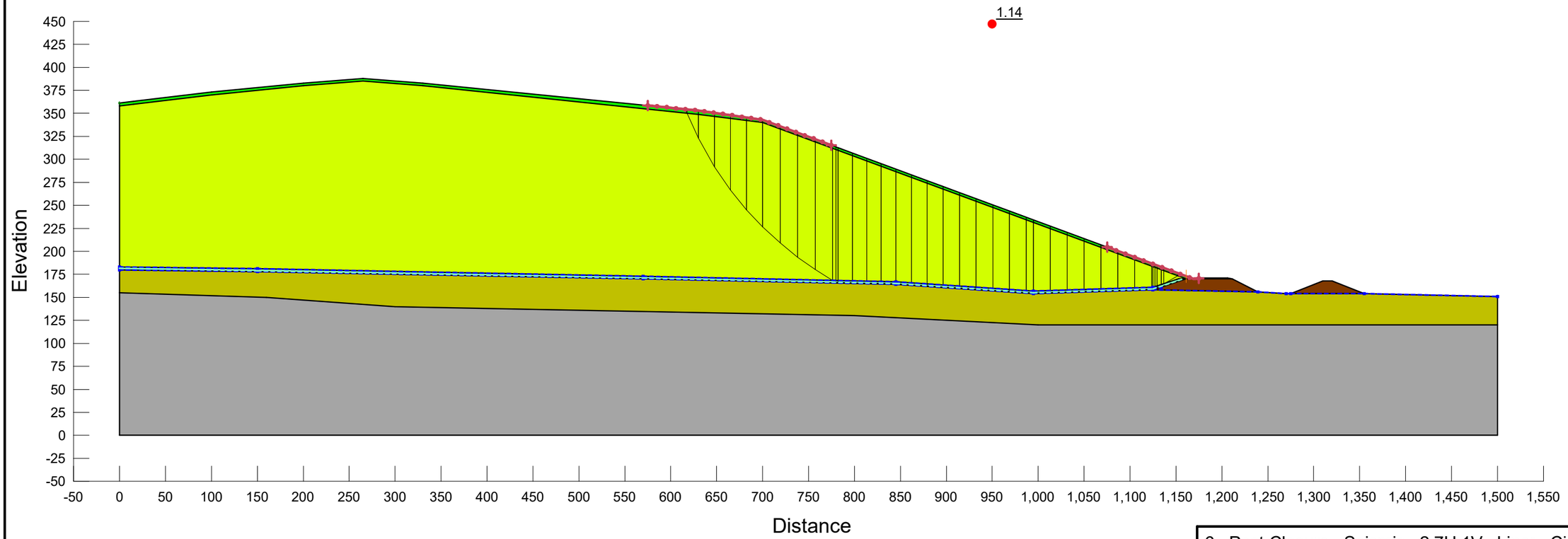
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



5 - Post-Closure - Seismic - 2.7H:1V - Waste Mass
JRL_Phase-II-Expansion_Section_C-C'_East.gsz
08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 6 - Post-Closure - Seismic - 2.7H:1V - Liner - Circular
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



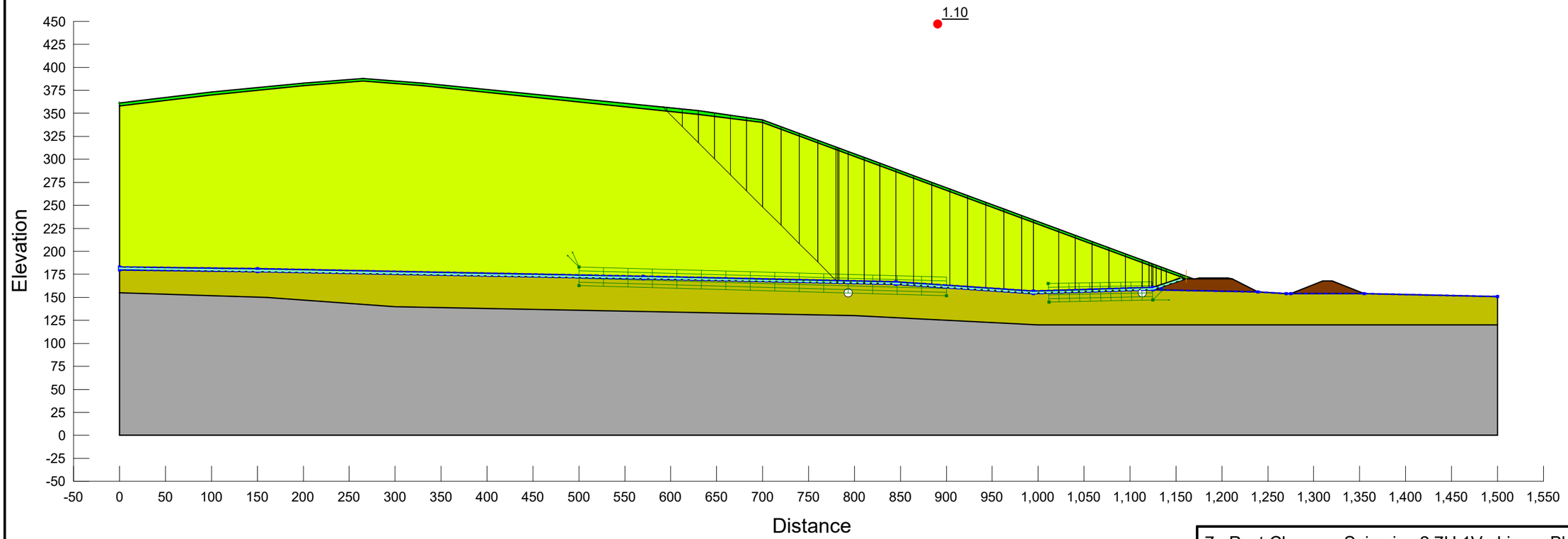
6 - Post-Closure - Seismic - 2.7H:1V - Liner - Circular

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 7 - Post-Closure - Seismic - 2.7H:1V - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



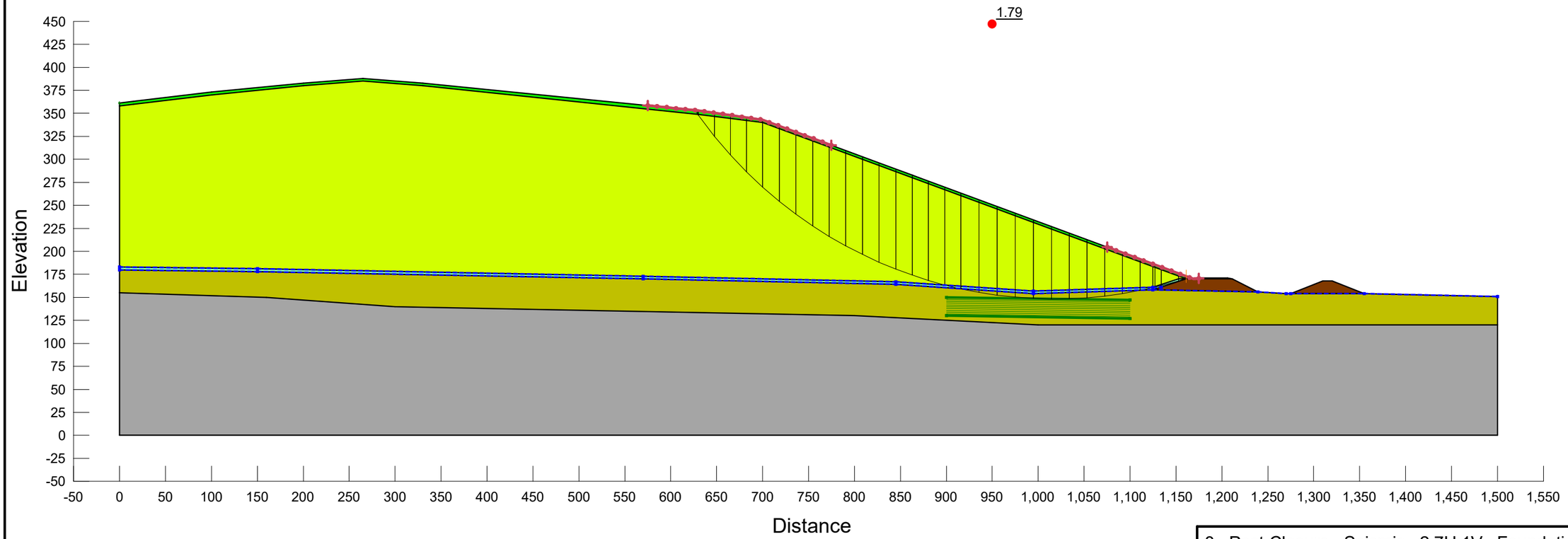
7 - Post-Closure - Seismic - 2.7H:1V - Liner - Block

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 8 - Post-Closure - Seismic - 2.7H:1V - Foundation
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.14

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	1 - Cover System	Mohr-Coulomb	125	0	30	1	
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



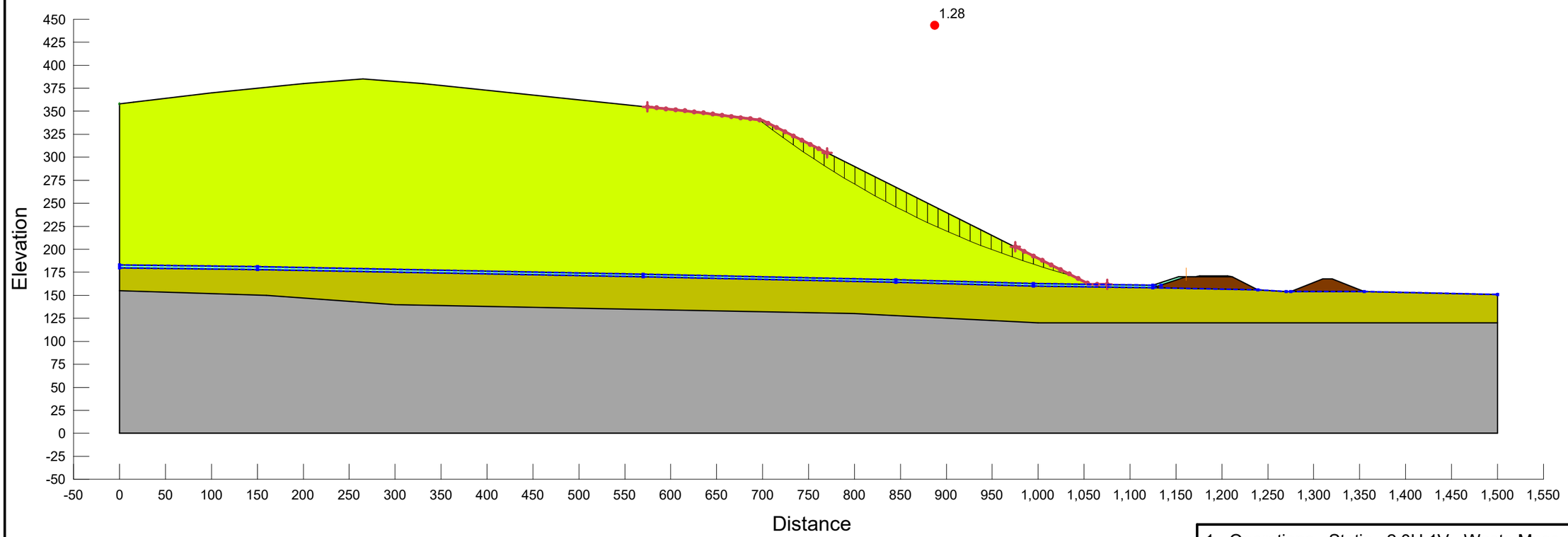
8 - Post-Closure - Seismic - 2.7H:1V - Foundation

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 1 - Operations - Static - 2.0H:1V - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0

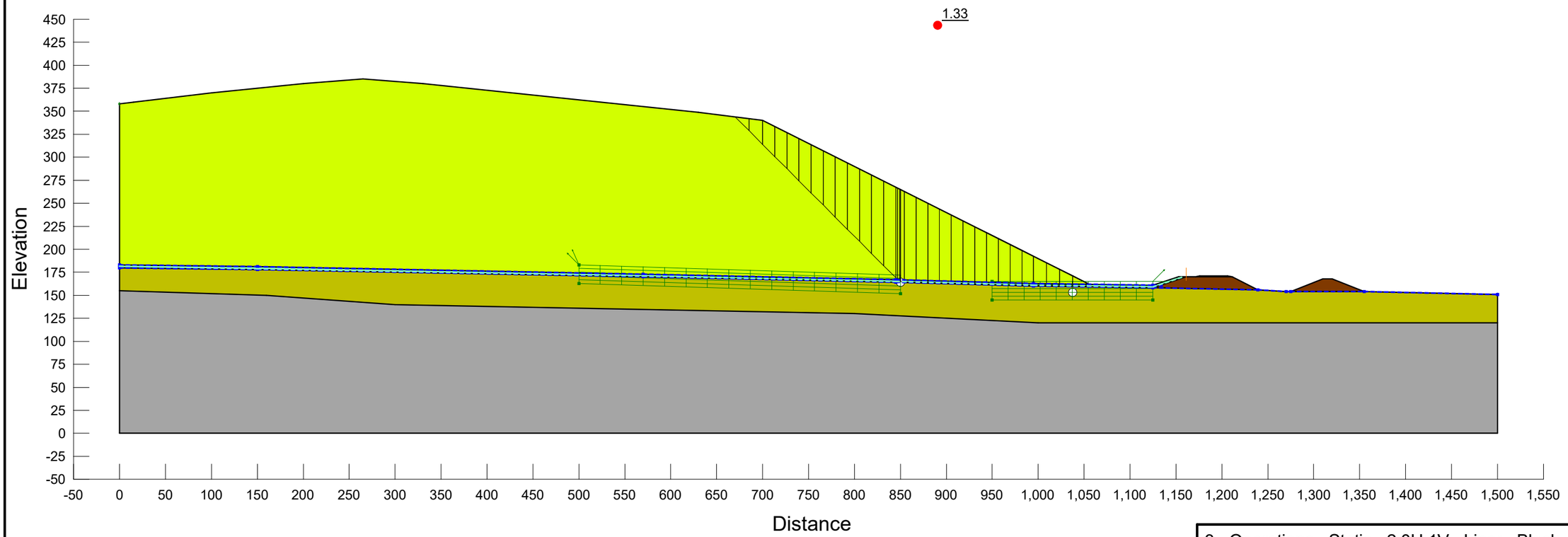
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



1 - Operations - Static - 2.0H:1V - Waste Mass
JRL_Phase-II-Expansion_Section_C-C'_East.gsz
08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 3 - Operations - Static - 2.0H:1V - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0

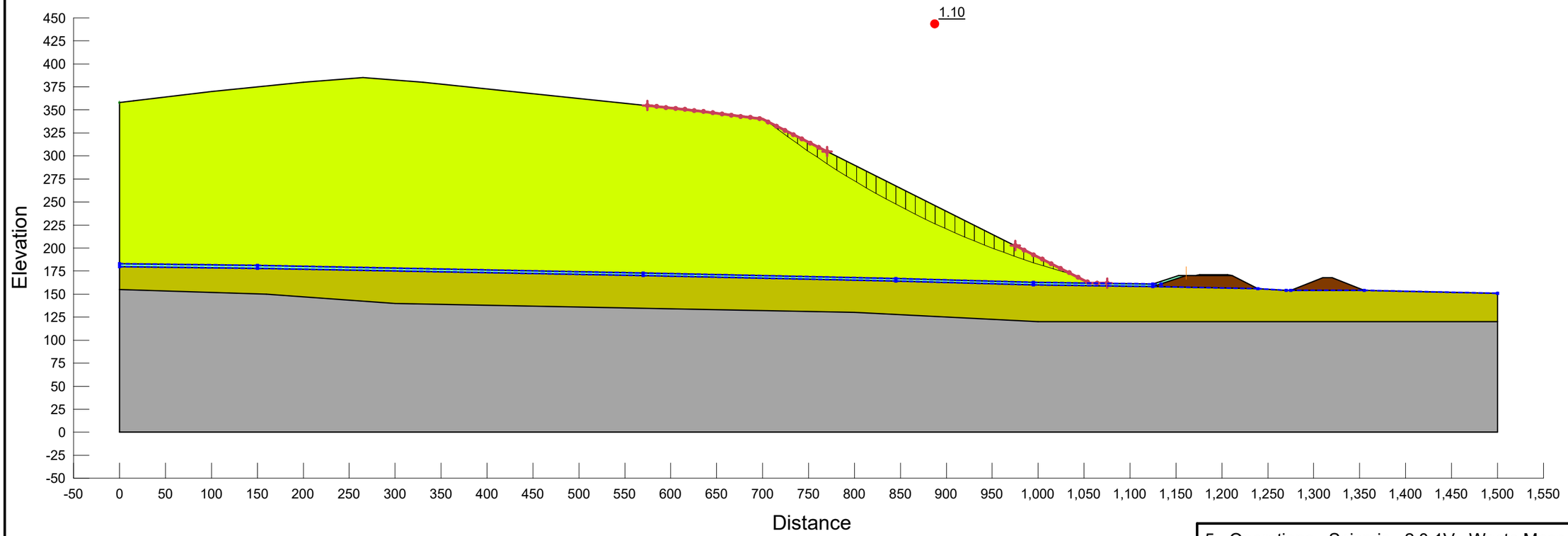
Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



3 - Operations - Static - 2.0H:1V - Liner - Block	
JRL_Phase-II-Expansion_Section_C-C'_East.gsz	
08/14/2025	1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 5 - Operations - Seismic - 2.0:1V - Waste Mass
Analysis Type: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.06

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



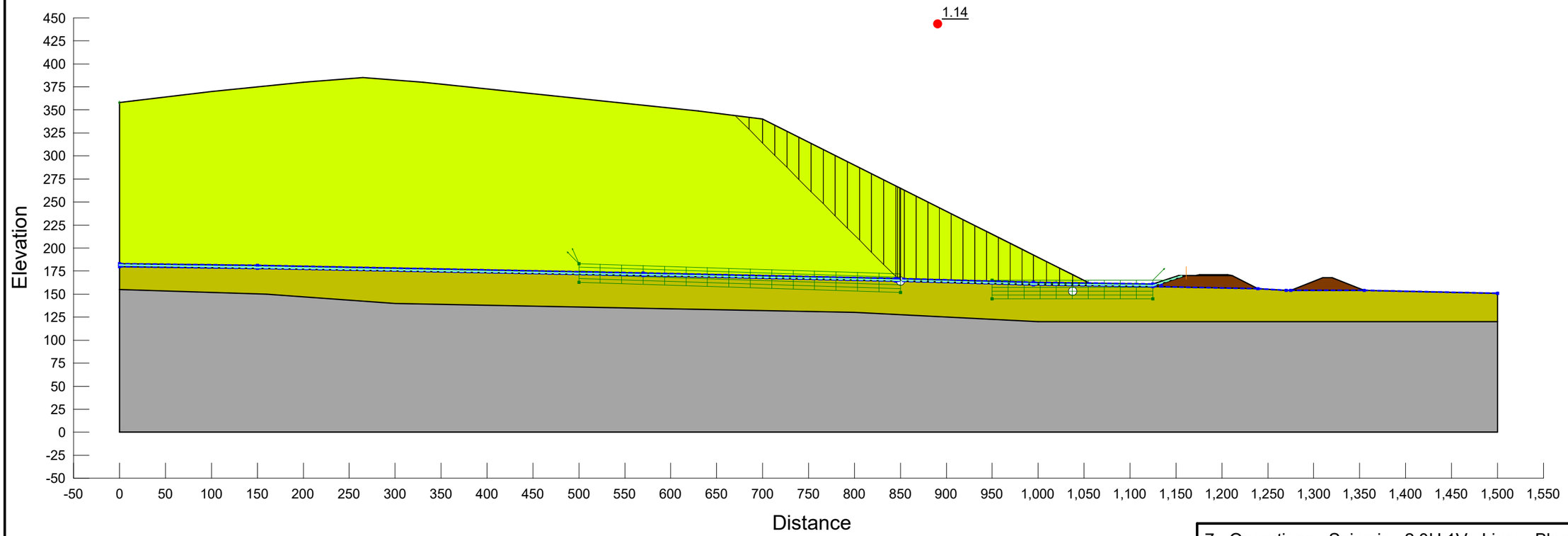
5 - Operations - Seismic - 2.0:1V - Waste Mass

JRL_Phase-II-Expansion_Section_C-C'_East.gsz

08/14/2025 1:1,400

File Name: JRL_Phase-II-Expansion_Section_C-C'_East.gsz
Date: 08/14/2025
Name: 7 - Operations - Seismic - 2.0H:1V - Liner - Block
Analysis Type: Spencer
Slip Surface Option: Block
Minimum Slip Surface Depth: 20 ft
Horz Seismic Coef.: 0.06

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface	Shear/Normal Strength Fn.
	2 - Waste Mass	Mohr-Coulomb	74	0	32	2	
	3 - Liner System	Shear/Normal Fn.	120			2	Liner - 2024 - Peak Strength
	4 - Subgrade Fill / Perimeter Berms	Mohr-Coulomb	128	250	34	1	
	5 - Roadbase Gravel	Mohr-Coulomb	130	0	34	1	
	6 - Foundation Soil (Till)	Mohr-Coulomb	132	1,000	38	1	
	8 - Bedrock	Bedrock (Impenetrable)				1	



7 - Operations - Seismic - 2.0H:1V - Liner - Block
JRL_Phase-II-Expansion_Section_C-C'_East.gsz
08/14/2025 1:1,400

2D

SEISMIC LIQUEFACTION ANALYSIS

SME
SEVEE & MAHER
ENGINEERS

JRL EXPANSION
LIQUIFACTION POTENTIAL ASSESSMENT (BASED EPA, 1995)

Exploration	Depth	N_{60}	Ground Surface Elevation	SPT Test Elevation	Phreatic Surface Elev.	Base of Liner System Elev.	Will Soil Remain After Liner is Constructed?	Top of Cover Elev.	Vertical Stresses				rd	CSReq	CN	$(N_1)_{60}$	If (N1)60 >22 then Not Liquifiable	CSR	K-sigma	K-alpha	CSR-L	FOS
									Existing Before Constuction		After Construction											
									total	effective	total	effective										
	(ft-bgs)	(bpf)	(ft-msl)	(ft-msl)	(ft-msl)	(ft-msl)		(ft-msl)	(psf)	(psf)	(psf)	(psf)				(bpf)						
	Note 1	Note 2	Note 3						Note 4		Note 5		Note 6	Note 7	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Note 14	Note 15
B-225 (P-225)	1	12	212.8	211.8	212	212.7	Yes	378.66	138	126	12793	12781	1.00	0.11	0.40	9.00	Continue	0.18	0.4	2.0	0.144	1.3
B-225 (P-225)	6	109	212.8	206.8	212	212.7	Yes	378.66	828	504	13483	13159	0.99	0.11	0.39	81.75	Non-Liquifiable					
MW-302	3	32	202.1	199.1	199	203.1	Yes	282.26	414	414	6798	6798	0.99	0.11	0.54	24.00	Non-Liquifiable					
MW-302	6	78	202.1	196.1	199	203.1	Yes	282.26	828	647	7212	7031	0.99	0.11	0.53	58.50	Non-Liquifiable					
MW-304A	1	6	214.7	213.7	200	214.9	Yes	240.42	138	138	2442	2442	1.00	0.11	0.90	4.50	Continue	0.12	0.6	2.0	0.144	1.3
MW-304A	16	102	214.7	198.7	200	214.9	Yes	240.42	2208	2127	4512	4431	0.96	0.11	0.67	68.53	Non-Liquifiable					
P-04-05	1	8	201	200	198	195.3	No															
P-04-05	6	70	201	195	198	195.3	Yes	301.42	828	641	8282	8095	0.99	0.11	0.50	52.50	Non-Liquifiable					
P-04-05	11	70	201	190	198	195.3	Yes	301.42	1518	1019	8972	8473	0.97	0.11	0.49	34.01	Non-Liquifiable					
P-04-05	20	122	201	181	198	195.3	Yes	301.42	2760	1699	10214	9153	0.95	0.12	0.47	57.03	Non-Liquifiable					
P-04-05	22	62	201	179	198	195.3	Yes	301.42	3036	1850	10490	9305	0.95	0.12	0.46	28.74	Non-Liquifiable					
P-04-05	24	60	201	177	198	195.3	Yes	301.42	3312	2002	10766	9456	0.94	0.12	0.46	27.59	Non-Liquifiable					
P-04-05	26	96	201	175	198	195.3	Yes	301.42	3588	2153	11042	9607	0.94	0.12	0.46	43.80	Non-Liquifiable					
P-04-06	1	12	208.3	207.3	203	209	Yes	355.49	138	138	11463	11463	1.00	0.11	0.42	9.00	Continue	0.18	0.4	2.0	0.144	1.3
P-04-06	3	72	208.3	205.3	203	209	Yes	355.49	414	414	11739	11739	0.99	0.11	0.41	54.00	Non-Liquifiable					
P-04-06	5	76	208.3	203.3	203	209	Yes	355.49	690	690	12015	12015	0.99	0.11	0.41	57.00	Non-Liquifiable					
P-04-06	13	123	208.3	195.3	203	209	Yes	355.49	1794	1314	13119	12638	0.97	0.11	0.40	48.93	Non-Liquifiable					
P-04-06	17	145	208.3	191.3	203	209	Yes	355.49	2346	1616	13671	12941	0.96	0.11	0.39	57.00	Non-Liquifiable					
P-04-06	19	88	208.3	189.3	203	209	Yes	355.49	2622	1767	13947	13092	0.96	0.11	0.39	34.39	Non-Liquifiable					
P-04-06	21	88	208.3	187.3	203	209	Yes	355.49	2898	1918	14223	13243	0.95	0.11	0.39	34.20	Non-Liquifiable					
P-04-06	23	36	208.3	185.3	203	209	Yes	355.49	3174	2070	14499	13394	0.95	0.11	0.39	13.91	Continue	0.20	0.4	2.0	0.16	1.4
P-04-06	25	72	208.3	183.3	203	209	Yes	355.49	3450	2221	14775	13546	0.94	0.11	0.38	27.67	Non-Liquifiable					
P-04-06	27	102	208.3	181.3	203	209	Yes	355.49	3726	2372	15051	13697	0.94	0.11	0.38	38.98	Non-Liquifiable					
B-08-05	5.75	28	199.1	193.35	194	199.9	Yes	272.52	793.5	753	6666	6625	0.99	0.11	0.55	21.00	Continue	0.30	0.4	2.0	0.24	2.2
B-08-05	10	66	199.1	189.1	194	199.9	Yes	272.52	1380	1074	7252	6947	0.98	0.11	0.54	35.41	Non-Liquifiable					
B-08-07	6	38	211.7	205.7	209	210.1	Yes	378.11	828	622	13428	13222	0.99	0.11	0.39	28.50	Non-Liquifiable					
B-08-08	6	47	207.8	201.8	197.5	201.4	No															
B-08-08	12	56	207.8	195.8	197.5	201.4	Yes	270	1656	1550	6237	6131	0.97	0.11	0.57	31.98	Non-Liquifiable					
B-08-08	18	91	207.8	189.8	197.5	201.4	Yes	270	2484	2004	7065	6585	0.96	0.11	0.55	50.15	Non-Liquifiable					
B-08-08	24	80	207.8	183.8	197.5	201.4	Yes	270	3312	2457	7893	7038	0.94	0.12	0.53	42.65	Non-Liquifiable					
B-08-08	27	123	207.8	180.8	197.5	201.4	Yes	270	3726	2684	8307	7265	0.94	0.12	0.52	64.54	Non-Liquifiable					

1. Depth of middle of the SPT sample, from boring logs.
2. Boring logs show N-value in blows per foot, assumed to be N_{60} since not otherwise noted on logs.
3. Elevation, from boring logs. Site Datum
4. Assume total unit weight of overburden = 138 pcf.
5. Assume total unit weight of waste = 74 pcf; the 4 ft thick liner system weight is 120 pcf; and the 4 ft thick cover weight is 125 pcf.
6. Stress reduction factor (Use figure 5.3, (EPA, 1995)) {if depth is < 9.15m: rd= 1-0.00765*depth (m)}
7. Critical stress ratio induced by the design earthquake. (a_{max}/g = 0.17)
8. Blowcount correction factor (CN).
9. Normalized standardized SPT blowcount
10. EPA, 1995; Section 5.1: Soil Penetration Resistance: If (N1)60 >22 the soils are non-liquifiable.
11. Critical Stress Ratio (Use figure 5.5, (EPA, 1995)). Fines content of the samples based on logs are all greater than or equal to 35% (Silty/Clayey)
12. K-sigma is from Figure 5.7 in EPA, 1995.
13. K-alpha is from Figure 5.8 in EPA, 1995. The relative Density of the Basal Till is at least 70%. Till cohesion = 1,000 psf. When alpha is greater than plot, use k-alpha = 2
14. Stress level correction. At M=7.5 k_M = 1.0 from Fig 5.6 in EPA, 1995.
15. Factor of safety against liquifaction. Values greater than 1.0 are considered acceptable (not likely to liquify).

PROJECT West Old Town Landfill | JOB NO. 3006 | BORING NO. B225

DATE COMPLETED 02.17.20 | WELLS INSTALLED P225 | DRILLING METHOD WASHED BORING

GROUND SURFACE ELEVATION (FT) 212.8 | DRILLING CONTRACTOR Maine Test Boring, Inc. | LOGGED BY KAW

BOREHOLE DIAMETER (IN) 3.5" O.D. | ROCK CORE DIAMETER (IN) N/A | SHEET 1 OF 1

SAMPLE NO.	MATERIAL DESCRIPTION	N	MC (%)	% ORG & LOI	ATTER-BERG LIMIT	PERMEABILITY (FT/DAY)	INSTRUMENT LOG	DEPTH (FT)
1D	0.5 TOPSOIL	12						
	Brown Sandy Gravelly Silt-Clay Trace of Cobbles (Basal Till)						3.0 4.0 6.0 P-225 5' Screen 12.7 13.5 15.1	
2D		109				K_p = 0.093		
3D		10						
	15.1 REFUSAL BOE							

NOTES

SEVEE & MAHER ENGINEERS

PROJECT WEST OLD TOWN LANDFILL JOB NO. 90006 BORING NO. B505 (MW 302)

DATE COMPLETED 03.10.92	DATE WELLS INSTALLED 03.10.92	DRILLING METHOD HSA/HSD BORING
GROUND SURFACE ELEVATION (FT) 202.1	DRILLING CONTRACTOR MANN TECH BORING, INC.	LOGGED BY KPN
BOREHOLE DIAMETER (IN) 4" ID	ROCK CORE DIAMETER (IN) 3.875" OD (NW)	SHEET ___ OF ___

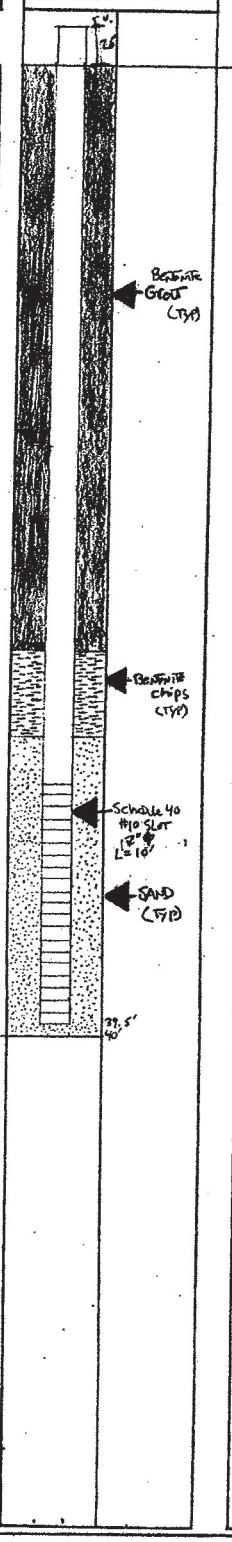
DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N	RQD %				INSTRUMENT LOG	DEPTH (FT)
0	1D	Brown Silty Gravelly Sand Trace of Cobbles	32						0
	2D		78					BENTONITE 2.0	5
	8Z								
10	1R			25					10
	2R			95				15.0 SAND 17.0	15
15		BEDROCK							
	3R			95					20
20	4R			100				10 FT 2" ϕ SLOTTED PVC SCREEN	25
25	5R			82				27.0 29.7 30.4	
30	304							ROCK CORE NOT RECOVERED	30
		BOE							

NOTES

PROJECT West Old Town Landfill Expansion	JOB NO. 03076.09	BORING NO. MW-304A	
DATE COMPLETED 7/16/04	DATE WELLS INSTALLED 7/15/04	DRILLING METHOD Wash-Rotary	
GROUND SURFACE ELEVATION (FT) 214.7'	DRILLING CONTRACTOR M.T.B.	LOGGED BY T. Riley / JCS	
BOREHOLE DIAMETER (IN) 4.5" O.D.	ROCK CORE DIAMETER (IN.) 2.5"	SHEET 1 OF 1	

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N	RQD	% Passing #200 screen	Water Content (%)
0		0-0.2' topsoil				
	1D	Brown SILT / CLAY w/ A Trace of Medium SAND, Gravel and Cobbles	6			
2.5'						
	2D	Olive silt w/ Fine to Medium SAND w/ Little Gravel and Cobbles.	75/3.5'		57.7%	11.6%
10.5'	3DA	(BASAL TILL)	61			
	3DB	Brown Fine to Medium SAND w/ Little Coarse Sand (SAND LENSE)	90			
15.5'	4D	Becoming ... VERY SILTY with Clayey Layers	102		21.7%	18.2%
19.5'		(BASAL TILL)				
	5D	BROWN SILTY TO CLAYEY SAND	50/0.3'			
24'		(WASHED TILL)				
	1R	GRAY PHYLLITE ... WX		100%		
	2R			91%		
	3R			61%		
	4R			97%		
40'		B.O.E (Bedrock)				

INSTRUMENT LOG



NOTES

5/90

SEVEE & MAHER ENGINEERS

PROJECT WEST OLD TOWN LANDFILL EXPANSION		JOB NO. 03076.09	BORING NO. P-04-05
DATE COMPLETED 7/20/04	DATE WELLS INSTALLED 7/20/04		DRILLING METHOD WASH-ROTARY
GROUND SURFACE ELEVATION (FT) 201.0'	DRILLING CONTRACTOR M.T.B		LOGGED BY T. Riley / JGS
BOREHOLE DIAMETER (IN) 4.5" O.D.	ROCK CORE DIAMETER (IN.) N/A		SHEET 1 OF 1

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N	% Passing #200 Screen	K cm/sec	Water Content %
0	1D	0.5' 0-0.2' TOPSOIL	8			
		MOTTLED SILTY FINE TO MEDIUM SANDY SILT WITH A TRACE CLAY, GRAVEL				
5	2D	2.0'	70			
		BECOMING... OLIVE W/ TRACE COBBLES.				
10	3D		70	60.2%		10.2%
	4D		50/0.1'			
15		15'				
	5D		75/0.4'			
	6D	INCREASED CLAY CONTENT	50/0.3'			
20	7D		122			
	8D		62			
25	9D		60			
	10D		96			
	11D		50/0.1			
30	12D		99			
	13D	31' OLIVE SILTY FINE SAND W/ SOME GRAVEL, COBBLES	50/0.2'			
	13D	AND A TRACE OF COARSE SAND	50/0.4'		K_v =	
35	BR			44.5%	5.5×10^{-7}	9.6%
	15D	BROWN SILTY FINE TO MEDIUM SAND W/ COARSE SAND, GRAVEL AND COBBLES.	50/0.1'			
40	16D	41'	50/0.4'			
		42.2' BOULDER				
	17D		50/0.2'	67%		14.3%
	18D	BROWN FINE SANDY SILT W/ LITTLE COARSE SAND AND GRAVEL, TRACE OF CLAY AND COBBLES.	50/0.1'			
45	19D		65/0.5'			
		48.5' (BASALT TILL) B.O.E.				
50						
55						
60						

INSTRUMENT LOG

B 48.7' I.D. A 2.91'

- Bentonite chips (typ)
- 3' Sand (typ)
- 1' Bentonite chips (typ)
- 13' Sand (typ)
- 1' Schedule 40 #10 slot PVC screen, 3" ϕ, L=1'
- 16.5'
- Bentonite Chips (typ)
- 20.5'
- Bentonite Grout (typ)
- 40.5'
- Bentonite Chips
- 47' 1' Schedule 40 #10 slot screen, 3" ϕ, L=1'
- 48' 48.5'

NOTES

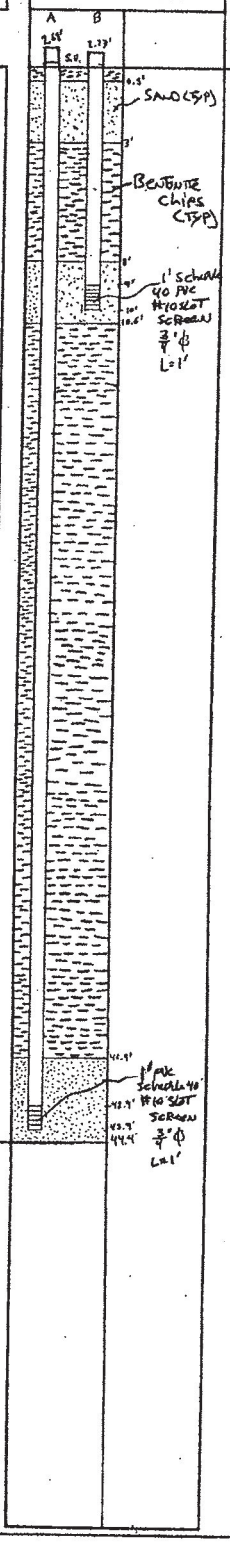
5/90

SEVEE & MAHER ENGINEERS

PROJECT WEST OLD TOWN LANDFILL EXPANSION	JOB NO. 03016.09	BORING NO. P-04-06	
DATE COMPLETED 7/22/04	DATE WELLS INSTALLED 7/21/04	DRILLING METHOD WASH ROTARY	
GROUND SURFACE ELEVATION (FT) 208.3'	DRILLING CONTRACTOR M.T.B	LOGGED BY T. Riley / JGS	
BOREHOLE DIAMETER (IN) 4.5" O.D.	ROCK CORE DIAMETER (IN.) 2.5"	SHEET 1 OF 1	

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N	RQD	% PASSING #200 SIEVE	WATER CONTENT %
0		0-0.3 TOPSOIL				
	1D	Brown SAT, gravelly FINE TO MEDIUM SAND W/ TRACE OF COBBLES	12			
1'						
	2D		72			
6	3D		76		62%	12.0%
	4D	Olive FINE TO Medium SANDY [illegible] W/ little COURSE SAND AND GRAVEL & TRACE OF COBBLES	50/0.1'			
	5D		50/0.2'			
10	6D		50/0.2'			
	7D		123			
	BD		50/0.1'			
15						
16'						
	9D		145			
20	10D	Olive Clayey SILTY W/ FINE TO Medium SAND W/ LITTLE COURSE SAND AND GRAVEL. TRACE OF COBBLES	88			
	11D		88			
	12D		36			
25	13D		72		49.9%	12.4%
	14D		102			
	FD	28.5' (BASALT TILL)	70/0.5'			
30	1R	GRAY META-GRAYWACKE ... WX		20%		
35	2R	... WITH SILTSTONE LAMINAE		100%?		
40	3R			100%		
		44.4' (Bedrock) BOE				
45						
50						
55						
60						

INSTRUMENT LOG



NOTES

5/90

SEVEE & MAHER ENGINEERS

PROJECT CASELLA - JRLF - OLD TOWN	JOB NO. 08097.01	BORING NO. B-08-05	
DATE COMPLETED 7/3/08	DATE WELLS INSTALLED NA	DRILLING METHOD DRIVE & WASH	
GROUND SURFACE ELEVATION (FT) 199.1	DRILLING CONTRACTOR MTB	LOGGED BY WCM / JCS	
BOREHOLE DIAMETER (IN) 4.5 (HW)	ROCK CORE DIAMETER (IN.) NA	SHEET 1 OF 1	

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N (BPF)	REC (FT)	WC (%)	>200 (%)	K_V (cm/s)	INSTRUMENT LOG	DEPTH (FT)
5	1D	OLIVE BROWN SANDY CLAYEY SILT WITH TRACE GRAVEL	28					BENTONITE CHIPS	5
	1S	(BASAL TILL)		1.37	12.4	55	5.2×10^{-7}		
10	2D	... COBBLE	66						10
		11.5' (BEDROCK?) REFUSAL						12 BOG	
15		BOE @ 12'							15

NOTES

COLLECT TUBE SAMPLE OF TILL. ROLLER CONE 0.5' INTO ROCK. BACKFILL TO GROUND SURFACE WITH BENTONITE CHIPS

REFERENCE: FIELD BOOK # 508

PROJECT CASELLA JRLF - OLD TOWN	JOB NO. 08097.01	BORING NO. B-08-07	
DATE COMPLETED 7/8/08	DATE WELLS INSTALLED 7/8/08	DRILLING METHOD DRIVE & WASH	
GROUND SURFACE ELEVATION (FT) 211.7	DRILLING CONTRACTOR MTB	LOGGED BY WCH / JES	
BOREHOLE DIAMETER (IN) 4.5" (HW)	ROCK CORE DIAMETER (IN.) NA	SHEET 1 OF 1	

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N (BPF)	REC (FT)	WC (%)	>200 (%)	K (CM/S)
5	1D	OLIVE BROWN CLAYEY SILT WITH TRACE SAND AND GRAVEL (BASAL TILL)	38				
10	1S			1.3	11	55	
15	2D	15.2' (BEDROCK?) REFUSAL	150/0.2				
20		BOE @ 15.6					

INSTRUMENT LOG

1" Ø SCH 40 PVC RISER

BENTONITE CHIPS

SAND PACK

2' LONG 1" Ø SLOTTED (0.01") PVC

9.6
10.0
12.0
12.4
15.6

BOE

1S: $K_V = 2.9 \times 10^{-8}$

$K_F = 1.4 \times 10^{-6}$

NOTES

COLLECTED TUBE SAMPLE OF TILL. ROLLER CONE 0.4' INTO ROCK. INSTALLED 1-INCH DIAMETER SCH 40 PVC PIEZOMETER P-08-07 IN BORING.

REFERENCE: FIELD BOOK # 508

PROJECT CASELLA - JRLF - OLD TOWN	JOB NO. 08097.01	BORING NO. B-08-08	
DATE COMPLETED 7/8/08	DATE WELLS INSTALLED NA	DRILLING METHOD DRIVE & WASH	
GROUND SURFACE ELEVATION (FT) 207.8	DRILLING CONTRACTOR MTB	LOGGED BY WLM / JES	
BOREHOLE DIAMETER (IN) 4.5 (HW)	ROCK CORE DIAMETER (IN.) NA	SHEET 1 OF 1	

DEPTH (FT)	SAMPLE NO.	MATERIAL DESCRIPTION	N (BPF)	TUBE REC (FT)	INSTRUMENT LOG	DEPTH (FT)
5	1D	OLIVE BROWN CLAYEY SILT/ SILTY CLAY WITH SOME SAND AND TRACE GRAVEL	47			5
10	1S			0.9		10
	2D		56		BENTONITE CHIPS	
15						15
	3D	ooo INCREASING SAND	91			
20						20
25	4D	ooo SILTY ZONE	80			25
	5D	CLAYEY SILT AND SAND (BASAL TILL)	123			
30		29.3' (BEDROCK) 30 REFUSAL			30' BOE	30

BOE @ 30'

NOTES

COLLECTED TUBE SAMPLE OF TILL. ROLLER CONE 0-7' INTO ROCK. BACKFILL TO GROUND SURFACE WITH BENTONITE CHIPS.

REFERENCE = FIELD BOOK #509

JRL EXPANSION
LIQUIFACTION POTENTIAL ANALYSIS FOR SAND (BASED ON SEED AND IDRISS 1982)

Exploration	Depth	N	Ground Elev	Test Elev	Phreatic Surface	Landfill Design-Elev	Vertical Stress				rd[6]	CSReq[7]	CN[8]	N1-60[9]	CSR[10]	K-sigma[11]	CSR-L[12]	FOS[13]
							Before Constuction		After Construction									
	(ft-bgs)[1]	(bpf)[2]	(ft-msl)[3]	(ft-msl)	(ft-msl)	(ft-msl)	total[4] (psf)	effective (psf)	total[5] (psf)	effective (psf)								
MW-06-02	18	26	188.8	171	184	330	2484	1660	12933	12109	0.27	0.03	0.41	10.57	0.2	0.5	0.12	3.7
P-04-06A	22	32	208.3	186	191.3	380	3036	2724	15742	15430	0.11	0.01	0.36	11.52	0.2	0.5	0.12	9.3
P-04-06A	24	36	208.3	184	191.3	380	3312	2875	16018	15581	0.11	0.01	0.36	12.90	0.2	0.5	0.13	11.1
P-08-06	7	38	182.2	175	178.5	250	966	760	5983	5777	0.66	0.08	0.59	22.36	1	0.5	0.60	8.0
P-08-06	11.5	40	182.2	171	178.5	250	1587	1100	6604	6117	0.64	0.08	0.57	22.87	1	0.5	0.60	7.9
P-08-06	22	30	182.2	160	178.5	250	3036	1894	8053	6911	0.59	0.08	0.54	16.14	0.3	0.5	0.18	2.4
P-08-03A	14	35	168.9	155	166.3	280	1932	1221	10153	9442	0.43	0.05	0.46	16.11	0.3	0.5	0.18	3.5

1. ft-bgs - feet below ground surface
2. bpf - blows per foot
3. ft-msl - elevation in feet, datum = mean sea level
4. Assume total unit weight of overburden = 138 pcf.
5. Assume total unit weight of waste = 74 pcf.
6. Stress reduction factor (Use figure 5.3, (EPA, 1995))
7. Critical stress ratio induced by the design earthquake.
8. Blowcount correction factor
9. Normalized standardized SPT blowcount
10. Critical Stress Ratio (Use figure 5.5, (EPA, 1995))
11. Stress level correction
12. Corrected critical stress ratio resisting liquifaction (Use figures 5.6, 5.7 and 5.8 (EPA, 1995))
13. Factor of safety

PW-08-02
B-08-05
mw-302
mw-302R
PZ25
P-08-07
P-04-05B
P-08-08
B-08-08

mw-304A
mw-207
mw-212

	PointNo.	Northing(Y)	Easting(X)	~~Elev~~ Elev(Z) (TOP OF WASTE)	Phreatic High Elev	BASE GRADE
MW-304	240	478986.54	927168.78	236.42	200	214.9
BOB-08	241	479710.51	926803.54	266.00	197.5	201.4
B04-05	242	480079.54	926554.76	297.42	198	195.3
BOB-07	243	479750.33	926241.59	374.11	209	210.1
P-225	244	479575.83	926305.33	374.66	212	212.7
B04-06	245	479998.42	925785.89	351.49	203	209.0
BOB-05	246	479742.63	925373.86	268.52	194	199.9
MW-302	247	479356.03	925546.81	278.26	199	203.1

2E

SEISMIC DEFORMATION ANALYSIS

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JRL EXPANSION

DEFORMATION ANALYSIS (EPA, 1995 - Subtitle D Seismic Design Guidance for Landfills)

Cross-Section	Failure Location	Seismic Coefficient (Kmax)[1]	Minimum Safety Factor	Yield Accelation (Ky)[2]	Ky/Kmax	Deformation [3]
A-A'	**Construction and Operational Period**					
	Waste	0.07	2.14	0.440	6.3	<1 cm
	Liner	0.07	1.37	0.183	2.6	<1 cm
	Foundation	0.07	1.54	0.246	3.5	<1 cm
	Post-Closure Period					
	Waste	0.18	1.11	0.225	1.3	<1 cm
	Liner	0.18	1	0.180	1.0	<1 cm
	Foundation	0.18	1.62	0.445	2.5	<1 cm

Notes:

1) Ref: 2014 USGS PGA values for 2% in 50yrs and 10% in 50 yrs.
2) Acceleration which yields a safety factor of 1.0
3) Ref: EPA, 1995 Figure 6-6 (Makdisi and Seed, 1978)

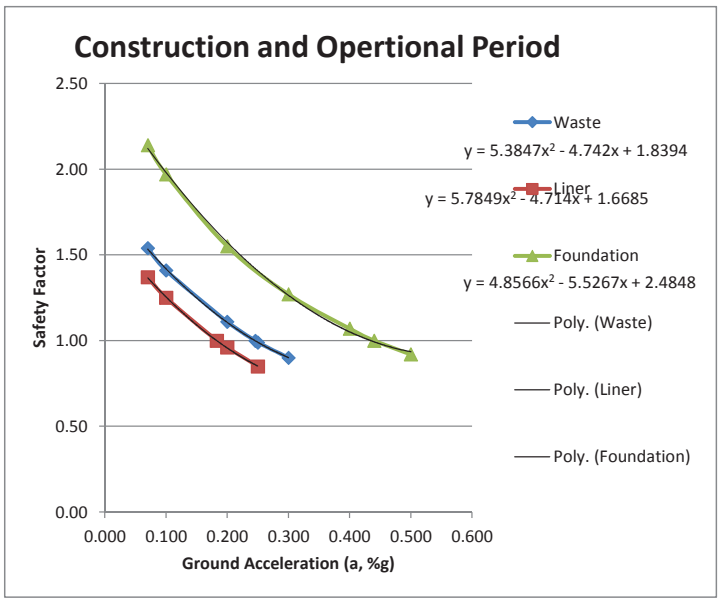
Similar results would be produced for Cross-Sections B-B', C'C' and D-D'; where deformations would be predicted to be less than 1 cm and therefore have not been evaluated.

JRL EXPANSION

DEFORMATION ANALYSIS (EPA, 1995 - Subtitle D Seismic Design Guidance for Landfills)

File Attached

	a	Safety Factor		Using Curve
Waste	0.070	1.54		
	0.100	1.41		
	0.200	1.11		
	0.246	1.00	0.246	0.999
	0.250	0.99		
	0.300	0.90		
Liner	0.070	1.37		
	0.100	1.25		
	0.183	1.00	0.183	1.000
	0.200	0.96		
	0.250	0.85		
Foundation	0.070	2.14		
	0.100	1.97		
	0.200	1.55		
	0.300	1.27		
	0.400	1.07		
	0.440	1.00	0.44	0.993
	0.500	0.92		

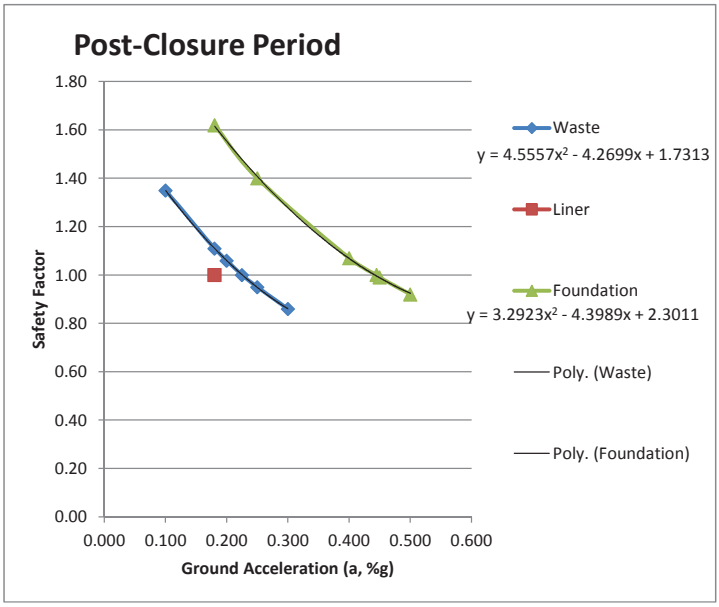


JRL EXPANSION

DEFORMATION ANALYSIS (EPA, 1995 - Subtitle D Seismic Design Guidance for Landfills)

File Attached

	a	Safety Factor		Using Curve
Waste	0.100	1.35		
	0.180	1.11		
	0.200	1.06		
	0.225	1.00	0.225	1.001
	0.250	0.95		
	0.300	0.86		
Liner	0.180	1.00		
Foundation	0.180	1.62		
	0.250	1.40		
	0.400	1.07		
	0.445	1.00	0.445	0.996
	0.450	0.99		
	0.500	0.92		



ATTACHMENT 3

SETTLEMENT ASSESSMENT

3A SETTLEMENT EVALUATION POINTS
(RELATIVE TO BASE GRADES & FINAL GRADES)

3B SETTLEMENT OF FOUNDATION SOILS
(LINER & LEACHATE MANAGEMENT SYSTEMS)

3C SETTLEMENT OF WASTE MASS
(FINAL COVER SYSTEM)

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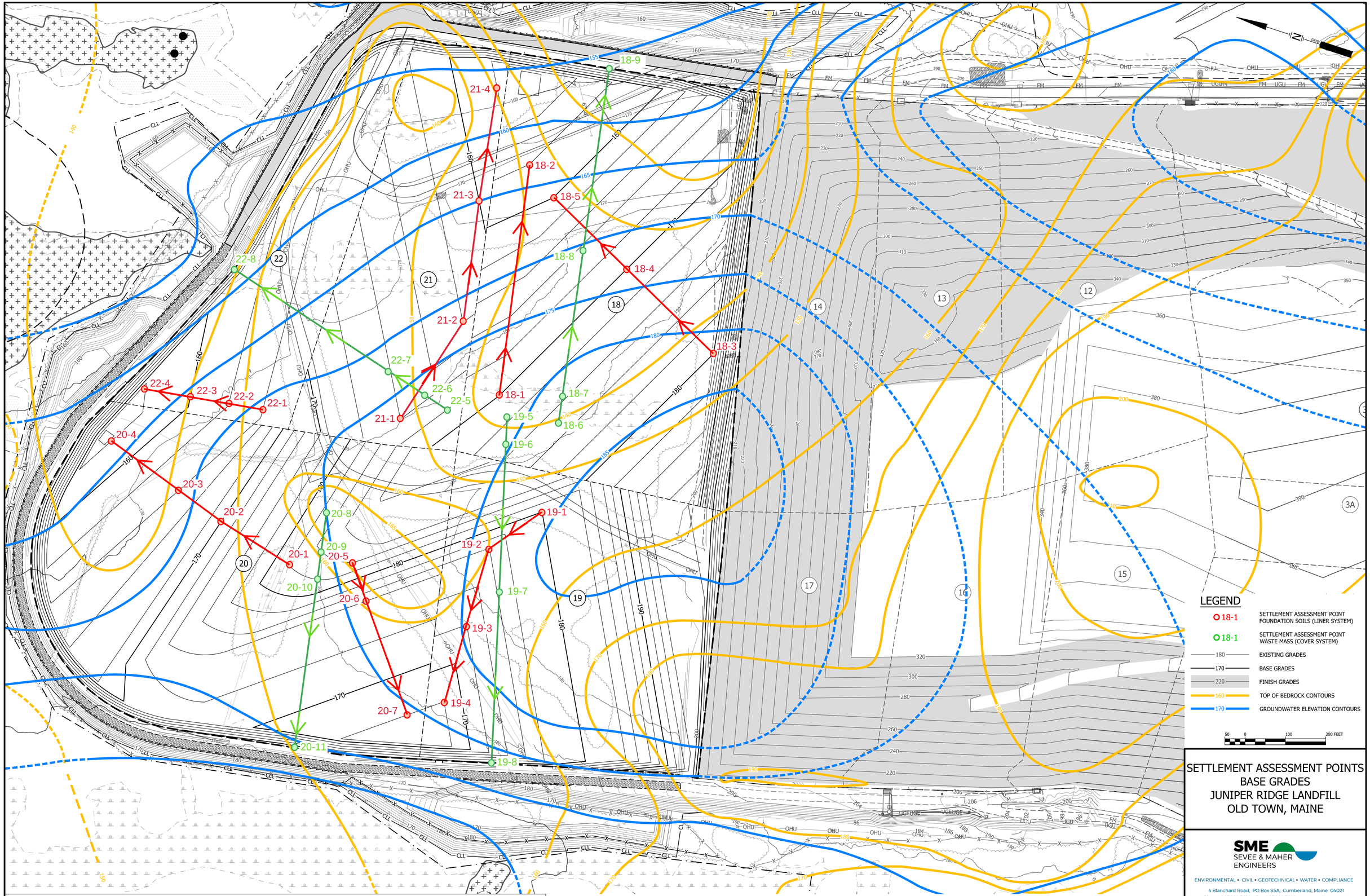
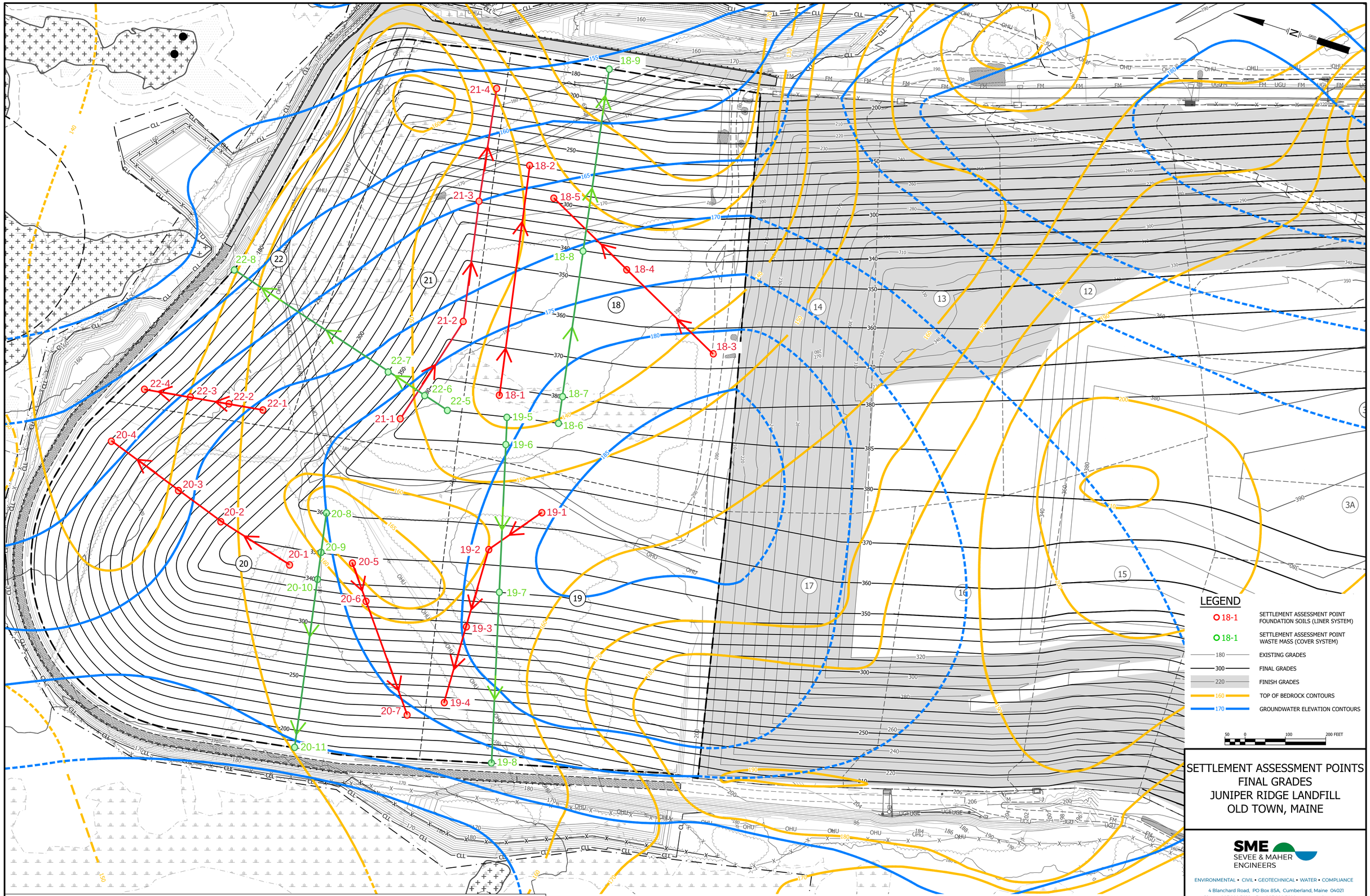
3A

SETTLEMENT EVALUATION POINTS
(RELATIVE TO BASE GRADES & FINAL GRADES)

SME
SEVEE & MAHER
ENGINEERS


LEGEND
18-1 SETTLEMENT ASSESSMENT POINT FOUNDATION SOILS (LINER SYSTEM)
18-1 SETTLEMENT ASSESSMENT POINT WASTE MASS (COVER SYSTEM)
180 EXISTING GRADES
170 BASE GRADES
220 FINISH GRADES
160 TOP OF BEDROCK CONTOURS
170 GROUNDWATER ELEVATION CONTOURS
50 0 100 200 FEET
SETTLEMENT ASSESSMENT POINTS
BASE GRADES
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE
SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com
DWG: BASE
LMN: SETTLE-BASE GRADES
CTB: SME-STD.CTB
JOB#: 240101.01
REV: 11/6/2025



SETTLEMENT ASSESSMENT POINTS
FINAL GRADES
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

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DWG: BASE LMN: SETTLE-FINAL GRADES CTB: SME-STD.CTB JOB#: 240101.01 REV: 11/6/2025

N:\Share\SME\Create\Old Town\Landfill\Expansion\Phase II Expansion\Acad\Plans\BASE.dwg, SETTLE-FINAL GRADES, 11/6/2025 2:05:40 PM, kjm

3B

SETTLEMENT OF FOUNDATION SOILS
(LINER & LEACHATE MANAGEMENT SYSTEMS)

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SETTLEMENT ASSESSMENT
Foundation Soils
(Liner & Leachate Management Systems)
Table 1: Existing & Proposed Conditions

Client:	NEWSME	**Prepared By / Date:**	TCC	11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC	11/07/25
Location:	Old Town, Maine			
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88	

Point Information		Existing & Proposed Conditions						
		Existing Elevations			Proposed Elevations			
No.	Location Along Line	Ground Surface	Top Bedrock	Ground Water	Base Grade	Top Liner/ Bot. Waste	Top Waste/ Bot. Cover	Final Grade
B	C	D	E	F	G	H	I	J
See Fig 1	From Fig 1	From Fig 1	From Fig 1	From Fig 1	From Fig 1	= G + 4	= J- 3	From Fig 2
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
18-1	0.0	185.0	139.0	178.0	170.0	174.0	378.5	381.5
18-2	575.0	170.0	137.0	163.0	158.0	162.0	267.0	270.0
18-3	0.0	195.0	145.0	182.0	180.0	184.0	363.0	366.0
18-4	300.0	185.0	132.5	173.0	170.0	174.0	341.5	344.5
18-5	550.0	170.0	134.5	166.0	160.0	164.0	294.0	297.0
19-1	0.0	194.0	153.5	184.0	180.0	184.0	361.0	364.0
19-2	160.0	192.0	160.0	181.5	176.0	180.0	351.0	354.0
19-3	360.0	188.0	160.0	180.0	172.0	176.0	304.5	307.5
19-4	550.0	181.0	156.5	176.5	168.0	172.0	232.0	235.0
20-1	0.0	179.0	156.0	173.5	182.0	186.0	341.0	344.0
20-2	200.0	175.0	147.5	171.0	170.0	174.0	320.0	323.0
20-3	330.0	173.0	141.5	169.0	164.0	168.0	274.5	277.5
20-4	535.0	168.0	140.0	163.5	158.0	162.0	198.0	201.0
20-5	0.0	182.5	165.0	175.5	184.0	188.0	344.5	347.5
20-6	100.0	183.0	161.5	176.0	174.0	178.0	322.0	325.0
20-7	400.0	178.0	155.0	174.0	168.0	172.0	219.0	222.0
21-1	0.0	180.0	152.0	176.0	166.0	170.0	372.0	375.0
21-2	285.0	176.0	156.5	172.5	162.0	166.0	362.0	365.0
21-3	585.0	168.0	155.0	165.0	160.0	164.0	307.0	310.0
21-4	870.0	158.0	139.5	156.5	158.0	162.0	200.5	203.5
22-1	0.0	172.0	152.0	170.5	164.0	168.0	274.0	277.0
22-2	85.0	170.0	147.0	168.5	162.0	166.0	247.0	250.0
22-3	185.0	168.0	140.0	165.5	160.0	164.0	217.5	220.5
22-4	300.0	166.0	140.0	162.0	158.0	162.0	185.0	188.0

Thickness of Liner System =	4.0	ft
Thickness of Cover System =	3.0	ft

SETTLEMENT ASSESSMENT
Foundation Soils
(Liner & Leachate Management Systems)
Table 2: Material Thicknesses & Proposed Slopes

Client:	NEWSME	**Prepared By / Date:**	TCC 11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC 11/07/25
Location:	Old Town, Maine		
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88

Point Information		Material Thicknesses							Proposed Slopes				
No.	Location Along Line	Foundation Soil(s)				Liner System	Waste	Cover System	Segment	Horizontal Length	Liner System		
		Existing	Proposed	Net Cut (Excavation)	Net Fill (Berm Fill)						Δ Elev.	Slope	
M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
From Table 1	From Table 1	= D - E	= G - E	= D - G	= G - D	Per Design	= I - H	Per Design	From Fig 1	$= N_{X+1} - N_X$	$= G_X - G_{X+1}$	= X/W*100	= W / X
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)		(ft)	(ft)	%	H:V
18-1	0.0	46.0	31.0	15.0	-	4.0	204.5	3.0	18-1 to 18-2	575.0	12.0	2.1	47.9
18-2	575.0	33.0	21.0	12.0	-	4.0	105.0	3.0	-	-	-	-	-
18-3	0.0	50.0	35.0	15.0	-	4.0	179.0	3.0	18-3 to 18-4	300.0	10.0	3.3	30.0
18-4	300.0	52.5	37.5	15.0	-	4.0	167.5	3.0	18-4 to 18-5	250.0	10.0	4.0	25.0
18-5	550.0	35.5	25.5	10.0	-	4.0	130.0	3.0	-	-	-	-	-
19-1	0.0	40.5	26.5	14.0	-	4.0	177.0	3.0	19-1 to 19-2	160.0	4.0	2.5	40.0
19-2	160.0	32.0	16.0	16.0	-	4.0	171.0	3.0	19-2 to 19-3	200.0	4.0	2.0	50.0
19-3	360.0	28.0	12.0	16.0	-	4.0	128.5	3.0	19-3 to 19-4	190.0	4.0	2.1	47.5
19-4	550.0	24.5	11.5	13.0	-	4.0	60.0	3.0	-	-	-	-	-
20-1	0.0	23.0	23.0	-	3.0	4.0	155.0	3.0	20-1 to 20-2	200.0	12.0	6.0	16.7
20-2	200.0	27.5	22.5	5.0	-	4.0	146.0	3.0	20-2 to 20-3	130.0	6.0	4.6	21.7
20-3	330.0	31.5	22.5	9.0	-	4.0	106.5	3.0	20-3 to 20-4	205.0	6.0	2.9	34.2
20-4	535.0	28.0	18.0	10.0	-	4.0	36.0	3.0	-	-	-	-	-
20-5	0.0	17.5	17.5	-	1.5	4.0	156.5	3.0	20-5 to 20-6	100.0	10.0	10.0	10.0
20-6	100.0	21.5	12.5	9.0	-	4.0	144.0	3.0	20-6 to 20-7	300.0	6.0	2.0	50.0
20-7	400.0	23.0	13.0	10.0	-	4.0	47.0	3.0	-	-	-	-	-
21-1	0.0	28.0	14.0	14.0	-	4.0	202.0	3.0	21-1 to 21-2	285.0	4.0	1.4	71.3
21-2	285.0	19.5	5.5	14.0	-	4.0	196.0	3.0	21-2 to 21-3	300.0	2.0	0.7	150.0
21-3	585.0	13.0	5.0	8.0	-	4.0	143.0	3.0	21-3 to 21-4	285.0	2.0	0.7	142.5
21-4	870.0	18.5	18.5	0.0	-	4.0	38.5	3.0	-	-	-	-	-
22-1	0.0	20.0	12.0	8.0	-	4.0	106.0	3.0	22-1 to 22-2	85.0	2.0	2.4	42.5
22-2	85.0	23.0	15.0	8.0	-	4.0	81.0	3.0	22-2 to 22-3	100.0	2.0	2.0	50.0
22-3	185.0	28.0	20.0	8.0	-	4.0	53.5	3.0	22-3 to 22-4	115.0	2.0	1.7	57.5
22-4	300.0	26.0	18.0	8.0	-	4.0	23.0	3.0	-	-	-	-	-

SETTLEMENT ASSESSMENT
Foundation Soils
(Liner & Leachate Management Systems)
Table 3: Estimated Settlements

Client:	NEWSME	**Prepared By / Date:**	TCC 11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC 11/07/25
Location:	Old Town, Maine		
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88

Point Information		Estimated Settlements											
		Material Thicknesses				Δ Effective Stress				Strain		Settlement	
No.	Location Along Line	Found. Soil	Berm Fill	Liner System	Waste	Base Grade Cut/Fill	Liner System	Waste	Cover	Found. Soil (Stress-Based)	Berm/Sub Fill (Stress-Based)	Found. Soil (Stress-Based)	Berm/Sub Fill (Stress-Based)
						AI							
AC	AD	AE	AF	AG	AH	= Q * 69.6 * -1 or AF * 128	AJ	AK	AL	AM	AN	AO	AP
From Table 1	From Table 1	= P	= R	= S	= T		= AG * 120	= AH * 74	= U * 125	=(AI+AJ+AK+AL) / 2880000	=(AJ+AK+AL) / 1440000	= AM * AE	= AN * AF
	(ft)	(ft)	(ft)	(ft)	(ft)	(psf)	(psf)	(psf)	(psf)	(ft/ft)	(ft/ft)	(ft)	(ft)
18-1	0.0	31.0	-	4.0	204.5	-1044.0	480.0	15133.0	375.0	0.005	-	0.16	-
18-2	575.0	21.0	-	4.0	105.0	-835.2	480.0	7770.0	375.0	0.003	-	0.06	-
18-3	0.0	35.0	-	4.0	179.0	-1044.0	480.0	13246.0	375.0	0.005	-	0.16	-
18-4	300.0	37.5	-	4.0	167.5	-1044.0	480.0	12395.0	375.0	0.004	-	0.16	-
18-5	550.0	25.5	-	4.0	130.0	-696.0	480.0	9620.0	375.0	0.003	-	0.09	-
19-1	0.0	26.5	-	4.0	177.0	-974.4	480.0	13098.0	375.0	0.005	-	0.12	-
19-2	160.0	16.0	-	4.0	171.0	-1113.6	480.0	12654.0	375.0	0.004	-	0.07	-
19-3	360.0	12.0	-	4.0	128.5	-1113.6	480.0	9509.0	375.0	0.003	-	0.04	-
19-4	550.0	11.5	-	4.0	60.0	-904.8	480.0	4440.0	375.0	0.002	-	0.02	-
20-1	0.0	23.0	3.0	4.0	155.0	384.0	480.0	11470.0	375.0	0.004	0.009	0.10	0.03
20-2	200.0	22.5	-	4.0	146.0	-348.0	480.0	10804.0	375.0	0.004	-	0.09	-
20-3	330.0	22.5	-	4.0	106.5	-626.4	480.0	7881.0	375.0	0.003	-	0.06	-
20-4	535.0	18.0	-	4.0	36.0	-696.0	480.0	2664.0	375.0	0.001	-	0.02	-
20-5	0.0	17.5	1.5	4.0	156.5	192.0	480.0	11581.0	375.0	0.004	0.009	0.08	0.01
20-6	100.0	12.5	-	4.0	144.0	-626.4	480.0	10656.0	375.0	0.004	-	0.05	-
20-7	400.0	13.0	-	4.0	47.0	-696.0	480.0	3478.0	375.0	0.001	-	0.02	-
21-1	0.0	14.0	-	4.0	202.0	-974.4	480.0	14948.0	375.0	0.005	-	0.07	-
21-2	285.0	5.5	-	4.0	196.0	-974.4	480.0	14504.0	375.0	0.005	-	0.03	-
21-3	585.0	5.0	-	4.0	143.0	-556.8	480.0	10582.0	375.0	0.004	-	0.02	-
21-4	870.0	18.5	-	4.0	38.5	0.0	480.0	2849.0	375.0	0.001	-	0.02	-
22-1	0.0	12.0	-	4.0	106.0	-556.8	480.0	7844.0	375.0	0.003	-	0.03	-
22-2	85.0	15.0	-	4.0	81.0	-556.8	480.0	5994.0	375.0	0.002	-	0.03	-
22-3	185.0	20.0	-	4.0	53.5	-556.8	480.0	3959.0	375.0	0.001	-	0.03	-
22-4	300.0	18.0	-	4.0	23.0	-556.8	480.0	1702.0	375.0	0.001	-	0.01	-

Found. Soil Unit Weight, γ_{fs} =	69.6	pcf (for Base Grade cuts; assume sub. unit weight for all excav.).	Foundation Soil Modulus of Elasticity, E_{fs} =	2880000.0	psf
Berm Fill Unit Weight, γ_{bf} =	128.0	pcf (for Base Grade fills; assume sat. unit weight for all subgrade fill).	Berm Fill Modulus of Elasticity, E_{bf} =	1440000.0	psf
Liner System Unit Weight, γ_{ls} =	120.0	pcf (saturated).	Waste Modulus of Elasticity, E_{w} =	100000.0	psf
Waste Unit Weight, γ_{wt} =	74.0	pcf (saturated).	Post-Closure Waste Strain Rate, $e_{wt\text{-}avg}$ =	0.000004	ft/ft / day
Cover System Unit Weight, γ_{cs} =	125.0	pcf (moist).	Post-Closure Time Period, $T_{P\text{-}C}$ =	30.0	years

SETTLEMENT ASSESSMENT
Foundation Soils
(Liner & Leachate Management Systems)
Table 4: Post-Closure Elevations, Slopes, & Strains

Client:	NEWSME	**Prepared By / Date:**	TCC 11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC 11/07/25
Location:	Old Town, Maine		
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88

Point Information		Post-Closure Elevations, Slopes, & Estimated Strains										
No.	Location Along Line	Post-Closure Elevations		Segment	Post-Closure Slopes			Estimated Strains				
					Liner System			Liner System				
		Top Liner/ Bot. Waste	Final Grade/ Top Cover		Original	Post-Closure	Accepable?	Original Length	Post-Closure Length	Strain	Accepable?
AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD
From Table 1	From Table 1	= H - AO	N/A	= V	= Y	= $(AU_X - AU_{X+1}) / W_X * 100$	= If AY > 0	= SQRT of $W^2 + X^2$	= SQRT of $W^2 + (AU_X - AU_{X+1})^2$	=(BB - BA)/BA *100	= If BC < 5%	
	(ft)	(ft)	(ft)		(%)	(%)	(See Note 1)	(ft)	(ft)	(%)	(See Note 2)	
18-1	0.0	173.8	-	18-1 to 18-2	2.1	2.1	Yes	575.1	575.1	-0.0004	Yes	
18-2	575.0	161.9	-	-	-	-	-	-	-	-	-	
18-3	0.0	183.8	-	18-3 to 18-4	3.3	3.3	Yes	300.2	300.2	0.0000	Yes	
18-4	300.0	173.8	-	18-4 to 18-5	4.0	4.0	Yes	250.2	250.2	-0.0012	Yes	
18-5	550.0	163.9	-	-	-	-	-	-	-	-	-	
19-1	0.0	183.9	-	19-1 to 19-2	2.5	2.5	Yes	160.0	160.0	-0.0008	Yes	
19-2	160.0	179.9	-	19-2 to 19-3	2.0	2.0	Yes	200.0	200.0	-0.0003	Yes	
19-3	360.0	176.0	-	19-3 to 19-4	2.1	2.1	Yes	190.0	190.0	-0.0002	Yes	
19-4	550.0	172.0	-	-	-	-	-	-	-	-	-	
20-1	0.0	185.9	-	20-1 to 20-2	6.0	6.0	Yes	200.4	200.4	-0.0012	Yes	
20-2	200.0	173.9	-	20-2 to 20-3	4.6	4.6	Yes	130.1	130.1	-0.0009	Yes	
20-3	330.0	167.9	-	20-3 to 20-4	2.9	2.9	Yes	205.1	205.1	-0.0006	Yes	
20-4	535.0	162.0	-	-	-	-	-	-	-	-	-	
20-5	0.0	187.9	-	20-5 to 20-6	10.0	10.0	Yes	100.5	100.5	-0.0042	Yes	
20-6	100.0	178.0	-	20-6 to 20-7	2.0	2.0	Yes	300.1	300.1	-0.0002	Yes	
20-7	400.0	172.0	-	-	-	-	-	-	-	-	-	
21-1	0.0	169.9	-	21-1 to 21-2	1.4	1.4	Yes	285.0	285.0	-0.0002	Yes	
21-2	285.0	166.0	-	21-2 to 21-3	0.7	0.7	Yes	300.0	300.0	0.0000	Yes	
21-3	585.0	164.0	-	21-3 to 21-4	0.7	0.7	Yes	285.0	285.0	0.0000	Yes	
21-4	870.0	162.0	-	-	-	-	-	-	-	-	-	
22-1	0.0	168.0	-	22-1 to 22-2	2.4	2.4	Yes	85.0	85.0	0.0000	Yes	
22-2	85.0	166.0	-	22-2 to 22-3	2.0	2.0	Yes	100.0	100.0	-0.0001	Yes	
22-3	185.0	164.0	-	22-3 to 22-4	1.7	1.7	Yes	115.0	115.0	-0.0003	Yes	
22-4	300.0	162.0	-	-	-	-	-	-	-	-	-	

NOTES:

1. A positive slope is considered acceptable. A negative (reversed) slope is not.
2. 5% max. tensile strain on geosynthetics per Manufacturer recommendations.

Liner System Max. Strain, $LS_{\varepsilon max}$=	5.0	%
Cover System Max. Strain, $CS_{\varepsilon max}$=	5.0	%

3C

SETTLEMENT OF WASTE MASS (FINAL COVER SYSTEM)

SME
SEVEE & MAHER
ENGINEERS

SETTLEMENT ASSESSMENT
Waste Mass
(Cover System)
Table 1: Existing & Proposed Conditions

Client:	NEWSME	**Prepared By / Date:**	TCC	11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC	11/07/25
Location:	Old Town, Maine			
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88	

Point Information		Existing & Proposed Conditions						
		Existing Elevations			Proposed Elevations			
No.	Location Along Line	Ground Surface	Top Bedrock	Ground Water	Base Grade	Top Liner/ Bot. Waste	Top Waste/ Bot. Cover	Final Grade
B See Fig 2	C From Fig 2	D From Fig 2	E From Fig 2	F From Fig 2	G From Fig 1	H = G + 4	I = J- 3	J From Fig 2
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
18-6	0.0	189.0	140.0	182.0	175.0	179.0	382.0	385.0
18-7	66.7	188.0	139.5	181.0	174.0	178.0	377.0	380.0
18-8	433.0	181.0	134.0	170.5	166.0	170.0	337.0	340.0
18-9	892.0	158.0	119.0	156.0	169.0	167.0	167.0	170.0
19-5	0.0	185.0	139.5	179.0	172.0	176.0	382.0	385.0
19-6	66.7	187.0	143.0	179.5	173.5	177.5	377.0	380.0
19-7	433.0	191.0	160.0	182.5	176.0	180.0	337.0	340.0
19-8	858.3	176.0	157.5	173.0	180.0	177.8	179.5	182.5
20-8	0.0	181.5	165.0	175.0	182.5	186.5	357.0	360.0
20-9	100.0	180.0	160.0	174.5	184.0	188.0	347.0	350.0
20-10	166.7	180.0	158.0	174.0	182.0	186.0	337.0	340.0
20-11	592.0	171.5	150.0	169.0	181.0	177.8	179.5	182.5
22-5	0.0	181.0	145.0	177.0	168.0	172.0	382.0	385.0
22-6	66.7	179.0	148.5	176.0	166.0	170.0	377.0	380.0
22-7	174.7	176.0	151.0	172.5	166.0	170.0	337.0	340.0
22-8	633.7	160.5	140.0	158.0	168.0	162.9	167.0	170.0

Thickness of Liner System =	4.0	ft
Thickness of Cover System =	3.0	ft

SETTLEMENT ASSESSMENT
Waste Mass
(Cover System)
Table 2: Material Thicknesses & Proposed Slopes

Client:	NEWSME	**Prepared By / Date:**	TCC 11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC 11/07/25
Location:	Old Town, Maine		
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88

Point Information		Material Thicknesses							Proposed Slopes				
No.	Location Along Line	Foundation Soil(s)				Liner System	Waste	Cover System	Segment	Horizontal Length	Cover System		
		Existing	Proposed	Net Cut (Excavation)	Net Fill (Berm Fill)						Δ Elev.	Slope	
M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
From Table 1	From Table 1	= D - E	= G - E	= D - G	= G - D	Per Design	= I - H	Per Design	From Fig 2	$= N_{X+1} - N_X$	$= J_X - J_{X+1}$	= X/W*100	= W / X
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)		(ft)	(ft)	%	H:V
18-6	0.0	49.0	35.0	14.0	-	4.0	203.0	3.0	18-6 to 18-7	66.7	5.0	7.5	13.3
18-7	66.7	48.5	34.5	14.0	-	4.0	199.0	3.0	18-7 to 18-8	366.3	40.0	10.9	9.2
18-8	433.0	47.0	32.0	15.0	-	4.0	167.0	3.0	18-8 to 18-9	459.0	170.0	37.0	2.7
18-9	892.0	39.0	39.0	-	11.0	4.0	0.0	3.0	-	-	-	-	-
19-5	0.0	45.5	32.5	13.0	-	4.0	206.0	3.0	19-5 to 19-6	66.7	5.0	7.5	13.3
19-6	66.7	44.0	30.5	13.5	-	4.0	199.5	3.0	19-6 to 19-7	366.3	40.0	10.9	9.2
19-7	433.0	31.0	16.0	15.0	-	4.0	157.0	3.0	19-7 to 19-8	425.3	157.5	37.0	2.7
19-8	858.3	18.5	18.5	-	4.0	4.0	1.8	3.0	-	-	-	-	-
20-8	0.0	16.5	16.5	-	1.0	4.0	170.5	3.0	20-8 to 20-9	100.0	10.0	10.0	10.0
20-9	100.0	20.0	20.0	-	4.0	4.0	159.0	3.0	20-9 to 20-10	66.7	10.0	15.0	6.7
20-10	166.7	22.0	22.0	-	2.0	4.0	151.0	3.0	20-10 to 20-11	425.3	157.5	37.0	2.7
20-11	592.0	21.5	21.5	-	9.5	4.0	1.8	3.0	-	-	-	-	-
22-5	0.0	36.0	23.0	13.0	-	4.0	210.0	3.0	22-5 to 22-6	66.7	5.0	7.5	13.3
22-6	66.7	30.5	17.5	13.0	-	4.0	207.0	3.0	22-6 to 22-7	108.0	40.0	37.0	2.7
22-7	174.7	25.0	15.0	10.0	-	4.0	167.0	3.0	22-7 to 22-8	459.0	170.0	37.0	2.7
22-8	633.7	20.5	20.5	-	7.5	4.0	4.1	3.0	-	-	-	-	-

SETTLEMENT ASSESSMENT
Waste Masss
(Cover System)
Table 3: Estimated Settlements

Client:	NEWSME	**Prepared By / Date:**	TCC 11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC 11/07/25
Location:	Old Town, Maine		
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88

Point Information		Estimated Settlements													
		Material Thicknesses				Δ Effective Stress				Strain			Settlement		
No.	Location Along Line	Found. Soil	Berm Fill	Liner System	Waste	Base Grade Cut/Fill	Liner System	Waste	Cover	Waste (Stress-Waste)	Waste (Stress-Cover)	Waste (Non-Stress-Based)	Waste (Stress-Waste)	Waste (Stress-Cover)	Waste (Non-Stress-Based)
AC	AD	AE	AF	AG	AH	= Q * 69.6 * -1 or AF * 128	AJ	AK	AL	AM	AN	AO	AP	AQ	AR
From Table 1	From Table 1	= P	= R	= S	= T		= AG * 120	= AH * 74	= U * 125	= AK / 100000	= AL / 100000	Per Below (Attachment)	= AM * AH	= AN * AH	=AO*AH*30*365
	(ft)	(ft)	(ft)	(ft)	(ft)	(psf)	(psf)	(psf)	(psf)	(ft/ft)	(ft/ft)	(ft/ft / day)	(ft)	(ft)	(ft)
18-6	0.0	35.0	-	4.0	203.0	-974.4	480.0	15022.0	375.0	0.150	0.004	0.000004	30.49	0.76	8.89
18-7	66.7	34.5	-	4.0	199.0	-974.4	480.0	14726.0	375.0	0.147	0.004	0.000004	29.30	0.75	8.72
18-8	433.0	32.0	-	4.0	167.0	-1044.0	480.0	12358.0	375.0	0.124	0.004	0.000004	20.64	0.63	7.31
18-9	892.0	39.0	11.0	4.0	0.0	1408.0	480.0	0.0	375.0	0.000	0.004	0.000004	0.00	0.00	0.00
19-5	0.0	32.5	-	4.0	206.0	-904.8	480.0	15244.0	375.0	0.152	0.004	0.000004	31.40	0.77	9.02
19-6	66.7	30.5	-	4.0	199.5	-939.6	480.0	14763.0	375.0	0.148	0.004	0.000004	29.45	0.75	8.74
19-7	433.0	16.0	-	4.0	157.0	-1044.0	480.0	11618.0	375.0	0.116	0.004	0.000004	18.24	0.59	6.88
19-8	858.3	18.5	4.0	4.0	1.8	512.0	480.0	129.5	375.0	0.001	0.004	0.000004	0.00	0.01	0.08
20-8	0.0	16.5	1.0	4.0	170.5	128.0	480.0	12617.0	375.0	0.126	0.004	0.000004	21.51	0.64	7.47
20-9	100.0	20.0	4.0	4.0	159.0	512.0	480.0	11766.0	375.0	0.118	0.004	0.000004	18.71	0.60	6.96
20-10	166.7	22.0	2.0	4.0	151.0	256.0	480.0	11174.0	375.0	0.112	0.004	0.000004	16.87	0.57	6.61
20-11	592.0	21.5	9.5	4.0	1.8	1216.0	480.0	129.5	375.0	0.001	0.004	0.000004	0.00	0.01	0.08
22-5	0.0	23.0	-	4.0	210.0	-904.8	480.0	15540.0	375.0	0.155	0.004	0.000004	32.63	0.79	9.20
22-6	66.7	17.5	-	4.0	207.0	-904.8	480.0	15318.0	375.0	0.153	0.004	0.000004	31.71	0.78	9.07
22-7	174.7	15.0	-	4.0	167.0	-696.0	480.0	12358.0	375.0	0.124	0.004	0.000004	20.64	0.63	7.31
22-8	633.7	20.5	7.5	4.0	4.1	960.0	480.0	303.4	375.0	0.003	0.004	0.000004	0.01	0.02	0.18

Found. Soil Unit Weight, γ_{fs} =	69.6	pcf (for Base Grade cuts; assume sub. unit weight for all excav.).	Foundation Soil Modulus of Elasticity, E_{fs} =	2880000.0	psf REW
Berm Fill Unit Weight, γ_{bf} =	128.0	pcf (for Base Grade fills; assume sat. unit weight for all subgrade fill).	Berm Fill Modulus of Elasticity, E_{bf} =	1440000.0	psf REW
Liner System Unit Weight, γ_{ls} =	120.0	pcf (saturated).	Waste Modulus of Elasticity, E_w =	100000.0	psf REW
Waste Unit Weight, γ_{wt} =	74.0	pcf (saturated).	Post-Closure Waste Strain Rate, $e_{wt\text{-}avg}$ =	0.000004	ft/ft / day See Attachment F-X.
Cover System Unit Weight, γ_{cs} =	125.0	pcf (moist).	Post-Closure Time Period, $T_{P\text{-}C}$ =	30.0	years

SETTLEMENT ASSESSMENT
Waste Mass
(Cover System)
Table 4: Post-Closure Elevations, Slopes, & Strains

Client:	NEWSME	**Prepared By / Date:**	TCC 11/03/25
Project:	JRL - Phase II Expansion	**Checked By / Date:**	MC 11/07/25
Location:	Old Town, Maine		
SME Project No.:	240101.01	**Elevation Datum:**	NAVD 88

Point Information		Post-Closure Elevations, Slopes, & Estimated Strains												
No.	Location Along Line	Post-Closure Elevations		Segment	Post-Closure Slopes					Estimated Strains			
					Cover System					Cover System			
					Original		Post-Closure		Accepable?	Original Length	Post-Closure Length	Strain	Accepable?
AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH
From Table 1	From Table 1	N/A	= J - AQ - AR	= V	= Y	= Z	= $(AX_X - AX_{X+1}) / W_X * 100$	=1 / BB * 100	= If BB > 0	= SQRT of $W^2 + X^2$	= SQRT of $W^2 + (AX_X - AX_{X+1})^2$	=(BF - BE)/BE * 100	= If BG < 5%
	(ft)	(ft)	(ft)		(%)	H:V	(%)	H:V	(See Note 1)	(ft)	(ft)	(%)	(See Note 2)
18-6	0.0	-	375.3	18-6 to 18-7	7.5	13.3	7.2	13.9	Yes	66.9	66.8	-0.02	Yes
18-7	66.7	-	370.5	18-7 to 18-8	10.9	9.2	10.5	9.5	Yes	368.5	368.3	-0.04	Yes
18-8	433.0	-	332.1	18-8 to 18-9	37.0	2.7	35.3	2.8	Yes	489.5	486.8	-0.55	Yes
18-9	892.0	-	170.0	-	-	-	-	-	-	-	-	-	-
19-5	0.0	-	375.2	19-5 to 19-6	7.5	13.3	7.0	14.2	Yes	66.9	66.8	-0.03	Yes
19-6	66.7	-	370.5	19-6 to 19-7	10.9	9.2	10.4	9.6	Yes	368.5	368.3	-0.06	Yes
19-7	433.0	-	332.5	19-7 to 19-8	37.0	2.7	35.3	2.8	Yes	453.5	451.0	-0.55	Yes
19-8	858.3	-	182.4	-	-	-	-	-	-	-	-	-	-
20-8	0.0	-	351.9	20-8 to 20-9	10.0	10.0	9.5	10.6	Yes	100.5	100.4	-0.05	Yes
20-9	100.0	-	342.4	20-9 to 20-10	15.0	6.7	14.4	6.9	Yes	67.4	67.4	-0.08	Yes
20-10	166.7	-	332.8	20-10 to 20-11	37.0	2.7	35.4	2.8	Yes	453.6	451.1	-0.53	Yes
20-11	592.0	-	182.4	-	-	-	-	-	-	-	-	-	-
22-5	0.0	-	375.0	22-5 to 22-6	7.5	13.3	7.3	13.7	Yes	66.9	66.8	-0.02	Yes
22-6	66.7	-	370.2	22-6 to 22-7	37.0	2.7	35.3	2.8	Yes	115.2	114.5	-0.56	Yes
22-7	174.7	-	332.1	22-7 to 22-8	37.0	2.7	35.3	2.8	Yes	489.5	486.8	-0.54	Yes
22-8	633.7	-	169.8	-	-	-	-	-	-	-	-	-	-

NOTES:

1. A positive slope is considered acceptable. A negative (reversed) slope is not.
2. 5% max. tensile strain on geosynthetics per Manufacturer recommendations.

Liner System Max. Strain, $LS_{\varepsilon max}$=	5.0	%
Cover System Max. Strain, $CS_{\varepsilon max}$=	5.0	%

ATTACHMENT 4

STABILITY ASSESSMENT – COVER SYSTEM

4A PRIOR INTERFACE FRICTION TESTING RESULTS FROM STAGE 1 FINAL COVER
4B PRIOR INTERFACE FRICTION TESTING RESULTS FROM STAGE 2 FINAL COVER
4C CONSTRUCTION EQUIPMENT LOADING
4D INTERFACE ANALYSES – PEAK STRENGTHS
4E INTERFACE ANALYSES – LARGE-DISPLACEMENT STRENGTHS
4F INFINITE SLOPE ANALYSES – COVER SYSTEM SOILS
4G INTERFACE ANALYSES – CONSIDERING SEEPAGE FORCES

SME
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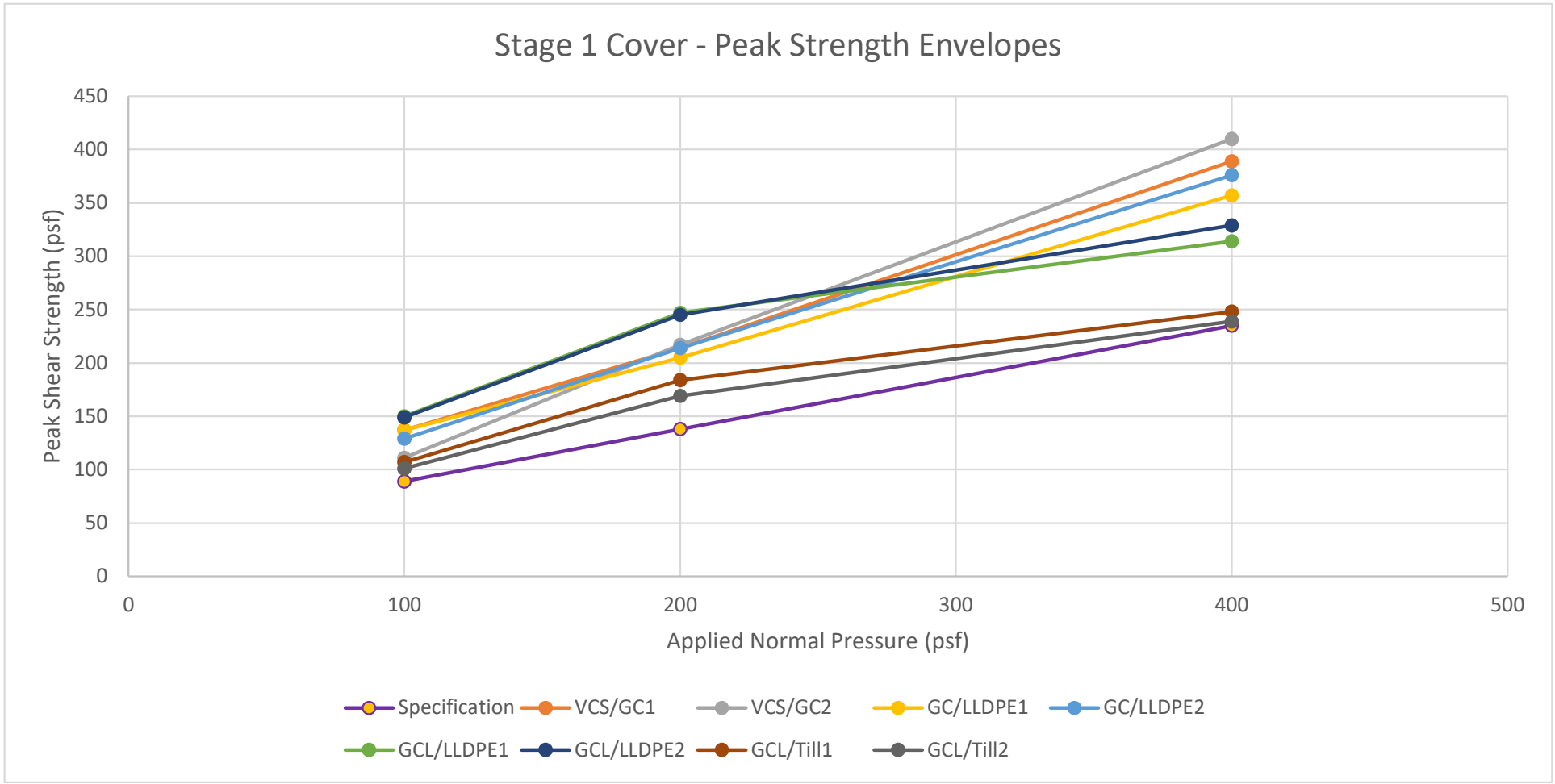
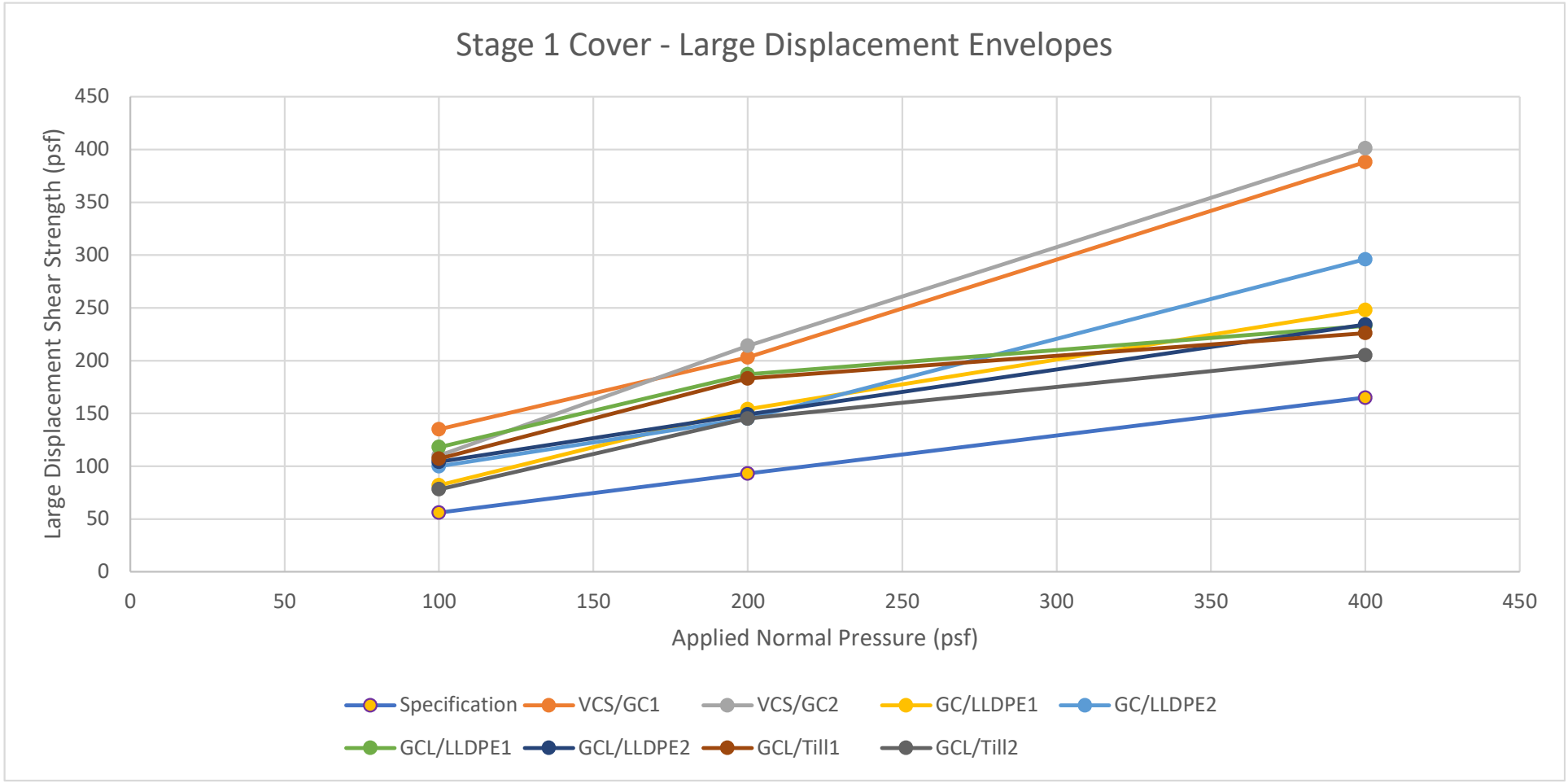
ENGINEERS

4A

PRIOR INTERFACE FRICTION TESTING RESULTS FROM STAGE 1 FINAL COVER

SME
SEVEE & MAHER
ENGINEERS


Stage 1 Cover - Peak Strength Envelopes
Peak Shear Strength (psf)
450
400
350
300
250
200
150
100
50
0
0
100
200
300
400
500
Applied Normal Pressure (psf)
Specification
VCS/GC1
VCS/GC2
GC/LLDPE1
GC/LLDPE2
GCL/LLDPE1
GCL/LLDPE2
GCL/Till1
GCL/Till2


Stage 1 Cover - Large Displacement Envelopes
Large Displacement Shear Strength (psf)
0
50
100
150
200
250
300
350
400
450
Applied Normal Pressure (psf)
Specification
VCS/GC1
VCS/GC2
GC/LLDPE1
GC/LLDPE2
GCL/LLDPE1
GCL/LLDPE2
GCL/Till1
GCL/Till2

SUMMARY OF PRIOR SITE-SPECIFIC INTERFACE FRICTION TESTING

STAGE 1 COVER: CONFORMANCE TESTING RESULTS

Test No.	Material Configuration	Peak[1]						Large Displacement[2]	
		Peak Shear Stress			Interface Friction Angle	Adhesion	Secant Angle for 100 psf Load	Interface Friction Angle	Adhesion
		At 100 psf Normal Stress (psf)	At 200 psf Normal Stress (psf)	At 400 psf Normal Stress (psf)	(deg)	(psf)	(deg)	(deg)	(psf)
23014-1	Vegetative Cover Soil / TN250-2-6 DS Geocomposite	137	214	389	40.1	50	53.9	40.6	42
23014-2	Vegetative Cover Soil / TN250-2-6 DS Geocomposite	111	217	410	44.8	15	48	44	17
23014-3	TN250-2-6 DS Geocomposite / Solmax 40-mil Textured LLDPE	137	205	357	36.5	61	53.9	28.4	35
23014-4	TN250-2-6 DS Geocomposite / Solmax 40-mil Textured LLDPE	129	214	376	39.4	48	52.2	33.7	25
23014-5	Terrafix Bentofix GCL / 40-mil Textured LLDPE	150	247	314	27.4	116	56.3	19.9	95
23014-6	Terrafix Bentofix GCL / 40-mil Textured LLDPE	149	245	329	29.9	107	56.2	23.4	61
23014-7	Terrafix Bentofix GCL / Glacial Till	107	184	248	24.2	75	47	20.3	86
23014-8	Terrafix Bentofix GCL / Glacial Till	101	169	239	24	66	45.3	22.1	48
23014-9	Terrafix Bentofix GCL Internal Shear	N/A	1,004	N/A	N/A	N/A	78.7 [3]	N/A	N/A

Notes:

1. Per project specs, the specified min. peak shear stresses for applied normal stresses of 100 psf, 200 psf, and 400 psf are 89 psf, 138 psf, and 235 psf, respectively.
2. Per project specs, the specified min. large displacement shear stresses for applied normal stresses of 100 psf, 200 psf, and 400 psf are 56 psf, 93 psf, and 165 psf, respectively.
3. Test 23014-9 performed at a normal stress of 200 psf.

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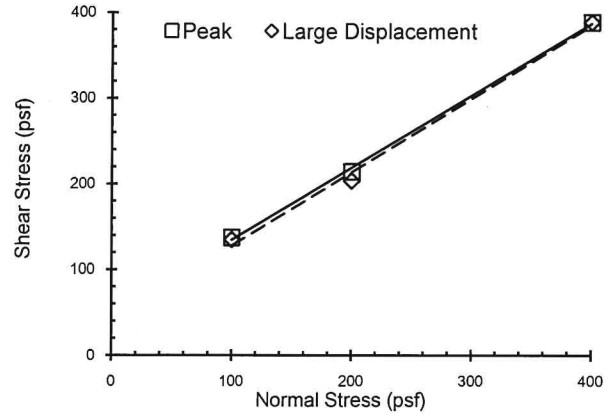
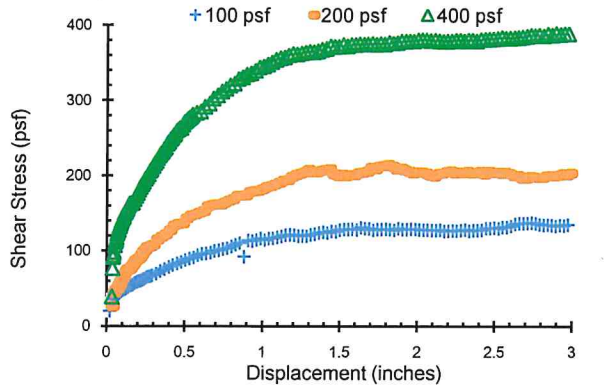
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-1
Richard S. Lacey, P.E. 5/8/2023
Analysis & Quality Review/Date

Vegetative Cover Soil vs. SKAPS TN250-2-6 DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	40.1	40.6
Y-intercept or Adhesion	psf	50	42
Minimum Secant Angle	Degrees	44.2	44.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Vegetative Cover Soil	
	ω = 10.4%, γ_d = 117.4 pcf	
Lower Box	SKAPS TN250-2-6 DS Geocomposite	
	R# 0131711010003	
Conditioning	Wet- Interface soaked at 1 psi for 1 hour, then normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	137	214	389
	Secant Angle	deg.	53.9	47.0	44.2
Large Displacement	Shear Stress	psf	135	203	388
	Secant Angle	deg.	53.5	45.5	44.2

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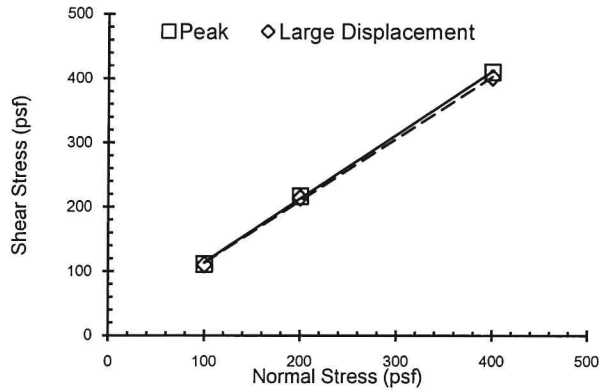
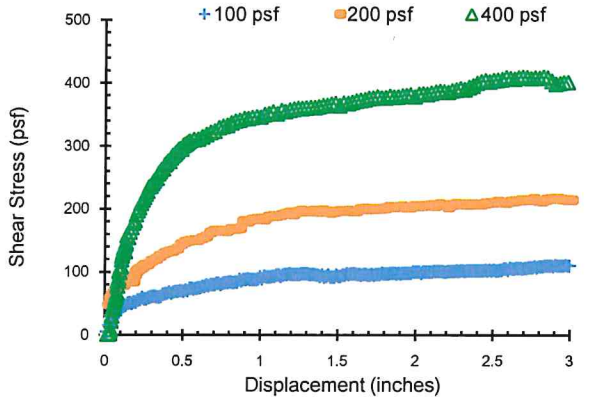
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-2
Richard S. Lacey, P.E. 5/8/2023
Analysis & Quality Review/Date

Vegetative Cover Soil vs. SKAPS TN250-2-6 DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	44.8	44.0
Y-intercept or Adhesion	psf	15	17
Minimum Secant Angle	Degrees	45.7	45.1

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Vegetative Cover Soil	
	ω = 10.4%, γ_d = 117.4 pcf	
Lower Box	SKAPS TN250-2-6 DS Geocomposite	
	R# 0131711010028	
Conditioning	Wet - Interface soaked at 1 psi for 1 hour, then normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	111	217	410
	Secant Angle	deg.	48.0	47.3	45.7
Large Displacement	Shear Stress	psf	110	214	401
	Secant Angle	deg.	47.7	47.0	45.1

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Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.

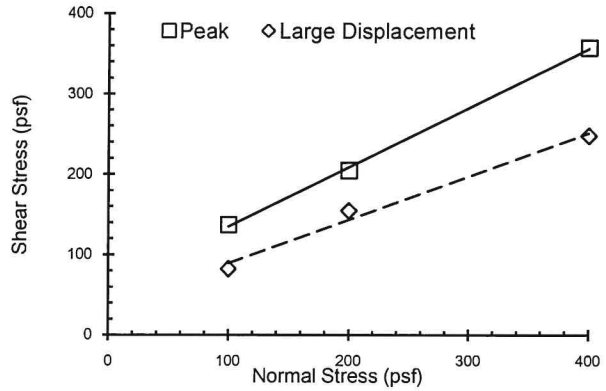
Project: Juniper Ridge Landfill Stage 1 Final Cover

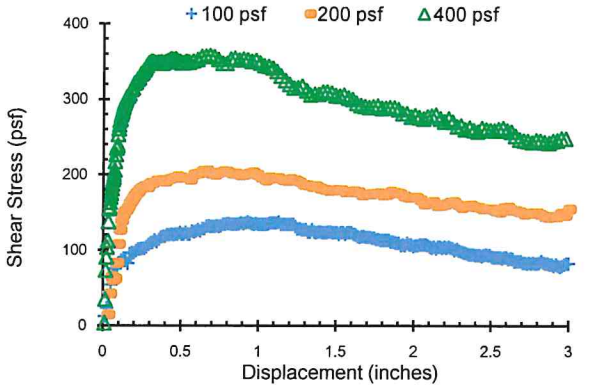
TRI Log #: IF23014-3

Richard S. Lacey, P.E. 5/8/2023

Analysis & Quality Review/Date

Solmax 40mil DS Textured LLDPE vs. SKAPS TN250-2-6 DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	36.5	28.4
Y-intercept or Adhesion	psf	61	35
Minimum Secant Angle	Degrees	41.8	31.8

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax 40mil DS Textured LLDPE	
	R# 1005-068258	
Lower Box	SKAPS TN250-2-6 DS Geocomposite	
	R# 0131711010003	
Conditioning	Wet- Normal loading applied and interface flooded for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	137	205	357
	Secant Angle	deg.	53.9	45.7	41.8
Large Displacement	Shear Stress	psf	82	154	248
	Secant Angle	deg.	39.4	37.7	31.8
Asperity Height, Avg. of 5 Meas.		mils	26	26	27

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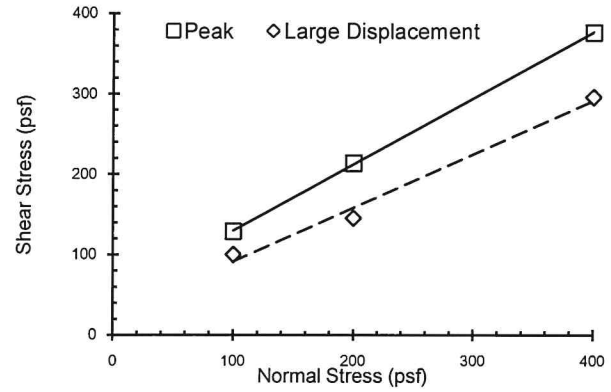
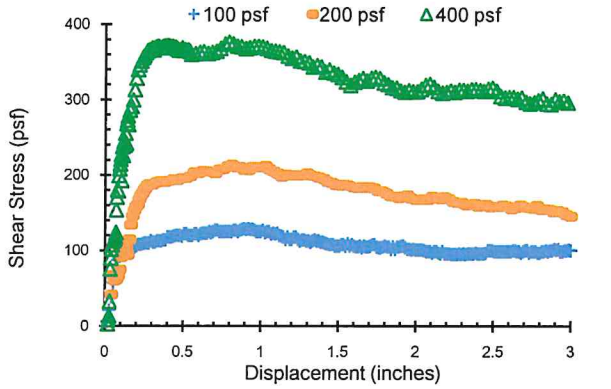
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-4
Richard S. Lacey, P.E. 5/8/2023
Analysis & Quality Review/Date

Solmax 40mil DS Textured LLDPE vs. SKAPS TN250-2-6 DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	39.4	33.7
Y-intercept or Adhesion	psf	48	25
Minimum Secant Angle	Degrees	43.2	36.0

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax 40mil DS Textured LLDPE	
	R# 1005-068272	
Lower Box	SKAPS TN250-2-6 DS Geocomposite	
	R# 0131711010028	
Conditioning	Wet- Normal loading applied and interface flooded for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	129	214	376
	Secant Angle	deg.	52.2	46.9	43.2
Large Displacement	Shear Stress	psf	100	145	296
	Secant Angle	deg.	45.0	36.0	36.5
Asperity Height, Avg. of 5 Meas.		mils	27	27	27

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By Peter Mailey at 9:29 am, Jun 07, 2023

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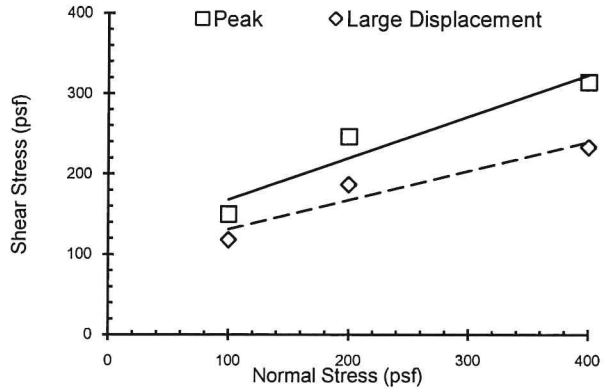
By Peter Mailey at 10:03 am, Jun 07, 2023

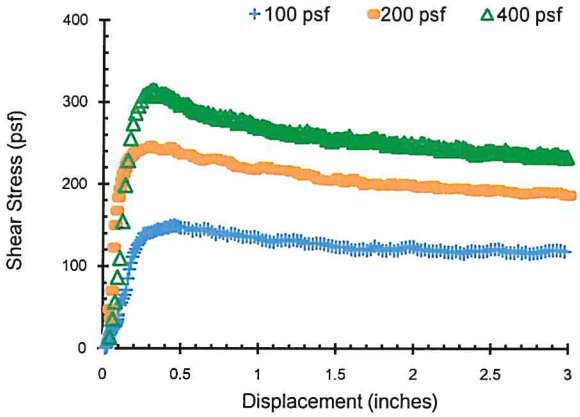
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-5
Richard S. Lacey, P.E. 6/6/2023
Analysis & Quality Review/Date

Terrafix Bentofix NSL GCL vs. Solmax 40mil DS Textured LLDPE





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	27.4	19.9
Y-intercept or Adhesion	psf	116	95
Minimum Secant Angle	Degrees	38.1	30.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Terrafix Bentofix NSL GCL (non-woven side against HDPE) R# 283759	
Lower Box	Solmax 40mil DS Textured LLDPE R# 1005-068258	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	150	247	314
	Secant Angle	deg.	56.3	50.9	38.1
Large Displacement	Shear Stress	psf	118	187	233
	Secant Angle	deg.	49.7	43.0	30.2
Asperity Height, Avg. of 5 Meas.		mils	25	26	26

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Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.

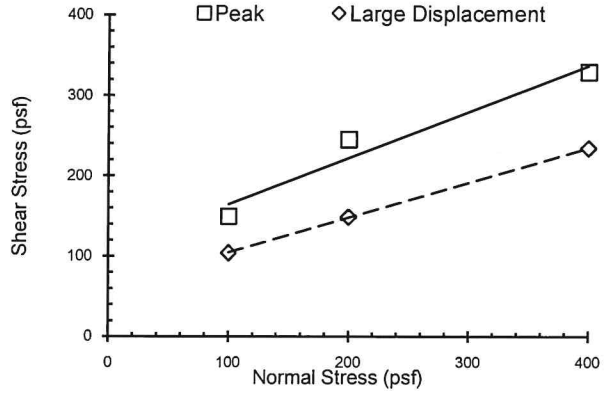
Project: Juniper Ridge Landfill Stage 1 Final Cover

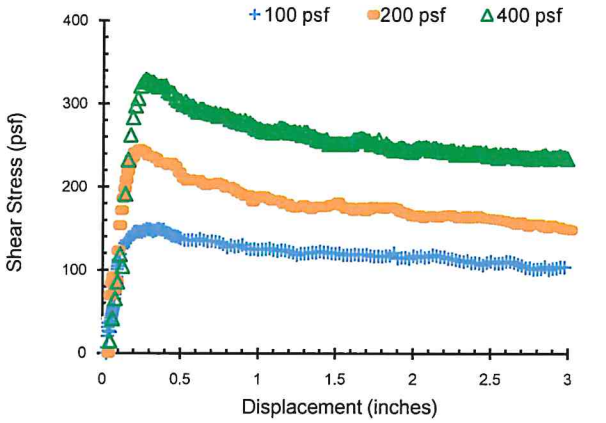
TRI Log #: IF23014-6

Richard S. Lacey, P.E. 6/6/2023

Analysis & Quality Review/Date

Terrafix Bentofix NSL GCL vs. Solmax 40mil DS Textured LLDPE





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	29.9	23.4
Y-intercept or Adhesion	psf	107	61
Minimum Secant Angle	Degrees	39.5	30.3

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Terrafix Bentofix NSL GCL (non-woven side against HDPE) R# 284105	
Lower Box	Solmax 40mil DS Textured LLDPE R# 1005-068272	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	149	245	329
	Secant Angle	deg.	56.2	50.8	39.5
Large Displacement	Shear Stress	psf	104	149	234
	Secant Angle	deg.	46.1	36.6	30.3
Asperity Height, Avg. of 5 Meas.		mils	26	26	26

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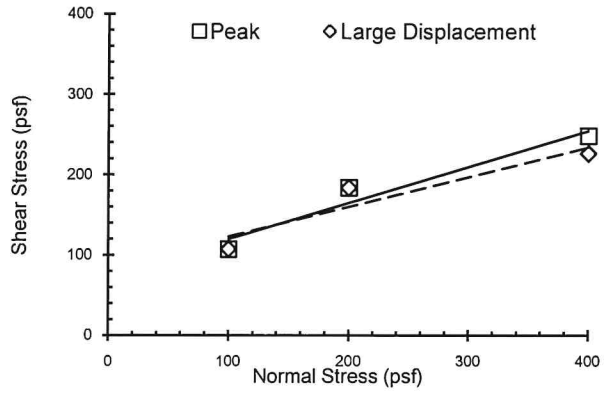
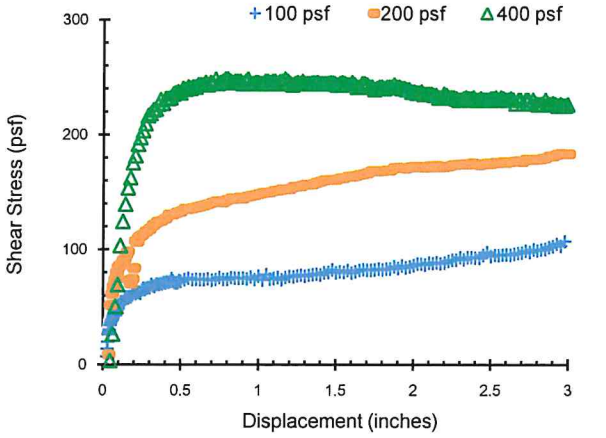
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-7
Richard S. Lacey, P.E. 6/9/2023
Analysis & Quality Review/Date

Terrafix Bentofix NSL GCL vs. Compacted Till





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	24.2	20.3
Y-intercept or Adhesion	psf	75	86
Minimum Secant Angle	Degrees	31.8	29.5

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Terrafix Bentofix NSL GCL (woven side against soil)	
	R# 283759	
Lower Box	Compacted Till	
	ω = 10.4%, γ_d = 114.3 pcf	
Conditioning	GCL hydrated under 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	107	184	248
	Secant Angle	deg.	47.0	42.6	31.8
Large Displacement	Shear Stress	psf	107	183	226
	Secant Angle	deg.	47.0	42.5	29.5

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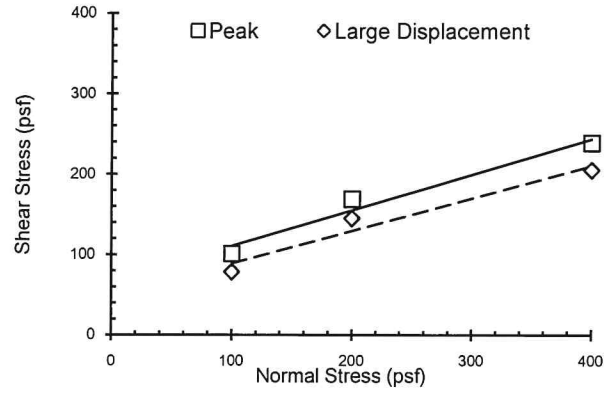
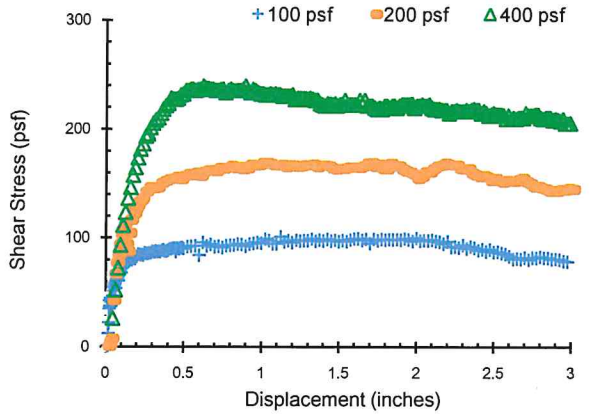
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-8
Richard S. Lacey, P.E. 6/9/2023
Analysis & Quality Review/Date

Terrafix Bentofix NSL GCL vs. Compacted Till





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	24.0	22.1
Y-intercept or Adhesion	psf	66	48
Minimum Secant Angle	Degrees	30.9	27.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Terrafix Bentofix NSL GCL (woven side against soil)	
	R# 284105	
Lower Box	Compacted Till	
	ω = 10.4%, γ_d = 114.3 pcf	
Conditioning	GCL hydrated under 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	101	169	239
	Secant Angle	deg.	45.3	40.2	30.9
Large Displacement	Shear Stress	psf	78	145	205
	Secant Angle	deg.	38.1	35.9	27.2

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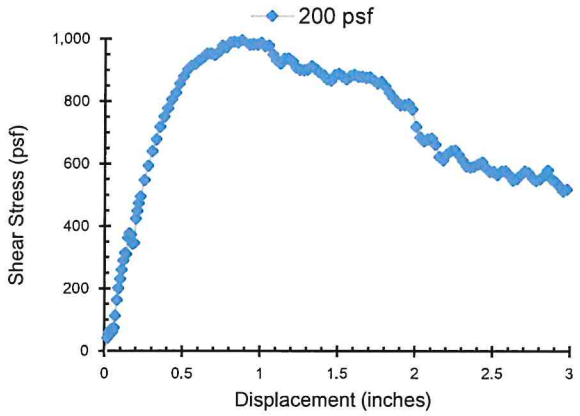
Internal Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 1 Final Cover

TRI Log #: IF23014-9
Richard S. Lacey, P.E. 6/9/2023
Analysis & Quality Review/Date

Terrafix Bentofix NSL GCL
INTERNAL SHEAR



Test Results			
Single Point Test Results		Peak	Large Displacement
Shear Stress	psf	1004	519

Note: Large displacement value reported for 3.0 inches of displacement.

Specimen No.		-	1
Normal Stress		psf	200
Box Edge Dimension		in	12
Bearing Slide Resistance		lbs	10
Peak	Shear Stress	psf	1,004
	Secant Angle	deg.	78.7
Large Displacement	Shear Stress	psf	519
	Secant Angle	deg.	68.9

Test Conditions		
	Terrafix Bentofix NSL GCL INTERNAL SHEAR R# 283759	
Conditioning	GCL hydrated under 1 psi for 48 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes
The GCL sheared internally.

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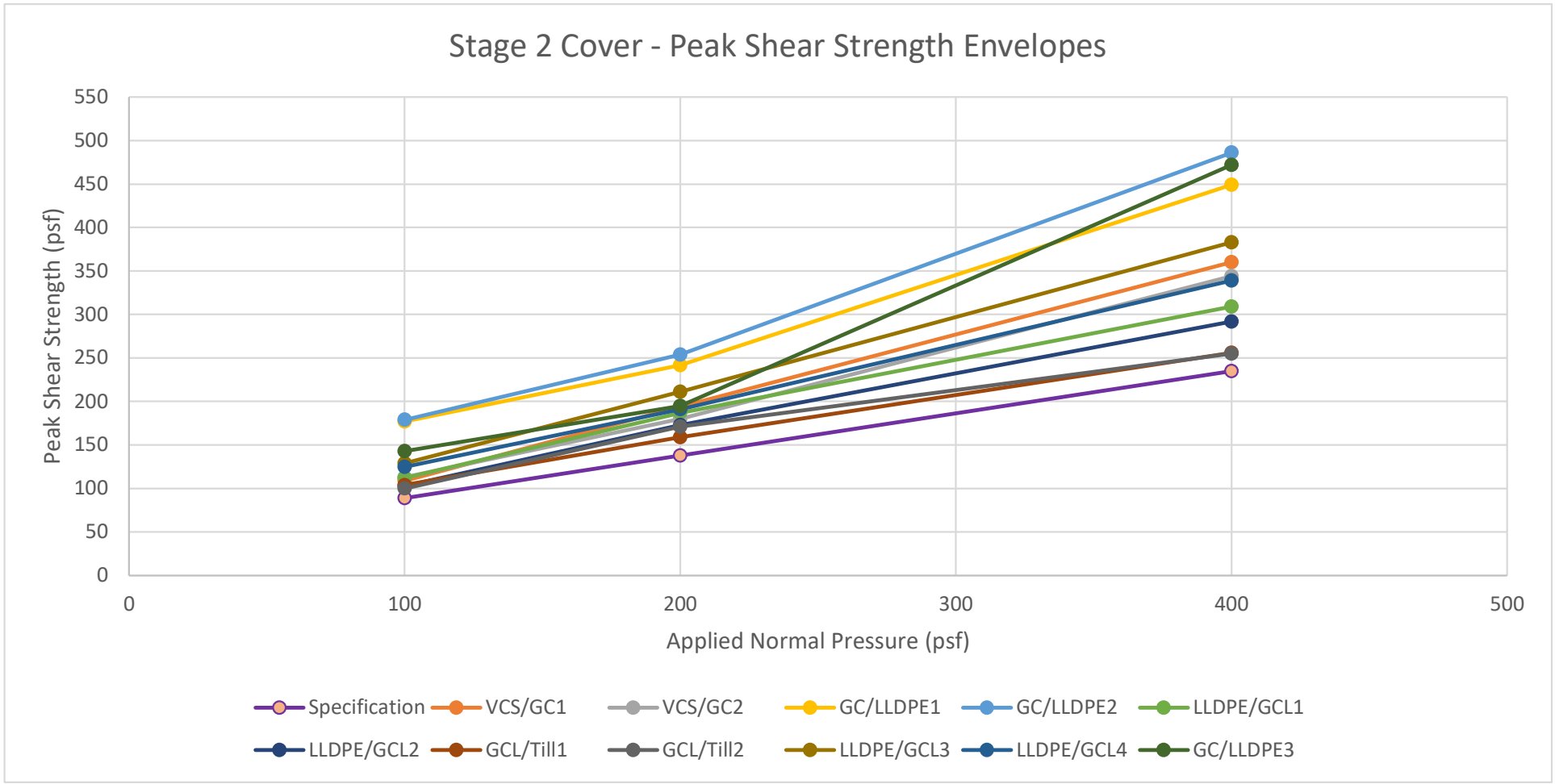
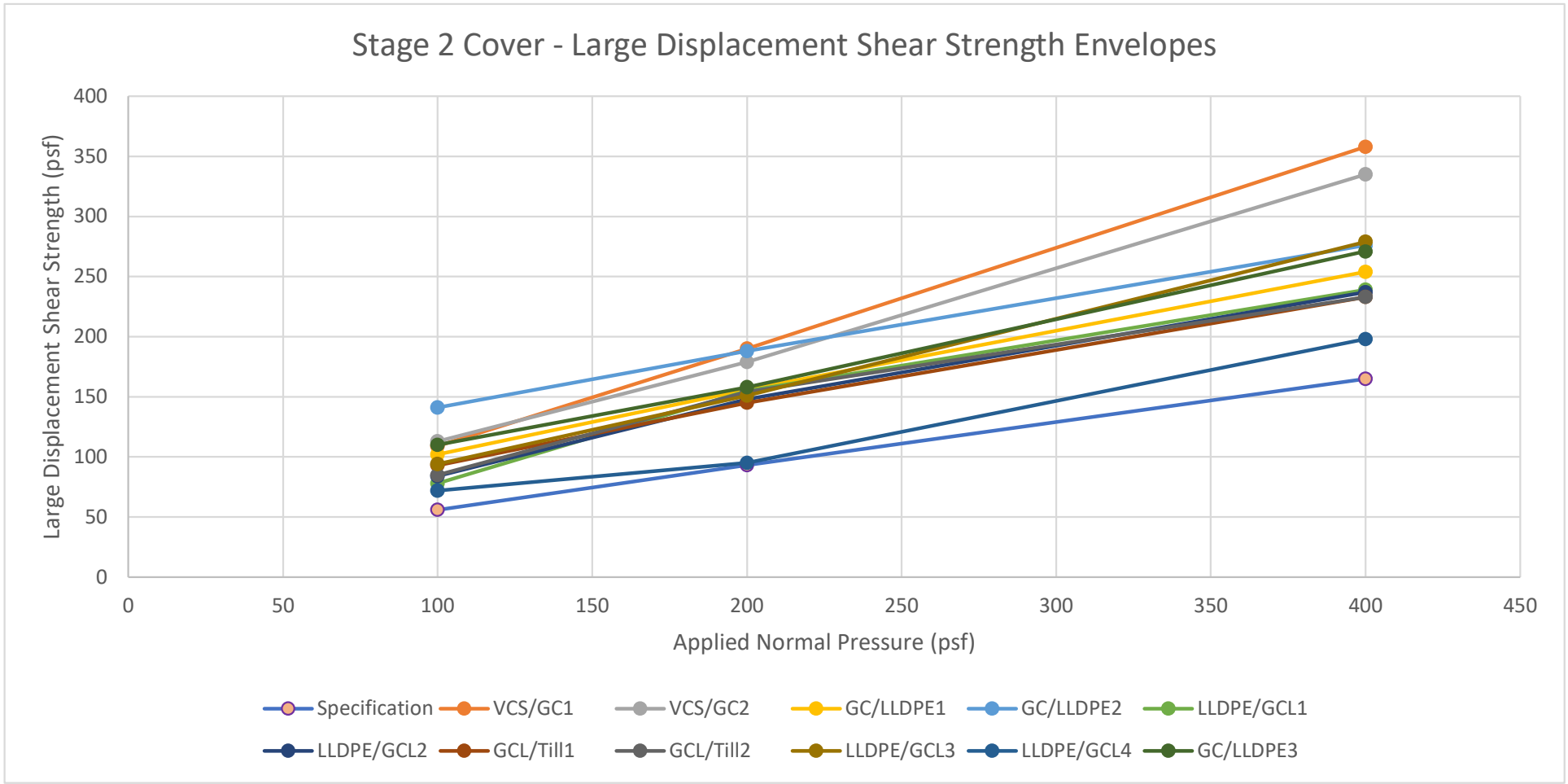
4B

PRIOR INTERFACE FRICTION TESTING RESULTS FROM STAGE 2 FINAL COVER

SME
SEVEE & MAHER
ENGINEERS


Stage 2 Cover - Peak Shear Strength Envelopes
Peak Shear Strength (psf)
550
500
450
400
350
300
250
200
150
100
50
0
0
100
200
300
400
500
Applied Normal Pressure (psf)
Specification
VCS/GC1
VCS/GC2
GC/LLDPE1
GC/LLDPE2
LLDPE/GCL1
LLDPE/GCL2
GCL/Till1
GCL/Till2
LLDPE/GCL3
LLDPE/GCL4
GC/LLDPE3


Stage 2 Cover - Large Displacement Shear Strength Envelopes
Large Displacement Shear Strength (psf)
0
50
100
150
200
250
300
350
400
0
50
100
150
200
250
300
350
400
450
Applied Normal Pressure (psf)
Specification
VCS/GC1
VCS/GC2
GC/LLDPE1
GC/LLDPE2
LLDPE/GCL1
LLDPE/GCL2
GCL/Till1
GCL/Till2
LLDPE/GCL3
LLDPE/GCL4
GC/LLDPE3

SUMMARY OF PRIOR SITE-SPECIFIC INTERFACE FRICTION TESTING

STAGE 2 COVER: CONFORMANCE TESTING RESULTS

Test No.	Material Configuration	Peak[1]						Large Displacement[2]	
		Peak Shear Stress			Interface Friction Angle	Adhesion	Secant Angle for 100 psf Load	Interface Friction Angle	Adhesion
		At 100 psf Normal Stress (psf)	At 200 psf Normal Stress (psf)	At 400 psf Normal Stress (psf)	(deg)	(psf)	(deg)	(deg)	(psf)
24008-01	Vegetative Cover Soil / Solmax 225mil DS Geocomposite	109	194	360	39.9	26	47.5	39.7	25
24008-02	Vegetative Cover Soil / Solmax 225mil DS Geocomposite	113	180	344	37.9	31	48.5	36.7	35
24008-03	Solmax 225mil DS Geocomposite / AGRU 40mil DS LLDPE Microspike	177	242	449	42.5	75	60.5	26.8	53
24008-04	Solmax 225mil DS Geocomposite / AGRU 40mil DS LLDPE Microspike	179	254	486	46.2	24.2	60.8	24.2	97
24008-05	AGRU 40mil DS LLDPE Microspike / Solmax Bentoliner NS Peel 35 GCL	112	187	309	33	51	48.3	27.5	36
24008-06	AGRU 40mil DS LLDPE Microspike / Solmax Bentoliner NS Peel 35 GCL	103	173	292	32	43	45.9	26.6	39
24008-07	Solmax Bentoliner NS Peel 35 GCL / Glacial Till	104	159	256	26.8	55	46.1	24.8	49
24008-08	Solmax Bentoliner NS Peel 35 GCL / Glacial Till	100	171	255	26.7	58	45	25.6	46
24008-09	Solmax Bentoliner NS Peel 35 GCL Internal Shear	N/A	1,119	N/A	N/A	N/A	79.9 [3]	N/A	N/A
24008-10	AGRU 40mil DS LLDPE Microspike / Bentofix NSL GCL	129	211	383	40.4	43	52.2	31.8	30
24008-11	AGRU 40mil DS LLDPE Microspike / Solmax Bentoliner NS Peel 35 GCL	125	191	339	35.6	51	51.4	23.4	21
24008-12	Solmax 225mil DS Geocomposite / AGRU 40ml DS LLDPE Microspike	143	195	472	48.7	4	55	28.4	53

Notes:

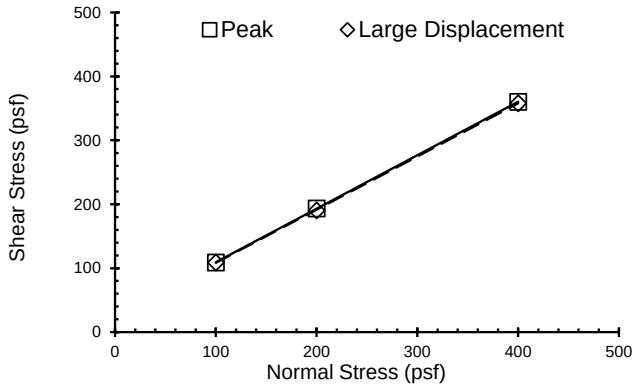
1. Per project specifications, the specified minimum peak shear stresses for applied normal stresses of 100 psf, 200 psf, and 400 psf are 89 psf, 138 psf, and 235 psf, respectively.
2. Per project specs, the specified min. large displacement shear stresses for applied normal stresses of 100 psf, 200 psf, and 400 psf are 56 psf, 93 psf, and 165 psf, respectively.
3. Test 24008-09 performed at a normal stress of 200 psf.

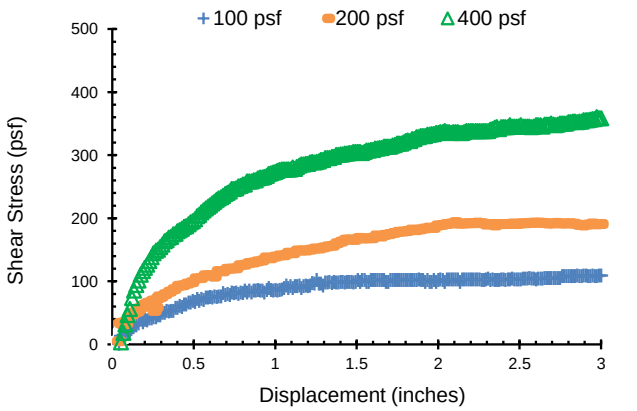
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-1
Richard S. Lacey, P.E. 5/17/2024
Analysis & Quality Review/Date

Vegetative Cover Soil vs. Solmax 225mil DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	39.9	39.7
Y-intercept or Adhesion	psf	26	25
Minimum Secant Angle	Degrees	42.0	41.8

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Vegetative Cover Soil	
	ω = 10.4%, γ_d = 114.3 pcf	
Lower Box	Solmax 225mil DS Geocomposite	
	R# 2331-649421	
Conditioning	Interface soaked at 1 psi for 1 hour then normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	109	194	360
	Secant Angle	deg.	47.5	44.1	42.0
Large Displacement	Shear Stress	psf	109	190	358
	Secant Angle	deg.	47.5	43.6	41.8

RECEIVED
By Darren Ward at 10:03 am, May 23, 2024

REVIEWED
By TJM at 10:44 am, May 31, 2024

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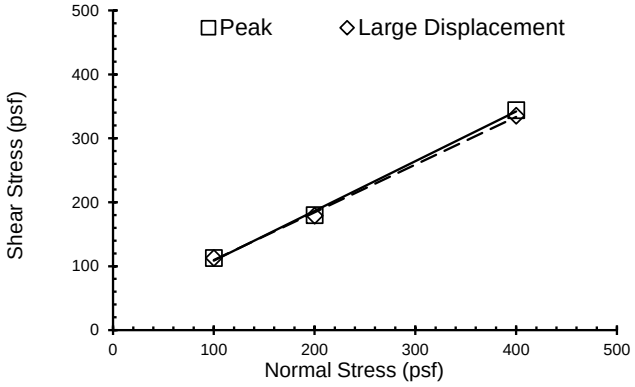
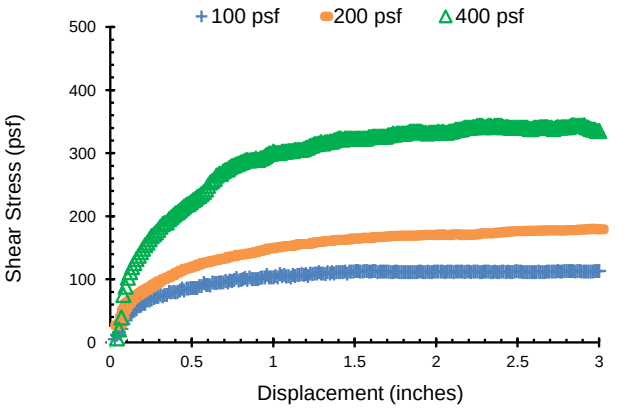
Shear Strength of Soil-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-2
Richard S. Lacey, P.E. 5/17/2024
Analysis & Quality Review/Date

Vegetative Cover Soil vs. Solmax 225mil DS Geocomposite





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	37.9	36.7
Y-intercept or Adhesion	psf	31	35
Minimum Secant Angle	Degrees	40.7	40.0

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Vegetative Cover Soil	
	ω = 10.4%, γ_d = 114.3 pcf	
Lower Box	Solmax 225mil DS Geocomposite	
	R# 2331-649481	
Conditioning	Interface soaked at 1 psi for 1 hour then normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	113	180	344
	Secant Angle	deg.	48.5	42.0	40.7
Large Displacement	Shear Stress	psf	113	179	335
	Secant Angle	deg.	48.5	41.8	40.0

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By Darren Ward at 10:04 am, May 23, 2024

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By TJM at 10:54 am, May 31, 2024

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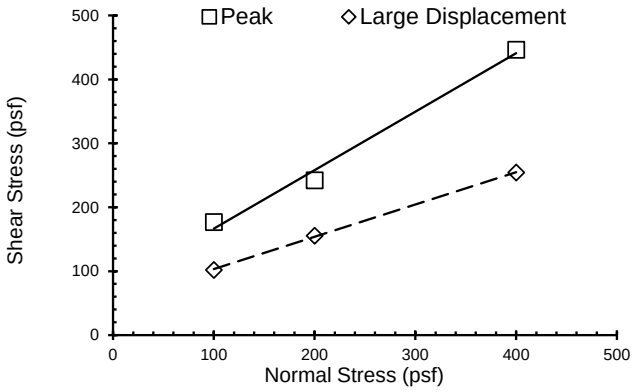
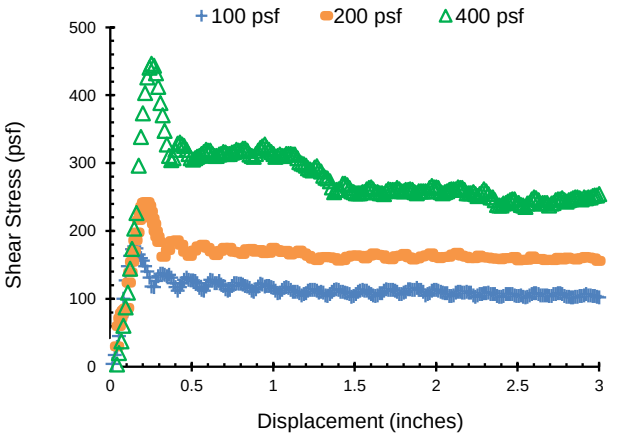
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-3
Richard S. Lacey, P.E. 6/20/2024
Analysis & Quality Review/Date

Solmax 225mil DS Geocomposite vs. AGRU 40mil DS LLDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	42.5	26.8
Y-intercept or Adhesion	psf	75	53
Minimum Secant Angle	Degrees	48.1	32.4

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax 225mil DS Geocomposite	
	R# 2331-649421	
Lower Box	AGRU 40mil DS LLDPE Microspike	
	(dull side against geocomposite)	
	R# GTB0133590014	
Conditioning	Normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	177	242	446
	Secant Angle	deg.	60.5	50.4	48.1
Large Displacement	Shear Stress	psf	102	156	254
	Secant Angle	deg.	45.6	37.9	32.4
Asperity Height, Avg. of 5 Meas.		mils	31	30	30

RECEIVED
By Darren Ward at 3:56 pm, Jun 20, 2024

REVIEWED
By Darren Ward at 4:04 pm, Jun 20, 2024

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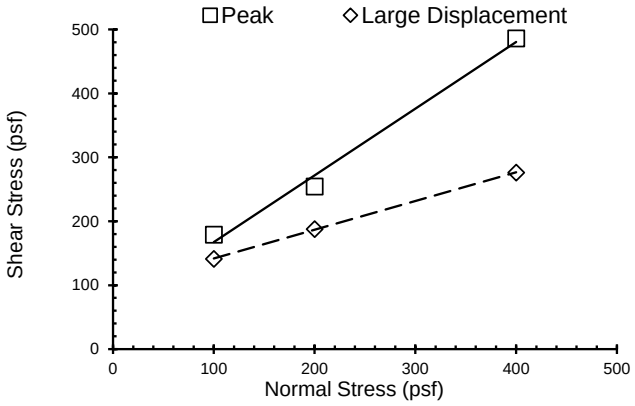
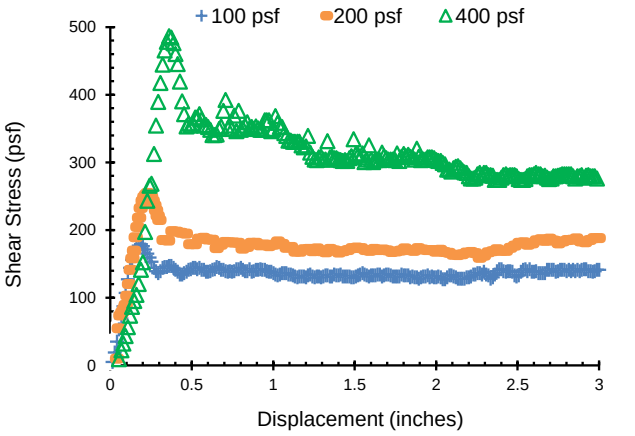
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-4
Richard S. Lacey, P.E. 6/20/2024
Analysis & Quality Review/Date

Solmax 225mil DS Geocomposite vs. AGRU 40mil DS LLDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	46.2	24.2
Y-intercept or Adhesion	psf	63	97
Minimum Secant Angle	Degrees	50.6	34.6

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax 225mil DS Geocomposite	
	R# 2331-649481	
Lower Box	AGRU 40mil DS LLDPE Microspike	
	(dull side against geocomposite)	
	R# GTB0133590024	
Conditioning	Normal loading applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	179	254	486
	Secant Angle	deg.	60.8	51.8	50.6
Large Displacement	Shear Stress	psf	141	188	276
	Secant Angle	deg.	54.7	43.2	34.6
Asperity Height, Avg. of 5 Meas.		mils	30	31	30

RECEIVED
By Darren Ward at 3:57 pm, Jun 20, 2024

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By Darren Ward at 4:08 pm, Jun 20, 2024

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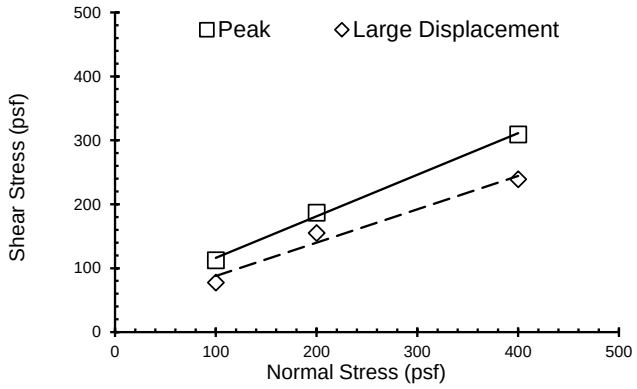
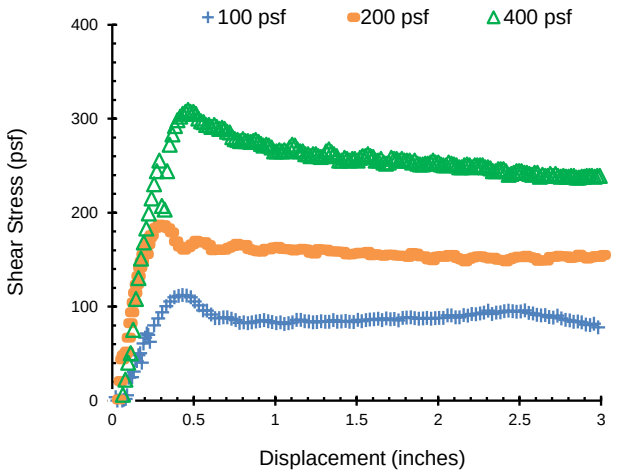
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-5
Richard S. Lacey, P.E. 6/18/2024
Analysis & Quality Review/Date

AGRU 40mil DS LLDPE Microspike vs. Solmax Bentoliner NS Peel 35 GCL





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	33.0	27.5
Y-intercept or Adhesion	psf	51	36
Minimum Secant Angle	Degrees	37.7	30.9

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	AGRU 40mil DS LLDPE Microspike (shiny side against GCL)	
	R# GTB0133590014	
Lower Box	Solmax Bentoliner NS Peel 35 GCL	
	(non-woven side against HDPE)	
	R# 2335-139960	
Conditioning	GCL hydrated at 144 psf for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	112	187	309
	Secant Angle	deg.	48.3	43.1	37.7
Large Displacement	Shear Stress	psf	78	155	239
	Secant Angle	deg.	37.9	37.8	30.9
Asperity Height, Avg. of 5 Meas.		mils	31	31	31

RECEIVED
By Darren Ward at 3:14 pm, Jun 18, 2024

REVIEWED
By Darren Ward at 3:33 pm, Jun 18, 2024

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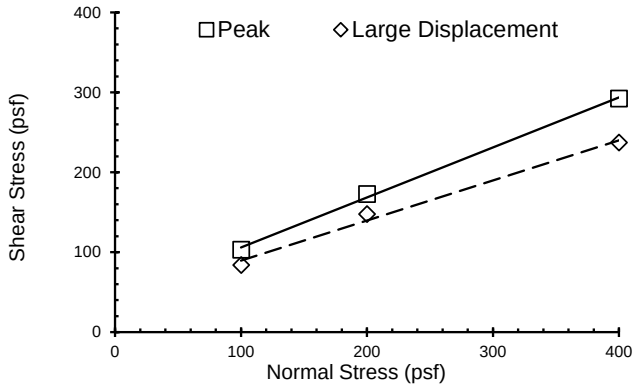
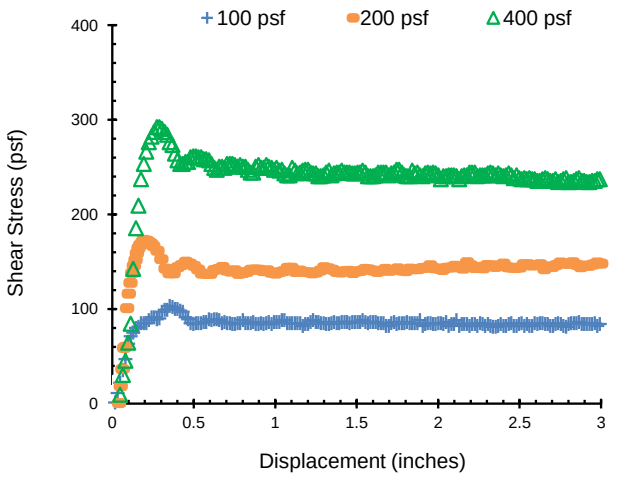
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-6
Richard S. Lacey, P.E. 6/18/2024
Analysis & Quality Review/Date

AGRU 40mil DS LLDPE Microspike vs. Solmax Bentoliner NS Peel 35 GCL





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	32.0	26.6
Y-intercept or Adhesion	psf	43	39
Minimum Secant Angle	Degrees	36.1	30.7

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	AGRU 40mil DS LLDPE Microspike (shiny side against GCL)	
	R# GTB0133590024	
Lower Box	Solmax Bentoliner NS Peel 35 GCL	
	(non-woven side against HDPE)	
	R# 2335-140063	
Conditioning	GCL hydrated at 144 psf for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	103	173	292
	Secant Angle	deg.	45.9	40.8	36.1
Large Displacement	Shear Stress	psf	84	148	237
	Secant Angle	deg.	40.0	36.5	30.7
Asperity Height, Avg. of 5 Meas.		mils	31	31	32

RECEIVED
By Darren Ward at 3:14 pm, Jun 18, 2024

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By Darren Ward at 3:39 pm, Jun 18, 2024

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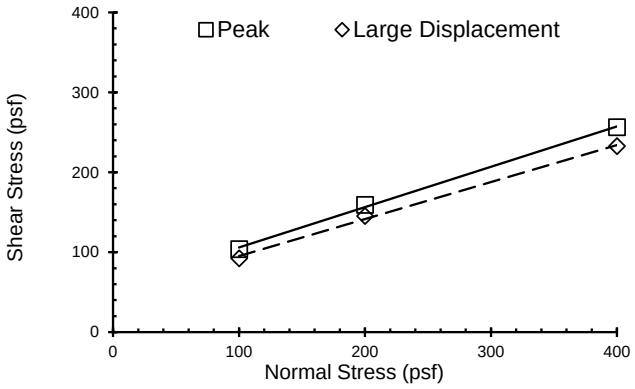
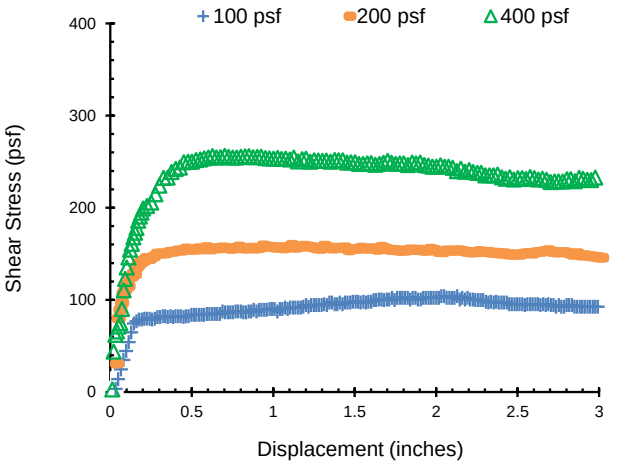
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-7
Richard S. Lacey, P.E. 6/18/2024
Analysis & Quality Review/Date

Solmax Bentoliner NS Peel 35 GCL vs. Compacted Till





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	26.8	24.8
Y-intercept or Adhesion	psf	55	49
Minimum Secant Angle	Degrees	32.7	30.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax Bentoliner NS Peel 35 GCL (woven side against soil)	
	R# 2335-139960	
Lower Box	Compacted Till	
	ω = 10.4%, γ_d = 114.3 pcf	
Conditioning	GCL hydrated at 144 psf for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	104	159	256
	Secant Angle	deg.	46.1	38.5	32.7
Large Displacement	Shear Stress	psf	93	145	233
	Secant Angle	deg.	42.8	36.0	30.2

RECEIVED
By Darren Ward at 3:15 pm, Jun 18, 2024

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By Darren Ward at 3:44 pm, Jun 18, 2024

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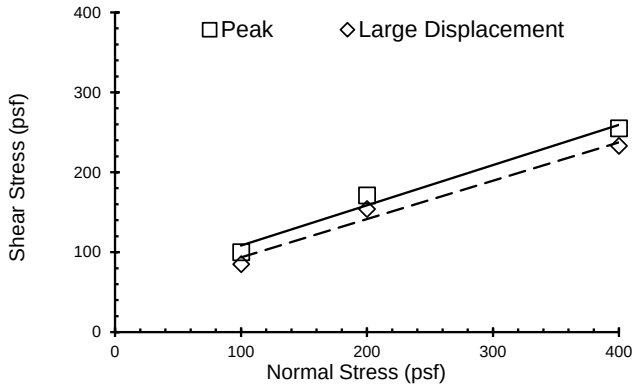
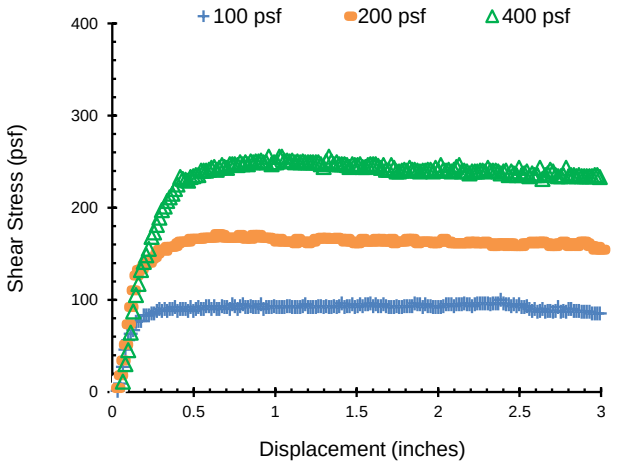
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-8
Richard S. Lacey, P.E. 6/18/2024
Analysis & Quality Review/Date

Solmax Bentoliner NS Peel 35 GCL vs. Compacted Till





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	26.7	25.6
Y-intercept or Adhesion	psf	58	46
Minimum Secant Angle	Degrees	32.5	30.2

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax Bentoliner NS Peel 35 GCL (woven side against soil)	
	R# 2335-140063	
Lower Box	Compacted Till	
	ω = 10.4%, γ_d = 114.3 pcf	
Conditioning	GCL hydrated at 144 psf for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	100	171	255
	Secant Angle	deg.	45.0	40.5	32.5
Large Displacement	Shear Stress	psf	85	154	233
	Secant Angle	deg.	40.4	37.6	30.2

RECEIVED
By Darren Ward at 3:15 pm, Jun 18, 2024

REVIEWED
By Darren Ward at 3:45 pm, Jun 18, 2024

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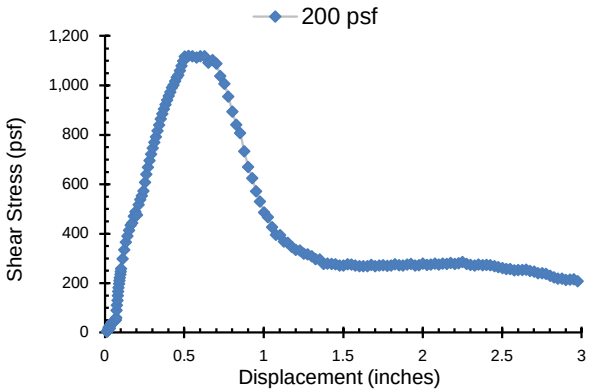
Internal Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF4008-9
Richard S. Lacey, P.E. 6/18/2024
Analysis & Quality Review/Date

Solmax Bentoliner NS Peel 35 GCL
INTERNAL SHEAR



Specimen No.		-	1
Normal Stress		psf	200
Box Edge Dimension		in	12
Bearing Slide Resistance		lbs	10
Peak	Shear Stress	psf	1,119
	Secant Angle	deg.	79.9
Large Displacement	Shear Stress	psf	208
	Secant Angle	deg.	46.1

Test Results			
Single Point Test Results		Peak	Large Displacement
Shear Stress	psf	1119	208

Note: Large displacement value reported for 3.0 inches of displacement.

Test Conditions		
	Solmax Bentoliner NS Peel 35 GCL R# 2335-140063	
Conditioning	Interface soaked and loading applied for 48 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

The GCL did not shear internally. GCL was torn near the grip.

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By Darren Ward at 4:53 pm, Jun 18, 2024

REVIEWED
By Darren Ward at 4:53 pm, Jun 18, 2024

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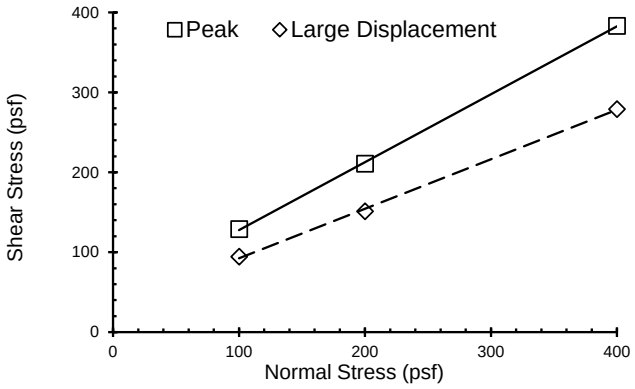
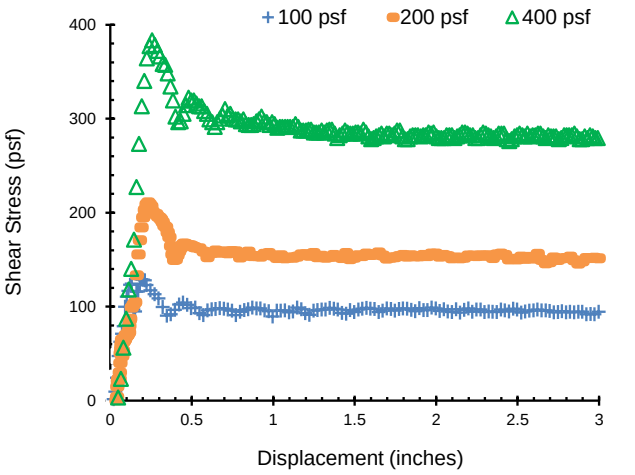
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-10
Richard S. Lacey, P.E. 6/20/2024
Analysis & Quality Review/Date

AGRU 40mil DS LLDPE Microspike vs. Bentofix NSL GCL





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	40.4	31.8
Y-intercept or Adhesion	psf	43	30
Minimum Secant Angle	Degrees	43.8	34.9

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	AGRU 40mil DS LLDPE Microspike (shiny side down against GCL)	
	R# GTB0133590014	
Lower Box	Bentofix NSL GCL	
	(nonwoven side against HDPE)	
	R# 292533	
Conditioning	GCL hydrated at 1 psi for 24 hours in the box. Interface soaked and loading applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	129	211	383
	Secant Angle	deg.	52.2	46.5	43.8
Large Displacement	Shear Stress	psf	94	151	279
	Secant Angle	deg.	43.3	37.1	34.9
Asperity Height, Avg. of 5 Meas.		mils	25	26	26

RECEIVED
By Darren Ward at 3:57 pm, Jun 20, 2024

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By Darren Ward at 4:22 pm, Jun 20, 2024

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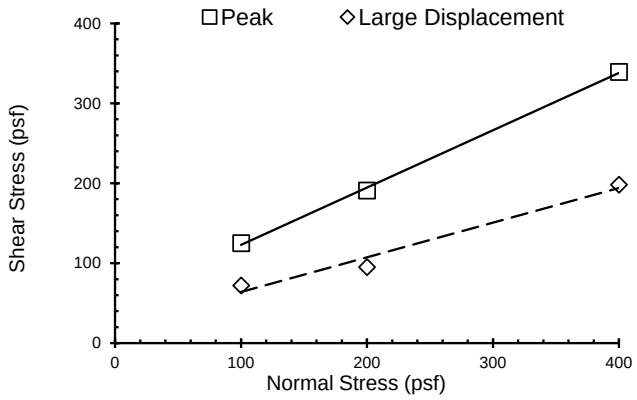
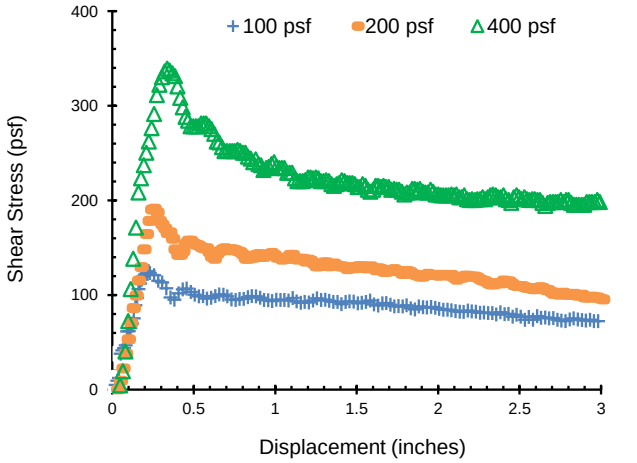
Interface Shear Strength of Geosynthetic Clay Liner by Direct Shear (ASTM D6243)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-11
Richard S. Lacey, P.E. 8/9/2024
Analysis & Quality Review/Date

AGRU 40mil DS LLDPE Microspike vs. Solmax Bentoliner NS Peel 35 GCL





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	35.6	23.4
Y-intercept or Adhesion	psf	51	21
Minimum Secant Angle	Degrees	40.3	25.4

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	AGRU 40mil DS LLDPE Microspike (shiny side against GCL)	
	R# GTB0098950001	
Lower Box	Solmax Bentoliner NS Peel 35 GCL	
	(non-woven side against HDPE)	
	R# 2335-140095	
Conditioning	GCL hydrated under 1 psi for 24 hours in the box. Interface flooded and load applied for 24 hours prior to shear.	
Shearing Rate	inches/minute	0.004

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	125	191	339
	Secant Angle	deg.	51.4	43.7	40.3
Large Displacement	Shear Stress	psf	72	95	198
	Secant Angle	deg.	35.8	25.4	26.4
Asperity Height, Avg. of 5 Meas.		mils	29	29	30

RECEIVED
By Darren Ward at 12:00 pm, Aug 14, 2024

REVIEWED
By Darren Ward at 12:11 pm, Aug 14, 2024

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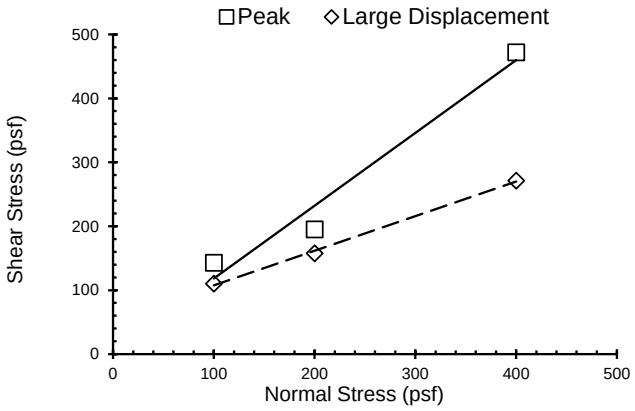
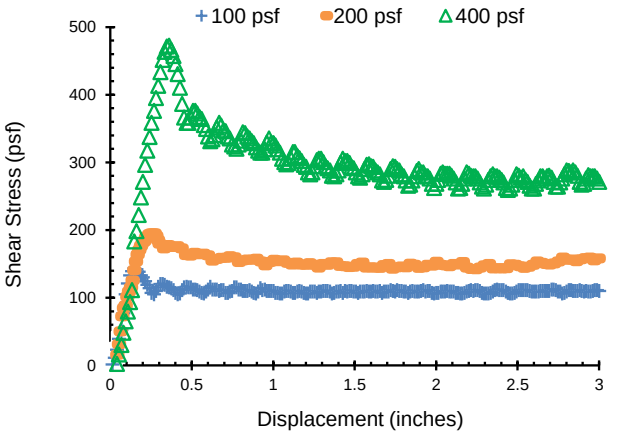
Shear Strength of Geosynthetic-Geosynthetic Interface by Direct Shear (ASTM D5321)

Client: Casella Waste Systems, Inc.
Project: Juniper Ridge Landfill Stage 2 Final Cover

TRI Log #: IF24008-12
Richard S. Lacey, P.E. 8/9/2024
Analysis & Quality Review/Date

Solmax 225mil DS Geocomposite vs. AGRU 40mil DS LLDPE Microspike





Test Results, Linear Regression			
Mohr-Coulomb Parameters		Peak	Large Displacement
Friction Angle	Degrees	48.7	28.4
Y-intercept or Adhesion	psf	4	53
Minimum Secant Angle	Degrees	44.3	34.1

Note - Large Displacement Values Reported for 3.0 inches of Displacement

Test Conditions		
Upper Box	Solmax 225mil DS Geocomposite	
	R# 2331-649530	
Lower Box	AGRU 40mil DS LLDPE Microspike	
	(dull side against geocomposite)	
	R# GTB0098950001	
Conditioning	Interface flooded and normal load applied for 4 hours prior to shear.	
Shearing Rate	inches/minute	0.2

Test Notes

Shearing occurred at the interface at all stresses.

Specimen No.		-	1	2	3
Normal Stress		psf	100	200	400
Box Edge Dimension		in	12	12	12
Bearing Slide Resistance		lbs	9	10	12
Peak	Shear Stress	psf	143	195	472
	Secant Angle	deg.	55.0	44.3	49.7
Large Displacement	Shear Stress	psf	110	158	271
	Secant Angle	deg.	47.7	38.3	34.1
Asperity Height, Avg. of 5 Meas.		mils	30	30	30

RECEIVED
By Darren Ward at 12:00 pm, Aug 14, 2024

REVIEWED
By Darren Ward at 12:12 pm, Aug 14, 2024

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4C

CONSTRUCTION EQUIPMENT LOADING

SME
SEVEE & MAHER
ENGINEERS

D6/D6 XE

Track-Type Tractors

Technical Specifications

Engine

Engine Model	Cat® C9.3B	
Emissions	U.S. EPA Tier 4 Final, EU Stage V, Korea Tier 4 Final	
Build Number	20A	
Net Power (Rated) – D6 2,200 rpm/D6 XE 1,700 rpm		
ISO 9249/SAE J1349	161 kW	215 hp
ISO 9249/SAE J1349 (DIN)		219 hp
D6 Engine Power (Maximum) – 1,200 rpm		
ISO 14396	187 kW	251 hp
ISO 14396 (DIN)		254 hp
D6 XE Engine Power (Maximum) – 1,400 rpm		
ISO 14396	177 kW	237 hp
ISO 14396 (DIN)		241 hp
Bore	115 mm	4.5 in
Stroke	149 mm	5.9 in
Displacement	9.3 L	567 in^3

- The new Cat C9.3B engine features a new high pressure common rail fuel system, simplified engine system electronics, and simplified air system through the removal of the previously used exhaust gas recirculation (EGR) system.
- The XE drive train allows the engine to operate in a tighter rpm range, 1,400-1,700 rpm, which helps extend engine life and provide improved fuel economy. The increased drive train efficiency also allows the machine to provide more engine power to the ground, resulting in greater machine performance.
- Net power advertised is the power available at the engine flywheel when the engine is equipped with a fan, air cleaner, clean emissions module and alternator.
- No derating required up to 2286 m (7,500 ft). Above this, automatic derating occurs.
- All non-road Tier 4 Interim and Final, Stage IIIB, IV and V and Korea Tier 4 Final diesel engines are required to use only ultra-low sulfur diesel (ULSD) fuels containing 15 ppm (mg/kg) sulfur or less. Biodiesel blends up to B20 (20% blend by volume) are acceptable when blended with 15 ppm (mg/kg) sulfur or less ULSD. B20 should meet ASTM D7467 specification (biodiesel blend stock should meet Cat biodiesel spec, ASTM D6751 or EN 14214). Cat DEO-ULS™ or oils that meet the Cat ECF-3, API CJ-4, and ACEA E9 specification are required. Consult your OMM for further machine specific fuel recommendations.
- Diesel Exhaust Fluid (DEF) used in Cat Selective Catalytic Reduction (SCR) systems must meet the requirements outlined in the International Organization for Standardization (ISO) standard 22241.

D6 XE Drive Train

Type	Electric Drive
Electric Drive System Nominal Voltage	715 Volts

CAT®

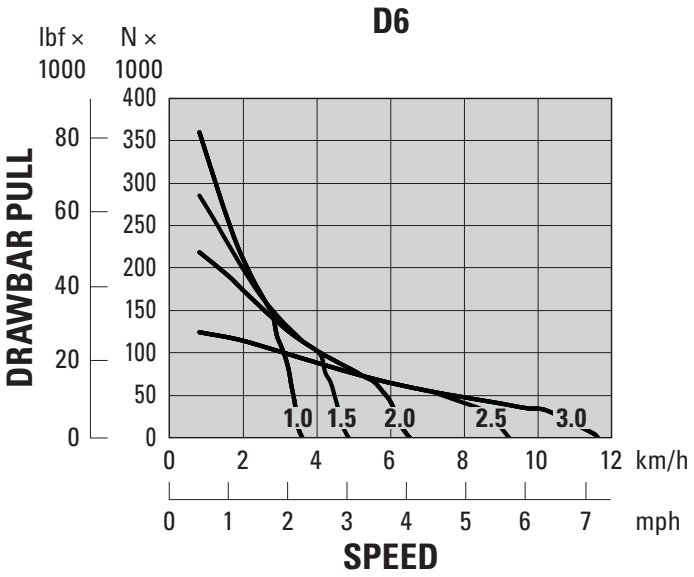
D6/D6 XE Track-Type Tractors Specifications

Maximum Drawbar Power

D6	114 kW	153 hp
D6 XE	119 kW	160 hp

D6 Travel Speed

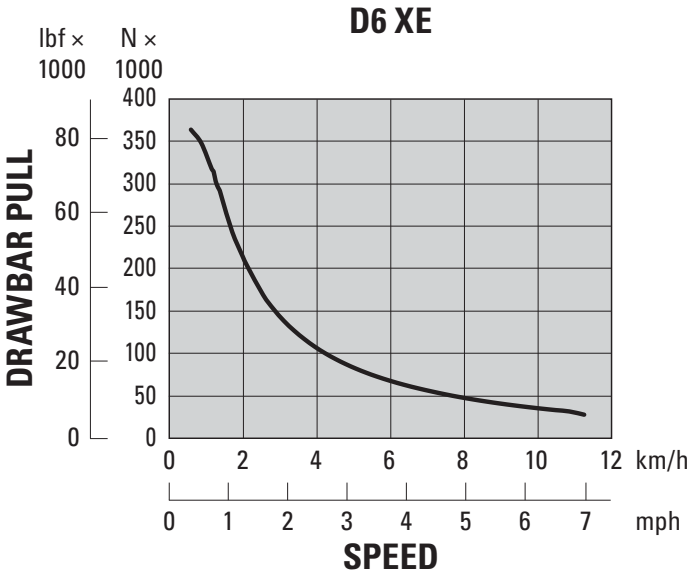
1.0 Forward	3.6 km/h	2.2 mph
1.5 Forward	4.9 km/h	3.0 mph
2.0 Forward	6.5 km/h	4.0 mph
2.5 Forward	9.2 km/h	5.7 mph
3.0 Forward	11.7 km/h	7.2 mph
1.0 Reverse	3.6 km/h	2.2 mph
1.5 Reverse	4.9 km/h	3.0 mph
2.0 Reverse	6.5 km/h	4.0 mph
2.5 Reverse	8.7 km/h	5.4 mph
3.0 Reverse	11.7 km/h	7.2 mph



NOTE: Usable pull will depend on traction and weight of machine.

D6 XE Travel Speed

1.0 Forward	3.6 km/h	2.2 mph
1.5 Forward	4.9 km/h	3.0 mph
2.0 Forward	6.5 km/h	4.0 mph
2.5 Forward	9.2 km/h	5.7 mph
3.0 Forward	11.7 km/h	7.2 mph
1.0 Reverse	3.6 km/h	2.2 mph
1.5 Reverse	4.9 km/h	3.0 mph
2.0 Reverse	6.5 km/h	4.0 mph
2.5 Reverse	9.2 km/h	5.7 mph
3.0 Reverse	11.7 km/h	7.2 mph



NOTE: Usable pull will depend on traction and weight of machine.

- The fully automatic D6 4-speed transmission, with lock-up clutch torque divider, continuously optimizes gear and engine speed for the application.
- The D6 XE Electric Drive power train has no gears to shift. The dozer automatically optimizes power and efficiency for the application and provides constant power to the ground.
- Thirty ground speed selections are available for both power trains, from 0.0 to 3.0 in 0.1 increments.

D6/D6 XE Track-Type Tractors Specifications

Configuration Tables – D6/D6 XE

	Configuration	D6/D6 XE*	
	Operating Weight**	22 000 kg	48,500 lb
	Shipping Weight***	19 060 kg	42,020 lb
	Ground Pressure (ISO 16754)	54 kPa	7.9 psi
	Undercarriage (Standard)	42 Section with 7 Bottom Rollers	
1	Track Gauge	1.930 m	76 in
2	Width of Maximum Track Shoe	0.610 m	24 in
3	Width over Tracks	2.540 m	100 in
	Width over Trunnions	2.692 m	106 in
4	Length of Track on Ground	2.964 m	116.7 in
	Ground Contact Area (ISO 16754)	3.992 m²	6188 in²
	Track Pitch	0.2028 m	7.9 in
	Grouser Height (Moderate Service)	0.065 m	2.6 in
	Ground Clearance	0.361 m	14.2 in
	Oscillation at Front Idler	0.103 m	4.0 in
5	Machine Height****	3.172 m	124.9 in
6	Length of Machine without Blade	4.730 m	186.2 in

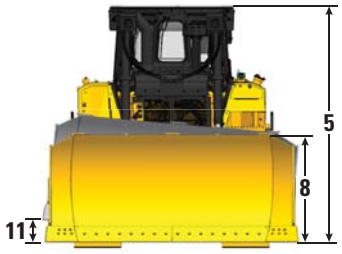
All dimensions above with Heavy Duty undercarriage with Moderate Service shoes of maximum width for configuration, 6 SU blade, and calculated per ISO 16754 unless otherwise specified.

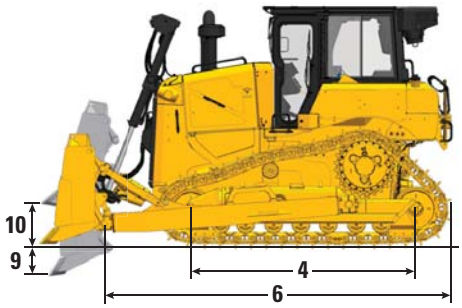
*XE power train adds 0.7 kPA (0.1 psi) and 273 kg (600 lb) to the published ground pressure and weights.

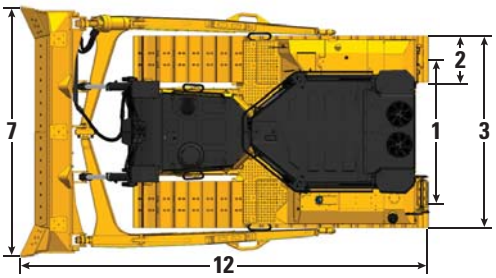
**Operating weight includes blade, lubricants, coolant, full fuel tank, ROPS/FOPS cab, drawbar, and 75 kg (165 lb) operator.

***Shipping weight includes blade lift cylinders, lubricants, coolant, 10% fuel, ROPS/FOPS cab, and drawbar.

****Machine height from tip of grouser to top of Product Link™ Antenna. For sweeps, add 66 mm (2.6 in) to overall machine height. For forestry sweeps, add 122 mm (4.4 in). With Extreme Service Track Shoes add 12 mm (0.5 in). When Cat GRADE with 3D antennas are installed there is no addition to machine height.







Blades

	Configuration	6 SU		6 SU Landfill		6A	
	Capacity (ISO 9246)	5.7 m³	7.5 yd³	11.2 m³	14.6 yd³	4.2 m³	5.5 yd³
7	Width across End Bits	3.312 m	10 ft 10.4 in	3.312 m	10 ft 10.4 in	4.389 m	14 ft 4.8 in
	Width without End Bits	3.246 m	10 ft 7.8 in	3.246 m	10 ft 7.8 in	4.250 m	13 ft 11.3 in
	Width across End Bits (Blade Angled)	N/A		N/A		3.982 m	13 ft 0.8 in
	Width without End Bits (Blade Angled)	N/A		N/A		3.858 m	12 ft 7.9 in
	Maximum Blade Angle	N/A		N/A		25 degrees	
8	Height	1.408 m	4 ft 7.4 in	2.027 m	6 ft 7.8 in	1.150 m	3 ft 9.3 in
9	Dig Depth	0.502 m	19.8 in	0.502 m	19.8 in	0.595 m	23.4 in
10	Lift Height	1.180 m	46.5 in	1.180 m	46.5 in	1.084 m	42.7 in
11	Maximum Tilt at Blade Corner	0.564 m	22.2 in	0.564 m	22.2 in	0.599 m	23.6 in
	Maximum Tilt Angle	9.8 degrees		9.8 degrees		7.8 degrees	
	Pitch Adjustment	±4.2 degrees		±4.2 degrees		N/A	
12	Length of Machine (Blade Straight)	5.436 m	17 ft 10.0 in	5.436 m	17 ft 10.0 in	5.377 m	17 ft 7.7 in
	Length of Machine (Blade Angled)	N/A		N/A		6.418 m	21 ft 0.7 in
	Weight (Blade)	1373 kg	3,027 lb	1592 kg	3,510 lb	1253 kg	2,762 lb
	Weight (Blade and Push Arms)	2608 kg	5,750 lb	2827 kg	6,232 lb	3394 kg	7,842 lb

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AEXQ2470 (11-2018)
Build Number: 20A
(North America, Europe,
ANZ, Turkey, Korea)

4D

INTERFACE ANALYSES – PEAK STRENGTHS

SME
SEVEE & MAHER
ENGINEERS

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

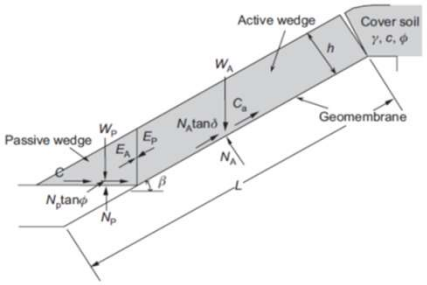
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Moist Cover Soil

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge

$$W_A = \gamma h^2 \left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2} \right)$$

$$N_A = W_A \cos\beta$$

$$C_a = c_a \left(L - \frac{h}{\sin\beta} \right)$$

W_A = 14247.2
N_A = 13360.3
C_a = 3026.4

By balancing the forces in the vertical direction, the following formulation results:

$$E_A \sin\beta = W_A - N_A \cos\beta - \frac{N_A \tan\delta + C_a}{FS} \sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(W_A - N_A \cos\beta) - (N_A \tan\delta + C_a)\sin\beta}{\sin\beta (FS)}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877

Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_P + E_P \sin\beta$$

$$C = \frac{ch}{\sin\beta}$$

W_p = 435.2
N_p = Not needed
C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P \cos\beta = \frac{C + N_P \tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P \tan\phi}{\cos\beta (FS) - \sin\beta \tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$$a(FS)^2 + b(FS) + c = 0 \quad \text{, where:}$$

a = 1611.6
b = -3575.4
c = 719.3

$$a = (W_A - N_A \cos\beta)\cos\beta$$

$$b = -[(W_A - N_A \cos\beta)\sin\beta\tan\phi + (N_A \tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P \tan\phi)]$$

$$c = (N_A \tan\delta + C_a)\sin^2\beta\tan\phi$$

"Parts" to make b

373.0
3108.0
94.5

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
3575.4	8E+06	2854.3	3223.2

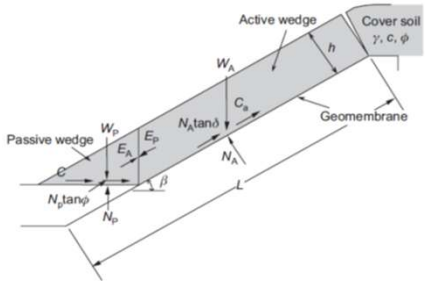
FS = 1.99

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App. **Performed By / Date:** TCC 03/03/25
Project Location: Old Town, Maine **Checked By / Date:** MC 06/20/25
Project No.: 240101.01

Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).
Cover Slope: 2.7 H:1V 37.0 % 20.3 deg
Case Description: Long-Term, Gravity, Saturated Cover Soil
Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge

$$W_A = \gamma h^2\left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right)$$

$$N_A = W_A \cos\beta$$

$$C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$$

W_A = 14925.7
N_A = 13996.5
C_a = 3026.4

By balancing the forces in the vertical direction, the following formulation results:

$$E_A \sin\beta = W_A - N_A\cos\beta - \frac{N_A\tan\delta + C_a}{FS}\sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(W_A - N_A\cos\beta) - (N_A\tan\delta + C_a)\sin\beta}{\sin\beta(FS)}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877

Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_P + E_P\sin\beta$$

$$C = \frac{ch}{\sin\beta}$$

W_p = 456.0
N_p = Not needed
C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P\cos\beta = \frac{C + N_P\tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P\tan\phi}{\cos\beta(FS) - \sin\beta\tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

$$a = (W_A - N_A\cos\beta)\cos\beta$$

$$b = -[(W_A - N_A\cos\beta)\sin\beta\tan\phi + (N_A\tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P\tan\phi)]$$

$$c = (N_A\tan\delta + C_a)\sin^2\beta\tan\phi$$

a = 1688.4
b = -3698.7
c = 742.7

"Parts" to make b

	390.7
	3209.0
	99.0

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
3698.7	9E+06	2943.6	3376.7

FS = 1.97

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

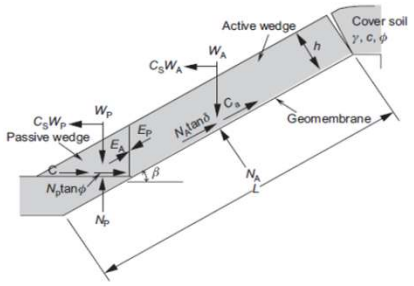
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Seismic, Moist Cover Soil

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).
C_s =	0.14	-	Seismic coeff. adjusted for waste thickness.



Calculations

Active Wedge

$$W_A = \gamma h^2\left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right)$$

$$N_A = W_A\cos\beta$$

$$C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$$

W_A = 14247.2
N_A = 13360.3
C_a = 3026.4

By balancing the forces in the horizontal direction, the following formulation results:

$$E_A\cos\beta + \frac{(N_A\tan\delta + C_a)\cos\beta}{FS} = C_SW_A + N_A\sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(C_SW_A + N_A\sin\beta)}{(FS)\cos\beta} - \frac{(N_A\tan\delta + C_a)\cos\beta}{(FS)\cos\beta}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877

Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_P + E_P\sin\beta$$

$$C = \frac{ch}{\sin\beta}$$

W_p = 435.2
N_p = Not needed
C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P\cos\beta + C_SW_P = \frac{C + N_P\tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P\tan\phi - C_SW_P(FS)}{(FS)\cos\beta - \sin\beta\tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$$a(FS)^2 + b(FS) + c = 0$$, where:

Missing "cos" before β in the "a" eq. below.

$$a = (C_SW_A + N_A\sin\beta)\cos\beta + C_SW_P\beta$$

$$b = -[(C_SW_A + N_A\sin\beta)\sin\beta\tan\phi + (N_A\tan\delta + C_a)\cos^2\beta + (C + W_P\tan\phi)\cos\beta]$$

$$c = (N_A\tan\delta + C_a)\cos\beta\sin\beta\tan\phi$$

a = 6279.0
b = -10086.5
c = 1942.1

"Parts" to make b

	1439.9
	8391.6
	255.0

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
10086.5	5E+07	7277.4	12557.9

FS = 1.38

LANDFILL COVER SYSTEM STABILITY ANALYSIS

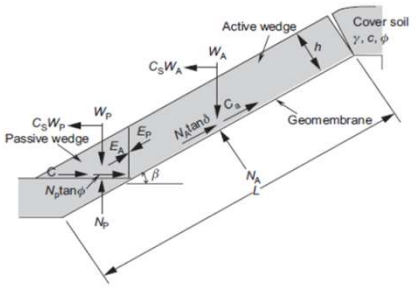
Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope:	2.7	H:1V	37.0	%	20.3	deg
Case Description:	Construction, Seismic, Moist Cover Soil					
Strength Cond.:	Peak					

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).
C_s =	0.06	-	Seismic coeff. adjusted for waste thickness.



Calculations

Active Wedge

$$W_A = \gamma h^2\left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right)$$

$$N_A = W_A \cos\beta$$

$$C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$$

W_a = 14247.2
N_a = 13360.3
C_a = 3026.4

By balancing the forces in the horizontal direction, the following formulation results:

$$E_A \cos\beta + \frac{(N_A \tan\delta + C_a)\cos\beta}{FS} = C_S W_A + N_A \sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(C_S W_A + N_A \sin\beta)}{(FS)\cos\beta} - \frac{(N_A \tan\delta + C_a)\cos\beta}{(FS)\cos\beta}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877

Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_P + E_P \sin\beta$$

$$C = \frac{ch}{\sin\beta}$$

W_p = 435.2
N_p = Not needed
C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P \cos\beta + C_S W_P = \frac{C + N_P \tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P \tan\phi - C_S W_P (FS)}{(FS)\cos\beta - \sin\beta \tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$$a(FS)^2 + b(FS) + c = 0 \quad \text{, where:}$$

Missing "cos" before β in the "a" eq. below.

$$a = (C_S W_A + N_A \sin\beta)\cos\beta + C_S W_P \beta$$

$$b = -[(C_S W_A + N_A \sin\beta)\sin\beta\tan\phi + (N_A \tan\delta + C_a)\cos^2\beta + (C + W_P \tan\phi)\cos\beta]$$

$$c = (N_A \tan\delta + C_a)\cos\beta \sin\beta \tan\phi$$

a = 5177.5
b = -9839.2
c = 1942.1

"Parts" to make b

1192.6
8391.6
255.0

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
9839.2	6E+07	7522.5	10355.0

FS = 1.68

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

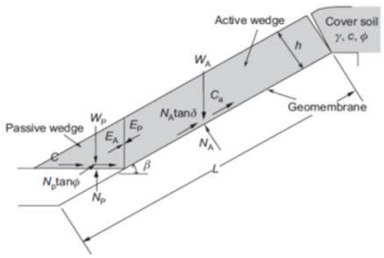
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Construction, Equipment Loading - Filling Upslope (Recommended)

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).
W_b =	49100.0	lbs	Total weight of equip. (D6 bulldozer).
w =	9.7	ft	Length of equip. track.
b =	2.0	ft	Width of equip. track.
q =	1260.1	psf	Equip. ground press. = W_b/(2 x w x b).
b / h =	1.33	-	Ratio of track width to cover thick.
I =	0.96	-	Influence factor, from Ref. Figure 7.



Calculations

Active Wedge

$$W_A = \gamma h^2 \left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right)$$

W_A = 14247.2

$$N_A = W_A \cos\beta$$

N_A = 13360.3

$$C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$$

C_a = 3026.4

$$W_e = qwI$$

W_e = 11784.0

N_e = 11050.4 $N_e = W_e \cos\beta$

Add W_e & N_e into Eqs. for a, b, & c below. Add W_e to W_A. Add N_e to N_A.

By balancing the forces in the vertical direction, the following formulation results:

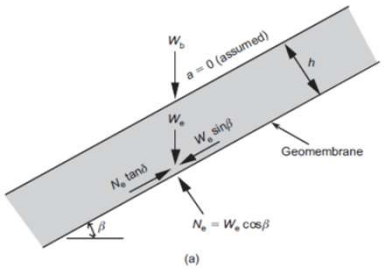
$$E_A \sin\beta = W_A - N_A \cos\beta - \frac{N_A \tan\delta + C_a}{FS} \sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(W_A - N_A\cos\beta) - (N_A\tan\delta + C_a)\sin\beta}{\sin\beta(FS)}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877



Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

W_p = 435.2

$$N_p = W_P + E_P \sin\beta$$

N_p = Not needed

$$C = \frac{ch}{\sin\beta}$$

C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P \cos\beta = \frac{C + N_P \tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P \tan\phi}{\cos\beta(FS) - \sin\beta\tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$$a(FS)^2 + b(FS) + c = 0 \quad \text{, where:}$$

a = 2944.6

$$a = (W_A - N_A\cos\beta)\cos\beta$$

b = -5639.3

$$b = -[(W_A - N_A\cos\beta)\sin\beta\tan\phi + (N_A\tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P\tan\phi)]$$

c = 1125.5

$$c = (N_A\tan\delta + C_a)\sin^2\beta\tan\phi$$

Added W_e to W_A & N_e to N_A in the Eqs. for a, b, & c, as applicable.

"Parts" to make b

	681.5
	4863.4
	94.5

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
5639.3	2E+07	4306.3	5889.2

FS = 1.69

4E

INTERFACE ANALYSES – LARGE-DISPLACEMENT STRENGTHS

SME
SEVEE & MAHER
ENGINEERS

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

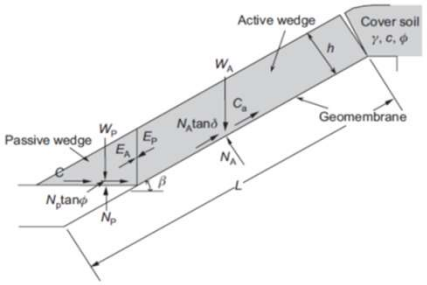
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Moist Cover Soil

Strength Cond.: Large-Displacement

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	20.0	deg	Interface friction angle (spec value).
c_a =	20.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge

$$W_A = \gamma h^2 \left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2} \right)$$

$$N_A = W_A \cos\beta$$

$$C_a = c_a \left(L - \frac{h}{\sin\beta} \right)$$

W_A = 14247.2
N_A = 13360.3
C_a = 1513.2

By balancing the forces in the vertical direction, the following formulation results:

$$E_A \sin\beta = W_A - N_A \cos\beta - \frac{N_A \tan\delta + C_a}{FS} \sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(W_A - N_A \cos\beta) - (N_A \tan\delta + C_a)\sin\beta}{\sin\beta (FS)}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.3420	0.9397	0.3640

Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_P + E_P \sin\beta$$

$$C = \frac{ch}{\sin\beta}$$

W_p = 435.2
N_p = Not needed
C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P \cos\beta = \frac{C + N_P \tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P \tan\phi}{\cos\beta (FS) - \sin\beta \tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$$a(FS)^2 + b(FS) + c = 0 \quad \text{, where:}$$

$$a = (W_A - N_A \cos\beta)\cos\beta$$

$$b = -[(W_A - N_A \cos\beta)\sin\beta\tan\phi + (N_A \tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P \tan\phi)]$$

$$c = (N_A \tan\delta + C_a)\sin^2\beta\tan\phi$$

a = 1611.6
b = -2544.0
c = 480.6

"Parts" to make b

373.0
2076.6
94.5

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
2544.0	3E+06	1836.8	3223.2

FS = 1.36

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

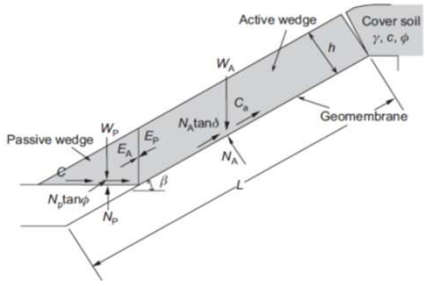
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope:	2.7	H:1V	37.0	%	20.3	deg

Case Description: Long-Term, Gravity, Saturated Cover Soil

Strength Cond.: Large-Displacement

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
δ =	20.0	deg	Interface friction angle (spec value).
c_a =	20.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge

$$W_A = \gamma h^2\left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right)$$

$$N_A = W_A \cos\beta$$

$$C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$$

W_A = 14925.7
N_A = 13996.5
C_a = 1513.2

By balancing the forces in the vertical direction, the following formulation results:

$$E_A \sin\beta = W_A - N_A\cos\beta - \frac{N_A\tan\delta + C_a}{FS}\sin\beta$$

Hence the interwedge force acting on the active wedge is

$$E_A = \frac{(FS)(W_A - N_A\cos\beta) - (N_A\tan\delta + C_a)\sin\beta}{\sin\beta(FS)}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.3420	0.9397	0.3640

Passive Wedge

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$N_p = W_P + E_P\sin\beta$$

$$C = \frac{ch}{\sin\beta}$$

W_p = 456.0
N_p = Not needed
C = 0.0

By balancing the forces in the horizontal direction, the following formulation results:

$$E_P\cos\beta = \frac{C + N_P\tan\phi}{FS}$$

Hence the interwedge force acting on the passive wedge is

$$E_P = \frac{C + W_P\tan\phi}{\cos\beta(FS) - \sin\beta\tan\phi}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

$$a = (W_A - N_A\cos\beta)\cos\beta$$

$$b = -[(W_A - N_A\cos\beta)\sin\beta\tan\phi + (N_A\tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P\tan\phi)]$$

$$c = (N_A\tan\delta + C_a)\sin^2\beta\tan\phi$$

a = 1688.4
b = -2641.7
c = 498.1

"Parts" to make b

	390.7
	2152.0
	99.0

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
2641.7	4E+06	1901.4	3376.7

FS = 1.35

4F

INFINITE SLOPE ANALYSES – COVER SYSTEM SOILS

SME
SEVEE & MAHER
ENGINEERS

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

Methodology: Infinite Slope
Cover Slope: 2.7 H:1V 37.0 % 20.3 deg
Case Description: Infinite Slope FS for Cover Soil, Compacted Glacial Till (Barrier Soil), & Base Grade Bedding Layer.
Strength Cond.: Peak

ß =	20.3	deg	Slope angle.
ϕ_{VCS} =	32.0	deg	Vegetative cover soil friction angle.
ϕ_{Till} =	34.0	deg	Compacted glacial till friction angle.
ϕ_{BL} =	32.0	deg	Base grade bedding layer friction angle.

Calculations

FS_{VCS} = 1.69 = (Tan ϕ_{VCS}) / (Tan β)

FS_{Till} = 1.82 = (Tan ϕ_{Till}) / (Tan β)

FS_{BGBL} = 1.69 = (Tan ϕ_{VCS}) / (Tan β)

4G

INTERFACE ANALYSES – CONSIDERING SEEPAGE FORCES

SME
SEVEE & MAHER
ENGINEERS

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

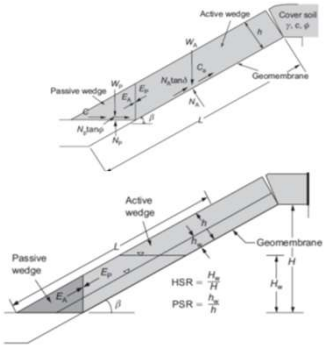
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Horizontal Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
H_w =	6.9	ft	Vertical ht of water above the toe.
HSR =	0.250	-	Horizontal submergence ratio = H_w/H.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Horizontal Seepage Build-Up)

W_A = 14839.9 $W_A = \frac{\gamma_{sat'd}(h)(2H_w\cos\beta - h)}{\sin 2\beta} + \frac{\gamma_{dry}(h)(H - H_w)}{\sin\beta}$

N_A = 12388.7 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 1551.8 $U_n = \frac{\gamma_w(h)(\cos\beta)(2H_w\cos\beta - h)}{\sin 2\beta}$

U_h = 70.2 $U_h = \frac{\gamma_w h^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Horizontal Seepage Build-Up)

W_p = 456.0 $W_P = \frac{\gamma_{sat'd}h^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 189.5 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4701.3 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -6937.0 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 1311.4 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
4833.3	1118.6	1311.4
131.9	14.3	
	5666.2	
	166.5	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
6937.0	2E+07	4843.7	9402.6

FS = 1.25

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

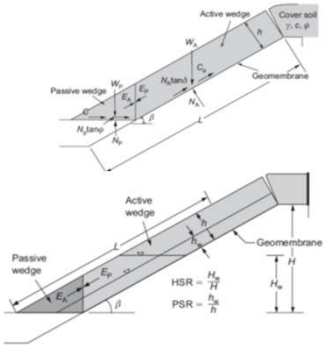
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Horizontal Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
H_w =	13.9	ft	Vertical ht of water above the toe.
HSR =	0.500	-	Horizontal submergence ratio = H_w/H.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Horizontal Seepage Build-Up)

W_A = 15020.0 $W_A = \frac{\gamma_{sat'd}(h)(2H_w\cos\beta - h)}{\sin 2\beta} + \frac{\gamma_{dry}(h)(H - H_w)}{\sin\beta}$

N_A = 10801.2 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 3308.2 $U_n = \frac{\gamma_w(h)(\cos\beta)(2H_w\cos\beta - h)}{\sin 2\beta}$

U_h = 70.2 $U_h = \frac{\gamma_w h^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Horizontal Seepage Build-Up)

W_p = 456.0 $W_P = \frac{\gamma_{sat'd}h^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 189.5 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4760.0 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -6224.5 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 1143.3 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
4891.9	1132.1	1143.3
131.9	14.3	
	4940.1	
	166.5	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
6224.5	2E+07	4120.1	9520.0

FS = 1.09

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

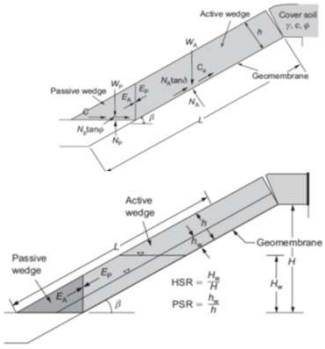
Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope:	2.7	H:1V	37.0	%	20.3	deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Horizontal Seepage
Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
H_w =	20.8	ft	Vertical ht of water above the toe.
HSR =	0.750	-	Horizontal submergence ratio = H_w/H.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Horizontal Seepage Build-Up)

W_A = 15199.8 $W_A = \frac{\gamma_{sat'd}(h)(2H_w\cos\beta - h)}{\sin 2\beta} + \frac{\gamma'_{dry}(h)(H - H_w)}{\sin\beta}$

N_A = 9215.9 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 5062.0 $U_n = \frac{\gamma_w(h)(\cos\beta)(2H_w\cos\beta - h)}{\sin 2\beta}$

U_h = 70.2 $U_h = \frac{\gamma_w h^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Horizontal Seepage Build-Up)

W_p = 456.0 $W_P = \frac{\gamma_{sat'd}h^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 189.5 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4818.5 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -5513.0 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 975.5 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
4950.5	1145.7	975.5
131.9	14.3	
	4215.1	
	166.5	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
5513.0	1E+07	3404.5	9637.1

FS = 0.93

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

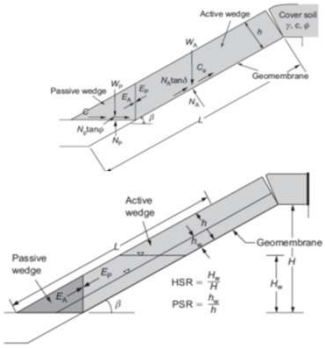
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Horizontal Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
H_w =	27.8	ft	Vertical ht of water above the toe.
HSR =	1.000	-	Horizontal submergence ratio = H_w/H.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Horizontal Seepage Build-Up)

W_A = 15379.9 $W_A = \frac{\gamma_{sat'd}(h)(2H_w\cos\beta - h)}{\sin 2\beta} + \frac{\gamma_{dry}(h)(H - H_w)}{\sin\beta}$

N_A = 7628.9 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 6817.9 $U_n = \frac{\gamma_w(h)(\cos\beta)(2H_w\cos\beta - h)}{\sin 2\beta}$

U_h = 70.2 $U_h = \frac{\gamma_w h^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Horizontal Seepage Build-Up)

W_p = 456.0 $W_P = \frac{\gamma_{sat'd}h^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 189.5 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4877.2 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -4800.7 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 807.5 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
5009.1	1159.3	807.5
131.9	14.3	
	3489.2	
	166.5	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
4800.7	7E+06	2700.5	9754.4

FS = 0.77

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

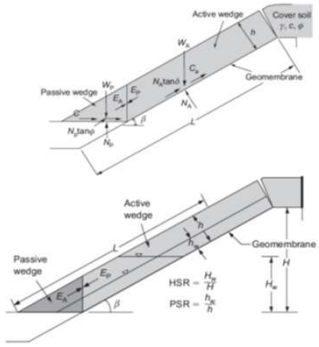
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Parallel Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
h_w =	0.4	ft	Ht of water above gm (perp. to slope).
PSR =	0.250	-	Parralel submergence ratio = h_w/h.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Parallel Seepage Build-Up)

W_A = 14859.4 $W_A = \frac{\gamma_{dry}(h-h_w)[2H\cos\beta-(h+h_w)]}{\sin 2\beta} + \frac{\gamma_{sat'd}h_w(2H\cos\beta-h_w)}{\sin 2\beta}$

N_A = 12193.6 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 1742.4 $U_n = \frac{\gamma_w h_w\cos\beta(2H\cos\beta - h_w)}{\sin 2\beta}$

U_h = 4.4 $U_h = \frac{\gamma_w h_w^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Parallel Seepage Build-Up)

W_p = 436.5 $W_P = \frac{\gamma_{dry}(h^2 - h_w^2) + \gamma_{sat'd}h_w^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 11.8 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4831.4 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -6961.5 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 1290.7 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
4839.6	1120.0	1290.7
8.2	0.9	
	5577.0	
	265.4	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
6961.5	2E+07	4849.6	9662.7

FS = 1.22

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

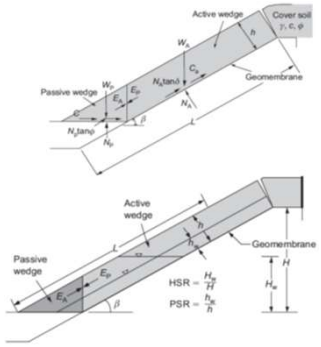
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Parallel Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
h_w =	0.8	ft	Ht of water above gm (perp. to slope).
PSR =	0.500	-	Parralel submergence ratio = h_w/h.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Parallel Seepage Build-Up)

W_A = 15035.5 $W_A = \frac{\gamma_{dry}(h-h_w)[2H\cos\beta-(h+h_w)]}{\sin 2\beta} + \frac{\gamma_{sat'd}h_w(2H\cos\beta-h_w)}{\sin 2\beta}$

N_A = 10646.1 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 3459.5 $U_n = \frac{\gamma_w h_w\cos\beta(2H\cos\beta - h_w)}{\sin 2\beta}$

U_h = 17.6 $U_h = \frac{\gamma_w h_w^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Parallel Seepage Build-Up)

W_p = 440.4 $W_P = \frac{\gamma_{dry}(h^2 - h_w^2) + \gamma_{sat'd}h_w^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 47.4 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4864.0 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -6244.6 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 1126.9 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
4897.0	1133.3	1126.9
33.0	3.6	
	4869.2	
	245.6	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
6244.6	2E+07	4131.5	9728.0

FS = 1.07

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

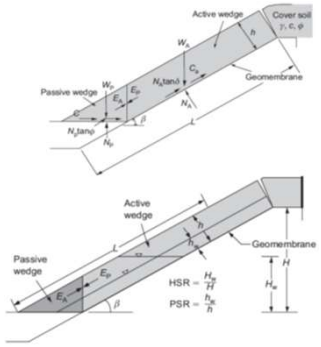
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Parallel Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
h_w =	1.1	ft	Ht of water above gm (perp. to slope).
PSR =	0.750	-	Parralel submergence ratio = h_w/h.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Parallel Seepage Build-Up)

W_A = 15209.0 $W_A = \frac{\gamma_{dry}(h-h_w)[2H\cos\beta-(h+h_w)]}{\sin 2\beta} + \frac{\gamma_{sat'd}h_w(2H\cos\beta-h_w)}{\sin 2\beta}$

N_A = 9124.6 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 5151.3 $U_n = \frac{\gamma_w h_w\cos\beta(2H\cos\beta - h_w)}{\sin 2\beta}$

U_h = 39.5 $U_h = \frac{\gamma_w h_w^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Parallel Seepage Build-Up)

W_p = 446.9 $W_P = \frac{\gamma_{dry}(h^2 - h_w^2) + \gamma_{sat'd}h_w^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 106.6 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4879.3 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -5524.3 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 965.8 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
4953.5	1146.4	965.8
74.2	8.0	
	4173.3	
	212.6	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
5524.3	1E+07	3415.8	9758.5

FS = 0.92

LANDFILL COVER SYSTEM STABILITY ANALYSIS

Project Name: Juniper Ridge Landfill (JRL) - Phase II Expansion App.
Project Location: Old Town, Maine
Project No.: 240101.01

Performed By / Date: TCC 03/03/25
Checked By / Date: MC 06/20/25

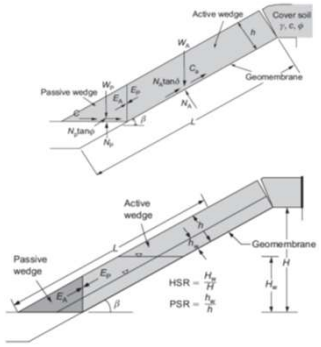
Methodology: Numeric method that follows "Analysis and Design of Veneer Cover Soils" by Koerner & Soong (2005).

Cover Slope: 2.7 H:1V | 37.0 % | 20.3 deg

Case Description: Long-Term, Gravity, Saturated Cover Soil w/Parallel Seepage

Strength Cond.: Peak

Slope Length (Plan) =	75.0	ft	Typical for prior Stages of JRL Closure.
Slope Height, H =	27.8	ft	-
Slope Length, L =	80.0	ft	-
ß =	20.3	deg	Slope angle.
h =	1.5	ft	Cover thickness above geosynthetics.
γ_w =	62.4	pcf	Unit weight of water.
γ_{sat} =	132.0	pcf	Saturated unit weight of cover soil.
γ_t =	126.0	pcf	Moist unit weight of cover soil.
ϕ =	32.0	deg	Cover soil friction angle.
c =	0.0	psf	Cover soil cohesion.
h_w =	1.5	ft	Ht of water above gm (perp. to slope).
PSR =	1.000	-	Parralel submergence ratio = h_w/h.
δ =	26.0	deg	Interface friction angle (spec value).
c_a =	40.0	psf	Interface adhesion (spec value).



Calculations

Active Wedge (Parallel Seepage Build-Up)

W_A = 15379.8 $W_A = \frac{\gamma_{dry}(h-h_w)[2H\cos\beta-(h+h_w)]}{\sin 2\beta} + \frac{\gamma_{sat'd}h_w(2H\cos\beta-h_w)}{\sin 2\beta}$

N_A = 7628.9 $N_A = W_A\cos\beta + U_h\sin\beta - U_n$

C_a = 3026.4 $C_a = c_a\left(L - \frac{h}{\sin\beta}\right)$

U_n = 6817.9 $U_n = \frac{\gamma_w h_w\cos\beta(2H\cos\beta - h_w)}{\sin 2\beta}$

U_h = 70.2 $U_h = \frac{\gamma_w h_w^2}{2}$

The interwedge force acting on the active wedge can then be expressed as

$$E_A = W_A\sin\beta - U_h\cos\beta - \frac{N_A\tan\delta}{FS}$$

Angles: Sin, Cos, Tan

	sin	cos	tan
ß	0.3473	0.9377	0.3704
ϕ	0.5299	0.8480	0.6249
δ	0.4384	0.8988	0.4877
2β	0.6514	-	-

Passive Wedge (Parallel Seepage Build-Up)

W_p = 456.0 $W_P = \frac{\gamma_{dry}(h^2 - h_w^2) + \gamma_{sat'd}h_w^2}{\sin 2\beta}$

N_p = Not needed -

C = 0.0 $C = \frac{ch}{\sin\beta}$

U_v = 189.5 $U_V = U_h\cot\beta$

The interwedge force acting on the passive wedge can then be expressed as

$$E_P = \frac{U_h(FS) - (W_P - U_V)\tan\phi}{\sin\beta\tan\phi - \cos\beta(FS)}$$

Quadratic Solution

By setting $E_A = E_P$, the resulting equation can be arranged in the form of the quadratic equation $ax^2 + bx + c = 0$, which in our case, using FS-values, is

$a(FS)^2 + b(FS) + c = 0$, where:

a = 4877.2 $a = W_A\sin\beta\cos\beta - U_h\cos^2\beta + U_h$

b = -4800.7 $b = -W_A\sin^2\beta\tan\phi + U_h\sin\beta\cos\beta\tan\phi - N_A\cos\beta\tan\delta - (W_P - U_V)\tan\phi$

c = 807.5 $c = N_A\sin\beta\tan\delta\tan\phi$

The resulting FS-value is then obtained from the solution of the quadratic equation:

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

a "Parts"	b "Parts"	c "Parts"
5009.1	1159.3	807.5
131.9	14.3	
	3489.3	
	166.5	

"Parts" to calculate FS

b	b^2 - 4ac	sqrt	2a
4800.7	7E+06	2700.6	9754.4

FS = 0.77

APPPENDIX G

LEACHATE QUALITY/WASTE CHARACTERIZATION

SME
SEVEE & MAHER
ENGINEERS

DATA SUMMARY TABLE

Leachate - Field Data

SME
SEVEE & MAHER ENGINEERS

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)

Date	Type	Sample ID	Specific Conductance µmhos/cm @25°C	pH STU	Temperature Deg C	Eh mV	Dissolved Oxygen mg/L	Alkalinity (CaCO3) (field) mg/L	Turbidity (field) NTU	Flow Rate cfs							
LT-C4L & LT-C4LR																	
4/22/2014	XX	LTC4LX6EH	15370	7.2	13.3	134	D2	D3	D3								
7/30/2014	XX	LTC4LX6J4	23800	7.2	22.3	-30	D2	D3	D3								
10/21/2014	XX	LTC4LX72F	21300	7.2	15.8	238	D2	D3	D3								
4/28/2015	XX	LTC4LX78C	22600	7.5	12.1	-151	D2		D3								
7/15/2015	XX	LTC4LX7C4	21500	6.9	22.7	-178	D2		D3								
10/27/2015	XX	LTC4LX7HD	29100	7.6	9.4	-133	D2		D3								
4/5/2016	XX	LTC4LX863	19950	5.5	10.9	100	D2		D3								
7/26/2016	XX	LTC4LX8AD	29200	6.3	27.1	-6	D2		D3								
10/25/2016	XX	LTC4LX8IC	25800	6.3	14.7	113	D2		1416								
4/18/2017	XX	LTC4LX96I	26400	6.3	12.7	-102	D2		1009								
7/25/2017	XX	LTC4LX9CG	25900	7.3	20.8	-141	D2		156								
10/24/2017	XX	LTC4LX9GB	29800	7.6	22.2	-12	D2		126								
4/3/2018	XX	LTC4LXA2A	11520	7	12.7	-41	D2		198								
7/17/2018	XX	LTC4LXABB	26000	7.2	23.1	-127	D2		190								
10/2/2018	XX	LTC4LXB09	23000	7.5	15.4	-76	D2		7.84								
4/23/2019	XX	LTC4LXB56	13730	7	9.6	-6	7.5		1733								
7/16/2019	XX	LTC4LXBBI	21908	7.1	26.1	7	D2		609								
10/29/2019	XX	LTC4LXBHB	18730	7.1	15.2	-59	D2		1407								
4/28/2020	XX	LTC4LXCCI	17490	6.6	12.6	-20	2.8		D3								
7/21/2020	XX	LTC4LXCHB	25800	5.9	29	-311	1.1		D3								
10/27/2020	XX	LTC4LXD2F	21900	7.5	12.8	-299	D2		741								
4/6/2021	XX	LTC4LXDBH	17300	7.4	13	52	2.2		D3								
7/13/2021	XX	LTC4LXDJ9	21200	7.2	23.9	-71	0.5		D3								
10/5/2021	XX	LTC4LXE5H	18480	7.2	25.1	-41	0.9		4.4								
5/26/2022	XX	LTC4LXF09	18909	7.5	22.1	46	0.2		D3								
7/19/2022	XX	LTC4LXF87	22260	6.8	26.4	-98	FK		D3								
10/4/2022	XX	LTC4LXFI8	21263	6.7	16.3	-62	0.3		D3	0.0071							
4/18/2023	XX	LTC4LXGHJ	20000	7.5	13.1	-113	1.3		D3	0.0071							
7/11/2023	XX	LTC4LXH81	19380	7.1	25.2	-135	0.3		66.5	0.0071							
10/2/2023	XX	LTC4LX059	17673	6.8	23.4	-108	0.1		D3	0.0071							
4/2/2024	XX	LTC4LX11J	12151	7.1	13.5	-39	0.4		D3	0.0071							

DATA SUMMARY TABLE

Leachate - Field Data

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Specific Conductance	pH	Temperature	Eh	Dissolved Oxygen	Alkalinity (CaCO3) (field)	Turbidity (field)	Flow Rate
Date	Type	Sample ID	µmhos/cm @25°C	STU	Deg C	mV	mg/L	mg/L	NTU	cfs

Units Abbreviations:

µmhos/cm @25°C - MICROSIEMENS PER CENTIMETER
cfs - CUBIC FEET PER SECOND
Deg C - DEGREES CELCIUS (TEMPERATURE)
mg/L - MILLIGRAMS PER LITER
mV - MILLIVOLTS
NTU - NEPHELOMETRIC TURBIDITY UNIT (TURBIDITY)
STU - STANDARD PH UNIT

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

D2 - Sample too dark to read D.O. reading.
D3 - Sample too dark to take reading.
FK - Outside range of available field kits.

REPORT PREPARED: 6/12/2024 09:53
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2014 - 12/31/2024

DATA SUMMARY TABLE

Leachate - Inorganics Group 1 of 2

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

Date	Type	Sample ID	Total Kjeldahl Nitrogen mg/L	Ammonia (N) mg/L	Nitrate (N) mg/L	Total Phosphorus mg/L	Total Dissolved Solids mg/L	Total Suspended Solids mg/L	Sulfate mg/L	Sulfide mg/L	Ca-mg Hardness (CaCO3) mg/L	Bicarbonate Alkalinity (CaCO3) mg/L	Alkalinity (CaCO3) mg/L	Organic Carbon mg/L	Biochemical Oxygen Demand mg/L	Nitrite/Nitrate - (N) mg/L	Chemical Oxygen Demand mg/L
4/22/2014	XX	LTC4LX6EH	520	434	45 U		8600	28	300 U	4	1889	2010	2010	364	434		1620
7/30/2014	XX	LTC4LX6J4	850	708	348		12040	64	2250			3200		761			2760
10/21/2014	XX	LTC4LX72F	820	700	30 U	0.83	13280	44	200 U	6		2740		460	448		2320
4/28/2015	XX	LTC4LX78C	800	636	48 U		10080	38	320 U	40	1738	3560	3560	580	1284		2955
7/15/2015	XX	LTC4LX7C4				2.93	17940	40	800			4710		373		10 U	
10/27/2015	XX	LTC4LX7HD				2.99	15800	17	2670			3850		363		3 U	
4/5/2016	XX	LTC4LX863	680	554	30 U		11850	119	205	16	2910	2800	2800	1426	2700		5000
7/26/2016	XX	LTC4LX8AD	550				16460	125	970			3850		1900		0.3 U	
10/25/2016	XX	LTC4LX8IC	990				14380	60	1780			3490		1150		0.05 U	
4/18/2017	XX	LTC4LX96I	1100	830	190		12732	30	640	31	2000	3700	3700	1200	890		3200
7/25/2017	XX	LTC4LX9CG	1300				15448	34	1500			4100		680		0.1 U	
10/24/2017	XX	LTC4LX9GB	1000				15836	13	2700			3400		480		0.1 U	
4/3/2018	XX	LTC4LXA2A	610	520	260		7956	25	1100	11	1400	2200	2200	360	320		1600
7/17/2018	XX	LTC4LXABB	1400				13	42	600 U			3600		450		0.5 U	
10/2/2018	XX	LTC4LXB09	1000				12960	29	2900			2900		430		0.05 U	
4/23/2019	XX	LTC4LXB56	470	330	240		8744	40	2200	29	2300	1900	1900	110	760		1400
7/16/2019	XX	LTC4LXBBI	780				12152	180	2000			3000		480		0.5 U	
10/29/2019	XX	LTC4LXBHB	660				9832	48	1900			2600		570		0.073	
4/28/2020	XX	LTC4LXCCI	730	590	210		10160	48	1300	16	1700	2400	2400	880	200		1700
7/21/2020	XX	LTC4LXCHB	780				14610	8	2000			3100		500		0.2	
10/27/2020	XX	LTC4LXD2F	660				10940	29	120			2700		1100 M10		0.05 U	
4/6/2021	XX	LTC4LXDBH	710	600	310		9970	7	1600	4.5	1300	2300	2300	330	150		1700
7/13/2021	XX	LTC4LXDJ9	660				12000	7	500 U			2900		520		0.3 U	
10/5/2021	XX	LTC4LXE5H	890				11040	4.5	32			2800		450		0.05 U	
5/26/2022	XX	LTC4LXF09	970	750	30 U		12340	40	200 U	3.5	1500	3300	3300	430	150		2300
7/19/2022	XX	LTC4LXF87	990				13120	8	20 U			3500		470		0.2 U	
10/4/2022	XX	LTC4LXFI8	1000				11000	16	50			3100		370		0.15	
4/18/2023	XX	LTC4LXGHJ	940	720	7.5 U		11760	10	78	18	1500	3300	3300	530	220		2200
7/11/2023	XX	LTC4LXH81	910				12160	10	100 U			3300		480		0.3 U	
10/2/2023	XX	LTC4LX059	810				10010	2.5 U	43			3400		490		0.3 U	
4/2/2024	XX	LTC4LX11J	490				6930	8.3 U	330			2400		580		0.082	

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes:

Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

M10 - Due to a identified laboratory instrumentation malfunction, this analytical result is likely elevated–the laboratory has fixed the issue.
U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Leachate - Inorganics Group 2 of 2

SME SEVEE & MAHER ENGINEERS

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)

LT-C4L & LT-C4LR

Date	Type	Sample ID	Chloride mg/L	Bromide mg/L	Cyanide ug/L											
4/22/2014	XX	LTC4LX6EH	7650	63.6	5 U											
7/30/2014	XX	LTC4LX6J4	13950	39												
10/21/2014	XX	LTC4LX72F	7070	100												
4/28/2015	XX	LTC4LX78C	5420	57	5 U											
7/15/2015	XX	LTC4LX7C4	11600	10 U												
10/27/2015	XX	LTC4LX7HD	16100	30 U												
4/5/2016	XX	LTC4LX863	5910	84.1	5 U											
7/26/2016	XX	LTC4LX8AD	11100	72.7												
10/25/2016	XX	LTC4LX8IC	16100	120												
4/18/2017	XX	LTC4LX96I	12000	75	74											
7/25/2017	XX	LTC4LX9CG	12000	72												
10/24/2017	XX	LTC4LX9GB	14000	20 U												
4/3/2018	XX	LTC4LXA2A	9300	52	43											
7/17/2018	XX	LTC4LXABB	8100	83												
10/2/2018	XX	LTC4LXB09	15000	63												
4/23/2019	XX	LTC4LXB56	12000	83	17											
7/16/2019	XX	LTC4LXBBI	14000	40 U												
10/29/2019	XX	LTC4LXBHB	11000	47												
4/28/2020	XX	LTC4LXCCI	8300	52	5 U											
7/21/2020	XX	LTC4LXCHB	13000	120												
10/27/2020	XX	LTC4LXD2F	7400	77												
4/6/2021	XX	LTC4LXDBH	9900	66	5 U											
7/13/2021	XX	LTC4LXDJ9	6800	59												
10/5/2021	XX	LTC4LXE5H	4800	41												
5/26/2022	XX	LTC4LXF09	5700	69	430											
7/19/2022	XX	LTC4LXF87	6600	75												
10/4/2022	XX	LTC4LXFI8	5700	84												
4/18/2023	XX	LTC4LXGHJ	5000	71	810											
7/11/2023	XX	LTC4LXH81	5000	63												
10/2/2023	XX	LTC4LX059	3900	53												
4/2/2024	XX	LTC4LX11J	2500	31												

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER
ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

REPORT PREPARED: 6/12/2024 09:54
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2014 - 12/31/2024

DATA SUMMARY TABLE

Leachate - Metal Parameters Group 1 of 2

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

Date	Type	Sample ID	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Potassium mg/L	Selenium mg/L
4/22/2014	XX	LTC4LX6EH	0.22	0.005 U	0.131	1.222	0.0006 U	329	0.049	0.016	13.2	0.022	259	2.73	0.0005 U	941	0.035
7/30/2014	XX	LTC4LX6J4			0.143			311			28.6		289	3.8		1140	
10/21/2014	XX	LTC4LX72F			0.186			406			27.3		355	4.23		1472	
4/28/2015	XX	LTC4LX78C	0.556	0.026	0.209	1.316	0.0012	259	0.093	0.034	11	0.095	265	1.8	0.0005 U	1118	0.052
7/15/2015	XX	LTC4LX7C4			0.287			393			9.7		431	1.9		1845	
10/27/2015	XX	LTC4LX7HD			0.29			318			5.9		307	1.6		1247	
4/5/2016	XX	LTC4LX863	0.231	0.005 U	0.157	1.304	0.0006 U	656	0.105	0.015	60.3	0.004	309	15.9	0.0005 U	954	0.005 U
7/26/2016	XX	LTC4LX8AD			0.331			686			44.3		411	7.5		1498	
10/25/2016	XX	LTC4LX8IC			0.403			541			21.7		307	5.95		1131	
4/18/2017	XX	LTC4LX96I	0.72	0.025 U	0.54	1.5	0.003 U	300	0.025 U	0.05 U	8.5	0.03 U	300	1.8	0.0005 U	1261	0.098
7/25/2017	XX	LTC4LX9CG			0.6			300			6.7		350	1.5		1300	
10/24/2017	XX	LTC4LX9GB			0.34			310			5.4		310	2.5 U		1300	
4/3/2018	XX	LTC4LXA2A	0.65	0.025 U	0.33	0.77	0.003 U	260	0.09	0.05 U	9	0.015 U	190	2.2	0.0005 U	740	0.043
7/17/2018	XX	LTC4LXABB			0.39			300			9.4		280	2.4		1200	
10/2/2018	XX	LTC4LXB09			0.3			290			7.8		270	2.2		1100	
4/23/2019	XX	LTC4LXB56	0.52	0.005 U	0.14	0.86	0.0006 U	560	0.078	0.01 U	17	0.007	230	10	0.0005 U	580	0.017
7/16/2019	XX	LTC4LXBBI			0.24			510			5.1		310	4.4		1000	
10/29/2019	XX	LTC4LXBHB			0.23			350			12		280	4.1		870	
4/28/2020	XX	LTC4LXCCI	0.54	0.005 U	0.25	0.94	0.0006 U	300	0.1	0.01 U	6	0.003 U	220	1.7	0.0005 U	790	0.022
7/21/2020	XX	LTC4LXCHB			0.33			310			3.5		340	1.3		1400	
10/27/2020	XX	LTC4LXD2F			0.24			310			7.5		250	14		900	
4/6/2021	XX	LTC4LXDBH	0.45	0.006	0.2	1.1	0.0033	240	0.13	0.044	5	0.035	170	3.1	0.0005 U	740	0.046
7/13/2021	XX	LTC4LXDJ9			0.35			240			5		210	2.2		930	
10/5/2021	XX	LTC4LXE5H			0.45			200			3.1		200	1.7		870	
5/26/2022	XX	LTC4LXF09	1.4	0.005 U	0.4	1	0.0012 U	250	0.21	0.011	12	0.006 U	200	16	Y	1100	0.0082
7/19/2022	XX	LTC4LXF87			0.42			230			5.8		230	2.2		1100	
10/4/2022	XX	LTC4LXFI8			0.33			250			6.6		220	2.8		1000	
4/18/2023	XX	LTC4LXGHJ	0.81	0.021	0.42	1.1	0.0006 U	260	0.29	0.011	3.2	0.0035	210	1.8	0.0005 U	1000	0.011
7/11/2023	XX	LTC4LXH81			0.43			290			2.9		200	2.1		1000	
10/2/2023	XX	LTC4LX059			0.25			290			8.8		200	5.8		760	
4/2/2024	XX	LTC4LX11J			0.19			370			5.8		140	3.6		500	

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes:

Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.
Y - Laboratory error, results not available.

DATA SUMMARY TABLE

Leachate - Metal Parameters Group 2 of 2

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)

LT-C4L & LT-C4LR

Date	Type	Sample ID	Silver mg/L	Sodium mg/L	Thallium mg/L	Vanadium mg/L	Zinc mg/L	Tin mg/L									
4/22/2014	XX	LTC4LX6EH	0.001 U	1633	0.004 U	0.027	0.101	0.015 U									
7/30/2014	XX	LTC4LX6J4		1948													
10/21/2014	XX	LTC4LX72F		2316													
4/28/2015	XX	LTC4LX78C	0.0021	3401	0.008 U	0.063	0.258	0.157									
7/15/2015	XX	LTC4LX7C4		8135													
10/27/2015	XX	LTC4LX7HD		5081													
4/5/2016	XX	LTC4LX863	0.0011 U	1681	0.004 U	0.024	0.136	0.015 U									
7/26/2016	XX	LTC4LX8AD		2687													
10/25/2016	XX	LTC4LX8IC		2288													
4/18/2017	XX	LTC4LX96I	0.0055 U	3000	0.02 U	0.1	0.031	0.075 U									
7/25/2017	XX	LTC4LX9CG		3100													
10/24/2017	XX	LTC4LX9GB		2600													
4/3/2018	XX	LTC4LXA2A	0.2	1500	0.02 U	0.05 U	0.051	0.075 U									
7/17/2018	XX	LTC4LXABB		2700													
10/2/2018	XX	LTC4LXB09		2400													
4/23/2019	XX	LTC4LXB56	0.001 U	1300	0.004 U	0.016	0.093	0.015 U									
7/16/2019	XX	LTC4LXBBI		2200													
10/29/2019	XX	LTC4LXBHB		1900													
4/28/2020	XX	LTC4LXCCI	0.001 U	1700	0.004 U	0.039	0.046	0.016									
7/21/2020	XX	LTC4LXCHB		2800													
10/27/2020	XX	LTC4LXD2F		2000													
4/6/2021	XX	LTC4LXDBH	0.001 U	1600	0.025	0.031	0.051	0.015 U									
7/13/2021	XX	LTC4LXDJ9		2200													
10/5/2021	XX	LTC4LXE5H		2000													
5/26/2022	XX	LTC4LXF09	0.0026	2400	0.004 U	0.01 U	0.014	0.047									
7/19/2022	XX	LTC4LXF87		2500													
10/4/2022	XX	LTC4LXFI8		2100													
4/18/2023	XX	LTC4LXGHJ	0.001 U	2500	0.004 U	0.056	0.053	0.015 U									
7/11/2023	XX	LTC4LXH81		2400													
10/2/2023	XX	LTC4LX059		2000													
4/2/2024	XX	LTC4LX11J		1200													

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

REPORT PREPARED: 6/12/2024 09:56
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2014 - 12/31/2024

DATA SUMMARY TABLE

Leachate - VOAs Group 1 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR) Date	Type	Sample ID	Chloromethane ug/L	Bromomethane ug/L	Vinyl Chloride ug/L	Chloroethane ug/L	Methylene Chloride ug/L	Acetone ug/L	Carbon Disulfide ug/L	1,1-Dichloroethene ug/L	1,1-Dichloroethane ug/L	trans-1,2-Dichloroethene ug/L	Chloroform ug/L	1,2-Dichloroethane ug/L	Methyl Ethyl Ketone ug/L	1,1,1-Trichloroethane ug/L	Carbon Tetrachloride ug/L
LT-C4L & LT-C4LR																	
4/22/2014	XX	LTC4LX6EH	40 U	40 U	40 U	100 U	100 U	1000	40 U	20 U	20 U	20 U	20 U	20 U	1400	20 U	20 U
7/30/2014	XX	LTC4LX6J4	2 U	2 U	2 U	5 U	5 U	60	5 U	1 U	2 U	2 U	2 U	2 U	200	2 U	2 U
10/21/2014	XX	LTC4LX72F	20 U	20 U	20 U	50 U	50 U	400	20 U	10 U	10 U	10 U	10 U	10 U	1200	10 U	10 U
4/28/2015	XX	LTC4LX78C	20 U	20 U	20 U	50 U	50 U	2400	20 U	10 U	10 U	10 U	10 U	10 U	4400	10 U	10 U
7/15/2015	XX	LTC4LX7C4	20 U	20 U	20 U	50 U	50 U	1400	20 U	10 U	10 U	10 U	10 U	10 U	2000	10 U	10 U
10/27/2015	XX	LTC4LX7HD	20 U	20 U	20 U	50 U	50 U	1200	20 U	10 U	10 U	10 U	10 U	10 U	1300	10 U	10 U
4/5/2016	XX	LTC4LX863	20 U	20 U	20 U	50 U	50 U	2300	20 U	10 U	10 U	10 U	10 U	10 U	5900	10 U	10 U
7/26/2016	XX	LTC4LX8AD	20 U	20 U	20 U	50 U	50 U	2800	20 U	10 U	10 U	10 U	10 U	10 U	8000	10 U	10 U
10/25/2016	XX	LTC4LX8IC	2 U	2 U	2 U	5 U	5 U	2500	5 U	1 U	2 U	2 U	2 U	5	4800	2 U	2 U
4/18/2017	XX	LTC4LX96I	2 U	2 U	2 U	5 U	5 U	1900	2 U	1 U	1 U	1 U	1 U	1 U	2500	1 U	1 U
7/25/2017	XX	LTC4LX9CG	2 U	2 U	2 U	5 U	5 U	1100	2 U	1 U	1 U	1 U	1 U	4	1400	1 U	1 U
10/24/2017	XX	LTC4LX9GB	2 U	2 U	2 U	5 U	5 U	800	2 U	1 U	1 U	1 U	1 U	2	800	1 U	1 U
4/3/2018	XX	LTC4LXA2A	2 U	2 U	2 U	5 U	5.3	1700	2 U	1 U	1 U	1 U	1 U	6.1	1700	1 U	1 U
7/17/2018	XX	LTC4LXABB	2 U	2 U	2 U	5 U	5 U	230	2 U	1 U	1 U	1 U	1 U	1 U	210	1 U	1 U
10/2/2018	XX	LTC4LXB09	20 U	20 U	20 U	50 U	50 U	1000	20 U	10 U	10 U	10 U	10 U	10 U	970	10 U	10 U
4/23/2019	XX	LTC4LXB56	40 U	40 U	40 U	100 U	100 U	2000	40 U	20 U	20 U	20 U	20 U	20 U	2000	20 U	20 U
7/16/2019	XX	LTC4LXBBI	20 U	20 U	20 U	50 U	50 U	1200	20 U	10 U	10 U	10 U	10 U	10 U	1000	10 U	10 U
10/29/2019	XX	LTC4LXBHB	20 U	20 U	20 U	50 U	50 U	2100	20 U	10 U	10 U	10 U	10 U	10 U	2100	10 U	10 U
4/28/2020	XX	LTC4LXCCI	20 U	20 U	10 U	20 U	10 U	1200	20 U	5 U	10 U	10 U	10 U	10 U	1000	10 U	10 U
7/21/2020	XX	LTC4LXCHB	2 U	2 U	1 U	2 U	1.2	560	2 U	0.5 U	1 U	1 U	1 U	1.8	300	1 U	1 U
10/27/2020	XX	LTC4LXD2F	20 U	20 U	10 U	20 U	30	1700	20 U	5 U	10 U	10 U	10 U	10 U	2100	10 U	10 U
4/6/2021	XX	LTC4LXDBH	2 U	2 U	1 U	2 U	1.1	970	2 U	0.5 U	1 U	1 U	1 U	2.7	770	1 U	1 U
7/13/2021	XX	LTC4LXDJ9	2 U	2 U	1 U	2 U	1 U	800	3.6	0.5 U	1 U	1 U	1 U	1 U	660	1 U	1 U
10/5/2021	XX	LTC4LXE5H	2 U	2 U	1 U	2 U	1.9	450	2 U	0.5 U	1 U	1 U	1 U	1.7	340	1 U	1 U
5/26/2022	XX	LTC4LXF09	2 U	2 U	1 U	2 U	1 U	260	2 U	0.5 U	1 U	1 U	1 U	1.8	180	1 U	1 U
7/19/2022	XX	LTC4LXF87	2 U	2 U	1 U	2 U	1 U	100	2 U	0.5 U	1 U	1 U	1 U	1.8	92	1 U	1 U
10/4/2022	XX	LTC4LXFI8	2 U	2 U	1 U	2 U	1 U	210	2 U	0.5 U	1 U	1 U	1 U	2.7	200	1 U	1 U
4/18/2023	XX	LTC4LXGHJ	2 U	2 U	1.5	2 U	1 U	1300	2 U	0.5 U	1 U	1 U	1 U	2	900	1 U	1 U
7/11/2023	XX	LTC4LXH81	2 U	2 U	1 U	2 U	1 U	430	2 U	0.5 U	1 U	1 U	1 U	2.4	300	1 U	1 U
10/2/2023	XX	LTC4LX059	2 U	2 U	1 U	2 U	30	930	2 U	0.5 U	1	5.3	1 U	5.3	780	1 U	1 U
4/2/2024	XX	LTC4LX11J	2 U	2 U	1 U	2 U	1.2	1300	2 U	0.5 U	1 U	1 U	1 U	3.4	1100	1 U	1 U
QCBT																	
4/21/2014	XX	BTXXXX6G4	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
4/22/2014	XX	BTXXXX6G5	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
7/30/2014	XX	BTXXXX70B	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
10/21/2014	XX	BTXXXX748	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
4/27/2015	XX	BTXXXX79E	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
4/27/2015	XX	BTXXXX79F	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
4/27/2015	XX	BTXXXX79J	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
7/15/2015	XX	BTXXXX7DB	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
10/27/2015	XX	BTXXXX7II	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
7/26/2016	XX	BTXXXX8BF	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
10/25/2016	XX	BTXXXX8JE	2 U	2 U	2 U	5 U	5 U	10 U	5 U	1 U	2 U	2 U	2 U	2 U	10 U	2 U	2 U
4/18/2017	XX	BTXXXX980	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/25/2017	XX	BTXXXX9DI	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/24/2017	XX	BTXXXX9HD	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/3/2018	XX	BTXXXXHG3	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U

REPORT PREPARED: 6/12/2024 09:56
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2014 - 12/31/2024

DATA SUMMARY TABLE

Leachate - VOAs Group 1 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(QCBT) Date	Type	Sample ID	Chloromethane ug/L	Bromomethane ug/L	Vinyl Chloride ug/L	Chloroethane ug/L	Methylene Chloride ug/L	Acetone ug/L	Carbon Disulfide ug/L	1,1-Dichloroethene ug/L	1,1-Dichloroethane ug/L	trans-1,2-Dichloroethene ug/L	Chloroform ug/L	1,2-Dichloroethane ug/L	Methyl Ethyl Ketone ug/L	1,1,1-Trichloroethane ug/L	Carbon Tetrachloride ug/L
7/17/2018	XX	BTXXXXACD	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/2/2018	XX	BTXXXXB1B	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/23/2019	XX	BTXXXXB68	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/16/2019	XX	BTXXXXBCJ	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/29/2019	XX	BTXXXXBIC	2 U	2 U	2 U	5 U	5 U	10 U	2 U	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/28/2020	XX	BTXXXXCE4	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/21/2020	XX	BTXXXXCIC	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/27/2020	XX	BTXXXXD3G	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/6/2021	XX	BTXXXXDDJ	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/13/2021	XX	BTXXXXE0B	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/5/2021	XX	BTXXXXE6I	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
5/26/2022	XX	BTXXXXF1A	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/19/2022	XX	BTXXXXFE7	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/4/2022	XX	BTXXXXFJ9	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/18/2023	XX	BTXXXXH24	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/11/2023	XX	BTXXXXH92	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/2/2023	XX	BTXXXX076	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/2/2024	XX	BTXXXX151	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

REPORT PREPARED: 6/12/2024 09:56
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2014 - 12/31/2024

DATA SUMMARY TABLE

Leachate - VOAs Group 2 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Vinyl Acetate	Bromo dichloro methane	1,2-Dichloro propane	cis-1,3-Dichloro propene	Trichloroethene	Dibromo chloromethane	1,1,2-Trichloroethane	Benzene	trans-1,3-Dichloro propene	Bromoform	4-Methyl-2-Pentanone	2-Hexanone	Tetrachloro ethene	1,1,2,2-Tetrachloro ethane	Toluene
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/22/2014	XX	LTC4LX6EH	200 U	10 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	40 U	200 U	200 U	20 U	20 U	20 U
7/30/2014	XX	LTC4LX6J4	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
10/21/2014	XX	LTC4LX72F	100 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	100 U	100 U	10 U	10 U	10 U
4/28/2015	XX	LTC4LX78C	100 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	100 U	100 U	10 U	10 U	10
7/15/2015	XX	LTC4LX7C4	100 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	100 U	100 U	10 U	10 U	10
10/27/2015	XX	LTC4LX7HD	100 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	100 U	100 U	10 U	10 U	10
4/5/2016	XX	LTC4LX863	100 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	100 U	100 U	10 U	10 U	20
7/26/2016	XX	LTC4LX8AD	100 U	5 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	20 U	100 U	100 U	10 U	10 U	20
10/25/2016	XX	LTC4LX8IC	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	2	2 U	2 U	50	20	2 U	2 U	17
4/18/2017	XX	LTC4LX96I	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4	0.5 U	2 U	40	10 U	1 U	1 U	14
7/25/2017	XX	LTC4LX9CG	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5	0.5 U	2 U	30	10 U	1 U	1 U	19
10/24/2017	XX	LTC4LX9GB	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	2	0.5 U	2 U	20	10 U	1 U	1 U	6
4/3/2018	XX	LTC4LXA2A	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5.6	0.5	2 U	35	10 U	1 U	1 U	26
7/17/2018	XX	LTC4LXABB	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1	0.5 U	2 U	10 U	10 U	1 U	1 U	4.4
10/2/2018	XX	LTC4LXB09	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	26
4/23/2019	XX	LTC4LXB56	200 U	10 U	20 U	10 U	20 U	20 U	20 U	20 U	10 U	40 U	200 U	200 U	20 U	20 U	25
7/16/2019	XX	LTC4LXBBI	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	16
10/29/2019	XX	LTC4LXBHB	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	53
4/28/2020	XX	LTC4LXCCI	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	26
7/21/2020	XX	LTC4LXCHB	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5	0.5 U	2 U	20	10 U	1 U	1 U	16
10/27/2020	XX	LTC4LXD2F	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	24
4/6/2021	XX	LTC4LXDBH	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.9	0.5 U	2 U	33	16	1 U	1 U	24
7/13/2021	XX	LTC4LXDJ9	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5.5	0.5 U	2 U	22	10 U	1 U	1 U	28
10/5/2021	XX	LTC4LXE5H	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.7	0.5 U	2 U	19	10 U	1 U	1 U	17
5/26/2022	XX	LTC4LXF09	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.7	0.5 U	2 U	21	10 U	1 U	1 U	37
7/19/2022	XX	LTC4LXF87	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.8	0.5 U	2 U	12	10 U	1 U	1 U	74
10/4/2022	XX	LTC4LXFI8	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.8	0.5 U	2 U	10 U	10 U	1 U	1 U	16
4/18/2023	XX	LTC4LXGHJ	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	6.6	0.5 U	2 U	46	10 U	1 U	1 U	33
7/11/2023	XX	LTC4LXH81	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	6.2	0.5 U	2 U	27	10 U	1 U	1 U	30
10/2/2023	XX	LTC4LX059	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5.5	0.5 U	2 U	33	10 U	1.3	1 U	48
4/2/2024	XX	LTC4LX11J	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.6	0.5 U	2 U	28	10 U	1 U	1 U	56
QCBT																	
4/21/2014	XX	BTXXXX6G4	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
4/22/2014	XX	BTXXXX6G5	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
7/30/2014	XX	BTXXXX70B	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
10/21/2014	XX	BTXXXX748	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
4/27/2015	XX	BTXXXX79E	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
4/27/2015	XX	BTXXXX79F	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
4/27/2015	XX	BTXXXX79J	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
7/15/2015	XX	BTXXXX7DB	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
10/27/2015	XX	BTXXXX7II	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
7/26/2016	XX	BTXXXX8BF	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
10/25/2016	XX	BTXXXX8JE	10 U	0.5 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U	10 U	10 U	2 U	2 U	1 U
4/18/2017	XX	BTXXXX980	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/25/2017	XX	BTXXXX9DI	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/24/2017	XX	BTXXXX9HD	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/3/2018	XX	BTXXXXHG3	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U

DATA SUMMARY TABLE

Leachate - VOAs Group 2 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(QCBT) Date	Type	Sample ID	Vinyl Acetate ug/L	Bromo dichloro methane ug/L	1,2-Dichloro propane ug/L	cis-1,3-Dichloro propene ug/L	Trichloroethene ug/L	Dibromo chloromethane ug/L	1,1,2-Trichloroethane ug/L	Benzene ug/L	trans-1,3-Dichloro propene ug/L	Bromoform ug/L	4-Methyl-2-Pentanone ug/L	2-Hexanone ug/L	Tetrachloro ethene ug/L	1,1,2,2-Tetrachloro ethane ug/L	Toluene ug/L
7/17/2018	XX	BTXXXXACD	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/2/2018	XX	BTXXXXB1B	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/23/2019	XX	BTXXXXB68	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/16/2019	XX	BTXXXXBCJ	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/29/2019	XX	BTXXXXBIC	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/28/2020	XX	BTXXXXCE4	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/21/2020	XX	BTXXXXCIC	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/27/2020	XX	BTXXXXD3G	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/6/2021	XX	BTXXXXDDJ	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/13/2021	XX	BTXXXXE0B	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/5/2021	XX	BTXXXXE6I	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
5/26/2022	XX	BTXXXXF1A	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/19/2022	XX	BTXXXXFE7	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/4/2022	XX	BTXXXXFJ9	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/18/2023	XX	BTXXXXH24	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/11/2023	XX	BTXXXXH92	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/2/2023	XX	BTXXXX076	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/2/2024	XX	BTXXXX151	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Leachate - VOAs Group 3 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Chlorobenzene	Ethylbenzene	Styrene	o-Xylene	m,p-Xylene	Tetra hydrofuran	Trichloro fluoromethane	cis-1,2-Dichloroethene	Bromochloro methane	Dibromo methane	1,2-Dibromoethane	1,1,1,2-Tetrachloro ethane	1,2,3-Trichloro propane	1,2-Dibromo-3-Chloropropane	1,4-Dichloro benzene
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/22/2014	XX	LTC4LX6EH	20 U	20 U	20 U	20 U	20 U		100 U	20 U	20 U	20 U	40 U	20 U	20 U	40 U	9.6 U
7/30/2014	XX	LTC4LX6J4	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
10/21/2014	XX	LTC4LX72F	10 U	10 U	10 U	10 U	10 U		50 U	10 U	10 U	10 U	20 U	10 U	10 U	20 U	10 U
4/28/2015	XX	LTC4LX78C	10 U	10 U	10 U	10 U	10 U		50 U	10 U	10 U	10 U	20 U	10 U	10 U	20 U	10 U
7/15/2015	XX	LTC4LX7C4	10 U	10 U	10 U	10 U	10 U		50 U	10 U	10 U	10 U	20 U	10 U	10 U	20 U	10 U
10/27/2015	XX	LTC4LX7HD	10 U	10 U	10 U	10 U	10 U		50 U	10 U	10 U	10 U	20 U	10 U	10 U	20 U	10 U
4/5/2016	XX	LTC4LX863	10 U	10	10 U	10 U	10 U	400	50 U	10 U	10 U	10 U	20 U	10 U	10 U	20 U	10 U
7/26/2016	XX	LTC4LX8AD	10 U	10 U	10 U	10 U	10 U	600	50 U	10 U	10 U	10 U	20 U	10 U	10 U	20 U	10 U
10/25/2016	XX	LTC4LX8IC	2 U	13	1 U	3	6	400	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
4/18/2017	XX	LTC4LX96I	1 U	7	1 U	3	6	500	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
7/25/2017	XX	LTC4LX9CG	1 U	7	1 U	5	9	500	5 U	1	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
10/24/2017	XX	LTC4LX9GB	1 U	3	1 U	2	3	400	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
4/3/2018	XX	LTC4LXA2A	1 U	7.5	1.1	5	9.6	400	5 U	1.4	1 U	1 U	2 U	1 U	0.5 U	2 U	1
7/17/2018	XX	LTC4LXABB	1 U	1.5	1 U	1 U	1.7	110	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
10/2/2018	XX	LTC4LXB09	10 U	10 U	10 U	10 U	11	430	50 U	10 U	10 U	10 U	20 U	10 U	5 U	20 U	10 U
4/23/2019	XX	LTC4LXB56	20 U	20 U	20 U	20 U	20 U	280	100 U	20 U	20 U	20 U	40 U	20 U	10 U	40 U	20 U
7/16/2019	XX	LTC4LXBBI	10 U	10 U	10 U	10 U	10	390	50 U	10 U	10 U	10 U	20 U	10 U	5 U	20 U	10 U
10/29/2019	XX	LTC4LXBHB	10 U	12	10 U	10 U	10 U	370	50 U	10 U	10 U	10 U	20 U	10 U	5 U	20 U	10 U
4/28/2020	XX	LTC4LXCCI	10 U	10 U	10 U	10 U	10 U	420	20 U	10 U	10 U	10 U	5 U	10 U	5 U	20 U	10 U
7/21/2020	XX	LTC4LXCHB	1 U	7.8	1 U	5.3	9.1	490	2 U	1.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1
10/27/2020	XX	LTC4LXD2F	10 U	10 U	10 U	10 U	12	350	20 U	10 U	10 U	10 U	5 U	10 U	5 U	20 U	10 U
4/6/2021	XX	LTC4LXDBH	1 U	10	1 U	6.9	13	320	2 U	2.2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.2
7/13/2021	XX	LTC4LXDJ9	1 U	11	1 U	8	13	480	2 U	2.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
10/5/2021	XX	LTC4LXE5H	1 U	6.6	1 U	4.7	8.5	360	2 U	1.6	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
5/26/2022	XX	LTC4LXF09	1 U	6.8	1 U	4.8	9	410	2 U	2.2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/19/2022	XX	LTC4LXF87	1 U	7.7	1 U	6.3	11	420	2 U	2.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/4/2022	XX	LTC4LXFI8	1 U	8.6	1 U	6.2	12	410	2 U	1.8	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.1
4/18/2023	XX	LTC4LXGHJ	1 U	12	1 U	8.5	16	480	2 U	2.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
7/11/2023	XX	LTC4LXH81	1 U	13	1.2	11	19	450	2 U	3.2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
10/2/2023	XX	LTC4LX059	1 U	13	2	9.9	20	560	2 U	3.1	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
4/2/2024	XX	LTC4LX11J	1 U	10	1.2	6.7	15	310	2 U	2.8	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
QCBT																	
4/21/2014	XX	BTXXXX6G4	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
4/22/2014	XX	BTXXXX6G5	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
7/30/2014	XX	BTXXXX70B	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
10/21/2014	XX	BTXXXX748	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
4/27/2015	XX	BTXXXX79E	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
4/27/2015	XX	BTXXXX79F	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
4/27/2015	XX	BTXXXX79J	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
7/15/2015	XX	BTXXXX7DB	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
10/27/2015	XX	BTXXXX7II	2 U	1 U	1 U	1 U	1 U		5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
7/26/2016	XX	BTXXXX8BF	2 U	1 U	1 U	1 U	1 U	10 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
10/25/2016	XX	BTXXXX8JE	2 U	1 U	1 U	1 U	1 U	10 U	5 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
4/18/2017	XX	BTXXXX980	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
7/25/2017	XX	BTXXXX9DI	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
10/24/2017	XX	BTXXXX9HD	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
4/3/2018	XX	BTXXXXHG3	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U

DATA SUMMARY TABLE

Leachate - VOAs Group 3 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(QCBT) Date	Type	Sample ID	Chlorobenzene ug/L	Ethylbenzene ug/L	Styrene ug/L	o-Xylene ug/L	m,p-Xylene ug/L	Tetra hydrofuran ug/L	Trichloro fluoromethane ug/L	cis-1,2-Dichloroethene ug/L	Bromochloro methane ug/L	Dibromo methane ug/L	1,2-Dibromoethane ug/L	1,1,1,2-Tetrachloro ethane ug/L	1,2,3-Trichloro propane ug/L	1,2-Dibromo-3-Chloropropane ug/L	1,4-Dichloro benzene ug/L
7/17/2018	XX	BTXXXXACD	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
10/2/2018	XX	BTXXXXB1B	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
4/23/2019	XX	BTXXXXB68	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
7/16/2019	XX	BTXXXXBCJ	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
10/29/2019	XX	BTXXXXBIC	1 U	1 U	1 U	1 U	1 U	10 U	5 U	1 U	1 U	1 U	2 U	1 U	0.5 U	2 U	1 U
4/28/2020	XX	BTXXXXCE4	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/21/2020	XX	BTXXXXCIC	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/27/2020	XX	BTXXXXD3G	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
4/6/2021	XX	BTXXXXDDJ	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/13/2021	XX	BTXXXXE0B	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/5/2021	XX	BTXXXXE6I	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
5/26/2022	XX	BTXXXXF1A	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/19/2022	XX	BTXXXXFE7	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/4/2022	XX	BTXXXXFJ9	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
4/18/2023	XX	BTXXXXH24	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/11/2023	XX	BTXXXXH92	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/2/2023	XX	BTXXXX076	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
4/2/2024	XX	BTXXXX151	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Leachate - VOAs Group 4 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			1,2-Dichloro benzene	Acrylonitrile	Diethyl ether	trans-1,4-Dichloro-2-butene	Iodomethane									
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L									
LT-C4L & LT-C4LR																
4/22/2014	XX	LTC4LX6EH	9.6 U	400 U		100 U	100 U									
7/30/2014	XX	LTC4LX6J4	1 U	20 U		5 U	5 U									
10/21/2014	XX	LTC4LX72F	10 U	200 U		50 U	50 U									
4/28/2015	XX	LTC4LX78C	10 U	200 U		50 U	50 U									
7/15/2015	XX	LTC4LX7C4	10 U	200 U		50 U	50 U									
10/27/2015	XX	LTC4LX7HD	10 U	200 U		50 U	50 U									
4/5/2016	XX	LTC4LX863	10 U	200 U	50 U	50 U	50 U									
7/26/2016	XX	LTC4LX8AD	10 U	200 U	50 U	50 U	50 U									
10/25/2016	XX	LTC4LX8IC	1 U	20 U	8	5 U	5 U									
4/18/2017	XX	LTC4LX96I	1 U	20 U	5 U	5 U	5 U									
7/25/2017	XX	LTC4LX9CG	1 U	20 U	5 U	5 U	5 U									
10/24/2017	XX	LTC4LX9GB	1 U	20 U	5 U	5 U	5 U									
4/3/2018	XX	LTC4LXA2A	1 U	20 U	5 U	5 U	5 U									
7/17/2018	XX	LTC4LXABB	1 U	20 U	5 U	5 U	5 U									
10/2/2018	XX	LTC4LXB09	10 U	200 U	50 U	50 U	50 U									
4/23/2019	XX	LTC4LXB56	20 U	400 U	100 U	100 U	100 U									
7/16/2019	XX	LTC4LXBBI	10 U	200 U	50 U	50 U	50 U									
10/29/2019	XX	LTC4LXBHB	10 U	200 U	50 U	50 U	50 U									
4/28/2020	XX	LTC4LXCCI	10 U	200 U	20 U	50 U	50 U									
7/21/2020	XX	LTC4LXCHB	1 U	20 U	6.5	5 U	5 U									
10/27/2020	XX	LTC4LXD2F	10 U	200 U	20 U	50 U	50 U									
4/6/2021	XX	LTC4LXDBH	1 U	20 U	2 U	5 U	5 U									
7/13/2021	XX	LTC4LXDJ9	1 U	20 U	9.3	5 U	5 U									
10/5/2021	XX	LTC4LXE5H	1 U	20 U	7.3	5 U	5 U									
5/26/2022	XX	LTC4LXF09	1 U	20 U	16	5 U	5 U									
7/19/2022	XX	LTC4LXF87	1 U	20 U	14	5 U	5 U									
10/4/2022	XX	LTC4LXFI8	1 U	20 U	11	5 U	5 U									
4/18/2023	XX	LTC4LXGHJ	1 U	20 U	16	5 U	5 U									
7/11/2023	XX	LTC4LXH81	1 U	20 U	12	5 U	5 U									
10/2/2023	XX	LTC4LX059	1 U	20 U	35	5 U	5 U									
4/2/2024	XX	LTC4LX11J	1 U	20 U	2 U	5 U	5 U									
QCBT																
4/21/2014	XX	BTXXXX6G4	1 U	20 U		5 U	5 U									
4/22/2014	XX	BTXXXX6G5	1 U	20 U		5 U	5 U									
7/30/2014	XX	BTXXXX70B	1 U	20 U		5 U	5 U									
10/21/2014	XX	BTXXXX748	1 U	20 U		5 U	5 U									
4/27/2015	XX	BTXXXX79E	1 U	20 U		5 U	5 U									
4/27/2015	XX	BTXXXX79F	1 U	20 U		5 U	5 U									
4/27/2015	XX	BTXXXX79J	1 U	20 U		5 U	5 U									
7/15/2015	XX	BTXXXX7DB	1 U	20 U		5 U	5 U									
10/27/2015	XX	BTXXXX7II	1 U	20 U		5 U	5 U									
7/26/2016	XX	BTXXXX8BF	1 U	20 U	5 U	5 U	5 U									
10/25/2016	XX	BTXXXX8JE	1 U	20 U	5 U	5 U	5 U									
4/18/2017	XX	BTXXXX980	1 U	20 U	5 U	5 U	5 U									
7/25/2017	XX	BTXXXX9DI	1 U	20 U	5 U	5 U	5 U									
10/24/2017	XX	BTXXXX9HD	1 U	20 U	5 U	5 U	5 U									
4/3/2018	XX	BTXXXXHG3	1 U	20 U	5 U	5 U	5 U									

DATA SUMMARY TABLE

Leachate - VOAs Group 4 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(QCBT) Date	Type	Sample ID	1,2-Dichloro benzene ug/L	Acrylonitrile ug/L	Diethyl ether ug/L	trans-1,4-Dichloro-2-butene ug/L	Iodomethane ug/L										
7/17/2018	XX	BTXXXXACD	1 U	20 U	5 U	5 U	5 U										
10/2/2018	XX	BTXXXXB1B	1 U	20 U	5 U	5 U	5 U										
4/23/2019	XX	BTXXXXB68	1 U	20 U	5 U	5 U	5 U										
7/16/2019	XX	BTXXXXBCJ	1 U	20 U	5 U	5 U	5 U										
10/29/2019	XX	BTXXXXBIC	1 U	20 U	5 U	5 U	5 U										
4/28/2020	XX	BTXXXXCE4	1 U	20 U	2 U	5 U	5 U										
7/21/2020	XX	BTXXXXCIC	1 U	20 U	2 U	5 U	5 U										
10/27/2020	XX	BTXXXXD3G	1 U	20 U	2 U	5 U	5 U										
4/6/2021	XX	BTXXXXDDJ	1 U	20 U	2 U	5 U	5 U										
7/13/2021	XX	BTXXXXE0B	1 U	20 U	2 U	5 U	5 U										
10/5/2021	XX	BTXXXXE6I	1 U	20 U	2 U	5 U	5 U										
5/26/2022	XX	BTXXXXF1A	1 U	20 U	2 U	5 U	5 U										
7/19/2022	XX	BTXXXXFE7	1 U	20 U	2 U	5 U	5 U										
10/4/2022	XX	BTXXXXFJ9	1 U	20 U	2 U	5 U	5 U										
4/18/2023	XX	BTXXXXH24	1 U	20 U	2 U	5 U	5 U										
7/11/2023	XX	BTXXXXH92	1 U	20 U	2 U	5 U	5 U										
10/2/2023	XX	BTXXXX076	1 U	20 U	2 U	5 U	5 U										
4/2/2024	XX	BTXXXX151	1 U	20 U	2 U	5 U	5 U										

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

APPENDIX H

WASTE COMPATIBILITY TEST RESULTS

SME
SEVEE & MAHER
ENGINEERS

A Final Report:

Laboratory Testing of HDPE Geomembrane for Waste Containment EPA Method 9090A

August 1998

Submitted to:
Solmax International
2801 Marie-Victorin
Varennes, Quebec
Canada J3X 1P7

Attn: **Mr. Stephan Henes**

Submitted by:

TRI/Environmental, Inc.
9063 Bee Caves Rd.
Austin, Texas 78733

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

August 17, 1998

Mr. Stephan Henes
Solmax International
2801 Marie-Victorin
Varennes, Quebec
Canada J3X 1P7

Dear Mr. Henes:

TRI/Environmental, Inc. (TRI) is pleased to present this Final Report for a HDPE geomembrane chemical compatibility study via EPA Method 9090A.

TRI thanks Solmax International for the opportunity to participate in this project. Please call me if you have any questions or require any additional information.

Respectfully submitted,

Sam R. Allen (09-04-98)

Sam R. Allen
Vice President and Division Manager
Geosynthetics Services

9063 Bee Caves Road • Austin, TX 78733-6201 • (512) 263-2101 • FAX (512) 263-2558

FOREWORD

The testing reported herein is based upon accepted industry practice as well as the test method listed. TRI/Environmental Inc. (TRI) neither accepts responsibility for nor makes claim as to the final use and purpose of the materials tested.

Tests were performed under laboratory conditions and not under actual usage conditions. TRI can give no conclusions as to the serviceability, life expectancy or general durability of the products tested when used in a lining and/or leachate collection system.

1.0 INTRODUCTION

This report describes the work performed by TRI/Environmental, Inc. (TRI) to determine the chemical compatibility of a single liner product with one waste leachate. The product selected for testing was a high density polyethylene (HDPE) geomembrane. The objective was to determine the resistance of the geomembrane to changes caused by exposure to leachate. Changes in physical and mechanical properties were measured after exposure to the leachate at 23°C and 50°C for 30, 60, 90 and 120 days following the exposure regime specified in United States Environmental Protection Agency (EPA) Method 9090A.

Methods, results and discussion are provided in the sections which follow. Test results are provided in the Tables of Results which accompany this report.

2.0 METHODS

2.1 Materials

The material received for this study was received and tested under TRI Log number E2068-94-05. Table 1 describes the product selected for evaluation in this chemical compatibility study.

Table 1. List of geomembranes evaluated in chemical compatibility study

Geosynthetic	Source
60 mil textured HDPE geomembrane, roll #5208	Solmax

2.2 Leachate

The waste leachate used was stock municipal waste leachate maintained at TRI laboratories in Austin. The leachate was characterized as follows.

Table 2. Characterization of leachate used in chemical compatibility study

Parameter (units)	Level
Biological oxygen demand (mg/L)	2,130
Chemical Oxygen Demand (mg/L)	6,180
Conductivity (umhos/cm)	41,700
N-Ammonia (mg/L)	3,000
pH (units)	8.6

Table 2. Characterization of leachate used in chemical compatibility study	
Parameter (units)	**Level**
Volatile Acids (mg/L)	10,000

2.3 Exposure Conditions

Geomembrane coupons were exposed to the waste leachate following the specifications of EPA Method 9090A as they relate to exposure to waste fluids. The tanks used for these exposures were maintained at 23 $\pm$2°C and 50 $\pm$ 2°C throughout the 120-day exposure period. Tanks were constructed from glass, fitted with stirrers and heated with a circulating hot water heat exchanger system. The 50°C tanks were sealed with a lid, and a reflux condenser was installed to minimize loss of volatile leachate components.

2.4 Testing Procedures

The following table lists tests performed on the HDPE geomembrane product. The number of test replicates was doubled for baseline determinations on unexposed material.

Table 3. Tests performed on HDPE geomembrane		
Test or Physical Property	**Method**	**Number of replicate specimens**
Dimensions and weight	EPA 9090A	3
Hardness	ASTM D 2240 D scale	5
Volatiles and Extractables	EPA SW 870, Appendix III	2
Specific Gravity	ASTM D 792	2
Tensile Properties	ASTM D 638	5
Modulus of Elasticity	ASTM D 882	5
Hydrostatic Resistance	ASTM D 751 Method A	5
Tear Strength	ASTM D 1004	5
Puncture Resistance	FTMS 101C Method 2065	2

Note that tensile properties were determined in accordance with ASTM D638 procedures as modified by National Sanitation Foundation (NSF) Standard 54 - 93, which gives specific methods for testing HDPE geomembranes. The tensile tests were performed on a screw-type tensile testing machine. The Type IV die was used. Load measurement were made by a strain-gage bridge load cell with calibration certified by an outside standards service. Elongation was determined by crosshead movement as recorded by Series IX Instron data acquisition software. The rate of grip separation was 2 inches per minute. Gauge length ratios of 1.3 inches for yield values, and 2.5 inches for break values were used to calculate elongation from grip movement. The parameters reported for ASTM D638 testing included: tensile stress at yield, tensile strength at break, elongation at yield and elongation at break.

3.0 RESULTS AND DISCUSSION

Test results are presented in the Tables of Test Results (raw data) and graphical presentations are presented in Appendix A.

In considering these results, it must be determined through engineering judgment whether observed differences in the value of test results measured before and after immersion are due to product variability, unidentified factors relating to the test procedure, or leachate interaction with the products. Any significant chemical interaction with leachate would be expected to result in degradation trends which are consistent across the various properties being evaluated, and not isolated to one set of test results only. However, with each type of material there may be specific properties which are highly sensitive to leachate-induced effects. These factors must be considered in evaluating the various test results for a given product.

Also of critical importance is the issue of product variability. With geomembranes, a range of physical and mechanical index test values covering 15% or more of the average is not uncommon. This can be traced to variability inherent in the product, and the randomness associated with the onset of failure under the specified testing conditions. However, in chemical compatibility testing the statistical sampling of a broad range of manufactured product is not possible. Therefore, the small size of the sample population tested at each time point must be taken into consideration. The criteria to be applied in evaluating data measured before and after leachate immersion should be that property changes, if observed, are consistent and so great that product variability and experimental factors can be ruled out.

In this report, standard deviations (STD) are reported for most measurements involving three or more replicate specimens. In statistics, the standard deviation is defined as root of the mean squared deviations of individual test results about the mean value. The standard deviation is a quantitative measure of variability within a group of measurements.

One related measure of variability observed within a sample set, relative to the magnitude of the mean value itself, is the *coefficient of variation or variance* (COV). The coefficient of variance is defined as the standard deviation divided by the mean associated with a group of specimens, and may be expressed as a percentage. The COV provides an indication of what proportion of the mean value may be attributable to random experimental factors or product variability. It is useful to consider apparent changes in property values against the criterion of COV since observed changes which fall below the COV may not be significant. This approach was used in preparing the tables below.

The term *range* refers to the difference between the extreme highest and lowest points within a group of measured values. Considering range as a percentage of the mean values provides another measure of variability within a dataset.

In the table below, the high and low extremes for percentage change in mean values are listed for comparison against COV and range as a percentage of mean from the baseline sample group. The high and low percentage changes are the extremes from data measured at 30, 60, 90 and 120 days.

Table 4. Baseline COV and Range of Percent Change Results

Test	Baseline COV (%)	Baseline Range as % of Mean	High Observed % Change	Low Observed % Change
Stress at yield (MD)	4	10	+7	-3
Stress at break (MD)	13	41	+10	-23
Elongation at yield (MD)	4	12	+9	-5
Elongation at break (MD)	11	36	+4	-13
Modulus (MD)	9	24	+14	-12
Tear strength (MD)	4	10	+7	-8
Puncture Resistance	1	4	+8	-3
Hydrostatic resistance	1	3	0	-1

4.0 CONCLUSION

While changes in certain measured mechanical properties were noted, they were not observed to be consistent throughout the exposure period. The effects of product variability and experimental factors could not be ruled out as causes for observed changes. The data, considered together, do not support the conclusion that observed changes were caused by the test exposures.

TRI/Environmental, Inc. is pleased to have been selected to participate in this project. We trust that the information provided in this report meets your requirements for technical documentation of this chemical compatibility study. Please do not hesitate to call if we can provide any further information (1-800-880-8378).

Respectfully submitted,

Sam R. Allen (09.04.98)

Sam R. Allen
Vice President and Division Manager
Geosynthetics Services

EPA METHOD 9090A TEST RESULTS

TRI LOG #: E2068-94-05

GEOSYNTHETIC DIMENSIONS - HDPE

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Exposed to MSW Leachate

Report Date: August 17, 1998

Exposure Time and Temperature

Test Parameters	Temp.	30 Day Baseline	30 Day Exposed	30 Day % Change	60 Day Baseline	60 Day Exposed	60 Day % Change	90 Day Baseline	90 Day Exposed	90 Day % Change	120 Day Baseline	120 Day Exposed	120 Day % Change
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208													
Thickness (mils)	23C	68	67	-1.5	65	65	0.0	62	62	0.0	63	63	0.0
	50C	65	65	0.0	67	67	0.0	63	64	1.6	64	64	0.0
Length (inches)	23C	9.97	9.99	0.2	9.98	9.99	0.1	9.96	9.98	0.2	10.00	10.01	0.1
	50C	9.98	10.00	0.2	9.98	9.98	0.0	10.00	10.00	0.0	10.00	9.99	-0.1
Width (inches)	23C	7.97	7.98	0.1	7.96	7.97	0.1	8.00	7.99	-0.1	8.00	8.00	0.0
	50C	8.00	8.00	0.0	7.95	7.96	0.1	8.00	8.00	0.0	8.00	7.98	-0.2
Mass (g)	23C	83.70	83.72	0.0	84.82	84.87	0.1	85.42	85.99	0.7	84.88	84.55	-0.4
	50C	88.76	88.81	0.1	89.56	89.77	0.2	88.66	89.35	0.8	87.01	86.65	-0.4

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Client: SOLMAX, File: 609-dim.wb1

EPA METHOD 9090A TEST RESULTS

TRI LOG #: E2068-94-05

60 MIL TEXTURED HDPE GEOMEMBRANE

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Exposed to MSW Leachate

Report Date: August 17, 1998

Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Tensile Properties:	2648	2649	2803	2643	2766	2776	2489	2906	2647	2703	2623	2691
Tensile Stress @ Yield (psi)	2525	2620	2738	2893	2601	2659	2547	2386	2776	2628	2780	2924
ASTM D638	2448	2429	2629	2732	2655	2996	2631	2711	2651	2642	2618	2905
Machine Direction	2716			2780			2650			2656		
	2514			2711			2646			2670		
	2505			2788			2511			2635		
Average	2559	2566	2723	2758	2674	2810	2579	2668	2591	2656	2674	2840
STD	92	98	72	77	69	140	66	214	60	25	75	106
Coefficient of Variation	4	4	3	3	3	5	3	8	2	1	3	4
% Change		0	6		-3	2		3	4		1	7
Tensile Properties:	3429	3999	2859	4007	4016	3392	3952	3719	3427	3471	4307	3131
Tensile Strength @ Break (psi)	4207	3772	3437	4300	3807	1930	3739	3950	3946	4311	4267	4381
ASTM D638	2757	2589	3971	3778	2782	3786	2690	2201	3971	3933	4048	3329
Machine Direction	3917			3662			4110			3597		
	3308			3919			3798			3459		
	3547						3507			4159		
Average	3528	3453	3422	3933	3535	3036	3633	3290	3781	3822	4207	3614
STD	459	618	454	218	539	798	461	776	251	334	114	549
Coefficient of Variation	13	18	13	6	15	26	13	24	7	9	3	15
% Change		-2	-3		-10	-23		-9	4		10	-5
Tensile Properties:	16	18	17	15	16	17	14	14	16	15	13	15
Elongation @ Yield (%)	18	16	18	15	15	16	14	14	15	14	15	15
ASTM D638	17	21	16	14	16	16	15	14	15	13	12	13
Machine Direction	18			17			16			14		
	17			16			14			14		
	18			13			15			14		
Average	17	18	17	15	16	16	15	14	15	14	13	14
STD	1	2	1	1	0	0	1	0	0	1	1	1
Coefficient of Variation	4	11	5	9	3	3	5	0	3	4	9	7
% Change		6	-2		4	9		-5	5		-5	2

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Client: SOLMAX, File: 945-solm .WB1

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Exposed to MSW Leachate

Report Date: August 17, 1998

Exposure Time and Temperature

Test Parameters	30 Day Baseline	30 Day 23C	30 Day 50C	60 Day Baseline	60 Day 23C	60 Day 50C	90 Day Baseline	90 Day 23C	90 Day 50C	120 Day Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Tensile Properties:	605	726	474	686	660	584	699	574	605	668	714	529
Elongation @ Break (%)	745	667	583	691	684	559	648	717	655	717	679	694
ASTM D638	513	471	706	639	613	622	470	546	676	647	672	617
Machine Direction	689			691			682			621		
	609			657			628			633		
	658			712			640			692		
Average	637	621	588	679	652	588	628	612	645	663	688	613
STD	73	109	95	24	29	26	75	75	30	33	18	67
Coefficient of Variation	11	18	16	4	5	4	12	12	5	5	3	11
% Change		-2	-8		-4	-13		-2	3		4	-7
Tensile Properties:	589	555	450	640	600	570	640	540	530	630	620	500
Set after Break (%)	661	610	550	650	620	500	630	610	630	670	620	630
ASTM D638	422	490	700	580	560	620	480	590	650	590	650	590
Machine Direction	632			640			620			620		
	596			620			600			630		
	630			640			660			660		
Average	588	552	567	628	593	563	605	580	603	633	630	573
STD	78	49	103	23	25	49	59	29	52	26	14	54
Coefficient of Variation	13	9	18	4	4	9	10	5	9	4	2	9
% Change		-6	-4		-6	-10		-4	-0		-1	-9
Tensile Properties:	1975	1979	2171	2059	2160	2192	2030	2319	2105	2138	2113	2084
Tensile Stress @ 100% Elongation (psi)	2005	2116	2191	2103	2017	2006	2049	1919	2137	2118	2198	2301
ASTM D638	1968	1865	2154	2218	2126	2200	2152	2068	2079	2107	1979	2258
Machine Direction	2069			2321			2095			2147		
	1911			2100			2186			2179		
	1923			2461			1942			2032		
Average	1975	1987	2172	2210	2101	2133	2076	2102	2107	2120	2097	2214
STD	53	103	15	142	61	90	81	165	24	46	90	94
Coefficient of Variation	3	5	1	6	3	4	4	8	1	2	4	4
% Change		1	10		-5	-4		1	2		-1	4
Tensile Properties:	2051	1927	2053	2165	2111	2203	2033	2327	2093	2068	2269	2112
Tensile Stress @ 200% Elongation (psi)	1915	2122	2192	2223	2041	1955	2036	1944	2209	2131	2244	2435
ASTM D638	1930	1946	2313	2136	2110	2291	2204	2122	1974	2236	2139	2412
Machine Direction	2053			2219			2244			2212		
	2029			2110			2110			2222		
	1929			2510			2061			2105		
Average	1985	1998	2186	2227	2087	2150	2115	2131	2092	2162	2217	2320
STD	61	88	106	133	33	142	82	156	96	64	56	147
Coefficient of Variation	3	4	5	6	2	7	4	7	5	3	3	6
% Change		1	10		-6	-3		1	-1		3	7

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TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
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Report Date: August 17, 1998

Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Tensile Properties:	2680	2899	2769	2822	2793	2913	2803	2576	3085	2981	2858	2876
Tensile Stress @ Yield (psi)	2626	2705	2852	2741	2938	2792	2632	2653	2833	2738	2630	2877
ASTM D638	2541	2581	2853	2848	2785	2837	2543	2736	2973	2637	2658	2868
Transverse Direction	2558			2752			2652			2809		
	2535			2760			2719			2838		
	2504			2792			2743			2941		
Average	2574	2728	2825	2786	2839	2847	2682	2655	2964	2824	2715	2874
STD	60	131	39	39	70	50	84	65	103	116	102	4
Coefficient of Variation	2	5	1	1	2	2	3	2	3	4	4	0
% Change		6	10		2	2		-1	11		-4	2
Tensile Properties:	2947	3207	2930	3210	3792	2610	3591	2215	3410	2303	3000	3124
Tensile Strength @ Break (psi)	3023	3243	2986	3104	3807	3379	3446	2962	2998	3350	3635	3025
ASTM D638	3135	3338	3399	3224	3710	3924	2908	3972	2711	3132	3867	3058
Transverse Direction	3070			3360			3379			3993		
	2642			3590			3009			3050		
	2834			3076			3478			3038		
Average	2942	3263	3105	3261	3770	3304	3302	3050	3040	3144	3501	3069
STD	164	55	209	174	43	539	252	720	287	498	366	41
Coefficient of Variation	6	2	7	5	1	16	8	24	9	16	10	1
% Change		11	6		16	1		-8	-8		11	-2
Tensile Properties:	16	17	16	15	16	15	14	13	13	13	13	15
Elongation @ Yield (%)	16	16	16	16	14	15	14	14	14	13	15	14
ASTM D638	16	17	17	15	16	15	13	13	14	15	12	14
Transverse Direction	16			15			15			14		
	17			16			15			13		
	15			16			14			13		
Average	16	17	16	16	15	15	14	13	14	14	13	14
STD	1	0	0	1	1	0	1	0	0	1	1	0
Coefficient of Variation	4	3	3	3	6	0	5	4	3	6	9	3
% Change		4	2		-1	-3		-6	-4		-1	6
Tensile Properties:	546	567	530	596	695	684	622	576	538	637	687	525
Elongation @ Break (%)	576	592	517	635	636	632	620	523	506	596	658	521
ASTM D638	597	640	608	577	673	684	551	672	456	592	684	529
Transverse Direction	597			610			618			633		
	501			662			531			526		
	565			564			602			457		
Average	564	600	552	607	668	667	591	590	500	574	676	525
STD	33	30	40	33	24	25	36	62	34	64	13	3
Coefficient of Variation	6	5	7	5	4	4	6	10	7	11	2	1
% Change		6	-2		10	10		-0	-15		18	-8

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TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
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Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Tensile Properties:	528	590	530	490	630	670	620	480	510	530	660	470
Set after Break (%)	540	570	540	580	600	600	560	540	470	630	580	540
ASTM D638	603	670	600	540	620	630	520	630	500	580	620	520
Transverse Direction	580			560			580			500		
	480			640			560			470		
	550			530			570			560		
Average	547	610	557	557	617	633	568	550	493	545	620	510
STD	39	43	31	46	12	29	30	62	17	53	33	29
Coefficient of Variation	7	7	6	8	2	5	5	11	3	10	5	6
% Change		12	2		11	14		-3	-13		14	-6
Tensile Properties:	1855	2049	1976	2014	2029	2017	2064	1900	2343	2120	2099	2173
Tensile Stress @ 100% Elongation (psi)	1981	2164	2063	2042	2057	2033	1992	1960	2031	1973	2000	2184
ASTM D638	1894	1875	2051	1985	1991	1965	1925	2084	2243	1949	2099	2112
Transverse Direction	1879			1996			1978			1933		
	1909			1966			2037			2114		
	1813			2003			2092			2117		
Average	1889	2029	2030	2001	2026	2005	2015	1981	2206	2034	2066	2156
STD	52	119	38	24	27	29	56	77	130	83	47	32
Coefficient of Variation	3	6	2	1	1	1	3	4	6	4	2	1
% Change		7	7		1	0		-2	9		2	6
Tensile Properties:	2001	2230	2140	1960	2063	2154	2110	2070	2411	2111	2112	2173
Tensile Stress @ 200% Elongation (psi)	1959	1997	2287	1977	2198	2036	2094	2188	2274	2060	1977	2184
ASTM D638	1883	1951	2092	2130	2262	2176	1920	2113	2236	2157	1976	2112
Transverse Direction	1894			2021			1979			2071		
	1904			2034			2098			2028		
	1832			2103			2029			2114		
Average	1912	2059	2173	2038	2174	2122	2038	2124	2307	2090	2022	2156
STD	54	122	83	62	83	61	70	49	75	42	64	32
Coefficient of Variation	3	6	4	3	4	3	3	2	3	2	3	1
% Change		8	14		7	4		4	13		-3	3
Modulus of Elasticity:	70644	73204	78480	59111	82198	60637	88225	93041	90817	86064	77409	100973
Tangential (psi)	75228	63342	79443	80482	80299	55160	96060	80782	96047	92464	78106	78877
ASTM D882	58675	79013	66809	82828	75488	67210	78987	94857	84229	87198	81733	89756
Machine Direction	74413			67188			93845			85945		
	66482			69939			98644			88026		
	74905			58022			92562			76861		
Average	70058	71853	74911	69595	79328	61002	91387	89560	90364	86093	79083	89869
STD	6510	7922	7033	9517	2824	4926	6399	6251	4835	4669	1896	9021
Coefficient of Variation	9	11	9	14	4	8	7	7	5	5	2	10
% Change		3	7		14	-12		-2	-1		-8	4

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TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
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Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Modulus of Elasticity:	68824	66267	64814	74443	67481	51166	91068	96451	98962	86184	85325	95277
Tangential (psi)	75703	63804	69670	89596	67069	66527	87564	90012	97964	85069	94018	89320
ASTM D882	48426	55667	67199	61057	72639	81059	96630	88136	86942	78951	88647	77268
Transverse Direction	78404			36407			93845			90728		
	65292			66296			80976			90117		
	79774			52288			78544			86050		
Average	69404	61913	67228	63348	69063	66251	88105	91533	94623	86183	89330	87288
STD	11709	5547	2428	16704	2534	12205	6544	3561	5446	3866	3582	7491
Coefficient of Variation	17	9	4	26	4	18	7	4	6	4	4	9
% Change		-11	-3		9	5		4	7		4	1
Indentation Hardness:	58	57	58	57	57	57	57	56	57	57	57	57
Reading	55	57	56	58	57	58	58	56	56	57	56	58
ASTM D2240	57	56	56	59	58	58	58	57	58	58	58	57
(with TYPE D DUROMETER)	58			58			56			56		
	57			57			58			54		
	57			58			58			59		
Average	57	57	57	58	57	58	58	56	57	57	57	57
STD	1	1	1	0	0	0	1	0	1	2	1	0
Coefficient of Variation	2	1	2	1	1	1	1	1	1	3	1	1
% Change		-1	-1		-1	0		-2	-1		0	1
Specific Gravity:	0.947	0.947	0.947	0.947	0.946	0.947	0.947	0.947	0.947	0.947	0.946	0.947
Specific Gravity (grams/cu.cm)	0.948	0.947	0.948	0.947	0.947	0.947	0.947	0.946	0.947	0.947	0.947	0.947
ASTM D792, Method A	0.948	0.947	0.947	0.947	0.947	0.947	0.948	0.947	0.947	0.946	0.947	0.947
	0.948			0.949			0.947			0.948		
	0.947			0.946			0.947			0.947		
	0.947			0.948			0.947			0.947		
Average	0.948	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947	0.947
STD	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Coefficient of Variation	0.058	0.000	0.061	0.100	0.050	0.000	0.039	0.050	0.000	0.061	0.050	0.000
% Change		-0.05	-0.02		-0.07	-0.04		-0.05	-0.02		-0.04	0.00
Environmental Stress Crack Resistance:												
ASTM D1693, Condition B												
Machine Direction (% Failed)	N/A	0	0	N/A	0	0	N/A	0	0	N/A	0	0
Transverse Direction (% Failed)	N/A	0	0	N/A	0	0	N/A	0	0	N/A	0	0

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TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
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Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Puncture Resistance:	105	102	99	104	106	100	100	104	110	101	104	107
Load @ Rupture (lbs)	103	109	101	100	102	102	102	107	110	105	99	107
FTMS 101C Method 2065	103	102	98	101	95	107	100	106	106	105	101	108
	102			105			99			104		
	101			99			102			105		
	101			99			102			103		
Average	103	104	99	101	101	103	101	106	109	104	101	107
STD	1	3	1	2	5	3	1	1	2	1	2	0
Coefficient of Variation	1	3	1	2	5	3	1	1	2	1	2	0
% Change		2	-3		-0	2		5	8		-2	3
Volatiles and Extractables:	-0.13	-0.03	-0.20	-0.08	-0.03	-0.08	-0.05	-0.03	-0.05	-0.03	-0.05	-0.10
Diameter Change (%)	-0.25	-0.13	-0.05	-0.03	0.05	-0.03	-0.03	-0.05	-0.05	-0.05	0.00	-0.05
SW 870 - Appendix III-D	0.00			0.00			-0.10			0.00		
Machine Direction	0.05			-0.08			-0.05			-0.05		
Average	-0.08	-0.08	-0.13	-0.05	0.01	-0.06	-0.06	-0.04	-0.05	-0.03	-0.03	-0.08
STD	0.12	0.05	0.08	0.03	0.04	0.03	0.03	0.01	0.00	0.02	0.03	0
Volatiles and Extractables:	0.38	0.28	0.23	0.05	0.13	0.20	0.08	0.10	0.08	0.08	0.08	0.20
Diameter Change (%)	0.28	0.18	0.28	0.15	0.13	0.23	0.13	0.18	0.08	0.03	-0.03	0.18
SW 870 - Appendix III-D	0.08			0.18			0.13			0.10		
Transverse Direction	0.18			0.05			0.1			0.03		
Average	0.23	0.23	0.26	0.11	0.13	0.22	0.11	0.14	0.08	0.06	0.03	0.19
STD	0.11	0.05	0.03	0.06	0.00	0.01	0.02	0.04	0.00	0.03	0.06	0.01
Volatiles and Extractables:	0.05	0.06	0.05	0.05	0.07	0.05	0.05	0.05	0.06	0.06	0.06	0.11
% Volatiles	0.05	0.05	0.06	0.05	0.06	0.06	0.05	0.05	0.06	0.05	0.05	0.06
SW 870 - Appendix III-D	0.06			0.06			0.05			0.05		
	0.05			0.06			0.05			0.05		
Average	0.05	0.06	0.06	0.06	0.07	0.06	0.05	0.05	0.06	0.05	0.06	0.09
STD	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.03
Volatiles and Extractables:	0.18	-0.10	0.18	0.20	0.22	0.22	0.22	0.20	0.22	0.21	0.21	0.29
% Extractables	0.24	0.21	0.19	0.20	0.21	0.20	0.20	0.23	0.22	0.22	0.21	0.22
SW 870 - Appendix III-D	0.17			0.21			0.21			0.21		
	0.23			0.21			0.14			0.21		
Average	0.21	0.06	0.19	0.21	0.22	0.21	0.19	0.22	0.22	0.21	0.21	0.26
STD	0.03	0.16	0.01	0.01	0.01	0.01	0.03	0.01	0.00	0.00	0.00	0.03

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Report Date: August 17, 1998

Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED HDPE - ROLL # 5208												
Tear Resistance:	61	54	59	59	55	60	65	55	58	58	61	64
Tear Resistance (lbs)	55	55	53	60	54	58	61	57	56	58	59	62
ASTM D1004	57	54	55	59	54	57	61	57	55	57	56	57
Machine Direction	58			57			60			55		
	58			54			59			56		
	60			63			60			57		
Average	58	54	56	59	54	58	61	56	56	57	59	61
STD	2	1	3	3	0	1	2	1	1	1	2	3
Coefficient of Variation	4	1	5	5	1	2	3	2	2	2	4	5
% Change		-7	-4		-7	-1		-8	-8		3	7
Tear Resistance:	56	56	59	57	58	61	59	57	62	55	56	62
Tear Resistance (lbs)	56	54	58	57	56	60	57	55	58	58	55	61
ASTM D1004	53	54	59	56	58	60	59	54	59	56	56	61
Transverse Direction	56			54			60			58		
	53			55			60			56		
	56			55			59			57		
Average	55	55	59	56	57	60	59	55	60	57	56	61
STD	2	1	1	1	1	0	1	1	2	1	0	0
Coefficient of Variation	3	2	1	2	2	1	2	2	3	2	1	1
% Change		-1	7		3	8		-6	1		-2	8
Hydrostatic Resistance:	530	530	530	525	520	530	520	515	520	520	520	520
Load @ Rupture (psi)	520	520	530	525	525	525	515	515	515	510	525	515
ASTM D751	535	525	530	525	520	525	510	520	525	530	520	515
	535			530			530			520		
	530			515			530			525		
	525			535			520			525		
Average	529	525	530	526	522	527	521	517	520	522	522	517
STD	6	5	0	6	2	2	7	2	4	6	2	2
Coefficient of Variation	1	1	0	1	0	0	1	0	1	1	0	0
% Change		-1	0		-1	0		-1	-0		0	-1

SRA 09.04.98
Quality Review/Date

Client: SOLMAX, File: 945-solm .WB1

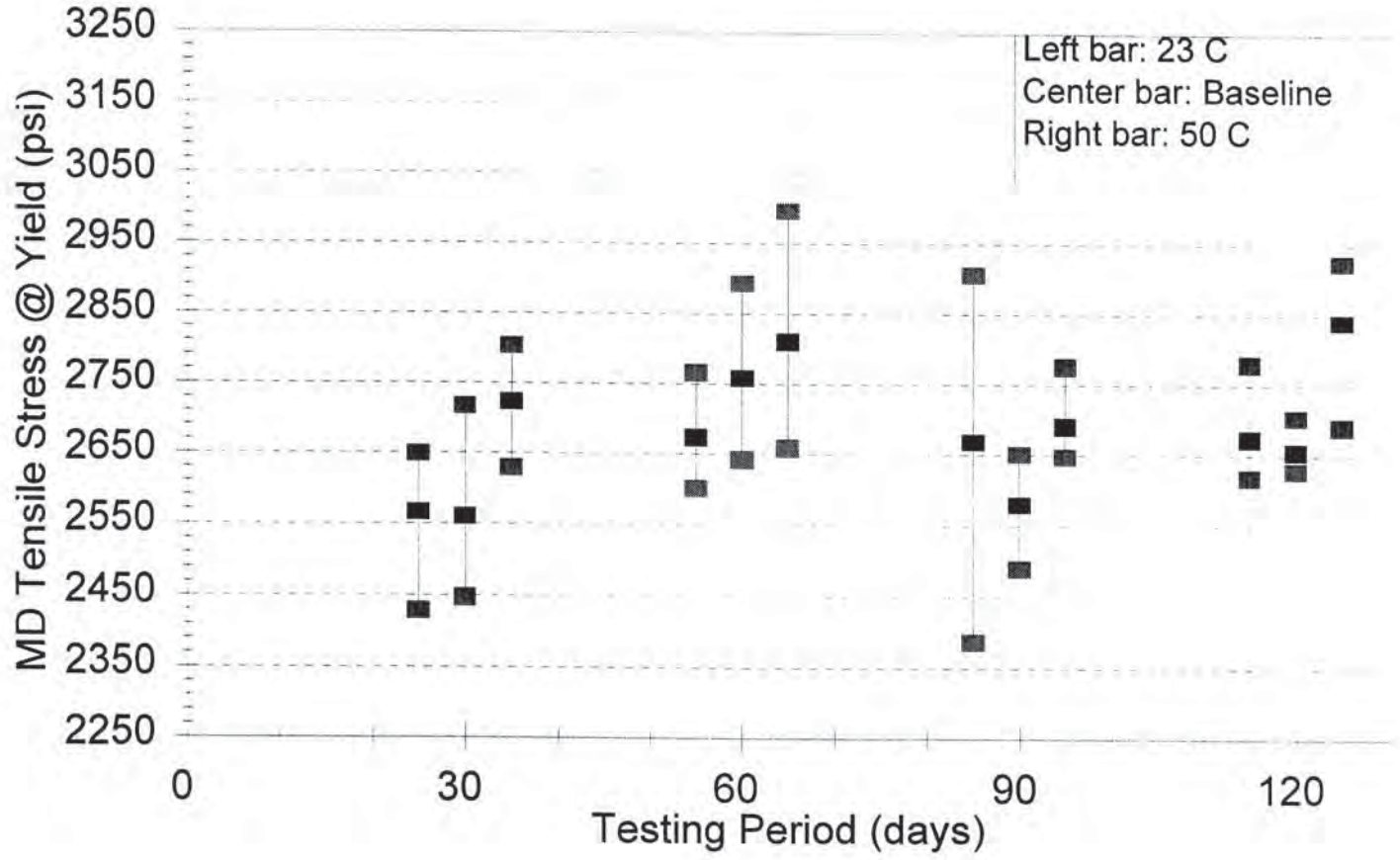
EPA METHOD 9090A TEST RESULTS

TRI LOG #: E2068-94-05

GRAPHS OF SELECTED TEST RESULTS - HDPE

SOLMAX EPA METHOD 9090A

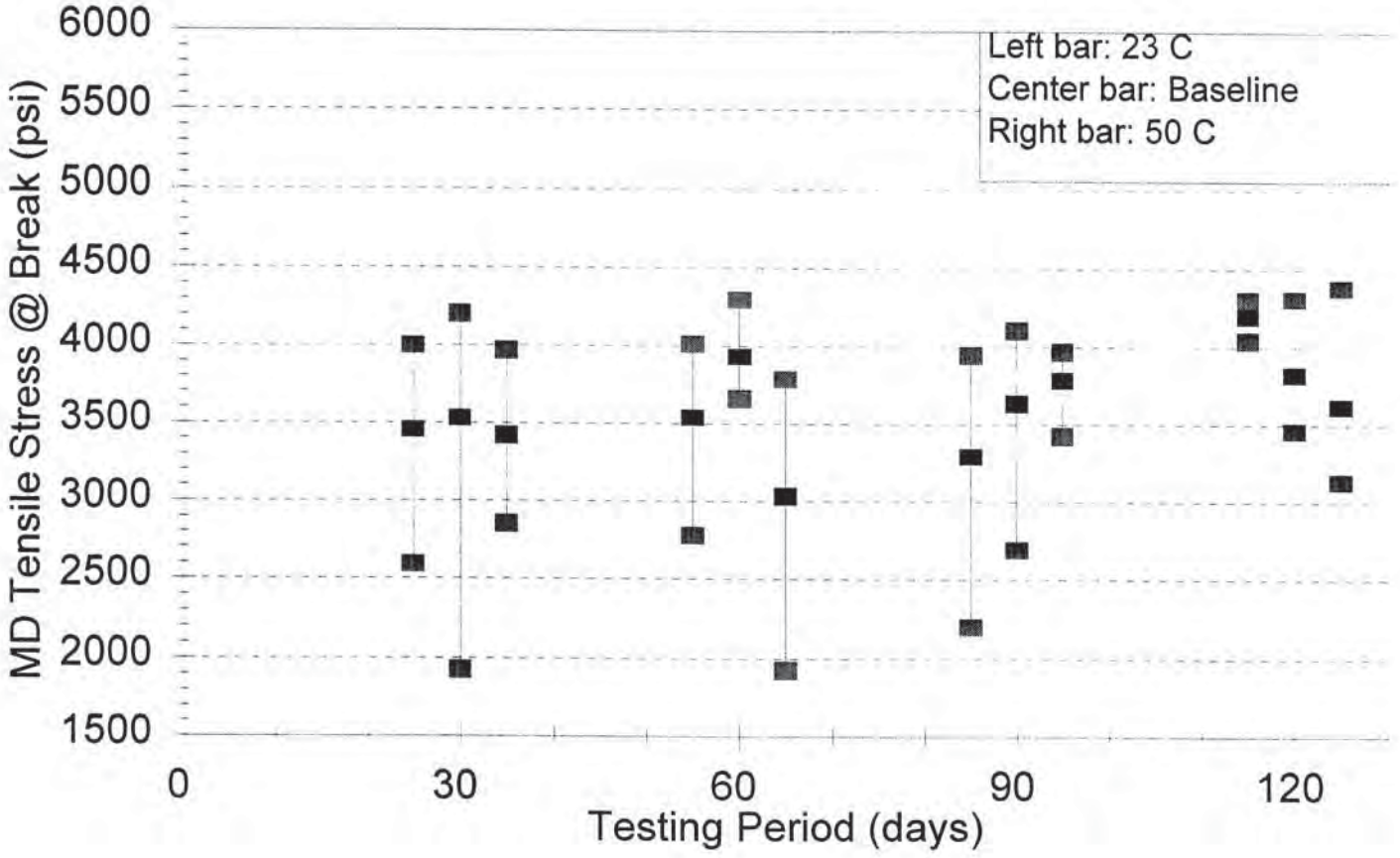
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

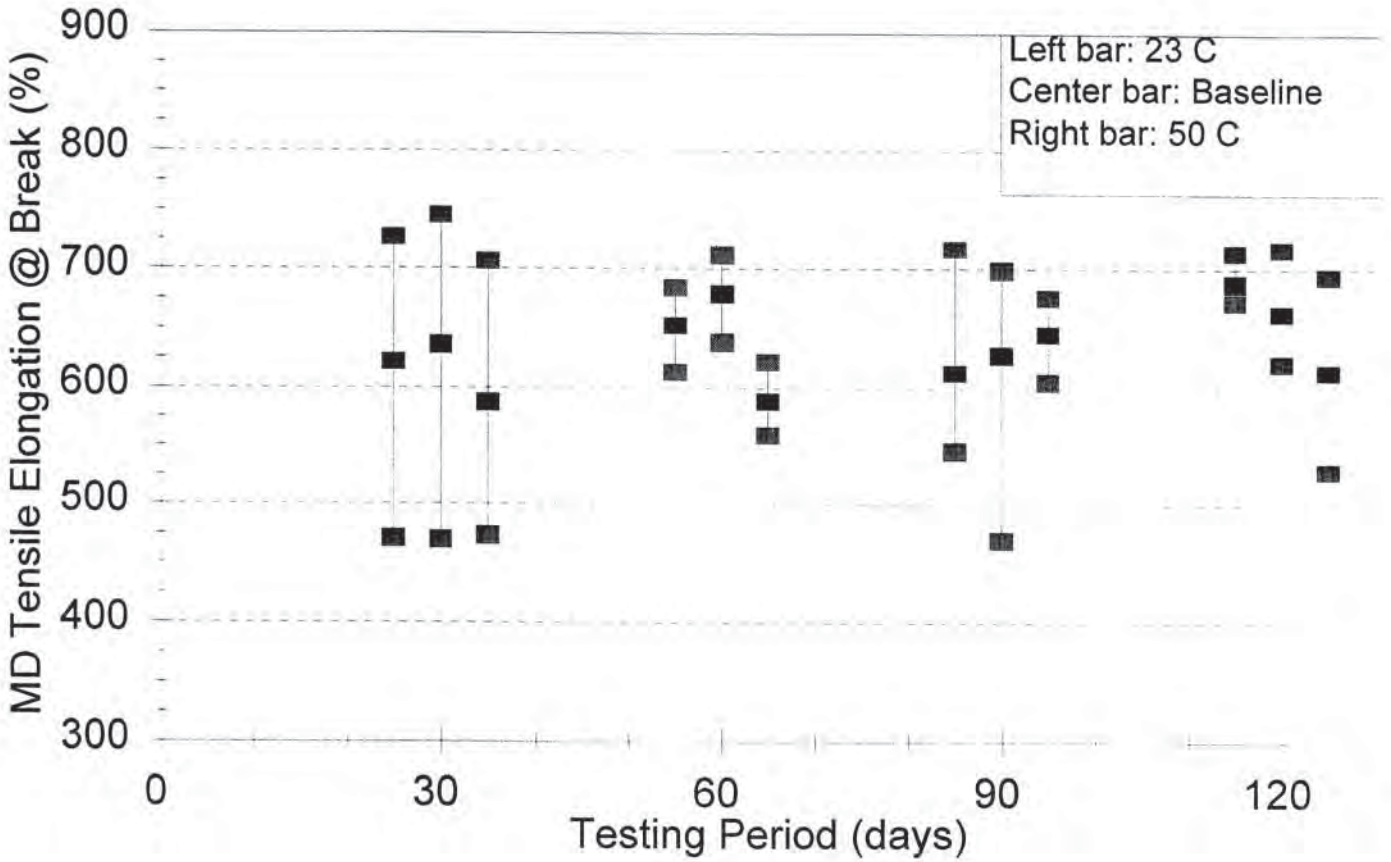
40 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

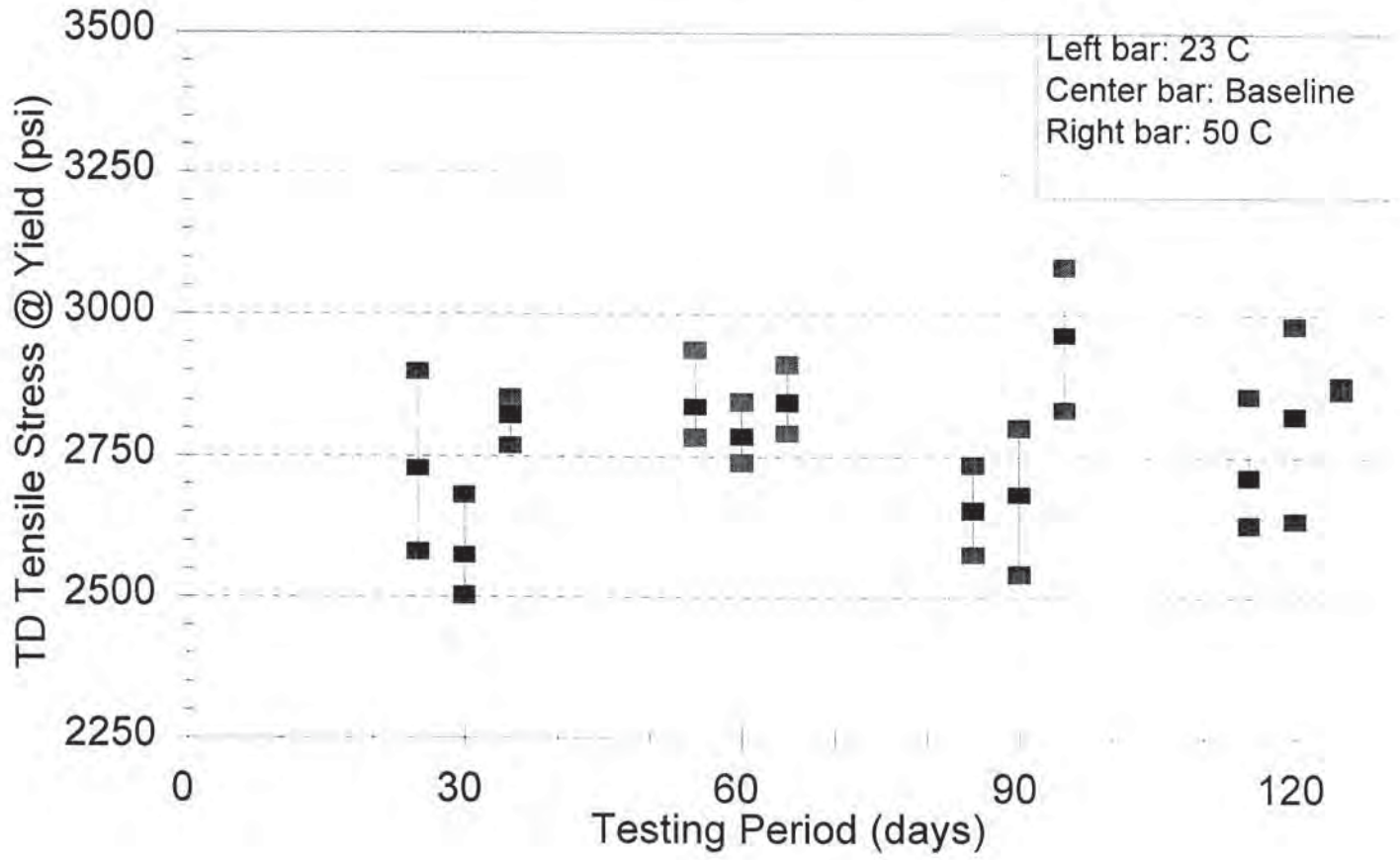
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

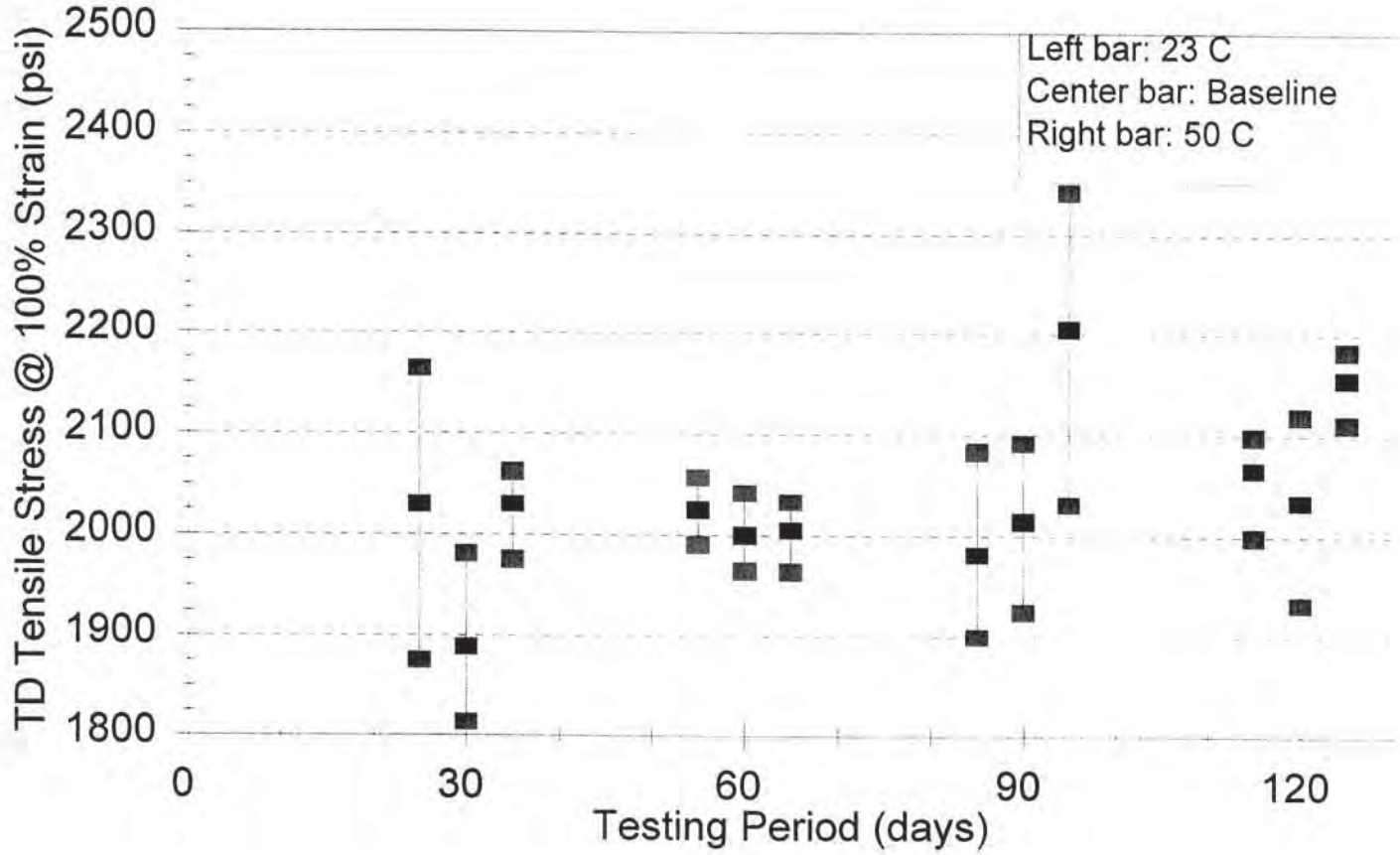
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

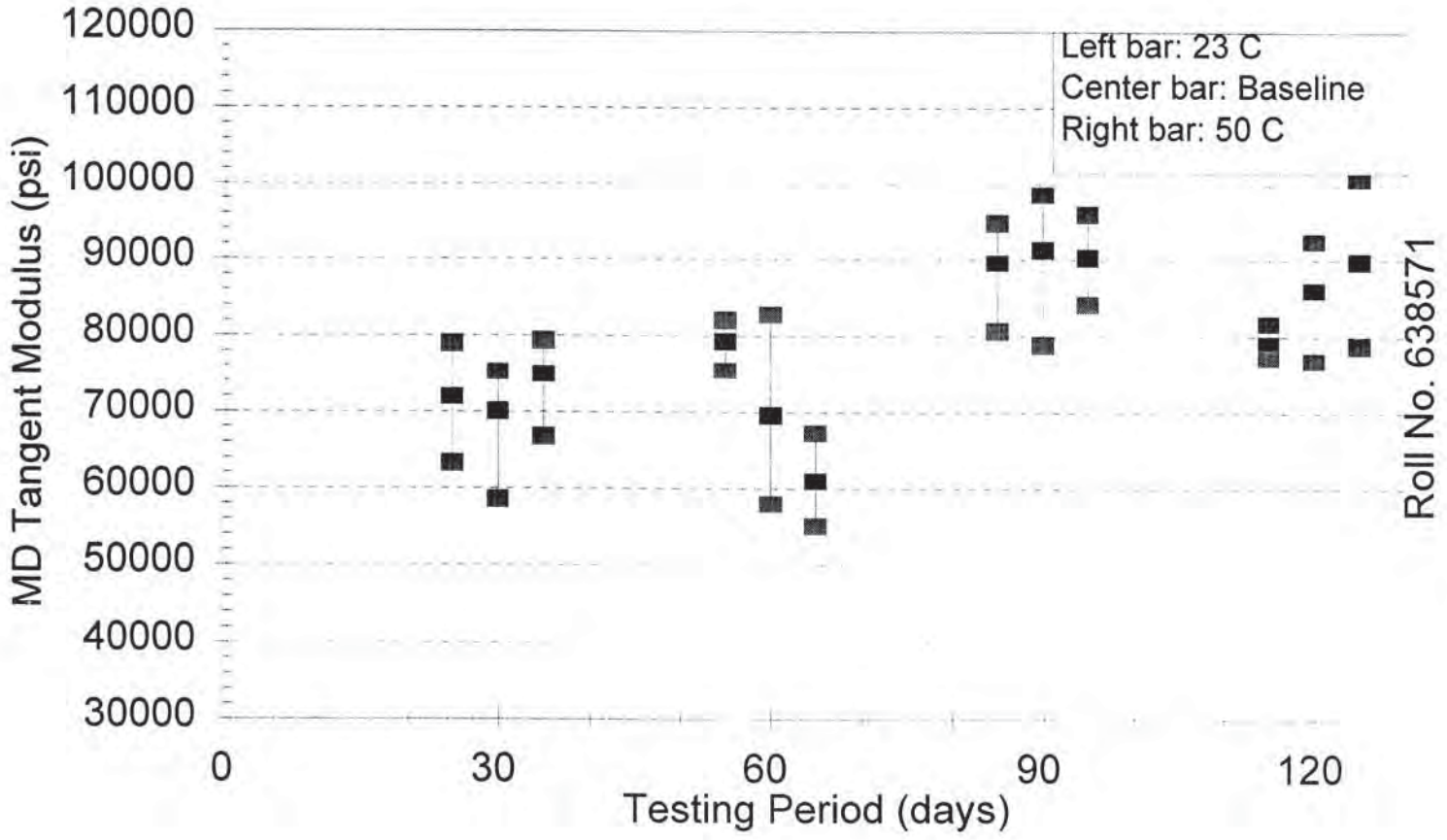
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

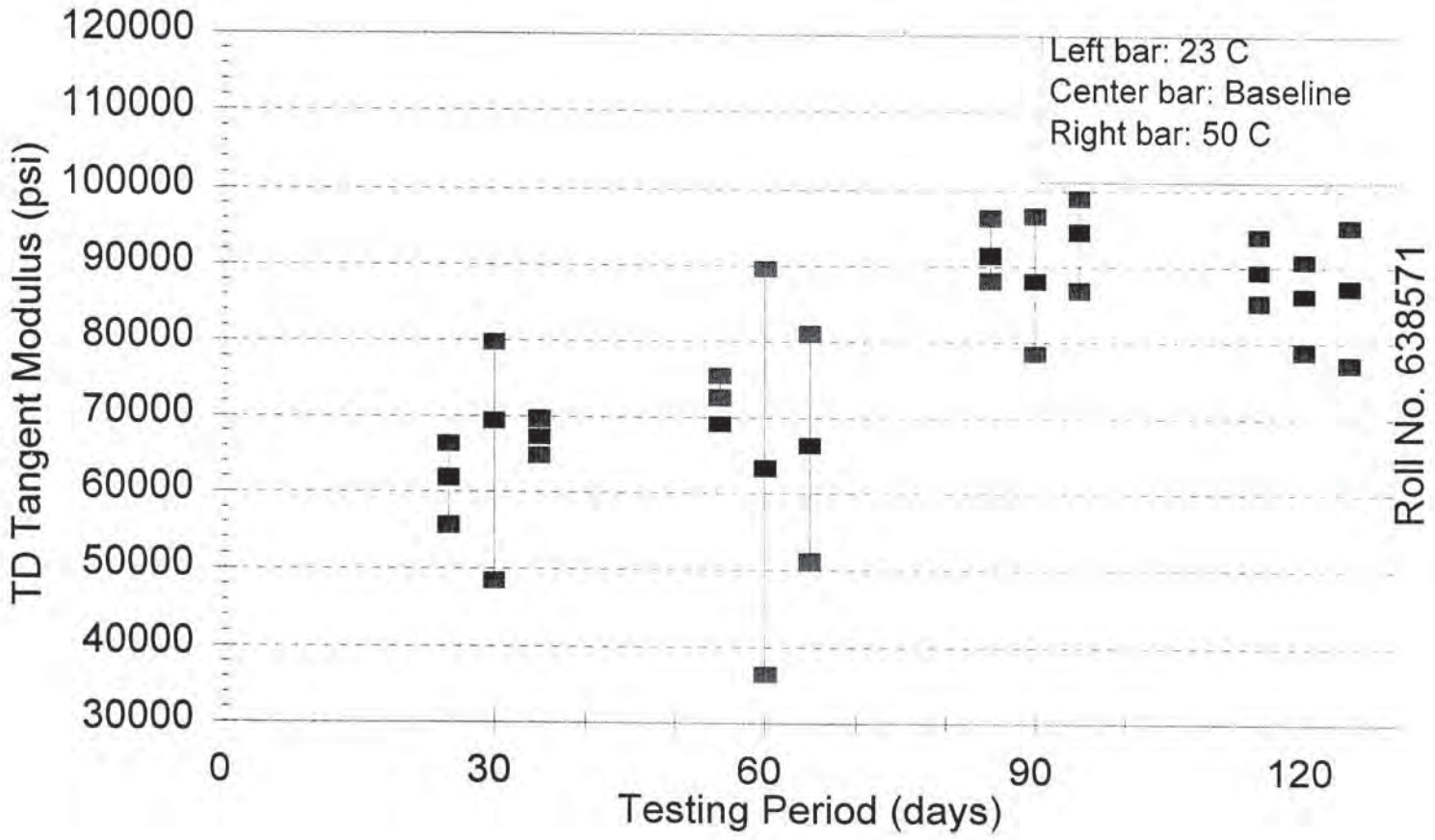
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

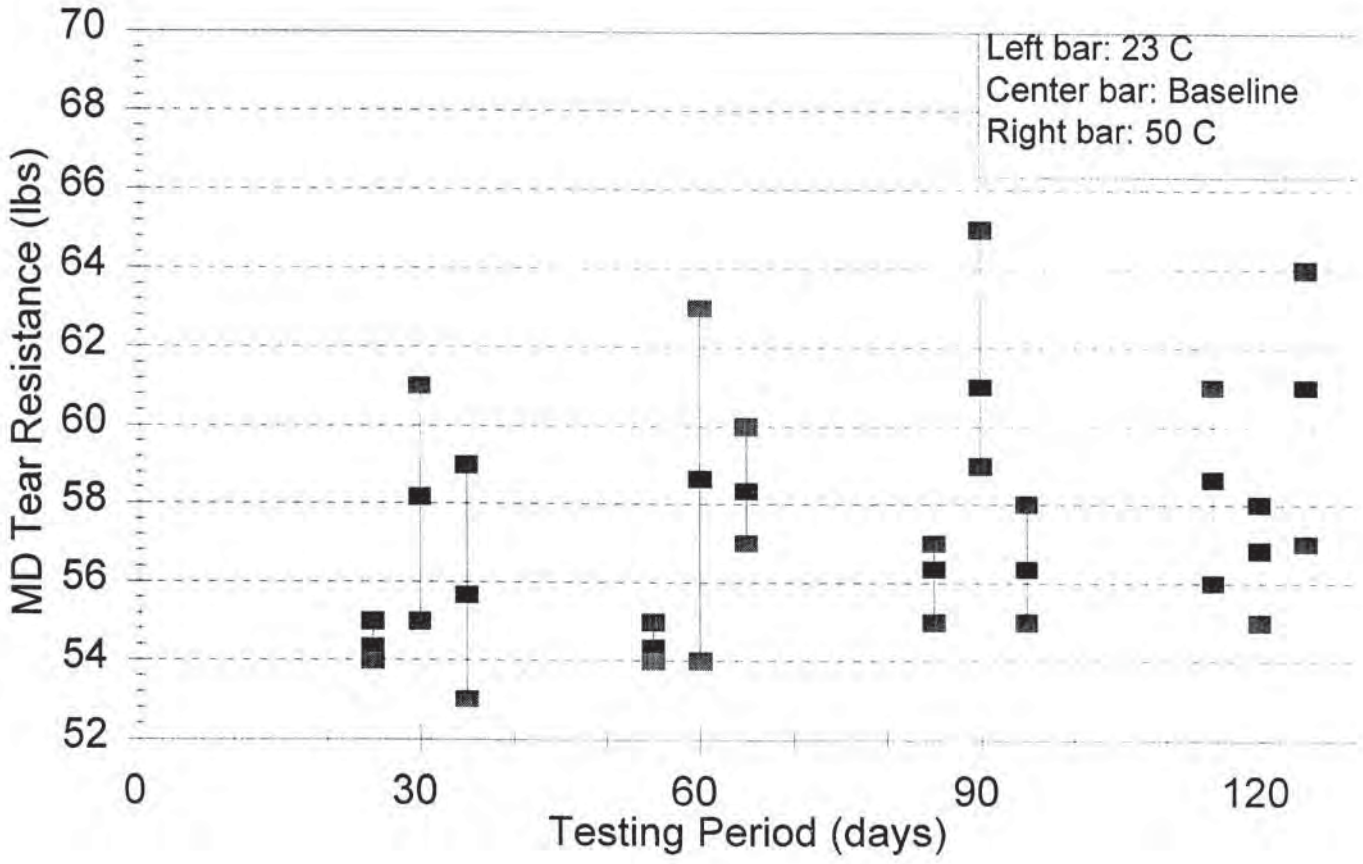
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

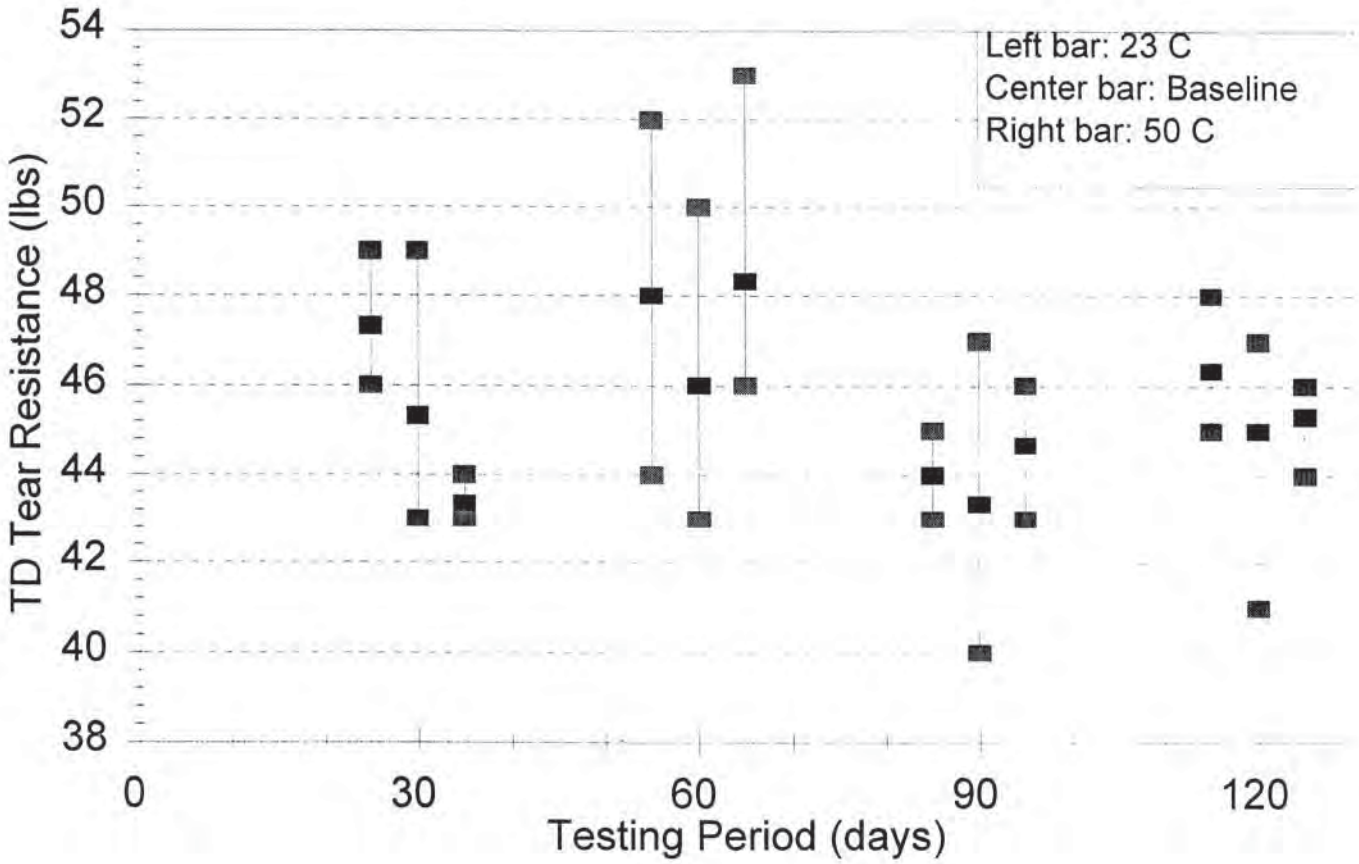
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

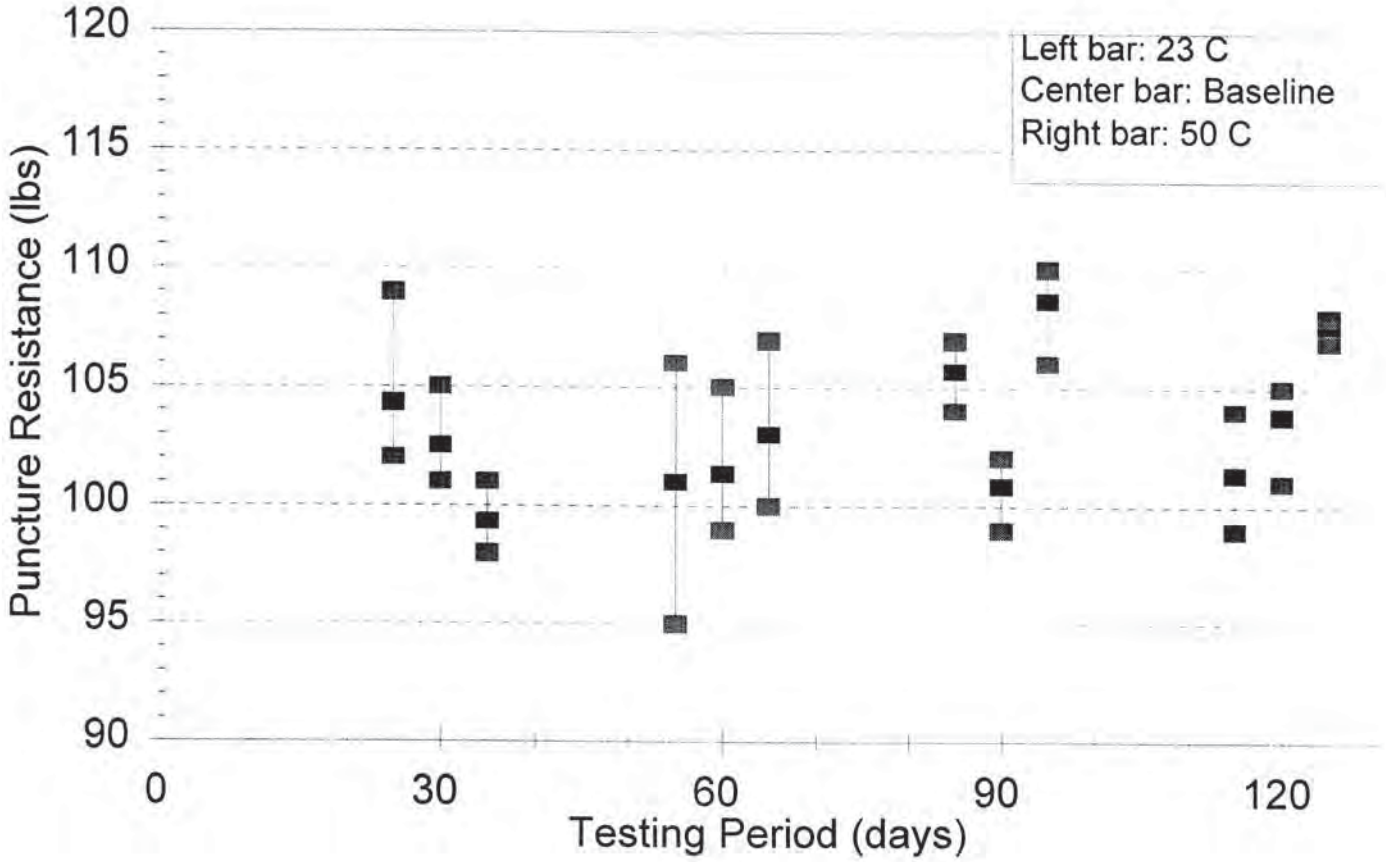
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

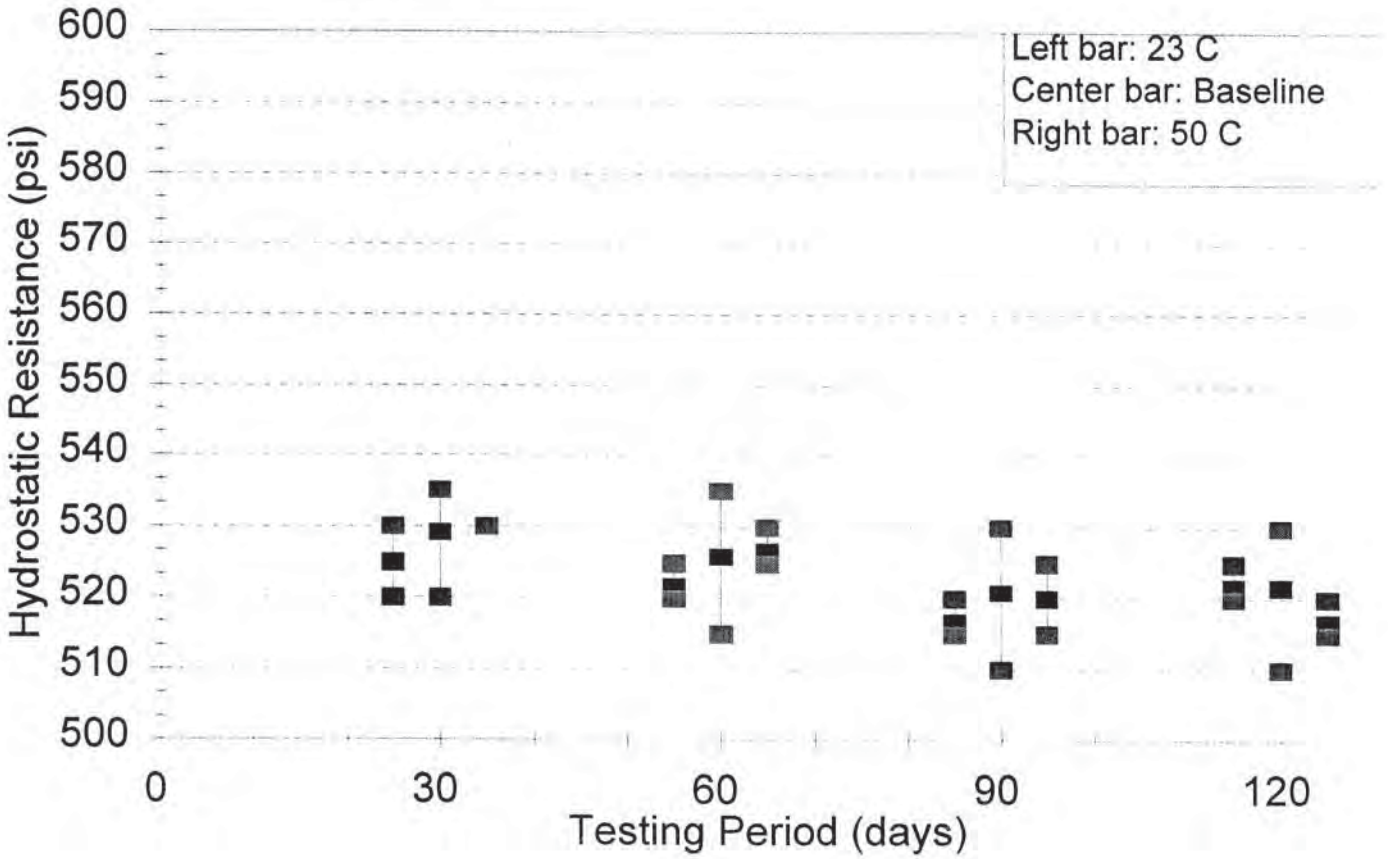
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

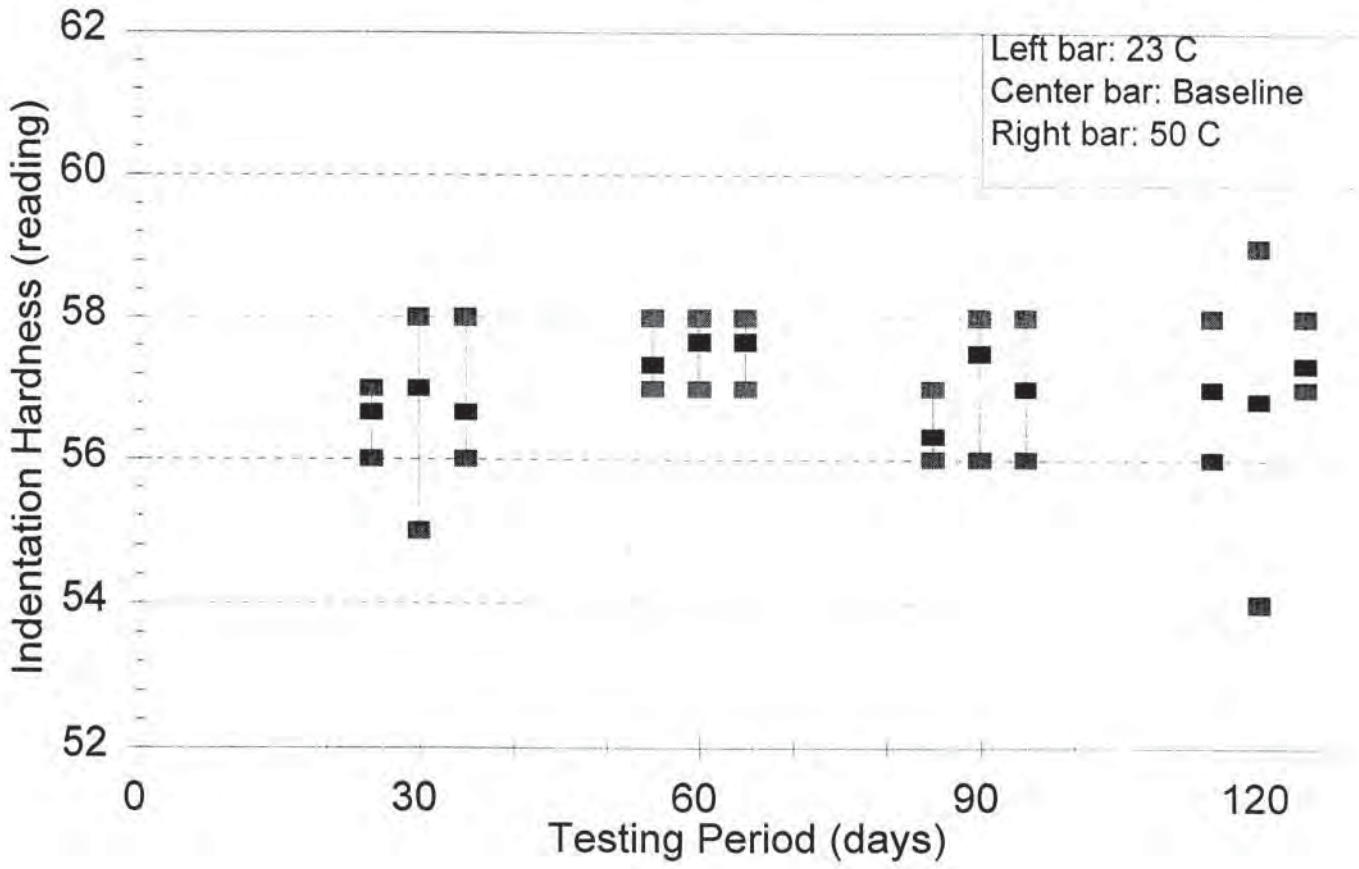
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

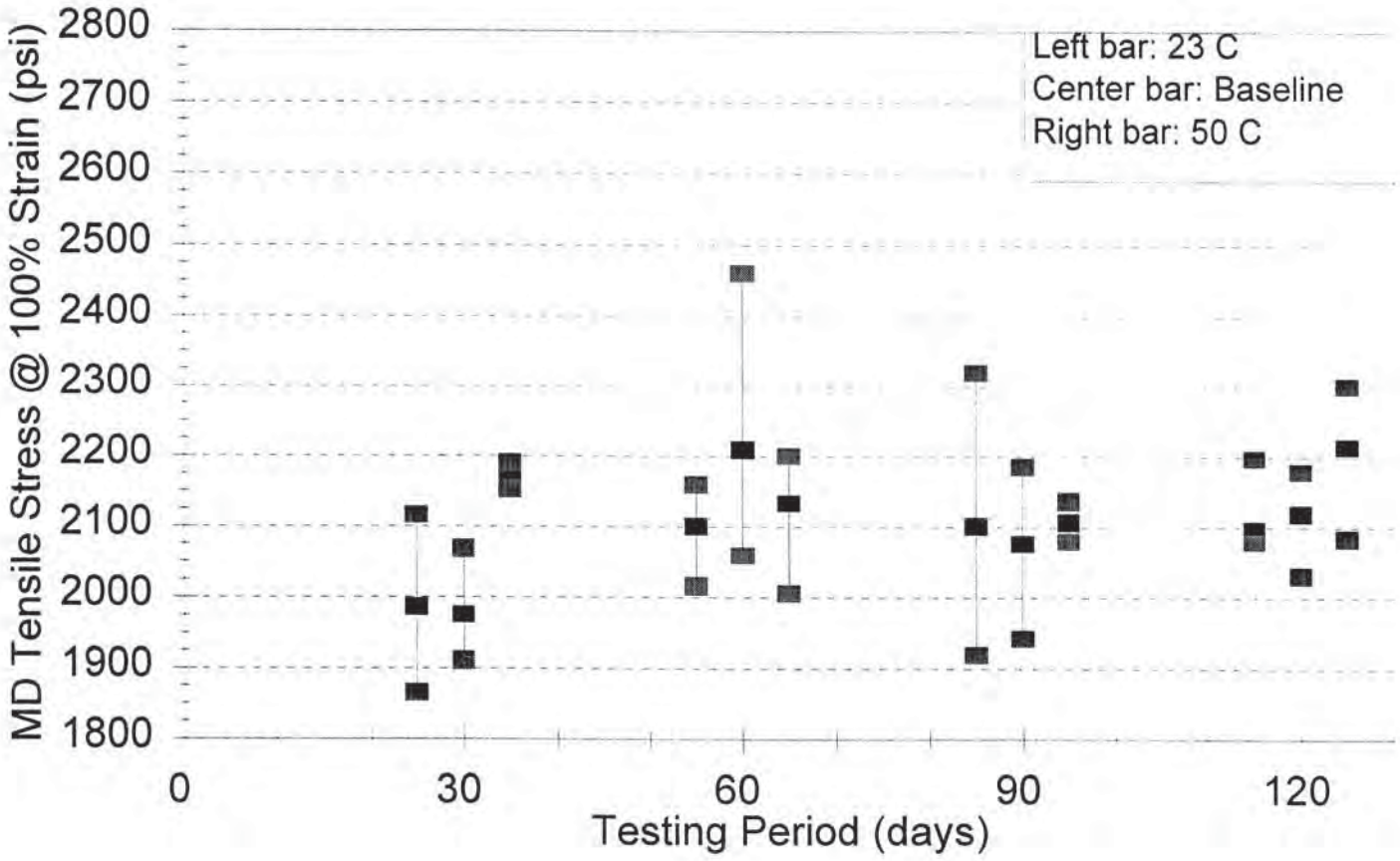
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

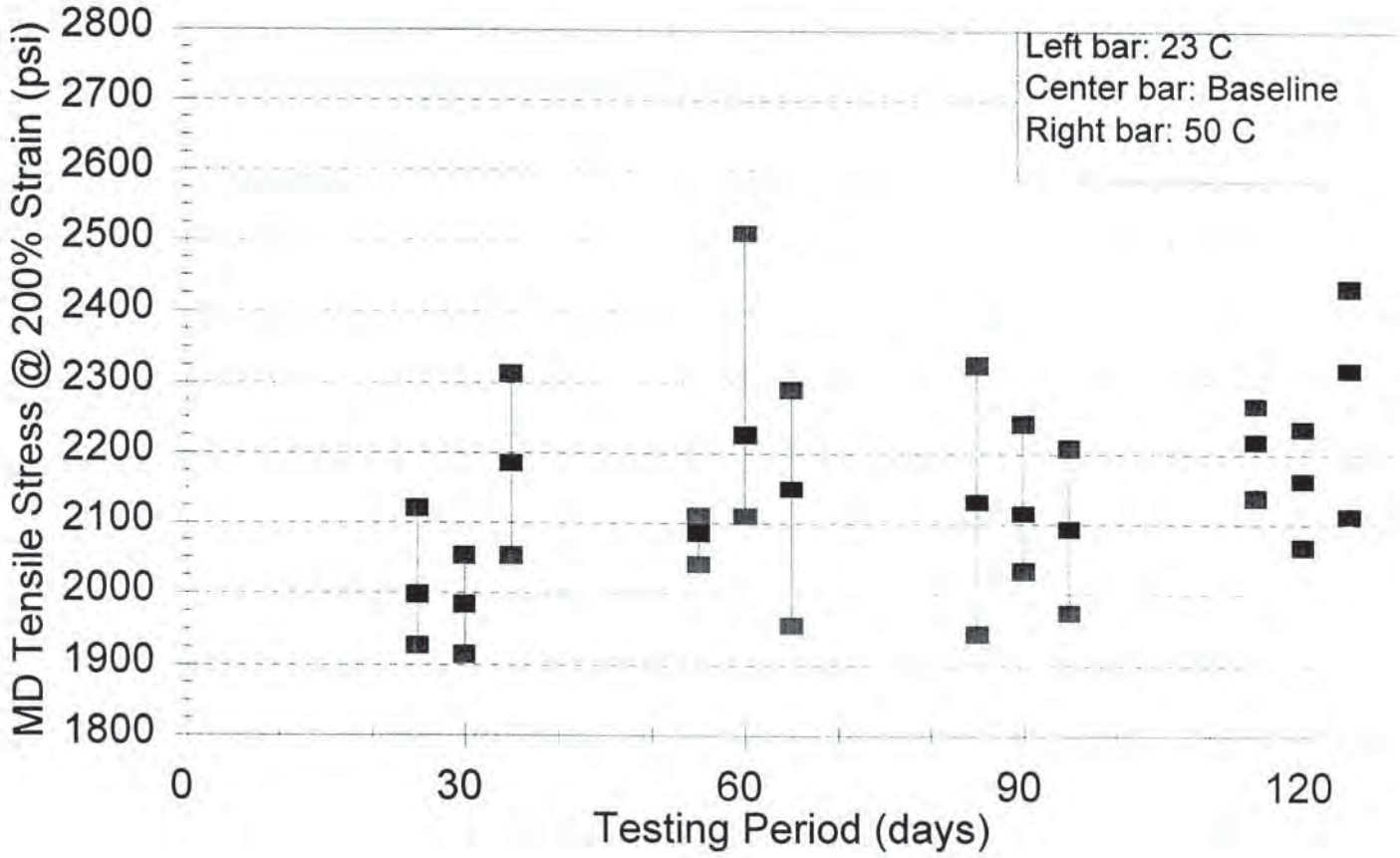
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

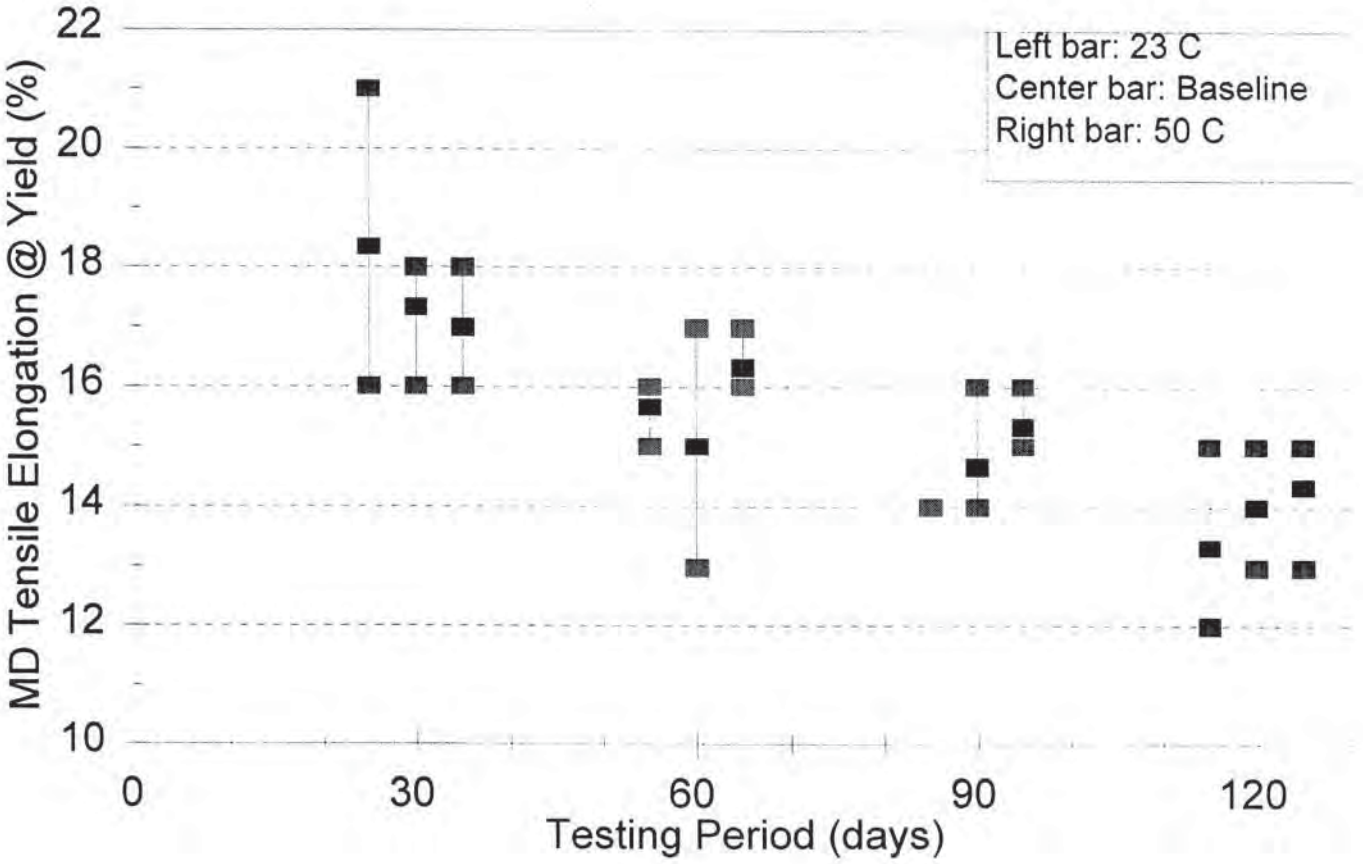
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

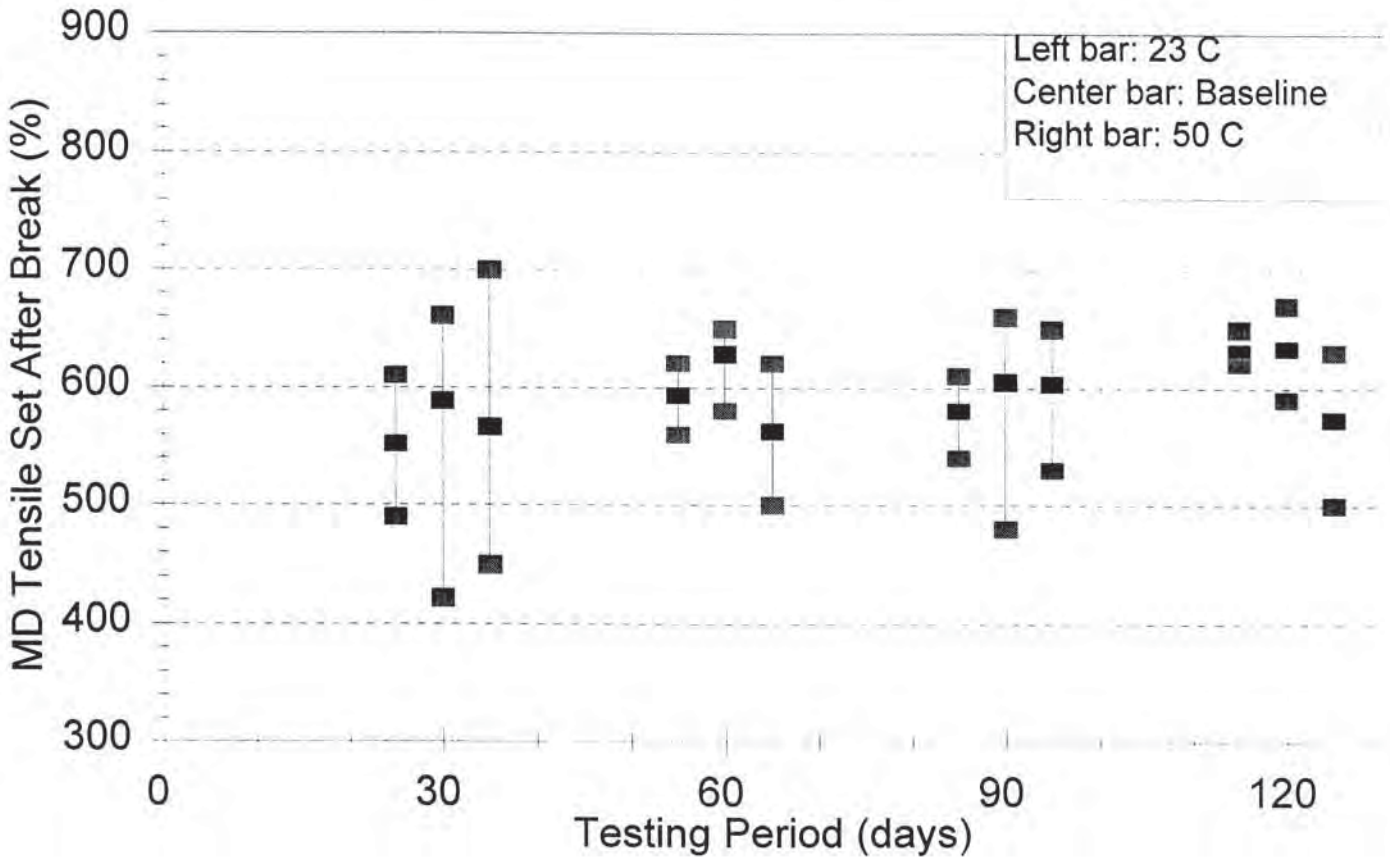
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

60 mil THDPE GM vs MSW Leachate



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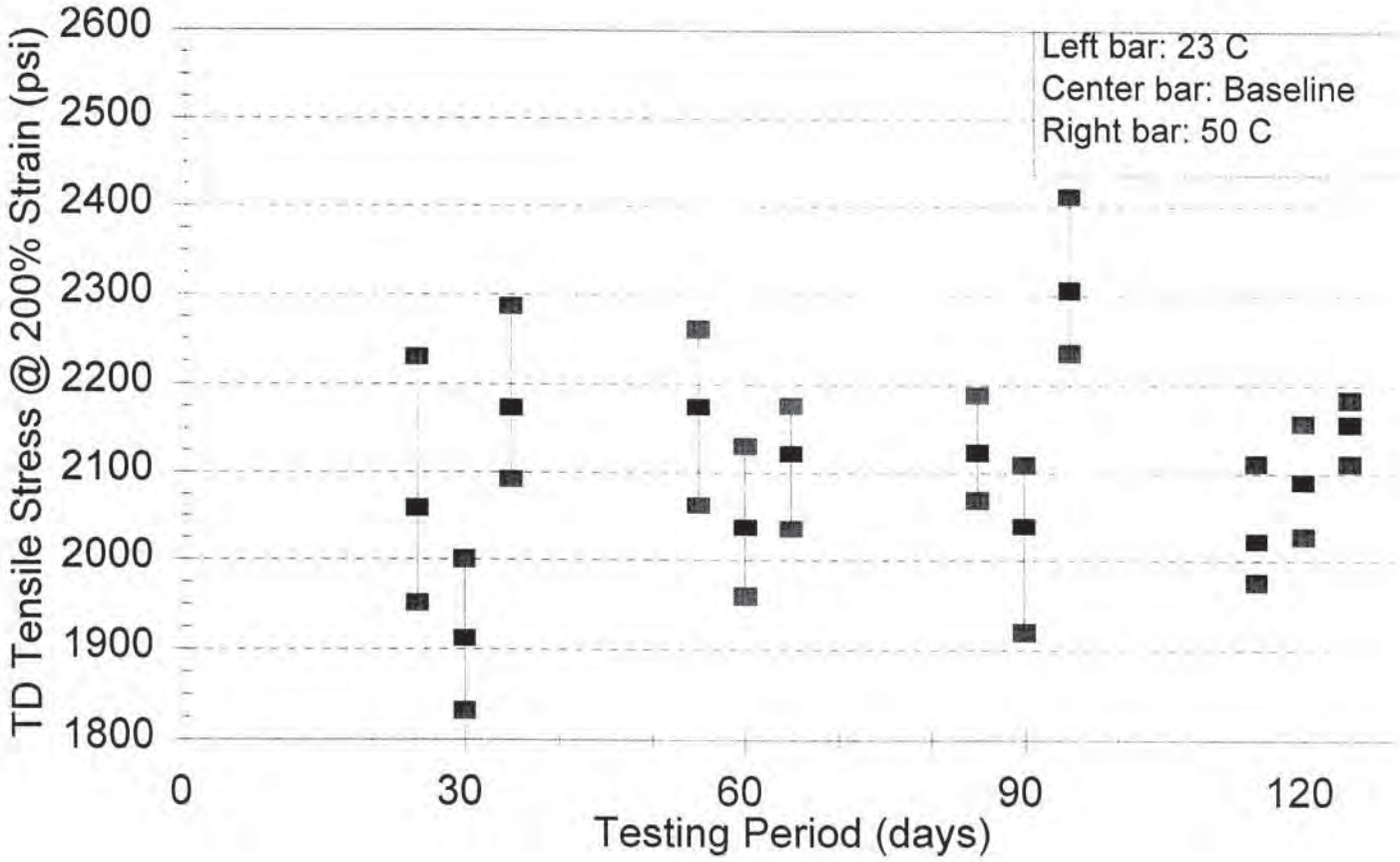
SOLMAX EPA METHOD 9090A

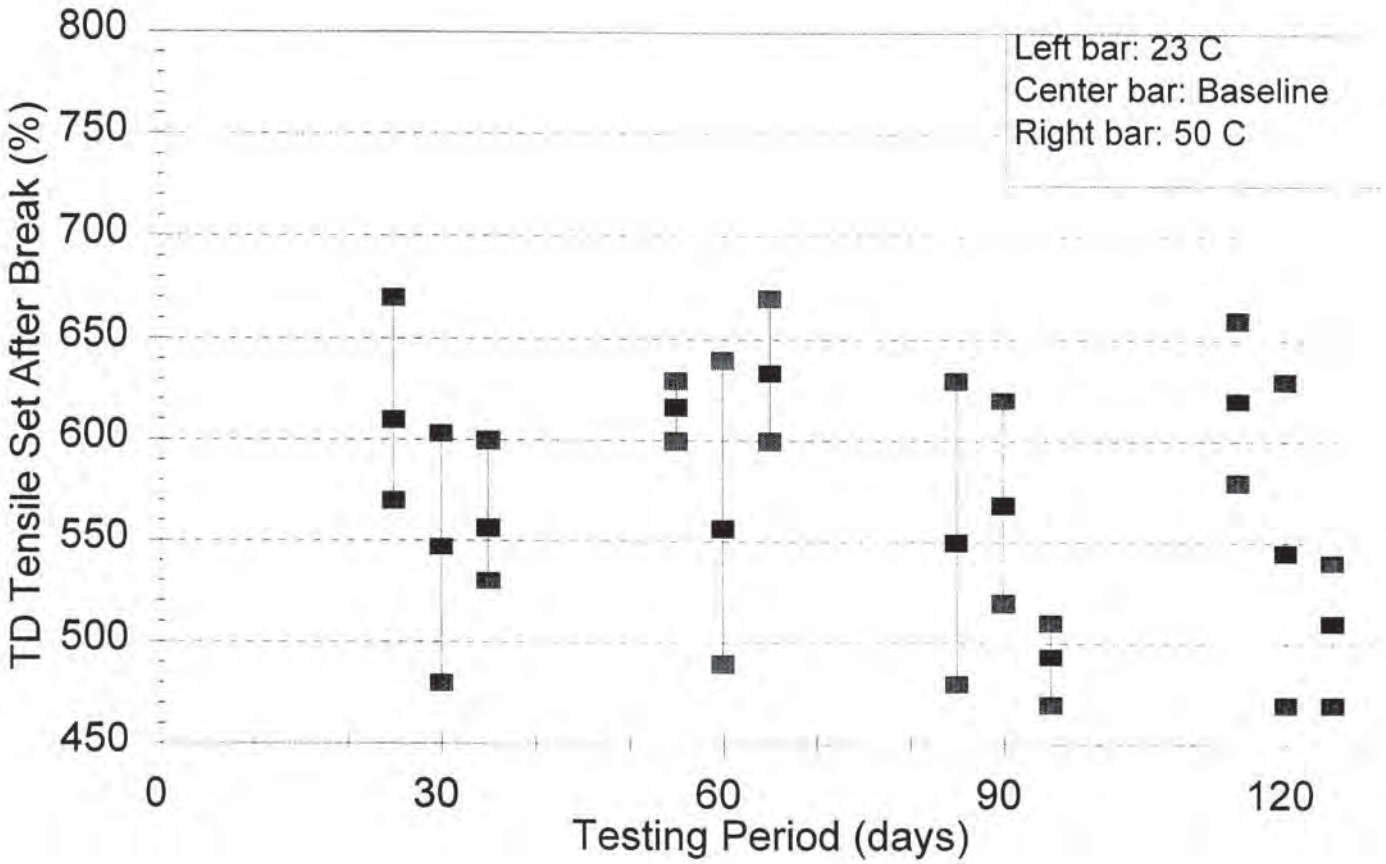
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

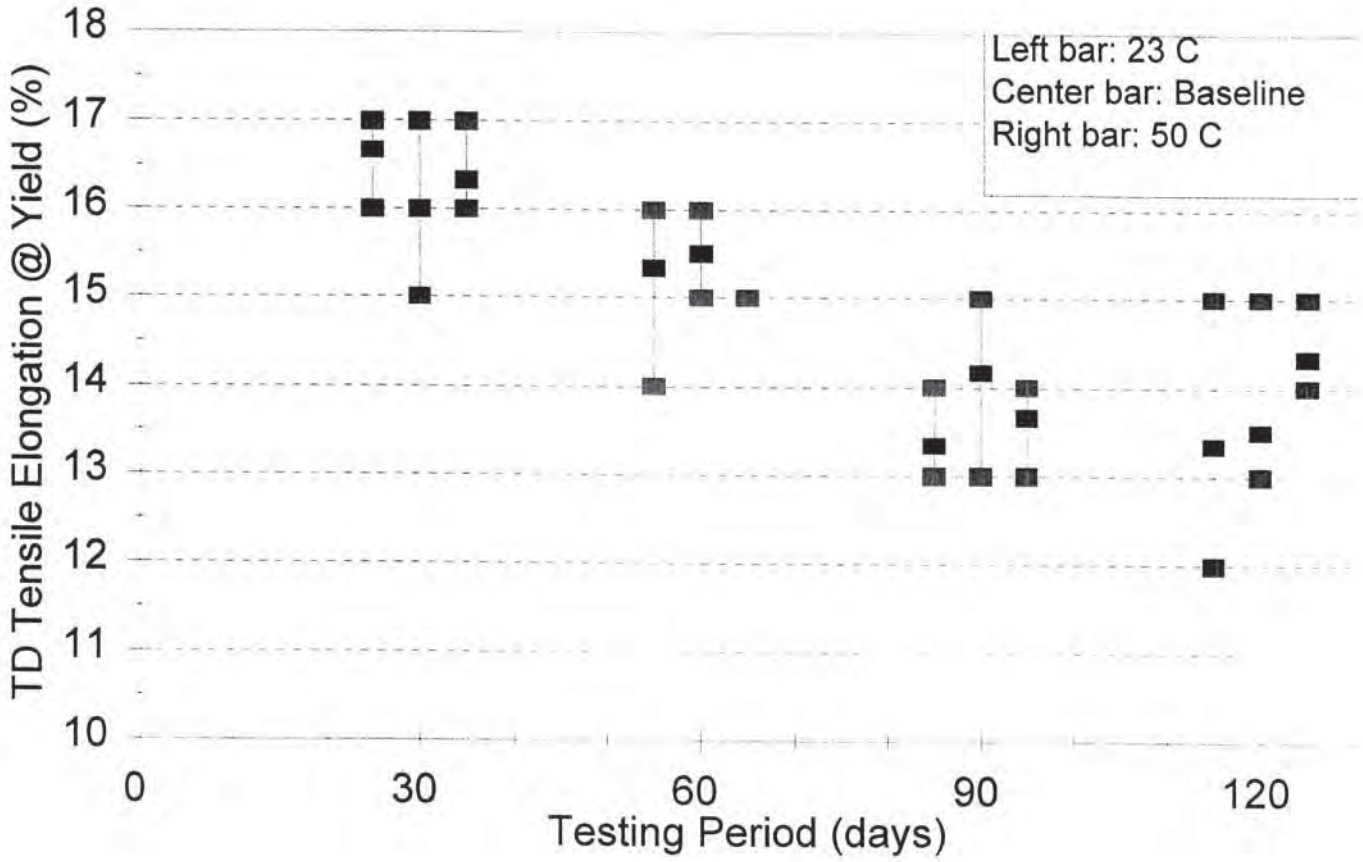
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

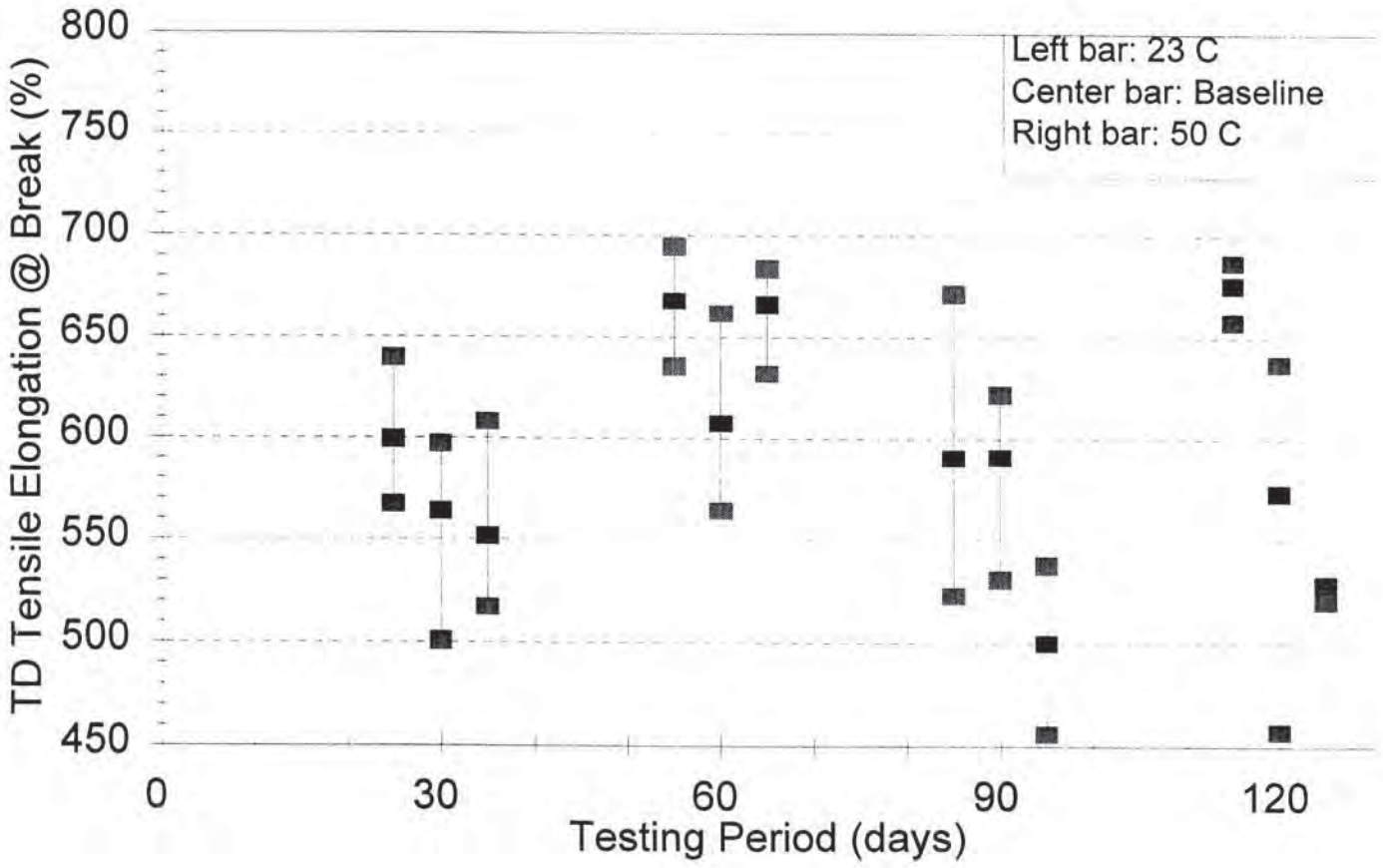
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

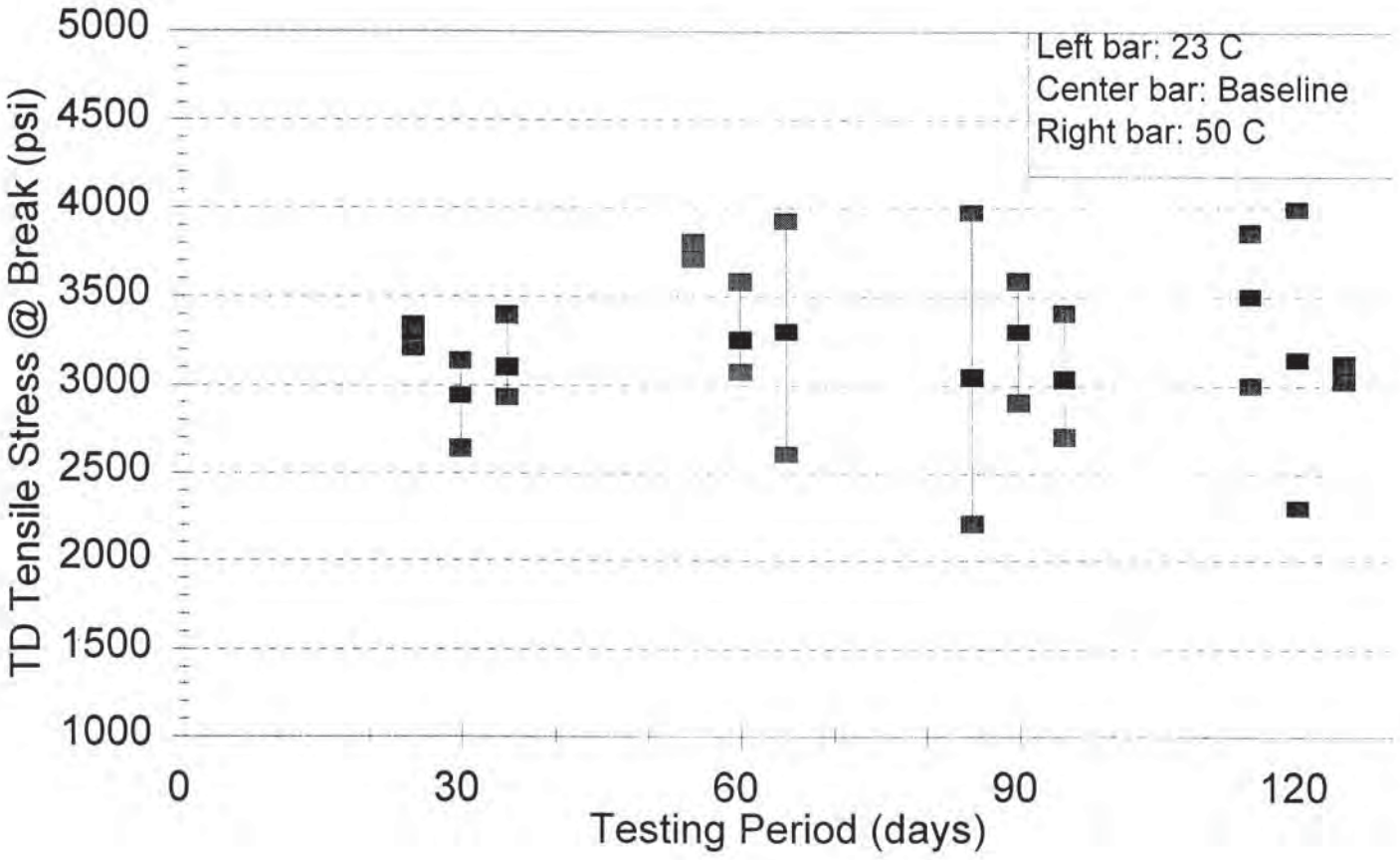
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

A Final Report:

Laboratory Testing of LLDPE Geomembrane for Waste Containment EPA Method 9090A

August 1998

Submitted to:
Solmax International
2801 Marie-Victorin
Varennes, Quebec
Canada J3X 1P7

Attn: **Mr. Stephan Henes**

Submitted by:

TRI/Environmental, Inc.
9063 Bee Caves Rd.
Austin, Texas 78733

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

August 17, 1998

Mr. Stephan Henes
Solmax International
2801 Marie-Victorin
Varennes, Quebec
Canada J3X 1P7

Dear Mr. Henes:

TRI/Environmental, Inc. (TRI) is pleased to present this Final Report for a LLDPE geomembrane chemical compatibility study via EPA Method 9090A.

TRI thanks Solmax International for the opportunity to participate in this project. Please call me if you have any questions or require any additional information.

Respectfully submitted,

Sam R. Allen (09.04.98)

Sam R. Allen
Vice President and Division Manager
Geosynthetics Services

9063 Bee Caves Road • Austin, TX 78733-6201 • (512) 263-2101 • FAX (512) 263-2558

FOREWORD

The testing reported herein is based upon accepted industry practice as well as the test method listed. TRI/Environmental Inc. (TRI) neither accepts responsibility for nor makes claim as to the final use and purpose of the materials tested.

Tests were performed under laboratory conditions and not under actual usage conditions. TRI can give no conclusions as to the serviceability, life expectancy or general durability of the products tested when used in a lining and/or leachate collection system.

1.0 INTRODUCTION

This report describes the work performed by TRI/Environmental, Inc. (TRI) to determine the chemical compatibility of a single liner product with one waste leachate. The product selected for testing was a linear low density polyethylene (LLDPE) geomembrane. The objective was to determine the resistance of the geomembrane to changes caused by exposure to leachate. Changes in physical and mechanical properties were measured after exposure to the leachate at 23°C and 50°C for 30, 60, 90 and 120 days following the exposure regime specified in United States Environmental Protection Agency (EPA) Method 9090A.

Methods, results and discussion are provided in the sections which follow. Test results are provided in the Tables of Results which accompany this report.

2.0 METHODS

2.1 Materials

The material received for this study was received and tested under TRI Log number E2068-94-05. Table 1 describes the product selected for evaluation in this chemical compatibility study.

Table 1. List of geomembranes evaluated in chemical compatibility study

Geosynthetic	Source
60 mil textured LLDPE geomembrane, roll #3299	Solmax

2.2 Leachate

The waste leachate used was stock municipal waste leachate maintained at TRI laboratories in Austin. The leachate was characterized as follows.

Table 2. Characterization of leachate used in chemical compatibility study

Parameter (units)	Level
Biological oxygen demand (mg/L)	2,130
Chemical Oxygen Demand (mg/L)	6,180
Conductivity (umhos/cm)	41,700
N-Ammonia (mg/L)	3,000
pH (units)	8.6

Table 2. Characterization of leachate used in chemical compatibility study	
Parameter (units)	**Level**
Volatile Acids (mg/L)	10,000

2.3 Exposure Conditions

Geomembrane coupons were exposed to the waste leachate following the specifications of EPA Method 9090A as they relate to exposure to waste fluids. The tanks used for these exposures were maintained at 23 $\pm$2°C and 50 $\pm$ 2°C throughout the 120-day exposure period. Tanks were constructed from glass, fitted with stirrers and heated with a circulating hot water heat exchanger system. The 50°C tanks were sealed with a lid, and a reflux condenser was installed to minimize loss of volatile leachate components.

2.4 Testing Procedures

The following table lists tests performed on the HDPE geomembrane product. The number of test replicates was doubled for baseline determinations on unexposed material.

Table 3. Tests performed on HDPE geomembrane		
Test or Physical Property	**Method**	**Number of replicate specimens**
Dimensions and weight	EPA 9090A	3
Hardness	ASTM D 2240 D scale	5
Volatiles and Extractables	EPA SW 870, Appendix III	2
Specific Gravity	ASTM D 792	2
Tensile Properties	ASTM D 638	5
Modulus of Elasticity	ASTM D 882	5
Hydrostatic Resistance	ASTM D 751 Method A	5
Tear Strength	ASTM D 1004	5
Puncture Resistance	FTMS 101C Method 2065	2

Note that tensile properties were determined in accordance with ASTM D638 procedures as modified by National Sanitation Foundation (NSF) Standard 54 - 93, which gives specific methods for testing HDPE geomembranes. The tensile tests were performed on a screw-type tensile testing machine. The Type IV die was used. Load measurement were made by a strain-gage bridge load cell with calibration certified by an outside standards service. Elongation was determined by crosshead movement as recorded by Series IX Instron data acquisition software. The rate of grip separation was 2 inches per minute. Gauge length ratios of 1.3 inches for yield values, and 2.5 inches for break values were used to calculate elongation from grip movement. The parameters reported for ASTM D638 testing included: tensile stress at yield, tensile strength at break, elongation at yield and elongation at break.

3.0 RESULTS AND DISCUSSION

Test results are presented in the Tables of Test Results (raw data) and graphical presentations are presented in Appendix A.

In considering these results, it must be determined through engineering judgment whether observed differences in the value of test results measured before and after immersion are due to product variability, unidentified factors relating to the test procedure, or leachate interaction with the products. Any significant chemical interaction with leachate would be expected to result in degradation trends which are consistent across the various properties being evaluated, and not isolated to one set of test results only. However, with each type of material there may be specific properties which are highly sensitive to leachate-induced effects. These factors must be considered in evaluating the various test results for a given product.

Also of critical importance is the issue of product variability. With geomembranes, a range of physical and mechanical index test values covering 15% or more of the average is not uncommon. This can be traced to variability inherent in the product, and the randomness associated with the onset of failure under the specified testing conditions. However, in chemical compatibility testing the statistical sampling of a broad range of manufactured product is not possible. Therefore, the small size of the sample population tested at each time point must be taken into consideration. The criteria to be applied in evaluating data measured before and after leachate immersion should be that property changes, if observed, are consistent and so great that product variability and experimental factors can be ruled out.

In this report, standard deviations (STD) are reported for most measurements involving three or more replicate specimens. In statistics, the standard deviation is defined as root of the mean squared deviations of individual test results about the mean value. The standard deviation is a quantitative measure of variability within a group of measurements.

One related measure of variability observed within a sample set, relative to the magnitude of the mean value itself, is the *coefficient of variation or variance* (COV). The coefficient of variance is defined as the standard deviation divided by the mean associated with a group of specimens, and may be expressed as a percentage. The COV provides an indication of what proportion of the mean value may be attributable to random experimental factors or product variability. It is useful to consider apparent changes in property values against the criterion of COV since observed changes which fall below the COV may not be significant. This approach was used in preparing the tables below.

The term *range* refers to the difference between the extreme highest and lowest points within a group of measured values. Considering range as a percentage of the mean values provides another measure of variability within a dataset.

In the table below, the high and low extremes for percentage change in mean values are listed for comparison against COV and range as a percentage of mean from the baseline sample group. The high and low percentage changes are the extremes from data measured at 30, 60, 90 and 120 days.

Table 4. Baseline COV and Range of Percent Change Results

Test	Baseline COV (%)	Baseline Range as % of Mean	High Observed % Change	Low Observed % Change
Stress at yield (MD)	7	21	+7	-4
Stress at break (MD)	6	15	+9	-15
Elongation at yield (MD)	2	4	+12	-3
Elongation at break (MD)	4	11	+2	-4
Modulus (MD)	12	35	+8	-11
Tear strength (MD)	3	7	+13	-4
Puncture Resistance	3	9	+2	-7
Hydrostatic resistance	1	3	+1	-3

4.0 CONCLUSION

While changes in certain measured mechanical properties were noted, they were not observed to be consistent throughout the exposure period. The effects of product variability and experimental factors could not be ruled out as causes for observed changes. The data, considered together, do not support the conclusion that observed changes were caused by the test exposures.

TRI/Environmental, Inc. is pleased to have been selected to participate in this project. We trust that the information provided in this report meets your requirements for technical documentation of this chemical compatibility study. Please do not hesitate to call if we can provide any further information (1-800-880-8378).

Respectfully submitted,

Sam R. Allen (09-04-98)

Sam R. Allen
Vice President and Division Manager
Geosynthetics Services

EPA METHOD 9090A TEST RESULTS

TRI LOG #: E2068-94-05

GEOSYNTHETIC DIMENSIONS - LLDPE

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Exposed to MSW Leachate

Report Date: August 17, 1998

Exposure Time and Temperature

Test Parameters	Temp.	30 Day Baseline	30 Day Exposed	30 Day % Change	60 Day Baseline	60 Day Exposed	60 Day % Change	90 Day Baseline	90 Day Exposed	90 Day % Change	120 Day Baseline	120 Day Exposed	120 Day % Change
GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299													
Thickness (mils)	23C	64	64	0.0	68	67	-1.5	65	65	0.0	70	70	0.0
	50C	68	68	0.0	66	65	-1.5	68	68	0.0	65	64	-1.5
Length (inches)	23C	9.98	9.99	0.1	9.97	9.97	0.0	9.96	9.97	0.1	9.98	9.98	0.0
	50C	9.98	9.99	0.1	9.94	9.95	0.1	10.00	10.00	0.0	10.00	9.99	-0.1
Width (inches)	23C	7.99	8.00	0.1	7.99	8.00	0.1	8.00	8.00	0.0	7.99	7.98	-0.1
	50C	7.99	7.99	0.0	8.00	8.00	0.0	8.00	8.00	0.0	8.00	8.00	0.0
Mass (g)	23C	87.93	87.90	-0.0	84.84	84.91	0.1	86.04	86.72	0.8	87.80	88.49	0.8
	50C	85.46	85.50	0.0	84.75	84.86	0.1	86.32	87.13	0.9	86.39	86.94	0.6

SJZ 09.04.98
Quality Review/Date

Client: SOLMAX, File: 609-dim.wb1

EPA METHOD 9090A TEST RESULTS

TRI LOG #: E2068-94-05

60 MIL TEXTURED LLDPE GEOMEMBRANE

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Exposed to MSW Leachate

August 17, 1998

Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Tensile Properties:	1716	1531	1742	1679	1582	1667	1587	1614	1694	1583	1699	1662
Tensile Stress @ Yield (psi)	1977	1753	1601	1537	1617	1643	1684	1627	1637	1627	1723	1672
ASTM D638	1815	1726	1687	1623	1492	1623	1682	1688	1688	1566	1716	1676
Machine Direction	1636			1563			1663			1549		
	1610			1513			1572			1654		
	1704			1673			1472			1636		
Average	1743	1670	1677	1598	1564	1644	1610	1643	1673	1603	1713	1670
STD	123	99	58	65	53	18	76	32	26	39	10	6
Coefficient of Variation	7	6	3	4	3	1	5	2	2	2	1	0
% Change		-4	-4		-2	3		2	4		7	4
Tensile Properties:	3878	3326	3854	4033	3703	3464	3811	3138	3564	3288	4320	3706
Tensile Strength @ Break (psi)	3943	3680	2998	3677	3637	3026	3819	3698	3696	3822	3786	3939
ASTM D638	3862	3648	4068	3466	3203	2938	3700	3909	3608	3321	3674	4087
Machine Direction	3548			3726			3668			4029		
	3373			3392			3521			3392		
	3902			3817			3512			3848		
Average	3751	3551	3640	3685	3514	3143	3672	3582	3623	3617	3927	3911
STD	213	160	462	214	222	230	123	325	55	292	282	157
Coefficient of Variation	6	5	13	6	6	7	3	9	2	8	7	4
% Change		-5	-3		-5	-15		-2	-1		9	8
Tensile Properties:	22	23	24	21	22	21	21	20	22	16	19	20
Elongation @ Yield (%)	22	24	24	23	21	23	20	21	22	19	18	21
ASTM D638	23	21	23	22	22	23	19	19	22	21	20	22
Machine Direction	23			22			21			19		
	23			21			22			17		
	23			21			21			20		
Average	23	23	24	22	22	22	21	20	22	19	19	21
STD	0	1	0	1	0	1	1	1	0	2	1	1
Coefficient of Variation	2	6	2	3	2	4	5	4	0	9	4	4
% Change		0	4		0	3		-3	6		2	12

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Test Parameters	Baseline	30 Day 23C	30 Day 50C	Baseline	60 Day 23C	60 Day 50C	Baseline	90 Day 23C	90 Day 50C	Baseline	120 Day 23C	120 Day 50C
GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Tensile Properties:	735	698	728	740	699	651	710	668	669	720	769	665
Elongation @ Break (%)	656	679	612	742	684	705	678	684	709	708	662	699
ASTM D638	686	689	784	647	660	706	669	695	666	637	648	718
Machine Direction	700			750			681			747		
	661			672			684			622		
	724			713			699			707		
Average	694	689	708	711	681	687	687	682	681	690	693	694
STD	29	8	72	39	16	26	14	11	20	45	54	22
Coefficient of Variation	4	1	10	5	2	4	2	2	3	7	8	3
% Change		-1	2		-4	-3		-1	-1		0	1
Tensile Properties:	600	700	490	650	600	550	540	470	540	530	580	520
Set after Break (%)	490	560	500	630	570	600	500	520	560	540	530	570
ASTM D638	570	550	550	540	550	600	540	570	530	500	470	560
Machine Direction	580			650			570			570		
	570			560			580			500		
	600			600			520			600		
Average	568	603	513	605	573	583	542	520	543	540	527	550
STD	37	68	26	43	21	24	27	41	12	36	45	22
Coefficient of Variation	7	11	5	7	4	4	5	8	2	7	9	4
% Change		6	-10		-5	-4		-4	0		-2	2
Tensile Properties:	1599	1425	1588	1515	1426	1563	1538	1523	1623	1552	1617	1538
Tensile Stress @ 100% Elongation (psi)	1845	1607	1479	1382	1559	1510	1543	1583	1513	1532	1650	1599
ASTM D638	1654	1589	1551	1465	1402	1478	1627	1624	1600	1477	1633	1538
Machine Direction	1483			1455			1519			1378		
	1496			1382			1475			1622		
	1608			1531			1359			1564		
Average	1614	1540	1539	1455	1462	1517	1510	1577	1579	1521	1633	1558
STD	120	82	45	58	69	35	81	41	47	77	13	29
Coefficient of Variation	7	5	3	4	5	2	5	3	3	5	1	2
% Change		-5	-5		1	4		4	5		7	2
Tensile Properties:	1661	1488	1652	1632	1558	1554	1625	1596	1630	1600	1676	1592
Tensile Stress @ 200% Elongation (psi)	1912	1701	1596	1519	1623	1600	1614	1641	1596	1574	1706	1609
ASTM D638	1704	1666	1614	1557	1431	1586	1645	1675	1652	1541	1706	1619
Machine Direction	1570			1509			1589			1578		
	1590			1454			1579			1578		
	1720			1589			1460			1666		
Average	1693	1618	1621	1543	1537	1580	1585	1637	1626	1590	1696	1607
STD	112	93	23	58	80	19	60	32	23	38	14	11
Coefficient of Variation	7	6	1	4	5	1	4	2	1	2	1	1
% Change		-4	-4		-0	2		3	3		7	1

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GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Tensile Properties:	1575	1769	1711	1372	1612	1687	1638	1562	1692	1658	1733	1677
Tensile Stress @ Yield (psi)	1711	1689	1682	1376	1704	1585	1672	1693	1695	1584	1610	1738
ASTM D638	1732	1675	1688	1609	1551	1584	1688	1647	1563	1666	1704	1664
Transverse Direction	1684			1529			1681			1626		
	1749			1521			1585			1683		
	1630			1545			1676			1665		
Average	1680	1711	1694	1492	1622	1619	1657	1634	1650	1647	1682	1693
STD	61	41	12	88	63	48	36	54	62	33	52	32
Coefficient of Variation	4	2	1	6	4	3	2	3	4	2	3	2
% Change		2	1		9	8		-1	-0		2	3
Tensile Properties:	2849	3600	3467	3269	3409	3417	2297	2756	3310	3240	3747	3308
Tensile Strength @ Break (psi)	3093	3114	3493	2677	3097	1661	3347	3590	3597	3101	3390	3615
ASTM D638	3540	3050	3466	3253	2850	3100	3365	2539	2357	3132	3415	3731
Transverse Direction	3208			3387			2154			3174		
	3560			3161			3026			3118		
	3181			2992			3485			4045		
Average	3239	3255	3475	3123	3119	2726	2946	2962	3088	3302	3517	3551
STD	249	246	12	233	229	764	529	453	530	336	163	178
Coefficient of Variation	8	8	0	7	7	28	18	15	17	10	5	5
% Change		0	7		-0	-13		1	5		7	8
Tensile Properties:	23	23	23	24	20	23	19	23	20	20	19	21
Elongation @ Yield (%)	23	24	24	22	21	22	19	20	19	19	18	22
ASTM D638	23	24	23	21	22	23	20	20	22	20	19	22
Transverse Direction	23			21			19			18		
	24			21			19			20		
	23			21			22			19		
Average	23	24	23	22	21	23	20	21	20	19	19	22
STD	0	0	0	1	1	0	1	1	1	1	0	0
Coefficient of Variation	2	2	2	5	4	2	6	7	6	4	3	2
% Change		2	1		-3	5		7	3		-3	12
Tensile Properties:	607	665	669	684	670	643	587	644	632	612	669	614
Elongation @ Break (%)	593	620	683	607	580	667	614	652	665	717	624	636
ASTM D638	660	600	678	614	644	629	625	580	515	605	633	594
Transverse Direction	626			680			665			697		
	673			625			585			566		
	640			636			639			730		
Average	633	628	677	641	631	646	619	625	604	655	642	615
STD	28	27	6	30	38	16	28	32	64	63	19	17
Coefficient of Variation	4	4	1	5	6	2	5	5	11	10	3	3
% Change		-1	7		-2	1		1	-2		-2	-6

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GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Tensile Properties:	601	550	510	580	570	540	480	540	560	640	550	520
Set after Break (%)	470	500	540	500	480	570	530	520	540	480	450	530
ASTM D638	540	500	580	520	550	520	520	470	420	460	550	480
Transverse Direction	500			580			500			520		
	600			530			470			500		
	590			540			520			530		
Average	550	517	543	542	533	543	503	510	507	522	517	510
STD	51	24	29	30	39	21	22	29	62	58	47	22
Coefficient of Variation	9	5	5	5	7	4	4	6	12	11	9	4
% Change		-6	-1		-2	0		1	1		-1	-2
Tensile Properties:	1483	1671	1565	1308	1488	1539	1502	1527	1526	1522	1656	1566
Tensile Stress @ 100% Elongation (psi)	1612	1555	1563	1231	1609	1447	1607	1653	1565	1477	1547	1566
ASTM D638	1637	1564	1597	1494	1401	1419	1590	1571	1457	1554	1604	1548
Transverse Direction	1561			1477			1515			1603		
	1664			1418			1510			1619		
	1486			1392			1562			1536		
Average	1574	1597	1575	1387	1499	1468	1548	1584	1516	1552	1602	1560
STD	70	53	16	92	85	51	41	52	45	48	45	8
Coefficient of Variation	4	3	1	7	6	3	3	3	3	3	3	1
% Change		1	0		8	6		2	-2		3	1
Tensile Properties:	1475	1696	1660	1457	1559	1557	1565	1632	1631	1632	1713	1650
Tensile Stress @ 200% Elongation (psi)	1658	1607	1636	1337	1642	1497	1655	1648	1675	1534	1610	1648
ASTM D638	1707	1638	1605	1525	1518	1515	1652	1602	1508	1636	1660	1636
Transverse Direction	1594			1470			1596			1663		
	1708			1464			1614			1685		
	1602			1420			1658			1619		
Average	1624	1647	1634	1446	1573	1523	1623	1627	1605	1628	1661	1645
STD	80	37	23	57	52	25	35	19	71	47	42	6
Coefficient of Variation	5	2	1	4	3	2	2	1	4	3	3	0
% Change		1	1		9	5		0	-1		2	1
Modulus of Elasticity:	37122	36561	35758	46904	42624	33524	41961	47255	40423	38936	46237	40267
Tangential (psi)	38193	42626	38545	34519	40227	39892	40727	47428	41311	45310	40892	39000
ASTM D882	33492	42215	45068	41773	43385	43504	43654	41129	42985	45471	42786	39655
Machine Direction	44921			44899			42832			43001		
	38553			42176			41436			45316		
	31910			46819			43760			48176		
Average	37365	40467	39790	42848	42079	38973	42395	45271	41573	44368	43305	39641
STD	4561	3389	4778	4231	1346	4126	1120	2929	1062	2854	2213	517
Coefficient of Variation	12	8	12	10	3	11	3	6	3	6	5	1
% Change		8	6		-2	-9		7	-2		-2	-11

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GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Modulus of Elasticity:	30734	35367	35044	40397	39310	40387	35362	41901	41901	35875	43418	41390
Tangential (psi)	41752	35479	37057	44046	43640	36248	39619	39840	39840	43090	44343	40196
ASTM D882	40528	35600	37499	37524	45699	46022	38806	39649	39649	42530	42081	44505
Transverse Direction	42841			44149			41702			41587		
	44419			41557			45890			37131		
	43232			44826			46589			40946		
Average	40584	35482	36533	42083	42883	40886	41328	40463	40463	40193	43281	42030
STD	5004	117	1309	2567	2663	4006	3948	1020	1020	2720	929	1816
Coefficient of Variation	12	0	4	6	6	10	10	3	3	7	2	4
% Change		-13	-10		2	-3		-2	-2		8	5
Indentation Hardness:	50	51	50	51	50	50	50	50	50	50	50	50
Reading	50	50	51	50	50	50	51	50	51	50	49	49
ASTM D2240	51	49	51	50	51	50	51	50	50	51	50	49
(with TYPE D DUROMETER)	53			51			51			49		
	50			51			51			49		
	51			50			50			51		
Average	51	50	51	51	50	50	51	50	50	50	50	49
STD	1	1	1	1	0	0	0	0	0	1	0	0
Coefficient of Variation	2	2	1	1	1	0	1	0	1	2	1	1
% Change		-2	-0		-0	-1		-1	-1		0	-1
Specific Gravity:	0.927	0.927	0.927	0.926	0.927	0.926	0.927	0.927	0.926	0.927	0.927	0.928
Specific Gravity (grams/cu.cm)	0.927	0.926	0.927	0.926	0.927	0.926	0.927	0.927	0.928	0.926	0.927	0.927
ASTM D792, Method A	0.927	0.927	0.928	0.927	0.926	0.927	0.926	0.926	0.926	0.926	0.926	0.927
	0.927			0.927			0.928			0.927		
	0.928			0.927			0.928			0.928		
	0.927			0.926			0.927			0.927		
Average	0.927	0.927	0.927	0.927	0.927	0.926	0.927	0.927	0.927	0.927	0.927	0.927
STD	0.000	0.001	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.000	0.000
Coefficient of Variation	0.044	0.062	0.062	0.054	0.051	0.051	0.074	0.051	0.102	0.074	0.051	0.051
% Change		-0.05	0.02		0.02	-0.02		-0.05	-0.05		-0.02	0.05
Environmental Stress Crack Resistance:												
ASTM D1693, Condition B												
Machine Direction (% Failed)	N/A	0	0	N/A	0	0	N/A	0	0	N/A	0	0
Transverse Direction (% Failed)	N/A	0	0	N/A	0	0	N/A	0	0	N/A	0	0

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GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Puncture Resistance:	87	88	85	94	90	92	96	102	98	94	100	95
Load @ Rupture (lbs)	81	86	92	91	85	96	101	94	99	96	98	93
FTMS 101C Method 2065	83	83	87	98	85	88	102	95	94	99	96	89
	88			93			108			94		
	89			90			107			95		
	88			93			97			99		
Average	86	86	88	93	87	92	102	97	97	96	98	92
STD	3	2	3	3	2	3	5	4	2	2	2	2
Coefficient of Variation	3	2	3	3	3	4	4	4	2	2	2	3
% Change		-0	2		-7	-1		-5	-5		2	-4
Volatiles and Extractables:	0.00	0.05	-0.05	-0.36	-0.20	-0.18	-0.05	-0.05	-0.05	-0.08	-0.05	-0.08
Diameter Change (%)	-0.13	-0.05	0.00	-0.10	-0.08	-0.25	-0.03	0.00	-0.03	0.00	-0.10	0.00
SW 870 - Appendix III-D	-0.05			-0.25			-0.03			-0.06		
Machine Direction	-0.20			-0.23			-0.03			0.03		
Average	-0.10	0.00	-0.03	-0.24	-0.14	-0.22	-0.04	-0.03	-0.04	-0.03	-0.08	-0.04
STD	0.08	0.05	0.03	0.09	0.06	0.04	0.01	0.03	0.01	0.04	0.02	-100
Volatiles and Extractables:	0.10	0.28	0.20	0.48	0.23	0.43	0.10	0.10	0.08	0.10	0.05	0.15
Diameter Change (%)	0.38	0.28	0.23	0.38	0.41	0.40	0.05	0.08	0.13	0.13	0.08	0.03
SW 870 - Appendix III-D	0.15			0.3			0.00			0.10		
Transverse Direction	0.38			0.13			0.15			0.13		
Average	0.25	0.28	0.22	0.32	0.32	0.42	0.08	0.09	0.11	0.12	0.07	0.09
STD	0.13	0.00	0.01	0.13	0.09	0.01	0.06	0.01	0.02	0.01	0.02	0.06
Volatiles and Extractables:	0.06	0.07	0.07	0.05	0.05	0.06	0.09	0.08	0.08	0.05	0.06	0.06
% Volatiles	0.07	0.06	0.08	0.05	0.05	0.05	0.08	0.08	0.09	0.05	0.05	0.06
SW 870 - Appendix III-D	0.06			0.06			0.08			0.05		
	0.07			0.05			0.08			0.05		
Average	0.07	0.07	0.08	0.05	0.05	0.06	0.08	0.08	0.09	0.05	0.06	0.06
STD	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00
Volatiles and Extractables:	0.24	0.24	0.02	0.23	0.19	0.23	0.31	0.32	0.30	0.21	0.22	0.22
% Extractables	0.24	0.11	0.24	0.22	0.24	0.21	0.28	0.31	0.33	0.21	0.22	0.22
SW 870 - Appendix III-D	0.24			0.25			0.29			0.22		
	0.23			0.25			0.31			0.22		
Average	0.24	0.18	0.13	0.24	0.22	0.22	0.30	0.32	0.32	0.22	0.22	0.22
STD	0.00	0.07	0.11	0.01	0.03	0.01	0.01	0.00	0.02	0.01	0.00	0.00

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GEOMEMBRANE: SOLMAX 60 mil TEXTURED LLDPE - ROLL # 3299												
Tear Resistance:	47	48	43	46	51	47	43	46	47	42	47	45
Tear Resistance (lbs)	45	44	44	45	51	48	46	43	45	45	48	50
ASTM D1004	47	44	44	45	46	52	43	47	46	41	46	46
Machine Direction	44			43			43			47		
	45			42			43			43		
	46			42			42			46		
Average	46	45	44	44	49	49	43	45	46	44	47	47
STD	1	2	1	2	2	2	1	2	1	2	1	2
Coefficient of Variation	3	5	1	4	5	4	3	4	2	5	2	5
% Change		-1	-4		13	12		5	6		7	7
Tear Resistance:	46	49	43	44	48	46	41	45	46	41	45	46
Tear Resistance (lbs)	44	46	44	48	44	53	47	44	45	46	48	46
ASTM D1004	49	47	43	44	52	46	40	43	43	47	46	44
Transverse Direction	44			50			46			45		
	46			43			40			44		
	43			47			46			47		
Average	45	47	43	46	48	48	43	44	45	45	46	45
STD	2	2	1	3	3	3	3	1	1	2	1	1
Coefficient of Variation	5	3	1	5	7	7	7	2	3	5	3	2
% Change		4	-4		4	5		2	3		3	1
Hydrostatic Resistance:	340	345	350	355	350	350	350	355	345	355	350	345
Load @ Rupture (psi)	340	345	350	355	345	355	355	355	355	350	355	350
ASTM D751	345	345	340	350	345	350	355	350	355	350	340	345
	345			350			345			395		
	340			355			340			345		
	350			345			355			355		
Average	343	345	347	352	347	352	350	353	352	358	348	347
STD	4	0	6	4	2	2	6	2	5	17	6	2
Coefficient of Variation	1	0	2	1	1	1	2	1	1	5	2	1
% Change		0	1		-1	0		1	0		-3	-3

SRA 09.04.99
Quality Review/Date

Client: SOLMAX, File: 609-solm .WB1

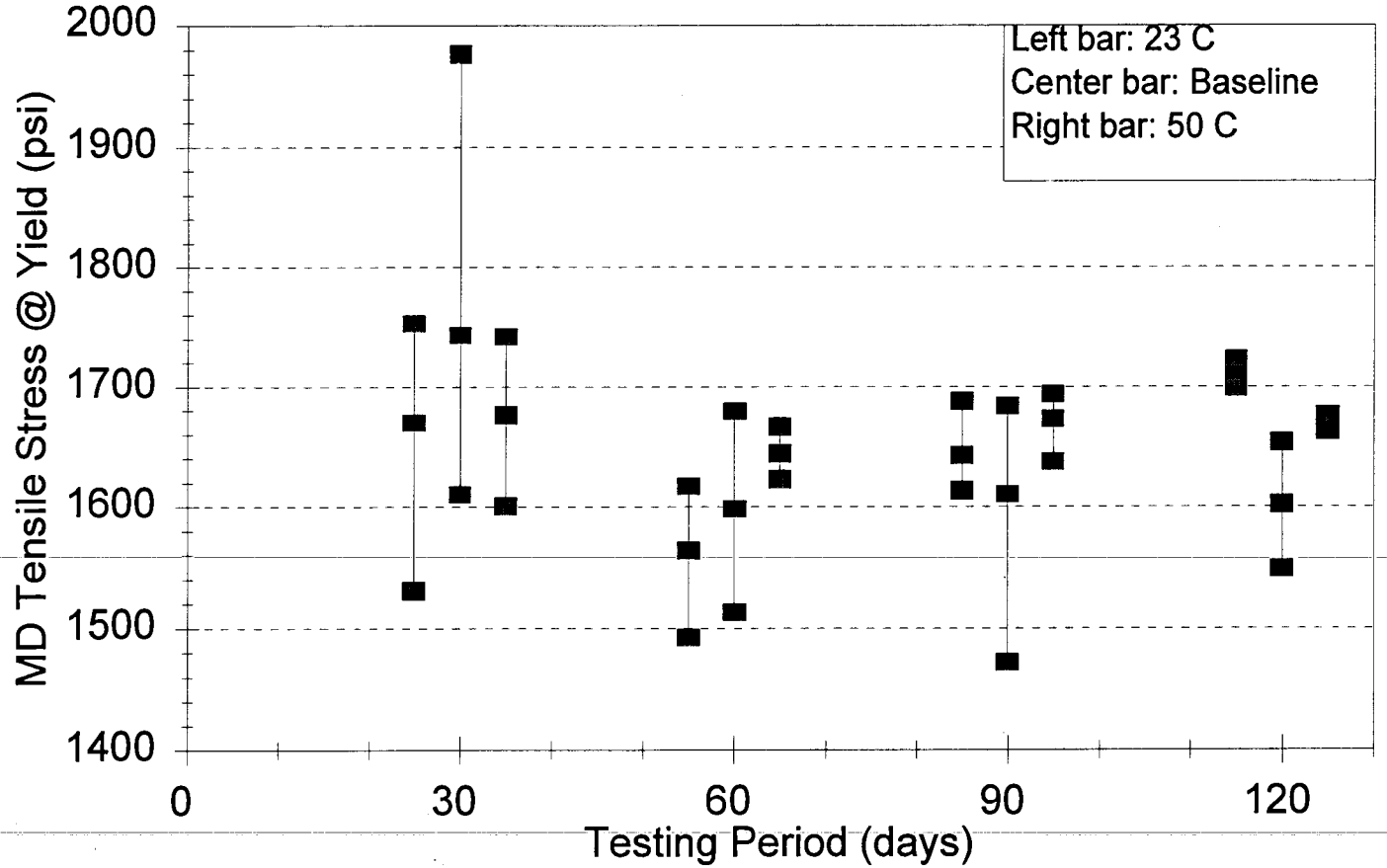
EPA METHOD 9090A TEST RESULTS

TRI LOG #: E2068-94-05

GRAPHS OF SELECTED TEST RESULTS - LLDPE

SOLMAX EPA METHOD 9090A

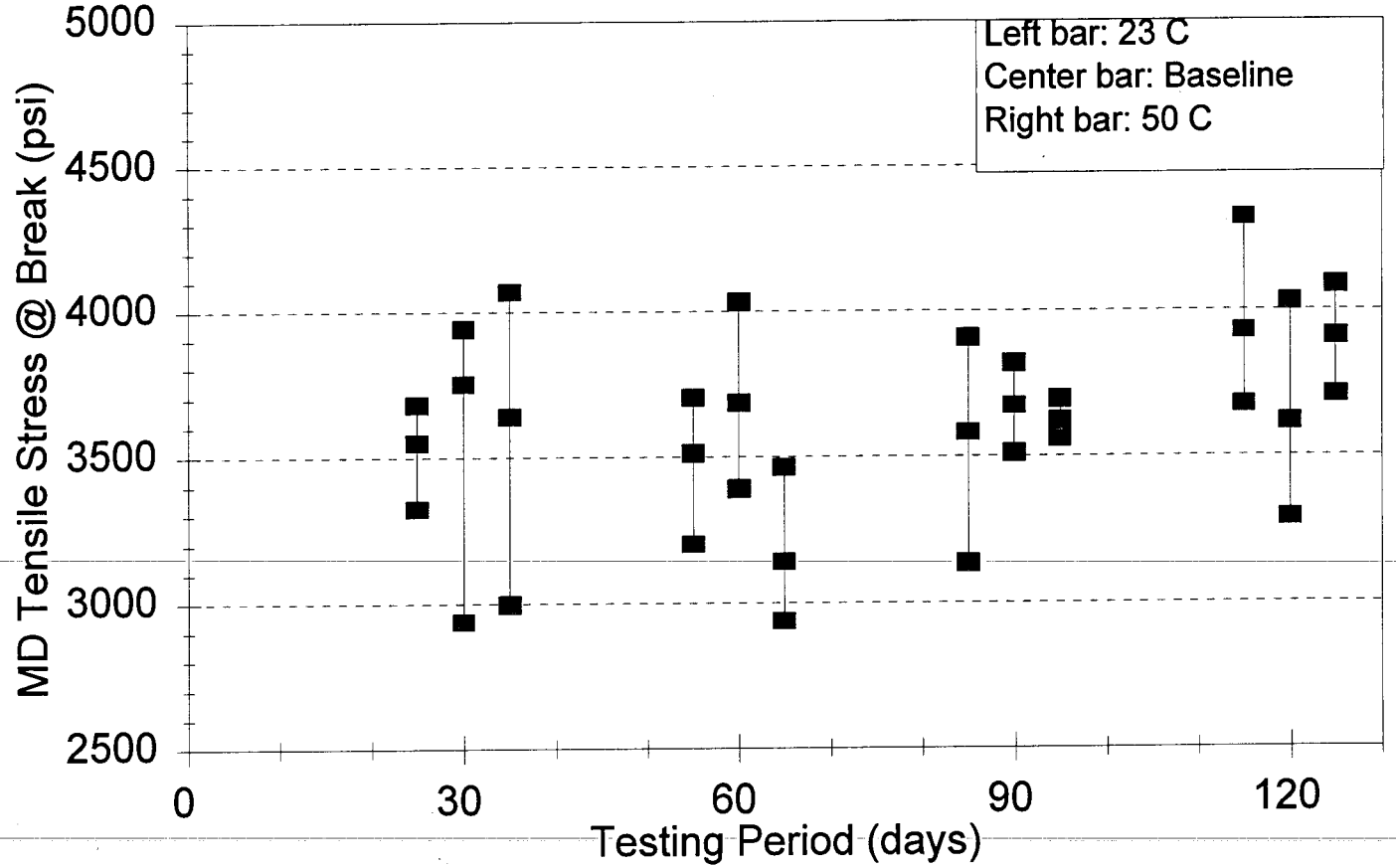
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

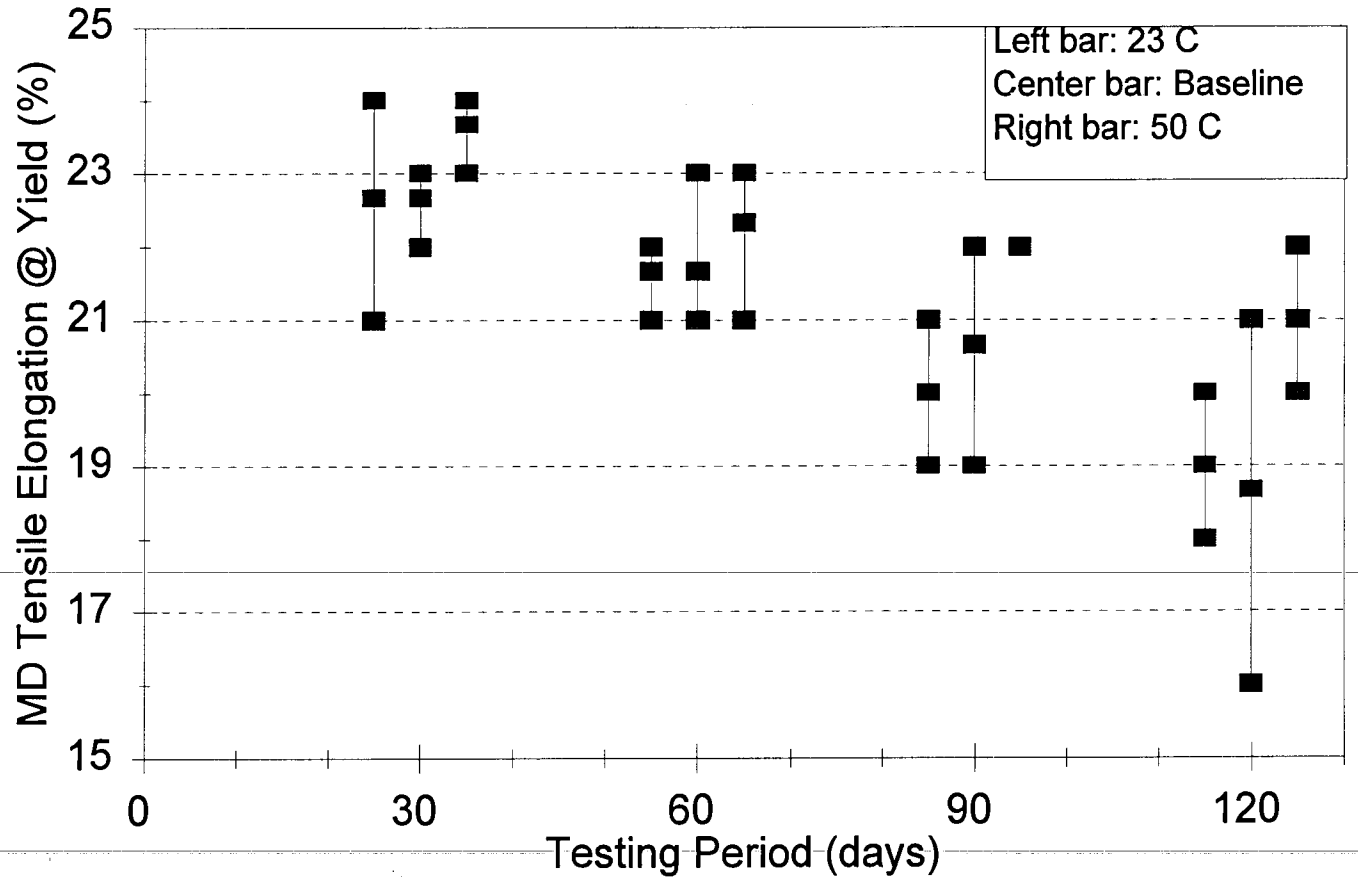
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

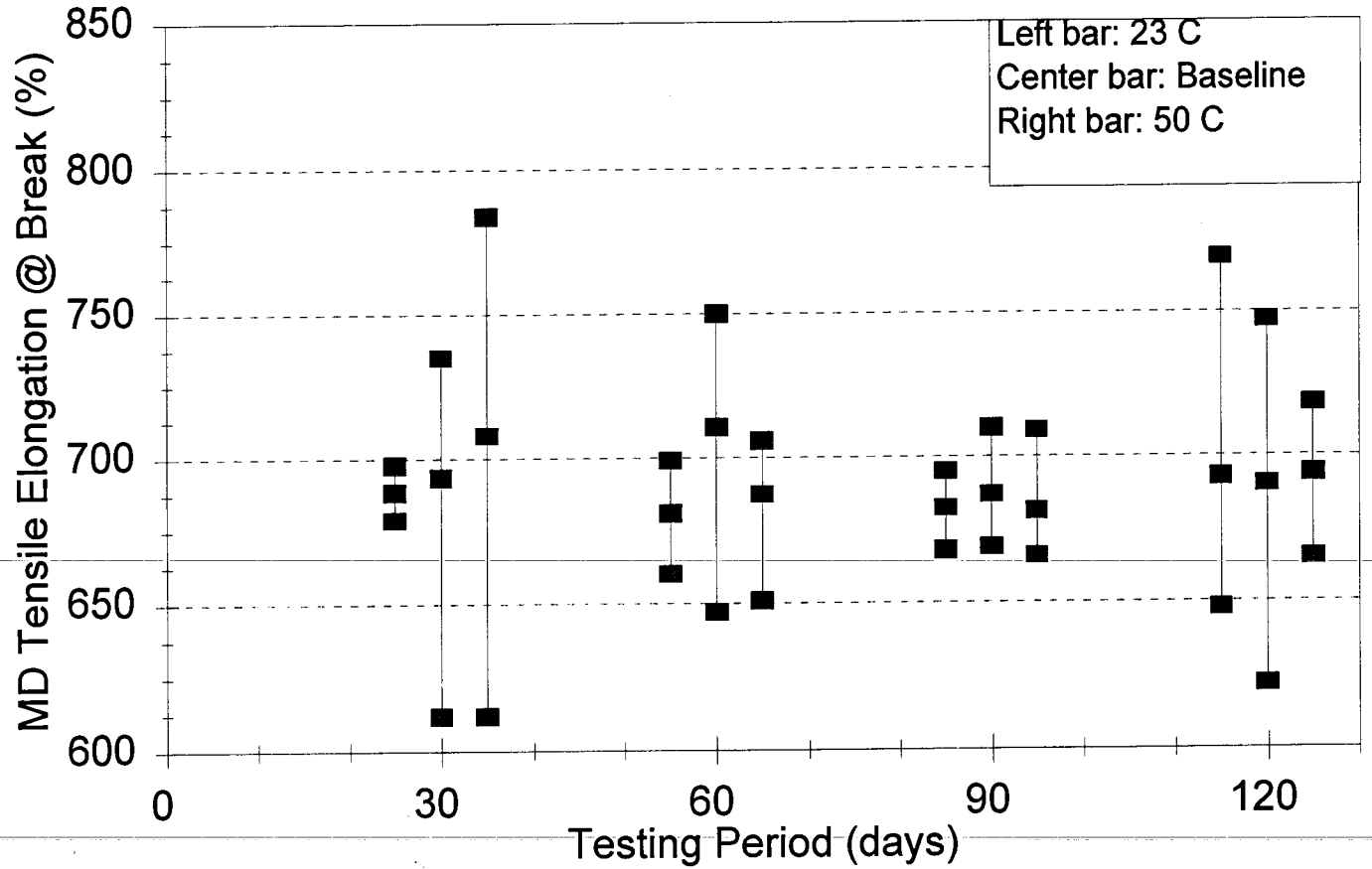
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

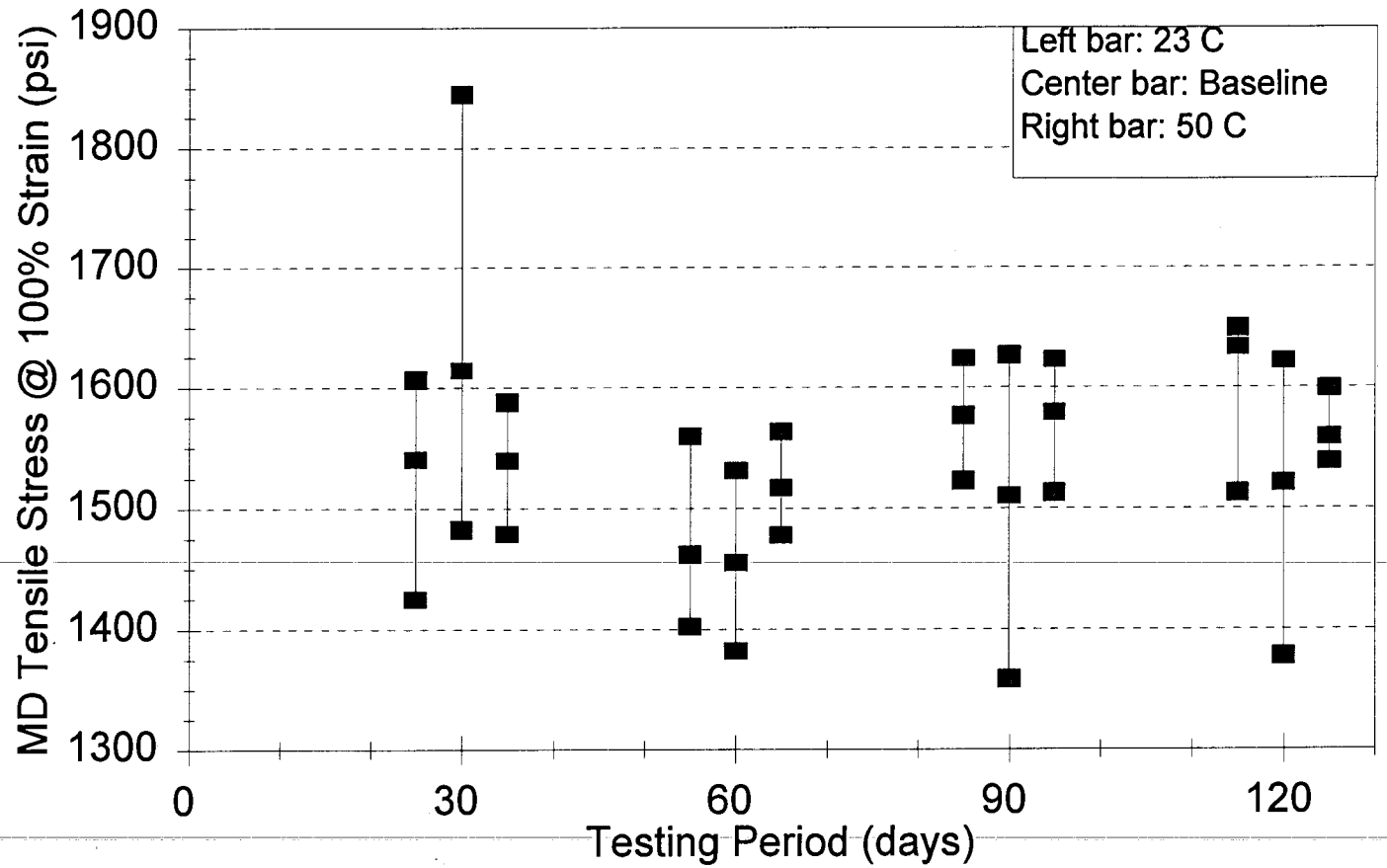
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

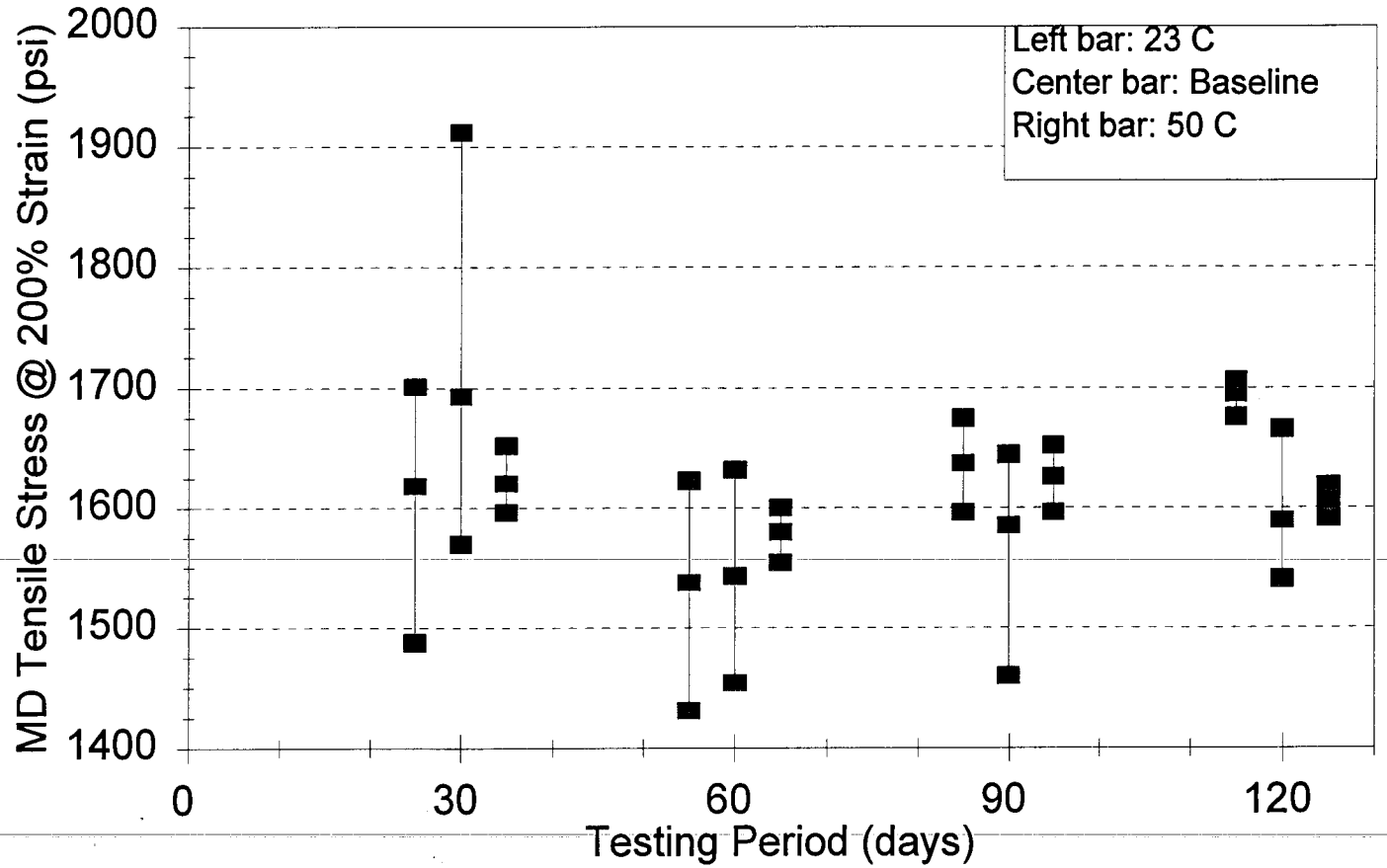
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

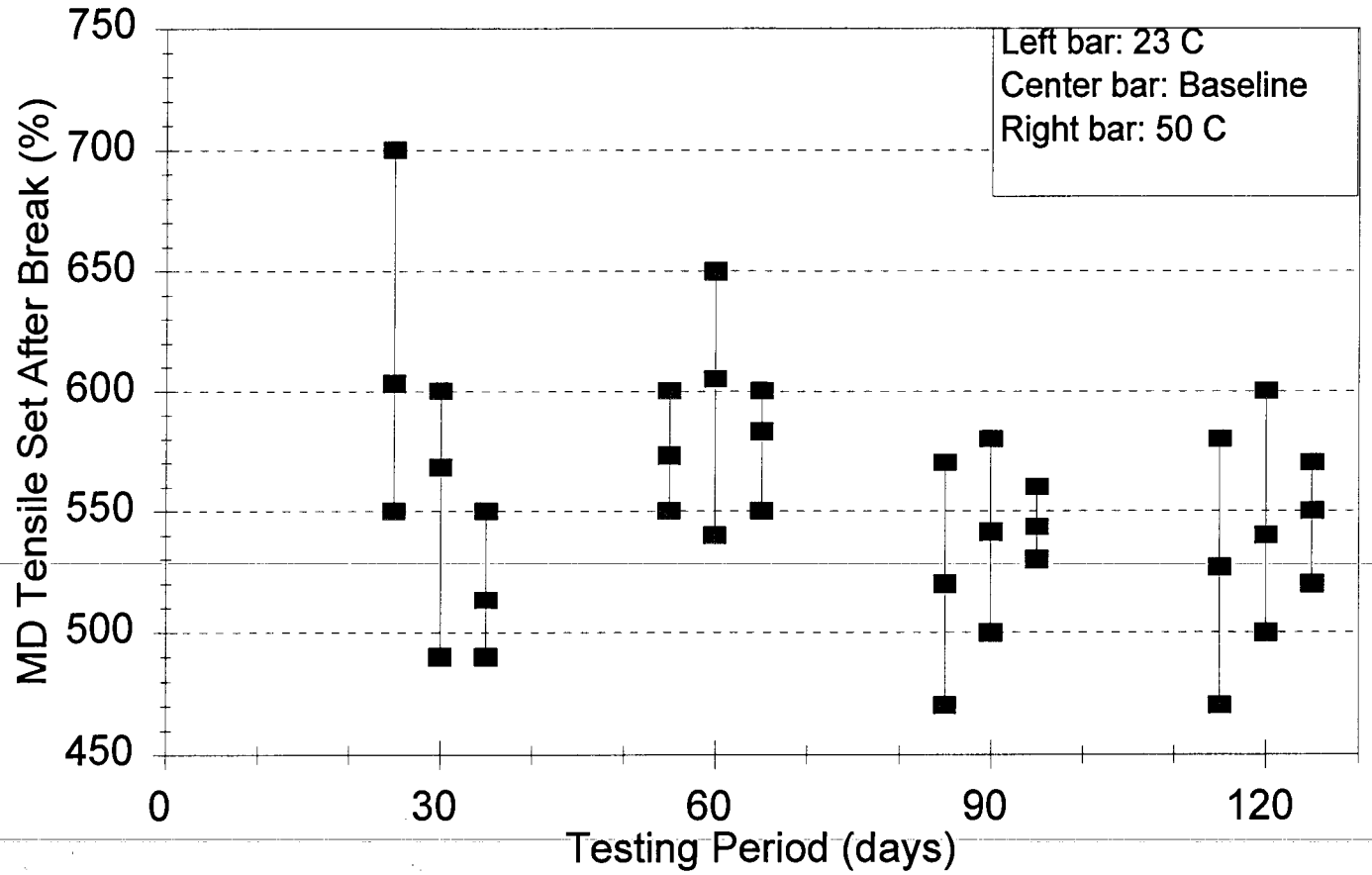
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

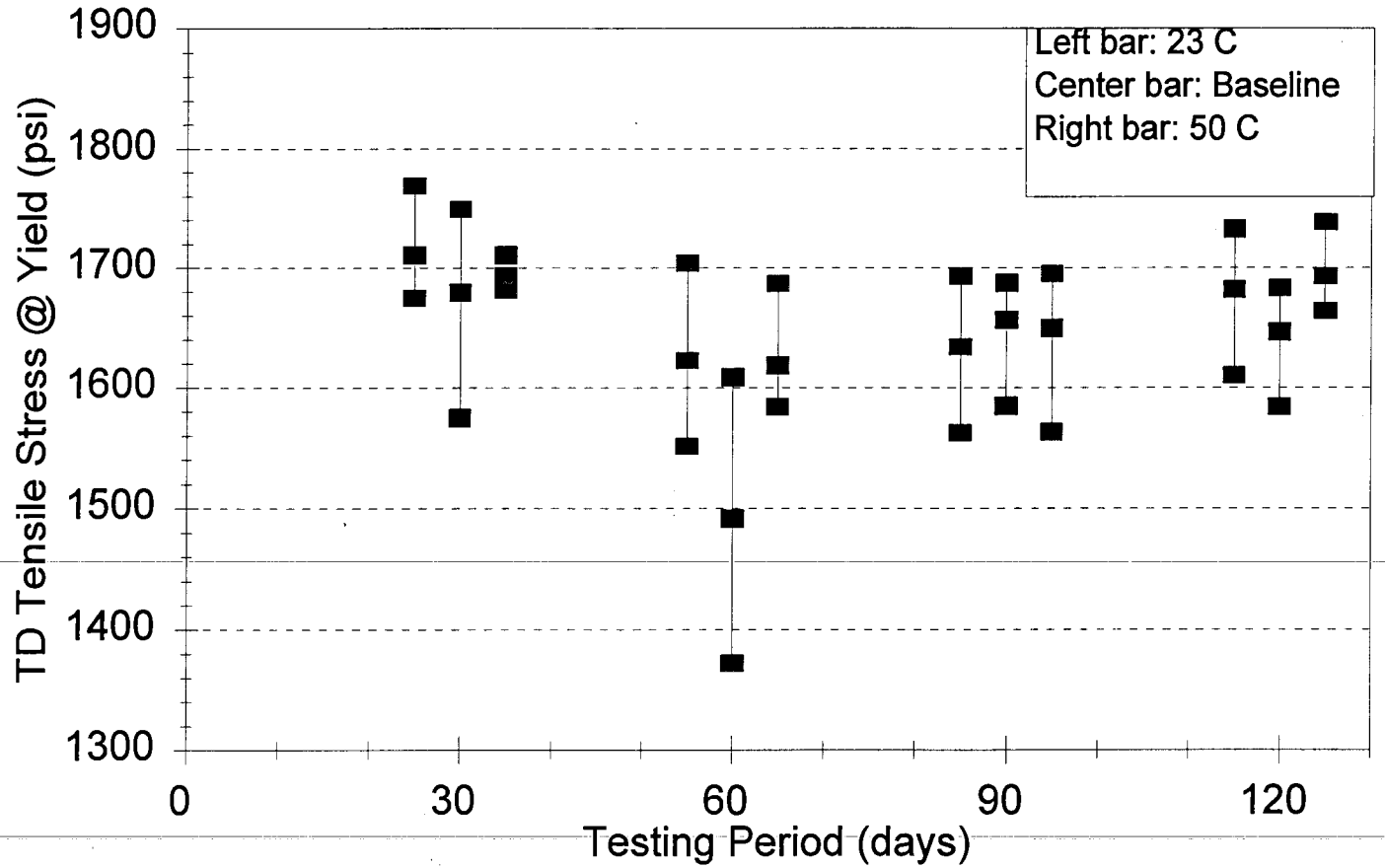
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

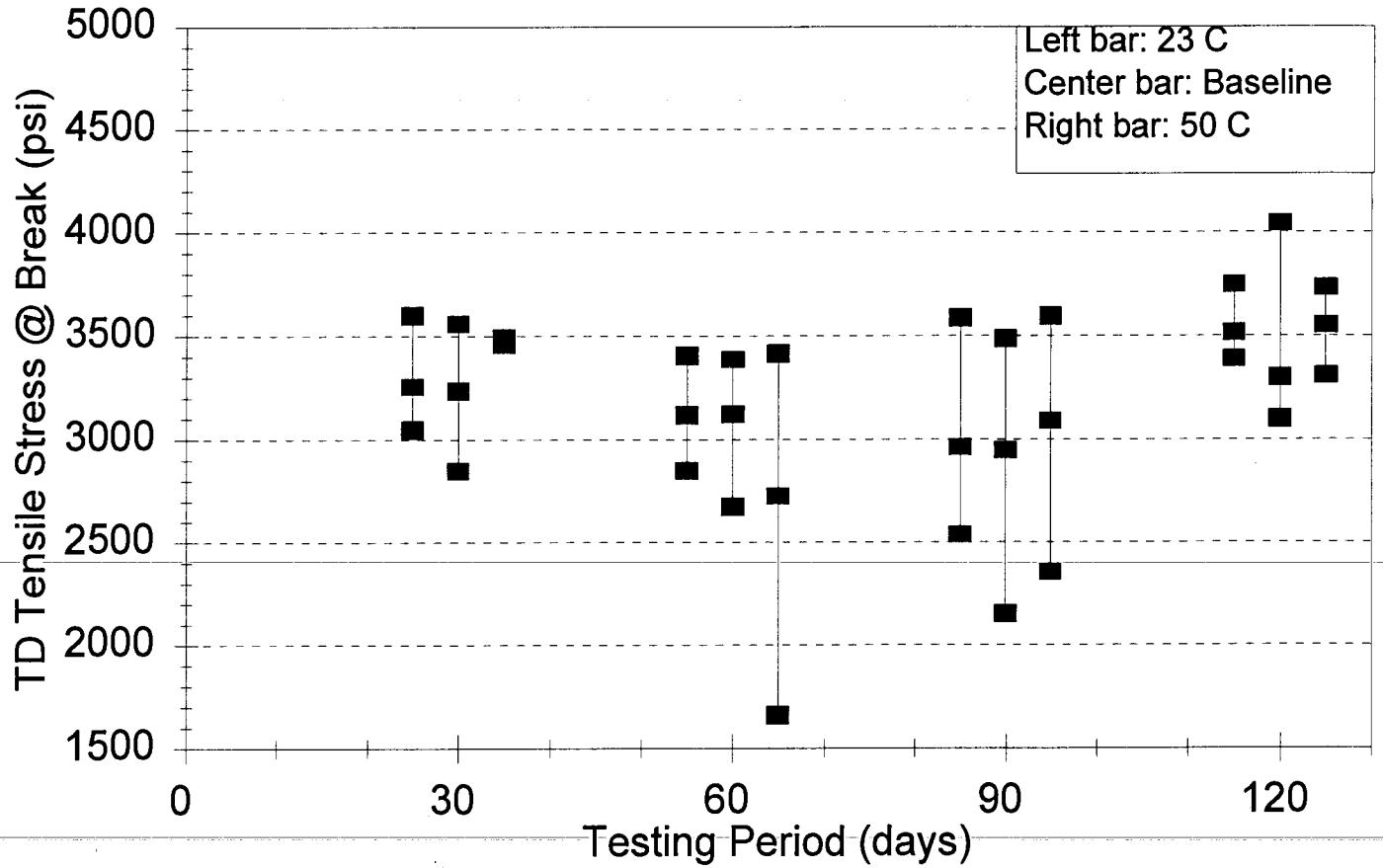
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

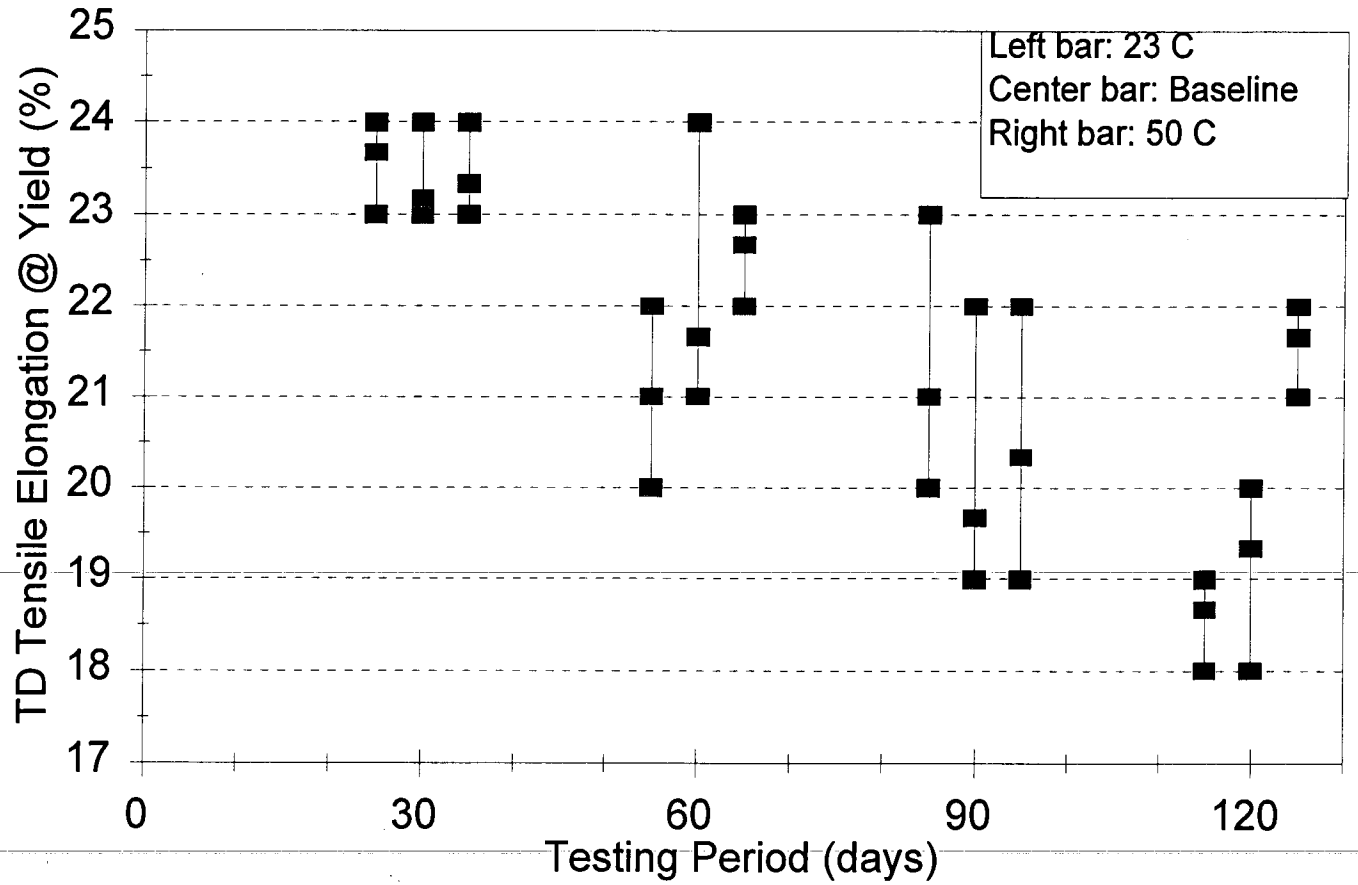
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

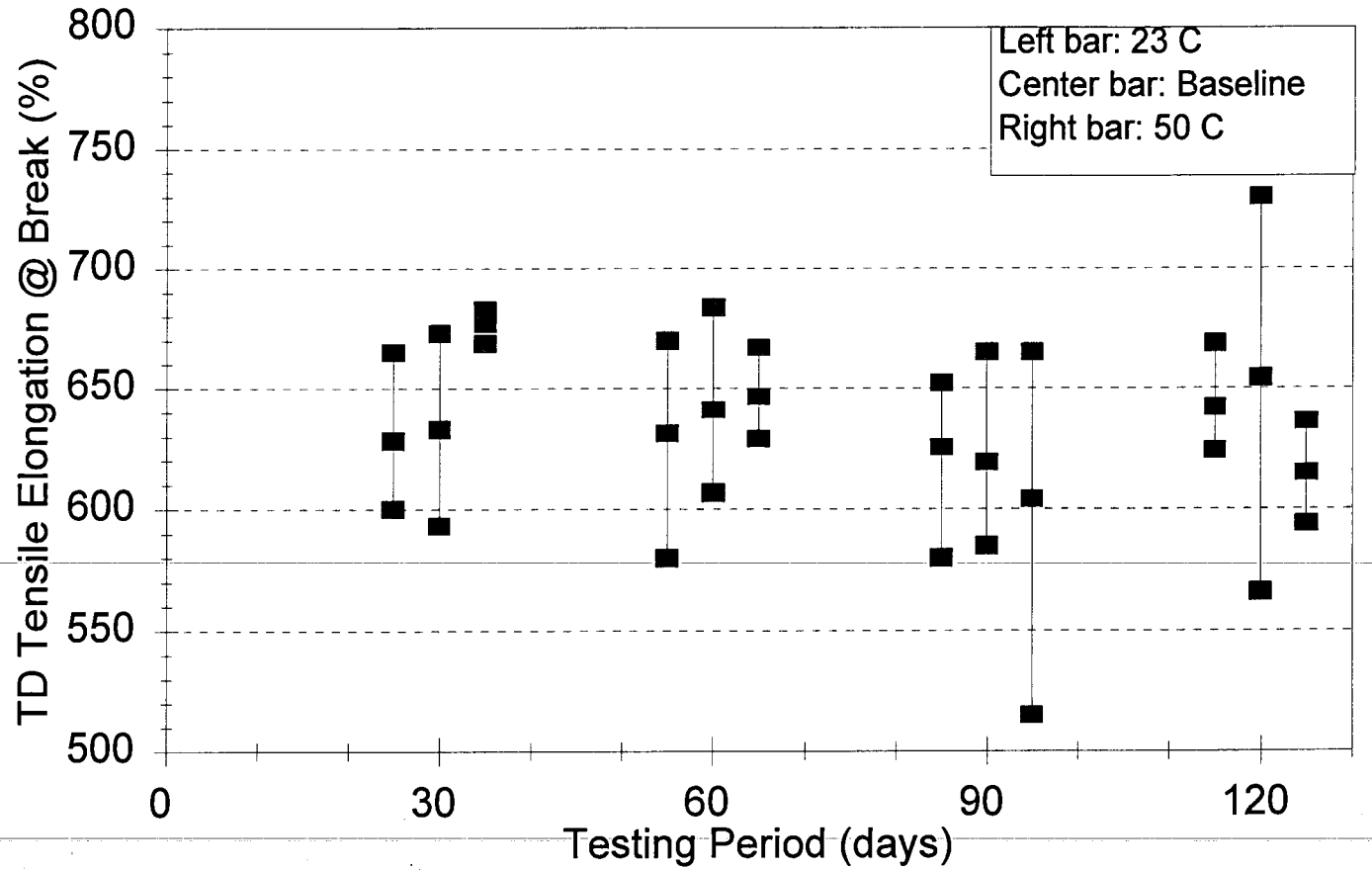
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

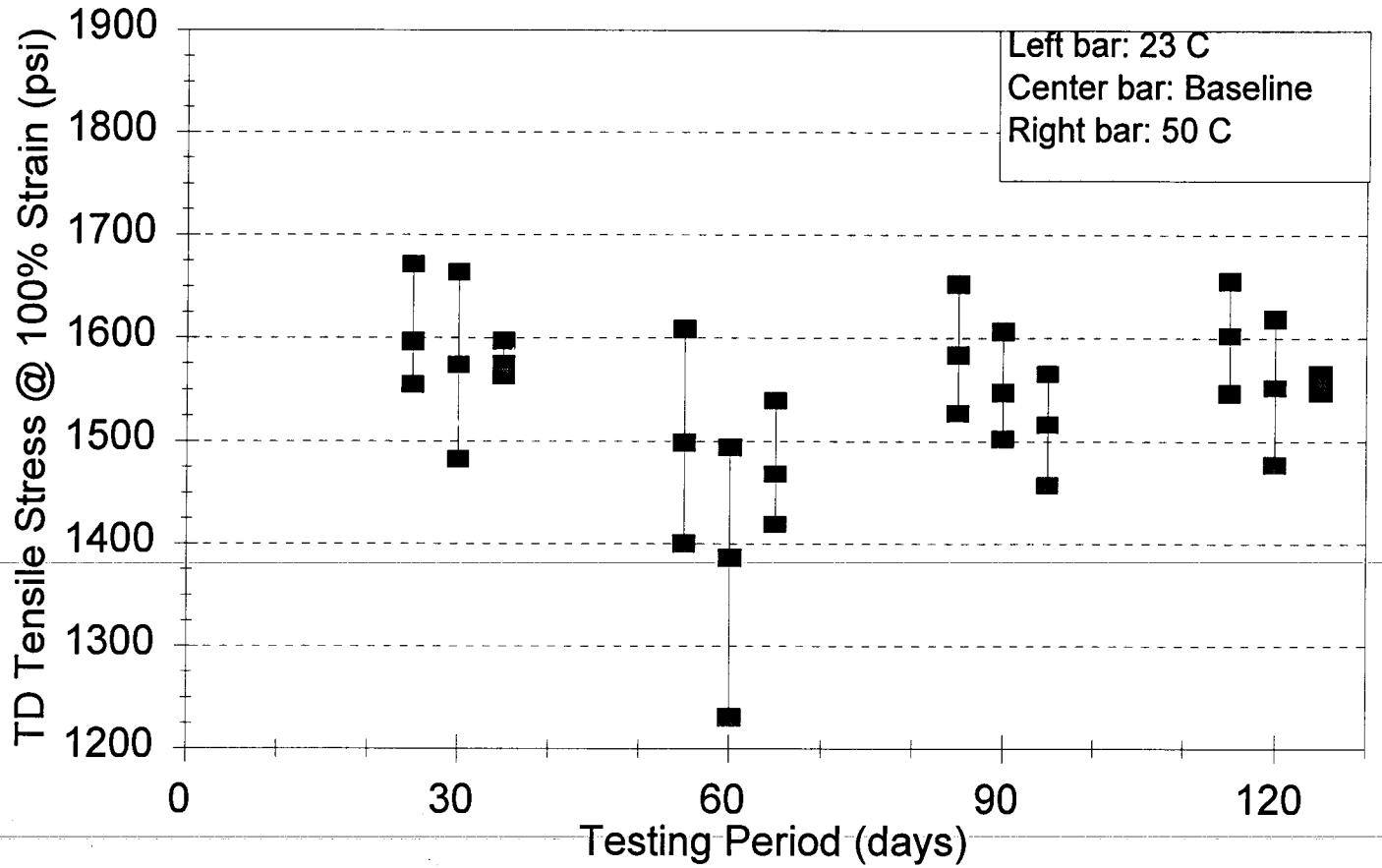
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

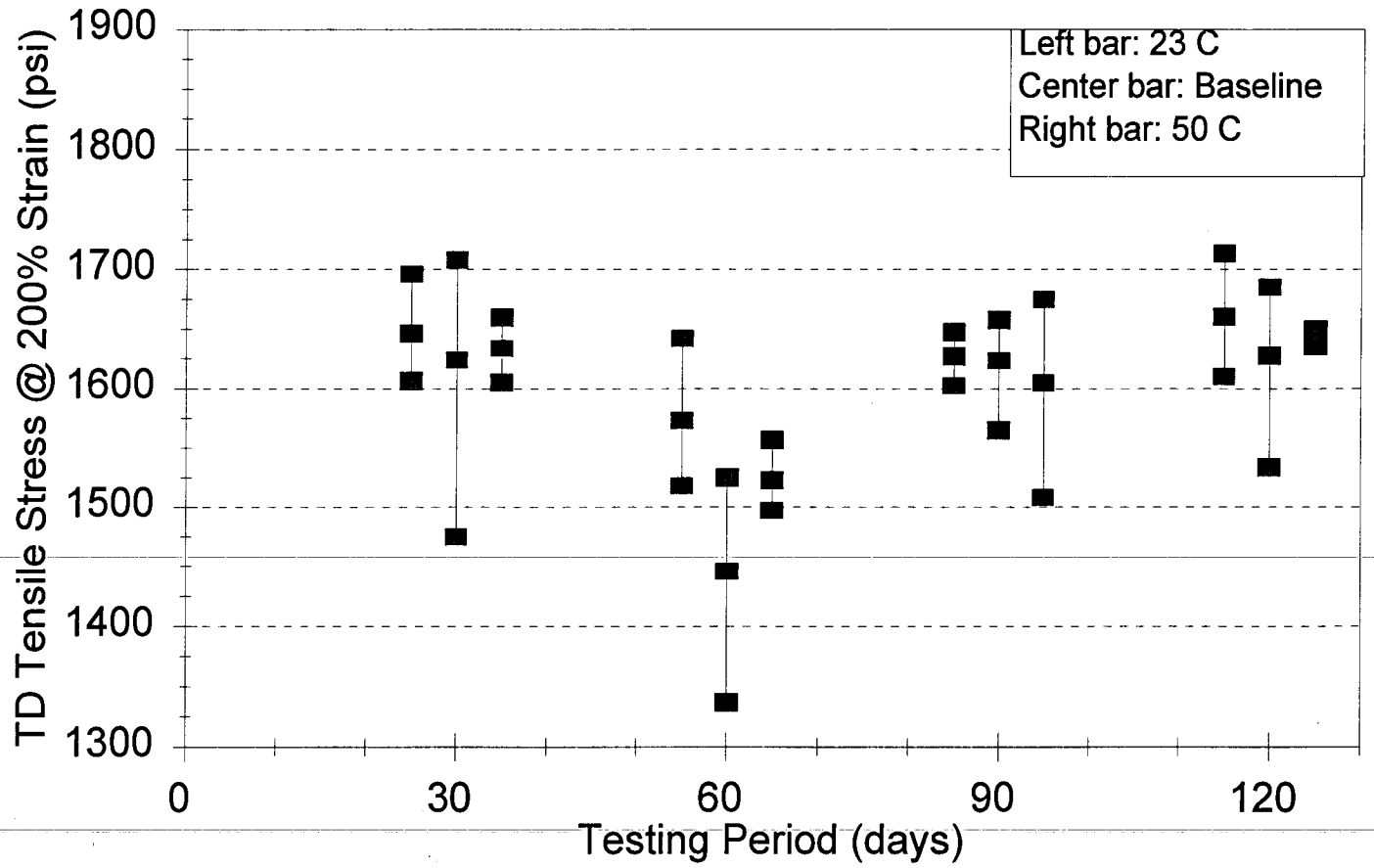
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

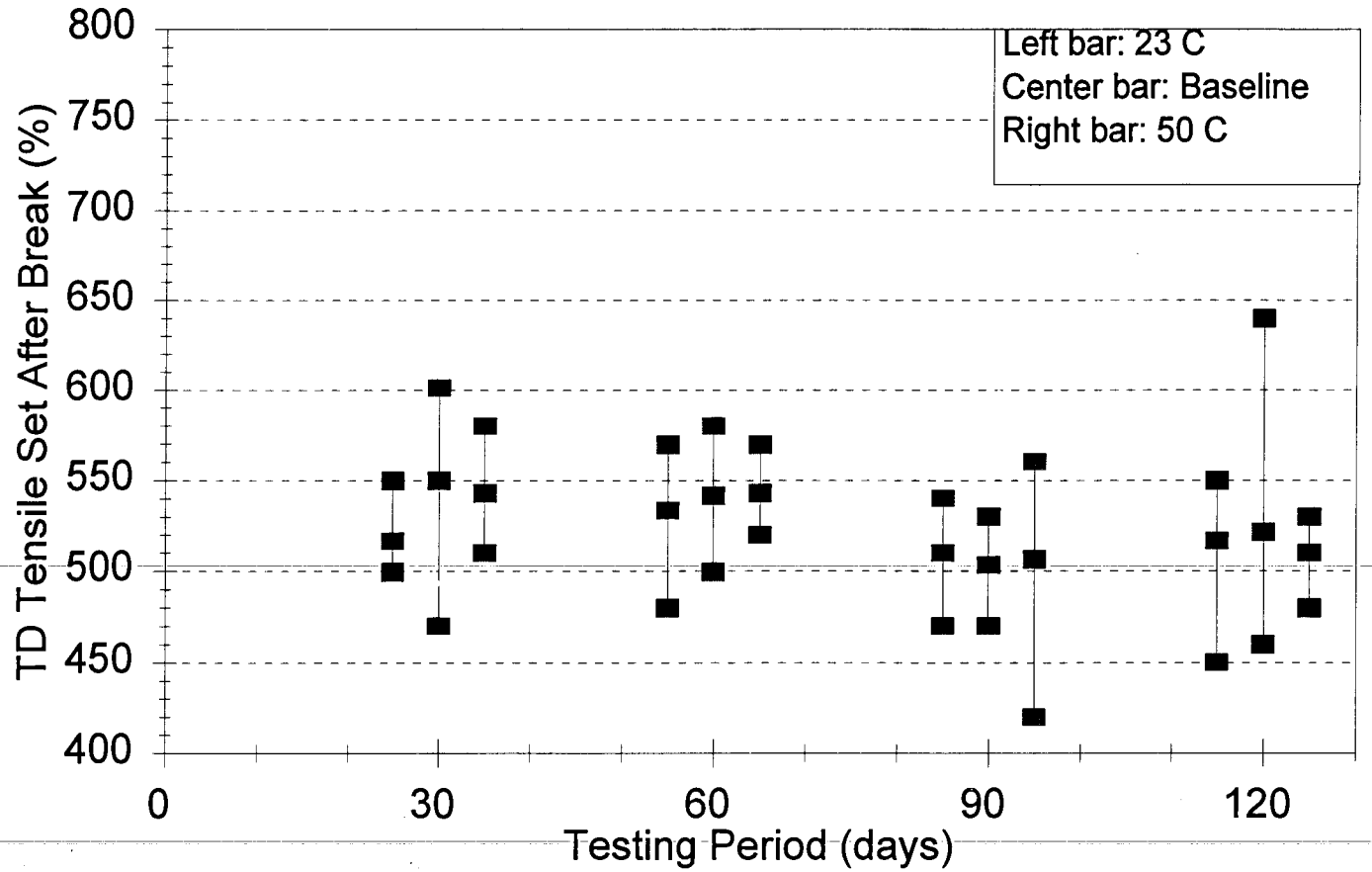
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

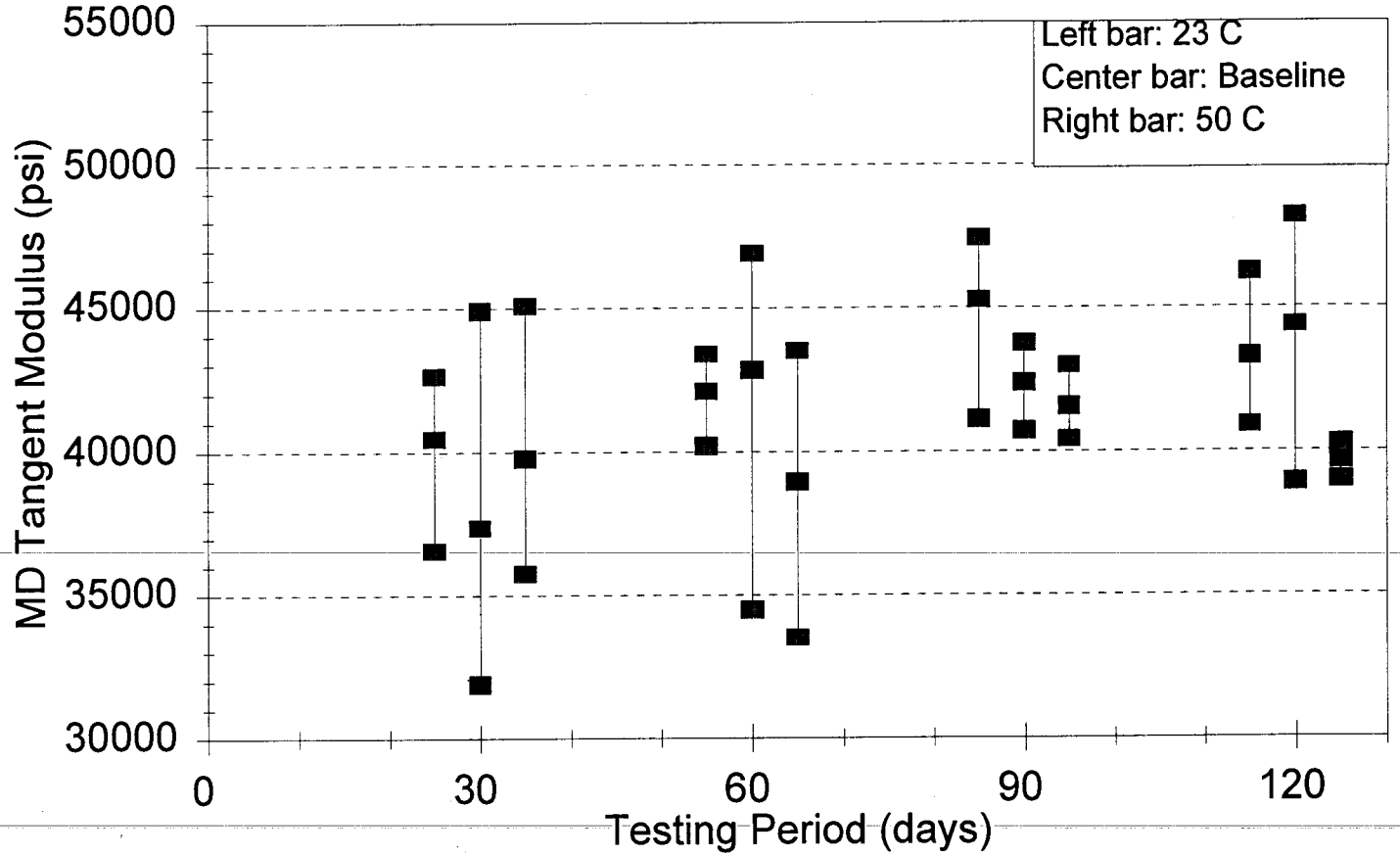
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

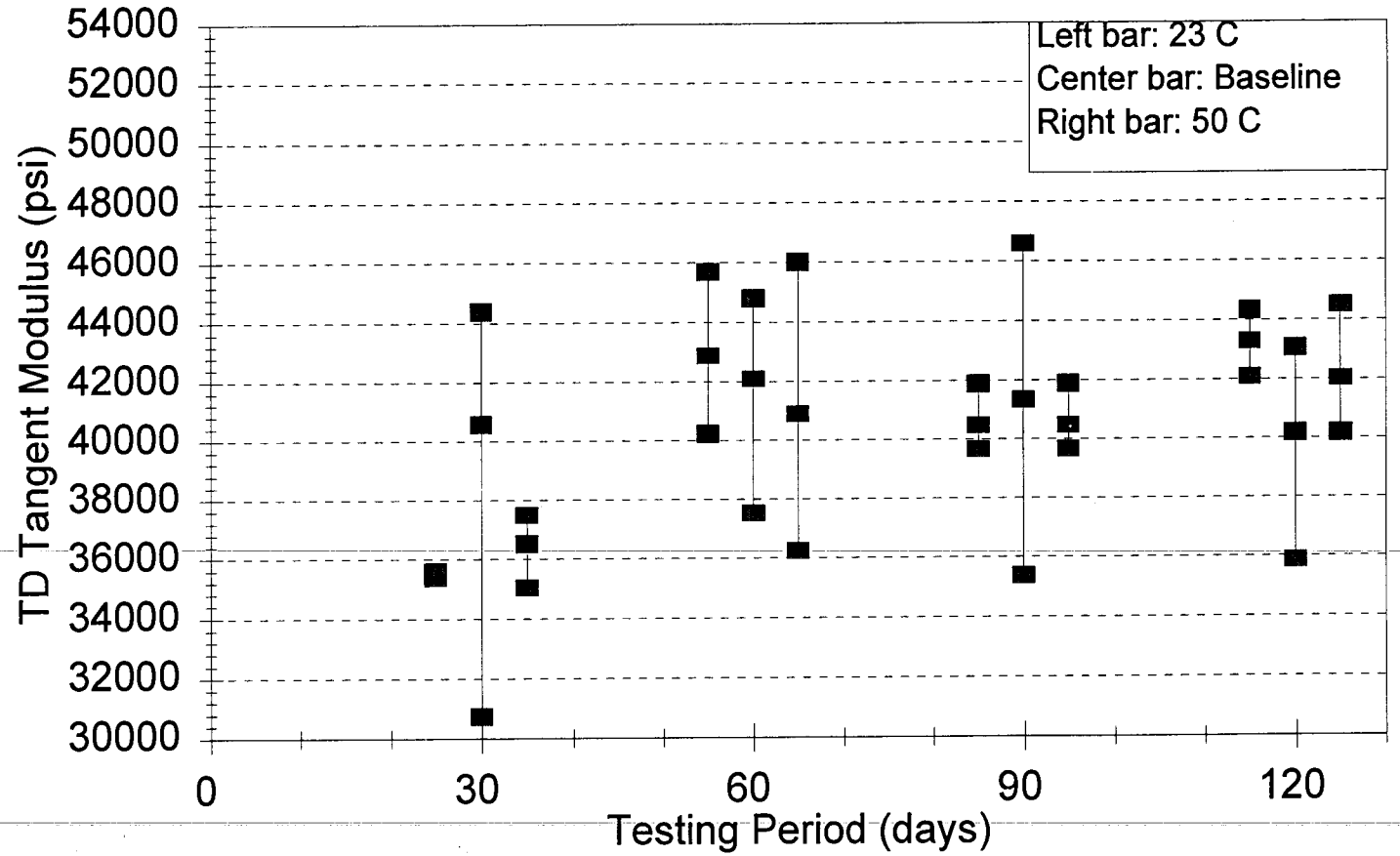
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

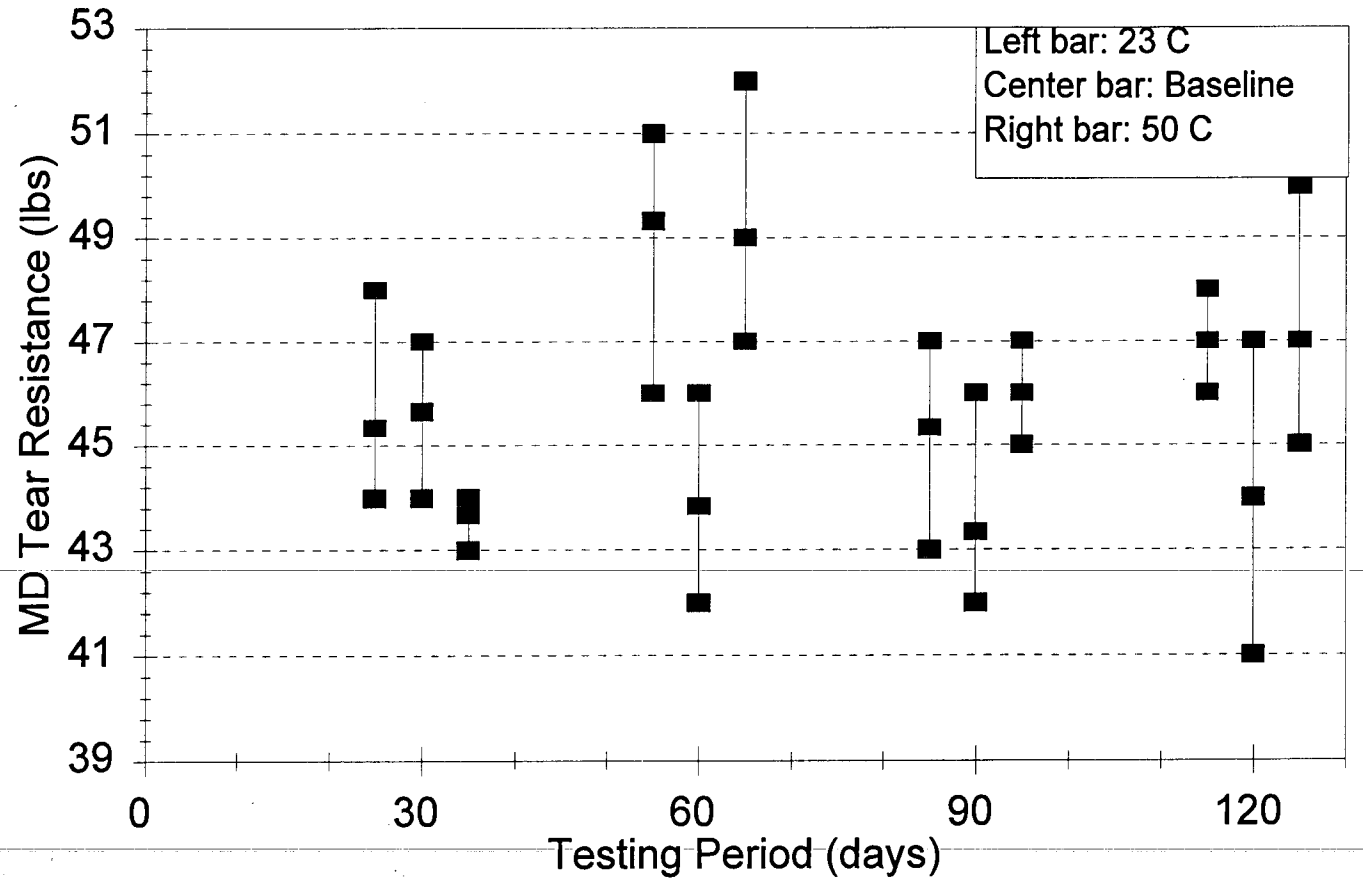
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

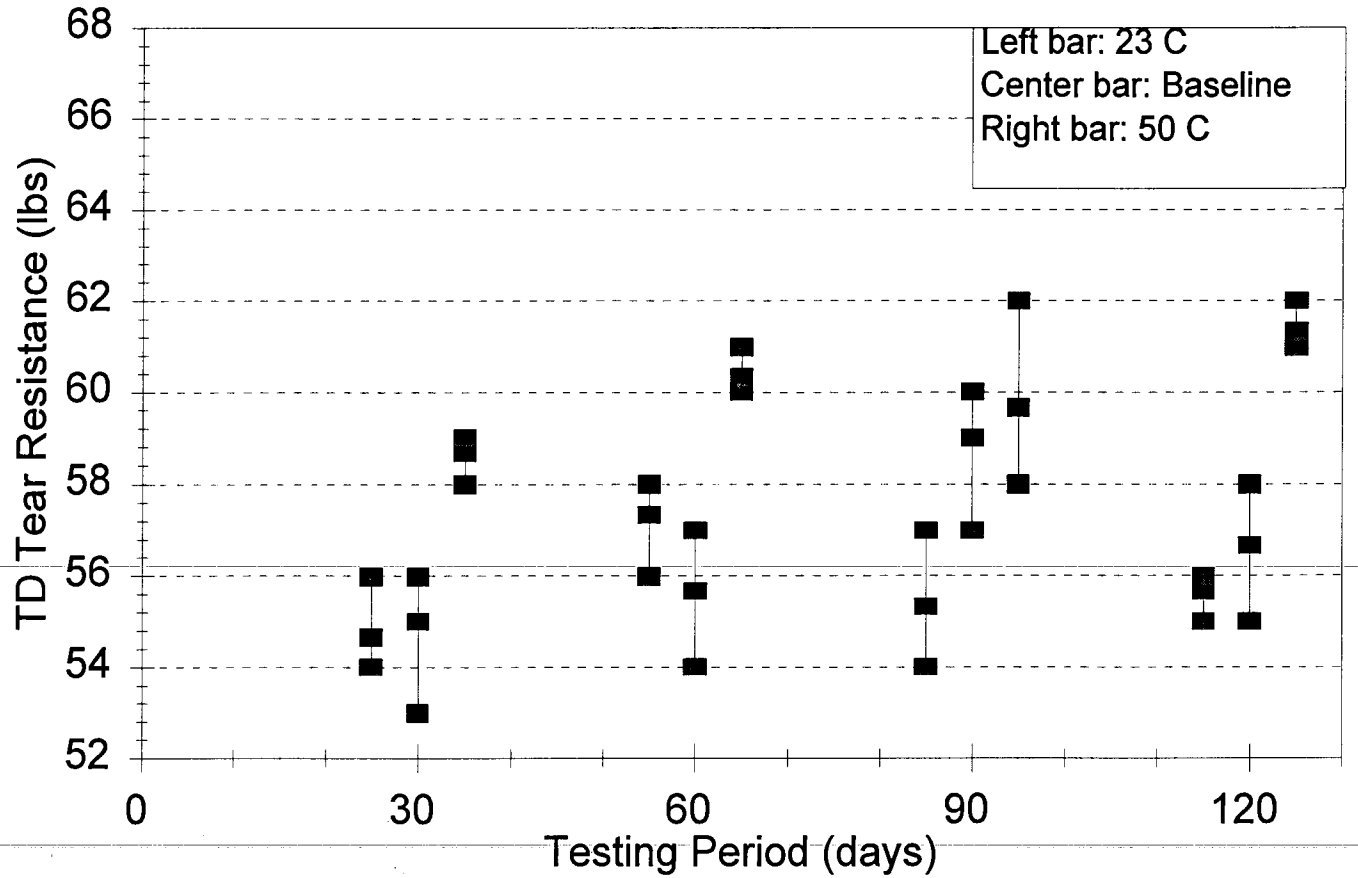
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

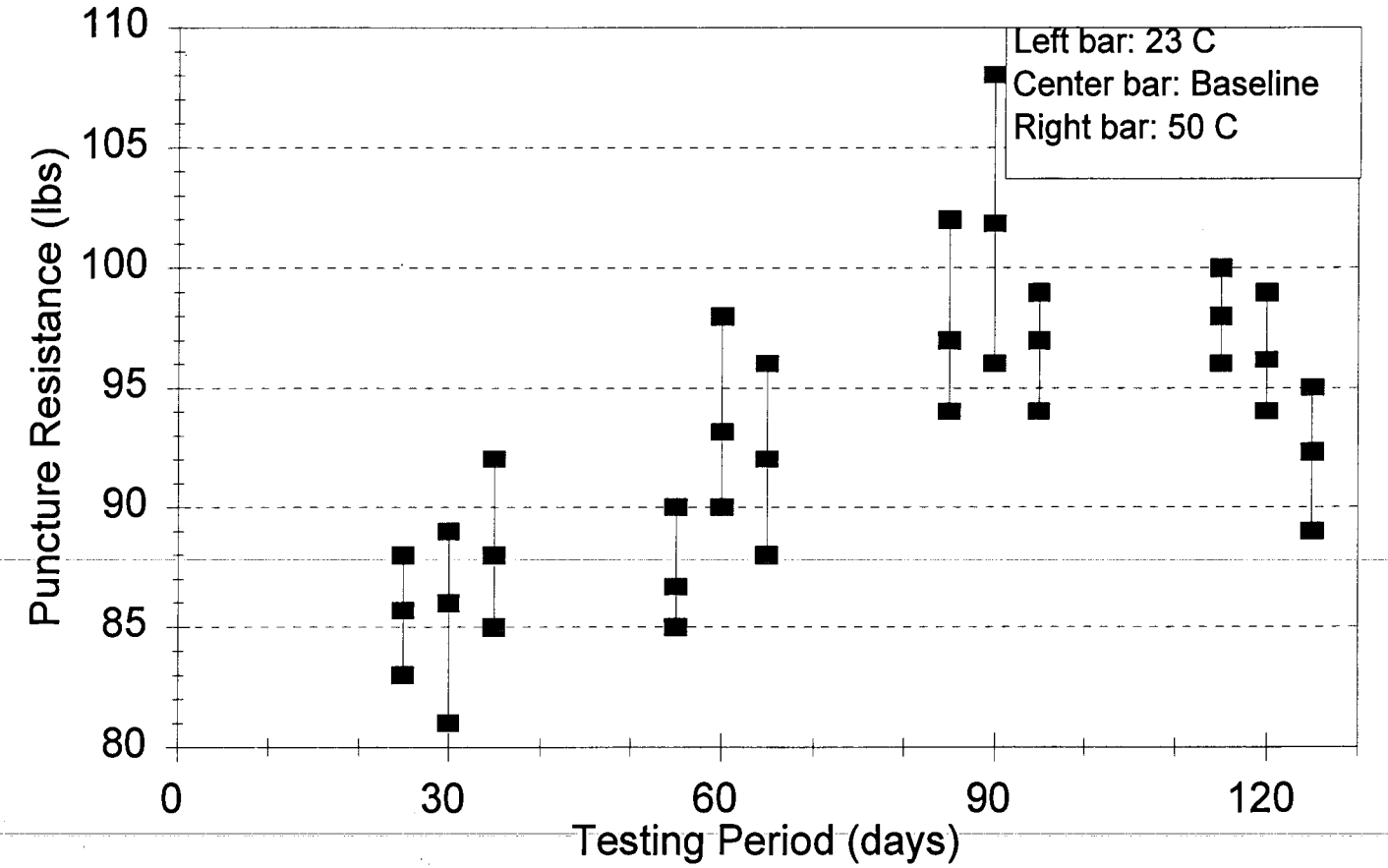
60 mil THDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

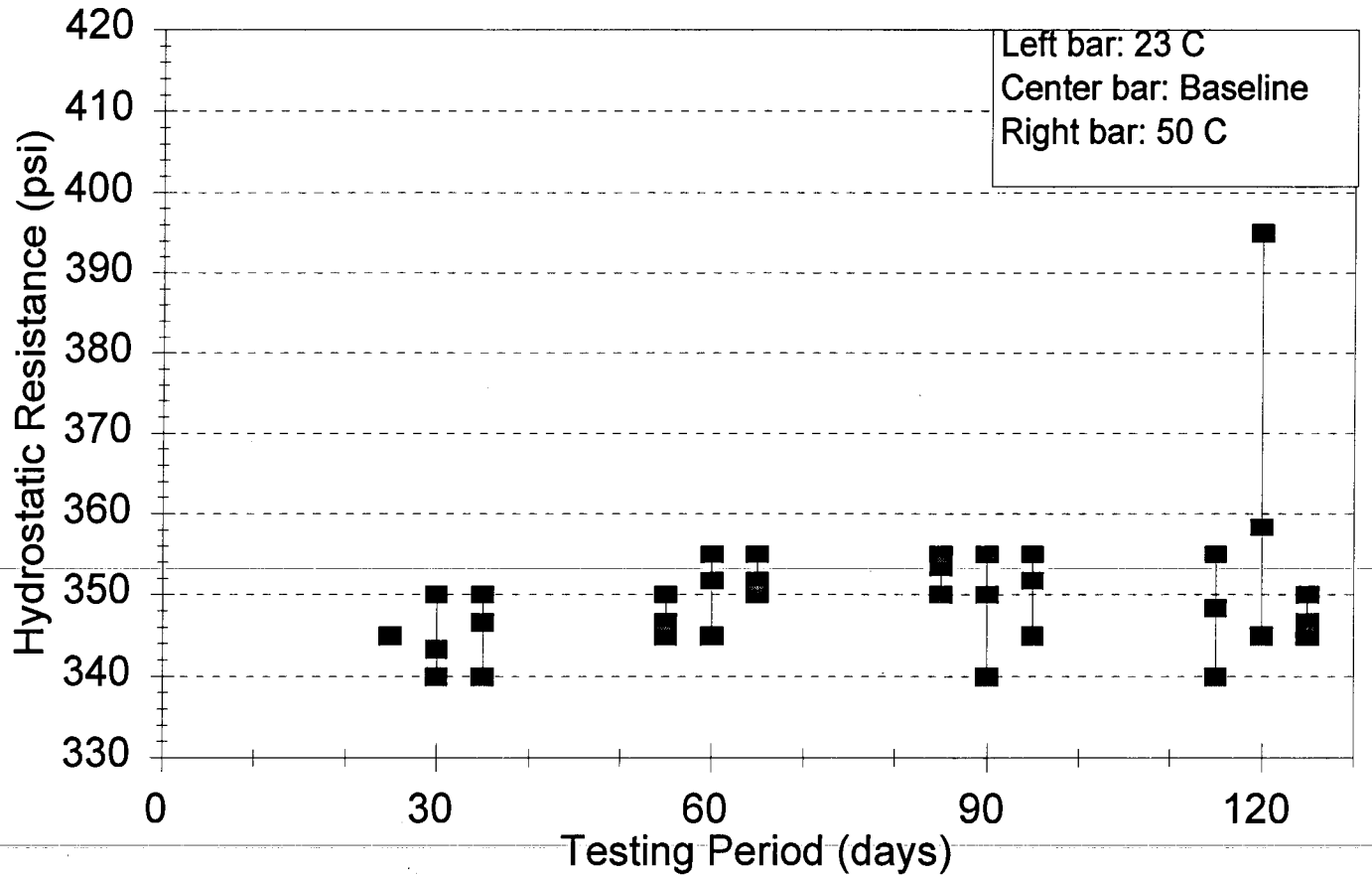
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

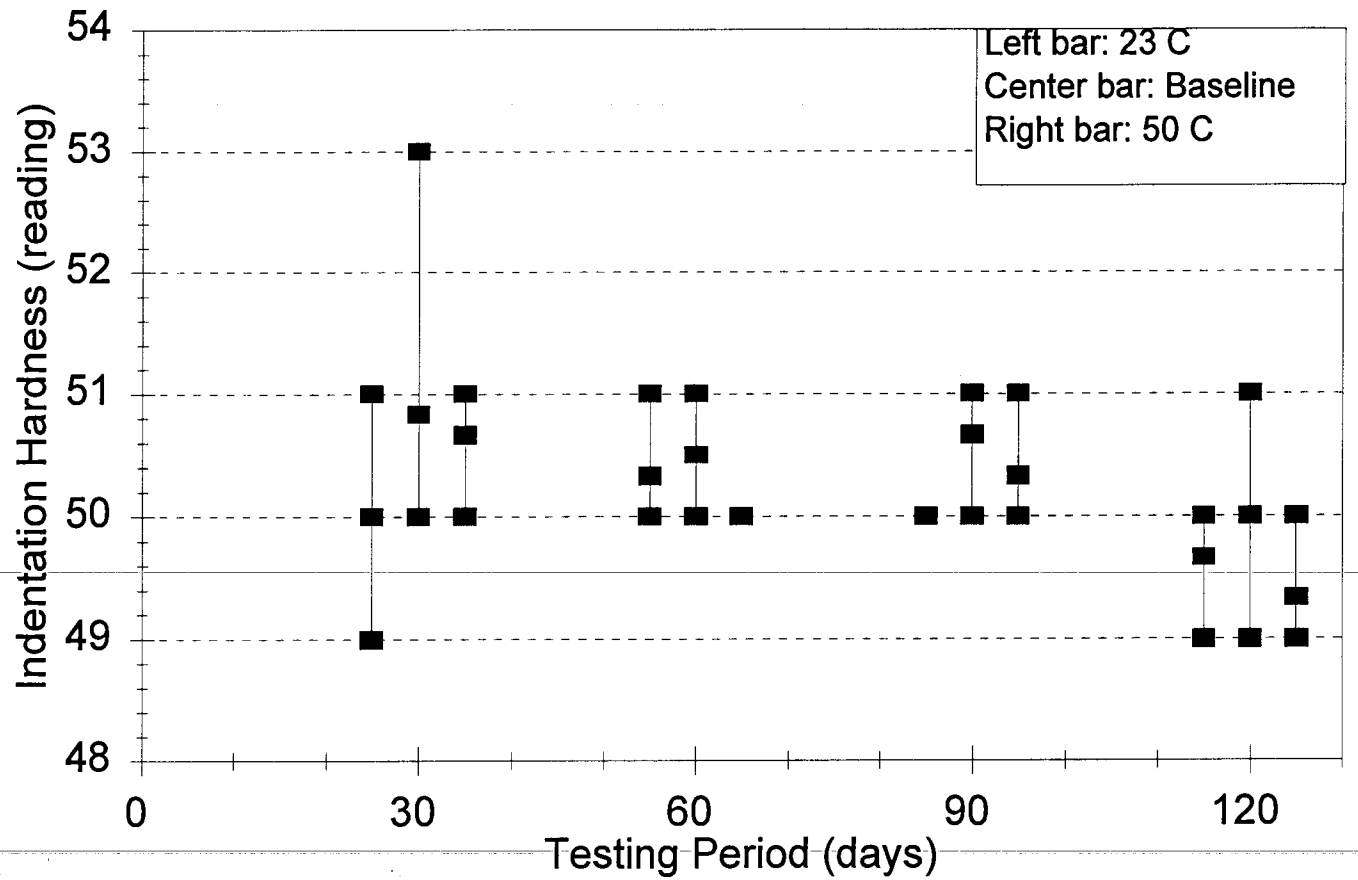
60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

SOLMAX EPA METHOD 9090A

60 mil TLLDPE GM vs MSW Leachate



Client: SOLMAX, File: 945-solm.wb1

A Final Report:

Laboratory Testing of SKAPS Industries HDPE Geonet EPA Method 9090A

January 2003

Submitted to:

SKAPS Industries
571 Industrial Parkway
Commerce, GA 30529

Attn: **Mr. Perry Vyas**

Submitted by:

TRI/Environmental, Inc.
9063 Bee Caves Rd.
Austin, Texas 78733

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

January 10, 2003

Mr. Perry Vyas
SKAPS Industries
571 Industrial Parkway
Commerce, GA 30529

Dear Mr. Vyas:

TRI/Environmental, Inc. (TRI) is pleased to present this Final Report for a geonet chemical compatibility study performed in general accordance with EPA Method 9090A.

TRI is very pleased to be of service to SKAPS Industries. Please call me if you have any questions or require any additional information.

Respectfully submitted,

Sam R. Allen
Vice President and Division Manager
Geosynthetic Services Division

9063 Bee Caves Road, Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

FOREWORD

The testing reported herein is based upon accepted industry practice as well as the test method listed. TRI/Environmental Inc. (TRI) neither accepts responsibility for nor makes claim as to the final use and purpose of the materials tested.

Tests were performed under laboratory conditions and not under actual usage conditions. TRI can give no conclusions as to the serviceability, life expectancy or general durability of the products tested when used in a lining and/or leachate collection system.

1.0 INTRODUCTION

This report describes the work performed by TRI/Environmental, Inc. (TRI) to determine the chemical compatibility of one HDPE geonet product with one waste leachate. The objective was to determine the resistance of the geonet to changes caused by exposure to leachate. Changes in physical, mechanical and hydraulic properties were measured after exposure to the leachate at 23°C and 50°C for 30, 60, 90 and 120 days. Exposures were performed in accordance with the exposure regimen specified in United States Environmental Protection Agency (EPA) Method 9090A.

All samples were logged in and all testing performed under TRI log number E2173-46-05. Methods, results and discussion are provided in the sections which follow. Test results are provided in the Tables of Results which accompany this report.

2.0 METHODS

2.1 Materials

The material selected for evaluation in this chemical compatibility study was Skaps Industries HDPE biplaner geonet.

2.2 Leachate

The waste leachate used was supplied by TRI and was a synthetic MSW leachate approximating the PaDER leachate recipe.

2.3 Exposure Conditions

Geonet specimens were exposed to the waste leachate following the specifications of EPA Method 9090A as they relate to exposure to waste fluids. The tanks used for these exposures were maintained at 23 ± 2°C and 50 ± 2°C throughout the 120-day exposure period. Tanks were constructed from chemically resistant glass fitted with stirrers. The 50°C tanks were heated with a circulating hot water heat exchanger system. They were also sealed with a lid, and a reflux condenser was installed to minimize loss of volatile leachate components.

2.4 Testing Procedures

Table 1 lists tests performed on the geonet. The number of test replicates was doubled for baseline determinations on unexposed material.

Table 1. Tests performed on Skaps Industries HDPE Geonet		
Test or Physical Property	**Method**	**Number of replicate specimens**
Dimensions and weight	EPA 9090	2 readings
Strip Tensile Strength	ASTM D 5035	3 MD & TD readings
Strip Tensile Elongation	ASTM D 5035	3 MD & TD readings
Compressive Strength	ASTM D 1621	3 readings
Transmissivity	ASTM D 4716	3 readings
CBR Puncture	ASTM D 6241	3 readings
Volatiles and Extractables	SW870 - Appendix III-D	2 readings

3.0 RESULTS AND DISCUSSION

Test results are presented in the Test Results section which is included with this report. Test results are presented in tabular form as well as graphical form.

In considering these results, it must be determined through engineering judgment whether observed differences in the value of test results measured before and after immersion are due to product variability, unidentified factors relating to the test procedure, or leachate interaction with the product. Any significant chemical interaction with leachate would be expected to result in degradation trends which are consistent across the various properties being evaluated, and not isolated to one set of test results only. However, with each type of material there may be specific properties which are highly sensitive to leachate-induced effects. These factors must be considered in evaluating the various test results for a given product.

Also of critical importance is the issue of product variability. With HDPE geonets, a range of physical and mechanical index test values covering 20% or more of the average is not uncommon. This can be traced to variability inherent in the product, and the randomness associated with the onset of failure under the specified testing conditions. However, in chemical compatibility testing the statistical sampling of a broad range of manufactured product is not possible. Therefore, the small size of the sample population tested at each time point must be taken into consideration. The criteria to be applied in evaluating data measured before and after leachate immersion should be that property changes, if observed, are consistent and so great that product variability and experimental factors can be ruled out.

In this report, standard deviations (STD) are reported for measurements involving three or more replicate specimens. In statistics, the standard deviation is defined as root of the mean squared deviations of individual test results about the mean value. The standard deviation is a quantitative measure of variability within a group of measurements.

One related measure of variability observed within a sample set, relative to the magnitude of the mean value itself, is the *coefficient of variation or variance* (COV). The coefficient of variance is defined as the standard deviation divided by the mean associated with a group of specimens, and may be expressed as a percentage. The COV provides an indication of what proportion of the mean value may be attributable to random experimental factors or product variability. It is useful to consider apparent changes in property values against the criterion of COV since observed changes which fall below the COV may not be significant. This approach was used in preparing the tables in the next section.

The term *range* refers to the difference between the extreme highest and lowest points within a group of measured values. Considering range as a percentage of the mean values provides another measure of variability within a dataset.

In the tables, the high and low extremes for percentage change in mean values are listed for comparison against COV and range as a percentage of mean from the baseline sample group. The high and low percentage changes are the extremes from data measured at 30, 60, 90 and 120 days.

Skaps Industries HDPE Biplaner Geonet

Table 2 illustrates the range of variability in baseline data compared with some of the observed changes in average test values measured after immersion for the geonet.

Table 2. Baseline coefficients of variation and range of percentage change results

Test	Baseline COV (%)*	Baseline Range as % of Mean*	High Observed % Change	Low Observed % Change
Strip Tensile Strength (MD)	7	17	9	-9
Strip Tensile Elongation @ Maximum Load (MD)	6	18	9	-8
Compressive Strength	6	17	4	-6
Transmissivity	2.18	6.63	-0.17	-9.54
CBR Puncture	7	20	9	-9

4.0 CONCLUSION

Changes in certain measured physical and mechanical properties were noted for the geonet. However, the observed variances were random and are believed to be the effects of product variability and experimental factors. In the opinion of the authors, the data, considered together, support the conclusion that observed variances were not caused by exposure to the test leachate.

TRI/Environmental, Inc. is pleased to have been selected to participate in this project. We trust that the information provided in this report meets your requirements for technical documentation of this chemical compatibility study. Please do not hesitate to call if you have any questions or require any additional information.

Respectfully submitted,

Sam R. Allen

Sam R. Allen
Vice President and Division Manager
Geosynthetic Services Division

TRI/Environmental, Inc.

APPENDIX:

EPA METHOD 9090A TEST RESULTS

SKAPS INDUSTRIES HDPE GEONET TEST RESULTS

Dimensions

TRI LOG NUMBER: E2173-46-05

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: January 2003
TRI Log Number: E2173-46-05

Exposure Time and Temperature

Test Parameters	Temp.	30 Day Baseline	30 Day Exposed	30 Day % Change	60 Day Baseline	60 Day Exposed	60 Day % Change	90 Day Baseline	90 Day Exposed	90 Day % Change	120 Day Baseline	120 Day Exposed	120 Day % Change
GEONET: HDPE GEONET EXPOSED TO PADER MSW SYNTHETIC LEACHATE													
Thickness (mils)	23C	224	228	1.8	234	234	0.0	230	230	0.0	228	228	0.0
	50C	232	232	0.0	228	229	0.4	230	231	0.4	229	229	0.0
Length (inches)	23C	6.00	6.00	0.0	6.00	5.85	-2.5	6.00	5.96	-0.7	6.02	6.01	-0.2
	50C	6.00	5.83	-2.8	6.00	5.89	-1.8	6.00	6.00	0.0	5.99	6.00	0.2
Width (inches)	23C	4.04	4.06	0.5	4.01	4.02	0.2	4.01	4.04	0.7	4.02	4.04	0.5
	50C	4.02	4.02	0.0	4.01	4.01	0.0	4.03	4.03	0.0	4.03	4.01	-0.5
Mass (g)	23C	14.91	14.92	0.1	15.46	15.47	0.1	15.30	15.31	0.1	15.23	15.25	0.1
	50C	17.06	17.06	0.0	16.86	16.86	0.0	17.05	17.05	0.0	14.93	14.93	0.0

EPA METHOD 9090A TEST RESULTS

SKAPS INDUSTRIES HDPE GEONET TEST RESULTS

TRI LOG NUMBER: E2173-46-05

NOTE ON TEST RESULTS

This section includes generated test data provided in both tabular and graphical form. Each graph is represented by a series of "I" beam plots. Each "I" beam represents a single test population and illustrates the high and low value as the end points, and the mean as a central box on the beam.

At each testing period, two "I" beams are shown. The left beam represents the 23°C exposed specimens while the right beam represents the 50°C specimens. The initial "I" beam represents the baseline or unexposed test specimens.

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: January 2003
TRI Log Number: E2173-46-05

Test Parameters	Baseline	Exposure Time and Temperature: 30 Day 23C	30 Day 50C	60 Day 23C	60 Day 50C	90 Day 23C	90 Day 50C	120 Day 23C	120 Day 50C
GEONET: HDPE GEONET EXPOSED TO PaDER MSW SYNTHETIC LEACHATE									
Strip Tensile Properties:	143	158	173	130	167	131	166	168	133
Maximum Strength (lbs)	167	144	162	153	152	167	148	165	150
ASTM D5035	153	151	147	149	173	126	157	172	144
Machine Direction	150								
	170								
	144								
Average	155	151	161	144	164	141	157	168	142
STD	11	6	11	10	9	18	7	3	7
Coefficient of Variation	7	4	7	7	5	13	5	2	5
% Change		-2	4	-7	6	-9	2	9	-8
Strip Tensile Properties:	33	34	35	30	35	35	31	35	33
Elongation @ Max. Strength (%)	36	28	32	35	42	34	33	36	28
ASTM D5035	35	33	24	32	31	31	35	33	31
Machine Direction	30								
	31								
	33								
Average	33	32	30	32	36	33	33	35	31
STD	2	3	5	2	5	2	2	1	2
Coefficient of Variation	6	8	15	6	13	5	5	4	7
% Change		-4	-8	-2	9	1	0	5	-7

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: January 2003
TRI Log Number: E2173-46-05

Exposure Time and Temperature

Test Parameters	Baseline	30 Day 23C	30 Day 50C	60 Day 23C	60 Day 50C	90 Day 23C	90 Day 50C	120 Day 23C	120 Day 50C
GEONET: HDPE GEONET EXPOSED TO PaDER MSW SYNTHETIC LEACHATE									
Strip Tensile Properties:	56	55	60	57	49	59	53	60	47
Maximum Strength (lbs)	57	53	59	57	56	54	53	61	59
ASTM D5035	64	51	60	56	62	51	52	58	56
Transverse Direction	57								
	51								
	53								
Average	56	53	60	57	58	55	53	60	54
STD	4	2	0	0	5	3	0	1	5
Coefficient of Variation	7	3	1	1	10	6	1	2	9
% Change		-6	6	1	-1	-3	-7	6	-4
Strip Tensile Properties:	129	171	163	151	169	148	155	135	165
Elongation @ Max. Strength (%)	172	160	139	159	157	141	168	147	177
ASTM D5035	153	115	133	160	189	149	167	149	148
Transverse Direction	133								
	151								
	149								
Average	148	149	145	157	172	146	163	144	163
STD	14	24	13	4	13	4	6	6	12
Coefficient of Variation	10	16	9	3	8	2	4	4	7
% Change		1	-2	6	16	-1	10	-3	10

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

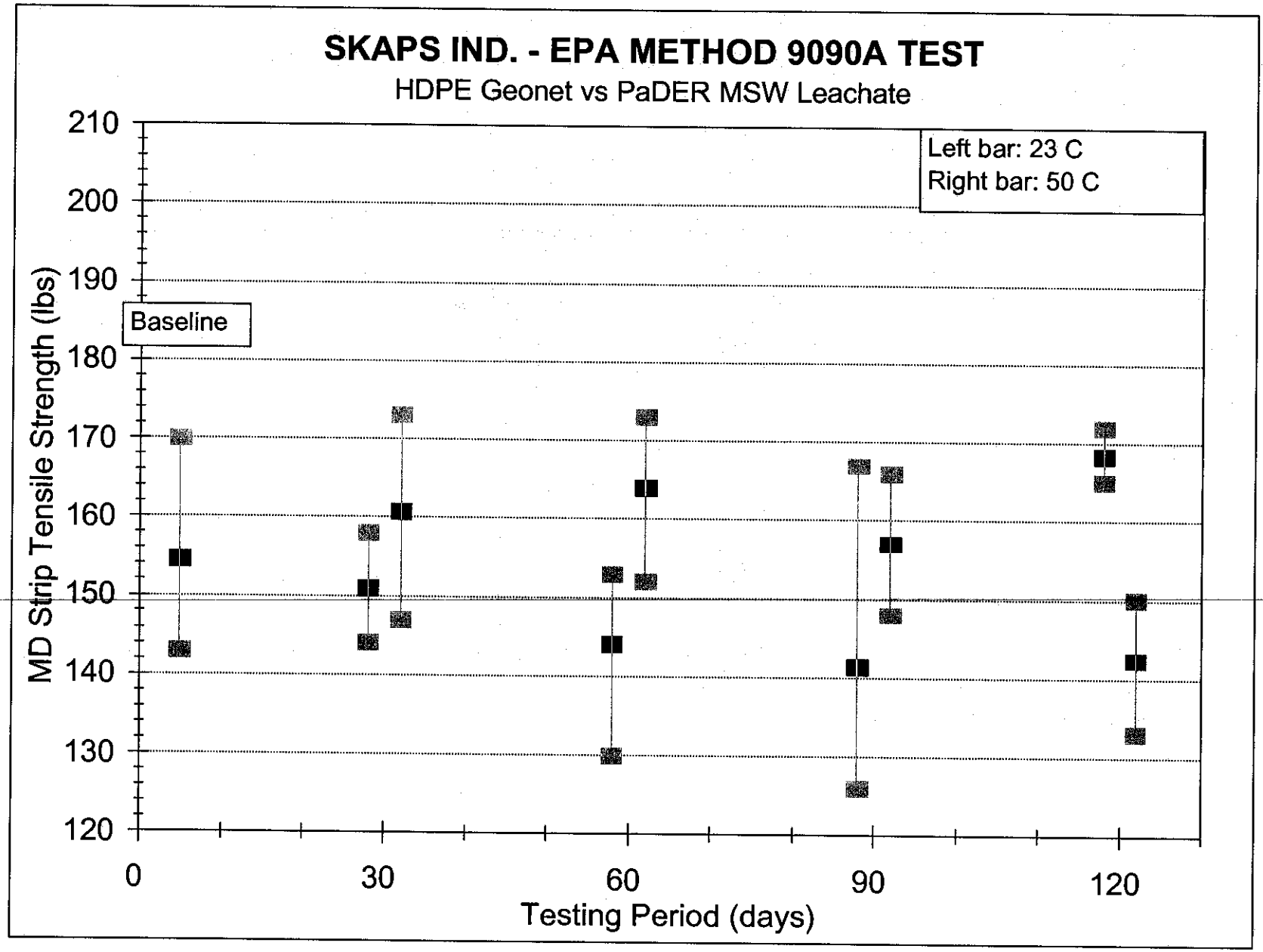
Report Date: January 2003
TRI Log Number: E2173-46-05

Test Parameters	Baseline	Exposure Time and Temperature: 30 Day 23C	30 Day 50C	60 Day 23C	60 Day 50C	90 Day 23C	90 Day 50C	120 Day 23C	120 Day 50C
GEONET: HDPE GEONET EXPOSED TO PaDER MSW SYNTHETIC LEACHATE									
Compressive Strength:	35951	36083	33732	25141	34508	39672	33045	35164	31349
Strength at Rib Layover (psf)	35677	31833	39106	40149	23798	32742	32879	34119	33234
ASTM D1621	38252	34801	31922	37048	42045	37877	39494	40486	36492
	36837								
	32100								
	33888								
Average	35451	34239	34920	34113	33450	36764	35139	36590	33692
STD	1989	1780	3051	6469	7487	2937	3080	2788	2124
Coefficient of Variation	6	5	9	19	22	8	9	8	6
% Change		-3	-1	-4	-6	4	-1	3	-5
Transmissivity:	1.96E-03	1.88E-03	1.91E-03	1.77E-03	1.94E-03	1.87E-03	1.90E-03	1.96E-03	1.90E-03
(m2/sec)	1.95E-03	1.88E-03	1.69E-03	1.76E-03	1.91E-03	1.84E-03	1.93E-03	1.96E-03	1.96E-03
ASTM D4716	2.01E-03	1.89E-03	1.94E-03	1.78E-03	1.84E-03	1.82E-03	1.95E-03	1.94E-03	1.89E-03
	1.94E-03								
	2.00E-03								
	1.88E-03								
Average	1.96E-03	1.88E-03	1.91E-03	1.77E-03	1.90E-03	1.84E-03	1.93E-03	1.95E-03	1.92E-03
STD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coefficient of Variation	2.18	0.25	1.07	0.46	2.21	1.11	1.07	0.48	1.61
% Change		-3.75	-2.21	-9.54	-3.07	-5.79	-1.53	-0.17	-2.04
CBR Puncture:	292	238	292	279	345	296	308	279	256
Puncture Resistance (lbs)	235	247	298	289	276	278	311	265	275
ASTM D6241	280	270	265	240	273	255	289	246	288
	285								
	286								
	284								
Average	277	252	285	269	298	276	303	263	273
STD	19	13	14	21	33	17	10	14	13
Coefficient of Variation	7	5	5	8	11	6	3	5	5
% Change		-9	3	-3	8	-0	9	-5	-1

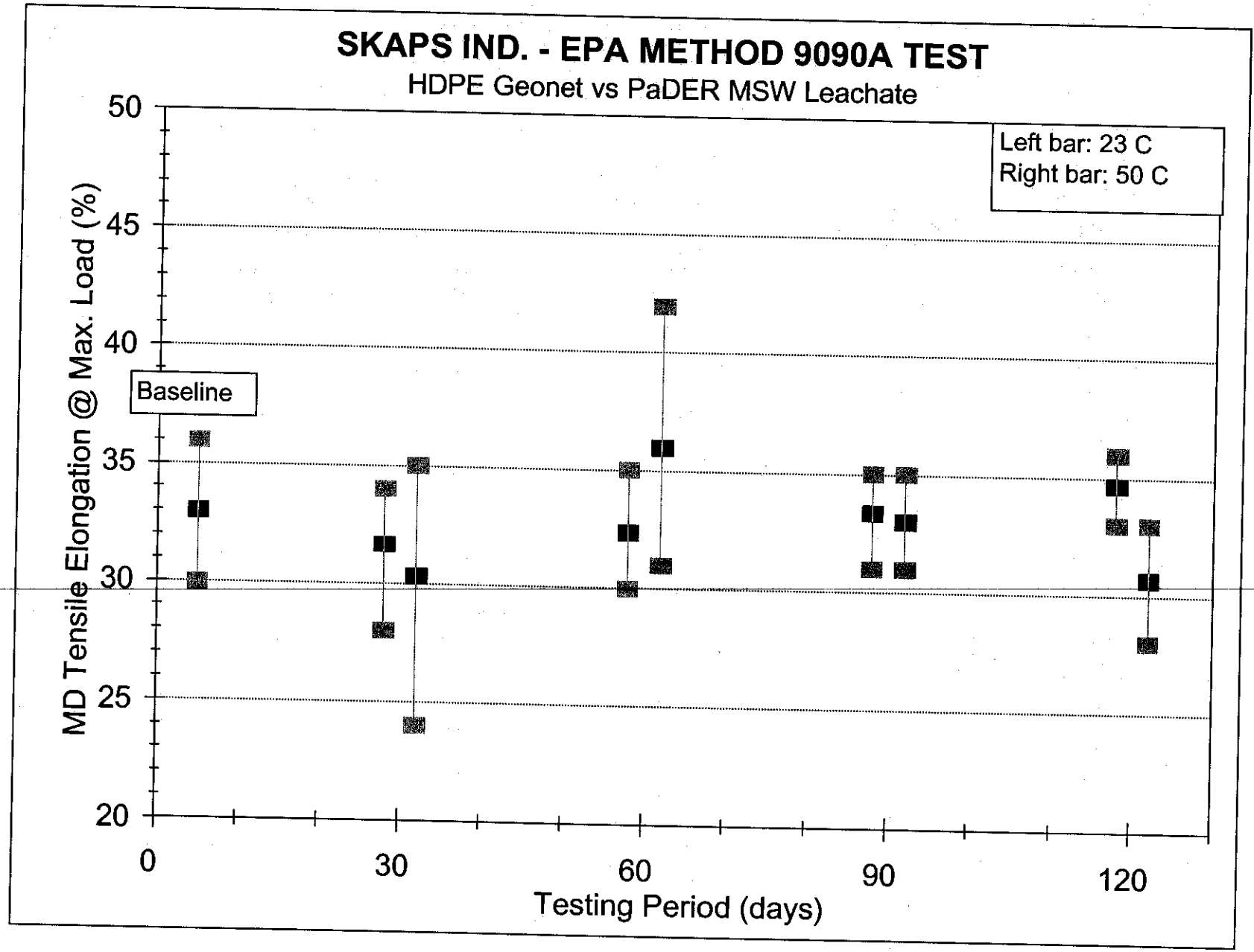
TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: January 2003
TRI Log Number: E2173-46-05

Test Parameters	Baseline	Exposure Time and Temperature: 30 Day 23C	30 Day 50C	60 Day 23C	60 Day 50C	90 Day 23C	90 Day 50C	120 Day 23C	120 Day 50C
GEONET: HDPE GEONET EXPOSED TO PaDER MSW SYNTHETIC LEACHATE									
Volatiles and Extractables:	-1.51	-1.51	-1.01	-2.00	-0.51	0.00	-1.00	-0.50	-1.01
Machine Diameter Change (%)	-3.02	-2.51	-1.51	-1.01	-1.50	-1.01	-2.01	-2.53	-0.51
SW 870 - Appendix III-D	-2.51								
	-1.01								
Average	-2.01	-2.01	-1.26	-1.51	-1.01	-0.51	-1.51	-1.52	-0.76
STD	0.79	0.50	0.25	0.50	0.50	0.51	0.50	1.02	0.25
Volatiles and Extractables:	-3.02	-3.48	-1.51	-1.04	-1.01	-1.49	-0.51	-1.03	-1.54
Transverse Diameter Change (%)	-3.98	-3.48	-1.00	-3.05	-1.00	-1.52	-1.02	-1.54	-1.53
SW 870 - Appendix III-D	-1.99								
	-0.50								
Average	-2.37	-3.48	-1.26	-2.05	-1.01	-1.51	-0.77	-1.29	-1.54
STD	1.29	0.00	0.26	1.01	0.01	0.02	0.26	0.25	0.00
Volatiles and Extractables:	0.07	0.11	0.09	0.11	0.16	0.12	0.11	0.12	0.11
% Volatiles	0.07	0.11	0.12	0.10	0.16	0.08	0.10	0.13	0.08
SW 870 - Appendix III-D	0.07								
	0.07								
Average	0.07	0.11	0.11	0.11	0.16	0.10	0.11	0.13	0.10
STD	0.00	0.00	0.02	0.00	0.00	0.02	0.00	0.01	0.01
Volatiles and Extractables:	0.16	0.25	0.21	0.16	0.13	0.22	0.08	0.18	0.10
% Extractables	0.14	0.18	0.25	0.32	0.30	0.27	0.19	0.35	0.30
SW 870 - Appendix III-D	0.16								
	0.25								
Average	0.18	0.22	0.23	0.24	0.22	0.25	0.14	0.27	0.20
STD	0.04	0.04	0.02	0.08	0.09	0.03	0.05	0.08	0.10



TRI Geosynthetics Division Client: Skaps Industries, File: 465-skaps-gn .WB1



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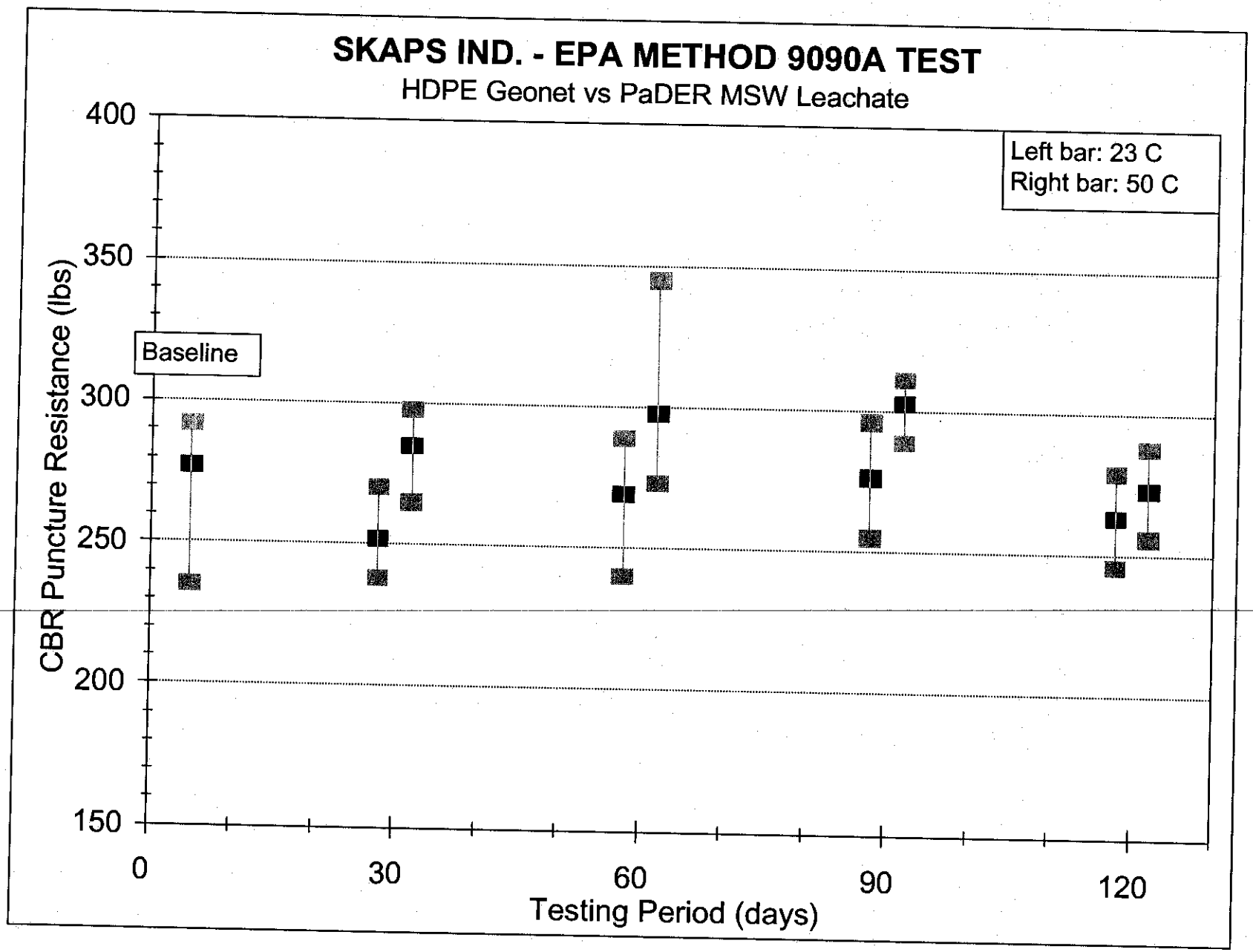

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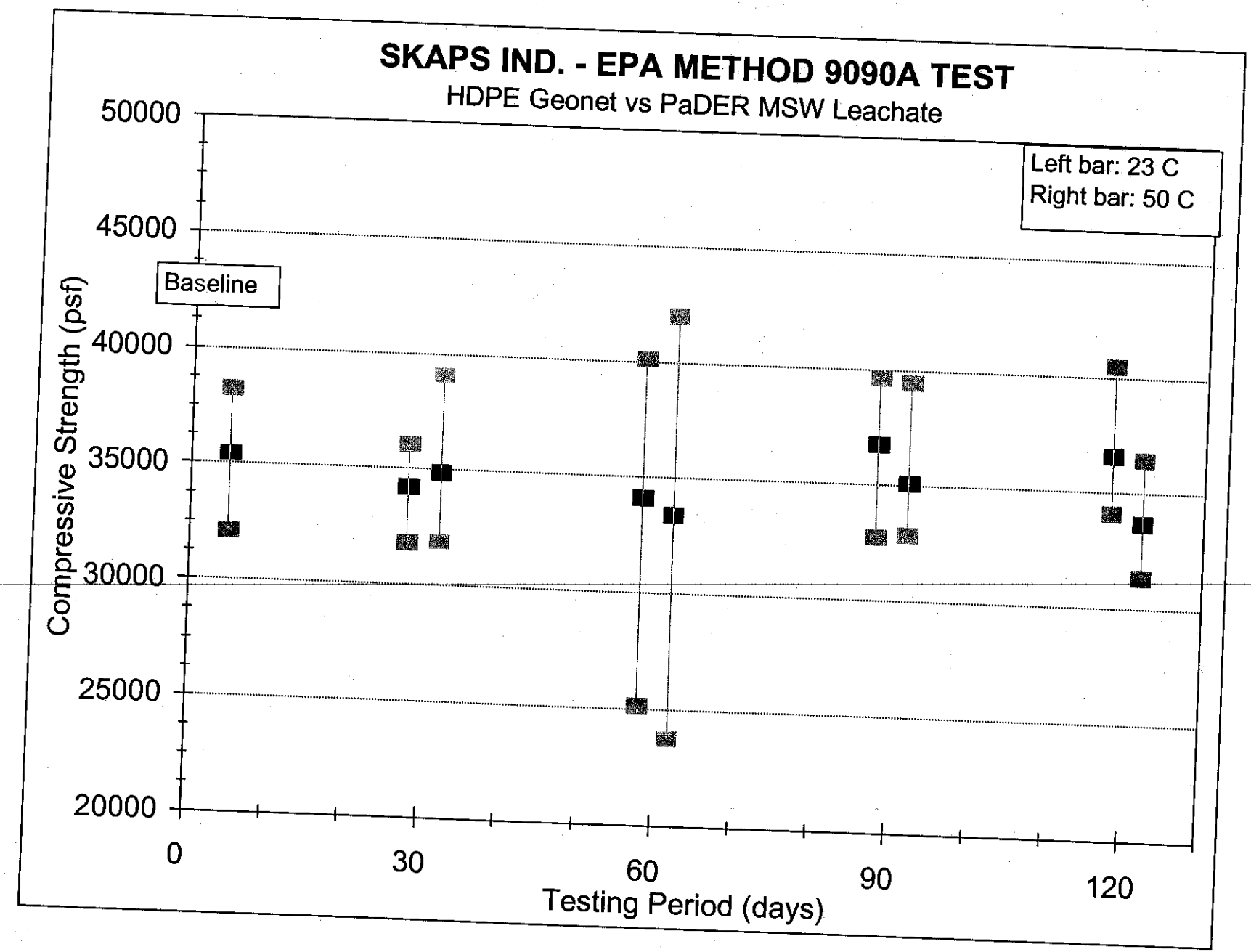
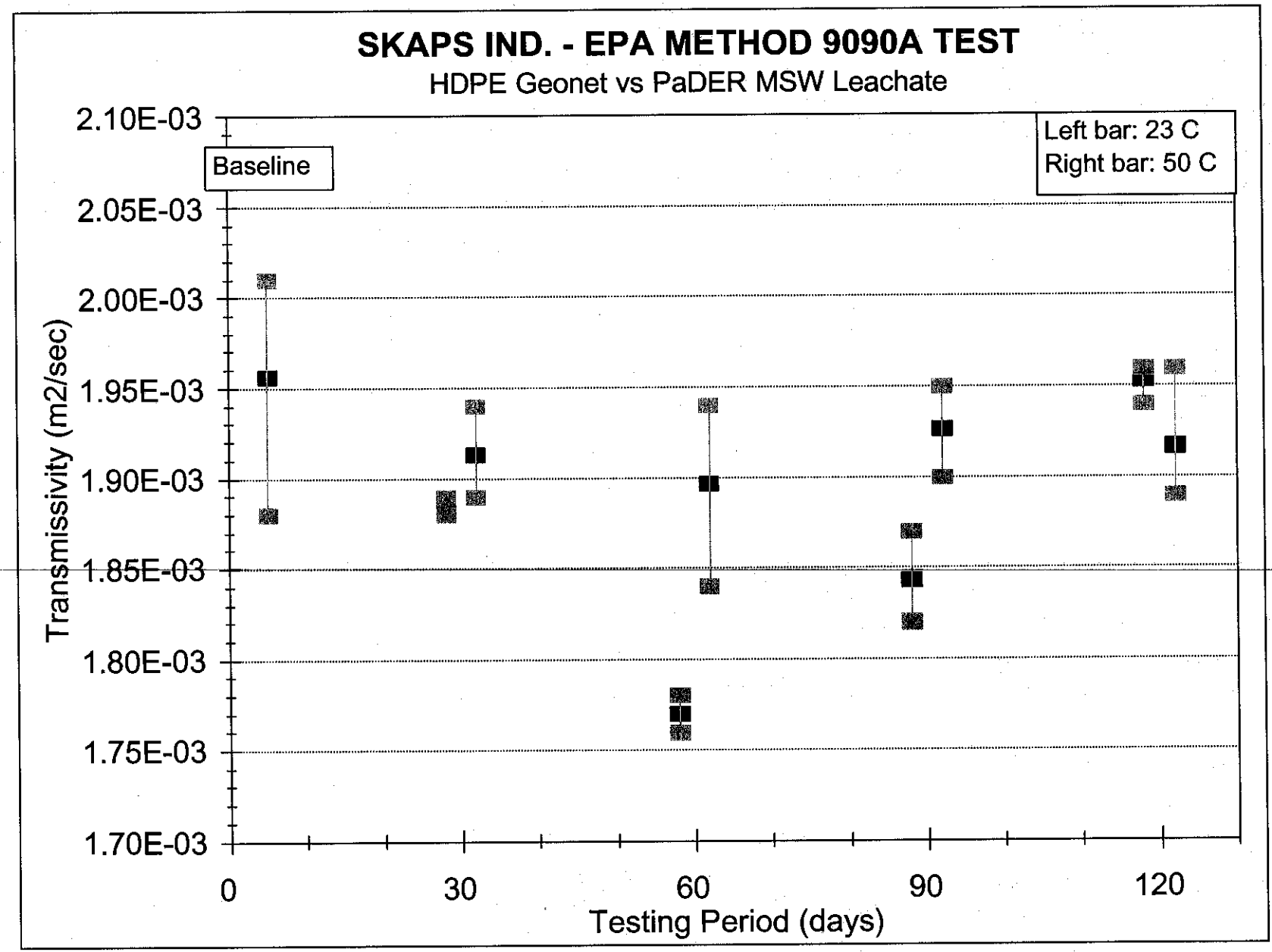


TRI Geosynthetics Division Client: Skaps Industries, File: 465-skaps-gn .WB1



TRI Geosynthetics Division Client: Skaps Industries, File: 465-skaps-gn .WB1

A Final Report:

Laboratory Testing of Geotextile for Waste Containment EPA Method 9090A

February 2004

Submitted to:

Skaps Industries

571 Industrial Parkway
Commerce, GA 30529

Attn: **Mr. Anurag**

Submitted by:

TRI/Environmental, Inc.
9063 Bee Caves Rd.
Austin, Texas 78733

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

February 11, 2004

Mr. Anurag
Skaps Industries
571 Industrial Parkway
Commerce, GA 30529

Dear Mr. Anarag:

TRI/Environmental, Inc. (TRI) is pleased to present this Final Report for a geotextile chemical resistance study performed in general accordance with EPA Method 9090A as applied by ASTM D 6389-99, *Standard Practice for Tests to Evaluate the Chemical Resistance of Geotextiles to Liquids*.

TRI is very pleased to be of service to Skaps Industries. Please call me if you have any questions or require any additional information (800 880 8378).

Respectfully submitted,

Sam R. Allen

Sam R. Allen
Vice President and Division Manager
Geosynthetic Services Division
www.GeosyntheticTesting.com

FOREWORD

The testing reported herein is based upon accepted industry practice as well as the test method listed. TRI/Environmental Inc. (TRI) neither accepts responsibility for nor makes claim as to the final use and purpose of the materials tested.

Tests were performed under laboratory conditions and not under actual usage conditions. TRI can give no conclusions as to the serviceability, life expectancy or general durability of the products tested when used in a lining and/or leachate collection system.

1.0 INTRODUCTION

This report describes the work performed by TRI/Environmental, Inc. (TRI) to determine the chemical compatibility of one geotextile product with one synthetic waste leachate. The objective was to determine the resistance of the geotextile to changes caused by exposure to leachate. Changes in physical, mechanical and hydraulic properties were measured after exposure to the leachate at 23°C and 50°C for 30, 60, 90 and 120 days. Exposures were performed in accordance with the exposure regimen specified in United States Environmental Protection Agency (EPA) Method 9090A.

All samples were logged in and all testing performed under TRI log number E2183-79-10. Methods, results and discussion are provided in the sections which follow. Test results are provided in the Tables of Results which accompany this report.

2.0 METHODS

2.1 Materials

The material selected for evaluation in this chemical compatibility study was Skaps.GTE 160 polypropylene staple fiber nonwoven needlepunched geotextile.

2.2 Leachate

The waste leachate used was supplied by TRI and was a synthetic MSW leachate approximating the PaDER leachate recipe.

2.3 Exposure Conditions

Geotextile specimens were exposed to the waste leachate following the specifications of EPA Method 9090A as they relate to exposure to waste fluids. The tanks used for these exposures were maintained at 23 ± 2ºC and 50 ± 2ºC throughout the 120-day exposure period. Tanks were constructed from chemically resistant glass fitted with stirrers. The 50ºC tanks were heated with a circulating hot water heat exchanger system. They were also sealed with a lid, and a reflux condenser was installed to minimize loss of volatile leachate components.

2.4 Testing Procedures

Table 1 lists tests performed on the geotextile. The number of test replicates was doubled for baseline determinations on unexposed material.

Table 1. Tests performed on TNS - Nevown, Inc. nonwoven geotextile

Test or Physical Property	Method	Number of replicate specimens
Dimensions and weight	EPA 9090A	2 readings
Grab Tensile Strength	ASTM D 4632	3 MD & TD readings
Grab Tensile Elongation	ASTM D 4632	3 MD & TD readings
Trapezoidal Tear Strength	ASTM D 4533	3 MD & TD readings
Puncture Resistance	ASTM D 4833	3 readings
Mullen Burst	ASTM D 3786	3 readings
Permittivity	ASTM D 4491	3 readings

3.0 RESULTS AND DISCUSSION

Test results are presented in the Test Results section which is included with this report. Test results are presented in tabular form as well as graphical form.

In considering these results, it must be determined through engineering judgment whether observed differences in the value of test results measured before and after immersion are due to product variability, unidentified factors relating to the test procedure, or leachate interaction with the product. Any significant chemical interaction with leachate would be expected to result in degradation trends which are consistent across the various properties being evaluated, and not isolated to one set of test results only. However, with each type of material there may be specific properties which are highly sensitive to leachate-induced effects. These factors must be considered in evaluating the various test results for a given product.

Also of critical importance is the issue of product variability. With nonwoven geotextiles, a range of physical and mechanical index test values covering 20% or more of the average is not uncommon. This can be traced to variability inherent in the product, and the randomness associated with the onset of failure under the specified testing conditions. However, in chemical compatibility testing the statistical sampling of a broad range of manufactured product is not possible. Therefore, the small size of the sample population tested at each time point must be taken into consideration. The criteria to be applied in evaluating data measured before and after leachate immersion should be that property changes, if observed, are consistent and so great that product variability and experimental factors can be ruled out.

In this report, standard deviations (STD) are reported for measurements involving three or more replicate specimens. In statistics, the standard deviation is defined as root of the mean squared deviations of

individual test results about the mean value. The standard deviation is a quantitative measure of variability within a group of measurements.

One related measure of variability observed within a sample set, relative to the magnitude of the mean value itself, is the *coefficient of variation or variance* (COV). The coefficient of variance is defined as the standard deviation divided by the mean associated with a group of specimens, and may be expressed as a percentage. The COV provides an indication of what proportion of the mean value may be attributable to random experimental factors or product variability. It is useful to consider apparent changes in property values against the criterion of COV since observed changes which fall below the COV may not be significant. This approach was used in preparing the tables in the next section.

The term *range* refers to the difference between the extreme highest and lowest points within a group of measured values. Considering range as a percentage of the mean values provides another measure of variability within a dataset.

In the tables, the high and low extremes for percentage change in mean values are listed for comparison against COV and range as a percentage of mean from the baseline sample group. The high and low percentage changes are the extremes from data measured at 30, 60, 90 and 120 days.

SKAPS GTE 160 nonwoven polypropylene geotextile

Table 2 illustrates the range of variability in baseline data compared with some of the observed changes in average test values measured after immersion for the geotextile.

Table 2. Baseline coefficients of variation and range of percentage change results for geotextile

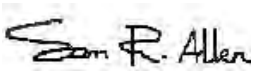
Test	Baseline COV (%)*	Baseline Range as % of Mean*	High Observed % Change	Low Observed % Change
Grab Tensile Strength (MD)	**8**	**22**	**12**	**-1**
Grab Tensile Elongation @ Maximum Load (MD)	**8**	**24**	**2**	**-4**
Trapezoidal Tear Strength (MD)	**8**	**22**	**7**	**-8**
Puncture Strength	**17**	**50**	**3**	**-9**
Mullen Burst Strength	**8**	**26**	**5**	**-9**

4.0 CONCLUSION

While some changes in certain measured physical and mechanical properties were noted for the geotextile, the observed variances were random and are believed to be the effects of product variability and experimental factors.

TRI/Environmental, Inc. is pleased to have been selected to participate in this project. We trust that the information provided in this report meets your requirements for technical documentation of this chemical compatibility study. Please do not hesitate to call if you have any questions or require any additional information.

Respectfully submitted,



Sam R. Allen
Vice President and Division Manager
Geosynthetic Services Division

TRI/Environmental, Inc.

APPENDIX:

EPA METHOD 9090A TEST RESULTS

SKAPS GTE 160 Nonwoven Geotextile TEST RESULTS

Dimensions

TRI LOG NUMBER: E2183-79-10

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: February 2004
TRI Log Number: E2189-79-10

Exposure Time and Temperature

Test Parameters	Temp.	30 Day Baseline	30 Day Exposed	30 Day % Change	60 Day Baseline	60 Day Exposed	60 Day % Change	90 Day Baseline	90 Day Exposed	90 Day % Change	120 Day Baseline	120 Day Exposed	120 Day % Change
GEOTEXTILE: POLYPROPYLENE NONWOVEN EXPOSED TO PaDER SYNTHETIC MSW LEACHATE													
GEOTEXTILE ROLL ID: GTE-160													
Thickness (mils)	23C	115	112	-2.6	112	112	0.0	118	118	0.0	108	107	-0.9
	50C	107	104	-2.8	118	117	-0.8	117	113	-3.4	114	117	2.6
Length (inches)	23C	8.06	8.04	-0.2	8.07	8.03	-0.5	8.10	8.00	-1.2	8.05	8.00	-0.6
	50C	8.08	7.97	-1.4	8.06	7.96	-1.2	8.08	7.95	-1.6	8.01	7.94	-0.9
Width (inches)	23C	4.05	4.01	-1.0	4.02	4.00	-0.5	4.00	3.96	-1.0	3.98	3.95	-0.8
	50C	4.00	3.92	-2.0	4.01	3.99	-0.5	4.06	4.02	-1.0	4.06	4.04	-0.5
Mass (g)	23C	4.88	4.87	-0.2	4.88	4.95	1.4	5.01	5.01	0.0	6.55	6.51	-0.6
	50C	4.38	4.38	0.0	5.15	5.08	-1.4	5.08	5.05	-0.6	5.60	5.53	-1.2

EPA METHOD 9090A TEST RESULTS

SKAPS GTE 160 Nonwoven Geotextile TEST RESULTS

TRI LOG NUMBER: E2183-79-10

NOTE ON TEST RESULTS

This section includes generated test data provided in both tabular and graphical form. Each graph is represented by a series of "I" beam plots. Each "I" beam represents a single test population and illustrates the high and low value as the end points, and the mean as a central box on the beam.

At each testing period, two "I" beams are shown. The left beam represents the 23^{o}C exposed specimens while the right beam represents the 50^{o}C specimens. The initial "I" beam represents the baseline or unexposed test specimens.

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: February 2004
TRI Log Number: E2183-79-10

Test Parameters	Baseline	Exposure Time and Temperature: 30 Day 23C	30 Day 50C	60 Day 23C	60 Day 50C	90 Day 23C	90 Day 50C	120 Day 23C	120 Day 50C
GEOTEXTILE: POLYPROPYLENE NONWOVEN EXPOSED TO PaDER SYNTHETIC MSW LEACHATE									
GEOTEXTILE ROLL ID: GTE-160									
Grab Tensile Properties:	221	206	183	182	215	208	204	214	230
Maximum Strength (lbs)	177	185	208	184	223	196	199	246	205
ASTM D4632	202	211	222	232	240	215	192	161	218
Machine Direction	204								
	187								
	215								
Average	201	201	204	199	226	206	198	207	218
STD	15	11	16	23	10	8	5	35	10
Coefficient of Variation	8	6	8	12	5	4	2	17	5
% Change		-0	2	-1	12	3	-1	3	8
Grab Tensile Properties:	96	94	93	99	100	91	103	95	108
Elongation @ Max. Strength (%)	89	105	100	106	105	98	99	107	98
ASTM D4632	95	107	101	100	103	101	100	103	103
Machine Direction	104								
	109								
	113								
Average	101	102	98	102	103	97	101	102	103
STD	8	6	4	3	2	4	2	5	4
Coefficient of Variation	8	6	4	3	2	4	2	5	4
% Change		1	-3	1	2	-4	-0	1	2

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: February 2004
TRI Log Number: E2183-79-10

		Exposure Time and Temperature							
		30 Day		60 Day		90 Day		120 Day	
Test Parameters	Baseline	23C	50C	23C	50C	23C	50C	23C	50C
GEOTEXTILE: POLYPROPYLENE NONWOVEN EXPOSED TO PaDER SYNTHETIC MSW LEACHATE									
GEOTEXTILE ROLL ID: GTE-160									
Grab Tensile Properties:	321	345	289	308	338	323	290	285	274
Maximum Strength (lbs)	325	343	310	338	277	317	309	303	309
ASTM D4632	282	252	282	287	252	329	292	310	298
Transverse Direction	288								
	220								
	258								
Average	282	313	294	311	289	323	297	299	294
STD	36	43	12	21	36	5	9	11	15
Coefficient of Variation	13	14	4	7	12	2	3	4	5
% Change		11	4	10	2	14	5	6	4
Grab Tensile Properties:	98	97	93	97	98	93	99	91	93
Elongation @ Max. Strength (%)	115	112	104	109	99	100	99	103	104
ASTM D4632	94	94	103	97	85	93	92	94	95
Transverse Direction	83								
	95								
	99								
Average	97	101	100	101	94	95	97	96	97
STD	9	8	5	6	6	3	3	5	5
Coefficient of Variation	10	8	5	6	7	3	3	5	5
% Change		4	3	4	-3	-2	-1	-1	0

TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

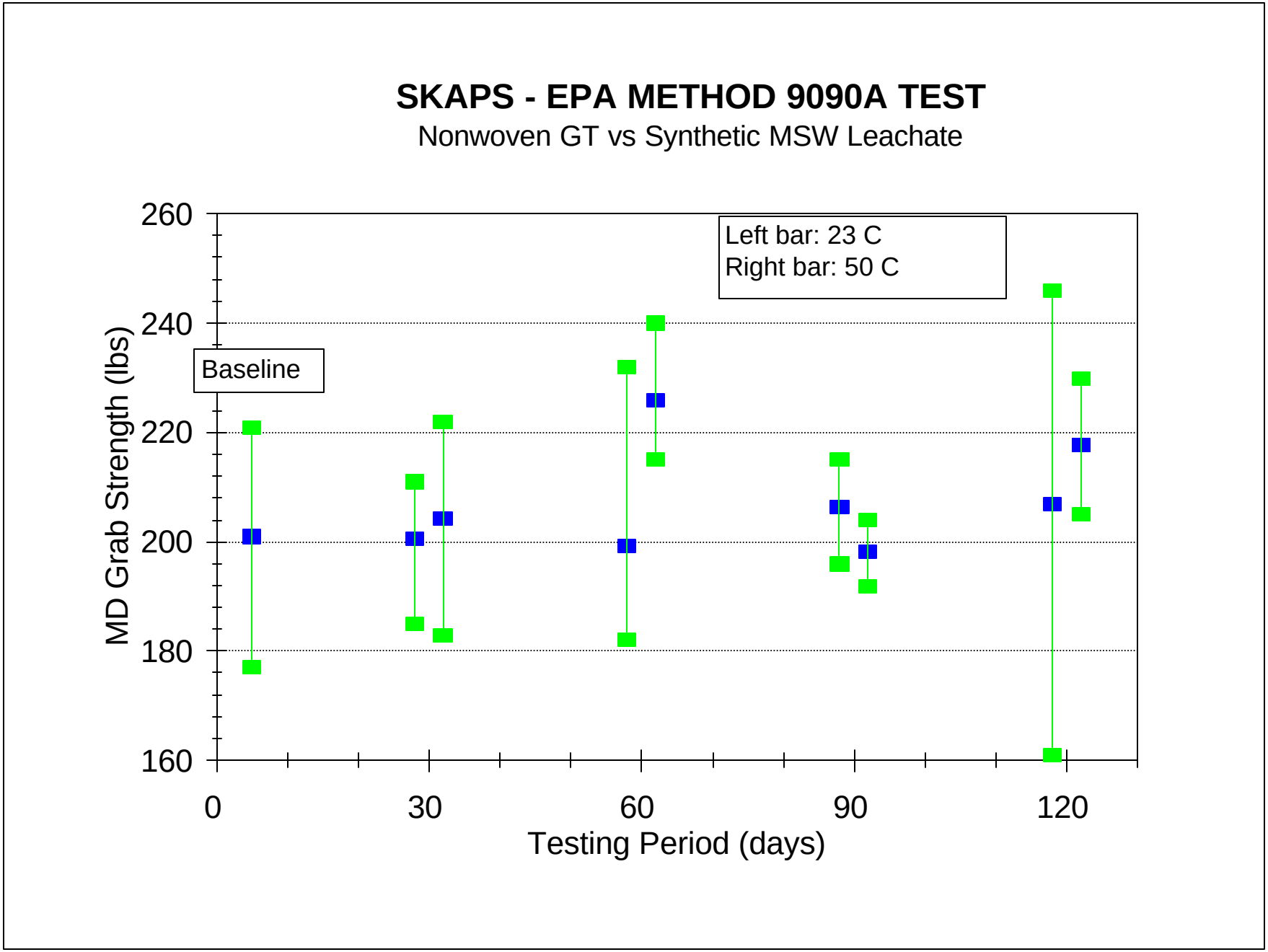
Report Date: February 2004
TRI Log Number: E2183-79-10

Test Parameters	Baseline	Exposure Time and Temperature: 30 Day 23C	30 Day 50C	60 Day 23C	60 Day 50C	90 Day 23C	90 Day 50C	120 Day 23C	120 Day 50C
GEOTEXTILE: POLYPROPYLENE NONWOVEN EXPOSED TO PaDER SYNTHETIC MSW LEACHATE									
GEOTEXTILE ROLL ID: GTE-160									
Mullen Burst Strength:	455	380	415	390	450	450	435	415	380
Burst Strength (psi)	420	400	380	400	430	415	410	405	385
ASTM D3786	425	345	415	400	410	410	380	365	350
	400								
	350								
	405								
Average	409	375	403	397	430	425	408	395	372
STD	32	23	16	5	16	18	22	22	15
Coefficient of Variation	8	6	4	1	4	4	6	5	4
% Change		-8	-1	-3	5	4	-0	-3	-9
Permittivity:	1.63	1.61	1.79	1.53	1.66	1.97	1.83	1.78	1.72
(sec -1)	1.81	1.64	1.64	1.97	1.97	1.76	1.86	1.67	1.61
ASTM D4491	1.63	1.53	1.88	1.97	1.83	1.88	1.81	1.91	2.00
	1.79								
	1.76								
	1.68								
Average	1.72	1.59	1.77	1.82	1.82	1.87	1.83	1.79	1.78
STD	0.07	0.05	0.10	0.21	0.13	0.09	0.02	0.10	0.16
Coefficient of Variation	4.28	2.91	5.59	11.38	6.96	4.60	1.12	5.49	9.24
% Change		-7	3	6	6	9	7	4	3
Trapezoidal Tear	87	97	78	95	94	89	85	102	88
Tear Strength - (lbs)	86	87	94	82	91	78	101	70	104
ASTM D4533	105	112	82	77	109	106	111	87	99
Machine Direction	92								
	85								
	95								
Average	92	99	85	85	98	91	99	86	97
STD	7	10	7	8	8	12	11	13	7
Coefficient of Variation	8	10	8	9	8	13	11	15	7
% Change		8	-8	-8	7	-1	8	-6	6

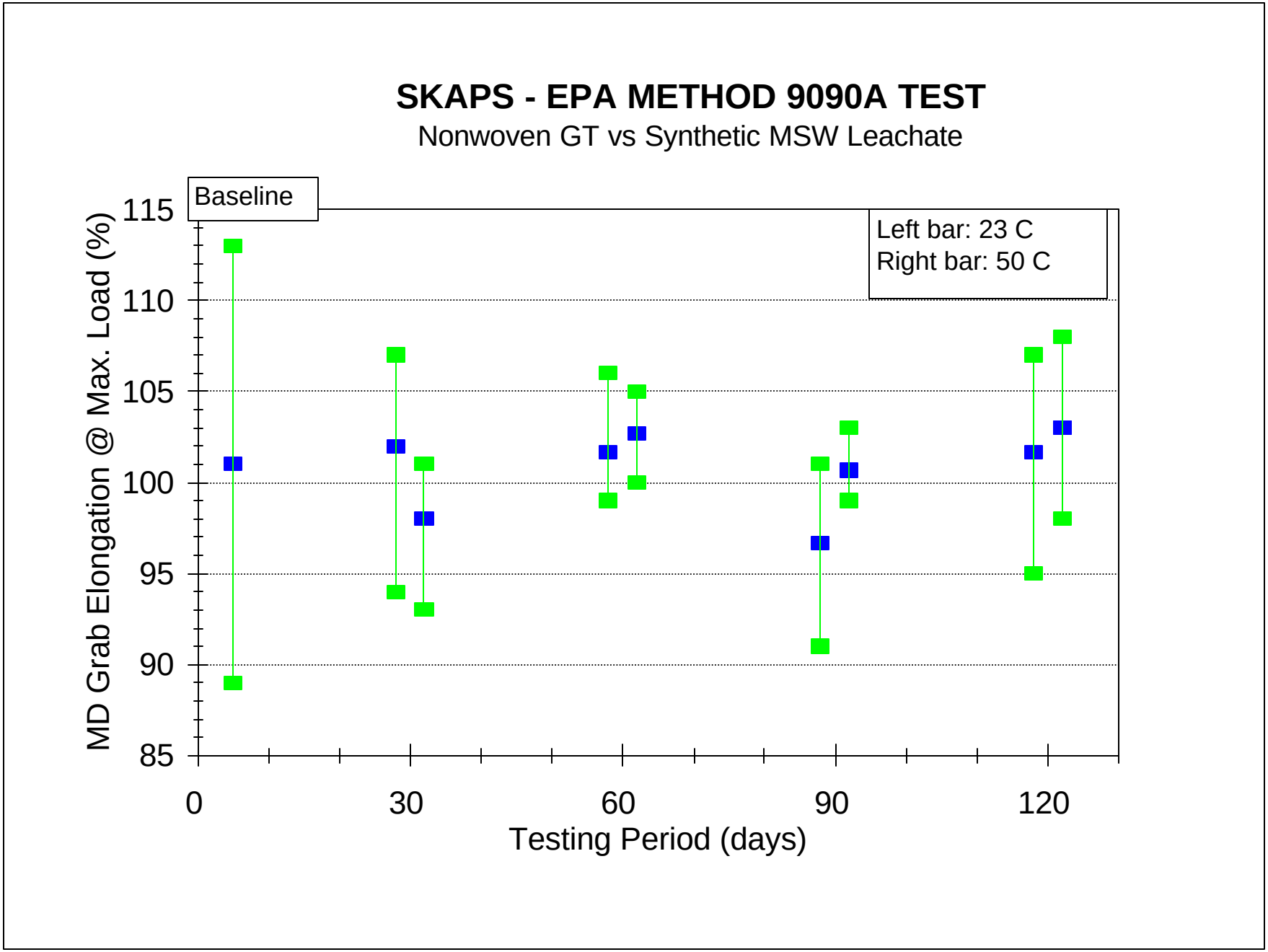
TABLE OF CHEMICAL COMPATIBILITY TEST RESULTS
Client: Skaps Industries

Report Date: February 2004
TRI Log Number: E2183-79-10

		Exposure Time and Temperature							
		30 Day		60 Day		90 Day		120 Day	
Test Parameters	Baseline	23C	50C	23C	50C	23C	50C	23C	50C
GEOTEXTILE: POLYPROPYLENE NONWOVEN EXPOSED TO PaDER SYNTHETIC MSW LEACHATE									
GEOTEXTILE ROLL ID: GTE-160									
Trapezoidal Tear	150	189	164	137	156	200	145	196	146
Tear Strength - (lbs)	165	179	162	174	156	151	181	158	175
ASTM D4533	140	155	147	176	168	176	173	135	140
Transverse Direction	208								
	161								
	162								
Average	164	174	158	162	160	176	166	163	154
STD	21	14	8	18	6	20	15	25	15
Coefficient of Variation	13	8	5	11	4	11	9	15	10
% Change		6	-4	-1	-3	7	1	-1	-6
Puncture	147	119	118	129	130	131	150	145	117
Puncture Strength (lbs)	165	127	158	149	132	120	112	148	126
ASTM D4833	143	120	133	114	118	136	147	118	161
	134								
	99								
	112								
Average	133	122	136	131	127	129	136	137	135
STD	22	4	16	14	6	7	17	13	19
Coefficient of Variation	17	3	12	11	5	5	13	10	14
% Change		-9	2	-2	-5	-3	2	3	1



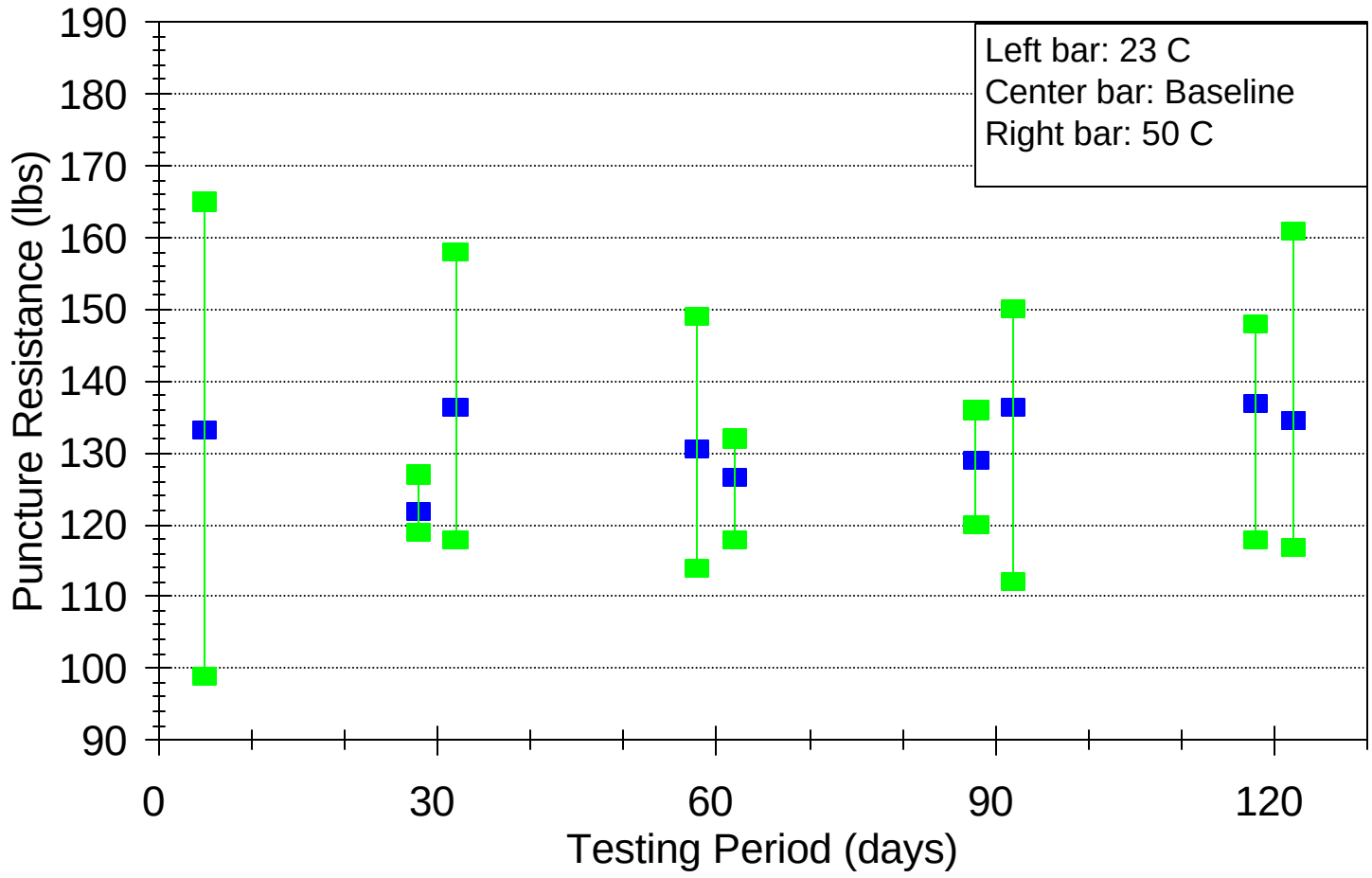
Client: Skaps, File: E2183-79-10



Client: Skaps, File: E2183-79-10

SKAPS EPA METHOD 9090 TEST

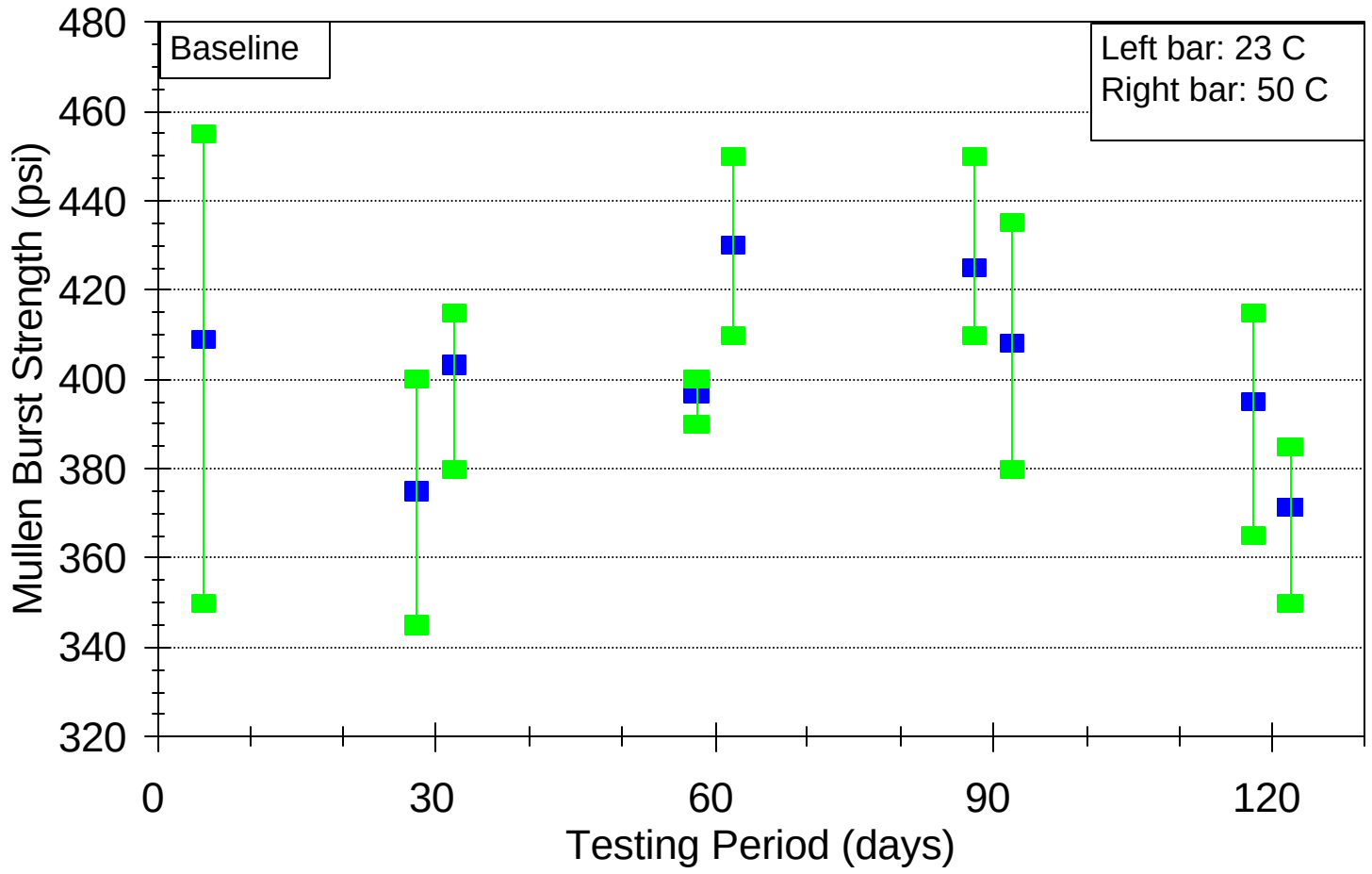
Nonwoven GT vs Synthetic MSW Leachate



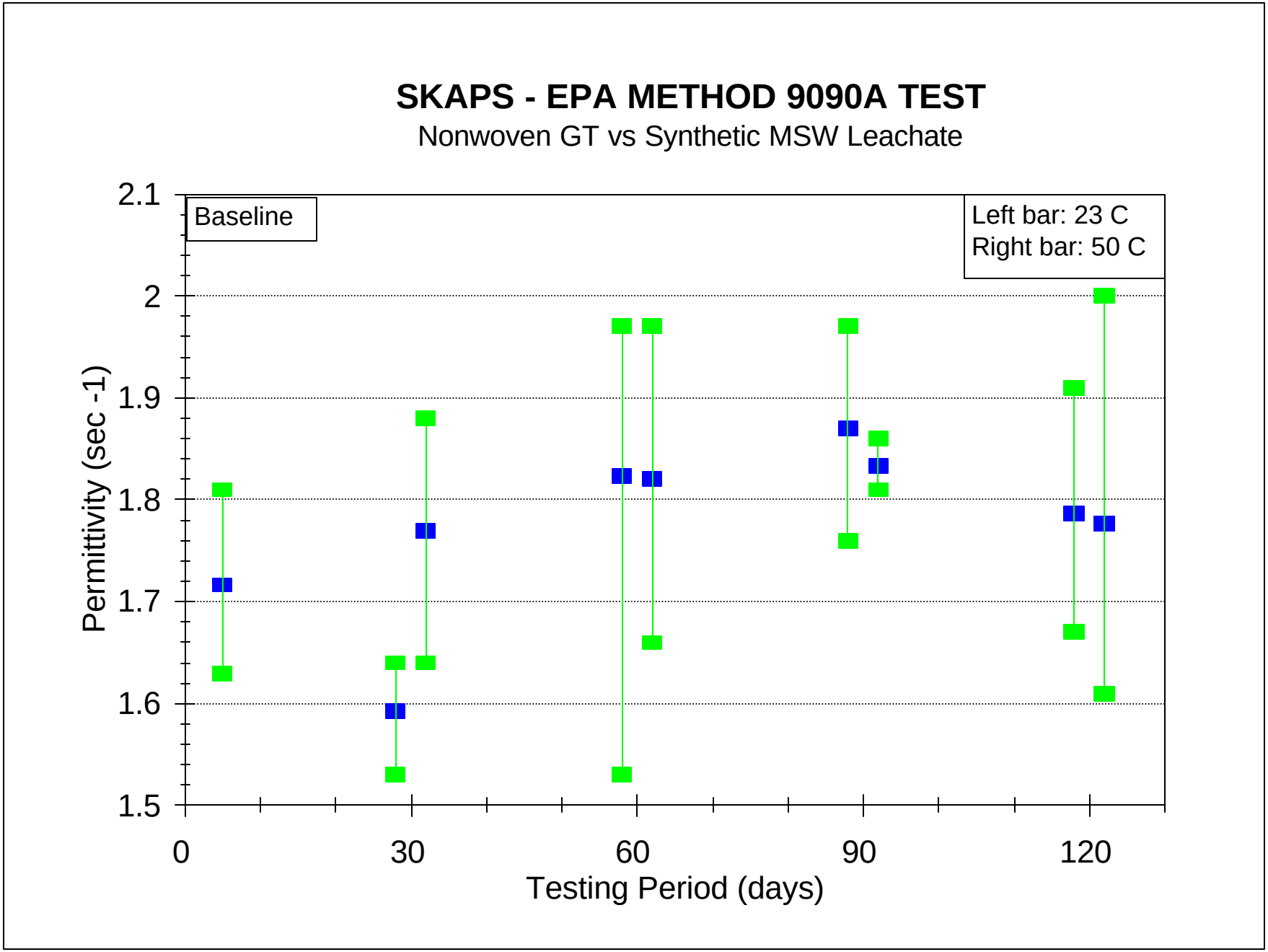
Client: Skaps, File: E2183-79-10

SKAPS - EPA METHOD 9090A TEST

Nonwoven GT vs Synthetic MS Leachate



Client: Skaps, File: E2183-79-10



Client: Skaps, File: E2183-79-10

EPA 9090 TESTING OF 82 TEX WOVEN GEOTEXTILE

Samples of 82 Tex, a woven polypropylene geotextile manufactured by Synthetic Industries, were tested for compatibility with landfill leachate sampled from the Lakeview Landfill Disposal facility located in Erie, Pennsylvania. Numerous laboratory tests were completed on specimens subjected to leachate to determine if conditions found in a landfill will adversely affect the properties of 82 Tex. Laboratory tests include:

Grab Strength	ASTM D-4632
Trapezoidal Tear	ASTM D 4533
Puncture	ASTM D 4833
Mullen Burst	ASTM D 3786
Permittivity	ASTM D 4491
Dimensional Stability	ASTM D 4591
Thickness	ASTM D 5199
Mass/Unit Area	ASTM D 3776

The above testing was conducted at temperatures of 23℃ and 50℃ to model potential conditions that a geotextile would experience in a landfill application. Testing was conducted after exposure to leachate at intervals of 30, 60, 90 and 120 days. Initial baseline testing of specimens not immersed in leachate was also conducted for comparison purposes.

Test data shows that the fabric performed well when subjected to the leachate and temperature conditions used in the testing program. Variations in test results can be attributed the general variability of the material itself. Graphical representation of test data in the form of percent change from specimens not immersed in leachate can be viewed in the document.

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Final Report
EPA 9090 Testing
82 Tex Woven Geotextile

Synthetic Industries

Performed For:

Synthetic Industries
Construction Products Division
4019 Industry Drive
Chattanooga, TN 37416

Performed By:

J&L Testing Company, Inc.
938 South Central Avenue
Canonsburg, PA 15317

May 4, 1994
Job No: 93R1419

JLT J&L TESTING COMPANY, INC.
GEOTECHNICAL AND GEOSYNTHETICS MATERIALS TESTING AND RESEARCH

May 4, 1994
93R1419

Synthetic Industries
Construction Products Division
4019 Industry Drive
Chattanooga, TN 37416

Attention: Mr. Rick Riggs

RE: **FINAL REPORT**
EPA 9090 TESTING
82 TEX WOVEN GEOTEXTILE
SYNTHETIC INDUSTRIES

Dear Mr. Riggs:

We are pleased to submit herein the final test results for EPA 9090 testing performed on Synthetic Industries 82 Tex woven geotextile. The test was performed using leachate from the Lakeview Landfill Disposal Facility located in Erie, Pennsylvania, owned and operated by Waste Management of North America. Results of the tests are presented in Appendix A with a description of the leachate presented in Appendix B.

Upon receipt of the material, coupons were cut from the sheet to statistically sample the material per ASTM protocols. These samples were then randomly selected for the initial baseline testing and for immersion in the 23°C and 50°C temperature controlled 22 gallon glass tanks. Initial baseline/reference tests included:

Grab Strength	ASTM D-4632	Machine & Cross Direction
Trap Tear	ASTM D-4533	Machine & Cross Direction
Puncture	ASTM D-4833	
Mullen Burst	ASTM D-3786	
Permittivity	ASTM D-4491	
Dimensional Stability	ASTM D-4594	
Thickness	ASTM D-5199	
Mass/Unit Area	ASTM D-3776	

At 30, 60, 90 and 120 day intervals, randomly sampled coupons were extracted from each of the two temperature controlled tanks and these samples were tested for the same property characteristics as the baseline sample. The results are presented on the attached tables and the percent differences in the results are compared to the baseline samples and plotted as shown in Appendix A.

Each of the plots are discussed below:

Grab Strength (Machine and Cross Direction)

In the machine direction the data, on average, indicates little change in the material and probably within the range of the statistical differences of the product itself. In the cross direction there is a slightly downward trend in strength averaging about 6% strength loss over 120 days. However, the woven fibers tend to slightly loosen during exposure in the tank due to the recirculating system of the apparatus. This may have caused the slight loss in strength.

Trapezoidal Tear Strength (Machine and Cross Direction)

Both machine and cross direction tests indicated a variation in data, however, on the average, the strength essentially remained unchanged over the 120 day test period.

Puncture Strength

No significant changes in the material occurred over the 120 test period except for the statistical differences in the material itself.

Mullen Burst

Similar to puncture strength, no significant changes were observed. The data may appear to indicate a strength gain, however, this could be attributed to the variations of the product through random sampling procedures.

Permittivity

The data shows a general downward trend. Inspection of the samples revealed a build-up of sediments, over time, on the fabric from the leachate. These sediments tend to retard flow during the permittivity test.

Dimensions

No significant changes were observed.

Thickness

The only anomaly in this test are the results at 120 days. A careful inspection of the fabric sample used for thickness indicated a slight build-up of leachate residue on the material. This accounted for the slight increase in thickness. Had these accumulations been scraped off the fibers, the thickness would have been comparable to the other tests.

Mass/Unit Area

The data appears to show a slight downward trend in mass/unit area. However, the loss is generally less than 2% and probably within the statistical variation of the material itself.

In summary, the fabric performs well although there were some noted variations in the product. For the most part, these variations can be attributed to leachate particulate accumulations on the material over time, some loosening of the fibers associated with the recirculation system of the tanks and the general variability of the material.

Should you have any questions, please do not hesitate to call.

Sincerely,

J&L TESTING COMPANY, INC.

John Boschuk, Jr., P.E., REP
Director - Research & Development

Enclosure
JB/lao
(L100.156)

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

INITIAL (UNIMMERSED)

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		179.6	151.7	152.0			161.1	13.082
CD		157.3	154.4	180.2			164.0	11.540
TRAP TEAR	lbs							
MD		60.1	68.6	61.3			63.3	3.756
CD		61.9	58.8	58.3			59.7	1.592
PUNCTURE	lbs	85.8	77.0	87.4			83.4	4.572
MULLEN BURST	psi	310	312	322	325	308	315	6.800
PERMITTIVITY	sec-1							
23 deg.spec.		0.15	0.18	0.16			0.16	0.012
50 deg.spec.		0.15	0.18	0.16			0.16	0.012

SYNTHETIC INDUSTRIES

J & L TESTING CO.,INC. TEST RESULTS

SUMMARY OF TEST DATA

82 TEX WOVEN GEOTEXTILE

IMMERSION PERIOD

MECHANICAL PROPERTY	IMMERS. TEMP.	DIR.	INITIAL	30-DAY		60-DAY			90-DAY			120 DAY		
			VALUE	VALUE	%CHANGE	VALUE	%CHANGE		VALUE	%CHANGE		VALUE	%CHANGE	
							Initial	Prev.		Initial	Prev.		Initial	Prev.
GRAB STRENGTH	23	MD	161.1	151.8	-5.77	176.6	9.62	16.34	160.1	-0.62	-9.3	145.3	-9.81	-9.2
(lbs)		CD	164.0	158.4	-3.41	166.8	1.71	5.30	156.4	-4.63	-6.2	157.1	-4.21	0.4
	50	MD	161.1	166.1	3.10	163.2	1.30	-1.75	149.4	-7.26	-8.5	169.2	5.03	13.3
		CD	164.0	167.2	1.95	158.1	-3.60	-5.44	163.5	-0.30	3.4	149.9	-8.60	-8.3
TRAP TEAR	23	MD	63.3	54.3	-14.22	78.2	23.54	44.01	74.1	17.06	-5.2	64.4	1.74	-13.1
(lbs)		CD	59.6	51.6	-13.42	91.5	53.52	77.33	89.8	50.67	-1.9	64.4	8.05	-28.3
	50	MD	63.3	54.9	-13.27	76.8	21.33	39.89	76.9	21.48	0.1	66.1	4.42	-14.0
		CD	59.6	53.7	-9.90	89.0	49.33	65.74	65.7	10.23	-26.2	62.4	4.70	-5.0
PUNCTURE	23		83.4	85.8	2.88	72.1	-13.55	-15.97	83.5	0.12	15.8	96.1	15.23	15.1
(lbs)	50		83.4	92.5	10.91	83.4	0.00	-9.84	83.5	0.12	0.1	93.2	11.75	11.6
MULLEN BURST	23		315	314	-0.32	337	6.98	7.32	333	5.71	-1.2	324	2.86	-2.7
	50		315	323	2.54	335	6.35	3.72	325	3.17	-3.0	326	3.49	0.3
PERMITTIVITY	23		0.16	0.16	0.00	0.12	-25.00	-25.00	0.15	-6.25	25.0	0.12	-25.00	-20.0
	50		0.16	0.17	6.25	0.13	-18.75	-23.53	0.17	6.25	30.8	0.12	-25.00	-29.4

PHYSICAL PROPERTY	IMMERS. TEMP.		30 DAY %CHANGE	60 DAY %CHANGE	90 DAY %CHANGE	120 DAY %CHANGE
DIMENSIONS	23		0.00	0.08	0.14	0.00
(Ave.both dir.)	50		-0.06	-0.08	0.30	0.00
THICKNESS	23		0.45	0.01	-0.01	11.46
	50		0.47	0.02	1.45	8.66
MASS/UNIT AREA	23		3.31	-0.42	-2.45	-0.68
	50		-0.44	0.62	-1.28	-2.09

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

30 DAY, 23 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		157.5	148.4	149.4			151.8	4.075
CD		160.7	151.2	163.2			158.4	5.169
TRAP TEAR	lbs							
MD		51.8	53.8	57.3			54.3	2.273
CD		50.4	55.9	48.5			51.6	3.138
PUNCTURE	lbs	87.3	81.5	88.6			85.8	3.087
MULLEN BURST	psi	310	340	310	320	290	314	16.248
PERMITTIVITY	sec-1	0.16	0.15	0.16			0.16	0.005

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.13	20.00					
Final Length		20.13	20.00					
% Change		0.00	0.00				0.00	0.000
Initial Width		13.94	14.16					
Final Width		13.94	14.16					
% Change		0.00	0.00				0.00	0.000
THICKNESS	mils							
Initial		11	11					
Final		11	11					
% Change		-0.90	1.80				0.45	1.351
MASS/UNIT AREA	oz/sy							
Initial		3.19	3.44					
Final		3.42	3.42					
% Change		7.21	-0.58				3.31	3.896

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

30 DAY, 50 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		167.8	173.2	157.2			166.1	6.646
CD		158.5	172.0	171.0			167.2	6.142
TRAP TEAR	lbs							
MD		55.7	54.3	54.6			54.9	0.602
CD		51.3	56.4	53.5			53.7	2.089
PUNCTURE	lbs	97.0	84.3	96.2			92.5	5.807
MULLEN BURST	psi	340	310	325	330	310	323	11.662
PERMITTIVITY	sec-1	0.17	0.17	0.17			0.17	0.000

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.13	19.94					
Final Length		20.19	19.88					
% Change		0.30	-0.30				-0.00	0.299
Initial Width		14.06	14.03					
Final Width		14.06	14.00					
% Change		0.00	-0.21				-0.11	0.107
THICKNESS	mils							
Initial		11	11					
Final		11	11					
% Change		1.83	-0.89				0.47	1.364
MASS/UNIT AREA	oz/sy							
Initial		3.42	3.46					
Final		3.40	3.45					
% Change		-0.58	-0.29				-0.44	0.148

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

60 DAY, 23 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		191.7	178.6	159.6			176.6	13.178
CD		164.6	171.7	164.1			166.8	3.471
TRAP TEAR	lbs							
MD		74.4	83.6	76.7			78.2	3.909
CD		82.0	91.2	101.3			91.5	7.882
PUNCTURE	lbs	75.1	63.7	77.6			72.1	6.069
MULLEN BURST	psi	360	336	314	334	340	337	14.675
PERMITTIVITY	sec-1	0.11	0.10	0.14			0.12	0.017

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.00	19.94					
Final Length		20.00	20.00					
% Change		0.00	0.30				0.15	0.150
Initial Width		13.97	14.00					
Final Width		13.97	14.00					
% Change		0.00	0.00				0.00	0.000
THICKNESS	mils							
Initial		111	110					
Final		109	112					
% Change		-1.80	1.82				0.01	1.810
MASS/UNIT AREA	oz/sy							
Initial		3.55	3.59					
Final		3.55	3.56					
% Change		0.00	-0.84				-0.42	0.418

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

60 DAY, 50 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		165.3	157.9	166.4			163.2	3.774
CD		153.8	160.1	160.4			158.1	3.043
TRAP TEAR	lbs							
MD		94.8	69.5	66.2			76.8	12.776
CD		97.8	75.1	94.2			89.0	9.961
PUNCTURE	lbs	83.7	82.4	84.2			83.4	0.763
MULLEN BURST	psi	340	330	342	326	337	335	6.066
PERMITTIVITY	sec-1	0.13	0.13	0.14			0.13	0.005

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.00	20.06					
Final Length		20.00	20.00					
% Change		0.00	-0.30				-0.15	0.150
Initial Width		14.06	14.44					
Final Width		14.06	14.44					
% Change		0.00	0.00				0.00	0.000
THICKNESS	mils							
Initial		110	115					
Final		111	114					
% Change		0.91	-0.87				0.02	0.889
MASS/UNIT AREA	oz/sy							
Initial		3.45	3.34					
Final		3.40	3.43					
% Change		-1.45	2.69				0.62	2.072

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

90 DAY, 23 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		162.2	162.9	155.3			160.1	3.430
CD		163.7	161.7	143.8			156.4	8.947
TRAP TEAR	lbs							
MD		72.8	68.9	80.7			74.1	4.909
CD		72.2	102.9	94.3			89.8	12.931
PUNCTURE	lbs	80.6	84.9	84.9			83.5	2.046
MULLEN BURST	psi	330	345	340	320	330	333	8.718
PERMITTIVITY	sec-1	0.16	0.14	0.16			0.15	0.009

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.13	19.13					
Final Length		20.13	19.06					
% Change		0.00	-0.34				-0.17	0.170
Initial Width		14.69	14.06					
Final Width		14.75	14.13					
% Change		0.41	0.46				0.44	0.027
THICKNESS	mils							
Initial		11	11					
Final		11	11					
% Change		-1.80	1.79				-0.01	1.794
MASS/UNIT AREA	oz/sy							
Initial		3.45	3.47					
Final		3.42	3.33					
% Change		-0.85	-4.04				-2.45	1.592

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

90 DAY, 50 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		144.2	141.6	162.4			149.4	9.253
CD		164.6	160.3	165.7			163.5	2.330
TRAP TEAR	lbs							
MD		77.2	74.2	79.2			76.9	2.055
CD		66.9	59.8	70.4			65.7	4.410
PUNCTURE	lbs	92.0	73.1	85.4			83.5	7.826
MULLEN BURST	psi	320	320	322	334	330	325	5.741
PERMITTIVITY	sec-1	0.18	0.16	0.15			0.17	0.013

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.13	19.88					
Final Length		20.25	19.94					
% Change		0.62	0.30				0.46	0.160
Initial Width		14.09	14.06					
Final Width		14.19	14.00					
% Change		0.71	-0.44				0.13	0.577
THICKNESS	mils							
Initial		12	11					
Final		11	11					
% Change		-1.72	4.63				1.45	3.177
MASS/UNIT AREA	oz/sy							
Initial		3.43	3.58					
Final		3.35	3.57					
% Change		-2.24	-0.31				-1.28	0.966

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

120 DAY, 23 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		139.4	145.7	150.8			145.3	4.674
CD		167.3	156.0	147.9			157.1	7.944
TRAP TEAR	lbs							
MD		67.9	66.4	59.0			64.4	3.909
CD		61.6	60.2	71.4			64.4	4.979
PUNCTURE	lbs	92.0	89.8	106.6			96.1	7.452
MULLEN BURST	psi	320	335	310	335	320	324	9.695
PERMITTIVITY	sec-1	0.12	0.11	0.12			0.12	0.005

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		19.94	20.10					
Final Length		19.94	20.10					
% Change		0.00	0.00				0.00	0.000
Initial Width		14.12	14.00					
Final Width		14.12	14.00					
% Change		0.00	0.00				0.00	0.000
THICKNESS	mils							
Initial		11	11					
Final		13	13					
% Change		12.39	10.53				11.46	0.932
MASS/UNIT AREA	oz/sy							
Initial		3.55	3.46					
Final		3.49	3.47					
% Change		-1.83	0.47				-0.68	1.148

SYNTHETIC INDUSTRIES

J & L TESTING CO., INC. TEST RESULTS

82 TEX WOVEN GEOTEXTILE

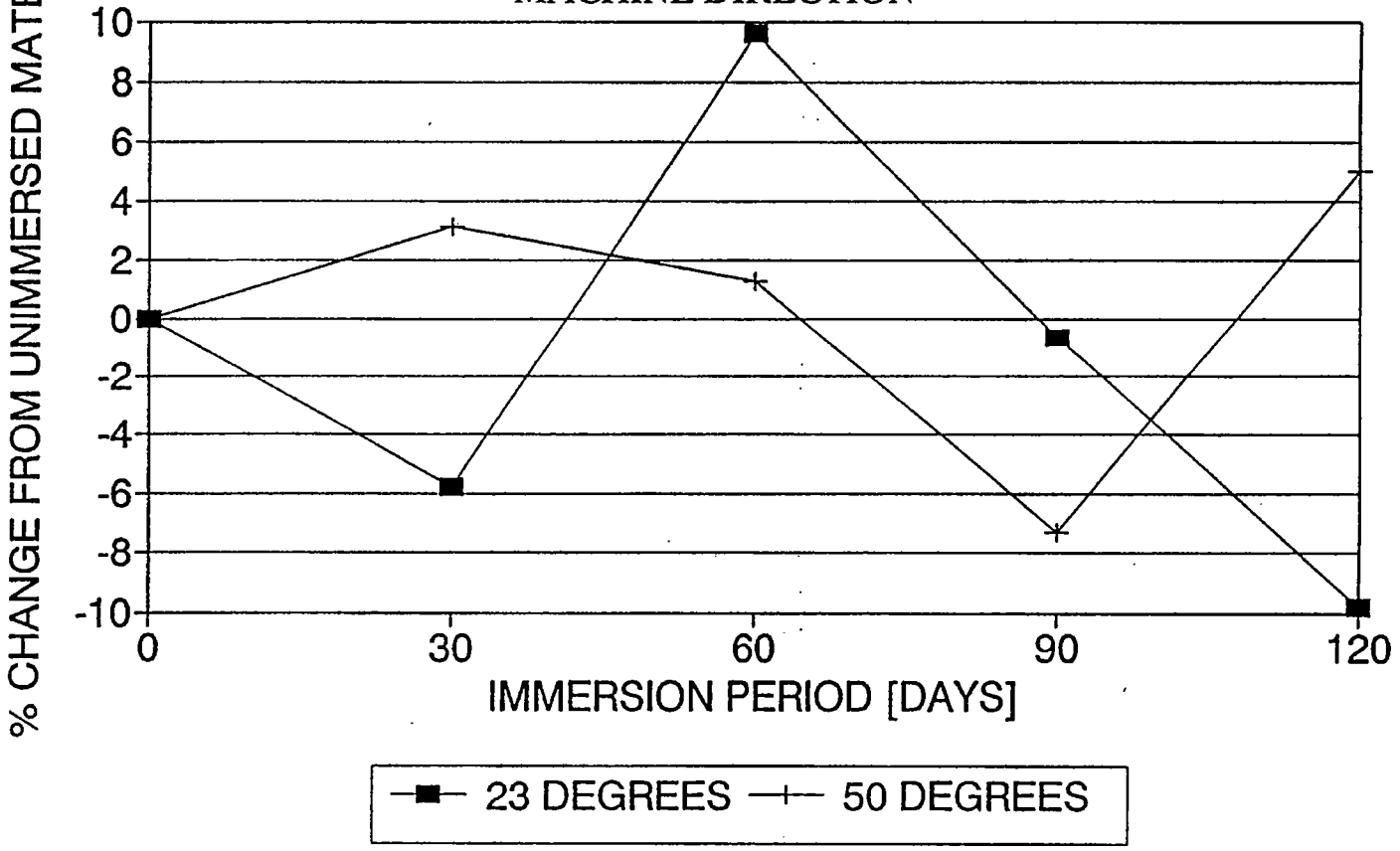
120 DAY, 50 DEGREE

MECHANICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
GRAB TENSILE	lbs							
MD		164.6	170.4	172.6			169.2	3.366
CD		141.7	153.1	154.7			149.9	5.780
TRAP TEAR	lbs							
MD		66.6	67.4	64.2			66.1	1.380
CD		58.9	62.6	65.8			62.4	2.806
PUNCTURE	lbs	95.5	91.1	93.1			93.2	1.807
MULLEN BURST	psi	325	310	335	330	330	326	8.602
PERMITTIVITY	sec-1	0.12	0.11	0.11			0.12	0.003

PHYSICAL PROPERTY	UNITS	SPEC 1	SPEC 2	SPEC 3	SPEC 4	SPEC 5	MEAN	STD.DEV.
DIMENSIONS	in							
Initial Length		20.12	19.90					
Final Length		20.12	19.90					
% Change		0.00	0.00				0.00	0.000
Initial Width		14.00	14.00					
Final Width		14.00	14.00					
% Change		0.00	0.00				0.00	0.000
THICKNESS	mils							
Initial		12	12					
Final		13	13					
% Change		9.57	7.76				8.66	0.903
MASS/UNIT AREA	oz/sy							
Initial		3.49	3.57					
Final		3.37	3.54					
% Change		-3.26	-0.92				-2.09	1.169

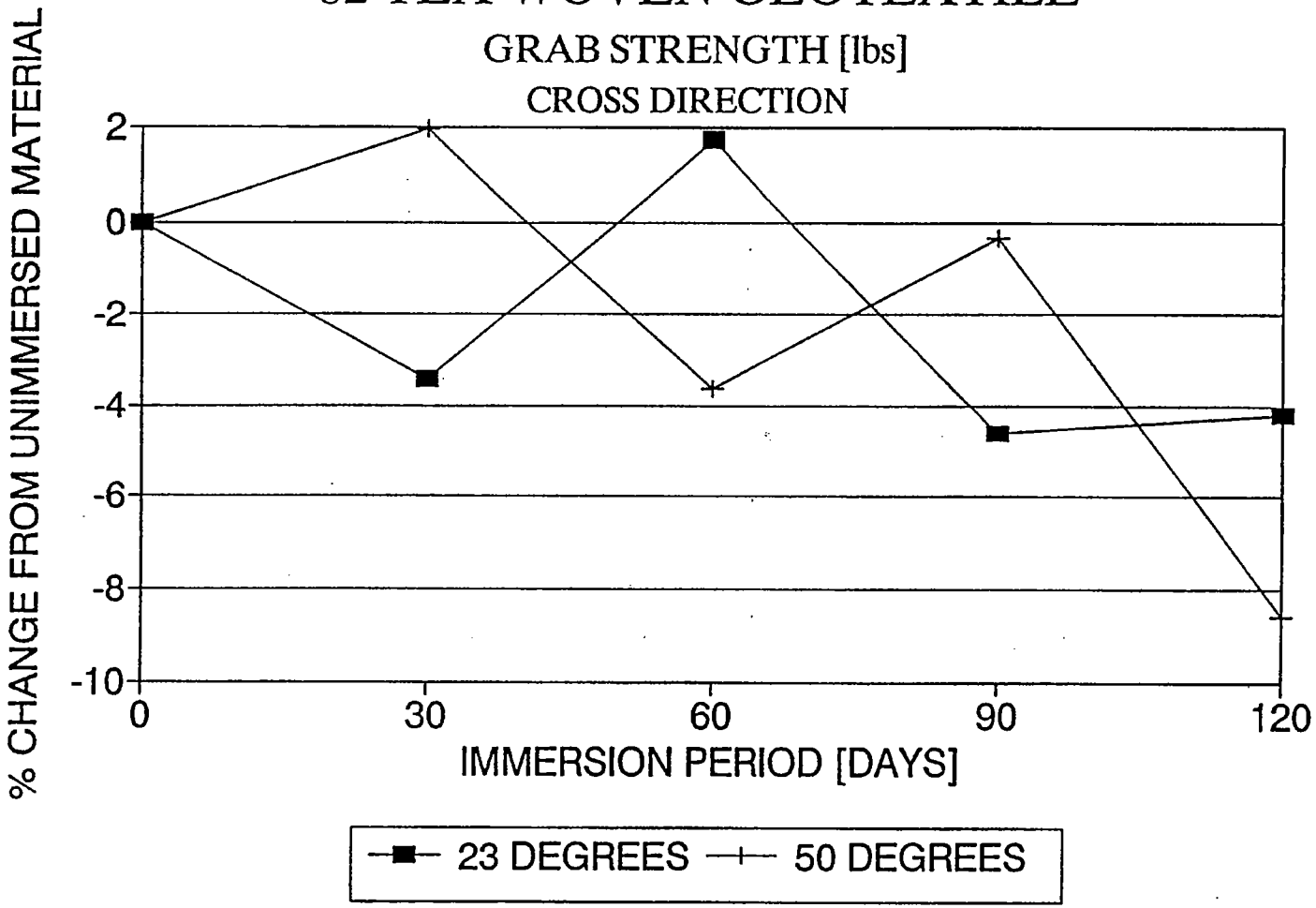
SYNTHETIC INDUSTRIES
82 TEX WOVEN GEOTEXTILE

GRAB STRENGTH [lbs]
MACHINE DIRECTION



J&L TESTING COMPANY, INC.

SYNTHETIC INDUSTRIES
82 TEX WOVEN GEOTEXTILE



J&L TESTING COMPANY, INC.

SYNTHETIC INDUSTRIES
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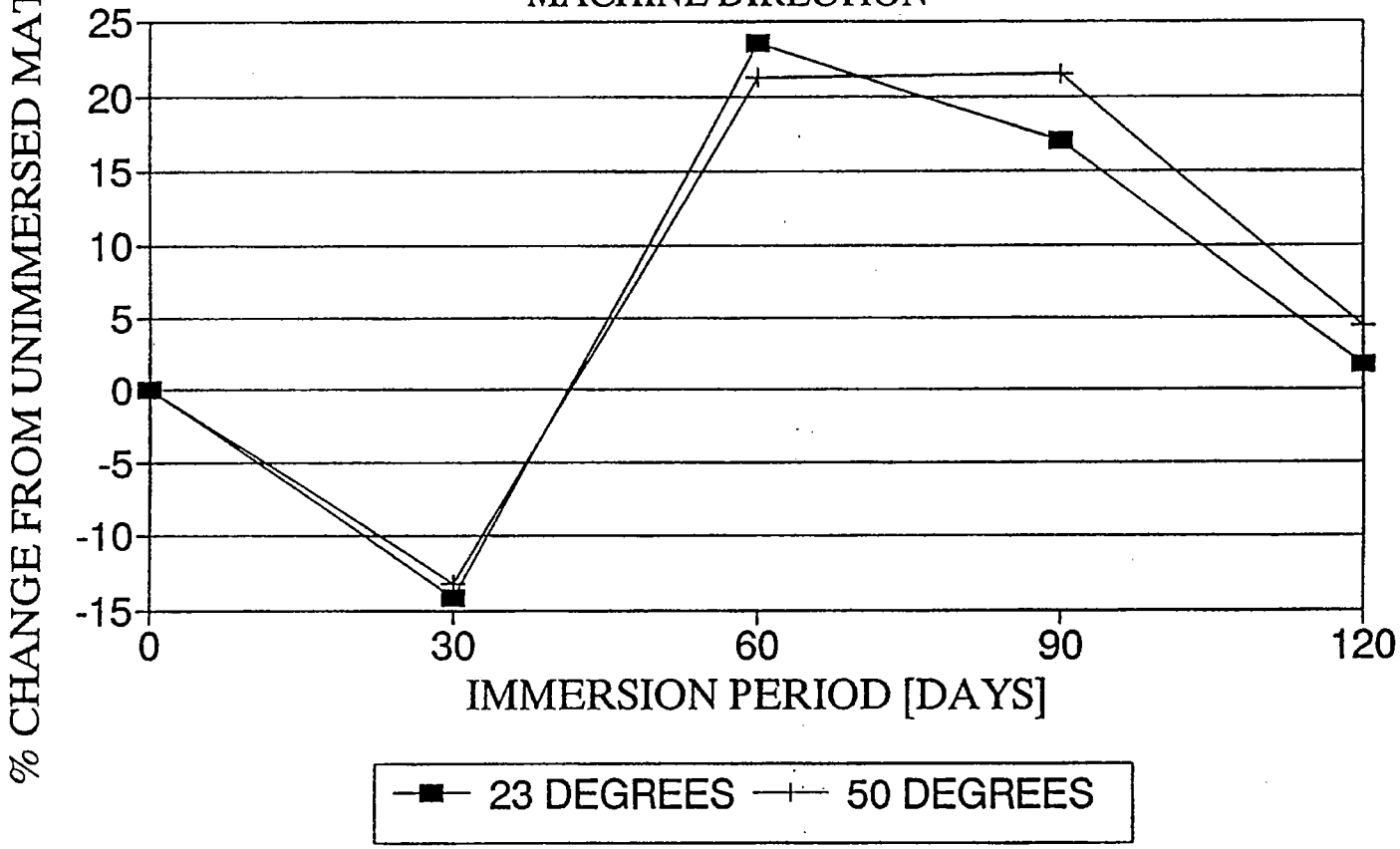
TRAPEZOIDAL TEAR STRENGTH [lbs]

MACHINE DIRECTION



J&L TESTING COMPANY, INC.

SYNTHETIC INDUSTRIES
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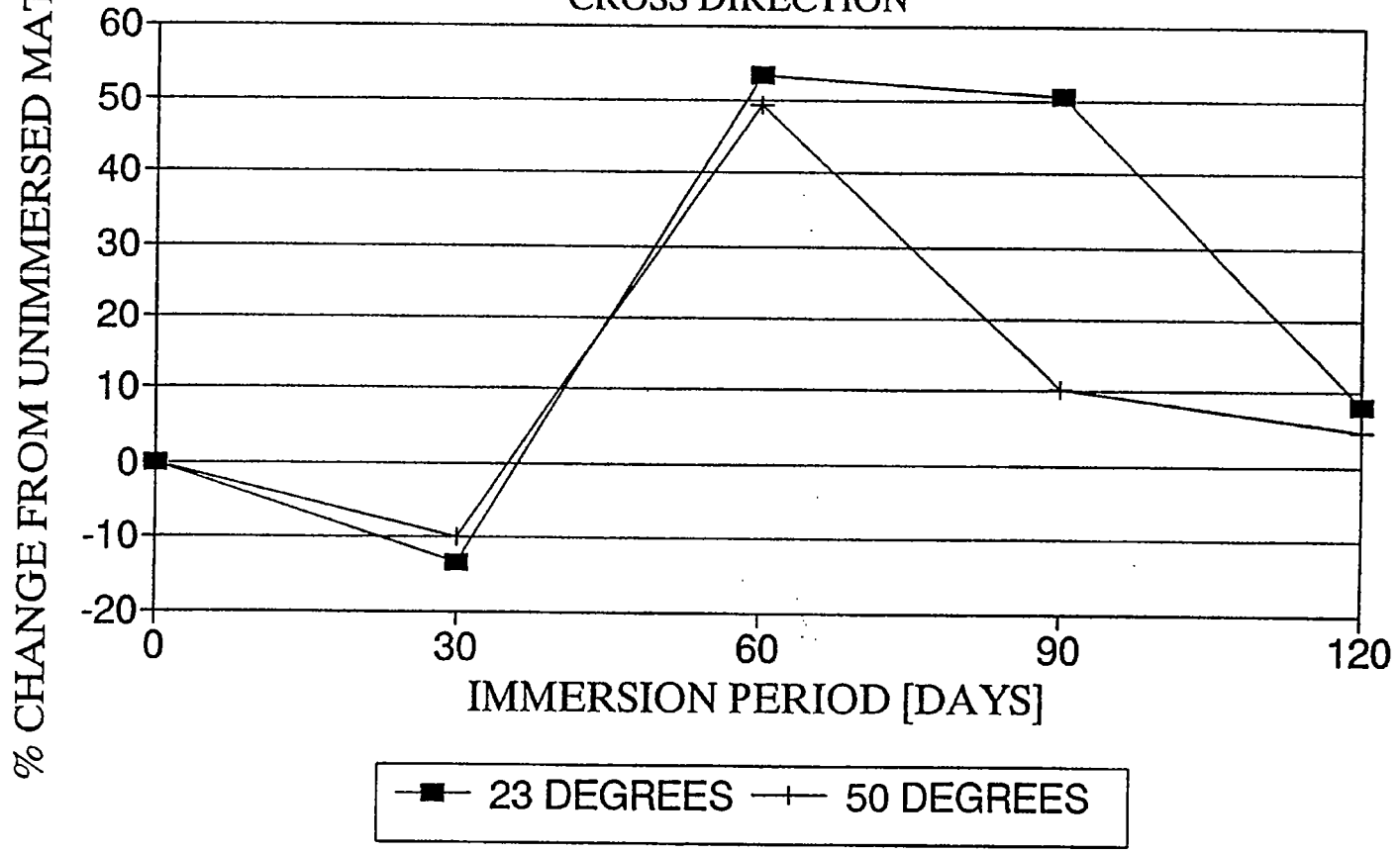
TRAPEZOIDAL TEAR STRENGTH [lbs]

CROSS DIRECTION



J&L TESTING COMPANY, INC.

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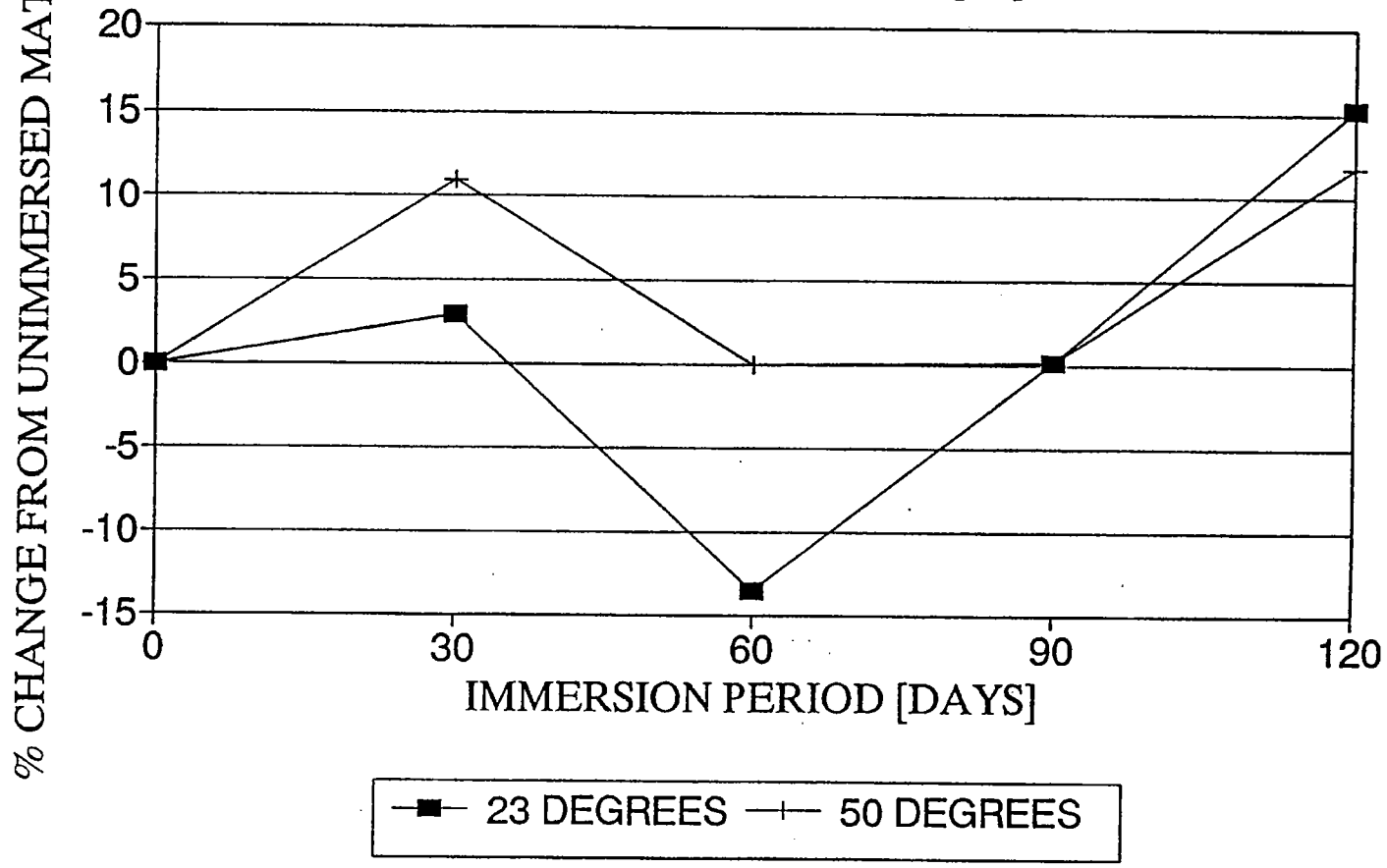
PUNCTURE STRENGTH [lbs]



J&L TESTING COMPANY, INC.

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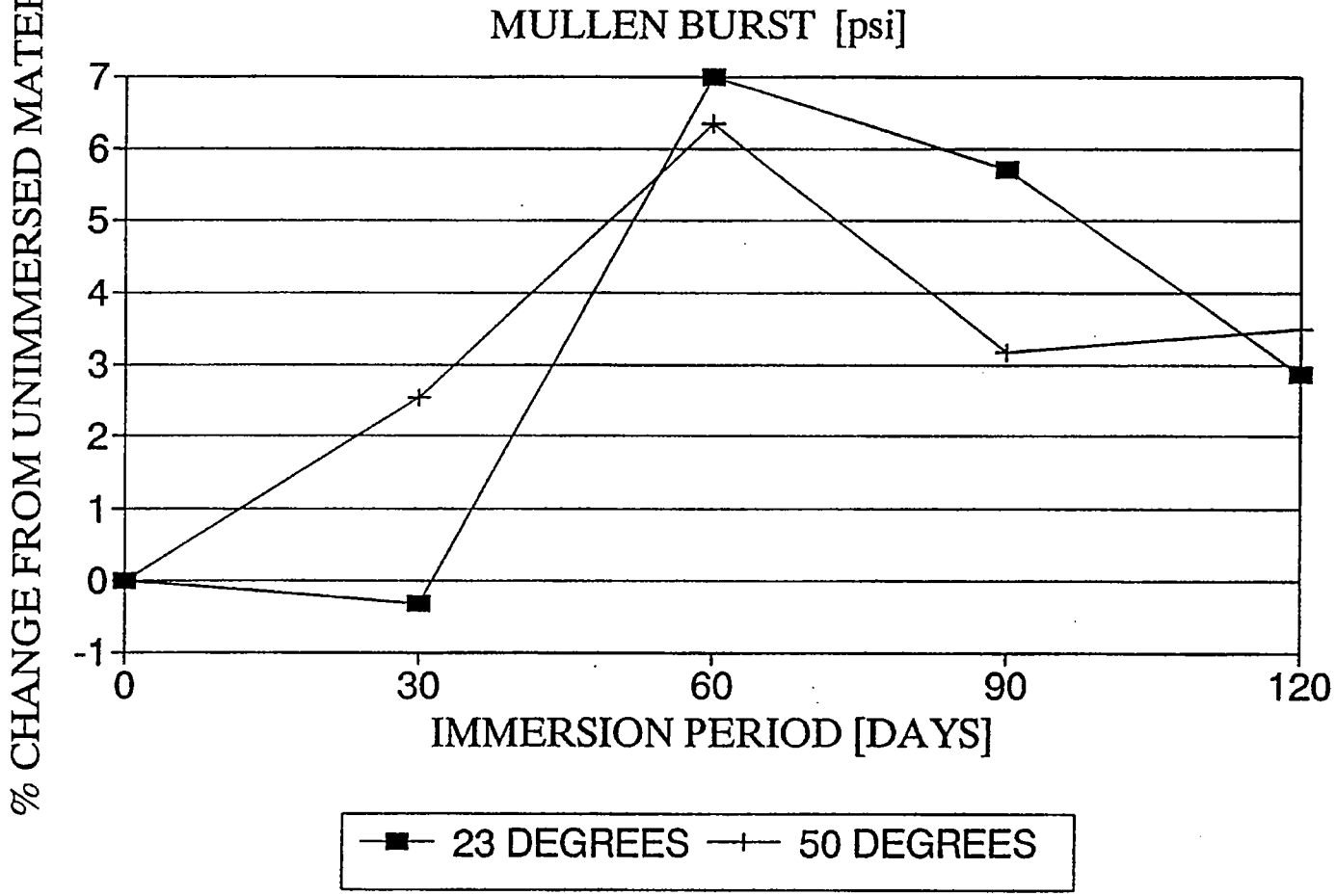
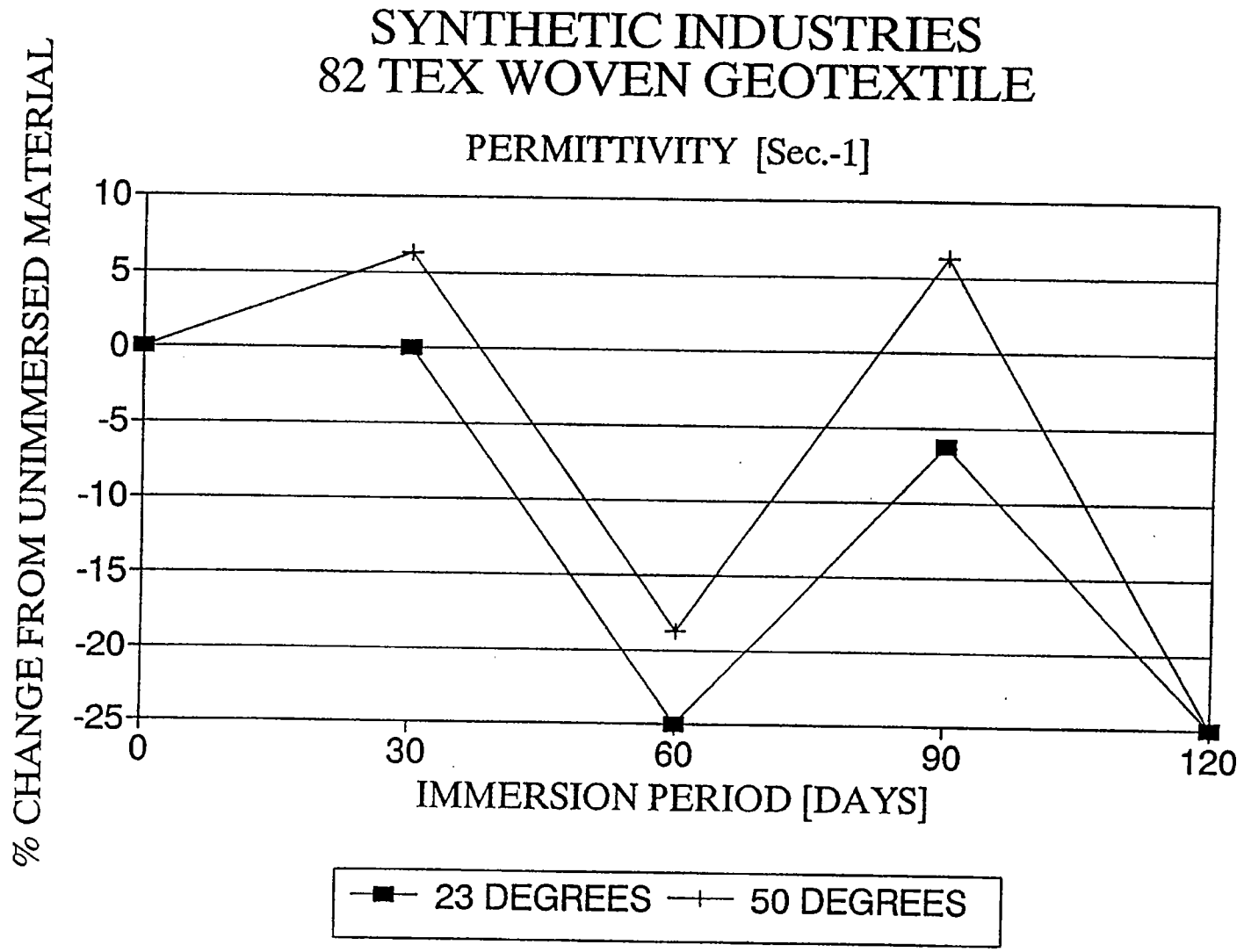
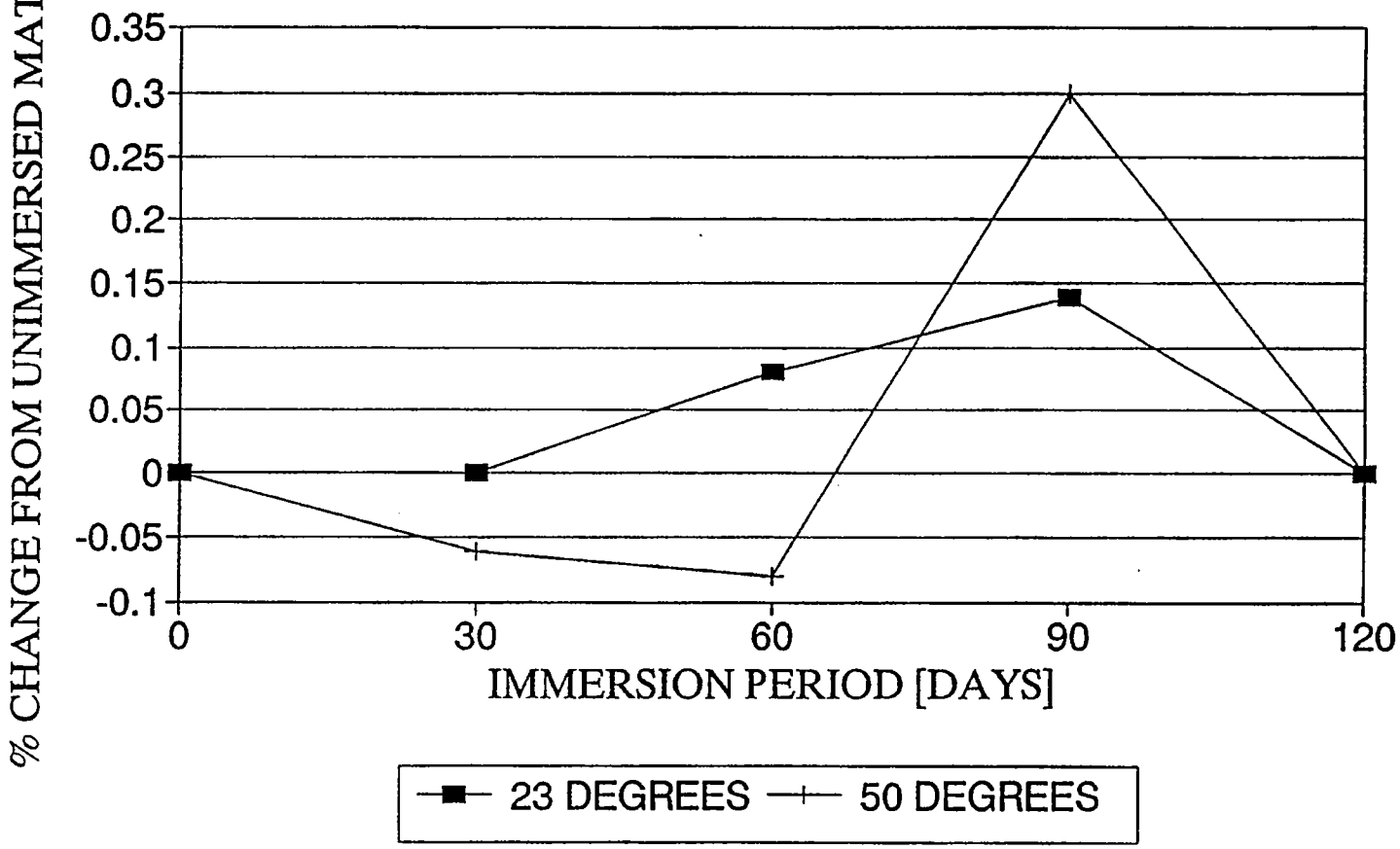


J&L TESTING COMPANY, INC.


SYNTHETIC INDUSTRIES
82 TEX WOVEN GEOTEXTILE
PERMITTIVITY [Sec.-1]
% CHANGE FROM UNIMMERSED MATERIAL
10
5
0
-5
-10
-15
-20
-25
0
30
60
90
120
IMMERSION PERIOD [DAYS]
23 DEGREES
50 DEGREES
J&L TESTING COMPANY, INC.

SYNTHETIC INDUSTRIES
82 TEX WOVEN GEOTEXTILE

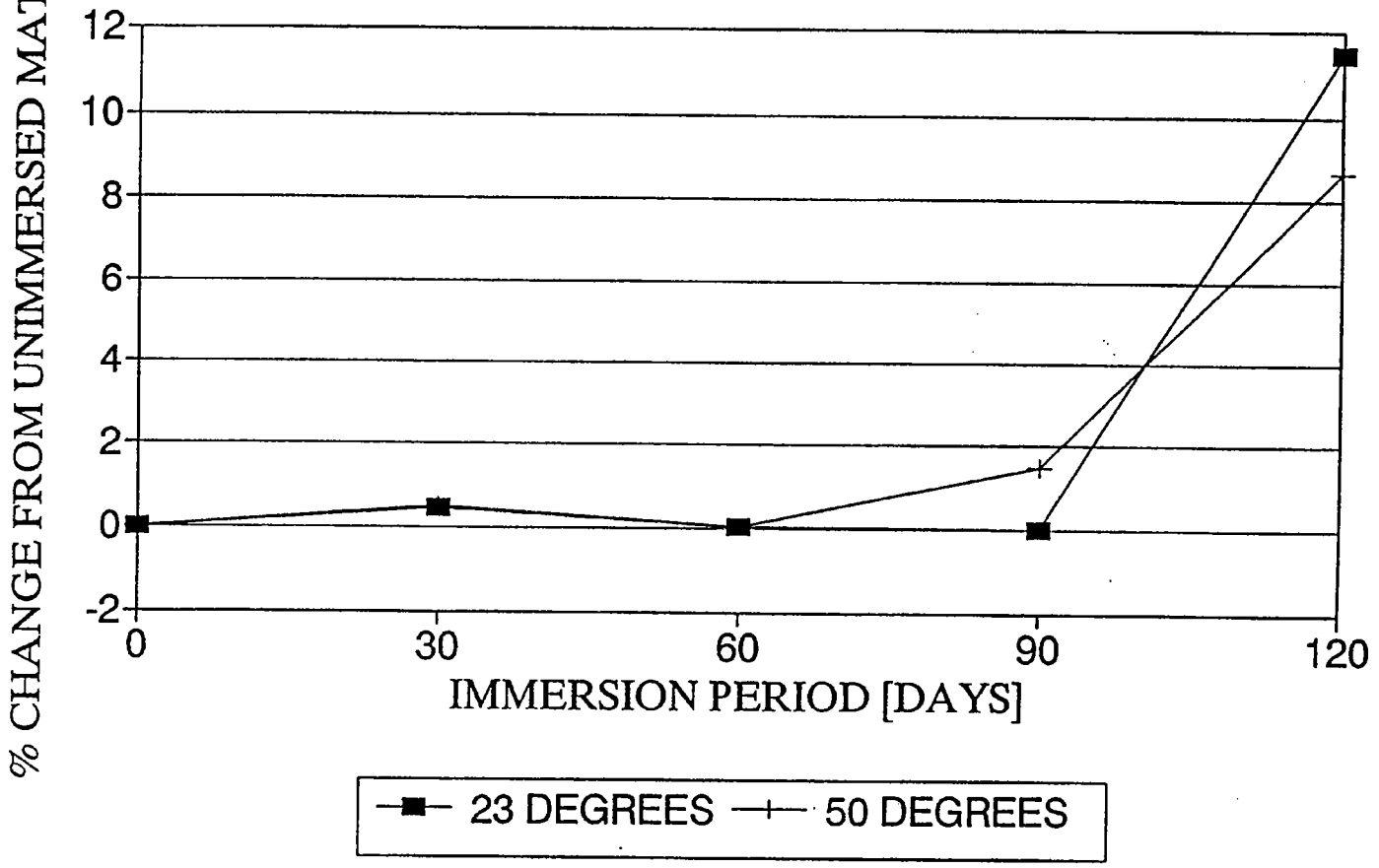
DIMENSIONS (Ave. both dir.)



J&L TESTING COMPANY, INC.

SYNTHETIC INDUSTRIES
82 TEX WOVEN GEOTEXTILE

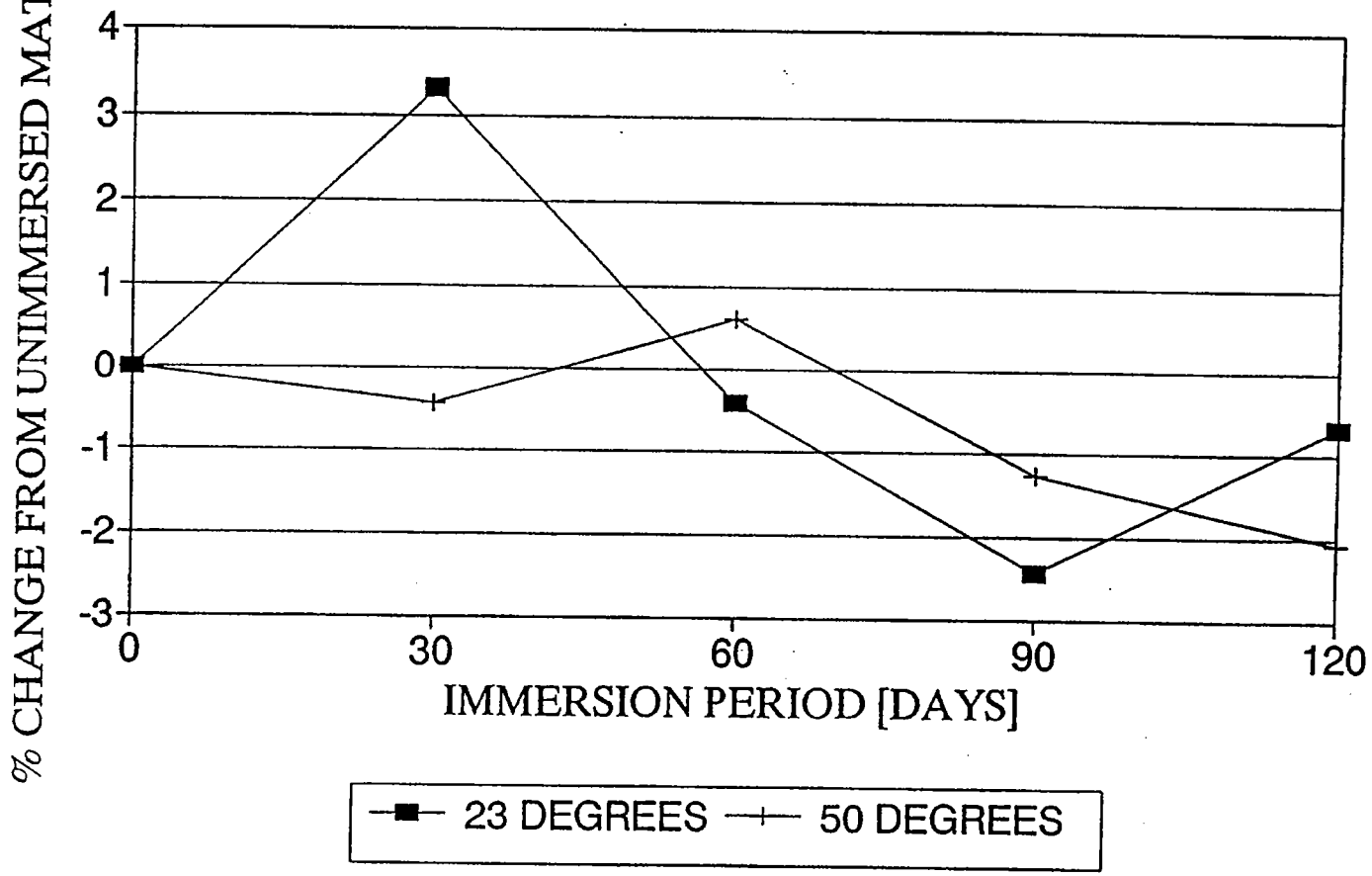
THICKNESS [mils]



J&L TESTING COMPANY, INC.

SYNTHETIC INDUSTRIES
82 TEX WOVEN GEOTEXTILE

MASS/UNIT AREA [oz/sy]



J&L TESTING COMPANY, INC.

NEMR ENVIRONMENTAL MONITORING LABORATORIES, INC

CLIENT REPORT

Site: 426 — Lake View Landfill
Disposal Facility
851 Robinson Road East
Erie PA 16509

Sample Point: METPIT
Sample Type: LEACHATE
Sample Number: AIS461

ENS: 93-14364
MP: 425932
REV: 02

Sampled: 4-NOV-1993
Received: 5-NOV-1993
Reported: 6-DEC-1993

Analyte	Result	EML RL	Units	Comments	Method
FIELD DATA:					
DEPTH TO LEACHATE	NA		FT		FDCXDATA01
LEACHATE ELEVATION	NA		FT MSL		FDCXDATA01
PH FIELD	6.99		PH UNITS		FDPHQUAD01
PH FIELD	6.98		PH UNITS		FDPHQUAD01
PH FIELD	6.97		PH UNITS		FDPHQUAD01
PH FIELD	6.95		PH UNITS		FDPHQUAD01
SAMPLE COLLECTORS NAME	R. WAGNER				FDXSAMPLER
SAMPLING EQUIPMENT	N				FDCXDATA01
SAMPLING MATERIAL	PLAS/BOTT				FDCXDATA01
SPECIFIC CONDUCTANCE FIELD	2910		UMHOS/CM		FDSPCOND04
SPECIFIC CONDUCTANCE FIELD	2900		UMHOS/CM		FDSPCOND04
SPECIFIC CONDUCTANCE FIELD	2900		UMHOS/CM		FDSPCOND04
SPECIFIC CONDUCTANCE FIELD	2890		UMHOS/CM		FDSPCOND04
WATER TEMPERATURE IN DEGREES CELSIUS	8.4		DEGREES C		FDXTEMPC01
CHEMICAL METHODS & ROBOTICS:					
CHEMICAL OXYGEN DEMAND	418	50.	MG/L	DL	CRCODXXX01
NITROGEN, AMMONIA	45.2	1.00	MG/L	DL	CRN2NH3X01
PH	6.79	0.05	PH UNITS		CRPHXQUD04
PH	6.79	0.05	PH UNITS		CRPHXQUD04
PH	6.79	0.05	PH UNITS		CRPHXQUD04
PH	6.78	0.05	PH UNITS		CRPHXQUD04
PHENOLS	.069	0.0050	MG/L	NQ,PX	CRPNLRAX01
SOLIDS, TOTAL SUSPENDED	2020	3.	MG/L		CRTSSXXX01
SOLIDS,TOTAL DISSOLVED	1360	10.	MG/L	DL	CRTDSXXX01
SPECIFIC CONDUCTANCE	2460	1.0	UMHOS/CM		CRCNDQUD04
SPECIFIC CONDUCTANCE	2450	1.0	UMHOS/CM		CRCNDQUD04
SPECIFIC CONDUCTANCE	2450	1.0	UMHOS/CM		CRCNDQUD04
SPECIFIC CONDUCTANCE	2450	1.0	UMHOS/CM		CRCNDQUD04
INORGANICS:					
ALKALINITY,BICARBONATE	1110	10.	MG/L		INALKB1C01
BIOCHEMICAL OXYGEN DEMAND	200	120.	MG/L	DL,NQ	INBODXXX01
CALCIUM-TOTAL	292000	5000	UG/L	DL	INICPTOTCA
CHLORIDE	187	2.5	MG/L	DL	INCHLORI01
IRON-TOTAL	549000	100.	UG/L		INICPTOTFE
LEAD-TOTAL	112	16.0	UG/L	DL	INGFAATOPB
MANGANESE-TOTAL	17500	56.0	UG/L	DL	INICPTOTMN
NICKEL-TOTAL	306	200.	UG/L	DL	INICPTOTNI
SODIUM-TOTAL	142000	8000	UG/L	DL	INICPTOTNA
SULFATE	113	25.0	MG/L	DL	INSULFAT01
ZINC-TOTAL	3110	84.0	UG/L	DL	INICPTOTZN
VOLATILE ORGANICS:					

NA = Not Analyzed ND = Not Detected TBK = Trip Blank

Item	Additional Comment Explanations (NQ/DL)
CHEMICAL OXYGEN DEMAND	Dilution factor 5 applied.
NITROGEN, AMMONIA	Dilution factor 50 applied.
PHENOLS	CLOUDY SAMPLE. RESULTS WERE OBTAINED FROM METHOD 420.1 TO ELIMINATE MATRIX PROBLEMS.
SOLIDS,TOTAL DISSOLVED	Dilution factor 2 applied.
BIOCHEMICAL OXYGEN DEMAND	Dilution factor 60 applied. DILUTION WATER DEPLETED MORE THAN 0.2 MG/L D.O.
CALCIUM-TOTAL	Dilution factor 5 applied.
CHLORIDE	Dilution factor 5 applied.
LEAD-TOTAL	Dilution factor 05 applied.
MANGANESE-TOTAL	Dilution factor 5 applied.
NICKEL-TOTAL	Dilution factor 5 applied.
SODIUM-TOTAL	Dilution factor 5 applied.
SULFATE	Dilution factor 5 applied.
ZINC-TOTAL	Dilution factor 5 applied.
VOMSAAN101	Dilution factor 10 applied. SAMPLE FOAMED THEREFORE DILUTION WAS NECESSARY.

NMX ENVIRONMENTAL MONITORING LABORATORIES, INC

C L I E N T R E P O R T

Site: 425 - Lake View Landfill
Disposal Facility
851 Robinson Road East
Erie PA 16509

Sample Point: METPIT
Sample Type: LEACHATE
Sample Number: AI5461

RNS: 93-14364
MF: 425932
REV: 02

Sampled: 4-NOV-1993
Received: 5-NOV-1993
Reported: 6-DEC-1993

Analyte	Result	RML RL	Units	Comments	Method
1,1,1-TRICHLOROETHANE	ND	50.	UG/L		VOMSAAN101
1,1-DICHLOROETHANE	ND	50.	UG/L		VOMSAAN101
1,1-DICHLOROETHENE	ND	50.	UG/L		VOMSAAN101
1,2-DIBROMOETHANE	ND	80.	UG/L		VOMSAAN101
1,2-DICHLOROETHANE	ND	50.	UG/L		VOMSAAN101
BENZENE	ND	40.	UG/L		VOMSAAN101
CIS-1,2-DICHLOROETHENE	ND	80.	UG/L		VOMSAAN101
ETHYLBENZENE	70.	40.	UG/L		VOMSAAN101
METHYLENE CHLORIDE	170.	50.	UG/L		VOMSAAN101
TETRACHLOROETHENE	ND	40.	UG/L		VOMSAAN101
TOLUENE	170.	40.	UG/L		VOMSAAN101
TRANS-1,2-DICHLOROETHENE	ND	100	UG/L		VOMSAAN101
TRICHLOROETHENE	ND	40.	UG/L		VOMSAAN101
VINYL CHLORIDE	ND	80.	UG/L		VOMSAAN101
XYLENE (TOTAL)	140.	80.	UG/L		VOMSAAN101

NA = Not Analyzed ND = Not Detected TRK = Trip Blank

MAX ENVIRONMENTAL MONITORING LABORATORIES, INC

CLIENT REPORT

Site: 425 - Lake View Landfill
Disposal Facility
851 Robinson Road East
Erie PA 16509

Sample Point: METPIT
Sample Type: LEACHATE
Sample Number: AI2506

ENS: 93-13793
MP: 425932
REV: 02

Sampled: 29-DEC-1993
Received: 31-DEC-1993
Reported: 19-JAN-1994

Analyte	Result	EML RL	Units	Comments	Method
FIELD DATA:					
DEPTH TO LEACHATE	NA		FT		FDCXDATA01
LEACHATE ELEVATION	NA		FT MSL		FDCXDATA01
PH FIELD	7.59		PH UNITS		FDPHQUAD01
PH FIELD	7.56		PH UNITS		FDPHQUAD01
PH FIELD	7.59		PH UNITS		FDPHQUAD01
PH FIELD	7.60		PH UNITS		FDPHQUAD01
SAMPLE COLLECTORS NAME	C. FERRICK				FDXSAMPLER
SAMPLING EQUIPMENT	Y				FDCXDATA01
SAMPLING MATERIAL	GLASS				FDCXDATA01
SPECIFIC CONDUCTANCE FIELD	2360		UMHOS/CM		FDSPCOND04
SPECIFIC CONDUCTANCE FIELD	2360		UMHOS/CM		FDSPCOND04
SPECIFIC CONDUCTANCE FIELD	2350		UMHOS/CM		FDSPCOND04
SPECIFIC CONDUCTANCE FIELD	2360		UMHOS/CM		FDSPCOND04
WATER TEMPERATURE IN DEGREES CELSIUS	4.5		DEGREES C		FDXTEMPC01
CHEMICAL METHODS & ROBOTICS:					
NITROGEN, AMMONIA	34.5	0.40	MG/L	DL	CRN2NH3X01
NITROGEN, NITRATE	.15	0.050	MG/L		CRNO3IYD01
PH	7.56	0.05	PH UNITS		CRPHXQUD04
PH	7.55	0.05	PH UNITS		CRPHXQUD04
PH	7.56	0.05	PH UNITS		CRPHXQUD04
PH	7.56	0.05	PH UNITS		CRPHXQUD04
PHENOLS	ND	0.050	MG/L	NQ	CRPNHRAX01
SOLIDS, TOTAL SUSPENDED	28	3.	MG/L		CRTSSXXX01
SPECIFIC CONDUCTANCE	1770	1.0	UMHOS/CM		CRCNDQUD04
SPECIFIC CONDUCTANCE	1770	1.0	UMHOS/CM		CRCNDQUD04
SPECIFIC CONDUCTANCE	1170	1.0	UMHOS/CM		CRCNDQUD04
SPECIFIC CONDUCTANCE	1170	1.0	UMHOS/CM		CRCNDQUD04
TOTAL ORGANIC CARBON	70.3	1.0	MG/L		CRTOCQUD01
TOTAL ORGANIC CARBON	71.9	1.0	MG/L		CRTOCQUD01
TOTAL ORGANIC CARBON	70.5	1.0	MG/L		CRTOCQUD01
TOTAL ORGANIC CARBON	70.1	1.0	MG/L		CRTOCQUD01
TURBIDITY	35	1.0	NTU	TX	CRTURBID01
INORGANICS:					
BIOCHEMICAL OXYGEN DEMAND	131	120.	MG/L	DL,NQ	INBODXXX01
IRON-TOTAL	5840	100.	UG/L		INICPTOTFE
LEAD-TOTAL	ND	16.0	UG/L	DL	INGFAATCPB
NICKEL-TOTAL	ND	40.0	UG/L		INICPTOTNI
ZINC-TOTAL	42.5	20.0	UG/L		INICPTOTZN

NA = Not Analyzed ND = Not Detected TBK = Trip Blank

Item	Additional Comment Explanations (NQ/DL)
NITROGEN, AMMONIA	Dilution factor 20 applied.
PHENOLS	CLOUDY SAMPLE AND RESULTS WERE DETERMINED FROM METHOD 420.1 TO ELIMINATE MATRIX PROBLEMS.
INBODXXX01	EMPTY - ALIQUOT FROM : AI2506-D0
BIOCHEMICAL OXYGEN DEMAND	GLUCOSE-GLUTAMIC ACID RESULTS WERE NOT WITHIN THE CONTROL LIMITS. HOWEVER APG STANDARDS ARE WITHIN THE CONTROL LIMITS.
LEAD-TOTAL	Dilution factor 60 applied. Dilution factor 05 applied.

APPENDIX I

LANDFILL GAS DESIGN REPORT

SME
SEVEE & MAHER
ENGINEERS

SANBORN HEAD

LFG System Design Report
Phase II Expansion

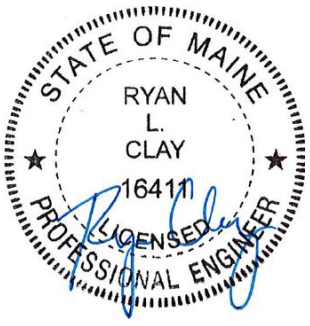
JUNIPER RIDGE LANDFILL

Old Town, Maine

Prepared for NEWSME Landfill Operations, LLC

File No. 2536.40

November 2025



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3.0 EXISTING GCCS DESCRIPTION....2
4.0 LANDFILL GAS COLLECTION ESTIMATES....3
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5.2 Gas Collection Trenches....4
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5.5 Condensate Collection....5
5.6 Flare Capacity....6
6.0 OPERATIONS AND MAINTENANCE....6
7.0 CONCLUSION....6

FIGURES
Figure 1 As-built Gas Collection and Control System Plan

APPENDICES
Appendix A Calculations
- Landfill Gas Generation Modeling Results Summary
- Header Sizing Calculations
- Condensate Generation Calculations
Appendix B Engineering Drawings
Appendix C Technical Specifications
Appendix D Construction Quality Assurance Plan
Appendix E Operations and Maintenance Manual

1.0 INTRODUCTION

Sanborn, Head & Associates, Inc. (Sanborn Head) prepared this Landfill Gas System Expansion Design Report in support of the proposed 11.9 million cubic yard (MCY) Phase II expansion of the Juniper Ridge Landfill (JRL). The proposed landfill expansion (Phase II expansion) will be located north of the existing landfill. The purpose of this report is to provide an estimate of future landfill gas (LFG) generation with a description of the proposed gas collection and control system (GCCS) and how it will connect to the existing GCCS infrastructure.

This document fulfills the application submittal requirements of the Maine Solid Waste Management Rules Chapters 401, Section 2.F(6) for a landfill engineering report on the gas management system, and 4.C(11) for landfill operations. Engineering drawings, technical specifications, Construction Quality Assurance (CQA) Plan, Operations and Maintenance (O&M) Plan, and supporting calculations are provided as appendices to this report.

2.0 BACKGROUND

JRL is owned by the State of Maine Bureau of General Services (BGS) and operated by NEWSME Landfill Operations, LLC (NEWSME). Located on the western side of Interstate 95 in Old Town, Maine, the facility is licensed as a Secure Landfill (i.e., lined with leachate collection) and is composed of sequentially constructed contiguous landfill cells. The most recently constructed active landfill cell is Cell 16. The following provides a bulleted summary of relevant history for JRL and does not include all licensing actions:

- The original solid waste facility license for JRL (previously known as the West Old Town Landfill) was issued on July 28, 1993, by the Maine Department of Environmental Protection (MEDEP). At that time, the facility was owned by the James River Paper Company and was licensed for disposal of pulp and papermaking residuals generated from a paper mill in Old Town, Maine. Solid waste disposal activities began in 1997.

- In April 2004, MEDEP issued Amendment Order #S-020700-WD-N-A to the JRL license that increased the disposal capacity by 10 MCY to approximately 10.28 MCY. The April 2004 Amendment Order allowed the disposal of non-hazardous waste streams generated in Maine, including construction and demolition debris and processing residues, residues (ash, front-end process, and oversized bulky wastes) generated by municipal solid waste (MSW) incinerators located in Maine, a limited amount of MSW bypass from the incinerators, water/wastewater treatment plant sludge, and smaller amounts of miscellaneous, non-hazardous waste.

- Beginning in 2005, an active gas collection system, consisting of horizontal and vertical LFG collectors, a blower, and flare was installed at the facility. The system is still operational and has been modified/expanded several times since 2005.

- In 2015, MEDEP issued minor revision license #S-020700-WD-BE-M approving the construction and operation of a Thiopaq® LFG sulfur removal facility.

- On June 1, 2017, MEDEP approved construction and operation of a 9.35 MCY expansion at JRL (license #S- 020700-WD-BI-N) in a phased manner, designed as Cells 11 through 16. This expansion would later be divided into Cells 11 through 17 (without a change to capacity).

- In November 2022, MEDEP approved a minor revision (License #S-020700-WD-CO-M) to the landfill license relative to LFG management and treatment processes at the facility allowing for construction and operation of a Renewable Natural Gas ("RNG") processing facility at JRL. The RNG facility is designed to accept partially treated LFG from the existing Thiopaq® LFG sulfur removal facility and further process, treat, and compress it to meet natural gas pipeline specifications. The RNG facility began operating in 2024.

3.0 EXISTING GCCS DESCRIPTION

JRL has an active GCCS that is designed to comply with the air resource requirements from MEDEP and the U.S. Environmental Protection Agency's (USEPA's) New Source Performance Standards (NSPS) for MSW landfills. The primary objective of the GCCS is to reduce emissions of regulated air pollutants and greenhouse gases and limit the potential for odors. NEWSME monitors the GCCS by documenting the rate of LFG extraction and the concentration (percent by volume) of methane, oxygen, carbon dioxide, and balance gas (primarily nitrogen) contained in the LFG.

The GCCS is regularly expanded by adding gas extraction points and related infrastructure as the landfill expands. LFG is currently managed using gas collection trenches (GCTs) and/or vertical gas extraction wells. Vertical extraction wells are installed in areas where the outer slopes of the cells are filled to final grades. The vacuum applied at each extraction location is regularly adjusted (tuned) with a manually controlled wellhead. The active system contains approximately 168 vertical wells and 98 GCTs installed throughout the landfill. LFG is also collected from condensate traps and leachate collection system cleanouts as needed to remove gas buildup where present. For reference, the existing GCCS is depicted on an as-built drawing included as Figure 1.

LFG extracted from the waste mass passes through a moisture separator to remove entrained liquid before the LFG is treated for total sulfur removal (described in more detail below) and then combusted in existing Flare #4, or backup Flares #2 and #3. Flare #4 is licensed for 106.5 million British thermal units per hour (MMBtu/hr), which is equivalent to approximately 3,550 standard cubic feet per minute (scfm) of LFG at 50 percent methane (% CH_4). Flare #3 is licensed for 40.5 MMBtu/hr (equivalent to approximately 1,350 scfm at 50% CH_4) and Flare #2 is licensed for 22.5 MMBtu/hr (equivalent to approximately 750 scfm at 50% CH_4). Flares #2 and #3 are licensed as backup combustion devices and are limited to 100 hours of operation per year. In early 2015, NEWSME began operating a Thiopaq® sulfur removal system to reduce the total sulfur (mostly hydrogen sulfide) in the LFG prior to combustion to decrease emissions of sulfur dioxide.

In 2024, an RNG facility owned and operated by Archaea Energy, began operating at the site. Archaea Energy entered into an agreement with BGS and NEWSME to install and operate the

RNG facility on the landfill property. The RNG facility can process up to approximately 3,200 scfm of raw landfill gas to pipeline quality natural gas suitable for beneficial use.

4.0 LANDFILL GAS COLLECTION ESTIMATES

Estimates for future LFG collection (LFG projections) at the site, including the proposed Phase II expansion, were prepared by Sanborn Head based on historical and projected annual waste acceptance rates at the site, the types of waste, the landfill capacity, and other modeling inputs. The LFG collection rate estimates are based on modeling with the USEPA's *Landfill Gas Emissions Model, Version 3.1* (LandGEM) and guidance from 40 CFR Part 98 Subpart HH, Mandatory Greenhouse Gas Reporting for Municipal Solid Waste (MSW) Landfills.

LandGEM uses a first-order decomposition rate equation to quantify potential long-term gas generation based on user-defined and/or site-specific modeling inputs. The input assumptions and results of the LandGEM modeling are summarized in Appendix A. Figure A-1 in Appendix A is a graph of the projected peak LFG collection rate for the Phase II expansion area. Figure A-2 in Appendix A is a graph of the projected peak LFG collection rate from the entire facility (including gas flow from older sections of the landfill).

The design flow for pipe sizing is based on LFG generation and collection rate modeling with LandGEM. The facility-wide design flow after applying a factor of safety (e.g., 1.1) and rounding up is 5,600 scfm. This flow rate was used for the facility-wide design flow for pipe-sizing calculations.

For the Phase II expansion area, the design flow based on LandGEM modeling plus a factor of safety (e.g., 1.1) and rounding up is 4,000 scfm. This flow rate was used for expansion area pipe-sizing calculations. See Appendix A for details of the LandGEM modeling. The following table shows the LFG design flow rates (collection rates) used for LFG piping design.

LFG Collection Modeling Scenario	LFG Piping Design Flow
Expansion Area Annual Average Flow	4,000 scfm
Facility-Wide Annual Average Flow	5,600 scfm

5.0 PROPOSED LFG EXTRACTION SYSTEM EXPANSION

The design of the LFG extraction system for the proposed 11.9 MCY Phase II Expansion is shown on Sheets 2 and 3 of the Engineering Drawings provided in Appendix B. Descriptions of the components of the LFG extraction system are provided below.

5.1 Vertical Extraction Wells

Vertical extraction wells will be installed at the locations indicated on the Engineering Drawings (see Appendix B) when waste in those areas reaches final grade. The wells are located in areas where the waste thickness will be 60 feet or greater and spaced horizontally assuming an effective radius of influence of approximately 100 feet.

The LFG extraction well schedule provided on the Engineering Drawings includes the proposed coordinates for each well (by northing and easting), and the elevations of the ground surface and base of the wells. The wells will be drilled using a 36-inch-diameter bucket auger advanced to a design depth no closer than 15 feet above the top of the leachate collection system. The wells are proposed to be constructed of 8-inch-diameter schedule 80 polyvinyl chloride (PVC) pipe. The lower portion of the pipe will be perforated with 4 rows of 5/8-inch-diameter holes spaced 90 degrees apart circumferentially and 4 inches apart along the length of the pipe with the rows staggered 2 inches from row to row.

The perforated sections of each well will extend from about 15 feet below grade to the bottom of the well. The annular space between the slotted portion of the well and borehole wall will be backfilled with a 2-inch nominal diameter ballast stone. A 12-inch-thick layer of filter sand and gravel will be placed above the stone, which in turn will be overlain by a minimum 12-inch-thick bentonite seal. Common fill, a soil with a maximum of 35 percent of its particles passing through the No. 200 sieve, will be placed above the bentonite seal to the waste surface. The well construction detail is presented on Sheet 4 of the Engineering Drawings (Appendix B).

5.2 Gas Collection Trenches

GCTs will be constructed as an interim method of gas collection until vertical extraction wells can be installed at final grades. The GCTs will be positioned assuming an elliptical radius of influence with a vertical spacing of 40 feet and horizontal spacing of 100 feet. The 4-foot-wide by 5-foot-deep collection trenches will be constructed within the waste mass during active filling to capture LFG early in its generation phase and reduce the potential for LFG migration and odors. Each GCT will consist of a 6-inch-diameter perforated high-density polyethylene (HDPE) pipe embedded within a coarse aggregate (drainage stone). Intermediate cover will be placed above the trenches. The trench construction detail is presented on Sheet 12 of the Engineering Drawings (Appendix B). For clarity, the Engineering Drawings do not show the locations of interim GCCS infrastructure (including GCT's) to be installed within each cell. The actual locations of the GCT installations will be positioned based on the effective radius of influence described above.

5.3 Conveyance Pipe

An engineered network of high-density polyethylene (HDPE) pipes, shown on Sheets 2 of 3 of the Engineering Drawings, will be used to convey LFG extracted from the vertical LFG extraction wells and GCTs to the existing sulfur removal system (Thiopaq) and the RNG Facility for processing. HDPE pipe is well-suited for such applications due to its chemical resistivity and flexibility. The conveyance pipe network of the proposed GCCS will primarily incorporate SDR 17 pipe ranging in diameter from 6 inches to 24 inches. The largest of the LFG header pipes will be the continuation of the two existing 24-inch diameter perimeter header pipes located below grade along the interior edge of the east and west perimeter roads of the landfill.

Based on the design flow of approximately 5,600 scfm (see Appendix A), the 24-inch diameter perimeter headers will provide sufficient flow capacity for the Phase II Expansion of the JRL facility. The 24-inch headers will be extended around the northern perimeter of the landfill to eventually connect and establish a loop in the perimeter header network. Header sizing

calculations were performed for several sections of the proposed and existing 24-inch diameter perimeter LFG header pipes. The pipe sizing criteria allows for a head loss, estimated by the low-pressure Mueller equation, of one inch of water column per 100 feet of pipe. The resultant gas velocities were calculated to be below 40 feet-per-second in concurrent flow conditions and below 20 feet-per-second in counter-current flow conditions, indicating acceptable sizing. The results of the header sizing calculations, including tabulated flows, are provided in Appendix A.

Condensate pump stations will be located at low points along the perimeter header to remove LFG condensate from the system and pump it to the landfill's leachate collection system. Due to the cell development sequence (Cell 18, Cell 19, etc.) and the locations of the low points along the proposed perimeter headers, temporary condensate pump stations are expected to be needed as the perimeter road is constructed in sections. The temporary pump stations can be eliminated after the header pipes are extended and the permanent pump stations are installed. The permanent pump stations are located at low points along the proposed header that will be present in the final condition.

Smaller LFG conveyance pipes, primarily consisting of 12-inch-diameter and 6-inch-diameter pipe, will extend from the 24-inch-diameter header into the landfill. The HDPE pipe and associated fittings will be connected using fusion welds and pneumatically tested for leaks during construction. The pipes will be installed within the waste mass a minimum of 2 feet below grade and be sufficiently sloped to promote drainage of LFG condensate and allow for settlement of the waste over time. The extracted LFG will pass through condensate traps (or U-traps) located at each perimeter header connection, which passively remove condensate from the gas. The condensate traps will drain by gravity and be connected (hard piped) to primary leachate collection system cleanouts. The locations of the LFG conveyance pipes and their connection points to the existing GCCS are shown on the Engineering Drawings contained in Appendix B. Technical Specifications for the proposed LFG system, including HDPE pipe, can be found in Appendix C.

5.4 Wellheads

Flow control and sampling will be performed using wellheads installed between gas extraction locations and the gas conveyance pipes. A detail of a typical wellhead is provided on Sheet 4 of the Engineering Drawings provided in Appendix B. Flexible hose between the wellhead and the conveyance pipe is intended to accommodate differential movement. Sample ports on the wellhead allow for monitoring of the pressure, flow, and composition of the gas, and the wellhead valve will be used to regulate the flow based on monitoring results.

5.5 Condensate Collection

As mentioned above, condensate traps will be provided at low points along the conveyance pipe to remove liquids. The traps consist of U-shaped tubes filled with liquid that provide a seal between the portions of the system under vacuum and the portions of the system under atmospheric pressure. Condensate collected in the traps will drain to a cleanout riser pipe and into the primary leachate collection system where it can be removed and disposed of as leachate.

Condensate pump stations will be located outside the landfill limit of waste containment. The pump stations are intended to remove LFG condensate from the perimeter header and pump it to the nearest cleanout riser and into the primary leachate collection system. As the pump stations are located outside the landfill limits, the lower portion of the pump station is constructed with two layers of HDPE (dual-walled). The condensate pump stations will be Class 1 Division 1 Group D classified spaces, and as such, require explosion-proof or intrinsically safe electrical equipment. The structure will also be considered a confined space with entry by permit only. A typical detail of the condensate pump station is shown on Sheet 6 of the engineering drawings provided in Appendix B.

5.6 Flare Capacity

The location of the existing flare (Flare #4) is shown on Figure 1, the as-built gas collection and control system drawing, and on Sheet 1 of the engineering drawings provided in Appendix B. The licensed capacity of Flare #4 is 106.5 MMBtu/hr, equivalent to approximately 3,550 scfm at 50% CH_4.

The LFG design flow including the Phase II expansion is approximately 5,600 scfm. At 50 percent methane, this is equivalent to approximately 170 MMBtu/hr. An additional flare, proposed Flare #5, will be required to control the maximum LFG projection of 170 MMBtu/hr. JRL is applying to install the second flare when needed (i.e., Flare #5) and increase the licensed LFG flow rate to the flare(s). The proposed location of Flare #5 is shown on Sheet 2 in Appendix B.

6.0 OPERATIONS AND MAINTENANCE

The O&M Plan for the expanded LFG system is provided in Appendix E. The O&M manual identifies typical LFG characteristics, hazards, and related precautionary measures. It includes general descriptions of system components, their function, and procedures for maintenance and monitoring. In general, the operation and maintenance of the expanded LFG system will adhere to methods and practices currently employed at the site.

7.0 CONCLUSION

In Summary, the LFG system described in this report is designed to collect the peak flow of LFG projected to be generated from existing and future waste placement at JRL (including the Phase II expansion) and convey it for sulfur treatment and further processing into RNG. This document and appendices were prepared to fulfill the application submittal requirements of the Maine Solid Waste Management Rules Chapters 401, Section 2.F(6) for a landfill engineering report on the gas management system, and 4.C(11) for landfill operations.

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Figure 1

As-Built Gas Collection & Control System Plan

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GAS TREATMENT BUILDING

RNG FACILITY

FLARE NO. 4

CELL 1
CELL 2
CELL 3A
CELL 3B
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 12
CELL 13
CELL 14
CELL 15
CELL 16

(ABANDONED)

MAINE STATE PLANE

NOTES:

1. THE EXISTING LANDFILL GAS EXTRACTION SYSTEM INFRASTRUCTURE FEATURES SHOWN ARE BASED ON A COMBINATION OF DESIGN AND AS-BUILT DOCUMENTATION AVAILABLE TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD). ACTUAL LOCATIONS OF INDIVIDUAL FEATURES MAY BE DIFFERENT THAN SHOWN.
2. THERE MAY BE RECENTLY INSTALLED LFG SYSTEM INFRASTRUCTURE THAT IS NOT YET SHOWN ON THIS PLAN.
3. ABANDONED LFG SYSTEM INFRASTRUCTURE IS NOT SHOWN FOR CLARITY.
4. TOPOGRAPHY SHOWN IS PHOTOGRAMMETRIC MAPPING PREPARED BY AERIAL SURVEY & PHOTO, INC. OF NORRIDGEWOCK, MAINE. PHOTO DATE: MAY 1, 2025.
5. HORIZONTAL DATUM IS MAINE STATE COORDINATE SYSTEM, EAST ZONE, NAD83. VERTICAL DATUM IS BRASS PLUG AT PUMP STATION (APPROX .3 FEET HIGHER THAN NAVD 88).

LEGEND (EXISTING):

- 190 — 10-FOOT CONTOUR
- 2-FOOT CONTOUR
- LIMIT OF WASTE CONTAINMENT
- CELL LIMIT
- EDGE OF ROAD
- LFG CONVEYANCE PIPE ≧ 12"Ø
- LFG CONVEYANCE PIPE < 12"Ø
- LFG COLLECTION TRECH
- FENCE LINE
- GW-9 — LFG EXTRACTION WELL
- GCT-901 — COLLECTION TRENCH WELLHEAD
- PIPE END CAP
- CT-7 — CONDENSATE TRAP
- ISOLATION VALVE
- ACCESS RISER

SANBORN HEAD

GRAPHICAL SCALE
120' 60' 0' 120' 240'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: O. HERNANDEZ
DESIGNED BY: O. HERNANDEZ
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

AS-BUILT GAS COLLECTION & CONTROL SYSTEM PLAN

PROJECT NUMBER: 2536.40

FIGURE: 1

FILE: P:\2536\2536-40\Graphics\FreeCAD\As-Built Figures\20251103 JRLfAsWideLFGAsBuilt.dwg
LAYOUT: 1
LTSCALE: 1
C:\Program Files\Autodesk\AutoCAD 2025\UserDataCache\Support\acad.ctb
PLOTDATE: 11/13/25

Appendix A

Calculations:

LFG Collection Modeling Results Summary
Header Sizing Calculation
Condensate Generation Calculation

Landfill Gas Collection Modeling Results Summary
Phase II Expansion at Juniper Ridge Landfill

To project potential landfill gas (LFG) collection rates for the proposed Phase II 11.9 million cubic yard (cy) expansion at the Juniper Ridge Landfill in Old Town, Maine (JRL), Sanborn, Head & Associates, Inc. (Sanborn Head) used the United States Environmental Protection Agency's (USEPA's) Landfill Gas Emissions Model, Version 3.1 (LandGEM). A third-party renewable natural gas (RNG) facility began accepting LFG from JRL in March 2024, however, JRL maintains combustion capacity for the full amount of gas being collected at the site for periods when the RNG facility is not operating.

The assumed waste compaction density for JRL is 0.86 tons per cy (ton/cy). The proposed expansion of 11.9 million cy corresponds to a tonnage increase of approximately 10.23 million tons. Based on the average waste acceptance during recent years, JRL assumed the site will receive approximately 880,000 tons per year of waste.

We assume the currently licensed landfill has capacity through approximately early 2028 and that the expansion will provide capacity for approximately 12 years from 2028 to 2040. The following table shows the volume of the approved cells at JRL and the volume of the proposed expansion, beginning with Cell 18.

JRL Expansion Applications / Approvals	Volume (cy)	Cumulative Volume (cy)	Tons Assuming Waste Density of 0.86 ton/cy	Cumulative Tons
Pre-2004	280,000	280,000	240,800	240,800
Cells 1 to 10 (2004)	10,000,000	10,280,000	8,600,000	8,840,800
Cells 11 to 17 (2015)	9,350,000	19,630,000	8,041,000	16,881,800
Cells 18+ (2025)	11,900,000	31,530,000	10,234,000	27,115,800

Modeling was performed using LandGEM with historical and projected waste acceptance and with parameters from USEPA modeling guidance (40 CFR Part 98 Subpart HH, Table HH-1)[1] for the methane (CH_4) generation rate constant (k) and for the degradable organic content (DOC). The k values are from the high end of the ranges in Table HH-1 for sites located in areas with annual average precipitation greater than 40 inches per year that are expected to have faster waste decay. The following values were used for LandGEM modeling:

- Construction and demolition (C&D) waste, including oversized bulky waste (OBW), was modeled with Table HH-1 values for C&D waste of k = 0.04/year and DOC = 0.08;
- Sludge was modeled with Table HH-1 values for sewage sludge of k = 0.185/year and DOC = 0.05; and
- Other waste accepted at the site, including bypass municipal solid waste (MSW), was modeled with Table HH-1 values for bulk waste of k = 0.098/year and DOC = 0.2.

[1] Values from Table HH-1 are included as defaults in the current version of LandGEM, version 3.1.

We performed modeling for the proposed expansion using projected tonnages from early 2028 to 2040. We performed facility-wide modeling using historical waste acceptance tonnages through 2024 and projected waste acceptance tonnages for 2025 to 2040. The projected annual waste types are based on the average waste mix accepted at the site from 2021 to 2023. Inert waste is assumed to be non-methane producing (e.g., ash). The following table shows the projected annual waste tonnages and the approximate percentage of each waste type.

Projected Annual Waste				
C&D Waste Including OBW	Sludge	Inert Waste	Other Waste Including Bypass MSW	Total
484,342 tons	83,186 tons	24,063 tons	288,409 tons	880,000 tons
55.0%	9.5%	2.7%	32.8%	100.0%

To convert from the LFG generation estimates from LandGEM to LFG collection rate estimates, we assumed a gas collection efficiency of 85 percent[2] and air infiltration that decreases the methane concentration to 43 percent (the JRL methane concentration is typically 43 percent or greater).

The modeling for the proposed expansion area by itself resulted in a peak LFG collection rate of approximately 3,441 scfm at 43% CH_4 during 2040. The design flow rate used for the expansion area pipe sizing is 4,000 scfm based on applying a factor of safety to the modeling results (e.g., 1.1) and rounding up.

The facility-wide modeling, including the proposed expansion area, resulted in a peak LFG flow rate estimate of approximately 5,033 scfm at 43% CH_4. The design flow rate used for the facility-wide pipe sizing is 5,600 scfm based on applying a factor of safety to the modeling results (e.g., 1.1) and rounding up.

LFG Collection Rate Modeling Scenario	Modeled LFG Flow used for LFG Piping Design
Expansion Area Annual Average Flow	4,000 scfm
Facility-Wide Annual Average Flow	5,600 scfm

The existing Flare #4 is currently licensed for 106.5 MMBtu/hr, equivalent to approximately 3,550 scfm LFG at 50% CH_4. This heat input limit is based on the assumption that the methane content of the gas could be as low as 20 to 30 percent methane.

[2] The collection efficiency is supported by the Solid Waste Industry for Climate Solutions (SWICS, 2009) method and by site-specific collection efficiency data as the facility is designed to control gas emissions. The landfill area is designed and operated to collect landfill gas in accordance with USEPA regulatory requirements. The facility reserves the right to refine the collection efficiency estimates for future emission projections.

JRL is preparing an air license application to submit to the Maine DEP Bureau of Air Quality for the planned Phase II expansion. Based on the LFG design flow of 5,600 scfm, equivalent to approximately 170 MMBtu/hr at 50% CH_4, JRL plans to apply to install and operate another flare, Flare #5, near the location of Flare #4. To allow Flare #5 to be installed relatively close to Flare #4, JRL is planning for Flare #5 to have a similar height (and similar combustion capacity) to Flare #4. The additional flare will provide excess combustion capacity relative to the maximum modeled LFG collection rate.

The attached Table A-1 shows the projected annual waste acceptance for the Phase II expansion. Table A-2 shows facility-wide historical and projected annual waste acceptance including the Phase II Expansion.

Table A-3 shows the modeling results for the annual average LFG collection from the proposed expansion area only. Table A-4 shows the modeling results for the facility-wide annual average LFG collection including the proposed Phase II expansion.

Figure A-1 shows the projected LFG flow for the Phase II expansion. Figure A-2 shows the facility-wide projected LFG flow including the Phase II expansion.

To provide additional context in Table A-4 and Figure A-2, the facility-wide LFG projections included in the 2015 application for the Phase I expansion are shown.

Table A-1
Projected Annual Waste Acceptance for the Phase II Expansion

Juniper Ridge Landfill
Old Town, Maine

Year	C&D Including OBW (ton)	Sludge (ton)	Inert (ton)	Other Waste Including Bypass MSW (ton)	Total (ton)
2028	282,793	48,570	14,049	168,394	513,806
2029	484,342	83,186	24,063	288,409	880,000
2030	484,342	83,186	24,063	288,409	880,000
2031	484,342	83,186	24,063	288,409	880,000
2032	484,342	83,186	24,063	288,409	880,000
2033	484,342	83,186	24,063	288,409	880,000
2034	484,342	83,186	24,063	288,409	880,000
2035	484,342	83,186	24,063	288,409	880,000
2036	484,342	83,186	24,063	288,409	880,000
2037	484,342	83,186	24,063	288,409	880,000
2038	484,342	83,186	24,063	288,409	880,000
2039	484,342	83,186	24,063	288,409	880,000
2040	22,122	3,799	1,099	13,173	40,193
Total	**5,632,679**	**967,419**	**279,837**	**3,354,064**	**10,234,000**

Notes:
1. The historical waste acceptance tonnages through 2024 were provided by JRL.
2. Based on waste compaction density of 0.86 ton/cy and annual waste acceptance of approximately 880,000 ton/yr, we project the 11.9 million cubic yard expansion will provide capacity until approximately 2040.

Table A-2
Facility-Wide Historical and Projected Annual Waste Acceptance including the Phase II Expansion

Juniper Ridge Landfill
Old Town, Maine

Year	C&D Including OBW (ton)	Sludge (ton)	Inert (ton)	Other Waste Including Bypass MSW (ton)	Total (ton)
1997	1,406	22,180	1,589	1,194	26,369
1998	3,908	26,198	1,008	1,411	32,525
1999	3,743	29,164	1,539	40	34,486
2000	2,600	32,250	6,344	355	41,549
2001	1,371	30,263	7,250	2,685	41,569
2002	2,341	38,785	5,953	611	47,690
2003	5,331	44,113	10,200	128	59,772
2004	0	26,686	20,880	5,846	53,412
2005	96,290	35,336	58,269	62,419	252,314
2006	235,126	36,286	118,184	136,162	525,758
2007	194,211	61,262	100,448	116,678	472,599
2008	192,343	72,275	203,069	150,095	617,782
2009	202,491	70,265	133,717	138,122	544,595
2010	329,457	58,558	137,594	182,589	708,198
2011	373,933	51,053	135,907	142,987	703,880
2012	367,566	49,270	111,676	108,791	637,303
2013	374,686	64,559	77,167	89,842	606,254
2014	373,776	46,004	78,902	130,339	629,021
2015	361,479	62,177	68,064	140,042	631,762
2016	410,630	39,473	60,139	160,658	670,900
2017	445,359	36,713	62,150	158,307	702,529
2018	486,931	53,023	62,774	133,214	735,942
2019	524,421	82,888	45,770	165,378	818,457
2020	508,118	82,407	38,132	206,604	835,261
2021	496,992	90,069	31,975	263,087	882,124
2022	485,150	94,272	35,828	318,399	933,649
2023	476,463	66,176	4,662	287,062	834,363
2024	394,961	63,274	1,223	336,087	795,544
2025	484,342	83,186	24,063	288,409	880,000
2026	484,342	83,186	24,063	288,409	880,000
2027	484,342	83,186	24,063	288,409	880,000
2028	484,342	83,186	24,063	288,409	880,000
2029	484,342	83,186	24,063	288,409	880,000
2030	484,342	83,186	24,063	288,409	880,000
2031	484,342	83,186	24,063	288,409	880,000
2032	484,342	83,186	24,063	288,409	880,000
2033	484,342	83,186	24,063	288,409	880,000
2034	484,342	83,186	24,063	288,409	880,000
2035	484,342	83,186	24,063	288,409	880,000
2036	484,342	83,186	24,063	288,409	880,000
2037	484,342	83,186	24,063	288,409	880,000
2038	484,342	83,186	24,063	288,409	880,000
2039	484,342	83,186	24,063	288,409	880,000
2040	22,122	3,799	1,099	13,173	40,193
Total	**14,638,338**	**2,716,573**	**1,982,451**	**7,778,438**	**27,115,800**

Juniper Ridge Landfill	Approved Volume (cubic yards)	Cumulative Volume (cubic yards)	Tons Assuming Waste Density of 0.86 ton/cy	Cumulative Tons
Pre-2004	280,000	280,000	240,800	240,800
Cells 1 to 10 (2004 Approval)	10,000,000	10,280,000	8,600,000	8,840,800
Cells 11 to 17 (2015 Application)	9,350,000	19,630,000	8,041,000	16,881,800
Cells 18+ (2024/25 Application)	11,900,000	31,530,000	10,234,000	27,115,800

Average Waste Types from 2021 to 2023 used for Waste Projections				
C&D Including OBW (ton)	**Sludge (ton)**	**Inert (Ash) (ton)**	**Other Waste Including Bypass MSW (ton)**	**2021-23 Average Total (ton)**
486,202	83,506	24,155	289,516	883,378
55.0%	9.5%	2.7%	32.8%	100.0%

Projected Annual tonnage for 2025 to closure assuming 880,000 ton/yr				
C&D Including OBW (ton)	**Sludge (ton)**	**Inert (Ash) (ton)**	**Other Waste Including Bypass MSW (ton)**	**Assumed Total (ton)**
484,342	83,186	24,063	288,409	880,000
55.0%	9.5%	2.7%	32.8%	100.0%

Notes:
1. The historical waste acceptance tonnages through 2024 were provided by JRL.
2. Based on waste compaction density of 0.86 ton/cy and annual waste acceptance of approximately 880,000 ton/yr, we project the 11.9 million cubic yard expansion will provide capacity until approximately 2040.

Table A-3
Projected Landfill Gas from the Phase II Expansion

Juniper Ridge Landfill
Old Town, Maine

Year	Modeled LFG Generation from C&D (k=0.04/yr, DOC=0.08) (scfm at 50% CH4)	Modeled LFG Generation from Sludge (k=0.185/yr, DOC=0.05) (scfm at 50% CH4)	Modeled LFG Generation from Other Waste (k=0.098/yr, DOC=0.2) (scfm at 50% CH4)	Total Modeled Generation (scfm at 50% CH4)	Modeled Collection Efficiency	Modeled Annual Average LFG Collection from Phase II Expansion (scfm at 43% CH4)
2028	0	0	0	0	85%	0
2029	54	25	192	271	85%	267
2030	144	64	502	710	85%	701
2031	231	96	783	1,110	85%	1,097
2032	315	122	1,038	1,475	85%	1,458
2033	395	144	1,269	1,808	85%	1,787
2034	472	163	1,478	2,113	85%	2,089
2035	546	178	1,668	2,393	85%	2,365
2036	617	191	1,841	2,649	85%	2,618
2037	686	201	1,997	2,884	85%	2,850
2038	751	210	2,138	3,100	85%	3,064
2039	814	218	2,267	3,299	85%	3,260
2040	875	224	2,383	3,482	85%	**3,441**
2041	845	188	2,176	3,208	85%	3,171
2042	812	156	1,973	2,940	85%	2,906
2043	780	130	1,788	2,698	85%	2,667
2044	749	108	1,621	2,479	85%	2,450
2045	720	90	1,470	2,280	85%	2,253
2046	692	75	1,333	2,099	85%	2,075
2047	664	62	1,208	1,935	85%	1,912
2048	639	51	1,096	1,785	85%	1,765
2049	614	43	993	1,649	85%	1,630
2050	589	35	901	1,525	85%	1,508
2051	566	30	817	1,413	85%	1,396
2052	544	25	740	1,309	85%	1,294
2053	523	20	671	1,214	85%	1,200
2054	502	17	609	1,128	85%	1,115
2055	483	14	552	1,048	85%	1,036
2056	464	12	500	975	85%	964
2057	446	10	454	909	85%	898
2058	428	8	411	847	85%	837
2059	411	7	373	791	85%	782
2060	395	6	338	739	85%	730
2061	380	5	306	691	85%	683
2062	365	4	278	646	85%	639
2063	350	3	252	606	85%	599
2064	337	3	228	568	85%	561
2065	323	2	207	533	85%	527
2066	311	2	188	500	85%	495
2067	299	2	170	470	85%	465
2068	287	1	154	442	85%	437
2069	276	1	140	417	85%	412
2070	265	1	127	393	85%	388
2071	254	1	115	370	85%	366
2072	245	1	104	349	85%	345
2073	235	1	94	330	85%	326
2074	226	0	86	312	85%	308
2075	217	0	78	295	85%	292
2076	208	0	70	279	85%	276
2077	200	0	64	264	85%	261
2078	192	0	58	251	85%	248
2079	185	0	53	237	85%	235
2080	177	0	48	225	85%	223
2081	171	0	43	214	85%	211
2082	164	0	39	203	85%	201
2083	158	0	35	193	85%	191
2084	151	0	32	183	85%	181
2085	145	0	29	175	85%	173
2086	140	0	26	166	85%	164
2087	134	0	24	158	85%	156
2088	129	0	22	151	85%	149
2089	124	0	20	144	85%	142
2090	119	0	18	137	85%	135
2091	114	0	16	131	85%	129
2092	110	0	15	124	85%	123
2093	106	0	13	119	85%	117
2094	101	0	12	113	85%	112
2095	97	0	11	108	85%	107
2096	94	0	10	104	85%	102
2097	90	0	9	99	85%	98
2098	86	0	8	95	85%	94
2099	83	0	7	90	85%	89
2100	80	0	7	86	85%	85
2101	77	0	6	83	85%	82
2102	74	0	5	79	85%	78
2103	71	0	5	76	85%	75
2104	68	0	4	72	85%	71
2105	65	0	4	69	85%	68
2106	63	0	4	66	85%	66

Table A-4
Facility-Wide Landfill Gas Projections including the Phase II Expansion

Juniper Ridge Landfill
Old Town, Maine

Year	Modeled Annual Average LFG Collection before the Phase I Expansion (scfm at 43% CH4)	Modeled Annual Average LFG Collection including the Phase I Expansion (scfm at 43% CH4)	Modeled LFG Generation from C&D (k=0.04/yr, DOC=0.08) (scfm at 50% CH4)	Modeled LFG Generation from Sludge (k=0.185/yr, DOC=0.05) (scfm at 50% CH4)	Modeled LFG Generation from Other Waste (k=0.098/yr, DOC=0.2) (scfm at 50% CH4)	Modeled Annual Average LFG Generation including the Phase II Expansion (scfm at 50% CH4)	Modeled Collection Efficiency	Modeled Annual Average LFG Collection including the Phase II Expansion (scfm at 43% CH4)
1997	0	0	0	0	0	0	85%	0
1998	28	28	0	11	1	13	85%	13
1999	59	59	1	23	3	27	85%	26
2000	91	91	2	34	3	38	85%	38
2001	123	123	2	45	3	50	85%	49
2002	150	150	2	53	6	61	85%	60
2003	185	185	3	64	6	72	85%	71
2004	224	224	4	76	5	85	85%	84
2005	244	244	3	77	11	92	85%	91
2006	392	392	22	82	81	185	85%	183
2007	689	689	66	87	229	381	85%	377
2008	932	932	100	104	340	544	85%	538
2009	1,219	1,219	133	123	479	735	85%	727
2010	1,490	1,490	167	139	591	897	85%	886
2011	1,866	1,866	223	145	744	1,112	85%	1,099
2012	2,165	2,165	286	147	837	1,270	85%	1,255
2013	2,358	2,358	345	148	882	1,375	85%	1,359
2014	2,521	2,521	403	156	902	1,461	85%	1,444
2015	2,718	2,718	458	153	966	1,578	85%	1,559
2016	2,896	2,896	510	159	1,035	1,704	85%	1,684
2017	3,057	3,057	568	153	1,121	1,842	85%	1,821
2018	3,203	3,203	631	146	1,197	1,973	85%	1,950
2019	**3,335**	3,335	699	148	1,237	2,084	85%	2,060
2020	3,018	3,454	772	166	1,309	2,247	85%	2,221
2021	2,730	3,563	839	180	1,422	2,441	85%	2,412
2022	2,471	3,660	901	196	1,588	2,685	85%	2,654
2023	2,236	3,749	958	211	1,802	2,972	85%	2,937
2024	2,023	3,829	1,012	210	1,960	3,182	85%	3,145
2025	1,830	3,901	1,047	207	2,160	3,414	85%	3,374
2026	1,656	3,967	1,099	215	2,286	3,600	85%	3,558
2027	1,499	4,026	1,148	221	2,401	3,770	85%	3,726
2028	1,356	4,080	1,196	227	2,505	3,927	85%	3,882
2029	1,227	4,129	1,242	231	2,599	4,071	85%	4,024
2030	1,110	**4,173**	1,285	235	2,684	4,204	85%	4,155
2031	1,004	3,797	1,328	238	2,762	4,327	85%	4,277
2032	909	3,436	1,368	241	2,832	4,440	85%	4,389
2033	822	3,109	1,407	243	2,895	4,545	85%	4,492
2034	744	2,813	1,444	245	2,953	4,642	85%	4,588
2035	673	2,545	1,480	246	3,005	4,732	85%	4,677
2036	609	2,303	1,515	247	3,053	4,815	85%	4,759
2037	551	2,084	1,548	248	3,096	4,892	85%	4,835
2038	499	1,886	1,580	249	3,135	4,964	85%	4,906
2039	451	1,706	1,610	250	3,170	5,030	85%	4,972
2040	408	1,544	1,640	250	3,202	5,092	85%	**5,033**
2041	370	1,397	1,580	210	2,918	4,708	85%	4,653
2042	334	1,264	1,518	175	2,646	4,338	85%	4,288
2043	303	1,144	1,458	145	2,399	4,002	85%	3,956
2044	274	1,035	1,401	121	2,175	3,696	85%	3,653
2045	248	936	1,346	100	1,972	3,418	85%	3,378
2046	224	847	1,293	83	1,788	3,165	85%	3,128
2047	203	767	1,243	69	1,621	2,933	85%	2,899
2048	184	694	1,194	58	1,470	2,721	85%	2,689
2049	166	628	1,147	48	1,332	2,527	85%	2,498
2050	150	568	1,102	40	1,208	2,350	85%	2,322
2051	136	514	1,059	33	1,095	2,187	85%	2,162
2052	123	465	1,017	27	993	2,038	85%	2,014
2053	111	421	978	23	900	1,901	85%	1,879
2054	101	381	939	19	816	1,774	85%	1,754
2055	91	344	902	16	740	1,658	85%	1,639
2056	82	312	867	13	671	1,551	85%	1,533
2057	75	282	833	11	608	1,452	85%	1,435
2058	68	255	800	9	551	1,361	85%	1,345
2059	61	231	769	7	500	1,276	85%	1,262
2060	55	209	739	6	453	1,198	85%	1,185
2061	50	189	710	5	411	1,126	85%	1,113
2062	45	171	682	4	373	1,059	85%	1,047
2063	41	155	655	4	338	997	85%	985
2064	37	140	629	3	306	939	85%	928
2065	34	127	605	2	278	885	85%	875
2066	30	115	581	2	252	835	85%	825
2067	27	104	558	2	228	788	85%	779
2068	25	94	536	1	207	745	85%	736
2069	22	85	515	1	188	704	85%	696
2070	20	77	495	1	170	666	85%	659
2071	18	70	476	1	154	631	85%	624
2072	17	63	457	1	140	597	85%	590
2073	15	57	439	1	127	567	85%	560
2074	14	52	422	0	115	537	85%	531
2075	12	47	405	0	104	510	85%	504

Figure A-1
Projected LFG Flow for the Phase II Expansion

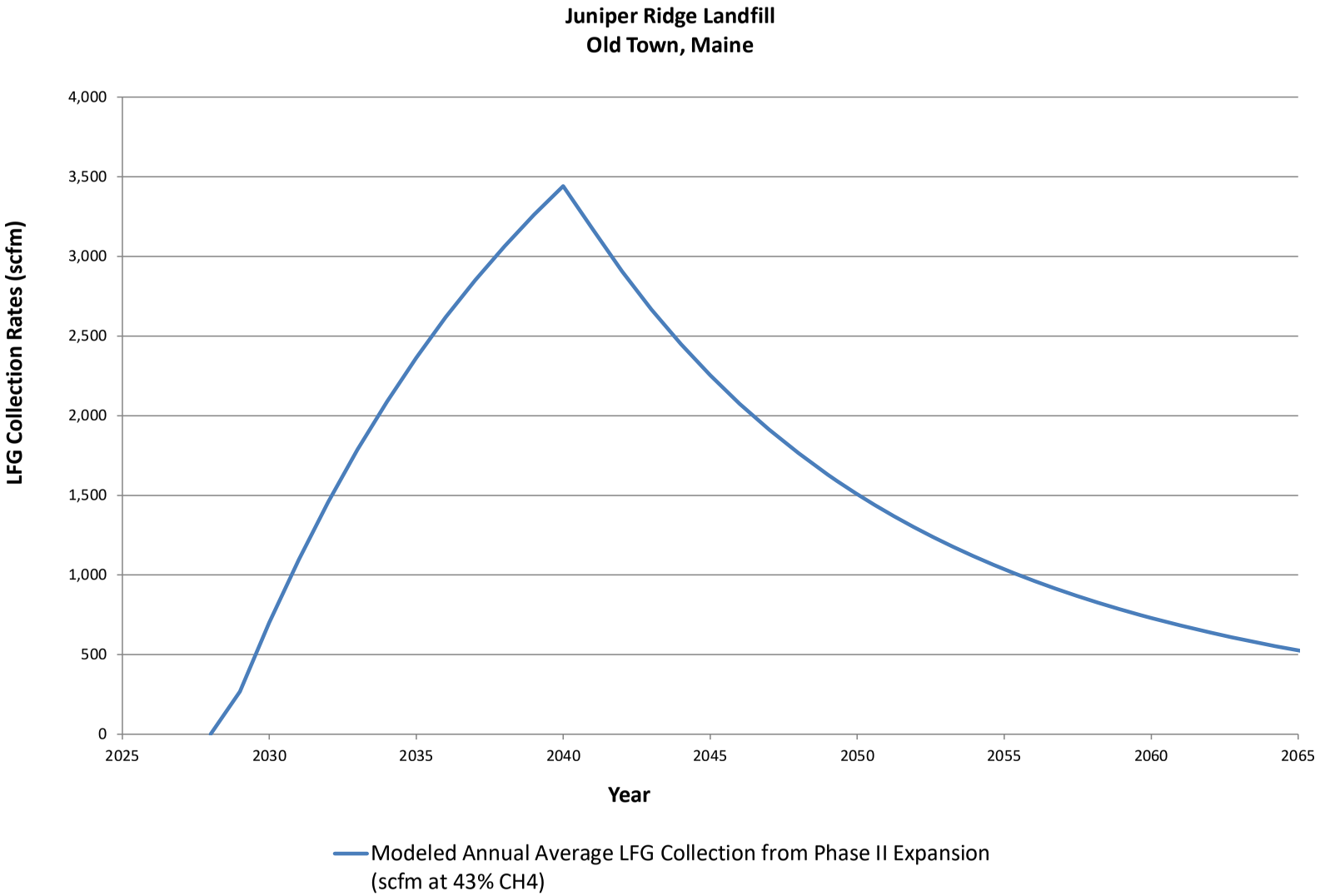
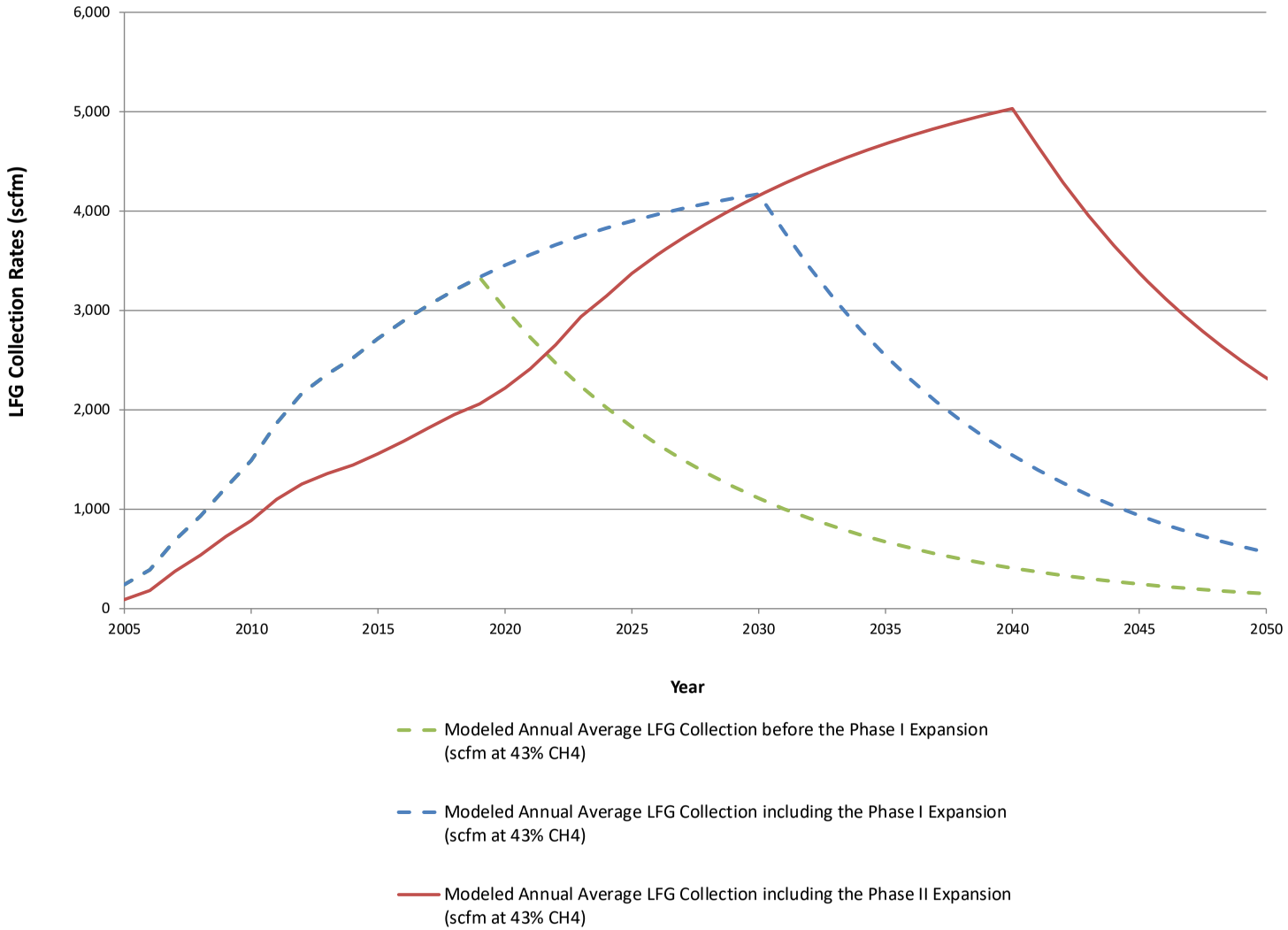


Figure A-2
Facility-Wide Projected LFG Flow including the Phase II Expansion

Juniper Ridge Landfill
Old Town, Maine



Header Sizing Calculation

PURPOSE: Estimate the internal gas velocities and pressure losses that can be expected for the perimeter landfill gas (LFG) header pipes associated with the 11.9 million cubic yard (MCY) Phase II expansion of Juniper Ridge Landfill (JRL) in Old Town, Maine based on projected LFG flow rates. Compare the calculated values with industry accepted values to check that the pipe sizing is adequate for the expansion.

GIVEN: The existing perimeter headers on the east and west sides of the landfill are 24-inch diameter and will be extended around the perimeter of the expansion area. The pipe will have sections that experience concurrent flow conditions and others that will experience countercurrent flow conditions. The 24-inch diameter pipes come together into one 30-inch diameter pipe before the blowers.

Based on the results of LandGEM modeling, the LFG design flow rate from the entire landfill is 5,600 scfm (includes LFG from Phase II and from older sections of the landfill). The LFG design flow from the proposed Phase II expansion area is projected to be approximately 4,000 scfm in the year 2040. The flow from the old landfill (in the year 2040) can therefore be approximated as the difference between 5,600 scfm and 4,000 scfm, or 1,600 scfm. In Summary:

LFG design flow from Phase II expansion area = 4,000 scfm
LFG design flow from old landfill at overall peak LFG flow = 1,600 scfm
LFG design flow from entire landfill (existing and proposed expansion) = 5,600 scfm

METHOD:
Separate the perimeter LFG header into distinct sections for evaluation based on the locations of low points and high points along the header pipe which correspond to changes in flow characteristics (concurrent vs. counter-current flow). Identify the corresponding landfill areas that are expected to provide gas flow to each section of header pipe. Assume that LFG generated from waste on the east side of the landfill will flow into the east side header and that flow on the west side of the landfill will flow to the west side header. Table 1 below summarizes the area name, description, which side of the landfill the area is on, and LFG flow in that area:

Table 1

Side of Landfill LFG will flow to?	Area No. (See Figure 1)	Area Description	Assumed LFG Flow breakdown (scfm)
East	1A	East Expansion	2,000
	1B	Northeast Existing	400
	2	Southeast Existing	400
West	3	West Expansion	2,000
	4	Northwest Existing	400
	5	Southwest Existing	400

These areas are expected to have LFG that flows into sections of the perimeter header that are described in more detail in Table 2 below. The table includes the side of the landfill the header pipe is on, the pipe designation, pipe size, standard dimension ratio (SDR), how the estimated flow is calculated in the pipe, total LFG flow in the pipe, and the LFG flow conditions. The areas and pipes described in Tables 1 & 2 are shown on Figure 1.

Table 2

Side of Landfill	Header No.	Pipe Size (inch)	SDR	LFG Flow Calculation	Est. Max LFG Flow (scfm)	Flow Conditions
East	P-1	24	17	= Area 1A + Area 1B	2,400	Counter-current
	P-2	24	17	= P-1 + Area 2	2,800	Concurrent
West	P-3	24	17	= Area 3	2,000	Counter-current
	P-4	24	17	= P-3 + Area 4	2,400	Concurrent
	P-5	24	17	= P-4 + Area 5	2,800	Counter-current
Header to Blowers	P-6	30	17	= P-2 + P-5	5,600	Concurrent

SAMPLE CALCULATION FOR HEADER PIPE DESIGNATED AS P-1:

GIVEN:

- P-1 is shown as 24-inch diameter (see attached Figure 1 for location of pipe)
- P-1 experiences counter-current flow conditions
- Internal diameter of 24-inch diameter SDR-17 HDPE pipe = 21.007 in.
- Cross-sectional area of 24-inch diameter SDR-17 HDPE pipe = 2.407 ft^2
- Approximate length of pipe = 3,973 feet

METHOD: Utilize the continuity equation to check if the velocity of LFG, V, will be no greater than 20 ft/s for counter-current gas and condensate flow direction or 40 ft/s for concurrent gas and condensate flow direction [REF. 2, p. 371] for the predicted LFG flow rate. Next, use the Low-Pressure Mueller Equation to estimate pipe pressure losses. Check to see if Pressure Loss, ΔP, is less than 1 inch per 100 feet of pipe or 0.01 in/ft [REF. 2, p. 371].

CALCULATION:

Velocity of the gas inside pipe, V:

$$V = \frac{Q}{A}$$

where V = LFG Velocity, feet per second
Q = LFG flow rate, cubic feet per second

A= Cross sectional area of the pipe in square feet
where A= πr^2 and r=radius of the pipe (ft)

$$V = \left((2{,}400 \text{ scfm})\left(\frac{1 \text{ min}}{60 \text{ sec}}\right)\right) \div 2.407 \text{ ft}^2 = 16.6 \text{ ft/s}$$

Check: $16.6 \text{ ft/s} < 20 \text{ ft/s}$ OKAY

Friction Losses in Pipe: Low-Pressure Mueller Equation [REF 1]:

$$\Delta P = L\left[\frac{60 \cdot Q \cdot G^{0.425}}{2971 \cdot d^{2.725}}\right]^{1.739}$$

Where:
- ΔP = pressure loss, inches of water column
- L = length of pipe, ft.
- Q = gas flow rate, ft^3/min.
- G = specific gravity of the gas, use 0.87 for landfill gas [REF 2, p. 374]
- d = internal pipe diameter, in.

$$\Delta P = 3{,}973 \text{ ft} \times \left[\frac{60 \cdot (2{,}400 \text{ scfm}) \cdot (0.87)^{0.425}}{2971 \cdot (21.007 \text{ in})^{2.725}}\right]^{1.739}$$

$$\Delta P = 1.65 \text{ in W. C.}$$

$$\text{Check:} \quad \frac{\Delta P}{L} < \frac{0.01 \text{ in}}{\text{ft}}$$

$$\frac{1.65 \text{ in}}{3{,}973 \text{ ft}} = \frac{0.0004 \text{ in}}{1 \text{ ft}} < \frac{0.01 \text{ in}}{1 \text{ ft}} \quad \text{OKAY}$$

RESULTS:

The calculation results indicate that Pipe P-1 meets the above criteria for velocity (counter-current flow) and pressure loss.

Spreadsheet calculations using the methods detailed above were performed for each of the perimeter LFG header pipe sections identified on Figure 1. The calculations are included as Attachment A and a

tabulated summary of the results are provided in Table 3 (shown below). The attached Figure 1 depicts the location of each of the proposed pipes (designated as P-1 thru P-6).

Estimated maximum LFG flow rates for each section of header pipe are based on:

1. The overall gas projection from LandGEM for the design year (2040);
2. Assumptions regarding the expected split of LFG flow directed to east side vs. west side of the GCCS; and
3. The expectation that, in year 2040, most of the LFG flow will come from the north side of the landfill (Phase II expansion area) due to the relative ages of waste expected to be in place.

Actual maximum flow rates experienced may differ from those estimated by Sanborn Head and shown in Table 3. The individual pipe sizes were selected in consideration of concurrent vs. counter- current flow conditions, and to provide some additional flow capacity to account for flow rate fluctuations and operational uncertainties relative to the GCCS.

Table 3

Header No.	Est. Max. LFG Flow Rate in Pipe (scfm)	Pipe Diameter (in)	Pipe Length (ft)	Calculated LFG Velocity (ft/s)	Calculated Pressure Loss (in W.C.)	Pressure Loss is less than 1in/100ft?	Concurrent or Counter-current Flow
P-1	2,400	24	3,973	16.6	1.65	Yes	Counter-current
P-2	2,800	24	1,691	19.4	0.92	Yes	Concurrent
P-3	2,000	24	2,860	13.8	0.87	Yes	Counter-current
P-4	2,400	24	2,046	16.6	0.85	Yes	Concurrent
P-5	2,800	24	2,083	19.4	1.13	Yes	Counter-current
P-6	5,600	30	108	24.8	0.07	Yes	Concurrent

REFERENCES:

1. *AP 42: Compilation of Air Emissions Factors from Stationary Sources*, Fifth Edition, Volume I, Chapter 2: Solid Waste Disposal, Section 2.4.4.2, United States Environmental Protection Agency (USEPA), 1995.

2. *Geotechnical Aspects of Landfill Design and Construction*, Xuede Qian, Robert M. Koerner, Donald H. Gray, Prentice Hall, Upper Saddle River, NJ, 2002, pp. 370-373.

Attachment A

File Number: 2536.40
Project: JRL Phase II Expansion
Location: Old Town, Maine
Subject: Header Sizing Calculations
Calculated By: V. Zucchelli Date: Nov-25
Checked By: R. Clay Date: Nov-25
Header: **P-1 (from Sample Calc)**

Header Information

Nominal Diameter	24	in
SDR-	17	
Condensate Flow	Counter-Current	
Approximate Pipe Length	3,973	ft
Inside Diameter	21.007	in
Flow Area	2.407	ft^2

Flow Parameters

Spec. Gravity of LFG	0.87			
Predicted Max. LFG Flow	2,400	scfm		
Velocity	16.6	ft/s	ACCEPTABLE	V = Q/A
Pressure Loss	1.65	in WC	ACCEPTABLE	$\Delta P = L*[(60*Q*G^{0.425})/(2971*d^{2.725})]^{(1/0.575)}$

Attachment A

File Number: 2536.40
Project: JRL Phase II Expansion
Location: Old Town, Maine
Subject: Header Sizing Calculations
Calculated By: V. Zucchelli Date: Nov-25
Checked By: R. Clay Date: Nov-25
Header: **P-2**

Header Information

Nominal Diameter	24	in
SDR-	17	
Condensate Flow	Concurrent	
Approximate Pipe Length	1,691	ft
Inside Diameter	21.007	in
Flow Area	2.407	ft^2

Flow Parameters

Spec. Gravity of LFG	0.87			
Predicted Max. LFG Flow	2,800	scfm		
Velocity	19.4	ft/s	ACCEPTABLE	V = Q/A
Pressure Loss	0.92	in WC	ACCEPTABLE	$\Delta P = L*[(60*Q*G^{0.425})/(2971*d^{2.725})]^{(1/0.575)}$

Attachment A

File Number: 2536.40
Project: JRL Phase II Expansion
Location: Old Town, Maine
Subject: Header Sizing Calculations
Calculated By: V. Zucchelli Date: Nov-25
Checked By: R. Clay Date: Nov-25
Header: **P-3**

Header Information

Nominal Diameter	24	in
SDR-	17	
Condensate Flow	Counter-Current	
Approximate Pipe Length	2,860	ft
Inside Diameter	21.007	in
Flow Area	2.407	ft^2

Flow Parameters

Spec. Gravity of LFG	0.87			
Predicted Max. LFG Flow	2,000	scfm		
Velocity	13.8	ft/s	ACCEPTABLE	V = Q/A
Pressure Loss	0.87	in WC	ACCEPTABLE	$\Delta P = L*[(60*Q*G^{0.425})/(2971*d^{2.725})]^{(1/0.575)}$

Attachment A

File Number: 2536.40
Project: JRL Phase II Expansion
Location: Old Town, Maine
Subject: Header Sizing Calculations
Calculated By: V. Zucchelli Date: Nov-25
Checked By: R. Clay Date: Nov-25
Header: **P-4**

Header Information

Nominal Diameter	24	in
SDR-	17	
Condensate Flow	Concurrent	
Approximate Pipe Length	2,046	ft
Inside Diameter	21.007	in
Flow Area	2.407	ft^2

Flow Parameters

Spec. Gravity of LFG	0.87			
Predicted Max. LFG Flow	2,400	scfm		
Velocity	16.6	ft/s	ACCEPTABLE	V = Q/A
Pressure Loss	0.85	in WC	ACCEPTABLE	$\Delta P = L*[(60*Q*G^{0.425})/(2971*d^{2.725})]^{(1/0.575)}$

Attachment A

File Number: 2536.40
Project: JRL Phase II Expansion
Location: Old Town, Maine
Subject: Header Sizing Calculations
Calculated By: V. Zucchelli Date: Nov-25
Checked By: R. Clay Date: Nov-25
Header: **P-5**

Header Information

Nominal Diameter	24	in
SDR-	17	
Condensate Flow	Counter-Current	
Approximate Pipe Length	2,083	ft
Inside Diameter	21.007	in
Flow Area	2.407	ft^2

Flow Parameters

Spec. Gravity of LFG	0.87			
Predicted Max. LFG Flow	2,800	scfm		
Velocity	19.4	ft/s	ACCEPTABLE	V = Q/A
Pressure Loss	1.13	in WC	ACCEPTABLE	$\Delta P = L*[(60*Q*G^{0.425})/(2971*d^{2.725})]^{(1/0.575)}$

Attachment A

File Number: 2536.40
Project: JRL Phase II Expansion
Location: Old Town, Maine
Subject: Header Sizing Calculations
Calculated By: V. Zucchelli Date: Nov-25
Checked By: R. Clay Date: Nov-25
Header: **P-6**

Header Information

Nominal Diameter	30	in
SDR-	17	
Condensate Flow	Concurrent	
Approximate Pipe Length	108	ft
Inside Diameter	26.258	in
Flow Area	3.761	ft^2

Flow Parameters

Spec. Gravity of LFG	0.87			
Predicted Max. LFG Flow	5,600	scfm		
Velocity	24.8	ft/s	ACCEPTABLE	V = Q/A
Pressure Loss	0.07	in WC	ACCEPTABLE	$\Delta P = L*[(60*Q*G^{0.425})/(2971*d^{2.725})]^{(1/0.575)}$

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GIVEN / ASSUMPTIONS:

1. FROM LANDGEM MODEL, THE PEAK FLOW RATE FOR ENTIRE LANDFILL IS PROJECTED TO BE 5,600 SCFM IN YEAR 2040.

   THE LANDGEM MODEL RESULTS CAN BE FOUND IN APPENDIX A OF THE DESIGN REPORT FOR THE PHASE II LFG SYSTEM.

2. THE PORTION OF THE PEAK FLOW COMING FROM THE PHASE II EXPANSION IS 4,000 SCFM.

3. PORTION OF FLOW COMING FROM OLD LANDFILL IS 1,600 SCFM. THIS IS CALCULATED BY TAKING ASSUMPTION 1 AND SUBTRACTING IT FROM ASSUMPTION 2.
   (5,600 SCFM - 4,000 SCFM = 1,600 SCFM)

4. GAS FLOW WAS ASSUMED TO BE SPLIT EVENLY BETWEEN THE WEST AND EAST PERIMETER HEADERS.

ANTICIPATED FLOW RATES FOR EACH SECTION OF PIPE IN DESIGN YEAR (2040):

24-INCH PIPE

EAST

P-1 = AREA 1A + AREA 1B = 2,000 SCFM + 400 SCFM = 2,400 SCFM (COUNTER-CURRENT)

P-2 = P-1 + AREA 2 = 2,400 SCFM + 400 SCFM = 2,800 SCFM (CONCURRENT)

WEST

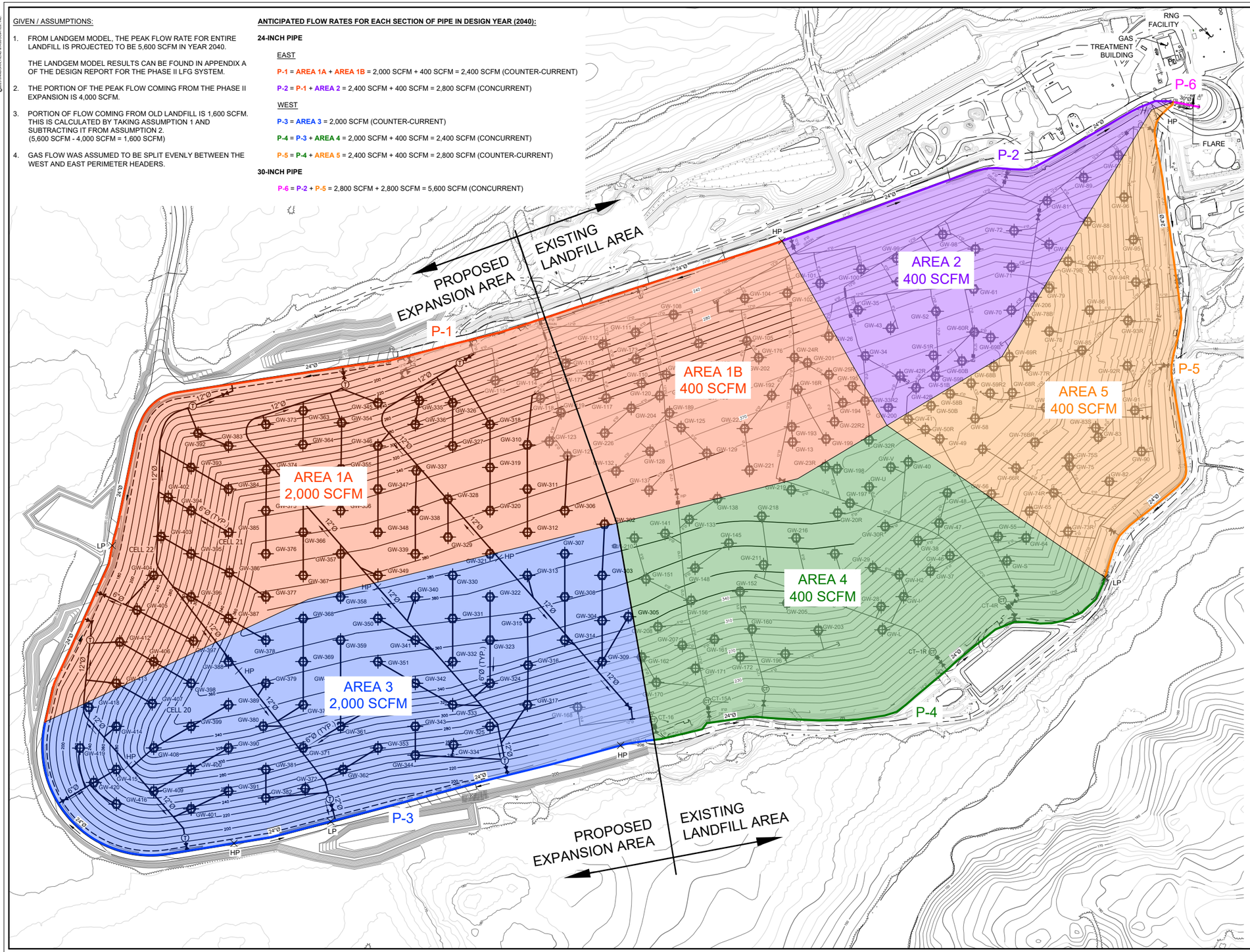
P-3 = AREA 3 = 2,000 SCFM (COUNTER-CURRENT)

P-4 = P-3 + AREA 4 = 2,000 SCFM + 400 SCFM = 2,400 SCFM (CONCURRENT)

P-5 = P-4 + AREA 5 = 2,400 SCFM + 400 SCFM = 2,800 SCFM (COUNTER-CURRENT)

30-INCH PIPE

P-6 = P-2 + P-5 = 2,800 SCFM + 2,800 SCFM = 5,600 SCFM (CONCURRENT)



NOTES:

1. THIS PLAN IS INTENDED TO ILLUSTRATE THE PROPOSED LAYOUT OF THE LANDFILL GAS (LFG) CONVEYANCE HEADERS FOR PIPE SIZING PURPOSES AND SHOULD BE PLOTTED IN COLOR. ACTUAL LOCATION OF WELLS, PIPE, AND VALVES MAY CHANGE DEPENDING ON SITE CONDITIONS AND CONSTRAINTS DURING CONSTRUCTION.
2. PROPOSED EXPANSION GRADES SHOWN WERE PROVIDED TO SANBORN HEAD BY SEVEE & MAHER, (SME) INC. OF CUMBERLAND, MAINE.

PIPE DESIGNATION / HEADER PIPE / COLLECTION AREA HATCH:

- P-1
- P-2
- P-3
- P-4
- P-5
- P-6

LEGEND:

EXISTING		PROPOSED
180	10 FOOT CONTOUR	370
	2 FOOT CONTOUR	
GW-11	VERTICAL LFG WELL	GW-35
GW-19R	REPLACEMENT VERTICAL LFG WELL	
12"ø	LFG CONVEYANCE PIPE (SIZE AND SLOPE DIRECTION)	
T	CONDENSATE TRAP	T
	CONTROL VALVE	
KO KO-1	CONDENSATE KNOCKOUT	KO KO-4
	LEACHATE COLLECTION CLEANOUT	
	VERTICAL RISER	
	LIMIT OF WASTE CONTAINMENT	
	CELL LIMIT	
	EDGE OF ROAD	
HP	HIGH POINT	HP
LP	LOW POINT	LP
	TEMPORARY PIPE TERMINATION	

SANBORN HEAD

GRAPHICAL SCALE
200' 100' 0' 200' 400'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: V. ZUCCHELLI
DESIGNED BY: V. ZUCCHELLI
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROJECT NUMBER: 2536.40

PIPE SIZING WORKSHEET

FIGURE NUMBER: 1

FILE: P:\2500\2536.40\Graphics Files\CAD\Phase II Expansion\Figures\Header Sizing Calc Figure 1.dwg
LAST SAVED BY: CTB
CTB FILE: $Ink Standard.ctb
PLOT DATE: 3-21-25

Condensate Generation Calculation

SANBORN HEAD

PURPOSE: Estimate the condensate generation expected in the proposed Phase II expansion of the Gas Collection and Conveyance System (GCCS) at the Juniper Ridge Landfill (JRL).

ASSUMPTIONS:

- Assumed Design Year = 2040
- Total landfill gas (LFG) flow rate in 2040 from LandGEM modeling = 5,600 scfm
- Assumed (Average) Initial Gas Temperature = 110°F (at wellhead locations)
- Assumed Final Gas Temperature = 35°F (after LFG temperature drop)
- Assume extracted LFG is saturated.

METHOD: The generation of condensate in saturated LFG is both temperature dependent and flow dependent [REF 1]. This calculation uses the attached psychrometric tables to estimate the rate of condensate generation [REF 2].

CALCULATION:

$$Q_{cond} = \left(Q_{LFG} * \frac{\text{Moisture Content}_{Final}}{\text{Specific Volume}_{Final}}\right) - \left(Q_{LFG} * \frac{\text{Moisture Content}_{Initial}}{\text{Specific Volume}_{Initial}}\right)\left(\frac{1\text{ gal}}{8.34\text{ lbs}}\right)$$

where: Q_{Cond} = Condensate Generation rate (gal/min)
Q_{LFG} = LFG Flow Rate (scfm)
Moisture Contents are obtained from Psychrometric Chart (See Attached Table)[Ref 2]
Specific Volumes are obtained from Psychrometric Chart (See Attached Table)[Ref 2]

$$Q_{cond} = \left(\left(5{,}600\text{ scfm} * \frac{0.0593\text{ lbs}}{15.73\text{ lbs/ft}^3}\right) - \left(5{,}600\text{ scfm} * \frac{0.00427\text{ lbs}}{12.55\text{ lbs/ft}^3}\right)\right)\left(\frac{1\text{ gal}}{8.34\text{ lbs}}\right) = 2.30\ \frac{\text{gal}}{\text{min.}}$$

RESULTS:

Based on the calculation above, the calculated condensate generation for the proposed expansion at JRL for the predicted flow rate is expected to be approximately 2.3 gpm, or approximately 3,316 gallons per day. Condensate from the JRL Phase II expansion will be managed by a series of condensate trap and condensate pump stations connected to the leachate management system.

REFERENCES:

1. *Geotechnical Aspects of Landfill Design and Construction*, Xuede Qian, Robert M. Koerner, Donald H. Gray, Prentice Hall, Upper Saddle River, NJ, 2002, pp. 366-369.

2. *The Psychrometric Chart and Its Use*, Refrigeration Service Engineers Society, 1959, 2009.

DRY AIR			MIXTURES OF DRY AIR AND SATURATED WATER VAPOR						
	Specific Volume	Density	Specific Volume	Density	Moisture Content (per lb. of dry air)		Heat Content (Enthalpy) Btu/lb of air and moisture		
°F	Cu.ft/lb	lbs/cu.ft.	Cu.ft/lb	lbs/cu.ft	Pounds	Grains	Sensible	Latent	Total
0	11.58	.0864	11.59	.0863	.000781	5.47	0.0	.85	.85
1	11.60	.0862	11.63	.0860	.000825	5.77	.24	.90	1.14
2	11.63	.0860	11.65	.0858	.000869	6.08	.48	.95	1.43
3	11.65	.0858	11.67	.0857	.000916	6.41	.72	1.00	1.72
4	11.68	.0856	11.70	.0855	.000963	6.74	.96	1.05	2.01
5	11.70	.0854	11.72	.0853	.001015	7.10	1.21	1.11	2.31
6	11.73	.0852	11.75	.0851	.001067	7.47	1.45	1.16	2.61
7	11.75	.0851	11.77	.0849	.001125	7.87	1.69	1.22	2.91
8	11.78	.0849	11.80	.0847	.001183	8.28	1.93	1.29	3.21
9	11.80	.0847	11.83	.0845	.001246	8.72	2.17	1.35	3.52
10	11.83	.0845	11.86	.0843	.001309	9.16	2.41	1.42	3.83
11	11.85	.0843	11.88	.0841	.001378	9.64	2.65	1.51	4.16
12	11.88	.0841	11.91	.0840	.001447	10.13	2.89	1.57	4.46
13	11.91	.0839	11.94	.0838	.001523	10.66	3.13	1.65	4.78
14	11.94	.0837	11.97	.0836	.001599	11.19	3.38	1.73	5.11
15	11.96	.0836	12.00	.0834	.001681	11.77	3.62	1.82	5.44
16	11.99	.0834	12.02	.0832	.001764	12.35	3.86	1.91	5.77
17	12.02	.0832	12.05	.0830	.001855	12.98	4.10	2.01	6.11
18	12.04	.0830	12.06	.0828	.001946	13.62	4.34	2.10	6.44
19	12.06	.0829	12.10	.0826	.002045	14.31	4.58	2.21	6.79
20	12.09	.0827	12.13	.0824	.002144	15.0	4.82	2.31	7.14
21	12.11	.0825	12.16	.0822	.002252	15.8	5.06	2.43	7.49
22	12.14	.0823	12.19	.0820	.002360	16.5	5.31	2.55	7.85
23	12.16	.0822	12.22	.0819	.002478	17.4	5.55	2.67	8.22
24	12.19	.0820	12.24	.0817	.002596	18.2	5.79	2.80	8.58
25	12.21	.0819	12.27	.0815	.002725	19.1	6.03	2.93	8.96
26	12.24	.0817	12.30	.0813	.002854	20.0	6.27	3.07	9.34
27	12.26	.0815	12.33	.0812	.002994	20.9	6.51	3.22	9.73
28	12.29	.0813	12.35	.0810	.003134	21.9	6.75	3.37	10.12
29	12.31	.0812	12.39	.0808	.003289	23.0	6.99	3.54	10.53
30	12.34	.0810	12.41	.0806	.003444	24.1	7.23	3.70	10.93
31	12.37	.0809	12.44	.0804	.003613	25.3	7.48	3.88	11.36
32	12.39	.0807	12.47	.0802	.003782	26.5	7.72	4.06	11.78
33	12.41	.0806	12.49	.0801	.003938	27.6	7.96	4.22	12.18
34	12.44	.0804	12.52	.0799	.004100	28.7	8.20	4.40	12.60
35	12.47	.0802	12.55	.0797	.004268	29.9	8.44	4.57	13.02
36	12.49	.0800	12.58	.0795	.004442	31.1	8.68	4.76	13.44
37	12.52	.0799	12.61	.0793	.004622	32.4	8.93	4.95	13.87
38	12.54	.0797	12.64	.0791	.004809	33.7	9.17	5.14	14.31
39	12.57	.0795	12.67	.0789	.005002	35.0	9.41	5.35	14.76
40	12.59	.0794	12.70	.0787	.005202	36.4	9.65	5.56	15.21

Assumed Final Temp

TABLE 54T03 Thermodynamic Properties of Air based on one pound of air at a total pressure of 29.921 in.hg. (Atmospheric pressure)

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	DRY AIR		MIXTURES OF DRY AIR AND SATURATED WATER VAPOR						
	Specific Volume	Density	Specific Volume	Density	Moisture Content (per lb. of dry air)		Heat Content (Enthalpy) Btu/lb of air and moisture		
°F	Cu.ft/lb	lbs/cu.ft.	Cu.ft/lb	lbs/cu.ft	Pounds	Grains	Sensible	Latent	Total
41	12.62	.0792	12.73	.0785	.005410	37.9	9.89	5.78	15.67
42	12.64	.0791	12.76	.0784	.005625	39.4	10.14	6.01	16.14
43	12.67	.0789	12.79	.0782	.005848	40.9	10.38	6.24	16.62
44	12.69	.0788	12.82	.0780	.006078	42.5	10.62	6.48	17.10
45	12.72	.0786	12.85	.0778	.006322	44.2	10.86	6.73	17.59
46	12.74	.0785	12.88	.0776	.006564	45.9	11.10	6.99	18.09
47	12.77	.0783	12.91	.0775	.006823	47.7	11.34	7.26	18.60
48	12.79	.0782	12.94	.0773	.007086	49.6	11.58	7.54	19.12
49	12.82	.0780	12.97	.0771	.007364	51.5	11.83	7.83	19.65
50	12.84	.0779	13.00	.0769	.007643	53.5	12.07	8.12	20.19
51	12.87	.0777	13.03	.0767	.007932	55.5	12.31	8.43	20.74
52	12.89	.0776	13.07	.0765	.008234	57.6	12.55	8.75	21.30
53	12.92	.0774	13.10	.0763	.008556	59.8	12.79	9.08	21.87
54	12.95	.0772	13.13	.0762	.008872	62.1	13.03	9.41	22.45
55	12.97	.0771	13.16	.0760	.009201	64.4	13.28	9.76	23.04
56	13.00	.0769	13.20	.0758	.009550	66.8	13.52	10.13	23.64
57	13.02	.0768	13.23	.0756	.009912	69.3	13.76	10.50	24.25
58	13.05	.0766	13.26	.0754	.01028	71.9	14.00	10.89	24.88
59	13.07	.0765	13.30	.0752	.01066	74.6	14.24	11.28	25.52
60	13.10	.0763	13.33	.0750	.01105	77.3	14.48	11.69	26.18
61	13.12	.0762	13.36	.0748	.01146	80.2	14.72	12.12	26.84
62	13.15	.0760	13.40	.0746	.01188	83.2	14.97	12.56	27.52
63	13.17	.0759	13.43	.0745	.01231	86.2	15.21	13.01	28.22
64	13.20	.0758	13.47	.0743	.01276	89.3	15.45	13.48	28.93
65	13.22	.0756	13.50	.0741	.01323	92.6	15.69	13.96	29.65
66	13.25	.0755	13.54	.0739	.01370	95.9	15.93	14.46	30.39
67	13.27	.0754	13.58	.0737	.01420	99.4	16.18	14.97	31.15
68	13.30	.0752	13.61	.0735	.01471	103.0	16.42	15.50	31.92
69	13.32	.0751	13.65	.0733	.01524	106.6	16.66	16.05	32.71
70	13.35	.0749	13.69	.0731	.01578	110.5	16.90	16.61	33.51
71	13.38	.0747	13.73	.0729	.01634	114.4	17.14	17.19	34.33
72	13.40	.0746	13.76	.0727	.01692	118.4	17.38	17.79	35.17
73	13.43	.0745	13.80	.0725	.01751	122.6	17.63	18.41	36.03
74	13.45	.0743	13.84	.0723	.01813	126.9	17.87	19.05	36.91
75	13.48	.0742	13.88	.0720	.01877	131.4	18.11	19.71	37.81
76	13.50	.0741	13.92	.0718	.01942	135.9	18.35	20.38	38.73
77	13.53	.0739	13.96	.0716	.02010	140.7	18.59	21.08	39.67
78	13.55	.0738	14.00	.0714	.02080	145.6	18.84	21.80	40.64
79	13.58	.0736	14.05	.0712	.02152	150.6	19.08	22.55	41.63
80	13.60	.0735	14.09	.0710	.02226	155.8	19.32	23.31	42.64

TABLE 54T03 (cont) Thermodynamic Properties of Air based on one pound of air at a total pressure of 29.921 in.hg. (Atmospheric pressure)

Copyright © 1959, 2009, By Refrigeration Service Engineers Society.

°F	DRY AIR: Specific Volume Cu.ft/lb	DRY AIR: Density lbs/cu.ft.	MIXTURES OF DRY AIR AND SATURATED WATER VAPOR: Specific Volume Cu.ft/lb	Density lbs/cu.ft	Moisture Content (per lb. of dry air): Pounds	Grains	Heat Content (Enthalpy) Btu/lf of air and moisture: Sensible	Latent	Total
81	13.63	.0734	14.13	.0708	.02303	161.2	19.56	24.11	43.67
82	13.65	.0733	14.17	.0706	.02381	166.7	19.80	24.92	44.72
83	13.68	.0731	14.22	.0703	.02463	172.4	20.04	25.76	45.80
84	13.70	.0729	14.26	.0701	.02547	178.3	20.29	26.62	46.91
85	13.73	.0728	14.31	.0699	.02634	184.4	20.53	27.51	48.04
86	13.75	.0727	14.35	.0697	.02723	190.6	20.77	28.43	49.20
87	13.78	.0726	14.40	.0694	.02815	197.0	21.01	29.38	50.39
88	13.80	.0725	14.45	.0692	.02910	203.7	21.25	30.35	51.61
89	13.83	.0723	14.50	.0690	.03008	210.6	21.50	31.36	52.86
90	13.86	.0721	14.55	.0687	.03109	217.6	21.74	32.39	54.13
91	13.88	.0720	14.60	.0685	.03213	224.9	21.98	33.46	55.44
92	13.91	.0719	14.65	.0683	.03320	232.4	22.22	34.59	56.78
93	13.93	.0718	14.70	.0680	.03430	240.1	22.46	35.69	58.15
94	13.96	.0716	14.75	.0678	.03544	247.1	22.71	36.86	59.56
95	13.98	.0715	14.80	.0676	.03662	256.3	22.96	38.06	61.01
96	14.01	.0714	14.86	.0673	.03783	264.8	23.19	39.30	62.48
97	14.03	.0713	14.91	.0671	.03908	273.6	23.43	40.57	64.00
98	14.06	.0711	14.97	.0668	.04036	282.5	23.67	41.88	65.55
99	14.08	.0710	15.02	.0666	.04169	291.8	23.91	43.24	67.15
100	14.11	.0709	15.08	.0663	.04305	301.3	24.16	44.63	68.79
101	14.14	.0707	15.14	.0660	.04446	311.2	24.40	46.07	70.47
102	14.16	.0706	15.20	.0658	.04591	321.4	24.64	47.54	72.18
103	14.19	.0705	15.26	.0655	.04741	331.9	24.88	49.07	73.95
104	14.21	.0704	15.33	.0652	.04895	342.7	25.13	50.64	75.77
105	14.24	.0702	15.39	.0650	.0505	354.0	25.37	52.26	77.63
106	14.26	.0701	15.46	.0647	.0522	365	25.61	53.92	79.53
107	14.29	.0700	15.52	.0644	.0539	377	25.85	55.64	81.49
108	14.31	.0699	15.59	.0641	.0556	389	26.09	57.41	83.50
109	14.34	.0697	15.66	.0639	.0574	402	26.33	59.23	85.57
110	14.36	.0696	15.73	.0636	.0593	415	26.58	61.11	87.69
111	14.39	.0695	15.80	.0633	.0612	428	26.82	63.04	89.86
112	14.41	.0994	15.87	.0630	.0631	442	27.06	65.04	92.10
113	14.44	.0693	15.95	.0627	.0652	456	27.30	67.10	94.40
114	14.46	.0692	16.02	.0624	.0673	471	27.55	69.22	96.77
115	14.49	.0690	16.10	.0621	.0694	486	27.79	71.40	99.10
116	14.52	.0689	16.18	.0618	.0717	502	28.03	73.65	101.68
117	14.54	.0688	16.26	.0615	.0739	518	28.27	75.97	104.24
118	14.57	.0686	16.35	.0612	.0763	534	28.51	78.36	106.87
119	14.59	.0685	16.43	.0609	.0788	551	28.76	80.80	109.56
120	14.62	.0684	16.52	.0605	.0813	569	29.00	83.37	112.37

Assumed Initial Temp

TABLE 54T03 (cont) Thermodynamic Properties of Air based on one pound of air at a total pressure of 29.921 in.hg. (Atmospheric pressure)

This table, and in fact the whole psychrometric chart, is based on standard atmospheric pressure, also called barometric pressure, of 29.921 inches of mercury. This is the total pressure of the mixture of dry air and water vapor, each of which has its own partial pressure, and these pressures must be added together to get the total pressure. If we were to add water vapor to a cubic foot of dry air at standard atmospheric pressure, the total pressure would then be greater than 29.921 inches of mercury. To balance this and keep the same total pressure of 29.921 inches of mercury, we would have to let a little air out before we add the water vapor.

Since water vapor is very light compared to air, if we let the heavier air out and replace it with the lighter water vapor, the density of the mixture will be less than that of the dry air alone. If we look at the density of air at 60°F on Table 54T03, we find that its density at saturation is .0750 lbs/cu ft, while the density of dry air at 60°F is .0763 lbs/cu ft, or .0013 lbs more than the saturated air.

VAPOR PRESSURE

Water, like any other liquid such as ammonia, sulfur dioxide, or other refrigerants, has different boiling points at different pressures. These pressures are very low, however, compared to most refrigerants. Table 54T06 shows the pressure-temperature relationship for water. The pressures are in inches of mercury absolute (not vacuum) and the temperatures are in degrees Fahrenheit.

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Appendix B

Engineering Drawings

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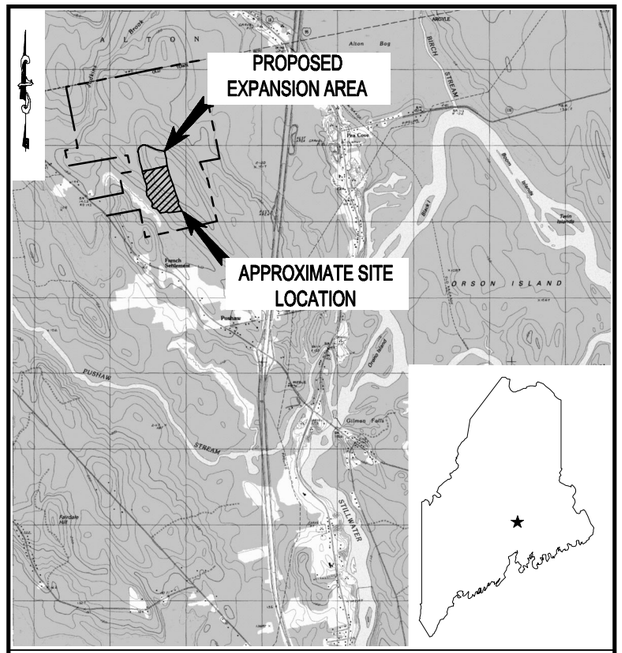
PHASE II LANDFILL GAS SYSTEM EXPANSION DRAWINGS
JUNIPER RIDGE LANDFILL

OLD TOWN, MAINE
NOVEMBER 2025



FROM: USGS TOPOGRAPHIC MAP- OLD TOWN, MAINE (1988)

LOCUS PLAN
SCALE: 1"=1000'

SHEET INDEX

SHEET 1	ANTICIPATED CONDITIONS PLAN
SHEET 2	OVERALL LANDFILL GAS EXTRACTION SYSTEM PLAN
SHEET 3	LANDFILL GAS EXTRACTION SYSTEM PLAN FOR PHASE II EXPANSION
SHEET 4-8	LANDFILL GAS EXTRACTION SYSTEM DETAILS

STATE OF MAINE
RYAN
L.
CLAY
16411
LICENSED
PROFESSIONAL ENGINEER

ISSUED FOR MAINE DEP PERMIT APPLICATION REVIEW

PREPARED FOR:

NEWSME LANDFILL OPERATIONS, LLC

JUNIPER RIDGE LANDFILL

OLD TOWN, MAINE

PREPARED BY:

SANBORN HEAD

6 BEFORD FARMS DRIVE, SUITE 201, BEDFORD, NEW HAMPSHIRE 03110
(603) 229-1900 FAX (603) 229-1919

PROJ.#: 2536.40 "PHASE II LANDFILL GAS EXPANSION DRAWINGS, JUNIPER RIDGE LANDFILL, OLD TOWN, MAINE," DATED NOVEMBER 2025

FILE: P:\2000s\2536.40\Greeks Flat\CAD\Phase II Expansion\00 - COVER.dwg
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CTB FILE: SHA STANDARD.ctb
PLOT DATE: 11-11-25

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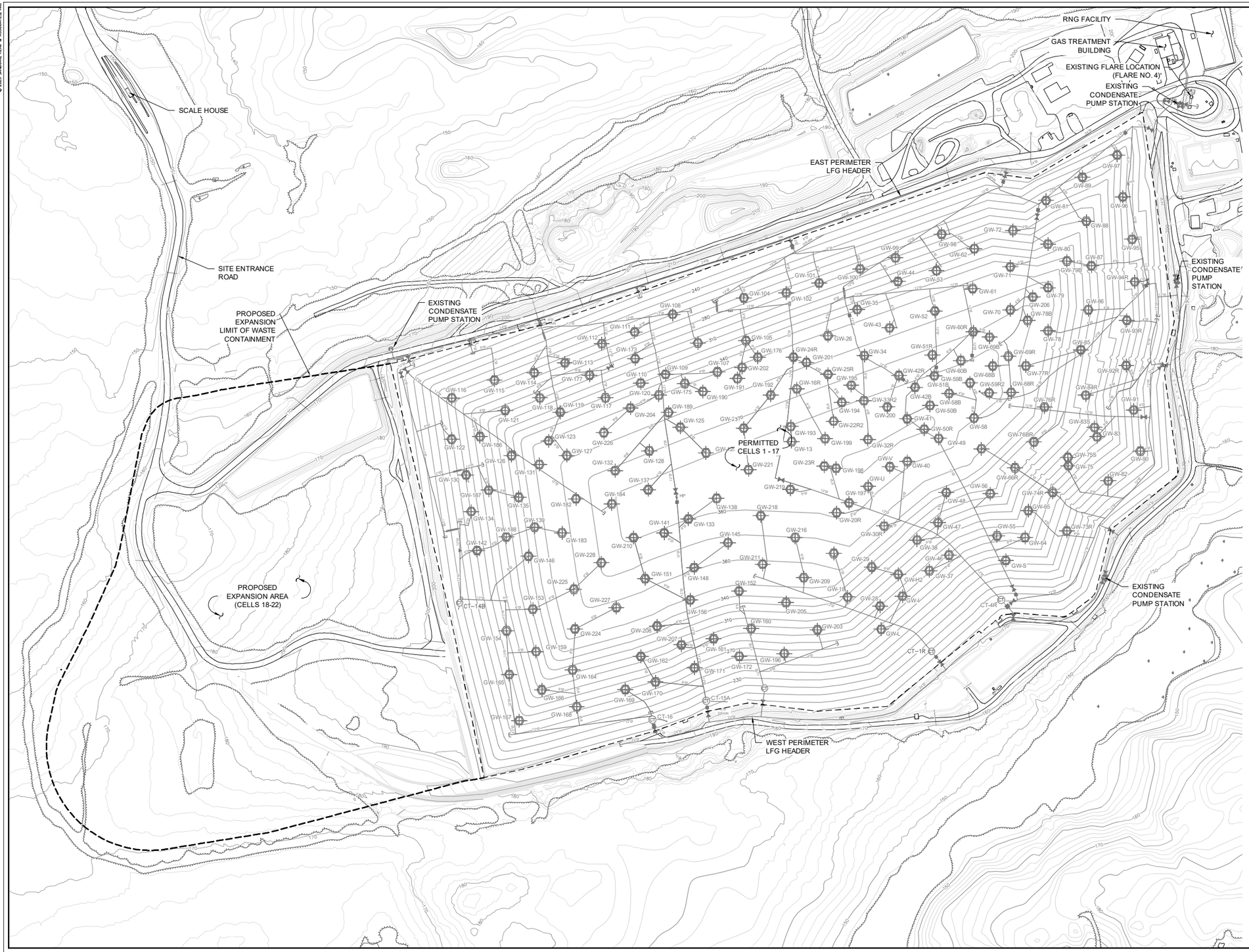

NOTES:

1. THE TOPOGRAPHY AND SITE FEATURES SHOWN OUTSIDE THE LIMIT OF WASTE CONTAINMENT WERE PREPARED BY AERIAL SURVEY & PHOTO INC., OF NORRIDGEWOCK, MAINE. PHOTO DATE MAY 1, 2025. VERTICAL DATUM: BRASS PLUG AT PUMP STATION. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY CASELLA WASTE SERVICES.
2. THE GRADES SHOWN INSIDE THE EXISTING LIMIT OF WASTE CONTAINMENT ARE PERMITTED FINAL WASTE GRADES FOR CELLS 1 - 17 AND WERE PROVIDED TO SANBORN HEAD BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
3. THE ANTICIPATED LANDFILL GAS SYSTEM INFRASTRUCTURE SHOWN FOR CELLS 1-17 IS A COMBINATION OF EXISTING AND PROPOSED INFRASTRUCTURE THAT IS EXPECTED TO BE IN PLACE PRIOR TO THE PROPOSED EXPANSION FOR CELLS 18-22. THE ACTUAL LOCATIONS OF LFG SYSTEM INFRASTRUCTURE MAY BE DIFFERENT THAN SHOWN AT THE TIME OF CONSTRUCTION OF THE EXPANSION.
4. THIS DRAWING DOES NOT IDENTIFY LANDFILL AREAS WITH EXISTING FINAL COVER.

LEGEND:

- 180 — 10 FOOT CONTOUR
- 2 FOOT CONTOUR
- GW-11 — VERTICAL LFG WELL
- GW-19R — REPLACEMENT VERTICAL LFG WELL
- 12"ø — LFG CONVEYANCE PIPE (SIZE AND SLOPE DIRECTION)
- CONDENSATE TRAP
- CONTROL VALVE
- VERTICAL RISER
- EDGE OF UNPAVED ROAD
- HP — HIGH POINT
- TEMPORARY PIPE TERMINATION
- LIMIT OF WASTE CONTAINMENT
- PHASE II EXPANSION LIMIT OF WASTE CONTAINMENT

SANBORN HEAD

GRAPHICAL SCALE
200' 100' 0' 200' 400'

STATE OF MAINE
RYAN L. CLAY
16411
LICENSED
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: M. PARENT
DESIGNED BY: O. HERNANDEZ
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

ANTICIPATED CONDITIONS PLAN (PRIOR TO EXPANSION)

PROJECT NUMBER: 2536.40

SHEET NUMBER: 1 OF 8

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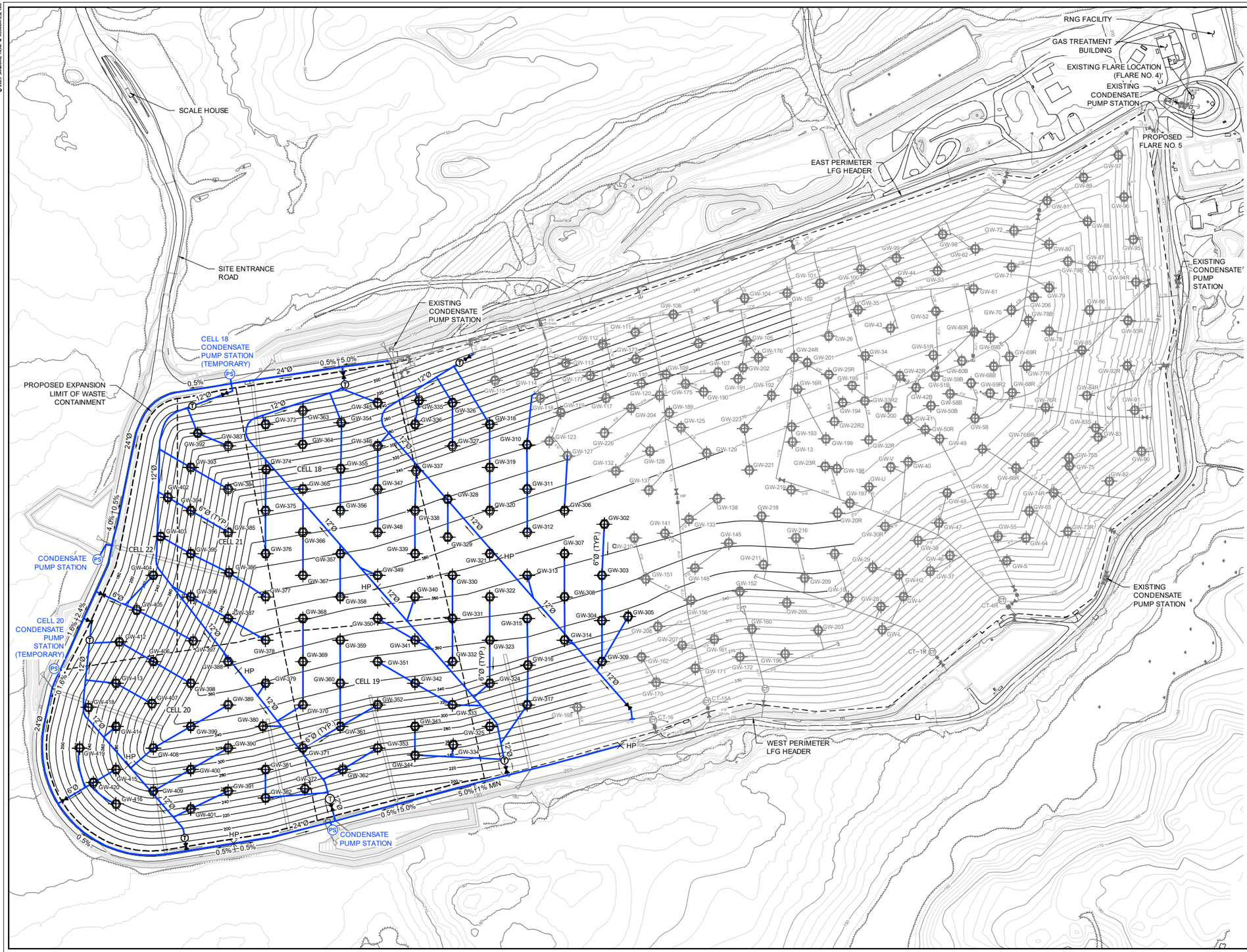

NOTES:

1. SEE SHEET 1 FOR ADDITIONAL NOTES.
2. PROPOSED GRADES SHOWN ARE FINAL WASTE GRADES AND WERE PROVIDED TO SANBORN HEAD BY SEVEE & MAHER, (SME) INC. OF CUMBERLAND, MAINE.
3. ACTUAL GRADES MAY DIFFER FROM GRADES SHOWN ON DRAWINGS AT THE TIME OF CONSTRUCTION.
4. THIS PLAN IS INTENDED TO ILLUSTRATE THE PROPOSED LAYOUT OF THE LANDFILL GAS (LFG) EXTRACTION SYSTEM. ACTUAL LOCATION OF WELLS, PIPE, AND VALVES MAY CHANGE DEPENDING ON SITE CONDITIONS AND CONSTRAINTS DURING CONSTRUCTION.
7. GAS COLLECTION TRENCHES WILL BE INSTALLED AS FILLING PROGRESSES IN EACH CELL AND ARE NOT SHOWN FOR CLARITY. GAS COLLECTION TRENCHES ARE INTENDED TO BE A TEMPORARY MEASURE OF GAS COLLECTION UNTIL FINAL GRADES ARE REACHED AND VERTICAL WELLS ARE INSTALLED.
8. SOLID LANDFILL GAS CONVEYANCE PIPE LOCATED INSIDE THE LIMIT OF WASTE CONTAINMENT SHALL BE INSTALLED AT A MINIMUM SLOPE OF 5 PERCENT. PERFORATED LANDFILL GAS COLLECTION TRENCHES SHALL BE INSTALLED AT A MINIMUM SLOPE OF 2 PERCENT. HDPE PIPE AND FITTINGS SHALL BE SDR-17. PROPOSED PIPE ALIGNMENTS MAY NEED TO BE ADJUSTED AT TIME OF CONSTRUCTION TO ACHIEVE TARGET SLOPE.

LEGEND:

EXISTING		PROPOSED
180	10 FOOT CONTOUR	370
	2 FOOT CONTOUR	
GW-11	VERTICAL LFG WELL	GW-305
GW-19R	REPLACEMENT VERTICAL LFG WELL	
12"ø	LFG CONVEYANCE PIPE (SIZE AND SLOPE DIRECTION)	12"ø
T	CONDENSATE TRAP	T
	CONTROL VALVE	
PS	CONDENSATE PUMP STATION	PS
	VERTICAL RISER	
	LIMIT OF WASTE CONTAINMENT	
	CELL LIMIT	
	EDGE OF UNPAVED ROAD	
HP	HIGH POINT	HP
	PIPE TERMINATION	
	STORMWATER DOWNCHUTE LOCATIONS	
	STORMWATER PIPE AND APRON	

SANBORN HEAD

GRAPHICAL SCALE
200' 100' 0' 200' 400'

STATE OF MAINE
RYAN L CLAY
16411
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: V. ZUCCHELLI / O. HERNANDEZ
DESIGNED BY: V. ZUCCHELLI
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

OVERALL LANDFILL GAS EXTRACTION SYSTEM PLAN

PROJECT NUMBER: 2536.40

SHEET NUMBER: 2 OF 8

FILE: P:\2500s\2536.40\Graphics Plan\CAD\Phase II Expansion\V2r-03 - LFG Plans.dwg
USER: OHernandez
CTB FILE: SHA Standard.ctb
PLOT DATE: 11-11-25

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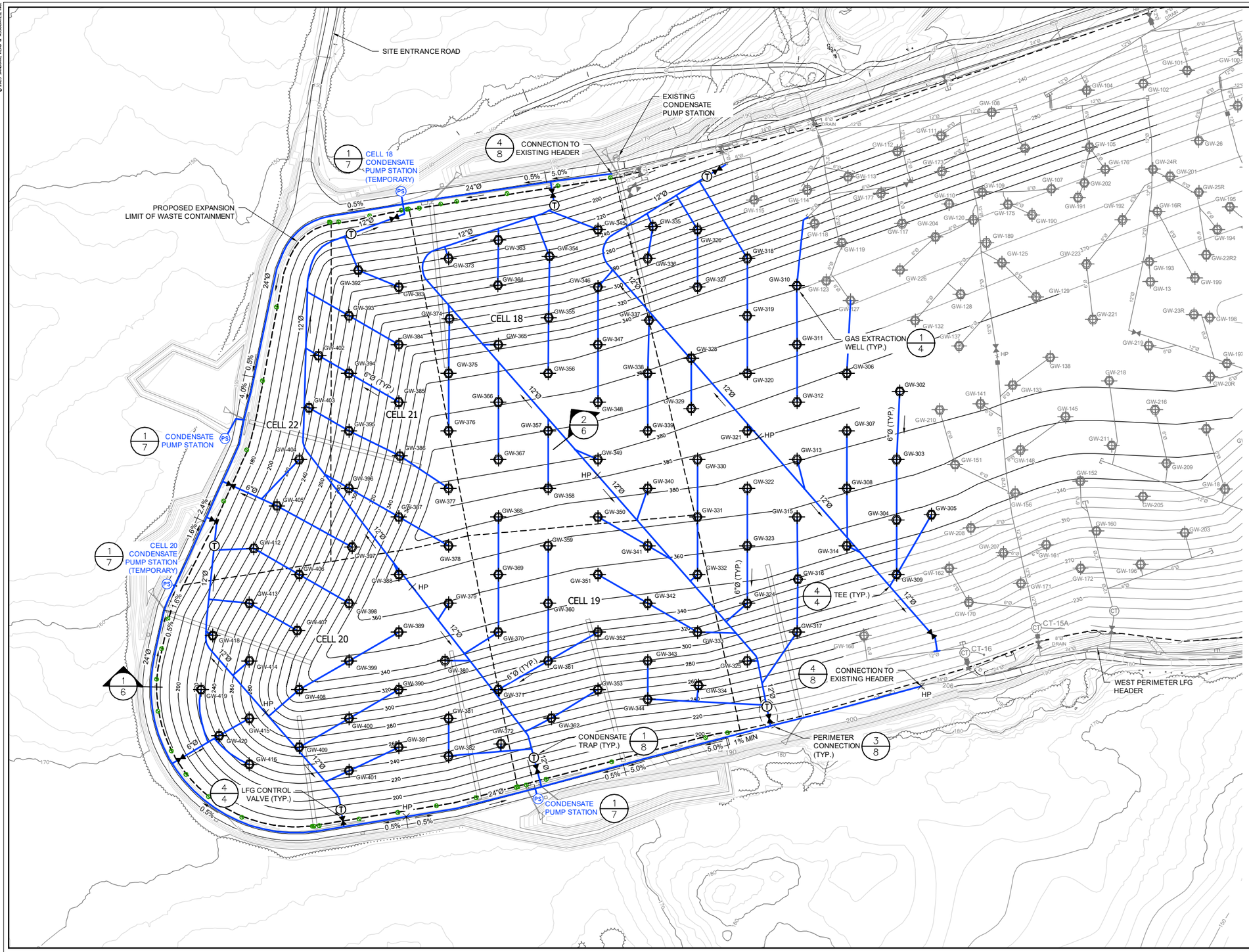

NOTES:

1. SEE SHEET 1 FOR ADDITIONAL NOTES.
2. PROPOSED GRADES SHOWN ARE FINAL WASTE GRADES AND WERE PROVIDED TO SANBORN HEAD BY SEVEE & MAHER, (SME) INC. OF CUMBERLAND, MAINE.
3. ACTUAL GRADES MAY DIFFER FROM GRADES SHOWN ON DRAWINGS AT THE TIME OF CONSTRUCTION.
4. THIS PLAN IS INTENDED TO ILLUSTRATE THE PROPOSED LAYOUT OF THE LANDFILL GAS (LFG) EXTRACTION SYSTEM. ACTUAL LOCATION OF WELLS, PIPE, AND VALVES MAY CHANGE DEPENDING ON SITE CONDITIONS AND CONSTRAINTS DURING CONSTRUCTION.
7. GAS COLLECTION TRENCHES WILL BE INSTALLED AS FILLING PROGRESSES IN EACH CELL AND ARE NOT SHOWN FOR CLARITY. GAS COLLECTION TRENCHES ARE INTENDED TO BE A TEMPORARY MEASURE OF GAS COLLECTION UNTIL FINAL GRADES ARE REACHED AND VERTICAL WELLS ARE INSTALLED.
8. SOLID LANDFILL GAS CONVEYANCE PIPE LOCATED INSIDE THE LIMIT OF WASTE CONTAINMENT SHALL BE INSTALLED AT A MINIMUM SLOPE OF 5 PERCENT. PERFORATED LANDFILL GAS COLLECTION TRENCHES SHALL BE INSTALLED AT A MINIMUM SLOPE OF 2 PERCENT. HDPE PIPE AND FITTINGS SHALL BE SDR-17. PROPOSED PIPE ALIGNMENTS MAY NEED TO BE ADJUSTED AT TIME OF CONSTRUCTION TO ACHIEVE TARGET SLOPE.

LEGEND:

EXISTING		PROPOSED
180	10 FOOT CONTOUR	370
	2 FOOT CONTOUR	
GW-11	VERTICAL LFG WELL	GW-305
GW-19R	REPLACEMENT VERTICAL LFG WELL	
12"ø	LFG CONVEYANCE PIPE (SIZE AND SLOPE DIRECTION)	12"ø
T	CONDENSATE TRAP	T
	CONTROL VALVE	
	CONDENSATE PUMP STATION	PS
	VERTICAL RISER	
	LIMIT OF WASTE CONTAINMENT	
	CELL LIMIT	
	EDGE OF UNPAVED ROAD	
HP	HIGH POINT	HP
	PIPE TERMINATION	
	STORMWATER DOWNCHUTE LOCATIONS	
	STORMWATER PIPE AND APRON	
	LEACHATE CLEANOUT LOCATION (SHOWN FOR REFERENCE)	

SANBORN HEAD

GRAPHICAL SCALE
150' 75' 0' 150' 300'

STATE OF MAINE
RYAN L. CLAY 16411
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: V. ZUCCHELLI / O. HERNANDEZ
DESIGNED BY: V. ZUCCHELLI
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROJECT NUMBER: 2536.40

LANDFILL GAS EXTRACTION SYSTEM PLAN FOR PHASE II EXPANSION

SHEET NUMBER: 3 OF 8

FILE: P:\2500s\2536.40\Graphics Files\CAD\Phase II Expansion\GE-03 - LFG Plans.dwg
LAST SAVED BY: tmcdonough
CTB FILE: SHA Standard.ctb
PLOT DATE: 11-11-25

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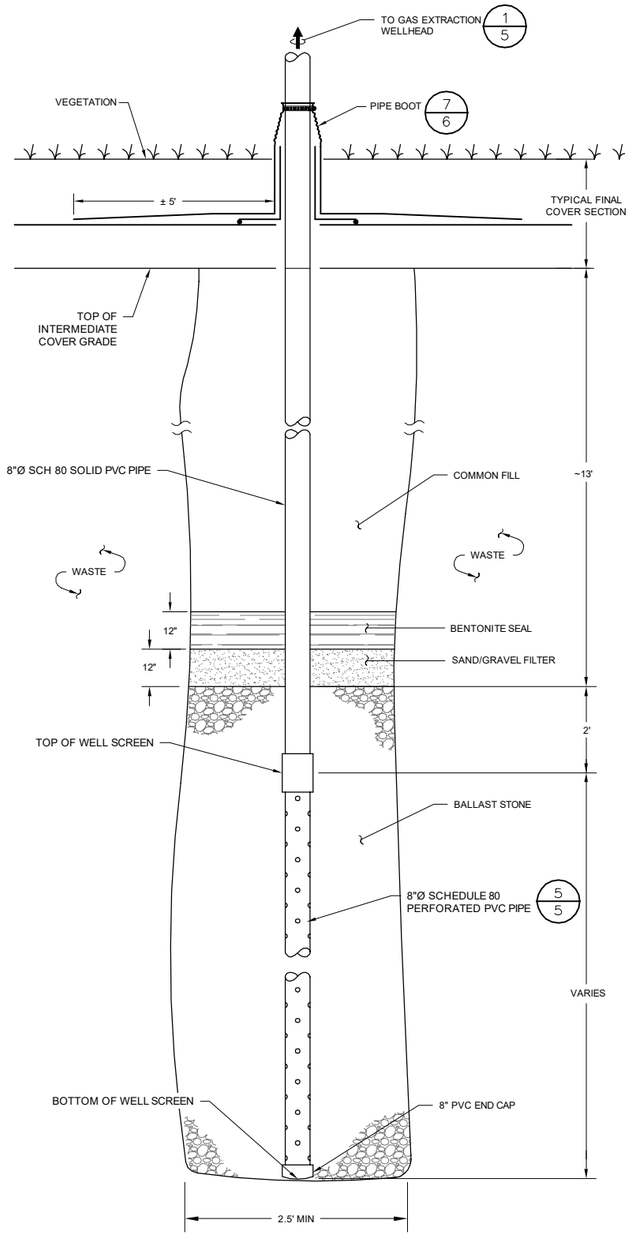

NOTES:

1. BOTTOM OF WELL IS DESIGNED TO BE 15 FEET ABOVE PRIMARY LINER SAND. REFER TO WELL SCHEDULE FOR ELEVATIONS.

TYPICAL GAS EXTRACTION WELL DETAIL

1

NOT TO SCALE

WELL SCHEDULE

WELL DESIGNATION	NORTHING	EASTING	BOTTOM OF WASTE (FT)	TOP OF EXISTING WASTE (FT)	TOTAL WELL DEPTH (FT)	BOTTOM OF WELL SCREEN (FT)	TOP OF WELL SCREEN (FT)	SCREEN LENGTH (FT)	TOP OF CASING ELEV. (FT)
GW-302	479814.9	926048.6	216.0	380.7	149.8	231.0	365.7	134.8	384.7
GW-303	479824.6	925843.3	215.4	374.4	144.0	230.4	359.4	129.0	378.4
GW-304	479824.6	925661.4	211.0	357.7	131.7	226.0	342.7	116.7	361.7
GW-305	479719.6	925677.6	211.1	355.9	129.9	226.1	340.9	114.9	359.9
GW-306	479974.6	926103.1	211.0	380.4	150.0	230.4	365.4	135.0	384.4
GW-307	479974.6	925929.9	213.5	382.3	150.0	232.3	367.3	135.0	386.3
GW-308	479974.6	925756.7	211.0	371.0	145.1	226.0	356.0	130.1	375.0
GW-309	479824.6	925496.9	207.7	315.2	92.5	222.7	300.2	77.5	319.2
GW-310	480125.2	926367.0	201.3	348.6	132.4	216.3	333.6	117.4	352.6
GW-311	480124.6	926189.7	204.5	366.7	147.2	219.5	351.7	132.2	370.7
GW-312	480124.6	926016.5	208.0	381.8	150.0	231.8	366.8	135.0	385.8
GW-313	480124.6	925843.3	213.9	380.2	150.0	230.2	365.2	135.0	384.2
GW-314	479974.6	925583.5	204.6	352.9	133.3	219.6	337.9	118.3	356.9
GW-315	480124.6	925670.1	207.3	367.2	144.9	222.3	352.2	129.9	371.2
GW-316	480122.0	925483.0	202.8	338.6	120.8	217.8	323.6	105.8	342.6
GW-317	480124.6	925323.7	199.3	286.1	71.7	214.3	271.1	56.7	290.1
GW-318	480274.6	926449.5	196.7	319.4	107.7	211.7	304.4	92.7	323.4
GW-319	480274.6	926276.3	199.3	353.4	139.1	214.3	338.4	124.1	357.4
GW-320	480274.6	926103.1	201.7	370.4	150.0	220.4	355.4	135.0	374.4
GW-321	480274.6	925929.9	204.9	383.5	150.0	233.5	368.5	135.0	387.5
GW-322	480274.6	925756.7	208.4	376.9	150.0	226.9	361.9	135.0	380.9
GW-323	480274.6	925583.5	203.6	360.6	142.0	218.6	345.6	127.0	364.6
GW-324	480274.6	925410.3	201.0	329.7	113.8	216.0	314.7	98.8	333.7
GW-325	480274.6	925237.0	198.5	270.1	56.6	213.5	255.1	41.6	274.1
GW-326	480424.6	926536.1	187.5	270.1	67.6	202.5	255.1	52.6	274.1
GW-327	480424.6	926362.9	192.0	331.2	124.2	207.0	316.2	109.2	335.2
GW-328	480443.5	926148.7	195.8	360.8	150.0	210.8	345.8	135.0	364.8
GW-329	480443.3	925996.8	198.7	375.2	150.0	225.2	360.2	135.0	379.2
GW-330	480424.6	925843.3	202.1	384.3	150.0	234.3	369.3	135.0	388.3
GW-331	480424.6	925670.1	208.0	371.0	148.0	223.0	356.0	133.0	375.0
GW-332	480424.6	925496.9	199.8	353.9	139.1	214.8	338.9	124.1	357.9
GW-333	480424.6	925323.7	196.9	314.5	102.6	211.9	299.5	87.6	318.5
GW-334	480421.2	925163.1	192.0	254.8	47.8	207.0	239.8	32.8	258.8
GW-335	480558.8	926545.0	182.0	250.0	53.0	197.0	235.0	38.0	254.0
GW-336	480574.6	926449.5	184.3	281.9	82.5	199.3	266.9	67.5	285.9
GW-337	480570.2	926262.9	193.9	343.5	134.7	208.9	328.5	119.7	347.5
GW-338	480574.6	926103.1	186.3	360.8	150.0	210.8	345.8	135.0	364.8
GW-339	480574.6	925929.9	182.0	377.2	150.0	227.2	362.2	135.0	381.2
GW-340	480574.6	925756.7	184.6	381.0	150.0	231.0	366.0	135.0	385.0
GW-341	480574.6	925583.5	196.4	364.3	150.0	214.3	349.3	135.0	368.3
GW-342	480574.6	925410.3	190.0	345.6	140.6	205.0	330.6	125.6	349.6
GW-343	480574.6	925237.0	183.3	289.3	91.0	198.3	274.3	76.0	293.3
GW-344	480574.6	925121.5	181.3	246.4	50.1	196.3	231.4	35.1	250.4
GW-345	480724.6	926536.1	168.3	232.7	49.4	183.3	217.7	34.4	236.7
GW-346	480724.6	926362.9	170.9	294.8	108.8	185.9	279.8	93.8	298.8
GW-347	480724.6	926189.7	173.6	346.9	150.0	196.9	331.9	135.0	350.9
GW-348	480724.6	926016.5	176.2	364.6	150.0	214.6	349.6	135.0	368.6
GW-349	480724.6	925843.3	178.8	381.0	150.0	231.0	366.0	135.0	385.0
GW-350	480724.6	925670.1	181.5	374.8	150.0	224.8	359.8	135.0	378.8
GW-351	480724.6	925496.9	182.5	357.6	150.0	207.6	342.6	135.0	361.6
GW-352	480724.6	925323.7	180.5	328.3	132.8	195.5	313.3	117.8	332.3
GW-353	480724.6	925150.4	178.9	265.0	71.1	193.9	250.0	56.1	269.0
GW-354	480870.2	926455.7	164.9	247.1	67.2	179.9	232.1	52.2	251.1
GW-355	480872.8	926270.8	167.9	314.5	131.6	182.9	299.5	116.6	318.5
GW-356	480874.6	926103.1	170.4	353.0	150.0	203.0	338.0	135.0	357.0
GW-357	480874.6	925929.9	173.1	370.1	150.0	220.1	355.1	135.0	374.1
GW-358	480874.6	925756.7	175.7	384.5	150.0	234.5	369.5	135.0	388.5
GW-359	480874.6	925583.5	184.2	368.8	150.0	218.8	353.8	135.0	372.8
GW-360	480874.6	925410.3	178.7	352.0	150.0	202.0	337.0	135.0	356.0
GW-361	480874.6	925237.0	175.9	309.3	118.5	190.9	294.3	103.5	313.3
GW-362	480864.6	925064.3	172.6	246.3	58.7	187.6	231.3	43.7	250.3
GW-363	481024.6	926504.2	159.0	219.9	45.9	174.0	204.9	30.9	223.9
GW-364	481025.7	926368.7	160.5	269.3	93.8	175.5	254.3	78.8	273.3
GW-365	481024.6	926189.7	164.2	334.8	150.0	184.8	319.8	135.0	338.8
GW-366	481024.6	926016.5	167.3	359.1	150.0	209.1	344.1	135.0	363.1
GW-367	481024.6	925843.3	170.0	376.1	150.0	226.1	361.1	135.0	380.1
GW-368	481024.6	925670.1	176.7	380.5	150.0	230.5	365.5	135.0	384.5
GW-369	481024.6	925496.9	186.1	363.9	150.0	213.9	348.9	135.0	367.9

WELL SCHEDULE

WELL DESIGNATION	NORTHING	EASTING	BOTTOM OF WASTE (FT)	TOP OF EXISTING WASTE (FT)	TOTAL WELL DEPTH (FT)	BOTTOM OF WELL SCREEN (FT)	TOP OF WELL SCREEN (FT)	SCREEN LENGTH (FT)	TOP OF CASING ELEV. (FT)
GW-370	481024.6	925323.7	174.8	345.6	150.0	195.6	330.6	135.0	349.6
GW-371	481024.6	925150.4	171.7	291.7	105.0	186.7	276.7	90.0	295.7
GW-372	481016.3	924986.7	168.3	232.4	49.1	183.3	217.4	34.1	236.4
GW-373	481174.6	926449.5	156.5	230.6	59.1	171.5	215.6	44.1	234.6
GW-374	481171.7	926267.5	159.0	297.2	123.2	174.0	282.2	108.2	301.2
GW-375	481174.6	926103.1	161.6	347.0	150.0	197.0	332.0	135.0	351.0
GW-376	481174.6	925929.9	163.4	365.1	150.0	215.1	350.1	135.0	369.1
GW-377	481174.6	925756.7	166.7	381.5	150.0	231.5	366.5	135.0	385.5
GW-378	481174.6	925583.5	174.2	376.1	150.0	226.1	361.1	135.0	380.1
GW-379	481174.6	925410.3	186.6	359.4	150.0	209.4	344.4	135.0	363.4
GW-380	481185.3	925237.9	175.9	338.9	147.9	190.9	323.9	132.9	342.9
GW-381	481174.6	925063.8	171.5	275.7	89.2	186.5	260.7	74.2	279.7
GW-382	481174.6	924950.0	169.7	235.1	50.4	184.7	220.1	35.4	239.1
GW-383	481324.6	926362.9	159.6	253.2	78.6	174.6	238.2	63.6	257.2
GW-384	481324.6	926189.7	161.5	312.1	135.5	176.5	297.1	120.5	316.1
GW-385	481324.6	926016.5	163.3	323.2	145.0	178.3	308.2	130.0	327.2
GW-386	481321.0	925854.0	164.8	335.7	150.0	185.7	320.7	135.0	339.7
GW-387	481324.6	925670.1	166.7	354.5	150.0	204.5	339.5	135.0	358.5
GW-388	481324.6	925496.9	183.6	370.1	150.0	220.1	355.1	135.0	374.1
GW-389	481324.6	925323.7	185.1	354.6	150.0	204.6	339.6	135.0	358.6
GW-390	481324.6	925150.4	177.6	318.4	125.8	192.6	303.4	110.8	322.4
GW-391	481324.6	924977.2	172.0	255.2	68.2	187.0	240.2	53.2	259.2
GW-392	481446.6	926413.8	161.4	227.5	51.1	176.4	212.5	36.1	231.5
GW-393	481474.6	926276.3	163.3	251.8	73.5	178.3	236.8	58.5	255.8
GW-394	481474.6	926103.1	165.0	262.9	82.9	180.0	247.9	67.9	266.9
GW-395	481474.6	925929.9	166.7	274.5	92.8	181.7	259.5	77.8	278.5
GW-396	481474.6	925756.7	168.4	290.9	107.5	183.4	275.9	92.5	294.9
GW-397	481465.2	925579.7	170.1	320.8	135.7	185.1	305.8	120.7	324.8
GW-398	481474.6	925410.3	176.5	344.2	150.0	194.2	329.2	135.0	348.2
GW-399	481474.6	925237.0	179.0	347.5	150.0	197.5	332.5	135.0	351.5
GW-400	481474.6	925063.8	177.3	294.9	102.6	192.3	279.9	87.6	298.9
GW-401	481474.6	924906.1	172.7	237.0	49.4	187.7	222.0	34.4	241.0
GW-402	481566.6	926156.2	165.0	226.0	45.9	180.0	211.0	30.9	230.0
GW-403	481595.0	925999.4	164.5	225.9	46.4	179.5	210.9	31.4	229.9
GW-404	481624.6	925843.3	163.9	227.9	49.0	178.9	212.9	34.0	231.9
GW-405	481691.6	925704.0	162.2	225.4	48.2	177.2	210.4	33.2	229.4
GW-406	481624.6	925496.9	164.3	280.0	100.7	179.3	265.0	85.7	284.0
GW-407	481630.7	925328.3	167.9	308.6	125.7	182.9	293.6	110.7	312.6
GW-408	481624.6	925150.4	171.6	331.5	144.9	186.6	316.5	129.9	335.5
GW-409	481624.6	924977.2	174.2	270.4	81.1	189.2	255.4	66.1	274.4
GW-412	481761.2	925575.7	160.6	221.6	46.0	175.6	206.6	31.0	225.6
GW-413	481774.6	925410.3	161.8	247.1	70.3	176.8	232.1	55.3	251.1
GW-414	481774.6	925237.0	164.2	273.0	93.8	179.2	258.0	78.8	277.0
GW-415	481774.6	925063.8	166.4	271.3	89.9	181.4	256.3	74.9	275.3
GW-416	481774.6	924925.2	167.4	234.9	52.5	182.4	219.9	37.5	238.9
GW-418	481885.2	925313.4	160.4	226.4	51.0	175.4	211.4	36.0	230.4
GW-419	481920.2	925150.3	161.9	225.6	48.7	176.9	210.6	33.7	229.6
GW-420	481865.7	925011.4	164.9	232.3	52.4	179.9	217.3	37.4	236.3

WELL SCHEDULE NOTES:

1. WELL SCHEDULE IS BASED ON DESIGN GRADES FOR THE LEACHATE COLLECTION SYSTEM. PRIOR TO DRILLING, WELL SCHEDULE SHALL BE UPDATED TO REFLECT AS-BUILT TOP OF LEACHATE COLLECTION SYSTEM GRADES FOR THE PHASE II EXPANSION.
2. LFG EXTRACTION WELLS SHALL BE INSTALLED WITHIN ONE FOOT OF LISTED LOCATIONS.
3. A TEMPORARY BENCHMARK WITH SURVEYED GROUND ELEVATION SHALL BE ESTABLISHED AT EACH WELL LOCATION PRIOR TO DRILLING.
4. 15 FEET OF SOLID RISER IS TO BE PROVIDED BELOW INTERMEDIATE COVER GRADES. THE INTENT IS TO PROVIDE 4 FEET OF STICK UP ABOVE FILL GRADES.
5. FINAL WELL LOCATIONS AND DEPTHS ARE SUBJECT TO CHANGE BASED ON FIELD CONDITIONS ENCOUNTERED AT TIME OF CONSTRUCTION.
6. PROPOSED CHANGES TO WELL SCHEDULE AT TIME OF CONSTRUCTION MUST BE REVIEWED AND APPROVED BY ENGINEER PRIOR TO DRILLING.
7. THE VALUES LISTED IN THE WELL SCHEDULE FOR BOTTOM OF WASTE, BOTTOM OF WELL SCREEN, TOP OF EXISTING WASTE, AND TOP OF WELL SCREEN ARE ELEVATIONS.
8. BOTTOM OF WASTE ELEVATIONS IN WELL SCHEDULE SHALL BE CONFIRMED AGAINST AS-BUILT TOP OF PRIMARY SAND GRADES PRIOR TO DRILLING.

SANBORN HEAD

SCALE AS NOTED

STATE OF MAINE
RYAN L CLAY
16411
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: R. CLAY / O. HERNANDEZ
DESIGNED BY: R. CLAY / V. ZUCCHELLI
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LANDFILL GAS EXTRACTION SYSTEM DETAILS

PROJECT NUMBER: 2536.40

SHEET NUMBER: 4 OF 8

FILE: P:\2500s\2536.40\Graphics Plan\CAD\Phase II Expansion\04-08 - DETAILS.dwg
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CTB FILE: SHA Standard.ctb
PLOT DATE: 11-11-25

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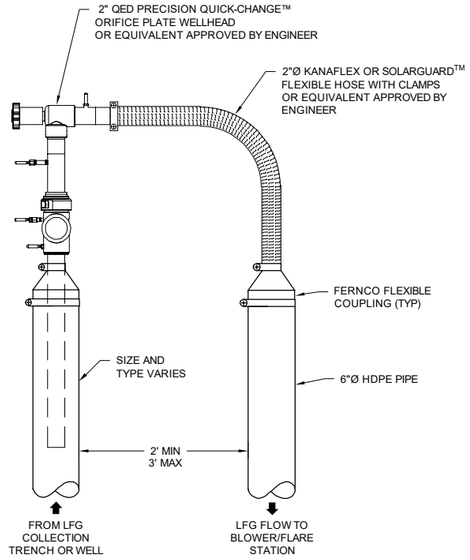


WELLHEAD NOTES:

A. WELLHEAD SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTION MANUAL. INSTRUCTIONS SHALL BE THOROUGHLY READ BEFORE ATTEMPTING ASSEMBLY AND INSTALLATION OF WELLHEAD.

B. WELLHEAD AND FLOW MEASUREMENT TUBE ASSEMBLY SHALL BE COMPATIBLE WITH LANDTEC GEM-2000 AND GEM-5000 LANDFILL GAS MONITORS.

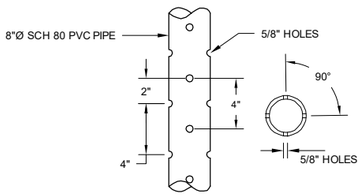
C. FOR FLEXIBLE CONNECTIONS TO PIPE, USE "IPS WELD-ON 795" PLASTIC PIPE CEMENT OR EQUIVALENT APPROVED BY ENGINEER.

D. WARNING: DO NOT CUT THE FLOW MEASUREMENT TUBE ASSEMBLY. FAILURE TO HEED THIS WARNING WILL RESULT IN A DAMAGED OR INOPERATIVE WELLHEAD AND VOID THE WARRANTY. SUCH DAMAGE WOULD REQUIRE REPLACEMENT OF THE WELLHEAD.

E. ALLOW SUFFICIENT SLACK IN FLEX HOSE FOR PIPE EXPANSION AND CONTRACTION; AN EXTRA 8 TO 12 INCHES IS RECOMMENDED.

1 WELLHEAD ASSEMBLY

NOT TO SCALE

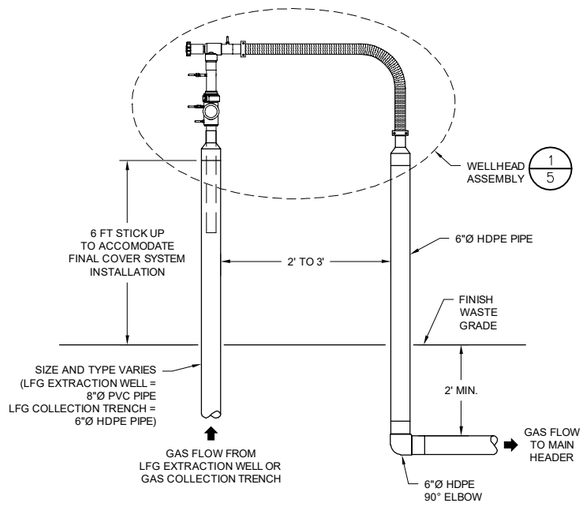


NOTES:

1. PERFORATIONS SPACED 90° APART HORIZONTALLY.
2. PERFORATIONS SPACED 4" APART VERTICALLY.
3. 90° AND 270° ROWS STAGGERED 2" BELOW 0° AND 180° ROWS.

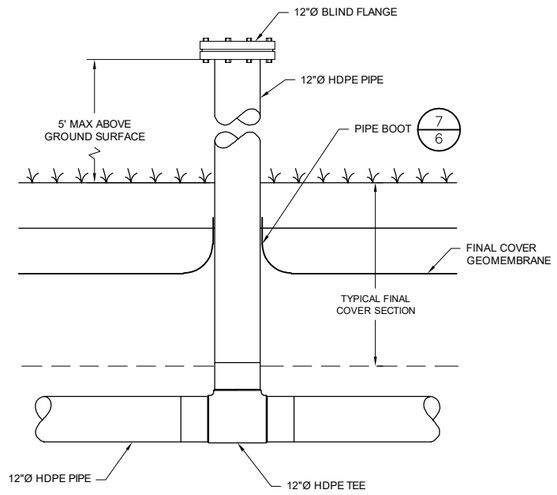
5 PERFORATED PVC PIPE

NOT TO SCALE



2 WELLHEAD RISERS

NOT TO SCALE

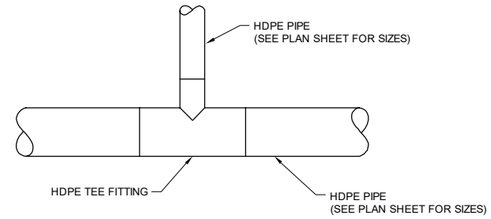


3 VERTICAL RISER DETAIL (TYP)

NOT TO SCALE

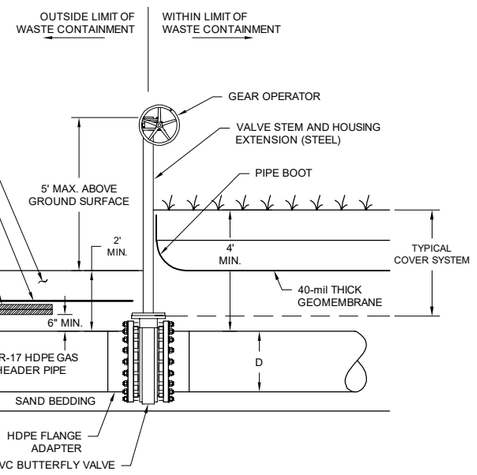
NOTES:

1. HDPE PIPE SHALL BE SDR 17. FITTINGS SHALL BE SDR 11 OR SDR 17.
2. SOLID HDPE PIPE SHALL BE BUTT-FUSION WELDED UNLESS OTHERWISE INDICATED.
3. COVER SOLID HDPE PIPE ON LANDFILL SLOPES WITH MINIMUM 2 FEET OF SOIL AND STABILIZE AGAINST EROSION.



4 "TEE" CONNECTION DETAIL

NOT TO SCALE



NOTE:

1. PROTECT BELOW GRADE BOLTS AND FLANGES BY COVERING WITH A 6-MIL THICK POLYETHYLENE WRAP. DUCT TAPE WRAP TO HDPE PIPE.
2. FOAM INSULATION REQUIRED ONLY WHERE LESS THAN 4-FEET OF COVER IS PROVIDED.

6 CONTROL VALVE DETAIL (TYP)

NOT TO SCALE

SANBORN HEAD

SCALE AS NOTED

STATE OF MAINE
RYAN
L
CLAY
16411
LICENSED
PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: R. CLAY / O. HERNANDEZ
DESIGNED BY: R. CLAY
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROJECT NUMBER: 2536.40

LANDFILL GAS EXTRACTION SYSTEM DETAILS

SHEET NUMBER: 5 OF 8

FILE: I:\2020\2536.40\Graphics\Plan\GAS\Phase II Expansion\GA-26 - DETAILS.dwg
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PLOT DATE: 11/14/25

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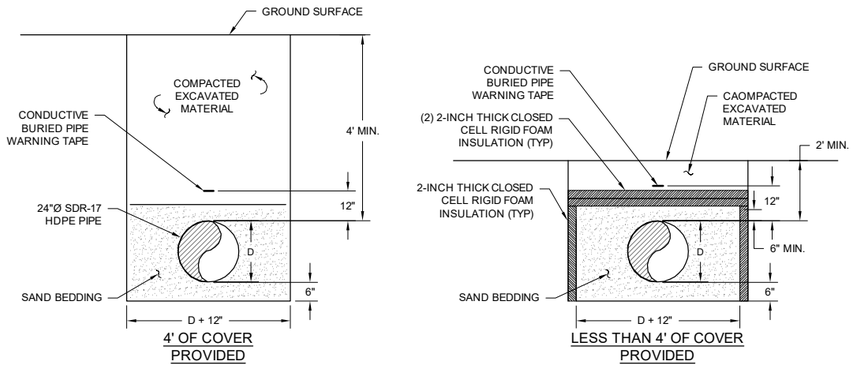
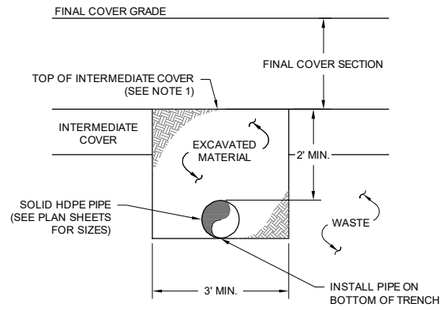


LFG HEADER TRENCH OUTSIDE LIMIT OF WASTE

1

NOT TO SCALE



LFG HEADER TRENCH INSIDE LIMIT OF WASTE

2

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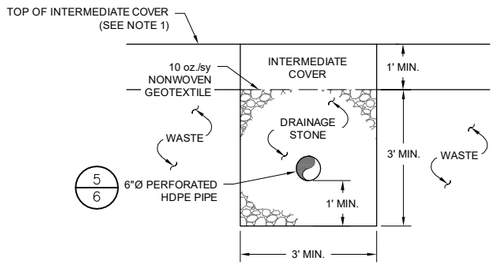


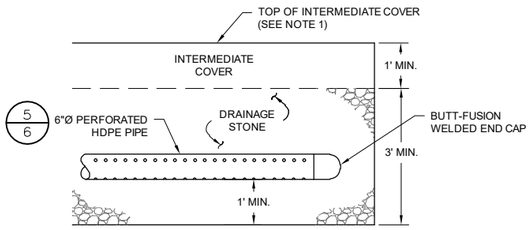
LFG COLLECTION TRENCH

3

NOT TO SCALE

NOTES:

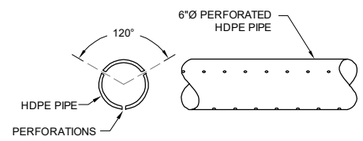
1. "TOP OF INTERMEDIATE COVER" REPRESENTS BASE GRADE TO BE ACHIEVED PRIOR TO FINAL COVER SYSTEM INSTALLATION.
2. FINAL COVER SYSTEM TO BE INSTALLED ABOVE THE INFRASTRUCTURE SHOWN.
3. HDPE PIPE SHALL BE SDR 17. FITTINGS SHALL BE SDR 11 OR SDR 17.
4. SOLID HDPE PIPE SHALL BE BUTT-FUSION WELDED UNLESS OTHERWISE INDICATED.
5. COVER SOLID HDPE PIPE ON LANDFILL SLOPES WITH MINIMUM 2 FEET OF SOIL AND STABILIZE AGAINST EROSION.
6. LFG COLLECTION TRENCHES WILL BE INSTALLED AT INTERIM GRADES DURING FILLING AND ARE NOT SHOWN ON DRAWINGS FOR CLARITY. DETAIL IS PROVIDED FOR REFERENCE ONLY.
7. THESE DRAWINGS DO NOT SHOW ALL LOCATIONS OF LANDFILL ACCESS ROADS (INTERIM AND FINAL) WHICH MAY BE CONSTRUCTED DURING FILLING OPERATIONS. ROAD CROSSING PIPE SLEEVE DETAIL APPLIES WHEN ROAD CROSSING CONDITIONS ARE PRESENT.



LFG COLLECTION TRENCH TERMINATION

4

NOT TO SCALE



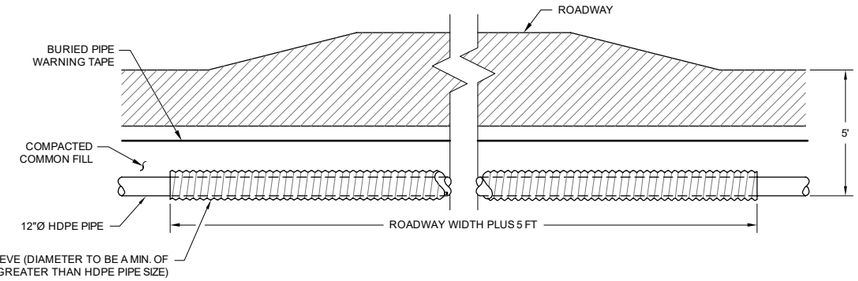
NOTE:

1. HOLES SHALL BE 1/2"Ø DRILLED HOLES SPACED 12" APART ALONG THE LENGTH OF THE PIPE OR APPROVED EQUIVALENT BY OWNER.

PERFORATED HDPE PIPE

5

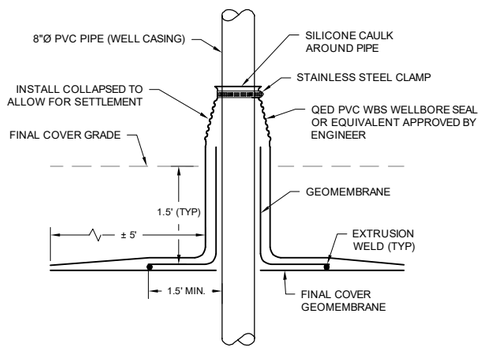
NOT TO SCALE



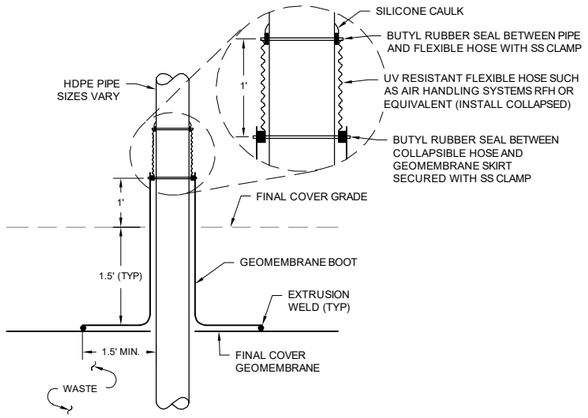
ROAD CROSSING PIPE SLEEVE

6

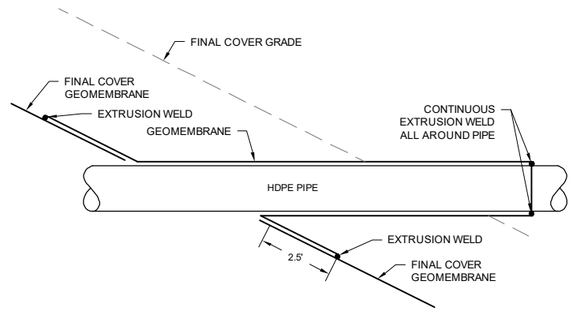
NOT TO SCALE



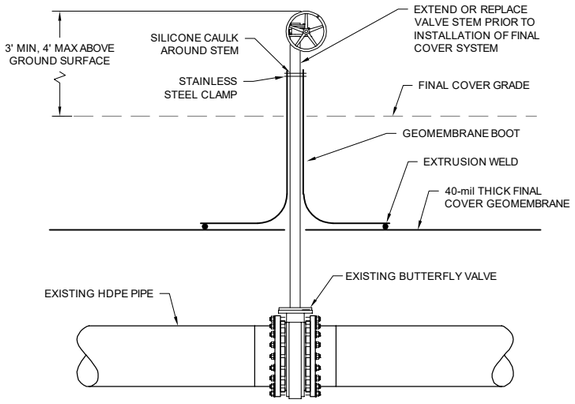
PVC PIPE RISER



HDPE PIPE RISER



HDPE PIPE SIDE PENETRATION



VALVE STEM

TYPICAL BOOT TYPES

7

NOT TO SCALE

SANBORN HEAD

SCALE AS NOTED

STATE OF MAINE
RYAN L. CLAY
16411
LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: R. CLAY
DESIGNED BY: R. CLAY
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

PROJECT NUMBER: 2536.40

LANDFILL GAS EXTRACTION SYSTEM DETAILS

SHEET NUMBER: 6 OF 8

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CTB FILE: Sheet-Bitonesc.ctb
PLOT DATE: 11/14/25

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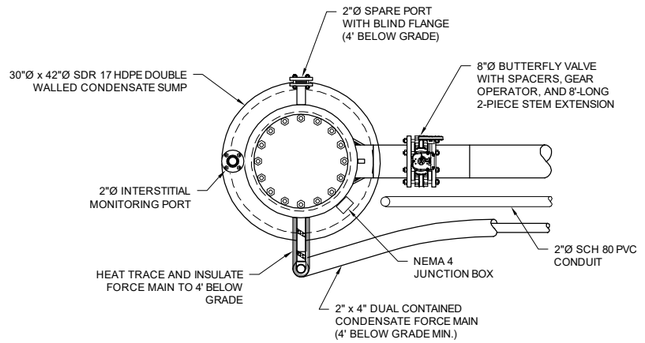
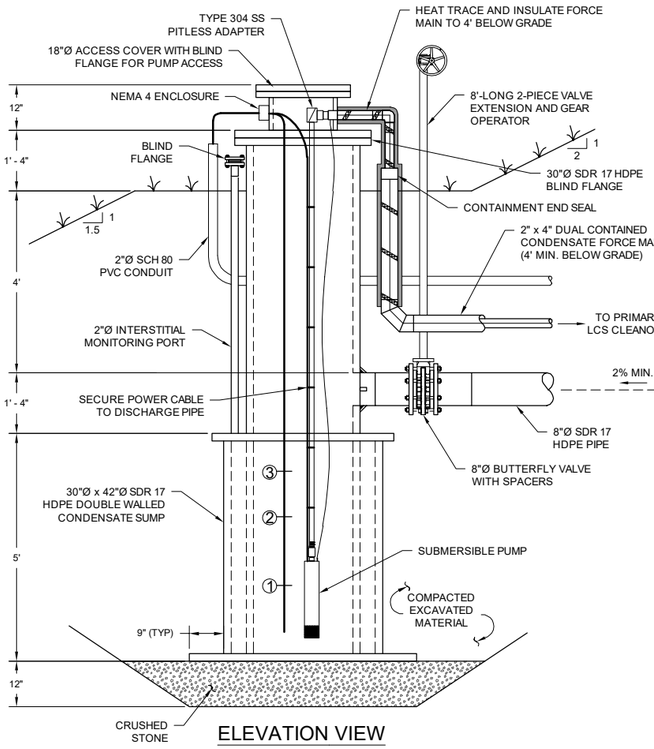
CONDENSATE PUMP STATION NOTES:

1. THE INLETS AND OUTLETS SHALL BE EXTRUSION WELDED ON THE INSIDE AND OUTSIDE. FOUR GUSSETS SHALL BE ATTACHED AT 90 DEGREES FROM EACH OTHER AROUND THE 8"Ø INLET.
2. THE STRUCTURE IS TO BE INSTALLED IN A DRY TRENCH WITH STABLE SOIL
3. COMPLETED PUMP STATION AND ALL WELDS SHALL BE LEAK FREE.
4. HDPE SPACERS SHALL BE INSTALLED ON BOTH SIDES OF BUTTERFLY VALVE.
5. LIQUID LEVEL ALARMS SHALL BE CONFIGURED TO ALARM AT THE NEAREST VAULT PANEL.
6. FLOATS SHALL BE INTRINSICALLY SAFE.
7. ALL HDPE PIPE AND FITTINGS SHALL BE SDR-17 UNLESS OTHERWISE NOTED.
8. CONDENSATE SUMP SHALL HAVE AN OSHA APPROVED CONFINED SPACE SIGN ATTACHED TO THE TOP OF THE COVER. SIGN SHALL BE 14" WIDE BY 10" HIGH, AND SHALL HAVE UV-RESISTANT PAINT ON AN ALUMINUM BASE. SIGN SHALL READ "DANGER CONFINED SPACE, HAZARDOUS ATMOSPHERE, ENTER BY PERMIT ONLY."
9. CONTRACTOR SHALL INSTALL PUMP CONTROLS, ASSOCIATED CONTROL WIRING, AND ELECTRICAL POWER AS NEEDED TO OPERATE THE PUMP AND PROVIDE NECESSARY ALARMS.
10. CONDENSATE SUMP IS A CLASS 1 DIVISION 1 GROUP D CLASSIFIED SPACE. PROVIDE EXPLOSION-PROOF OR INTRINSICALLY-SAFE ELECTRICAL EQUIPMENT. PROVIDE CONDUIT SEALS ON ALL ELECTRICAL CONDUIT.
11. PROTECT BELOW GRADE BOLTS AND FLANGES BY COVERING WITH A 6-MIL THICK POLYETHYLENE WRAP. DUCT TAPE WRAP TO HDPE PIPE.



PLAN VIEW



ELEVATION VIEW

CONDENSATE PUMP STATION

1

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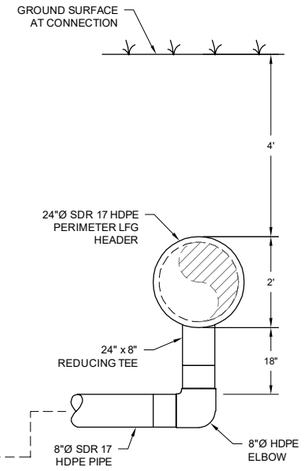


HEADER DRAIN CONNECTION

2

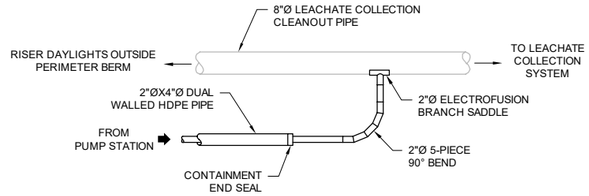
NOT TO SCALE

LIQUID LEVEL CONTROL SETTINGS:

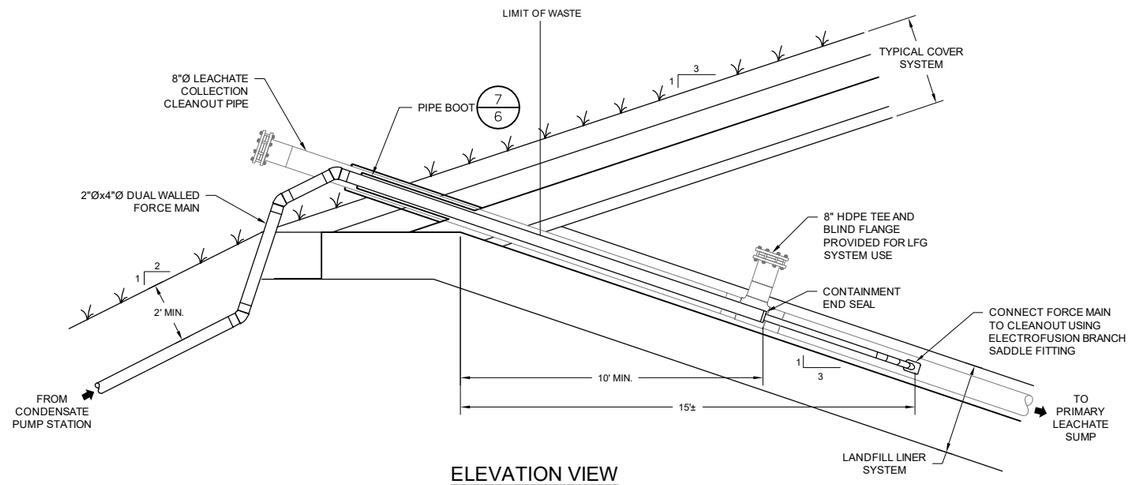
③ HIGH WATER ALARM - 54" OFF OF BOTTOM

② PUMP ON - 42" OFF OF BOTTOM

① PUMP OFF - 18" OFF OF BOTTOM



PLAN VIEW



ELEVATION VIEW

CONDENSATE PUMP STATION FORCE MAIN CONNECTION TO PRIMARY LEACHATE CLEANOUT

3

NOT TO SCALE

SANBORN HEAD

SCALE AS NOTED

STATE OF MAINE — RYAN L CLAY 16411 — LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: R. CLAY
DESIGNED BY: R. CLAY
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LANDFILL GAS EXTRACTION SYSTEM DETAILS

PROJECT NUMBER: 2536.40

SHEET NUMBER: 7 OF 8

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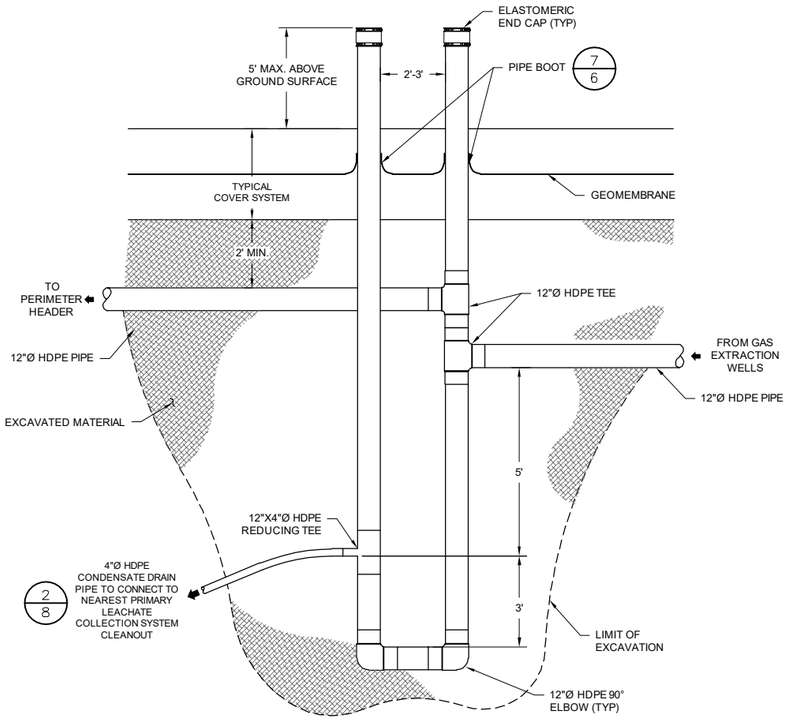

TYPICAL CONDENSATE TRAP

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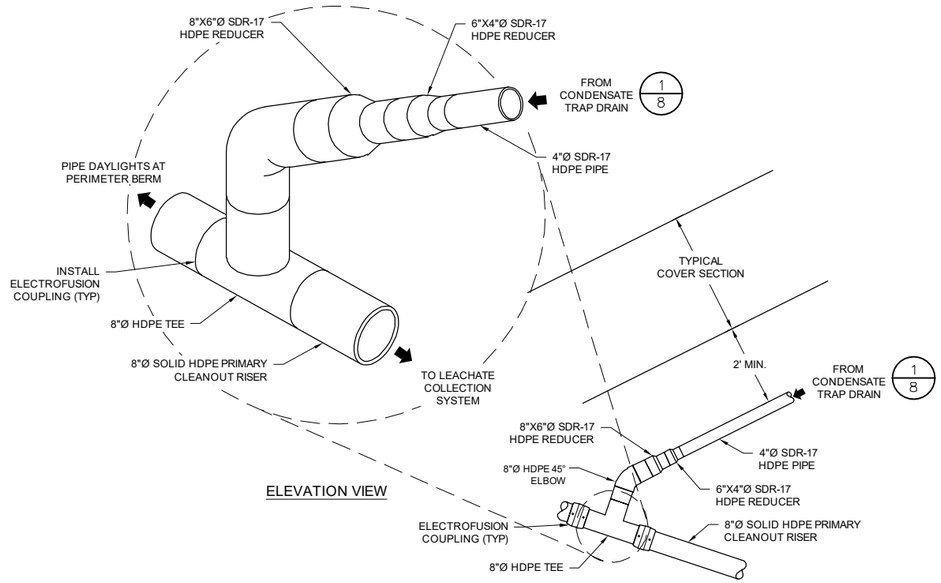
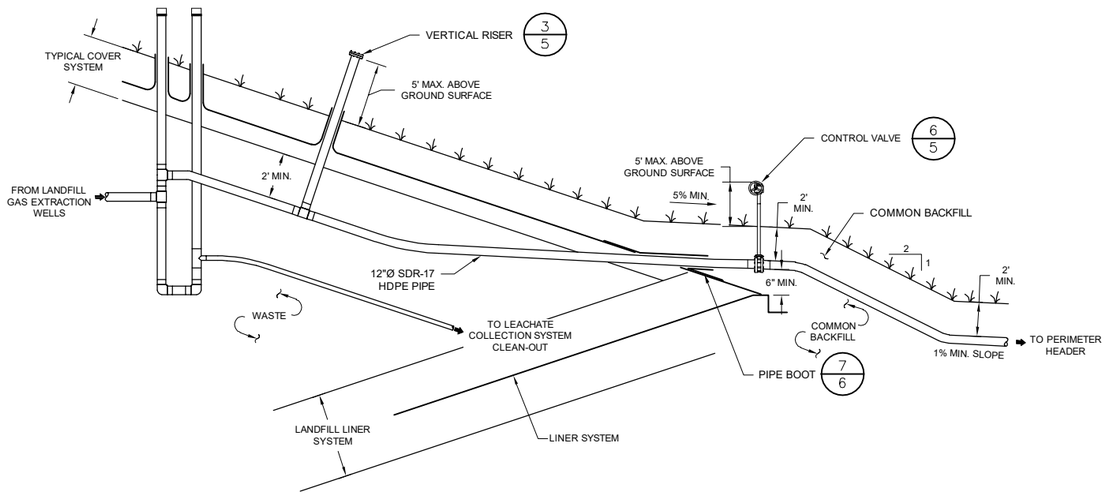


ELEVATION VIEW

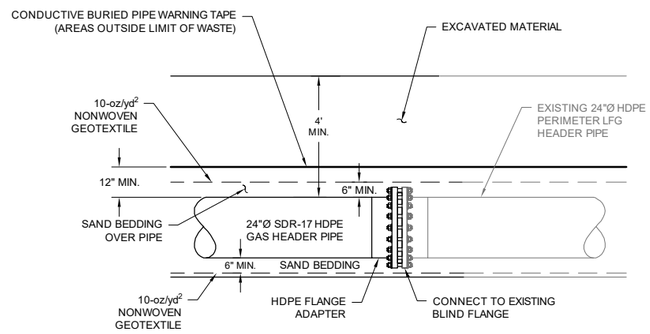
TYPICAL CLEANOUT TIE-IN DETAIL

2 NOT TO SCALE



PERIMETER CONNECTION DETAIL

3 NOT TO SCALE



PERIMETER LFG CONVEYANCE PIPE CONNECTION DETAIL

4 NOT TO SCALE

SANBORN HEAD

SCALE AS NOTED

STATE OF MAINE — RYAN L. CLAY — 16411 — LICENSED PROFESSIONAL ENGINEER

NO.	DATE	DESCRIPTION	BY

DRAWN BY: R. CLAY
DESIGNED BY: R. CLAY
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LANDFILL GAS EXTRACTION SYSTEM DETAILS

PROJECT NUMBER: 2536.40

SHEET NUMBER: 8 OF 8

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LAST SAVED BY: rclay
CTB FILE: sbha1.ctb
PLOT DATE: 11-14-25

Appendix C

Technical Specifications

SANBORN HEAD

Technical Specifications

Phase II Landfill Gas System Expansion

Juniper Ridge Landfill

Old Town, Maine

Prepared for

NEWSME Landfill Operations, LLC

Old Town, Maine

Prepared by

Sanborn, Head & Associates, Inc.

6 Bedford Farms Drive, Suite 201

Bedford, New Hampshire

File 2536.40

November 2025

CONTENTS

DIVISION 2 - SITE WORK

Section 02200 – Earthwork
Section 02560 - Landfill Gas Extraction Wells
Section 02565 - Landfill Gas Trenches

SECTION 02200

EARTHWORK

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. CONTRACTOR shall provide all labor, materials, equipment, and incidentals necessary to excavate and backfill trenches for the landfill gas management system as shown on the Drawings and specified herein, including, but not limited to: excavation, disposal, and/or replacement of waste; placement and compaction of earth materials; and grading.

1.2 SUBMITTALS

A. CONTRACTOR shall submit to ENGINEER laboratory test results for each type of material proposed a minimum of 15 days prior to its use.

PART 2 – PRODUCTS

2.1 GENERAL

A. All earth materials, unless otherwise specified, shall consist of clean soil substantially free from organic materials, wood, trash, and other objectionable materials that may be compressible or that cannot be properly compacted. Earth materials shall not contain stone blocks, broken concrete, masonry rubble, or other similar material. Earth materials shall have physical properties such that it can be readily spread and compacted to the specified density. Snow, ice, and frozen material shall not be permitted.

B. Non-hazardous chemically contaminated soil provided by OWNER may be used as backfill within the landfill.

C. Unless otherwise specified, the maximum particle size shall be no larger than two-thirds the loose lift thickness.

2.2 MATERIALS

A. Crushed Stone backfill material to be provided by CONTRACTOR.

B. Crushed Stone used as backfill shall be hard, durable, resistant to weathering and to water action, free from overburden, spoil, and organic materials. Crushed stone shall be washed, and uniformly blended according to the grading requirements for the respective particle sizes shown in the following table.

Sieve Size	Percent (%) Passing by Weight
1½-inch	100
1-inch	40 – 100
½-inch	5 – 60
No. 4	0 – 10
No. 8	0 – 5

C. Common backfill shall be soil containing no stone larger than 1 inch, and shall have a maximum of 75 percent passing the No. 40 sieve and a minimum of 35 percent passing the No. 200 sieve.

D. Sand shall consist primarily of particles with 100 percent passing the 3-in. sieve, 70 to 100 percent passing the No. 4 sieve, and no more than 10% passing the No. 200 sieve.

PART 3 – EXECUTION

3.1 GENERAL EXCAVATION BELOW GRADE

A. CONTRACTOR shall plan and perform earthwork activities to prevent damage to existing structures, safeguard people and property, minimize disruptions to site traffic, protect the structures to be installed, and provide safe working conditions in compliance with local safety regulations and provisions of the Occupational Safety and Health Administration (OSHA).

B. Excavation shall be made to the elevations, grades, and dimensions shown on the Drawings. Excavate sufficient material to provide suitable room for construction providing bracing and support as required.

3.2 EXCAVATION IN WASTE

A. CONTRACTOR shall take safety precautions during construction activities that conform to all OSHA regulations and the safety requirements of OWNER and the Specifications.

B. Trenches shall be excavated to the depths, widths, and alignments shown on the Drawings.

C. CONTRACTOR shall separate cover soil from excavated waste to the extent possible. Cover soil may be used to backfill trenches. Excavated material not suitable for use as backfill shall be transported to the working face as directed by OWNER.

D. Pockets of perched leachate may be encountered during waste excavation activities. CONTRACTOR shall immediately notify OWNER and ENGINEER when leachate is encountered. OWNER will provide CONTRACTOR with written directions on how to manage the leachate in narrative and/or drawing form. Potential leachate management techniques may include one or a combination of the following.
   1. Backfilling the affected area.
   2. Realigning the trench.
   3. Installing a French drain.

E. To the extent possible, the trench invert shall slope uniformly as indicated on the Drawings.

F. CONTRACTOR shall not excavate more trench than can be backfilled in one day after placement of the pipe. Excavations shall not be left open overnight.

G. CONTRACTOR shall provide odor control during construction activities. Odor control measures shall be approved by OWNER prior to use.

3.3 BACKFILL

A. Excavated material shall be placed in loose layers and compacted to the extent possible with the goal of establishing a firm, even surface. The loose lift thickness shall not exceed 12 inches.

3.4 QUALITY AND OVERSIGHT

A. ENGINEER does not have to be present and does not supervise or direct the actual Work by CONTRACTOR, his/her employees, or agents. Neither the presence of ENGINEER nor any observations and testing performed by ENGINEER shall excuse CONTRACTOR from defects discovered in their Work.

[END OF SECTION 02200]

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SECTION 02560

LANDFILL GAS EXTRACTION WELLS

PART 1 - GENERAL

1.1 SCOPE OF APPLICATION

A. Supply all equipment, materials, and labor needed to install landfill gas extraction wells as specified herein and as indicated on the Drawings.

1.2 SUBMITTALS

A. Submit to ENGINEER Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished.

B. Submit to ENGINEER well logs within 7 days of the completion of well installations.

C. The well logs shall depict a construction diagram for each well drilled, including the total depth of the well, the temperature of spoils, depth, thickness, and description of soil or waste strata, and the occurrence of any water bearing zones.

1.3 SITE CONDITIONS

A. Obstructions and saturated conditions such as sludges and foundry sands are sometimes encountered when drilling in landfills, many of which can be drilled through. CONTRACTOR is expected to make reasonable effort to drill through obstructions and saturated conditions and will be paid for offset redrilling and boring abandonment only with prior written approval from OWNER.

B. Well drilling shall be performed on a level surface. CONTRACTOR shall provide a level surface at each drilling location as required. The size of the level area shall be acceptable to the drilling subcontractor. Any soil placed to level the drilling location shall be removed following well installation. If soil placed for leveling contacts refuse, it shall be disposed of in the active area of the landfill.

PART 2 - PRODUCTS

2.1 BALLAST STONE

A. Ballast Stone shall be hard, durable, and resistant to weathering and to water action, free from overburden, spoil, and organic materials. Ballast Stone shall be

washed, and uniformly blended according to the particle size distribution requirements shown below.

Sieve Size	Percent Passing by Weight
2-inch	100
1½-inch	90 - 100
1-inch	30 - 40
¾-inch	10 - 15
½-inch	0 - 5
⅜-inch	0 - 5

2.2 BENTONITE SEAL

A. Bentonite Seal shall be constructed using hydrated bentonite powder, chips, or pellets.

2.3 SAND/GRAVEL FILTER

A. Sand/Gravel Filter should conform to the following particle size distribution.

Sieve Size	Percent Passing by Weight
1½-inch	100
No. 4	70 - 100
No. 40	30 - 80
No. 200	0 - 15

2.4 COMMON FILL

A. Common Fill should be soil containing no stone larger than 4 inches, and shall have a maximum of 75 percent passing the No. 40 sieve and a minimum of 35 percent passing the No. 200 sieve.

2.5 PVC PIPE

A. Refer to Specification Section 15212.

2.6 WELLHEAD

A. Wellheads should be nominal 2-inch size QED Quick Change Orifice Plate wellhead, with elastomer adapter kits, or equivalent approved by OWNER. The wellhead components are indicated on the Drawings.

B. Wellhead and flow measurement tube shall be compatible with the LANDTEC GEM-2000™ and GEM-5000™ Landfill Gas Monitors.

PART 3 - EXECUTION

3.1 DRILLING

A. ENGINEER shall observe all drilling operations.

B. Wells shall be drilled to the minimum diameter and the specific depths shown on the Drawings. CONTRACTOR shall drill the wells using bucket-type augers and dry drilling equipment; wet rotary drilling equipment may not be used.

C. Well depths shown on the Drawings are estimated based on projected top of waste elevations and may be adjusted in the field by ENGINEER. At no time shall the drilling extend deeper than the bottom of well screen elevation.

D. If water is encountered in a borehole, then CONTRACTOR may be directed to drill beyond the point that it was encountered. If wet conditions remain, then drilling may be terminated and the length of perforated pipe adjusted by ENGINEER, or the well may be relocated. If wet conditions cease (e.g., due to trapped water layer), then drilling will continue to the design depth.

E. As soon as drilling is completed, a safety screen shall be placed over the top of the borehole. This screen shall stay in place until backfilling is within 4 feet of the surface. Safety screen size should be large enough to accommodate all backfill materials and any tools used during backfill yet not large enough for any human to accidentally fall through.

F. Wells shall be drilled straight and plumb and the well pipe shall be installed in the center of the borehole. CONTRACTOR will take all compression off of the pipe by mechanical means and center the pipe in the middle of the borehole before starting to backfill.

G. PVC well pipe shall be solvent cemented and mechanically fastened with stainless steel fasteners.

3.2 BACKFILLING

A. Backfilling the borehole shall commence immediately after drilling is completed and the PVC pipe has been installed. Backfill materials shall be installed as indicated on the Drawings and as approved by ENGINEER.

B. Ballast Stone shall be poured or scooped through the safety screen at a rate that will not endanger the integrity of the well casing and limits the potential for bridging.

C. The Sand/Gravel Filter shall be poured through the safety screen until a layer at least 1-foot thick above the Ballast Stone is formed.

D. The Bentonite Seal will be formed by evenly distributing bentonite around the annulus of the well until a minimum plug thickness of 1 foot has been achieved.

E. Common Fill shall be rodded in the boring to provide even distribution and compaction.

3.3 DISPOSAL

A. Refuse from well drilling operations shall be hauled to the active face of the landfill operation the same day it is excavated.

[END OF SECTION 02560]

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SECTION 02565

LANDFILL GAS TRENCHES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. CONTRACTOR shall provide all labor, materials, equipment, and incidentals necessary to excavate and backfill trenches for the landfill gas management system as shown on the Drawings and specified herein, including, but not limited to: excavation of waste; placement of soil, aggregate, and pipe; compaction of soil; and grading.

PART 2 – PRODUCTS

2.1 GENERAL

A. All soil, unless otherwise specified, shall consist of clean soil substantially free from organic materials, wood, trash, and other objectionable materials that may be compressible or that cannot be properly compacted. Soil shall not contain stone blocks, broken concrete, masonry rubble, or other similar materials. Soil shall have physical properties such that it can be readily spread and compacted to the specified density. Snow, ice, and frozen soil shall not be permitted.

B. Unless otherwise specified, the maximum soil particle size shall be no larger than two-thirds the loose lift thickness.

2.2 MATERIALS

A. Drainage Stone used as backfill shall be hard, durable, resistant to weathering, free from overburden, spoil, and organic materials. Drainage Stone shall be washed, and uniformly blended according to the following gradation requirements.

Sieve Size	Percent (%) Passing by Weight
2-inch	100
1½-inch	80-100
1-inch	50 – 85
½-inch	0 – 50
No. 4	0 – 15
No. 10	0 – 5

B. HDPE pipe and fittings refer to Specification Section 15210.

PART 3 - EXECUTION

3.1 GENERAL EXCAVATION BELOW GRADE

A. CONTRACTOR shall plan and perform earthwork activities to prevent damage to existing structures, safeguard people and property, minimize disruptions to site traffic, protect the structures to be installed, and provide safe working conditions in compliance with local safety regulations and provisions of the Occupational Safety and Health Administration (OSHA).

B. Excavation shall be made to the elevations and dimensions shown on the Drawings. Excavate sufficient material to provide suitable room for construction providing bracing and support as required.

3.2 EXCAVATION IN WASTE

A. CONTRACTOR shall take safety precautions during construction activities that conform to all OSHA regulations and the safety requirements of OWNER and the Specifications.

B. Trenches shall be excavated to the depths, widths, and alignments shown on the Drawings.

C. CONTRACTOR shall separate cover soil from excavated refuse to the extent possible. Cover soil may be used to backfill trenches. Excavated material not suitable for use as soil shall be transported to the working face as directed by OWNER.

D. Pockets of perched leachate may be encountered during waste excavation activities. CONTRACTOR shall immediately notify OWNER and ENGINEER when leachate is encountered. ENGINEER will provide CONTRACTOR with directions on how to manage the leachate in narrative and/or drawing form. Potential leachate management techniques may include one or a combination of the following.
   1. Backfilling the affected area.
   2. Realigning the trench.
   3. Installing a French drain.

E. To the extent possible, the trench invert shall slope uniformly as indicated on the Drawings.

F. CONTRACTOR shall not excavate more trench than can be backfilled in one day after placement of the pipe. Excavations shall not be left open overnight.

3.3 BACKFILL

A. Excavated material shall be placed in loose layers and compacted to the extent possible with the goal of establishing a firm, even surface. The loose lift thickness shall not exceed 12 inches.

B. ENGINEER does not have to be present, and does not supervise or direct the actual Work by CONTRACTOR, his/her employees, or agents. Neither the presence of ENGINEER nor any observations and testing performed by ENGINEER shall excuse CONTRACTOR from defects discovered in their Work.

[END OF SECTION 02565]

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DIVISION 15 - MECHANICAL

Section 15210 – High-Density Polyethylene Pipe (HDPE), Fittings, and Appurtenances
Section 15212 - Polyvinyl Chloride (PVC) Pipe and Fittings

SECTION 15210

HIGH DENSITY POLYETHYLENE (HDPE) PIPE, FITTINGS, AND APPURTENANCES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install HDPE pipe and fittings for the landfill gas extraction system.

B. Pressure test HDPE pipe.

1.2 DELIVERY, STORAGE, AND HANDLING

A. The pipe and fitting manufacturer shall package products for shipment in a manner suitable for safe transport by commercial carrier. When delivered, CONTRACTOR shall inspect the shipment and report any damage to the pipe and fittings manufacturer. Pipe and fittings shall be handled, installed, and tested in accordance with manufacturer's recommendations, and the requirements of this Section.

B. Pipe Storage:
   1. Store or stack pipe to prevent damage from marring, crushing or puncture. Limit maximum stacking height to 6 feet or manufacturer's recommended maximum height, whichever is less.
   2. Store in accordance with manufacturer's recommendations.

C. Pipe Handling:

   1. Protect pipe from excessive heat or harmful chemicals.
   2. Handle pipe and use equipment needed to avoid gouging of the pipe surfaces.

PART 2 - PRODUCTS

2.1 PHYSICAL PROPERTIES:

A. Materials used for the manufacture of PE pipe and fittings shall meet the following physical property requirements:

Property	Unit	Test Procedure	Value
Material Designation	-	PPI/ASTM	-
PPI Material Listing	-	PPI TR-4	PE 4710
Cell Classification	-	ASTM D3350	445474C
Density	g/cm3	ASTM D1505	>0.941
Melt Index [E]	g/10 min	ASTM D1238	<0.15
Flexural Modulus	psi	ASTM D790	110,000 and <160,000 3000 to 3500
Tensile Strength	psi	ASTM D638	>100
PENT	hours	ASTM F1473	1600 at 23^{O} C
HDB	psi	ASTM D2837	2 to 3
UV Stabilizer [C]	% Carbon Black	ASTM D1603	
	psi		110,000
Elastic Modulus	^{o}F	ASTM D638	<-180
Brittleness Temperature	^{o}F	ASTM D746	255
Vicat Softening Temperature		ASTM D1525	
Thermal Expansion	in/in/ ^{o}F		8 x 10E-5
Hardness	Shore D	ASTM D696	64
Molecular Weight Category	-	ASTM D2240	Extra High
		-	

B. There shall be no evidence of splitting, cracking, or breaking when the pipe is tested.

C. Ring Stiffness Constant (RSC) values for the pipe shall be 90 percent of the nominal.

D. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

E. Clean rework or recycled material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of this Section.

2.2 PIPE AND FITTINGS

A. Dimensions:
   1. Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with ASTM D2513. Standard laying lengths shall be 40 feet $\pm$ 2 inches.
   2. Fitting Dimensions: Fittings such as couplings, wyes, tees, adaptors, etc. for use in laying pipe shall have standard dimensions that conform to ASTM D3261.
   3. Pipe shall be SDR-17. Fitting shall be SDR-11 or SDR-17.

B. Pipe and fittings shall be produced from identical materials meeting the requirements of this Section. Special or custom fittings may be exempted from this requirement.

C. Pipe and fittings shall be pressure rated to meet the service pressure requirements specified. Fittings shall be fully pressure rated to at least the same service pressure rating as the joining pipe.

D. Molded fittings shall meet the requirements of ASTM D3261 and this Section. At the point of fusion, the outside diameter and minimum wall thickness of fitting butt fusion outlets shall meet the diameter and wall thickness specifications of the mating system pipe. Fitting markings shall include a production code that identifies the location and date of manufacture. Upon request, the manufacturer shall provide an explanation of his production code.

E. Marking:
   1. Each standard and random length of pipe and fitting shall be clearly marked with the following information:
      a. Manufacturer's Name or Trademark;
      b. ASTM Standard Designation;
      c. Nominal Pipe Size;
      d. Class & Profile Number;
      e. Production Code, including Extrusion Date, and Lot or Batch Number; and
      f. Standard Dimension Ratio.

F. The pipe and fitting manufacturer shall certify that samples of production pipe have undergone stress regression testing, evaluation, and validation in accordance with ASTM D2837 and PPI TR-3. Under these procedures, the minimum hydrostatic design basis shall be certified by the pipe and fitting manufacturer to be 1600 psi at 73.4° F and 800 psi at 140° F.

G. Material shall be listed in the name of the pipe and fitting manufacturer by the Plastics Pipe Institute (PPI) in PPI TR-4 with the following Standard Grade ratings:

		73.4° F	140° F
1.	Hydrostatic Design Basis (HDB)	1,600 psi	800 psi
2.	Hydrostatic Design Stress (HDS)	800 psi	400 psi

H. PPI material listing in the name of the resin supplier is not acceptable in meeting this requirement.

I. Certification:
   1. As the basis of the acceptance of the material, the manufacturer shall furnish a certificate of conformance of this Section upon request. When prior agreement is being made in writing between CONTRACTOR and the

manufacturer, the manufacturer shall furnish other conformance certification in the form of affidavit of conformance, test results, or copies of test reports.

2.3 GASKETS AND HARDWARE

A. All gaskets shall be Viton or other similar materials approved by OWNER. Joint hardware shall be Type 304 stainless steel.

2.4 FITTINGS

A. Fittings shall be manufactured from polyethylene compound having cell classification equal to or exceeding compound used in pipe to ensure compatibility of polyethylene resins. Fittings shall be molded, fabricated fittings shall be avoided.

B. Dimensions of fittings conforming to standard dimensions and tolerances in accordance with ASTM D3261.

C. Fittings shall have the same or higher pressure rating as pipe.

D. Markings:
   1. Manufacturer's name or trademark.
   2. Nominal size.
   3. Type of plastic pipe (i.e., PE 4710).
   4. Standard dimension ratio.
   5. Extrusion date, lot number or batch number.

E. The Drawings do not show all fittings that may be required. Provide all fittings required for a complete installation.

PART 3 – EXECUTION

3.1 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to any of the following:
   1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of pipe, which may be cut off and discarded. All pipes within one shipment shall be rejected if defects exist in more than five percent of shipment or delivery.
   2. Cracks sufficient to impair strength, durability, or service ability of pipe.
   3. Defects indicating improper proportioning, mixing, and molding.
   4. Damaged ends, where such damage prevents making satisfactory joint.
   5. Damage due to handling or installation. Scratches and gouges exceeding five percent of the wall thickness shall be considered excessive, and may be rejected by ENGINEER or OWNER.

B. Acceptance of fittings, stubs, or other specially fabricated pipe sections shall be based on visual inspection by ENGINEER and documentation of conformance to this Section.

C. Prior to backfilling trench CONTRACTOR shall obtain as-built top of pipe coordinates and elevations at grade changes, terminations, fittings, and at least every 50 feet along the pipe.

3.2 INSTALLATION

A. Trench, backfill, and compact in accordance with Specification Section 02565.

B. Heat Fusion of Pipe:

1. Weld pipe in accordance with manufacturer's recommendation for butt fusion methods. The pipe manufacturer shall certify fusion machine operators.
2. Butt fusion equipment for joining procedures shall be capable of meeting conditions recommended by pipe manufacturer including, but not limited to, temperature, alignment, and fusion pressures.
3. Branch saddle fusions shall be joined in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment shall be of a size to facilitate saddle fusion within the trench.
4. For cleaning pipe ends, solutions such as detergents and solvents, when required, shall be used in accordance with manufacturer's recommendations. Solvents shall not be used unless approved by OWNER.
5. Do not bend pipe to greater degree than minimum radius recommended by manufacturer for type and grade.
6. Do not subject pipe to strains that will overstress or buckle pipe or impose excessive stress on joints.
7. Before butt fusing pipe, observe inside of each pipe length for presence of dirt, sand, mud, shavings, and other debris or animals. Remove debris from pipe prior to fusing.
8. Cap open ends of fused pipe at end of each working day to prevent entry by animals, debris, or stormwater.
9. Use compatible fusion techniques when polyethylenes of different melt indexes are fused together. Refer to manufacturer's specifications for compatible fusion.

C. Flange Jointing:
1. Use on flanged pipe connection sections.
2. At a minimum convoluted stainless steel backup rings shall be used for joining HDPE pipes below grade, and epoxy-coated carbon steel backup flanges shall be used above grade, unless stainless steel is specified by OWNER.
3. Butt fuse fabricated flange adapters to pipe or use electrofusion couplings.
4. Observe the following precautions in connection of flange joints:

a. Use full-face gaskets only.
b. All fasteners and back-up rings shall be Type 18-8 or Type 304 stainless steel below grade, and zinc-plated steel above grade.
c. Align flanges or flange/valve connections to provide tight seal.
d. U.S. Standard round washers may be used on some flanges when in accordance with manufacturer's recommendations. Bolts shall be lubricated prior to installation.

5. Protect below grade bolts and flanges by covering with a 6-mil thick PE wrap. Duct tape wrap to HDPE pipe.
6. Electrofusion couplers, where used, shall be installed per manufacturer's specifications. The outside diameter of the HDPE pipe and face shall be prepared in accordance with manufacturer's recommendations prior to installing the coupler.

D. Pipe Placement:
1. Grade control equipment shall be of the type to accurately maintain design grades and slopes during installation of pipe.
2. Unless otherwise specifically stated, install pipe in accordance with manufacturer's recommendations.
3. Maximum lengths of fused pipe to be handled as one section shall not exceed 400 feet and shall be placed according to the manufacturer's recommendations as to pipe size, pipe SDR, and topography so as not to cause excessive gouging or surface abrasion. Pipe wall gouges deeper than 3/16-inch may be cause for rejection of the pipe.
4. Cap pipe sections longer than single joint (usually 40 feet) on both ends during placement except during fusing operations.
5. Remove dirt or debris from inside of pipe before backfilling.
6. Notify ENGINEER prior to installing pipe into trench and allow time for observation. CONTRACTOR shall correct irregularities identified during observation.
7. Complete connections within trench whenever possible to prevent overstressed connections.
8. Allow pipe sufficient time to adjust to trench temperature prior to testing, fusion welding, making segment connections, or backfilling activity.
9. To reduce branch saddle stress, install saddles at slope equal to and continuous with connecting pipe.
10. Install reducers adjacent to laterals and tees unless directed otherwise.
11. Place pipe system in trench allowing at least 12 in./100 ft. for thermal contraction and expansion.

3.2 PIPE TESTING

A. CONTRACTOR shall perform a pneumatic test of the non-perforated pipe and fittings, with the exception of the 50-feet of solid pipe installed in the horizontal collection trenches, after placement in the trench, in accordance with manufacturer's recommendations.

B. Pipes shall be pressure tested in presence of ENGINEER. Provide adequate notice to ENGINEER before performing test.

C. Pneumatic testing shall be performed as follows:
   1. The test period at the test pressure shall last no more than 10 minutes.
   2. Provide all necessary connections, bulkheads, flanges, bracing, and blocking, as well as all required test equipment.
   3. Test pressure gauge shall have a recommended range of 20 psig, with minor gradations no greater than 0.1 psig.
   4. Pipe to be tested shall be exposed in the trench, except bends, reduced pressure rated fittings and components, which shall be buried or restrained. Flange connections shall be visible to check for leaks.
   5. Test pressure shall be 10 psig.
   6. Acceptance
      a. Test shall be accepted if the pressure drop over 10 minutes is less than 5 percent of the pressure at the beginning of the test period.

D. Test Report
   1. ENGINEER shall prepare and submit to OWNER a test report using the attached forms for each pipe system tested. Include following information in test report.
      a. Date of test.
      b. Description and identification of pipe system tested.
      c. Type of test performed.
      d. Test fluid.
      e. Test pressure.
      f. Results of test.
      g. Type and location of leaks detected.
      h. Corrective action taken to repair leaks.
      i. Results of retesting.
      j. Name of person performing test.

[END OF SECTION 15210]

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ATTACHMENT 1 TO SECTION 15210

PIPE PRESSURE AIR TEST LOG

SANBORN HEAD	Project No.:	
	Project Name:	
	Project Location:	
	Weather:	
Contractor:	Test No.:	
CQA Personnel:	Person/Company Performing the Test:	
Date of Test:	Time of Test:	Finish:
Pipe Length: ~ ft. Pipe Diameter: in.	Pipe Material:	Pipe SDR/Sch.:
Rated Working Pressure:	Test Pressure: psi	
Location/designation of pipe tested:		

t Time (min.)	T Pipe Temperature (ºC)	P_t Pressure Gauge Reading (psig)	P_c Pressure Drop (%)
0			
5			
10			
15			
30			
60			

Pass Fail	Retest? Yes No

Description of leaks and repairs of retested pipe segments:

P_c = Percent Pressure Drop $\frac{P_o - P_t}{P_o} \times 100$

P_o = Initial Pressure Gauge Reading

P_t = Pressure Gauge Reading at Time *t*

Comments:

Signature:

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SECTION 15212

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Supply polyvinyl chloride (PVC) Schedule 80 pipe and fittings as shown on the Drawings.

1.2 SUBMITTALS

A. Submit to ENGINEER manufacturer's technical product data and installation instructions for PVC pipe and fittings.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe and fittings shall be manufactured from a PVC compound which meets the requirements of Cell Classification 12454-B PVC as outlined in ASTM D1784.

B. PVC pipe used in the construction of landfill gas extraction system shall meet the requirements of ASTM D1784 and ASTM D1785 for Schedule 80 PVC pipe.

C. PVC fittings used in the construction of landfill gas extraction system shall meet the requirements of ASTM D2464 and ASTM D2467.

D. All PVC cements shall meet the requirements of ASTM D2564 for solvent cemented PVC joints.

E. Clean rework or recycle material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of this Section.

F. Fittings shall be industrial, heavy duty, hub style.

G. Socket fittings shall be pressure rated the same as the corresponding size pipe prescribed by ASTM D1785. Threaded fittings shall be pressure rated to at least 50 percent of the rating for socket fittings.

2.2 FLANGES

A. Flanges shall be one piece solid design or two-part Van Stone type that use the tapered, serrated face and full face gasket technique for joining and are compatible with ANSI B16.5 Class 150 metal flanges.

B. Flanges shall be pressure rated at 150 psi for water service at 73°F, non-shock and have a minimum burst requirement of 3.3 times the rated pressure.

C. Bolts shall be zinc-plated ASTM A193, Grade B8M hex head, and nuts shall be zinc-plated ASTM A194, Grade 8M hex head.

D. Gaskets shall be ⅛-inch thick, full face Viton or other similar materials approved by OWNER.

PART 3 - EXECUTION

3.1 PVC PIPE HANDLING

A. PVC pipe and pipe fittings shall be handled carefully in loading and unloading. They shall be lifted by hoists and lowered on skidways in such a manner as to avoid shock. Derricks, ropes, or other suitable equipment shall be used for lowering the pipe into well borings. Pipe and pipe fittings shall not be dropped or dumped.

3.2 PVC PIPE INSTALLATION

A. PVC pipe installation shall conform to the requirements of this Section, the manufacturer's recommendations, and as outlined in ASTM D2774V.

3.3 JOINING OF PVC PIPES

A. Pipes shall be joined in accordance with ASTM D2855.

B. Pipe shall be inspected for cuts, scratches, or other damages prior to installation. Pipe with imperfections shall not be used.

C. Burrs, chips, etc., shall be removed from pipe interior and exterior.

D. Loose dirt and moisture shall be wiped from the interior and exterior of the pipe end and the interior of the fitting.

E. Pipe cuts shall be square and perpendicular to the center line of pipe.

F. A coating of CPS primer, as recommended by pipe supplier, shall be applied to the entire interior surface of the fitting socket, and to an equivalent area on the exterior of the pipe prior to applying solvent cement.

G. The solvent cement shall comply with the requirements of ASTM D2564 and shall be applied in strict accordance with manufacturer's specifications.

H. Pipe and pipe fittings shall be selected so that there will be as small a deviation as possible at the joints, and so that inverts present a smooth surface. Pipe and fittings that do not fit together to form a tight fitting shall be rejected.

[END OF SECTION 15212]

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Appendix D

Construction Quality Assurance Plan

SANBORN HEAD

Construction Quality Assurance Plan
Landfill Gas Extraction System Expansion

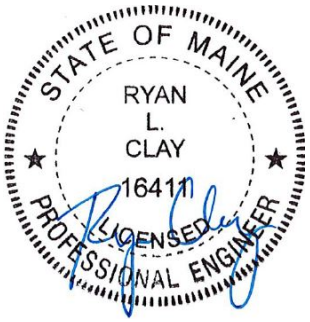
JUNIPER RIDGE LANDFILL

Old Town, Maine

Prepared for NEWSME Landfill Operations, LLC

File No. 2536.40

November 2025



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1.0 INTRODUCTION

This Construction Quality Assurance (CQA) Plan addresses the quality assurance activities specific to the installation of landfill gas (LFG) extraction system components at the Juniper Ridge Landfill. In the context of this Plan, quality assurance refers to means and actions employed to assure that the components of the LFG extraction system are installed in accordance with the drawings and specifications. Quality assurance is provided by a party independent from the Contractor. Quality control refers to those actions taken by the contractor and the manufacturers to ensure that materials and workmanship meet the requirements of the drawings and specifications.

The scope of this CQA Plan applies to manufacturing, shipment, handling, and installation of LFG extraction system components. The CQA Plan does not address design guidelines, installation specifications, or selection of the components. The specifications define the quality of materials and workmanship to be used and employed. The CQA Plan defines the means to assure that the level of material and workmanship used in the construction meets or exceeds the requirements of the drawings and specifications.

2.0 PARTIES

2.1 Project Manager

The Project Manager is an official representative of NEWSME Landfill Operations LLC (NEWSME) and is responsible for the construction project. The Project Manager coordinates the project meetings as defined in Section 3.0 and serves as a liaison between all parties involved in the project. The Project Manager is also responsible for proper resolution of quality assurance issues that arise during construction.

2.2 Design Engineer

The Design Engineer is the individual and/or firms responsible for the preparation of the design, including drawings and specifications. The Engineer is responsible for approving all changes to the drawings and specifications, and for making design clarifications during construction. The Engineer may attend the pre-construction meeting and progress meetings as requested by the Project Manager. At the completion of the construction, the Design Engineer will prepare record drawings based on as-built information provided by the CQA Engineer.

2.3 CQA Engineer

The CQA Engineer is either a qualified representative of NEWSME, or a representative of an engineering firm, independent of NEWSME, that is experienced in observing and documenting construction. The number of CQA Engineer personnel needed on site at a given time will be decided by the Contractor's schedule.

The CQA Engineer is responsible for observing and documenting the construction activities as defined in this CQA Plan. Specific duties of the CQA Engineer personnel include:

- Reviewing the drawings and specifications, and all modifications thereto;
- Reviewing other project-specific documentation, including proposed layouts, and manufacturer and Contractor literature;

- Documenting construction operations using field reports, logs, and/or photographs;
- Attending project meetings;
- Noting on-site activities that could result in damage and/or delays;
- Reporting unapproved construction deviations to the Project Manager;
- Verifying that the contractor is obtaining as-built survey information as required by this plan, the drawings, and specifications; and
- Preparing a construction documentation report.

3.0 COMMUNICATION

3.1 Pre-Construction Meeting

A pre-construction meeting should be held at the site prior to the start of construction. Typically, the meeting is to be attended by the Project Manager and representatives of the Design Engineer, CQA Engineer, and Contractor. Specific agenda topics for meeting include:

- Review of the project team members, and their roles and responsibilities;
- Review of the site-specific safety and security requirements;
- Review of the project design components and goals; and
- Review of construction schedule.

The meeting shall be documented by the Project Manager or his designee.

3.2 Progress Meetings

Progress meetings should be held with the Project Manager and representatives of the Contractor, CQA Engineer, and other parties invited by the Project Manager. The agenda for the progress meetings should include a discussion of:

- Current progress;
- Planned activities for the next week;
- Issues requiring resolution; and
- New business.

The Project Manager, or his designee, should document the meetings, specifically noting problems and decisions. If any matter remains unresolved at the end of this meeting, then the Project Manager is responsible for assuring that the matter is resolved and the resolution is communicated to the appropriate parties.

4.0 DOCUMENTATION

The CQA Engineer is responsible for providing the Project Manager with documentation that clearly and succinctly describes the construction activities and the locations of the constructed components. A complete file of the construction documentation should be maintained on site. Documentation consists of daily reports, test reports, as-built survey, and the Construction Documentation Report.

4.1 Daily Reports

A report and/or log should be prepared for each day construction is performed. The report and/or log should document the construction and monitoring activities performed that day, identifying problems encountered and remedial action taken. Documentation should include the equipment used, the work force provided including subcontractors. The report and/or log should be completed at the end of the work day, prior to the CQA Engineer leaving the site.

4.2 Testing Reports

On-site pneumatic pressure testing of pipe shall be reported on an appropriate Test Report Log. Test reports shall be submitted along with the daily report.

4.3 As-Built Survey

The CQA Engineer is responsible for verifying that the Contractor as-built survey is correct and accurate. In addition, the CQA Engineer is responsible for documenting changes to the construction details. As-built survey drawings are to include horizontal and vertical locations of trench end points, landfill gas extraction wells, and well heads. The Contractor is responsible for recording changes to pertinent details and supplying this information to the CQA Engineer. The CQA Engineer will forward the as-built survey and changes to the construction details to the Design Engineer, who will prepare the record drawings to be included in the CQA Engineer's Construction Documentation Report.

4.4 Construction Documentation Report

The CQA Engineer is responsible for preparing a report that documents the construction activities and includes the record drawings prepared by the Design Engineer. The report should include the following:

- Parties and personnel involved with the project;
- Seal and signature of a professional engineer licensed in the State of Maine;
- Record drawings, sealed and signed by a professional engineer licensed in the State of Maine;
- Written clarifications and interpretations of the specifications;
- Change Orders to the design;
- Minutes from pertinent meetings;
- Copies of the pertinent CQA records (e.g., contractor submittals; pipe test logs; and daily reports); and
- Photographs.

P:\2500s\2536.40\Source Files\Phase II Design Report\App D - CQA Plan\20251107 JRL LFG CQA Plan.docx

Appendix E

Operations And Maintenance Manual

SANBORN HEAD

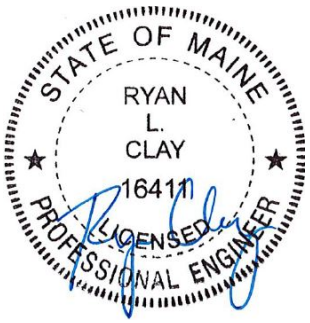
Operations and Maintenance Manual

Landfill Gas Management System
Juniper Ridge Landfill
Old Town, Maine

Prepared for
NEWSME Landfill Operations, LLC
Old Town, Maine

Prepared by
Sanborn, Head & Associates, Inc.

File No. 2536.40
November 2025



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1.0 INTRODUCTION

This manual describes operations and maintenance procedures related to the landfill gas (LFG) management system at the Juniper Ridge Landfill (JRL) in Old Town, Maine. The landfill is owned by the State of Maine and managed by the Bureau of General Services; however, the facility, and landfill gas, is operated by NEWSME Landfill Operations, LLC (NEWSME). The objectives of the landfill gas management system are to: (i) control odors emanating from the landfill; and (ii) to comply with the federal and state requirements regarding landfill gas emissions.

Currently, JRL has an active landfill gas management system installed in all constructed landfill cells that have reached the necessary grade to initiate installation.

Individuals designated to operate and maintain the landfill gas management system are properly trained with respect to the potential hazards of landfill gas and the proper operating procedures for the site-specific equipment. This manual is a general guide and is not intended to be a substitute for proper hands-on training in operations, regulatory requirements, and site-specific safety activities that may be required by various local, state, and/or federal agencies.

Landfill operations staff should become familiar with the properties of landfill gas and related hazards discussed below, and should receive proper training, which may include lockout/tag out procedures as well as electrical and pneumatic safety procedures.

2.0 CHARACTERISTICS OF LANDFILL GAS AND POTENTIAL HAZARDS

2.1 Landfill Gas Characteristics

Landfill gas is generated when anaerobic bacteria consume organic matter in waste. Landfill gas is composed of methane, carbon dioxide, oxygen, nitrogen, water vapor and trace amounts of hydrogen, ethane, hydrogen sulfide, and volatile organic compounds (VOCs). Oxygen and nitrogen are typically present because of air entrained in the landfill (air is approximately 21 percent oxygen and 79 percent nitrogen). Air entrainment in landfills occurs during placement of waste, from atmospheric weather effects, because of landfill gas management system operations, or from diffusion into the landfill. Typical ranges of constituent concentrations in landfill gas are presented in Table 1.

Important landfill gas characteristics are provided below.

- Landfill gas primarily consists of methane (up to approximately 50 percent) and carbon dioxide (up to approximately 40 percent).

- Landfill gas has relatively high moisture content; cooling generally results in the formation of condensate.

- Landfill gas is flammable and potentially explosive under the right combination of methane and oxygen, plus an ignition source. See below for more information on the flammable concentration range of methane.

- Landfill gas may migrate through surrounding soils, within open conduits, or in trench backfill material.
- Landfill gas may accumulate in confined spaces.
- Landfill gas has a specific gravity that is usually close to that of air.
- Within the landfill, the typical temperature range for landfill gas is 16 degrees (°) to 66° Celsius (C) (60° to 150° Fahrenheit (F)).
- Component gases (methane, carbon dioxide, water vapor, and others) tend to stay together, but may separate through soil and liquid contact.
- Secondary constituents (trace gases) may cause nuisance odors, environmental pollution, and may create a health risk.

The flammable range of methane is approximately 5 to 15 percent (by volume) in air. The lower limit of 5 percent is referred to as the Lower Explosive Limit (LEL); the upper limit of 15 percent is referred to as the Upper Explosive Limit (UEL). The specific gravity of methane and carbon dioxide are 0.55 and 1.52, respectively. However, the specific gravity of landfill gas is close to that of air, and it should not be assumed that methane gas would rise. The landfill gas mixture may be lighter or heavier than air and its behavior will be dictated by its overall composition.

Methane and carbon dioxide are odorless gasses. However, landfill gas has its own characteristic odor due to the presence of trace compounds in the gas. Some of the most significant examples of the classes of odor causing trace constituents include esters, phenols, organic acids, solvents, and sulfur compounds (including mercaptans). However, landfill gas may not always exhibit an identifiable odor because the odor carrying trace components may be stripped off because of movement through cover or adjacent soil, or if sulfur exceeded 100 ppm.

Landfill gas levels can be monitored using various meters. At a minimum, LEL, percent methane, percent oxygen, and parts per million (ppm) hydrogen sulfide should be measured at any location where there is potential for landfill gas to be present and where personnel could be exposed to landfill gas, including landfill sideriser buildings.

Personnel should take immediate action to evacuate the area, if monitoring results indicate:

- The LEL is 50 percent or higher (2.5 percent methane by volume);
- The concentration of oxygen is lower than 19.5 percent; or
- The concentration of hydrogen sulfide (H_2S) is more than 5 parts per million (ppm).

2.2 Potential Hazards to Personnel

Landfill operations staff should be familiar with the following types of hazards related to the presence of landfill gas and landfill gas condensate, and the appropriate and safe procedures to identify and avoid them.

Methane is a colorless, odorless, flammable, and potentially explosive gas that may be emitted into the atmosphere as landfill gas together with other volatile trace gases. Landfill gas, which may contain other gases, may migrate through soil and bedrock into surrounding areas or contact groundwater where it may adversely affect the environment. Landfill gas may travel long distances underground and accumulate underneath and in structures and confined or enclosed spaces creating a potential explosion hazard. Carbon dioxide, the other major component of landfill gas, is colorless, odorless, and non-combustible.

2.2.1 Respiratory Hazards

Methane and carbon dioxide are asphyxiates. A potential hazard posed by landfill gas is oxygen deficiency, which may cause asphyxiation. As landfill gas builds up it displaces air, hence reducing the amount of oxygen that can be inhaled by a person. An oxygen deficient atmosphere exists when the oxygen comprises 19.5 percent or less of the air. It is imperative that confined space regulations and procedures be followed before personnel enter confined spaces or locations where an oxygen deficient atmosphere could exist. Under certain circumstances, special "permitted entry" requirements apply.

Potentially lethal concentrations of H_2S may be present in landfill gas at JRL. Personnel must always be alert for the presence of H_2S. H_2S is a colorless, toxic, flammable gas, which at low concentrations has an offensive odor similar to that of rotten eggs. Sense of smell can be lost within 2 to 15 minutes of exposure to H_2S; therefore sense of smell is NOT adequate for indicating the continuing presence of H_2S or for warning of hazardous concentrations. The effects of inhalation depend on the concentration of H_2S and the duration of exposure. Exposure at high concentrations can quickly lead to death. Atmospheres containing concentrations of H_2S greater than 100 ppm are considered immediately dangerous to life and health (IDLH)[1] and are expected to be non-detectable by odor due to olfactory fatigue.

Air monitoring should be performed prior to entering areas expected to contain LFG or hazardous atmospheres. If significant concentrations of LFG constituents are present, the space should be ventilated to acceptable levels. Ventilation should be confirmed while personnel are working in the area or structure. If the gas cannot be removed, appropriate respiratory protection, necessary personal protective equipment (PPE), and rescue and communication equipment should be used before entering the area.

Other volatile organic components of landfill gas may also pose respiratory hazards.

2.2.2 Explosive Atmosphere

Landfill gas tends to migrate and may accumulate in confined spaces. The occurrence and accumulation of methane is sometimes transient. The presence of slight amounts of methane, less than the LEL, is an indication that more may accumulate under other conditions if corrective action is not taken. If methane is detected at concentrations greater than 15 percent (100 percent of the UEL) by volume, then there is the potential for an explosive methane-air "front" that could be formed nearby by dilution.

[1] https://www.osha.gov/Publications/hydrogen_sulfide.html

Personnel should take the following precautions.

- Avoid any possible source of ignition when working on the landfill gas management system. Sources of ignition may include cell phones (on or off), battery-powered watches, flashlights, non-intrinsically safe equipment, etc. **Smoking is prohibited when working on or near the landfill gas system components**.

- Avoid wearing synthetic clothing, such as polyester, as these materials are extremely flammable; natural fibers such as cotton and wool are recommended. **Wearing synthetic clothing can be fatal in a methane gas flash fire.**

2.2.3 Potential for Landfill Fire

If large quantities of air are introduced into the landfill in a localized area, through either natural occurrence or overly aggressive operation of the landfill gas extraction system, then poorly supported combustion of the buried waste may occur and carbon monoxide may be detected. Subsurface fires produce temperatures of several hundred degrees Fahrenheit within the landfill and typically results from short-circuiting air intrusion into:

- The landfill/cover soil interface;
- Cracks, breaks, or buried imperfections in the cover/cap;
- Breaks in buried collection piping and extraction wells; or
- Backfill surrounding collection system components (e.g., from the filter or gravel pack of an extraction well or the gravel backfill around a sump).

Preventing the introduction of air into the landfill by proper operation of the landfill gas extraction system and maintenance of the landfill cover is the best course of action.

2.2.4 Landfill Gas Condensate

Landfill gas condensate may contain trace chemicals and may be biologically active. Appropriate protective gloves, safety glasses, chemical resistant gloves and other splash protection equipment should be used when working with landfill gas condensate. Operating personnel should avoid direct skin contact.

Condensate is odorous, and may release VOCs. Careful control during condensate handling and disposal is necessary to limit release of odors.

The vapors emanating from condensate storage tanks may be flammable.

3.0 SYSTEM COMPONENTS AND MONITORING PROGRAM

3.1 Introduction

The primary objectives of the landfill gas management system are to: (i) control odors emanating from the landfill; and (ii) comply with the federal, state, and local requirements regarding landfill gas emissions. Further, the landfill gas management system should be operated to maintain

anaerobic conditions within the landfill, thereby limiting the intrusion of air into the waste. To meet these objectives, the system components should be monitored on a routine basis.

The landfill gas management systems at JRL are installed in phases as each landfill cell is developed and filled. Due to the waste stream mix at JRL (comprised of Wastewater Treatment Plant sludge, wastewater sludge, construction and demolition debris (CDD) residuals, Front End Processing Residuals (FEPR), and other special wastes) Hydrogen Sulfide (H_2S) tends to be generated rather quickly (within three months of initial waste placement within a cell). Due to the odor issues associated with rapid LFG generation, LFG is managed using horizontal collection trenches constructed in the waste as the cell is developed. Landfill gas extracted from the landfill is conveyed to the Thiopaq sulfur removal system and then to a blower/flare station for landfill gas treatment. As the outer slopes of the cells are filled to final grades, vertical extraction wells are installed in accordance with the final landfill gas plan approved by the Maine Department of Environmental Protection (MEDEP). The active landfill gas extraction system will continue to operate at the landfill, extracting landfill gas from the horizontal trenches and vertical extraction wells installed in areas where final grades are achieved.

Included with this manual are figures that illustrate the proposed landfill gas infrastructure associated with the constructed cells at the facility.

A description of the various components of the landfill gas management system is provided below. Where applicable, the monitoring requirements for the various components are also discussed below and summarized in Table 2.

3.2 Gas Collection Trenches

Gas collection trenches are installed at discrete locations in the waste mass to provide interim landfill gas collection coverage during filling of the landfill, prior to reaching final grade. The first series of trenches in an area of new waste fill will be excavated into the waste mass after approximately 20 feet of waste has been placed in the cell. Additional trenches are constructed at about 40-foot vertical increments thereafter. The trenches are spaced horizontally about 100 feet apart with typically 3 to 4 trenches per 40-foot lift (dependent upon overall cell width). The constructed trench will consist of a stone filled excavation with a perforated 6-inch diameter SDR-17 HDPE conveyance pipe. The trench will be installed at a minimum 2 percent slope and will drain away from the gas collection wellhead and back into the landfill via the perforations in the pipe. If necessary, collection trench risers will be extended by welding on additional lengths of HDPE pipe as filling progresses. Wellheads will be installed to extract LFG from the collection trenches.

3.3 Condensate Traps and Knockouts

Landfill gas condensate is managed primarily with condensate traps constructed inside the limit of waste containment, and with condensate knockout structures/pump stations constructed outside the limit of waste containment.

Condensate traps are typically constructed at low points along landfill gas conveyance pipes. The traps are designed to allow condensate to drain into the waste mass or to discharge to the

primary leachate collection system. Each trap consists of a U-shaped tube filled with liquid to provide a seal against the vacuum in the system. To maintain a seal, the liquid column in the trap must be at least as high as the maximum vacuum obtainable in that portion of the system.

Condensate knockout structures are constructed to remove condensate from landfill gas conveyance pipe located outside the limit of waste containment. Condensate collected in a knockout structure is pumped to either the nearest primary leachate collection system sideriser cleanout pipe or to a leachate storage tank on site. A condensate knockout structure at JRL is a Class 1 Division 1 Group D classified space and is considered to be a confined space with entry by permit only.

3.4 Wellhead Assemblies

The wellhead assemblies are generally installed at each horizontal collection trench and on the vertical extraction wells. The wellheads provide a means to control landfill gas flow and a means to collect monitoring data. The wellhead assemblies include a gate valve, flexible hose, fittings, and sample ports that are designed to allow for:

- Differential settlement between the landfill gas transmission pipe and the wellhead assembly;
- Sampling of the gas in the wellhead;
- Measurement of the gas flow rate;
- Measurement of the gas temperature;
- Control of the gas flow rate; and
- Access to the well from the top for equipment or measurements.

Wellheads are monitored on a monthly basis (as part of the LFG monitoring program) to observe their general condition, with particular attention to the condition of the flexible hose between the wellhead and the transmission pipe. Well bore seals should also be inspected and adjusted, if necessary, to create an adequate seal. Additional data to be gathered includes:

- Valve position (percent open);
- Gas flow rate;
- Static pressure;
- Percent methane;
- Percent carbon dioxide;
- Percent oxygen; and
- Gas temperature.

3.5 Sulfur Removal System

JRL operates a Thiopaq® sulfur removal system as part of the gas control system to remove total reduced sulfur (TRS) compounds, primarily H_2S, from the LFG prior to combustion. JRL maintains the flexibility to operate other temporary or additional TRS control equipment, such as Sulfatreat, for cases of scrubber downtime or temporary surges in LFG flow or TRS concentration.

The sulfur removal system is monitored to maintain the concentration of H_2S exiting the system to 1,000 ppmv or less. Using colorimetric tubes, the H_2S concentration must be measured at the inlet and outlet of the sulfur removal system on two days every week, with at least two days between sampling. On the two weekly sampling days (e.g., Monday and Friday), JRL must collect two rounds of samples at least four hours apart.

JRL also collects monthly samples from the inlet (three samples) and outlet of the Thiopaq System (three samples) to estimate sulfur dioxide (SO_2) emissions using an approved method such as laboratory analysis. OM procedures for the Thiopaq® sulfur removal system are detailed in a OM manual provided by the manufacturer and are separate from this document. The Compliance Assurance Monitoring (CAM) Plan for the Thiopaq® sulfur removal system is provided as Attachment 1. The CAM Plan was submitted to MEDEP in February 2021 as part of the Part 70 (Title V) air license renewal.

3.6 Blower/Flare Station/RNG Facility

There is one existing flare station (Flare #4) that is maintained and operated by NEWSME that is licensed to combust approximately 106.5 MMBtu/hr of LFG from the entire landfill, equivalent to approximately 3,550 standard cubic feet per minute (scfm) of landfill gas at 50% CH_4. The projected maximum LFG collection rate including a factor of safety is 170 MMBtu/hr (equivalent to approximately 5,600 scfm at 50% CH_4). JRL is applying to install an additional flare station, proposed Flare #5, when needed to control LFG. Flare # 5 would be located adjacent to Flare #4.

The system vacuum is generated using a dual blower system that is located at the existing Thiopaq Building. The blower/flare equipment is checked at least weekly to evaluate: (i) the condition of pipe and connections; (ii) the consistency of the flare operation; and (iii) the condition of the automatic sparking ignition system.

Operating separately from the blower/flare station is an RNG processing facility owned and operated by AHJRLLFG, LLC (c/o Archaea Energy) which is designed to accept up to 3,200 scfm of LFG (at 50% methane) from the Thiopaq® system for beneficial use. There is also a separate 6,400 scfm flare that is owned and operated by Archaea. The RNG facility, which is located just south of the Thiopaq® building, is designed to accept partially treated LFG for further treatment and processing into pipeline quality natural gas.

The RNG facility is owned and operated separately from the landfill gas extraction system. When in operation, the RNG facility reduces the percentage of LFG that would otherwise be flared by the main flare at JRL. The RNG facility does not set the vacuum supply to the LFG extraction system on the landfill, so if the facility is down for maintenance, it does not inhibit the ability of NEWSME to combust LFG from the Thiopaq® at NEWSME's main flare. Controls are also set up to run the flare associated with the RNG facility in the event that the RNG facility is operating at reduced capacity. The RNG Facility does not alter the operation of the Thiopaq® sulfur removal system. The separate flares owned by NEWSME and Archaea provide redundancy in combustion capacity at the landfill and simplifies the integration of the RNG facility with the existing landfill gas extraction system and flare system.

The RNG facility also includes an aboveground 15,000-gallon vertical double-walled carbon steel tank manufactured by Highland Tank LLC that provides a means to temporarily store LFG condensate collected at the RNG Facility. The tank measures approximately 10-feet in diameter by 26.5-feet tall and was installed vertically on a reinforced concrete foundation. The tank allows Archaea the ability to independently store a set amount of LFG condensate that is collected at the RNG Facility prior to it being hauled off site for treatment. If lab test results indicate that the condensate meets acceptable criteria and permission is granted by Maine DEP and NEWSME, the condensate may be pumped to the landfill's main leachate storage tank via a dual-walled force main and stored there prior to being hauled off site for treatment as coordinated by NEWSME. If the landfill's main leachate storage tank cannot accept the condensate generated at the RNG facility for any reason, then Archaea is responsible for management of the condensate.

3.7 Ancillary Observations

In the course of monitoring system components, the condition of the landfill cover systems should also be observed for indications of settlement, tears and rips in the exposed synthetic cover, stressed vegetation, improper drainage, and condition of cover soils. The presence of odors should be noted.

3.8 Monitoring and Reporting

NEWSME monitors the LFG system components on a monthly basis as required by the New Source Performance Standards (NSPS, 40 CFR Part 60 Subpart XXX) and National Emission Standards for Hazardous Air Pollutants (NESHAP, 40 CFR Part 63 Subpart AAAA) for MSW Landfills as described below in Section 4.0. On January 6, 2021, NSPS Subpart XXX and NESHAP Subpart AAAA superseded NSPS Subpart WWW (an earlier version of the NSPS for MSW Landfills). Since that time, JRL has operated the gas collection and control system to operate in compliance with the updated NESHAP Subpart AAAA which has an increased wellhead gas temperature limit of 145 °F (the limit under NSPS Subpart WWW was 131 °F).

4.0 OPERATION AND ADJUSTMENT

4.1 Well System Tuning

The adjustment or "tuning" of the landfill gas management system involves monitoring various parameters and making adjustments to optimize the extraction of landfill gas from each extraction point in the system. The objective of the tuning is to provide negative pressure (vacuum) at each extraction point without causing intrusion of air into the landfill. Tuning is an iterative process, as adjustments to any portion of the system have the potential to affect the entire system. A discussion of the monitoring and tuning procedures is provided below. A summary of the steps to be taken and data to be gathered is presented in Table 3.

4.2 Equipment

The instrument used to monitor landfill gas flow rates, pressures, and composition at JRL must be either a GEM-2000 or a GEM-5000 Portable Gas Analyzer (meter) manufactured by QED Landtec of Colton, California. Other site approved equivalents may be used. Like most analytical instrumentation, it is important to field calibrate the meter prior to using it to collect landfill gas

data. The instrument requires calibration with methane, carbon dioxide, and oxygen span gases. The meter should be field-checked with calibration gas, and if necessary, calibrated in accordance with the manufacturer's recommendations at least once each day that it is used. A log of the calibration should be kept with the instrument. Vibration, shock, and large temperature changes can affect the calibration of the instrument.

QED Landtec certifies that this instrument is intrinsically safe. However, it is generally good practice to avoid operating this instrument in an explosive atmosphere. Factory calibration should be performed in accordance with manufacturer's requirements.

4.3 Indicator Parameters

Typical ranges in concentrations of the various constituents found in landfill gas are presented in Table 1. Normal values for the landfill are established using data collected during operation. System tuning should be performed based on the methane, carbon dioxide, and oxygen concentrations in the landfill gas at individual wellheads. Typically, as the methane and carbon dioxide concentrations decrease, the concentrations of oxygen and nitrogen will increase. Such a trend indicates air intrusion into the system and adjustments should be made to reduce the landfill gas extraction (vacuum) rate to maintain oxygen to five percent or less. Alternatively, the landfill gas extraction rate could be increased if the methane and carbon dioxide concentrations are consistently in the middle to upper end of the typical ranges and/or indicate the development of an upward trend.

The composition of the landfill gas is measured using a meter. The gas sample is obtained through the static pressure port on the meter, and the percent methane, carbon dioxide, oxygen, and balance gas (predominately nitrogen) is reported.

4.4 Flow Rates

The landfill gas extraction flow rates will be different at each monitoring point and will vary with barometric pressure changes as well as landfill cover condition (i.e., whether geomembrane has been constructed over the extraction location or the condition of the intermediate cover). Likewise, the cumulative landfill gas flow rate at the flare will vary with time. The flow rates can be adjusted, if needed, based on the concentrations of the various constituents as described above. As the operating record of the system becomes established over time, "normal" flow ranges for the individual extraction points as well as the system may be established.

The landfill gas flow rate is calculated from differential pressure readings obtained at the wellheads. The portable gas meter can be programmed to directly correlate differential pressure to flow rate.

4.5 Pressures

Landfill gas pressure will vary throughout the system at any given time and will vary with varying extraction rates. The pressures at the extraction points should be negative to provide active extraction from that point. If the pressure is positive, then adjustments should be made to

increase the flow rate until negative pressure is achieved, provided that the methane concentration is at least 30 percent with no more than five percent oxygen.

The static pressure at the landfill gas extraction points and along the conveyance pipe is obtained by connecting the meter to the static pressure ports at the monitoring locations.

4.6 Temperature

Landfill gas temperature at the extraction points is obtained directly from thermometers installed on the wellhead assemblies or from a meter using a thermocouple inserted into the wellhead thermometer port.

As of January 6, 2021, JRL changed from operating the gas collection and control system to comply with NSPS Subpart WWW to operating the system to comply with NSPS Subpart XXX and NESHAP Subpart AAAA. Since that time, JRL has operated the gas collection and control system to operate in compliance with the updated NESHAP Subpart AAAA wellhead gas temperature limit of 145°F.

Operating at the default gas temperature for MSW landfills in NESHAP Subpart AAAA (145 °F) has not always been possible at JRL due to the type of waste disposed at the site and the corresponding decomposition temperature. To allow for gas collection with waste decomposition temperatures greater than 145°F, JRL has obtained approval from MEDEP to operate some gas extraction locations at an alternative operating temperature of 150°F.

LFG temperatures up to 150 °F do not cause fires or significantly inhibit anaerobic decomposition by killing methanogens. When the measured temperature is greater than the applicable limit of 145°F (the default temperature limit) or 150°F (the approved higher operating value [HOV] for some collectors), the wellhead valve opening should be reduced to decrease flow and temperature.

5.0 MAINTENANCE AND TROUBLESHOOTING

5.1 Collection System Maintenance

LFG system maintenance involves the following:

- Repairs to the conveyance pipes due to damage caused by accident, settlement, or environmental factors;
- Repair or replacement of system components (e.g., wellheads, access ports, flex hoses, valves, condensate traps, etc.);
- Excavation for repair of damaged pipe and components; and
- Repairing and re-adjusting pipe supports and anchors.

In many instances, repairing the system may involve shutting down the flare or certain sections of the LFG collection system temporarily. The duration of the shutdown should be kept to a minimum; where possible, the work should be scheduled to coincide with scheduled flare shutdowns.

The sulfur removal system has a 95 percent uptime requirement and records are maintained to demonstrate that there are no more than 438 hours of downtime per 12-month period.

5.2 Landfill Surface

The landfill cover is an integral part of the landfill gas management system. Proper landfill cover maintenance practices are important for effective operation and performance of the landfill gas management system. Experience has shown that in most cases, proper cover maintenance in conjunction with timely installation of active landfill gas management system components will address most landfill odor problems. A visual inspection is helpful in identifying rips, tears, pinholes, cracks, fissures, or bare spots in the synthetic and soil cover systems. Damaged areas should be evaluated and repaired as soon as practical.

5.3 Conveyance Pipe

Over time, the conveyance pipe may develop air leaks. Air leakage should be limited to the degree practicable and it is recommended that oxygen not exceed 3.5 percent by volume in landfill gas in the conveyance pipe. (Under normal operations, the landfill gas should contain no more than one percent oxygen.)

Leaks can occur in above-grade pipe systems due to pipe separations caused by thermal contraction resulting from cooling at night and during a system shutdown. Separations or damage can occur to below-grade pipe due to differential settlement. Buried pipe is also subject to expansion and contraction, but to a lesser degree because of a more uniform temperature and the anchoring effect of the soil support within the trench.

Solid conveyance pipes are typically installed with at least a 5 percent slope within the landfill footprint in order to reduce the potential for liquid (condensate) blockage in pipes due to differential settlement. Increased pitch (i.e., greater than 5 percent) is provided, if practical. Other factors, such as constraints encountered during construction, may limit slopes on pipes. Blockages in pipes can be evaluated by installing access ports for monitoring. With buried systems, it may be necessary to “pot hole” (i.e., perform exploratory excavation) with a backhoe to install access ports for monitoring. If the main conveyance pipe becomes blocked or restricted with condensate, then either re-establishing the slope of the pipe or installing an additional condensate trap and drain should rectify the condition.

Landfill gas conveyance pipes will be replaced prior to final closure of the landfill, and as such, will be located just below the final cover system. These conveyance pipes, installed close to final grade, are not expected to fail. However, if replacement or access to pipes becomes necessary, repairs should be designed to reduce impacts to the final cover system and to restore the cover system to match final closure conditions. The MEDEP should be notified prior to impacting the final cover system, and repair efforts should be documented.

5.4 Blower(s)/Flare Station Maintenance

A brief discussion of general maintenance requirements for specific equipment follows. For more detailed information refer to the applicable manufacturer's information. Table 4 describes the monitoring checklist for the blower(s)/flare station.

5.4.1 Pipe and Fittings

Conveyance pipe and fittings installed at JRL are primarily high-density polyethylene (HDPE), with Polyvinyl Chloride (PVC) pipe installed in vertical extraction wells and PVC valves in the HDPE header pipe.

Process plant pipe and fittings may be constructed of both steel and thermoplastic. Both are durable long-lived materials. However, thermoplastic pipe can be subject to damage from shock, strain, or heat. Thermoplastic pipe should not be used near sources of extreme heat such as the flare. Carbon steel piping can erode and corrode. Stainless steel, cast iron, and aluminum piping have all been successfully used in landfill gas applications.

Landfill gas and condensate exhibit corrosive properties. The presence of oxygen, carbon dioxide, and organic acids common to landfill gas can be present in landfill gas condensate. The combination of these constituents can promote corrosion of steel pipe that carries landfill gas condensate. The most common point of wear due to erosion or corrosion in steel pipe in landfill applications is typically at pipe elbows and other fittings that are subject to erosion and where liquid condensate accumulates. Theses pipes, where they occur, should be inspected for evidence of corrosion (leakage, particularly at fittings). Where questions of pipe integrity exist, ultrasonic thickness testing may be performed, if necessary.

5.4.2 Valves

LFG flow control valves installed at JRL are primarily gear operated PVC butterfly valves with stem extensions. Gaskets are typically Viton. Joint hardware is typically Type 304 stainless steel. Other valve types and components may be present. Valve seats and stem seals may wear and eventually require replacement. Butterfly valves with elastometer seals, such as Buna-N or EPDM, may be affected by landfill gas. In such cases, it may be necessary to replace with Viton or Teflon™. Viton or Teflon™ valve seats in butterfly and ball valves, respectively, have demonstrated reasonably good performance.

5.4.3 Blower Maintenance

Routine maintenance for blowers and motors consists of listening for signs of abnormal operating conditions, monitoring for excessive vibration or temperature, and draining condensate from the blower housing periodically and before startup (if not automatically drained). The blower drive belt tension and wear should be checked on a monthly basis. If belts are glazed or cracked, then they should be replaced. At least one spare set of matched belts should always be on hand. On direct drive machines, flexible coupling alignment should be checked on initial setup and periodically as recommended by the manufacturer (typically quarterly to annually). Bearings should be greased or repacked according to the manufacturers' recommendations, (typically quarterly to annually). The electric drive motor, if not equipped with sealed bearings, should also

be greased. Blower seals and packing should be checked periodically for leakage. If blower seals continually leak or will not last, then consult the manufacturer or try another type of seal or seal material. Consult the manufacturer's literature for detailed information on the maintenance of the blower.

5.4.4 Gas Inlet Automatic Block Valve

An automatic block valve shuts off the flow of landfill gas to the blower(s)/flare station when the flare is not operating or when a fault or shutdown is initiated. This is a butterfly-type valve and should be serviced only when a need is indicated. The automatic block valve seat should maintain a gas-tight seal whenever the valve is in the closed position. Refer to the manufacturer's literature for information on service.

5.4.5 Flame Arrester

A flame arrester is designed to prevent the migration of burning landfill gas from the flare backwards into the process pipe and the flare station. This condition can cause what is known as "detonation" (an explosion) or "flashback" within the pipe network. A flame arrester will only work properly if the velocity and pressure of the flashback in the pipe is within the allowable range and the flame arrester is properly assembled.

The differential pressure across the flame arrester should be checked during monthly monitoring. The normal differential pressure is typically less than 0.5 inches water column (w.c.). The differential pressure across the flame arrester should not exceed 1.0-inch w.c. If excessive differential pressure is observed, then the flame arrester should be serviced. To service the flame arrester, shut down the blower/flare station and block in the flame arrester upstream using the manual and automatic block valves (**verify the valves do not leak**). Closely follow the directions in the manufacturer's literature for maintenance and re-assembly of the flame arrester element. It is important to note that a flame arrester's effectiveness is based upon a design spacing or gap in the flame arrester element. During maintenance and re-assembly, this spacing must be maintained according to the manufacturer's original specifications if the flame arrester is to function as designed. Ensure that all parts are returned and in the proper orientation when re-assembling the flame arrester.

5.4.6 Flare

Operation and maintenance of the flare is straightforward and consists of maintaining proper fuel pressure, maintaining the igniter system, and keeping the flare drained of condensate. Proper fuel velocity, quality, mixing, and flame condition are key to performance. Also, to operate consistently, the flare burner assembly must be adequately shielded from excessive wind. Problems with flame stability in an open flare are usually caused by poor landfill gas quality.

The primary wear on flares is due to thermal stress. If the flare is operated in an imbalanced condition or at excessively high temperature, then it will exhibit signs of accelerated thermal stress. This may be indicated by wear and deformation of the burner.

The flare may require burner adjustment or modification to achieve and maintain proper combustion performance. Adjustment of the flare may involve changing an orifice or burner ring, or moving or changing a plate. Consult the manufacturer or seek qualified assistance.

Landfill gas velocity to the flare is adjusted at the blower/flare station inlet. This is accomplished by balancing the distribution of the blower's total pressure, so that there is sufficient fuel pressure at the flare. In severe cases where adjustment will not work, the flare burner or the blowers may need to be modified or replaced. **Never modify the flame arrester to increase gas velocity.**

The flame safeguard sensor system consists of an electronic controller mounted in the control panel and a thermocouple mounted near the tip of the flare. At least one spare thermocouple should be kept on the site.

A thermocouple can be checked independently with a voltmeter and thermocouple tables or with a digital thermocouple test meter or digital thermometer. Proper polarity must be observed when installing and monitoring a thermocouple. If the thermocouple is subjected to flame impingement, then its life may be shortened considerably. Thermocouples can be mounted in protective sheathing; however, this will cause some delay in response to temperature changes.

See the flare manufacturer's literature for specific component operation, maintenance, and troubleshooting information.

5.4.7 Electrical Equipment Controls and Instrumentation

Dust may accumulate in electrical cabinets and absorb moisture from the air. Over sufficient time, a conductive path can be created that can cause a failure. Connections may also become loose due to thermal expansion and contraction. Electrical service and control cabinets should be cleaned on an annual basis. Wire connections should be checked and tightened throughout the cabinets annually. Calibration and verification of instrumentation gages and thermocouples should be performed annually. Shutdown alarms and devices should be tested and the results recorded in a log. Thermocouples for sensing flare stack temperature should be maintained and replaced when they no longer perform properly. This is normally evident by failure of the temperature controller to properly read or control the flare stack temperature (usually due to an open junction) or by loose or corroded connection terminals at the temperature transmitter, connector block, or temperature controller.

Test and recalibrate instruments, fault protection, and shutdown devices. Large breakers or fused disconnects should be disconnected under load. Ensure high voltage breakers or disconnects are "locked out" in accordance with 29 CFR 1910.147 and 1910.333 Subpart S before working on equipment associated with them. Fuses should be physically pulled to isolate equipment. When the blower/flare station will be down for major maintenance or stand down, large breakers should be locked out (i.e., physically separated and disconnected) and the fuses should be pulled.

5.4.8 Lubrication - General

Follow the manufacturer's recommendations for specific types and brands of lubricants. It is important to use the recommended type of grease and not to mix types or brands of grease. Do not over lubricate. Personnel who perform lubrication services should be knowledgeable in lubrication practices and should follow the manufacturer's instructions for lubrication requirements.

Establish an initial lubrication frequency based upon the equipment manufacturer's recommendation. It may be necessary to adjust the lubrication frequency interval based upon experience with the equipment.

5.4.9 Other Equipment Maintenance and Operating Tips

The system operator should be proactive, remain alert, and develop a habit of observing equipment.

Equipment noises (such as bearings) may be monitored using an equipment stethoscope or using a wrench or similar tool by placing it on the equipment and placing the opposite end of the tool against the bone in front of the ear to listen. It is important to develop a sense of what baseline conditions are for comparison. The smell of leaking landfill gas or burned lubricant can indicate a seal, component, or lubricant failure.

When checking motors or other electrical devices for temperature by feel, the back of the hand should be used. Approach the equipment slowly and feel for radiant heat, which would indicate a very high temperature. If the equipment is too hot to maintain hand contact, then it is at or above a threshold of about 60 to 63°C (140 to 145°F) and may be considered excessive in many cases depending upon the equipment and service. The reason for using the back of the hand is that it is more heat sensitive and in the case of electrical fault to the casing, the natural reaction will be for the muscles of the arm to contract away from the device. This can prevent electrocution.

Operating personnel should wear all cotton clothing that provides some degree of protection in gas flash fires. Some synthetics such as polyester blends will melt readily, which can be fatal. Ties or loose items (e.g., identification badges hanging around the neck, etc.) should never be worn around rotating or belt-driven equipment. All watches, rings, identification bracelets, etc., should be removed when performing electrical testing or troubleshooting.

It is important that maintenance supplies, lubricants, and spare parts be inventoried on a frequent basis to ensure that adequate stocks are maintained for when they will be needed. Supplies should be reordered and restocked as used.

5.4.10 Condensate Handling Systems

Condensate is managed using traps constructed inside the limit of waste, and condensate knockout structures constructed outside the limit of waste. The condensate knockout structures collect condensate in perimeter landfill gas conveyance pipes located outside the limit of waste

and discharge the condensate into primary leachate collection system cleanouts. The condensate traps inside the limit of waste drain by gravity into primary leachate collection system cleanouts or in some cases drain back into the waste mass. The blower/flare station is fitted with various traps, drains, valves, and pumps for handling condensate. Condensate handling components installed for LFG treatment systems (i.e., Sulfatreat & Thiopaq) should also be inspected and maintained periodically. Condensate can be corrosive and the equipment should be checked carefully and frequently for the effects of corrosion. Seals, o-rings, and valves are usually high maintenance items. Refer to the manufacturer's information for maintenance of individual equipment or components.

6.0 COLD WEATHER OPERATIONAL CONSIDERATIONS

Condensate in exposed pipes and equipment or in below-grade pipes without adequate soil cover may freeze during winter operations. Care must be taken to limit the amount of condensate allowed to collect in the landfill gas system at any time. The landfill gas is a source of heat for the system. If the system shuts down for a short period during winter months, then condensate in the exposed portions of the system may freeze.

If freezing of condensate under normal operating conditions becomes a regular problem, then heat trace and insulate the affected areas.

7.0 DATA COLLECTION

Data will be collected routinely using a meter for the flare, the well field, structures, etc. These "readings" are transferred to a computer and then uploaded to a secure database website. The database can be accessed by approved landfill personnel. Data is also collected via the supervisory control and data acquisition (SCADA) system for the flare and Thiopaq system.

7.1 Data Assessment

LFG measurements at each wellhead may be compared with previous data to assess relative performance. Persons assessing the data should be aware of the normal operating range for each parameter, note changes, and assess their causes. Equipment deterioration that can be sudden or gradual may be indicated by an abnormal monitoring result. Such indications should be promptly investigated. Data should fall within established parameters for normal operating ranges by comparing monitoring data with previous readings and target criteria for pressure (vacuum), methane (45 percent or more), oxygen (five percent or less), and temperature (150°F or less).

7.2 Landfill Daily Log Book

Whenever the system is monitored for any reason, staff should make appropriate entries in the Daily Log Book stored in the landfill office.

- Name of person making the entry;
- Date and time;
- Reason for the monitoring (e.g., routine, shutdown, specific monitoring or maintenance activity, etc.);

- Reason for any shutdown;
- Actions taken or adjustments made;
- Equipment status upon leaving; and
- Unusual observations made.

The daily log is used as a record of events regarding the landfill and to communicate between operating personnel. The log entry also becomes part of the daily landfill readings.

7.3 Data Collection Routine

Data are collected manually at the individual data points (i.e., at wells on the landfill, etc.).

Equipment used for data collection includes:

- Portable Gas Analyzer (GEM-2000, GEM-5000, or equivalent);
- Calibration gases (use before going into the field);
- Data reading sheets;
- Field book;
- Site map of the data points;
- Carrying tray, toolbox, or backpack, etc.;
- Tools needed to access the system components; and
- Spare parts for maintenance such as access ports, plugs, etc.

8.0 APPROVAL PROCEDURES FOR LANDFILL MANAGEMENT SYSTEM INSTALLATION

Prior to the installation of new landfill gas management system infrastructure within the landfill, various procedures must be followed to assure that the proposed system modification is properly designed and approved. This section defines the procedures to be followed prior to the modifying the landfill gas management system.

8.1 System Design

The landfill gas management system structures, conveyance pipes, and condensate management structures at JRL are designed by Sanborn, Head & Associates, Inc. (Sanborn Head) using sound engineering principles that follow industry standard procedures. The blower(s)/flare station is sized according to projected landfill gas flow rates.

NEWSME routinely retains Sanborn Head to prepare detailed design packages for the expansion of the landfill gas management system associated with each new operational cell to comply with Condition 15.B of Solid Waste Order #S-020700-WD-N-A and Condition 18 of Solid Waste Order #S-020700-WD-BI-N. The detailed design package typically includes the following:

- A description of the basis for the design;
- Drawings;
- Specifications; and
- Quality assurance and quality control information.

The landfill gas system expansion design for each cell is based on the projected development plans as prepared by Sevee & Maher Engineers, Inc. and a yearly review of landfill gas generation rates performed by Sanborn Head. The landfill gas expansion design is then submitted to the MEDEP for review and approval.

Required changes to the existing LFG infrastructure are occasionally identified and proposed by NEWSME as the landfill gas generation rate and the disposal capacity needs are reviewed. In addition, NEWSME may propose changes to the approved landfill gas management system design to address observed conditions that may require modifications or additions to the system.

8.2 Approval Procedures

Procedures to modify approved landfill gas management system designs fall into two categories referred to as Major and Minor Revisions. A discussion of these revisions are discussed in Sections 8.3 and 8.4 below and depicted in the flow chart provided as Figure 3.

8.3 Approval of Major Revisions to Approved Design

Major revisions are defined as a modification that affects the design or operation of the gas management system and can include such projects as:

- The addition of vertical extraction wells;
- The installation or rerouting of conveyance pipes;
- Changes to the condensate management design; and
- The addition of gas collection trenches.

Major revisions to approved design projects will be handled as a Change Order pursuant to 06-096 CMR 401-3.D of the Maine Solid Waste Regulations. Prior to submitting a formal change order request, NEWSME will contact the MEDEP and describe the issue (orally) and the proposed remedy (i.e., construct additional wells). Appropriate sketches will be provided as necessary. NEWSME will identify the anticipated time frame for construction and the name of the qualifying person who will oversee the construction. Following this step, the proposed (MEDEP agreed upon) changes will be provided to Sanborn Head, who will revise the drawings to include the location of additional wells and associated conveyance pipe, to include well depth information, etc. NEWSME will submit a written change order request to the MEDEP for review and approval at least five business days prior to the planned construction, unless an alternate deadline has been agreed upon with the MEDEP. The MEDEP will issue a response to the change order request within five business days or approval of the Change Order is automatically granted.

8.4 Approval of Minor Revisions to Approved Design

Minor revisions to the design are defined as modifications that do not significantly affect the design or operation of the landfill gas management system and can include projects such as:

- Minor shifting of a previously approved trench;
- The addition of a pipe intended to bypass a “water-out” or non-functioning section of an existing trench; and
- The addition of a short stub to an existing gas collection trench.

These modifications do not typically require the installation of an additional wellhead and are often a means of addressing a concern in a section of the operational landfill area.

For major changes to the design of the landfill gas management system that require MEDEP approval, NEWSME will notify the MEDEP and describe the need for the change, the location, and how the structure will be connected to the existing infrastructure. A hand sketch will be provided as necessary.

9.0 INFRASTRUCTURE CONSTRUCTION AND DOCUMENTATION

Construction of landfill gas infrastructure will be performed by qualified NEWSME staff and specialty contractors when needed. This section describes the components of the landfill gas management system that can be installed by NEWSME staff and the system components that require specialty contractors.

9.1 Construction Projects by NEWSME Staff

Qualified NEWSME staff is authorized to install the below listed infrastructure:

- Gas collection trenches;
- Conveyance pipe within the solid waste boundary;
- Condensate structures located within the solid waste boundary; and
- Wellheads on new wells and trenches and replacement wellhead fixtures.

NEWSME staff will follow an approved set of technical specifications for each project and qualified personnel will document the construction using field survey techniques. Following construction, field survey data will be provided to Sanborn Head so that the as-built drawings may be updated. Updated as-built drawings will be provided to the MEDEP as part of the annual report.

9.2 Construction Projects by Specialty Contractors

Specialty contractors will be retained to perform the following installations:

- Vertical extraction wells;
- Conveyance pipes outside of the solid waste boundaries; and
- Condensate pipe and structures outside of the solid waste boundary.

NEWSME staff may also elect to perform the above installations with third party oversight.

9.3 Construction Quality Assurance and Quality Control

Construction activities by NEWSME staff as listed in Section 9.1 above (with the exception of LFG conveyance pipe installations) will be overseen and documented by qualified NEWSME staff. Construction of vertical extraction wells, conveyance pipes of 12-inches diameter or greater, and condensate pipe and structures outside of the solid waste boundary will be overseen by qualified construction quality assurance personnel separate from NEWSME and the installation contractor following an approved CQA plan. The construction will be documented and the information will be submitted to the MEDEP within 45 days of completion of work.

9.4 Licensing of LFG Infrastructure Installations

Proposals for new gas related projects will be submitted to the MEDEP in the form of a minor revision application pursuant to 06-096 CMR 400.3.B(2)(b) of the Maine Solid Waste Management Regulations, except that if a major redesign of the gas extraction system is being proposed, the MEDEP may require an amendment application be submitted. For projects related to new cell construction, including the layout for proposed gas collection trenches, the landfill gas management system design will be included with the application for the new cell construction. The MEDEP may include comments on the proposed landfill gas management system design as part of its review of the new cell design. MEDEP's review will be completed prior to the construction of the new cell.

9.5 Emergency Situations

In an after-hours emergency, such as vandalism or a catastrophic failure, that causes damage and/or shuts down the landfill gas management system, NEWSME will immediately notify the proper parties by all means (office, home, MEDEP spill response line) to notify them of any proposed activities associated with abating the condition. It is understood by MEDEP staff that any work required to get the landfill gas management system operating again will proceed as needed.

TABLE 1

TYPICAL LANDFILL GAS CONSTITUENTS AT JRL

Operations and Maintenance Manual
Juniper Ridge Landfill
Old Town, Maine

COMPONENT	PERCENT VOLUME (All are stated on a dry basis except moisture.)
Methane (CH_4)	40 to 50%.
Carbon Dioxide (CO_2)	38 to 50%.
Oxygen (O_2)	Less than 1%.
Nitrogen (N_2)	0 to 6%.
Hydrogen (H_2)	Trace to 5% plus; generally less than 1%.
Carbon Monoxide (CO)	Trace; CO is an indicator of the possible presence of a subsurface fire.
Hydrogen Sulfide (H_2S) & Other Sulfur Components	Varies up to 15,000 ppm
Moisture	Up to 14% (increases with gas temperature).
Volatile Organic Compounds (VOCs)	Less than 2%; typically 0.25 to 0.5%.

Note: This table represents typical characteristics of landfill gas at JRL. Fluctuations can occur. A difference between characteristics in the gas from the facility and the values tabulated above does not necessarily indicate a problem. However, a large disparity should be reviewed to evaluate the cause.

TABLE 2

RECOMMENDED MONITORING SCHEDULE

Operations and Maintenance Manual
Landfill Gas Management System
Juniper Ridge Landfill
Old Town, Maine

ITEM	FREQUENCY	PARAMETER
Wellheads	Monthly	• Condition of flex hose; • Valve position; • Gas flow rate; • Static Pressure; • Percent methane; • Percent carbon dioxide; • Percent oxygen; and • Temperature of gas.
Blower/Flare Station	Weekly	• Condition of pipe and connections; • Consistency of flame; and • Functioning of ignition sparker.
Conveyance Pipe	Bi-Annual	• General condition of exposed pipe.

Notes:

1. The monitoring frequency may be reduced with approval from the Maine Department of Environmental Protection.

2. In addition to the monitoring schedule outlined above mechanical components of the blower/flare station should also be monitored and serviced in accordance with the manufacturer's instructions.

TABLE 3

GAS EXTRACTION SYSTEM MONITORING CHECKLIST

Operations and Maintenance Manual
Landfill Gas Management System
Juniper Ridge Landfill
Old Town, Maine

A. Prior to going out onto the landfill.

1. Calibrate the GEM-5000 Portable Gas Analyzer (meter) using methane, carbon dioxide, and oxygen.
2. Calibrate the pressure transducers by performing the "Zero Pressure" function.
3. Record the ambient weather conditions including:
   - Temperature;
   - Barometric pressure;
   - Wind speed and direction;
   - Precipitation amounts; and
   - Current observations (i.e., drizzling, raining, snowing).

B. At each wellhead assembly.

1. Connect the striped tubing with the external filter/water trap assembly from the static pressure/sampling port on the meter to the static pressure port on the wellhead assembly.
2. Connect the clear tubing between the impact pressure port on the meter and the impact pressure port on the wellhead assembly.
3. Perform the "Read Gas Levels" function on the meter. Follow instructions on the meter.
4. Record the following data on the data sheets or in the meter memory:
   - Station identification;
   - Percent methane;
   - Percent carbon dioxide;
   - Percent oxygen;
   - Percent balance;
   - Percent LEL;
   - Temperature of the gas stream;
   - Static pressure;
   - Differential pressure;
   - Gas flow rate; and
   - Control valve percent open.
5. Make adjustments to the flow rate by adjusting the wellhead control valve, if required.

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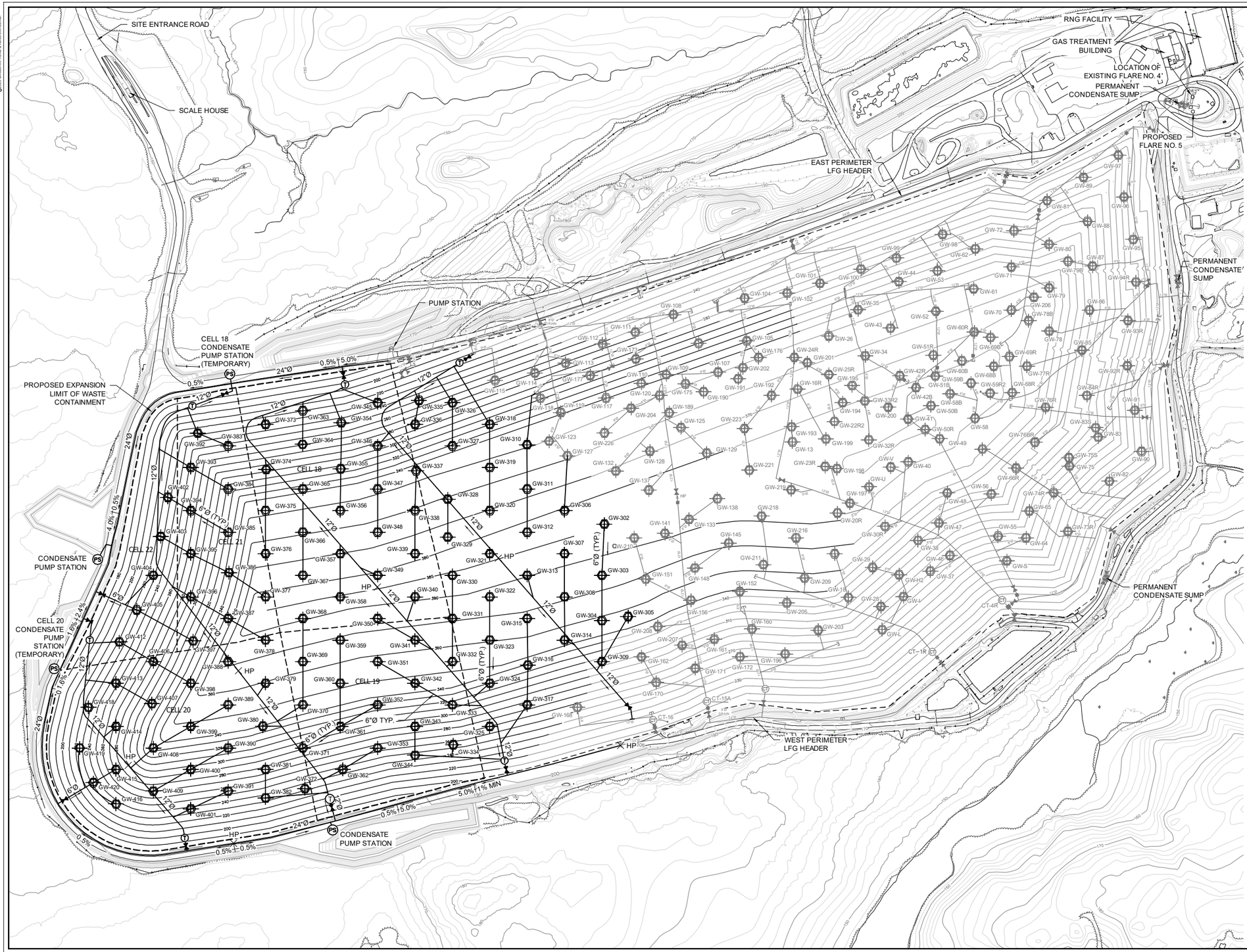

NOTES:

1. THE TOPOGRAPHY AND SITE FEATURES SHOWN OUTSIDE THE LIMIT OF WASTE CONTAINMENT WERE PREPARED BY AERIAL SURVEY & PHOTO INC., OF NORRIDGEWOCK, MAINE. PHOTO DATE MAY 1, 2025. VERTICAL DATUM: BRASS PLUG AT PUMP STATION. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY CASELLA WASTE SERVICES.
2. PROPOSED EXPANSION GRADES SHOWN WERE PROVIDED TO SANBORN HEAD BY SEVEE & MAHER, (SME) INC. OF CUMBERLAND, MAINE.
3. ACTUAL GRADES MAY DIFFER FROM GRADES SHOWN ON DRAWINGS AT THE TIME OF CONSTRUCTION.
4. THE EXISTING LANDFILL GAS EXTRACTION SYSTEM INFRASTRUCTURE FEATURES SHOWN ARE BASED ON A COMBINATION OF DESIGN AND AS-BUILT DOCUMENTATION AVAILABLE TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD). ACTUAL LOCATIONS OF INDIVIDUAL FEATURES MAY BE DIFFERENT THAN SHOWN.
5. THIS PLAN IS INTENDED TO ILLUSTRATE THE PROPOSED LAYOUT OF THE LANDFILL GAS (LFG) EXTRACTION SYSTEM. ACTUAL LOCATION OF WELLS, PIPE, AND VALVES MAY CHANGE DEPENDING ON SITE CONDITIONS AND CONSTRAINTS DURING CONSTRUCTION.
6. SOLID LANDFILL GAS CONVEYANCE PIPE LOCATED INSIDE THE LIMIT OF WASTE CONTAINMENT SHALL BE INSTALLED AT A MINIMUM SLOPE OF 5 PERCENT. PERFORATED LANDFILL GAS COLLECTION TRENCHES SHALL BE INSTALLED AT A MINIMUM SLOPE OF 2 PERCENT.
7. HDPE PIPE AND FITTINGS SHALL BE SDR-17. HDPE FITTINGS SHALL BE MOLDED, FABRICATED FITTING SHALL NOT BE USED.

LEGEND:

EXISTING		PROPOSED
180	10 FOOT CONTOUR	370
	2 FOOT CONTOUR	
GW-11	VERTICAL LFG WELL	GW-305
GW-19R	REPLACEMENT VERTICAL LFG WELL	
12"ø	LFG CONVEYANCE PIPE (SIZE AND SLOPE DIRECTION)	
T	CONDENSATE TRAP	T
	CONTROL VALVE	
	CONDENSATE PUMP STATION	
	LEACHATE COLLECTION CLEANOUT	
	VERTICAL RISER	
	LIMIT OF WASTE CONTAINMENT	
	CELL LIMIT	
	EDGE OF ROAD	
HP	HIGH POINT	HP
	TEMPORARY PIPE TERMINATION	

SANBORN HEAD

GRAPHICAL SCALE
200' 100' 0' 200' 400'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: O. HERNANDEZ
DESIGNED BY: V. ZUCCHELLI
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

PHASE II LFG SYSTEM EXPANSION
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

JRL LFG INFRASTRUCTURE PLAN (FULL BUILD-OUT)

PROJECT NUMBER: 2536.40

FIGURE NUMBER: 1

FILE: P:\2500\2536.40\Graphics\Final\CAD\Phase II Expansion\Figures\OnePlan\Figure 1.dwg
LAYOUT: Fig 1
CREATED: Rick Blankenship
PLOT DATE: 11/17/25

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GAS TREATMENT BUILDING

RNG FACILITY

FLARE NO. 4

CELL 1
CELL 2
CELL 3A
CELL 3B
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 12
CELL 13
CELL 14
CELL 15
CELL 16

MAINE STATE PLANE

NOTES:

1. THE EXISTING LANDFILL GAS EXTRACTION SYSTEM INFRASTRUCTURE FEATURES SHOWN ARE BASED ON A COMBINATION OF DESIGN AND AS-BUILT DOCUMENTATION AVAILABLE TO SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD). ACTUAL LOCATIONS OF INDIVIDUAL FEATURES MAY BE DIFFERENT THAN SHOWN.
2. THERE MAY BE RECENTLY INSTALLED LFG SYSTEM INFRASTRUCTURE THAT IS NOT YET SHOWN ON THIS PLAN.
3. ABANDONED LFG SYSTEM INFRASTRUCTURE IS NOT SHOWN FOR CLARITY.
4. TOPOGRAPHY SHOWN IS PHOTOGRAMMETRIC MAPPING PREPARED BY AERIAL SURVEY & PHOTO, INC. OF NORRIDGEWOCK, MAINE. PHOTO DATE: MAY 1, 2025.
5. HORIZONTAL DATUM IS MAINE STATE COORDINATE SYSTEM, EAST ZONE, NAD83. VERTICAL DATUM IS BRASS PLUG AT PUMP STATION (APPROX .3 FEET HIGHER THAN NAVD 88).

LEGEND (EXISTING):

- 190 — 10-FOOT CONTOUR
- 2-FOOT CONTOUR
- LIMIT OF WASTE CONTAINMENT
- CELL LIMIT
- EDGE OF ROAD
- LFG CONVEYANCE PIPE ≧ 12"Ø
- LFG CONVEYANCE PIPE < 12"Ø
- LFG COLLECTION TRECH
- FENCE LINE
- GW-9 — LFG EXTRACTION WELL
- GCT-901 — COLLECTION TRENCH WELLHEAD
- PIPE END CAP
- CT-7 — CONDENSATE TRAP
- ISOLATION VALVE
- ACCESS RISER

SANBORN HEAD

GRAPHICAL SCALE
120' 60' 0' 120' 240'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: O. HERNANDEZ
DESIGNED BY: O. HERNANDEZ
REVIEWED BY: R. CLAY
PROJECT MGR: R. CLAY
PIC: T. REED
DATE: NOVEMBER 2025

JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

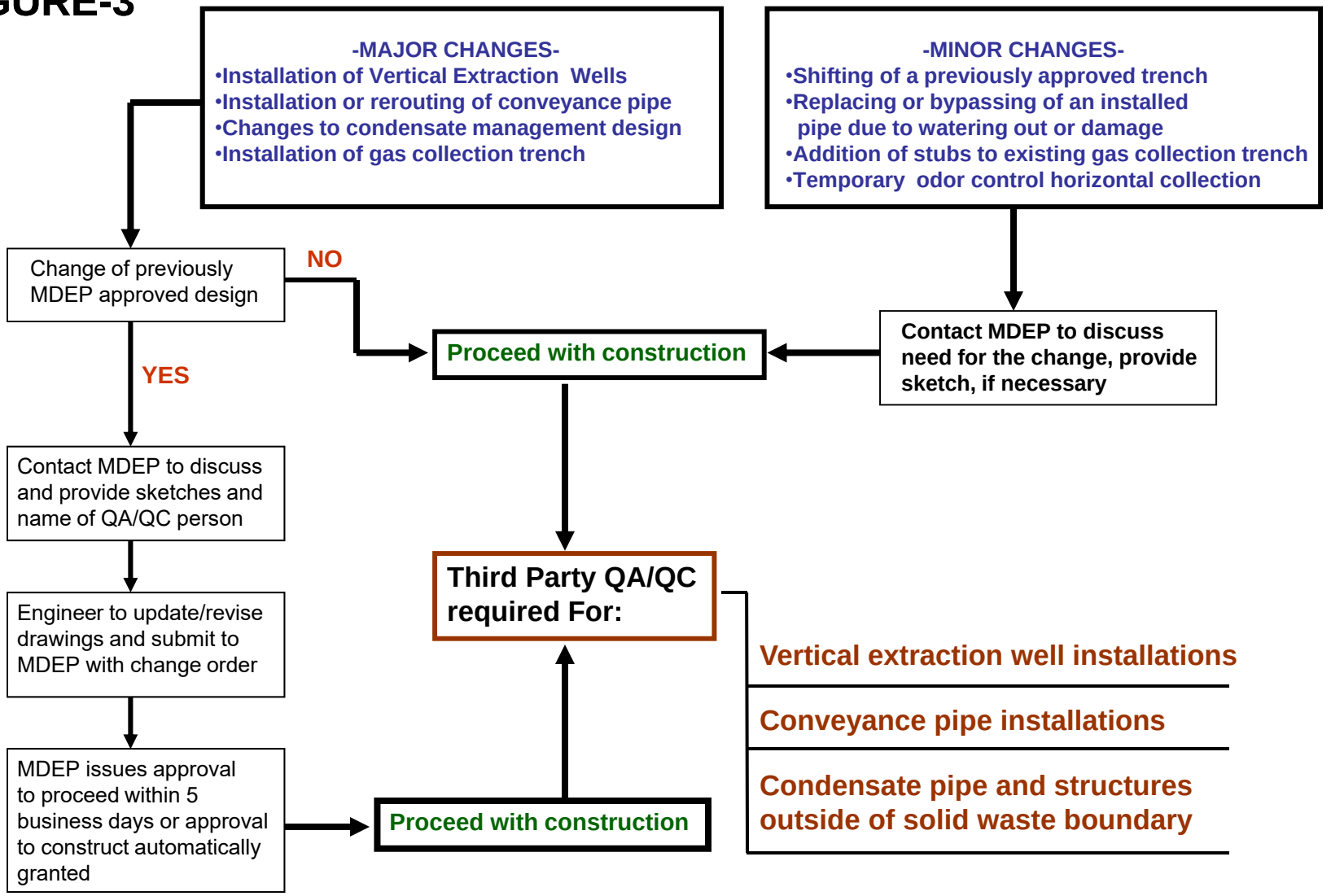
AS-BUILT GAS COLLECTION & CONTROL SYSTEM PLAN

PROJECT NUMBER: 2536.40

FIGURE: 2

FILE: P:\2536\2536-44\GIS\mxd\cx-F:\ext\CAD\As-Built Figures\20251103 JRLSite\Map\GCAs-built.dwg
LAYOUT: 2
LTSCALE: 1
C.TBLFILE: BHA Standards
PLOTDATE: 11/14/25

FIGURE-3



-PROTOCOL FOR LFG SYSTEMS INSTALLATION-

ATTACHMENT 1

COMPLIANCE ASSURANCE MONITORING

TRS CONTROL EQUIPMENT FOR TRS / SO2 CONTROL
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

I. Background

A. Emissions Unit

Description:	Landfill Gas Utility Flares #2, #3, and #4
Identification:	Flare #2, 22.5 MMBtu/hr Flare #3, 40.5 MMBtu/hr Flare #4, 106.5 MMBtu/hr
Facility:	Juniper Ridge Landfill Old Town, Maine

B. Applicable Regulation, Standard of Performance, Emission Limit, and Monitoring Requirements

Regulation:	BACT emission limits in Chapter 115 New Source Review Air License A-921-77-4-M, Part 70 Air Emission License A-921-70-B-R and Amendment #1, A-921-70-H-A
Standards of Performance:	
TRS:	On a 12-month rolling average basis: • An outlet concentration of 1,000 parts per million by volume (ppmv) for gas delivered to the flares.
Emission Limit:	
SO_2:	On a 12-month rolling average basis: • 33.09 lb/hr from Flare #2 • 59.56 lb/hr from Flare #3 • 157.0 lb/hr from Flare #4 • 449.0 tons per year from all flares combined
Monitoring Requirements:	Landfill gas (LFG) TRS concentration, flow rate, H_2S concentration, control equipment downtime, scrubber bypass flow, flow meter calibrations

C. Control Technology

TRS Control Equipment, including Thiopaq wet scrubber system and other alternative control equipment in conjunction with the Thiopaq as necessary to remove TRS from LFG.

II. Monitoring Approach

The key elements of the monitoring approach are presented in Table 1. The performance indicators are TRS concentration and LFG flow rate.

TABLE 1. MONITORING APPROACH

COMPLIANCE ASSURANCE MONITORING
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

	Indicator No. 1	Indicator No. 2	Indicator No. 3
I. Indicator	Landfill gas TRS concentration	Landfill gas flow rate	Facility-Wide SO_2 emission rate
Measurement Approach	TRS levels in the landfill gas entering (3 samples) and exiting (3 samples) the TRS control equipment will be measured once per month and laboratory analyses will be performed by ASTM-D5504 and ASTM-D1945 (or equivalent method), per MEDEP Air License A-921-77-4-M.	The landfill gas flow rate is measured using a thermal mass flow meter.	The SO_2 emission rate is estimated based on the measured flow rate of landfill gas to the flares, and the concentration of TRS compounds measured during once-per-month sampling events.
II. Indicator Range	An excursion is defined as landfill gas delivered to the flares at a concentration greater than 1,000 ppmv TRS on a 12-month rolling average basis. An excursion shall trigger an inspection, corrective action as necessary, and a reporting requirement as required by the Part 70 license.	An excursion is defined as a landfill gas flow rate exiting the TRS control equipment which when combined with a TRS control equipment outlet concentration, results in a 12-month rolling average SO_2 emission rate greater than 33.09 lb/hr from Flare #2, greater than 59.56 lb/hr from Flare #3, or greater than 157.0 lb/hr from Flare #4, except for periods of maintenance or unavoidable malfunction (as described in 38 M.R.S.A. §349.9) of the TRS control equipment. An excursion shall trigger an inspection, corrective action as necessary, and a reporting requirement as required by the Part 70 license.	An excursion is defined as an SO_2 emission rate greater than 449.0 tons per year from all flares combined on a 12-month rolling basis. An excursion shall trigger an inspection, corrective action as necessary, and a reporting requirement as required by the Part 70 license.
III. Performance Criteria			
A. Data Representativeness	The TRS concentration is measured at the inlet and outlet of the TRS control equipment.	The landfill gas flow rate should be equal at the inlet and outlet of the TRS control equipment. Therefore, a single landfill gas flowrate measurement will be recorded to document the flow through the TRS control equipment.	TRS levels in the landfill gas entering (3 samples) and exiting (3 samples) the TRS control equipment will be measured once per month and laboratory analyses will be performed by ASTM-D5504 and ASTM-D1945 (or equivalent method), per MEDEP Air License A-921-77-4-M. JRL shall record the gas flow rate on the day of sampling and the monthly volume of bypass flow.
B. Verification of Operational Status	Periodic monitoring of the TRS control equipment includes H_2S concentrations before and after the equipment. JRL will use colorimetric tubes to provide information for use as operational tools, but not for compliance determinations.	The flow meter is calibrated once per year, per MEDEP Air License A-921-77-4-M. Flow meter readings are recorded on the TRS sampling dates.	Laboratory analysis includes QA/QC checks. The flow meter is calibrated once per year, per MEDEP Air License A-921-77-4-M. Flow meter readings are recorded on the TRS sampling dates. Monthly bypass flow is measured and recorded.
C. QA/QC Practices and Criteria	Laboratory analysis includes QA/QC checks.	The flow meter is calibrated once per year, per MEDEP Air License A-921-77-4-M.	Laboratory analysis includes QA/QC checks. The flow meter is calibrated once per year, per MEDEP Air License A-921-77-4-M.
D. Monitoring Frequency and Data Collection	The TRS concentration entering and exiting the TRS control equipment is measured on a single day, once per month.	The TRS concentration entering and exiting the TRS control equipment is measured on a single day, once per month. The gas flow rate through the TRS control equipment is measured and recorded on the TRS sampling dates.	The TRS concentration entering and exiting the TRS control equipment is measured on a single day, once per month. The gas flow rate through the TRS control equipment is measured and recorded on the TRS sampling dates. The gas flow rate through the TRS control equipment is measured and recorded on the TRS sampling dates. Bypass flow is recorded monthly.
E. Averaging Period	Monthly	Monthly	Monthly

MONITORING APPROACH JUSTIFICATION

I. Background

This compliance assurance monitoring (CAM) plan is for the landfill gas total reduced sulfur (TRS) control equipment, which consists of a Thiopaq desulfurization system (scrubber) and other alternative control equipment (e.g., activated carbon), operated as necessary in conjunction with the Thiopaq, at the State of Maine Juniper Ridge Landfill (JRL) in Old Town, Maine. The TRS control equipment is used to control sulfur dioxide (SO_2) emissions by reducing the concentration of TRS in landfill gas (LFG) prior to combustion. The facility is operated by NEWSME Landfill Operations, LLC.

The LFG combustion devices at JRL consist of three utility flares: Flare #2 (22.5 MMBtu/hr), Flare #3 (40.5 MMBtu/hr), and Flare #4 (106.5 MMBtu/hr). SO_2 is an LFG combustion byproduct generated by the destruction of TRS compounds, primarily hydrogen sulfide (H_2S). The Maine Department of Environmental Protection (MEDEP) specified in Air License A-921-70-B-R an SO_2 emission rate limit from JRL of 449.0 tons per year (tpy) from all flares combined. The concentration of TRS in LFG delivered to the flares shall not exceed 1,000 parts per million by volume (ppmv) on a 12-month rolling average basis; and the emission rate of SO_2 shall not exceed 33.09 pounds per hour (lb/hr) from Flare #2, 59.56 lb/hr from Flare #3, or 157.0 lb/hr from Flare #4 except for periods of maintenance and unavoidable malfunction (as described in 38 M.R.S.A. §349.9). Compliance with the SO_2 lb/hr and tpy limits and the TRS ppmv limit shall be based on a 12-month rolling average (per MEDEP Air License A-921-77-4-M).

To demonstrate compliance with the SO_2 lb/hr and tpy limits and the TRS ppmv limit, TRS levels in the landfill gas entering (3 samples) and exiting (3 samples) the TRS control equipment will be measured once per month and laboratory analyses will be performed by ASTM-D5504 and ASTM-D1945 (or equivalent method), per MEDEP Air License A-921-77-4-M. JRL shall record the gas flow rate on the days of sampling and the monthly volume of bypass flow. It will be assumed that the remaining sulfur in the landfill gas is converted to SO_2 and emissions calculated accordingly.

II. Rationale for Selection of Performance Indicators

Measurement of TRS concentrations in LFG at the inlet and outlet of the TRS control equipment is required by Air License A-921-77-4-M; the license that established the 1,000 ppmv limit. That Air License also requires JRL to monitor LFG flow rate, H_2S concentration, control equipment downtime, and scrubber bypass.

III. Rationale for Selection of Indicator Ranges

Indicator ranges for LFG TRS concentrations were selected based on JRL's licensed limits (on a 12-month rolling average basis) for TRS control to an outlet concentration of 1,000 ppmv. To meet the licensed allowable SO_2 emission rates from the flares, the acceptable LFG flow rates are dependent on the TRS concentration at the TRS control equipment outlet. Specific LFG flow rate ranges were, therefore, not identified in the CAM Plan. Rather, the mass emission rate (i.e., combination of the LFG flow rate and TRS concentration) will be evaluated.

Monthly measurements of TRS concentrations at the inlet and outlet of the TRS control equipment, and the LFG flow rate conveyed to the flares is required by MEDEP Air License A-921-77-4-M. An excursion is defined as an exceedance of a flare's SO_2 lb/hr limit, calculated as a 12-month rolling average. As a proactive approach, JRL will undertake inspection and corrective action as necessary, when the monthly average TRS concentration in treated gas delivered to the flares exceeds 1,000 ppmv or a monthly average SO_2 emission rate exceeds a flare's lb/hr limit.

For the combined emissions from all the flares, an excursion is defined as an SO_2 emission rate greater than 449.0 tons per year on a 12-month rolling basis.

APPENDIX J

CONTAMINANT TRANSPORT ANALYSIS

J-1 TRANSPORT MODEL DESCRIPTION

J-2 LEACHATE QUALITY MONITORING ANALYTICAL RESULTS

J-3 SCENARIO A CONTAMINANT TRANSPORT ANALYSIS RESULTS (TABLE J-1)

J-4 SCENARIO A CONTAMINANT TRANSPORT ANALYSIS CALCULATION SHEETS

J-5 SCENARIO B CONTAMINANT TRANSPORT ANALYSIS RESULTS (TABLE J-2)

J-6 SCENARIO B CONTAMINANT TRANSPORT ANALYSIS CALCULATION SHEETS

J-7 SENSITIVITY ANALYSIS RESULTS (TABLE J-3)

J-1

TRANSPORT MODEL DESCRIPTION

SME
SEVEE & MAHER
ENGINEERS

DESCRIPTION OF CONTAMINANT TRANSPORT MODEL

The groundwater transport calculations and methodology used for this analysis are based on an analytical equation developed to represent the migration of a dissolved chemical in a porous media (Baetsle, L.H., 1969; Chang, T., et al., 1998). In this case, the dissolved chemicals are elements or chemical compounds in the landfill leachate. The equations allow the leachate analytes to migrate with the moving groundwater and disperse with travel distance. The following equation was used in the migration of a groundwater analyte as an instantaneous discharge in three dimensions through dispersion and advection in groundwater:

$$C(x,y,z,t) = \left[\frac{C_o V_o}{8(\pi t)^{1.5}\sqrt{D_x D_y D_z}}\right] \exp\left[-\frac{(x-vt)^2}{4D_x t} - \frac{y^2}{4D_y t} - \frac{z^2}{4D_z t} - \lambda t\right]$$

where,

$C(x,y,z,t)$ = analyte concentration [milligrams per liter (mg/L)] at location downgradient from the source.
t = time [days];
x, y, z = Cartesian coordinates [feet];
C_o = initial concentration at source [mg/L];
V_o = volume of source [cubic feet };
λ = analyte first order decay rate [days^{-1}];
v = average linear velocity of groundwater [feet per day]; and
D_x, D_y, D_z = coefficients of mechanical dispersion [square feet per day] in x, y, and z directions, respectively.

Hydrodynamic dispersion is the phenomena whereby portions of the simulated analyte plume spreads causing a lowering of the analyte concentration as it migrates with the groundwater similar to the way dye placed in moving water spreads out and dilutes areas downstream. This three-dimensional analysis allows for spreading of the analyte in both the longitudinal direction (along the direction of flow) and the lateral direction (transverse to the direction of seepage). The dispersion of groundwater refers to the spreading of a groundwater analyte from areas of high concentration near the source to less concentrated areas at greater distances from the source.

Average linear velocity of groundwater is a function of the hydraulic conductivity of the soil or bedrock (through which groundwater flows), the groundwater hydraulic gradient, and the effective porosity of the soil or bedrock, and is expressed as follows:

$$v = \frac{Ki}{n_e}$$

where,

K = hydraulic conductivity [ft/day]; and
n_e = effective porosity [ft^3/ft^3].

Coefficients of mechanical dispersion in the x, y, and z directions are functions of the average linear velocity of groundwater and dispersivity, and are expressed as follows:

$$D_x = v_x \alpha_x;$$
$$D_y = v_y \alpha_y; \text{ and}$$
$$D_z = v_z \alpha_z.$$

where,

$\alpha_{x,y,z}$ = dispersivity [ft] in the x, y, and z directions.

Dispersivity values used in the transport model are based on a publication that evaluates the relationship between dispersivity and field scale (Xu, M. et al., 1995). Based on this evaluation, dispersivity is expressed as:

$$\alpha_x = [3.28][0.83]\left[\log_{10}\frac{L_p}{3.28}\right]^{2.414}$$

where,

L_p = distance, x, from the analyte source [meters]; and
3.28 = conversion factor for meters to feet.

The transverse and vertical values for dispersivity are expressed as follows (ASTM, 1995):

$$\alpha_y = \frac{\alpha_x}{3}; \text{ and}$$
$$\alpha_z = \frac{\alpha_x}{20}.$$

The analyte transport model can allow for evaluating the velocity of groundwater analytes subject to analyte sorption/adsorption to the soil or bedrock fractures. This effect was not considered for evaluating the potential groundwater analytes for the Phase II Expansion, which causes conservative estimates of groundwater analyte concentrations and arrival times at potential receptors (i.e., the velocity of the groundwater analyte is equal to the average liner velocity of groundwater). Furthermore, the first order decay of leachate analytes was conservatively assumed to be zero (i.e., groundwater analyte concentrations are reduced only through mechanical dispersion and not by degradation or destruction of the analyte over time). This assumption results in conservative analyte concentrations at the receptors and analytes moving with the groundwater. "Conservative" means that the concentration of leachate analytes at a receptor is overestimated from what would be calculated if the analysis accounted for physical and chemical phenomena known to reduce analyte concentrations over time or travel distance. Applying the methodology described above allows for the calculation of an analyte's estimated concentration in groundwater at any time since the leachate first enters the groundwater system at its source, and at any location downgradient of the source. Thus, by calculating the analyte's estimated concentration in groundwater at a specific location over time, one can evaluate when the analyte arrives, increases to a peak concentration, and then dissipation over time.

In the case of groundwater influences from a potential leak at a landfill liner, leachate pump station, and/or leachate storage structure, the leakage source is assumed to be continuous for an extended period rather than an instantaneous discharge. This is accounted for in the transport model by use of the principle of superposition. Using the principle of superposition, an instantaneous discharge is modeled consecutively for each day. At each unique hydraulically downgradient location, the influence of the initial (i.e., day one) discharge from the source over time is added upon daily by the influences of subsequent, continuously repeating daily discharges. This compounding of continuous daily influences results in increasing analyte concentrations at a given location until the analyte concentration reaches a equilibrium concentration. For this transport analysis, contaminant sources from a potential leak at a landfill liner, leachate pump station, and/or leachate storage structure are assumed to be continuous.

DESCRIPTION OF SITE HYDROGEOLOGY FOR MODEL INPUT PARAMETERS

The extensive historical hydrogeologic investigations and evaluations at the JRL are presented in detail in Volume II of the Application. These data and evaluations provide a basis for completing the contaminant transport calculations. The Phase II Expansion area is situated over the north end of a glacial till drumlin. Volume II of the Application provides detailed information on the hydrogeologic properties of the till soils and underlying bedrock, the bedrock surface elevations, and the thickness of the till soils. Additionally, Volume II of the application presents interpreted groundwater level equipotential contours from a site-wide groundwater level monitoring round completed in October 2024.

Figure 4-1 in Volume III of the Application illustrates the proposed Phase II Expansion solid waste boundary location, and the October 2024 interpreted groundwater level equipotential contours. Groundwater is interpreted to generally flow in a direction perpendicular to groundwater level equipotential contours in a hydraulically downgradient direction. As can be seen on Figure 4-1 of Volume III of the Application, there is an interpreted groundwater flow divide across the proposed Phase II Expansion oriented generally in a northwest/southeast direction, which is generally consistent with the topographic drainage divide. Groundwater to the west of the divide is interpreted to flow generally west from the Phase II Expansion and groundwater to the east of the divide is interpreted to flow generally east from the Phase II Expansion.

The area within the Phase II Expansion solid waste boundary that is east of the groundwater flow divide is approximately 1,750,490.51 square feet. The area within the Phase II Expansion solid waste boundary that is west of the groundwater flow divide is approximately 715,554.72 square feet. These areas, along with the hydrogeologic characteristics of the soils, are used for estimating theoretical maximum leachate infiltration rates into the Site soils and groundwater. The estimated vertical hydraulic conductivity of the site-wide till soil is 9.07×10^{-4} ft/day (3.2×10^{-7} centimeters per second (cm/sec)), as reported in Section 5.3.1 of Volume II of the Application. Based on this hydraulic conductivity and the areas within the Phase II Expansion that are east and west of the interpreted groundwater flow divide, the maximum rate of vertical flow into the ground is approximately 11,877 gallons per day (gpd) in the area east of the groundwater flow divide and approximately 4,855 gpd in the area west of the groundwater flow divide.

The estimated site-wide horizontal hydraulic conductivities used in the contaminant transport analysis are 2.66×10^{-2} ft/day (9.4×10^{-6} cm/sec) for till and 9.92×10^{-2} ft/day (3.5×10^{-5} cm/sec) for bedrock, as reported in Sections 5.3.1 and 5.3.2 of Volume II of the Application, respectively.

The interpreted groundwater level potentiometric surface data are used as input data for the transport analysis based on case-by-case scenarios. Estimated horizontal hydraulic gradients are calculated based on groundwater potentiometric levels at various potential source locations and potential receptors and the distances of groundwater travel between the sources and receptors. The estimated site-wide effective porosity of the till soil is 0.25 and the estimated site-wide effective porosity of the bedrock is 0.001, as reported in Sections 3.1.7 and 3.3.5 of Volume II of the Application, respectively.

There will be a compacted marine clay layer in areas that are anticipated to be grubbed to within 5 feet of bedrock. With a hydraulic conductivity of 2.83×10^{-4} ft/day (1.0×10^{-7} cm/sec) and effective porosity of 0.39 (see Section 6.2 of Volume II of the Application), and a vertical gradient of one through the one-foot thickness of the compacted clay layer, the calculated travel time vertically downward to bedrock is increased by 3.8 years. The locations where compacted marine clay will be placed within the Phase II Expansion solid waste boundary are shown on Figure 4-1.

MODELING ASSUMPTIONS AND APPROACH

Assumptions made for the contaminant transport analysis and descriptions of the general approach of the analysis are provided below:

- Groundwater flow paths are interpreted to be perpendicular to the interpreted groundwater level equipotential surfaces shown on Figure 4-1.
- Hydraulic gradients are calculated based on the interpreted groundwater level equipotential surfaces shown on Figure 4-1 and distances along interpreted groundwater flow paths.
- Two simulations are provided for each contaminant transport analysis scenario:
    - One simulation assumes horizontal groundwater flow through the till soil.
    - One simulation assumes vertical flow through the till soil followed by horizontal flow through the bedrock. The simulated dispersion of an analyte is limited to the horizontal flow through bedrock; however, the time of travel vertically downward through the soil to the bedrock is incorporated into the estimate of the time of arrival of contamination of a potential sensitive receptor.
- Since the potential for an unreasonable threat to a sensitive receptor is defined by MEDEP "as an arrival time of less than 6 years from the landfill or less than 3 years from leachate storage structures and pump stations of a concentration of a pollutant which would result in contamination of that sensitive receptor" (MEDEP, 2015a), dispersion calculations are limited to

continuous daily contaminant discharges for 30 years (not including the time of travel vertically downward through the soil to the bedrock, when applicable).

- All model inputs are estimated based on historical hydrogeologic investigations and evaluations for the JRL, as described in this section (Section 4.0 of Volume III of the Application) and Volume II of the Application.

J-2

LEACHATE QUALITY MONITORING ANALYTICAL RESULTS

SME
SEVEE & MAHER
ENGINEERS

REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 1 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	Specific Conductance µmhos/cm @25°C	pH STU	Temperature Deg C	Eh mV	Dissolved Oxygen mg/L	Flow Rate cfs	Chloromethane ug/L	Bromomethane ug/L	Vinyl Chloride ug/L	Chloroethane ug/L	Methylene Chloride ug/L	Acetone ug/L	Carbon Disulfide ug/L	1,1-Dichloroethene ug/L	1,1-Dichloroethane ug/L
2/25/2020	XX	LTJRLXC9D	26966	7.4	8.4	-105	0.8		20 U	20 U	10 U	20 U	10 U	2100	20 U	5 U	10 U
4/28/2020	XX	LTJRLXCE9	17460	6.5	12.6	-18	2.8										
7/21/2020	XX	LTJRLXCGG	25400	5.9	28.7	313	1		2 U	2 U	1 U	2 U	1.2	440	2 U	0.5 U	1 U
10/27/2020	XX	LTJRLXD45	21800	7.4	13.2	-285	D2										
1/5/2021	XX	LTJRLXD8E	16935	7.5	9.2	23	2.2		20 U	20 U	10 U	20 U	10 U	1600	20 U	5 U	10 U
1/26/2021	XX	LTJRLXDA1	11542	7.7	7.2	107	4.8										
4/6/2021	XX	LTJRLXDD8	17420	7.1	13.1	24	1										
7/13/2021	XX	LTJRLXE29	20400	7.1	24.1	-82	0.7		2 U	2 U	1 U	2 U	1 U	780	12	0.5 U	1 U
10/26/2021	XX	LTJRLXED2	22100	7.4	14	48	2		2 U	2 U	1 U	2 U	4.4	600	2 U	0.5 U	1 U
1/26/2022	XX	LTJRLXEJG	26468	7.4	3.8	120	3.3		5.1	2 U	1 U	2 U	1 U	570	2 U	0.5 U	1 U
5/26/2022	XX	LTJRLXF43	18909	7.5	22.1	46	0.2		2 U	2 U	1 U	2 U	1 U	250	2 U	0.5 U	1 U
7/19/2022	XX	LTJRLXFE3	22143	6.8	26.1	-95	FK		2 U	2 U	1.9	2 U	1 U	110	2 U	0.5 U	1 U
10/4/2022	XX	LTJRLXG22							2 U	2 U	1 U	2 U	1 U	180	2 U	0.5 U	1 U
1/18/2023	XX	LTJRLXGBJ	16265	7.1	10	90	1		2 U	2 U	1.2	2 U	1 U	1300	2 U	0.5 U	1 U
4/18/2023	XX	LTJRLXH25	20300	7.5	12.7	-115	1.5	0.0071	2 U	2 U	1 U	2 U	1 U	1400	2 U	0.5 U	1 U
7/11/2023	XX	LTJRLX024	19340	7.1	24.7	-132	0.4	0.0071	2 U	2 U	2.2	2 U	1 U	440	2 U	0.5 U	1 U
10/3/2023	XX	LTJRLX09D	17664	6.8	23.4	-113	0.13	0.0071	17	2.1	1	2 U	15	810	5.5	0.5 U	1 U
1/25/2024	XX	LTJRLX0G8	20559	7.6	4.8	-210	0.7	0.0071	2 U	2 U	1.5	2 U	1 U	1300	2 U	0.5 U	1 U
4/2/2024	XX	LTJRLX116	12162	7.1	13.5	-55	0.2	0.0071	3	2 U	1 U	2 U	1.1	1400	5.8	0.5 U	1 U
4/10/2024	XX	LTJRLX179	12872	7.1	12.8	-72	0.5	0.0071									
7/16/2024	XX	LTJRLX1H5	17989	7	27.5	-11	0.4	0.0071									
7/18/2024	XX	LTJRLX1HA	19827	6.9	31.9	-40	0.1	0.0071	2 U	2 U	1.2	2 U	1 U	310	2 U	0.5 U	1 U
10/8/2024	XX	LTJRLX1HG	22107	6.8	19.6	-31	0.7	0.0071	2 U	2 U	1.7	2 U	1 U	860	2 U	0.5 U	1 U
11/14/2024	XX	LTJRLX28A	26738	7.4	12.7	37	1.2	0.0071									

Units Abbreviations:

µmhos/cm @25℃ - MICROSIEMENS PER CENTIMETER
cfs - CUBIC FEET PER SECOND
Deg C - DEGREES CELCIUS (TEMPERATURE)
mg/L - MILLIGRAMS PER LITER
mV - MILLIVOLTS
STU - STANDARD PH UNIT
ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

D2 - Sample too dark to read D.O. reading.
FK - Outside range of available field kits.
U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 2 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	trans-1,2-Dichloroethene ug/L	Chloroform ug/L	1,2-Dichloroethane ug/L	Methyl Ethyl Ketone ug/L	1,1,1-Trichloroethane ug/L	Carbon Tetrachloride ug/L	Vinyl Acetate ug/L	Bromo dichloro methane ug/L	1,2-Dichloro propane ug/L	cis-1,3-Dichloro propene ug/L	Trichloroethene ug/L	Dibromo chloromethane ug/L	1,1,2-Trichloroethane ug/L	Benzene ug/L	trans-1,3-Dichloro propene ug/L
2/25/2020	XX	LTJRLXC9D	10 U	10 U	10 U	1800	10 U	10 U	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U
7/21/2020	XX	LTJRLXCGG	1 U	1 U	1.9	270	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.8	0.5 U
1/5/2021	XX	LTJRLXD8E	10 U	10 U	10 U	1500	10 U	10 U	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U
7/13/2021	XX	LTJRLXE29	1 U	1 U	1.6	630	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.4	0.5 U
10/26/2021	XX	LTJRLXED2	1 U	1 U	3.3	480	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.3	0.5 U
1/26/2022	XX	LTJRLXEJG	1 U	1 U	1.4	280	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	2.4	0.5 U
5/26/2022	XX	LTJRLXF43	1 U	1 U	1.6	160	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.7	0.5 U
7/19/2022	XX	LTJRLXFE3	1 U	1 U	2	97	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.1	0.5 U
10/4/2022	XX	LTJRLXG22	1 U	1 U	2.5	180	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5	0.5 U
1/18/2023	XX	LTJRLXGBJ	1 U	1 U	2.6	880	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	7.4	0.5 U
4/18/2023	XX	LTJRLXH25	1 U	1 U	1.8	930	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	6.3	0.5 U
7/11/2023	XX	LTJRLX024	1 U	1 U	2.5	310	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	6.2	0.5 U
10/3/2023	XX	LTJRLX09D	2.8	1 U	2.8	780	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3	0.5 U
1/25/2024	XX	LTJRLX0G8	1 U	1 U	2.8	1000	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.7	0.5 U
4/2/2024	XX	LTJRLX116	1 U	1 U	3.5	1000	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.1	0.5 U
7/18/2024	XX	LTJRLX1HA	1 U	1 U	2.2	240	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4	0.5 U
10/8/2024	XX	LTJRLX1HG	1 U	1 U	2.5	590	1 U	1 U	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	8.1	0.5 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes:

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Concentration Qualifier Notes:

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DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 3 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(JRL LEACHATE) Date	Type	Sample ID	Bromoform ug/L	4-Methyl-2-Pentanone ug/L	2-Hexanone ug/L	Tetrachloro ethene ug/L	1,1,2,2-Tetrachloro ethane ug/L	Toluene ug/L	Chlorobenzene ug/L	Ethylbenzene ug/L	Styrene ug/L	o-Xylene ug/L	m,p-Xylene ug/L	Tetra hydrofuran ug/L	Dichloro difluoro methane ug/L	Trichloro fluoromethane ug/L	2,2-Dichloro propane ug/L
JRL LEACHATE																	
2/25/2020	XX	LTJRLXC9D	20 U	100 U	100 U	10 U	10 U	53	10 U	10 U	10 U	10 U	10 U	440	20 U	20 U	10 U
7/21/2020	XX	LTJRLXCGG	2 U	19	10 U	1 U	1 U	14	1 U	6.9	1 U	4.9	8	490	2 U	2 U	1 U
1/5/2021	XX	LTJRLXD8E	20 U	100 U	100 U	10 U	10 U	18	10 U	10 U	10 U	10 U	10 U	460	20 U	20 U	10 U
7/13/2021	XX	LTJRLXE29	2 U	16	10 U	1 U	1 U	21	1 U	8.7	1 U	5.9	13	460	2 U	2 U	1 U
10/26/2021	XX	LTJRLXED2	2 U	23	10 U	1 U	1 U	24	1 U	8.5	1 U	6.5	12	580	2 U	2 U	1 U
1/26/2022	XX	LTJRLXEJG	2 U	15	10 U	1 U	1 U	10	1 U	3.8	1 U	2.9	5.2	530	2 U	2 U	1 U
5/26/2022	XX	LTJRLXF43	2 U	20	10 U	1 U	1 U	38	1 U	6.4	1 U	4.6	8.6	410	2 U	2 U	1 U
7/19/2022	XX	LTJRLXFE3	2 U	14	10 U	1 U	1 U	78	1 U	8.5	1 U	6.9	12	460	2 U	2 U	1 U
10/4/2022	XX	LTJRLXG22	2 U	10 U	10 U	1 U	1 U	17	1 U	8.6	1 U	6.1	12	390	2 U	2 U	1 U
1/18/2023	XX	LTJRLXGBJ	2 U	37	10 U	1 U	1 U	51	1 U	11	1.3	7.8	15	450	2 U	2 U	1 U
4/18/2023	XX	LTJRLXH25	2 U	42	10 U	1 U	1 U	31	1 U	13	1 U	8.1	15	510	2 U	2 U	1 U
7/11/2023	XX	LTJRLX024	2 U	27	10 U	1 U	1 U	29	1 U	12	1.1	10	18	470	2 U	2 U	1 U
10/3/2023	XX	LTJRLX09D	2 U	25	10 U	1 U	1 U	22	1 U	6.2	1 U	4.5	9.5	530	2 U	2 U	1 U
1/25/2024	XX	LTJRLX0G8	2 U	36	10 U	1 U	1 U	49	1 U	11	1 U	8.7	15	640	2 U	2 U	1 U
4/2/2024	XX	LTJRLX116	2 U	26	10 U	1 U	1 U	50	1 U	9.4	1 U	6.7	13	300	2 U	2 U	1 U
7/18/2024	XX	LTJRLX1HA	2 U	16	10 U	1 U	1 U	30	1 U	9.1	1 U	7.2	13	520	2 U	2 U	1 U
10/8/2024	XX	LTJRLX1HG	2 U	19	10 U	1 U	1 U	31	1 U	9.9	1 U	7.5	15	760	2 U	2 U	1 U

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REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 4 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(JRL LEACHATE)			cis-1,2-Dichloroethene	Bromochloromethane	1,1-Dichloropropene	Dibromomethane	1,3-Dichloropropane	1,2-Dibromoethane	1,1,1,2-Tetrachloroethane	Isopropylbenzene	Bromobenzene	1,2,3-Trichloropropane	n-Propylbenzene	o-Chlorotoluene	1,3,5-Trimethylbenzene	p-Chlorotoluene	tert-Butylbenzene
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
JRL LEACHATE																	
2/25/2020	XX	LTJRLXC9D	10 U	10 U	10 U	10 U	10 U	5 U	10 U	10 U	10 U	5 U	10 U	10 U	10 U	10 U	10 U
7/21/2020	XX	LTJRLXCGG	1.5	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1/5/2021	XX	LTJRLXD8E	10 U	10 U	10 U	10 U	10 U	5 U	10 U	10 U	10 U	5 U	10 U	10 U	10 U	10 U	10 U
7/13/2021	XX	LTJRLXE29	2	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
10/26/2021	XX	LTJRLXED2	2.2	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1/26/2022	XX	LTJRLXEJG	1.2	1 U	1 U	1 U	1 U	0.5 U	1 U	1.3	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
5/26/2022	XX	LTJRLXF43	2.1	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
7/19/2022	XX	LTJRLXFE3	2.7	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
10/4/2022	XX	LTJRLXG22	1.7	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1/18/2023	XX	LTJRLXGBJ	3.3	1 U	1 U	1 U	1 U	0.5 U	1 U	1.2	1 U	0.5 U	1 U	1 U	1.2	1 U	1 U
4/18/2023	XX	LTJRLXH25	2.5	1 U	1 U	1 U	1 U	0.5 U	1 U	1.3	1 U	0.5 U	1 U	1 U	1.2	1 U	1 U
7/11/2023	XX	LTJRLX024	3.2	1 U	1 U	1 U	1 U	0.5 U	1 U	1.1	1 U	0.5 U	1 U	1 U	1.1	1 U	1 U
10/3/2023	XX	LTJRLX09D	1.6	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
1/25/2024	XX	LTJRLX0G8	2.5	1 U	1 U	1 U	1 U	0.5 U	1 U	1.1	1 U	0.5 U	1 U	1 U	1.1	1 U	1 U
4/2/2024	XX	LTJRLX116	2.5	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	1 U	1 U
7/18/2024	XX	LTJRLX1HA	2	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1	1 U	1 U
10/8/2024	XX	LTJRLX1HG	2.1	1 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1 U	0.5 U	1 U	1 U	1	1 U	1 U

Units Abbreviations:

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Concentration Qualifier Notes:

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REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 5 of 19

SME
SEVEE & MAHER ENGINEERS
SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(JRL LEACHATE) Date	Type	Sample ID	1,2,4-Trimethyl benzene ug/L	sec-Butylbenzene ug/L	p-Isopropyl toluene ug/L	n-Butylbenzene ug/L	1,2-Dibromo-3-Chloropropane ug/L	Tert-Amyl Methyl Ether ug/L	Ethyl-t-butyl-ether ug/L	Hexachloro butadiene ug/L	1,3-Dichloro benzene ug/L	1,4-Dichloro benzene ug/L	1,2-Dichloro benzene ug/L	1,4-Dioxane ug/L	Methyltertiary butylether ug/L	Tertiarybutyl alcohol ug/L	Acrylonitrile ug/L
JRL LEACHATE																	
2/25/2020	XX	LTJRLXC9D	10 U	10 U	10 U	10 U	20 U	20 U	20 U	5 U	10 U	10 U	10 U	500 U	10 U	860	200 U
7/21/2020	XX	LTJRLXCGG	1.9	1 U	2	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	140	1 U	1100	20 U
1/5/2021	XX	LTJRLXD8E	10 U	10 U	10 U	10 U	20 U	20 U	20 U	5 U	10 U	10 U	10 U	500 U	10 U	860	200 U
7/13/2021	XX	LTJRLXE29	2.3	1 U	2.1	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	50 U	1 U	1000	20 U
10/26/2021	XX	LTJRLXED2	2.5	1 U	2.2	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	110	1.4	1200	20 U
1/26/2022	XX	LTJRLXEJG	1.2	1 U	1.8	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	100	1.1	1000	20 U
5/26/2022	XX	LTJRLXF43	1.9	1 U	1.4	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	98	1.5	1000	20 U
7/19/2022	XX	LTJRLXFE3	2.2	1 U	1.6	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	110	1.3	1200	20 U
10/4/2022	XX	LTJRLXG22	2.4	1 U	1.7	1 U	2 U	2 U	2 U	0.5 U	1 U	1.1	1 U	170	1 U	830	20 U
1/18/2023	XX	LTJRLXGBJ	3.3	1 U	3	1 U	2 U	2 U	2 U	0.5 U	1 U	1.2	1 U	99	1.4	1100	20 U
4/18/2023	XX	LTJRLXH25	3.5	1 U	3.7	1 U	2 U	2 U	2 U	0.5 U	1 U	1.2	1 U	130	1	1100	20 U
7/11/2023	XX	LTJRLX024	3.3	1 U	3.3	1 U	2 U	2 U	2 U	0.5 U	1 U	1.2	1 U	93	1.1	1100	20 U
10/3/2023	XX	LTJRLX09D	1.7	1 U	2	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	50 U	1 U	580	20 U
1/25/2024	XX	LTJRLX0G8	3.1	1 U	3.1	1 U	2 U	2 U	2 U	0.5 U	1 U	1	1 U	140	1.4	1200	20 U
4/2/2024	XX	LTJRLX116	2.5	1 U	2.8	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	50 U	1.2	560	20 U
7/18/2024	XX	LTJRLX1HA	2.9	1 U	2.9	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	120	1.1	1200	20 U
10/8/2024	XX	LTJRLX1HG	3	1 U	3.1	1 U	2 U	2 U	2 U	0.5 U	1 U	1 U	1 U	120	1.1	1400	20 U

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REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 6 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	Diethyl ether ug/L	Naphthalene ug/L	1,2,4-Trichloro benzene ug/L	1,2,3-Trichloro benzene ug/L	trans-1,4-Dichloro-2-butene ug/L	Iodomethane ug/L	1,3,5-Trichloro benzene ug/L	Diisopropyl ether ug/L	Phenol ug/L	Bis (2-Chloroethyl) ether ug/L	2-Chlorophenol ug/L	1,3-Dichloro benzene (SVOC) ug/L	1,4-Dichloro benzene (SVOC) ug/L	Benzyl Alcohol ug/L	1,2-Dichloro benzene (SVOC) ug/L
2/25/2020	XX	LTJRLXC9D	20 U	20 U	10 U	5 U	50 U	50 U	10 U	20 U		9.5 U	9.5 U	9.5 U	9.5 U	19 U	9.5 U
2/25/2020	XX	LTJRLXC9DDL									130						
7/21/2020	XX	LTJRLXCGG	6.9	15	1 U	0.5 U	5 U	5 U	1 U	2 U	24	9.4 U	9.4 U	9.4 U	9.4 U	19 U	9.4 U
1/5/2021	XX	LTJRLXD8E	20 U	20 U	10 U	5 U	50 U	50 U	10 U	20 U							
1/5/2021	XX	LTJRLXD8ERE									100	9.4 U	9.4 U	9.4 U	9.4 U	19 U	9.4 U
7/13/2021	XX	LTJRLXE29	7.5	20	1 U	0.5 U	5 U	5 U	1 U	2 U	120	9.5 U	9.5 U	9.5 U	9.5 U	19 U	9.5 U
10/26/2021	XX	LTJRLXED2	13	17	1 U	0.5 U	5 U	5 U	1 U	2 U	92	9.6 U	9.6 U	9.6 U	9.6 U	19 U	9.6 U
1/26/2022	XX	LTJRLXEJG	9.9	15	1 U	0.5 U	5 U	5 U	1 U	2 U	55	9.5 U	9.5 U	9.5 U	9.5 U	19 U	9.5 U
5/26/2022	XX	LTJRLXF43	15	11	1 U	0.5 U	5 U	5 U	1 U	2 U	87	9.5 U	9.5 U	9.5 U	9.5 U	19 U	9.5 U
5/26/2022	XX	LTJRLXF43DL									89	19 U	19 U	19 U	19 U	38 U	19 U
7/19/2022	XX	LTJRLXFE3	15	9	1 U	0.5 U	5 U	5 U	1 U	2 U	13	9.3 U	9.3 U	9.3 U	9.3 U	19 U	9.3 U
10/4/2022	XX	LTJRLXG22	10	9.6	1 U	0.5 U	5 U	5 U	1 U	2 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	19 U	9.3 U
1/18/2023	XX	LTJRLXGBJ	2 U	18	1 U	0.5 U	5 U	5 U	1 U	2 U							
1/18/2023	XX	LTJRLXGBJDL									85	47 U	47 U	47 U	47 U	94 U	47 U
4/18/2023	XX	LTJRLXH25	15	35	1 U	0.5 U	5 U	5 U	1 U	2 U	76	10 U	10 U	10 U	10 U	20 U	10 U
7/11/2023	XX	LTJRLX024	12	30	1 U	0.5 U	5 U	5 U	1 U	2 U	13	9.3 U	9.3 U	9.3 U	9.3 U	19 U	9.3 U
10/3/2023	XX	LTJRLX09D	17	10	1 U	0.5 U	5 U	5 U	1 U	2 U	11	9.3 U	9.3 U	9.3 U	9.3 U	19 U	9.3 U
1/25/2024	XX	LTJRLX0G8	2 U	21	1 U	0.5 U	5 U	5 U	1 U	2 U	39	9.6 U	9.6 U	9.6 U	9.6 U	19 U	9.6 U
4/2/2024	XX	LTJRLX116	13	12	1 U	0.5 U	5 U	5 U	1 U	2 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	19 U	9.4 U
7/16/2024	XX	LTJRLX1H5									9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	20 U	9.8 U
7/18/2024	XX	LTJRLX1HA	12	13	1 U	0.5 U	5 U	5 U	1 U	2 U							
10/8/2024	XX	LTJRLX1HG	13	13	1 U	0.5 U	5 U	5 U	1 U	2 U	9.6	9.4 U	9.4 U	9.4 U	9.4 U	19 U	9.4 U

Units Abbreviations:

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Concentration Qualifier Notes:

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DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 7 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	2-Methylphenol ug/L	Bis(2-Chloroisopropyl) ether ug/L	N-Nitroso-di-n-propylamine ug/L	Hexachloroethane ug/L	Nitrobenzene ug/L	Isophorone ug/L	2-Nitrophenol ug/L	2,4-Dimethylphenol ug/L	Bis(2-Chloroethoxy)methane ug/L	2,4-Dichlorophenol ug/L	1,2,4-Trichlorobenzene (SVOC) ug/L	Naphthalene (SVOC) ug/L	4-Chloroaniline ug/L	Hexachlorobutadiene (SVOC) ug/L	4-Chloro-3-Methylphenol ug/L
2/25/2020	XX	LTJRLXC9D	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	11	9.5 U	9.5 U	9.5 U
7/21/2020	XX	LTJRLXCGG	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	12	9.4 U	9.4 U	9.4 U
1/5/2021	XX	LTJRLXD8ERE	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	17	9.4 U	9.4 U	9.4 U
7/13/2021	XX	LTJRLXE29	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	14	9.5 U	9.5 U	9.5 U
10/26/2021	XX	LTJRLXED2	12	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	12	9.6 U	9.6 U	9.6 U
1/26/2022	XX	LTJRLXEJG	9.6	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
5/26/2022	XX	LTJRLXF43	11	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
5/26/2022	XX	LTJRLXF43DL	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U
7/19/2022	XX	LTJRLXFE3	12	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
10/4/2022	XX	LTJRLXG22	14	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
1/18/2023	XX	LTJRLXGBJDL	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U
4/18/2023	XX	LTJRLXH25	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	15	10 U	10 U	10 U
7/11/2023	XX	LTJRLX024	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
10/3/2023	XX	LTJRLX09D	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
1/25/2024	XX	LTJRLX0G8	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.8	9.6 U	9.6 U	9.6 U
4/2/2024	XX	LTJRLX116	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	10	9.4 U	9.4 U	9.4 U
7/16/2024	XX	LTJRLX1H5	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8	9.8 U	9.8 U	9.8 UL
10/8/2024	XX	LTJRLX1HG	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 UL

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DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 8 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	2-Methyl naphthalene ug/L	Hexachloro cyclo pentadiene ug/L	2,4,6-Trichlorophenol ug/L	2,4,5-Trichlorophenol ug/L	2-Chloro naphthalene ug/L	2-Nitroaniline ug/L	Dimethyl Phthalate ug/L	Acenaphthylene ug/L	2,6-Dinitrotoluene ug/L	3-Nitroaniline ug/L	Acenaphthene ug/L	2,4-Dinitrophenol ug/L	4-Nitrophenol ug/L	Dibenzofuran ug/L	2,4-Dinitrotoluene ug/L
2/25/2020	XX	LTJRLXC9D	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	24 U	9.5 U	9.5 U
7/21/2020	XX	LTJRLXCGG	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	24 U	9.4 U	9.4 U
1/5/2021	XX	LTJRLXD8ERE	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	24 U	9.4 U	9.4 U
7/13/2021	XX	LTJRLXE29	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	24 U	9.5 U	9.5 U
10/26/2021	XX	LTJRLXED2	9.6 U	9.6 U	9.6 U	24 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U	24 U	24 U	9.6 U	9.6 U
1/26/2022	XX	LTJRLXEJG	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	24 U	9.5 U	9.5 U
5/26/2022	XX	LTJRLXF43	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	24 U	9.5 U	9.5 U
5/26/2022	XX	LTJRLXF43DL	19 U	19 U	19 U	48 U	19 U	48 U	19 U	19 U	19 U	48 U	19 U	48 U	48 U	19 U	19 U
7/19/2022	XX	LTJRLXFE3	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	23 U	9.3 U	9.3 U
10/4/2022	XX	LTJRLXG22	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	23 U	9.3 U	9.3 U
1/18/2023	XX	LTJRLXGBJDL	47 U	47 U	47 U	120 U	47 U	120 U	47 U	47 U	47 U	120 U	47 U	120 U	120 U	47 U	47 U
4/18/2023	XX	LTJRLXH25	10 U	10 U	10 U	25 U	10 U	25 U	10 U	10 U	10 U	25 U	10 U	25 U	25 U	10 U	10 U
7/11/2023	XX	LTJRLX024	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	23 U	9.3 U	9.3 U
10/3/2023	XX	LTJRLX09D	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	23 U	9.3 U	9.3 U
1/25/2024	XX	LTJRLX0G8	9.6 U	9.6 U	9.6 U	24 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U	24 U	24 U	9.6 U	9.6 U
4/2/2024	XX	LTJRLX116	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	24 U	9.4 U	9.4 U
7/16/2024	XX	LTJRLX1H5	9.8 U	9.8 U	9.8 U	24 U	9.8 ULL	24 U	9.8 U	9.8 U	9.8 U	24 U	9.8 U	24 U	24 U	9.8 U	9.8 U
10/8/2024	XX	LTJRLX1HG	9.4 U	9.4 U	9.4 U	24 U	9.4 UL	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	24 U	9.4 U	9.4 U

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REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 9 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(JRL LEACHATE) Date	Type	Sample ID	Diethyl phthalate ug/L	4-Chlorophenyl-phenylether ug/L	Fluorene ug/L	4-Nitroaniline ug/L	4,6-Dinitro-2-methylphenol ug/L	N-Nitroso diphenylamine ug/L	4-Bromophenyl-phenylether ug/L	Hexachloro benzene ug/L	Pentachlorophenol ug/L	Phenanthrene ug/L	Anthracene ug/L	Di-n-butylphthalate ug/L	Fluoranthene ug/L	Pyrene ug/L	Butylbenzyl phthalate ug/L
JRL LEACHATE																	
2/25/2020	XX	LTJRLXC9D	9.5 U	9.5 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
7/21/2020	XX	LTJRLXCGG	9.4 U	9.4 U	9.4 U	24 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U
1/5/2021	XX	LTJRLXD8ERE	9.4 U	9.4 U	9.4 U	24 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U
7/13/2021	XX	LTJRLXE29	9.5 U	9.5 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
10/26/2021	XX	LTJRLXED2	9.6 U	9.6 U	9.6 U	24 U	24 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
1/26/2022	XX	LTJRLXEJG	9.5 U	9.5 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
5/26/2022	XX	LTJRLXF43	9.5 U	9.5 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
5/26/2022	XX	LTJRLXF43DL	19 U	19 U	19 U	48 U	48 U	19 U	19 U	19 U	48 U	19 U	19 U	19 U	19 U	19 U	19 U
7/19/2022	XX	LTJRLXFE3	9.3 U	9.3 U	9.3 U	23 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
10/4/2022	XX	LTJRLXG22	9.3 U	9.3 U	9.3 U	23 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
1/18/2023	XX	LTJRLXGBJDL	47 U	47 U	47 U	120 U	120 U	47 U	47 U	47 U	120 U	47 U	47 U	47 U	47 U	47 U	47 U
4/18/2023	XX	LTJRLXH25	10 U	10 U	10 U	25 U	25 U	10 U	10 U	10 U	25 U	10 U	10 U	10 U	10 U	10 U	10 U
7/11/2023	XX	LTJRLX024	9.3 U	9.3 U	9.3 U	23 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
10/3/2023	XX	LTJRLX09D	9.3 U	9.3 U	9.3 U	23 U	23 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
1/25/2024	XX	LTJRLX0G8	9.6 U	9.6 U	9.6 U	24 U	24 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U
4/2/2024	XX	LTJRLX116	9.4 U	9.4 U	9.4 U	24 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U
7/16/2024	XX	LTJRLX1H5	9.8 U	9.8 U	9.8 U	24 U	24 U	9.8 U	9.8 U	9.8 U	24 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U
10/8/2024	XX	LTJRLX1HG	9.4 U	9.4 U	9.4 U	24 U	24 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U

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DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 10 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	3,3-Dichloro benzidine ug/L	Benzo(a) Anthracene ug/L	Chrysene ug/L	Bis(2-Ethylhexyl) phthalate ug/L	Di-n-octylphthalate ug/L	Benzo(b) Fluoranthene ug/L	Benzo(k) Fluoranthene ug/L	Benzo(a) Pyrene ug/L	Indeno(1,2,3-c,d) Pyrene ug/L	Dibenz(a,h) Anthracene ug/L	Benzo(g,h,i) perylene ug/L	N-Nitroso dimethylamine ug/L	2,3,4,6-Tetrachloro phenol ug/L	2,6-Dichlorophenol ug/L	3&4-Methylphenol ug/L
2/25/2020	XX	LTJRLXC9D	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	
2/25/2020	XX	LTJRLXC9DDL															680
7/21/2020	XX	LTJRLXCGG	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	
7/21/2020	XX	LTJRLXCGGDL															120
1/5/2021	XX	LTJRLXD8ERE	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	
1/5/2021	XX	LTJRLXD8EREDL															310
7/13/2021	XX	LTJRLXE29	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	
7/13/2021	XX	LTJRLXE29DL															440
10/26/2021	XX	LTJRLXED2	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	
10/26/2021	XX	LTJRLXED2DL															170
1/26/2022	XX	LTJRLXEJG	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	120
5/26/2022	XX	LTJRLXF43	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	
5/26/2022	XX	LTJRLXF43DL	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	190
7/19/2022	XX	LTJRLXFE3	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	100
10/4/2022	XX	LTJRLXG22	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	110
1/18/2023	XX	LTJRLXGBJDL	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	230
4/18/2023	XX	LTJRLXH25	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
4/18/2023	XX	LTJRLXH25DL															180
7/11/2023	XX	LTJRLX024	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	48
10/3/2023	XX	LTJRLX09D	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	62
1/25/2024	XX	LTJRLX0G8	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	
1/25/2024	XX	LTJRLX0G8DL															250
4/2/2024	XX	LTJRLX116	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	
4/2/2024	XX	LTJRLX116DL															370
7/16/2024	XX	LTJRLX1H5	9.8 UL	9.8 U	9.8 UL	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 UL	9.8 U	9.8 U	9.8 U	9.8 U	76
10/8/2024	XX	LTJRLX1HG	9.4 UL	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	46

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DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 11 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	alpha-BHC ug/L	beta-BHC ug/L	delta-BHC ug/L	gamma-BHC (Lindane) ug/L	Heptachlor ug/L	Aldrin ug/L	Heptachlor Epoxide ug/L	Endosulfan I ug/L	Dieldrin ug/L	4,4'-DDE ug/L	Endrin ug/L	Endosulfan II ug/L	4,4'-DDD ug/L	Endosulfan Sulfate ug/L	4,4'-DDT ug/L
2/25/2020	XX	LTJRLXC9D	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.19 J	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
7/21/2020	XX	LTJRLXCGG	0.047 U	0.047 U	0.94 J	0.047 U	0.047 U	0.047 U	0.4 J	2.3 J	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
1/5/2021	XX	LTJRLXD8E	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.43 J	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
7/13/2021	XX	LTJRLXE29	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U
10/26/2021	XX	LTJRLXED2	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U	0.096 U
1/26/2022	XX	LTJRLXEJG	0.048 UH	0.048 UH	0.048 UH	0.048 UH	0.048 UH	0.048 UH	0.048 UH	0.048 UH	0.095 UH	0.095 UH	0.095 UH	0.095 UH	0.095 UH	0.095 UH	0.095 UH
5/26/2022	XX	LTJRLXF43RA	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U
7/19/2022	XX	LTJRLXFE3RA	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
10/4/2022	XX	LTJRLXG22RA	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U
1/18/2023	XX	LTJRLXGBJDL	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U
4/18/2023	XX	LTJRLXH25	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
7/11/2023	XX	LTJRLX024	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U
10/3/2023	XX	LTJRLX09D	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U
1/25/2024	XX	LTJRLX0G8	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
4/2/2024	XX	LTJRLX116	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
7/16/2024	XX	LTJRLX1H5	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.048 U	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U	0.097 U
10/8/2024	XX	LTJRLX1HG	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

J - Analyte was positively identified/Associated value is an estimate.
U - Not Detected above the laboratory reporting limit.
UH - Not Detected above the laboratory reporting limit. Analyzed outside U.S.EPA's recommended hold time

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 12 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	Methoxychlor ug/L	Endrin Ketone ug/L	alpha-Chlordane ug/L	gamma-Chlordane ug/L	Toxaphene ug/L	Aroclor-1016 ug/L	Aroclor-1221 ug/L	Aroclor-1232 ug/L	Aroclor-1242 ug/L	Aroclor-1248 ug/L	Aroclor-1254 ug/L	Aroclor-1260 ug/L	Endrin Aldehyde ug/L	Chlordane (technical) ug/L	2,4-Dichloro phenoxyacetic Acid ug/L
2/25/2020	XX	LTJRLXC9D	0.47 U				0.94 U								0.094 U	0.47 U	2.7 U
2/25/2020	XX	LTJRLXC9DRA						0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U			
2/25/2020	XX	LTJRLXC9DRE2															2.7 U
7/21/2020	XX	LTJRLXCGG	0.47 U				0.94 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.094 U	0.47 U	2.6 U
1/5/2021	XX	LTJRLXD8E	0.47 U				0.94 U								0.094 U	0.47 U	2.6 U
1/5/2021	XX	LTJRLXD8ERA2						0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U			
7/13/2021	XX	LTJRLXE29	0.47 U				0.93 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.093 U	0.47 U	2.6 U
10/26/2021	XX	LTJRLXED2	0.48 U				0.96 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.096 U	0.48 U	2.6 U
1/26/2022	XX	LTJRLXEJG	0.48 UH				0.95 UH	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.095 UH	0.48 UH	2.7 UH
5/26/2022	XX	LTJRLXF43															2.7 U
5/26/2022	XX	LTJRLXF43RA	0.47 U				0.93 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.093 U	0.47 U	
7/19/2022	XX	LTJRLXFE3															2.7 U
7/19/2022	XX	LTJRLXFE3RA	0.47 U				0.94 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.094 U	0.47 U	
10/4/2022	XX	LTJRLXG22						0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U			2.7 U
10/4/2022	XX	LTJRLXG22RA	0.47 U				0.93 U								0.093 U	0.47 U	
1/18/2023	XX	LTJRLXGBJ						0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U			2.7 U
1/18/2023	XX	LTJRLXGBJDL	2.3 U	0.47 U	0.23 U	0.23 U	4.7 U								0.47 U		
4/18/2023	XX	LTJRLXH25	0.5 U	0.1 U	0.05 U	0.05 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 U		2.8 U
7/11/2023	XX	LTJRLX024	0.47 U	0.093 U	0.047 U	0.047 U	0.93 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.093 U	0.47 U	2.6 U
10/3/2023	XX	LTJRLX09D	0.47 U	0.093 U	0.047 U	0.047 U	0.93 U								0.093 U	0.47 U	2.6 U
10/3/2023	XX	LTJRLX09DRA						0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U			
1/25/2024	XX	LTJRLX0G8	0.47 U	0.094 U	0.047 U	0.047 U	0.94 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.094 U	0.47 U	2.7 U
4/2/2024	XX	LTJRLX116	0.47 U	0.094 U	0.047 U	0.047 U	0.94 U								0.094 U	0.47 U	
4/2/2024	XX	LTJRLX116DL						2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U			
4/10/2024	XX	LTJRLX179															2.6 U
7/16/2024	XX	LTJRLX1H5	0.48 U	0.097 U	0.048 U	0.048 U	0.97 U								0.097 U	0.48 U	2.8 U
7/16/2024	XX	LTJRLX1H5RA						0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U			
10/8/2024	XX	LTJRLX1HG	0.47 U	0.094 U	0.047 U	0.047 U	0.94 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.094 U	0.47 U	2.7 U
11/14/2024	XX	LTJRLX28A															2.6 UL

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

UH - Not Detected above the laboratory reporting limit. Analyzed outside U.S.EPA's recommended hold time

UL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 13 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	2,4,5-Trichlorophenoxypropionic Acid ug/L	2,4,5-Trichlorophenoxyacetic acid ug/L	Diallate ug/L	Isodrin ug/L	Kepone ug/L	Dimethoate ug/L	Chlorobenzilate ug/L	Disulfoton ug/L	Famphur ug/L	Methyl Parathion ug/L	Parathion ug/L	Phorate ug/L	Thionazin ug/L	o,o,o-Triethyl phosphorothioate ug/L	Dalapon ug/L
2/25/2020	XX	LTJRLXC9D	2.7 U	2.7 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	28 U	9.5 U	24 U	9.5 U	19 U	9.5 U	
2/25/2020	XX	LTJRLXC9DRE2	2.7 U	2.7 U													
7/21/2020	XX	LTJRLXCGG	2.7 U	2.6 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	28 U	9.4 U	24 U	9.4 U	19 U	9.4 U	
1/5/2021	XX	LTJRLXD8E	2.7 U	2.6 U													
1/5/2021	XX	LTJRLXD8ERE			9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	28 U	9.4 U	24 U	9.4 U	19 U	9.4 U	
7/13/2021	XX	LTJRLXE29	2.7 U	2.6 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	28 U	9.5 U	24 U	9.5 U	19 U	9.5 U	
10/26/2021	XX	LTJRLXED2	2.7 U	2.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	29 U	9.6 U	24 U	9.6 U	19 U	9.6 U	
1/26/2022	XX	LTJRLXEJG	2.7 UH	2.7 UH	9.5 UH	9.5 UH	24 UH	9.5 UH	9.5 UH	9.5 UH	28 UH	9.5 UH	24 UH	9.5 UH	19 UH	9.5 UH	
5/26/2022	XX	LTJRLXF43	2.8 U	2.8 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	28 U	9.5 U	24 U	9.5 U	19 U	9.5 U	
5/26/2022	XX	LTJRLXF43DL			19 U	19 U	48 U	19 U	19 U	19 U	57 U	19 U	48 U	19 U	38 U	19 U	
7/19/2022	XX	LTJRLXFE3	2.7 U	2.7 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	28 U	9.3 U	23 U	9.3 U	19 U	9.3 U	
10/4/2022	XX	LTJRLXG22	2.7 U	2.7 U	9.3 U	9.3 U		9.3 U	9.3 U	9.3 U		9.3 U	23 U	9.3 U	19 U	9.3 U	
1/18/2023	XX	LTJRLXGBJ	2.7 U	2.7 U													4.3 U
1/18/2023	XX	LTJRLXGBJDL			47 U	47 U	120 U	47 U	47 U	47 U	140 U	47 U	120 U	47 U	94 U	47 U	
4/18/2023	XX	LTJRLXH25	2.8 U	2.8 U	10 U	10 U	25 U	10 U	10 U	10 U	30 U	10 U	25 U	10 U	20 U	10 U	
7/11/2023	XX	LTJRLX024	2.7 U	2.6 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	28 U	9.3 U	23 U	9.3 U	19 U	9.3 U	
10/3/2023	XX	LTJRLX09D	2.7 U	2.6 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	28 U	9.3 U	23 U	9.3 U	19 U	9.3 U	
1/25/2024	XX	LTJRLX0G8	2.7 U	2.7 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	29 U	9.6 U	24 U	9.6 U	19 U	9.6 U	
4/2/2024	XX	LTJRLX116			9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	28 U	9.4 U	24 U	9.4 U	19 U	9.4 U	
4/10/2024	XX	LTJRLX179	2.7 U	2.6 U													
7/16/2024	XX	LTJRLX1H5	2.8 U	2.8 U	9.8 U	9.8 U	24 ULL	9.8 U	9.8 U	9.8 U	29 ULL	9.8 U	24 U	9.8 U	20 U	9.8 U	
10/8/2024	XX	LTJRLX1HG	2.7 U	2.7 U	9.4 U	9.4 U	24 ULL	9.4 U	9.4 U	9.4 U	28 ULL	9.4 U	24 U	9.4 U	19 U	9.4 U	
11/14/2024	XX	LTJRLX28A	2.7 U	2.7 U													

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

UH - Not Detected above the laboratory reporting limit. Analyzed outside U.S.EPA's recommended hold time

ULL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 14 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE)			Dicamba ug/L	Dichloroprop ug/L	MCPA ug/L	MCPP ug/L	2,4-DB ug/L	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L
Date	Type	Sample ID															
2/25/2020	XX	LTJRLXC9D						0.17	0.018	0.36	1.4	0.0006 U	0.005	320	0.14	0.01 U	0.003 U
4/28/2020	XX	LTJRLXCE9								0.28	0.95		0.0036	250	0.1		0.003 U
7/21/2020	XX	LTJRLXCGG						0.27	0.039	0.36	1.7	0.0006 U	0.0066	320	0.15	0.01 U	0.003 U
10/27/2020	XX	LTJRLXD45								0.3	1.3		0.014	320	0.13		0.015 U
1/5/2021	XX	LTJRLXD8E						0.3	0.007	0.24	1.1	0.0006 U	0.003	240	0.1	0.01 U	0.003 U
4/6/2021	XX	LTJRLXDD8								0.22	1		0.003	250	0.093		0.003 U
7/13/2021	XX	LTJRLXE29						0.42	0.022	0.38	1.2	0.0006 U	0.0049	240	0.16	0.01 U	0.003 U
10/26/2021	XX	LTJRLXED2						0.59	0.019	0.53	1.2	0.0006 U	0.0066	210	0.27	0.012	0.003 U
1/26/2022	XX	LTJRLXEJG						0.27	0.01	0.32	1.3	0.0041	0.01	250	0.15	0.02 U	0.018
5/26/2022	XX	LTJRLXF43						0.53	0.01 U	0.33	0.86	0.0006 U	0.0052	270	0.19	0.014	0.008
7/19/2022	XX	LTJRLXFE3						0.45	0.011	0.42	1.1	0.0006 U	0.0053	210	0.24	0.01	0.003 U
10/4/2022	XX	LTJRLXG22						0.54	0.019	0.37	1.1	0.0006 U	0.0081	250	0.2	0.016	0.003
1/18/2023	XX	LTJRLXGBJ	2.8 U	2.7 U	130 U	88 U	2.7 U	0.68	0.015	0.28	0.87	0.0006 U	0.0031	260	0.15	0.01 U	0.005
4/18/2023	XX	LTJRLXH25						0.81	0.017	0.42	1.2	0.0006 U	0.0052	250	0.26	0.01	0.003 U
7/11/2023	XX	LTJRLX024						0.89	0.02	0.35	0.97	0.0006 U	0.0046	290	0.28	0.01 U	0.004
10/3/2023	XX	LTJRLX09D						0.54	0.014	0.31	0.89	0.0012 U	0.0046	280	0.23	0.02 U	0.055
1/25/2024	XX	LTJRLX0G8						0.76	0.054	0.43	1.2	0.0012 U	0.024	300	0.31	0.02 U	0.014
4/2/2024	XX	LTJRLX116						0.89	0.026	0.2	0.64	0.001 U	0.0024	420	0.13	0.01 U	0.031
5/30/2024	XX	LTXXXX17G							0.025								0.1
7/16/2024	XX	LTJRLX1H5						0.53	0.021	0.33	0.96	0.001 U	0.0053	250	0.23	0.01 U	0.082
10/8/2024	XX	LTJRLX1HG						0.55	0.059	0.4	1.1	0.001 U	0.0065	320	0.28	0.01 U	0.003

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER
ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 15 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(JRL LEACHATE)			Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Molybdenum	Tin
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Date	Type	Sample ID															
JRL LEACHATE																	
2/25/2020	XX	LTJRLXC9D	5.4	0.006	310	1.7	0.0000719	0.048	1100	0.024	0.001 U	2600	0.007	0.045	0.015	0.015 U	0.015 U
4/28/2020	XX	LTJRLXCE9	6	0.003 U	210	1.6	0.0000226	0.032	750	0.022	0.001 U	1700		0.038	0.033	0.015 U	
7/21/2020	XX	LTJRLXCGG	3.6	0.003 U	330	1.4	0.0000103	0.04	1300	0.024	0.001 U	2800	0.004 U	0.054	0.007	0.015 U	0.015 U
10/27/2020	XX	LTJRLXD45	7.2	0.015 U	260	14	0.000001 U	0.026	1100	0.085	0.008	2300		0.09	0.039	0.075 U	
1/5/2021	XX	LTJRLXD8E	6.2	0.005	220	5.4	0.000037	0.029	920	0.011	0.001 U	2000	0.004 U	0.04	0.005 U	0.015 U	0.015
4/6/2021	XX	LTJRLXDD8	5.2	0.003 U	190	3.1	0.0000062	0.023	770	0.008	0.001 U	1700		0.036	0.013	0.015 U	
7/13/2021	XX	LTJRLXE29	5.3	0.004	230	2.2	0.0000774	0.034	980	0.013	0.001 U	2200	0.004 U	0.045	0.015	0.015 U	0.015 U
10/26/2021	XX	LTJRLXED2	4.3	0.003 U	220	2.3	0.0000306	0.041	950	0.014	0.001 U	2200	0.004 U	0.068	0.011	0.015 U	0.015 U
1/26/2022	XX	LTJRLXEJG	8.3	0.014	240	2.8	0.000005 U	0.032	1100	0.036	0.003	2600	0.01	0.055	0.052	0.03 U	0.041
5/26/2022	XX	LTJRLXF43	8.1	0.018	240	18	0.0000025 U	0.043	1100	0.011	0.0027	2300	0.004 U	0.04	0.041	0.015 U	0.015 U
7/19/2022	XX	LTJRLXFE3	5.2	0.003 U	220	2.1	0.0000005 UP	0.053	960	0.0062	0.005 U	2400	0.08 U	0.061	0.0068	0.015 U	0.016
10/4/2022	XX	LTJRLXG22	6.9	0.006 U	200	2.8	0.0000025 U	0.23	1100	0.0085	0.001 U	2500	0.004 U	0.12	0.016	0.015 U	0.015 U
1/18/2023	XX	LTJRLXGBJ	5.8	0.0052	190	2.5	0.0000025 U	0.045	780	0.005 U	0.001 U	1700	0.004 U	0.035	0.015	0.015 U	0.015 U
4/18/2023	XX	LTJRLXH25	2.8	0.01	190	1.7	0.0000025 U	0.054	1100	0.012	0.001 U	2500	0.004 U	0.052	0.013	0.018	0.015
7/11/2023	XX	LTJRLX024	2.3	0.0067	180	1.9	0.0000005 U	0.064	950	0.0089	0.001 U	2300	0.004 U	0.058	0.036	0.015 U	0.015 U
10/3/2023	XX	LTJRLX09D	7.9	0.006 U	180	5.8	0.0000005 U	0.043	700	0.012	0.002 U	1900	0.008 U	0.062	0.016	0.03 U	0.03 U
1/25/2024	XX	LTJRLX0G8	4.7	0.051	200	3.1	0.0000005 U	0.069	870	0.021	0.0032	2100	0.008 U	0.063	0.054	0.03 U	0.03 U
4/2/2024	XX	LTJRLX116	5.8	0.0074	150	3.7	0.0000005 U	0.036	520	0.005 U	0.001 U	1200	0.004 U	0.031	0.053	0.015 U	0.015 U
5/30/2024	XX	LTXXXX17G											0.004 U				0.015 U
7/16/2024	XX	LTJRLX1H5	3.4	0.01	170	1.9	0.0000005 U	0.053	730	0.021	0.001 U	1800	0.004 U	0.049	0.024	0.015 U	0.015 U
10/8/2024	XX	LTJRLX1HG	3.3	0.0044	190	1.8	0.0000005 U	0.062	870	0.017	0.001 U	2200	0.008 U	0.056	0.037	0.015 U	0.16

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

UP - Non detect. Sample was received above appropriate pH for the low-level mercury analysis. The lab added additional HCL; however, the pH would not adjust into the proper range.

REPORT PREPARED: 1/15/2025 14:44
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 16 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

Date	Type	Sample ID	Total Kjeldahl Nitrogen mg/L	Ammonia (N) mg/L	Nitrate (N) mg/L	Organic Nitrogen mg/L	Total Phosphorus mg/L	Total Dissolved Solids mg/L	Total Suspended Solids mg/L	Sulfate mg/L	Sulfide mg/L	Ca-mg Hardness (CaCO3) mg/L	Bicarbonate Alkalinity (CaCO3) mg/L	Alkalinity (CaCO3) mg/L	Organic Carbon mg/L	Biochemical Oxygen Demand mg/L	Chemical Oxygen Demand mg/L
2/25/2020	XX	LTJRLXC9D	980	820	260	160		13676	22	6300	13	2100	3200	3200	570	400	2600
4/28/2020	XX	LTJRLXCE9	710	580		130	1.4	9700	24	400 U		1500		2300		200	1700
7/21/2020	XX	LTJRLXCGG	960	880	60 U	80		16140	6	400 U	24	2200	3100	3100	500	170	2600
10/27/2020	XX	LTJRLXD45	890	690		200	1.3	10340	26	140		1900		2700		660	2500
1/5/2021	XX	LTJRLXD8E	720	650	60 U	70		11460	16	400 U	12	1500	2700	2700	380		2100
1/26/2021	XX	LTJRLXDA1														250	
4/6/2021	XX	LTJRLXDD8	600	570		50 U	1.1	10080	13	1900		1400		2300		150	1700
7/13/2021	XX	LTJRLXE29	810	760	75 U	50		11830	9	500 U	15	1500	2900	2900	510	250	2400
10/26/2021	XX	LTJRLXED2	910	750	60 U	160		12240	15	400 U	19	1400	3300	3300	430	210	2500
1/26/2022	XX	LTJRLXEJG	920	810	60 U	110		13000	14	400 U	0.63	1600	3100	3100	400	95	2400
5/26/2022	XX	LTJRLXF43	970	720	30 U	250		12600	52	200 U	1.6	1700	3300	3300	420	140	2000
7/19/2022	XX	LTJRLXFE3	980	830	7.5 U	150		13060	10	8.7	29	1400	3500	3500	400	150	2500
10/4/2022	XX	LTJRLXG22	950	710	15 U	240		11000	6.4	53	18	1400	3100	3100	380	110	2200
1/18/2023	XX	LTJRLXGBJ	700	540	15 U	160		9110	7	250	4.8	1400	2500	2500	390	100	1600
4/18/2023	XX	LTJRLXH25	930	730	3 U	200		11700	14	82	18	1400	3300	3300	510	230	2100
7/11/2023	XX	LTJRLX024	960	690	15 U	270		12450	8	81	26	1500	3300	3300	470	180	2100
10/3/2023	XX	LTJRLX09D	860	650	3 U	210		9580	2.5 U	47	35	1500	3400	3400	500	200	2300
1/25/2024	XX	LTJRLX0G8	810	630	6 U	180		10450	8.3 U	44	24.5	1600	3400	3400	460	200	1800
4/2/2024	XX	LTJRLX116	490	350	3 U	140		6820	8.3 U	330	0.1 U	1700	2400	2400	430	360	1500
5/30/2024	XX	LTXXXX17G														120	
7/16/2024	XX	LTJRLX1H5	770	620	6 U	150		9720	25 U	67	27	1300	3200	3200	400	140	2100
10/8/2024	XX	LTJRLX1HG	1100	820	3 U	280		12880	8.3 U	30	12	1600	3800	3800	500	140	2000

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes:

Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 17 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	Chloride mg/L	Bromide mg/L	Cyanide ug/L	Oil & grease mg/L	Turbidity (field) NTU	2-Acetyl aminofluorene ug/L	4-Aminobiphenyl ug/L	2-sec-Butyl-4-6-dinitrophenol (Dinoseb) ug/L	3,3'-Dimethyl benzidine ug/L	1,3-Dinitro benzene (m-Dinitrobenzene) ug/L	Ethyl methanesulfonate ug/L	Hexa chloropropene ug/L	Isosafrole ug/L	Methapyrilene ug/L	3-Methyl cholanthrene ug/L
2/25/2020	XX	LTJRLXC9D	15000	92	52	4.2 U	D3	9.5 U	9.5 U	4.4 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
2/25/2020	XX	LTJRLXC9DRE2								4.4 U							
4/28/2020	XX	LTJRLXCE9	5300		5 U	4.2 U	D3										
7/21/2020	XX	LTJRLXCGG	8200	100	5 U	4.2 U	D3	9.4 U	9.4 U	4.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
10/27/2020	XX	LTJRLXD45	6900		5 U	4.5	743										
1/5/2021	XX	LTJRLXD8E	5500	59	5 U	4.8	D3			4.4 U							
1/5/2021	XX	LTJRLXD8ERE						9.4 U	9.4 U		24 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
1/26/2021	XX	LTJRLXDA1					D3										
4/6/2021	XX	LTJRLXDD8	10000		5 U	4.2 U	D3										
7/13/2021	XX	LTJRLXE29	6900	74	640	4.2 U	D3	9.5 U	9.5 U	4.4 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
10/26/2021	XX	LTJRLXED2	5500	56	630	4.2 U	D3	9.6 U	9.6 U	4.4 U	24 U	9.6 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U
1/26/2022	XX	LTJRLXEJG	5000	61	240	4.2 U	D3	9.5 U	9.5 U	4.5 UH	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
5/26/2022	XX	LTJRLXF43	5700	69	440	7.5	D3	9.5 U	9.5 U	4.6 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
5/26/2022	XX	LTJRLXF43DL						19 U	19 U		48 U	19 U	19 U	19 U	19 U	48 U	19 U
7/19/2022	XX	LTJRLXFE3	5000	85	650	4.2 U	D3	9.3 U	9.3 U	4.4 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
10/4/2022	XX	LTJRLXG22	5700	78	300	4.2 U		9.3 U	9.3 U	4.4 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
1/18/2023	XX	LTJRLXGBJ	4200	54	220	4.2 U	D3			4.4 U							
1/18/2023	XX	LTJRLXGBJDL						47 U	47 U		120 U	47 U	47 U	47 U	47 U	120 U	47 U
4/18/2023	XX	LTJRLXH25	5000	72	540	4.2 U	D3	10 U	10 U	4.7 U	25 U	10 U	10 U	10 U	10 U	25 U	10 U
7/11/2023	XX	LTJRLX024	5100	69	470	4.2 U	67.5	9.3 U	9.3 U	4.4 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
10/3/2023	XX	LTJRLX09D	4300	57	580	4.2 U	D3	9.3 U	9.3 U	4.4 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
1/25/2024	XX	LTJRLX0G8	4400	56	320	4.2 U	D3	9.6 U	9.6 U	4.4 U	24 U	9.6 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U
4/2/2024	XX	LTJRLX116	2400	30	730	4.2 U	D3	9.4 U	9.4 U		24 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
4/10/2024	XX	LTJRLX179					D3			4.4 U							
7/16/2024	XX	LTJRLX1H5	4100	59	720	5	D3	9.8 U	9.8 U	4.7 U	24 UL	9.8 U	9.8 U	9.8 U	9.8 U	24 U	9.8 U
7/18/2024	XX	LTJRLX1HA					D3										
10/8/2024	XX	LTJRLX1HG	5700	69	500 U	4 U	D3	9.4 U	9.4 U	4.5 ULL	24 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
11/14/2024	XX	LTJRLX28A					D3			4.4 ULL							

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(JRL LEACHATE)			Chloride	Bromide	Cyanide	Oil & grease	Turbidity (field)	2-Acetyl aminofluorene	4-Aminobiphenyl	2-sec-Butyl-4-6-dinitrophenol (Dinoseb)	3,3'-Dimethyl benzidine	1,3-Dinitro benzene (m-Dinitrobenzene)	Ethyl methanesulfonate	Hexa chloropropene	Isosafrole	Methapyrilene	3-Methyl cholanthrene
Date	Type	Sample ID	mg/L	mg/L	ug/L	mg/L	NTU	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER
NTU - NEPHELOMETRIC TURBIDITY UNIT (TURBIDITY)
ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

D3 - Sample too dark to take reading.
U - Not Detected above the laboratory reporting limit.
UH - Not Detected above the laboratory reporting limit. Analyzed outside U.S.EPA's recommended hold time
UL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.
ULL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 18 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	Methyl methane sulfonate ug/L	1-Naphthalene amine (1-Naphthyl amine) ug/L	2-Naphthalene amine (2-Naphthyl amine) ug/L	1,4-Naphtho quinone ug/L	5-Nitro-o-toluidine ug/L	N-Nitroso diethylamine ug/L	N-Nitrosodi-n-butylamine ug/L	N-Nitrosomethyl ethylamine ug/L	N-Nitroso piperidine ug/L	N-Nitroso pyrrolidine ug/L	Pentachloro benzene ug/L	Pentachloro nitrobenzene ug/L	Phenacetin ug/L	p-Phenylene diamine ug/L	Pronamide ug/L
2/25/2020	XX	LTJRLXC9D	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
7/21/2020	XX	LTJRLXCGG	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
1/5/2021	XX	LTJRLXD8ERE	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
7/13/2021	XX	LTJRLXE29	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
10/26/2021	XX	LTJRLXED2	9.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U
1/26/2022	XX	LTJRLXEJG	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
5/26/2022	XX	LTJRLXF43	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U
5/26/2022	XX	LTJRLXF43DL	19 U	19 U	19 U	48 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	19 U	48 U	19 U
7/19/2022	XX	LTJRLXFE3	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
10/4/2022	XX	LTJRLXG22	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
1/18/2023	XX	LTJRLXGBJDL	47 U	47 U	47 U	120 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	47 U	120 U	47 U
4/18/2023	XX	LTJRLXH25	10 U	10 U	10 U	25 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	25 U	10 U
7/11/2023	XX	LTJRLX024	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
10/3/2023	XX	LTJRLX09D	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U
1/25/2024	XX	LTJRLX0G8	9.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	9.6 U	24 U	9.6 U
4/2/2024	XX	LTJRLX116	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U
7/16/2024	XX	LTJRLX1H5	9.8 U	9.8 U	9.8 U	24 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	9.8 U	24 ULL	9.8 U
10/8/2024	XX	LTJRLX1HG	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	24 ULL	9.4 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

ULL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

DATA SUMMARY TABLE

JRL Leachate - All Parameters Group 19 of 19

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

JRL LEACHATE

(JRL LEACHATE) Date	Type	Sample ID	1,2,4,5-Tetrachloro benzene ug/L	1,3,5-Trinitro benzene (sym-Trinitrobenzene) ug/L	Safrole ug/L	O-Toluidine ug/L	p-(Dimethyl amino) azobenzene ug/L	7,12-Dimethylbenz (a)anthracene ug/L	Acetophenone ug/L							
2/25/2020	XX	LTJRLXC9D	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	17							
7/21/2020	XX	LTJRLXCGG	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U							
1/5/2021	XX	LTJRLXD8ERE	9.4 U	24 U	9.4 U	24 U	9.4 U	9.4 U	11							
7/13/2021	XX	LTJRLXE29	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U							
10/26/2021	XX	LTJRLXED2	9.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	9.6 U							
1/26/2022	XX	LTJRLXEJG	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U							
5/26/2022	XX	LTJRLXF43	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U							
5/26/2022	XX	LTJRLXF43DL	19 U	19 U	19 U	48 U	19 U	19 U	19 U							
7/19/2022	XX	LTJRLXFE3	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U							
10/4/2022	XX	LTJRLXG22	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U							
1/18/2023	XX	LTJRLXGBJDL	47 U	47 U	47 U	120 U	47 U	47 U	47 U							
4/18/2023	XX	LTJRLXH25	10 U	10 U	10 U	25 U	10 U	10 U	11							
7/11/2023	XX	LTJRLX024	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U							
10/3/2023	XX	LTJRLX09D	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U							
1/25/2024	XX	LTJRLX0G8	9.6 U	9.6 U	9.6 U	24 U	9.6 U	9.6 U	13							
4/2/2024	XX	LTJRLX116	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4							
7/16/2024	XX	LTJRLX1H5	9.8 U	9.8 U	9.8 U	24 U	9.8 U	9.8 U	9.8 U							
10/8/2024	XX	LTJRLX1HG	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U							

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

REPORT PREPARED: 5/12/2025 06:49
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

Leachate - Field Data

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)

Date	Type	Sample ID	Specific Conductance µmhos/cm @25°C	pH STU	Temperature Deg C	Eh mV	Dissolved Oxygen mg/L	Turbidity (field) NTU	Flow Rate cfs								
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	17490	6.6	12.6	-20	2.8	D3									
7/21/2020	XX	LTC4LXCHB	25800	5.9	29	-311	1.1	D3									
10/27/2020	XX	LTC4LXD2F	21900	7.5	12.8	-299	D2	741									
4/6/2021	XX	LTC4LXDBH	17300	7.4	13	52	2.2	D3									
7/13/2021	XX	LTC4LXDJ9	21200	7.2	23.9	-71	0.5	D3									
10/5/2021	XX	LTC4LXE5H	18480	7.2	25.1	-41	0.9	4.4									
5/26/2022	XX	LTC4LXF09	18909	7.5	22.1	46	0.2	D3									
7/19/2022	XX	LTC4LXF87	22260	6.8	26.4	-98	FK	D3									
10/4/2022	XX	LTC4LXFI8	21263	6.7	16.3	-62	0.3	D3	0.0071								
4/18/2023	XX	LTC4LXGHJ	20000	7.5	13.1	-113	1.3	D3	0.0071								
7/11/2023	XX	LTC4LXH81	19380	7.1	25.2	-135	0.3	66.5	0.0071								
10/2/2023	XX	LTC4LX059	17673	6.8	23.4	-108	0.1	D3	0.0071								
4/2/2024	XX	LTC4LX11J	12151	7.1	13.5	-39	0.4	D3	0.0071								
7/16/2024	XX	LTC4LX1D1	18034	7	27.5	-40	0.5	D3	0.0071								
7/18/2024	XX	LTC4LX1H9	19800	6.9	31.9	-50	0.1	D3	0.0071								
10/8/2024	XX	LTC4LX1IC	22146	6.8	19.6	-46	0.1	D3	0.0071								

Units Abbreviations:

µmhos/cm @25°C - MICROSIEMENS PER CENTIMETER
cfs - CUBIC FEET PER SECOND
Deg C - DEGREES CELCIUS (TEMPERATURE)
mg/L - MILLIGRAMS PER LITER
mV - MILLIVOLTS
NTU - NEPHELOMETRIC TURBIDITY UNIT (TURBIDITY)
STU - STANDARD PH UNIT

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

D2 - Sample too dark to read D.O. reading.
D3 - Sample too dark to take reading.
FK - Outside range of available field kits.

REPORT PREPARED: 5/12/2025 06:49
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

Leachate - Inorganics

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

Date	Type	Sample ID	Total Kjeldahl Nitrogen mg/L	Ammonia (N) mg/L	Nitrate (N) mg/L	Total Dissolved Solids mg/L	Total Suspended Solids mg/L	Sulfate mg/L	Sulfide mg/L	Ca-mg Hardness (CaCO3) mg/L	Bicarbonate Alkalinity (CaCO3) mg/L	Alkalinity (CaCO3) mg/L	Organic Carbon mg/L	Biochemical Oxygen Demand mg/L	Nitrite/Nitrate - (N) mg/L	Chemical Oxygen Demand mg/L	
4/28/2020	XX	LTC4LXCCI	730	590	210	10160	48	1300	16	1700	2400	2400	880	200		1700	
7/21/2020	XX	LTC4LXCHB	780			14610	8	2000			3100		500		0.2		
10/27/2020	XX	LTC4LXD2F	660			10940	29	120			2700		1100 M10		0.05 U		
4/6/2021	XX	LTC4LXDBH	710	600	310	9970	7	1600	4.5	1300	2300	2300	330	150		1700	
7/13/2021	XX	LTC4LXDJ9	660			12000	7	500 U			2900		520		0.3 U		
10/5/2021	XX	LTC4LXE5H	890			11040	4.5	32			2800		450		0.05 U		
5/26/2022	XX	LTC4LXF09	970	750	30 U	12340	40	200 U	3.5	1500	3300	3300	430	150		2300	
7/19/2022	XX	LTC4LXF87	990			13120	8	20 U			3500		470		0.2 U		
10/4/2022	XX	LTC4LXFI8	1000			11000	16	50			3100		370		0.15		
4/18/2023	XX	LTC4LXGHJ	940	720	7.5 U	11760	10	78	18	1500	3300	3300	530	220		2200	
7/11/2023	XX	LTC4LXH81	910			12160	10	100 U			3300		480		0.3 U		
10/2/2023	XX	LTC4LX059	810			10010	2.5 U	43			3400		490		0.3 U		
4/2/2024	XX	LTC4LX11J	490			6930	8.3 U	330			2400		580		0.082		
7/16/2024	XX	LTC4LX1D1	720	630	6 U	9590	25 U	70	22	1400	3200	3200	420	160		2000	
10/8/2024	XX	LTC4LX1IC	1100			12710	8.3 U	32			390		490		0.3 U		

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

M10 - Due to a identified laboratory instrumentation malfunction, this analytical result is likely elevated–the laboratory has fixed the issue.
U - Not Detected above the laboratory reporting limit.

REPORT PREPARED: 5/12/2025 06:50
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

Leachate - Metal Parameters Group 1 of 2

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

Date	Type	Sample ID	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L
4/28/2020	XX	LTC4LXCCI	0.54	0.005 U	0.25	0.94	0.0006 U	0.0053	300	0.1	0.01 U	0.003 U	6	0.003 U	220	1.7	0.0005 U
7/21/2020	XX	LTC4LXCHB			0.33				310				3.5		340	1.3	
10/27/2020	XX	LTC4LXD2F			0.24				310				7.5		250	14	
4/6/2021	XX	LTC4LXDBH	0.45	0.006	0.2	1.1	0.0033	0.025	240	0.13	0.044	0.093	5	0.035	170	3.1	0.0005 U
7/13/2021	XX	LTC4LXDJ9			0.35				240				5		210	2.2	
10/5/2021	XX	LTC4LXE5H			0.45				200				3.1		200	1.7	
5/26/2022	XX	LTC4LXF09	1.4	0.005 U	0.4	1	0.0012 U	0.0055	250	0.21	0.011	0.0059	12	0.006 U	200	16	Y
7/19/2022	XX	LTC4LXF87			0.42				230				5.8		230	2.2	
10/4/2022	XX	LTC4LXFI8			0.33				250				6.6		220	2.8	
4/18/2023	XX	LTC4LXGHJ	0.81	0.021	0.42	1.1	0.0006 U	0.0065	260	0.29	0.011	0.007	3.2	0.0035	210	1.8	0.0005 U
7/11/2023	XX	LTC4LXH81			0.43				290				2.9		200	2.1	
10/2/2023	XX	LTC4LX059			0.25				290				8.8		200	5.8	
4/2/2024	XX	LTC4LX11J			0.19				370				5.8		140	3.6	
7/16/2024	XX	LTC4LX1D1	0.53	0.035	0.24	0.9	0.001 U	0.0044	260	0.22	0.01	0.0072	4.2	0.027	190	2.2	0.0005 U
10/8/2024	XX	LTC4LX1IC			0.37				200				2.8		190	1.3	

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes:

Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.
Y - Laboratory error, results not available.

REPORT PREPARED: 5/12/2025 06:50
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

Leachate - Metal Parameters Group 2 of 2

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)

Date	Type	Sample ID	Nickel mg/L	Potassium mg/L	Selenium mg/L	Silver mg/L	Sodium mg/L	Thallium mg/L	Vanadium mg/L	Zinc mg/L	Tin mg/L						
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	0.035	790	0.022	0.001 U	1700	0.004 U	0.039	0.046	0.016						
7/21/2020	XX	LTC4LXCHB		1400			2800										
10/27/2020	XX	LTC4LXD2F		900			2000										
4/6/2021	XX	LTC4LXDBH	0.064	740	0.046	0.001 U	1600	0.025	0.031	0.051	0.015 U						
7/13/2021	XX	LTC4LXDJ9		930			2200										
10/5/2021	XX	LTC4LXE5H		870			2000										
5/26/2022	XX	LTC4LXF09	0.043	1100	0.0082	0.0026	2400	0.004 U	0.01 U	0.014	0.047						
7/19/2022	XX	LTC4LXF87		1100			2500										
10/4/2022	XX	LTC4LXFI8		1000			2100										
4/18/2023	XX	LTC4LXGHJ	0.071	1000	0.011	0.001 U	2500	0.004 U	0.056	0.053	0.015 U						
7/11/2023	XX	LTC4LXH81		1000			2400										
10/2/2023	XX	LTC4LX059		760			2000										
4/2/2024	XX	LTC4LX11J		500			1200										
7/16/2024	XX	LTC4LX1D1	0.054	820	0.0053	0.0013	2000	0.004 U	0.062	0.047	0.041						
10/8/2024	XX	LTC4LX1IC		890			2100										

Units Abbreviations:

mg/L - MILLIGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Pesticides, Herbicides and PCBs Group 1 of 3

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)

Date	Type	Sample ID	alpha-BHC ug/L	beta-BHC ug/L	delta-BHC ug/L	gamma-BHC (Lindane) ug/L	Heptachlor ug/L	Aldrin ug/L	Heptachlor Epoxide ug/L	Endosulfan I ug/L	Dieldrin ug/L	4,4'-DDE ug/L	Endrin ug/L	Endosulfan II ug/L	4,4'-DDD ug/L	Endosulfan Sulfate ug/L	4,4'-DDT ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U	0.093 U
4/6/2021	XX	LTC4LXDBH	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
5/26/2022	XX	LTC4LXF09RA	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
4/18/2023	XX	LTC4LXGHJ	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
7/16/2024	XX	LTC4LX1D1	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.047 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Pesticides, Herbicides and PCBs Group 2 of 3

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

(LT-C4L & LT-C4LR) Date	Type	Sample ID	Methoxychlor ug/L	Endrin Ketone ug/L	alpha-Chlordane ug/L	gamma-Chlordane ug/L	Toxaphene ug/L	Aroclor-1016 ug/L	Aroclor-1221 ug/L	Aroclor-1232 ug/L	Aroclor-1242 ug/L	Aroclor-1248 ug/L	Aroclor-1254 ug/L	Aroclor-1260 ug/L	Endrin Aldehyde ug/L	Chlordane (technical) ug/L	2,4-Dichlorophenoxyacetic Acid ug/L
4/28/2020	XX	LTC4LXCCI	0.47 U				0.93 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.093 U	0.47 U	2.6 U
4/28/2020	XX	LTC4LXCCIRE															2.7 U
4/6/2021	XX	LTC4LXDBH	0.47 U				0.94 U								0.094 U	0.47 U	2.6 U
4/6/2021	XX	LTC4LXDBHRA						0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U			
5/26/2022	XX	LTC4LXF09															2.7 U
5/26/2022	XX	LTC4LXF09RA	0.47 U				0.94 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.094 U	0.47 U	
4/18/2023	XX	LTC4LXGHJ	0.5 U	0.1 U	0.05 U	0.05 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 U		2.8 U
7/16/2024	XX	LTC4LX1D1	0.47 U	0.095 U	0.047 U	0.047 U	0.95 U								0.095 U	0.47 U	2.7 U
7/16/2024	XX	LTC4LX1D1RA						0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U	0.47 U			

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Pesticides, Herbicides and PCBs Group 3 of 3

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

(LT-C4L & LT-C4LR) Date	Type	Sample ID	2,4,5-Trichlorophenoxypropionic Acid ug/L	2,4,5-Trichlorophenoxyacetic acid ug/L	Diallate ug/L	Isodrin ug/L	Kepone ug/L	Dimethoate ug/L	Chlorobenzilate ug/L	Disulfoton ug/L	Famphur ug/L	Methyl Parathion ug/L	Parathion ug/L	Phorate ug/L	Thionazin ug/L	o,o,o-Triethyl phosphorothioate ug/L	2-sec-Butyl-4-6-dinitrophenol (Dinoseb) ug/L
4/28/2020	XX	LTC4LXCCI	2.7 U	2.6 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	28 U	9.5 U	24 U	9.5 U	19 U	9.5 U	4.4 U
4/28/2020	XX	LTC4LXCCIRE	2.7 U	2.7 U													4.4 U
4/6/2021	XX	LTC4LXDBH	2.7 U	2.6 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	28 U	9.4 U	24 U	9.4 U	19 U	9.4 U	4.4 U
5/26/2022	XX	LTC4LXF09	2.7 U	2.7 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	28 U	9.3 U	23 U	9.3 U	19 U	9.3 U	4.4 U
5/26/2022	XX	LTC4LXF09DL			19 U	19 U	47 U	19 U	19 U	19 U	56 U	19 U	47 U	19 U	37 U	19 U	
4/18/2023	XX	LTC4LXGHJ	2.8 U	2.8 U	10 U	10 U	25 U	10 U	10 U	10 U	30 U	10 U	25 U	10 U	20 U	10 U	4.7 U
7/16/2024	XX	LTC4LX1D1	2.7 U	2.7 U	9.5 U	9.5 U	24 ULL	9.5 U	9.5 U	9.5 U	28 ULL	9.5 U	24 U	9.5 U	19 U	9.5 U	4.5 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

ULL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 1 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Phenol	Bis (2-Chloroethyl) ether	2-Chlorophenol	1,3-Dichloro benzene (SVOC)	1,4-Dichloro benzene (SVOC)	Benzyl Alcohol	1,2-Dichloro benzene (SVOC)	2-Methylphenol	Bis(2-Chloroiso propyl) ether	N-Nitroso-di-n-propylamine	Hexachloro ethane	Nitrobenzene	Isophorone	2-Nitrophenol	2,4-Dimethyl phenol
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI		9.5 U	9.5 U	9.5 U	9.5 U	19 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
4/28/2020	XX	LTC4LXCCIDL	190														
4/6/2021	XX	LTC4LXDBH		9.4 U	9.4 U	9.4 U	9.4 U	19 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U
4/6/2021	XX	LTC4LXDBHDL	200														
5/26/2022	XX	LTC4LXF09		9.3 U	9.3 U	9.3 U	9.3 U	19 U	9.3 U	11	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
5/26/2022	XX	LTC4LXF09DL	94														
4/18/2023	XX	LTC4LXGHJ		10 U	10 U	10 U	10 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4/18/2023	XX	LTC4LXGHJDL	84														
7/16/2024	XX	LTC4LX1D1	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	19 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 2 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Bis(2-Chloroethoxy)methane	2,4-Dichlorophenol	1,2,4-Trichlorobenzene (SVOC)	Naphthalene (SVOC)	4-Chloroaniline	Hexachlorobutadiene (SVOC)	4-Chloro-3-Methylphenol	2-Methylnaphthalene	Hexachlorocyclopentadiene	2,4,6-Trichlorophenol	2,4,5-Trichlorophenol	2-Chloronaphthalene	2-Nitroaniline	Dimethyl Phthalate	Acenaphthylene
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	9.5 U	9.5 U	9.5 U	20	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	24 U	9.5 U	9.5 U
4/6/2021	XX	LTC4LXDBH	9.4 U	9.4 U	9.4 U	17	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	24 U	9.4 U	9.4 U
5/26/2022	XX	LTC4LXF09	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	23 U	9.3 U	9.3 U
4/18/2023	XX	LTC4LXGHJ	10 U	10 U	10 U	16	10 U	10 U	10 U	10 U	10 U	10 U	25 U	10 U	25 U	10 U	10 U
7/16/2024	XX	LTC4LX1D1	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 UL	9.5 U	9.5 U	9.5 U	24 U	9.5 ULL	24 U	9.5 U	9.5 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

UL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

ULL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

REPORT PREPARED: 5/12/2025 08:43
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 3 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR) Date	Type	Sample ID	2,6-Dinitrotoluene ug/L	3-Nitroaniline ug/L	Acenaphthene ug/L	2,4-Dinitrophenol ug/L	4-Nitrophenol ug/L	Dibenzofuran ug/L	2,4-Dinitrotoluene ug/L	Diethyl phthalate ug/L	4-Chlorophenyl-phenylether ug/L	Fluorene ug/L	4-Nitroaniline ug/L	4,6-Dinitro-2-methylphenol ug/L	N-Nitroso diphenylamine ug/L	4-Bromophenyl-phenylether ug/L	Hexachloro benzene ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	9.5 U	24 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U
4/6/2021	XX	LTC4LXDBH	9.4 U	24 U	9.4 U	24 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	24 U	9.4 U	9.4 U	9.4 U
5/26/2022	XX	LTC4LXF09	9.3 U	23 U	9.3 U	23 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	23 U	9.3 U	9.3 U	9.3 U
4/18/2023	XX	LTC4LXGHJ	10 U	25 U	10 U	25 U	25 U	10 U	10 U	10 U	10 U	10 U	25 U	25 U	10 U	10 U	10 U
7/16/2024	XX	LTC4LX1D1	9.5 U	24 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	24 U	9.5 U	9.5 U	9.5 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 4 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Pentachlorophenol	Phenanthrene	Anthracene	Di-n-butylphthalate	Fluoranthene	Pyrene	Butylbenzyl phthalate	3,3-Dichloro benzidine	Benzo(a) Anthracene	Chrysene	Bis(2-Ethylhexyl) phthalate	Di-n-octylphthalate	Benzo(b) Fluoranthene	Benzo(k) Fluoranthene	Benzo(a) Pyrene
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
4/6/2021	XX	LTC4LXDBH	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U
5/26/2022	XX	LTC4LXF09	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
4/18/2023	XX	LTC4LXGHJ	25 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
7/16/2024	XX	LTC4LX1D1	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 UL	9.5 U	9.5 UL	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample

Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

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UL - Not Detected above the laboratory reporting limit. Flagged compound did not meet DoD criteria in the LCS and/or LCSD prepared and/or analyzed concurrently with the sample. The laboratory's policy is to qualify with these qualifiers regardless of whether it is a Department of Defense job.

DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 5 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

(LT-C4L & LT-C4LR) Date	Type	Sample ID	Indeno(1,2,3-c,d) Pyrene ug/L	Dibenz(a,h) Anthracene ug/L	Benzo(g,h,i) perylene ug/L	N-Nitroso dimethylamine ug/L	2,3,4,6-Tetrachloro phenol ug/L	2,6-Dichlorophenol ug/L	3&4-Methylphenol ug/L	2-Acetyl aminofluorene ug/L	4-Aminobiphenyl ug/L	3,3'-Dimethyl benzidine ug/L	1,3-Dinitro benzene (m-Dinitrobenzene) ug/L	Ethyl methanesulfonate ug/L	Hexa chloropropene ug/L	Isosafrole ug/L	
4/28/2020	XX	LTC4LXCCI	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U		9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	
4/28/2020	XX	LTC4LXCCIDL							540								
4/6/2021	XX	LTC4LXDBH	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U		9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	
4/6/2021	XX	LTC4LXDBHDL							320								
5/26/2022	XX	LTC4LXF09	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U		9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	
5/26/2022	XX	LTC4LXF09DL							200								
4/18/2023	XX	LTC4LXGHJ	10 U	10 U	10 U	10 U	10 U	10 U		10 U	10 U	25 U	10 U	10 U	10 U	10 U	
4/18/2023	XX	LTC4LXGHJDL							210								
7/16/2024	XX	LTC4LX1D1	9.5 U	9.5 UL	9.5 U	9.5 U	9.5 U	9.5 U	63	9.5 U	9.5 U	24 UL	9.5 U	9.5 U	9.5 U	9.5 U	

Units Abbreviations:

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DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 6 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Methapyrilene	3-Methyl cholanthrene	Methyl methane sulfonate	1-Naphthalene amine (1-Naphthyl amine)	2-Naphthalene amine (2-Naphthyl amine)	1,4-Naphtho quinone	5-Nitro-o-toluidine	N-Nitroso diethylamine	N-Nitrosodi-n-butylamine	N-Nitrosomethyl ethylamine	N-Nitroso piperidine	N-Nitroso pyrrolidine	Pentachloro benzene	Pentachloro nitrobenzene	Phenacetin
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U
4/6/2021	XX	LTC4LXDBH	24 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U	9.4 U
5/26/2022	XX	LTC4LXF09	23 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U	9.3 U
4/18/2023	XX	LTC4LXGHJ	25 U	10 U	10 U	10 U	10 U	25 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
7/16/2024	XX	LTC4LX1D1	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U	9.5 U

Units Abbreviations:

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Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
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Concentration Qualifier Notes:

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REPORT PREPARED: 5/12/2025 08:43
FOR: Juniper Ridge Landfill
DATE RANGE: 1/1/2020 - 12/31/2024

DATA SUMMARY TABLE

Semivolatile Organic Compounds Group 7 of 7

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

LT-C4L & LT-C4LR

(LT-C4L & LT-C4LR) Date	Type	Sample ID	p-Phenylene diamine ug/L	Pronamide ug/L	1,2,4,5-Tetrachloro benzene ug/L	1,3,5-Trinitro benzene (sym-Trinitrobenzene) ug/L	Safrole ug/L	O-Toluidine ug/L	p-(Dimethyl amino) azobenzene ug/L	7,12-Dimethylbenz (a)anthracene ug/L	Acetophenone ug/L						
4/28/2020	XX	LTC4LXCCI	24 U	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	14						
4/6/2021	XX	LTC4LXDBH	24 U	9.4 U	9.4 U	9.4 U	9.4 U	24 U	9.4 U	9.4 U	12						
5/26/2022	XX	LTC4LXF09	23 U	9.3 U	9.3 U	9.3 U	9.3 U	23 U	9.3 U	9.3 U	9.3 U						
4/18/2023	XX	LTC4LXGHJ	25 U	10 U	10 U	10 U	10 U	25 U	10 U	10 U	12						
7/16/2024	XX	LTC4LX1D1	24 ULL	9.5 U	9.5 U	9.5 U	9.5 U	24 U	9.5 U	9.5 U	9.5 U						

Units Abbreviations:

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Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
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DATA SUMMARY TABLE

Leachate - Volatile Organic Compounds Group 1 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Chloromethane	Bromomethane	Vinyl Chloride	Chloroethane	Methylene Chloride	Acetone	Carbon Disulfide	1,1-Dichloroethene	1,1-Dichloroethane	trans-1,2-Dichloroethene	Chloroform	1,2-Dichloroethane	Methyl Ethyl Ketone	1,1,1-Trichloroethane	Carbon Tetrachloride
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	20 U	20 U	10 U	20 U	10 U	1200	20 U	5 U	10 U	10 U	10 U	10 U	1000	10 U	10 U
7/21/2020	XX	LTC4LXCHB	2 U	2 U	1 U	2 U	1.2	560	2 U	0.5 U	1 U	1 U	1 U	1.8	300	1 U	1 U
10/27/2020	XX	LTC4LXD2F	20 U	20 U	10 U	20 U	30	1700	20 U	5 U	10 U	10 U	10 U	10 U	2100	10 U	10 U
4/6/2021	XX	LTC4LXDBH	2 U	2 U	1 U	2 U	1.1	970	2 U	0.5 U	1 U	1 U	1 U	2.7	770	1 U	1 U
7/13/2021	XX	LTC4LXDJ9	2 U	2 U	1 U	2 U	1 U	800	3.6	0.5 U	1 U	1 U	1 U	1 U	660	1 U	1 U
10/5/2021	XX	LTC4LXE5H	2 U	2 U	1 U	2 U	1.9	450	2 U	0.5 U	1 U	1 U	1 U	1.7	340	1 U	1 U
5/26/2022	XX	LTC4LXF09	2 U	2 U	1 U	2 U	1 U	260	2 U	0.5 U	1 U	1 U	1 U	1.8	180	1 U	1 U
7/19/2022	XX	LTC4LXF87	2 U	2 U	1 U	2 U	1 U	100	2 U	0.5 U	1 U	1 U	1 U	1.8	92	1 U	1 U
10/4/2022	XX	LTC4LXFI8	2 U	2 U	1 U	2 U	1 U	210	2 U	0.5 U	1 U	1 U	1 U	2.7	200	1 U	1 U
4/18/2023	XX	LTC4LXGHJ	2 U	2 U	1.5	2 U	1 U	1300	2 U	0.5 U	1 U	1 U	1 U	2	900	1 U	1 U
7/11/2023	XX	LTC4LXH81	2 U	2 U	1 U	2 U	1 U	430	2 U	0.5 U	1 U	1 U	1 U	2.4	300	1 U	1 U
10/2/2023	XX	LTC4LX059	2 U	2 U	1 U	2 U	30	930	2 U	0.5 U	1	5.3	1 U	5.3	780	1 U	1 U
4/2/2024	XX	LTC4LX11J	2 U	2 U	1 U	2 U	1.2	1300	2 U	0.5 U	1 U	1 U	1 U	3.4	1100	1 U	1 U
7/18/2024	XX	LTC4LX1H9	2 U	2 U	1.1	2 U	1 U	720	2 U	0.5 U	1 U	1 U	1 U	2.2	550	1 U	1 U
10/8/2024	XX	LTC4LX1IC	2 U	2 U	1.6	2 U	1 U	820	2 U	0.5 U	1 U	1 U	1 U	2.4	560	1 U	1 U
QCBT																	
4/28/2020	XX	BTXXXXCE4	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/21/2020	XX	BTXXXXCIC	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/27/2020	XX	BTXXXXD3G	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/6/2021	XX	BTXXXXDDJ	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/13/2021	XX	BTXXXXE0B	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/5/2021	XX	BTXXXXE6I	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
5/26/2022	XX	BTXXXXF1A	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/19/2022	XX	BTXXXXFE7	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/4/2022	XX	BTXXXXFJ9	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/18/2023	XX	BTXXXXH24	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/11/2023	XX	BTXXXXH92	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/2/2023	XX	BTXXXX076	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
4/2/2024	XX	BTXXXX151	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
7/18/2024	XX	BTXXXXI9E	2 U	2 U	0.2 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U
10/8/2024	XX	BTXXXX208	2 U	2 U	1 U	2 U	1 U	10 U	2 U	0.5 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U

Units Abbreviations:

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Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Leachate - Volatile Organic Compounds Group 2 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR) Date	Type	Sample ID	Vinyl Acetate ug/L	Bromo dichloro methane ug/L	1,2-Dichloro propane ug/L	cis-1,3-Dichloro propene ug/L	Trichloroethene ug/L	Dibromo chloromethane ug/L	1,1,2-Trichloroethane ug/L	Benzene ug/L	trans-1,3-Dichloro propene ug/L	Bromoform ug/L	4-Methyl-2-Pentanone ug/L	2-Hexanone ug/L	Tetrachloro ethene ug/L	1,1,2,2-Tetrachloro ethane ug/L	Toluene ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	26
7/21/2020	XX	LTC4LXCHB	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5	0.5 U	2 U	20	10 U	1 U	1 U	16
10/27/2020	XX	LTC4LXD2F	100 U	5 U	10 U	5 U	10 U	10 U	10 U	10 U	5 U	20 U	100 U	100 U	10 U	10 U	24
4/6/2021	XX	LTC4LXDBH	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.9	0.5 U	2 U	33	16	1 U	1 U	24
7/13/2021	XX	LTC4LXDJ9	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5.5	0.5 U	2 U	22	10 U	1 U	1 U	28
10/5/2021	XX	LTC4LXE5H	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.7	0.5 U	2 U	19	10 U	1 U	1 U	17
5/26/2022	XX	LTC4LXF09	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.7	0.5 U	2 U	21	10 U	1 U	1 U	37
7/19/2022	XX	LTC4LXF87	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	3.8	0.5 U	2 U	12	10 U	1 U	1 U	74
10/4/2022	XX	LTC4LXFI8	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.8	0.5 U	2 U	10 U	10 U	1 U	1 U	16
4/18/2023	XX	LTC4LXGHJ	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	6.6	0.5 U	2 U	46	10 U	1 U	1 U	33
7/11/2023	XX	LTC4LXH81	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	6.2	0.5 U	2 U	27	10 U	1 U	1 U	30
10/2/2023	XX	LTC4LX059	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	5.5	0.5 U	2 U	33	10 U	1.3	1 U	48
4/2/2024	XX	LTC4LX11J	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.6	0.5 U	2 U	28	10 U	1 U	1 U	56
7/18/2024	XX	LTC4LX1H9	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	4.1	0.5 U	2 U	18	10 U	1 U	1 U	29
10/8/2024	XX	LTC4LX1IC	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	7.7	0.5 U	2 U	19	10 U	1 U	1 U	29
QCBT																	
4/28/2020	XX	BTXXXXCE4	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/21/2020	XX	BTXXXXCIC	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/27/2020	XX	BTXXXXD3G	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/6/2021	XX	BTXXXXDDJ	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/13/2021	XX	BTXXXXE0B	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/5/2021	XX	BTXXXXE6I	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
5/26/2022	XX	BTXXXXF1A	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/19/2022	XX	BTXXXXFE7	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/4/2022	XX	BTXXXXFJ9	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/18/2023	XX	BTXXXXH24	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/11/2023	XX	BTXXXXH92	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/2/2023	XX	BTXXXX076	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
4/2/2024	XX	BTXXXX151	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
7/18/2024	XX	BTXXXXI9E	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U
10/8/2024	XX	BTXXXX208	10 U	0.5 U	1 U	0.5 U	1 U	1 U	1 U	1 U	0.5 U	2 U	10 U	10 U	1 U	1 U	1 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Leachate - Volatile Organic Compounds Group 3 of 4

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			Chlorobenzene	Ethylbenzene	Styrene	o-Xylene	m,p-Xylene	Tetra hydrofuran	Trichloro fluoromethane	cis-1,2-Dichloroethene	Bromochloro methane	Dibromo methane	1,2-Dibromoethane	1,1,1,2-Tetrachloro ethane	1,2,3-Trichloro propane	1,2-Dibromo-3-Chloropropane	1,4-Dichloro benzene
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
LT-C4L & LT-C4LR																	
4/28/2020	XX	LTC4LXCCI	10 U	10 U	10 U	10 U	10 U	420	20 U	10 U	10 U	10 U	5 U	10 U	5 U	20 U	10 U
7/21/2020	XX	LTC4LXCHB	1 U	7.8	1 U	5.3	9.1	490	2 U	1.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1
10/27/2020	XX	LTC4LXD2F	10 U	10 U	10 U	10 U	12	350	20 U	10 U	10 U	10 U	5 U	10 U	5 U	20 U	10 U
4/6/2021	XX	LTC4LXDBH	1 U	10	1 U	6.9	13	320	2 U	2.2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.2
7/13/2021	XX	LTC4LXDJ9	1 U	11	1 U	8	13	480	2 U	2.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
10/5/2021	XX	LTC4LXE5H	1 U	6.6	1 U	4.7	8.5	360	2 U	1.6	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
5/26/2022	XX	LTC4LXF09	1 U	6.8	1 U	4.8	9	410	2 U	2.2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/19/2022	XX	LTC4LXF87	1 U	7.7	1 U	6.3	11	420	2 U	2.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/4/2022	XX	LTC4LXFI8	1 U	8.6	1 U	6.2	12	410	2 U	1.8	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.1
4/18/2023	XX	LTC4LXGHJ	1 U	12	1 U	8.5	16	480	2 U	2.5	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
7/11/2023	XX	LTC4LXH81	1 U	13	1.2	11	19	450	2 U	3.2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
10/2/2023	XX	LTC4LX059	1 U	13	2	9.9	20	560	2 U	3.1	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1.3
4/2/2024	XX	LTC4LX11J	1 U	10	1.2	6.7	15	310	2 U	2.8	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/18/2024	XX	LTC4LX1H9	1 U	8.9	1 U	6.5	13	450	2 U	2	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/8/2024	XX	LTC4LX1IC	1 U	9.5	1 U	7.2	14	740	2 U	2.1	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
QCBT																	
4/28/2020	XX	BTXXXXCE4	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/21/2020	XX	BTXXXXCIC	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/27/2020	XX	BTXXXXD3G	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
4/6/2021	XX	BTXXXXDDJ	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/13/2021	XX	BTXXXXE0B	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/5/2021	XX	BTXXXXE6I	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
5/26/2022	XX	BTXXXXF1A	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/19/2022	XX	BTXXXXFE7	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/4/2022	XX	BTXXXXFJ9	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
4/18/2023	XX	BTXXXXH24	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/11/2023	XX	BTXXXXH92	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/2/2023	XX	BTXXXX076	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
4/2/2024	XX	BTXXXX151	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
7/18/2024	XX	BTXXXXI9E	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U
10/8/2024	XX	BTXXXX208	1 U	1 U	1 U	1 U	1 U	10 U	2 U	1 U	1 U	1 U	0.5 U	1 U	0.5 U	2 U	1 U

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

DATA SUMMARY TABLE

Leachate - Volatile Organic Compounds Group 4 of 4

SME SEVEE & MAHER ENGINEERS

SEVEE & MAHER ENGINEERS, INC.
4 BLANCHARD ROAD
CUMBERLAND CENTER, ME 04021

(LT-C4L & LT-C4LR)			1,2-Dichloro benzene	Acrylonitrile	Diethyl ether	trans-1,4-Dichloro-2-butene	Iodomethane									
Date	Type	Sample ID	ug/L	ug/L	ug/L	ug/L	ug/L									
LT-C4L & LT-C4LR																
4/28/2020	XX	LTC4LXCCI	10 U	200 U	20 U	50 U	50 U									
7/21/2020	XX	LTC4LXCHB	1 U	20 U	6.5	5 U	5 U									
10/27/2020	XX	LTC4LXD2F	10 U	200 U	20 U	50 U	50 U									
4/6/2021	XX	LTC4LXDBH	1 U	20 U	2 U	5 U	5 U									
7/13/2021	XX	LTC4LXDJ9	1 U	20 U	9.3	5 U	5 U									
10/5/2021	XX	LTC4LXE5H	1 U	20 U	7.3	5 U	5 U									
5/26/2022	XX	LTC4LXF09	1 U	20 U	16	5 U	5 U									
7/19/2022	XX	LTC4LXF87	1 U	20 U	14	5 U	5 U									
10/4/2022	XX	LTC4LXFI8	1 U	20 U	11	5 U	5 U									
4/18/2023	XX	LTC4LXGHJ	1 U	20 U	16	5 U	5 U									
7/11/2023	XX	LTC4LXH81	1 U	20 U	12	5 U	5 U									
10/2/2023	XX	LTC4LX059	1 U	20 U	35	5 U	5 U									
4/2/2024	XX	LTC4LX11J	1 U	20 U	2 U	5 U	5 U									
7/18/2024	XX	LTC4LX1H9	1 U	20 U	2 U	5 U	5 U									
10/8/2024	XX	LTC4LX1IC	1 U	20 U	12	5 U	5 U									
QCBT																
4/28/2020	XX	BTXXXXCE4	1 U	20 U	2 U	5 U	5 U									
7/21/2020	XX	BTXXXXCIC	1 U	20 U	2 U	5 U	5 U									
10/27/2020	XX	BTXXXXD3G	1 U	20 U	2 U	5 U	5 U									
4/6/2021	XX	BTXXXXDDJ	1 U	20 U	2 U	5 U	5 U									
7/13/2021	XX	BTXXXXE0B	1 U	20 U	2 U	5 U	5 U									
10/5/2021	XX	BTXXXXE6I	1 U	20 U	2 U	5 U	5 U									
5/26/2022	XX	BTXXXXF1A	1 U	20 U	2 U	5 U	5 U									
7/19/2022	XX	BTXXXXFE7	1 U	20 U	2 U	5 U	5 U									
10/4/2022	XX	BTXXXXFJ9	1 U	20 U	2 U	5 U	5 U									
4/18/2023	XX	BTXXXXH24	1 U	20 U	2 U	5 U	5 U									
7/11/2023	XX	BTXXXXH92	1 U	20 U	2 U	5 U	5 U									
10/2/2023	XX	BTXXXX076	1 U	20 U	2 U	5 U	5 U									
4/2/2024	XX	BTXXXX151	1 U	20 U	2 U	5 U	5 U									
7/18/2024	XX	BTXXXXI9E	1 U	20 U	2 U	5 U	5 U									
10/8/2024	XX	BTXXXX208	1 U	20 U	2 U	5 U	5 U									

Units Abbreviations:

ug/L - MICROGRAMS PER LITER

Notes: Sample Type XX = Environmental Sample, XD = Duplicate Sample
Blank Cells appear when a parameter was not analyzed.

Concentration Qualifier Notes:

U - Not Detected above the laboratory reporting limit.

SCENARIO A CONTAMINANT TRANSPORT ANALYSIS RESULTS (TABLE J-1)

TABLE J-1

SUMMARY OF SCENARIO A

Scenario	Description	Horizontal Groundwater Travel Distance (feet)	Till Thickness at Source (feet)	Interpreted Groundwater Level at Source (ft NAVD)	Interpreted Groundwater Level at Receptor (ft NAVD)	Source - Maximum Rate of Vertical Flow into Till (gpd)	Equilibrium Concentration and Travel Time	Arrival Time of Exceedance of Standard	Criterion
Scenario A – 1a	Horizontal groundwater flow through till from nearest boundary of leaking Phase II Expansion to Receptor B	868.81	49.60	157.39	142.48	11,877.10 [2]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 1b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor B						25.3 mg/L Ammonia (40.6 years) 0.0152 mg/L Arsenic (38.9 years)	1.4 mg/L Ammonia (38.4 years) 0.01 mg/L Arsenic (40.0 years)	
Scenario A – 2a	Horizontal groundwater flow through till from leaking Cell 18 Pump Station to Receptor B	999.01	27.13	153.64	142.48	1.36 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 2b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from leaking Cell 18 Pump Station to Receptor B						3.63E-3 mg/L Ammonia (25.3 years) 2.19E-6 mg/L Arsenic (25.5 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 3a	Horizontal groundwater flow through till from leaking Cell 20 Pump Station to Receptor B	3,128.36	23.59	161.07	142.48	1.36 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 3b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from leaking Cell 20 Pump Station to Receptor B						1.41E-3 mg/L Ammonia (44.8 years) 8.46E-7 mg/L Arsenic (24.0 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 4a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 1 within boundary of leaking Phase II Expansion to Receptor B	1,717.12	5.45 [1]	159.17	142.48	11,877.10 [2]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 4b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 1 within boundary of leaking Phase II Expansion to Receptor B						17.1 mg/L Ammonia (16.4 years) 0.0103 mg/L Arsenic (16.0 years)	1.4 mg/L Ammonia (11.6 years) 0.01 mg/L Arsenic (14.8 years)	
Scenario A – 5a	Horizontal groundwater flow through till from boundary of leaking Phase II Expansion (via interpreted flow path) to Receptor D	1,006.53	50.45	185.00	168.00	4,855.05 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 5b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from boundary of leaking Phase II Expansion (via interpreted flow path) to Receptor D						8.50 mg/L Ammonia (41.4 years) 5.12E-3 mg/L Arsenic (41.4 years)	1.4 mg/L Ammonia (See Note 7) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 6a	Horizontal groundwater flow through till from nearest boundary of leaking Phase II Expansion to Receptor E	717.37	25.55	171.40	162.00	4,855.05 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 6b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor E						17.8 mg/L Ammonia (22.2 years) 0.0107 mg/L Arsenic (22.0 years)	1.4 mg/L Ammonia (20.3 years) 0.01 mg/L Arsenic (21.4 years)	
Scenario A – 7a	Horizontal groundwater flow through till from Cell 19 Pump Station to Receptor E	699.75	18.98	170.66	162.00	1.36 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 7b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Cell 19 Pump Station to Receptor E						5.47E-3 mg/L Ammonia (18.1 years) 3.29E-6 mg/L Arsenic (17.5 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 8a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 2 within boundary of leaking Phase II Expansion to Receptor E	1,002.62	12.53 [1]	175.68	162.00	4,855.05 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)

TABLE J-1 (cont'd)

SUMMARY OF CONTAMINANT SCENARIO A

Scenario A – 8b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 2 within boundary of leaking Phase II Expansion to Receptor E						10.6 mg/L Ammonia (17.0 years) 6.38E-3 mg/L Arsenic (18.3 years)	1.4 mg/L Ammonia (14.8 years) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 9a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor E	1,392.46	9.00 [1]	174.56	162.00	4,855.05 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 9b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor E						10.6 mg/L Ammonia (18.2 years) 6.07E-3 mg/L Arsenic (19.1 years)	1.4 mg/L Ammonia (13.9 years) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 10a	Horizontal groundwater flow through till from nearest boundary of leaking Phase II Expansion to Receptor F	924.35	29.94	168.36	159.54	4,855.05 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 10b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor F						17.0 mg/L Ammonia (27.7 years) 0.0107 mg/L Arsenic (27.2 years)	1.4 mg/L Ammonia (24.5 years) 0.01 mg/L Arsenic (26.8 years)	
Scenario A – 11a	Horizontal groundwater flow through till from Cell 19 Pump Station to Receptor F	1,460.88	18.98	170.66	159.54	1.36 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 11b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Cell 19 Pump Station to Receptor F						3.12E-3 mg/L Ammonia (23.9 years) 1.88E-6 mg/L Arsenic (23.8 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 12a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor F	1,552.34	9.00 [1]	174.56	159.54	4,855.05 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario A – 12b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor F						8.07 mg/L Ammonia (19.1 years) 4.86E-3 mg/L Arsenic (18.7 years)	1.4 mg/L Ammonia (14.2 years) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 13a	Horizontal groundwater flow through till from Leachate Storage Tanks Containment Area to Receptor G	831.22	56.35	177.24	153.53	377.11 [5]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 13b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Leachate Storage Tanks Containment Area to Receptor G						5.14E-1 mg/L Ammonia (44.2 years) 3.10E-4 mg/L Arsenic (44.3 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 14a	Horizontal groundwater flow through till from leaking Dual Containment Leachate Transport Pipe to Receptor B	868.81	49.60	157.39	142.48	6.11 [6]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 14b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from leaking Dual Containment Leachate Transport Pipe to Receptor B						1.30E-2 mg/L Ammonia (40.1 years) 7.82E-6 mg/L Arsenic (40.3 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 15a	Horizontal groundwater flow through till from leaking Dual Containment Leachate Transport Pipe to Receptor E	717.37	25.55	171.40	162.00	6.11 [6]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 15b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from leaking Dual Containment Leachate Transport Pipe to Receptor E						2.24E-2 mg/L Ammonia (22.3 years) 1.35E-5 mg/L Arsenic (22.3 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario A – 16a	Horizontal groundwater flow through till from leaking Dual Containment Leachate Transport Pipe to Receptor F	924.35	29.94	168.36	159.54	6.11 [6]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario A – 16b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from leaking Dual Containment Leachate Transport Pipe to Receptor F						2.14E-2 mg/L Ammonia (28.1 years) 1.26E-5 mg/L Arsenic (27.9 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	

TABLE J-1 (cont'd)

SUMMARY OF CONTAMINANT SCENARIO A

Notes:

1 Source location is in an area with a compacted marine clay layer since it is anticipated to be grubbed to within 5 feet of bedrock. Calculated travel time vertically downward to bedrock is increased by 3.8 years.

2 Based on the maximum rate of flow into till soils in area within Phase II Expansion solid waste boundary that is east of the northwest/southeast oriented groundwater flow divide.

3 Based on the maximum rate of flow into till soils in area of base of pump station structure.

4 Based on maximum rate of flow into till soils in area within Phase II Expansion solid waste boundary that is west of the northwest/southeast oriented groundwater flow divide.

5 Based on maximum rate of flow into till soils in containment area for leachate storage tanks.

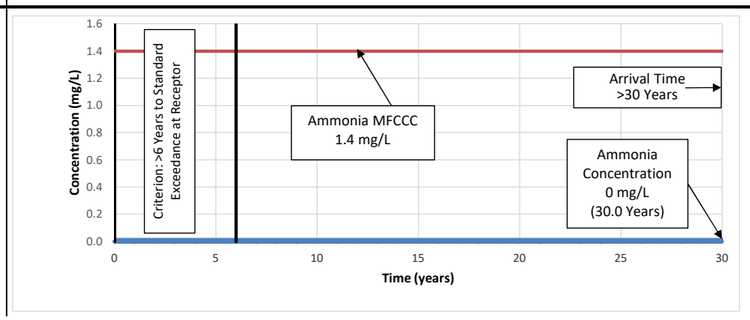
6 Based on the maximum rate of flow into till soils in area within 300 feet long section of dual containment leachate transport pipeline trench.

7 Receptor D represents groundwater at the property boundary west of the proposed Phase II Expansion. MFCCC exceedances are not applicable to groundwater.

SCENARIO A CONTAMINANT TRANSPORT ANALYSIS CALCULATION SHEETS

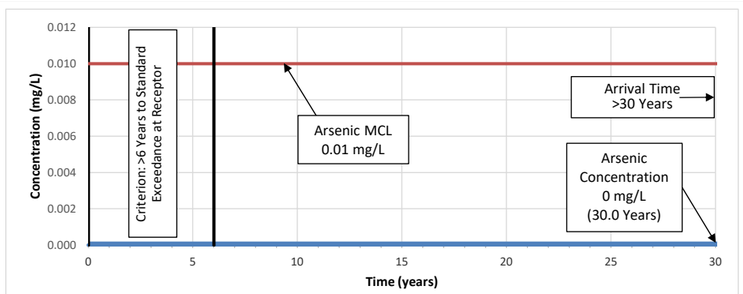
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 1a - Horizontal flow through till from nearest boundary of leaking Phase II Expansion to Receptor B (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**						=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0.00		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	0.00		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	0.01		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	0.01		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	0.01		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	0.01		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	39564538.58	← *=C11*C12*3.7854118*	6	0.02		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	0.02		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	0.02		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	0.02		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.83E-03	← *=C14*C15/C16*	10	0.03		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	0.03		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	0.03		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	0.04		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	0.04		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	0.04		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	0.04		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1303	← *=(C20/C17)*365.25*	17	0.05		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	0.05		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	0.05		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	0.05		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	0.06		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	0.06		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	0.06		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	0.07		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	0.07		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	0.07		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	0.07		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	0.08		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	0.08		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	0.08		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	29.96		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	29.96		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	29.96		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	29.98		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	29.98		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	29.98		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	29.98		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	29.99		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	29.99		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	29.99		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	30.00		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	30.00		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	30.00		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



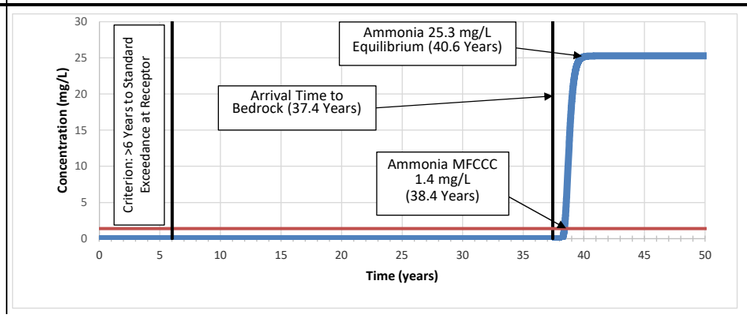
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 1a - Horizontal flow through till from nearest boundary of leaking Phase II Expansion to Receptor B (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	23828.64	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.83E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1303	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



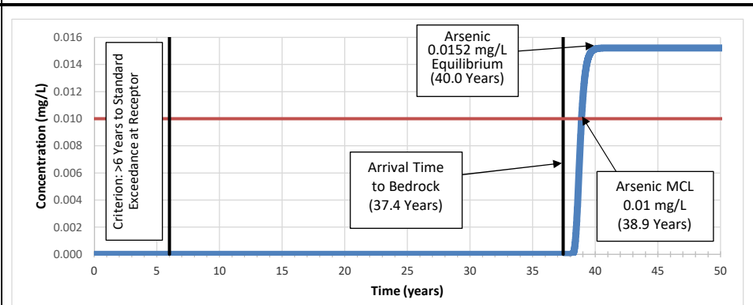
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 1b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor B (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13670	37.43	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13671	37.43	1.70	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	13672	37.43	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	13673	37.43	5.11	0.05	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	13674	37.44	6.81	0.17	0.06	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	13675	37.44	8.51	0.32	0.11	0.02	0.55	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	39564538.58	← *=C11*C12*3.7854118*	6	13676	37.44	10.21	0.49	0.16	0.02	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13677	37.45	11.92	0.67	0.22	0.03	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	13678	37.45	13.62	0.85	0.28	0.04	1.45	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13679	37.45	15.32	1.03	0.34	0.05	1.76	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.70	← *=C14*C15/C16*	10	13680	37.45	17.02	1.21	0.40	0.06	2.06	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13681	37.46	18.73	1.39	0.46	0.07	2.36	0.79	0.12	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13682	37.46	20.43	1.56	0.52	0.08	2.66	0.89	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13683	37.46	22.13	1.73	0.58	0.09	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13684	37.47	23.83	1.90	0.63	0.09	3.23	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13685	37.47	25.54	2.06	0.69	0.10	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13686	37.47	27.24	2.22	0.74	0.11	3.78	1.26	0.19	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	169.60	*INPUT*	17	13687	37.47	28.94	2.38	0.79	0.12	4.05	1.35	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	120.00	*INPUT*	18	13688	37.48	30.64	2.53	0.84	0.13	4.31	1.44	0.22	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	49.60	← *=C24-C25*	19	13689	37.48	32.35	2.68	0.89	0.13	4.57	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	13690	37.48	34.05	2.83	0.94	0.14	4.82	1.61	0.24	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	13691	37.48	35.75	2.97	0.99	0.15	5.06	1.69	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	13692	37.49	37.45	3.12	1.04	0.16	5.31	1.77	0.27	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	13670	← *=C26/C29*	23	13693	37.49	39.16	3.26	1.09	0.16	5.54	1.85	0.28	0.00E+00	0.00E+00	#DIV/0!
31				24	13694	37.49	40.86	3.39	1.13	0.17	5.77	1.92	0.29	0.00E+00	0.00E+00	#DIV/0!
32				25	13695	37.50	42.56	3.53	1.18	0.18	6.00	2.00	0.30	0.00E+00	0.00E+00	#DIV/0!
33				26	13696	37.50	44.26	3.66	1.22	0.18	6.23	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
34				27	13697	37.50	45.97	3.79	1.26	0.19	6.45	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
35				28	13698	37.50	47.67	3.91	1.30	0.20	6.66	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
36				29	13699	37.51	49.37	4.04	1.35	0.20	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
37				30	13700	37.51	51.07	4.16	1.39	0.21	7.09	2.36	0.35	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24612	67.38	18627.78	66.35	22.12	3.32	112.96	37.65	5.65	3.50E-32	2.53E+01	1.00E+00
10950				10943	24613	67.39	18629.49	66.35	22.12	3.32	112.96	37.65	5.65	3.48E-32	2.53E+01	1.00E+00
10951				10944	24614	67.39	18631.19	66.36	22.12	3.32	112.97	37.66	5.65	3.46E-32	2.53E+01	1.00E+00
10952				10945	24615	67.39	18632.89	66.36	22.12	3.32	112.97	37.66	5.65	3.45E-32	2.53E+01	1.00E+00
10953				10946	24616	67.40	18634.59	66.36	22.12	3.32	112.97	37.66	5.65	3.43E-32	2.53E+01	1.00E+00
10954				10947	24617	67.40	18636.30	66.36	22.12	3.32	112.97	37.66	5.65	3.41E-32	2.53E+01	1.00E+00
10955				10948	24618	67.40	18638.00	66.36	22.12	3.32	112.98	37.66	5.65	3.40E-32	2.53E+01	1.00E+00
10956				10949	24619	67.40	18639.70	66.36	22.12	3.32	112.98	37.66	5.65	3.38E-32	2.53E+01	1.00E+00
10957				10950	24620	67.41	18641.40	66.37	22.12	3.32	112.98	37.66	5.65	3.36E-32	2.53E+01	1.00E+00
10958				10951	24621	67.41	18643.11	66.37	22.12	3.32	112.99	37.66	5.65	3.35E-32	2.53E+01	1.00E+00
10959				10952	24622	67.41	18644.81	66.37	22.12	3.32	112.99	37.66	5.65	3.33E-32	2.53E+01	1.00E+00
10960				10953	24623	67.41	18646.51	66.37	22.12	3.32	112.99	37.66	5.65	3.31E-32	2.53E+01	1.00E+00
10961				10954	24624	67.42	18648.21	66.37	22.12	3.32	112.99	37.66	5.65	3.30E-32	2.53E+01	1.00E+00
10962				10955	24625	67.42	18649.92	66.38	22.13	3.32	113.00	37.67	5.65	3.28E-32	2.53E+01	1.00E+00
10963				10956	24626	67.42	18651.62	66.38	22.13	3.32	113.00	37.67	5.65	3.26E-32	2.53E+01	1.00E+00
10964				10957	24627	67.43	18653.32	66.38	22.13	3.32	113.00	37.67	5.65	3.25E-32	2.53E+01	1.00E+00
10965				10958	24628	67.43	18655.02	66.38	22.13	3.32	113.01	37.67	5.65	3.23E-32	2.53E+01	1.00E+00



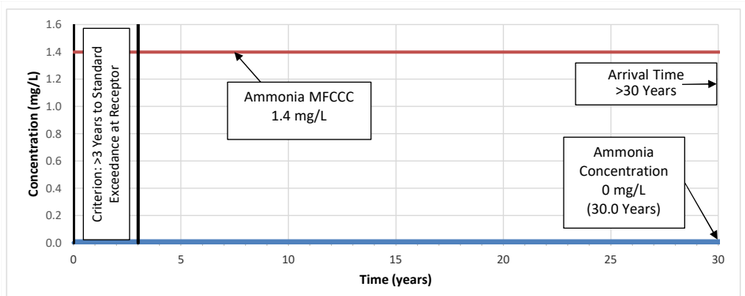
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 1b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor B (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13670	37.43	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13671	37.43	1.70	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	13672	37.43	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	13673	37.43	5.11	0.05	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	13674	37.44	6.81	0.17	0.06	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	13675	37.44	8.51	0.32	0.11	0.02	0.55	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	23828.64	← *=C11*C12*3.7854118*	6	13676	37.44	10.21	0.49	0.16	0.02	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13677	37.45	11.92	0.67	0.22	0.03	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	13678	37.45	13.62	0.85	0.28	0.04	1.45	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13679	37.45	15.32	1.03	0.34	0.05	1.76	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.70	← *=C14*C15/C16*	10	13680	37.45	17.02	1.21	0.40	0.06	2.06	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13681	37.46	18.73	1.39	0.46	0.07	2.36	0.79	0.12	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13682	37.46	20.43	1.56	0.52	0.08	2.66	0.89	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13683	37.46	22.13	1.73	0.58	0.09	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13684	37.47	23.83	1.90	0.63	0.09	3.23	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13685	37.47	25.54	2.06	0.69	0.10	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13686	37.47	27.24	2.22	0.74	0.11	3.78	1.26	0.19	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	169.60	*INPUT*	17	13687	37.47	28.94	2.38	0.79	0.12	4.05	1.35	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	120.00	*INPUT*	18	13688	37.48	30.64	2.53	0.84	0.13	4.31	1.44	0.22	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	49.60	← *=C24-C25*	19	13689	37.48	32.35	2.68	0.89	0.13	4.57	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	13690	37.48	34.05	2.83	0.94	0.14	4.82	1.61	0.24	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	13691	37.48	35.75	2.97	0.99	0.15	5.06	1.69	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	13692	37.49	37.45	3.12	1.04	0.16	5.31	1.77	0.27	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	13670	← *=C26/C29*	23	13693	37.49	39.16	3.26	1.09	0.16	5.54	1.85	0.28	0.00E+00	0.00E+00	#DIV/0!
31				24	13694	37.49	40.86	3.39	1.13	0.17	5.77	1.92	0.29	0.00E+00	0.00E+00	#DIV/0!
32				25	13695	37.50	42.56	3.53	1.18	0.18	6.00	2.00	0.30	0.00E+00	0.00E+00	#DIV/0!
33				26	13696	37.50	44.26	3.66	1.22	0.18	6.23	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
34				27	13697	37.50	45.97	3.79	1.26	0.19	6.45	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
35				28	13698	37.50	47.67	3.91	1.30	0.20	6.66	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
36				29	13699	37.51	49.37	4.04	1.35	0.20	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
37				30	13700	37.51	51.07	4.16	1.39	0.21	7.09	2.36	0.35	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24612	67.38	18627.78	66.35	22.12	3.32	112.96	37.65	5.65	2.11E-35	1.52E-02	1.00E+00
10950				10943	24613	67.39	18629.49	66.35	22.12	3.32	112.96	37.65	5.65	2.10E-35	1.52E-02	1.00E+00
10951				10944	24614	67.39	18631.19	66.36	22.12	3.32	112.97	37.66	5.65	2.09E-35	1.52E-02	1.00E+00
10952				10945	24615	67.39	18632.89	66.36	22.12	3.32	112.97	37.66	5.65	2.08E-35	1.52E-02	1.00E+00
10953				10946	24616	67.40	18634.59	66.36	22.12	3.32	112.97	37.66	5.65	2.07E-35	1.52E-02	1.00E+00
10954				10947	24617	67.40	18636.30	66.36	22.12	3.32	112.97	37.66	5.65	2.06E-35	1.52E-02	1.00E+00
10955				10948	24618	67.40	18638.00	66.36	22.12	3.32	112.98	37.66	5.65	2.05E-35	1.52E-02	1.00E+00
10956				10949	24619	67.40	18639.70	66.36	22.12	3.32	112.98	37.66	5.65	2.03E-35	1.52E-02	1.00E+00
10957				10950	24620	67.41	18641.40	66.37	22.12	3.32	112.98	37.66	5.65	2.02E-35	1.52E-02	1.00E+00
10958				10951	24621	67.41	18643.11	66.37	22.12	3.32	112.99	37.66	5.65	2.01E-35	1.52E-02	1.00E+00
10959				10952	24622	67.41	18644.81	66.37	22.12	3.32	112.99	37.66	5.65	2.00E-35	1.52E-02	1.00E+00
10960				10953	24623	67.41	18646.51	66.37	22.12	3.32	112.99	37.66	5.65	2.00E-35	1.52E-02	1.00E+00
10961				10954	24624	67.42	18648.21	66.37	22.12	3.32	112.99	37.66	5.65	1.99E-35	1.52E-02	1.00E+00
10962				10955	24625	67.42	18649.92	66.38	22.13	3.32	113.00	37.67	5.65	1.98E-35	1.52E-02	1.00E+00
10963				10956	24626	67.42	18651.62	66.38	22.13	3.32	113.00	37.67	5.65	1.97E-35	1.52E-02	1.00E+00
10964				10957	24627	67.43	18653.32	66.38	22.13	3.32	113.00	37.67	5.65	1.96E-35	1.52E-02	1.00E+00
10965				10958	24628	67.43	18655.02	66.38	22.13	3.32	113.01	37.67	5.65	1.95E-35	1.52E-02	1.00E+00



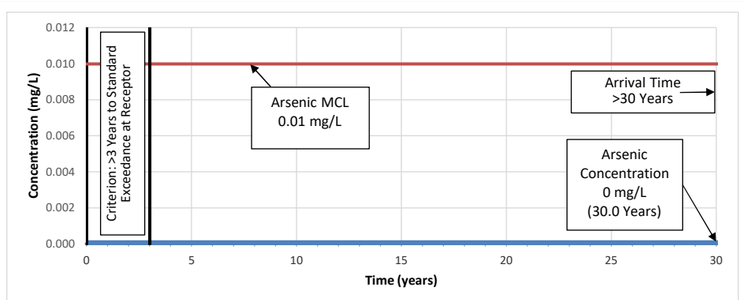
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 2a - Horizontal flow through till from leaking Cell 18 Pump Station to Receptor B (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	999.01	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	153.64	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.12E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.19E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	999.01	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2301	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



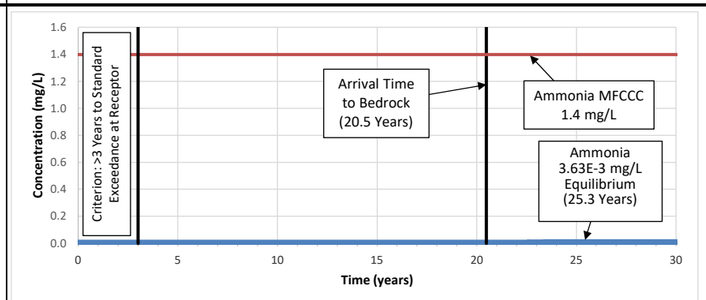
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 2a - Horizontal flow through till from leaking Cell 18 Pump Station to Receptor B (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	999.01	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	153.64	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.12E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.19E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	999.01	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2301	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		13.01	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		13.02	0.79	0.26	0.04	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



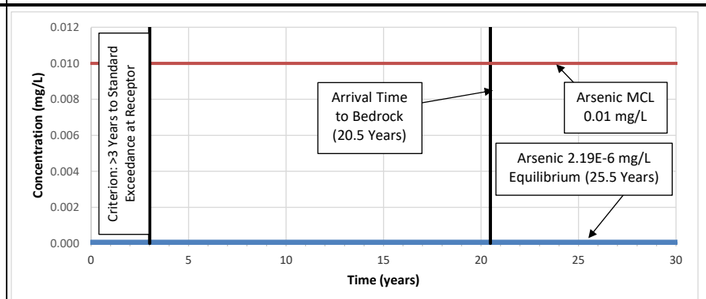
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 2b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 18 Pump Station to Receptor B (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	999.01	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	153.64	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	7478	20.47	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	7479	20.48	1.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	7480	20.48	2.22	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	7481	20.48	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	7482	20.49	4.43	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	7483	20.49	5.54	0.08	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	7484	20.49	6.65	0.16	0.05	0.01	0.17	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7485	20.49	7.76	0.25	0.08	0.01	0.28	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.12E-02	← *=(C4-C5)/C3*	8	7486	20.50	8.87	0.36	0.12	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7487	20.50	9.97	0.47	0.16	0.02	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.11	← *=C14*C15/C16*	10	7488	20.50	11.08	0.58	0.19	0.03	0.65	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7489	20.50	12.19	0.70	0.23	0.04	0.78	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7490	20.51	13.30	0.82	0.27	0.04	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	999.01	← *=C3*	13	7491	20.51	14.41	0.94	0.31	0.05	1.04	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7492	20.51	15.51	1.05	0.35	0.05	1.17	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7493	20.52	16.62	1.17	0.39	0.06	1.30	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7494	20.52	17.73	1.29	0.43	0.06	1.42	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	155.78	*INPUT*	17	7495	20.52	18.84	1.40	0.47	0.07	1.55	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	128.65	*INPUT*	18	7496	20.52	19.95	1.51	0.50	0.08	1.68	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	27.13	← *=C24-C25*	19	7497	20.53	21.06	1.62	0.54	0.08	1.80	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	7498	20.53	22.16	1.74	0.58	0.09	1.92	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	7499	20.53	23.27	1.84	0.61	0.09	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	7500	20.53	24.38	1.95	0.65	0.10	2.16	0.72	0.11	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	7478	← *=C26/C29*	23	7501	20.54	25.49	2.06	0.69	0.10	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
31				24	7502	20.54	26.60	2.16	0.72	0.11	2.40	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
32				25	7503	20.54	27.70	2.27	0.76	0.11	2.51	0.84	0.13	0.00E+00	0.00E+00	#DIV/0!
33				26	7504	20.55	28.81	2.37	0.79	0.12	2.62	0.87	0.13	0.00E+00	0.00E+00	#DIV/0!
34				27	7505	20.55	29.92	2.47	0.82	0.12	2.73	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
35				28	7506	20.55	31.03	2.57	0.86	0.13	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
36				29	7507	20.55	32.14	2.66	0.89	0.13	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
37				30	7508	20.56	33.25	2.76	0.92	0.14	3.06	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
10949				10942	18420	50.43	12125.59	58.68	19.56	2.93	65.02	21.67	3.25	5.92E-27	3.63E-03	1.00E+00
10950				10943	18421	50.43	12126.69	58.68	19.56	2.93	65.02	21.67	3.25	5.90E-27	3.63E-03	1.00E+00
10951				10944	18422	50.44	12127.80	58.68	19.56	2.93	65.03	21.68	3.25	5.88E-27	3.63E-03	1.00E+00
10952				10945	18423	50.44	12128.91	58.68	19.56	2.93	65.03	21.68	3.25	5.86E-27	3.63E-03	1.00E+00
10953				10946	18424	50.44	12130.02	58.68	19.56	2.93	65.03	21.68	3.25	5.84E-27	3.63E-03	1.00E+00
10954				10947	18425	50.45	12131.13	58.68	19.56	2.93	65.03	21.68	3.25	5.82E-27	3.63E-03	1.00E+00
10955				10948	18426	50.45	12132.24	58.68	19.56	2.93	65.03	21.68	3.25	5.79E-27	3.63E-03	1.00E+00
10956				10949	18427	50.45	12133.34	58.69	19.56	2.93	65.03	21.68	3.25	5.77E-27	3.63E-03	1.00E+00
10957				10950	18428	50.45	12134.45	58.69	19.56	2.93	65.04	21.68	3.25	5.75E-27	3.63E-03	1.00E+00
10958				10951	18429	50.46	12135.56	58.69	19.56	2.93	65.04	21.68	3.25	5.73E-27	3.63E-03	1.00E+00
10959				10952	18430	50.46	12136.67	58.69	19.56	2.93	65.04	21.68	3.25	5.71E-27	3.63E-03	1.00E+00
10960				10953	18431	50.46	12137.78	58.69	19.56	2.93	65.04	21.68	3.25	5.69E-27	3.63E-03	1.00E+00
10961				10954	18432	50.46	12138.88	58.69	19.56	2.93	65.04	21.68	3.25	5.67E-27	3.63E-03	1.00E+00
10962				10955	18433	50.47	12139.99	58.70	19.57	2.93	65.04	21.68	3.25	5.65E-27	3.63E-03	1.00E+00
10963				10956	18434	50.47	12141.10	58.70	19.57	2.93	65.05	21.68	3.25	5.63E-27	3.63E-03	1.00E+00
10964				10957	18435	50.47	12142.21	58.70	19.57	2.93	65.05	21.68	3.25	5.60E-27	3.63E-03	1.00E+00
10965				10958	18436	50.48	12143.32	58.70	19.57	2.94	65.05	21.68	3.25	5.58E-27	3.63E-03	1.00E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

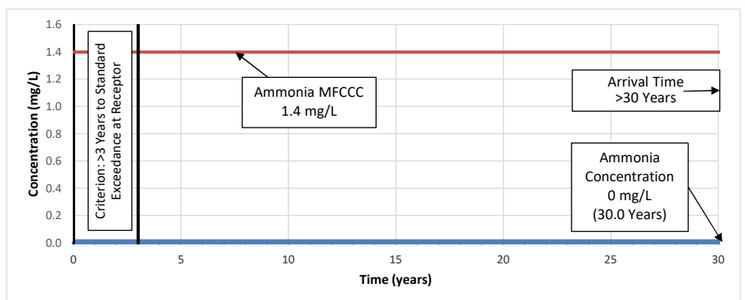
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 2b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 18 Pump Station to Receptor B (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	999.01	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	153.64	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	7478	20.47	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	7479	20.48	1.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	7480	20.48	2.22	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	7481	20.48	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	7482	20.49	4.43	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	7483	20.49	5.54	0.08	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	7484	20.49	6.65	0.16	0.05	0.01	0.17	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7485	20.49	7.76	0.25	0.08	0.01	0.28	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.12E-02	← *=(C4-C5)/C3*	8	7486	20.50	8.87	0.36	0.12	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7487	20.50	9.97	0.47	0.16	0.02	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.11	← *=C14*C15/C16*	10	7488	20.50	11.08	0.58	0.19	0.03	0.65	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7489	20.50	12.19	0.70	0.23	0.04	0.78	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7490	20.51	13.30	0.82	0.27	0.04	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	999.01	← *=C3*	13	7491	20.51	14.41	0.94	0.31	0.05	1.04	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7492	20.51	15.51	1.05	0.35	0.05	1.17	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7493	20.52	16.62	1.17	0.39	0.06	1.30	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7494	20.52	17.73	1.29	0.43	0.06	1.42	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	155.78	*INPUT*	17	7495	20.52	18.84	1.40	0.47	0.07	1.55	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	128.65	*INPUT*	18	7496	20.52	19.95	1.51	0.50	0.08	1.68	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	27.13	← *=C24-C25*	19	7497	20.53	21.06	1.62	0.54	0.08	1.80	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	7498	20.53	22.16	1.74	0.58	0.09	1.92	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	7499	20.53	23.27	1.84	0.61	0.09	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	7500	20.53	24.38	1.95	0.65	0.10	2.16	0.72	0.11	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	7478	← *=C26/C29*	23	7501	20.54	25.49	2.06	0.69	0.10	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
31				24	7502	20.54	26.60	2.16	0.72	0.11	2.40	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
32				25	7503	20.54	27.70	2.27	0.76	0.11	2.51	0.84	0.13	0.00E+00	0.00E+00	#DIV/0!
33				26	7504	20.55	28.81	2.37	0.79	0.12	2.62	0.87	0.13	0.00E+00	0.00E+00	#DIV/0!
34				27	7505	20.55	29.92	2.47	0.82	0.12	2.73	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
35				28	7506	20.55	31.03	2.57	0.86	0.13	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
36				29	7507	20.55	32.14	2.66	0.89	0.13	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
37				30	7508	20.56	33.25	2.76	0.92	0.14	3.06	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!



10949				10942	18420	50.43	12125.59	58.68	19.56	2.93	65.02	21.67	3.25	3.57E-30	2.19E-06	1.00E+00
10950				10943	18421	50.43	12126.69	58.68	19.56	2.93	65.02	21.67	3.25	3.56E-30	2.19E-06	1.00E+00
10951				10944	18422	50.44	12127.80	58.68	19.56	2.93	65.03	21.68	3.25	3.54E-30	2.19E-06	1.00E+00
10952				10945	18423	50.44	12128.91	58.68	19.56	2.93	65.03	21.68	3.25	3.53E-30	2.19E-06	1.00E+00
10953				10946	18424	50.44	12130.02	58.68	19.56	2.93	65.03	21.68	3.25	3.52E-30	2.19E-06	1.00E+00
10954				10947	18425	50.45	12131.13	58.68	19.56	2.93	65.03	21.68	3.25	3.50E-30	2.19E-06	1.00E+00
10955				10948	18426	50.45	12132.24	58.68	19.56	2.93	65.03	21.68	3.25	3.49E-30	2.19E-06	1.00E+00
10956				10949	18427	50.45	12133.34	58.69	19.56	2.93	65.03	21.68	3.25	3.48E-30	2.19E-06	1.00E+00
10957				10950	18428	50.45	12134.45	58.69	19.56	2.93	65.04	21.68	3.25	3.46E-30	2.19E-06	1.00E+00
10958				10951	18429	50.46	12135.56	58.69	19.56	2.93	65.04	21.68	3.25	3.45E-30	2.19E-06	1.00E+00
10959				10952	18430	50.46	12136.67	58.69	19.56	2.93	65.04	21.68	3.25	3.44E-30	2.19E-06	1.00E+00
10960				10953	18431	50.46	12137.78	58.69	19.56	2.93	65.04	21.68	3.25	3.43E-30	2.19E-06	1.00E+00
10961				10954	18432	50.46	12138.88	58.69	19.56	2.93	65.04	21.68	3.25	3.41E-30	2.19E-06	1.00E+00
10962				10955	18433	50.47	12139.99	58.70	19.57	2.93	65.04	21.68	3.25	3.40E-30	2.19E-06	1.00E+00
10963				10956	18434	50.47	12141.10	58.70	19.57	2.93	65.05	21.68	3.25	3.39E-30	2.19E-06	1.00E+00
10964				10957	18435	50.47	12142.21	58.70	19.57	2.93	65.05	21.68	3.25	3.38E-30	2.19E-06	1.00E+00
10965				10958	18436	50.48	12143.32	58.70	19.57	2.94	65.05	21.68	3.25	3.36E-30	2.19E-06	1.00E+00

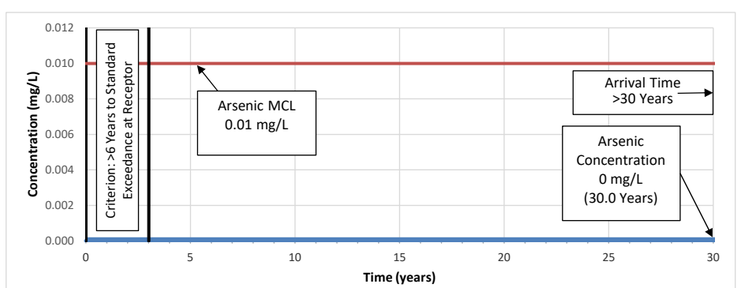
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 3a - Horizontal flow through till from leaking Cell 20 Pump Station to Receptor B (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	3128.36	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	161.07	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	6		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	5.94E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	6.32E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	3128.36	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	13546	← *=(C20/C17)*365.25*	17	17		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



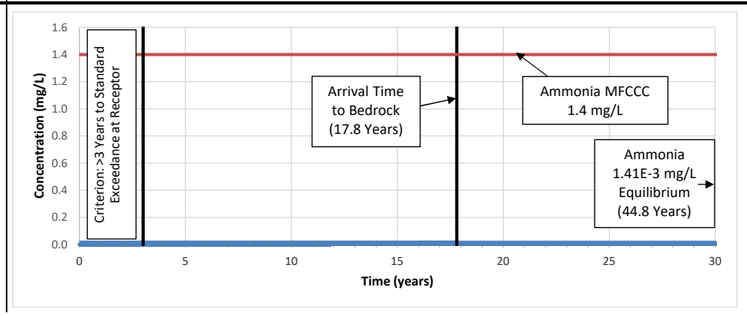
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 3a - Horizontal flow through till from Leaking Cell 20 Pump Station to Receptor B (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	3128.36	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	161.07	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	6		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	5.94E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	6.32E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	3128.36	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	13546	← *=(C20/C17)*365.25*	17	17		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		6.92	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		6.93	0.18	0.06	0.01	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

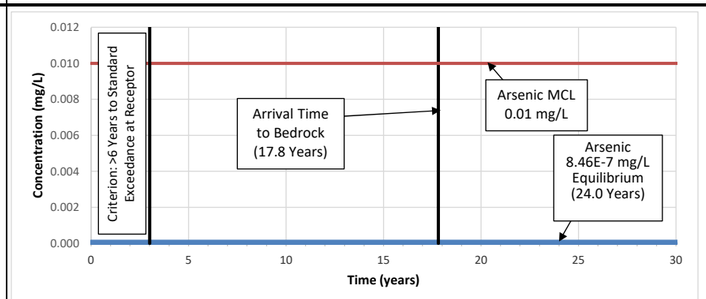
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 3b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 20 Pump Station to Receptor B (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	3128.36	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	161.07	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	6502	17.80	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1	0.00	0.59	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2	0.01	1.18	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3	0.01	1.77	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4	0.01	2.36	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5	0.01	2.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	6	0.02	3.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7	0.02	4.13	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	5.94E-03	← *=(C4-C5)/C3*	8	8	0.02	4.72	0.03	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	9	0.02	5.31	0.06	0.02	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.59	← *=C14*C15/C16*	10	10	0.03	5.89	0.10	0.03	0.01	0.06	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11	0.03	6.48	0.14	0.05	0.01	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12	0.03	7.07	0.19	0.06	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	3128.36	← *=C3*	13	13	0.04	7.66	0.24	0.08	0.01	0.14	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14	0.04	8.25	0.30	0.10	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15	0.04	8.84	0.36	0.12	0.02	0.21	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	16	0.04	9.43	0.41	0.14	0.02	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	163.59	*INPUT*	17	17	0.05	10.02	0.47	0.16	0.02	0.28	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	140.00	*INPUT*	18	18	0.05	10.61	0.54	0.18	0.03	0.32	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	23.59	← *=C24-C25*	19	19	0.05	11.20	0.60	0.20	0.03	0.35	0.12	0.02	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	20	0.05	11.79	0.66	0.22	0.03	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	21	0.06	12.38	0.72	0.24	0.04	0.43	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	22	0.06	12.97	0.78	0.26	0.04	0.46	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	6502	← *=C26/C29*	23	23	0.06	13.56	0.85	0.28	0.04	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
31				24	24	0.07	14.15	0.91	0.30	0.05	0.54	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
32				25	25	0.07	14.74	0.97	0.32	0.05	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
33				26	26	0.07	15.33	1.03	0.34	0.05	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
34				27	27	0.07	15.92	1.10	0.37	0.05	0.65	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
35				28	28	0.08	16.51	1.16	0.39	0.06	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
36				29	29	0.08	17.10	1.22	0.41	0.06	0.72	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
37				30	30	0.08	17.68	1.28	0.43	0.06	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!



10949	10942	10942	29.96	6450.17	48.38	16.13	2.42	28.52	9.51	1.43	2.31E-11	1.41E-03	1.00E+00
10950	10943	10943	29.96	6450.76	48.38	16.13	2.42	28.52	9.51	1.43	2.30E-11	1.41E-03	1.00E+00
10951	10944	10944	29.96	6451.35	48.38	16.13	2.42	28.52	9.51	1.43	2.29E-11	1.41E-03	1.00E+00
10952	10945	10945	29.97	6451.94	48.38	16.13	2.42	28.52	9.51	1.43	2.29E-11	1.41E-03	1.00E+00
10953	10946	10946	29.97	6452.53	48.38	16.13	2.42	28.52	9.51	1.43	2.28E-11	1.41E-03	1.00E+00
10954	10947	10947	29.97	6453.12	48.38	16.13	2.42	28.52	9.51	1.43	2.28E-11	1.41E-03	1.00E+00
10955	10948	10948	29.97	6453.71	48.39	16.13	2.42	28.52	9.51	1.43	2.27E-11	1.41E-03	1.00E+00
10956	10949	10949	29.98	6454.29	48.39	16.13	2.42	28.52	9.51	1.43	2.27E-11	1.41E-03	1.00E+00
10957	10950	10950	29.98	6454.88	48.39	16.13	2.42	28.52	9.51	1.43	2.26E-11	1.41E-03	1.00E+00
10958	10951	10951	29.98	6455.47	48.39	16.13	2.42	28.53	9.51	1.43	2.26E-11	1.41E-03	1.00E+00
10959	10952	10952	29.98	6456.06	48.39	16.13	2.42	28.53	9.51	1.43	2.25E-11	1.41E-03	1.00E+00
10960	10953	10953	29.99	6456.65	48.39	16.13	2.42	28.53	9.51	1.43	2.25E-11	1.41E-03	1.00E+00
10961	10954	10954	29.99	6457.24	48.39	16.13	2.42	28.53	9.51	1.43	2.24E-11	1.41E-03	1.00E+00
10962	10955	10955	29.99	6457.83	48.40	16.13	2.42	28.53	9.51	1.43	2.24E-11	1.41E-03	1.00E+00
10963	10956	10956	30.00	6458.42	48.40	16.13	2.42	28.53	9.51	1.43	2.23E-11	1.41E-03	1.00E+00
10964	10957	10957	30.00	6459.01	48.40	16.13	2.42	28.53	9.51	1.43	2.23E-11	1.41E-03	1.00E+00
10965	10958	10958	30.00	6459.60	48.40	16.13	2.42	28.53	9.51	1.43	2.22E-11	1.41E-03	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

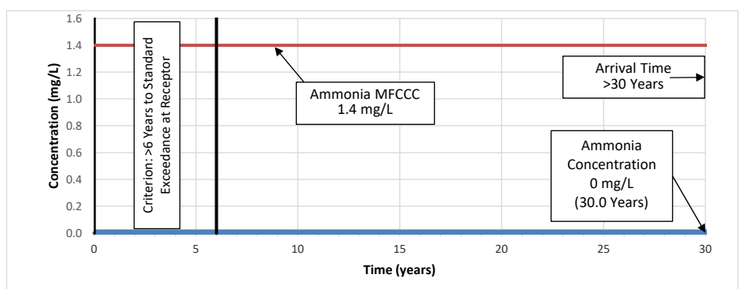
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 3b - Vertical downward flow through till and horizontal flow through bedrock from Leaking Cell 20 Pump Station to Receptor B (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	3128.36	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	161.07	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	6502	17.80	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	6503	17.81	0.59	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	6504	17.81	1.18	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	6505	17.81	1.77	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	6506	17.81	2.36	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	6507	17.82	2.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	6508	17.82	3.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	6509	17.82	4.13	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	5.94E-03	← *=(C4-C5)/C3*	8	6510	17.82	4.72	0.03	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	6511	17.83	5.31	0.06	0.02	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.59	← *=C14*C15/C16*	10	6512	17.83	5.89	0.10	0.03	0.01	0.06	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	6513	17.83	6.48	0.14	0.05	0.01	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	6514	17.84	7.07	0.19	0.06	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	3128.36	← *=C3*	13	6515	17.84	7.66	0.24	0.08	0.01	0.14	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	6516	17.84	8.25	0.30	0.10	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	6517	17.84	8.84	0.36	0.12	0.02	0.21	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	6518	17.85	9.43	0.41	0.14	0.02	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	163.59	*INPUT*	17	6519	17.85	10.02	0.47	0.16	0.02	0.28	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	140.00	*INPUT*	18	6520	17.85	10.61	0.54	0.18	0.03	0.32	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	23.59	← *=C24-C25*	19	6521	17.85	11.20	0.60	0.20	0.03	0.35	0.12	0.02	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	6522	17.86	11.79	0.66	0.22	0.03	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	6523	17.86	12.38	0.72	0.24	0.04	0.43	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	6524	17.86	12.97	0.78	0.26	0.04	0.46	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	6502	← *=C26/C29*	23	6525	17.87	13.56	0.85	0.28	0.04	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
31				24	6526	17.87	14.15	0.91	0.30	0.05	0.54	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
32				25	6527	17.87	14.74	0.97	0.32	0.05	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
33				26	6528	17.87	15.33	1.03	0.34	0.05	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
34				27	6529	17.88	15.92	1.10	0.37	0.05	0.65	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
35				28	6530	17.88	16.51	1.16	0.39	0.06	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
36				29	6531	17.88	17.10	1.22	0.41	0.06	0.72	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
37				30	6532	17.88	17.68	1.28	0.43	0.06	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!



10949				10942	17444	47.76	6450.17	48.38	16.13	2.42	28.52	9.51	1.43	1.39E-14	8.46E-07	1.00E+00
10950				10943	17445	47.76	6450.76	48.38	16.13	2.42	28.52	9.51	1.43	1.39E-14	8.46E-07	1.00E+00
10951				10944	17446	47.77	6451.35	48.38	16.13	2.42	28.52	9.51	1.43	1.38E-14	8.46E-07	1.00E+00
10952				10945	17447	47.77	6451.94	48.38	16.13	2.42	28.52	9.51	1.43	1.38E-14	8.46E-07	1.00E+00
10953				10946	17448	47.77	6452.53	48.38	16.13	2.42	28.52	9.51	1.43	1.38E-14	8.46E-07	1.00E+00
10954				10947	17449	47.77	6453.12	48.38	16.13	2.42	28.52	9.51	1.43	1.37E-14	8.46E-07	1.00E+00
10955				10948	17450	47.78	6453.71	48.39	16.13	2.42	28.52	9.51	1.43	1.37E-14	8.46E-07	1.00E+00
10956				10949	17451	47.78	6454.29	48.39	16.13	2.42	28.52	9.51	1.43	1.37E-14	8.46E-07	1.00E+00
10957				10950	17452	47.78	6454.88	48.39	16.13	2.42	28.52	9.51	1.43	1.36E-14	8.46E-07	1.00E+00
10958				10951	17453	47.78	6455.47	48.39	16.13	2.42	28.53	9.51	1.43	1.36E-14	8.46E-07	1.00E+00
10959				10952	17454	47.79	6456.06	48.39	16.13	2.42	28.53	9.51	1.43	1.36E-14	8.46E-07	1.00E+00
10960				10953	17455	47.79	6456.65	48.39	16.13	2.42	28.53	9.51	1.43	1.35E-14	8.46E-07	1.00E+00
10961				10954	17456	47.79	6457.24	48.39	16.13	2.42	28.53	9.51	1.43	1.35E-14	8.46E-07	1.00E+00
10962				10955	17457	47.80	6457.83	48.40	16.13	2.42	28.53	9.51	1.43	1.35E-14	8.46E-07	1.00E+00
10963				10956	17458	47.80	6458.42	48.40	16.13	2.42	28.53	9.51	1.43	1.35E-14	8.46E-07	1.00E+00
10964				10957	17459	47.80	6459.01	48.40	16.13	2.42	28.53	9.51	1.43	1.34E-14	8.46E-07	1.00E+00
10965				10958	17460	47.80	6459.60	48.40	16.13	2.42	28.53	9.51	1.43	1.34E-14	8.46E-07	1.00E+00

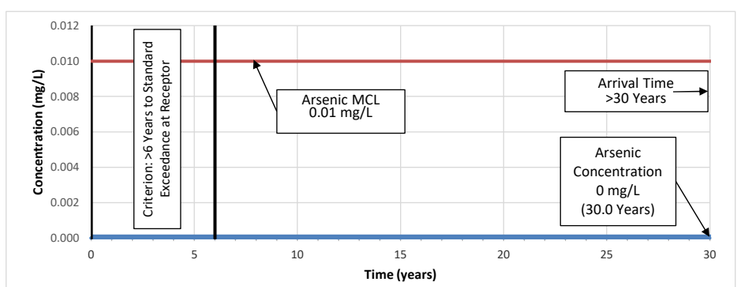
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 4a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 1 within boundary of leaking Phase II Expansion to Receptor B (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	39564538.58	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4546	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



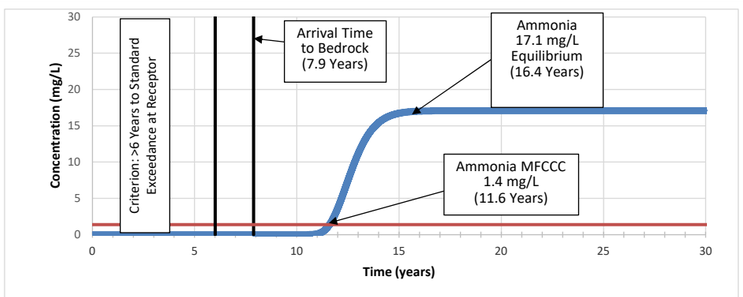
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 4a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 1 within boundary of leaking Phase II Expansion to Receptor B (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	23828.64	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4546	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



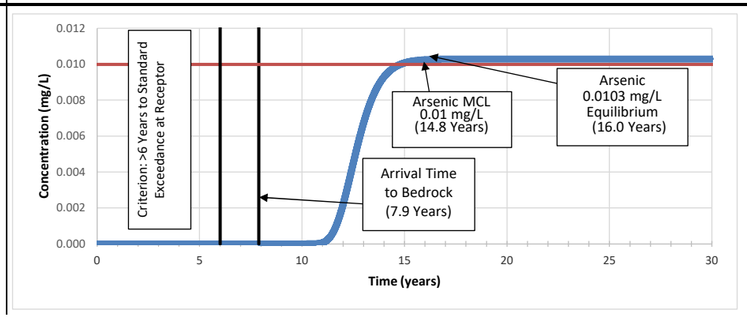
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 4b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 1 within boundary of leaking Phase II Expansion to Receptor B (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	2877	7.88	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	2878	7.88	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2879	7.88	1.93	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	2880	7.89	2.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	2881	7.89	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	2882	7.89	4.82	0.04	0.01	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	39564538.58	← *=C11*C12*3.7854118*	6	2883	7.89	5.79	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	2884	7.90	6.75	0.17	0.06	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	2885	7.90	7.71	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	2886	7.90	8.68	0.34	0.11	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	2887	7.91	9.64	0.44	0.15	0.02	0.42	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	2888	7.91	10.61	0.54	0.18	0.03	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	2889	7.91	11.57	0.64	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	2890	7.91	12.53	0.74	0.25	0.04	0.71	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	2891	7.92	13.50	0.84	0.28	0.04	0.81	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	2892	7.92	14.46	0.94	0.31	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	2893	7.92	15.43	1.04	0.35	0.05	1.01	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	164.78	*INPUT*	17	2894	7.92	16.39	1.15	0.38	0.06	1.10	0.37	0.06	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	159.33	*INPUT*	18	2895	7.93	17.36	1.25	0.42	0.06	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	5.45	← *=C24-C25*	19	2896	7.93	18.32	1.35	0.45	0.07	1.30	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	2897	7.93	19.28	1.45	0.48	0.07	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	2898	7.94	20.25	1.54	0.51	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	2899	7.94	21.21	1.64	0.55	0.08	1.58	0.53	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	1502	← *=C26/C29*	23	2900	7.94	22.18	1.74	0.58	0.09	1.67	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	2901	7.94	23.14	1.83	0.61	0.09	1.77	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	2902	7.95	24.11	1.92	0.64	0.10	1.86	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	2903	7.95	25.07	2.02	0.67	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	2904	7.95	26.03	2.11	0.70	0.11	2.03	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	2905	7.95	27.00	2.20	0.73	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	2906	7.96	27.96	2.29	0.76	0.11	2.21	0.74	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	2907	7.96	28.93	2.38	0.79	0.12	2.29	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	13819	37.84	10550.28	56.30	18.77	2.82	54.29	18.10	2.71	2.91E-18	1.71E+01	1.00E+00
10950				10943	13820	37.84	10551.25	56.31	18.77	2.82	54.29	18.10	2.71	2.90E-18	1.71E+01	1.00E+00
10951				10944	13821	37.84	10552.21	56.31	18.77	2.82	54.29	18.10	2.71	2.89E-18	1.71E+01	1.00E+00
10952				10945	13822	37.84	10553.17	56.31	18.77	2.82	54.29	18.10	2.71	2.88E-18	1.71E+01	1.00E+00
10953				10946	13823	37.85	10554.14	56.31	18.77	2.82	54.29	18.10	2.71	2.87E-18	1.71E+01	1.00E+00
10954				10947	13824	37.85	10555.10	56.31	18.77	2.82	54.30	18.10	2.71	2.86E-18	1.71E+01	1.00E+00
10955				10948	13825	37.85	10556.07	56.31	18.77	2.82	54.30	18.10	2.71	2.85E-18	1.71E+01	1.00E+00
10956				10949	13826	37.85	10557.03	56.32	18.77	2.82	54.30	18.10	2.71	2.84E-18	1.71E+01	1.00E+00
10957				10950	13827	37.86	10558.00	56.32	18.77	2.82	54.30	18.10	2.72	2.83E-18	1.71E+01	1.00E+00
10958				10951	13828	37.86	10558.96	56.32	18.77	2.82	54.30	18.10	2.72	2.82E-18	1.71E+01	1.00E+00
10959				10952	13829	37.86	10559.92	56.32	18.77	2.82	54.30	18.10	2.72	2.81E-18	1.71E+01	1.00E+00
10960				10953	13830	37.87	10560.89	56.32	18.77	2.82	54.31	18.10	2.72	2.80E-18	1.71E+01	1.00E+00
10961				10954	13831	37.87	10561.85	56.32	18.77	2.82	54.31	18.10	2.72	2.79E-18	1.71E+01	1.00E+00
10962				10955	13832	37.87	10562.82	56.32	18.77	2.82	54.31	18.10	2.72	2.78E-18	1.71E+01	1.00E+00
10963				10956	13833	37.87	10563.78	56.33	18.78	2.82	54.31	18.10	2.72	2.77E-18	1.71E+01	1.00E+00
10964				10957	13834	37.88	10564.75	56.33	18.78	2.82	54.31	18.10	2.72	2.76E-18	1.71E+01	1.00E+00
10965				10958	13835	37.88	10565.71	56.33	18.78	2.82	54.31	18.10	2.72	2.75E-18	1.71E+01	1.00E+00



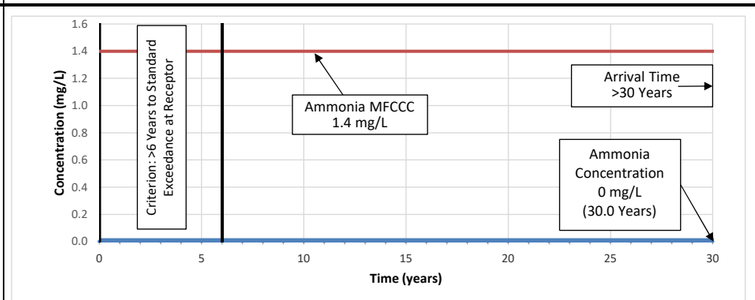
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 4b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 1 within boundary of leaking Phase II Expansion to Receptor B (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	2877	7.88	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	2878	7.88	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2879	7.88	1.93	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	1587.85	← *=C7*C9*	3	2880	7.89	2.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	11877.10	← *=C10*7.48*	4	2881	7.89	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	2882	7.89	4.82	0.04	0.01	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	23828.64	← *=C11*C12*3.7854118*	6	2883	7.89	5.79	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	2884	7.90	6.75	0.17	0.06	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	2885	7.90	7.71	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	2886	7.90	8.68	0.34	0.11	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	2887	7.91	9.64	0.44	0.15	0.02	0.42	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	2888	7.91	10.61	0.54	0.18	0.03	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	2889	7.91	11.57	0.64	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	2890	7.91	12.53	0.74	0.25	0.04	0.71	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	2891	7.92	13.50	0.84	0.28	0.04	0.81	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	2892	7.92	14.46	0.94	0.31	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	2893	7.92	15.43	1.04	0.35	0.05	1.01	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	164.78	*INPUT*	17	2894	7.92	16.39	1.15	0.38	0.06	1.10	0.37	0.06	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	159.33	*INPUT*	18	2895	7.93	17.36	1.25	0.42	0.06	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	5.45	← *=C24-C25*	19	2896	7.93	18.32	1.35	0.45	0.07	1.30	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	2897	7.93	19.28	1.45	0.48	0.07	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	2898	7.94	20.25	1.54	0.51	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	2899	7.94	21.21	1.64	0.55	0.08	1.58	0.53	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	1502	← *=C26/C29*	23	2900	7.94	22.18	1.74	0.58	0.09	1.67	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	2901	7.94	23.14	1.83	0.61	0.09	1.77	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	2902	7.95	24.11	1.92	0.64	0.10	1.86	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	2903	7.95	25.07	2.02	0.67	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	2904	7.95	26.03	2.11	0.70	0.11	2.03	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	2905	7.95	27.00	2.20	0.73	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	2906	7.96	27.96	2.29	0.76	0.11	2.21	0.74	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	2907	7.96	28.93	2.38	0.79	0.12	2.29	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	13819	37.84	10550.28	56.30	18.77	2.82	54.29	18.10	2.71	1.75E-21	1.03E-02	1.00E+00
10950				10943	13820	37.84	10551.25	56.31	18.77	2.82	54.29	18.10	2.71	1.75E-21	1.03E-02	1.00E+00
10951				10944	13821	37.84	10552.21	56.31	18.77	2.82	54.29	18.10	2.71	1.74E-21	1.03E-02	1.00E+00
10952				10945	13822	37.84	10553.17	56.31	18.77	2.82	54.29	18.10	2.71	1.73E-21	1.03E-02	1.00E+00
10953				10946	13823	37.85	10554.14	56.31	18.77	2.82	54.29	18.10	2.71	1.73E-21	1.03E-02	1.00E+00
10954				10947	13824	37.85	10555.10	56.31	18.77	2.82	54.30	18.10	2.71	1.72E-21	1.03E-02	1.00E+00
10955				10948	13825	37.85	10556.07	56.31	18.77	2.82	54.30	18.10	2.71	1.72E-21	1.03E-02	1.00E+00
10956				10949	13826	37.85	10557.03	56.32	18.77	2.82	54.30	18.10	2.71	1.71E-21	1.03E-02	1.00E+00
10957				10950	13827	37.86	10558.00	56.32	18.77	2.82	54.30	18.10	2.72	1.70E-21	1.03E-02	1.00E+00
10958				10951	13828	37.86	10558.96	56.32	18.77	2.82	54.30	18.10	2.72	1.70E-21	1.03E-02	1.00E+00
10959				10952	13829	37.86	10559.92	56.32	18.77	2.82	54.30	18.10	2.72	1.69E-21	1.03E-02	1.00E+00
10960				10953	13830	37.87	10560.89	56.32	18.77	2.82	54.31	18.10	2.72	1.69E-21	1.03E-02	1.00E+00
10961				10954	13831	37.87	10561.85	56.32	18.77	2.82	54.31	18.10	2.72	1.68E-21	1.03E-02	1.00E+00
10962				10955	13832	37.87	10562.82	56.32	18.77	2.82	54.31	18.10	2.72	1.68E-21	1.03E-02	1.00E+00
10963				10956	13833	37.87	10563.78	56.33	18.78	2.82	54.31	18.10	2.72	1.67E-21	1.03E-02	1.00E+00
10964				10957	13834	37.88	10564.75	56.33	18.78	2.82	54.31	18.10	2.72	1.66E-21	1.03E-02	1.00E+00
10965				10958	13835	37.88	10565.71	56.33	18.78	2.82	54.31	18.10	2.72	1.66E-21	1.03E-02	1.00E+00



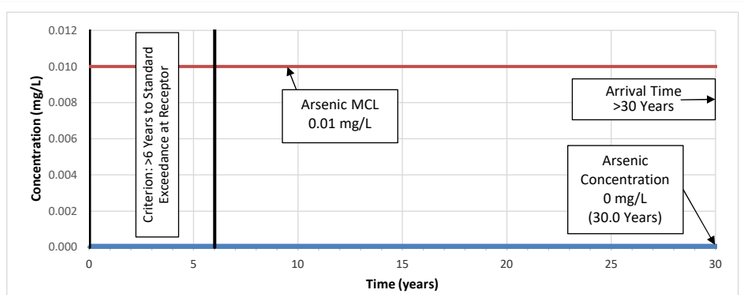
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 5a - Horizontal flow through till from boundary of leaking Phase II Expansion (via interpreted flow path) to Receptor D (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.59E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.69E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1533	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



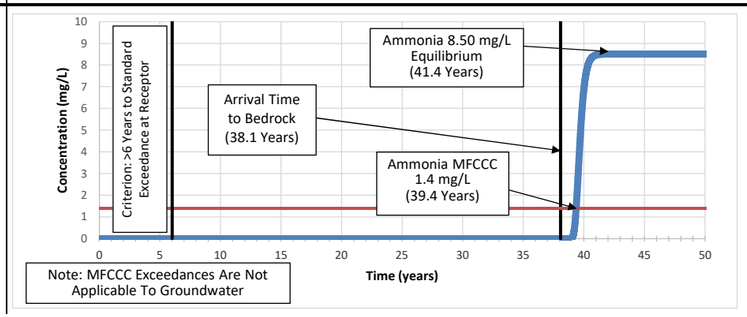
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 5a - Horizontal flow through till from boundary of leaking Phase II Expansion (via interpreted flow path) to Receptor D (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.59E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.69E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1533	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		18.51	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		18.52	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		18.53	1.37	0.46	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



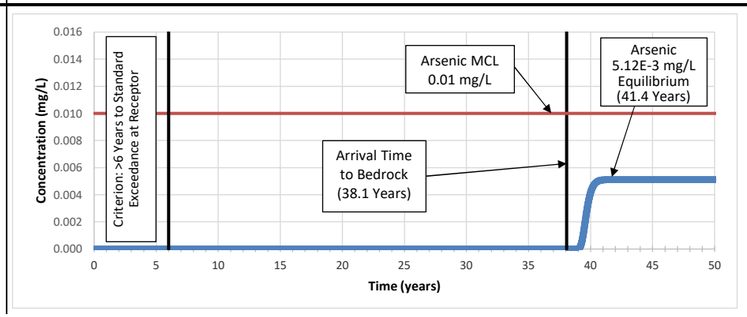
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 5b - Vertical downward flow through till and horizontal flow through bedrock from boundary of leaking Phase II Expansion (via interpreted flow path) to Receptor D (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13903	38.07	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13904	38.07	1.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	13905	38.07	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	13906	38.07	5.03	0.05	0.02	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	13907	38.08	6.70	0.16	0.05	0.01	0.27	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	13908	38.08	8.38	0.31	0.10	0.02	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	13909	38.08	10.05	0.48	0.16	0.02	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13910	38.08	11.73	0.65	0.22	0.03	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.69E-02	← *=(C4-C5)/C3*	8	13911	38.09	13.40	0.83	0.28	0.04	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13912	38.09	15.08	1.01	0.34	0.05	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.68	← *=C14*C15/C16*	10	13913	38.09	16.75	1.18	0.39	0.06	1.98	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13914	38.10	18.43	1.36	0.45	0.07	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13915	38.10	20.11	1.53	0.51	0.08	2.56	0.85	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13916	38.10	21.78	1.70	0.57	0.08	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13917	38.10	23.46	1.86	0.62	0.09	3.12	1.04	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13918	38.11	25.13	2.02	0.67	0.10	3.39	1.13	0.17	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13919	38.11	26.81	2.18	0.73	0.11	3.66	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	207.60	*INPUT*	17	13920	38.11	28.48	2.34	0.78	0.12	3.92	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	157.16	*INPUT*	18	13921	38.11	30.16	2.49	0.83	0.12	4.17	1.39	0.21	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	50.45	← *=C24-C25*	19	13922	38.12	31.83	2.64	0.88	0.13	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	13923	38.12	33.51	2.78	0.93	0.14	4.66	1.55	0.23	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	13924	38.12	35.18	2.93	0.98	0.15	4.90	1.63	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	13925	38.13	36.86	3.07	1.02	0.15	5.14	1.71	0.26	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	13903	← *=C26/C29*	23	13926	38.13	38.54	3.21	1.07	0.16	5.37	1.79	0.27	0.00E+00	0.00E+00	#DIV/0!
31				24	13927	38.13	40.21	3.34	1.11	0.17	5.60	1.87	0.28	0.00E+00	0.00E+00	#DIV/0!
32				25	13928	38.13	41.89	3.47	1.16	0.17	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
33				26	13929	38.14	43.56	3.60	1.20	0.18	6.04	2.01	0.30	0.00E+00	0.00E+00	#DIV/0!
34				27	13930	38.14	45.24	3.73	1.24	0.19	6.25	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
35				28	13931	38.14	46.91	3.86	1.29	0.19	6.46	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
36				29	13932	38.14	48.59	3.98	1.33	0.20	6.67	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
37				30	13933	38.15	50.26	4.10	1.37	0.21	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24845	68.02	18332.88	66.06	22.02	3.30	110.68	36.89	5.53	9.08E-32	8.50E+00	1.00E+00
10950				10943	24846	68.03	18334.55	66.06	22.02	3.30	110.68	36.89	5.53	9.03E-32	8.50E+00	1.00E+00
10951				10944	24847	68.03	18336.23	66.06	22.02	3.30	110.68	36.89	5.53	8.99E-32	8.50E+00	1.00E+00
10952				10945	24848	68.03	18337.90	66.06	22.02	3.30	110.69	36.90	5.53	8.94E-32	8.50E+00	1.00E+00
10953				10946	24849	68.03	18339.58	66.06	22.02	3.30	110.69	36.90	5.53	8.90E-32	8.50E+00	1.00E+00
10954				10947	24850	68.04	18341.25	66.07	22.02	3.30	110.69	36.90	5.53	8.86E-32	8.50E+00	1.00E+00
10955				10948	24851	68.04	18342.93	66.07	22.02	3.30	110.69	36.90	5.53	8.81E-32	8.50E+00	1.00E+00
10956				10949	24852	68.04	18344.60	66.07	22.02	3.30	110.70	36.90	5.53	8.77E-32	8.50E+00	1.00E+00
10957				10950	24853	68.04	18346.28	66.07	22.02	3.30	110.70	36.90	5.53	8.73E-32	8.50E+00	1.00E+00
10958				10951	24854	68.05	18347.95	66.07	22.02	3.30	110.70	36.90	5.54	8.68E-32	8.50E+00	1.00E+00
10959				10952	24855	68.05	18349.63	66.07	22.02	3.30	110.71	36.90	5.54	8.64E-32	8.50E+00	1.00E+00
10960				10953	24856	68.05	18351.31	66.08	22.03	3.30	110.71	36.90	5.54	8.60E-32	8.50E+00	1.00E+00
10961				10954	24857	68.06	18352.98	66.08	22.03	3.30	110.71	36.90	5.54	8.56E-32	8.50E+00	1.00E+00
10962				10955	24858	68.06	18354.66	66.08	22.03	3.30	110.71	36.90	5.54	8.52E-32	8.50E+00	1.00E+00
10963				10956	24859	68.06	18356.33	66.08	22.03	3.30	110.72	36.91	5.54	8.47E-32	8.50E+00	1.00E+00
10964				10957	24860	68.06	18358.01	66.08	22.03	3.30	110.72	36.91	5.54	8.43E-32	8.50E+00	1.00E+00
10965				10958	24861	68.07	18359.68	66.08	22.03	3.30	110.72	36.91	5.54	8.39E-32	8.50E+00	1.00E+00



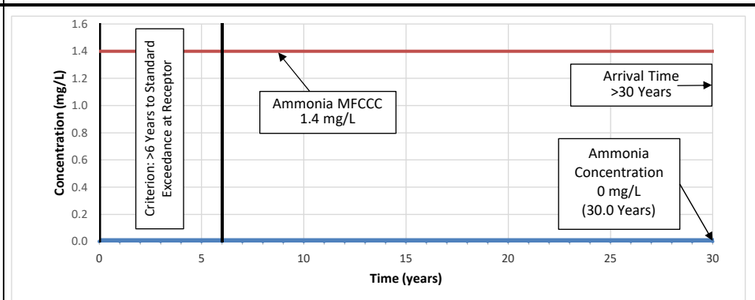
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 5b - Vertical downward flow through till and horizontal flow through bedrock from boundary of leaking Phase II Expansion (via interpreted flow path) to Receptor D (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13903	38.07	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13904	38.07	1.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	13905	38.07	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	13906	38.07	5.03	0.05	0.02	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	13907	38.08	6.70	0.16	0.05	0.01	0.27	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	13908	38.08	8.38	0.31	0.10	0.02	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	13909	38.08	10.05	0.48	0.16	0.02	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13910	38.08	11.73	0.65	0.22	0.03	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.69E-02	← *=(C4-C5)/C3*	8	13911	38.09	13.40	0.83	0.28	0.04	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13912	38.09	15.08	1.01	0.34	0.05	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.68	← *=C14*C15/C16*	10	13913	38.09	16.75	1.18	0.39	0.06	1.98	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13914	38.10	18.43	1.36	0.45	0.07	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13915	38.10	20.11	1.53	0.51	0.08	2.56	0.85	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13916	38.10	21.78	1.70	0.57	0.08	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13917	38.10	23.46	1.86	0.62	0.09	3.12	1.04	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13918	38.11	25.13	2.02	0.67	0.10	3.39	1.13	0.17	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13919	38.11	26.81	2.18	0.73	0.11	3.66	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	207.60	*INPUT*	17	13920	38.11	28.48	2.34	0.78	0.12	3.92	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	157.16	*INPUT*	18	13921	38.11	30.16	2.49	0.83	0.12	4.17	1.39	0.21	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	50.45	← *=C24-C25*	19	13922	38.12	31.83	2.64	0.88	0.13	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	13923	38.12	33.51	2.78	0.93	0.14	4.66	1.55	0.23	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	13924	38.12	35.18	2.93	0.98	0.15	4.90	1.63	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	13925	38.13	36.86	3.07	1.02	0.15	5.14	1.71	0.26	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	13903	← *=C26/C29*	23	13926	38.13	38.54	3.21	1.07	0.16	5.37	1.79	0.27	0.00E+00	0.00E+00	#DIV/0!
31				24	13927	38.13	40.21	3.34	1.11	0.17	5.60	1.87	0.28	0.00E+00	0.00E+00	#DIV/0!
32				25	13928	38.13	41.89	3.47	1.16	0.17	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
33				26	13929	38.14	43.56	3.60	1.20	0.18	6.04	2.01	0.30	0.00E+00	0.00E+00	#DIV/0!
34				27	13930	38.14	45.24	3.73	1.24	0.19	6.25	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
35				28	13931	38.14	46.91	3.86	1.29	0.19	6.46	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
36				29	13932	38.14	48.59	3.98	1.33	0.20	6.67	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
37				30	13933	38.15	50.26	4.10	1.37	0.21	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24845	68.02	18332.88	66.06	22.02	3.30	110.68	36.89	5.53	5.47E-35	5.12E-03	1.00E+00
10950				10943	24846	68.03	18334.55	66.06	22.02	3.30	110.68	36.89	5.53	5.44E-35	5.12E-03	1.00E+00
10951				10944	24847	68.03	18336.23	66.06	22.02	3.30	110.68	36.89	5.53	5.41E-35	5.12E-03	1.00E+00
10952				10945	24848	68.03	18337.90	66.06	22.02	3.30	110.69	36.90	5.53	5.39E-35	5.12E-03	1.00E+00
10953				10946	24849	68.03	18339.58	66.06	22.02	3.30	110.69	36.90	5.53	5.36E-35	5.12E-03	1.00E+00
10954				10947	24850	68.04	18341.25	66.07	22.02	3.30	110.69	36.90	5.53	5.33E-35	5.12E-03	1.00E+00
10955				10948	24851	68.04	18342.93	66.07	22.02	3.30	110.69	36.90	5.53	5.31E-35	5.12E-03	1.00E+00
10956				10949	24852	68.04	18344.60	66.07	22.02	3.30	110.70	36.90	5.53	5.28E-35	5.12E-03	1.00E+00
10957				10950	24853	68.04	18346.28	66.07	22.02	3.30	110.70	36.90	5.53	5.26E-35	5.12E-03	1.00E+00
10958				10951	24854	68.05	18347.95	66.07	22.02	3.30	110.70	36.90	5.54	5.23E-35	5.12E-03	1.00E+00
10959				10952	24855	68.05	18349.63	66.07	22.02	3.30	110.71	36.90	5.54	5.20E-35	5.12E-03	1.00E+00
10960				10953	24856	68.05	18351.31	66.08	22.03	3.30	110.71	36.90	5.54	5.18E-35	5.12E-03	1.00E+00
10961				10954	24857	68.06	18352.98	66.08	22.03	3.30	110.71	36.90	5.54	5.15E-35	5.12E-03	1.00E+00
10962				10955	24858	68.06	18354.66	66.08	22.03	3.30	110.71	36.90	5.54	5.13E-35	5.12E-03	1.00E+00
10963				10956	24859	68.06	18356.33	66.08	22.03	3.30	110.72	36.91	5.54	5.10E-35	5.12E-03	1.00E+00
10964				10957	24860	68.06	18358.01	66.08	22.03	3.30	110.72	36.91	5.54	5.08E-35	5.12E-03	1.00E+00
10965				10958	24861	68.07	18359.68	66.08	22.03	3.30	110.72	36.91	5.54	5.05E-35	5.12E-03	1.00E+00



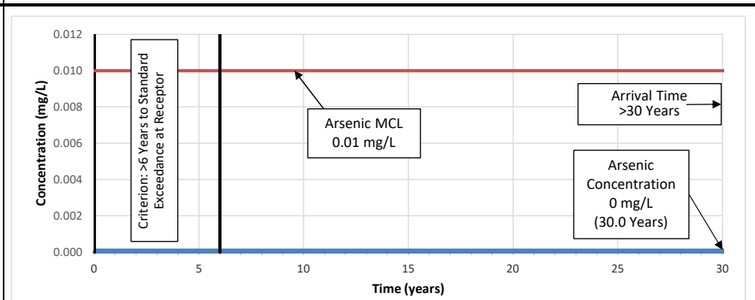
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 6a - Horizontal flow through till from nearest boundary of leaking Phase II Expansion to Receptor E (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.39E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1409	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



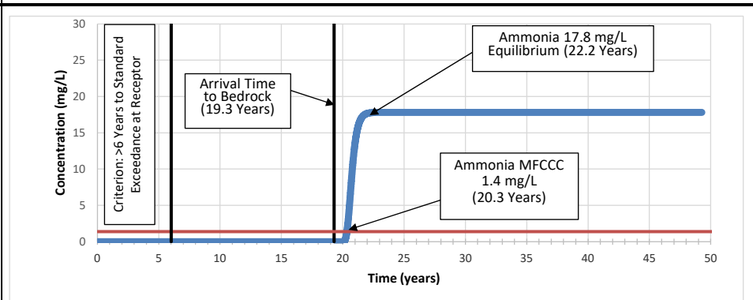
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 6a - Horizontal flow through till from nearest boundary of leaking Phase II Expansion to Receptor E (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.39E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1409	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

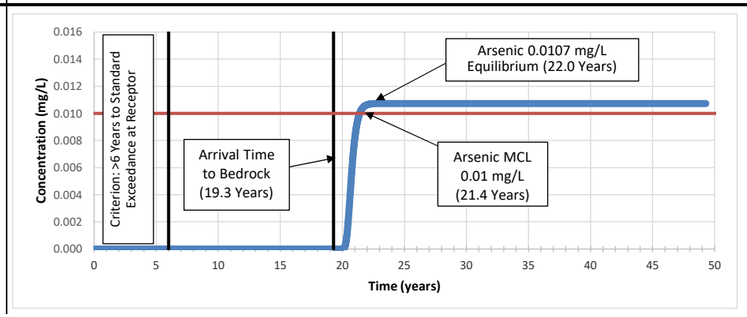
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 6b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor E (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	7043	19.28	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	7044	19.28	1.30	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	7045	19.29	2.60	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	7046	19.29	3.90	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	7047	19.29	5.20	0.06	0.02	0.00	0.07	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	7048	19.30	6.50	0.15	0.05	0.01	0.19	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	7049	19.30	7.80	0.26	0.09	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7050	19.30	9.10	0.38	0.13	0.02	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	7051	19.30	10.40	0.51	0.17	0.03	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7052	19.31	11.70	0.65	0.22	0.03	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.30	← *=C14*C15/C16*	10	7053	19.31	13.00	0.79	0.26	0.04	1.02	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7054	19.31	14.30	0.92	0.31	0.05	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7055	19.31	15.60	1.06	0.35	0.05	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	7056	19.32	16.90	1.20	0.40	0.06	1.56	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7057	19.32	18.20	1.33	0.44	0.07	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7058	19.32	19.50	1.47	0.49	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7059	19.33	20.80	1.60	0.53	0.08	2.08	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	179.82	*INPUT*	17	7060	19.33	22.10	1.73	0.58	0.09	2.25	0.75	0.11	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.27	*INPUT*	18	7061	19.33	23.40	1.86	0.62	0.09	2.41	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	25.55	← *=C24-C25*	19	7062	19.33	24.70	1.98	0.66	0.10	2.58	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	7063	19.34	26.00	2.11	0.70	0.11	2.74	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	7064	19.34	27.30	2.23	0.74	0.11	2.90	0.97	0.14	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	7065	19.34	28.60	2.35	0.78	0.12	3.05	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	7043	← *=C26/C29*	23	7066	19.34	29.90	2.47	0.82	0.12	3.20	1.07	0.16	0.00E+00	0.00E+00	#DIV/0!
31				24	7067	19.35	31.20	2.58	0.86	0.13	3.36	1.12	0.17	0.00E+00	0.00E+00	#DIV/0!
32				25	7068	19.35	32.50	2.70	0.90	0.13	3.50	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
33				26	7069	19.35	33.80	2.81	0.94	0.14	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
34				27	7070	19.36	35.10	2.92	0.97	0.15	3.80	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
35				28	7071	19.36	36.40	3.03	1.01	0.15	3.94	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
36				29	7072	19.36	37.70	3.14	1.05	0.16	4.08	1.36	0.20	0.00E+00	0.00E+00	#DIV/0!
37				30	7073	19.36	39.00	3.24	1.08	0.16	4.22	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!



10949				10942	17985	49.24	14223.06	61.46	20.49	3.07	79.89	26.63	3.99	2.70E-27	1.78E+01	1.00E+00
10950				10943	17986	49.24	14224.36	61.47	20.49	3.07	79.90	26.63	3.99	2.68E-27	1.78E+01	1.00E+00
10951				10944	17987	49.24	14225.66	61.47	20.49	3.07	79.90	26.63	3.99	2.67E-27	1.78E+01	1.00E+00
10952				10945	17988	49.25	14226.96	61.47	20.49	3.07	79.90	26.63	4.00	2.66E-27	1.78E+01	1.00E+00
10953				10946	17989	49.25	14228.26	61.47	20.49	3.07	79.90	26.63	4.00	2.65E-27	1.78E+01	1.00E+00
10954				10947	17990	49.25	14229.56	61.47	20.49	3.07	79.91	26.64	4.00	2.64E-27	1.78E+01	1.00E+00
10955				10948	17991	49.26	14230.86	61.47	20.49	3.07	79.91	26.64	4.00	2.63E-27	1.78E+01	1.00E+00
10956				10949	17992	49.26	14232.16	61.48	20.49	3.07	79.91	26.64	4.00	2.62E-27	1.78E+01	1.00E+00
10957				10950	17993	49.26	14233.46	61.48	20.49	3.07	79.91	26.64	4.00	2.61E-27	1.78E+01	1.00E+00
10958				10951	17994	49.26	14234.76	61.48	20.49	3.07	79.91	26.64	4.00	2.60E-27	1.78E+01	1.00E+00
10959				10952	17995	49.27	14236.06	61.48	20.49	3.07	79.92	26.64	4.00	2.59E-27	1.78E+01	1.00E+00
10960				10953	17996	49.27	14237.36	61.48	20.49	3.07	79.92	26.64	4.00	2.58E-27	1.78E+01	1.00E+00
10961				10954	17997	49.27	14238.66	61.48	20.49	3.07	79.92	26.64	4.00	2.57E-27	1.78E+01	1.00E+00
10962				10955	17998	49.27	14239.96	61.49	20.50	3.07	79.92	26.64	4.00	2.56E-27	1.78E+01	1.00E+00
10963				10956	17999	49.28	14241.26	61.49	20.50	3.07	79.92	26.64	4.00	2.55E-27	1.78E+01	1.00E+00
10964				10957	18000	49.28	14242.56	61.49	20.50	3.07	79.93	26.64	4.00	2.54E-27	1.78E+01	1.00E+00
10965				10958	18001	49.28	14243.86	61.49	20.50	3.07	79.93	26.64	4.00	2.53E-27	1.78E+01	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

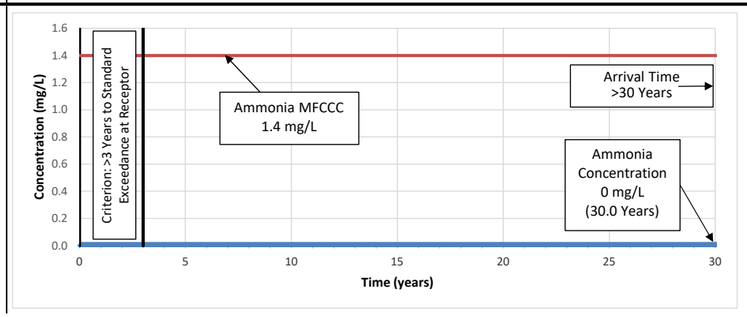
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 6b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor E (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	7043	19.28	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	7044	19.28	1.30	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	7045	19.29	2.60	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	7046	19.29	3.90	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	7047	19.29	5.20	0.06	0.02	0.00	0.07	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	7048	19.30	6.50	0.15	0.05	0.01	0.19	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	7049	19.30	7.80	0.26	0.09	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7050	19.30	9.10	0.38	0.13	0.02	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	7051	19.30	10.40	0.51	0.17	0.03	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7052	19.31	11.70	0.65	0.22	0.03	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.30	← *=C14*C15/C16*	10	7053	19.31	13.00	0.79	0.26	0.04	1.02	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7054	19.31	14.30	0.92	0.31	0.05	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7055	19.31	15.60	1.06	0.35	0.05	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	7056	19.32	16.90	1.20	0.40	0.06	1.56	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7057	19.32	18.20	1.33	0.44	0.07	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7058	19.32	19.50	1.47	0.49	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7059	19.33	20.80	1.60	0.53	0.08	2.08	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	179.82	*INPUT*	17	7060	19.33	22.10	1.73	0.58	0.09	2.25	0.75	0.11	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.27	*INPUT*	18	7061	19.33	23.40	1.86	0.62	0.09	2.41	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	25.55	← *=C24-C25*	19	7062	19.33	24.70	1.98	0.66	0.10	2.58	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	7063	19.34	26.00	2.11	0.70	0.11	2.74	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	7064	19.34	27.30	2.23	0.74	0.11	2.90	0.97	0.14	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	7065	19.34	28.60	2.35	0.78	0.12	3.05	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	7043	← *=C26/C29*	23	7066	19.34	29.90	2.47	0.82	0.12	3.20	1.07	0.16	0.00E+00	0.00E+00	#DIV/0!
31				24	7067	19.35	31.20	2.58	0.86	0.13	3.36	1.12	0.17	0.00E+00	0.00E+00	#DIV/0!
32				25	7068	19.35	32.50	2.70	0.90	0.13	3.50	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
33				26	7069	19.35	33.80	2.81	0.94	0.14	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
34				27	7070	19.36	35.10	2.92	0.97	0.15	3.80	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
35				28	7071	19.36	36.40	3.03	1.01	0.15	3.94	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
36				29	7072	19.36	37.70	3.14	1.05	0.16	4.08	1.36	0.20	0.00E+00	0.00E+00	#DIV/0!
37				30	7073	19.36	39.00	3.24	1.08	0.16	4.22	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!



10942	17985	49.24	14223.06	61.46	20.49	3.07	79.89	26.63	3.99	1.62E-30	1.07E-02	1.00E+00
10943	17986	49.24	14224.36	61.47	20.49	3.07	79.90	26.63	3.99	1.62E-30	1.07E-02	1.00E+00
10944	17987	49.24	14225.66	61.47	20.49	3.07	79.90	26.63	3.99	1.61E-30	1.07E-02	1.00E+00
10945	17988	49.25	14226.96	61.47	20.49	3.07	79.90	26.63	4.00	1.60E-30	1.07E-02	1.00E+00
10946	17989	49.25	14228.26	61.47	20.49	3.07	79.90	26.63	4.00	1.60E-30	1.07E-02	1.00E+00
10947	17990	49.25	14229.56	61.47	20.49	3.07	79.91	26.64	4.00	1.59E-30	1.07E-02	1.00E+00
10948	17991	49.26	14230.86	61.47	20.49	3.07	79.91	26.64	4.00	1.58E-30	1.07E-02	1.00E+00
10949	17992	49.26	14232.16	61.48	20.49	3.07	79.91	26.64	4.00	1.58E-30	1.07E-02	1.00E+00
10950	17993	49.26	14233.46	61.48	20.49	3.07	79.91	26.64	4.00	1.57E-30	1.07E-02	1.00E+00
10951	17994	49.26	14234.76	61.48	20.49	3.07	79.91	26.64	4.00	1.56E-30	1.07E-02	1.00E+00
10952	17995	49.27	14236.06	61.48	20.49	3.07	79.92	26.64	4.00	1.56E-30	1.07E-02	1.00E+00
10953	17996	49.27	14237.36	61.48	20.49	3.07	79.92	26.64	4.00	1.55E-30	1.07E-02	1.00E+00
10954	17997	49.27	14238.66	61.48	20.49	3.07	79.92	26.64	4.00	1.55E-30	1.07E-02	1.00E+00
10955	17998	49.27	14239.96	61.49	20.50	3.07	79.92	26.64	4.00	1.54E-30	1.07E-02	1.00E+00
10956	17999	49.28	14241.26	61.49	20.50	3.07	79.92	26.64	4.00	1.53E-30	1.07E-02	1.00E+00
10957	18000	49.28	14242.56	61.49	20.50	3.07	79.93	26.64	4.00	1.53E-30	1.07E-02	1.00E+00
10958	18001	49.28	14243.86	61.49	20.50	3.07	79.93	26.64	4.00	1.52E-30	1.07E-02	1.00E+00

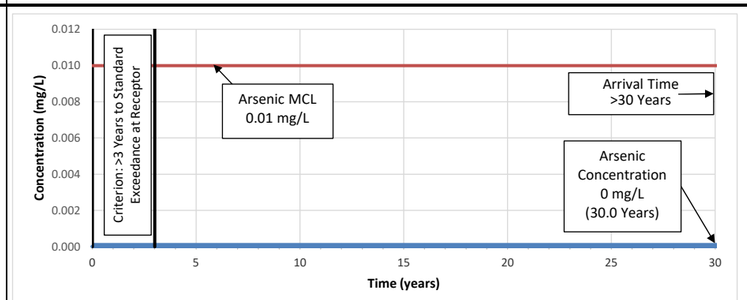
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 7a - Horizontal flow through till from leaking Cell 19 Pump Station to Receptor E (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	699.75	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.24E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.32E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	699.75	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1455	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



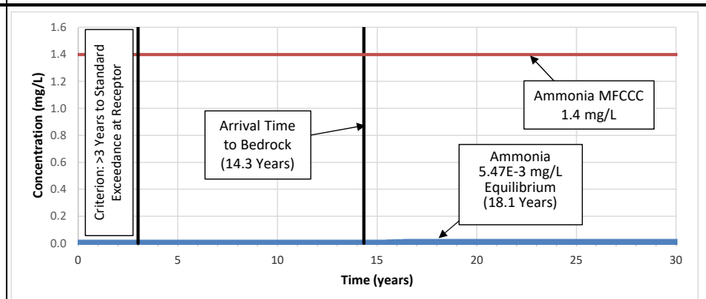
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 7a - Horizontal flow through till from leaking Cell 19 Pump Station to Receptor E (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	699.75	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.24E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.32E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	699.75	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1455	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		14.41	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		14.42	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		14.43	0.94	0.31	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



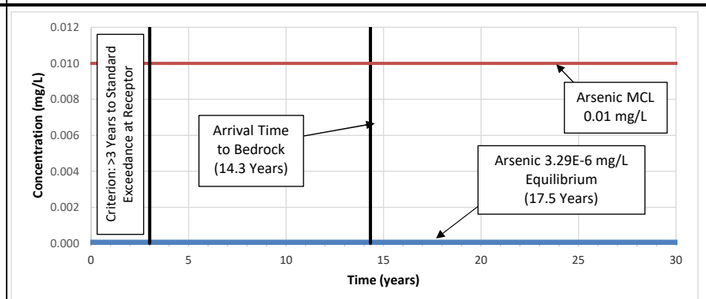
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 7b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 19 Pump Station to Receptor E (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	699.75	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	5232	14.32	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	5233	14.33	1.23	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	5234	14.33	2.46	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	5235	14.33	3.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	5236	14.33	4.91	0.04	0.01	0.00	0.05	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5237	14.34	6.14	0.12	0.04	0.01	0.14	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	5238	14.34	7.37	0.22	0.07	0.01	0.27	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	5239	14.34	8.59	0.33	0.11	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.24E-02	← *=(C4-C5)/C3*	8	5240	14.35	9.82	0.45	0.15	0.02	0.56	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	5241	14.35	11.05	0.58	0.19	0.03	0.71	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.23	← *=C14*C15/C16*	10	5242	14.35	12.28	0.71	0.24	0.04	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	5243	14.35	13.50	0.84	0.28	0.04	1.03	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	5244	14.36	14.73	0.97	0.32	0.05	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	699.75	← *=C3*	13	5245	14.36	15.96	1.10	0.37	0.06	1.35	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	5246	14.36	17.19	1.23	0.41	0.06	1.51	0.50	0.08	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	5247	14.37	18.42	1.36	0.45	0.07	1.67	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	5248	14.37	19.64	1.48	0.49	0.07	1.82	0.61	0.09	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	173.07	*INPUT*	17	5249	14.37	20.87	1.61	0.54	0.08	1.97	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.08	*INPUT*	18	5250	14.37	22.10	1.73	0.58	0.09	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	18.98	← *=C24-C25*	19	5251	14.38	23.33	1.85	0.62	0.09	2.27	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	5252	14.38	24.55	1.97	0.66	0.10	2.42	0.81	0.12	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	5253	14.38	25.78	2.09	0.70	0.10	2.56	0.85	0.13	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	5254	14.38	27.01	2.20	0.73	0.11	2.70	0.90	0.14	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	5232	← *=C26/C29*	23	5255	14.39	28.24	2.31	0.77	0.12	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
31				24	5256	14.39	29.46	2.43	0.81	0.12	2.98	0.99	0.15	0.00E+00	0.00E+00	#DIV/0!
32				25	5257	14.39	30.69	2.54	0.85	0.13	3.11	1.04	0.16	0.00E+00	0.00E+00	#DIV/0!
33				26	5258	14.40	31.92	2.65	0.88	0.13	3.25	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
34				27	5259	14.40	33.15	2.75	0.92	0.14	3.38	1.13	0.17	0.00E+00	0.00E+00	#DIV/0!
35				28	5260	14.40	34.38	2.86	0.95	0.14	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
36				29	5261	14.40	35.60	2.96	0.99	0.15	3.64	1.21	0.18	0.00E+00	0.00E+00	#DIV/0!
37				30	5262	14.41	36.83	3.07	1.02	0.15	3.76	1.25	0.19	0.00E+00	0.00E+00	#DIV/0!
10949				10942	16174	44.28	13433.32	60.46	20.15	3.02	74.22	24.74	3.71	7.98E-30	5.47E-03	1.00E+00
10950				10943	16175	44.28	13434.55	60.46	20.15	3.02	74.22	24.74	3.71	7.95E-30	5.47E-03	1.00E+00
10951				10944	16176	44.29	13435.78	60.46	20.15	3.02	74.23	24.74	3.71	7.92E-30	5.47E-03	1.00E+00
10952				10945	16177	44.29	13437.00	60.46	20.15	3.02	74.23	24.74	3.71	7.89E-30	5.47E-03	1.00E+00
10953				10946	16178	44.29	13438.23	60.46	20.15	3.02	74.23	24.74	3.71	7.86E-30	5.47E-03	1.00E+00
10954				10947	16179	44.30	13439.46	60.46	20.15	3.02	74.23	24.74	3.71	7.83E-30	5.47E-03	1.00E+00
10955				10948	16180	44.30	13440.69	60.47	20.16	3.02	74.23	24.74	3.71	7.80E-30	5.47E-03	1.00E+00
10956				10949	16181	44.30	13441.91	60.47	20.16	3.02	74.24	24.75	3.71	7.77E-30	5.47E-03	1.00E+00
10957				10950	16182	44.30	13443.14	60.47	20.16	3.02	74.24	24.75	3.71	7.74E-30	5.47E-03	1.00E+00
10958				10951	16183	44.31	13444.37	60.47	20.16	3.02	74.24	24.75	3.71	7.71E-30	5.47E-03	1.00E+00
10959				10952	16184	44.31	13445.60	60.47	20.16	3.02	74.24	24.75	3.71	7.68E-30	5.47E-03	1.00E+00
10960				10953	16185	44.31	13446.82	60.47	20.16	3.02	74.24	24.75	3.71	7.65E-30	5.47E-03	1.00E+00
10961				10954	16186	44.31	13448.05	60.48	20.16	3.02	74.25	24.75	3.71	7.62E-30	5.47E-03	1.00E+00
10962				10955	16187	44.32	13449.28	60.48	20.16	3.02	74.25	24.75	3.71	7.59E-30	5.47E-03	1.00E+00
10963				10956	16188	44.32	13450.51	60.48	20.16	3.02	74.25	24.75	3.71	7.56E-30	5.47E-03	1.00E+00
10964				10957	16189	44.32	13451.74	60.48	20.16	3.02	74.25	24.75	3.71	7.53E-30	5.47E-03	1.00E+00
10965				10958	16190	44.33	13452.96	60.48	20.16	3.02	74.25	24.75	3.71	7.50E-30	5.47E-03	1.00E+00



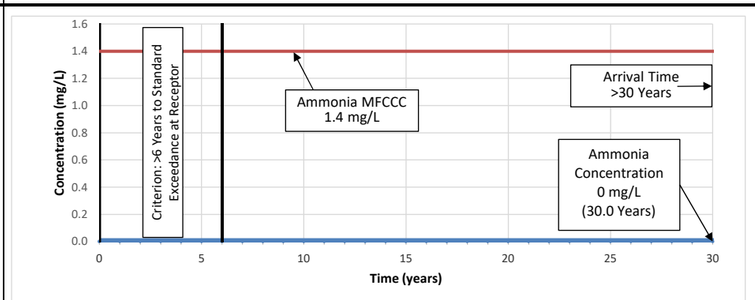
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 7b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 19 Pump Station to Receptor E (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	699.75	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	5232	14.32	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	5233	14.33	1.23	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	5234	14.33	2.46	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	5235	14.33	3.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	5236	14.33	4.91	0.04	0.01	0.00	0.05	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5237	14.34	6.14	0.12	0.04	0.01	0.14	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	5238	14.34	7.37	0.22	0.07	0.01	0.27	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	5239	14.34	8.59	0.33	0.11	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.24E-02	← *=(C4-C5)/C3*	8	5240	14.35	9.82	0.45	0.15	0.02	0.56	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	5241	14.35	11.05	0.58	0.19	0.03	0.71	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.23	← *=C14*C15/C16*	10	5242	14.35	12.28	0.71	0.24	0.04	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	5243	14.35	13.50	0.84	0.28	0.04	1.03	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	5244	14.36	14.73	0.97	0.32	0.05	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	699.75	← *=C3*	13	5245	14.36	15.96	1.10	0.37	0.06	1.35	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	5246	14.36	17.19	1.23	0.41	0.06	1.51	0.50	0.08	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	5247	14.37	18.42	1.36	0.45	0.07	1.67	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	5248	14.37	19.64	1.48	0.49	0.07	1.82	0.61	0.09	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	173.07	*INPUT*	17	5249	14.37	20.87	1.61	0.54	0.08	1.97	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.08	*INPUT*	18	5250	14.37	22.10	1.73	0.58	0.09	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	18.98	← *=C24-C25*	19	5251	14.38	23.33	1.85	0.62	0.09	2.27	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	5252	14.38	24.55	1.97	0.66	0.10	2.42	0.81	0.12	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	5253	14.38	25.78	2.09	0.70	0.10	2.56	0.85	0.13	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	5254	14.38	27.01	2.20	0.73	0.11	2.70	0.90	0.14	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	5232	← *=C26/C29*	23	5255	14.39	28.24	2.31	0.77	0.12	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
31				24	5256	14.39	29.46	2.43	0.81	0.12	2.98	0.99	0.15	0.00E+00	0.00E+00	#DIV/0!
32				25	5257	14.39	30.69	2.54	0.85	0.13	3.11	1.04	0.16	0.00E+00	0.00E+00	#DIV/0!
33				26	5258	14.40	31.92	2.65	0.88	0.13	3.25	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
34				27	5259	14.40	33.15	2.75	0.92	0.14	3.38	1.13	0.17	0.00E+00	0.00E+00	#DIV/0!
35				28	5260	14.40	34.38	2.86	0.95	0.14	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
36				29	5261	14.40	35.60	2.96	0.99	0.15	3.64	1.21	0.18	0.00E+00	0.00E+00	#DIV/0!
37				30	5262	14.41	36.83	3.07	1.02	0.15	3.76	1.25	0.19	0.00E+00	0.00E+00	#DIV/0!
10949				10942	16174	44.28	13433.32	60.46	20.15	3.02	74.22	24.74	3.71	4.81E-33	3.29E-06	1.00E+00
10950				10943	16175	44.28	13434.55	60.46	20.15	3.02	74.22	24.74	3.71	4.79E-33	3.29E-06	1.00E+00
10951				10944	16176	44.29	13435.78	60.46	20.15	3.02	74.23	24.74	3.71	4.77E-33	3.29E-06	1.00E+00
10952				10945	16177	44.29	13437.00	60.46	20.15	3.02	74.23	24.74	3.71	4.75E-33	3.29E-06	1.00E+00
10953				10946	16178	44.29	13438.23	60.46	20.15	3.02	74.23	24.74	3.71	4.73E-33	3.29E-06	1.00E+00
10954				10947	16179	44.30	13439.46	60.46	20.15	3.02	74.23	24.74	3.71	4.71E-33	3.29E-06	1.00E+00
10955				10948	16180	44.30	13440.69	60.47	20.16	3.02	74.23	24.74	3.71	4.70E-33	3.29E-06	1.00E+00
10956				10949	16181	44.30	13441.91	60.47	20.16	3.02	74.24	24.75	3.71	4.68E-33	3.29E-06	1.00E+00
10957				10950	16182	44.30	13443.14	60.47	20.16	3.02	74.24	24.75	3.71	4.66E-33	3.29E-06	1.00E+00
10958				10951	16183	44.31	13444.37	60.47	20.16	3.02	74.24	24.75	3.71	4.64E-33	3.29E-06	1.00E+00
10959				10952	16184	44.31	13445.60	60.47	20.16	3.02	74.24	24.75	3.71	4.62E-33	3.29E-06	1.00E+00
10960				10953	16185	44.31	13446.82	60.47	20.16	3.02	74.24	24.75	3.71	4.60E-33	3.29E-06	1.00E+00
10961				10954	16186	44.31	13448.05	60.48	20.16	3.02	74.25	24.75	3.71	4.59E-33	3.29E-06	1.00E+00
10962				10955	16187	44.32	13449.28	60.48	20.16	3.02	74.25	24.75	3.71	4.57E-33	3.29E-06	1.00E+00
10963				10956	16188	44.32	13450.51	60.48	20.16	3.02	74.25	24.75	3.71	4.55E-33	3.29E-06	1.00E+00
10964				10957	16189	44.32	13451.74	60.48	20.16	3.02	74.25	24.75	3.71	4.53E-33	3.29E-06	1.00E+00
10965				10958	16190	44.33	13452.96	60.48	20.16	3.02	74.25	24.75	3.71	4.52E-33	3.29E-06	1.00E+00



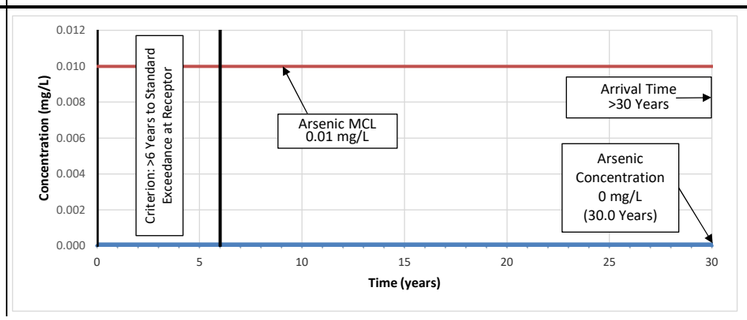
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 8a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 2 within boundary of leaking Phase II Expansion to Receptor E (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.45E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1891	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.91	1.10	0.37	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



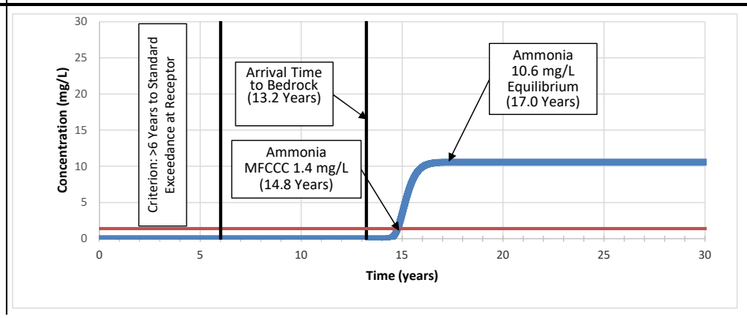
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 8a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 2 within boundary of leaking Phase II Expansion to Receptor E (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.45E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1891	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.91	1.10	0.37	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

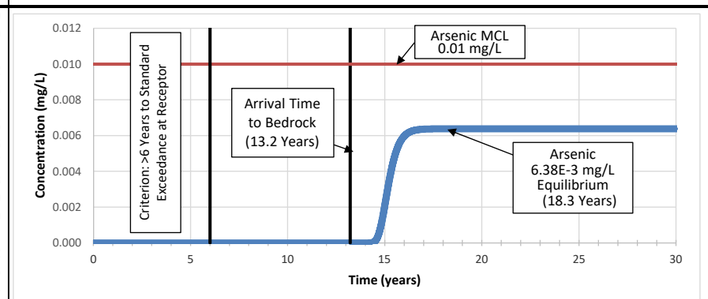
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 8b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 2 within boundary of leaking Phase II Expansion to Receptor E (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	4828	13.22	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	4829	13.22	1.35	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	4830	13.22	2.71	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	4831	13.23	4.06	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4832	13.23	5.41	0.07	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	4833	13.23	6.77	0.17	0.06	0.01	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	4834	13.24	8.12	0.29	0.10	0.01	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	4835	13.24	9.47	0.42	0.14	0.02	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	4836	13.24	10.83	0.56	0.19	0.03	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	4837	13.24	12.18	0.70	0.23	0.04	0.95	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.35	← *=C14*C15/C16*	10	4838	13.25	13.54	0.84	0.28	0.04	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	4839	13.25	14.89	0.99	0.33	0.05	1.34	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	4840	13.25	16.24	1.13	0.38	0.06	1.53	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	4841	13.26	17.60	1.27	0.42	0.06	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	4842	13.26	18.95	1.41	0.47	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	4843	13.26	20.30	1.55	0.52	0.08	2.10	0.70	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	4844	13.26	21.66	1.68	0.56	0.08	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	193.73	*INPUT*	17	4845	13.27	23.01	1.82	0.61	0.09	2.46	0.82	0.12	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	181.20	*INPUT*	18	4846	13.27	24.36	1.95	0.65	0.10	2.64	0.88	0.13	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	12.53	← *=C24-C25*	19	4847	13.27	25.72	2.08	0.69	0.10	2.81	0.94	0.14	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	4848	13.27	27.07	2.21	0.74	0.11	2.99	1.00	0.15	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	4849	13.28	28.42	2.33	0.78	0.12	3.16	1.05	0.16	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	4850	13.28	29.78	2.45	0.82	0.12	3.32	1.11	0.17	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	3453	← *=C26/C29*	23	4851	13.28	31.13	2.58	0.86	0.13	3.49	1.16	0.17	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	4852	13.29	32.48	2.69	0.90	0.13	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	4853	13.29	33.84	2.81	0.94	0.14	3.81	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	4854	13.29	35.19	2.93	0.98	0.15	3.96	1.32	0.20	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	4855	13.29	36.54	3.04	1.01	0.15	4.12	1.37	0.21	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	4856	13.30	37.90	3.15	1.05	0.16	4.27	1.42	0.21	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	4857	13.30	39.25	3.26	1.09	0.16	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
37				30	4858	13.30	40.61	3.37	1.12	0.17	4.56	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!



10949				10942	15770	43.18	14810.10	62.18	20.73	3.11	84.17	28.06	4.21	3.75E-27	1.06E+01	1.00E+00
10950				10943	15771	43.18	14811.46	62.18	20.73	3.11	84.17	28.06	4.21	3.74E-27	1.06E+01	1.00E+00
10951				10944	15772	43.18	14812.81	62.19	20.73	3.11	84.17	28.06	4.21	3.72E-27	1.06E+01	1.00E+00
10952				10945	15773	43.19	14814.16	62.19	20.73	3.11	84.17	28.06	4.21	3.71E-27	1.06E+01	1.00E+00
10953				10946	15774	43.19	14815.52	62.19	20.73	3.11	84.17	28.06	4.21	3.69E-27	1.06E+01	1.00E+00
10954				10947	15775	43.19	14816.87	62.19	20.73	3.11	84.18	28.06	4.21	3.67E-27	1.06E+01	1.00E+00
10955				10948	15776	43.19	14818.23	62.19	20.73	3.11	84.18	28.06	4.21	3.66E-27	1.06E+01	1.00E+00
10956				10949	15777	43.20	14819.58	62.19	20.73	3.11	84.18	28.06	4.21	3.64E-27	1.06E+01	1.00E+00
10957				10950	15778	43.20	14820.93	62.20	20.73	3.11	84.18	28.06	4.21	3.63E-27	1.06E+01	1.00E+00
10958				10951	15779	43.20	14822.29	62.20	20.73	3.11	84.19	28.06	4.21	3.61E-27	1.06E+01	1.00E+00
10959				10952	15780	43.20	14823.64	62.20	20.73	3.11	84.19	28.06	4.21	3.60E-27	1.06E+01	1.00E+00
10960				10953	15781	43.21	14824.99	62.20	20.73	3.11	84.19	28.06	4.21	3.58E-27	1.06E+01	1.00E+00
10961				10954	15782	43.21	14826.35	62.20	20.73	3.11	84.19	28.06	4.21	3.57E-27	1.06E+01	1.00E+00
10962				10955	15783	43.21	14827.70	62.20	20.73	3.11	84.19	28.06	4.21	3.55E-27	1.06E+01	1.00E+00
10963				10956	15784	43.22	14829.05	62.21	20.74	3.11	84.20	28.07	4.21	3.54E-27	1.06E+01	1.00E+00
10964				10957	15785	43.22	14830.41	62.21	20.74	3.11	84.20	28.07	4.21	3.52E-27	1.06E+01	1.00E+00
10965				10958	15786	43.22	14831.76	62.21	20.74	3.11	84.20	28.07	4.21	3.51E-27	1.06E+01	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

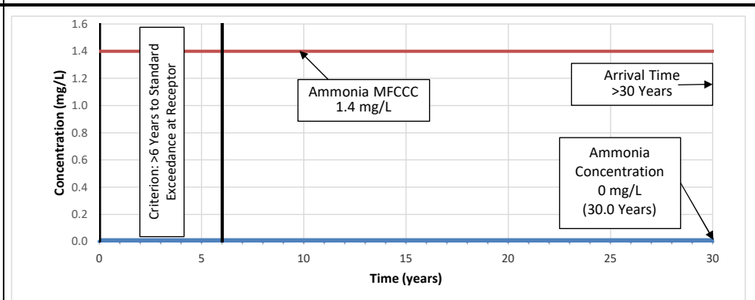
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 8b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 2 within boundary of leaking Phase II Expansion to Receptor E (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	4828	13.22	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	4829	13.22	1.35	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	4830	13.22	2.71	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	4831	13.23	4.06	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4832	13.23	5.41	0.07	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	4833	13.23	6.77	0.17	0.06	0.01	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	4834	13.24	8.12	0.29	0.10	0.01	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	4835	13.24	9.47	0.42	0.14	0.02	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	4836	13.24	10.83	0.56	0.19	0.03	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	4837	13.24	12.18	0.70	0.23	0.04	0.95	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.35	← *=C14*C15/C16*	10	4838	13.25	13.54	0.84	0.28	0.04	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	4839	13.25	14.89	0.99	0.33	0.05	1.34	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	4840	13.25	16.24	1.13	0.38	0.06	1.53	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	4841	13.26	17.60	1.27	0.42	0.06	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	4842	13.26	18.95	1.41	0.47	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	4843	13.26	20.30	1.55	0.52	0.08	2.10	0.70	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	4844	13.26	21.66	1.68	0.56	0.08	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	193.73	*INPUT*	17	4845	13.27	23.01	1.82	0.61	0.09	2.46	0.82	0.12	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	181.20	*INPUT*	18	4846	13.27	24.36	1.95	0.65	0.10	2.64	0.88	0.13	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	12.53	← *=C24-C25*	19	4847	13.27	25.72	2.08	0.69	0.10	2.81	0.94	0.14	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	4848	13.27	27.07	2.21	0.74	0.11	2.99	1.00	0.15	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	4849	13.28	28.42	2.33	0.78	0.12	3.16	1.05	0.16	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	4850	13.28	29.78	2.45	0.82	0.12	3.32	1.11	0.17	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	3453	← *=C26/C29*	23	4851	13.28	31.13	2.58	0.86	0.13	3.49	1.16	0.17	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	4852	13.29	32.48	2.69	0.90	0.13	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	4853	13.29	33.84	2.81	0.94	0.14	3.81	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	4854	13.29	35.19	2.93	0.98	0.15	3.96	1.32	0.20	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	4855	13.29	36.54	3.04	1.01	0.15	4.12	1.37	0.21	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	4856	13.30	37.90	3.15	1.05	0.16	4.27	1.42	0.21	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	4857	13.30	39.25	3.26	1.09	0.16	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
37				30	4858	13.30	40.61	3.37	1.12	0.17	4.56	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!



10942	15770	43.18	14810.10	62.18	20.73	3.11	84.17	28.06	4.21	2.26E-30	6.38E-03	1.00E+00
10943	15771	43.18	14811.46	62.18	20.73	3.11	84.17	28.06	4.21	2.25E-30	6.38E-03	1.00E+00
10944	15772	43.18	14812.81	62.19	20.73	3.11	84.17	28.06	4.21	2.24E-30	6.38E-03	1.00E+00
10945	15773	43.19	14814.16	62.19	20.73	3.11	84.17	28.06	4.21	2.23E-30	6.38E-03	1.00E+00
10946	15774	43.19	14815.52	62.19	20.73	3.11	84.17	28.06	4.21	2.22E-30	6.38E-03	1.00E+00
10947	15775	43.19	14816.87	62.19	20.73	3.11	84.18	28.06	4.21	2.21E-30	6.38E-03	1.00E+00
10948	15776	43.19	14818.23	62.19	20.73	3.11	84.18	28.06	4.21	2.20E-30	6.38E-03	1.00E+00
10949	15777	43.20	14819.58	62.19	20.73	3.11	84.18	28.06	4.21	2.19E-30	6.38E-03	1.00E+00
10950	15778	43.20	14820.93	62.20	20.73	3.11	84.18	28.06	4.21	2.19E-30	6.38E-03	1.00E+00
10951	15779	43.20	14822.29	62.20	20.73	3.11	84.19	28.06	4.21	2.18E-30	6.38E-03	1.00E+00
10952	15780	43.20	14823.64	62.20	20.73	3.11	84.19	28.06	4.21	2.17E-30	6.38E-03	1.00E+00
10953	15781	43.21	14824.99	62.20	20.73	3.11	84.19	28.06	4.21	2.16E-30	6.38E-03	1.00E+00
10954	15782	43.21	14826.35	62.20	20.73	3.11	84.19	28.06	4.21	2.15E-30	6.38E-03	1.00E+00
10955	15783	43.21	14827.70	62.20	20.73	3.11	84.19	28.06	4.21	2.14E-30	6.38E-03	1.00E+00
10956	15784	43.22	14829.05	62.21	20.74	3.11	84.20	28.07	4.21	2.13E-30	6.38E-03	1.00E+00
10957	15785	43.22	14830.41	62.21	20.74	3.11	84.20	28.07	4.21	2.12E-30	6.38E-03	1.00E+00
10958	15786	43.22	14831.76	62.21	20.74	3.11	84.20	28.07	4.21	2.11E-30	6.38E-03	1.00E+00

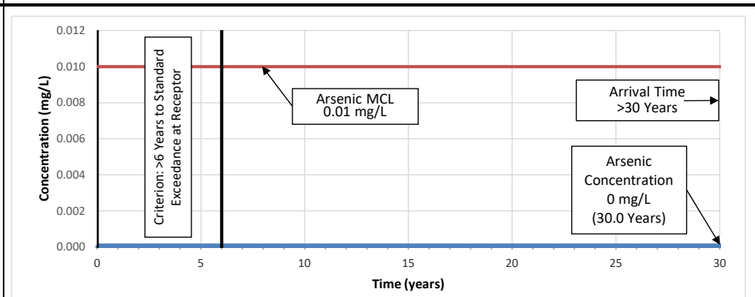
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 9a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor E (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	9.60E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	3972	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



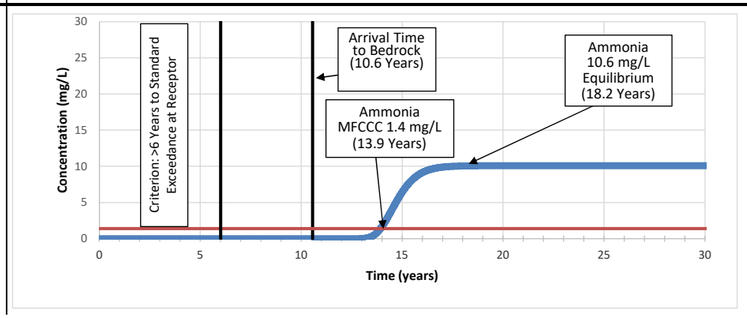
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 9a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor E (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	9.60E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	3972	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



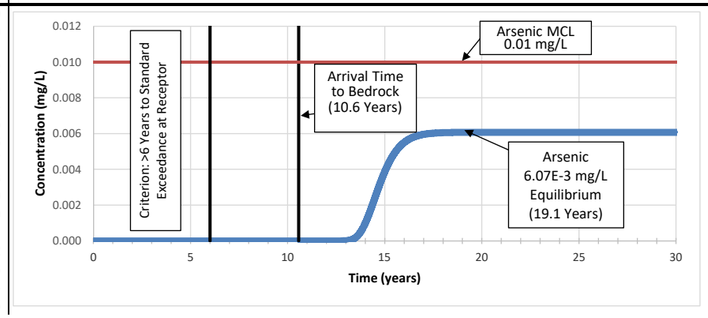
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 9b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor E (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	3858	10.56	1.79	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3859	10.56	2.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	3860	10.57	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	3861	10.57	4.47	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	3862	10.57	5.37	0.07	0.02	0.00	0.06	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.26	0.13	0.04	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.16	0.20	0.07	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.05	0.28	0.09	0.01	0.25	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.89	← *=C14*C15/C16*	10	3866	10.58	8.95	0.37	0.12	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	9.84	0.46	0.15	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	10.74	0.55	0.18	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	3869	10.59	11.63	0.64	0.21	0.03	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	12.53	0.74	0.25	0.04	0.66	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	13.42	0.83	0.28	0.04	0.74	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	14.32	0.93	0.31	0.05	0.83	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	15.21	1.02	0.34	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	16.11	1.12	0.37	0.06	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	17.00	1.21	0.40	0.06	1.08	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	3876	10.61	17.90	1.30	0.43	0.07	1.17	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	3877	10.61	18.79	1.39	0.46	0.07	1.25	0.42	0.06	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	3878	10.62	19.69	1.49	0.50	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	2480	← *=C26/C29*	23	3879	10.62	20.58	1.58	0.53	0.08	1.41	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	3880	10.62	21.47	1.67	0.56	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	3881	10.63	22.37	1.76	0.59	0.09	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	3882	10.63	23.26	1.84	0.61	0.09	1.65	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	3883	10.63	24.16	1.93	0.64	0.10	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	3884	10.63	25.05	2.02	0.67	0.10	1.80	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	3885	10.64	25.95	2.10	0.70	0.11	1.88	0.63	0.09	0.00E+00	0.00E+00	#DIV/0!
37				30	3886	10.64	26.84	2.19	0.73	0.11	1.96	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
10949				10942	14798	40.51	9790.73	55.06	18.35	2.75	49.26	16.42	2.46	1.56E-18	1.01E+01	1.00E+00
10950				10943	14799	40.52	9791.63	55.06	18.35	2.75	49.26	16.42	2.46	1.55E-18	1.01E+01	1.00E+00
10951				10944	14800	40.52	9792.52	55.06	18.35	2.75	49.27	16.42	2.46	1.55E-18	1.01E+01	1.00E+00
10952				10945	14801	40.52	9793.42	55.06	18.35	2.75	49.27	16.42	2.46	1.54E-18	1.01E+01	1.00E+00
10953				10946	14802	40.53	9794.31	55.06	18.35	2.75	49.27	16.42	2.46	1.54E-18	1.01E+01	1.00E+00
10954				10947	14803	40.53	9795.21	55.06	18.35	2.75	49.27	16.42	2.46	1.53E-18	1.01E+01	1.00E+00
10955				10948	14804	40.53	9796.10	55.06	18.35	2.75	49.27	16.42	2.46	1.53E-18	1.01E+01	1.00E+00
10956				10949	14805	40.53	9797.00	55.07	18.36	2.75	49.27	16.42	2.46	1.52E-18	1.01E+01	1.00E+00
10957				10950	14806	40.54	9797.89	55.07	18.36	2.75	49.27	16.42	2.46	1.52E-18	1.01E+01	1.00E+00
10958				10951	14807	40.54	9798.79	55.07	18.36	2.75	49.27	16.42	2.46	1.51E-18	1.01E+01	1.00E+00
10959				10952	14808	40.54	9799.68	55.07	18.36	2.75	49.28	16.43	2.46	1.51E-18	1.01E+01	1.00E+00
10960				10953	14809	40.54	9800.58	55.07	18.36	2.75	49.28	16.43	2.46	1.50E-18	1.01E+01	1.00E+00
10961				10954	14810	40.55	9801.47	55.07	18.36	2.75	49.28	16.43	2.46	1.50E-18	1.01E+01	1.00E+00
10962				10955	14811	40.55	9802.37	55.08	18.36	2.75	49.28	16.43	2.46	1.49E-18	1.01E+01	1.00E+00
10963				10956	14812	40.55	9803.26	55.08	18.36	2.75	49.28	16.43	2.46	1.49E-18	1.01E+01	1.00E+00
10964				10957	14813	40.56	9804.16	55.08	18.36	2.75	49.28	16.43	2.46	1.49E-18	1.01E+01	1.00E+00
10965				10958	14814	40.56	9805.05	55.08	18.36	2.75	49.28	16.43	2.46	1.48E-18	1.01E+01	1.00E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

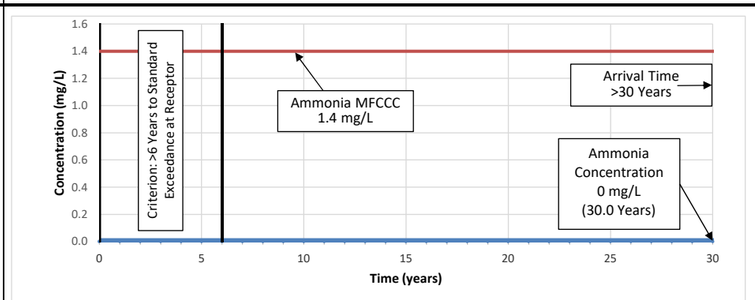
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 9b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor E (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	3858	10.56	1.79	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3859	10.56	2.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	3860	10.57	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	3861	10.57	4.47	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	3862	10.57	5.37	0.07	0.02	0.00	0.06	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.26	0.13	0.04	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.16	0.20	0.07	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.05	0.28	0.09	0.01	0.25	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.89	← *=C14*C15/C16*	10	3866	10.58	8.95	0.37	0.12	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	9.84	0.46	0.15	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	10.74	0.55	0.18	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	3869	10.59	11.63	0.64	0.21	0.03	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	12.53	0.74	0.25	0.04	0.66	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	13.42	0.83	0.28	0.04	0.74	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	14.32	0.93	0.31	0.05	0.83	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	15.21	1.02	0.34	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	16.11	1.12	0.37	0.06	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	17.00	1.21	0.40	0.06	1.08	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	3876	10.61	17.90	1.30	0.43	0.07	1.17	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	3877	10.61	18.79	1.39	0.46	0.07	1.25	0.42	0.06	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	3878	10.62	19.69	1.49	0.50	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	2480	← *=C26/C29*	23	3879	10.62	20.58	1.58	0.53	0.08	1.41	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	3880	10.62	21.47	1.67	0.56	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	3881	10.63	22.37	1.76	0.59	0.09	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	3882	10.63	23.26	1.84	0.61	0.09	1.65	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	3883	10.63	24.16	1.93	0.64	0.10	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	3884	10.63	25.05	2.02	0.67	0.10	1.80	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	3885	10.64	25.95	2.10	0.70	0.11	1.88	0.63	0.09	0.00E+00	0.00E+00	#DIV/0!
37				30	3886	10.64	26.84	2.19	0.73	0.11	1.96	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!



10949				10942	14798	40.51	9790.73	55.06	18.35	2.75	49.26	16.42	2.46	9.39E-22	6.07E-03	1.00E+00
10950				10943	14799	40.52	9791.63	55.06	18.35	2.75	49.26	16.42	2.46	9.36E-22	6.07E-03	1.00E+00
10951				10944	14800	40.52	9792.52	55.06	18.35	2.75	49.27	16.42	2.46	9.33E-22	6.07E-03	1.00E+00
10952				10945	14801	40.52	9793.42	55.06	18.35	2.75	49.27	16.42	2.46	9.30E-22	6.07E-03	1.00E+00
10953				10946	14802	40.53	9794.31	55.06	18.35	2.75	49.27	16.42	2.46	9.27E-22	6.07E-03	1.00E+00
10954				10947	14803	40.53	9795.21	55.06	18.35	2.75	49.27	16.42	2.46	9.24E-22	6.07E-03	1.00E+00
10955				10948	14804	40.53	9796.10	55.06	18.35	2.75	49.27	16.42	2.46	9.21E-22	6.07E-03	1.00E+00
10956				10949	14805	40.53	9797.00	55.07	18.36	2.75	49.27	16.42	2.46	9.18E-22	6.07E-03	1.00E+00
10957				10950	14806	40.54	9797.89	55.07	18.36	2.75	49.27	16.42	2.46	9.15E-22	6.07E-03	1.00E+00
10958				10951	14807	40.54	9798.79	55.07	18.36	2.75	49.27	16.42	2.46	9.12E-22	6.07E-03	1.00E+00
10959				10952	14808	40.54	9799.68	55.07	18.36	2.75	49.28	16.43	2.46	9.09E-22	6.07E-03	1.00E+00
10960				10953	14809	40.54	9800.58	55.07	18.36	2.75	49.28	16.43	2.46	9.06E-22	6.07E-03	1.00E+00
10961				10954	14810	40.55	9801.47	55.07	18.36	2.75	49.28	16.43	2.46	9.03E-22	6.07E-03	1.00E+00
10962				10955	14811	40.55	9802.37	55.08	18.36	2.75	49.28	16.43	2.46	9.00E-22	6.07E-03	1.00E+00
10963				10956	14812	40.55	9803.26	55.08	18.36	2.75	49.28	16.43	2.46	8.97E-22	6.07E-03	1.00E+00
10964				10957	14813	40.56	9804.16	55.08	18.36	2.75	49.28	16.43	2.46	8.94E-22	6.07E-03	1.00E+00
10965				10958	14814	40.56	9805.05	55.08	18.36	2.75	49.28	16.43	2.46	8.92E-22	6.07E-03	1.00E+00

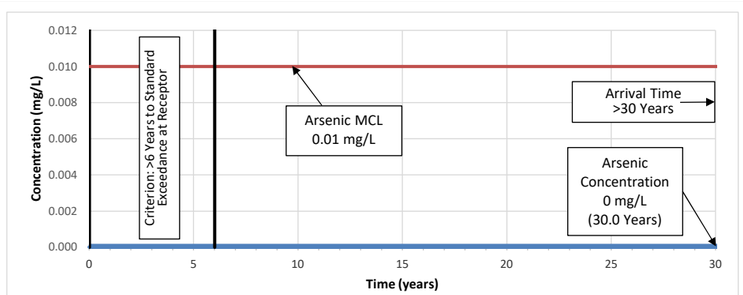
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 10a - Horizontal flow through till from nearest boundary of leaking Phase II Expansion to Receptor F (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.02E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2493	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.13	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



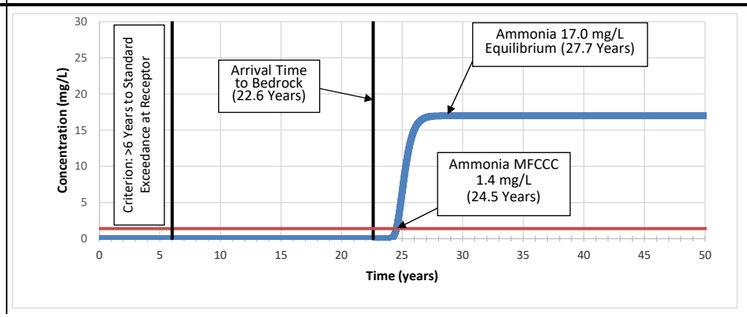
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 10a - Horizontal flow through till from nearest boundary of leaking Phase II Expansion to Receptor F (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.02E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2493	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.13	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

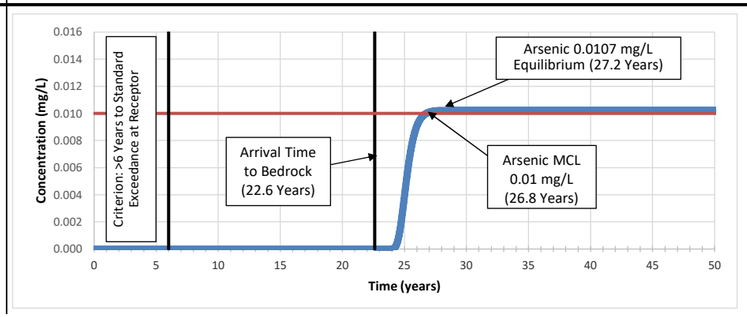
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 10b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor F (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8251	22.59	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8252	22.59	0.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	8253	22.60	1.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	8254	22.60	2.84	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	8255	22.60	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	8256	22.60	4.73	0.03	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	8257	22.61	5.68	0.09	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8258	22.61	6.63	0.16	0.05	0.01	0.15	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8259	22.61	7.57	0.24	0.08	0.01	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8260	22.62	8.52	0.32	0.11	0.02	0.31	0.10	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.95	← *=C14*C15/C16*	10	8261	22.62	9.47	0.42	0.14	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8262	22.62	10.41	0.51	0.17	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8263	22.62	11.36	0.61	0.20	0.03	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	8264	22.63	12.31	0.71	0.24	0.04	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	8265	22.63	13.25	0.81	0.27	0.04	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	8266	22.63	14.20	0.91	0.30	0.05	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8267	22.63	15.14	1.01	0.34	0.05	0.96	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	177.83	*INPUT*	17	8268	22.64	16.09	1.11	0.37	0.06	1.05	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.89	*INPUT*	18	8269	22.64	17.04	1.21	0.40	0.06	1.15	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	29.94	← *=C24-C25*	19	8270	22.64	17.98	1.31	0.44	0.07	1.24	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	8271	22.65	18.93	1.41	0.47	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	8272	22.65	19.88	1.51	0.50	0.08	1.43	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	8273	22.65	20.82	1.60	0.53	0.08	1.52	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	8251	← *=C26/C29*	23	8274	22.65	21.77	1.70	0.57	0.08	1.61	0.54	0.08	0.00E+00	0.00E+00	#DIV/0!
31				24	8275	22.66	22.72	1.79	0.60	0.09	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
32				25	8276	22.66	23.66	1.88	0.63	0.09	1.78	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
33				26	8277	22.66	24.61	1.97	0.66	0.10	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
34				27	8278	22.66	25.56	2.06	0.69	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
35				28	8279	22.67	26.50	2.15	0.72	0.11	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
36				29	8280	22.67	27.45	2.24	0.75	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	8281	22.67	28.40	2.33	0.78	0.12	2.20	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!



10949	10942	19193	52.55	10357.16	55.99	18.66	2.80	53.00	17.67	2.65	4.94E-21	1.70E+01	1.00E+00
10950	10943	19194	52.55	10358.10	56.00	18.67	2.80	53.00	17.67	2.65	4.93E-21	1.70E+01	1.00E+00
10951	10944	19195	52.55	10359.05	56.00	18.67	2.80	53.00	17.67	2.65	4.91E-21	1.70E+01	1.00E+00
10952	10945	19196	52.56	10360.00	56.00	18.67	2.80	53.01	17.67	2.65	4.89E-21	1.70E+01	1.00E+00
10953	10946	19197	52.56	10360.94	56.00	18.67	2.80	53.01	17.67	2.65	4.88E-21	1.70E+01	1.00E+00
10954	10947	19198	52.56	10361.89	56.00	18.67	2.80	53.01	17.67	2.65	4.86E-21	1.70E+01	1.00E+00
10955	10948	19199	52.56	10362.84	56.00	18.67	2.80	53.01	17.67	2.65	4.84E-21	1.70E+01	1.00E+00
10956	10949	19200	52.57	10363.78	56.00	18.67	2.80	53.01	17.67	2.65	4.83E-21	1.70E+01	1.00E+00
10957	10950	19201	52.57	10364.73	56.01	18.67	2.80	53.01	17.67	2.65	4.81E-21	1.70E+01	1.00E+00
10958	10951	19202	52.57	10365.68	56.01	18.67	2.80	53.01	17.67	2.65	4.80E-21	1.70E+01	1.00E+00
10959	10952	19203	52.58	10366.62	56.01	18.67	2.80	53.02	17.67	2.65	4.78E-21	1.70E+01	1.00E+00
10960	10953	19204	52.58	10367.57	56.01	18.67	2.80	53.02	17.67	2.65	4.76E-21	1.70E+01	1.00E+00
10961	10954	19205	52.58	10368.51	56.01	18.67	2.80	53.02	17.67	2.65	4.75E-21	1.70E+01	1.00E+00
10962	10955	19206	52.58	10369.46	56.01	18.67	2.80	53.02	17.67	2.65	4.73E-21	1.70E+01	1.00E+00
10963	10956	19207	52.59	10370.41	56.02	18.67	2.80	53.02	17.67	2.65	4.72E-21	1.70E+01	1.00E+00
10964	10957	19208	52.59	10371.35	56.02	18.67	2.80	53.02	17.67	2.65	4.70E-21	1.70E+01	1.00E+00
10965	10958	19209	52.59	10372.30	56.02	18.67	2.80	53.02	17.67	2.65	4.69E-21	1.70E+01	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

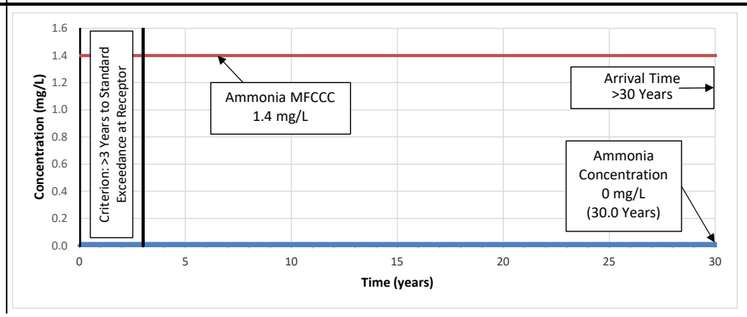
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 10b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of leaking Phase II Expansion to Receptor F (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8251	22.59	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8252	22.59	0.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	8253	22.60	1.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	8254	22.60	2.84	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	8255	22.60	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	8256	22.60	4.73	0.03	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	8257	22.61	5.68	0.09	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8258	22.61	6.63	0.16	0.05	0.01	0.15	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8259	22.61	7.57	0.24	0.08	0.01	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8260	22.62	8.52	0.32	0.11	0.02	0.31	0.10	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.95	← *=C14*C15/C16*	10	8261	22.62	9.47	0.42	0.14	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8262	22.62	10.41	0.51	0.17	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8263	22.62	11.36	0.61	0.20	0.03	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	8264	22.63	12.31	0.71	0.24	0.04	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	8265	22.63	13.25	0.81	0.27	0.04	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	8266	22.63	14.20	0.91	0.30	0.05	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8267	22.63	15.14	1.01	0.34	0.05	0.96	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	177.83	*INPUT*	17	8268	22.64	16.09	1.11	0.37	0.06	1.05	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.89	*INPUT*	18	8269	22.64	17.04	1.21	0.40	0.06	1.15	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	29.94	← *=C24-C25*	19	8270	22.64	17.98	1.31	0.44	0.07	1.24	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	8271	22.65	18.93	1.41	0.47	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	8272	22.65	19.88	1.51	0.50	0.08	1.43	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	8273	22.65	20.82	1.60	0.53	0.08	1.52	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	8251	← *=C26/C29*	23	8274	22.65	21.77	1.70	0.57	0.08	1.61	0.54	0.08	0.00E+00	0.00E+00	#DIV/0!
31				24	8275	22.66	22.72	1.79	0.60	0.09	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
32				25	8276	22.66	23.66	1.88	0.63	0.09	1.78	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
33				26	8277	22.66	24.61	1.97	0.66	0.10	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
34				27	8278	22.66	25.56	2.06	0.69	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
35				28	8279	22.67	26.50	2.15	0.72	0.11	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
36				29	8280	22.67	27.45	2.24	0.75	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	8281	22.67	28.40	2.33	0.78	0.12	2.20	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!



10949				10942	19193	52.55	10357.16	55.99	18.66	2.80	53.00	17.67	2.65	2.98E-24	1.02E-02	1.00E+00
10950				10943	19194	52.55	10358.10	56.00	18.67	2.80	53.00	17.67	2.65	2.97E-24	1.02E-02	1.00E+00
10951				10944	19195	52.55	10359.05	56.00	18.67	2.80	53.00	17.67	2.65	2.96E-24	1.02E-02	1.00E+00
10952				10945	19196	52.56	10360.00	56.00	18.67	2.80	53.01	17.67	2.65	2.95E-24	1.02E-02	1.00E+00
10953				10946	19197	52.56	10360.94	56.00	18.67	2.80	53.01	17.67	2.65	2.94E-24	1.02E-02	1.00E+00
10954				10947	19198	52.56	10361.89	56.00	18.67	2.80	53.01	17.67	2.65	2.93E-24	1.02E-02	1.00E+00
10955				10948	19199	52.56	10362.84	56.00	18.67	2.80	53.01	17.67	2.65	2.92E-24	1.02E-02	1.00E+00
10956				10949	19200	52.57	10363.78	56.00	18.67	2.80	53.01	17.67	2.65	2.91E-24	1.02E-02	1.00E+00
10957				10950	19201	52.57	10364.73	56.01	18.67	2.80	53.01	17.67	2.65	2.90E-24	1.02E-02	1.00E+00
10958				10951	19202	52.57	10365.68	56.01	18.67	2.80	53.01	17.67	2.65	2.89E-24	1.02E-02	1.00E+00
10959				10952	19203	52.58	10366.62	56.01	18.67	2.80	53.02	17.67	2.65	2.88E-24	1.02E-02	1.00E+00
10960				10953	19204	52.58	10367.57	56.01	18.67	2.80	53.02	17.67	2.65	2.87E-24	1.02E-02	1.00E+00
10961				10954	19205	52.58	10368.51	56.01	18.67	2.80	53.02	17.67	2.65	2.86E-24	1.02E-02	1.00E+00
10962				10955	19206	52.58	10369.46	56.01	18.67	2.80	53.02	17.67	2.65	2.85E-24	1.02E-02	1.00E+00
10963				10956	19207	52.59	10370.41	56.02	18.67	2.80	53.02	17.67	2.65	2.84E-24	1.02E-02	1.00E+00
10964				10957	19208	52.59	10371.35	56.02	18.67	2.80	53.02	17.67	2.65	2.83E-24	1.02E-02	1.00E+00
10965				10958	19209	52.59	10372.30	56.02	18.67	2.80	53.02	17.67	2.65	2.82E-24	1.02E-02	1.00E+00

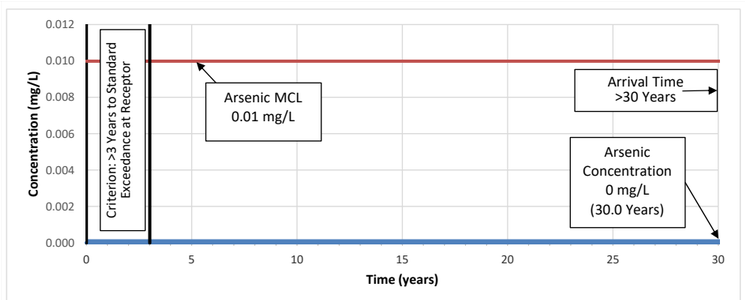
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 11a - Horizontal flow through till from leaking Cell 19 Pump Station to Receptor F (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1460.88	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	6		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	7.61E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	8.10E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1460.88	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4938	← *=(C20/C17)*365.25*	17	17		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



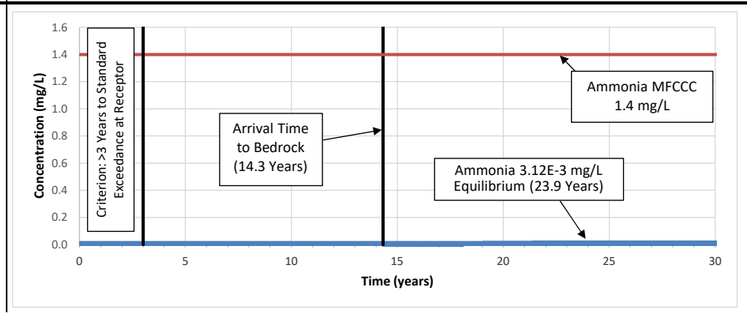
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 11a - Horizontal flow through till from leaking Cell 19 Pump Station to Receptor F (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1460.88	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	6		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	7.61E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	8.10E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1460.88	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4938	← *=(C20/C17)*365.25*	17	17		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		8.86	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		8.87	0.36	0.12	0.02	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



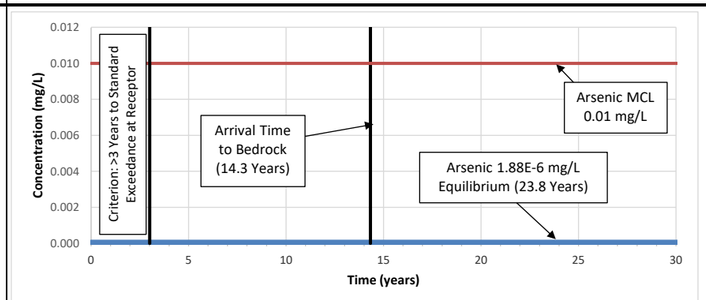
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 11b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 19 Pump Station to Receptor F (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1460.88	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	5232	14.32	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	5233	14.33	0.76	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	5234	14.33	1.51	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	5235	14.33	2.27	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	5236	14.33	3.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5237	14.34	3.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	4520.39	← *=C11*C12*3.7854118*	6	5238	14.34	4.53	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	5239	14.34	5.29	0.06	0.02	0.00	0.05	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	7.61E-03	← *=(C4-C5)/C3*	8	5240	14.35	6.04	0.11	0.04	0.01	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	5241	14.35	6.80	0.17	0.06	0.01	0.13	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.76	← *=C14*C15/C16*	10	5242	14.35	7.55	0.23	0.08	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	5243	14.35	8.31	0.30	0.10	0.02	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	5244	14.36	9.06	0.38	0.13	0.02	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1460.88	← *=C3*	13	5245	14.36	9.82	0.45	0.15	0.02	0.34	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	5246	14.36	10.57	0.53	0.18	0.03	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	5247	14.37	11.33	0.61	0.20	0.03	0.46	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	5248	14.37	12.08	0.69	0.23	0.03	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	173.07	*INPUT*	17	5249	14.37	12.84	0.77	0.26	0.04	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.08	*INPUT*	18	5250	14.37	13.59	0.85	0.28	0.04	0.64	0.21	0.03	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	18.98	← *=C24-C25*	19	5251	14.38	14.35	0.93	0.31	0.05	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	5252	14.38	15.10	1.01	0.34	0.05	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	5253	14.38	15.86	1.09	0.36	0.05	0.82	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	5254	14.38	16.61	1.17	0.39	0.06	0.88	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	5232	← *=C26/C29*	23	5255	14.39	17.37	1.25	0.42	0.06	0.94	0.31	0.05	0.00E+00	0.00E+00	#DIV/0!
31				24	5256	14.39	18.12	1.33	0.44	0.07	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
32				25	5257	14.39	18.88	1.40	0.47	0.07	1.06	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
33				26	5258	14.40	19.63	1.48	0.49	0.07	1.12	0.37	0.06	0.00E+00	0.00E+00	#DIV/0!
34				27	5259	14.40	20.39	1.56	0.52	0.08	1.18	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
35				28	5260	14.40	21.14	1.63	0.54	0.08	1.23	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
36				29	5261	14.40	21.90	1.71	0.57	0.09	1.29	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
37				30	5262	14.41	22.65	1.78	0.59	0.09	1.35	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
10949				10942	16174	44.28	8262.26	52.28	17.43	2.61	39.47	13.16	1.97	2.30E-19	3.12E-03	1.00E+00
10950				10943	16175	44.28	8263.01	52.28	17.43	2.61	39.48	13.16	1.97	2.30E-19	3.12E-03	1.00E+00
10951				10944	16176	44.29	8263.77	52.28	17.43	2.61	39.48	13.16	1.97	2.29E-19	3.12E-03	1.00E+00
10952				10945	16177	44.29	8264.52	52.28	17.43	2.61	39.48	13.16	1.97	2.28E-19	3.12E-03	1.00E+00
10953				10946	16178	44.29	8265.28	52.28	17.43	2.61	39.48	13.16	1.97	2.28E-19	3.12E-03	1.00E+00
10954				10947	16179	44.30	8266.03	52.29	17.43	2.61	39.48	13.16	1.97	2.27E-19	3.12E-03	1.00E+00
10955				10948	16180	44.30	8266.79	52.29	17.43	2.61	39.48	13.16	1.97	2.26E-19	3.12E-03	1.00E+00
10956				10949	16181	44.30	8267.54	52.29	17.43	2.61	39.48	13.16	1.97	2.26E-19	3.12E-03	1.00E+00
10957				10950	16182	44.30	8268.30	52.29	17.43	2.61	39.48	13.16	1.97	2.25E-19	3.12E-03	1.00E+00
10958				10951	16183	44.31	8269.05	52.29	17.43	2.61	39.48	13.16	1.97	2.24E-19	3.12E-03	1.00E+00
10959				10952	16184	44.31	8269.81	52.29	17.43	2.61	39.49	13.16	1.97	2.24E-19	3.12E-03	1.00E+00
10960				10953	16185	44.31	8270.56	52.29	17.43	2.61	39.49	13.16	1.97	2.23E-19	3.12E-03	1.00E+00
10961				10954	16186	44.31	8271.32	52.30	17.43	2.61	39.49	13.16	1.97	2.22E-19	3.12E-03	1.00E+00
10962				10955	16187	44.32	8272.07	52.30	17.43	2.61	39.49	13.16	1.97	2.22E-19	3.12E-03	1.00E+00
10963				10956	16188	44.32	8272.83	52.30	17.43	2.61	39.49	13.16	1.97	2.21E-19	3.12E-03	1.00E+00
10964				10957	16189	44.32	8273.58	52.30	17.43	2.62	39.49	13.16	1.97	2.20E-19	3.12E-03	1.00E+00
10965				10958	16190	44.33	8274.34	52.30	17.43	2.62	39.49	13.16	1.97	2.20E-19	3.12E-03	1.00E+00



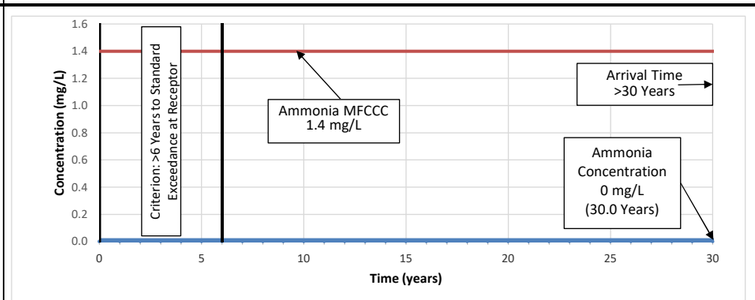
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 11b - Vertical downward flow through till and horizontal flow through bedrock from leaking Cell 19 Pump Station to Receptor F (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1460.88	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	170.66	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Pump Station Chamber Area (ft^2)	200	*INPUT*	0	5232	14.32	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	5233	14.33	0.76	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	5234	14.33	1.51	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Pump Station Chamber (ft^3/d)	0.18	← *=C7*C9*	3	5235	14.33	2.27	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Pump Station Chamber (gpd)	1.36	← *=C10*7.48*	4	5236	14.33	3.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5237	14.34	3.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	2.72	← *=C11*C12*3.7854118*	6	5238	14.34	4.53	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	5239	14.34	5.29	0.06	0.02	0.00	0.05	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	7.61E-03	← *=(C4-C5)/C3*	8	5240	14.35	6.04	0.11	0.04	0.01	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	5241	14.35	6.80	0.17	0.06	0.01	0.13	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.76	← *=C14*C15/C16*	10	5242	14.35	7.55	0.23	0.08	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	5243	14.35	8.31	0.30	0.10	0.02	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	5244	14.36	9.06	0.38	0.13	0.02	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1460.88	← *=C3*	13	5245	14.36	9.82	0.45	0.15	0.02	0.34	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	5246	14.36	10.57	0.53	0.18	0.03	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	5247	14.37	11.33	0.61	0.20	0.03	0.46	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	5248	14.37	12.08	0.69	0.23	0.03	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	173.07	*INPUT*	17	5249	14.37	12.84	0.77	0.26	0.04	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.08	*INPUT*	18	5250	14.37	13.59	0.85	0.28	0.04	0.64	0.21	0.03	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	18.98	← *=C24-C25*	19	5251	14.38	14.35	0.93	0.31	0.05	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	5252	14.38	15.10	1.01	0.34	0.05	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	5253	14.38	15.86	1.09	0.36	0.05	0.82	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	5254	14.38	16.61	1.17	0.39	0.06	0.88	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	5232	← *=C26/C29*	23	5255	14.39	17.37	1.25	0.42	0.06	0.94	0.31	0.05	0.00E+00	0.00E+00	#DIV/0!
31				24	5256	14.39	18.12	1.33	0.44	0.07	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
32				25	5257	14.39	18.88	1.40	0.47	0.07	1.06	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
33				26	5258	14.40	19.63	1.48	0.49	0.07	1.12	0.37	0.06	0.00E+00	0.00E+00	#DIV/0!
34				27	5259	14.40	20.39	1.56	0.52	0.08	1.18	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
35				28	5260	14.40	21.14	1.63	0.54	0.08	1.23	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
36				29	5261	14.40	21.90	1.71	0.57	0.09	1.29	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
37				30	5262	14.41	22.65	1.78	0.59	0.09	1.35	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
10949				10942	16174	44.28	8262.26	52.28	17.43	2.61	39.47	13.16	1.97	1.39E-22	1.88E-06	1.00E+00
10950				10943	16175	44.28	8263.01	52.28	17.43	2.61	39.48	13.16	1.97	1.38E-22	1.88E-06	1.00E+00
10951				10944	16176	44.29	8263.77	52.28	17.43	2.61	39.48	13.16	1.97	1.38E-22	1.88E-06	1.00E+00
10952				10945	16177	44.29	8264.52	52.28	17.43	2.61	39.48	13.16	1.97	1.38E-22	1.88E-06	1.00E+00
10953				10946	16178	44.29	8265.28	52.28	17.43	2.61	39.48	13.16	1.97	1.37E-22	1.88E-06	1.00E+00
10954				10947	16179	44.30	8266.03	52.29	17.43	2.61	39.48	13.16	1.97	1.37E-22	1.88E-06	1.00E+00
10955				10948	16180	44.30	8266.79	52.29	17.43	2.61	39.48	13.16	1.97	1.36E-22	1.88E-06	1.00E+00
10956				10949	16181	44.30	8267.54	52.29	17.43	2.61	39.48	13.16	1.97	1.36E-22	1.88E-06	1.00E+00
10957				10950	16182	44.30	8268.30	52.29	17.43	2.61	39.48	13.16	1.97	1.36E-22	1.88E-06	1.00E+00
10958				10951	16183	44.31	8269.05	52.29	17.43	2.61	39.48	13.16	1.97	1.35E-22	1.88E-06	1.00E+00
10959				10952	16184	44.31	8269.81	52.29	17.43	2.61	39.49	13.16	1.97	1.35E-22	1.88E-06	1.00E+00
10960				10953	16185	44.31	8270.56	52.29	17.43	2.61	39.49	13.16	1.97	1.34E-22	1.88E-06	1.00E+00
10961				10954	16186	44.31	8271.32	52.30	17.43	2.61	39.49	13.16	1.97	1.34E-22	1.88E-06	1.00E+00
10962				10955	16187	44.32	8272.07	52.30	17.43	2.61	39.49	13.16	1.97	1.34E-22	1.88E-06	1.00E+00
10963				10956	16188	44.32	8272.83	52.30	17.43	2.61	39.49	13.16	1.97	1.33E-22	1.88E-06	1.00E+00
10964				10957	16189	44.32	8273.58	52.30	17.43	2.62	39.49	13.16	1.97	1.33E-22	1.88E-06	1.00E+00
10965				10958	16190	44.33	8274.34	52.30	17.43	2.62	39.49	13.16	1.97	1.32E-22	1.88E-06	1.00E+00



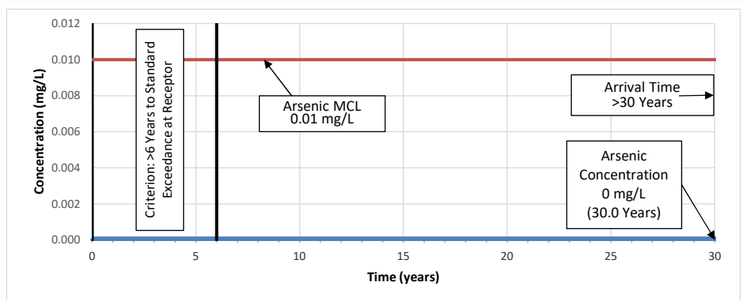
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 12a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor F (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4128	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.26	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

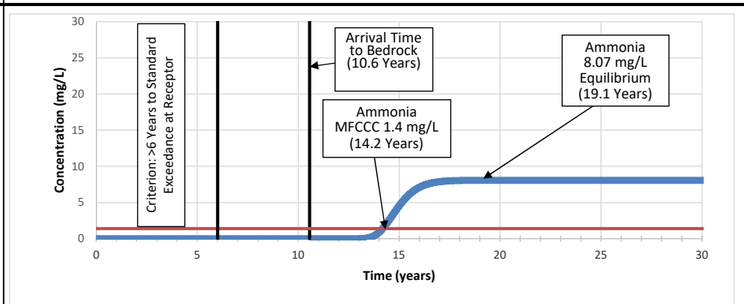
1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 12a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor F (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4128	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!



10949				10942	10942		11.26	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!

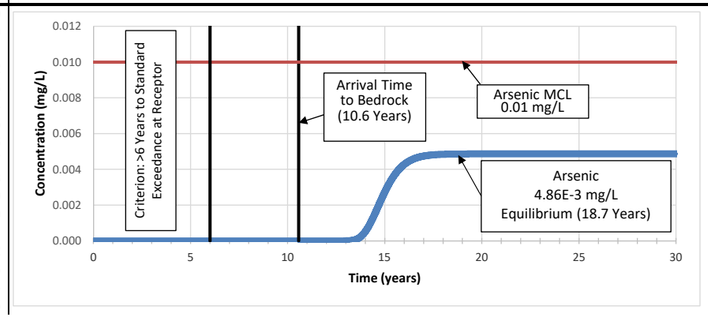
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 12b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor F (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	3858	10.56	1.92	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3859	10.56	2.88	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	3860	10.57	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	3861	10.57	4.80	0.04	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	16172948.19	← *=C11*C12*3.7854118*	6	3862	10.57	5.76	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.72	0.16	0.05	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.68	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.64	0.34	0.11	0.02	0.32	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	3866	10.58	9.60	0.43	0.14	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	10.56	0.53	0.18	0.03	0.51	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	11.52	0.63	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	3869	10.59	12.48	0.73	0.24	0.04	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	13.44	0.83	0.28	0.04	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	14.40	0.94	0.31	0.05	0.90	0.30	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	15.36	1.04	0.35	0.05	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	16.32	1.14	0.38	0.06	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	17.28	1.24	0.41	0.06	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	18.24	1.34	0.45	0.07	1.28	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	3876	10.61	19.20	1.44	0.48	0.07	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	3877	10.61	20.16	1.53	0.51	0.08	1.47	0.49	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	3878	10.62	21.12	1.63	0.54	0.08	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	2480	← *=C26/C29*	23	3879	10.62	22.08	1.73	0.58	0.09	1.66	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	3880	10.62	23.04	1.82	0.61	0.09	1.75	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	3881	10.63	24.00	1.91	0.64	0.10	1.84	0.61	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	3882	10.63	24.96	2.01	0.67	0.10	1.93	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	3883	10.63	25.92	2.10	0.70	0.10	2.01	0.67	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	3884	10.63	26.88	2.19	0.73	0.11	2.10	0.70	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	3885	10.64	27.84	2.28	0.76	0.11	2.19	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	3886	10.64	28.79	2.37	0.79	0.12	2.27	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	14798	40.51	10502.47	56.23	18.74	2.81	53.97	17.99	2.70	4.10E-19	8.07E+00	1.00E+00
10950				10943	14799	40.52	10503.43	56.23	18.74	2.81	53.97	17.99	2.70	4.08E-19	8.07E+00	1.00E+00
10951				10944	14800	40.52	10504.39	56.23	18.74	2.81	53.97	17.99	2.70	4.07E-19	8.07E+00	1.00E+00
10952				10945	14801	40.52	10505.35	56.23	18.74	2.81	53.97	17.99	2.70	4.05E-19	8.07E+00	1.00E+00
10953				10946	14802	40.53	10506.31	56.23	18.74	2.81	53.98	17.99	2.70	4.04E-19	8.07E+00	1.00E+00
10954				10947	14803	40.53	10507.27	56.24	18.75	2.81	53.98	17.99	2.70	4.03E-19	8.07E+00	1.00E+00
10955				10948	14804	40.53	10508.23	56.24	18.75	2.81	53.98	17.99	2.70	4.01E-19	8.07E+00	1.00E+00
10956				10949	14805	40.53	10509.19	56.24	18.75	2.81	53.98	17.99	2.70	4.00E-19	8.07E+00	1.00E+00
10957				10950	14806	40.54	10510.15	56.24	18.75	2.81	53.98	17.99	2.70	3.99E-19	8.07E+00	1.00E+00
10958				10951	14807	40.54	10511.11	56.24	18.75	2.81	53.98	17.99	2.70	3.97E-19	8.07E+00	1.00E+00
10959				10952	14808	40.54	10512.07	56.24	18.75	2.81	53.98	17.99	2.70	3.96E-19	8.07E+00	1.00E+00
10960				10953	14809	40.54	10513.03	56.25	18.75	2.81	53.99	18.00	2.70	3.94E-19	8.07E+00	1.00E+00
10961				10954	14810	40.55	10513.99	56.25	18.75	2.81	53.99	18.00	2.70	3.93E-19	8.07E+00	1.00E+00
10962				10955	14811	40.55	10514.95	56.25	18.75	2.81	53.99	18.00	2.70	3.92E-19	8.07E+00	1.00E+00
10963				10956	14812	40.55	10515.91	56.25	18.75	2.81	53.99	18.00	2.70	3.90E-19	8.07E+00	1.00E+00
10964				10957	14813	40.56	10516.87	56.25	18.75	2.81	53.99	18.00	2.70	3.89E-19	8.07E+00	1.00E+00
10965				10958	14814	40.56	10517.83	56.25	18.75	2.81	53.99	18.00	2.70	3.88E-19	8.07E+00	1.00E+00



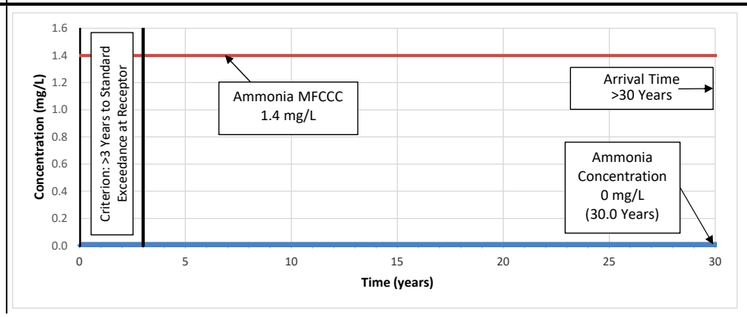
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 12b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of leaking Phase II Expansion to Receptor F (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	3858	10.56	1.92	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	649.07	← *=C8*C9*	3	3859	10.56	2.88	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	4855.05	← *=C10*7.48*	4	3860	10.57	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	3861	10.57	4.80	0.04	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	9740.53	← *=C11*C12*3.7854118*	6	3862	10.57	5.76	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.72	0.16	0.05	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.68	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.64	0.34	0.11	0.02	0.32	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	3866	10.58	9.60	0.43	0.14	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	10.56	0.53	0.18	0.03	0.51	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	11.52	0.63	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	3869	10.59	12.48	0.73	0.24	0.04	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	13.44	0.83	0.28	0.04	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	14.40	0.94	0.31	0.05	0.90	0.30	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	15.36	1.04	0.35	0.05	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	16.32	1.14	0.38	0.06	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	17.28	1.24	0.41	0.06	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	18.24	1.34	0.45	0.07	1.28	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	3876	10.61	19.20	1.44	0.48	0.07	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	3877	10.61	20.16	1.53	0.51	0.08	1.47	0.49	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	3878	10.62	21.12	1.63	0.54	0.08	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	2480	← *=C26/C29*	23	3879	10.62	22.08	1.73	0.58	0.09	1.66	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Augmented Layer Clay Thickness (ft)	1	*INPUT*	24	3880	10.62	23.04	1.82	0.61	0.09	1.75	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	25	3881	10.63	24.00	1.91	0.64	0.10	1.84	0.61	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	26	3882	10.63	24.96	2.01	0.67	0.10	1.93	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	27	3883	10.63	25.92	2.10	0.70	0.10	2.01	0.67	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C32*C34/C33*	28	3884	10.63	26.88	2.19	0.73	0.11	2.10	0.70	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Time of Vertical Flow Through Clay (days)	1376	← *=C31/C35*	29	3885	10.64	27.84	2.28	0.76	0.11	2.19	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	3886	10.64	28.79	2.37	0.79	0.12	2.27	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	14798	40.51	10502.47	56.23	18.74	2.81	53.97	17.99	2.70	2.47E-22	4.86E-03	1.00E+00
10950				10943	14799	40.52	10503.43	56.23	18.74	2.81	53.97	17.99	2.70	2.46E-22	4.86E-03	1.00E+00
10951				10944	14800	40.52	10504.39	56.23	18.74	2.81	53.97	17.99	2.70	2.45E-22	4.86E-03	1.00E+00
10952				10945	14801	40.52	10505.35	56.23	18.74	2.81	53.97	17.99	2.70	2.44E-22	4.86E-03	1.00E+00
10953				10946	14802	40.53	10506.31	56.23	18.74	2.81	53.98	17.99	2.70	2.43E-22	4.86E-03	1.00E+00
10954				10947	14803	40.53	10507.27	56.24	18.75	2.81	53.98	17.99	2.70	2.42E-22	4.86E-03	1.00E+00
10955				10948	14804	40.53	10508.23	56.24	18.75	2.81	53.98	17.99	2.70	2.42E-22	4.86E-03	1.00E+00
10956				10949	14805	40.53	10509.19	56.24	18.75	2.81	53.98	17.99	2.70	2.41E-22	4.86E-03	1.00E+00
10957				10950	14806	40.54	10510.15	56.24	18.75	2.81	53.98	17.99	2.70	2.40E-22	4.86E-03	1.00E+00
10958				10951	14807	40.54	10511.11	56.24	18.75	2.81	53.98	17.99	2.70	2.39E-22	4.86E-03	1.00E+00
10959				10952	14808	40.54	10512.07	56.24	18.75	2.81	53.98	17.99	2.70	2.38E-22	4.86E-03	1.00E+00
10960				10953	14809	40.54	10513.03	56.25	18.75	2.81	53.99	18.00	2.70	2.38E-22	4.86E-03	1.00E+00
10961				10954	14810	40.55	10513.99	56.25	18.75	2.81	53.99	18.00	2.70	2.37E-22	4.86E-03	1.00E+00
10962				10955	14811	40.55	10514.95	56.25	18.75	2.81	53.99	18.00	2.70	2.36E-22	4.86E-03	1.00E+00
10963				10956	14812	40.55	10515.91	56.25	18.75	2.81	53.99	18.00	2.70	2.35E-22	4.86E-03	1.00E+00
10964				10957	14813	40.56	10516.87	56.25	18.75	2.81	53.99	18.00	2.70	2.34E-22	4.86E-03	1.00E+00
10965				10958	14814	40.56	10517.83	56.25	18.75	2.81	53.99	18.00	2.70	2.34E-22	4.86E-03	1.00E+00



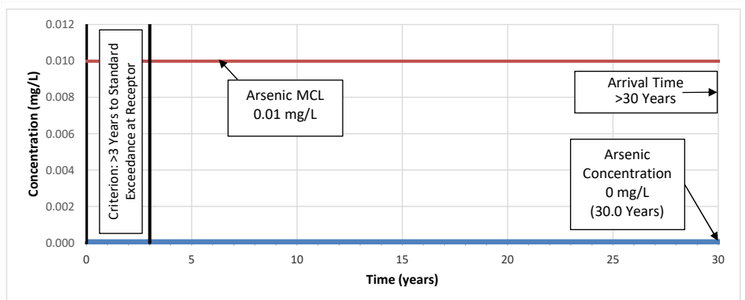
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 13a - Horizontal flow through till from leaking Leachate Storage Tanks Containment Area to Receptor G (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (ft^3/d)	50.42	← *=C7*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (gpd)	377.11	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	1256218.77	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.03E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	750	← *=(C20/C17)*365.25*	17	17		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		33.26	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



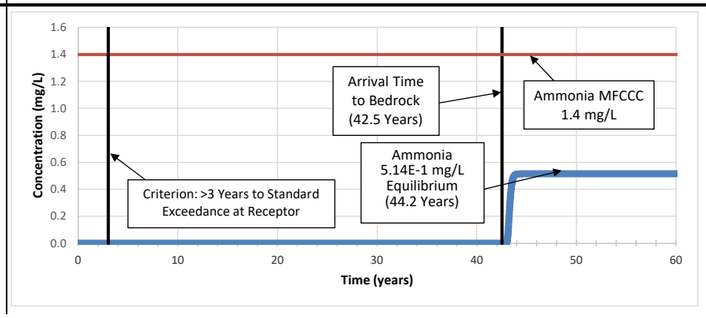
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 13a - Horizontal flow through till from leaking Leachate Storage Tanks Containment Area to Receptor G (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (ft^3/d)	50.42	← *=C7*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (gpd)	377.11	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	756.59	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.03E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	750	← *=(C20/C17)*365.25*	17	17		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		33.26	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



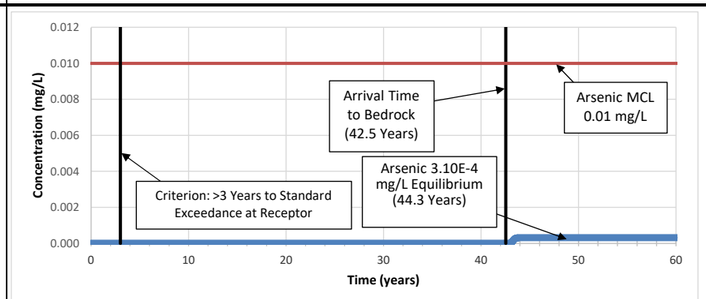
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 13b - Vertical downward flow through till and horizontal flow through bedrock from leaking Leachate Storage Tanks Containment Area to Receptor G (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	15530	42.52	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	15531	42.52	2.83	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	15532	42.53	5.66	0.08	0.03	0.00	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (ft^3/d)	50.42	← *=C7*C9*	3	15533	42.53	8.49	0.32	0.11	0.02	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (gpd)	377.11	← *=C10*7.48*	4	15534	42.53	11.32	0.61	0.20	0.03	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	15535	42.53	14.15	0.91	0.30	0.05	2.57	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	1256218.77	← *=C11*C12*3.7854118*	6	15536	42.54	16.98	1.21	0.40	0.06	3.42	1.14	0.17	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	15537	42.54	19.81	1.50	0.50	0.07	4.24	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	15538	42.54	22.64	1.78	0.59	0.09	5.04	1.68	0.25	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	15539	42.54	25.47	2.06	0.69	0.10	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.83	← *=C14*C15/C16*	10	15540	42.55	28.30	2.32	0.77	0.12	6.56	2.19	0.33	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	15541	42.55	31.13	2.58	0.86	0.13	7.29	2.43	0.36	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	15542	42.55	33.96	2.82	0.94	0.14	7.99	2.66	0.40	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	15543	42.56	36.78	3.06	1.02	0.15	8.66	2.89	0.43	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	15544	42.56	39.61	3.29	1.10	0.16	9.32	3.11	0.47	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15545	42.56	42.44	3.52	1.17	0.18	9.95	3.32	0.50	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	15546	42.56	45.27	3.74	1.25	0.19	10.57	3.52	0.53	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	203.85	*INPUT*	17	15547	42.57	48.10	3.95	1.32	0.20	11.17	3.72	0.56	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.50	*INPUT*	18	15548	42.57	50.93	4.15	1.38	0.21	11.75	3.92	0.59	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	56.35	← *=C24-C25*	19	15549	42.57	53.76	4.35	1.45	0.22	12.32	4.11	0.62	8.10E-281	8.10E-281	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	15550	42.57	56.59	4.55	1.52	0.23	12.87	4.29	0.64	1.43E-253	1.43E-253	1.77E+27
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	15551	42.58	59.42	4.74	1.58	0.24	13.41	4.47	0.67	3.33E-230	3.33E-230	2.33E+23
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	15552	42.58	62.25	4.92	1.64	0.25	13.93	4.64	0.70	5.29E-210	5.29E-210	1.59E+20
30	Time of Vertical Flow Through Till (days)	15530	← *=C26/C29*	23	15553	42.58	65.08	5.11	1.70	0.26	14.45	4.82	0.72	2.07E-192	2.07E-192	3.91E+17
31				24	15554	42.59	67.91	5.28	1.76	0.26	14.95	4.98	0.75	5.44E-177	5.44E-177	2.63E+15
32				25	15555	42.59	70.74	5.46	1.82	0.27	15.44	5.15	0.77	2.16E-163	2.16E-163	3.96E+13
33				26	15556	42.59	73.57	5.63	1.88	0.28	15.92	5.31	0.80	2.46E-151	2.46E-151	1.14E+12
34				27	15557	42.59	76.40	5.79	1.93	0.29	16.39	5.46	0.82	1.36E-140	1.36E-140	5.54E+10
35				28	15558	42.60	79.23	5.96	1.99	0.30	16.85	5.62	0.84	5.65E-131	5.65E-131	4.15E+09
36				29	15559	42.60	82.06	6.11	2.04	0.31	17.30	5.77	0.87	2.50E-122	2.50E-122	4.43E+08
37				30	15560	42.60	84.89	6.27	2.09	0.31	17.75	5.92	0.89	1.59E-114	1.59E-114	6.36E+07
10949				10942	26472	72.48	30961.64	76.16	25.39	3.81	215.51	71.84	10.78	3.38E-48	5.14E-01	1.00E+00
10950				10943	26473	72.48	30964.47	76.16	25.39	3.81	215.51	71.84	10.78	3.36E-48	5.14E-01	1.00E+00
10951				10944	26474	72.48	30967.30	76.17	25.39	3.81	215.52	71.84	10.78	3.33E-48	5.14E-01	1.00E+00
10952				10945	26475	72.49	30970.13	76.17	25.39	3.81	215.52	71.84	10.78	3.31E-48	5.14E-01	1.00E+00
10953				10946	26476	72.49	30972.96	76.17	25.39	3.81	215.53	71.84	10.78	3.28E-48	5.14E-01	1.00E+00
10954				10947	26477	72.49	30975.79	76.17	25.39	3.81	215.54	71.85	10.78	3.26E-48	5.14E-01	1.00E+00
10955				10948	26478	72.49	30978.62	76.17	25.39	3.81	215.54	71.85	10.78	3.24E-48	5.14E-01	1.00E+00
10956				10949	26479	72.50	30981.45	76.17	25.39	3.81	215.55	71.85	10.78	3.21E-48	5.14E-01	1.00E+00
10957				10950	26480	72.50	30984.28	76.18	25.39	3.81	215.55	71.85	10.78	3.19E-48	5.14E-01	1.00E+00
10958				10951	26481	72.50	30987.11	76.18	25.39	3.81	215.56	71.85	10.78	3.17E-48	5.14E-01	1.00E+00
10959				10952	26482	72.51	30989.94	76.18	25.39	3.81	215.56	71.85	10.78	3.15E-48	5.14E-01	1.00E+00
10960				10953	26483	72.51	30992.77	76.18	25.39	3.81	215.57	71.86	10.78	3.12E-48	5.14E-01	1.00E+00
10961				10954	26484	72.51	30995.60	76.18	25.39	3.81	215.57	71.86	10.78	3.10E-48	5.14E-01	1.00E+00
10962				10955	26485	72.51	30998.42	76.19	25.40	3.81	215.58	71.86	10.78	3.08E-48	5.14E-01	1.00E+00
10963				10956	26486	72.52	31001.25	76.19	25.40	3.81	215.58	71.86	10.78	3.06E-48	5.14E-01	1.00E+00
10964				10957	26487	72.52	31004.08	76.19	25.40	3.81	215.59	71.86	10.78	3.04E-48	5.14E-01	1.00E+00
10965				10958	26488	72.52	31006.91	76.19	25.40	3.81	215.59	71.86	10.78	3.01E-48	5.14E-01	1.00E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

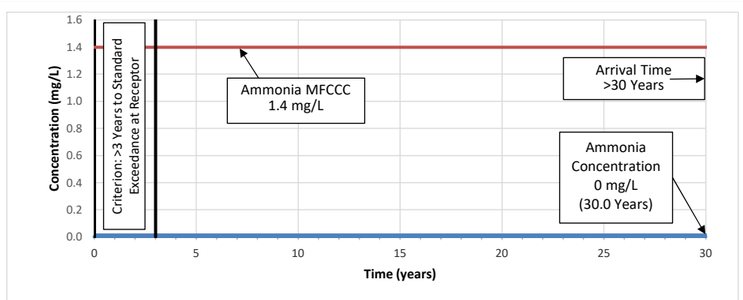
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 13b - Vertical downward flow through till and horizontal flow through bedrock from leaking Leachate Storage Tanks Containment Area to Receptor G (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	15530	42.52	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	15531	42.52	2.83	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	15532	42.53	5.66	0.08	0.03	0.00	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (ft^3/d)	50.42	← *=C7*C9*	3	15533	42.53	8.49	0.32	0.11	0.02	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow Below Leachate Storage Tanks (gpd)	377.11	← *=C10*7.48*	4	15534	42.53	11.32	0.61	0.20	0.03	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	15535	42.53	14.15	0.91	0.30	0.05	2.57	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	756.59	← *=C11*C12*3.7854118*	6	15536	42.54	16.98	1.21	0.40	0.06	3.42	1.14	0.17	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	15537	42.54	19.81	1.50	0.50	0.07	4.24	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	15538	42.54	22.64	1.78	0.59	0.09	5.04	1.68	0.25	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	15539	42.54	25.47	2.06	0.69	0.10	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.83	← *=C14*C15/C16*	10	15540	42.55	28.30	2.32	0.77	0.12	6.56	2.19	0.33	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	15541	42.55	31.13	2.58	0.86	0.13	7.29	2.43	0.36	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	15542	42.55	33.96	2.82	0.94	0.14	7.99	2.66	0.40	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	15543	42.56	36.78	3.06	1.02	0.15	8.66	2.89	0.43	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	15544	42.56	39.61	3.29	1.10	0.16	9.32	3.11	0.47	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15545	42.56	42.44	3.52	1.17	0.18	9.95	3.32	0.50	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	15546	42.56	45.27	3.74	1.25	0.19	10.57	3.52	0.53	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	203.85	*INPUT*	17	15547	42.57	48.10	3.95	1.32	0.20	11.17	3.72	0.56	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.50	*INPUT*	18	15548	42.57	50.93	4.15	1.38	0.21	11.75	3.92	0.59	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	56.35	← *=C24-C25*	19	15549	42.57	53.76	4.35	1.45	0.22	12.32	4.11	0.62	4.88E-284	4.88E-284	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	15550	42.57	56.59	4.55	1.52	0.23	12.87	4.29	0.64	8.61E-257	8.61E-257	1.77E+27
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	15551	42.58	59.42	4.74	1.58	0.24	13.41	4.47	0.67	2.00E-233	2.00E-233	2.33E+23
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	15552	42.58	62.25	4.92	1.64	0.25	13.93	4.64	0.70	3.19E-213	3.19E-213	1.59E+20
30	Time of Vertical Flow Through Till (days)	15530	← *=C26/C29*	23	15553	42.58	65.08	5.11	1.70	0.26	14.45	4.82	0.72	1.24E-195	1.24E-195	3.91E+17
31				24	15554	42.59	67.91	5.28	1.76	0.26	14.95	4.98	0.75	3.28E-180	3.28E-180	2.63E+15
32				25	15555	42.59	70.74	5.46	1.82	0.27	15.44	5.15	0.77	1.30E-166	1.30E-166	3.96E+13
33				26	15556	42.59	73.57	5.63	1.88	0.28	15.92	5.31	0.80	1.48E-154	1.48E-154	1.14E+12
34				27	15557	42.59	76.40	5.79	1.93	0.29	16.39	5.46	0.82	8.21E-144	8.21E-144	5.54E+10
35				28	15558	42.60	79.23	5.96	1.99	0.30	16.85	5.62	0.84	3.40E-134	3.40E-134	4.15E+09
36				29	15559	42.60	82.06	6.11	2.04	0.31	17.30	5.77	0.87	1.51E-125	1.51E-125	4.43E+08
37				30	15560	42.60	84.89	6.27	2.09	0.31	17.75	5.92	0.89	9.59E-118	9.59E-118	6.36E+07



10949				10942	26472	72.48	30961.64	76.16	25.39	3.81	215.51	71.84	10.78	2.04E-51	3.10E-04	1.00E+00
10950				10943	26473	72.48	30964.47	76.16	25.39	3.81	215.51	71.84	10.78	2.02E-51	3.10E-04	1.00E+00
10951				10944	26474	72.48	30967.30	76.17	25.39	3.81	215.52	71.84	10.78	2.01E-51	3.10E-04	1.00E+00
10952				10945	26475	72.49	30970.13	76.17	25.39	3.81	215.52	71.84	10.78	1.99E-51	3.10E-04	1.00E+00
10953				10946	26476	72.49	30972.96	76.17	25.39	3.81	215.53	71.84	10.78	1.98E-51	3.10E-04	1.00E+00
10954				10947	26477	72.49	30975.79	76.17	25.39	3.81	215.54	71.85	10.78	1.96E-51	3.10E-04	1.00E+00
10955				10948	26478	72.49	30978.62	76.17	25.39	3.81	215.54	71.85	10.78	1.95E-51	3.10E-04	1.00E+00
10956				10949	26479	72.50	30981.45	76.17	25.39	3.81	215.55	71.85	10.78	1.94E-51	3.10E-04	1.00E+00
10957				10950	26480	72.50	30984.28	76.18	25.39	3.81	215.55	71.85	10.78	1.92E-51	3.10E-04	1.00E+00
10958				10951	26481	72.50	30987.11	76.18	25.39	3.81	215.56	71.85	10.78	1.91E-51	3.10E-04	1.00E+00
10959				10952	26482	72.51	30989.94	76.18	25.39	3.81	215.56	71.85	10.78	1.90E-51	3.10E-04	1.00E+00
10960				10953	26483	72.51	30992.77	76.18	25.39	3.81	215.57	71.86	10.78	1.88E-51	3.10E-04	1.00E+00
10961				10954	26484	72.51	30995.60	76.18	25.39	3.81	215.57	71.86	10.78	1.87E-51	3.10E-04	1.00E+00
10962				10955	26485	72.51	30998.42	76.19	25.40	3.81	215.58	71.86	10.78	1.86E-51	3.10E-04	1.00E+00
10963				10956	26486	72.52	31001.25	76.19	25.40	3.81	215.58	71.86	10.78	1.84E-51	3.10E-04	1.00E+00
10964				10957	26487	72.52	31004.08	76.19	25.40	3.81	215.59	71.86	10.78	1.83E-51	3.10E-04	1.00E+00
10965				10958	26488	72.52	31006.91	76.19	25.40	3.81	215.59	71.86	10.78	1.82E-51	3.10E-04	1.00E+00

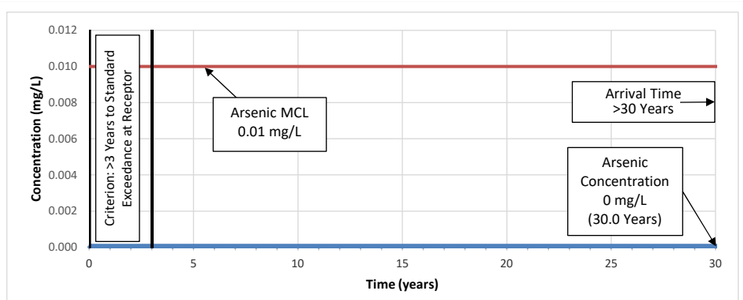
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 14a - Horizontal flow through till from nearest leaking Duel Containment Leachate Transport Pipe to Receptor B (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	0.82	← *=C7*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	20341.78	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.83E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1303	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



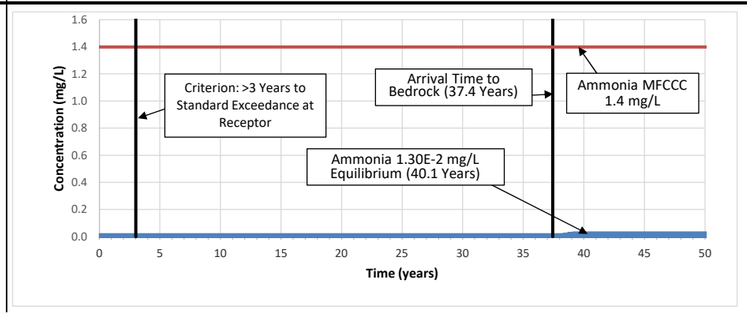
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 14a - Horizontal flow through till from nearest leaking Duel Containment Leachate Transport Pipe to Receptor B (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	0.82	← *=C7*C9*	3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	12.25	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.83E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1303	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



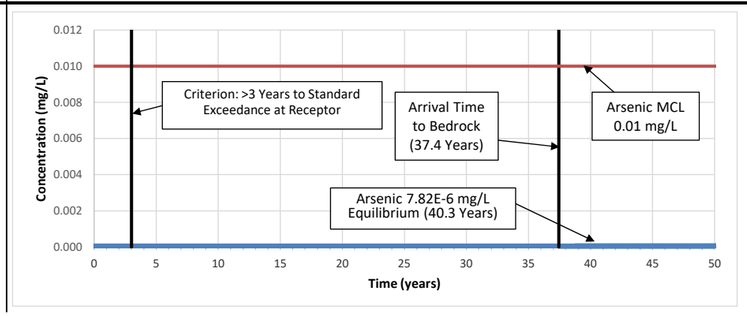
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 14b - Vertical downward flow through till and horizontal flow through bedrock from nearest leaking Dual Containment Leachate Transport Pipe to Receptor B (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	13670	37.43	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	13671	37.43	1.70	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	13672	37.43	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	0.82	← *=C7*C9*	3	13673	37.43	5.11	0.05	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	13674	37.44	6.81	0.17	0.06	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	13675	37.44	8.51	0.32	0.11	0.02	0.55	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	20341.78	← *=C11*C12*3.7854118*	6	13676	37.44	10.21	0.49	0.16	0.02	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13677	37.45	11.92	0.67	0.22	0.03	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	13678	37.45	13.62	0.85	0.28	0.04	1.45	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13679	37.45	15.32	1.03	0.34	0.05	1.76	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.70	← *=C14*C15/C16*	10	13680	37.45	17.02	1.21	0.40	0.06	2.06	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13681	37.46	18.73	1.39	0.46	0.07	2.36	0.79	0.12	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13682	37.46	20.43	1.56	0.52	0.08	2.66	0.89	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13683	37.46	22.13	1.73	0.58	0.09	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13684	37.47	23.83	1.90	0.63	0.09	3.23	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13685	37.47	25.54	2.06	0.69	0.10	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13686	37.47	27.24	2.22	0.74	0.11	3.78	1.26	0.19	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	169.60	*INPUT*	17	13687	37.47	28.94	2.38	0.79	0.12	4.05	1.35	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	120.00	*INPUT*	18	13688	37.48	30.64	2.53	0.84	0.13	4.31	1.44	0.22	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	49.60	← *=C24-C25*	19	13689	37.48	32.35	2.68	0.89	0.13	4.57	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	13690	37.48	34.05	2.83	0.94	0.14	4.82	1.61	0.24	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	13691	37.48	35.75	2.97	0.99	0.15	5.06	1.69	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	13692	37.49	37.45	3.12	1.04	0.16	5.31	1.77	0.27	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	13670	← *=C26/C29*	23	13693	37.49	39.16	3.26	1.09	0.16	5.54	1.85	0.28	0.00E+00	0.00E+00	#DIV/0!
31				24	13694	37.49	40.86	3.39	1.13	0.17	5.77	1.92	0.29	0.00E+00	0.00E+00	#DIV/0!
32				25	13695	37.50	42.56	3.53	1.18	0.18	6.00	2.00	0.30	0.00E+00	0.00E+00	#DIV/0!
33				26	13696	37.50	44.26	3.66	1.22	0.18	6.23	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
34				27	13697	37.50	45.97	3.79	1.26	0.19	6.45	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
35				28	13698	37.50	47.67	3.91	1.30	0.20	6.66	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
36				29	13699	37.51	49.37	4.04	1.35	0.20	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
37				30	13700	37.51	51.07	4.16	1.39	0.21	7.09	2.36	0.35	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24612	67.38	18627.78	66.35	22.12	3.32	112.96	37.65	5.65	1.80E-35	1.30E-02	1.00E+00
10950				10943	24613	67.39	18629.49	66.35	22.12	3.32	112.96	37.65	5.65	1.79E-35	1.30E-02	1.00E+00
10951				10944	24614	67.39	18631.19	66.36	22.12	3.32	112.97	37.66	5.65	1.78E-35	1.30E-02	1.00E+00
10952				10945	24615	67.39	18632.89	66.36	22.12	3.32	112.97	37.66	5.65	1.77E-35	1.30E-02	1.00E+00
10953				10946	24616	67.40	18634.59	66.36	22.12	3.32	112.97	37.66	5.65	1.76E-35	1.30E-02	1.00E+00
10954				10947	24617	67.40	18636.30	66.36	22.12	3.32	112.97	37.66	5.65	1.75E-35	1.30E-02	1.00E+00
10955				10948	24618	67.40	18638.00	66.36	22.12	3.32	112.98	37.66	5.65	1.75E-35	1.30E-02	1.00E+00
10956				10949	24619	67.40	18639.70	66.36	22.12	3.32	112.98	37.66	5.65	1.74E-35	1.30E-02	1.00E+00
10957				10950	24620	67.41	18641.40	66.37	22.12	3.32	112.98	37.66	5.65	1.73E-35	1.30E-02	1.00E+00
10958				10951	24621	67.41	18643.11	66.37	22.12	3.32	112.99	37.66	5.65	1.72E-35	1.30E-02	1.00E+00
10959				10952	24622	67.41	18644.81	66.37	22.12	3.32	112.99	37.66	5.65	1.71E-35	1.30E-02	1.00E+00
10960				10953	24623	67.41	18646.51	66.37	22.12	3.32	112.99	37.66	5.65	1.70E-35	1.30E-02	1.00E+00
10961				10954	24624	67.42	18648.21	66.37	22.12	3.32	112.99	37.66	5.65	1.69E-35	1.30E-02	1.00E+00
10962				10955	24625	67.42	18649.92	66.38	22.13	3.32	113.00	37.67	5.65	1.69E-35	1.30E-02	1.00E+00
10963				10956	24626	67.42	18651.62	66.38	22.13	3.32	113.00	37.67	5.65	1.68E-35	1.30E-02	1.00E+00
10964				10957	24627	67.43	18653.32	66.38	22.13	3.32	113.00	37.67	5.65	1.67E-35	1.30E-02	1.00E+00
10965				10958	24628	67.43	18655.02	66.38	22.13	3.32	113.01	37.67	5.65	1.66E-35	1.30E-02	1.00E+00



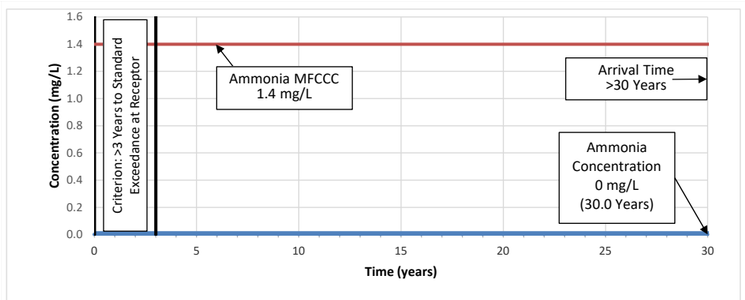
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 14b - Vertical downward flow through till and horizontal flow through bedrock from nearest leaking Dual Containment Leachate Transport Pipe to Receptor B (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	13670	37.43	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	13671	37.43	1.70	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	13672	37.43	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow East of Groundwater Divide (ft^3/d)	0.82	← *=C7*C9*	3	13673	37.43	5.11	0.05	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow East of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	13674	37.44	6.81	0.17	0.06	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	13675	37.44	8.51	0.32	0.11	0.02	0.55	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	12.25	← *=C11*C12*3.7854118*	6	13676	37.44	10.21	0.49	0.16	0.02	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13677	37.45	11.92	0.67	0.22	0.03	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	13678	37.45	13.62	0.85	0.28	0.04	1.45	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13679	37.45	15.32	1.03	0.34	0.05	1.76	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.70	← *=C14*C15/C16*	10	13680	37.45	17.02	1.21	0.40	0.06	2.06	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13681	37.46	18.73	1.39	0.46	0.07	2.36	0.79	0.12	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13682	37.46	20.43	1.56	0.52	0.08	2.66	0.89	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13683	37.46	22.13	1.73	0.58	0.09	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13684	37.47	23.83	1.90	0.63	0.09	3.23	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13685	37.47	25.54	2.06	0.69	0.10	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13686	37.47	27.24	2.22	0.74	0.11	3.78	1.26	0.19	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	169.60	*INPUT*	17	13687	37.47	28.94	2.38	0.79	0.12	4.05	1.35	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	120.00	*INPUT*	18	13688	37.48	30.64	2.53	0.84	0.13	4.31	1.44	0.22	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	49.60	← *=C24-C25*	19	13689	37.48	32.35	2.68	0.89	0.13	4.57	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	13690	37.48	34.05	2.83	0.94	0.14	4.82	1.61	0.24	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	13691	37.48	35.75	2.97	0.99	0.15	5.06	1.69	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	13692	37.49	37.45	3.12	1.04	0.16	5.31	1.77	0.27	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	13670	← *=C26/C29*	23	13693	37.49	39.16	3.26	1.09	0.16	5.54	1.85	0.28	0.00E+00	0.00E+00	#DIV/0!
31				24	13694	37.49	40.86	3.39	1.13	0.17	5.77	1.92	0.29	0.00E+00	0.00E+00	#DIV/0!
32				25	13695	37.50	42.56	3.53	1.18	0.18	6.00	2.00	0.30	0.00E+00	0.00E+00	#DIV/0!
33				26	13696	37.50	44.26	3.66	1.22	0.18	6.23	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
34				27	13697	37.50	45.97	3.79	1.26	0.19	6.45	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
35				28	13698	37.50	47.67	3.91	1.30	0.20	6.66	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
36				29	13699	37.51	49.37	4.04	1.35	0.20	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
37				30	13700	37.51	51.07	4.16	1.39	0.21	7.09	2.36	0.35	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24612	67.38	18627.78	66.35	22.12	3.32	112.96	37.65	5.65	1.08E-38	7.82E-06	1.00E+00
10950				10943	24613	67.39	18629.49	66.35	22.12	3.32	112.96	37.65	5.65	1.08E-38	7.82E-06	1.00E+00
10951				10944	24614	67.39	18631.19	66.36	22.12	3.32	112.97	37.66	5.65	1.07E-38	7.82E-06	1.00E+00
10952				10945	24615	67.39	18632.89	66.36	22.12	3.32	112.97	37.66	5.65	1.07E-38	7.82E-06	1.00E+00
10953				10946	24616	67.40	18634.59	66.36	22.12	3.32	112.97	37.66	5.65	1.06E-38	7.82E-06	1.00E+00
10954				10947	24617	67.40	18636.30	66.36	22.12	3.32	112.97	37.66	5.65	1.06E-38	7.82E-06	1.00E+00
10955				10948	24618	67.40	18638.00	66.36	22.12	3.32	112.98	37.66	5.65	1.05E-38	7.82E-06	1.00E+00
10956				10949	24619	67.40	18639.70	66.36	22.12	3.32	112.98	37.66	5.65	1.05E-38	7.82E-06	1.00E+00
10957				10950	24620	67.41	18641.40	66.37	22.12	3.32	112.98	37.66	5.65	1.04E-38	7.82E-06	1.00E+00
10958				10951	24621	67.41	18643.11	66.37	22.12	3.32	112.99	37.66	5.65	1.04E-38	7.82E-06	1.00E+00
10959				10952	24622	67.41	18644.81	66.37	22.12	3.32	112.99	37.66	5.65	1.03E-38	7.82E-06	1.00E+00
10960				10953	24623	67.41	18646.51	66.37	22.12	3.32	112.99	37.66	5.65	1.03E-38	7.82E-06	1.00E+00
10961				10954	24624	67.42	18648.21	66.37	22.12	3.32	112.99	37.66	5.65	1.02E-38	7.82E-06	1.00E+00
10962				10955	24625	67.42	18649.92	66.38	22.13	3.32	113.00	37.67	5.65	1.02E-38	7.82E-06	1.00E+00
10963				10956	24626	67.42	18651.62	66.38	22.13	3.32	113.00	37.67	5.65	1.01E-38	7.82E-06	1.00E+00
10964				10957	24627	67.43	18653.32	66.38	22.13	3.32	113.00	37.67	5.65	1.01E-38	7.82E-06	1.00E+00
10965				10958	24628	67.43	18655.02	66.38	22.13	3.32	113.01	37.67	5.65	1.00E-38	7.82E-06	1.00E+00



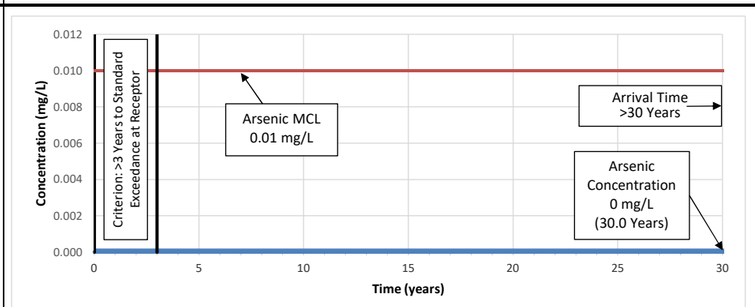
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 15a - Horizontal flow through till and horizontal flow through bedrock from nearest leaking Duel Containment Leachate Transport Pipe to Receptor E (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	20341.78	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.39E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1409	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



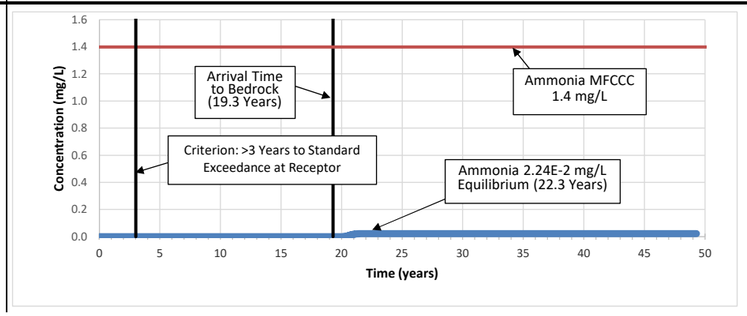
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 15a - Horizontal flow through till from nearest leaking Duel Containment Leachate Transport Pipe to Receptor E (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	12.25	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.39E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1409	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

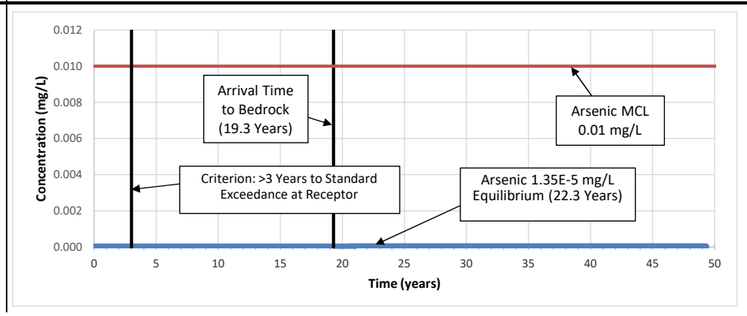
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 15b - Vertical downward flow through till and horizontal flow through bedrock from nearest leaking Dual Containment Leachate Transport Pipe to Receptor E (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	7043	19.28	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	7044	19.28	1.30	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	7045	19.29	2.60	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	7046	19.29	3.90	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	7047	19.29	5.20	0.06	0.02	0.00	0.07	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	7048	19.30	6.50	0.15	0.05	0.01	0.19	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	20341.78	← *=C11*C12*3.7854118*	6	7049	19.30	7.80	0.26	0.09	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7050	19.30	9.10	0.38	0.13	0.02	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	7051	19.30	10.40	0.51	0.17	0.03	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7052	19.31	11.70	0.65	0.22	0.03	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.30	← *=C14*C15/C16*	10	7053	19.31	13.00	0.79	0.26	0.04	1.02	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7054	19.31	14.30	0.92	0.31	0.05	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7055	19.31	15.60	1.06	0.35	0.05	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	7056	19.32	16.90	1.20	0.40	0.06	1.56	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7057	19.32	18.20	1.33	0.44	0.07	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7058	19.32	19.50	1.47	0.49	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7059	19.33	20.80	1.60	0.53	0.08	2.08	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	179.82	*INPUT*	17	7060	19.33	22.10	1.73	0.58	0.09	2.25	0.75	0.11	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.27	*INPUT*	18	7061	19.33	23.40	1.86	0.62	0.09	2.41	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	25.55	← *=C24-C25*	19	7062	19.33	24.70	1.98	0.66	0.10	2.58	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	7063	19.34	26.00	2.11	0.70	0.11	2.74	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	7064	19.34	27.30	2.23	0.74	0.11	2.90	0.97	0.14	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	7065	19.34	28.60	2.35	0.78	0.12	3.05	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	7043	← *=C26/C29*	23	7066	19.34	29.90	2.47	0.82	0.12	3.20	1.07	0.16	0.00E+00	0.00E+00	#DIV/0!
31				24	7067	19.35	31.20	2.58	0.86	0.13	3.36	1.12	0.17	0.00E+00	0.00E+00	#DIV/0!
32				25	7068	19.35	32.50	2.70	0.90	0.13	3.50	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
33				26	7069	19.35	33.80	2.81	0.94	0.14	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
34				27	7070	19.36	35.10	2.92	0.97	0.15	3.80	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
35				28	7071	19.36	36.40	3.03	1.01	0.15	3.94	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
36				29	7072	19.36	37.70	3.14	1.05	0.16	4.08	1.36	0.20	0.00E+00	0.00E+00	#DIV/0!
37				30	7073	19.36	39.00	3.24	1.08	0.16	4.22	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!



10949				10942	17985	49.24	14223.06	61.46	20.49	3.07	79.89	26.63	3.99	3.39E-30	2.24E-02	1.00E+00
10950				10943	17986	49.24	14224.36	61.47	20.49	3.07	79.90	26.63	3.99	3.38E-30	2.24E-02	1.00E+00
10951				10944	17987	49.24	14225.66	61.47	20.49	3.07	79.90	26.63	3.99	3.36E-30	2.24E-02	1.00E+00
10952				10945	17988	49.25	14226.96	61.47	20.49	3.07	79.90	26.63	4.00	3.35E-30	2.24E-02	1.00E+00
10953				10946	17989	49.25	14228.26	61.47	20.49	3.07	79.90	26.63	4.00	3.34E-30	2.24E-02	1.00E+00
10954				10947	17990	49.25	14229.56	61.47	20.49	3.07	79.91	26.64	4.00	3.32E-30	2.24E-02	1.00E+00
10955				10948	17991	49.26	14230.86	61.47	20.49	3.07	79.91	26.64	4.00	3.31E-30	2.24E-02	1.00E+00
10956				10949	17992	49.26	14232.16	61.48	20.49	3.07	79.91	26.64	4.00	3.29E-30	2.24E-02	1.00E+00
10957				10950	17993	49.26	14233.46	61.48	20.49	3.07	79.91	26.64	4.00	3.28E-30	2.24E-02	1.00E+00
10958				10951	17994	49.26	14234.76	61.48	20.49	3.07	79.91	26.64	4.00	3.27E-30	2.24E-02	1.00E+00
10959				10952	17995	49.27	14236.06	61.48	20.49	3.07	79.92	26.64	4.00	3.25E-30	2.24E-02	1.00E+00
10960				10953	17996	49.27	14237.36	61.48	20.49	3.07	79.92	26.64	4.00	3.24E-30	2.24E-02	1.00E+00
10961				10954	17997	49.27	14238.66	61.48	20.49	3.07	79.92	26.64	4.00	3.23E-30	2.24E-02	1.00E+00
10962				10955	17998	49.27	14239.96	61.49	20.50	3.07	79.92	26.64	4.00	3.22E-30	2.24E-02	1.00E+00
10963				10956	17999	49.28	14241.26	61.49	20.50	3.07	79.92	26.64	4.00	3.20E-30	2.24E-02	1.00E+00
10964				10957	18000	49.28	14242.56	61.49	20.50	3.07	79.93	26.64	4.00	3.19E-30	2.24E-02	1.00E+00
10965				10958	18001	49.28	14243.86	61.49	20.50	3.07	79.93	26.64	4.00	3.18E-30	2.24E-02	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

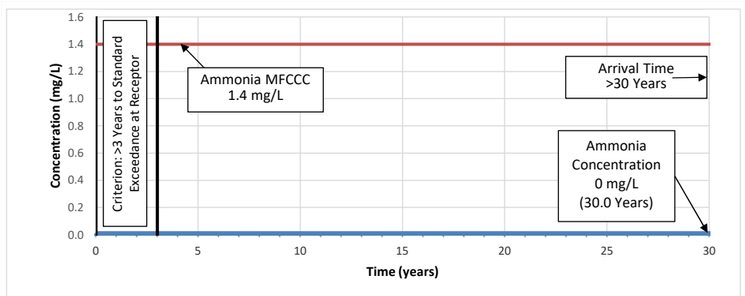
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 15b - Vertical downward flow through till and horizontal flow through bedrock from nearest leaking Dual Containment Leachate Transport Pipe to Receptor E (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	7043	19.28	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	7044	19.28	1.30	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	7045	19.29	2.60	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	7046	19.29	3.90	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	7047	19.29	5.20	0.06	0.02	0.00	0.07	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	7048	19.30	6.50	0.15	0.05	0.01	0.19	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	12.25	← *=C11*C12*3.7854118*	6	7049	19.30	7.80	0.26	0.09	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7050	19.30	9.10	0.38	0.13	0.02	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	7051	19.30	10.40	0.51	0.17	0.03	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7052	19.31	11.70	0.65	0.22	0.03	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.30	← *=C14*C15/C16*	10	7053	19.31	13.00	0.79	0.26	0.04	1.02	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7054	19.31	14.30	0.92	0.31	0.05	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7055	19.31	15.60	1.06	0.35	0.05	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	7056	19.32	16.90	1.20	0.40	0.06	1.56	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7057	19.32	18.20	1.33	0.44	0.07	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7058	19.32	19.50	1.47	0.49	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7059	19.33	20.80	1.60	0.53	0.08	2.08	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	179.82	*INPUT*	17	7060	19.33	22.10	1.73	0.58	0.09	2.25	0.75	0.11	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.27	*INPUT*	18	7061	19.33	23.40	1.86	0.62	0.09	2.41	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	25.55	← *=C24-C25*	19	7062	19.33	24.70	1.98	0.66	0.10	2.58	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	7063	19.34	26.00	2.11	0.70	0.11	2.74	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	7064	19.34	27.30	2.23	0.74	0.11	2.90	0.97	0.14	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	7065	19.34	28.60	2.35	0.78	0.12	3.05	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	7043	← *=C26/C29*	23	7066	19.34	29.90	2.47	0.82	0.12	3.20	1.07	0.16	0.00E+00	0.00E+00	#DIV/0!
31				24	7067	19.35	31.20	2.58	0.86	0.13	3.36	1.12	0.17	0.00E+00	0.00E+00	#DIV/0!
32				25	7068	19.35	32.50	2.70	0.90	0.13	3.50	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
33				26	7069	19.35	33.80	2.81	0.94	0.14	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
34				27	7070	19.36	35.10	2.92	0.97	0.15	3.80	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
35				28	7071	19.36	36.40	3.03	1.01	0.15	3.94	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
36				29	7072	19.36	37.70	3.14	1.05	0.16	4.08	1.36	0.20	0.00E+00	0.00E+00	#DIV/0!
37				30	7073	19.36	39.00	3.24	1.08	0.16	4.22	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!



10949				10942	17985	49.24	14223.06	61.46	20.49	3.07	79.89	26.63	3.99	2.04E-33	1.35E-05	1.00E+00
10950				10943	17986	49.24	14224.36	61.47	20.49	3.07	79.90	26.63	3.99	2.03E-33	1.35E-05	1.00E+00
10951				10944	17987	49.24	14225.66	61.47	20.49	3.07	79.90	26.63	3.99	2.03E-33	1.35E-05	1.00E+00
10952				10945	17988	49.25	14226.96	61.47	20.49	3.07	79.90	26.63	4.00	2.02E-33	1.35E-05	1.00E+00
10953				10946	17989	49.25	14228.26	61.47	20.49	3.07	79.90	26.63	4.00	2.01E-33	1.35E-05	1.00E+00
10954				10947	17990	49.25	14229.56	61.47	20.49	3.07	79.91	26.64	4.00	2.00E-33	1.35E-05	1.00E+00
10955				10948	17991	49.26	14230.86	61.47	20.49	3.07	79.91	26.64	4.00	1.99E-33	1.35E-05	1.00E+00
10956				10949	17992	49.26	14232.16	61.48	20.49	3.07	79.91	26.64	4.00	1.98E-33	1.35E-05	1.00E+00
10957				10950	17993	49.26	14233.46	61.48	20.49	3.07	79.91	26.64	4.00	1.98E-33	1.35E-05	1.00E+00
10958				10951	17994	49.26	14234.76	61.48	20.49	3.07	79.91	26.64	4.00	1.97E-33	1.35E-05	1.00E+00
10959				10952	17995	49.27	14236.06	61.48	20.49	3.07	79.92	26.64	4.00	1.96E-33	1.35E-05	1.00E+00
10960				10953	17996	49.27	14237.36	61.48	20.49	3.07	79.92	26.64	4.00	1.95E-33	1.35E-05	1.00E+00
10961				10954	17997	49.27	14238.66	61.48	20.49	3.07	79.92	26.64	4.00	1.94E-33	1.35E-05	1.00E+00
10962				10955	17998	49.27	14239.96	61.49	20.50	3.07	79.92	26.64	4.00	1.94E-33	1.35E-05	1.00E+00
10963				10956	17999	49.28	14241.26	61.49	20.50	3.07	79.92	26.64	4.00	1.93E-33	1.35E-05	1.00E+00
10964				10957	18000	49.28	14242.56	61.49	20.50	3.07	79.93	26.64	4.00	1.92E-33	1.35E-05	1.00E+00
10965				10958	18001	49.28	14243.86	61.49	20.50	3.07	79.93	26.64	4.00	1.91E-33	1.35E-05	1.00E+00

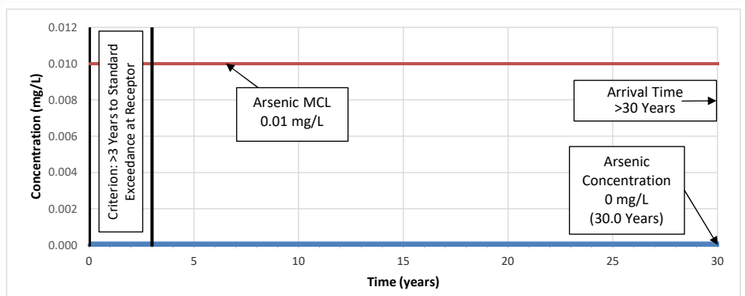
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 16a - Horizontal flow through till from nearest leaking Duel Containment Leachate Transport Pipe to Receptor F (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	20341.78	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.02E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2493	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.13	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



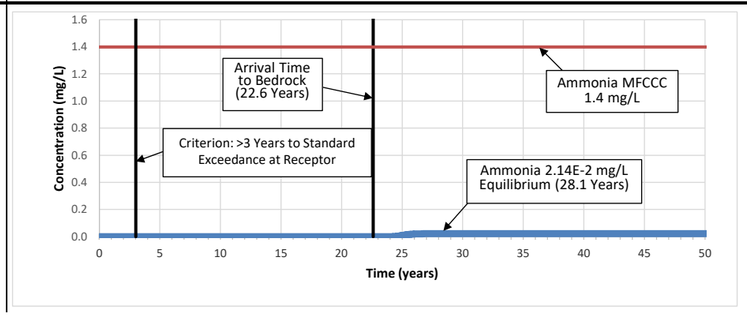
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 16a - Horizontal flow through till from nearest leaking Duel Containment Leachate Transport Pipe to Receptor F (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	12.25	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.02E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2493	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.13	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

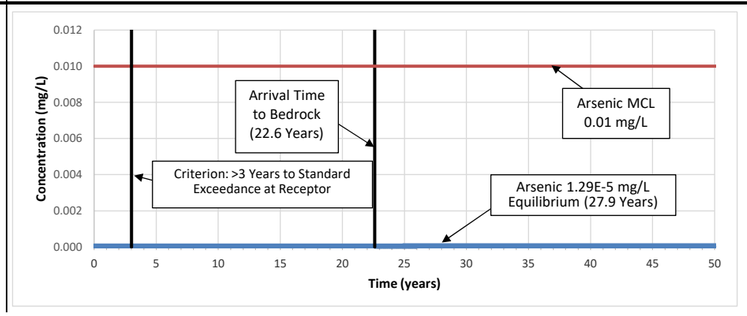
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 16b - Vertical downward flow through till and horizontal flow through bedrock from nearest leaking Dual Containment Leachate Transport Pipe to Receptor F (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	8251	22.59	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	8252	22.59	0.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	8253	22.60	1.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	8254	22.60	2.84	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	8255	22.60	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	8256	22.60	4.73	0.03	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	20341.78	← *=C11*C12*3.7854118*	6	8257	22.61	5.68	0.09	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8258	22.61	6.63	0.16	0.05	0.01	0.15	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8259	22.61	7.57	0.24	0.08	0.01	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8260	22.62	8.52	0.32	0.11	0.02	0.31	0.10	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.95	← *=C14*C15/C16*	10	8261	22.62	9.47	0.42	0.14	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8262	22.62	10.41	0.51	0.17	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8263	22.62	11.36	0.61	0.20	0.03	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	8264	22.63	12.31	0.71	0.24	0.04	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	8265	22.63	13.25	0.81	0.27	0.04	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	8266	22.63	14.20	0.91	0.30	0.05	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8267	22.63	15.14	1.01	0.34	0.05	0.96	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	177.83	*INPUT*	17	8268	22.64	16.09	1.11	0.37	0.06	1.05	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.89	*INPUT*	18	8269	22.64	17.04	1.21	0.40	0.06	1.15	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	29.94	← *=C24-C25*	19	8270	22.64	17.98	1.31	0.44	0.07	1.24	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	8271	22.65	18.93	1.41	0.47	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	8272	22.65	19.88	1.51	0.50	0.08	1.43	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	8273	22.65	20.82	1.60	0.53	0.08	1.52	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	8251	← *=C26/C29*	23	8274	22.65	21.77	1.70	0.57	0.08	1.61	0.54	0.08	0.00E+00	0.00E+00	#DIV/0!
31				24	8275	22.66	22.72	1.79	0.60	0.09	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
32				25	8276	22.66	23.66	1.88	0.63	0.09	1.78	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
33				26	8277	22.66	24.61	1.97	0.66	0.10	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
34				27	8278	22.66	25.56	2.06	0.69	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
35				28	8279	22.67	26.50	2.15	0.72	0.11	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
36				29	8280	22.67	27.45	2.24	0.75	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	8281	22.67	28.40	2.33	0.78	0.12	2.20	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!



10949	10942	19193	52.55	10357.16	55.99	18.66	2.80	53.00	17.67	2.65	6.22E-24	2.14E-02	1.00E+00
10950	10943	19194	52.55	10358.10	56.00	18.67	2.80	53.00	17.67	2.65	6.20E-24	2.14E-02	1.00E+00
10951	10944	19195	52.55	10359.05	56.00	18.67	2.80	53.00	17.67	2.65	6.17E-24	2.14E-02	1.00E+00
10952	10945	19196	52.56	10360.00	56.00	18.67	2.80	53.01	17.67	2.65	6.15E-24	2.14E-02	1.00E+00
10953	10946	19197	52.56	10360.94	56.00	18.67	2.80	53.01	17.67	2.65	6.13E-24	2.14E-02	1.00E+00
10954	10947	19198	52.56	10361.89	56.00	18.67	2.80	53.01	17.67	2.65	6.11E-24	2.14E-02	1.00E+00
10955	10948	19199	52.56	10362.84	56.00	18.67	2.80	53.01	17.67	2.65	6.09E-24	2.14E-02	1.00E+00
10956	10949	19200	52.57	10363.78	56.00	18.67	2.80	53.01	17.67	2.65	6.07E-24	2.14E-02	1.00E+00
10957	10950	19201	52.57	10364.73	56.01	18.67	2.80	53.01	17.67	2.65	6.05E-24	2.14E-02	1.00E+00
10958	10951	19202	52.57	10365.68	56.01	18.67	2.80	53.01	17.67	2.65	6.03E-24	2.14E-02	1.00E+00
10959	10952	19203	52.58	10366.62	56.01	18.67	2.80	53.02	17.67	2.65	6.01E-24	2.14E-02	1.00E+00
10960	10953	19204	52.58	10367.57	56.01	18.67	2.80	53.02	17.67	2.65	5.99E-24	2.14E-02	1.00E+00
10961	10954	19205	52.58	10368.51	56.01	18.67	2.80	53.02	17.67	2.65	5.97E-24	2.14E-02	1.00E+00
10962	10955	19206	52.58	10369.46	56.01	18.67	2.80	53.02	17.67	2.65	5.95E-24	2.14E-02	1.00E+00
10963	10956	19207	52.59	10370.41	56.02	18.67	2.80	53.02	17.67	2.65	5.93E-24	2.14E-02	1.00E+00
10964	10957	19208	52.59	10371.35	56.02	18.67	2.80	53.02	17.67	2.65	5.91E-24	2.14E-02	1.00E+00
10965	10958	19209	52.59	10372.30	56.02	18.67	2.80	53.02	17.67	2.65	5.89E-24	2.14E-02	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario A - 16b - Vertical downward flow through till and horizontal flow through bedrock from nearest leaking Dual Containment Leachate Transport Pipe to Receptor F (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	300-ft Duel Containment Transport Pipe in 3-ft Wide Trench Area (ft^2)	900	*INPUT*	0	8251	22.59	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	8252	22.59	0.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	2	8253	22.60	1.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10	Maximum Rate of Vertical Flow West of Groundwater Divide (ft^3/d)	0.82	← *=C8*C9*	3	8254	22.60	2.84	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Maximum Rate of Vertical Flow West of Groundwater Divide (gpd)	6.11	← *=C10*7.48*	4	8255	22.60	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	8256	22.60	4.73	0.03	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	12.25	← *=C11*C12*3.7854118*	6	8257	22.61	5.68	0.09	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8258	22.61	6.63	0.16	0.05	0.01	0.15	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8259	22.61	7.57	0.24	0.08	0.01	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8260	22.62	8.52	0.32	0.11	0.02	0.31	0.10	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.95	← *=C14*C15/C16*	10	8261	22.62	9.47	0.42	0.14	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8262	22.62	10.41	0.51	0.17	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8263	22.62	11.36	0.61	0.20	0.03	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	8264	22.63	12.31	0.71	0.24	0.04	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	8265	22.63	13.25	0.81	0.27	0.04	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	8266	22.63	14.20	0.91	0.30	0.05	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8267	22.63	15.14	1.01	0.34	0.05	0.96	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	177.83	*INPUT*	17	8268	22.64	16.09	1.11	0.37	0.06	1.05	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.89	*INPUT*	18	8269	22.64	17.04	1.21	0.40	0.06	1.15	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	29.94	← *=C24-C25*	19	8270	22.64	17.98	1.31	0.44	0.07	1.24	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	20	8271	22.65	18.93	1.41	0.47	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	21	8272	22.65	19.88	1.51	0.50	0.08	1.43	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C9*C28/C27*	22	8273	22.65	20.82	1.60	0.53	0.08	1.52	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Time of Vertical Flow Through Till (days)	8251	← *=C26/C29*	23	8274	22.65	21.77	1.70	0.57	0.08	1.61	0.54	0.08	0.00E+00	0.00E+00	#DIV/0!
31				24	8275	22.66	22.72	1.79	0.60	0.09	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
32				25	8276	22.66	23.66	1.88	0.63	0.09	1.78	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
33				26	8277	22.66	24.61	1.97	0.66	0.10	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
34				27	8278	22.66	25.56	2.06	0.69	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
35				28	8279	22.67	26.50	2.15	0.72	0.11	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
36				29	8280	22.67	27.45	2.24	0.75	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	8281	22.67	28.40	2.33	0.78	0.12	2.20	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	19193	52.55	10357.16	55.99	18.66	2.80	53.00	17.67	2.65	3.74E-27	1.29E-05	1.00E+00
10950				10943	19194	52.55	10358.10	56.00	18.67	2.80	53.00	17.67	2.65	3.73E-27	1.29E-05	1.00E+00
10951				10944	19195	52.55	10359.05	56.00	18.67	2.80	53.00	17.67	2.65	3.72E-27	1.29E-05	1.00E+00
10952				10945	19196	52.56	10360.00	56.00	18.67	2.80	53.01	17.67	2.65	3.71E-27	1.29E-05	1.00E+00
10953				10946	19197	52.56	10360.94	56.00	18.67	2.80	53.01	17.67	2.65	3.69E-27	1.29E-05	1.00E+00
10954				10947	19198	52.56	10361.89	56.00	18.67	2.80	53.01	17.67	2.65	3.68E-27	1.29E-05	1.00E+00
10955				10948	19199	52.56	10362.84	56.00	18.67	2.80	53.01	17.67	2.65	3.67E-27	1.29E-05	1.00E+00
10956				10949	19200	52.57	10363.78	56.00	18.67	2.80	53.01	17.67	2.65	3.66E-27	1.29E-05	1.00E+00
10957				10950	19201	52.57	10364.73	56.01	18.67	2.80	53.01	17.67	2.65	3.65E-27	1.29E-05	1.00E+00
10958				10951	19202	52.57	10365.68	56.01	18.67	2.80	53.01	17.67	2.65	3.63E-27	1.29E-05	1.00E+00
10959				10952	19203	52.58	10366.62	56.01	18.67	2.80	53.02	17.67	2.65	3.62E-27	1.29E-05	1.00E+00
10960				10953	19204	52.58	10367.57	56.01	18.67	2.80	53.02	17.67	2.65	3.61E-27	1.29E-05	1.00E+00
10961				10954	19205	52.58	10368.51	56.01	18.67	2.80	53.02	17.67	2.65	3.60E-27	1.29E-05	1.00E+00
10962				10955	19206	52.58	10369.46	56.01	18.67	2.80	53.02	17.67	2.65	3.59E-27	1.29E-05	1.00E+00
10963				10956	19207	52.59	10370.41	56.02	18.67	2.80	53.02	17.67	2.65	3.57E-27	1.29E-05	1.00E+00
10964				10957	19208	52.59	10371.35	56.02	18.67	2.80	53.02	17.67	2.65	3.56E-27	1.29E-05	1.00E+00
10965				10958	19209	52.59	10372.30	56.02	18.67	2.80	53.02	17.67	2.65	3.55E-27	1.29E-05	1.00E+00



SCENARIO B CONTAMINANT TRANSPORT ANALYSIS RESULTS (TABLE J-2)

TABLE J-2

SUMMARY OF SCENARIO B

Scenario	Description	Horizontal Groundwater Travel Distance (feet)	Till Thickness at Source (feet)	Interpreted Groundwater Level at Source (ft NAVD)	Interpreted Groundwater Level at Receptor (ft NAVD)	Source - Maximum Rate of Vertical Flow into Till (gpd)	Equilibrium Concentration and Travel Time	Arrival Time of Exceedance of Standard	Criterion
Scenario B – 1a	Horizontal groundwater flow through till from nearest boundary of Phase II Expansion to Receptor B based on design leakage rate	868.81	49.60	157.39	142.48	184.85 [2]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 1b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to Receptor B based on design leakage rate						3.93E-1 mg/L Ammonia (40.3 years) 2.37E-4 mg/L Arsenic (40.4 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 2a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 1 within boundary of Phase II Expansion to Receptor B based on design leakage rate	1,717.12	5.45 [1]	159.17	142.48	184.85 [2]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 2b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 1 within boundary of Phase II Expansion to Receptor B based on design leakage rate						2.66E-1 mg/L Ammonia (16.6 years) 1.60E-4 mg/L Arsenic (16.0 Years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 3a	Horizontal groundwater flow through till from boundary of Phase II Expansion (via interpreted flow path) to Receptor D based on design leakage rate	1,006.53	50.44	185.00	168.00	75.56 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 3b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from boundary of Phase II Expansion (via interpreted flow path) to Receptor D based on design leakage rate						1.32E-1 mg/L Ammonia (41.9 years) 7.97E-5 mg/L Arsenic (41.5 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	
Scenario B – 4a	Horizontal groundwater flow through till from nearest boundary of Phase II Expansion to Receptor E based on design leakage rate	717.37	25.55	171.40	162.00	75.56 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 4b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to Receptor E based on design leakage rate						2.77E-1 mg/L Ammonia (22.2 years) 1.67E-4 mg/L Arsenic (22.3 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	
Scenario B – 5a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 2 within boundary of Phase II Expansion to Receptor E based on design leakage rate	1,002.62	12.53 [1]	175.68	162.00	75.56 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 5b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 2 within boundary of Phase II Expansion to Receptor E based on design leakage rate						1.65E-1 mg/L Ammonia (17.2 years) 9.92E-5 mg/L Arsenic (17.5 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	
Scenario B – 6a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor E based on design leakage rate	1,392.46	9.00 [1]	174.56	162.00	75.56 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 6b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor E based on design leakage rate						1.57E-1 mg/L Ammonia (18.3 years) 9.44E-5 mg/L Arsenic (18.7 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	
Scenario B – 7a	Horizontal groundwater flow through till from nearest boundary of Phase II Expansion to Receptor F based on design leakage rate	924.35	29.94	168.36	159.54	75.56 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 7b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to Receptor F based on design leakage rate						2.65E-1 mg/L Ammonia (29.3 years) 1.59E-4 mg/L Arsenic (27.5 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	

TABLE J-2 (cont'd)

SUMMARY OF CONTAMINANT SCENARIO B

Scenario B – 8a	Horizontal groundwater flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor F based on design leakage rate	1,552.34	9.00 [1]	174.56	159.54	75.56 [3]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>6 years to standard exceedance at Receptor)
Scenario B – 8b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor F based on design leakage rate						1.26E-1 mg/L Ammonia (18.9 years) 7.57E-5 mg/L Arsenic (20.4 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	
Scenario B – 9a	Horizontal groundwater flow through till from Leachate Storage Tanks Containment Area to Receptor G	831.22	56.35	177.24	153.53	5.87 [4]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Criterion Met (>3 years to standard exceedance at Receptor)
Scenario B – 9b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from Leachate Storage Tanks Containment Area to Receptor G						8.00E-3 mg/L Ammonia (44.3 years) 4.82E-6 mg/L Arsenic (44.3 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does not Exceed)	
Scenario B – 10a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-612B based on design leakage rate	183.22	42.83	154.90	149.75	184.85 [2]	Equilibrium >30 Years for Ammonia and Arsenic (See Appendix J5 for Negligible Estimated Concentrations at 30 Years)	>30 Years (If Applicable)	Not Applicable (Not a Receptor)
Scenario B – 10b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-612A based on design leakage rate						2.51 mg/L Ammonia (32.8 years) 1.51E-3 mg/L Arsenic (32.8 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 11a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-613B based on design leakage rate	171.43	24.60	152.98	149.49	184.85 [2]	Equilibrium >30 Years for Ammonia and Arsenic (See Appendix J5 for Negligible Estimated Concentrations at 30 Years)	>30 Years (If Applicable)	Not Applicable (Not a Receptor)
Scenario B – 11b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-613A based on design leakage rate						3.86 mg/L Ammonia (19.5 years) 2.32E-3 mg/L Arsenic (19.2 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 12a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-614B based on design leakage rate	338.24	27.86	158.50	153.81	184.85 [2]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Not Applicable (Not a Receptor)
Scenario B – 12b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-614A based on design leakage rate						1.96 mg/L Ammonia (23.1 years) 1.18E-3 mg/L Arsenic (22.7 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 13a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-615B based on design leakage rate	170.43	31.41	160.52	155.00	184.85 [2]	Equilibrium >30 Years for Ammonia and Arsenic (See Appendix J5 for Negligible Estimated Concentrations at 30 Years)	>30 Years (If Applicable)	Not Applicable (Not a Receptor)
Scenario B – 13b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-615A based on design leakage rate						2.45 mg/L Ammonia (24.2 years) 1.47E-7 mg/L Arsenic (24.1 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	

TABLE J-2 (cont'd)

SUMMARY OF CONTAMINANT SCENARIO B

Scenario B – 14a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-616B based on design leakage rate	100.03	32.98	162.96	161.06	184.85 [2]	Equilibrium >30 Years for Ammonia and Arsenic (See Appendix J5 for Negligible Estimated Concentrations at 30 Years)	>30 Years (If Applicable)	Not Applicable (Not a Receptor)
Scenario B – 14b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-616A based on design leakage rate						10.1 mg/L Ammonia (25.3 years) 6.08E-3 mg/L Arsenic (25.5 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 15a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-617B based on design leakage rate	251.26	22.55	173.92	165.00	75.56 [3]	Equilibrium >30 Years for Ammonia and Arsenic (See Appendix J5 for Negligible Estimated Concentrations at 30 Years)	>30 Years (If Applicable)	Not Applicable (Not a Receptor)
Scenario B – 15b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-617A based on design leakage rate						4.93E-1 mg/L Ammonia (17.5 years) 2.97E-4 mg/L Arsenic (17.5 years)	1.4 mg/L Ammonia (Does Not Exceed) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 16a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well P-04-12B based on design leakage rate	145.92	31.20	167.79	164.56	75.56 [3]	Equilibrium >30 Years for Ammonia and Arsenic (See Appendix J5 for Negligible Estimated Concentrations at 30 Years)	>30 Years (If Applicable)	Not Applicable (Not a Receptor)
Scenario B – 16b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well P-04-12A based on design leakage rate						1.88 mg/L Ammonia (24.0 years) 1.13E-3 mg/L Arsenic (24.0 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	
Scenario B – 17a	Horizontal groundwater flow through the till from nearest boundary of Phase II Expansion to monitoring well OW-08-04B based on design leakage rate	193.19	31.00	170.00	168.03	184.85 [2]	Ammonia and Arsenic Arrival >30 Years	Ammonia and Arsenic Arrival >30 Years	Not Applicable (Not a Receptor)
Scenario B – 17b	Vertical downward groundwater flow through till and horizontal groundwater flow through bedrock from nearest boundary of Phase II Expansion to monitoring well OW-08-04A based on design leakage rate						6.36 mg/L Ammonia (25.4 years) 3.83E-3 mg/L Arsenic (25.1 years)	1.4 mg/L Ammonia (See Note 5) 0.01 mg/L Arsenic (Does Not Exceed)	

Notes:

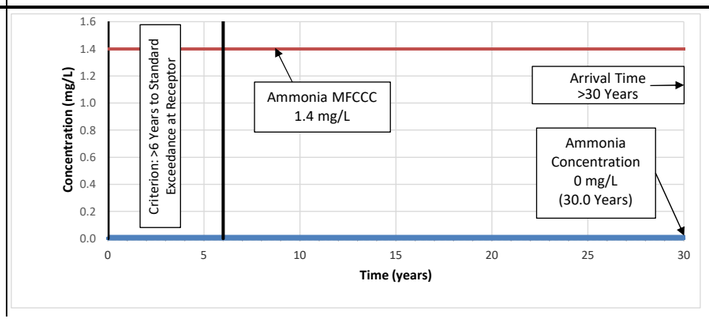
1. Source location is in an area with a compacted marine clay layer since it is anticipated to be grubbed to within 5 feet of bedrock. Calculated travel time vertically downward to bedrock is increased by 3.8 years.
2. Based on design leakage rate in area within Phase II Expansion solid waste boundary that is east of the northwest/southeast oriented groundwater flow divide.
3. Based on design leakage rate in area within Phase II Expansion solid waste boundary that is west of the northwest/southeast oriented groundwater flow divide.
4. Based on maximum rate of flow into till soils in containment area for leachate storage tanks.
5. Estimated values for monitoring wells represent groundwater quality. MFCCC exceedances are not applicable to groundwater.

SCENARIO B CONTAMINANT TRANSPORT ANALYSIS CALCULATION SHEETS

SME
SEVEE & MAHER
ENGINEERS

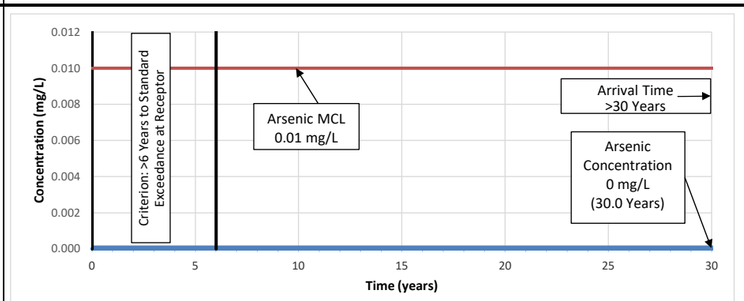
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 1a - Horizontal flow through till from nearest boundary of Phase II Expansion to Receptor B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**						=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0.00		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	0.00		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	0.01		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	0.01		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	0.01		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	0.01		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	0.02		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	0.02		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	0.02		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	0.02		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.83E-03	← *=C14*C15/C16*	10	0.03		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	0.03		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	0.03		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	0.04		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	0.04		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	0.04		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	0.04		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1303	← *=(C20/C17)*365.25*	17	0.05		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	0.05		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	0.05		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	0.05		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	0.06		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	0.06		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	0.06		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	0.07		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	0.07		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	0.07		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	0.07		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	0.08		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	0.08		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	0.08		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	29.96		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	29.96		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	29.96		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	29.97		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	29.98		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	29.98		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	29.98		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	29.98		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	29.99		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	29.99		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	29.99		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	30.00		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	30.00		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	30.00		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



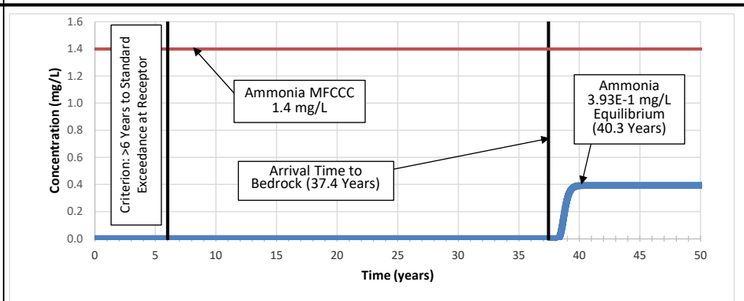
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 1a - Horizontal flow through till from nearest boundary of Phase II Expansion to Receptor B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.83E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1303	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		19.98	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		19.99	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		20.00	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		20.01	1.52	0.51	0.08	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



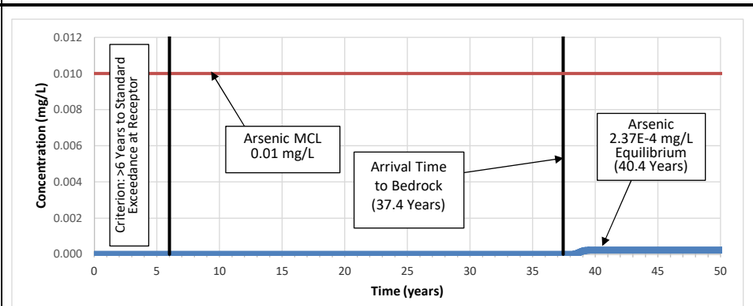
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 1b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to Receptor B based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13670	37.43	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13671	37.43	1.70	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	13672	37.43	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	13673	37.43	5.11	0.05	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	13674	37.44	6.81	0.17	0.06	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	13675	37.44	8.51	0.32	0.11	0.02	0.55	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	13676	37.44	10.21	0.49	0.16	0.02	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13677	37.45	11.92	0.67	0.22	0.03	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	13678	37.45	13.62	0.85	0.28	0.04	1.45	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13679	37.45	15.32	1.03	0.34	0.05	1.76	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.70	← *=C14*C15/C16*	10	13680	37.45	17.02	1.21	0.40	0.06	2.06	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13681	37.46	18.73	1.39	0.46	0.07	2.36	0.79	0.12	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13682	37.46	20.43	1.56	0.52	0.08	2.66	0.89	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13683	37.46	22.13	1.73	0.58	0.09	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13684	37.47	23.83	1.90	0.63	0.09	3.23	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13685	37.47	25.54	2.06	0.69	0.10	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13686	37.47	27.24	2.22	0.74	0.11	3.78	1.26	0.19	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	169.60	*INPUT*	17	13687	37.47	28.94	2.38	0.79	0.12	4.05	1.35	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	120.00	*INPUT*	18	13688	37.48	30.64	2.53	0.84	0.13	4.31	1.44	0.22	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	49.60	← *=C24-C25*	19	13689	37.48	32.35	2.68	0.89	0.13	4.57	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	13690	37.48	34.05	2.83	0.94	0.14	4.82	1.61	0.24	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	13691	37.48	35.75	2.97	0.99	0.15	5.06	1.69	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	13692	37.49	37.45	3.12	1.04	0.16	5.31	1.77	0.27	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	13693	37.49	39.16	3.26	1.09	0.16	5.54	1.85	0.28	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	13670	← *=C26/C30*	24	13694	37.49	40.86	3.39	1.13	0.17	5.77	1.92	0.29	0.00E+00	0.00E+00	#DIV/0!
32				25	13695	37.50	42.56	3.53	1.18	0.18	6.00	2.00	0.30	0.00E+00	0.00E+00	#DIV/0!
33				26	13696	37.50	44.26	3.66	1.22	0.18	6.23	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
34				27	13697	37.50	45.97	3.79	1.26	0.19	6.45	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
35				28	13698	37.50	47.67	3.91	1.30	0.20	6.66	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
36				29	13699	37.51	49.37	4.04	1.35	0.20	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
37				30	13700	37.51	51.07	4.16	1.39	0.21	7.09	2.36	0.35	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24612	67.38	18627.78	66.35	22.12	3.32	112.96	37.65	5.65	5.44E-34	3.93E-01	1.00E+00
10950				10943	24613	67.39	18629.49	66.35	22.12	3.32	112.96	37.65	5.65	5.42E-34	3.93E-01	1.00E+00
10951				10944	24614	67.39	18631.19	66.36	22.12	3.32	112.97	37.66	5.65	5.39E-34	3.93E-01	1.00E+00
10952				10945	24615	67.39	18632.89	66.36	22.12	3.32	112.97	37.66	5.65	5.36E-34	3.93E-01	1.00E+00
10953				10946	24616	67.40	18634.59	66.36	22.12	3.32	112.97	37.66	5.65	5.34E-34	3.93E-01	1.00E+00
10954				10947	24617	67.40	18636.30	66.36	22.12	3.32	112.97	37.66	5.65	5.31E-34	3.93E-01	1.00E+00
10955				10948	24618	67.40	18638.00	66.36	22.12	3.32	112.98	37.66	5.65	5.28E-34	3.93E-01	1.00E+00
10956				10949	24619	67.40	18639.70	66.36	22.12	3.32	112.98	37.66	5.65	5.26E-34	3.93E-01	1.00E+00
10957				10950	24620	67.41	18641.40	66.37	22.12	3.32	112.98	37.66	5.65	5.23E-34	3.93E-01	1.00E+00
10958				10951	24621	67.41	18643.11	66.37	22.12	3.32	112.99	37.66	5.65	5.21E-34	3.93E-01	1.00E+00
10959				10952	24622	67.41	18644.81	66.37	22.12	3.32	112.99	37.66	5.65	5.18E-34	3.93E-01	1.00E+00
10960				10953	24623	67.41	18646.51	66.37	22.12	3.32	112.99	37.66	5.65	5.16E-34	3.93E-01	1.00E+00
10961				10954	24624	67.42	18648.21	66.37	22.12	3.32	112.99	37.66	5.65	5.13E-34	3.93E-01	1.00E+00
10962				10955	24625	67.42	18649.92	66.38	22.13	3.32	113.00	37.67	5.65	5.10E-34	3.93E-01	1.00E+00
10963				10956	24626	67.42	18651.62	66.38	22.13	3.32	113.00	37.67	5.65	5.08E-34	3.93E-01	1.00E+00
10964				10957	24627	67.43	18653.32	66.38	22.13	3.32	113.00	37.67	5.65	5.05E-34	3.93E-01	1.00E+00
10965				10958	24628	67.43	18655.02	66.38	22.13	3.32	113.01	37.67	5.65	5.03E-34	3.93E-01	1.00E+00



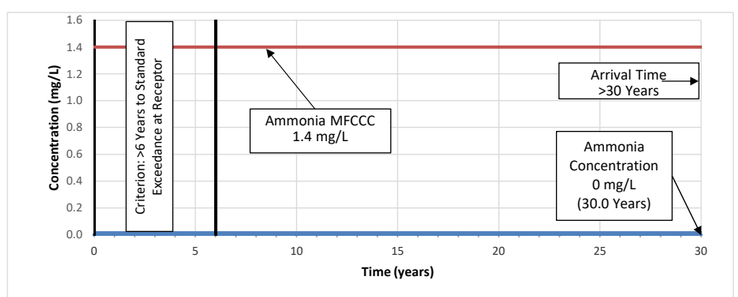
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 1b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to Receptor B based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	868.81	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	157.39	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13670	37.43	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13671	37.43	1.70	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	13672	37.43	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	13673	37.43	5.11	0.05	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	13674	37.44	6.81	0.17	0.06	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	13675	37.44	8.51	0.32	0.11	0.02	0.55	0.18	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	13676	37.44	10.21	0.49	0.16	0.02	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13677	37.45	11.92	0.67	0.22	0.03	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.72E-02	← *=(C4-C5)/C3*	8	13678	37.45	13.62	0.85	0.28	0.04	1.45	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13679	37.45	15.32	1.03	0.34	0.05	1.76	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.70	← *=C14*C15/C16*	10	13680	37.45	17.02	1.21	0.40	0.06	2.06	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13681	37.46	18.73	1.39	0.46	0.07	2.36	0.79	0.12	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13682	37.46	20.43	1.56	0.52	0.08	2.66	0.89	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	868.81	← *=C3*	13	13683	37.46	22.13	1.73	0.58	0.09	2.95	0.98	0.15	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13684	37.47	23.83	1.90	0.63	0.09	3.23	1.08	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13685	37.47	25.54	2.06	0.69	0.10	3.51	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13686	37.47	27.24	2.22	0.74	0.11	3.78	1.26	0.19	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	169.60	*INPUT*	17	13687	37.47	28.94	2.38	0.79	0.12	4.05	1.35	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	120.00	*INPUT*	18	13688	37.48	30.64	2.53	0.84	0.13	4.31	1.44	0.22	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	49.60	← *=C24-C25*	19	13689	37.48	32.35	2.68	0.89	0.13	4.57	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	13690	37.48	34.05	2.83	0.94	0.14	4.82	1.61	0.24	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	13691	37.48	35.75	2.97	0.99	0.15	5.06	1.69	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	13692	37.49	37.45	3.12	1.04	0.16	5.31	1.77	0.27	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	13693	37.49	39.16	3.26	1.09	0.16	5.54	1.85	0.28	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	13670	← *=C26/C30*	24	13694	37.49	40.86	3.39	1.13	0.17	5.77	1.92	0.29	0.00E+00	0.00E+00	#DIV/0!
32				25	13695	37.50	42.56	3.53	1.18	0.18	6.00	2.00	0.30	0.00E+00	0.00E+00	#DIV/0!
33				26	13696	37.50	44.26	3.66	1.22	0.18	6.23	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
34				27	13697	37.50	45.97	3.79	1.26	0.19	6.45	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
35				28	13698	37.50	47.67	3.91	1.30	0.20	6.66	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
36				29	13699	37.51	49.37	4.04	1.35	0.20	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
37				30	13700	37.51	51.07	4.16	1.39	0.21	7.09	2.36	0.35	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24612	67.38	18627.78	66.35	22.12	3.32	112.96	37.65	5.65	3.28E-37	2.37E-04	1.00E+00
10950				10943	24613	67.39	18629.49	66.35	22.12	3.32	112.96	37.65	5.65	3.26E-37	2.37E-04	1.00E+00
10951				10944	24614	67.39	18631.19	66.36	22.12	3.32	112.97	37.66	5.65	3.25E-37	2.37E-04	1.00E+00
10952				10945	24615	67.39	18632.89	66.36	22.12	3.32	112.97	37.66	5.65	3.23E-37	2.37E-04	1.00E+00
10953				10946	24616	67.40	18634.59	66.36	22.12	3.32	112.97	37.66	5.65	3.21E-37	2.37E-04	1.00E+00
10954				10947	24617	67.40	18636.30	66.36	22.12	3.32	112.97	37.66	5.65	3.20E-37	2.37E-04	1.00E+00
10955				10948	24618	67.40	18638.00	66.36	22.12	3.32	112.98	37.66	5.65	3.18E-37	2.37E-04	1.00E+00
10956				10949	24619	67.40	18639.70	66.36	22.12	3.32	112.98	37.66	5.65	3.17E-37	2.37E-04	1.00E+00
10957				10950	24620	67.41	18641.40	66.37	22.12	3.32	112.98	37.66	5.65	3.15E-37	2.37E-04	1.00E+00
10958				10951	24621	67.41	18643.11	66.37	22.12	3.32	112.99	37.66	5.65	3.14E-37	2.37E-04	1.00E+00
10959				10952	24622	67.41	18644.81	66.37	22.12	3.32	112.99	37.66	5.65	3.12E-37	2.37E-04	1.00E+00
10960				10953	24623	67.41	18646.51	66.37	22.12	3.32	112.99	37.66	5.65	3.11E-37	2.37E-04	1.00E+00
10961				10954	24624	67.42	18648.21	66.37	22.12	3.32	112.99	37.66	5.65	3.09E-37	2.37E-04	1.00E+00
10962				10955	24625	67.42	18649.92	66.38	22.13	3.32	113.00	37.67	5.65	3.07E-37	2.37E-04	1.00E+00
10963				10956	24626	67.42	18651.62	66.38	22.13	3.32	113.00	37.67	5.65	3.06E-37	2.37E-04	1.00E+00
10964				10957	24627	67.43	18653.32	66.38	22.13	3.32	113.00	37.67	5.65	3.04E-37	2.37E-04	1.00E+00
10965				10958	24628	67.43	18655.02	66.38	22.13	3.32	113.01	37.67	5.65	3.03E-37	2.37E-04	1.00E+00



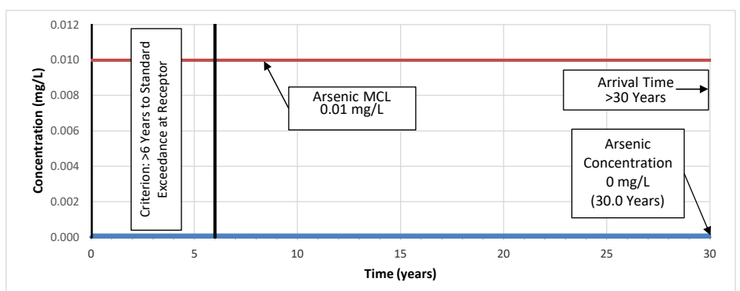
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 2a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 1 within boundary of Phase II Expansion to Receptor B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4546	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



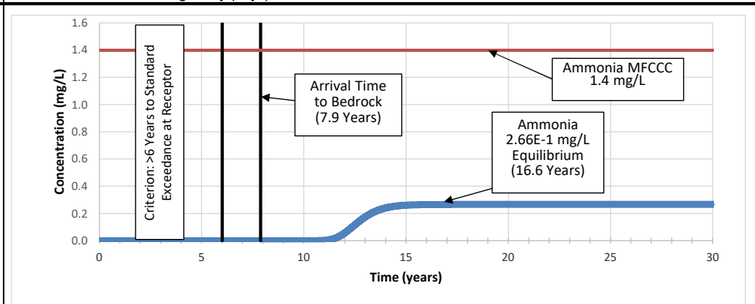
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 2a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 1 within boundary of Phase II Expansion to Receptor B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4546	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.32	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.33	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



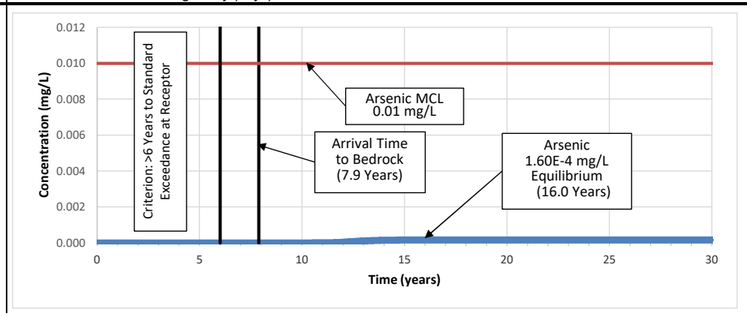
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 2b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 1 within boundary of Phase II Expansion to Receptor B based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	2877	7.88	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	2878	7.88	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2879	7.88	1.93	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	2880	7.89	2.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	2881	7.89	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	2882	7.89	4.82	0.04	0.01	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	2883	7.89	5.79	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	2884	7.90	6.75	0.17	0.06	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	2885	7.90	7.71	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	2886	7.90	8.68	0.34	0.11	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	2887	7.91	9.64	0.44	0.15	0.02	0.42	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	2888	7.91	10.61	0.54	0.18	0.03	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	2889	7.91	11.57	0.64	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	2890	7.91	12.53	0.74	0.25	0.04	0.71	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	2891	7.92	13.50	0.84	0.28	0.04	0.81	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	2892	7.92	14.46	0.94	0.31	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	2893	7.92	15.43	1.04	0.35	0.05	1.01	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	164.78	*INPUT*	17	2894	7.92	16.39	1.15	0.38	0.06	1.10	0.37	0.06	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	159.33	*INPUT*	18	2895	7.93	17.36	1.25	0.42	0.06	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	5.45	← *=C24-C25*	19	2896	7.93	18.32	1.35	0.45	0.07	1.30	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	2897	7.93	19.28	1.45	0.48	0.07	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	2898	7.94	20.25	1.54	0.51	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	2899	7.94	21.21	1.64	0.55	0.08	1.58	0.53	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	2900	7.94	22.18	1.74	0.58	0.09	1.67	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	1502	← *=C26/C30*	24	2901	7.94	23.14	1.83	0.61	0.09	1.77	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	2902	7.95	24.11	1.92	0.64	0.10	1.86	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	2903	7.95	25.07	2.02	0.67	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	2904	7.95	26.03	2.11	0.70	0.11	2.03	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	2905	7.95	27.00	2.20	0.73	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	2906	7.96	27.96	2.29	0.76	0.11	2.21	0.74	0.11	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	2907	7.96	28.93	2.38	0.79	0.12	2.29	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	13819	37.84	10550.28	56.30	18.77	2.82	54.29	18.10	2.71	4.53E-20	2.66E-01	1.00E+00
10950				10943	13820	37.84	10551.25	56.31	18.77	2.82	54.29	18.10	2.71	4.51E-20	2.66E-01	1.00E+00
10951				10944	13821	37.84	10552.21	56.31	18.77	2.82	54.29	18.10	2.71	4.50E-20	2.66E-01	1.00E+00
10952				10945	13822	37.84	10553.17	56.31	18.77	2.82	54.29	18.10	2.71	4.48E-20	2.66E-01	1.00E+00
10953				10946	13823	37.85	10554.14	56.31	18.77	2.82	54.29	18.10	2.71	4.47E-20	2.66E-01	1.00E+00
10954				10947	13824	37.85	10555.10	56.31	18.77	2.82	54.30	18.10	2.71	4.45E-20	2.66E-01	1.00E+00
10955				10948	13825	37.85	10556.07	56.31	18.77	2.82	54.30	18.10	2.71	4.44E-20	2.66E-01	1.00E+00
10956				10949	13826	37.85	10557.03	56.32	18.77	2.82	54.30	18.10	2.71	4.42E-20	2.66E-01	1.00E+00
10957				10950	13827	37.86	10558.00	56.32	18.77	2.82	54.30	18.10	2.72	4.41E-20	2.66E-01	1.00E+00
10958				10951	13828	37.86	10558.96	56.32	18.77	2.82	54.30	18.10	2.72	4.39E-20	2.66E-01	1.00E+00
10959				10952	13829	37.86	10559.92	56.32	18.77	2.82	54.30	18.10	2.72	4.38E-20	2.66E-01	1.00E+00
10960				10953	13830	37.87	10560.89	56.32	18.77	2.82	54.31	18.10	2.72	4.36E-20	2.66E-01	1.00E+00
10961				10954	13831	37.87	10561.85	56.32	18.77	2.82	54.31	18.10	2.72	4.34E-20	2.66E-01	1.00E+00
10962				10955	13832	37.87	10562.82	56.32	18.77	2.82	54.31	18.10	2.72	4.33E-20	2.66E-01	1.00E+00
10963				10956	13833	37.87	10563.78	56.33	18.78	2.82	54.31	18.10	2.72	4.32E-20	2.66E-01	1.00E+00
10964				10957	13834	37.88	10564.75	56.33	18.78	2.82	54.31	18.10	2.72	4.30E-20	2.66E-01	1.00E+00
10965				10958	13835	37.88	10565.71	56.33	18.78	2.82	54.31	18.10	2.72	4.29E-20	2.66E-01	1.00E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

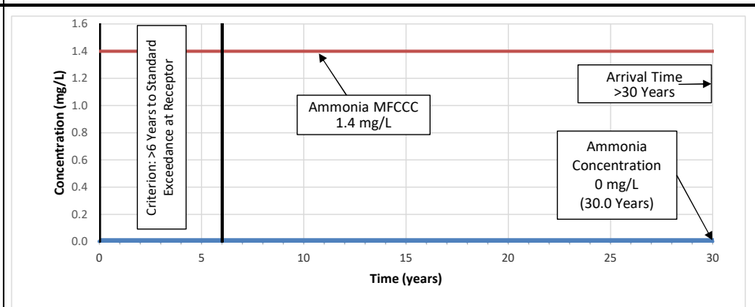
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 2b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 1 within boundary of Phase II Expansion to Receptor B based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1717.12	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	159.17	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor B Elevation (ft-NGVD)	142.48	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$30+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	2877	7.88	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	2878	7.88	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2879	7.88	1.93	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	2880	7.89	2.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	2881	7.89	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	2882	7.89	4.82	0.04	0.01	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	2883	7.89	5.79	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	2884	7.90	6.75	0.17	0.06	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.72E-03	← *=(C4-C5)/C3*	8	2885	7.90	7.71	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	2886	7.90	8.68	0.34	0.11	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	2887	7.91	9.64	0.44	0.15	0.02	0.42	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	2888	7.91	10.61	0.54	0.18	0.03	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	2889	7.91	11.57	0.64	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1717.12	← *=C3*	13	2890	7.91	12.53	0.74	0.25	0.04	0.71	0.24	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	2891	7.92	13.50	0.84	0.28	0.04	0.81	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	2892	7.92	14.46	0.94	0.31	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	2893	7.92	15.43	1.04	0.35	0.05	1.01	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	164.78	*INPUT*	17	2894	7.92	16.39	1.15	0.38	0.06	1.10	0.37	0.06	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	159.33	*INPUT*	18	2895	7.93	17.36	1.25	0.42	0.06	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	5.45	← *=C24-C25*	19	2896	7.93	18.32	1.35	0.45	0.07	1.30	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	2897	7.93	19.28	1.45	0.48	0.07	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	2898	7.94	20.25	1.54	0.51	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	2899	7.94	21.21	1.64	0.55	0.08	1.58	0.53	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	2900	7.94	22.18	1.74	0.58	0.09	1.67	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	1502	← *=C26/C30*	24	2901	7.94	23.14	1.83	0.61	0.09	1.77	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	2902	7.95	24.11	1.92	0.64	0.10	1.86	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	2903	7.95	25.07	2.02	0.67	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	2904	7.95	26.03	2.11	0.70	0.11	2.03	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	2905	7.95	27.00	2.20	0.73	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	2906	7.96	27.96	2.29	0.76	0.11	2.21	0.74	0.11	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	2907	7.96	28.93	2.38	0.79	0.12	2.29	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!



10942	13819	37.84	10550.28	56.30	18.77	2.82	54.29	18.10	2.71	2.73E-23	1.60E-04	1.00E+00
10943	13820	37.84	10551.25	56.31	18.77	2.82	54.29	18.10	2.71	2.72E-23	1.60E-04	1.00E+00
10944	13821	37.84	10552.21	56.31	18.77	2.82	54.29	18.10	2.71	2.71E-23	1.60E-04	1.00E+00
10945	13822	37.84	10553.17	56.31	18.77	2.82	54.29	18.10	2.71	2.70E-23	1.60E-04	1.00E+00
10946	13823	37.85	10554.14	56.31	18.77	2.82	54.29	18.10	2.71	2.69E-23	1.60E-04	1.00E+00
10947	13824	37.85	10555.10	56.31	18.77	2.82	54.30	18.10	2.71	2.68E-23	1.60E-04	1.00E+00
10948	13825	37.85	10556.07	56.31	18.77	2.82	54.30	18.10	2.71	2.67E-23	1.60E-04	1.00E+00
10949	13826	37.85	10557.03	56.32	18.77	2.82	54.30	18.10	2.71	2.66E-23	1.60E-04	1.00E+00
10950	13827	37.86	10558.00	56.32	18.77	2.82	54.30	18.10	2.72	2.65E-23	1.60E-04	1.00E+00
10951	13828	37.86	10558.96	56.32	18.77	2.82	54.30	18.10	2.72	2.64E-23	1.60E-04	1.00E+00
10952	13829	37.86	10559.92	56.32	18.77	2.82	54.30	18.10	2.72	2.63E-23	1.60E-04	1.00E+00
10953	13830	37.87	10560.89	56.32	18.77	2.82	54.31	18.10	2.72	2.63E-23	1.60E-04	1.00E+00
10954	13831	37.87	10561.85	56.32	18.77	2.82	54.31	18.10	2.72	2.62E-23	1.60E-04	1.00E+00
10955	13832	37.87	10562.82	56.32	18.77	2.82	54.31	18.10	2.72	2.61E-23	1.60E-04	1.00E+00
10956	13833	37.87	10563.78	56.33	18.78	2.82	54.31	18.10	2.72	2.60E-23	1.60E-04	1.00E+00
10957	13834	37.88	10564.75	56.33	18.78	2.82	54.31	18.10	2.72	2.59E-23	1.60E-04	1.00E+00
10958	13835	37.88	10565.71	56.33	18.78	2.82	54.31	18.10	2.72	2.58E-23	1.60E-04	1.00E+00

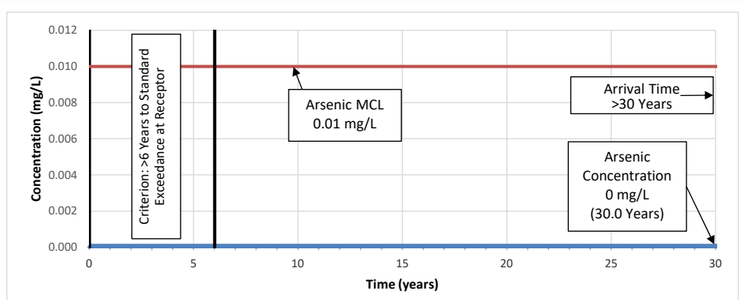
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 3a - Horizontal flow through till from boundary of Phase II Expansion (via interpreted flow path) to Receptor D based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.69E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.80E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1533	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		19.66	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		19.67	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		19.67	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



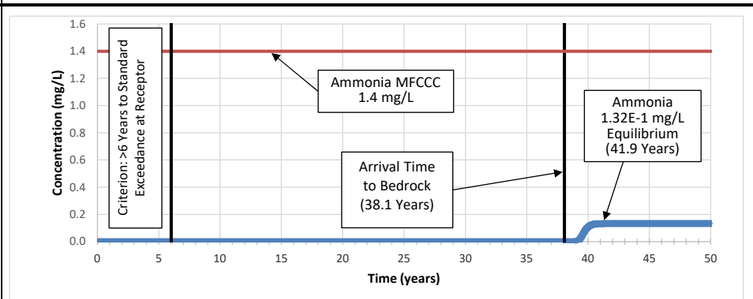
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 3a - Horizontal flow through till from boundary of Phase II Expansion (via interpreted flow path) to Receptor D based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.69E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.80E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1533	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		19.66	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		19.67	1.48	0.49	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		19.67	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		19.67	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		19.68	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		19.69	1.49	0.50	0.07	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



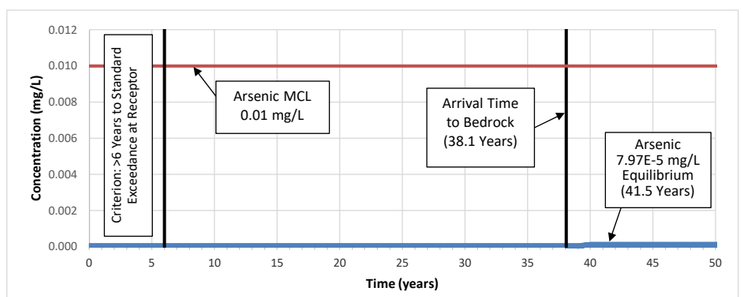
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 3b - Vertical downward flow through till and horizontal flow through bedrock from boundary of Phase II Expansion (via interpreted flow path) to Receptor D based on design flow rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13902	38.06	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13903	38.06	1.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	13904	38.07	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	13905	38.07	5.03	0.05	0.02	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	13906	38.07	6.70	0.16	0.05	0.01	0.27	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	13907	38.07	8.38	0.31	0.10	0.02	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	13908	38.08	10.05	0.48	0.16	0.02	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13909	38.08	11.73	0.65	0.22	0.03	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.69E-02	← *=(C4-C5)/C3*	8	13910	38.08	13.40	0.83	0.28	0.04	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13911	38.09	15.08	1.01	0.34	0.05	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.68	← *=C14*C15/C16*	10	13912	38.09	16.75	1.18	0.39	0.06	1.98	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13913	38.09	18.43	1.36	0.45	0.07	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13914	38.09	20.11	1.53	0.51	0.08	2.56	0.85	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13915	38.10	21.78	1.70	0.57	0.08	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13916	38.10	23.46	1.86	0.62	0.09	3.12	1.04	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13917	38.10	25.13	2.02	0.67	0.10	3.39	1.13	0.17	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13918	38.10	26.81	2.18	0.73	0.11	3.66	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	207.60	*INPUT*	17	13919	38.11	28.48	2.34	0.78	0.12	3.92	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	157.16	*INPUT*	18	13920	38.11	30.16	2.49	0.83	0.12	4.17	1.39	0.21	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	50.44	← *=C24-C25*	19	13921	38.11	31.83	2.64	0.88	0.13	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	13922	38.12	33.51	2.78	0.93	0.14	4.66	1.55	0.23	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	13923	38.12	35.18	2.93	0.98	0.15	4.90	1.63	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	13924	38.12	36.86	3.07	1.02	0.15	5.14	1.71	0.26	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	13925	38.12	38.54	3.21	1.07	0.16	5.37	1.79	0.27	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	13902	← *=C26/C30*	24	13926	38.13	40.21	3.34	1.11	0.17	5.60	1.87	0.28	0.00E+00	0.00E+00	#DIV/0!
32				25	13927	38.13	41.89	3.47	1.16	0.17	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
33				26	13928	38.13	43.56	3.60	1.20	0.18	6.04	2.01	0.30	0.00E+00	0.00E+00	#DIV/0!
34				27	13929	38.13	45.24	3.73	1.24	0.19	6.25	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
35				28	13930	38.14	46.91	3.86	1.29	0.19	6.46	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
36				29	13931	38.14	48.59	3.98	1.33	0.20	6.67	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
37				30	13932	38.14	50.26	4.10	1.37	0.21	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24844	68.02	18332.88	66.06	22.02	3.30	110.68	36.89	5.53	1.41E-33	1.32E-01	1.00E+00
10950				10943	24845	68.02	18334.55	66.06	22.02	3.30	110.68	36.89	5.53	1.41E-33	1.32E-01	1.00E+00
10951				10944	24846	68.02	18336.23	66.06	22.02	3.30	110.68	36.89	5.53	1.40E-33	1.32E-01	1.00E+00
10952				10945	24847	68.03	18337.90	66.06	22.02	3.30	110.69	36.90	5.53	1.39E-33	1.32E-01	1.00E+00
10953				10946	24848	68.03	18339.58	66.06	22.02	3.30	110.69	36.90	5.53	1.39E-33	1.32E-01	1.00E+00
10954				10947	24849	68.03	18341.25	66.07	22.02	3.30	110.69	36.90	5.53	1.38E-33	1.32E-01	1.00E+00
10955				10948	24850	68.03	18342.93	66.07	22.02	3.30	110.69	36.90	5.53	1.37E-33	1.32E-01	1.00E+00
10956				10949	24851	68.04	18344.60	66.07	22.02	3.30	110.70	36.90	5.53	1.37E-33	1.32E-01	1.00E+00
10957				10950	24852	68.04	18346.28	66.07	22.02	3.30	110.70	36.90	5.53	1.36E-33	1.32E-01	1.00E+00
10958				10951	24853	68.04	18347.95	66.07	22.02	3.30	110.70	36.90	5.54	1.35E-33	1.32E-01	1.00E+00
10959				10952	24854	68.05	18349.63	66.07	22.02	3.30	110.71	36.90	5.54	1.35E-33	1.32E-01	1.00E+00
10960				10953	24855	68.05	18351.31	66.08	22.03	3.30	110.71	36.90	5.54	1.34E-33	1.32E-01	1.00E+00
10961				10954	24856	68.05	18352.98	66.08	22.03	3.30	110.71	36.90	5.54	1.33E-33	1.32E-01	1.00E+00
10962				10955	24857	68.05	18354.66	66.08	22.03	3.30	110.71	36.90	5.54	1.33E-33	1.32E-01	1.00E+00
10963				10956	24858	68.06	18356.33	66.08	22.03	3.30	110.72	36.91	5.54	1.32E-33	1.32E-01	1.00E+00
10964				10957	24859	68.06	18358.01	66.08	22.03	3.30	110.72	36.91	5.54	1.31E-33	1.32E-01	1.00E+00
10965				10958	24860	68.06	18359.68	66.08	22.03	3.30	110.72	36.91	5.54	1.31E-33	1.32E-01	1.00E+00



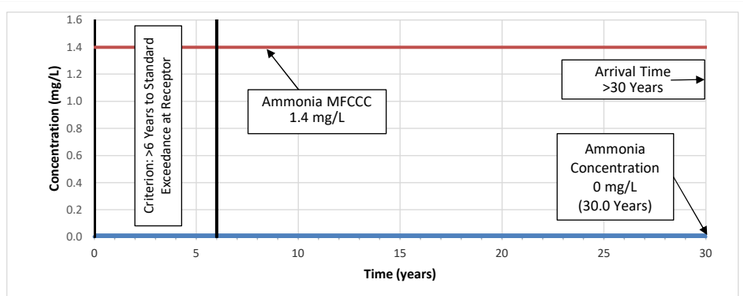
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 3b - Vertical downward flow through till and horizontal flow through bedrock from boundary of Phase II Expansion (via interpreted flow path) to Receptor D based on design flow rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1006.53	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	185.00	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor D Elevation (ft-NGVD)	168.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	13902	38.06	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	13903	38.06	1.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	13904	38.07	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	13905	38.07	5.03	0.05	0.02	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	13906	38.07	6.70	0.16	0.05	0.01	0.27	0.09	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	13907	38.07	8.38	0.31	0.10	0.02	0.52	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	13908	38.08	10.05	0.48	0.16	0.02	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	13909	38.08	11.73	0.65	0.22	0.03	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.69E-02	← *=(C4-C5)/C3*	8	13910	38.08	13.40	0.83	0.28	0.04	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	13911	38.09	15.08	1.01	0.34	0.05	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.68	← *=C14*C15/C16*	10	13912	38.09	16.75	1.18	0.39	0.06	1.98	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	13913	38.09	18.43	1.36	0.45	0.07	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	13914	38.09	20.11	1.53	0.51	0.08	2.56	0.85	0.13	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1006.53	← *=C3*	13	13915	38.10	21.78	1.70	0.57	0.08	2.84	0.95	0.14	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	13916	38.10	23.46	1.86	0.62	0.09	3.12	1.04	0.16	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	13917	38.10	25.13	2.02	0.67	0.10	3.39	1.13	0.17	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	13918	38.10	26.81	2.18	0.73	0.11	3.66	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	207.60	*INPUT*	17	13919	38.11	28.48	2.34	0.78	0.12	3.92	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	157.16	*INPUT*	18	13920	38.11	30.16	2.49	0.83	0.12	4.17	1.39	0.21	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	50.44	← *=C24-C25*	19	13921	38.11	31.83	2.64	0.88	0.13	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	13922	38.12	33.51	2.78	0.93	0.14	4.66	1.55	0.23	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	13923	38.12	35.18	2.93	0.98	0.15	4.90	1.63	0.25	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	13924	38.12	36.86	3.07	1.02	0.15	5.14	1.71	0.26	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	13925	38.12	38.54	3.21	1.07	0.16	5.37	1.79	0.27	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	13902	← *=C26/C30*	24	13926	38.13	40.21	3.34	1.11	0.17	5.60	1.87	0.28	0.00E+00	0.00E+00	#DIV/0!
32				25	13927	38.13	41.89	3.47	1.16	0.17	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
33				26	13928	38.13	43.56	3.60	1.20	0.18	6.04	2.01	0.30	0.00E+00	0.00E+00	#DIV/0!
34				27	13929	38.13	45.24	3.73	1.24	0.19	6.25	2.08	0.31	0.00E+00	0.00E+00	#DIV/0!
35				28	13930	38.14	46.91	3.86	1.29	0.19	6.46	2.15	0.32	0.00E+00	0.00E+00	#DIV/0!
36				29	13931	38.14	48.59	3.98	1.33	0.20	6.67	2.22	0.33	0.00E+00	0.00E+00	#DIV/0!
37				30	13932	38.14	50.26	4.10	1.37	0.21	6.88	2.29	0.34	0.00E+00	0.00E+00	#DIV/0!
10949				10942	24844	68.02	18332.88	66.06	22.02	3.30	110.68	36.89	5.53	8.51E-37	7.97E-05	1.00E+00
10950				10943	24845	68.02	18334.55	66.06	22.02	3.30	110.68	36.89	5.53	8.47E-37	7.97E-05	1.00E+00
10951				10944	24846	68.02	18336.23	66.06	22.02	3.30	110.68	36.89	5.53	8.43E-37	7.97E-05	1.00E+00
10952				10945	24847	68.03	18337.90	66.06	22.02	3.30	110.69	36.90	5.53	8.38E-37	7.97E-05	1.00E+00
10953				10946	24848	68.03	18339.58	66.06	22.02	3.30	110.69	36.90	5.53	8.34E-37	7.97E-05	1.00E+00
10954				10947	24849	68.03	18341.25	66.07	22.02	3.30	110.69	36.90	5.53	8.30E-37	7.97E-05	1.00E+00
10955				10948	24850	68.03	18342.93	66.07	22.02	3.30	110.69	36.90	5.53	8.26E-37	7.97E-05	1.00E+00
10956				10949	24851	68.04	18344.60	66.07	22.02	3.30	110.70	36.90	5.53	8.22E-37	7.97E-05	1.00E+00
10957				10950	24852	68.04	18346.28	66.07	22.02	3.30	110.70	36.90	5.53	8.18E-37	7.97E-05	1.00E+00
10958				10951	24853	68.04	18347.95	66.07	22.02	3.30	110.70	36.90	5.54	8.14E-37	7.97E-05	1.00E+00
10959				10952	24854	68.05	18349.63	66.07	22.02	3.30	110.71	36.90	5.54	8.10E-37	7.97E-05	1.00E+00
10960				10953	24855	68.05	18351.31	66.08	22.03	3.30	110.71	36.90	5.54	8.06E-37	7.97E-05	1.00E+00
10961				10954	24856	68.05	18352.98	66.08	22.03	3.30	110.71	36.90	5.54	8.02E-37	7.97E-05	1.00E+00
10962				10955	24857	68.05	18354.66	66.08	22.03	3.30	110.71	36.90	5.54	7.98E-37	7.97E-05	1.00E+00
10963				10956	24858	68.06	18356.33	66.08	22.03	3.30	110.72	36.91	5.54	7.94E-37	7.97E-05	1.00E+00
10964				10957	24859	68.06	18358.01	66.08	22.03	3.30	110.72	36.91	5.54	7.90E-37	7.97E-05	1.00E+00
10965				10958	24860	68.06	18359.68	66.08	22.03	3.30	110.72	36.91	5.54	7.87E-37	7.97E-05	1.00E+00



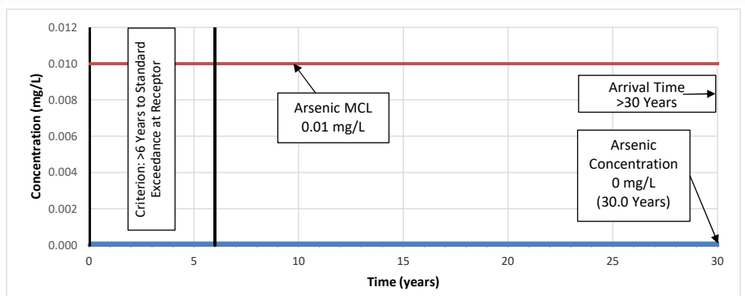
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 4a - Horizontal flow through till from nearest boundary of Phase II Expansion to Receptor E based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.39E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1409	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



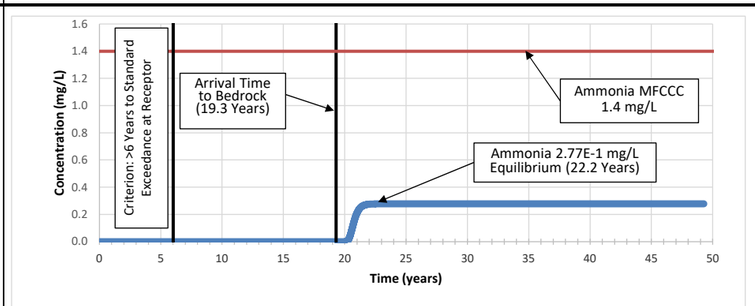
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 4a - Horizontal flow through till from nearest boundary of Phase II Expansion to Receptor E based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.39E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1409	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.26	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.27	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.28	1.03	0.34	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

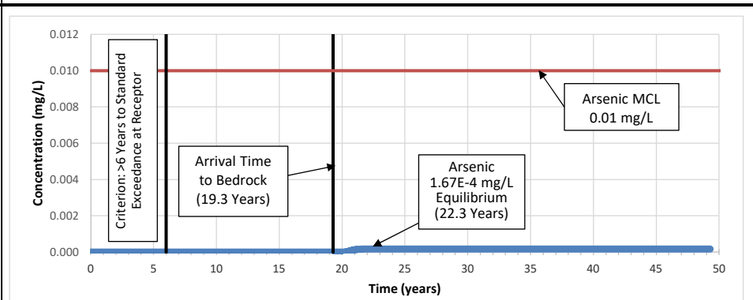
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 4b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to Receptor E based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	7043	19.28	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	7044	19.28	1.30	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	7045	19.29	2.60	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	7046	19.29	3.90	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	7047	19.29	5.20	0.06	0.02	0.00	0.07	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	7048	19.30	6.50	0.15	0.05	0.01	0.19	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	7049	19.30	7.80	0.26	0.09	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7050	19.30	9.10	0.38	0.13	0.02	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	7051	19.30	10.40	0.51	0.17	0.03	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7052	19.31	11.70	0.65	0.22	0.03	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.30	← *=C14*C15/C16*	10	7053	19.31	13.00	0.79	0.26	0.04	1.02	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7054	19.31	14.30	0.92	0.31	0.05	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7055	19.31	15.60	1.06	0.35	0.05	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	7056	19.32	16.90	1.20	0.40	0.06	1.56	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7057	19.32	18.20	1.33	0.44	0.07	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7058	19.32	19.50	1.47	0.49	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7059	19.33	20.80	1.60	0.53	0.08	2.08	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	179.82	*INPUT*	17	7060	19.33	22.10	1.73	0.58	0.09	2.25	0.75	0.11	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.27	*INPUT*	18	7061	19.33	23.40	1.86	0.62	0.09	2.41	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	25.55	← *=C24-C25*	19	7062	19.33	24.70	1.98	0.66	0.10	2.58	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	7063	19.34	26.00	2.11	0.70	0.11	2.74	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	7064	19.34	27.30	2.23	0.74	0.11	2.90	0.97	0.14	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	7065	19.34	28.60	2.35	0.78	0.12	3.05	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	7066	19.34	29.90	2.47	0.82	0.12	3.20	1.07	0.16	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	7043	← *=C26/C30*	24	7067	19.35	31.20	2.58	0.86	0.13	3.36	1.12	0.17	0.00E+00	0.00E+00	#DIV/0!
32				25	7068	19.35	32.50	2.70	0.90	0.13	3.50	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
33				26	7069	19.35	33.80	2.81	0.94	0.14	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
34				27	7070	19.36	35.10	2.92	0.97	0.15	3.80	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
35				28	7071	19.36	36.40	3.03	1.01	0.15	3.94	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
36				29	7072	19.36	37.70	3.14	1.05	0.16	4.08	1.36	0.20	0.00E+00	0.00E+00	#DIV/0!
37				30	7073	19.36	39.00	3.24	1.08	0.16	4.22	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!



10942	17985	49.24	14223.06	61.46	20.49	3.07	79.89	26.63	3.99	4.20E-29	2.77E-01	1.00E+00
10943	17986	49.24	14224.36	61.47	20.49	3.07	79.90	26.63	3.99	4.18E-29	2.77E-01	1.00E+00
10944	17987	49.24	14225.66	61.47	20.49	3.07	79.90	26.63	3.99	4.16E-29	2.77E-01	1.00E+00
10945	17988	49.25	14226.96	61.47	20.49	3.07	79.90	26.63	4.00	4.14E-29	2.77E-01	1.00E+00
10946	17989	49.25	14228.26	61.47	20.49	3.07	79.90	26.63	4.00	4.13E-29	2.77E-01	1.00E+00
10947	17990	49.25	14229.56	61.47	20.49	3.07	79.91	26.64	4.00	4.11E-29	2.77E-01	1.00E+00
10948	17991	49.26	14230.86	61.47	20.49	3.07	79.91	26.64	4.00	4.09E-29	2.77E-01	1.00E+00
10949	17992	49.26	14232.16	61.48	20.49	3.07	79.91	26.64	4.00	4.08E-29	2.77E-01	1.00E+00
10950	17993	49.26	14233.46	61.48	20.49	3.07	79.91	26.64	4.00	4.06E-29	2.77E-01	1.00E+00
10951	17994	49.26	14234.76	61.48	20.49	3.07	79.91	26.64	4.00	4.04E-29	2.77E-01	1.00E+00
10952	17995	49.27	14236.06	61.48	20.49	3.07	79.92	26.64	4.00	4.03E-29	2.77E-01	1.00E+00
10953	17996	49.27	14237.36	61.48	20.49	3.07	79.92	26.64	4.00	4.01E-29	2.77E-01	1.00E+00
10954	17997	49.27	14238.66	61.48	20.49	3.07	79.92	26.64	4.00	3.99E-29	2.77E-01	1.00E+00
10955	17998	49.27	14239.96	61.49	20.50	3.07	79.92	26.64	4.00	3.98E-29	2.77E-01	1.00E+00
10956	17999	49.28	14241.26	61.49	20.50	3.07	79.92	26.64	4.00	3.96E-29	2.77E-01	1.00E+00
10957	18000	49.28	14242.56	61.49	20.50	3.07	79.93	26.64	4.00	3.95E-29	2.77E-01	1.00E+00
10958	18001	49.28	14243.86	61.49	20.50	3.07	79.93	26.64	4.00	3.93E-29	2.77E-01	1.00E+00

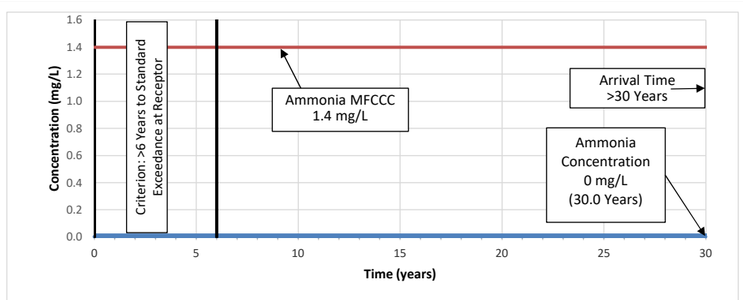
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 4b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to Receptor E based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	717.37	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	171.40	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	7043	19.28	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	7044	19.28	1.30	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	7045	19.29	2.60	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	7046	19.29	3.90	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	7047	19.29	5.20	0.06	0.02	0.00	0.07	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	7048	19.30	6.50	0.15	0.05	0.01	0.19	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	7049	19.30	7.80	0.26	0.09	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7050	19.30	9.10	0.38	0.13	0.02	0.50	0.17	0.02	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.31E-02	← *=(C4-C5)/C3*	8	7051	19.30	10.40	0.51	0.17	0.03	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7052	19.31	11.70	0.65	0.22	0.03	0.84	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.30	← *=C14*C15/C16*	10	7053	19.31	13.00	0.79	0.26	0.04	1.02	0.34	0.05	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7054	19.31	14.30	0.92	0.31	0.05	1.20	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7055	19.31	15.60	1.06	0.35	0.05	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	717.37	← *=C3*	13	7056	19.32	16.90	1.20	0.40	0.06	1.56	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	7057	19.32	18.20	1.33	0.44	0.07	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	7058	19.32	19.50	1.47	0.49	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7059	19.33	20.80	1.60	0.53	0.08	2.08	0.69	0.10	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	179.82	*INPUT*	17	7060	19.33	22.10	1.73	0.58	0.09	2.25	0.75	0.11	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	154.27	*INPUT*	18	7061	19.33	23.40	1.86	0.62	0.09	2.41	0.80	0.12	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	25.55	← *=C24-C25*	19	7062	19.33	24.70	1.98	0.66	0.10	2.58	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	7063	19.34	26.00	2.11	0.70	0.11	2.74	0.91	0.14	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	7064	19.34	27.30	2.23	0.74	0.11	2.90	0.97	0.14	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	7065	19.34	28.60	2.35	0.78	0.12	3.05	1.02	0.15	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	7066	19.34	29.90	2.47	0.82	0.12	3.20	1.07	0.16	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	7043	← *=C26/C30*	24	7067	19.35	31.20	2.58	0.86	0.13	3.36	1.12	0.17	0.00E+00	0.00E+00	#DIV/0!
32				25	7068	19.35	32.50	2.70	0.90	0.13	3.50	1.17	0.18	0.00E+00	0.00E+00	#DIV/0!
33				26	7069	19.35	33.80	2.81	0.94	0.14	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
34				27	7070	19.36	35.10	2.92	0.97	0.15	3.80	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
35				28	7071	19.36	36.40	3.03	1.01	0.15	3.94	1.31	0.20	0.00E+00	0.00E+00	#DIV/0!
36				29	7072	19.36	37.70	3.14	1.05	0.16	4.08	1.36	0.20	0.00E+00	0.00E+00	#DIV/0!
37				30	7073	19.36	39.00	3.24	1.08	0.16	4.22	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!
10949				10942	17985	49.24	14223.06	61.46	20.49	3.07	79.89	26.63	3.99	2.53E-32	1.67E-04	1.00E+00
10950				10943	17986	49.24	14224.36	61.47	20.49	3.07	79.90	26.63	3.99	2.52E-32	1.67E-04	1.00E+00
10951				10944	17987	49.24	14225.66	61.47	20.49	3.07	79.90	26.63	3.99	2.51E-32	1.67E-04	1.00E+00
10952				10945	17988	49.25	14226.96	61.47	20.49	3.07	79.90	26.63	4.00	2.50E-32	1.67E-04	1.00E+00
10953				10946	17989	49.25	14228.26	61.47	20.49	3.07	79.90	26.63	4.00	2.49E-32	1.67E-04	1.00E+00
10954				10947	17990	49.25	14229.56	61.47	20.49	3.07	79.91	26.64	4.00	2.48E-32	1.67E-04	1.00E+00
10955				10948	17991	49.26	14230.86	61.47	20.49	3.07	79.91	26.64	4.00	2.47E-32	1.67E-04	1.00E+00
10956				10949	17992	49.26	14232.16	61.48	20.49	3.07	79.91	26.64	4.00	2.46E-32	1.67E-04	1.00E+00
10957				10950	17993	49.26	14233.46	61.48	20.49	3.07	79.91	26.64	4.00	2.45E-32	1.67E-04	1.00E+00
10958				10951	17994	49.26	14234.76	61.48	20.49	3.07	79.91	26.64	4.00	2.44E-32	1.67E-04	1.00E+00
10959				10952	17995	49.27	14236.06	61.48	20.49	3.07	79.92	26.64	4.00	2.43E-32	1.67E-04	1.00E+00
10960				10953	17996	49.27	14237.36	61.48	20.49	3.07	79.92	26.64	4.00	2.42E-32	1.67E-04	1.00E+00
10961				10954	17997	49.27	14238.66	61.48	20.49	3.07	79.92	26.64	4.00	2.41E-32	1.67E-04	1.00E+00
10962				10955	17998	49.27	14239.96	61.49	20.50	3.07	79.92	26.64	4.00	2.40E-32	1.67E-04	1.00E+00
10963				10956	17999	49.28	14241.26	61.49	20.50	3.07	79.92	26.64	4.00	2.39E-32	1.67E-04	1.00E+00
10964				10957	18000	49.28	14242.56	61.49	20.50	3.07	79.93	26.64	4.00	2.38E-32	1.67E-04	1.00E+00
10965				10958	18001	49.28	14243.86	61.49	20.50	3.07	79.93	26.64	4.00	2.37E-32	1.67E-04	1.00E+00



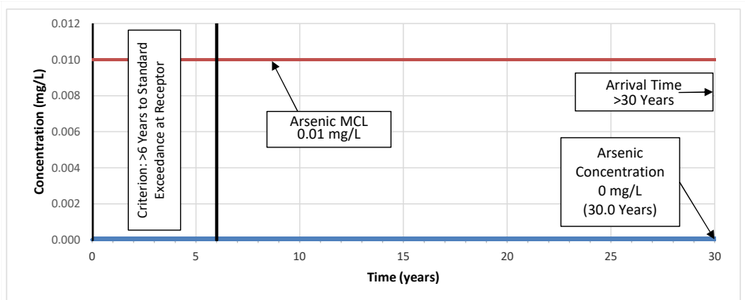
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 5a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 2 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.45E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1891	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.91	1.10	0.37	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



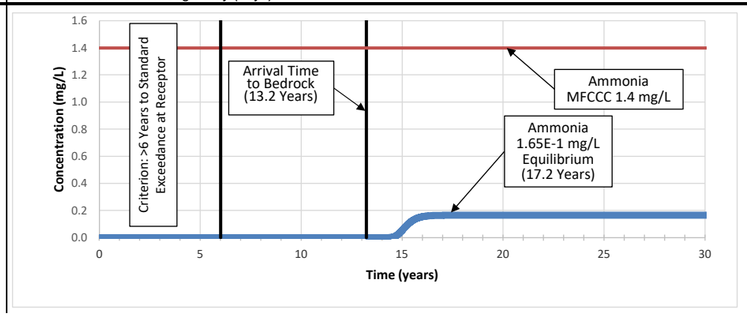
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 5a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 2 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.45E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	1891	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		15.89	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		15.90	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		15.91	1.09	0.36	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		15.91	1.10	0.37	0.05	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

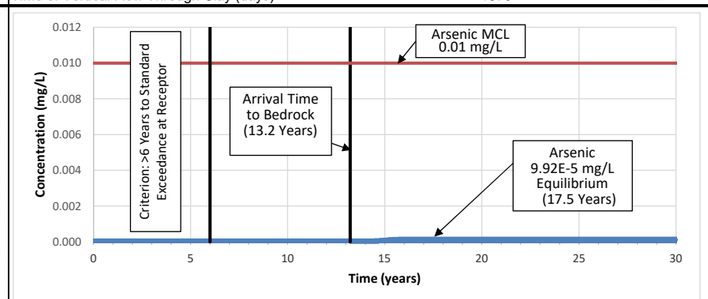
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 5b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 2 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	4828	13.22	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	4829	13.22	1.35	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	4830	13.22	2.71	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	4831	13.23	4.06	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4832	13.23	5.41	0.07	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	4833	13.23	6.77	0.17	0.06	0.01	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	4834	13.24	8.12	0.29	0.10	0.01	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	4835	13.24	9.47	0.42	0.14	0.02	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	4836	13.24	10.83	0.56	0.19	0.03	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	4837	13.24	12.18	0.70	0.23	0.04	0.95	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.35	← *=C14*C15/C16*	10	4838	13.25	13.54	0.84	0.28	0.04	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	4839	13.25	14.89	0.99	0.33	0.05	1.34	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	4840	13.25	16.24	1.13	0.38	0.06	1.53	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	4841	13.26	17.60	1.27	0.42	0.06	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	4842	13.26	18.95	1.41	0.47	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	4843	13.26	20.30	1.55	0.52	0.08	2.10	0.70	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	4844	13.26	21.66	1.68	0.56	0.08	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	193.73	*INPUT*	17	4845	13.27	23.01	1.82	0.61	0.09	2.46	0.82	0.12	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	181.20	*INPUT*	18	4846	13.27	24.36	1.95	0.65	0.10	2.64	0.88	0.13	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	12.53	← *=C24-C25*	19	4847	13.27	25.72	2.08	0.69	0.10	2.81	0.94	0.14	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	4848	13.27	27.07	2.21	0.74	0.11	2.99	1.00	0.15	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	4849	13.28	28.42	2.33	0.78	0.12	3.16	1.05	0.16	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	4850	13.28	29.78	2.45	0.82	0.12	3.32	1.11	0.17	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	4851	13.28	31.13	2.58	0.86	0.13	3.49	1.16	0.17	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	3453	← *=C26/C30*	24	4852	13.29	32.48	2.69	0.90	0.13	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	4853	13.29	33.84	2.81	0.94	0.14	3.81	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	4854	13.29	35.19	2.93	0.98	0.15	3.96	1.32	0.20	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	4855	13.29	36.54	3.04	1.01	0.15	4.12	1.37	0.21	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	4856	13.30	37.90	3.15	1.05	0.16	4.27	1.42	0.21	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	4857	13.30	39.25	3.26	1.09	0.16	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	4858	13.30	40.61	3.37	1.12	0.17	4.56	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!



10949				10942	15770	43.18	14810.10	62.18	20.73	3.11	84.17	28.06	4.21	5.84E-29	1.65E-01	1.00E+00
10950				10943	15771	43.18	14811.46	62.18	20.73	3.11	84.17	28.06	4.21	5.82E-29	1.65E-01	1.00E+00
10951				10944	15772	43.18	14812.81	62.19	20.73	3.11	84.17	28.06	4.21	5.79E-29	1.65E-01	1.00E+00
10952				10945	15773	43.19	14814.16	62.19	20.73	3.11	84.17	28.06	4.21	5.77E-29	1.65E-01	1.00E+00
10953				10946	15774	43.19	14815.52	62.19	20.73	3.11	84.17	28.06	4.21	5.74E-29	1.65E-01	1.00E+00
10954				10947	15775	43.19	14816.87	62.19	20.73	3.11	84.18	28.06	4.21	5.72E-29	1.65E-01	1.00E+00
10955				10948	15776	43.19	14818.23	62.19	20.73	3.11	84.18	28.06	4.21	5.70E-29	1.65E-01	1.00E+00
10956				10949	15777	43.20	14819.58	62.19	20.73	3.11	84.18	28.06	4.21	5.67E-29	1.65E-01	1.00E+00
10957				10950	15778	43.20	14820.93	62.20	20.73	3.11	84.18	28.06	4.21	5.65E-29	1.65E-01	1.00E+00
10958				10951	15779	43.20	14822.29	62.20	20.73	3.11	84.19	28.06	4.21	5.62E-29	1.65E-01	1.00E+00
10959				10952	15780	43.20	14823.64	62.20	20.73	3.11	84.19	28.06	4.21	5.60E-29	1.65E-01	1.00E+00
10960				10953	15781	43.21	14824.99	62.20	20.73	3.11	84.19	28.06	4.21	5.58E-29	1.65E-01	1.00E+00
10961				10954	15782	43.21	14826.35	62.20	20.73	3.11	84.19	28.06	4.21	5.55E-29	1.65E-01	1.00E+00
10962				10955	15783	43.21	14827.70	62.20	20.73	3.11	84.19	28.06	4.21	5.53E-29	1.65E-01	1.00E+00
10963				10956	15784	43.22	14829.05	62.21	20.74	3.11	84.20	28.07	4.21	5.51E-29	1.65E-01	1.00E+00
10964				10957	15785	43.22	14830.41	62.21	20.74	3.11	84.20	28.07	4.21	5.48E-29	1.65E-01	1.00E+00
10965				10958	15786	43.22	14831.76	62.21	20.74	3.11	84.20	28.07	4.21	5.46E-29	1.65E-01	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

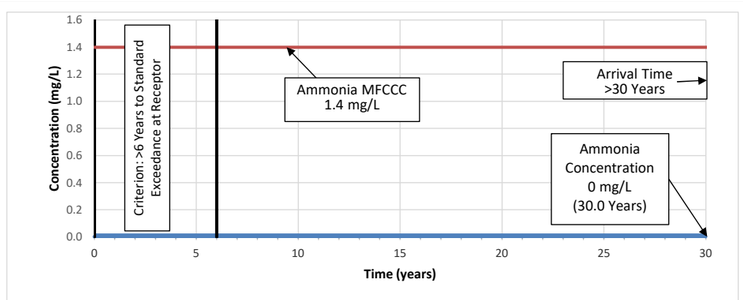
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 5b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 2 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1002.62	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	175.68	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	4828	13.22	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	4829	13.22	1.35	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	4830	13.22	2.71	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	4831	13.23	4.06	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4832	13.23	5.41	0.07	0.02	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	4833	13.23	6.77	0.17	0.06	0.01	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	4834	13.24	8.12	0.29	0.10	0.01	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	4835	13.24	9.47	0.42	0.14	0.02	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.36E-02	← *=(C4-C5)/C3*	8	4836	13.24	10.83	0.56	0.19	0.03	0.76	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	4837	13.24	12.18	0.70	0.23	0.04	0.95	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.35	← *=C14*C15/C16*	10	4838	13.25	13.54	0.84	0.28	0.04	1.14	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	4839	13.25	14.89	0.99	0.33	0.05	1.34	0.45	0.07	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	4840	13.25	16.24	1.13	0.38	0.06	1.53	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1002.62	← *=C3*	13	4841	13.26	17.60	1.27	0.42	0.06	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	4842	13.26	18.95	1.41	0.47	0.07	1.91	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	4843	13.26	20.30	1.55	0.52	0.08	2.10	0.70	0.10	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	4844	13.26	21.66	1.68	0.56	0.08	2.28	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	193.73	*INPUT*	17	4845	13.27	23.01	1.82	0.61	0.09	2.46	0.82	0.12	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	181.20	*INPUT*	18	4846	13.27	24.36	1.95	0.65	0.10	2.64	0.88	0.13	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	12.53	← *=C24-C25*	19	4847	13.27	25.72	2.08	0.69	0.10	2.81	0.94	0.14	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	4848	13.27	27.07	2.21	0.74	0.11	2.99	1.00	0.15	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	4849	13.28	28.42	2.33	0.78	0.12	3.16	1.05	0.16	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	4850	13.28	29.78	2.45	0.82	0.12	3.32	1.11	0.17	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	4851	13.28	31.13	2.58	0.86	0.13	3.49	1.16	0.17	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	3453	← *=C26/C30*	24	4852	13.29	32.48	2.69	0.90	0.13	3.65	1.22	0.18	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	4853	13.29	33.84	2.81	0.94	0.14	3.81	1.27	0.19	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	4854	13.29	35.19	2.93	0.98	0.15	3.96	1.32	0.20	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	4855	13.29	36.54	3.04	1.01	0.15	4.12	1.37	0.21	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	4856	13.30	37.90	3.15	1.05	0.16	4.27	1.42	0.21	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	4857	13.30	39.25	3.26	1.09	0.16	4.42	1.47	0.22	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	4858	13.30	40.61	3.37	1.12	0.17	4.56	1.52	0.23	0.00E+00	0.00E+00	#DIV/0!



10942	15770	43.18	14810.10	62.18	20.73	3.11	84.17	28.06	4.21	3.52E-32	9.92E-05	1.00E+00
10943	15771	43.18	14811.46	62.18	20.73	3.11	84.17	28.06	4.21	3.50E-32	9.92E-05	1.00E+00
10944	15772	43.18	14812.81	62.19	20.73	3.11	84.17	28.06	4.21	3.49E-32	9.92E-05	1.00E+00
10945	15773	43.19	14814.16	62.19	20.73	3.11	84.17	28.06	4.21	3.47E-32	9.92E-05	1.00E+00
10946	15774	43.19	14815.52	62.19	20.73	3.11	84.17	28.06	4.21	3.46E-32	9.92E-05	1.00E+00
10947	15775	43.19	14816.87	62.19	20.73	3.11	84.18	28.06	4.21	3.44E-32	9.92E-05	1.00E+00
10948	15776	43.19	14818.23	62.19	20.73	3.11	84.18	28.06	4.21	3.43E-32	9.92E-05	1.00E+00
10949	15777	43.20	14819.58	62.19	20.73	3.11	84.18	28.06	4.21	3.42E-32	9.92E-05	1.00E+00
10950	15778	43.20	14820.93	62.20	20.73	3.11	84.18	28.06	4.21	3.40E-32	9.92E-05	1.00E+00
10951	15779	43.20	14822.29	62.20	20.73	3.11	84.19	28.06	4.21	3.39E-32	9.92E-05	1.00E+00
10952	15780	43.20	14823.64	62.20	20.73	3.11	84.19	28.06	4.21	3.37E-32	9.92E-05	1.00E+00
10953	15781	43.21	14824.99	62.20	20.73	3.11	84.19	28.06	4.21	3.36E-32	9.92E-05	1.00E+00
10954	15782	43.21	14826.35	62.20	20.73	3.11	84.19	28.06	4.21	3.34E-32	9.92E-05	1.00E+00
10955	15783	43.21	14827.70	62.20	20.73	3.11	84.19	28.06	4.21	3.33E-32	9.92E-05	1.00E+00
10956	15784	43.22	14829.05	62.21	20.74	3.11	84.20	28.07	4.21	3.32E-32	9.92E-05	1.00E+00
10957	15785	43.22	14830.41	62.21	20.74	3.11	84.20	28.07	4.21	3.30E-32	9.92E-05	1.00E+00
10958	15786	43.22	14831.76	62.21	20.74	3.11	84.20	28.07	4.21	3.29E-32	9.92E-05	1.00E+00

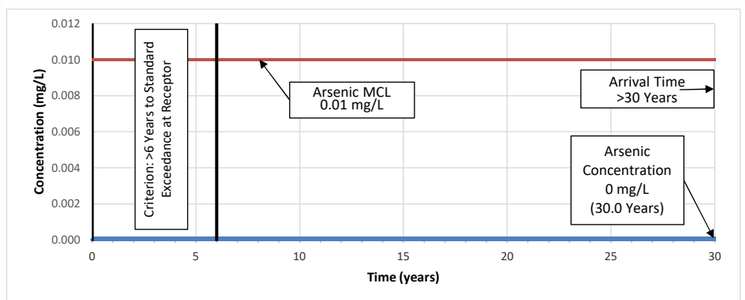
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 6a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	9.60E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	3972	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



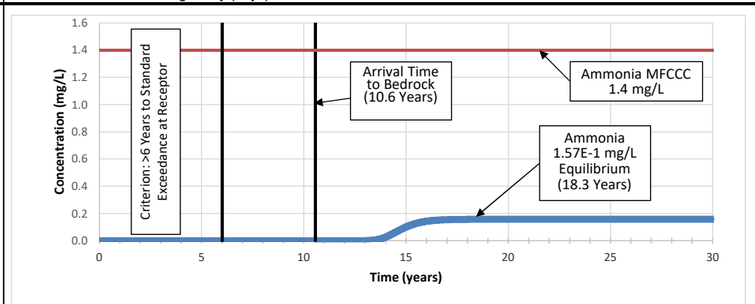
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 6a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	9.60E-04	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	3972	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		10.50	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		10.51	0.52	0.17	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		10.51	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		10.52	0.53	0.18	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



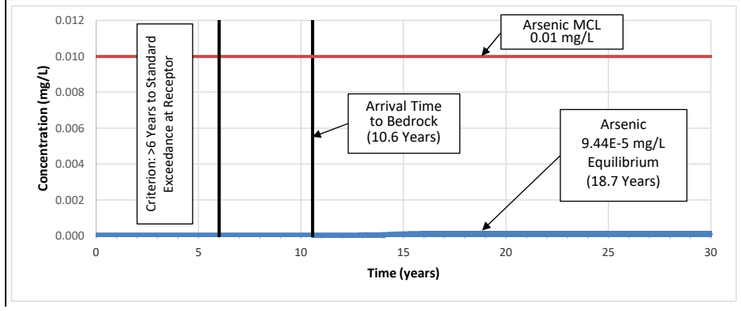
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 6b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	3858	10.56	1.79	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3859	10.56	2.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	3860	10.57	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	3861	10.57	4.47	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	3862	10.57	5.37	0.07	0.02	0.00	0.06	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.26	0.13	0.04	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.16	0.20	0.07	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.05	0.28	0.09	0.01	0.25	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.89	← *=C14*C15/C16*	10	3866	10.58	8.95	0.37	0.12	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	9.84	0.46	0.15	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	10.74	0.55	0.18	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	3869	10.59	11.63	0.64	0.21	0.03	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	12.53	0.74	0.25	0.04	0.66	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	13.42	0.83	0.28	0.04	0.74	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	14.32	0.93	0.31	0.05	0.83	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	15.21	1.02	0.34	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	16.11	1.12	0.37	0.06	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	17.00	1.21	0.40	0.06	1.08	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	3876	10.61	17.90	1.30	0.43	0.07	1.17	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	3877	10.61	18.79	1.39	0.46	0.07	1.25	0.42	0.06	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	3878	10.62	19.69	1.49	0.50	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	3879	10.62	20.58	1.58	0.53	0.08	1.41	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	2480	← *=C26/C30*	24	3880	10.62	21.47	1.67	0.56	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	3881	10.63	22.37	1.76	0.59	0.09	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	3882	10.63	23.26	1.84	0.61	0.09	1.65	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	3883	10.63	24.16	1.93	0.64	0.10	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	3884	10.63	25.05	2.02	0.67	0.10	1.80	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	3885	10.64	25.95	2.10	0.70	0.11	1.88	0.63	0.09	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	3886	10.64	26.84	2.19	0.73	0.11	1.96	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
10949				10942	14798	40.51	9790.73	55.06	18.35	2.75	49.26	16.42	2.46	2.43E-20	1.57E-01	1.00E+00
10950				10943	14799	40.52	9791.63	55.06	18.35	2.75	49.26	16.42	2.46	2.42E-20	1.57E-01	1.00E+00
10951				10944	14800	40.52	9792.52	55.06	18.35	2.75	49.27	16.42	2.46	2.41E-20	1.57E-01	1.00E+00
10952				10945	14801	40.52	9793.42	55.06	18.35	2.75	49.27	16.42	2.46	2.40E-20	1.57E-01	1.00E+00
10953				10946	14802	40.53	9794.31	55.06	18.35	2.75	49.27	16.42	2.46	2.40E-20	1.57E-01	1.00E+00
10954				10947	14803	40.53	9795.21	55.06	18.35	2.75	49.27	16.42	2.46	2.39E-20	1.57E-01	1.00E+00
10955				10948	14804	40.53	9796.10	55.06	18.35	2.75	49.27	16.42	2.46	2.38E-20	1.57E-01	1.00E+00
10956				10949	14805	40.53	9797.00	55.07	18.36	2.75	49.27	16.42	2.46	2.37E-20	1.57E-01	1.00E+00
10957				10950	14806	40.54	9797.89	55.07	18.36	2.75	49.27	16.42	2.46	2.36E-20	1.57E-01	1.00E+00
10958				10951	14807	40.54	9798.79	55.07	18.36	2.75	49.27	16.42	2.46	2.36E-20	1.57E-01	1.00E+00
10959				10952	14808	40.54	9799.68	55.07	18.36	2.75	49.28	16.43	2.46	2.35E-20	1.57E-01	1.00E+00
10960				10953	14809	40.54	9800.58	55.07	18.36	2.75	49.28	16.43	2.46	2.34E-20	1.57E-01	1.00E+00
10961				10954	14810	40.55	9801.47	55.07	18.36	2.75	49.28	16.43	2.46	2.33E-20	1.57E-01	1.00E+00
10962				10955	14811	40.55	9802.37	55.08	18.36	2.75	49.28	16.43	2.46	2.33E-20	1.57E-01	1.00E+00
10963				10956	14812	40.55	9803.26	55.08	18.36	2.75	49.28	16.43	2.46	2.32E-20	1.57E-01	1.00E+00
10964				10957	14813	40.56	9804.16	55.08	18.36	2.75	49.28	16.43	2.46	2.31E-20	1.57E-01	1.00E+00
10965				10958	14814	40.56	9805.05	55.08	18.36	2.75	49.28	16.43	2.46	2.30E-20	1.57E-01	1.00E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

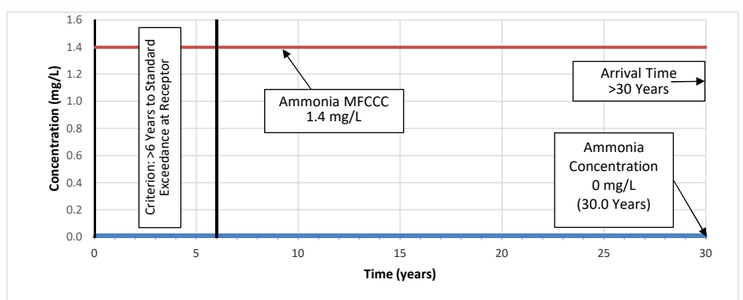
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 6b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor E based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1392.46	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor E Elevation (ft-NGVD)	162.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	3858	10.56	1.79	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3859	10.56	2.68	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	3860	10.57	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	3861	10.57	4.47	0.02	0.01	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	3862	10.57	5.37	0.07	0.02	0.00	0.06	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.26	0.13	0.04	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.02E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.16	0.20	0.07	0.01	0.18	0.06	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.05	0.28	0.09	0.01	0.25	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.89	← *=C14*C15/C16*	10	3866	10.58	8.95	0.37	0.12	0.02	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	9.84	0.46	0.15	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	10.74	0.55	0.18	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1392.46	← *=C3*	13	3869	10.59	11.63	0.64	0.21	0.03	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	12.53	0.74	0.25	0.04	0.66	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	13.42	0.83	0.28	0.04	0.74	0.25	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	14.32	0.93	0.31	0.05	0.83	0.28	0.04	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	15.21	1.02	0.34	0.05	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	16.11	1.12	0.37	0.06	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	17.00	1.21	0.40	0.06	1.08	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	3876	10.61	17.90	1.30	0.43	0.07	1.17	0.39	0.06	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	3877	10.61	18.79	1.39	0.46	0.07	1.25	0.42	0.06	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	3878	10.62	19.69	1.49	0.50	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	3879	10.62	20.58	1.58	0.53	0.08	1.41	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	2480	← *=C26/C30*	24	3880	10.62	21.47	1.67	0.56	0.08	1.49	0.50	0.07	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	3881	10.63	22.37	1.76	0.59	0.09	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	3882	10.63	23.26	1.84	0.61	0.09	1.65	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	3883	10.63	24.16	1.93	0.64	0.10	1.73	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	3884	10.63	25.05	2.02	0.67	0.10	1.80	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	3885	10.64	25.95	2.10	0.70	0.11	1.88	0.63	0.09	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	3886	10.64	26.84	2.19	0.73	0.11	1.96	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!



10942	14798	40.51	9790.73	55.06	18.35	2.75	49.26	16.42	2.46	1.46E-23	9.44E-05	1.00E+00
10943	14799	40.52	9791.63	55.06	18.35	2.75	49.26	16.42	2.46	1.46E-23	9.44E-05	1.00E+00
10944	14800	40.52	9792.52	55.06	18.35	2.75	49.27	16.42	2.46	1.45E-23	9.44E-05	1.00E+00
10945	14801	40.52	9793.42	55.06	18.35	2.75	49.27	16.42	2.46	1.45E-23	9.44E-05	1.00E+00
10946	14802	40.53	9794.31	55.06	18.35	2.75	49.27	16.42	2.46	1.44E-23	9.44E-05	1.00E+00
10947	14803	40.53	9795.21	55.06	18.35	2.75	49.27	16.42	2.46	1.44E-23	9.44E-05	1.00E+00
10948	14804	40.53	9796.10	55.06	18.35	2.75	49.27	16.42	2.46	1.43E-23	9.44E-05	1.00E+00
10949	14805	40.53	9797.00	55.07	18.36	2.75	49.27	16.42	2.46	1.43E-23	9.44E-05	1.00E+00
10950	14806	40.54	9797.89	55.07	18.36	2.75	49.27	16.42	2.46	1.42E-23	9.44E-05	1.00E+00
10951	14807	40.54	9798.79	55.07	18.36	2.75	49.27	16.42	2.46	1.42E-23	9.44E-05	1.00E+00
10952	14808	40.54	9799.68	55.07	18.36	2.75	49.28	16.43	2.46	1.41E-23	9.44E-05	1.00E+00
10953	14809	40.54	9800.58	55.07	18.36	2.75	49.28	16.43	2.46	1.41E-23	9.44E-05	1.00E+00
10954	14810	40.55	9801.47	55.07	18.36	2.75	49.28	16.43	2.46	1.41E-23	9.44E-05	1.00E+00
10955	14811	40.55	9802.37	55.08	18.36	2.75	49.28	16.43	2.46	1.40E-23	9.44E-05	1.00E+00
10956	14812	40.55	9803.26	55.08	18.36	2.75	49.28	16.43	2.46	1.40E-23	9.44E-05	1.00E+00
10957	14813	40.56	9804.16	55.08	18.36	2.75	49.28	16.43	2.46	1.39E-23	9.44E-05	1.00E+00
10958	14814	40.56	9805.05	55.08	18.36	2.75	49.28	16.43	2.46	1.39E-23	9.44E-05	1.00E+00

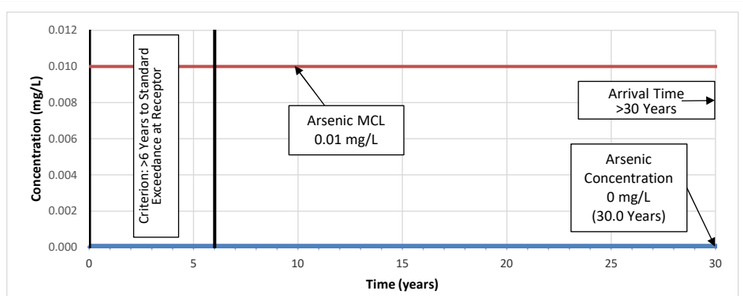
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 7a - Horizontal flow through till from nearest boundary of Phase II Expansion to Receptor F design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.02E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2493	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.13	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



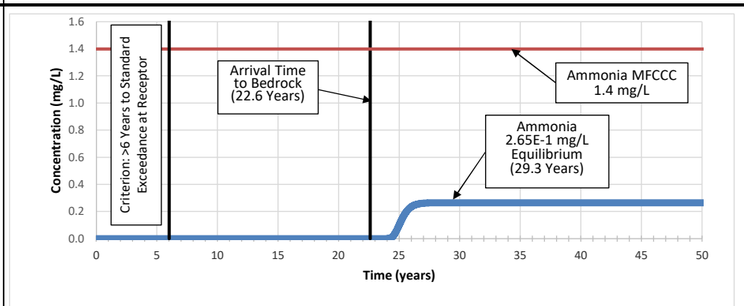
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 7a - Horizontal flow through till from nearest boundary of Phase II Expansion to Receptor F design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.02E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	2493	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949																
10950				10942	10942		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10943	10943		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10944	10944		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10945	10945		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10946	10946		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10947	10947		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10948	10948		11.11	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10949	10949		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10950	10950		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10951	10951		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10952	10952		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10953	10953		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10954	10954		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10955	10955		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10956	10956		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10957	10957		11.12	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
				10958	10958		11.13	0.59	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



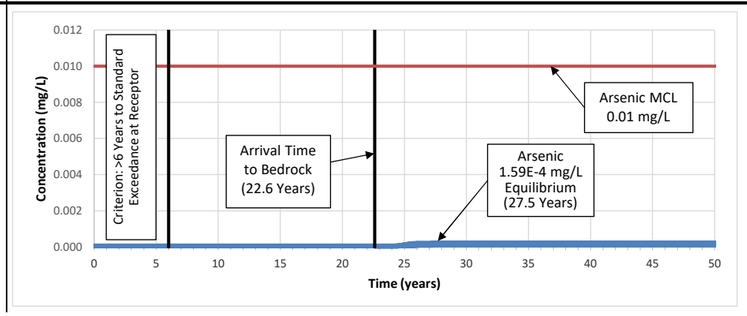
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 7b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to Receptor F based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8251	22.59	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8252	22.59	0.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8253	22.60	1.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	8254	22.60	2.84	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	8255	22.60	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	8256	22.60	4.73	0.03	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	8257	22.61	5.68	0.09	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8258	22.61	6.63	0.16	0.05	0.01	0.15	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8259	22.61	7.57	0.24	0.08	0.01	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8260	22.62	8.52	0.32	0.11	0.02	0.31	0.10	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.95	← *=C14*C15/C16*	10	8261	22.62	9.47	0.42	0.14	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8262	22.62	10.41	0.51	0.17	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8263	22.62	11.36	0.61	0.20	0.03	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	8264	22.63	12.31	0.71	0.24	0.04	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	8265	22.63	13.25	0.81	0.27	0.04	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	8266	22.63	14.20	0.91	0.30	0.05	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8267	22.63	15.14	1.01	0.34	0.05	0.96	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	177.83	*INPUT*	17	8268	22.64	16.09	1.11	0.37	0.06	1.05	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.89	*INPUT*	18	8269	22.64	17.04	1.21	0.40	0.06	1.15	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	29.94	← *=C24-C25*	19	8270	22.64	17.98	1.31	0.44	0.07	1.24	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8271	22.65	18.93	1.41	0.47	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8272	22.65	19.88	1.51	0.50	0.08	1.43	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8273	22.65	20.82	1.60	0.53	0.08	1.52	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8274	22.65	21.77	1.70	0.57	0.08	1.61	0.54	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	8251	← *=C26/C30*	24	8275	22.66	22.72	1.79	0.60	0.09	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
32				25	8276	22.66	23.66	1.88	0.63	0.09	1.78	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
33				26	8277	22.66	24.61	1.97	0.66	0.10	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
34				27	8278	22.66	25.56	2.06	0.69	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
35				28	8279	22.67	26.50	2.15	0.72	0.11	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
36				29	8280	22.67	27.45	2.24	0.75	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	8281	22.67	28.40	2.33	0.78	0.12	2.20	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	19193	52.55	10357.16	55.99	18.66	2.80	53.00	17.67	2.65	7.69E-23	2.65E-01	1.00E+00
10950				10943	19194	52.55	10358.10	56.00	18.67	2.80	53.00	17.67	2.65	7.67E-23	2.65E-01	1.00E+00
10951				10944	19195	52.55	10359.05	56.00	18.67	2.80	53.00	17.67	2.65	7.64E-23	2.65E-01	1.00E+00
10952				10945	19196	52.56	10360.00	56.00	18.67	2.80	53.01	17.67	2.65	7.62E-23	2.65E-01	1.00E+00
10953				10946	19197	52.56	10360.94	56.00	18.67	2.80	53.01	17.67	2.65	7.59E-23	2.65E-01	1.00E+00
10954				10947	19198	52.56	10361.89	56.00	18.67	2.80	53.01	17.67	2.65	7.57E-23	2.65E-01	1.00E+00
10955				10948	19199	52.56	10362.84	56.00	18.67	2.80	53.01	17.67	2.65	7.54E-23	2.65E-01	1.00E+00
10956				10949	19200	52.57	10363.78	56.00	18.67	2.80	53.01	17.67	2.65	7.52E-23	2.65E-01	1.00E+00
10957				10950	19201	52.57	10364.73	56.01	18.67	2.80	53.01	17.67	2.65	7.49E-23	2.65E-01	1.00E+00
10958				10951	19202	52.57	10365.68	56.01	18.67	2.80	53.01	17.67	2.65	7.47E-23	2.65E-01	1.00E+00
10959				10952	19203	52.58	10366.62	56.01	18.67	2.80	53.02	17.67	2.65	7.44E-23	2.65E-01	1.00E+00
10960				10953	19204	52.58	10367.57	56.01	18.67	2.80	53.02	17.67	2.65	7.42E-23	2.65E-01	1.00E+00
10961				10954	19205	52.58	10368.51	56.01	18.67	2.80	53.02	17.67	2.65	7.39E-23	2.65E-01	1.00E+00
10962				10955	19206	52.58	10369.46	56.01	18.67	2.80	53.02	17.67	2.65	7.37E-23	2.65E-01	1.00E+00
10963				10956	19207	52.59	10370.41	56.02	18.67	2.80	53.02	17.67	2.65	7.34E-23	2.65E-01	1.00E+00
10964				10957	19208	52.59	10371.35	56.02	18.67	2.80	53.02	17.67	2.65	7.32E-23	2.65E-01	1.00E+00
10965				10958	19209	52.59	10372.30	56.02	18.67	2.80	53.02	17.67	2.65	7.29E-23	2.65E-01	1.00E+00



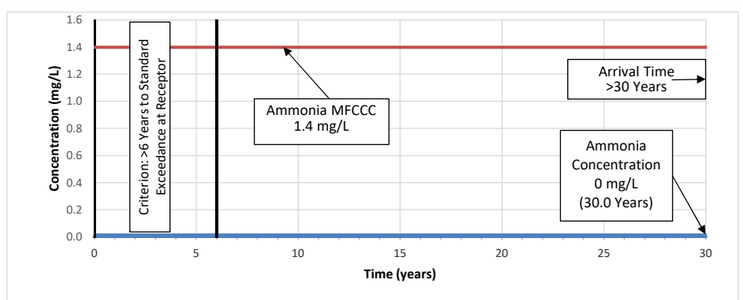
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 7b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to Receptor F based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	924.35	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	168.36	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8251	22.59	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8252	22.59	0.95	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8253	22.60	1.89	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	8254	22.60	2.84	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	8255	22.60	3.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	8256	22.60	4.73	0.03	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	8257	22.61	5.68	0.09	0.03	0.00	0.08	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8258	22.61	6.63	0.16	0.05	0.01	0.15	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.54E-03	← *=(C4-C5)/C3*	8	8259	22.61	7.57	0.24	0.08	0.01	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8260	22.62	8.52	0.32	0.11	0.02	0.31	0.10	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.95	← *=C14*C15/C16*	10	8261	22.62	9.47	0.42	0.14	0.02	0.40	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8262	22.62	10.41	0.51	0.17	0.03	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8263	22.62	11.36	0.61	0.20	0.03	0.58	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	924.35	← *=C3*	13	8264	22.63	12.31	0.71	0.24	0.04	0.68	0.23	0.03	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	8265	22.63	13.25	0.81	0.27	0.04	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	8266	22.63	14.20	0.91	0.30	0.05	0.87	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8267	22.63	15.14	1.01	0.34	0.05	0.96	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	177.83	*INPUT*	17	8268	22.64	16.09	1.11	0.37	0.06	1.05	0.35	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.89	*INPUT*	18	8269	22.64	17.04	1.21	0.40	0.06	1.15	0.38	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	29.94	← *=C24-C25*	19	8270	22.64	17.98	1.31	0.44	0.07	1.24	0.41	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8271	22.65	18.93	1.41	0.47	0.07	1.33	0.44	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8272	22.65	19.88	1.51	0.50	0.08	1.43	0.48	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8273	22.65	20.82	1.60	0.53	0.08	1.52	0.51	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8274	22.65	21.77	1.70	0.57	0.08	1.61	0.54	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	8251	← *=C26/C30*	24	8275	22.66	22.72	1.79	0.60	0.09	1.69	0.56	0.08	0.00E+00	0.00E+00	#DIV/0!
32				25	8276	22.66	23.66	1.88	0.63	0.09	1.78	0.59	0.09	0.00E+00	0.00E+00	#DIV/0!
33				26	8277	22.66	24.61	1.97	0.66	0.10	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
34				27	8278	22.66	25.56	2.06	0.69	0.10	1.95	0.65	0.10	0.00E+00	0.00E+00	#DIV/0!
35				28	8279	22.67	26.50	2.15	0.72	0.11	2.04	0.68	0.10	0.00E+00	0.00E+00	#DIV/0!
36				29	8280	22.67	27.45	2.24	0.75	0.11	2.12	0.71	0.11	0.00E+00	0.00E+00	#DIV/0!
37				30	8281	22.67	28.40	2.33	0.78	0.12	2.20	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
10949				10942	19193	52.55	10357.16	55.99	18.66	2.80	53.00	17.67	2.65	4.63E-26	1.59E-04	1.00E+00
10950				10943	19194	52.55	10358.10	56.00	18.67	2.80	53.00	17.67	2.65	4.62E-26	1.59E-04	1.00E+00
10951				10944	19195	52.55	10359.05	56.00	18.67	2.80	53.00	17.67	2.65	4.60E-26	1.59E-04	1.00E+00
10952				10945	19196	52.56	10360.00	56.00	18.67	2.80	53.01	17.67	2.65	4.59E-26	1.59E-04	1.00E+00
10953				10946	19197	52.56	10360.94	56.00	18.67	2.80	53.01	17.67	2.65	4.57E-26	1.59E-04	1.00E+00
10954				10947	19198	52.56	10361.89	56.00	18.67	2.80	53.01	17.67	2.65	4.56E-26	1.59E-04	1.00E+00
10955				10948	19199	52.56	10362.84	56.00	18.67	2.80	53.01	17.67	2.65	4.54E-26	1.59E-04	1.00E+00
10956				10949	19200	52.57	10363.78	56.00	18.67	2.80	53.01	17.67	2.65	4.53E-26	1.59E-04	1.00E+00
10957				10950	19201	52.57	10364.73	56.01	18.67	2.80	53.01	17.67	2.65	4.51E-26	1.59E-04	1.00E+00
10958				10951	19202	52.57	10365.68	56.01	18.67	2.80	53.01	17.67	2.65	4.50E-26	1.59E-04	1.00E+00
10959				10952	19203	52.58	10366.62	56.01	18.67	2.80	53.02	17.67	2.65	4.48E-26	1.59E-04	1.00E+00
10960				10953	19204	52.58	10367.57	56.01	18.67	2.80	53.02	17.67	2.65	4.47E-26	1.59E-04	1.00E+00
10961				10954	19205	52.58	10368.51	56.01	18.67	2.80	53.02	17.67	2.65	4.45E-26	1.59E-04	1.00E+00
10962				10955	19206	52.58	10369.46	56.01	18.67	2.80	53.02	17.67	2.65	4.44E-26	1.59E-04	1.00E+00
10963				10956	19207	52.59	10370.41	56.02	18.67	2.80	53.02	17.67	2.65	4.42E-26	1.59E-04	1.00E+00
10964				10957	19208	52.59	10371.35	56.02	18.67	2.80	53.02	17.67	2.65	4.41E-26	1.59E-04	1.00E+00
10965				10958	19209	52.59	10372.30	56.02	18.67	2.80	53.02	17.67	2.65	4.39E-26	1.59E-04	1.00E+00



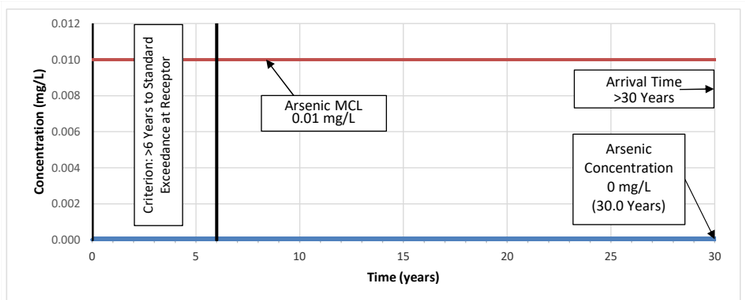
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 8a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor F based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4128	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.26	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



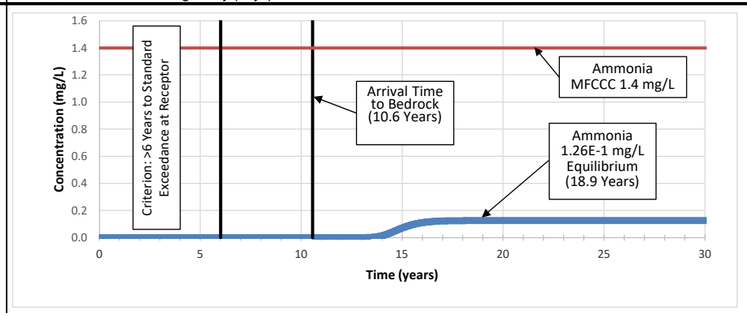
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 8a - Horizontal flow through till from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor F based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30+ $C$36 ↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.03E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	4128	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.26	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.27	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.28	0.60	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.28	0.61	0.20	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

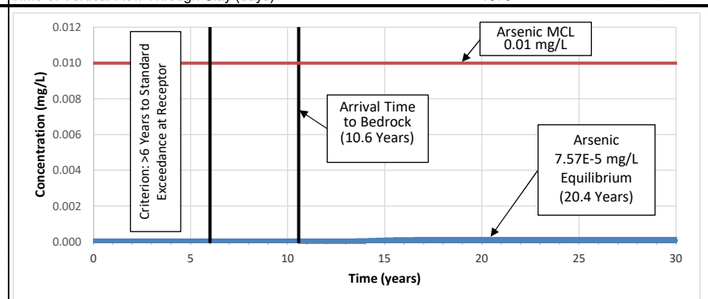
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 8b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor F based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	3858	10.56	1.92	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3859	10.56	2.88	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	3860	10.57	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	3861	10.57	4.80	0.04	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	3862	10.57	5.76	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.72	0.16	0.05	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.68	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.64	0.34	0.11	0.02	0.32	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	3866	10.58	9.60	0.43	0.14	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	10.56	0.53	0.18	0.03	0.51	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	11.52	0.63	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	3869	10.59	12.48	0.73	0.24	0.04	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	13.44	0.83	0.28	0.04	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	14.40	0.94	0.31	0.05	0.90	0.30	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	15.36	1.04	0.35	0.05	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	16.32	1.14	0.38	0.06	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	17.28	1.24	0.41	0.06	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	18.24	1.34	0.45	0.07	1.28	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	3876	10.61	19.20	1.44	0.48	0.07	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	3877	10.61	20.16	1.53	0.51	0.08	1.47	0.49	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	3878	10.62	21.12	1.63	0.54	0.08	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	3879	10.62	22.08	1.73	0.58	0.09	1.66	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	2480	← *=C26/C30*	24	3880	10.62	23.04	1.82	0.61	0.09	1.75	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	3881	10.63	24.00	1.91	0.64	0.10	1.84	0.61	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	3882	10.63	24.96	2.01	0.67	0.10	1.93	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	3883	10.63	25.92	2.10	0.70	0.10	2.01	0.67	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	3884	10.63	26.88	2.19	0.73	0.11	2.10	0.70	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	3885	10.64	27.84	2.28	0.76	0.11	2.19	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	3886	10.64	28.79	2.37	0.79	0.12	2.27	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!



10949		10942	14798	40.51	10502.47	56.23	18.74	2.81	53.97	17.99	2.70	6.37E-21	1.26E-01	1.00E+00
10950		10943	14799	40.52	10503.43	56.23	18.74	2.81	53.97	17.99	2.70	6.35E-21	1.26E-01	1.00E+00
10951		10944	14800	40.52	10504.39	56.23	18.74	2.81	53.97	17.99	2.70	6.33E-21	1.26E-01	1.00E+00
10952		10945	14801	40.52	10505.35	56.23	18.74	2.81	53.97	17.99	2.70	6.31E-21	1.26E-01	1.00E+00
10953		10946	14802	40.53	10506.31	56.23	18.74	2.81	53.98	17.99	2.70	6.29E-21	1.26E-01	1.00E+00
10954		10947	14803	40.53	10507.27	56.24	18.75	2.81	53.98	17.99	2.70	6.27E-21	1.26E-01	1.00E+00
10955		10948	14804	40.53	10508.23	56.24	18.75	2.81	53.98	17.99	2.70	6.25E-21	1.26E-01	1.00E+00
10956		10949	14805	40.53	10509.19	56.24	18.75	2.81	53.98	17.99	2.70	6.22E-21	1.26E-01	1.00E+00
10957		10950	14806	40.54	10510.15	56.24	18.75	2.81	53.98	17.99	2.70	6.20E-21	1.26E-01	1.00E+00
10958		10951	14807	40.54	10511.11	56.24	18.75	2.81	53.98	17.99	2.70	6.18E-21	1.26E-01	1.00E+00
10959		10952	14808	40.54	10512.07	56.24	18.75	2.81	53.98	17.99	2.70	6.16E-21	1.26E-01	1.00E+00
10960		10953	14809	40.54	10513.03	56.25	18.75	2.81	53.99	18.00	2.70	6.14E-21	1.26E-01	1.00E+00
10961		10954	14810	40.55	10513.99	56.25	18.75	2.81	53.99	18.00	2.70	6.12E-21	1.26E-01	1.00E+00
10962		10955	14811	40.55	10514.95	56.25	18.75	2.81	53.99	18.00	2.70	6.10E-21	1.26E-01	1.00E+00
10963		10956	14812	40.55	10515.91	56.25	18.75	2.81	53.99	18.00	2.70	6.08E-21	1.26E-01	1.00E+00
10964		10957	14813	40.56	10516.87	56.25	18.75	2.81	53.99	18.00	2.70	6.06E-21	1.26E-01	1.00E+00
10965		10958	14814	40.56	10517.83	56.25	18.75	2.81	53.99	18.00	2.70	6.03E-21	1.26E-01	1.00E+00

JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

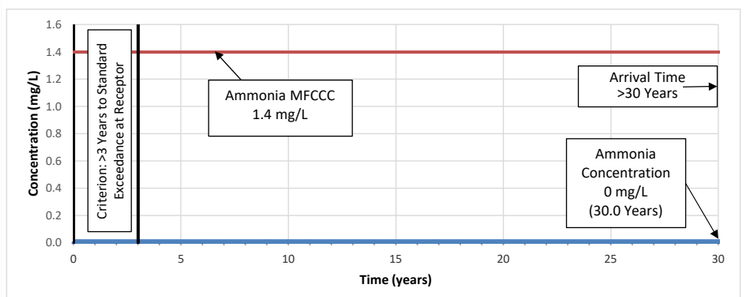
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 8b - Vertical downward flow through till and horizontal flow through bedrock from Shallow Bedrock/Thin Till Area 3 within boundary of Phase II Expansion to Receptor F based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	1552.34	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	174.56	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor F Elevation (ft-NGVD)	159.54	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31+ $C$37 ↓	=F7/365.25 ↓	=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	3856	10.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	3857	10.56	0.96	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	3858	10.56	1.92	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3859	10.56	2.88	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	3860	10.57	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	3861	10.57	4.80	0.04	0.01	0.00	0.03	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	3862	10.57	5.76	0.09	0.03	0.00	0.09	0.03	0.00	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	3863	10.58	6.72	0.16	0.05	0.01	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	9.68E-03	← *=(C4-C5)/C3*	8	3864	10.58	7.68	0.25	0.08	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	3865	10.58	8.64	0.34	0.11	0.02	0.32	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	0.96	← *=C14*C15/C16*	10	3866	10.58	9.60	0.43	0.14	0.02	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	3867	10.59	10.56	0.53	0.18	0.03	0.51	0.17	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	3868	10.59	11.52	0.63	0.21	0.03	0.61	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	1552.34	← *=C3*	13	3869	10.59	12.48	0.73	0.24	0.04	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	3870	10.60	13.44	0.83	0.28	0.04	0.80	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	3871	10.60	14.40	0.94	0.31	0.05	0.90	0.30	0.04	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	3872	10.60	15.36	1.04	0.35	0.05	1.00	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	183.42	*INPUT*	17	3873	10.60	16.32	1.14	0.38	0.06	1.09	0.36	0.05	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	174.42	*INPUT*	18	3874	10.61	17.28	1.24	0.41	0.06	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	9.00	← *=C24-C25*	19	3875	10.61	18.24	1.34	0.45	0.07	1.28	0.43	0.06	0.00E+00	0.00E+00	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	3876	10.61	19.20	1.44	0.48	0.07	1.38	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	3877	10.61	20.16	1.53	0.51	0.08	1.47	0.49	0.07	0.00E+00	0.00E+00	#DIV/0!
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	3878	10.62	21.12	1.63	0.54	0.08	1.57	0.52	0.08	0.00E+00	0.00E+00	#DIV/0!
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	3879	10.62	22.08	1.73	0.58	0.09	1.66	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
31	Time of Vertical Flow Through Till (days)	2480	← *=C26/C30*	24	3880	10.62	23.04	1.82	0.61	0.09	1.75	0.58	0.09	0.00E+00	0.00E+00	#DIV/0!
32	Augmented Layer Clay Thickness (ft)	1	*INPUT*	25	3881	10.63	24.00	1.91	0.64	0.10	1.84	0.61	0.09	0.00E+00	0.00E+00	#DIV/0!
33	Augmented Layer Clay Hydraulic Conductivity (ft/day)	2.83E-04	*INPUT*	26	3882	10.63	24.96	2.01	0.67	0.10	1.93	0.64	0.10	0.00E+00	0.00E+00	#DIV/0!
34	Effective Porosity of Clay (ft^3/ft^3)	0.39	*INPUT*	27	3883	10.63	25.92	2.10	0.70	0.10	2.01	0.67	0.10	0.00E+00	0.00E+00	#DIV/0!
35	Hydraulic Gradient (Assumed Vertical Movement Through Clay) (ft/ft)	1	*INPUT*	28	3884	10.63	26.88	2.19	0.73	0.11	2.10	0.70	0.11	0.00E+00	0.00E+00	#DIV/0!
36	Vertical Clay Groundwater Average Linear Velocity (ft/d)	7.27E-04	← *=C33*C35/C34*	29	3885	10.64	27.84	2.28	0.76	0.11	2.19	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
37	Time of Vertical Flow Through Clay (days)	1376	← *=C32/C36*	30	3886	10.64	28.79	2.37	0.79	0.12	2.27	0.76	0.11	0.00E+00	0.00E+00	#DIV/0!



10949				10942	14798	40.51	10502.47	56.23	18.74	2.81	53.97	17.99	2.70	3.84E-24	7.57E-05	1.00E+00
10950				10943	14799	40.52	10503.43	56.23	18.74	2.81	53.97	17.99	2.70	3.83E-24	7.57E-05	1.00E+00
10951				10944	14800	40.52	10504.39	56.23	18.74	2.81	53.97	17.99	2.70	3.81E-24	7.57E-05	1.00E+00
10952				10945	14801	40.52	10505.35	56.23	18.74	2.81	53.97	17.99	2.70	3.80E-24	7.57E-05	1.00E+00
10953				10946	14802	40.53	10506.31	56.23	18.74	2.81	53.98	17.99	2.70	3.79E-24	7.57E-05	1.00E+00
10954				10947	14803	40.53	10507.27	56.24	18.75	2.81	53.98	17.99	2.70	3.77E-24	7.57E-05	1.00E+00
10955				10948	14804	40.53	10508.23	56.24	18.75	2.81	53.98	17.99	2.70	3.76E-24	7.57E-05	1.00E+00
10956				10949	14805	40.53	10509.19	56.24	18.75	2.81	53.98	17.99	2.70	3.75E-24	7.57E-05	1.00E+00
10957				10950	14806	40.54	10510.15	56.24	18.75	2.81	53.98	17.99	2.70	3.74E-24	7.57E-05	1.00E+00
10958				10951	14807	40.54	10511.11	56.24	18.75	2.81	53.98	17.99	2.70	3.72E-24	7.57E-05	1.00E+00
10959				10952	14808	40.54	10512.07	56.24	18.75	2.81	53.98	17.99	2.70	3.71E-24	7.57E-05	1.00E+00
10960				10953	14809	40.54	10513.03	56.25	18.75	2.81	53.99	18.00	2.70	3.70E-24	7.57E-05	1.00E+00
10961				10954	14810	40.55	10513.99	56.25	18.75	2.81	53.99	18.00	2.70	3.68E-24	7.57E-05	1.00E+00
10962				10955	14811	40.55	10514.95	56.25	18.75	2.81	53.99	18.00	2.70	3.67E-24	7.57E-05	1.00E+00
10963				10956	14812	40.55	10515.91	56.25	18.75	2.81	53.99	18.00	2.70	3.66E-24	7.57E-05	1.00E+00
10964				10957	14813	40.56	10516.87	56.25	18.75	2.81	53.99	18.00	2.70	3.65E-24	7.57E-05	1.00E+00
10965				10958	14814	40.56	10517.83	56.25	18.75	2.81	53.99	18.00	2.70	3.63E-24	7.57E-05	1.00E+00

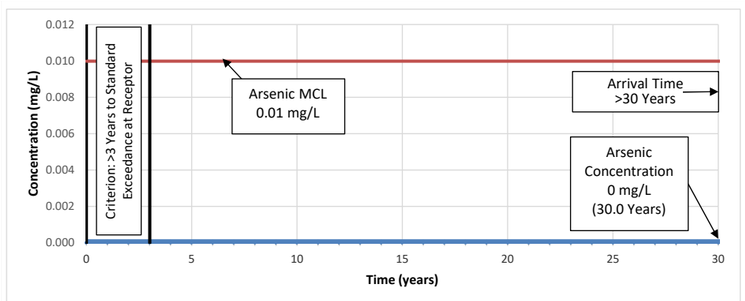
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 9a - Horizontal flow through till from Leachate Storage Tanks Containment Area to Receptor G based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	5.87	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	19551.71	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.03E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	750	← *=(C20/C17)*365.25*	17	17		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		33.26	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



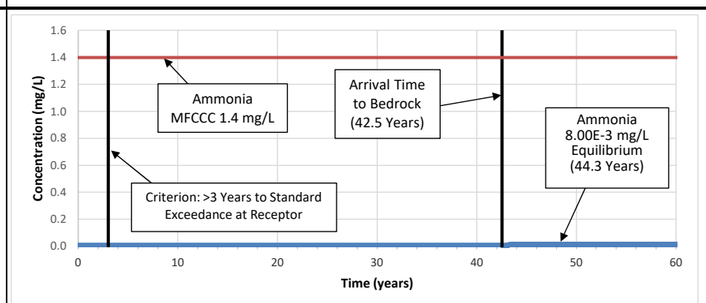
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 9a - Horizontal flow through till from Leachate Storage Tanks Containment Area to Receptor G based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	5.87	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	11.78	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.03E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	14		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Receptor (Years)	750	← *=(C20/C17)*365.25*	17	17		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		33.21	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		33.22	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		33.23	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		33.24	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		33.25	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		33.26	2.76	0.92	0.14	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



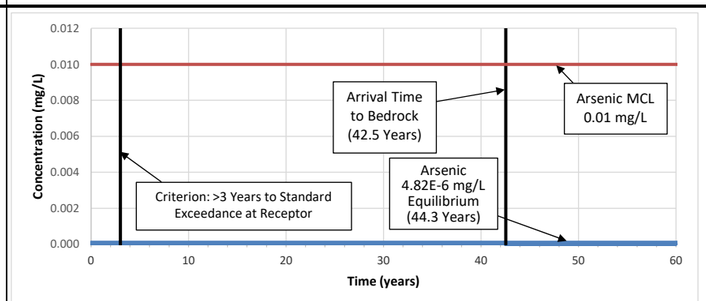
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 9b - Vertical downward flow through till and horizontal flow through bedrock from Leachate Storage Tanks Containment Area to Receptor G based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	15530	42.52	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	15531	42.52	2.83	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	15532	42.53	5.66	0.08	0.03	0.00	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
10				3	15533	42.53	8.49	0.32	0.11	0.02	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage Below Leachate Storage Tanks (gpd)	5.87	← *=(C8/43560)*C9*	4	15534	42.53	11.32	0.61	0.20	0.03	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	15535	42.53	14.15	0.91	0.30	0.05	2.57	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	19551.71	← *=C11*C12*3.7854118*	6	15536	42.54	16.98	1.21	0.40	0.06	3.42	1.14	0.17	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	15537	42.54	19.81	1.50	0.50	0.07	4.24	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	15538	42.54	22.64	1.78	0.59	0.09	5.04	1.68	0.25	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	15539	42.54	25.47	2.06	0.69	0.10	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.83	← *=C14*C15/C16*	10	15540	42.55	28.30	2.32	0.77	0.12	6.56	2.19	0.33	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	15541	42.55	31.13	2.58	0.86	0.13	7.29	2.43	0.36	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	15542	42.55	33.96	2.82	0.94	0.14	7.99	2.66	0.40	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	15543	42.56	36.78	3.06	1.02	0.15	8.66	2.89	0.43	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	15544	42.56	39.61	3.29	1.10	0.16	9.32	3.11	0.47	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15545	42.56	42.44	3.52	1.17	0.18	9.95	3.32	0.50	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	15546	42.56	45.27	3.74	1.25	0.19	10.57	3.52	0.53	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	203.85	*INPUT*	17	15547	42.57	48.10	3.95	1.32	0.20	11.17	3.72	0.56	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.50	*INPUT*	18	15548	42.57	50.93	4.15	1.38	0.21	11.75	3.92	0.59	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	56.35	← *=C24-C25*	19	15549	42.57	53.76	4.35	1.45	0.22	12.32	4.11	0.62	1.26E-282	1.26E-282	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	15550	42.57	56.59	4.55	1.52	0.23	12.87	4.29	0.64	2.23E-255	2.23E-255	1.77E+27
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	15551	42.58	59.42	4.74	1.58	0.24	13.41	4.47	0.67	5.18E-232	5.18E-232	2.33E+23
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	15552	42.58	62.25	4.92	1.64	0.25	13.93	4.64	0.70	8.23E-212	8.23E-212	1.59E+20
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	15553	42.58	65.08	5.11	1.70	0.26	14.45	4.82	0.72	3.22E-194	3.22E-194	3.91E+17
31	Time of Vertical Flow Through Till (days)	15530	← *=C26/C30*	24	15554	42.59	67.91	5.28	1.76	0.26	14.95	4.98	0.75	8.47E-179	8.47E-179	2.63E+15
32				25	15555	42.59	70.74	5.46	1.82	0.27	15.44	5.15	0.77	3.36E-165	3.36E-165	3.96E+13
33				26	15556	42.59	73.57	5.63	1.88	0.28	15.92	5.31	0.80	3.83E-153	3.83E-153	1.14E+12
34				27	15557	42.59	76.40	5.79	1.93	0.29	16.39	5.46	0.82	2.12E-142	2.12E-142	5.54E+10
35				28	15558	42.60	79.23	5.96	1.99	0.30	16.85	5.62	0.84	8.80E-133	8.80E-133	4.15E+09
36				29	15559	42.60	82.06	6.11	2.04	0.31	17.30	5.77	0.87	3.90E-124	3.90E-124	4.43E+08
37				30	15560	42.60	84.89	6.27	2.09	0.31	17.75	5.92	0.89	2.48E-116	2.48E-116	6.36E+07
10949				10942	26472	72.48	30961.64	76.16	25.39	3.81	215.51	71.84	10.78	5.26E-50	8.00E-03	1.00E+00
10950				10943	26473	72.48	30964.47	76.16	25.39	3.81	215.51	71.84	10.78	5.22E-50	8.00E-03	1.00E+00
10951				10944	26474	72.48	30967.30	76.17	25.39	3.81	215.52	71.84	10.78	5.19E-50	8.00E-03	1.00E+00
10952				10945	26475	72.49	30970.13	76.17	25.39	3.81	215.52	71.84	10.78	5.15E-50	8.00E-03	1.00E+00
10953				10946	26476	72.49	30972.96	76.17	25.39	3.81	215.53	71.84	10.78	5.11E-50	8.00E-03	1.00E+00
10954				10947	26477	72.49	30975.79	76.17	25.39	3.81	215.54	71.85	10.78	5.08E-50	8.00E-03	1.00E+00
10955				10948	26478	72.49	30978.62	76.17	25.39	3.81	215.54	71.85	10.78	5.04E-50	8.00E-03	1.00E+00
10956				10949	26479	72.50	30981.45	76.17	25.39	3.81	215.55	71.85	10.78	5.00E-50	8.00E-03	1.00E+00
10957				10950	26480	72.50	30984.28	76.18	25.39	3.81	215.55	71.85	10.78	4.97E-50	8.00E-03	1.00E+00
10958				10951	26481	72.50	30987.11	76.18	25.39	3.81	215.56	71.85	10.78	4.93E-50	8.00E-03	1.00E+00
10959				10952	26482	72.51	30989.94	76.18	25.39	3.81	215.56	71.85	10.78	4.90E-50	8.00E-03	1.00E+00
10960				10953	26483	72.51	30992.77	76.18	25.39	3.81	215.57	71.86	10.78	4.86E-50	8.00E-03	1.00E+00
10961				10954	26484	72.51	30995.60	76.18	25.39	3.81	215.57	71.86	10.78	4.83E-50	8.00E-03	1.00E+00
10962				10955	26485	72.51	30998.42	76.19	25.40	3.81	215.58	71.86	10.78	4.79E-50	8.00E-03	1.00E+00
10963				10956	26486	72.52	31001.25	76.19	25.40	3.81	215.58	71.86	10.78	4.76E-50	8.00E-03	1.00E+00
10964				10957	26487	72.52	31004.08	76.19	25.40	3.81	215.59	71.86	10.78	4.73E-50	8.00E-03	1.00E+00
10965				10958	26488	72.52	31006.91	76.19	25.40	3.81	215.59	71.86	10.78	4.69E-50	8.00E-03	1.00E+00



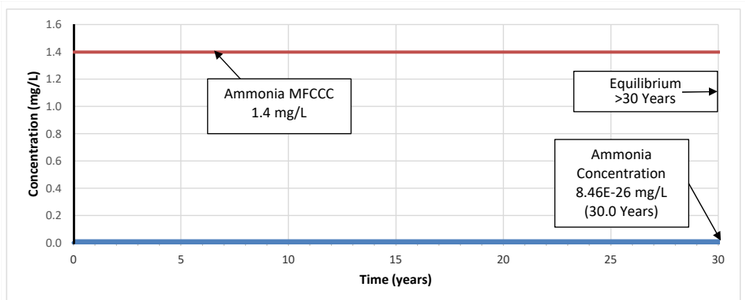
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 9b - Vertical downward flow through till and horizontal flow through bedrock from Leachate Storage Tanks Containment Area to Receptor G based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	831.22	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	177.24	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Receptor G Elevation (ft-NGVD)	153.53	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Area Existing and Proposed Leachate Storage Tank Containment (ft^2)	55580.05	*INPUT*	0	15530	42.52	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8				1	15531	42.52	2.83	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	15532	42.53	5.66	0.08	0.03	0.00	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
10				3	15533	42.53	8.49	0.32	0.11	0.02	0.91	0.30	0.05	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage Below Leachate Storage Tanks (gpd)	5.87	← *=(C8/43560)*C9*	4	15534	42.53	11.32	0.61	0.20	0.03	1.72	0.57	0.09	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	15535	42.53	14.15	0.91	0.30	0.05	2.57	0.86	0.13	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	11.78	← *=C11*C12*3.7854118*	6	15536	42.54	16.98	1.21	0.40	0.06	3.42	1.14	0.17	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	15537	42.54	19.81	1.50	0.50	0.07	4.24	1.41	0.21	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.85E-02	← *=(C4-C5)/C3*	8	15538	42.54	22.64	1.78	0.59	0.09	5.04	1.68	0.25	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	15539	42.54	25.47	2.06	0.69	0.10	5.82	1.94	0.29	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.83	← *=C14*C15/C16*	10	15540	42.55	28.30	2.32	0.77	0.12	6.56	2.19	0.33	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	15541	42.55	31.13	2.58	0.86	0.13	7.29	2.43	0.36	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	15542	42.55	33.96	2.82	0.94	0.14	7.99	2.66	0.40	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Receptor (ft)	831.22	← *=C3*	13	15543	42.56	36.78	3.06	1.02	0.15	8.66	2.89	0.43	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Receptor (ft)	0	*INPUT*	14	15544	42.56	39.61	3.29	1.10	0.16	9.32	3.11	0.47	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Receptor (ft)	0	*INPUT*	15	15545	42.56	42.44	3.52	1.17	0.18	9.95	3.32	0.50	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	15546	42.56	45.27	3.74	1.25	0.19	10.57	3.52	0.53	0.00E+00	0.00E+00	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	203.85	*INPUT*	17	15547	42.57	48.10	3.95	1.32	0.20	11.17	3.72	0.56	0.00E+00	0.00E+00	#DIV/0!
25	Bedrock Surface Elevation (ft-NGVD)	147.50	*INPUT*	18	15548	42.57	50.93	4.15	1.38	0.21	11.75	3.92	0.59	0.00E+00	0.00E+00	#DIV/0!
26	Till Thickness (ft)	56.35	← *=C24-C25*	19	15549	42.57	53.76	4.35	1.45	0.22	12.32	4.11	0.62	7.59E-286	7.59E-286	#DIV/0!
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	15550	42.57	56.59	4.55	1.52	0.23	12.87	4.29	0.64	1.34E-258	1.34E-258	1.77E+27
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	15551	42.58	59.42	4.74	1.58	0.24	13.41	4.47	0.67	3.12E-235	3.12E-235	2.33E+23
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	15552	42.58	62.25	4.92	1.64	0.25	13.93	4.64	0.70	4.96E-215	4.96E-215	1.59E+20
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	15553	42.58	65.08	5.11	1.70	0.26	14.45	4.82	0.72	1.94E-197	1.94E-197	3.91E+17
31	Time of Vertical Flow Through Till (days)	15530	← *=C26/C30*	24	15554	42.59	67.91	5.28	1.76	0.26	14.95	4.98	0.75	5.10E-182	5.10E-182	2.63E+15
32				25	15555	42.59	70.74	5.46	1.82	0.27	15.44	5.15	0.77	2.02E-168	2.02E-168	3.96E+13
33				26	15556	42.59	73.57	5.63	1.88	0.28	15.92	5.31	0.80	2.31E-156	2.31E-156	1.14E+12
34				27	15557	42.59	76.40	5.79	1.93	0.29	16.39	5.46	0.82	1.28E-145	1.28E-145	5.54E+10
35				28	15558	42.60	79.23	5.96	1.99	0.30	16.85	5.62	0.84	5.30E-136	5.30E-136	4.15E+09
36				29	15559	42.60	82.06	6.11	2.04	0.31	17.30	5.77	0.87	2.35E-127	2.35E-127	4.43E+08
37				30	15560	42.60	84.89	6.27	2.09	0.31	17.75	5.92	0.89	1.49E-119	1.49E-119	6.36E+07
10949				10942	26472	72.48	30961.64	76.16	25.39	3.81	215.51	71.84	10.78	3.17E-53	4.82E-06	1.00E+00
10950				10943	26473	72.48	30964.47	76.16	25.39	3.81	215.51	71.84	10.78	3.15E-53	4.82E-06	1.00E+00
10951				10944	26474	72.48	30967.30	76.17	25.39	3.81	215.52	71.84	10.78	3.12E-53	4.82E-06	1.00E+00
10952				10945	26475	72.49	30970.13	76.17	25.39	3.81	215.52	71.84	10.78	3.10E-53	4.82E-06	1.00E+00
10953				10946	26476	72.49	30972.96	76.17	25.39	3.81	215.53	71.84	10.78	3.08E-53	4.82E-06	1.00E+00
10954				10947	26477	72.49	30975.79	76.17	25.39	3.81	215.54	71.85	10.78	3.06E-53	4.82E-06	1.00E+00
10955				10948	26478	72.49	30978.62	76.17	25.39	3.81	215.54	71.85	10.78	3.04E-53	4.82E-06	1.00E+00
10956				10949	26479	72.50	30981.45	76.17	25.39	3.81	215.55	71.85	10.78	3.01E-53	4.82E-06	1.00E+00
10957				10950	26480	72.50	30984.28	76.18	25.39	3.81	215.55	71.85	10.78	2.99E-53	4.82E-06	1.00E+00
10958				10951	26481	72.50	30987.11	76.18	25.39	3.81	215.56	71.85	10.78	2.97E-53	4.82E-06	1.00E+00
10959				10952	26482	72.51	30989.94	76.18	25.39	3.81	215.56	71.85	10.78	2.95E-53	4.82E-06	1.00E+00
10960				10953	26483	72.51	30992.77	76.18	25.39	3.81	215.57	71.86	10.78	2.93E-53	4.82E-06	1.00E+00
10961				10954	26484	72.51	30995.60	76.18	25.39	3.81	215.57	71.86	10.78	2.91E-53	4.82E-06	1.00E+00
10962				10955	26485	72.51	30998.42	76.19	25.40	3.81	215.58	71.86	10.78	2.89E-53	4.82E-06	1.00E+00
10963				10956	26486	72.52	31001.25	76.19	25.40	3.81	215.58	71.86	10.78	2.87E-53	4.82E-06	1.00E+00
10964				10957	26487	72.52	31004.08	76.19	25.40	3.81	215.59	71.86	10.78	2.85E-53	4.82E-06	1.00E+00
10965				10958	26488	72.52	31006.91	76.19	25.40	3.81	215.59	71.86	10.78	2.83E-53	4.82E-06	1.00E+00



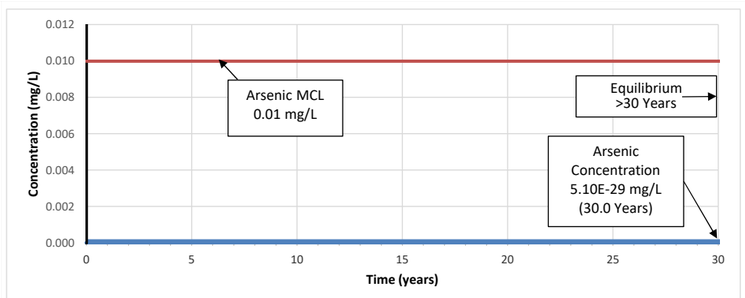
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 10a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-612B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	183.22	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	154.90	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.75	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.81E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.99E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	183.22	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	168	← *=(C20/C17)*365.25*	17	17		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		32.72	2.72	0.91	0.14	0.01	0.00	0.00	9.67E-28	6.72E-26	1.01E+00
10950				10943	10943		32.73	2.72	0.91	0.14	0.01	0.00	0.00	9.80E-28	6.81E-26	1.01E+00
10951				10944	10944		32.73	2.72	0.91	0.14	0.01	0.00	0.00	9.94E-28	6.91E-26	1.01E+00
10952				10945	10945		32.73	2.72	0.91	0.14	0.01	0.00	0.00	1.01E-27	7.01E-26	1.01E+00
10953				10946	10946		32.74	2.72	0.91	0.14	0.01	0.00	0.00	1.02E-27	7.12E-26	1.01E+00
10954				10947	10947		32.74	2.72	0.91	0.14	0.01	0.00	0.00	1.04E-27	7.22E-26	1.01E+00
10955				10948	10948		32.74	2.72	0.91	0.14	0.01	0.00	0.00	1.05E-27	7.32E-26	1.01E+00
10956				10949	10949		32.75	2.72	0.91	0.14	0.01	0.00	0.00	1.07E-27	7.43E-26	1.01E+00
10957				10950	10950		32.75	2.72	0.91	0.14	0.01	0.00	0.00	1.08E-27	7.54E-26	1.01E+00
10958				10951	10951		32.75	2.72	0.91	0.14	0.01	0.00	0.00	1.10E-27	7.65E-26	1.01E+00
10959				10952	10952		32.75	2.72	0.91	0.14	0.01	0.00	0.00	1.11E-27	7.76E-26	1.01E+00
10960				10953	10953		32.76	2.72	0.91	0.14	0.01	0.00	0.00	1.13E-27	7.87E-26	1.01E+00
10961				10954	10954		32.76	2.72	0.91	0.14	0.01	0.00	0.00	1.15E-27	7.99E-26	1.01E+00
10962				10955	10955		32.76	2.72	0.91	0.14	0.01	0.00	0.00	1.16E-27	8.10E-26	1.01E+00
10963				10956	10956		32.77	2.72	0.91	0.14	0.01	0.00	0.00	1.18E-27	8.22E-26	1.01E+00
10964				10957	10957		32.77	2.72	0.91	0.14	0.01	0.00	0.00	1.20E-27	8.34E-26	1.01E+00
10965				10958	10958		32.77	2.72	0.91	0.14	0.01	0.00	0.00	1.21E-27	8.46E-26	1.01E+00



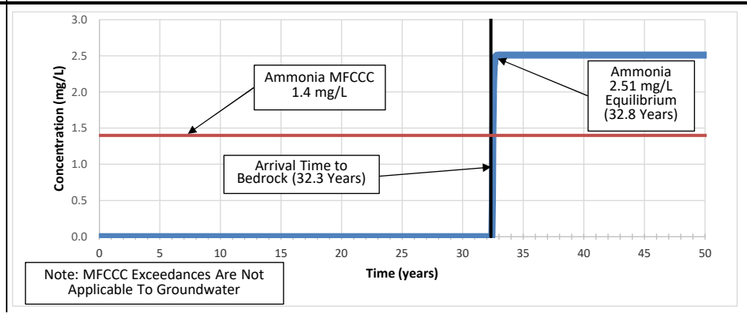
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 10a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-612B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	183.22	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	154.90	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.75	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.81E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.99E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	183.22	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	168	← *=(C20/C17)*365.25*	17	17		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		32.72	2.72	0.91	0.14	0.01	0.00	0.00	5.82E-31	4.04E-29	1.01E+00
10950				10943	10943		32.73	2.72	0.91	0.14	0.01	0.00	0.00	5.90E-31	4.10E-29	1.01E+00
10951				10944	10944		32.73	2.72	0.91	0.14	0.01	0.00	0.00	5.99E-31	4.16E-29	1.01E+00
10952				10945	10945		32.73	2.72	0.91	0.14	0.01	0.00	0.00	6.07E-31	4.22E-29	1.01E+00
10953				10946	10946		32.74	2.72	0.91	0.14	0.01	0.00	0.00	6.16E-31	4.29E-29	1.01E+00
10954				10947	10947		32.74	2.72	0.91	0.14	0.01	0.00	0.00	6.25E-31	4.35E-29	1.01E+00
10955				10948	10948		32.74	2.72	0.91	0.14	0.01	0.00	0.00	6.34E-31	4.41E-29	1.01E+00
10956				10949	10949		32.75	2.72	0.91	0.14	0.01	0.00	0.00	6.43E-31	4.48E-29	1.01E+00
10957				10950	10950		32.75	2.72	0.91	0.14	0.01	0.00	0.00	6.52E-31	4.54E-29	1.01E+00
10958				10951	10951		32.75	2.72	0.91	0.14	0.01	0.00	0.00	6.61E-31	4.61E-29	1.01E+00
10959				10952	10952		32.75	2.72	0.91	0.14	0.01	0.00	0.00	6.71E-31	4.67E-29	1.01E+00
10960				10953	10953		32.76	2.72	0.91	0.14	0.01	0.00	0.00	6.80E-31	4.74E-29	1.01E+00
10961				10954	10954		32.76	2.72	0.91	0.14	0.01	0.00	0.00	6.90E-31	4.81E-29	1.01E+00
10962				10955	10955		32.76	2.72	0.91	0.14	0.01	0.00	0.00	7.00E-31	4.88E-29	1.01E+00
10963				10956	10956		32.77	2.72	0.91	0.14	0.01	0.00	0.00	7.10E-31	4.95E-29	1.01E+00
10964				10957	10957		32.77	2.72	0.91	0.14	0.01	0.00	0.00	7.20E-31	5.02E-29	1.01E+00
10965				10958	10958		32.77	2.72	0.91	0.14	0.01	0.00	0.00	7.30E-31	5.10E-29	1.01E+00



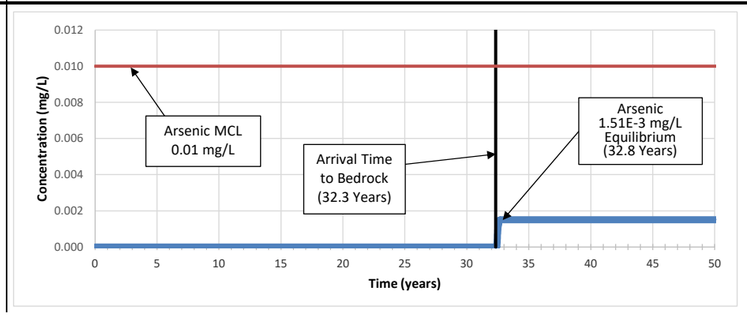
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 10b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-612A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	183.22	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	154.90	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.75	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	11804	32.32	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	11805	32.32	2.79	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	11806	32.32	5.58	0.08	0.03	0.00	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
10				3	11807	32.33	8.37	0.31	0.10	0.02	0.86	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	11808	32.33	11.15	0.59	0.20	0.03	1.65	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	11809	32.33	13.94	0.89	0.30	0.04	2.47	0.82	0.12	2.38E-250	2.38E-250	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	11810	32.33	16.73	1.18	0.39	0.06	3.29	1.10	0.16	2.28E-151	2.28E-151	9.60E+98
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	11811	32.34	19.52	1.47	0.49	0.07	4.10	1.37	0.20	8.78E-101	8.78E-101	3.85E+50
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.81E-02	← *=(C4-C5)/C3*	8	11812	32.34	22.31	1.75	0.58	0.09	4.88	1.63	0.24	1.38E-71	1.38E-71	1.57E+29
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	11813	32.34	25.10	2.02	0.67	0.10	5.63	1.88	0.28	2.93E-53	2.93E-53	2.12E+18
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.79	← *=C14*C15/C16*	10	11814	32.35	27.88	2.28	0.76	0.11	6.36	2.12	0.32	4.96E-41	4.96E-41	1.69E+12
18	Retardation Factor	1	*INPUT*	11	11815	32.35	30.67	2.53	0.84	0.13	7.07	2.36	0.35	1.76E-32	1.76E-32	3.54E+08
19	1st Order Decay Constant	0	*INPUT*	12	11816	32.35	33.46	2.78	0.93	0.14	7.75	2.58	0.39	2.77E-26	2.77E-26	1.58E+06
20	Longitudinal Distance to Monitoring Well (ft)	183.22	← *=C3*	13	11817	32.35	36.25	3.02	1.01	0.15	8.41	2.80	0.42	1.18E-21	1.18E-21	4.25E+04
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	11818	32.36	39.04	3.25	1.08	0.16	9.05	3.02	0.45	4.08E-18	4.08E-18	3.47E+03
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	11819	32.36	41.83	3.47	1.16	0.17	9.67	3.22	0.48	2.36E-15	2.37E-15	5.79E+02
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	11820	32.36	44.61	3.68	1.23	0.18	10.27	3.42	0.51	3.67E-13	3.70E-13	1.56E+02
24	Proposed Base Grade Elevation (ft-NGVD)	168.34	*INPUT*	17	11821	32.36	47.40	3.89	1.30	0.19	10.86	3.62	0.54	2.14E-11	2.17E-11	5.88E+01
25	Bedrock Surface Elevation (ft-NGVD)	125.51	*INPUT*	18	11822	32.37	50.19	4.10	1.37	0.20	11.43	3.81	0.57	5.86E-10	6.08E-10	2.80E+01
26	Till Thickness (ft)	42.83	← *=C24-C25*	19	11823	32.37	52.98	4.30	1.43	0.21	11.98	3.99	0.60	8.98E-09	9.59E-09	1.58E+01
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	11824	32.37	55.77	4.49	1.50	0.22	12.52	4.17	0.63	8.68E-08	9.64E-08	1.01E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	11825	32.38	58.56	4.68	1.56	0.23	13.05	4.35	0.65	5.81E-07	6.78E-07	7.03E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	11826	32.38	61.34	4.87	1.62	0.24	13.57	4.52	0.68	2.89E-06	3.57E-06	5.27E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	11827	32.38	64.13	5.05	1.68	0.25	14.07	4.69	0.70	1.13E-05	1.49E-05	4.17E+00
31	Time of Vertical Flow Through Till (days)	11804	← *=C26/C30*	24	11828	32.38	66.92	5.22	1.74	0.26	14.56	4.85	0.73	3.63E-05	5.12E-05	3.44E+00
32				25	11829	32.39	69.71	5.39	1.80	0.27	15.04	5.01	0.75	9.87E-05	1.50E-04	2.93E+00
33				26	11830	32.39	72.50	5.56	1.85	0.28	15.51	5.17	0.78	2.34E-04	3.83E-04	2.56E+00
34				27	11831	32.39	75.29	5.73	1.91	0.29	15.97	5.32	0.80	4.92E-04	8.76E-04	2.28E+00
35				28	11832	32.39	78.07	5.89	1.96	0.29	16.42	5.47	0.82	9.40E-04	1.82E-03	2.07E+00
36				29	11833	32.40	80.86	6.05	2.02	0.30	16.86	5.62	0.84	1.65E-03	3.47E-03	1.91E+00
37				30	11834	32.40	83.65	6.20	2.07	0.31	17.30	5.77	0.86	2.70E-03	6.16E-03	1.78E+00
10949				10942	22746	62.28	30510.04	75.87	25.29	3.79	211.54	70.51	10.58	7.78E-50	2.51E+00	1.00E+00
10950				10943	22747	62.28	30512.83	75.87	25.29	3.79	211.55	70.52	10.58	7.72E-50	2.51E+00	1.00E+00
10951				10944	22748	62.28	30515.61	75.87	25.29	3.79	211.55	70.52	10.58	7.67E-50	2.51E+00	1.00E+00
10952				10945	22749	62.28	30518.40	75.87	25.29	3.79	211.56	70.52	10.58	7.62E-50	2.51E+00	1.00E+00
10953				10946	22750	62.29	30521.19	75.87	25.29	3.79	211.56	70.52	10.58	7.56E-50	2.51E+00	1.00E+00
10954				10947	22751	62.29	30523.98	75.88	25.29	3.79	211.57	70.52	10.58	7.51E-50	2.51E+00	1.00E+00
10955				10948	22752	62.29	30526.77	75.88	25.29	3.79	211.57	70.52	10.58	7.46E-50	2.51E+00	1.00E+00
10956				10949	22753	62.30	30529.56	75.88	25.29	3.79	211.58	70.53	10.58	7.41E-50	2.51E+00	1.00E+00
10957				10950	22754	62.30	30532.34	75.88	25.29	3.79	211.58	70.53	10.58	7.36E-50	2.51E+00	1.00E+00
10958				10951	22755	62.30	30535.13	75.88	25.29	3.79	211.59	70.53	10.58	7.30E-50	2.51E+00	1.00E+00
10959				10952	22756	62.30	30537.92	75.89	25.30	3.79	211.59	70.53	10.58	7.25E-50	2.51E+00	1.00E+00
10960				10953	22757	62.31	30540.71	75.89	25.30	3.79	211.60	70.53	10.58	7.20E-50	2.51E+00	1.00E+00
10961				10954	22758	62.31	30543.50	75.89	25.30	3.79	211.61	70.54	10.58	7.15E-50	2.51E+00	1.00E+00
10962				10955	22759	62.31	30546.29	75.89	25.30	3.79	211.61	70.54	10.58	7.10E-50	2.51E+00	1.00E+00
10963				10956	22760	62.31	30549.07	75.89	25.30	3.79	211.62	70.54	10.58	7.05E-50	2.51E+00	1.00E+00
10964				10957	22761	62.32	30551.86	75.89	25.30	3.79	211.62	70.54	10.58	7.01E-50	2.51E+00	1.00E+00
10965				10958	22762	62.32	30554.65	75.90	25.30	3.79	211.63	70.54	10.58	6.96E-50	2.51E+00	1.00E+00



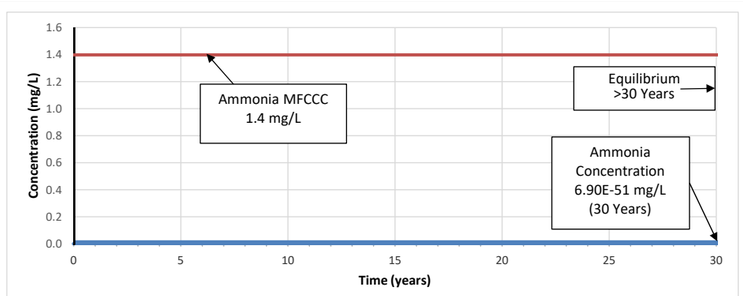
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 10b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-612A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	183.22	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	154.90	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.75	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	11804	32.32	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	11805	32.32	2.79	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	11806	32.32	5.58	0.08	0.03	0.00	0.22	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
10				3	11807	32.33	8.37	0.31	0.10	0.02	0.86	0.29	0.04	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	11808	32.33	11.15	0.59	0.20	0.03	1.65	0.55	0.08	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	11809	32.33	13.94	0.89	0.30	0.04	2.47	0.82	0.12	1.43E-253	1.43E-253	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	11810	32.33	16.73	1.18	0.39	0.06	3.29	1.10	0.16	1.38E-154	1.38E-154	9.60E+98
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	11811	32.34	19.52	1.47	0.49	0.07	4.10	1.37	0.20	5.29E-104	5.29E-104	3.85E+50
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.81E-02	← *=(C4-C5)/C3*	8	11812	32.34	22.31	1.75	0.58	0.09	4.88	1.63	0.24	8.33E-75	8.33E-75	1.57E+29
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	11813	32.34	25.10	2.02	0.67	0.10	5.63	1.88	0.28	1.76E-56	1.76E-56	2.12E+18
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.79	← *=C14*C15/C16*	10	11814	32.35	27.88	2.28	0.76	0.11	6.36	2.12	0.32	2.99E-44	2.99E-44	1.69E+12
18	Retardation Factor	1	*INPUT*	11	11815	32.35	30.67	2.53	0.84	0.13	7.07	2.36	0.35	1.06E-35	1.06E-35	3.54E+08
19	1st Order Decay Constant	0	*INPUT*	12	11816	32.35	33.46	2.78	0.93	0.14	7.75	2.58	0.39	1.67E-29	1.67E-29	1.58E+06
20	Longitudinal Distance to Monitoring Well (ft)	183.22	← *=C3*	13	11817	32.35	36.25	3.02	1.01	0.15	8.41	2.80	0.42	7.09E-25	7.09E-25	4.25E+04
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	11818	32.36	39.04	3.25	1.08	0.16	9.05	3.02	0.45	2.46E-21	2.46E-21	3.47E+03
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	11819	32.36	41.83	3.47	1.16	0.17	9.67	3.22	0.48	1.42E-18	1.42E-18	5.79E+02
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	11820	32.36	44.61	3.68	1.23	0.18	10.27	3.42	0.51	2.21E-16	2.23E-16	1.56E+02
24	Proposed Base Grade Elevation (ft-NGVD)	168.34	*INPUT*	17	11821	32.36	47.40	3.89	1.30	0.19	10.86	3.62	0.54	1.29E-14	1.31E-14	5.88E+01
25	Bedrock Surface Elevation (ft-NGVD)	125.51	*INPUT*	18	11822	32.37	50.19	4.10	1.37	0.20	11.43	3.81	0.57	3.53E-13	3.66E-13	2.80E+01
26	Till Thickness (ft)	42.83	← *=C24-C25*	19	11823	32.37	52.98	4.30	1.43	0.21	11.98	3.99	0.60	5.41E-12	5.77E-12	1.58E+01
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	11824	32.37	55.77	4.49	1.50	0.22	12.52	4.17	0.63	5.23E-11	5.80E-11	1.01E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	11825	32.38	58.56	4.68	1.56	0.23	13.05	4.35	0.65	3.50E-10	4.08E-10	7.03E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	11826	32.38	61.34	4.87	1.62	0.24	13.57	4.52	0.68	1.74E-09	2.15E-09	5.27E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	11827	32.38	64.13	5.05	1.68	0.25	14.07	4.69	0.70	6.82E-09	8.97E-09	4.17E+00
31	Time of Vertical Flow Through Till (days)	11804	← *=C26/C30*	24	11828	32.38	66.92	5.22	1.74	0.26	14.56	4.85	0.73	2.19E-08	3.08E-08	3.44E+00
32				25	11829	32.39	69.71	5.39	1.80	0.27	15.04	5.01	0.75	5.94E-08	9.03E-08	2.93E+00
33				26	11830	32.39	72.50	5.56	1.85	0.28	15.51	5.17	0.78	1.41E-07	2.31E-07	2.56E+00
34				27	11831	32.39	75.29	5.73	1.91	0.29	15.97	5.32	0.80	2.96E-07	5.27E-07	2.28E+00
35				28	11832	32.39	78.07	5.89	1.96	0.29	16.42	5.47	0.82	5.66E-07	1.09E-06	2.07E+00
36				29	11833	32.40	80.86	6.05	2.02	0.30	16.86	5.62	0.84	9.94E-07	2.09E-06	1.91E+00
37				30	11834	32.40	83.65	6.20	2.07	0.31	17.30	5.77	0.86	1.62E-06	3.71E-06	1.78E+00
10949				10942	22746	62.28	30510.04	75.87	25.29	3.79	211.54	70.51	10.58	4.68E-53	1.51E-03	1.00E+00
10950				10943	22747	62.28	30512.83	75.87	25.29	3.79	211.55	70.52	10.58	4.65E-53	1.51E-03	1.00E+00
10951				10944	22748	62.28	30515.61	75.87	25.29	3.79	211.55	70.52	10.58	4.62E-53	1.51E-03	1.00E+00
10952				10945	22749	62.28	30518.40	75.87	25.29	3.79	211.56	70.52	10.58	4.59E-53	1.51E-03	1.00E+00
10953				10946	22750	62.29	30521.19	75.87	25.29	3.79	211.56	70.52	10.58	4.56E-53	1.51E-03	1.00E+00
10954				10947	22751	62.29	30523.98	75.88	25.29	3.79	211.57	70.52	10.58	4.52E-53	1.51E-03	1.00E+00
10955				10948	22752	62.29	30526.77	75.88	25.29	3.79	211.57	70.52	10.58	4.49E-53	1.51E-03	1.00E+00
10956				10949	22753	62.30	30529.56	75.88	25.29	3.79	211.58	70.53	10.58	4.46E-53	1.51E-03	1.00E+00
10957				10950	22754	62.30	30532.34	75.88	25.29	3.79	211.58	70.53	10.58	4.43E-53	1.51E-03	1.00E+00
10958				10951	22755	62.30	30535.13	75.88	25.29	3.79	211.59	70.53	10.58	4.40E-53	1.51E-03	1.00E+00
10959				10952	22756	62.30	30537.92	75.89	25.30	3.79	211.59	70.53	10.58	4.37E-53	1.51E-03	1.00E+00
10960				10953	22757	62.31	30540.71	75.89	25.30	3.79	211.60	70.53	10.58	4.34E-53	1.51E-03	1.00E+00
10961				10954	22758	62.31	30543.50	75.89	25.30	3.79	211.61	70.54	10.58	4.31E-53	1.51E-03	1.00E+00
10962				10955	22759	62.31	30546.29	75.89	25.30	3.79	211.61	70.54	10.58	4.28E-53	1.51E-03	1.00E+00
10963				10956	22760	62.31	30549.07	75.89	25.30	3.79	211.62	70.54	10.58	4.25E-53	1.51E-03	1.00E+00
10964				10957	22761	62.32	30551.86	75.89	25.30	3.79	211.62	70.54	10.58	4.22E-53	1.51E-03	1.00E+00
10965				10958	22762	62.32	30554.65	75.90	25.30	3.79	211.63	70.54	10.58	4.19E-53	1.51E-03	1.00E+00



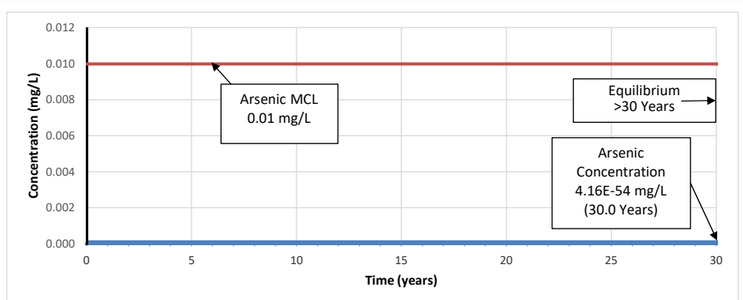
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 11a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-613B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	171.43	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	152.98	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.49	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.04E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.17E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	171.43	← *=C3*	13	13		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	217	← *=(C20/C17)*365.25*	17	17		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		23.70	1.89	0.63	0.09	0.00	0.00	0.00	1.23E-52	4.39E-51	1.03E+00
10950				10943	10943		23.70	1.89	0.63	0.09	0.00	0.00	0.00	1.26E-52	4.52E-51	1.03E+00
10951				10944	10944		23.71	1.89	0.63	0.09	0.00	0.00	0.00	1.30E-52	4.65E-51	1.03E+00
10952				10945	10945		23.71	1.89	0.63	0.09	0.00	0.00	0.00	1.34E-52	4.78E-51	1.03E+00
10953				10946	10946		23.71	1.89	0.63	0.09	0.00	0.00	0.00	1.37E-52	4.92E-51	1.03E+00
10954				10947	10947		23.71	1.89	0.63	0.09	0.00	0.00	0.00	1.41E-52	5.06E-51	1.03E+00
10955				10948	10948		23.71	1.89	0.63	0.09	0.00	0.00	0.00	1.45E-52	5.20E-51	1.03E+00
10956				10949	10949		23.72	1.89	0.63	0.09	0.00	0.00	0.00	1.49E-52	5.35E-51	1.03E+00
10957				10950	10950		23.72	1.89	0.63	0.09	0.00	0.00	0.00	1.54E-52	5.51E-51	1.03E+00
10958				10951	10951		23.72	1.89	0.63	0.09	0.00	0.00	0.00	1.58E-52	5.66E-51	1.03E+00
10959				10952	10952		23.72	1.89	0.63	0.09	0.00	0.00	0.00	1.62E-52	5.83E-51	1.03E+00
10960				10953	10953		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.67E-52	5.99E-51	1.03E+00
10961				10954	10954		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.72E-52	6.17E-51	1.03E+00
10962				10955	10955		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.77E-52	6.34E-51	1.03E+00
10963				10956	10956		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.82E-52	6.52E-51	1.03E+00
10964				10957	10957		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.87E-52	6.71E-51	1.03E+00
10965				10958	10958		23.74	1.89	0.63	0.09	0.00	0.00	0.00	1.92E-52	6.90E-51	1.03E+00



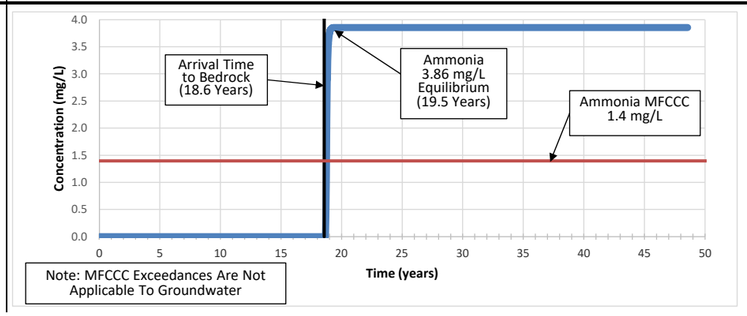
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 11a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-613B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	171.43	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	152.98	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.49	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.04E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.17E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	171.43	← *=C3*	13	13		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	217	← *=(C20/C17)*365.25*	17	17		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		23.70	1.89	0.63	0.09	0.00	0.00	0.00	7.40E-56	2.64E-54	1.03E+00
10950				10943	10943		23.70	1.89	0.63	0.09	0.00	0.00	0.00	7.61E-56	2.72E-54	1.03E+00
10951				10944	10944		23.71	1.89	0.63	0.09	0.00	0.00	0.00	7.82E-56	2.80E-54	1.03E+00
10952				10945	10945		23.71	1.89	0.63	0.09	0.00	0.00	0.00	8.05E-56	2.88E-54	1.03E+00
10953				10946	10946		23.71	1.89	0.63	0.09	0.00	0.00	0.00	8.27E-56	2.96E-54	1.03E+00
10954				10947	10947		23.71	1.89	0.63	0.09	0.00	0.00	0.00	8.51E-56	3.05E-54	1.03E+00
10955				10948	10948		23.71	1.89	0.63	0.09	0.00	0.00	0.00	8.75E-56	3.13E-54	1.03E+00
10956				10949	10949		23.72	1.89	0.63	0.09	0.00	0.00	0.00	9.00E-56	3.22E-54	1.03E+00
10957				10950	10950		23.72	1.89	0.63	0.09	0.00	0.00	0.00	9.25E-56	3.32E-54	1.03E+00
10958				10951	10951		23.72	1.89	0.63	0.09	0.00	0.00	0.00	9.52E-56	3.41E-54	1.03E+00
10959				10952	10952		23.72	1.89	0.63	0.09	0.00	0.00	0.00	9.79E-56	3.51E-54	1.03E+00
10960				10953	10953		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.01E-55	3.61E-54	1.03E+00
10961				10954	10954		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.03E-55	3.71E-54	1.03E+00
10962				10955	10955		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.06E-55	3.82E-54	1.03E+00
10963				10956	10956		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.09E-55	3.93E-54	1.03E+00
10964				10957	10957		23.73	1.89	0.63	0.09	0.00	0.00	0.00	1.13E-55	4.04E-54	1.03E+00
10965				10958	10958		23.74	1.89	0.63	0.09	0.00	0.00	0.00	1.16E-55	4.16E-54	1.03E+00



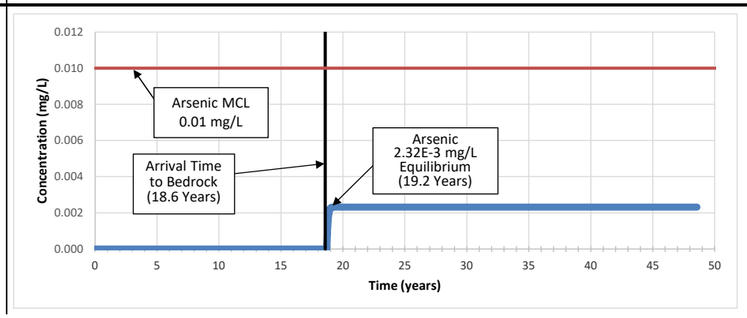
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 11b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-613A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	171.43	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	152.98	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.49	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	6780	18.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	6781	18.57	2.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	6782	18.57	4.04	0.01	0.00	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	6783	18.57	6.06	0.11	0.04	0.01	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	6784	18.57	8.08	0.28	0.09	0.01	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	6785	18.58	10.10	0.48	0.16	0.02	0.97	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6786	18.58	12.12	0.69	0.23	0.03	1.40	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	6787	18.58	14.14	0.91	0.30	0.05	1.83	0.61	0.09	3.91E-208	3.91E-208	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.04E-02	← *=(C4-C5)/C3*	8	6788	18.58	16.16	1.12	0.37	0.06	2.26	0.75	0.11	1.51E-143	1.51E-143	3.85E+64
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	6789	18.59	18.18	1.33	0.44	0.07	2.69	0.90	0.13	1.39E-104	1.39E-104	9.26E+38
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.02	← *=C14*C15/C16*	10	6790	18.59	20.20	1.54	0.51	0.08	3.11	1.04	0.16	2.49E-79	2.49E-79	1.78E+25
18	Retardation Factor	1	*INPUT*	11	6791	18.59	22.21	1.74	0.58	0.09	3.51	1.17	0.18	4.58E-62	4.58E-62	1.84E+17
19	1st Order Decay Constant	0	*INPUT*	12	6792	18.60	24.23	1.94	0.65	0.10	3.91	1.30	0.20	9.25E-50	9.25E-50	2.02E+12
20	Longitudinal Distance to Monitoring Well (ft)	171.43	← *=C3*	13	6793	18.60	26.25	2.13	0.71	0.11	4.30	1.43	0.22	1.08E-40	1.08E-40	1.17E+09
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	6794	18.60	28.27	2.32	0.77	0.12	4.68	1.56	0.23	7.89E-34	7.89E-34	7.31E+06
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	6795	18.60	30.29	2.50	0.83	0.13	5.05	1.68	0.25	1.63E-28	1.63E-28	2.06E+05
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	6796	18.61	32.31	2.68	0.89	0.13	5.41	1.80	0.27	2.54E-24	2.54E-24	1.56E+04
24	Proposed Base Grade Elevation (ft-NGVD)	170.11	*INPUT*	17	6797	18.61	34.33	2.85	0.95	0.14	5.76	1.92	0.29	5.85E-21	5.85E-21	2.30E+03
25	Bedrock Surface Elevation (ft-NGVD)	145.51	*INPUT*	18	6798	18.61	36.35	3.03	1.01	0.15	6.11	2.04	0.31	3.17E-18	3.18E-18	5.42E+02
26	Till Thickness (ft)	24.60	← *=C24-C25*	19	6799	18.61	38.37	3.19	1.06	0.16	6.45	2.15	0.32	5.63E-16	5.66E-16	1.78E+02
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	6800	18.62	40.39	3.35	1.12	0.17	6.78	2.26	0.34	4.18E-14	4.24E-14	7.49E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	6801	18.62	42.41	3.51	1.17	0.18	7.10	2.37	0.35	1.56E-12	1.60E-12	3.77E+01
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	6802	18.62	44.43	3.67	1.22	0.18	7.41	2.47	0.37	3.32E-11	3.48E-11	2.18E+01
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	6803	18.63	46.45	3.82	1.27	0.19	7.72	2.57	0.39	4.51E-10	4.86E-10	1.40E+01
31	Time of Vertical Flow Through Till (days)	6780	← *=C26/C30*	24	6804	18.63	48.47	3.97	1.32	0.20	8.02	2.67	0.40	4.24E-09	4.72E-09	9.72E+00
32				25	6805	18.63	50.49	4.12	1.37	0.21	8.32	2.77	0.42	2.93E-08	3.40E-08	7.20E+00
33				26	6806	18.63	52.51	4.26	1.42	0.21	8.61	2.87	0.43	1.57E-07	1.91E-07	5.61E+00
34				27	6807	18.64	54.53	4.41	1.47	0.22	8.90	2.97	0.44	6.77E-07	8.68E-07	4.55E+00
35				28	6808	18.64	56.55	4.55	1.52	0.23	9.18	3.06	0.46	2.44E-06	3.31E-06	3.81E+00
36				29	6809	18.64	58.57	4.68	1.56	0.23	9.45	3.15	0.47	7.52E-06	1.08E-05	3.27E+00
37				30	6810	18.64	60.59	4.82	1.61	0.24	9.72	3.24	0.49	2.03E-05	3.11E-05	2.88E+00
10949				10942	17722	48.52	22097.70	69.56	23.19	3.48	140.48	46.83	7.02	2.19E-40	3.86E+00	1.00E+00
10950				10943	17723	48.52	22099.72	69.56	23.19	3.48	140.49	46.83	7.02	2.18E-40	3.86E+00	1.00E+00
10951				10944	17724	48.53	22101.73	69.57	23.19	3.48	140.49	46.83	7.02	2.17E-40	3.86E+00	1.00E+00
10952				10945	17725	48.53	22103.75	69.57	23.19	3.48	140.49	46.83	7.02	2.15E-40	3.86E+00	1.00E+00
10953				10946	17726	48.53	22105.77	69.57	23.19	3.48	140.50	46.83	7.02	2.14E-40	3.86E+00	1.00E+00
10954				10947	17727	48.53	22107.79	69.57	23.19	3.48	140.50	46.83	7.03	2.13E-40	3.86E+00	1.00E+00
10955				10948	17728	48.54	22109.81	69.57	23.19	3.48	140.50	46.83	7.03	2.12E-40	3.86E+00	1.00E+00
10956				10949	17729	48.54	22111.83	69.57	23.19	3.48	140.51	46.84	7.03	2.11E-40	3.86E+00	1.00E+00
10957				10950	17730	48.54	22113.85	69.58	23.19	3.48	140.51	46.84	7.03	2.10E-40	3.86E+00	1.00E+00
10958				10951	17731	48.54	22115.87	69.58	23.19	3.48	140.52	46.84	7.03	2.08E-40	3.86E+00	1.00E+00
10959				10952	17732	48.55	22117.89	69.58	23.19	3.48	140.52	46.84	7.03	2.07E-40	3.86E+00	1.00E+00
10960				10953	17733	48.55	22119.91	69.58	23.19	3.48	140.52	46.84	7.03	2.06E-40	3.86E+00	1.00E+00
10961				10954	17734	48.55	22121.93	69.58	23.19	3.48	140.53	46.84	7.03	2.05E-40	3.86E+00	1.00E+00
10962				10955	17735	48.56	22123.95	69.59	23.20	3.48	140.53	46.84	7.03	2.04E-40	3.86E+00	1.00E+00
10963				10956	17736	48.56	22125.97	69.59	23.20	3.48	140.53	46.84	7.03	2.03E-40	3.86E+00	1.00E+00
10964				10957	17737	48.56	22127.99	69.59	23.20	3.48	140.54	46.85	7.03	2.02E-40	3.86E+00	1.00E+00
10965				10958	17738	48.56	22130.01	69.59	23.20	3.48	140.54	46.85	7.03	2.01E-40	3.86E+00	1.00E+00



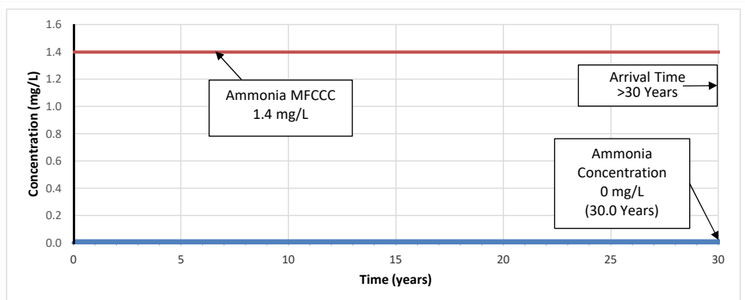
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 11b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-613A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	171.43	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	152.98	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	149.49	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	6780	18.56	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	6781	18.57	2.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	6782	18.57	4.04	0.01	0.00	0.00	0.02	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	6783	18.57	6.06	0.11	0.04	0.01	0.23	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	6784	18.57	8.08	0.28	0.09	0.01	0.57	0.19	0.03	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	6785	18.58	10.10	0.48	0.16	0.02	0.97	0.32	0.05	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6786	18.58	12.12	0.69	0.23	0.03	1.40	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	6787	18.58	14.14	0.91	0.30	0.05	1.83	0.61	0.09	2.36E-211	2.36E-211	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.04E-02	← *=(C4-C5)/C3*	8	6788	18.58	16.16	1.12	0.37	0.06	2.26	0.75	0.11	9.07E-147	9.07E-147	3.85E+64
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	6789	18.59	18.18	1.33	0.44	0.07	2.69	0.90	0.13	8.40E-108	8.40E-108	9.26E+38
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.02	← *=C14*C15/C16*	10	6790	18.59	20.20	1.54	0.51	0.08	3.11	1.04	0.16	1.50E-82	1.50E-82	1.78E+25
18	Retardation Factor	1	*INPUT*	11	6791	18.59	22.21	1.74	0.58	0.09	3.51	1.17	0.18	2.76E-65	2.76E-65	1.84E+17
19	1st Order Decay Constant	0	*INPUT*	12	6792	18.60	24.23	1.94	0.65	0.10	3.91	1.30	0.20	5.57E-53	5.57E-53	2.02E+12
20	Longitudinal Distance to Monitoring Well (ft)	171.43	← *=C3*	13	6793	18.60	26.25	2.13	0.71	0.11	4.30	1.43	0.22	6.50E-44	6.50E-44	1.17E+09
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	6794	18.60	28.27	2.32	0.77	0.12	4.68	1.56	0.23	4.75E-37	4.75E-37	7.31E+06
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	6795	18.60	30.29	2.50	0.83	0.13	5.05	1.68	0.25	9.81E-32	9.81E-32	2.06E+05
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	6796	18.61	32.31	2.68	0.89	0.13	5.41	1.80	0.27	1.53E-27	1.53E-27	1.56E+04
24	Proposed Base Grade Elevation (ft-NGVD)	170.11	*INPUT*	17	6797	18.61	34.33	2.85	0.95	0.14	5.76	1.92	0.29	3.52E-24	3.53E-24	2.30E+03
25	Bedrock Surface Elevation (ft-NGVD)	145.51	*INPUT*	18	6798	18.61	36.35	3.03	1.01	0.15	6.11	2.04	0.31	1.91E-21	1.91E-21	5.42E+02
26	Till Thickness (ft)	24.60	← *=C24-C25*	19	6799	18.61	38.37	3.19	1.06	0.16	6.45	2.15	0.32	3.39E-19	3.41E-19	1.78E+02
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	6800	18.62	40.39	3.35	1.12	0.17	6.78	2.26	0.34	2.52E-17	2.55E-17	7.49E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	6801	18.62	42.41	3.51	1.17	0.18	7.10	2.37	0.35	9.37E-16	9.63E-16	3.77E+01
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	6802	18.62	44.43	3.67	1.22	0.18	7.41	2.47	0.37	2.00E-14	2.10E-14	2.18E+01
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	6803	18.63	46.45	3.82	1.27	0.19	7.72	2.57	0.39	2.72E-13	2.93E-13	1.40E+01
31	Time of Vertical Flow Through Till (days)	6780	← *=C26/C30*	24	6804	18.63	48.47	3.97	1.32	0.20	8.02	2.67	0.40	2.55E-12	2.85E-12	9.72E+00
32				25	6805	18.63	50.49	4.12	1.37	0.21	8.32	2.77	0.42	1.76E-11	2.05E-11	7.20E+00
33				26	6806	18.63	52.51	4.26	1.42	0.21	8.61	2.87	0.43	9.45E-11	1.15E-10	5.61E+00
34				27	6807	18.64	54.53	4.41	1.47	0.22	8.90	2.97	0.44	4.08E-10	5.23E-10	4.55E+00
35				28	6808	18.64	56.55	4.55	1.52	0.23	9.18	3.06	0.46	1.47E-09	1.99E-09	3.81E+00
36				29	6809	18.64	58.57	4.68	1.56	0.23	9.45	3.15	0.47	4.53E-09	6.52E-09	3.27E+00
37				30	6810	18.64	60.59	4.82	1.61	0.24	9.72	3.24	0.49	1.22E-08	1.88E-08	2.88E+00
10949				10942	17722	48.52	22097.70	69.56	23.19	3.48	140.48	46.83	7.02	1.32E-43	2.32E-03	1.00E+00
10950				10943	17723	48.52	22099.72	69.56	23.19	3.48	140.49	46.83	7.02	1.31E-43	2.32E-03	1.00E+00
10951				10944	17724	48.53	22101.73	69.57	23.19	3.48	140.49	46.83	7.02	1.30E-43	2.32E-03	1.00E+00
10952				10945	17725	48.53	22103.75	69.57	23.19	3.48	140.49	46.83	7.02	1.30E-43	2.32E-03	1.00E+00
10953				10946	17726	48.53	22105.77	69.57	23.19	3.48	140.50	46.83	7.02	1.29E-43	2.32E-03	1.00E+00
10954				10947	17727	48.53	22107.79	69.57	23.19	3.48	140.50	46.83	7.03	1.28E-43	2.32E-03	1.00E+00
10955				10948	17728	48.54	22109.81	69.57	23.19	3.48	140.50	46.83	7.03	1.28E-43	2.32E-03	1.00E+00
10956				10949	17729	48.54	22111.83	69.57	23.19	3.48	140.51	46.84	7.03	1.27E-43	2.32E-03	1.00E+00
10957				10950	17730	48.54	22113.85	69.58	23.19	3.48	140.51	46.84	7.03	1.26E-43	2.32E-03	1.00E+00
10958				10951	17731	48.54	22115.87	69.58	23.19	3.48	140.52	46.84	7.03	1.26E-43	2.32E-03	1.00E+00
10959				10952	17732	48.55	22117.89	69.58	23.19	3.48	140.52	46.84	7.03	1.25E-43	2.32E-03	1.00E+00
10960				10953	17733	48.55	22119.91	69.58	23.19	3.48	140.52	46.84	7.03	1.24E-43	2.32E-03	1.00E+00
10961				10954	17734	48.55	22121.93	69.58	23.19	3.48	140.53	46.84	7.03	1.24E-43	2.32E-03	1.00E+00
10962				10955	17735	48.56	22123.95	69.59	23.20	3.48	140.53	46.84	7.03	1.23E-43	2.32E-03	1.00E+00
10963				10956	17736	48.56	22125.97	69.59	23.20	3.48	140.53	46.84	7.03	1.22E-43	2.32E-03	1.00E+00
10964				10957	17737	48.56	22127.99	69.59	23.20	3.48	140.54	46.85	7.03	1.21E-43	2.32E-03	1.00E+00
10965				10958	17738	48.56	22130.01	69.59	23.20	3.48	140.54	46.85	7.03	1.21E-43	2.32E-03	1.00E+00



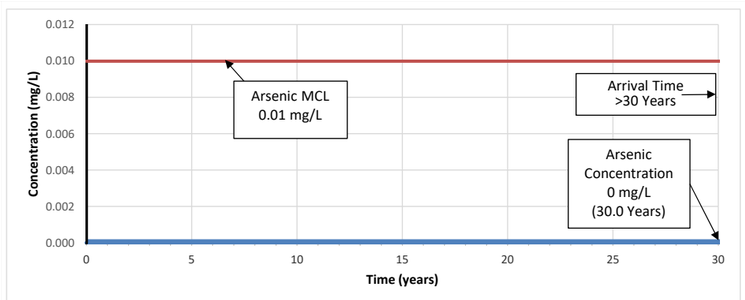
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 12a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-614B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	338.24	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	158.50	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	153.81	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.39E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.48E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	338.24	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	628	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		16.14	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		16.14	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		16.17	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		16.17	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



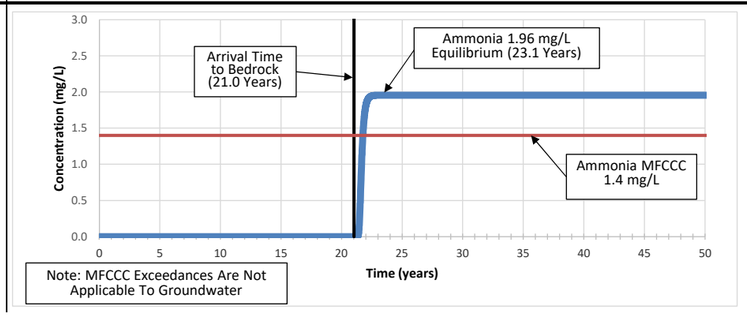
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 12a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-614B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	338.24	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	158.50	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	153.81	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.39E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.48E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	338.24	← *=C3*	13	13		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	628	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		16.14	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		16.14	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		16.15	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		16.16	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		16.17	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		16.17	1.12	0.37	0.06	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

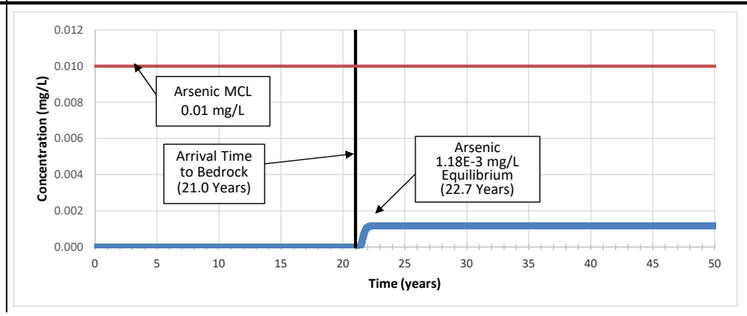
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 12b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-614A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	338.24	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	158.50	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	153.81	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	7676	21.01	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	7677	21.02	1.38	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	7678	21.02	2.75	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	7679	21.02	4.13	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	7680	21.03	5.50	0.07	0.02	0.00	0.10	0.03	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	7681	21.03	6.88	0.18	0.06	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	7682	21.03	8.25	0.30	0.10	0.01	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7683	21.03	9.63	0.43	0.14	0.02	0.60	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.39E-02	← *=(C4-C5)/C3*	8	7684	21.04	11.00	0.58	0.19	0.03	0.79	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7685	21.04	12.38	0.72	0.24	0.04	0.99	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.38	← *=C14*C15/C16*	10	7686	21.04	13.75	0.87	0.29	0.04	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7687	21.04	15.13	1.01	0.34	0.05	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7688	21.05	16.51	1.16	0.39	0.06	1.59	0.53	0.08	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	338.24	← *=C3*	13	7689	21.05	17.88	1.30	0.43	0.07	1.79	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	7690	21.05	19.26	1.44	0.48	0.07	1.98	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	7691	21.06	20.63	1.58	0.53	0.08	2.18	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7692	21.06	22.01	1.72	0.57	0.09	2.37	0.79	0.12	2.08E-286	2.08E-286	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	167.83	*INPUT*	17	7693	21.06	23.38	1.85	0.62	0.09	2.55	0.85	0.13	9.11E-248	9.11E-248	4.38E+38
25	Bedrock Surface Elevation (ft-NGVD)	139.98	*INPUT*	18	7694	21.06	24.76	1.99	0.66	0.10	2.73	0.91	0.14	1.78E-216	1.78E-216	1.96E+31
26	Till Thickness (ft)	27.85	← *=C24-C25*	19	7695	21.07	26.13	2.12	0.71	0.11	2.91	0.97	0.15	8.92E-191	8.92E-191	5.00E+25
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	7696	21.07	27.51	2.25	0.75	0.11	3.09	1.03	0.15	2.09E-169	2.09E-169	2.34E+21
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	7697	21.07	28.89	2.37	0.79	0.12	3.27	1.09	0.16	1.92E-151	1.92E-151	9.19E+17
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	7698	21.08	30.26	2.50	0.83	0.12	3.44	1.15	0.17	3.38E-136	3.38E-136	1.77E+15
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	7699	21.08	31.64	2.62	0.87	0.13	3.60	1.20	0.18	3.83E-123	3.83E-123	1.13E+13
31	Time of Vertical Flow Through Till (days)	7676	← *=C26/C30*	24	7700	21.08	33.01	2.74	0.91	0.14	3.77	1.26	0.19	7.04E-112	7.04E-112	1.84E+11
32				25	7701	21.08	34.39	2.86	0.95	0.14	3.93	1.31	0.20	4.33E-102	4.33E-102	6.14E+09
33				26	7702	21.09	35.76	2.98	0.99	0.15	4.09	1.36	0.20	1.57E-93	1.57E-93	3.64E+08
34				27	7703	21.09	37.14	3.09	1.03	0.15	4.25	1.42	0.21	5.34E-86	5.34E-86	3.39E+07
35				28	7704	21.09	38.51	3.20	1.07	0.16	4.41	1.47	0.22	2.44E-79	2.44E-79	4.57E+06
36				29	7705	21.09	39.89	3.31	1.10	0.17	4.56	1.52	0.23	2.02E-73	2.02E-73	8.30E+05
37				30	7706	21.10	41.26	3.42	1.14	0.17	4.71	1.57	0.24	3.89E-68	3.89E-68	1.92E+05
10949				10942	18618	50.97	15050.68	62.47	20.82	3.12	85.93	28.64	4.30	4.19E-31	1.96E+00	1.00E+00
10950				10943	18619	50.98	15052.06	62.47	20.82	3.12	85.93	28.64	4.30	4.17E-31	1.96E+00	1.00E+00
10951				10944	18620	50.98	15053.44	62.47	20.82	3.12	85.93	28.64	4.30	4.16E-31	1.96E+00	1.00E+00
10952				10945	18621	50.98	15054.81	62.48	20.83	3.12	85.94	28.65	4.30	4.14E-31	1.96E+00	1.00E+00
10953				10946	18622	50.98	15056.19	62.48	20.83	3.12	85.94	28.65	4.30	4.12E-31	1.96E+00	1.00E+00
10954				10947	18623	50.99	15057.56	62.48	20.83	3.12	85.94	28.65	4.30	4.10E-31	1.96E+00	1.00E+00
10955				10948	18624	50.99	15058.94	62.48	20.83	3.12	85.94	28.65	4.30	4.09E-31	1.96E+00	1.00E+00
10956				10949	18625	50.99	15060.31	62.48	20.83	3.12	85.94	28.65	4.30	4.07E-31	1.96E+00	1.00E+00
10957				10950	18626	50.99	15061.69	62.48	20.83	3.12	85.95	28.65	4.30	4.05E-31	1.96E+00	1.00E+00
10958				10951	18627	51.00	15063.06	62.49	20.83	3.12	85.95	28.65	4.30	4.04E-31	1.96E+00	1.00E+00
10959				10952	18628	51.00	15064.44	62.49	20.83	3.12	85.95	28.65	4.30	4.02E-31	1.96E+00	1.00E+00
10960				10953	18629	51.00	15065.82	62.49	20.83	3.12	85.95	28.65	4.30	4.00E-31	1.96E+00	1.00E+00
10961				10954	18630	51.01	15067.19	62.49	20.83	3.12	85.96	28.65	4.30	3.99E-31	1.96E+00	1.00E+00
10962				10955	18631	51.01	15068.57	62.49	20.83	3.12	85.96	28.65	4.30	3.97E-31	1.96E+00	1.00E+00
10963				10956	18632	51.01	15069.94	62.49	20.83	3.12	85.96	28.65	4.30	3.95E-31	1.96E+00	1.00E+00
10964				10957	18633	51.01	15071.32	62.50	20.83	3.12	85.96	28.65	4.30	3.94E-31	1.96E+00	1.00E+00
10965				10958	18634	51.02	15072.69	62.50	20.83	3.12	85.96	28.65	4.30	3.92E-31	1.96E+00	1.00E+00



Note: MFCCC Exceedances Are Not Applicable To Groundwater

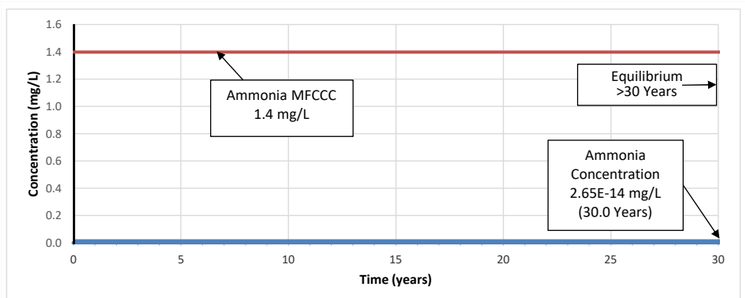
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 12b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-614A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	338.24	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	158.50	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	153.81	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	7676	21.01	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	7677	21.02	1.38	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	7678	21.02	2.75	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	7679	21.02	4.13	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	7680	21.03	5.50	0.07	0.02	0.00	0.10	0.03	0.01	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	7681	21.03	6.88	0.18	0.06	0.01	0.24	0.08	0.01	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	7682	21.03	8.25	0.30	0.10	0.01	0.41	0.14	0.02	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	7683	21.03	9.63	0.43	0.14	0.02	0.60	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.39E-02	← *=(C4-C5)/C3*	8	7684	21.04	11.00	0.58	0.19	0.03	0.79	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	7685	21.04	12.38	0.72	0.24	0.04	0.99	0.33	0.05	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.38	← *=C14*C15/C16*	10	7686	21.04	13.75	0.87	0.29	0.04	1.19	0.40	0.06	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	7687	21.04	15.13	1.01	0.34	0.05	1.39	0.46	0.07	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	7688	21.05	16.51	1.16	0.39	0.06	1.59	0.53	0.08	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	338.24	← *=C3*	13	7689	21.05	17.88	1.30	0.43	0.07	1.79	0.60	0.09	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	7690	21.05	19.26	1.44	0.48	0.07	1.98	0.66	0.10	0.00E+00	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	7691	21.06	20.63	1.58	0.53	0.08	2.18	0.73	0.11	0.00E+00	0.00E+00	#DIV/0!
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	7692	21.06	22.01	1.72	0.57	0.09	2.37	0.79	0.12	1.25E-289	1.25E-289	#DIV/0!
24	Proposed Base Grade Elevation (ft-NGVD)	167.83	*INPUT*	17	7693	21.06	23.38	1.85	0.62	0.09	2.55	0.85	0.13	5.49E-251	5.49E-251	4.38E+38
25	Bedrock Surface Elevation (ft-NGVD)	139.98	*INPUT*	18	7694	21.06	24.76	1.99	0.66	0.10	2.73	0.91	0.14	1.07E-219	1.07E-219	1.96E+31
26	Till Thickness (ft)	27.85	← *=C24-C25*	19	7695	21.07	26.13	2.12	0.71	0.11	2.91	0.97	0.15	5.37E-194	5.37E-194	5.00E+25
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	7696	21.07	27.51	2.25	0.75	0.11	3.09	1.03	0.15	1.26E-172	1.26E-172	2.34E+21
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	7697	21.07	28.89	2.37	0.79	0.12	3.27	1.09	0.16	1.15E-154	1.15E-154	9.19E+17
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	7698	21.08	30.26	2.50	0.83	0.12	3.44	1.15	0.17	2.04E-139	2.04E-139	1.77E+15
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	7699	21.08	31.64	2.62	0.87	0.13	3.60	1.20	0.18	2.31E-126	2.31E-126	1.13E+13
31	Time of Vertical Flow Through Till (days)	7676	← *=C26/C30*	24	7700	21.08	33.01	2.74	0.91	0.14	3.77	1.26	0.19	4.24E-115	4.24E-115	1.84E+11
32				25	7701	21.08	34.39	2.86	0.95	0.14	3.93	1.31	0.20	2.61E-105	2.61E-105	6.14E+09
33				26	7702	21.09	35.76	2.98	0.99	0.15	4.09	1.36	0.20	9.47E-97	9.47E-97	3.64E+08
34				27	7703	21.09	37.14	3.09	1.03	0.15	4.25	1.42	0.21	3.21E-89	3.21E-89	3.39E+07
35				28	7704	21.09	38.51	3.20	1.07	0.16	4.41	1.47	0.22	1.47E-82	1.47E-82	4.57E+06
36				29	7705	21.09	39.89	3.31	1.10	0.17	4.56	1.52	0.23	1.22E-76	1.22E-76	8.30E+05
37				30	7706	21.10	41.26	3.42	1.14	0.17	4.71	1.57	0.24	2.34E-71	2.34E-71	1.92E+05
10949				10942	18618	50.97	15050.68	62.47	20.82	3.12	85.93	28.64	4.30	2.52E-34	1.18E-03	1.00E+00
10950				10943	18619	50.98	15052.06	62.47	20.82	3.12	85.93	28.64	4.30	2.51E-34	1.18E-03	1.00E+00
10951				10944	18620	50.98	15053.44	62.47	20.82	3.12	85.93	28.64	4.30	2.50E-34	1.18E-03	1.00E+00
10952				10945	18621	50.98	15054.81	62.48	20.83	3.12	85.94	28.65	4.30	2.49E-34	1.18E-03	1.00E+00
10953				10946	18622	50.98	15056.19	62.48	20.83	3.12	85.94	28.65	4.30	2.48E-34	1.18E-03	1.00E+00
10954				10947	18623	50.99	15057.56	62.48	20.83	3.12	85.94	28.65	4.30	2.47E-34	1.18E-03	1.00E+00
10955				10948	18624	50.99	15058.94	62.48	20.83	3.12	85.94	28.65	4.30	2.46E-34	1.18E-03	1.00E+00
10956				10949	18625	50.99	15060.31	62.48	20.83	3.12	85.94	28.65	4.30	2.45E-34	1.18E-03	1.00E+00
10957				10950	18626	50.99	15061.69	62.48	20.83	3.12	85.95	28.65	4.30	2.44E-34	1.18E-03	1.00E+00
10958				10951	18627	51.00	15063.06	62.49	20.83	3.12	85.95	28.65	4.30	2.43E-34	1.18E-03	1.00E+00
10959				10952	18628	51.00	15064.44	62.49	20.83	3.12	85.95	28.65	4.30	2.42E-34	1.18E-03	1.00E+00
10960				10953	18629	51.00	15065.82	62.49	20.83	3.12	85.95	28.65	4.30	2.41E-34	1.18E-03	1.00E+00
10961				10954	18630	51.01	15067.19	62.49	20.83	3.12	85.96	28.65	4.30	2.40E-34	1.18E-03	1.00E+00
10962				10955	18631	51.01	15068.57	62.49	20.83	3.12	85.96	28.65	4.30	2.39E-34	1.18E-03	1.00E+00
10963				10956	18632	51.01	15069.94	62.49	20.83	3.12	85.96	28.65	4.30	2.38E-34	1.18E-03	1.00E+00
10964				10957	18633	51.01	15071.32	62.50	20.83	3.12	85.96	28.65	4.30	2.37E-34	1.18E-03	1.00E+00
10965				10958	18634	51.02	15072.69	62.50	20.83	3.12	85.96	28.65	4.30	2.36E-34	1.18E-03	1.00E+00



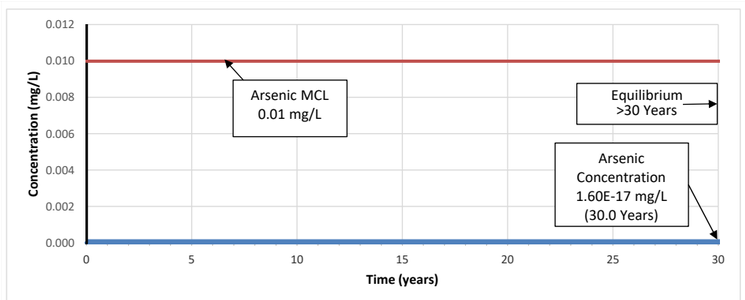
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 13a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-615B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	170.43	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	160.52	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	155.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.24E-02	← *=(C4-C5)/C3*	8	8		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.45E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	170.43	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	135	← *=(C20/C17)*365.25*	17	17		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		37.71	3.14	1.05	0.16	0.01	0.00	0.00	2.01E-16	2.31E-14	1.01E+00
10950				10943	10943		37.71	3.14	1.05	0.16	0.01	0.00	0.00	2.02E-16	2.33E-14	1.01E+00
10951				10944	10944		37.71	3.14	1.05	0.16	0.01	0.00	0.00	2.04E-16	2.35E-14	1.01E+00
10952				10945	10945		37.72	3.14	1.05	0.16	0.01	0.00	0.00	2.06E-16	2.37E-14	1.01E+00
10953				10946	10946		37.72	3.14	1.05	0.16	0.01	0.00	0.00	2.08E-16	2.39E-14	1.01E+00
10954				10947	10947		37.73	3.14	1.05	0.16	0.01	0.00	0.00	2.09E-16	2.41E-14	1.01E+00
10955				10948	10948		37.73	3.14	1.05	0.16	0.01	0.00	0.00	2.11E-16	2.43E-14	1.01E+00
10956				10949	10949		37.73	3.14	1.05	0.16	0.01	0.00	0.00	2.13E-16	2.45E-14	1.01E+00
10957				10950	10950		37.74	3.14	1.05	0.16	0.01	0.00	0.00	2.15E-16	2.47E-14	1.01E+00
10958				10951	10951		37.74	3.14	1.05	0.16	0.01	0.00	0.00	2.17E-16	2.50E-14	1.01E+00
10959				10952	10952		37.74	3.14	1.05	0.16	0.01	0.00	0.00	2.18E-16	2.52E-14	1.01E+00
10960				10953	10953		37.75	3.14	1.05	0.16	0.01	0.00	0.00	2.20E-16	2.54E-14	1.01E+00
10961				10954	10954		37.75	3.14	1.05	0.16	0.01	0.00	0.00	2.22E-16	2.56E-14	1.01E+00
10962				10955	10955		37.75	3.14	1.05	0.16	0.01	0.00	0.00	2.24E-16	2.58E-14	1.01E+00
10963				10956	10956		37.76	3.14	1.05	0.16	0.01	0.00	0.00	2.26E-16	2.61E-14	1.01E+00
10964				10957	10957		37.76	3.14	1.05	0.16	0.01	0.00	0.00	2.28E-16	2.63E-14	1.01E+00
10965				10958	10958		37.76	3.14	1.05	0.16	0.01	0.00	0.00	2.30E-16	2.65E-14	1.01E+00



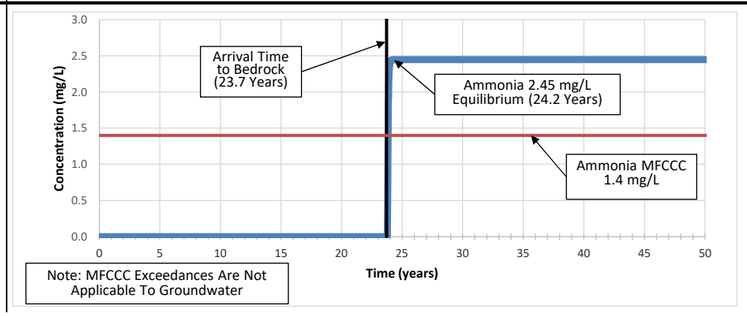
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 13a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-615B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	170.43	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	160.52	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	155.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.24E-02	← *=(C4-C5)/C3*	8	8		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.45E-03	← *=C14*C15/C16*	10	10		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	170.43	← *=C3*	13	13		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	135	← *=(C20/C17)*365.25*	17	17		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		37.71	3.14	1.05	0.16	0.01	0.00	0.00	1.21E-19	1.39E-17	1.01E+00
10950				10943	10943		37.71	3.14	1.05	0.16	0.01	0.00	0.00	1.22E-19	1.40E-17	1.01E+00
10951				10944	10944		37.71	3.14	1.05	0.16	0.01	0.00	0.00	1.23E-19	1.41E-17	1.01E+00
10952				10945	10945		37.72	3.14	1.05	0.16	0.01	0.00	0.00	1.24E-19	1.43E-17	1.01E+00
10953				10946	10946		37.72	3.14	1.05	0.16	0.01	0.00	0.00	1.25E-19	1.44E-17	1.01E+00
10954				10947	10947		37.73	3.14	1.05	0.16	0.01	0.00	0.00	1.26E-19	1.45E-17	1.01E+00
10955				10948	10948		37.73	3.14	1.05	0.16	0.01	0.00	0.00	1.27E-19	1.46E-17	1.01E+00
10956				10949	10949		37.73	3.14	1.05	0.16	0.01	0.00	0.00	1.28E-19	1.48E-17	1.01E+00
10957				10950	10950		37.74	3.14	1.05	0.16	0.01	0.00	0.00	1.29E-19	1.49E-17	1.01E+00
10958				10951	10951		37.74	3.14	1.05	0.16	0.01	0.00	0.00	1.30E-19	1.50E-17	1.01E+00
10959				10952	10952		37.74	3.14	1.05	0.16	0.01	0.00	0.00	1.32E-19	1.52E-17	1.01E+00
10960				10953	10953		37.75	3.14	1.05	0.16	0.01	0.00	0.00	1.33E-19	1.53E-17	1.01E+00
10961				10954	10954		37.75	3.14	1.05	0.16	0.01	0.00	0.00	1.34E-19	1.54E-17	1.01E+00
10962				10955	10955		37.75	3.14	1.05	0.16	0.01	0.00	0.00	1.35E-19	1.56E-17	1.01E+00
10963				10956	10956		37.76	3.14	1.05	0.16	0.01	0.00	0.00	1.36E-19	1.57E-17	1.01E+00
10964				10957	10957		37.76	3.14	1.05	0.16	0.01	0.00	0.00	1.37E-19	1.58E-17	1.01E+00
10965				10958	10958		37.76	3.14	1.05	0.16	0.01	0.00	0.00	1.38E-19	1.60E-17	1.01E+00



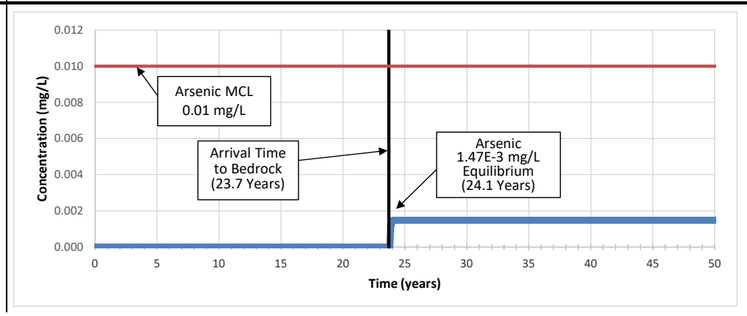
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 13b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-615A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	170.43	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	160.52	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	155.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8657	23.70	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8658	23.70	3.21	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8659	23.71	6.43	0.14	0.05	0.01	0.45	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
10				3	8660	23.71	9.64	0.44	0.15	0.02	1.40	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	8661	23.71	12.85	0.77	0.26	0.04	2.48	0.83	0.12	1.37E-270	1.37E-270	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	8662	23.71	16.06	1.11	0.37	0.06	3.57	1.19	0.18	6.58E-144	6.58E-144	4.81E+126
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	8663	23.72	19.28	1.44	0.48	0.07	4.64	1.55	0.23	2.25E-88	2.25E-88	3.42E+55
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8664	23.72	22.49	1.77	0.59	0.09	5.68	1.89	0.28	2.49E-59	2.49E-59	1.11E+29
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.24E-02	← *=(C4-C5)/C3*	8	8665	23.72	25.70	2.08	0.69	0.10	6.68	2.23	0.33	2.55E-42	2.55E-42	1.02E+17
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8666	23.73	28.92	2.38	0.79	0.12	7.64	2.55	0.38	1.52E-31	1.52E-31	5.97E+10
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	3.21	← *=C14*C15/C16*	10	8667	23.73	32.13	2.66	0.89	0.13	8.56	2.85	0.43	2.60E-24	2.60E-24	1.71E+07
18	Retardation Factor	1	*INPUT*	11	8668	23.73	35.34	2.94	0.98	0.15	9.45	3.15	0.47	3.07E-19	3.07E-19	1.18E+05
19	1st Order Decay Constant	0	*INPUT*	12	8669	23.73	38.56	3.21	1.07	0.16	10.30	3.43	0.52	1.47E-15	1.47E-15	4.80E+03
20	Longitudinal Distance to Monitoring Well (ft)	170.43	← *=C3*	13	8670	23.74	41.77	3.46	1.15	0.17	11.13	3.71	0.56	8.23E-13	8.25E-13	5.60E+02
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	8671	23.74	44.98	3.71	1.24	0.19	11.93	3.98	0.60	1.03E-10	1.04E-10	1.26E+02
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	8672	23.74	48.19	3.95	1.32	0.20	12.70	4.23	0.64	4.40E-09	4.50E-09	4.34E+01
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8673	23.74	51.41	4.19	1.40	0.21	13.45	4.48	0.67	8.54E-08	8.99E-08	2.00E+01
24	Proposed Base Grade Elevation (ft-NGVD)	169.09	*INPUT*	17	8674	23.75	54.62	4.41	1.47	0.22	14.18	4.73	0.71	9.18E-07	1.01E-06	1.12E+01
25	Bedrock Surface Elevation (ft-NGVD)	137.68	*INPUT*	18	8675	23.75	57.83	4.63	1.54	0.23	14.88	4.96	0.74	6.27E-06	7.28E-06	7.22E+00
26	Till Thickness (ft)	31.41	← *=C24-C25*	19	8676	23.75	61.05	4.85	1.62	0.24	15.57	5.19	0.78	3.02E-05	3.75E-05	5.14E+00
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8677	23.76	64.26	5.05	1.68	0.25	16.24	5.41	0.81	1.10E-04	1.47E-04	3.94E+00
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8678	23.76	67.47	5.26	1.75	0.26	16.89	5.63	0.84	3.22E-04	4.69E-04	3.18E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8679	23.76	70.69	5.45	1.82	0.27	17.52	5.84	0.88	7.88E-04	1.26E-03	2.68E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8680	23.76	73.90	5.65	1.88	0.28	18.14	6.05	0.91	1.67E-03	2.92E-03	2.33E+00
31	Time of Vertical Flow Through Till (days)	8657	← *=C26/C30*	24	8681	23.77	77.11	5.83	1.94	0.29	18.74	6.25	0.94	3.13E-03	6.06E-03	2.07E+00
32				25	8682	23.77	80.32	6.02	2.01	0.30	19.33	6.44	0.97	5.34E-03	1.14E-02	1.88E+00
33				26	8683	23.77	83.54	6.20	2.07	0.31	19.91	6.64	1.00	8.38E-03	1.98E-02	1.73E+00
34				27	8684	23.78	86.75	6.37	2.12	0.32	20.48	6.83	1.02	1.23E-02	3.20E-02	1.62E+00
35				28	8685	23.78	89.96	6.55	2.18	0.33	21.03	7.01	1.05	1.69E-02	4.90E-02	1.53E+00
36				29	8686	23.78	93.18	6.71	2.24	0.34	21.57	7.19	1.08	2.23E-02	7.12E-02	1.45E+00
37				30	8687	23.78	96.39	6.88	2.29	0.34	22.10	7.37	1.11	2.80E-02	9.93E-02	1.39E+00
10949				10942	19599	53.66	35156.16	78.74	26.25	3.94	252.99	84.33	12.65	8.06E-55	2.45E+00	1.00E+00
10950				10943	19600	53.66	35159.37	78.74	26.25	3.94	252.99	84.33	12.65	8.00E-55	2.45E+00	1.00E+00
10951				10944	19601	53.66	35162.58	78.74	26.25	3.94	253.00	84.33	12.65	7.94E-55	2.45E+00	1.00E+00
10952				10945	19602	53.67	35165.80	78.74	26.25	3.94	253.00	84.33	12.65	7.88E-55	2.45E+00	1.00E+00
10953				10946	19603	53.67	35169.01	78.75	26.25	3.94	253.01	84.34	12.65	7.82E-55	2.45E+00	1.00E+00
10954				10947	19604	53.67	35172.22	78.75	26.25	3.94	253.02	84.34	12.65	7.75E-55	2.45E+00	1.00E+00
10955				10948	19605	53.68	35175.44	78.75	26.25	3.94	253.02	84.34	12.65	7.70E-55	2.45E+00	1.00E+00
10956				10949	19606	53.68	35178.65	78.75	26.25	3.94	253.03	84.34	12.65	7.64E-55	2.45E+00	1.00E+00
10957				10950	19607	53.68	35181.86	78.75	26.25	3.94	253.03	84.34	12.65	7.58E-55	2.45E+00	1.00E+00
10958				10951	19608	53.68	35185.08	78.76	26.25	3.94	253.04	84.35	12.65	7.52E-55	2.45E+00	1.00E+00
10959				10952	19609	53.69	35188.29	78.76	26.25	3.94	253.05	84.35	12.65	7.46E-55	2.45E+00	1.00E+00
10960				10953	19610	53.69	35191.50	78.76	26.25	3.94	253.05	84.35	12.65	7.40E-55	2.45E+00	1.00E+00
10961				10954	19611	53.69	35194.71	78.76	26.25	3.94	253.06	84.35	12.65	7.35E-55	2.45E+00	1.00E+00
10962				10955	19612	53.69	35197.93	78.76	26.25	3.94	253.06	84.35	12.65	7.29E-55	2.45E+00	1.00E+00
10963				10956	19613	53.70	35201.14	78.77	26.26	3.94	253.07	84.36	12.65	7.23E-55	2.45E+00	1.00E+00
10964				10957	19614	53.70	35204.35	78.77	26.26	3.94	253.08	84.36	12.65	7.18E-55	2.45E+00	1.00E+00
10965				10958	19615	53.70	35207.57	78.77	26.26	3.94	253.08	84.36	12.65	7.12E-55	2.45E+00	1.00E+00



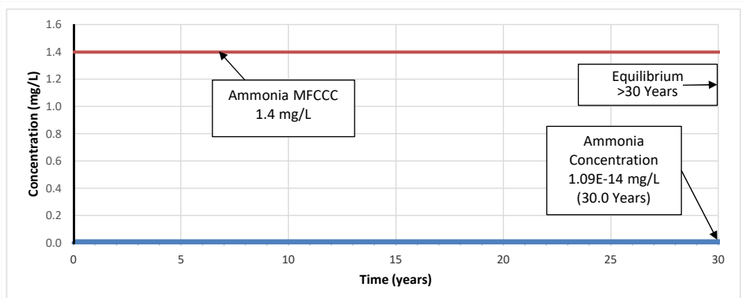
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 13b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-615A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	170.43	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	160.52	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	155.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8657	23.70	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8658	23.70	3.21	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8659	23.71	6.43	0.14	0.05	0.01	0.45	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
10				3	8660	23.71	9.64	0.44	0.15	0.02	1.40	0.47	0.07	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	8661	23.71	12.85	0.77	0.26	0.04	2.48	0.83	0.12	8.23E-274	8.23E-274	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	8662	23.71	16.06	1.11	0.37	0.06	3.57	1.19	0.18	3.96E-147	3.96E-147	4.81E+126
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	8663	23.72	19.28	1.44	0.48	0.07	4.64	1.55	0.23	1.36E-91	1.36E-91	3.42E+55
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8664	23.72	22.49	1.77	0.59	0.09	5.68	1.89	0.28	1.50E-62	1.50E-62	1.11E+29
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.24E-02	← *=(C4-C5)/C3*	8	8665	23.72	25.70	2.08	0.69	0.10	6.68	2.23	0.33	1.54E-45	1.54E-45	1.02E+17
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8666	23.73	28.92	2.38	0.79	0.12	7.64	2.55	0.38	9.18E-35	9.18E-35	5.97E+10
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	3.21	← *=C14*C15/C16*	10	8667	23.73	32.13	2.66	0.89	0.13	8.56	2.85	0.43	1.57E-27	1.57E-27	1.71E+07
18	Retardation Factor	1	*INPUT*	11	8668	23.73	35.34	2.94	0.98	0.15	9.45	3.15	0.47	1.85E-22	1.85E-22	1.18E+05
19	1st Order Decay Constant	0	*INPUT*	12	8669	23.73	38.56	3.21	1.07	0.16	10.30	3.43	0.52	8.87E-19	8.88E-19	4.80E+03
20	Longitudinal Distance to Monitoring Well (ft)	170.43	← *=C3*	13	8670	23.74	41.77	3.46	1.15	0.17	11.13	3.71	0.56	4.96E-16	4.97E-16	5.60E+02
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	8671	23.74	44.98	3.71	1.24	0.19	11.93	3.98	0.60	6.20E-14	6.25E-14	1.26E+02
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	8672	23.74	48.19	3.95	1.32	0.20	12.70	4.23	0.64	2.65E-12	2.71E-12	4.34E+01
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8673	23.74	51.41	4.19	1.40	0.21	13.45	4.48	0.67	5.14E-11	5.42E-11	2.00E+01
24	Proposed Base Grade Elevation (ft-NGVD)	169.09	*INPUT*	17	8674	23.75	54.62	4.41	1.47	0.22	14.18	4.73	0.71	5.53E-10	6.07E-10	1.12E+01
25	Bedrock Surface Elevation (ft-NGVD)	137.68	*INPUT*	18	8675	23.75	57.83	4.63	1.54	0.23	14.88	4.96	0.74	3.78E-09	4.39E-09	7.22E+00
26	Till Thickness (ft)	31.41	← *=C24-C25*	19	8676	23.75	61.05	4.85	1.62	0.24	15.57	5.19	0.78	1.82E-08	2.26E-08	5.14E+00
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8677	23.76	64.26	5.05	1.68	0.25	16.24	5.41	0.81	6.63E-08	8.88E-08	3.94E+00
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8678	23.76	67.47	5.26	1.75	0.26	16.89	5.63	0.84	1.94E-07	2.83E-07	3.18E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8679	23.76	70.69	5.45	1.82	0.27	17.52	5.84	0.88	4.74E-07	7.57E-07	2.68E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8680	23.76	73.90	5.65	1.88	0.28	18.14	6.05	0.91	1.00E-06	1.76E-06	2.33E+00
31	Time of Vertical Flow Through Till (days)	8657	← *=C26/C30*	24	8681	23.77	77.11	5.83	1.94	0.29	18.74	6.25	0.94	1.89E-06	3.65E-06	2.07E+00
32				25	8682	23.77	80.32	6.02	2.01	0.30	19.33	6.44	0.97	3.22E-06	6.86E-06	1.88E+00
33				26	8683	23.77	83.54	6.20	2.07	0.31	19.91	6.64	1.00	5.04E-06	1.19E-05	1.73E+00
34				27	8684	23.78	86.75	6.37	2.12	0.32	20.48	6.83	1.02	7.38E-06	1.93E-05	1.62E+00
35				28	8685	23.78	89.96	6.55	2.18	0.33	21.03	7.01	1.05	1.02E-05	2.95E-05	1.53E+00
36				29	8686	23.78	93.18	6.71	2.24	0.34	21.57	7.19	1.08	1.34E-05	4.29E-05	1.45E+00
37				30	8687	23.78	96.39	6.88	2.29	0.34	22.10	7.37	1.11	1.69E-05	5.98E-05	1.39E+00
10949				10942	19599	53.66	35156.16	78.74	26.25	3.94	252.99	84.33	12.65	4.85E-58	1.47E-03	1.00E+00
10950				10943	19600	53.66	35159.37	78.74	26.25	3.94	252.99	84.33	12.65	4.82E-58	1.47E-03	1.00E+00
10951				10944	19601	53.66	35162.58	78.74	26.25	3.94	253.00	84.33	12.65	4.78E-58	1.47E-03	1.00E+00
10952				10945	19602	53.67	35165.80	78.74	26.25	3.94	253.00	84.33	12.65	4.74E-58	1.47E-03	1.00E+00
10953				10946	19603	53.67	35169.01	78.75	26.25	3.94	253.01	84.34	12.65	4.71E-58	1.47E-03	1.00E+00
10954				10947	19604	53.67	35172.22	78.75	26.25	3.94	253.02	84.34	12.65	4.67E-58	1.47E-03	1.00E+00
10955				10948	19605	53.68	35175.44	78.75	26.25	3.94	253.02	84.34	12.65	4.63E-58	1.47E-03	1.00E+00
10956				10949	19606	53.68	35178.65	78.75	26.25	3.94	253.03	84.34	12.65	4.60E-58	1.47E-03	1.00E+00
10957				10950	19607	53.68	35181.86	78.75	26.25	3.94	253.03	84.34	12.65	4.56E-58	1.47E-03	1.00E+00
10958				10951	19608	53.68	35185.08	78.76	26.25	3.94	253.04	84.35	12.65	4.53E-58	1.47E-03	1.00E+00
10959				10952	19609	53.69	35188.29	78.76	26.25	3.94	253.05	84.35	12.65	4.49E-58	1.47E-03	1.00E+00
10960				10953	19610	53.69	35191.50	78.76	26.25	3.94	253.05	84.35	12.65	4.46E-58	1.47E-03	1.00E+00
10961				10954	19611	53.69	35194.71	78.76	26.25	3.94	253.06	84.35	12.65	4.42E-58	1.47E-03	1.00E+00
10962				10955	19612	53.69	35197.93	78.76	26.25	3.94	253.06	84.35	12.65	4.39E-58	1.47E-03	1.00E+00
10963				10956	19613	53.70	35201.14	78.77	26.26	3.94	253.07	84.36	12.65	4.36E-58	1.47E-03	1.00E+00
10964				10957	19614	53.70	35204.35	78.77	26.26	3.94	253.08	84.36	12.65	4.32E-58	1.47E-03	1.00E+00
10965				10958	19615	53.70	35207.57	78.77	26.26	3.94	253.08	84.36	12.65	4.29E-58	1.47E-03	1.00E+00



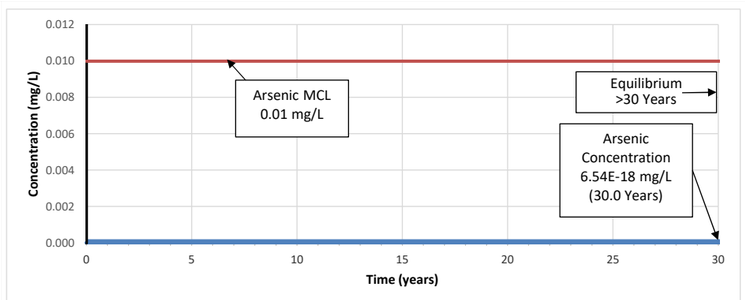
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 14a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-616B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	100.03	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	162.96	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	161.06	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.90E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.02E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	100.03	← *=C3*	13	13		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	136	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		22.11	1.73	0.58	0.09	0.00	0.00	0.00	9.44E-17	9.21E-15	1.01E+00
10950				10943	10943		22.12	1.73	0.58	0.09	0.00	0.00	0.00	9.54E-17	9.31E-15	1.01E+00
10951				10944	10944		22.12	1.73	0.58	0.09	0.00	0.00	0.00	9.63E-17	9.40E-15	1.01E+00
10952				10945	10945		22.12	1.73	0.58	0.09	0.00	0.00	0.00	9.73E-17	9.50E-15	1.01E+00
10953				10946	10946		22.12	1.73	0.58	0.09	0.00	0.00	0.00	9.83E-17	9.60E-15	1.01E+00
10954				10947	10947		22.12	1.73	0.58	0.09	0.00	0.00	0.00	9.93E-17	9.70E-15	1.01E+00
10955				10948	10948		22.13	1.73	0.58	0.09	0.00	0.00	0.00	1.00E-16	9.80E-15	1.01E+00
10956				10949	10949		22.13	1.73	0.58	0.09	0.00	0.00	0.00	1.01E-16	9.90E-15	1.01E+00
10957				10950	10950		22.13	1.73	0.58	0.09	0.00	0.00	0.00	1.02E-16	1.00E-14	1.01E+00
10958				10951	10951		22.13	1.73	0.58	0.09	0.00	0.00	0.00	1.03E-16	1.01E-14	1.01E+00
10959				10952	10952		22.13	1.73	0.58	0.09	0.00	0.00	0.00	1.04E-16	1.02E-14	1.01E+00
10960				10953	10953		22.14	1.73	0.58	0.09	0.00	0.00	0.00	1.05E-16	1.03E-14	1.01E+00
10961				10954	10954		22.14	1.73	0.58	0.09	0.00	0.00	0.00	1.06E-16	1.04E-14	1.01E+00
10962				10955	10955		22.14	1.73	0.58	0.09	0.00	0.00	0.00	1.07E-16	1.05E-14	1.01E+00
10963				10956	10956		22.14	1.73	0.58	0.09	0.00	0.00	0.00	1.09E-16	1.06E-14	1.01E+00
10964				10957	10957		22.14	1.73	0.58	0.09	0.00	0.00	0.00	1.10E-16	1.07E-14	1.01E+00
10965				10958	10958		22.15	1.73	0.58	0.09	0.00	0.00	0.00	1.11E-16	1.09E-14	1.01E+00



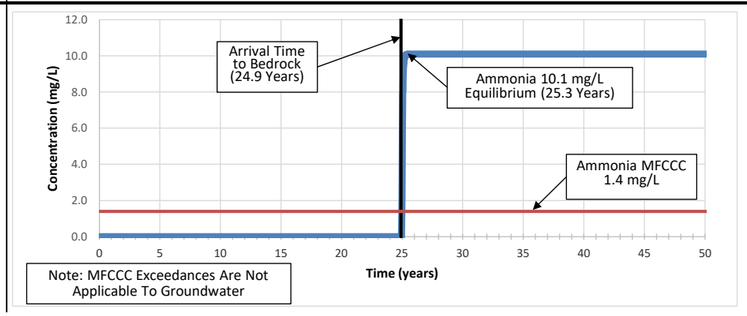
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 14a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-616B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	100.03	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	162.96	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	161.06	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.90E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.02E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	100.03	← *=C3*	13	13		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	136	← *=(C20/C17)*365.25*	17	17		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		22.11	1.73	0.58	0.09	0.00	0.00	0.00	5.69E-20	5.55E-18	1.01E+00
10950				10943	10943		22.12	1.73	0.58	0.09	0.00	0.00	0.00	5.74E-20	5.60E-18	1.01E+00
10951				10944	10944		22.12	1.73	0.58	0.09	0.00	0.00	0.00	5.80E-20	5.66E-18	1.01E+00
10952				10945	10945		22.12	1.73	0.58	0.09	0.00	0.00	0.00	5.86E-20	5.72E-18	1.01E+00
10953				10946	10946		22.12	1.73	0.58	0.09	0.00	0.00	0.00	5.92E-20	5.78E-18	1.01E+00
10954				10947	10947		22.12	1.73	0.58	0.09	0.00	0.00	0.00	5.98E-20	5.84E-18	1.01E+00
10955				10948	10948		22.13	1.73	0.58	0.09	0.00	0.00	0.00	6.04E-20	5.90E-18	1.01E+00
10956				10949	10949		22.13	1.73	0.58	0.09	0.00	0.00	0.00	6.10E-20	5.96E-18	1.01E+00
10957				10950	10950		22.13	1.73	0.58	0.09	0.00	0.00	0.00	6.16E-20	6.02E-18	1.01E+00
10958				10951	10951		22.13	1.73	0.58	0.09	0.00	0.00	0.00	6.22E-20	6.09E-18	1.01E+00
10959				10952	10952		22.13	1.73	0.58	0.09	0.00	0.00	0.00	6.28E-20	6.15E-18	1.01E+00
10960				10953	10953		22.14	1.73	0.58	0.09	0.00	0.00	0.00	6.34E-20	6.21E-18	1.01E+00
10961				10954	10954		22.14	1.73	0.58	0.09	0.00	0.00	0.00	6.41E-20	6.28E-18	1.01E+00
10962				10955	10955		22.14	1.73	0.58	0.09	0.00	0.00	0.00	6.47E-20	6.34E-18	1.01E+00
10963				10956	10956		22.14	1.73	0.58	0.09	0.00	0.00	0.00	6.54E-20	6.41E-18	1.01E+00
10964				10957	10957		22.14	1.73	0.58	0.09	0.00	0.00	0.00	6.60E-20	6.47E-18	1.01E+00
10965				10958	10958		22.15	1.73	0.58	0.09	0.00	0.00	0.00	6.67E-20	6.54E-18	1.01E+00



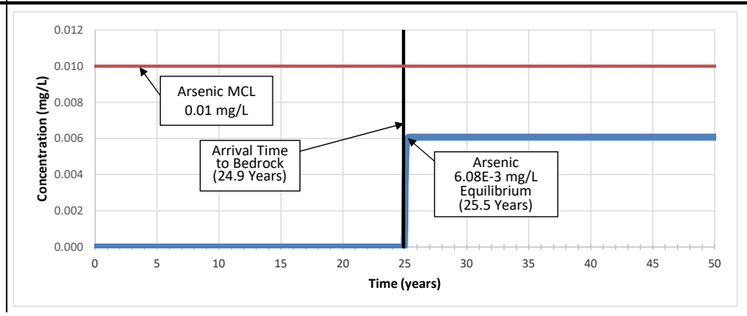
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 14b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-616A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	100.03	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	162.96	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	161.06	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	9090	24.89	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	9091	24.89	1.88	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	9092	24.89	3.77	0.00	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	9093	24.89	5.65	0.08	0.03	0.00	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	9094	24.90	7.54	0.23	0.08	0.01	0.44	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	9095	24.90	9.42	0.41	0.14	0.02	0.78	0.26	0.04	1.13E-226	1.13E-226	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	9096	24.90	11.31	0.61	0.20	0.03	1.15	0.38	0.06	9.59E-123	9.59E-123	8.50E+103
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	9097	24.90	13.19	0.81	0.27	0.04	1.52	0.51	0.08	1.36E-75	1.36E-75	1.42E+47
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.90E-02	← *=(C4-C5)/C3*	8	9098	24.91	15.07	1.01	0.34	0.05	1.90	0.63	0.09	1.53E-50	1.53E-50	1.12E+25
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	9099	24.91	16.96	1.21	0.40	0.06	2.27	0.76	0.11	8.93E-36	8.93E-36	5.84E+14
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.88	← *=C14*C15/C16*	10	9100	24.91	18.84	1.40	0.47	0.07	2.64	0.88	0.13	2.10E-26	2.10E-26	2.35E+09
18	Retardation Factor	1	*INPUT*	11	9101	24.92	20.73	1.59	0.53	0.08	3.00	1.00	0.15	4.01E-20	4.01E-20	1.91E+06
19	1st Order Decay Constant	0	*INPUT*	12	9102	24.92	22.61	1.78	0.59	0.09	3.35	1.12	0.17	9.87E-16	9.87E-16	2.46E+04
20	Longitudinal Distance to Monitoring Well (ft)	100.03	← *=C3*	13	9103	24.92	24.50	1.96	0.65	0.10	3.70	1.23	0.18	1.47E-12	1.47E-12	1.49E+03
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	9104	24.92	26.38	2.14	0.71	0.11	4.04	1.35	0.20	3.35E-10	3.36E-10	2.28E+02
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	9105	24.93	28.26	2.32	0.77	0.12	4.37	1.46	0.22	2.06E-08	2.09E-08	6.22E+01
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	9106	24.93	30.15	2.49	0.83	0.12	4.69	1.56	0.23	4.97E-07	5.17E-07	2.47E+01
24	Proposed Base Grade Elevation (ft-NGVD)	172.98	*INPUT*	17	9107	24.93	32.03	2.66	0.89	0.13	5.00	1.67	0.25	6.04E-06	6.55E-06	1.27E+01
25	Bedrock Surface Elevation (ft-NGVD)	140.00	*INPUT*	18	9108	24.94	33.92	2.82	0.94	0.14	5.31	1.77	0.27	4.40E-05	5.05E-05	7.71E+00
26	Till Thickness (ft)	32.98	← *=C24-C25*	19	9109	24.94	35.80	2.98	0.99	0.15	5.61	1.87	0.28	2.17E-04	2.67E-04	5.29E+00
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	9110	24.94	37.68	3.14	1.05	0.16	5.91	1.97	0.30	7.90E-04	1.06E-03	3.96E+00
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	9111	24.94	39.57	3.29	1.10	0.16	6.20	2.07	0.31	2.27E-03	3.33E-03	3.15E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	9112	24.95	41.45	3.44	1.15	0.17	6.48	2.16	0.32	5.41E-03	8.74E-03	2.63E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	9113	24.95	43.34	3.59	1.20	0.18	6.76	2.25	0.34	1.11E-02	1.98E-02	2.27E+00
31	Time of Vertical Flow Through Till (days)	9090	← *=C26/C30*	24	9114	24.95	45.22	3.73	1.24	0.19	7.03	2.34	0.35	2.01E-02	4.00E-02	2.01E+00
32				25	9115	24.95	47.11	3.87	1.29	0.19	7.30	2.43	0.36	3.30E-02	7.30E-02	1.83E+00
33				26	9116	24.96	48.99	4.01	1.34	0.20	7.56	2.52	0.38	4.99E-02	1.23E-01	1.68E+00
34				27	9117	24.96	50.87	4.15	1.38	0.21	7.82	2.61	0.39	7.05E-02	1.93E-01	1.57E+00
35				28	9118	24.96	52.76	4.28	1.43	0.21	8.07	2.69	0.40	9.39E-02	2.87E-01	1.49E+00
36				29	9119	24.97	54.64	4.41	1.47	0.22	8.32	2.77	0.42	1.19E-01	4.07E-01	1.42E+00
37				30	9120	24.97	56.53	4.54	1.51	0.23	8.56	2.85	0.43	1.46E-01	5.52E-01	1.36E+00
10949				10942	20032	54.84	20617.30	68.25	22.75	3.41	128.60	42.87	6.43	7.48E-39	1.01E+01	1.00E+00
10950				10943	20033	54.85	20619.18	68.25	22.75	3.41	128.60	42.87	6.43	7.44E-39	1.01E+01	1.00E+00
10951				10944	20034	54.85	20621.06	68.25	22.75	3.41	128.60	42.87	6.43	7.40E-39	1.01E+01	1.00E+00
10952				10945	20035	54.85	20622.95	68.25	22.75	3.41	128.61	42.87	6.43	7.36E-39	1.01E+01	1.00E+00
10953				10946	20036	54.85	20624.83	68.26	22.75	3.41	128.61	42.87	6.43	7.32E-39	1.01E+01	1.00E+00
10954				10947	20037	54.86	20626.72	68.26	22.75	3.41	128.61	42.87	6.43	7.29E-39	1.01E+01	1.00E+00
10955				10948	20038	54.86	20628.60	68.26	22.75	3.41	128.62	42.87	6.43	7.25E-39	1.01E+01	1.00E+00
10956				10949	20039	54.86	20630.49	68.26	22.75	3.41	128.62	42.87	6.43	7.21E-39	1.01E+01	1.00E+00
10957				10950	20040	54.87	20632.37	68.26	22.75	3.41	128.62	42.87	6.43	7.17E-39	1.01E+01	1.00E+00
10958				10951	20041	54.87	20634.25	68.26	22.75	3.41	128.63	42.88	6.43	7.14E-39	1.01E+01	1.00E+00
10959				10952	20042	54.87	20636.14	68.27	22.76	3.41	128.63	42.88	6.43	7.10E-39	1.01E+01	1.00E+00
10960				10953	20043	54.87	20638.02	68.27	22.76	3.41	128.63	42.88	6.43	7.06E-39	1.01E+01	1.00E+00
10961				10954	20044	54.88	20639.91	68.27	22.76	3.41	128.64	42.88	6.43	7.03E-39	1.01E+01	1.00E+00
10962				10955	20045	54.88	20641.79	68.27	22.76	3.41	128.64	42.88	6.43	6.99E-39	1.01E+01	1.00E+00
10963				10956	20046	54.88	20643.68	68.27	22.76	3.41	128.64	42.88	6.43	6.95E-39	1.01E+01	1.00E+00
10964				10957	20047	54.88	20645.56	68.27	22.76	3.41	128.65	42.88	6.43	6.92E-39	1.01E+01	1.00E+00
10965				10958	20048	54.89	20647.44	68.28	22.76	3.41	128.65	42.88	6.43	6.88E-39	1.01E+01	1.00E+00



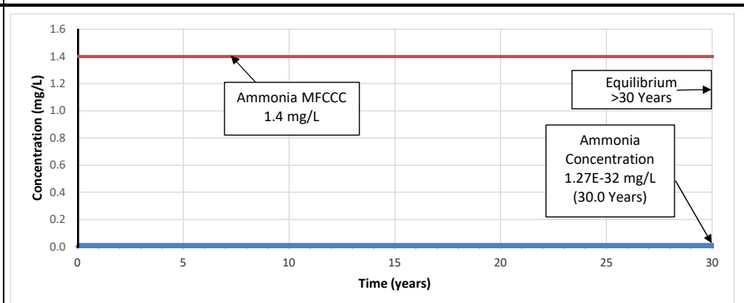
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 14b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-616A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	100.03	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	162.96	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	161.06	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	9090	24.89	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	9091	24.89	1.88	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	9092	24.89	3.77	0.00	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	9093	24.89	5.65	0.08	0.03	0.00	0.16	0.05	0.01	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	9094	24.90	7.54	0.23	0.08	0.01	0.44	0.15	0.02	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	9095	24.90	9.42	0.41	0.14	0.02	0.78	0.26	0.04	6.79E-230	6.79E-230	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	9096	24.90	11.31	0.61	0.20	0.03	1.15	0.38	0.06	5.77E-126	5.77E-126	8.50E+103
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	9097	24.90	13.19	0.81	0.27	0.04	1.52	0.51	0.08	8.22E-79	8.22E-79	1.42E+47
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.90E-02	← *=(C4-C5)/C3*	8	9098	24.91	15.07	1.01	0.34	0.05	1.90	0.63	0.09	9.21E-54	9.21E-54	1.12E+25
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	9099	24.91	16.96	1.21	0.40	0.06	2.27	0.76	0.11	5.38E-39	5.38E-39	5.84E+14
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.88	← *=C14*C15/C16*	10	9100	24.91	18.84	1.40	0.47	0.07	2.64	0.88	0.13	1.26E-29	1.26E-29	2.35E+09
18	Retardation Factor	1	*INPUT*	11	9101	24.92	20.73	1.59	0.53	0.08	3.00	1.00	0.15	2.41E-23	2.41E-23	1.91E+06
19	1st Order Decay Constant	0	*INPUT*	12	9102	24.92	22.61	1.78	0.59	0.09	3.35	1.12	0.17	5.94E-19	5.94E-19	2.46E+04
20	Longitudinal Distance to Monitoring Well (ft)	100.03	← *=C3*	13	9103	24.92	24.50	1.96	0.65	0.10	3.70	1.23	0.18	8.87E-16	8.88E-16	1.49E+03
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	9104	24.92	26.38	2.14	0.71	0.11	4.04	1.35	0.20	2.02E-13	2.03E-13	2.28E+02
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	9105	24.93	28.26	2.32	0.77	0.12	4.37	1.46	0.22	1.24E-11	1.26E-11	6.22E+01
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	9106	24.93	30.15	2.49	0.83	0.12	4.69	1.56	0.23	2.99E-10	3.12E-10	2.47E+01
24	Proposed Base Grade Elevation (ft-NGVD)	172.98	*INPUT*	17	9107	24.93	32.03	2.66	0.89	0.13	5.00	1.67	0.25	3.64E-09	3.95E-09	1.27E+01
25	Bedrock Surface Elevation (ft-NGVD)	140.00	*INPUT*	18	9108	24.94	33.92	2.82	0.94	0.14	5.31	1.77	0.27	2.65E-08	3.04E-08	7.71E+00
26	Till Thickness (ft)	32.98	← *=C24-C25*	19	9109	24.94	35.80	2.98	0.99	0.15	5.61	1.87	0.28	1.30E-07	1.61E-07	5.29E+00
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	9110	24.94	37.68	3.14	1.05	0.16	5.91	1.97	0.30	4.76E-07	6.37E-07	3.96E+00
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	9111	24.94	39.57	3.29	1.10	0.16	6.20	2.07	0.31	1.37E-06	2.00E-06	3.15E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	9112	24.95	41.45	3.44	1.15	0.17	6.48	2.16	0.32	3.26E-06	5.27E-06	2.63E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	9113	24.95	43.34	3.59	1.20	0.18	6.76	2.25	0.34	6.68E-06	1.20E-05	2.27E+00
31	Time of Vertical Flow Through Till (days)	9090	← *=C26/C30*	24	9114	24.95	45.22	3.73	1.24	0.19	7.03	2.34	0.35	1.21E-05	2.41E-05	2.01E+00
32				25	9115	24.95	47.11	3.87	1.29	0.19	7.30	2.43	0.36	1.99E-05	4.40E-05	1.83E+00
33				26	9116	24.96	48.99	4.01	1.34	0.20	7.56	2.52	0.38	3.01E-05	7.40E-05	1.68E+00
34				27	9117	24.96	50.87	4.15	1.38	0.21	7.82	2.61	0.39	4.24E-05	1.16E-04	1.57E+00
35				28	9118	24.96	52.76	4.28	1.43	0.21	8.07	2.69	0.40	5.66E-05	1.73E-04	1.49E+00
36				29	9119	24.97	54.64	4.41	1.47	0.22	8.32	2.77	0.42	7.19E-05	2.45E-04	1.42E+00
37				30	9120	24.97	56.53	4.54	1.51	0.23	8.56	2.85	0.43	8.77E-05	3.33E-04	1.36E+00
10949				10942	20032	54.84	20617.30	68.25	22.75	3.41	128.60	42.87	6.43	4.50E-42	6.08E-03	1.00E+00
10950				10943	20033	54.85	20619.18	68.25	22.75	3.41	128.60	42.87	6.43	4.48E-42	6.08E-03	1.00E+00
10951				10944	20034	54.85	20621.06	68.25	22.75	3.41	128.60	42.87	6.43	4.46E-42	6.08E-03	1.00E+00
10952				10945	20035	54.85	20622.95	68.25	22.75	3.41	128.61	42.87	6.43	4.43E-42	6.08E-03	1.00E+00
10953				10946	20036	54.85	20624.83	68.26	22.75	3.41	128.61	42.87	6.43	4.41E-42	6.08E-03	1.00E+00
10954				10947	20037	54.86	20626.72	68.26	22.75	3.41	128.61	42.87	6.43	4.39E-42	6.08E-03	1.00E+00
10955				10948	20038	54.86	20628.60	68.26	22.75	3.41	128.62	42.87	6.43	4.37E-42	6.08E-03	1.00E+00
10956				10949	20039	54.86	20630.49	68.26	22.75	3.41	128.62	42.87	6.43	4.34E-42	6.08E-03	1.00E+00
10957				10950	20040	54.87	20632.37	68.26	22.75	3.41	128.62	42.87	6.43	4.32E-42	6.08E-03	1.00E+00
10958				10951	20041	54.87	20634.25	68.26	22.75	3.41	128.63	42.88	6.43	4.30E-42	6.08E-03	1.00E+00
10959				10952	20042	54.87	20636.14	68.27	22.76	3.41	128.63	42.88	6.43	4.28E-42	6.08E-03	1.00E+00
10960				10953	20043	54.87	20638.02	68.27	22.76	3.41	128.63	42.88	6.43	4.25E-42	6.08E-03	1.00E+00
10961				10954	20044	54.88	20639.91	68.27	22.76	3.41	128.64	42.88	6.43	4.23E-42	6.08E-03	1.00E+00
10962				10955	20045	54.88	20641.79	68.27	22.76	3.41	128.64	42.88	6.43	4.21E-42	6.08E-03	1.00E+00
10963				10956	20046	54.88	20643.68	68.27	22.76	3.41	128.64	42.88	6.43	4.19E-42	6.08E-03	1.00E+00
10964				10957	20047	54.88	20645.56	68.27	22.76	3.41	128.65	42.88	6.43	4.17E-42	6.08E-03	1.00E+00
10965				10958	20048	54.89	20647.44	68.28	22.76	3.41	128.65	42.88	6.43	4.14E-42	6.08E-03	1.00E+00



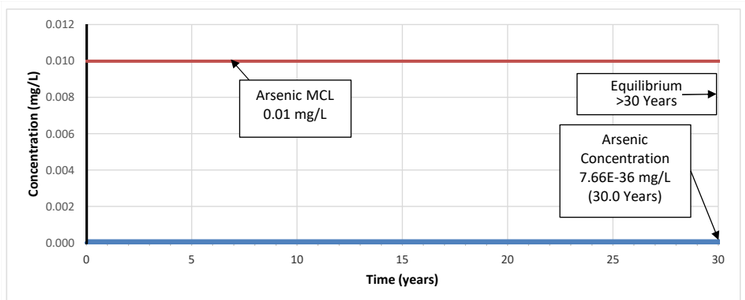
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 15a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-617B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	251.26	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	173.92	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	165.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.55E-02	← *=(C4-C5)/C3*	8	8		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.78E-03	← *=C14*C15/C16*	10	10		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	251.26	← *=C3*	13	13		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	182	← *=(C20/C17)*365.25*	17	17		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		41.33	3.43	1.14	0.17	0.01	0.00	0.00	1.61E-34	9.74E-33	1.02E+00
10950				10943	10943		41.34	3.43	1.14	0.17	0.01	0.00	0.00	1.64E-34	9.90E-33	1.02E+00
10951				10944	10944		41.34	3.43	1.14	0.17	0.01	0.00	0.00	1.67E-34	1.01E-32	1.02E+00
10952				10945	10945		41.34	3.43	1.14	0.17	0.01	0.00	0.00	1.69E-34	1.02E-32	1.02E+00
10953				10946	10946		41.35	3.43	1.14	0.17	0.01	0.00	0.00	1.72E-34	1.04E-32	1.02E+00
10954				10947	10947		41.35	3.43	1.14	0.17	0.01	0.00	0.00	1.75E-34	1.06E-32	1.02E+00
10955				10948	10948		41.35	3.43	1.14	0.17	0.01	0.00	0.00	1.78E-34	1.08E-32	1.02E+00
10956				10949	10949		41.36	3.43	1.14	0.17	0.01	0.00	0.00	1.81E-34	1.09E-32	1.02E+00
10957				10950	10950		41.36	3.43	1.14	0.17	0.01	0.00	0.00	1.84E-34	1.11E-32	1.02E+00
10958				10951	10951		41.37	3.43	1.14	0.17	0.01	0.00	0.00	1.87E-34	1.13E-32	1.02E+00
10959				10952	10952		41.37	3.43	1.14	0.17	0.01	0.00	0.00	1.90E-34	1.15E-32	1.02E+00
10960				10953	10953		41.37	3.43	1.14	0.17	0.01	0.00	0.00	1.93E-34	1.17E-32	1.02E+00
10961				10954	10954		41.38	3.43	1.14	0.17	0.01	0.00	0.00	1.96E-34	1.19E-32	1.02E+00
10962				10955	10955		41.38	3.43	1.14	0.17	0.01	0.00	0.00	2.00E-34	1.21E-32	1.02E+00
10963				10956	10956		41.38	3.43	1.14	0.17	0.01	0.00	0.00	2.03E-34	1.23E-32	1.02E+00
10964				10957	10957		41.39	3.43	1.14	0.17	0.01	0.00	0.00	2.06E-34	1.25E-32	1.02E+00
10965				10958	10958		41.39	3.43	1.14	0.17	0.01	0.00	0.00	2.10E-34	1.27E-32	1.02E+00



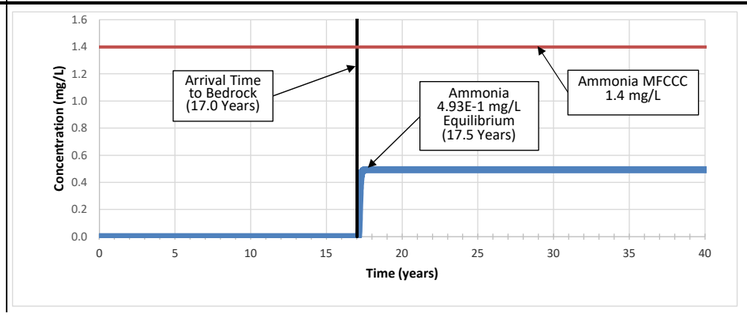
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 15a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-617B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	251.26	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	173.92	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	165.00	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.55E-02	← *=(C4-C5)/C3*	8	8		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	3.78E-03	← *=C14*C15/C16*	10	10		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	251.26	← *=C3*	13	13		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	182	← *=(C20/C17)*365.25*	17	17		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.08	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.09	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.10	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.11	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		41.33	3.43	1.14	0.17	0.01	0.00	0.00	9.72E-38	5.87E-36	1.02E+00
10950				10943	10943		41.34	3.43	1.14	0.17	0.01	0.00	0.00	9.88E-38	5.96E-36	1.02E+00
10951				10944	10944		41.34	3.43	1.14	0.17	0.01	0.00	0.00	1.00E-37	6.07E-36	1.02E+00
10952				10945	10945		41.34	3.43	1.14	0.17	0.01	0.00	0.00	1.02E-37	6.17E-36	1.02E+00
10953				10946	10946		41.35	3.43	1.14	0.17	0.01	0.00	0.00	1.04E-37	6.27E-36	1.02E+00
10954				10947	10947		41.35	3.43	1.14	0.17	0.01	0.00	0.00	1.05E-37	6.38E-36	1.02E+00
10955				10948	10948		41.35	3.43	1.14	0.17	0.01	0.00	0.00	1.07E-37	6.48E-36	1.02E+00
10956				10949	10949		41.36	3.43	1.14	0.17	0.01	0.00	0.00	1.09E-37	6.59E-36	1.02E+00
10957				10950	10950		41.36	3.43	1.14	0.17	0.01	0.00	0.00	1.11E-37	6.70E-36	1.02E+00
10958				10951	10951		41.37	3.43	1.14	0.17	0.01	0.00	0.00	1.13E-37	6.82E-36	1.02E+00
10959				10952	10952		41.37	3.43	1.14	0.17	0.01	0.00	0.00	1.14E-37	6.93E-36	1.02E+00
10960				10953	10953		41.37	3.43	1.14	0.17	0.01	0.00	0.00	1.16E-37	7.05E-36	1.02E+00
10961				10954	10954		41.38	3.43	1.14	0.17	0.01	0.00	0.00	1.18E-37	7.16E-36	1.02E+00
10962				10955	10955		41.38	3.43	1.14	0.17	0.01	0.00	0.00	1.20E-37	7.29E-36	1.02E+00
10963				10956	10956		41.38	3.43	1.14	0.17	0.01	0.00	0.00	1.22E-37	7.41E-36	1.02E+00
10964				10957	10957		41.39	3.43	1.14	0.17	0.01	0.00	0.00	1.24E-37	7.53E-36	1.02E+00
10965				10958	10958		41.39	3.43	1.14	0.17	0.01	0.00	0.00	1.26E-37	7.66E-36	1.02E+00



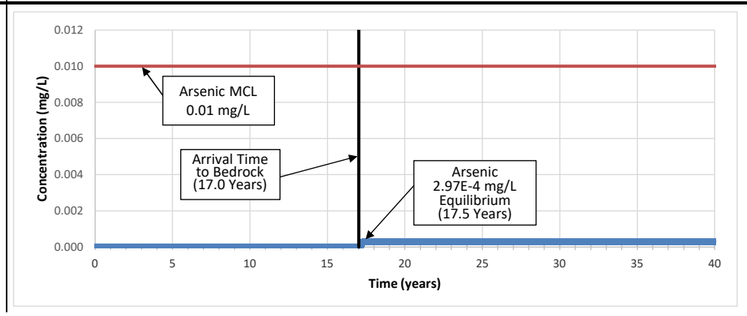
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 15b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-617A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	251.26	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	173.92	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	165.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	6215	17.02	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	6216	17.02	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	6217	17.02	7.04	0.19	0.06	0.01	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
10				3	6218	17.02	10.57	0.53	0.18	0.03	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	6219	17.03	14.09	0.90	0.30	0.05	3.18	1.06	0.16	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	6220	17.03	17.61	1.27	0.42	0.06	4.48	1.49	0.22	5.19E-264	5.19E-264	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6221	17.03	21.13	1.63	0.54	0.08	5.75	1.92	0.29	1.46E-166	1.46E-166	2.81E+97
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	6222	17.03	24.65	1.98	0.66	0.10	6.96	2.32	0.35	1.96E-114	1.96E-114	1.35E+52
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.55E-02	← *=(C4-C5)/C3*	8	6223	17.04	28.17	2.31	0.77	0.12	8.13	2.71	0.41	2.46E-83	2.46E-83	1.25E+31
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	6224	17.04	31.70	2.63	0.88	0.13	9.25	3.08	0.46	2.59E-63	2.59E-63	1.06E+20
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	3.52	← *=C14*C15/C16*	10	6225	17.04	35.22	2.93	0.98	0.15	10.32	3.44	0.52	1.13E-49	1.13E-49	4.36E+13
18	Retardation Factor	1	*INPUT*	11	6226	17.05	38.74	3.22	1.07	0.16	11.35	3.78	0.57	5.69E-40	5.69E-40	5.03E+09
19	1st Order Decay Constant	0	*INPUT*	12	6227	17.05	42.26	3.50	1.17	0.18	12.34	4.11	0.62	7.87E-33	7.87E-33	1.38E+07
20	Longitudinal Distance to Monitoring Well (ft)	251.26	← *=C3*	13	6228	17.05	45.78	3.77	1.26	0.19	13.29	4.43	0.66	1.99E-27	1.99E-27	2.53E+05
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	6229	17.05	49.30	4.03	1.34	0.20	14.21	4.74	0.71	3.02E-23	3.02E-23	1.52E+04
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	6230	17.06	52.83	4.29	1.43	0.21	15.10	5.03	0.75	6.01E-20	6.02E-20	1.99E+03
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	6231	17.06	56.35	4.53	1.51	0.23	15.96	5.32	0.80	2.65E-17	2.66E-17	4.42E+02
24	Proposed Base Grade Elevation (ft-NGVD)	181.19	*INPUT*	17	6232	17.06	59.87	4.77	1.59	0.24	16.79	5.60	0.84	3.75E-15	3.77E-15	1.42E+02
25	Bedrock Surface Elevation (ft-NGVD)	158.64	*INPUT*	18	6233	17.06	63.39	5.00	1.67	0.25	17.60	5.87	0.88	2.20E-13	2.24E-13	5.93E+01
26	Till Thickness (ft)	22.55	← *=C24-C25*	19	6234	17.07	66.91	5.22	1.74	0.26	18.39	6.13	0.92	6.49E-12	6.72E-12	3.00E+01
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	6235	17.07	70.43	5.44	1.81	0.27	19.15	6.38	0.96	1.11E-10	1.18E-10	1.75E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	6236	17.07	73.96	5.65	1.88	0.28	19.89	6.63	0.99	1.22E-09	1.34E-09	1.14E+01
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	6237	17.08	77.48	5.85	1.95	0.29	20.62	6.87	1.03	9.46E-09	1.08E-08	8.04E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	6238	17.08	81.00	6.06	2.02	0.30	21.33	7.11	1.07	5.45E-08	6.53E-08	6.05E+00
31	Time of Vertical Flow Through Till (days)	6215	← *=C26/C30*	24	6239	17.08	84.52	6.25	2.08	0.31	22.02	7.34	1.10	2.46E-07	3.12E-07	4.78E+00
32				25	6240	17.08	88.04	6.44	2.15	0.32	22.69	7.56	1.13	9.11E-07	1.22E-06	3.92E+00
33				26	6241	17.09	91.56	6.63	2.21	0.33	23.35	7.78	1.17	2.84E-06	4.06E-06	3.32E+00
34				27	6242	17.09	95.09	6.81	2.27	0.34	23.99	8.00	1.20	7.65E-06	1.17E-05	2.89E+00
35				28	6243	17.09	98.61	6.99	2.33	0.35	24.62	8.21	1.23	1.83E-05	3.00E-05	2.56E+00
36				29	6244	17.10	102.13	7.17	2.39	0.36	25.24	8.41	1.26	3.92E-05	6.92E-05	2.31E+00
37				30	6245	17.10	105.65	7.34	2.45	0.37	25.84	8.61	1.29	7.69E-05	1.46E-04	2.11E+00
10949				10942	17157	46.97	38534.51	80.63	26.88	4.03	283.96	94.65	14.20	1.73E-58	4.93E-01	1.00E+00
10950				10943	17158	46.98	38538.04	80.63	26.88	4.03	283.97	94.66	14.20	1.71E-58	4.93E-01	1.00E+00
10951				10944	17159	46.98	38541.56	80.64	26.88	4.03	283.98	94.66	14.20	1.70E-58	4.93E-01	1.00E+00
10952				10945	17160	46.98	38545.08	80.64	26.88	4.03	283.98	94.66	14.20	1.68E-58	4.93E-01	1.00E+00
10953				10946	17161	46.98	38548.60	80.64	26.88	4.03	283.99	94.66	14.20	1.67E-58	4.93E-01	1.00E+00
10954				10947	17162	46.99	38552.12	80.64	26.88	4.03	284.00	94.67	14.20	1.66E-58	4.93E-01	1.00E+00
10955				10948	17163	46.99	38555.64	80.64	26.88	4.03	284.00	94.67	14.20	1.64E-58	4.93E-01	1.00E+00
10956				10949	17164	46.99	38559.17	80.65	26.88	4.03	284.01	94.67	14.20	1.63E-58	4.93E-01	1.00E+00
10957				10950	17165	47.00	38562.69	80.65	26.88	4.03	284.02	94.67	14.20	1.61E-58	4.93E-01	1.00E+00
10958				10951	17166	47.00	38566.21	80.65	26.88	4.03	284.02	94.67	14.20	1.60E-58	4.93E-01	1.00E+00
10959				10952	17167	47.00	38569.73	80.65	26.88	4.03	284.03	94.68	14.20	1.59E-58	4.93E-01	1.00E+00
10960				10953	17168	47.00	38573.25	80.65	26.88	4.03	284.04	94.68	14.20	1.57E-58	4.93E-01	1.00E+00
10961				10954	17169	47.01	38576.77	80.65	26.88	4.03	284.04	94.68	14.20	1.56E-58	4.93E-01	1.00E+00
10962				10955	17170	47.01	38580.30	80.66	26.89	4.03	284.05	94.68	14.20	1.55E-58	4.93E-01	1.00E+00
10963				10956	17171	47.01	38583.82	80.66	26.89	4.03	284.06	94.69	14.20	1.54E-58	4.93E-01	1.00E+00
10964				10957	17172	47.01	38587.34	80.66	26.89	4.03	284.06	94.69	14.20	1.52E-58	4.93E-01	1.00E+00
10965				10958	17173	47.02	38590.86	80.66	26.89	4.03	284.07	94.69	14.20	1.51E-58	4.93E-01	1.00E+00



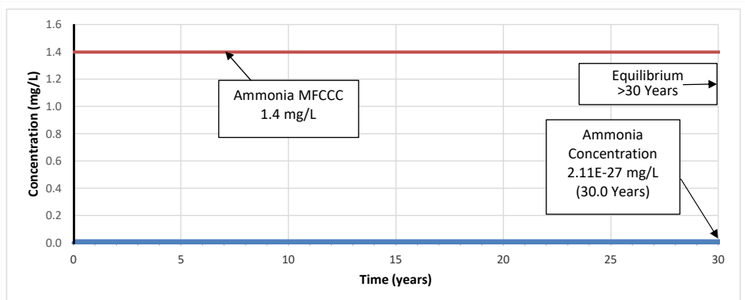
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 15b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-617A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	251.26	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	173.92	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	165.00	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	6215	17.02	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	6216	17.02	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	6217	17.02	7.04	0.19	0.06	0.01	0.67	0.22	0.03	0.00E+00	0.00E+00	#DIV/0!
10				3	6218	17.02	10.57	0.53	0.18	0.03	1.87	0.62	0.09	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	6219	17.03	14.09	0.90	0.30	0.05	3.18	1.06	0.16	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	6220	17.03	17.61	1.27	0.42	0.06	4.48	1.49	0.22	3.12E-267	3.12E-267	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6221	17.03	21.13	1.63	0.54	0.08	5.75	1.92	0.29	8.77E-170	8.77E-170	2.81E+97
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	6222	17.03	24.65	1.98	0.66	0.10	6.96	2.32	0.35	1.18E-117	1.18E-117	1.35E+52
15	Horizontal Flow Hydraulic Gradient (ft/ft)	3.55E-02	← *=(C4-C5)/C3*	8	6223	17.04	28.17	2.31	0.77	0.12	8.13	2.71	0.41	1.48E-86	1.48E-86	1.25E+31
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	6224	17.04	31.70	2.63	0.88	0.13	9.25	3.08	0.46	1.56E-66	1.56E-66	1.06E+20
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	3.52	← *=C14*C15/C16*	10	6225	17.04	35.22	2.93	0.98	0.15	10.32	3.44	0.52	6.81E-53	6.81E-53	4.36E+13
18	Retardation Factor	1	*INPUT*	11	6226	17.05	38.74	3.22	1.07	0.16	11.35	3.78	0.57	3.43E-43	3.43E-43	5.03E+09
19	1st Order Decay Constant	0	*INPUT*	12	6227	17.05	42.26	3.50	1.17	0.18	12.34	4.11	0.62	4.74E-36	4.74E-36	1.38E+07
20	Longitudinal Distance to Monitoring Well (ft)	251.26	← *=C3*	13	6228	17.05	45.78	3.77	1.26	0.19	13.29	4.43	0.66	1.20E-30	1.20E-30	2.53E+05
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	6229	17.05	49.30	4.03	1.34	0.20	14.21	4.74	0.71	1.82E-26	1.82E-26	1.52E+04
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	6230	17.06	52.83	4.29	1.43	0.21	15.10	5.03	0.75	3.62E-23	3.62E-23	1.99E+03
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	6231	17.06	56.35	4.53	1.51	0.23	15.96	5.32	0.80	1.60E-20	1.60E-20	4.42E+02
24	Proposed Base Grade Elevation (ft-NGVD)	181.19	*INPUT*	17	6232	17.06	59.87	4.77	1.59	0.24	16.79	5.60	0.84	2.26E-18	2.27E-18	1.42E+02
25	Bedrock Surface Elevation (ft-NGVD)	158.64	*INPUT*	18	6233	17.06	63.39	5.00	1.67	0.25	17.60	5.87	0.88	1.32E-16	1.35E-16	5.93E+01
26	Till Thickness (ft)	22.55	← *=C24-C25*	19	6234	17.07	66.91	5.22	1.74	0.26	18.39	6.13	0.92	3.91E-15	4.04E-15	3.00E+01
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	6235	17.07	70.43	5.44	1.81	0.27	19.15	6.38	0.96	6.69E-14	7.09E-14	1.75E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	6236	17.07	73.96	5.65	1.88	0.28	19.89	6.63	0.99	7.37E-13	8.08E-13	1.14E+01
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	6237	17.08	77.48	5.85	1.95	0.29	20.62	6.87	1.03	5.69E-12	6.50E-12	8.04E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	6238	17.08	81.00	6.06	2.02	0.30	21.33	7.11	1.07	3.28E-11	3.93E-11	6.05E+00
31	Time of Vertical Flow Through Till (days)	6215	← *=C26/C30*	24	6239	17.08	84.52	6.25	2.08	0.31	22.02	7.34	1.10	1.48E-10	1.88E-10	4.78E+00
32				25	6240	17.08	88.04	6.44	2.15	0.32	22.69	7.56	1.13	5.48E-10	7.36E-10	3.92E+00
33				26	6241	17.09	91.56	6.63	2.21	0.33	23.35	7.78	1.17	1.71E-09	2.45E-09	3.32E+00
34				27	6242	17.09	95.09	6.81	2.27	0.34	23.99	8.00	1.20	4.61E-09	7.06E-09	2.89E+00
35				28	6243	17.09	98.61	6.99	2.33	0.35	24.62	8.21	1.23	1.10E-08	1.81E-08	2.56E+00
36				29	6244	17.10	102.13	7.17	2.39	0.36	25.24	8.41	1.26	2.36E-08	4.17E-08	2.31E+00
37				30	6245	17.10	105.65	7.34	2.45	0.37	25.84	8.61	1.29	4.63E-08	8.80E-08	2.11E+00
10949				10942	17157	46.97	38534.51	80.63	26.88	4.03	283.96	94.65	14.20	1.04E-61	2.97E-04	1.00E+00
10950				10943	17158	46.98	38538.04	80.63	26.88	4.03	283.97	94.66	14.20	1.03E-61	2.97E-04	1.00E+00
10951				10944	17159	46.98	38541.56	80.64	26.88	4.03	283.98	94.66	14.20	1.02E-61	2.97E-04	1.00E+00
10952				10945	17160	46.98	38545.08	80.64	26.88	4.03	283.98	94.66	14.20	1.01E-61	2.97E-04	1.00E+00
10953				10946	17161	46.98	38548.60	80.64	26.88	4.03	283.99	94.66	14.20	1.01E-61	2.97E-04	1.00E+00
10954				10947	17162	46.99	38552.12	80.64	26.88	4.03	284.00	94.67	14.20	9.97E-62	2.97E-04	1.00E+00
10955				10948	17163	46.99	38555.64	80.64	26.88	4.03	284.00	94.67	14.20	9.89E-62	2.97E-04	1.00E+00
10956				10949	17164	46.99	38559.17	80.65	26.88	4.03	284.01	94.67	14.20	9.81E-62	2.97E-04	1.00E+00
10957				10950	17165	47.00	38562.69	80.65	26.88	4.03	284.02	94.67	14.20	9.72E-62	2.97E-04	1.00E+00
10958				10951	17166	47.00	38566.21	80.65	26.88	4.03	284.02	94.67	14.20	9.64E-62	2.97E-04	1.00E+00
10959				10952	17167	47.00	38569.73	80.65	26.88	4.03	284.03	94.68	14.20	9.56E-62	2.97E-04	1.00E+00
10960				10953	17168	47.00	38573.25	80.65	26.88	4.03	284.04	94.68	14.20	9.49E-62	2.97E-04	1.00E+00
10961				10954	17169	47.01	38576.77	80.65	26.88	4.03	284.04	94.68	14.20	9.41E-62	2.97E-04	1.00E+00
10962				10955	17170	47.01	38580.30	80.66	26.89	4.03	284.05	94.68	14.20	9.33E-62	2.97E-04	1.00E+00
10963				10956	17171	47.01	38583.82	80.66	26.89	4.03	284.06	94.69	14.20	9.25E-62	2.97E-04	1.00E+00
10964				10957	17172	47.01	38587.34	80.66	26.89	4.03	284.06	94.69	14.20	9.18E-62	2.97E-04	1.00E+00
10965				10958	17173	47.02	38590.86	80.66	26.89	4.03	284.07	94.69	14.20	9.10E-62	2.97E-04	1.00E+00



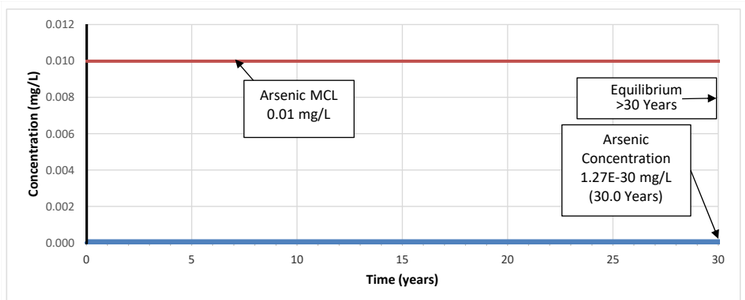
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 16a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well P-04-12B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	145.92	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	167.79	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	164.56	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.21E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.36E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	145.92	← *=C3*	13	13		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	170	← *=(C20/C17)*365.25*	17	17		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		25.77	2.08	0.69	0.10	0.00	0.00	0.00	2.59E-29	1.63E-27	1.02E+00
10950				10943	10943		25.77	2.08	0.69	0.10	0.00	0.00	0.00	2.63E-29	1.66E-27	1.02E+00
10951				10944	10944		25.78	2.08	0.69	0.10	0.00	0.00	0.00	2.67E-29	1.69E-27	1.02E+00
10952				10945	10945		25.78	2.08	0.69	0.10	0.00	0.00	0.00	2.72E-29	1.71E-27	1.02E+00
10953				10946	10946		25.78	2.09	0.70	0.10	0.00	0.00	0.00	2.76E-29	1.74E-27	1.02E+00
10954				10947	10947		25.78	2.09	0.70	0.10	0.00	0.00	0.00	2.80E-29	1.77E-27	1.02E+00
10955				10948	10948		25.78	2.09	0.70	0.10	0.00	0.00	0.00	2.85E-29	1.80E-27	1.02E+00
10956				10949	10949		25.79	2.09	0.70	0.10	0.00	0.00	0.00	2.89E-29	1.83E-27	1.02E+00
10957				10950	10950		25.79	2.09	0.70	0.10	0.00	0.00	0.00	2.94E-29	1.86E-27	1.02E+00
10958				10951	10951		25.79	2.09	0.70	0.10	0.00	0.00	0.00	2.98E-29	1.89E-27	1.02E+00
10959				10952	10952		25.79	2.09	0.70	0.10	0.00	0.00	0.00	3.03E-29	1.92E-27	1.02E+00
10960				10953	10953		25.80	2.09	0.70	0.10	0.00	0.00	0.00	3.08E-29	1.95E-27	1.02E+00
10961				10954	10954		25.80	2.09	0.70	0.10	0.00	0.00	0.00	3.13E-29	1.98E-27	1.02E+00
10962				10955	10955		25.80	2.09	0.70	0.10	0.00	0.00	0.00	3.18E-29	2.01E-27	1.02E+00
10963				10956	10956		25.80	2.09	0.70	0.10	0.00	0.00	0.00	3.23E-29	2.04E-27	1.02E+00
10964				10957	10957		25.81	2.09	0.70	0.10	0.00	0.00	0.00	3.28E-29	2.07E-27	1.02E+00
10965				10958	10958		25.81	2.09	0.70	0.10	0.00	0.00	0.00	3.33E-29	2.11E-27	1.02E+00



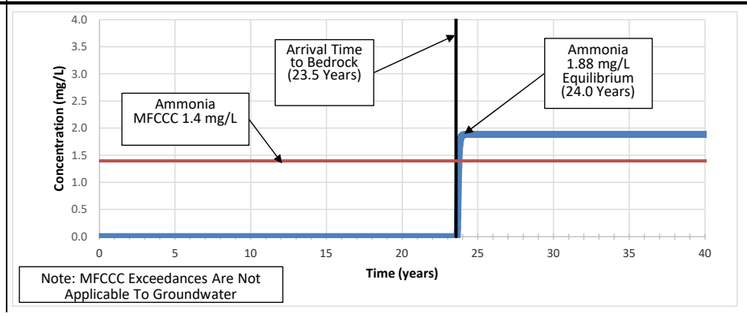
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 16a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well P-04-12B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	145.92	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	167.79	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	164.56	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	4		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.21E-02	← *=(C4-C5)/C3*	8	8		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	2.36E-03	← *=C14*C15/C16*	10	10		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	145.92	← *=C3*	13	13		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	170	← *=(C20/C17)*365.25*	17	17		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.04	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.05	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.06	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.07	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		25.77	2.08	0.69	0.10	0.00	0.00	0.00	1.56E-32	9.83E-31	1.02E+00
10950				10943	10943		25.77	2.08	0.69	0.10	0.00	0.00	0.00	1.59E-32	9.99E-31	1.02E+00
10951				10944	10944		25.78	2.08	0.69	0.10	0.00	0.00	0.00	1.61E-32	1.02E-30	1.02E+00
10952				10945	10945		25.78	2.08	0.69	0.10	0.00	0.00	0.00	1.64E-32	1.03E-30	1.02E+00
10953				10946	10946		25.78	2.09	0.70	0.10	0.00	0.00	0.00	1.66E-32	1.05E-30	1.02E+00
10954				10947	10947		25.78	2.09	0.70	0.10	0.00	0.00	0.00	1.69E-32	1.07E-30	1.02E+00
10955				10948	10948		25.78	2.09	0.70	0.10	0.00	0.00	0.00	1.71E-32	1.08E-30	1.02E+00
10956				10949	10949		25.79	2.09	0.70	0.10	0.00	0.00	0.00	1.74E-32	1.10E-30	1.02E+00
10957				10950	10950		25.79	2.09	0.70	0.10	0.00	0.00	0.00	1.77E-32	1.12E-30	1.02E+00
10958				10951	10951		25.79	2.09	0.70	0.10	0.00	0.00	0.00	1.80E-32	1.14E-30	1.02E+00
10959				10952	10952		25.79	2.09	0.70	0.10	0.00	0.00	0.00	1.82E-32	1.15E-30	1.02E+00
10960				10953	10953		25.80	2.09	0.70	0.10	0.00	0.00	0.00	1.85E-32	1.17E-30	1.02E+00
10961				10954	10954		25.80	2.09	0.70	0.10	0.00	0.00	0.00	1.88E-32	1.19E-30	1.02E+00
10962				10955	10955		25.80	2.09	0.70	0.10	0.00	0.00	0.00	1.91E-32	1.21E-30	1.02E+00
10963				10956	10956		25.80	2.09	0.70	0.10	0.00	0.00	0.00	1.94E-32	1.23E-30	1.02E+00
10964				10957	10957		25.81	2.09	0.70	0.10	0.00	0.00	0.00	1.97E-32	1.25E-30	1.02E+00
10965				10958	10958		25.81	2.09	0.70	0.10	0.00	0.00	0.00	2.00E-32	1.27E-30	1.02E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

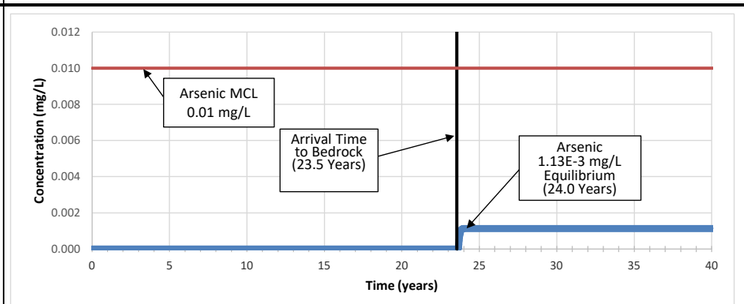
1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 16b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to P-04-12A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	145.92	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	167.79	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	164.56	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8599	23.54	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8600	23.55	2.20	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8601	23.55	4.39	0.02	0.01	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	8602	23.55	6.59	0.15	0.05	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	8603	23.55	8.78	0.35	0.12	0.02	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	8604	23.56	10.98	0.57	0.19	0.03	1.26	0.42	0.06	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	251714.72	← *=C11*C12*3.7854118*	6	8605	23.56	13.18	0.81	0.27	0.04	1.77	0.59	0.09	2.58E-179	2.58E-179	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8606	23.56	15.37	1.04	0.35	0.05	2.28	0.76	0.11	2.86E-115	2.86E-115	1.11E+64
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.21E-02	← *=(C4-C5)/C3*	8	8607	23.56	17.57	1.27	0.42	0.06	2.79	0.93	0.14	7.94E-80	7.94E-80	2.78E+35
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8608	23.57	19.76	1.49	0.50	0.07	3.28	1.09	0.16	2.93E-58	2.93E-58	3.69E+21
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.20	← *=C14*C15/C16*	10	8609	23.57	21.96	1.71	0.57	0.09	3.77	1.26	0.19	3.27E-44	3.27E-44	1.12E+14
18	Retardation Factor	1	*INPUT*	11	8610	23.57	24.15	1.93	0.64	0.10	4.24	1.41	0.21	1.40E-34	1.40E-34	4.29E+09
19	1st Order Decay Constant	0	*INPUT*	12	8611	23.58	26.35	2.14	0.71	0.11	4.70	1.57	0.23	1.05E-27	1.05E-27	7.47E+06
20	Longitudinal Distance to Monitoring Well (ft)	145.92	← *=C3*	13	8612	23.58	28.55	2.34	0.78	0.12	5.14	1.71	0.26	1.21E-22	1.21E-22	1.16E+05
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	8613	23.58	30.74	2.54	0.85	0.13	5.58	1.86	0.28	8.16E-19	8.16E-19	6.73E+03
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	8614	23.58	32.94	2.73	0.91	0.14	6.00	2.00	0.30	7.39E-16	7.40E-16	9.06E+02
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8615	23.59	35.13	2.92	0.97	0.15	6.42	2.14	0.32	1.56E-13	1.57E-13	2.12E+02
24	Proposed Base Grade Elevation (ft-NGVD)	181.20	*INPUT*	17	8616	23.59	37.33	3.11	1.04	0.16	6.82	2.27	0.34	1.13E-11	1.14E-11	7.27E+01
25	Bedrock Surface Elevation (ft-NGVD)	150.00	*INPUT*	18	8617	23.59	39.52	3.29	1.10	0.16	7.21	2.40	0.36	3.59E-10	3.70E-10	3.24E+01
26	Till Thickness (ft)	31.20	← *=C24-C25*	19	8618	23.59	41.72	3.46	1.15	0.17	7.60	2.53	0.38	6.09E-09	6.46E-09	1.75E+01
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8619	23.60	43.92	3.63	1.21	0.18	7.97	2.66	0.40	6.33E-08	6.98E-08	1.08E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8620	23.60	46.11	3.80	1.27	0.19	8.34	2.78	0.42	4.46E-07	5.16E-07	7.39E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8621	23.60	48.31	3.96	1.32	0.20	8.70	2.90	0.43	2.30E-06	2.81E-06	5.45E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8622	23.61	50.50	4.12	1.37	0.21	9.05	3.02	0.45	9.18E-06	1.20E-05	4.27E+00
31	Time of Vertical Flow Through Till (days)	8599	← *=C26/C30*	24	8623	23.61	52.70	4.28	1.43	0.21	9.39	3.13	0.47	2.98E-05	4.18E-05	3.49E+00
32				25	8624	23.61	54.90	4.43	1.48	0.22	9.73	3.24	0.49	8.17E-05	1.24E-04	2.95E+00
33	`		`	26	8625	23.61	57.09	4.58	1.53	0.23	10.06	3.35	0.50	1.94E-04	3.18E-04	2.57E+00
34				27	8626	23.62	59.29	4.73	1.58	0.24	10.39	3.46	0.52	4.09E-04	7.26E-04	2.29E+00
35				28	8627	23.62	61.48	4.87	1.62	0.24	10.70	3.57	0.54	7.78E-04	1.50E-03	2.07E+00
36				29	8628	23.62	63.68	5.02	1.67	0.25	11.02	3.67	0.55	1.36E-03	2.87E-03	1.90E+00
37				30	8629	23.62	65.87	5.16	1.72	0.26	11.32	3.77	0.57	2.21E-03	5.08E-03	1.77E+00
10949				10942	19541	53.50	24026.81	71.17	23.72	3.56	156.27	52.09	7.81	4.25E-43	1.88E+00	1.00E+00
10950				10943	19542	53.50	24029.00	71.17	23.72	3.56	156.28	52.09	7.81	4.22E-43	1.88E+00	1.00E+00
10951				10944	19543	53.51	24031.20	71.17	23.72	3.56	156.28	52.09	7.81	4.20E-43	1.88E+00	1.00E+00
10952				10945	19544	53.51	24033.40	71.17	23.72	3.56	156.28	52.09	7.81	4.17E-43	1.88E+00	1.00E+00
10953				10946	19545	53.51	24035.59	71.17	23.72	3.56	156.29	52.10	7.81	4.15E-43	1.88E+00	1.00E+00
10954				10947	19546	53.51	24037.79	71.18	23.73	3.56	156.29	52.10	7.81	4.13E-43	1.88E+00	1.00E+00
10955				10948	19547	53.52	24039.98	71.18	23.73	3.56	156.30	52.10	7.81	4.10E-43	1.88E+00	1.00E+00
10956				10949	19548	53.52	24042.18	71.18	23.73	3.56	156.30	52.10	7.81	4.08E-43	1.88E+00	1.00E+00
10957				10950	19549	53.52	24044.37	71.18	23.73	3.56	156.30	52.10	7.82	4.05E-43	1.88E+00	1.00E+00
10958				10951	19550	53.52	24046.57	71.18	23.73	3.56	156.31	52.10	7.82	4.03E-43	1.88E+00	1.00E+00
10959				10952	19551	53.53	24048.77	71.19	23.73	3.56	156.31	52.10	7.82	4.01E-43	1.88E+00	1.00E+00
10960				10953	19552	53.53	24050.96	71.19	23.73	3.56	156.31	52.10	7.82	3.98E-43	1.88E+00	1.00E+00
10961				10954	19553	53.53	24053.16	71.19	23.73	3.56	156.32	52.11	7.82	3.96E-43	1.88E+00	1.00E+00
10962				10955	19554	53.54	24055.35	71.19	23.73	3.56	156.32	52.11	7.82	3.94E-43	1.88E+00	1.00E+00
10963				10956	19555	53.54	24057.55	71.19	23.73	3.56	156.33	52.11	7.82	3.92E-43	1.88E+00	1.00E+00
10964				10957	19556	53.54	24059.75	71.19	23.73	3.56	156.33	52.11	7.82	3.89E-43	1.88E+00	1.00E+00
10965				10958	19557	53.54	24061.94	71.20	23.73	3.56	156.33	52.11	7.82	3.87E-43	1.88E+00	1.00E+00



Note: MFCCC Exceedances Are Not Applicable To Groundwater

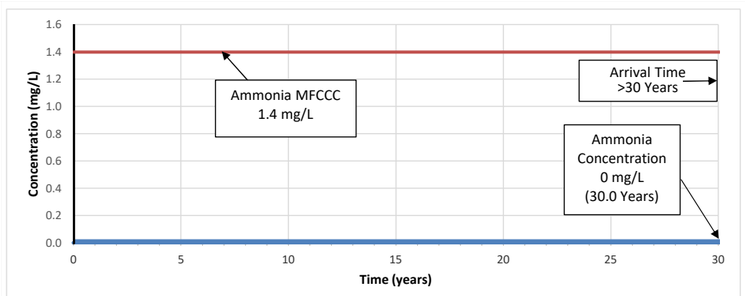
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 16b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to P-04-12A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	145.92	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	167.79	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	164.56	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8599	23.54	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8600	23.55	2.20	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8601	23.55	4.39	0.02	0.01	0.00	0.04	0.01	0.00	0.00E+00	0.00E+00	#DIV/0!
10				3	8602	23.55	6.59	0.15	0.05	0.01	0.33	0.11	0.02	0.00E+00	0.00E+00	#DIV/0!
11	Design Leakage West of Groundwater Divide (gpd)	75.56	← *=(C8/43560)*C9*	4	8603	23.55	8.78	0.35	0.12	0.02	0.77	0.26	0.04	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	8604	23.56	10.98	0.57	0.19	0.03	1.26	0.42	0.06	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	151.60	← *=C11*C12*3.7854118*	6	8605	23.56	13.18	0.81	0.27	0.04	1.77	0.59	0.09	1.55E-182	1.55E-182	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8606	23.56	15.37	1.04	0.35	0.05	2.28	0.76	0.11	1.72E-118	1.72E-118	1.11E+64
15	Horizontal Flow Hydraulic Gradient (ft/ft)	2.21E-02	← *=(C4-C5)/C3*	8	8607	23.56	17.57	1.27	0.42	0.06	2.79	0.93	0.14	4.78E-83	4.78E-83	2.78E+35
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8608	23.57	19.76	1.49	0.50	0.07	3.28	1.09	0.16	1.76E-61	1.76E-61	3.69E+21
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	2.20	← *=C14*C15/C16*	10	8609	23.57	21.96	1.71	0.57	0.09	3.77	1.26	0.19	1.97E-47	1.97E-47	1.12E+14
18	Retardation Factor	1	*INPUT*	11	8610	23.57	24.15	1.93	0.64	0.10	4.24	1.41	0.21	8.46E-38	8.46E-38	4.29E+09
19	1st Order Decay Constant	0	*INPUT*	12	8611	23.58	26.35	2.14	0.71	0.11	4.70	1.57	0.23	6.32E-31	6.32E-31	7.47E+06
20	Longitudinal Distance to Monitoring Well (ft)	145.92	← *=C3*	13	8612	23.58	28.55	2.34	0.78	0.12	5.14	1.71	0.26	7.31E-26	7.31E-26	1.16E+05
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	8613	23.58	30.74	2.54	0.85	0.13	5.58	1.86	0.28	4.92E-22	4.92E-22	6.73E+03
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	8614	23.58	32.94	2.73	0.91	0.14	6.00	2.00	0.30	4.45E-19	4.46E-19	9.06E+02
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8615	23.59	35.13	2.92	0.97	0.15	6.42	2.14	0.32	9.42E-17	9.46E-17	2.12E+02
24	Proposed Base Grade Elevation (ft-NGVD)	181.20	*INPUT*	17	8616	23.59	37.33	3.11	1.04	0.16	6.82	2.27	0.34	6.78E-15	6.88E-15	7.27E+01
25	Bedrock Surface Elevation (ft-NGVD)	150.00	*INPUT*	18	8617	23.59	39.52	3.29	1.10	0.16	7.21	2.40	0.36	2.16E-13	2.23E-13	3.24E+01
26	Till Thickness (ft)	31.20	← *=C24-C25*	19	8618	23.59	41.72	3.46	1.15	0.17	7.60	2.53	0.38	3.67E-12	3.89E-12	1.75E+01
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8619	23.60	43.92	3.63	1.21	0.18	7.97	2.66	0.40	3.81E-11	4.20E-11	1.08E+01
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8620	23.60	46.11	3.80	1.27	0.19	8.34	2.78	0.42	2.68E-10	3.10E-10	7.39E+00
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8621	23.60	48.31	3.96	1.32	0.20	8.70	2.90	0.43	1.38E-09	1.69E-09	5.45E+00
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8622	23.61	50.50	4.12	1.37	0.21	9.05	3.02	0.45	5.53E-09	7.22E-09	4.27E+00
31	Time of Vertical Flow Through Till (days)	8599	← *=C26/C30*	24	8623	23.61	52.70	4.28	1.43	0.21	9.39	3.13	0.47	1.80E-08	2.52E-08	3.49E+00
32				25	8624	23.61	54.90	4.43	1.48	0.22	9.73	3.24	0.49	4.92E-08	7.44E-08	2.95E+00
33				26	8625	23.61	57.09	4.58	1.53	0.23	10.06	3.35	0.50	1.17E-07	1.91E-07	2.57E+00
34				27	8626	23.62	59.29	4.73	1.58	0.24	10.39	3.46	0.52	2.46E-07	4.37E-07	2.29E+00
35				28	8627	23.62	61.48	4.87	1.62	0.24	10.70	3.57	0.54	4.69E-07	9.06E-07	2.07E+00
36				29	8628	23.62	63.68	5.02	1.67	0.25	11.02	3.67	0.55	8.19E-07	1.73E-06	1.90E+00
37				30	8629	23.62	65.87	5.16	1.72	0.26	11.32	3.77	0.57	1.33E-06	3.06E-06	1.77E+00
10949				10942	19541	53.50	24026.81	71.17	23.72	3.56	156.27	52.09	7.81	2.56E-46	1.13E-03	1.00E+00
10950				10943	19542	53.50	24029.00	71.17	23.72	3.56	156.28	52.09	7.81	2.54E-46	1.13E-03	1.00E+00
10951				10944	19543	53.51	24031.20	71.17	23.72	3.56	156.28	52.09	7.81	2.53E-46	1.13E-03	1.00E+00
10952				10945	19544	53.51	24033.40	71.17	23.72	3.56	156.28	52.09	7.81	2.51E-46	1.13E-03	1.00E+00
10953				10946	19545	53.51	24035.59	71.17	23.72	3.56	156.29	52.10	7.81	2.50E-46	1.13E-03	1.00E+00
10954				10947	19546	53.51	24037.79	71.18	23.73	3.56	156.29	52.10	7.81	2.48E-46	1.13E-03	1.00E+00
10955				10948	19547	53.52	24039.98	71.18	23.73	3.56	156.30	52.10	7.81	2.47E-46	1.13E-03	1.00E+00
10956				10949	19548	53.52	24042.18	71.18	23.73	3.56	156.30	52.10	7.81	2.46E-46	1.13E-03	1.00E+00
10957				10950	19549	53.52	24044.37	71.18	23.73	3.56	156.30	52.10	7.82	2.44E-46	1.13E-03	1.00E+00
10958				10951	19550	53.52	24046.57	71.18	23.73	3.56	156.31	52.10	7.82	2.43E-46	1.13E-03	1.00E+00
10959				10952	19551	53.53	24048.77	71.19	23.73	3.56	156.31	52.10	7.82	2.41E-46	1.13E-03	1.00E+00
10960				10953	19552	53.53	24050.96	71.19	23.73	3.56	156.31	52.10	7.82	2.40E-46	1.13E-03	1.00E+00
10961				10954	19553	53.53	24053.16	71.19	23.73	3.56	156.32	52.11	7.82	2.39E-46	1.13E-03	1.00E+00
10962				10955	19554	53.54	24055.35	71.19	23.73	3.56	156.32	52.11	7.82	2.37E-46	1.13E-03	1.00E+00
10963				10956	19555	53.54	24057.55	71.19	23.73	3.56	156.33	52.11	7.82	2.36E-46	1.13E-03	1.00E+00
10964				10957	19556	53.54	24059.75	71.19	23.73	3.56	156.33	52.11	7.82	2.34E-46	1.13E-03	1.00E+00
10965				10958	19557	53.54	24061.94	71.20	23.73	3.56	156.33	52.11	7.82	2.33E-46	1.13E-03	1.00E+00



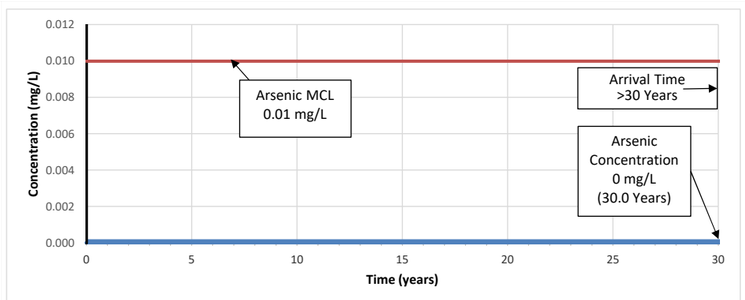
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 17a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-08-04B based on design leakage rate (Ammonia)**															
3	Interpreted Flow Path Distance (ft)	193.95	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	170.00	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	168.03	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^0.5)))*EXP(((-1)*((($C$20-($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7*$E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.02E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.08E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	193.95	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	491	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.83	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.84	0.66	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



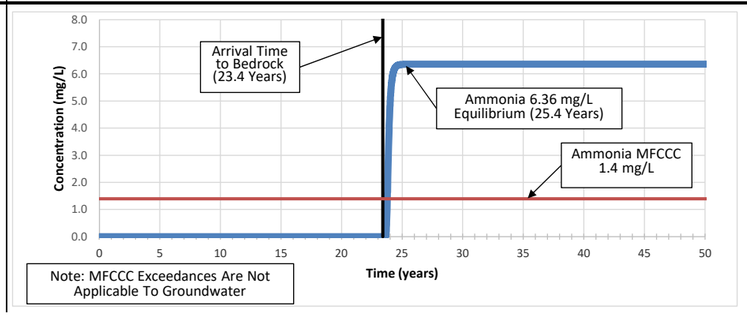
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 17a - Horizontal flow through till from nearest boundary of Phase II Expansion to monitoring well OW-08-04B based on design leakage rate (Arsenic)**															
3	Interpreted Flow Path Distance (ft)	193.19	*INPUT*													
4	Starting Groundwater Elevation (ft-NGVD)	170.00	*INPUT*	Model Days Starting At Till	Model Years Starting At Till		Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	168.03	*INPUT*													
6	**Data Input and Calculations**				=E7+$C$30↓		=$C$17*E7 ↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414) ↓	=I7/3 ↓	=I7/20 ↓	=I7*$C$17 ↓	=J7*$C$17 ↓	=K7*$C$17 ↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))))*0.0353147 ↓	=SUMIF($O7:O$7 ,">1E-300") ↓	=P7/P6 ↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	0		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	1		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	2		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	3		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	4		0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	5		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	6		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Till (ft/d)	2.66E-02	*INPUT*	7	7		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.02E-02	← *=(C4-C5)/C3*	8	8		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
16	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	9	9		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
17	Horizontal Till Groundwater Average Linear Velocity (ft/d)	1.08E-03	← *=C14*C15/C16*	10	10		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	11		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	12		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	193.19	← *=C3*	13	13		0.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	14		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	15		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
23				16	16		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
24	Estimate Travel Time to Monitoring Well (Years)	487	← *=(C20/C17)*365.25*	17	17		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
25				18	18		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
26				19	19		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
27				20	20		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
28				21	21		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
29				22	22		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
30				23	23		0.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
31				24	24		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
32				25	25		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
33				26	26		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
34				27	27		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
35				28	28		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
36				29	29		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
37				30	30		0.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10949				10942	10942		11.87	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10950				10943	10943		11.87	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10951				10944	10944		11.87	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10952				10945	10945		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10953				10946	10946		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10954				10947	10947		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10955				10948	10948		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10956				10949	10949		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10957				10950	10950		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10958				10951	10951		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10959				10952	10952		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10960				10953	10953		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10961				10954	10954		11.88	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10962				10955	10955		11.89	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10963				10956	10956		11.89	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10964				10957	10957		11.89	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
10965				10958	10958		11.89	0.67	0.22	0.03	0.00	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!



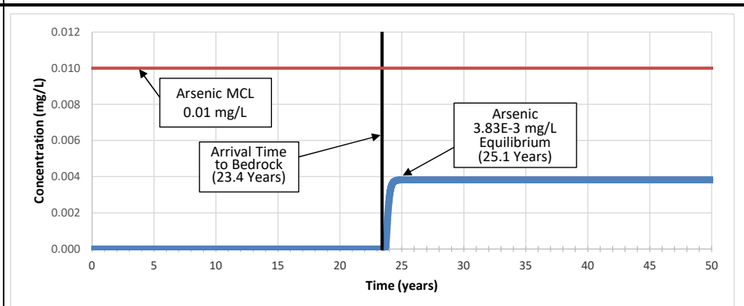
JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 17b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-08-04A based on design leakage rate (Ammonia)**														
3	Interpreted Flow Path Distance (ft)	193.19	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	170.00	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	168.03	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+((($C$22)^2)/(4*$N7*$E7))))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8544	23.39	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8545	23.39	1.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8546	23.40	2.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	8547	23.40	3.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	8548	23.40	4.05	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Ammonia Concentration (mg/L)	880	*INPUT*	5	8549	23.41	5.06	0.05	0.02	0.00	0.05	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	615779.92	← *=C11*C12*3.7854118*	6	8550	23.41	6.07	0.11	0.04	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8551	23.41	7.08	0.19	0.06	0.01	0.20	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.02E-02	← *=(C4-C5)/C3*	8	8552	23.41	8.09	0.28	0.09	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8553	23.42	9.10	0.38	0.13	0.02	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.01	← *=C14*C15/C16*	10	8554	23.42	10.12	0.48	0.16	0.02	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8555	23.42	11.13	0.59	0.20	0.03	0.60	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8556	23.42	12.14	0.70	0.23	0.03	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	193.19	← *=C3*	13	8557	23.43	13.15	0.80	0.27	0.04	0.81	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	8558	23.43	14.16	0.91	0.30	0.05	0.92	0.31	0.05	1.05E-268	1.05E-268	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	8559	23.43	15.17	1.02	0.34	0.05	1.03	0.34	0.05	9.09E-222	9.09E-222	8.68E+46
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8560	23.44	16.19	1.12	0.37	0.06	1.14	0.38	0.06	5.40E-186	5.40E-186	5.94E+35
24	Proposed Base Grade Elevation (ft-NGVD)	176.88	*INPUT*	17	8561	23.44	17.20	1.23	0.41	0.06	1.24	0.41	0.06	4.04E-158	4.04E-158	7.48E+27
25	Bedrock Surface Elevation (ft-NGVD)	145.88	*INPUT*	18	8562	23.44	18.21	1.33	0.44	0.07	1.35	0.45	0.07	5.47E-136	5.47E-136	1.35E+22
26	Till Thickness (ft)	31.00	← *=C24-C25*	19	8563	23.44	19.22	1.44	0.48	0.07	1.46	0.49	0.07	3.94E-118	3.94E-118	7.21E+17
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8564	23.45	20.23	1.54	0.51	0.08	1.56	0.52	0.08	1.62E-103	1.62E-103	4.11E+14
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8565	23.45	21.24	1.64	0.55	0.08	1.66	0.55	0.08	2.07E-91	2.07E-91	1.28E+12
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8566	23.45	22.25	1.74	0.58	0.09	1.76	0.59	0.09	2.86E-81	2.86E-81	1.38E+10
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8567	23.45	23.27	1.84	0.61	0.09	1.86	0.62	0.09	1.08E-72	1.08E-72	3.76E+08
31	Time of Vertical Flow Through Till (days)	8544	← *=C26/C30*	24	8568	23.46	24.28	1.94	0.65	0.10	1.96	0.65	0.10	2.23E-65	2.23E-65	2.07E+07
32				25	8569	23.46	25.29	2.04	0.68	0.10	2.06	0.69	0.10	4.33E-59	4.33E-59	1.95E+06
33				26	8570	23.46	26.30	2.13	0.71	0.11	2.16	0.72	0.11	1.21E-53	1.21E-53	2.79E+05
34				27	8571	23.47	27.31	2.23	0.74	0.11	2.25	0.75	0.11	6.70E-49	6.70E-49	5.56E+04
35				28	8572	23.47	28.32	2.32	0.77	0.12	2.35	0.78	0.12	9.66E-45	9.66E-45	1.44E+04
36				29	8573	23.47	29.34	2.41	0.80	0.12	2.44	0.81	0.12	4.46E-41	4.46E-41	4.62E+03
37				30	8574	23.47	30.35	2.51	0.84	0.13	2.53	0.84	0.13	7.84E-38	7.84E-38	1.76E+03
10949				10942	19486	53.35	11068.53	57.11	19.04	2.86	57.78	19.26	2.89	3.66E-26	6.36E+00	1.00E+00
10950				10943	19487	53.35	11069.54	57.12	19.04	2.86	57.78	19.26	2.89	3.65E-26	6.36E+00	1.00E+00
10951				10944	19488	53.35	11070.55	57.12	19.04	2.86	57.78	19.26	2.89	3.64E-26	6.36E+00	1.00E+00
10952				10945	19489	53.36	11071.57	57.12	19.04	2.86	57.78	19.26	2.89	3.62E-26	6.36E+00	1.00E+00
10953				10946	19490	53.36	11072.58	57.12	19.04	2.86	57.78	19.26	2.89	3.61E-26	6.36E+00	1.00E+00
10954				10947	19491	53.36	11073.59	57.12	19.04	2.86	57.78	19.26	2.89	3.60E-26	6.36E+00	1.00E+00
10955				10948	19492	53.37	11074.60	57.12	19.04	2.86	57.78	19.26	2.89	3.59E-26	6.36E+00	1.00E+00
10956				10949	19493	53.37	11075.61	57.13	19.04	2.86	57.79	19.26	2.89	3.58E-26	6.36E+00	1.00E+00
10957				10950	19494	53.37	11076.62	57.13	19.04	2.86	57.79	19.26	2.89	3.56E-26	6.36E+00	1.00E+00
10958				10951	19495	53.37	11077.63	57.13	19.04	2.86	57.79	19.26	2.89	3.55E-26	6.36E+00	1.00E+00
10959				10952	19496	53.38	11078.65	57.13	19.04	2.86	57.79	19.26	2.89	3.54E-26	6.36E+00	1.00E+00
10960				10953	19497	53.38	11079.66	57.13	19.04	2.86	57.79	19.26	2.89	3.53E-26	6.36E+00	1.00E+00
10961				10954	19498	53.38	11080.67	57.13	19.04	2.86	57.79	19.26	2.89	3.52E-26	6.36E+00	1.00E+00
10962				10955	19499	53.38	11081.68	57.14	19.05	2.86	57.80	19.27	2.89	3.51E-26	6.36E+00	1.00E+00
10963				10956	19500	53.39	11082.69	57.14	19.05	2.86	57.80	19.27	2.89	3.49E-26	6.36E+00	1.00E+00
10964				10957	19501	53.39	11083.70	57.14	19.05	2.86	57.80	19.27	2.89	3.48E-26	6.36E+00	1.00E+00
10965				10958	19502	53.39	11084.72	57.14	19.05	2.86	57.80	19.27	2.89	3.47E-26	6.36E+00	1.00E+00



JRL PHASE II EXPANSION
CONTAMINANT TRANSPORT ANALYSIS

1/A	B	C	D	F	G	H	I	J	K	L	M	N	O	P	Q
2	**Scenario B - 17b - Vertical downward flow through till and horizontal flow through bedrock from nearest boundary of Phase II Expansion to OW-08-04A based on design leakage rate (Arsenic)**														
3	Interpreted Flow Path Distance (ft)	193.19	*INPUT*												
4	Starting Groundwater Elevation (ft-NGVD)	170.00	*INPUT*	Model Days Starting At Bedrock	Model Days Adjusted for Vertical Travel to Bedrock	Model Years Adjusted for Vertical Travel to Bedrock	Plume Length, Lp (ft)	Longitudinal Dispersivity, ax (ft)	Transverse Dispersivity, ay (ft)	Vertical Dispersivity, az (ft)	Longitudinal Dispersion, Dx (ft^2/d)	Transverse Dispersion, Dy (ft^2/d)	Vertical Dispersion, Dz (ft^2/d)	One Time Release Concentration (mg/L)	Daily Release Concentration (mg/L)	Ratio of Current Value to Previous Value (Stabilization Check)
5	Monitoring Well Groundwater Elevation (ft-NGVD)	168.03	*INPUT*												
6	**Data Input and Calculations**				=E7+$C$31↓	=F7/365.25↓	=$C$17*E7↓	=(3.28)*(0.83)*((LOG (H7/3.28))^2.414)↓	=I7/3↓	=I7/20↓	=I7*$C$17↓	=J7*$C$17↓	=K7*$C$17↓	=(((($C$13)/(8*((3.141592*$E7)^1.5)*(($L7*$M7*$N7)^ 0.5)))*EXP(((-1)*((($C$20- ($C$17*$E7))^2))/(4*$L7*$E7)+(((($C$21)^2)/(4*$M7* $E7))+(((($C$22)^2)/(4*$N7*$E7)))))*0.0353147↓	=SUMIF($O7:O$7 ,">1E-300")↓	=P7/P6↓
7	Phase II Expansion Area East of Groundwater Divide (ft^2)	1750490.51	*INPUT*	0	8544	23.39	0.00	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#VALUE!
8	Phase II Expansion Area West of Groundwater Divide (ft^2)	715554.72	*INPUT*	1	8545	23.39	1.01	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
9	Design Leakage Rate (gpd/acre)	4.6	*INPUT*	2	8546	23.40	2.02	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
10				3	8547	23.40	3.03	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.00E+00	#DIV/0!
11	Design Leakage East of Groundwater Divide (gpd)	184.85	← *=(C7/43560)*C9*	4	8548	23.40	4.05	0.01	0.00	0.00	0.01	0.00	0.00	0.00E+00	0.00E+00	#DIV/0!
12	5-Year Maximum Arsenic Concentration (mg/L)	0.53	*INPUT*	5	8549	23.41	5.06	0.05	0.02	0.00	0.05	0.02	0.00	0.00E+00	0.00E+00	#DIV/0!
13	Source Mass (mg)	370.87	← *=C11*C12*3.7854118*	6	8550	23.41	6.07	0.11	0.04	0.01	0.11	0.04	0.01	0.00E+00	0.00E+00	#DIV/0!
14	Horizontal Hydraulic Conductivity of Bedrock (ft/d)	9.92E-02	*INPUT*	7	8551	23.41	7.08	0.19	0.06	0.01	0.20	0.07	0.01	0.00E+00	0.00E+00	#DIV/0!
15	Horizontal Flow Hydraulic Gradient (ft/ft)	1.02E-02	← *=(C4-C5)/C3*	8	8552	23.41	8.09	0.28	0.09	0.01	0.29	0.10	0.01	0.00E+00	0.00E+00	#DIV/0!
16	Effective Porosity of Bedrock (ft^3/ft^3)	0.001	*INPUT*	9	8553	23.42	9.10	0.38	0.13	0.02	0.39	0.13	0.02	0.00E+00	0.00E+00	#DIV/0!
17	Horizontal Bedrock Groundwater Average Linear Velocity (ft/d)	1.01	← *=C14*C15/C16*	10	8554	23.42	10.12	0.48	0.16	0.02	0.49	0.16	0.02	0.00E+00	0.00E+00	#DIV/0!
18	Retardation Factor	1	*INPUT*	11	8555	23.42	11.13	0.59	0.20	0.03	0.60	0.20	0.03	0.00E+00	0.00E+00	#DIV/0!
19	1st Order Decay Constant	0	*INPUT*	12	8556	23.42	12.14	0.70	0.23	0.03	0.70	0.23	0.04	0.00E+00	0.00E+00	#DIV/0!
20	Longitudinal Distance to Monitoring Well (ft)	193.19	← *=C3*	13	8557	23.43	13.15	0.80	0.27	0.04	0.81	0.27	0.04	0.00E+00	0.00E+00	#DIV/0!
21	Transverse Distance to Monitoring Well (ft)	0	*INPUT*	14	8558	23.43	14.16	0.91	0.30	0.05	0.92	0.31	0.05	6.31E-272	6.31E-272	#DIV/0!
22	Vertical Distance to Monitoring Well (ft)	0	*INPUT*	15	8559	23.43	15.17	1.02	0.34	0.05	1.03	0.34	0.05	5.48E-225	5.48E-225	8.68E+46
23	**Vertical Time of Travel Through Soils to Bedrock Surface**			16	8560	23.44	16.19	1.12	0.37	0.06	1.14	0.38	0.06	3.25E-189	3.25E-189	5.94E+35
24	Proposed Base Grade Elevation (ft-NGVD)	176.88	*INPUT*	17	8561	23.44	17.20	1.23	0.41	0.06	1.24	0.41	0.06	2.43E-161	2.43E-161	7.48E+27
25	Bedrock Surface Elevation (ft-NGVD)	145.88	*INPUT*	18	8562	23.44	18.21	1.33	0.44	0.07	1.35	0.45	0.07	3.29E-139	3.29E-139	1.35E+22
26	Till Thickness (ft)	31.00	← *=C24-C25*	19	8563	23.44	19.22	1.44	0.48	0.07	1.46	0.49	0.07	2.37E-121	2.37E-121	7.21E+17
27	Vertical Hydraulic Conductivity of Till (ft/d)	9.07E-04	*INPUT*	20	8564	23.45	20.23	1.54	0.51	0.08	1.56	0.52	0.08	9.75E-107	9.75E-107	4.11E+14
28	Effective Porosity of Till (ft^3/ft^3)	0.25	*INPUT*	21	8565	23.45	21.24	1.64	0.55	0.08	1.66	0.55	0.08	1.25E-94	1.25E-94	1.28E+12
29	Hydraulic Gradient (Assumed Vertical Movement Through Till) (ft/ft)	1	*INPUT*	22	8566	23.45	22.25	1.74	0.58	0.09	1.76	0.59	0.09	1.72E-84	1.72E-84	1.38E+10
30	Vertical Till Groundwater Average Linear Velocity (ft/d)	3.63E-03	← *=C27*C29/C28*	23	8567	23.45	23.27	1.84	0.61	0.09	1.86	0.62	0.09	6.49E-76	6.49E-76	3.76E+08
31	Time of Vertical Flow Through Till (days)	8544	← *=C26/C30*	24	8568	23.46	24.28	1.94	0.65	0.10	1.96	0.65	0.10	1.34E-68	1.34E-68	2.07E+07
32				25	8569	23.46	25.29	2.04	0.68	0.10	2.06	0.69	0.10	2.61E-62	2.61E-62	1.95E+06
33				26	8570	23.46	26.30	2.13	0.71	0.11	2.16	0.72	0.11	7.27E-57	7.27E-57	2.79E+05
34				27	8571	23.47	27.31	2.23	0.74	0.11	2.25	0.75	0.11	4.04E-52	4.04E-52	5.56E+04
35				28	8572	23.47	28.32	2.32	0.77	0.12	2.35	0.78	0.12	5.82E-48	5.82E-48	1.44E+04
36				29	8573	23.47	29.34	2.41	0.80	0.12	2.44	0.81	0.12	2.69E-44	2.69E-44	4.62E+03
37				30	8574	23.47	30.35	2.51	0.84	0.13	2.53	0.84	0.13	4.72E-41	4.72E-41	1.76E+03
10949				10942	19486	53.35	11068.53	57.11	19.04	2.86	57.78	19.26	2.89	2.20E-29	3.83E-03	1.00E+00
10950				10943	19487	53.35	11069.54	57.12	19.04	2.86	57.78	19.26	2.89	2.20E-29	3.83E-03	1.00E+00
10951				10944	19488	53.35	11070.55	57.12	19.04	2.86	57.78	19.26	2.89	2.19E-29	3.83E-03	1.00E+00
10952				10945	19489	53.36	11071.57	57.12	19.04	2.86	57.78	19.26	2.89	2.18E-29	3.83E-03	1.00E+00
10953				10946	19490	53.36	11072.58	57.12	19.04	2.86	57.78	19.26	2.89	2.18E-29	3.83E-03	1.00E+00
10954				10947	19491	53.36	11073.59	57.12	19.04	2.86	57.78	19.26	2.89	2.17E-29	3.83E-03	1.00E+00
10955				10948	19492	53.37	11074.60	57.12	19.04	2.86	57.78	19.26	2.89	2.16E-29	3.83E-03	1.00E+00
10956				10949	19493	53.37	11075.61	57.13	19.04	2.86	57.79	19.26	2.89	2.15E-29	3.83E-03	1.00E+00
10957				10950	19494	53.37	11076.62	57.13	19.04	2.86	57.79	19.26	2.89	2.15E-29	3.83E-03	1.00E+00
10958				10951	19495	53.37	11077.63	57.13	19.04	2.86	57.79	19.26	2.89	2.14E-29	3.83E-03	1.00E+00
10959				10952	19496	53.38	11078.65	57.13	19.04	2.86	57.79	19.26	2.89	2.13E-29	3.83E-03	1.00E+00
10960				10953	19497	53.38	11079.66	57.13	19.04	2.86	57.79	19.26	2.89	2.13E-29	3.83E-03	1.00E+00
10961				10954	19498	53.38	11080.67	57.13	19.04	2.86	57.79	19.26	2.89	2.12E-29	3.83E-03	1.00E+00
10962				10955	19499	53.38	11081.68	57.14	19.05	2.86	57.80	19.27	2.89	2.11E-29	3.83E-03	1.00E+00
10963				10956	19500	53.39	11082.69	57.14	19.05	2.86	57.80	19.27	2.89	2.10E-29	3.83E-03	1.00E+00
10964				10957	19501	53.39	11083.70	57.14	19.05	2.86	57.80	19.27	2.89	2.10E-29	3.83E-03	1.00E+00
10965				10958	19502	53.39	11084.72	57.14	19.05	2.86	57.80	19.27	2.89	2.09E-29	3.83E-03	1.00E+00



SENSITIVITY ANALYSIS RESULTS (TABLE J-3)

TABLE J-3

SENSITIVITY ANALYSIS FOR SCENARIO A – 4b

Input Parameter	Solute Transport Model Value	Resulting Arrival Time at Exceedance of Standard		50 Percent Increase Value	Resulting Arrival Time at Exceedance of Standard	Criterion		50 Percent Decrease Value	Resulting Arrival Time at Exceedance of Standard	Criterion
Vertical Hydraulic Conductivity of Till (ft/day)	9.07E-04	Ammonia (11.6 Years) Arsenic (14.8 Years)		1.36E-03	Ammonia (10.2 Years) Arsenic (11.6 Years)	Criterion Met (>6 years to standard exceedance at Receptor)		4.54E-04	Ammonia (16.0 Years) Arsenic (Does Not Exceed)	Criterion Met (>6 years to standard exceedance at Receptor)
Horizontal Hydraulic Conductivity of Bedrock (ft/day)	9.92E-02			1.49E-01	Ammonia (10.5 Years) Arsenic (Does Not Exceed)	Criterion Met (>6 years to standard exceedance at Receptor)		4.96E-02	Ammonia (14.9 Years) Arsenic (17.3 Years)	Criterion Met (>6 years to standard exceedance at Receptor)
Horizontal Hydraulic Gradient (ft/ft)	9.72E-03			1.46E-02	Ammonia (10.5 Years) Arsenic (Does Not Exceed)	Criterion Met (>6 years to standard exceedance at Receptor)		4.86E-03	Ammonia (14.9 Years) Arsenic 17.3 Years)	Criterion Met (>6 years to standard exceedance at Receptor)
Effective Porosity of Till (ft^3/ft^3)	2.50E-01			3.75E-01	Ammonia (14.4 Years) Arsenic (16.9 Years)	Criterion Met (>6 years to standard exceedance at Receptor)		1.25E-01	Ammonia (9.5 Years) Arsenic (12.7 Years)	Criterion Met (>6 years to standard exceedance at Receptor)
Effective Porosity of Bedrock (ft^3/ft^3)	1.00E-03			1.50E-03	Ammonia (13.3 Years) Arsenic (15.5 Years)	Criterion Met (>6 years to standard exceedance at Receptor)		5.00E-04	Ammonia (9.9 Years) Arsenic (Does Not Exceed)	Criterion Met (>6 years to standard exceedance at Receptor)

APPENDIX K

CELL 18 DESIGN DRAWINGS

SME
SEVEE & MAHER
ENGINEERS

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS, LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

TITLE	DWG NO
COVER SHEET	
SYMBOLS & ABBREVIATIONS	C-100
EXISTING CONDITIONS PLAN	C-101
SITE DEVELOPMENT OVERVIEW PLAN	C-102
BASE GRADING PLAN	C-103
UNDERDRAIN PIPING PLAN	C-104
LINER LAYOUT PLAN	C-105
LEAK DETECTION PIPING PLAN	C-106
LEACHATE COLLECTION PIPING PLAN	C-107
CELL 18 ACCESS PLAN	C-108
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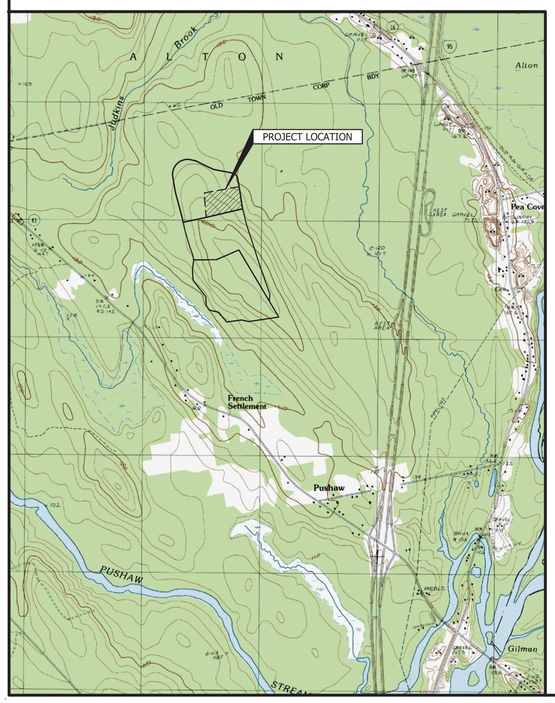
LOCATION MAP



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STATE OF MAINE
BRIAN M. PIERCE
3606
LICENSED PROFESSIONAL ENGINEER
11/17/2025

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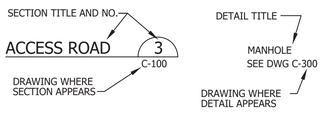
SYMBOLS

EXISTING	PROPOSED		EXISTING	PROPOSED		EXISTING	PROPOSED	
		NORTH ARROW (GRID)			DRAINAGE COURSE (WITH DIRECTION)	G	G	UNDERGROUND GAS MAIN
	DATE	NORTH ARROW (MAGNETIC)			EDGE OF WATER	UCC	UCC	UNDERGROUND COMMUNICATIONS LINE
25	25	CONTOUR LINES			STREAM	UGE	UGE	UNDERGROUND ELECTRICAL LINE
	INV 25.56	SPOT ELEVATION (INVERT ELEVATION)			WATER ELEVATION (GROUND OR SURFACE)	OHE	OHE	OVERHEAD ELECTRICAL LINE
		SURVEY BASELINE WITH TRIANGULATION OR INTERSECTION POINT			FENCE LINE (STOCKADE)	OT	OT	OVERHEAD TELEPHONE LINE
		PROPERTY LINE OR RIGHT-OF-WAY	X	X	FENCE LINE (METAL/CHAIN LINK)	SS	SS	SANITARY SEWER
		DEED RESTRICTION BOUNDARY			STONE WALL	FM	FM	FORCE MAIN
N35°-10'-10"W 251.17'	N35°-10'-10"W 251.17'	PROPERTY LINE W/ BEARING AND DISTANCE			RETAINING WALL	W	W	WATER MAIN
1	20	CELL DESIGNATION			GUARD RAIL	SD	SD	STORM DRAIN
		BOUNDARY LINE (State, County, Municipality)			BUILDING AND STRUCTURES	UD	UD	UNDERDRAIN
		SURVEY MONUMENT		2 1 OR 2:1	SLOPE RATIO (HORIZONTAL TO VERTICAL)	LFG	LFG	LANDFILL GAS
		SURVEY CONTROL	TOP OF SLOPE	TOP OF SLOPE	SLOPES (WITH SLOPE RATIO)	LT	LT	LEACHATE TRANSPORT
		PROPERTY PIN, DRILL HOLE, PK, OR STAKE			EDGE OF PAVEMENT	LC	LC	LEACHATE COLLECTION
		WOODS OR BRUSH LINE			EDGE OF GRAVEL	LD	LD	LEAK DETECTION
		INDIVIDUAL TREE			CONCRETE	GC	GC	GAS COLLECTION
		WETLAND DELINEATED	B-12 MW-12 P-12	B-12 MW-12 P-12	TEST BORING, MONITORING WELL, OR PIEZOMETER AND NUMBER	GT	GT	GAS TRANSPORT
		WETLAND PHOTO INTERPRETED	TP-12	TP-12	TEST PIT AND NUMBER			REDUCER
		WETLAND TO BE IMPACTED	SW-12	SW-12	SURFACE WATER SAMPLE LOCATION			MECHANICAL CAP OR PLUG
		WETLAND OF SPECIAL SIGNIFICANCE (WOSS)			GAS EXTRACTION WELL			COUPLING
		WOSS SETBACK (25-FOOT)	C	C	GAS CONDENSATE TRAP			BEND
		WOSS SETBACK (75-FOOT)	KO	KO	LFG KNOCKOUT			TEE
		VERNAL POOL			GAS WELL HEAD			PIPE TO BE ABANDONED
		VERNAL POOL SETBACK			GAS VENT CAPPED			RISER PIPE & INLET GRATE
		NRPA STREAM			CLEANOUT STRUCTURE			STORM GRATE
		BEDROCK OUTCROP			MANHOLE			DRAINAGE INLET STRUCTURE
		SAMPLE SUMP			CATCH BASIN			UNDERDRAIN SUMP
		SLOPE INCLINOMETER			CULVERT		LF	LITTER FENCE
		VIBRATING WIRE SETTLEMENT CELL			RIPRAP		SF	SILTATION FENCE
		VERTICAL/HORIZONTAL DISPLACEMENT MONUMENT			WATER OR GAS VALVE		LOW	LIMIT OF WORK LINE
		VERTICAL DISPLACEMENT MONUMENT			HYDRANT		CLL	CLEARING LIMIT LINE
				W	WELL (MAROOKA SUPPLY WELL)			100-YEAR FLOODPLAIN
					AIR RELEASE VALVE			WETLAND
				E	ELECTRICAL MANHOLE (EMH)			WETLAND OF SPECIAL SIGNIFICANCE (WOSS)
					UTILITY POLE			
					LIGHT POLE			

TYPICAL ABBREVIATIONS:

ACCMP	ASPHALT COATED CMP	CF	CUBIC FEET	EOP	EDGE OF PAVEMENT	ID	INSIDE DIAMETER	PC	POINT OF CURVE	TAN	TANGENT
ACP	ASBESTOS CEMENT PIPE	CFS	CUBIC FEET PER SECOND	EQUIP	EQUIPMENT	IN OR "	INCHES	PD	PERIMETER DRAIN	TDH	TOTAL DYNAMIC HEAD
AC	ACRE	CI	CAST IRON	EST	ESTIMATED	INV	INVERT	PI	POINT OF INTERSECTION	TEMP	TEMPORARY
AGG	AGGREGATE	CL	CLASS	EXC	EXCAVATE	INV EL	INVERT ELEVATION	PIV	POST INDICATOR VALVE	TYP	TYPICAL
ALUM	ALUMINUM	CONC	CONCRETE	EXIST	EXISTING			PT	POINT OF TANGENT		
APPD	APPROVED	CONST	CONSTRUCTION			LB	POUND	PERF	PERFORATED	UD	UNDERDRAIN
APPROX	APPROXIMATE	CONTR	CONTRACTOR	FI	FIELD INLET	LC	LEACHATE COLLECTION	PP	POWER POLE	V	VOLTS
ARMH	AIR RELEASE MANHOLE	CS	CURB STOP	FG	FINISH GRADE	LD	LEAK DETECTION	PSI	POUNDS PER SQUARE INCH	VA TEE	VALVE ANCHORING TEE
ASB	ASBESTOS	CTR	CENTER	FBRGL	FIBERGLASS	LF	LINEAR FEET	PVC	POLYVINYL CHLORIDE	VERT	VERTICAL
ASP	ASPHALT	CU	COPPER	FDN	FOUNDATION	LOC	LOCATION	PVMT	PAVEMENT	VGC	VERTICAL GRANITE CURB
AUTO	AUTOMATIC	CY	CUBIC YARD	FLEX	FLEXIBLE	LOW	LIMIT OF WORK				
AUX	AUXILIARY			FLG	FLANGE	LT	LEACHATE TRANSPORT	QTY	QUANTITY	WG	WATER GATE
AVE	AVENUE	D	DEGREE OF CURVE	FLR	FLOOR					W/	WITH
AZ	AZIMUTH	DBL	DOUBLE	FPS	FEET PER SECOND	MH	MANHOLE	RCP	REINFORCED CONCRETE PIPE	W/O	WITHOUT
		DEG OR °	DEGREE	FT OR '	FEET	MJ	MECHANICAL JOINT	ROW	RIGHT OF WAY		
BCCMP	BITUMINOUS COATED CMP	DEPT	DEPARTMENT	FTG	FOOTING	MATL	MATERIAL	RAD	RADIUS	YD	YARD
BM	BENCH MARK	DI	DUCTILE IRON			MAX	MAXIMUM	REQD	REQUIRED		
BIT	BITUMINOUS	DIA	DIAMETER	GA	GAUGE	MFR	MANUFACTURE	RT	RIGHT		
BLDG	BUILDING	DIM	DIMENSION	GAL	GALLON	MIN	MINIMUM	RTE	ROUTE		
BOT	BOTTOM	DIST	DISTANCE	GALV	GALVANIZED	MISC	MISCELLANEOUS				
BRG	BEARING	DN	DOWN	GPD	GALLONS PER DAY	MON	MONUMENT	S	SLOPE		
BV	BALL VALVE	DR	DRAIN	GPM	GALLONS PER MINUTE			SCH	SCHEDULE		
		DWG	DRAWING			NITC	NOT IN THIS CONTRACT	SF	SQUARE FEET		
CB	CATCH BASIN			HDPE	HIGH DENSITY POLYETHYLENE	NTS	NOT TO SCALE	SFC	SLIPFORM CONCRETE CURB		
CEN	CENTER	EA	EACH	HORIZ	HORIZONTAL	N/F	NOW OR FORMERLY	SHT	SHEET		
CEM LIN	CEMENT LINED	EG	EXISTING GROUND OR GRADE	HP	HORSEPOWER	NO OR #	NUMBER	SMH	SANITARY MANHOLE		
CMP	CORRUGATED METAL PIPE	ELEC	ELECTRIC	HYD	HYDRANT			ST	STREET		
CO	CLEAN OUT	EL	ELEVATION			OC	ON CENTER	STA	STATION		
		ELB	ELBOW			OD	OUTSIDE DIAMETER	SY	SQUARE YARD		

VIEW MARKERS & IDENTIFICATION



GENERAL NOTES

1. THE JUNIPER RIDGE LANDFILL IS AN ACTIVE FACILITY THAT RECEIVES WASTES ON A DAILY BASIS. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE WITH THE OWNER WITH REGARD TO USE OF PREMISES, INCLUDING HAUL ROUTES AND VEHICULAR ACCESS. THE CONTRACTOR SHALL COORDINATE ALL CONSTRUCTION ACTIVITIES SO AS NOT TO INTERFERE WITH ACTIVE LANDFILLING OPERATIONS. THE CONTRACTOR SHALL OBEY ALL TRAFFIC, NOISE, AND DUST CONTROL POLICIES OF THE JUNIPER RIDGE LANDFILL. THE CONTRACTOR SHALL MINIMIZE THE USE OF EQUIPMENT JAKE BRAKES AT THE INTERSECTION OF ROUTE 16 AND ALONG THE SITE ACCESS ROAD.

2. THE CONTRACTOR SHALL COMPLY FULLY WITH THE CONDITIONS CONTAINED IN:
   - THE MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION (MEDEP) BOARD ORDER (SEE APPENDIX A-1 OF TECHNICAL SPECIFICATIONS);
   - DEPARTMENT OF ARMY PERMIT (SEE APPENDIX A-2 OF TECHNICAL SPECIFICATIONS);
   - CITY OF OLD TOWN PLANNING BOARD SOLID WASTE FACILITIES PERMIT APPLICATION DECISIONS (SEE APPENDIX A-3 OF TECHNICAL SPECIFICATIONS);
   - MEDEP NRPA PERMIT BY RULE CONDITIONS;
   - MEDEP CONSTRUCTION GENERAL PERMIT;
   - MAINE DEPARTMENT OF TRANSPORTATION (MDOT) ENTRANCE PERMIT REQUIREMENTS, AS APPLICABLE;
   - MEDEP "MAINE EROSION AND SEDIMENT CONTROL HANDBOOK FOR CONSTRUCTION: BEST MANAGEMENT PRACTICES".

3. THE CONTRACTOR AND ITS SUBCONTRACTORS SHALL ABIDE BY ALL SAFETY REQUIREMENTS ASSOCIATED WITH WORKING AT AN ACTIVE SOLID WASTE LANDFILL FACILITY (i.e., RISK OF WORKER EXPOSURE TO LANDFILL GASES, LEACHATE, SOLID WASTE) INCLUDING THE FOLLOWING:
   - COMPLY WITH ALL OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REGULATIONS;
   - COMPLY WITH ALL NEWSME OPERATIONS SAFETY REQUIREMENTS, INCLUDING USE OF HARD HATS, SAFETY GLASSES, AND FLUORESCENT SAFETY VESTS AT ALL TIMES;
   - FOLLOW CONFINED SPACE ENTRY RULES ESTABLISHED BY NEWSME OPERATIONS AND OSHA FOR THE SITE, INCLUDING, BUT NOT LIMITED TO, MANHOLES, CATCH BASINS, PUMP STATIONS, TEST PITS, TRENCHES, ETC.; AND
   - ALL EQUIPMENT USED ON SITE SHALL BE EQUIPPED WITH BACK-UP WARNING LIGHTS AND AUDIBLE.

4. THE CONTRACTOR SHALL TAKE EVERY PRECAUTION TO ENSURE THAT NO SILTATION OF STORMWATER DRAINAGE COURSES OCCURS AS A RESULT OF SOIL DISTURBANCE ASSOCIATED WITH THE CONTRACT SCOPE OF WORK.

5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING COMPLETE PROTECTION OF THE PROJECT DURING CONSTRUCTION FROM ANY ACTS OF NATURE OR MAN, SUCH AS, BUT NOT LIMITED TO, FLOODS, WIND DAMAGE, EARTH SLIDES, AND SLOPE FAILURES. DAMAGE TO THE PROJECT CAUSED BY SUCH ACTS WILL NOT BE SUFFICIENT CAUSE TO INCREASE CONTRACT COSTS TO THE OWNER.

6. THE CONTRACTOR SHALL PROTECT EXISTING ON-SITE STRUCTURES FROM DAMAGE DURING CONSTRUCTION, INCLUDING: MONITORING WELLS, POWER LINES, MAINTENANCE FACILITIES, CELLS 1, 2, 3A, 3B, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, AND 17 LINER AND EXISTING LEACHATE COLLECTION AND TRANSPORT SYSTEMS, ETC. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REPAIRS REQUIRED TO CORRECT DAMAGE MADE TO EXISTING ON-SITE STRUCTURES DESCRIBED ABOVE RESULTING FROM ANY CONSTRUCTION ACTIVITY.

7. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC., NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLIGSA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC, CUMBERLAND, MAINE.

   SITE CONTROL POINTS INFORMATION:

POINT #	NORTHING	EASTING	ELEVATION (FT)	DESCRIPTION
1000	478242.06	925376.38	167.99	WET WELL-PLUG
1001	477837.90	925672.66	160.12	MH13-PK
1002	479259.38	925158.27	185.65	LEDGE-PK
1003	479589.83	925157.64	205.01	MH30-PK
1004	479820.27	925097.15	205.01	MH33-PK
1006	478246.50	925365.28	167.62	VALVE PIT-PK
1007	477451.45	926203.11	165.62	MH14-PK
1010	480071.86	926904.09	206.29	MH26-PK
1011	479669.08	927037.61	215.20	MH25-PK
1012	478065.49	927548.96	216.94	MH22-PK
1013	477534.13	927485.35	203.30	MH19-PK
1014	480638.39	926747.66	185.91	MH27-PK

8. LOCATIONS OF EXISTING UNDERGROUND UTILITIES INCLUDING ELECTRICAL AND PIPING BASED ON FIELD SURVEY DURING CONSTRUCTION OF CELLS 1 THROUGH 16, FORMER LEACHATE POND AND LANDFILL GAS HEADER AND FLARE RE-LOCATIONS.

9. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, AND 2015, AND BRI ENVIRONMENTAL IN 2024.

10. GRADES SHOWN WITHIN THE PERMITTED SOLID WASTE BOUNDARY REPRESENT ANTICIPATED GRADING AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.

11. LIMIT OF INTERMEDIATE GEOMEMBRANE COVER AND FINAL COVER SHOWN REPRESENTS ANTICIPATED SITE CONDITIONS AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE — BRIAN M. PIERCE — 9609 — REGISTERED PROFESSIONAL ENGINEER — 11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SYMBOLS & ABBREVIATIONS

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY: NMT
DRAWN BY: SJM
DATE: 11/2025
CHECKED BY: BDP
LMN: NONE
CTB: SME-STD.CTB
JOB NO. 250278 DWG FILE SYMSHT

C-100

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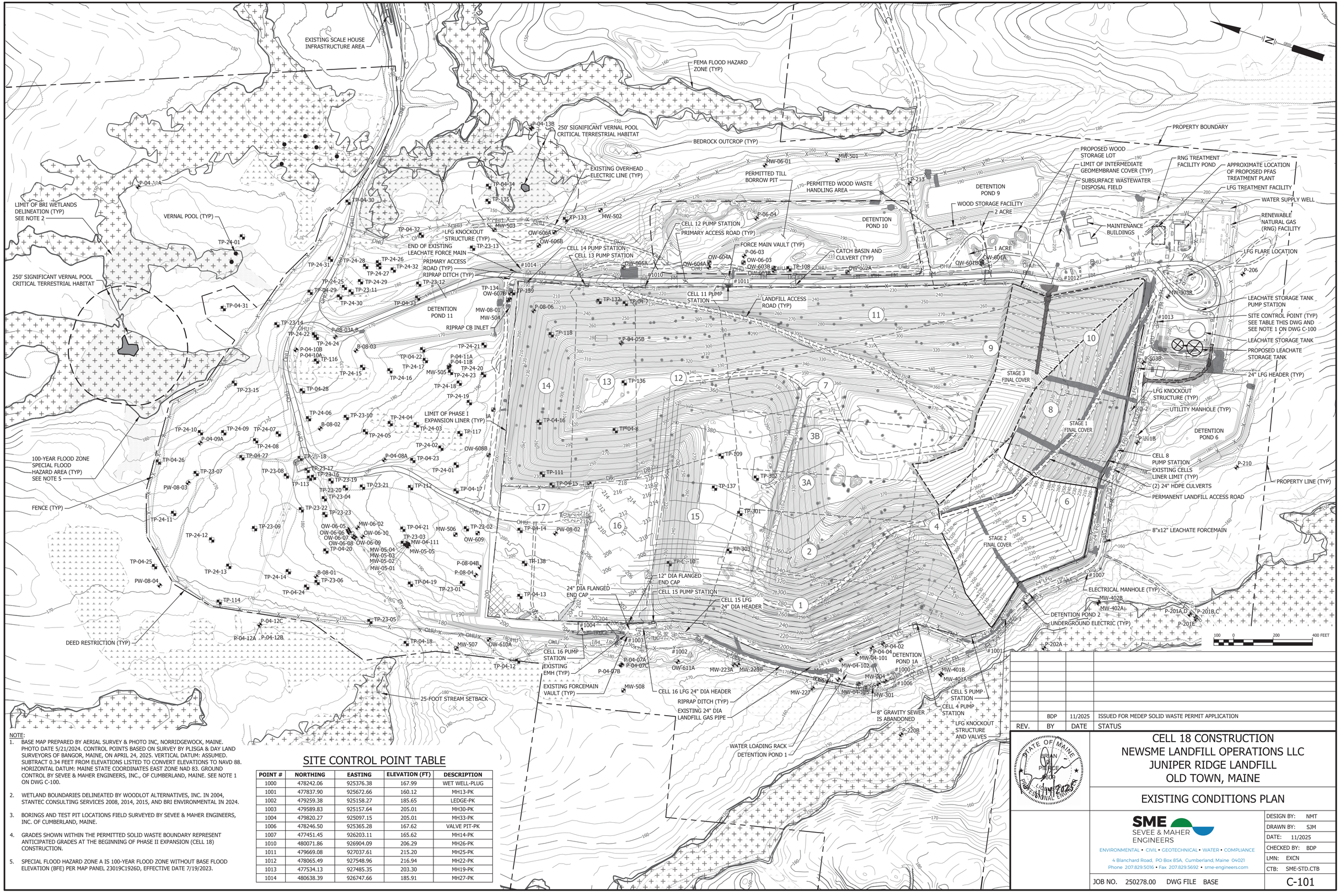

NOTE:

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2. WETLAND BOUNDARIES DELINEATED BY WOODLOT ALTERNATIVES, INC. IN 2004, STANTEC CONSULTING SERVICES 2008, 2014, 2015, AND BRI ENVIRONMENTAL IN 2024.
3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. GRADES SHOWN WITHIN THE PERMITTED SOLID WASTE BOUNDARY REPRESENT ANTICIPATED GRADES AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.
5. SPECIAL FLOOD HAZARD ZONE A IS 100-YEAR FLOOD ZONE WITHOUT BASE FLOOD ELEVATION (BFE) PER MAP PANEL 23019C1926D, EFFECTIVE DATE 7/19/2023.

SITE CONTROL POINT TABLE

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1000	478242.06	925376.38	167.99	WET WELL-PLUG
1001	477837.90	925672.66	160.12	MH13-PK
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STATE OF MAINE
BRIAN D. PIERCE
13609
REGISTERED PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

EXISTING CONDITIONS PLAN

SME
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CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-101

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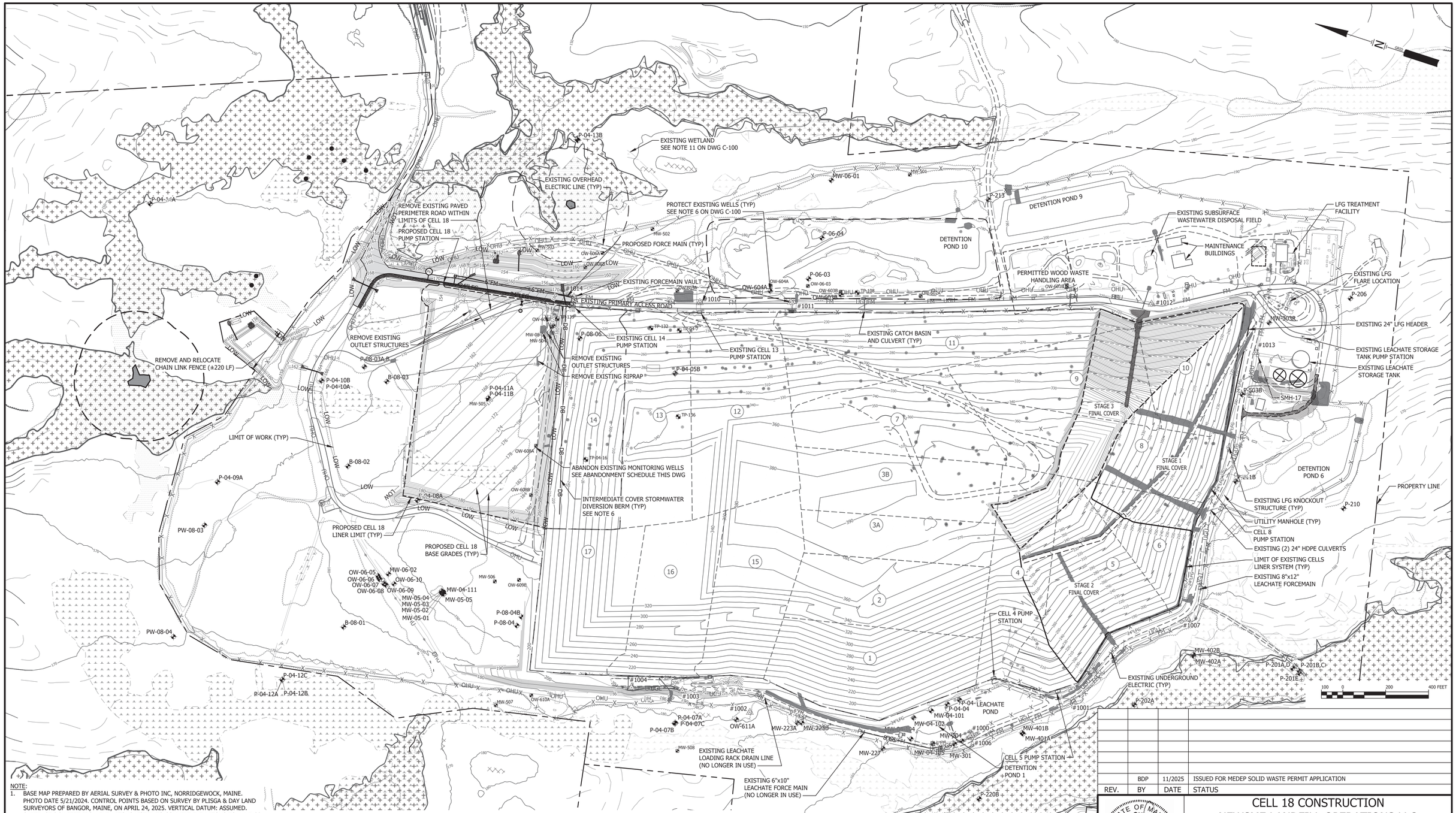

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6. CONTRACTOR SHALL INSTALL APPROXIMATELY 1,000 LINEAR FEET OF INTERMEDIATE COVER STORMWATER DIVERSION BERM ALONG NORTH FACING SIDE SLOPE OF CELL 14. OWNER SHALL IDENTIFY FINAL LOCATION OF DIVERSION BERM).

SITE CONTROL POINT TABLE

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1014	480638.39	926747.66	185.91	MH27-PK

MONITORING WELL ABANDONMENT TABLE

WELL	HOLE DIA	WELL DIA	BORING DEPTH (APPROXIMATE)
P-04-11A	4"	3/4"	±49'
P-04-11B	4"	3/4"	±10'
MW-504	4"	1"	±81.5
MW-505	4"	1"	±82.2'
OW-606B	4"	2"	±12.7'
OW-607B	4"	2"	±51"
OW-608A	8 3/4"	6"	±260'
OW-608B	8 3/4"	6"	±43.5'
P-04-10A	4 1/2"	1"	±35'
P-04-10B	4 1/2"	3/4"	±10'
P-08-03A,B	8 3/4"	6"	±235'
MW-08-01	4"	2"	±127'

REV.	BY	DATE	STATUS
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STATE OF MAINE
BRIAN D.
PIERCE
3609
REGISTERED
PROFESSIONAL ENGINEER
11/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SITE DEVELOPMENT OVERVIEW PLAN

SME
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JOB NO.	250278.00
DWG FILE	BASE

C-102

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PROPOSED 24" DIA CORR PE PIPE (A)
INV OUT 156.0
TIE INTO EXISTING ACCESS ROAD (TYP)
LEVEL SPREADER SEE DWG C-308
DO NOT DISTURB BEYOND DEED RESTRICTION
EMERGENCY SPILLWAY (TYP) SEE DWG C-309
END CAP (TYP)
DETENTION POND 14
CHAIN LINK FENCE SEE DWG C-306
INV OUT 154.7
PLUNGE POOL SEE DWG C-309
UD INV IN 155.0
OUTLET CONTROL STRUCTURE DP-14 SEE DWG C-309
INV OUT 162.0
INV IN 163.0
PROPOSED 24" DIA CORR PE PIPE (B)
SEED AND MULCH DISTURBED SOIL OUTSIDE OF LINER LIMIT (TYP)
LIMIT OF STOCKPILE AREA (TYP)
DOUBLE ROW OF SILT FENCE (TYP) SEE DWG C-308
RIPRAP INLET/OUTLET PROTECTION (TYP) SEE DWG C-308
CELL 18 LINER LIMIT (TYP)
GRADE TO DRAIN
INV IN 158.0
FINISH GRADE (TYP) SEE NOTE 5
RIPRAP INLET/OUTLET PROTECTION (TYP) SEE DWG C-308
PROPOSED 24" DIA CORR PE PIPE
CB 4G RIM 167.2 INV OUT 161.0
PROPOSED CELL 18 PUMP STATION
INV OUT 162.0
26'-WIDE PAVED ACCESS ROAD
RIPRAP DITCH SEE DWG C-309
PROPOSED GUARDRAIL (TYP) SEE DWG C-306
EMERGENCY SPILLWAY (TYP) SEE DWG C-309
PLUNGE POOL SEE DWG C-309
INV OUT 151.8
LEVEL SPREADER SEE DWG C-308
RIPRAP DITCH SEE DWG C-309
OUTLET CONTROL STRUCTURE DP-11R SEE DWG C-309
UD INV 152.2
DETENTION POND 11R
FINISH GRADE (TYP)
INV OUT 172.0
PROPOSED 24" DIA CORR PE PIPE
DOUBLE ROW OF SILT FENCE IN ALL AREAS WITHIN 100-FEET OF WETLANDS (TYP) SEE DWG C-308
END CAP (TYP)
EXISTING SMH #27
EXISTING PRIMARY ACCESS ROAD
EXISTING CULVERT PS-14
EXISTING CELL 14 PUMP STATION
CB 4H RIM 180.3 INV OUT 174.0
BASE GRADES (TYP) SEE NOTE 5
LINER SYSTEM CONNECTION AT CELL 14 SEE DWG C-300
CELL 14 LINER LIMIT (TYP)
CELL 17 LINER LIMIT (TYP)
CELL 18
12
13
14
17
1 C-303
2 C-303
3 C-303
4 C-303
5 C-303

NOTE:
1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
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3. BORINGS AND TEST PIT LOCATIONS FIELD SURVEYED BY SEVEE & MAHER ENGINEERS, INC. OF CUMBERLAND, MAINE.
4. GRADES SHOWN WITHIN THE PERMITTED SOLID WASTE BOUNDARY REPRESENT ANTICIPATED GRADES AT THE BEGINNING OF PHASE II EXPANSION (CELL 18) CONSTRUCTION.
5. BASE GRADES WITHIN LIMIT REPRESENT BOTTOM OF UNDERDRAIN SAND. GRADES BEYOND LINER LIMIT REPRESENT FINISH GRADES.

40 0 80 160 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE BRIAN D. PIERCE 13600 LICENSED PROFESSIONAL ENGINEER 11/19/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

BASE GRADING PLAN

SME SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	BASEGRADE
CTB:	SME-STD.CTB
JOB NO. 250278.00	DWG FILE BASE
	C-103

\\Server\Info\Data\Old\Town\Landfill\Cell18\Acad\Plans\BASE.dwg C-103, 11/19/2025 11:19:03 AM, sjm

4-INCH UD DISCHARGE PIPE INV 152.7

4-INCH UD DISCHARGE PIPE S=0.005 '/'

4" DIA UD DISCHARGE PIPE INV 153.5

4-INCH CELL 14 UD DISCHARGE PIPE INV 167.0

CONNECT TO EXISTING 4-INCH CELL 14 UD DISCHARGE PIPE AND REROUTE INV 167.5

CELL 18

4" DIA SDR 11 PERF HDPE PIPE (TYP)

PIPING AT PERIMETER BERM SEE DWG C-300

BASE GRADE (TYP) SEE DWG C-103

4" DIA FUSED END CAP

4" DIA FUSED END CAP (TYP)

1 C-301

2 C-303

3 C-303

4 C-303

5 C-303

12

13

14

17

NOTE:

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100 0 200 400 FEET

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
13609
REGISTERED PROFESSIONAL ENGINEER
11/26/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

UNDERDRAIN PIPING PLAN

SME SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
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Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	UD-PIPING
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-104

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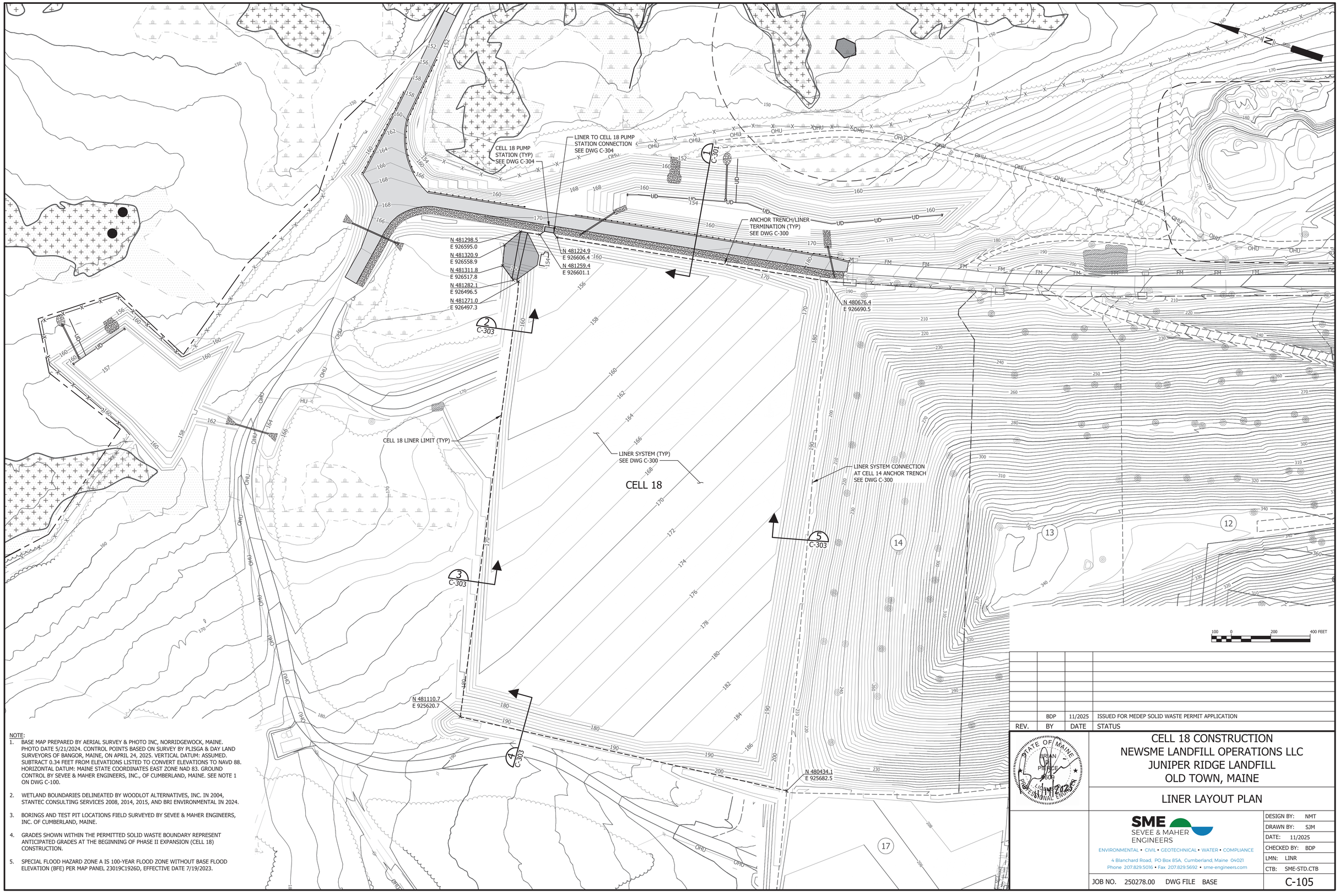

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REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN J. PIERCE
#6061
REGISTERED PROFESSIONAL ENGINEER
11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LINER LAYOUT PLAN

SME
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DATE:	11/2025
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LMN:	LINR
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-105

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CELL 18 PUMP STATION
SEE DWG C-304

LEAK DETECTION
CLEANOUT (TYP)
SEE DWG C-301

CELL 18 LINER LIMIT (TYP)
SEE DWG C-105

LEAK DETECTION SYSTEM
LATERAL (TYP)

PIPING AT
PERIMETER BERM
SEE DWG C-300

CELL 18

BASE GRADE (TYP)
SEE DWG C-103

6" DIA FUSED END CAP

6" DIA FUSED END CAP

1 C-301

2 C-303

3 C-303

4 C-303

5 C-303

12

13

14

17

100 0 200 400 FEET

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
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REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
13606
REGISTERED PROFESSIONAL ENGINEER
11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LEAK DETECTION PIPING PLAN

SME
SEVEE & MAHER ENGINEERS
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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LD-PIPE
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-106

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PERMANENT COLLECTION SUMP AREA AND PUMP STATION (TYP) CELL 18 SEE DWG C-302

SMH #34 TIE-IN VAULT (TYP) SEE DWG C-307

LFG KNOCKOUT STRUCTURE (TYP)

DETENTION POND 11R

LEACHATE COLLECTION SUMP (TYP) SEE DWG C-302

SMH #27 CONNECTION AT EXISTING VAULT (TYP) SEE DWG C-307

CELL 14 PUMP STATION

6"x10" DUAL CONTAINMENT HDPE FORCE MAIN (TYP)

DETENTION POND 14

CELL 18 LEACHATE LEVEL TRANSDUCER, CONNECT TO CELL 18 PUMP STATION

CELL 18 LINER LIMIT (TYP) SEE DWG C-105

CELL 18

LEACHATE COLLECTION PIPE (TYP) SEE DWG C-300

PIPING AT PERIMETER BERM SEE DWG C-300

BASE GRADE (TYP) SEE DWG C-103

LEACHATE COLLECTION CLEANOUT (TYP) SEE DWG C-301

1 C-301
2 C-303
3 C-303
4 C-303
5 C-303

12 13 14 17

40 0 80 160 FEET

NOTE:

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REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
9609
REGISTERED PROFESSIONAL ENGINEER
11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LEACHATE COLLECTION PIPING PLAN

SME SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LC-PIPE
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-107

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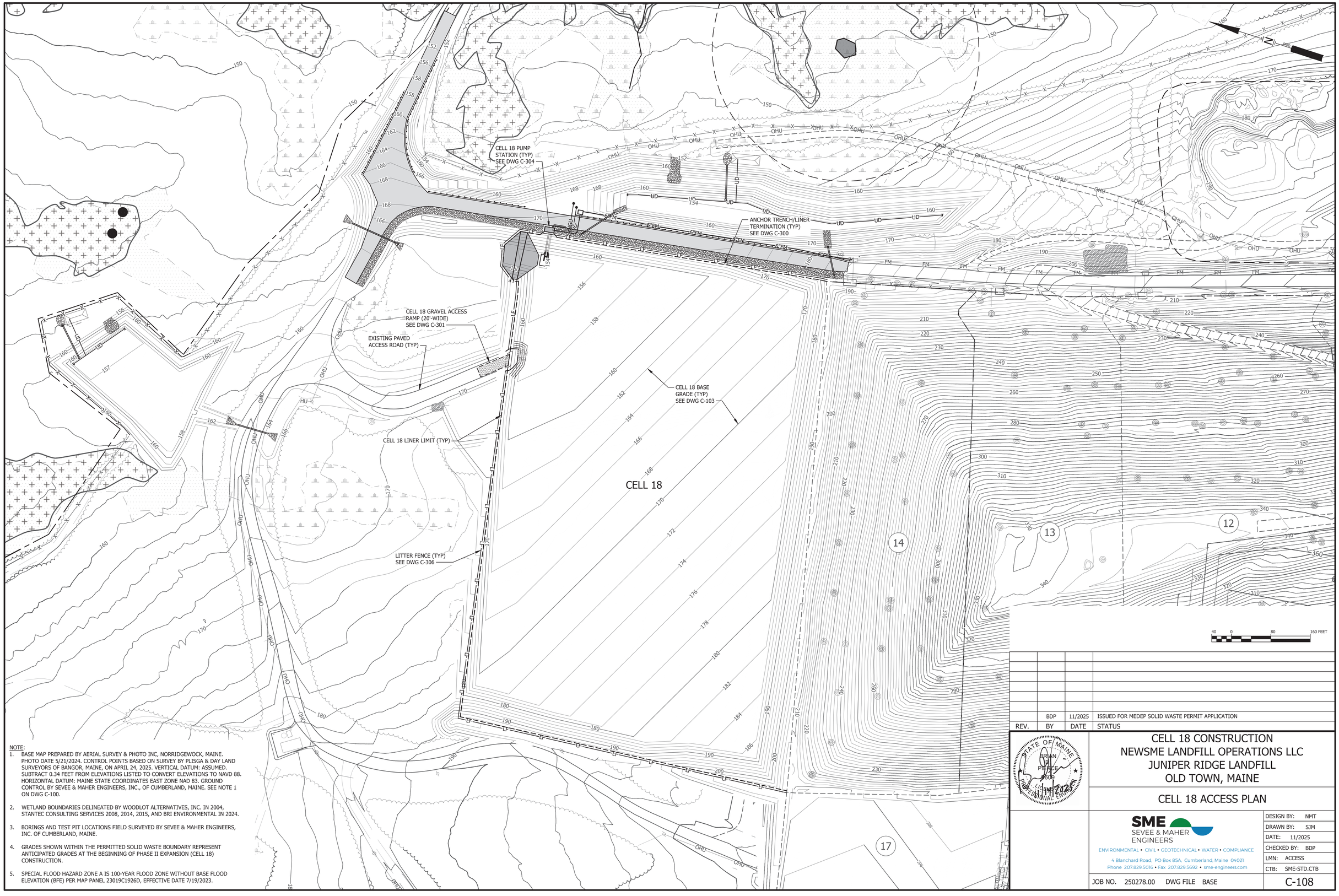

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REV.	BY	DATE	STATUS
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STATE OF MAINE
BRIAN D. PIERCE
9609
REGISTERED PROFESSIONAL ENGINEER
11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

CELL 18 ACCESS PLAN

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DRAWN BY:	SJM
DATE:	11/2025
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LMN:	ACCESS
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-108

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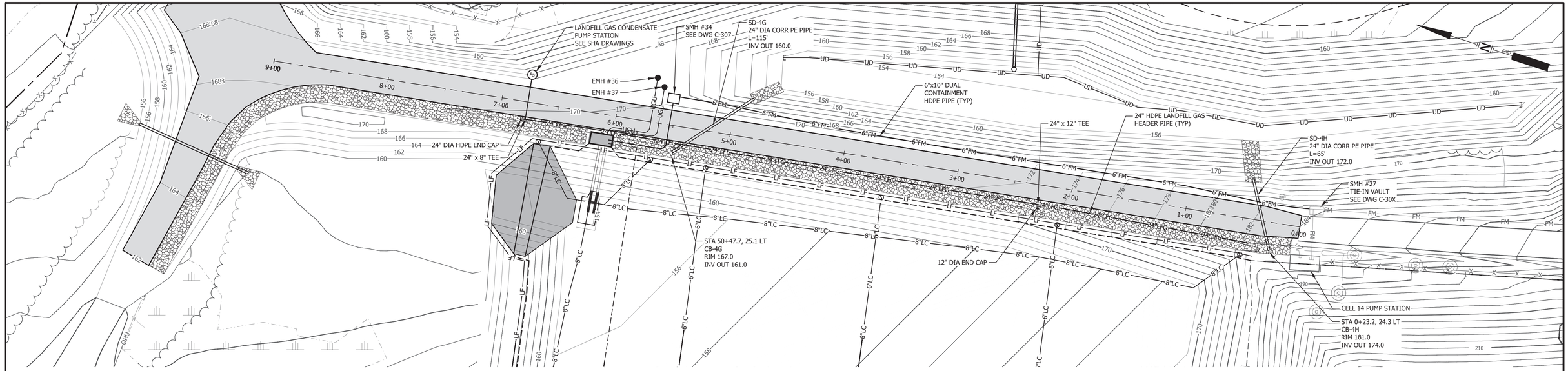
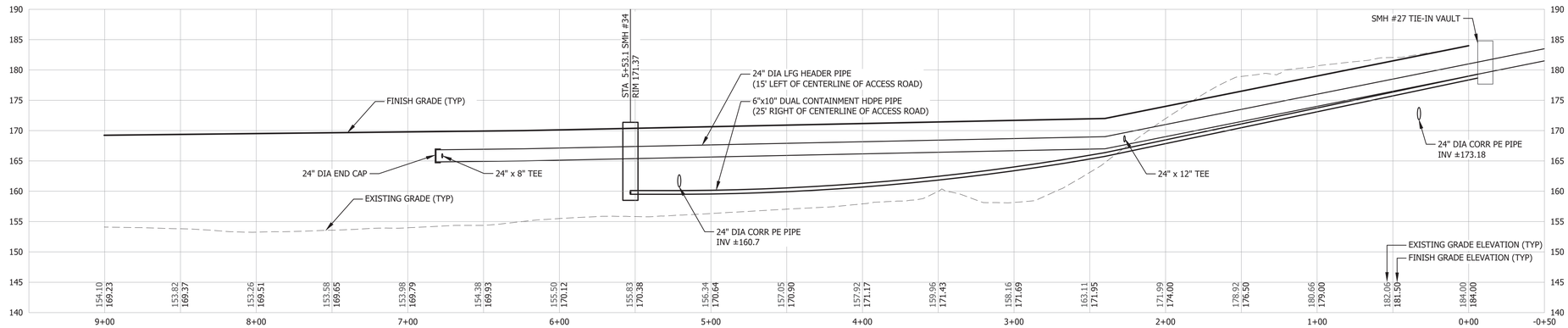


LEACHATE TRANSPORT AND LANDFILL GAS HEADER PIPE PLAN

20 0 40 80 FEET



LEACHATE TRANSPORT AND LANDFILL GAS HEADER PIPE PROFILE

20 0 40 80 FEET (HORZ)
5 0 10 20 FEET (VERT)

NOTE:

1. BASE MAP PREPARED BY AERIAL SURVEY & PHOTO INC, NORRIDGEWOCK, MAINE. PHOTO DATE 5/21/2024. CONTROL POINTS BASED ON SURVEY BY PLISGA & DAY LAND SURVEYORS OF BANGOR, MAINE, ON APRIL 24, 2025. VERTICAL DATUM: ASSUMED. SUBTRACT 0.34 FEET FROM ELEVATIONS LISTED TO CONVERT ELEVATIONS TO NAVD 88. HORIZONTAL DATUM: MAINE STATE COORDINATES EAST ZONE NAD 83. GROUND CONTROL BY SEVEE & MAHER ENGINEERS, INC., OF CUMBERLAND, MAINE. SEE NOTE 1 ON DWG C-100.
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REV.	BY	DATE	STATUS
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STATE OF MAINE
BRIAN D. PIERCE
9609
REGISTERED PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

LEACHATE TRANSPORT AND LANDFILL GAS HEADER PIPE PLAN AND PROFILE

SME
SEVEE & MAHER ENGINEERS
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Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	LT-LFG-PROF
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-200

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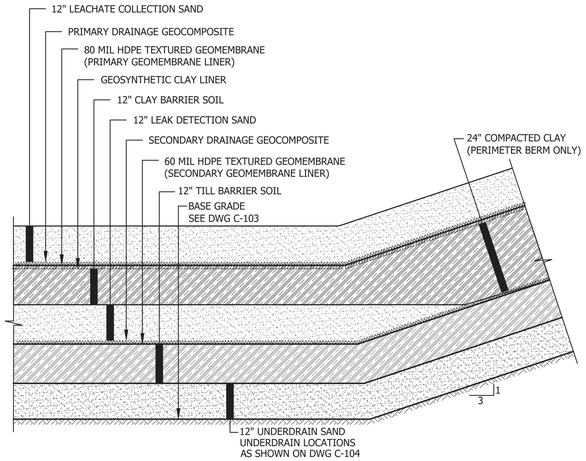

BASE LINER SYSTEM
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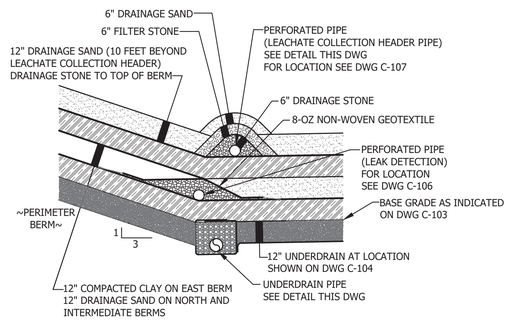
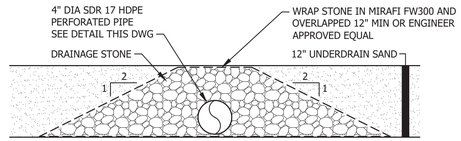
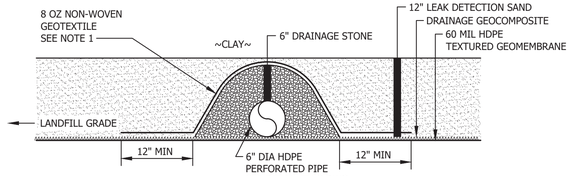


PIPING AT PERIMETER BERM
NTS

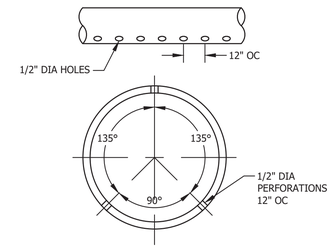


UNDERDRAIN PIPING
NTS

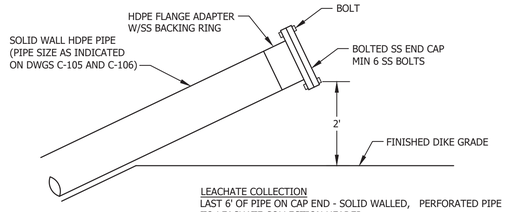


NOTE:
PLACE 8 OZ NON-WOVEN GEOTEXTILE OVER DRAINAGE STONE. EXTEND FABRIC ONE FOOT BEYOND LIMITS OF STONE ALONG THE ENTIRE LENGTH OF THE PIPE.

LEAK DETECTION PIPE
NTS



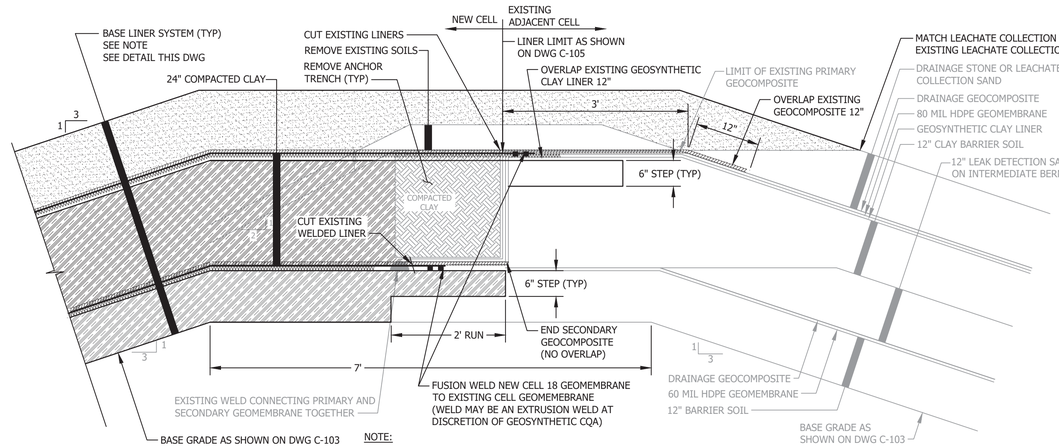
PERFORATED PIPE
NTS



LEACHATE COLLECTION
LAST 6' OF PIPE ON CAP END - SOLID WALLED, PERFORATED PIPE TO LEACHATE COLLECTION HEADER

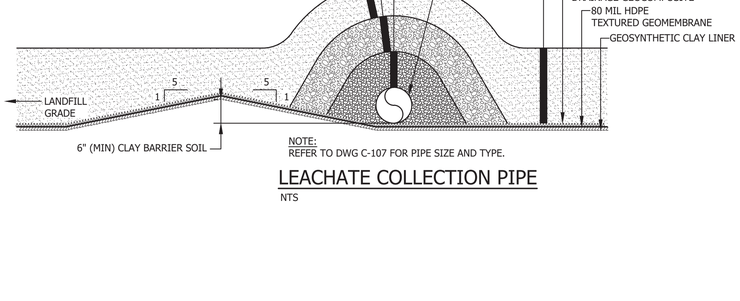
LEAK DETECTION CLEANOUT
SOLID WALLED ENTIRE LENGTH TO HEADER

FLANGED END CAP
NTS



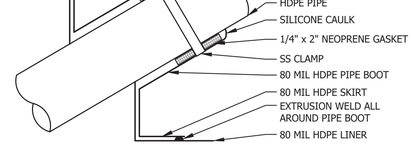
NOTE:
AREAS WITH BASE LINER SYSTEM DO NOT INCLUDE GCL UNDER THE SECONDARY GEOMEMBRANE OR THE CLAY BARRIER SOIL.

LINER SYSTEM TIE-IN CONNECTION TO ADJACENT CELLS
NTS

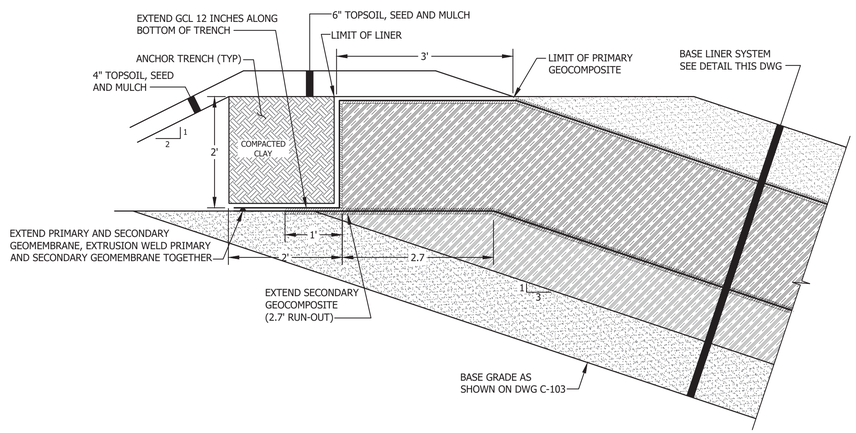


NOTE:
REFER TO DWG C-107 FOR PIPE SIZE AND TYPE.

LEACHATE COLLECTION PIPE
NTS



PIPE BOOT
NTS



ANCHOR TRENCH/LINER TERMINATION
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
#5609
REGISTERED PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
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Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-300

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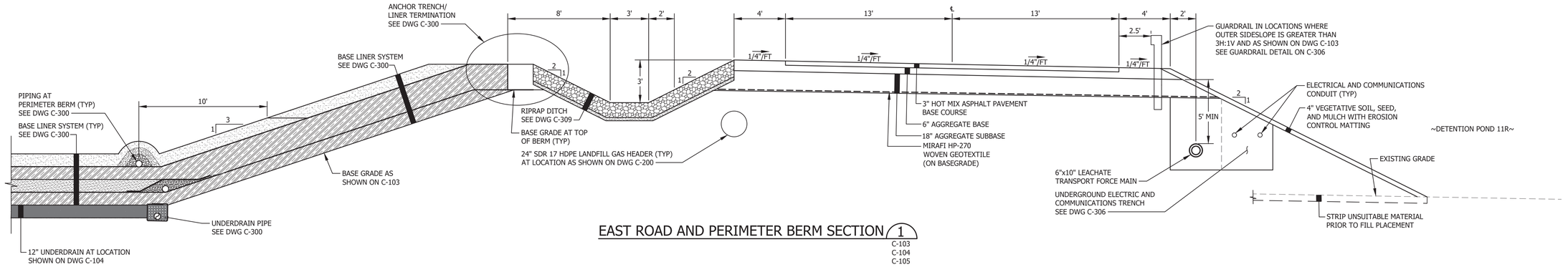
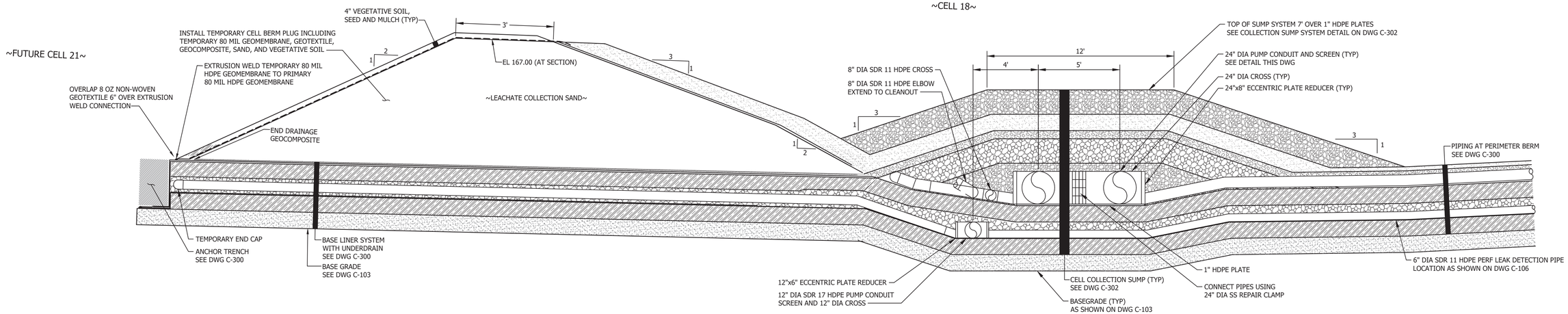


EAST ROAD AND PERIMETER BERM SECTION 1

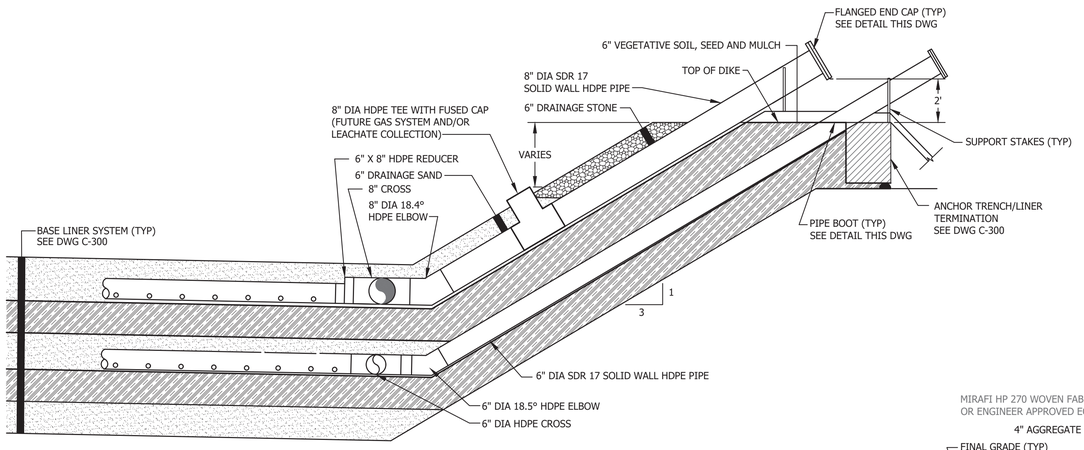
C-103
C-104
C-105
C-106
C-107



NOTE: SEE DWG C-302 FOR SECTION A-A' LOCATION.

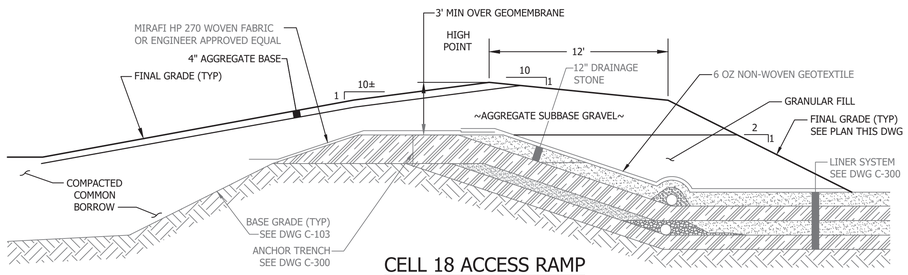
SECTION A-A'

NTS C-302



LEACHATE COLLECTION AND LEAK DETECTION CLEANOUTS

NTS



CELL 18 ACCESS RAMP

NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
11/14/2025
PROFESSIONAL ENGINEER

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB
JOB NO.	250278
DWG FILE	DETAILS

C-301

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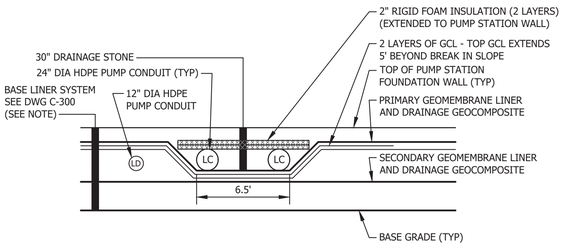
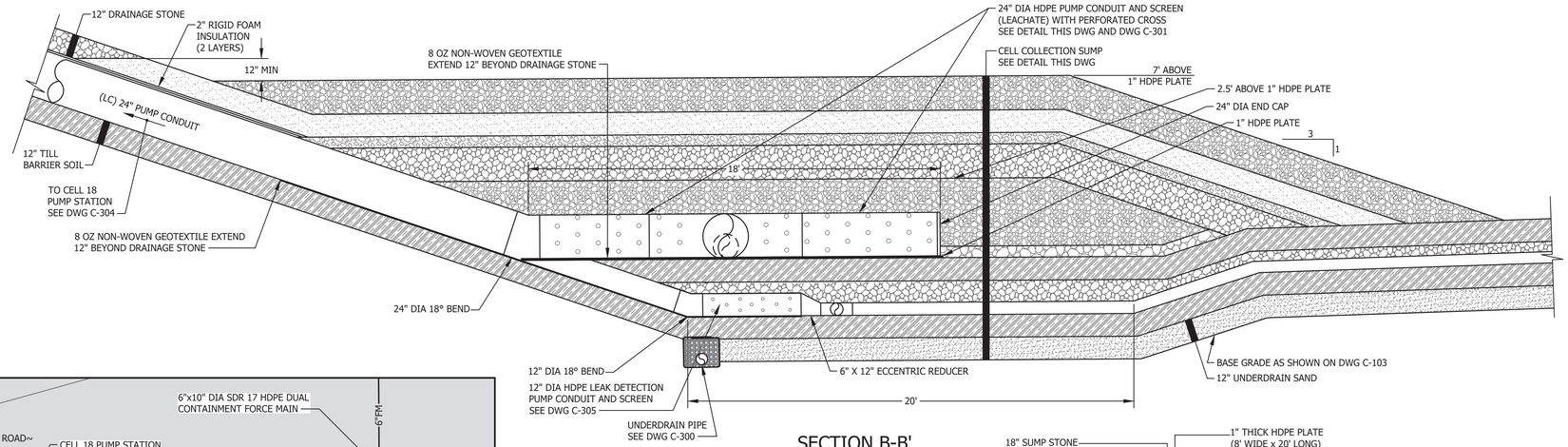
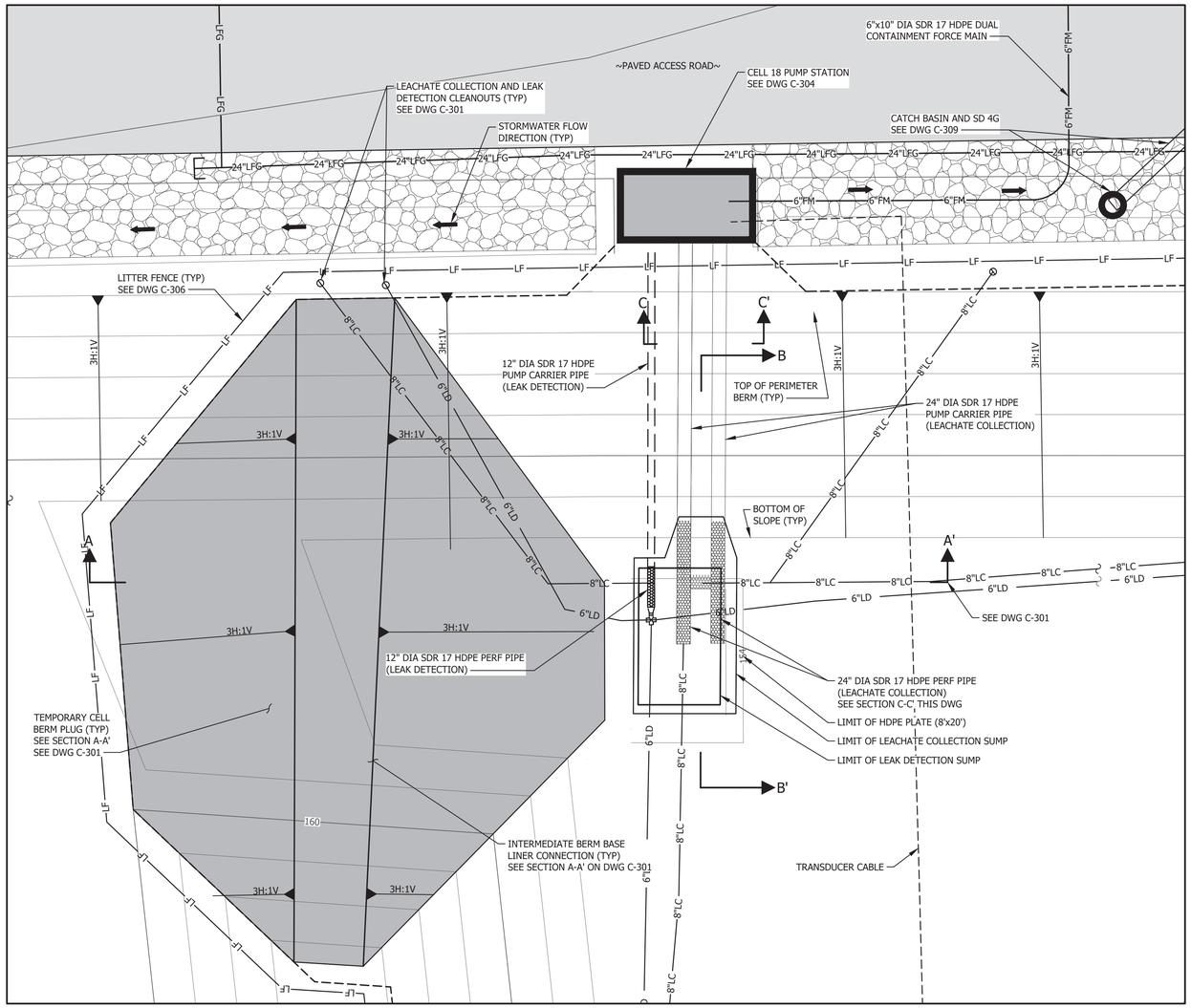


SECTION C-C'
NTS

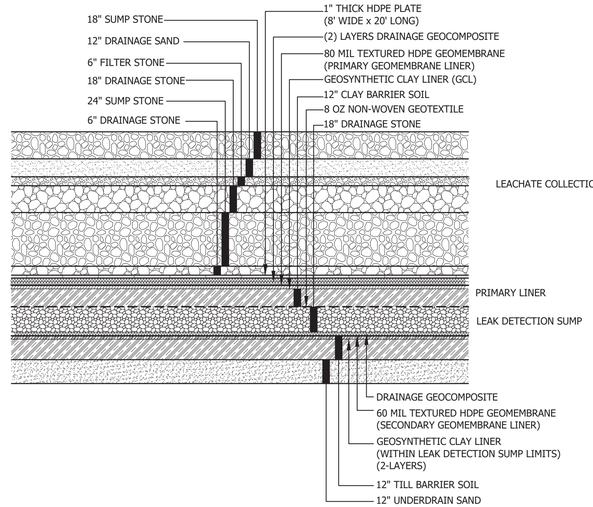


SECTION B-B'
NTS



PERMANENT COLLECTION SUMP AREA AND PUMP STATION PLAN - CELL 18

5 0 10 20 FEET



CELL COLLECTION SUMP
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN
D.
PIERCE
3609
REGISTERED
PROFESSIONAL ENGINEER
11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	PERM-PUMP
CTB:	SME-STD.CTB

JOB NO. 250278.00 DWG FILE BASE

C-302

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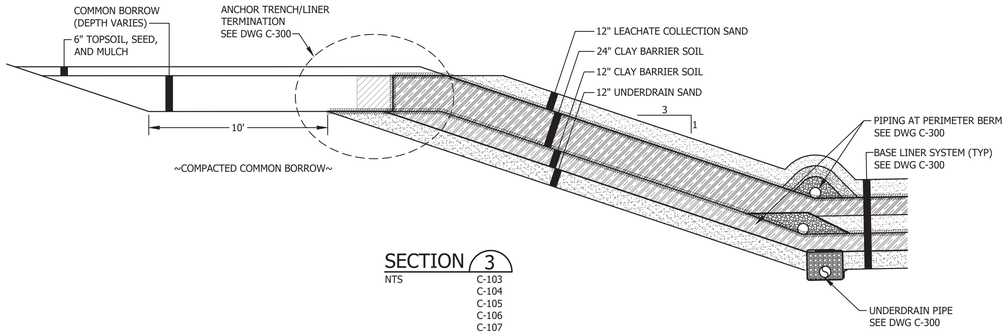

SECTION 3
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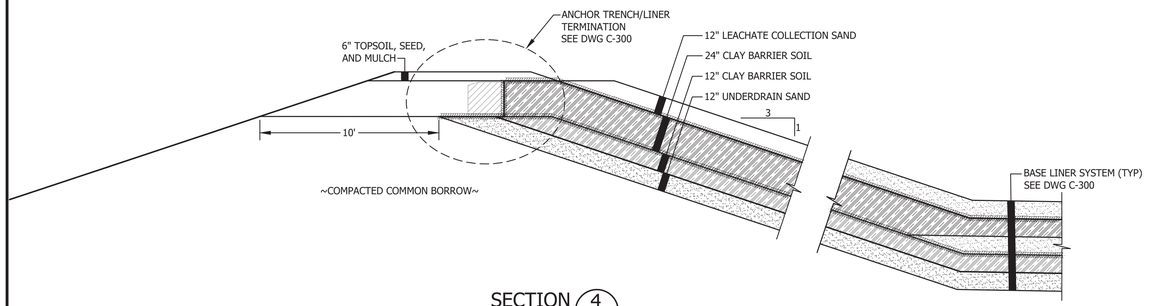
C-103
C-104
C-105
C-106
C-107



SECTION 4
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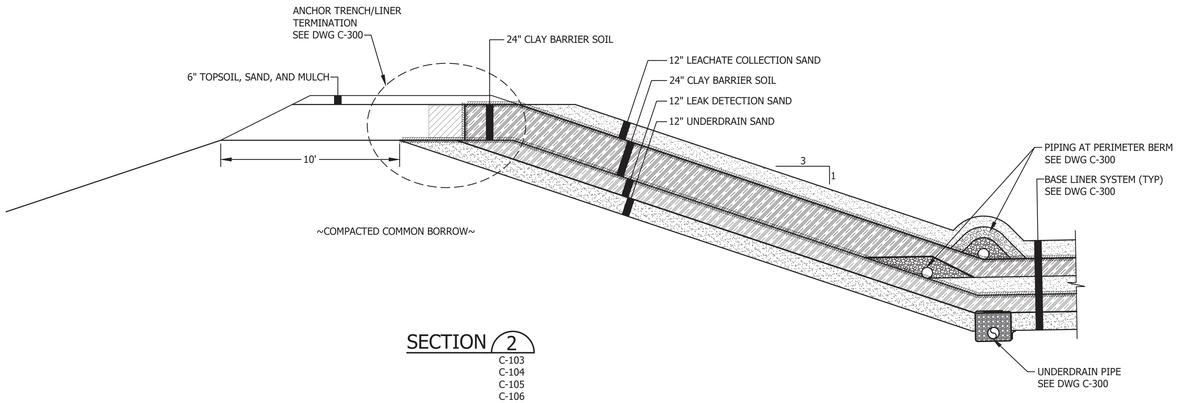
C-104
C-105
C-106
C-107



SECTION 2
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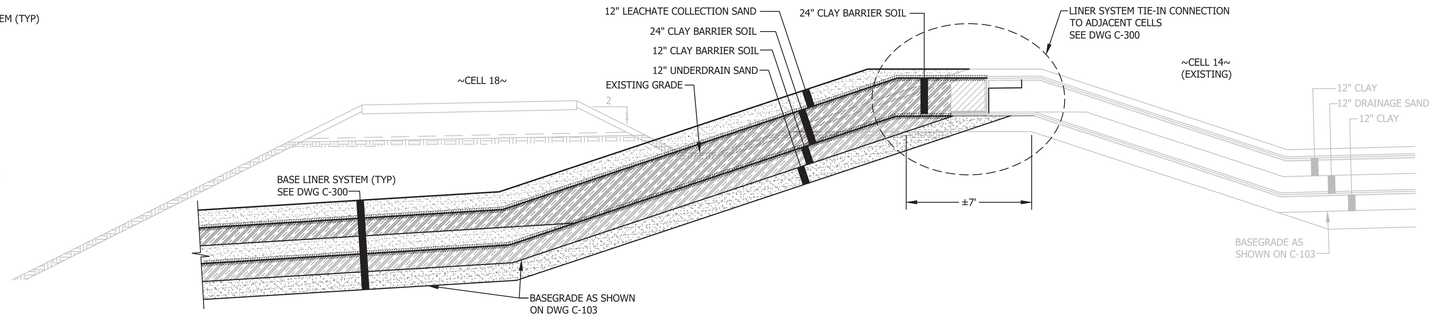
C-104
C-105
C-106
C-107



SECTION 5
NTS
C-103
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C-105
C-106
C-107

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN
D.
PIERCE
3609
REGISTERED
PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
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Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DRAWN BY:	SJM
DATE:	11/2025
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LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-303

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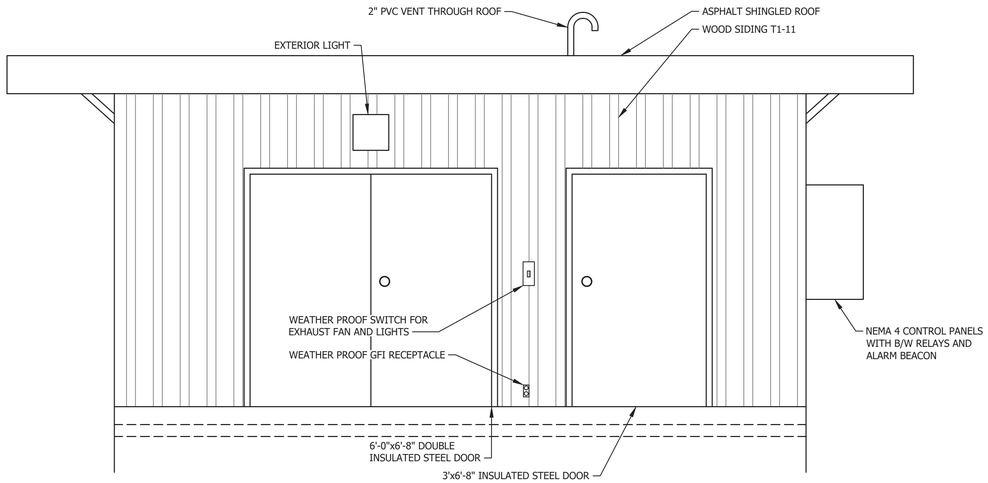
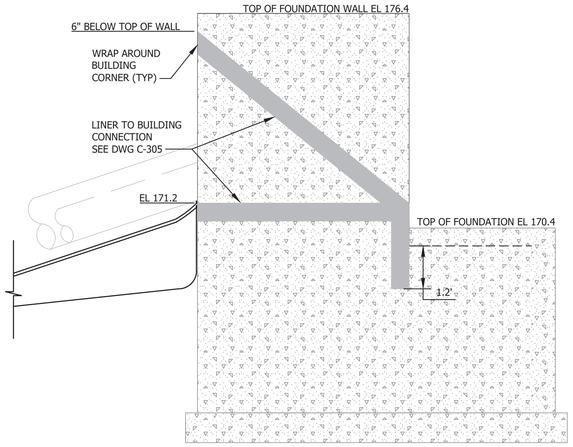
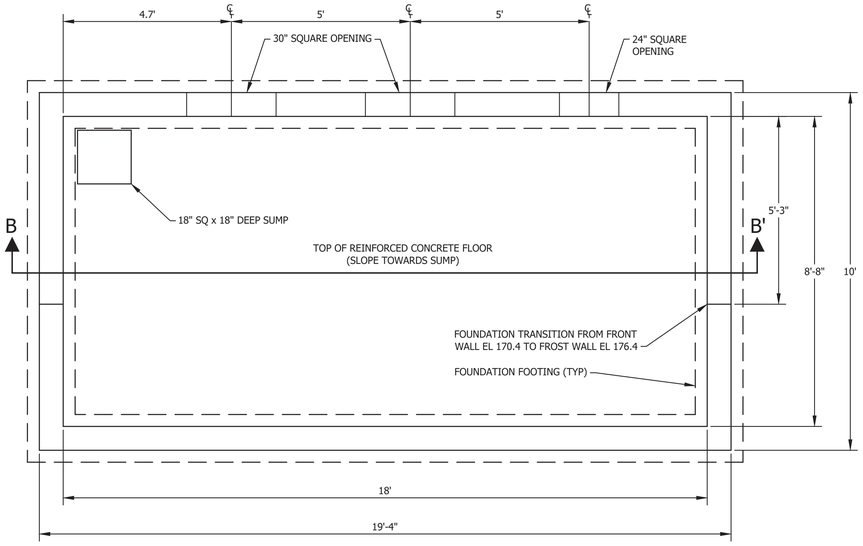


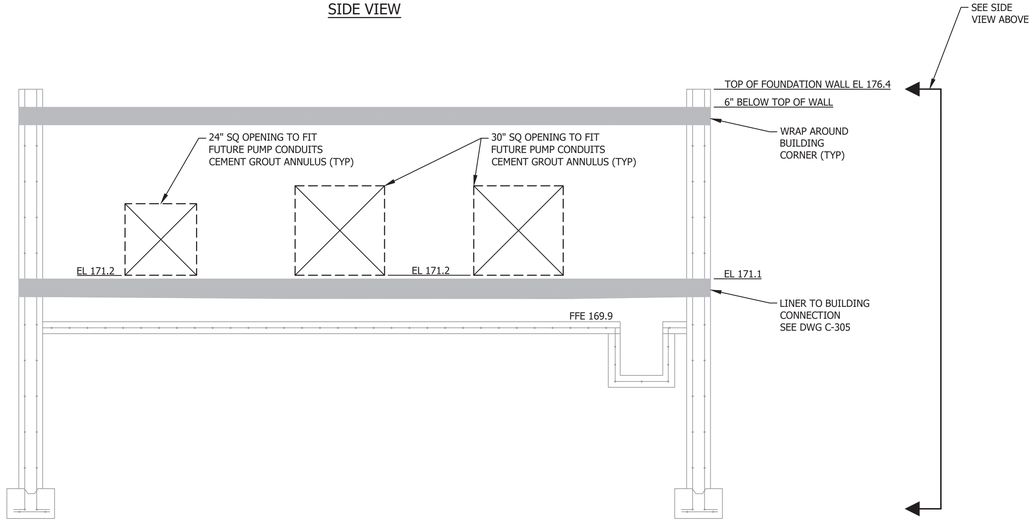
CELL 18 PUMP STATION EAST ELEVATION
NTS



SIDE VIEW



CELL 18 PUMP STATION FOUNDATION PLAN
NTS



ELEVATION VIEW

LINER TO CELL 18 PUMP STATION CONNECTION
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
LICENSED PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

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DATE:	11/2025
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LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-304

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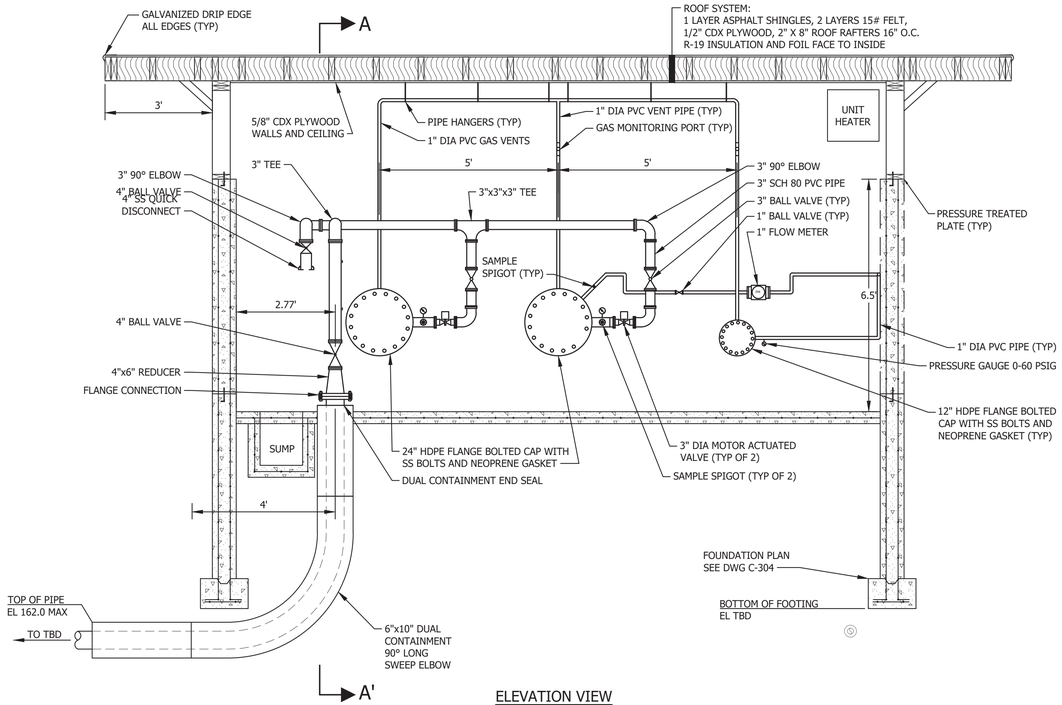
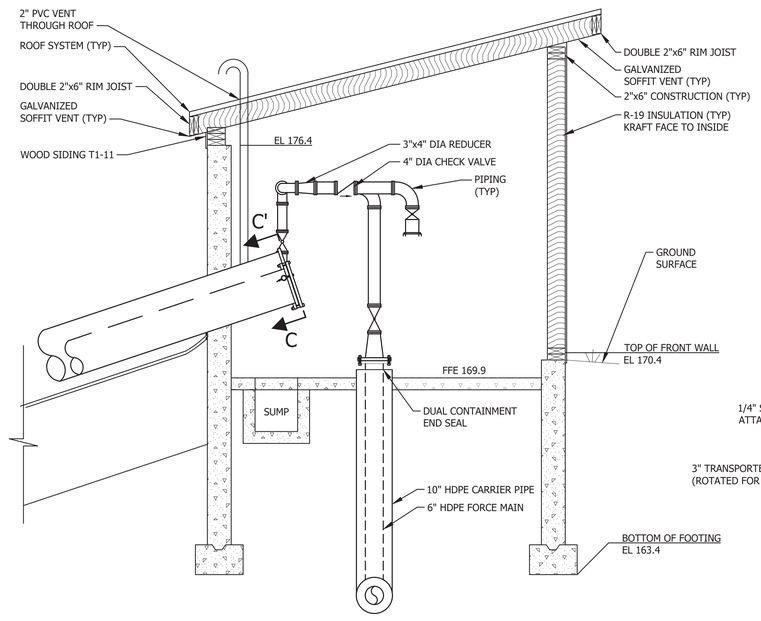
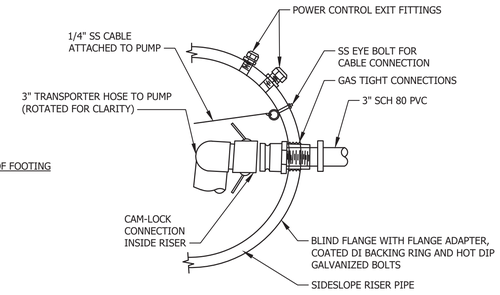


ELEVATION VIEW

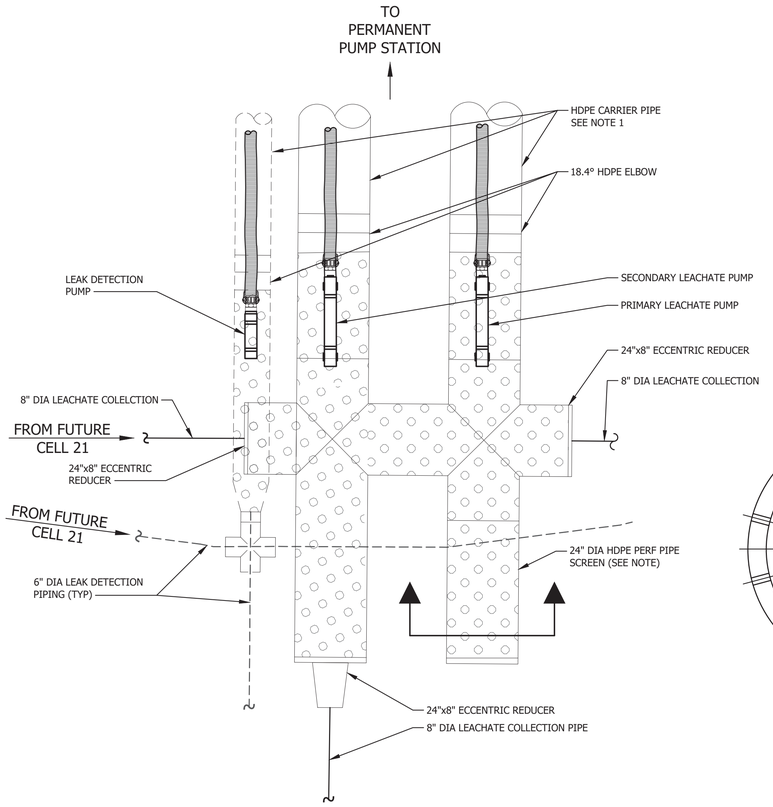


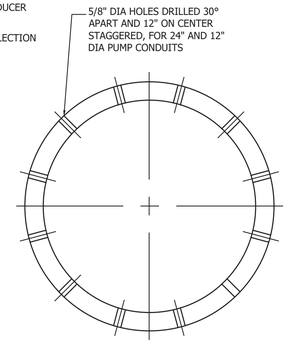
SECTION A-A'

PERMANENT PUMP STATION (CELL 18)
NTS



DISCHARGE CONNECTION - SECTION C-C'
NTS





SECTION

NOTES:
1. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF PUMP HDPE PUMP CONDUITS TO THE ENGINEER FOR REVIEW AND APPROVAL.
2. DIAMETER OF PUMP CONDUIT AND SCREEN IS 12" FOR LEAK DETECTION SYSTEM, 24" FOR PRIMARY LEACHATE COLLECTION SYSTEM AND SECONDARY LEACHATE COLLECTION SYSTEM.
3. PRIMARY AND SECONDARY LEACHATE PUMPS SHALL BE AT THE BOTTOM OF SUMP AND SIT HORIZONTALLY ON SUMP FLOOR. PRIMARY LEACHATE PUMP DISCHARGE HOSE IS 3-INCH DIAMETER.
4. LEAK DETECTION PUMP SHALL BE POSITIONED AT THE BOTTOM OF THE LEAK DETECTION SUMP AND SIT HORIZONTALLY ON SUMP FLOOR. LEAK DETECTION DISCHARGE HOSE IS 2-INCH DIAMETER.

HDPE PUMP CONDUIT AND SCREEN
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN
D.
PIERCE
9606
REGISTERED
PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER
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DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-305

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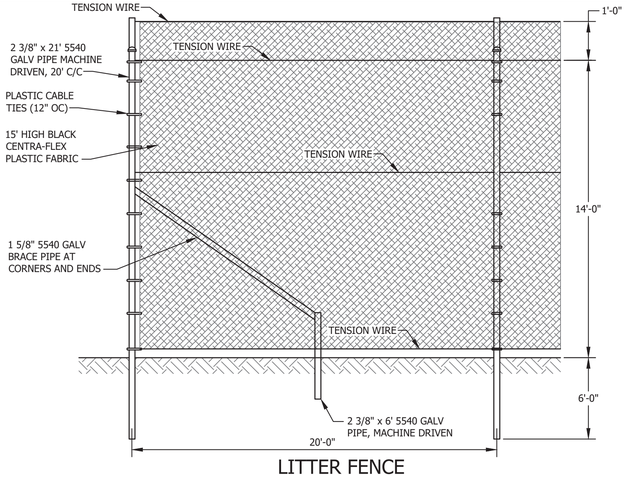
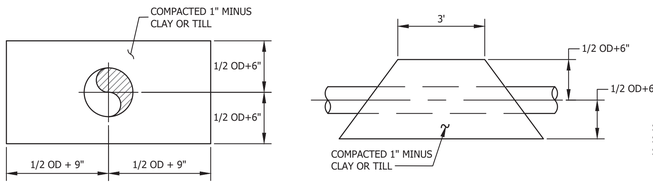


LITTER FENCE
NTS



PIPE DAM
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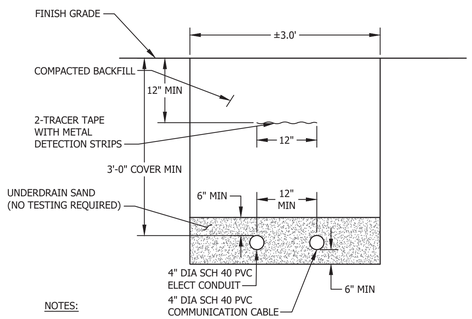
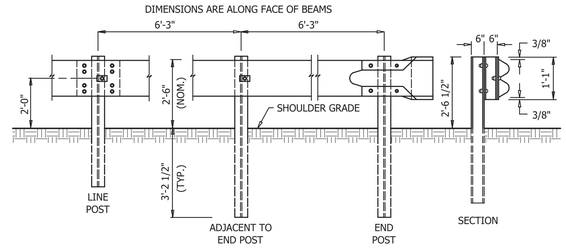


NOTES:

1. FROM POWER POLE TO PUMP STATION INSTALL TWO ELECTRICAL CONDUITS.
2. FROM PUMP STATION TO CLEANING/TIE-IN VAULT TWO ELECTRICAL CONDUITS AND ONE COMMUNICATION CONDUIT.
3. FIELD FIT AND MODIFY AS NECESSARY.

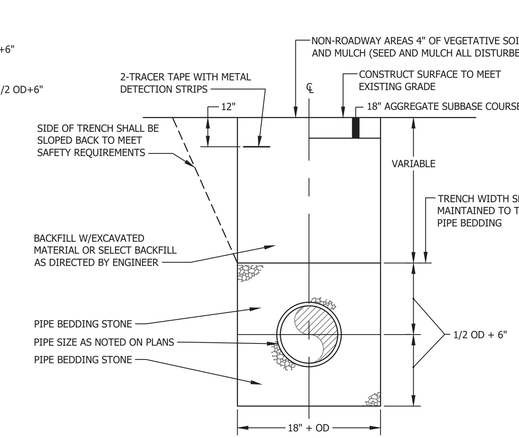
UNDERGROUND ELECTRIC AND COMMUNICATION TRENCH
NTS



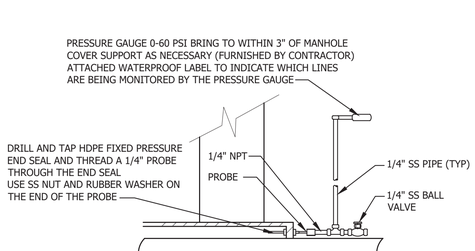
NOTES:

1. INTERMEDIATE POST SPACING SHALL BE 6'-3" UNLESS OTHERWISE SHOWN.
2. POST AND OFFSET BRACKETS SHALL BE 4"x 6" I-BEAM 8.5 OR 9.0 LBS/FT. LENGTH OF 5'-9" ATTACHED WITH 5/8" DIA HOT DIP GALVANIZED BOLTS WITH HEX NUTS.
3. ALL HOLES IN BEAM TO BE SHOP-PUNCHED PRIOR TO GALVANIZING.
4. RAIL PANELS AND END SECTIONS TO BE 12 GAUGE STEEL.
5. BACK-UP PLATE TO BE PLACED BEHIND RAIL ELEMENTS AT INTERMEDIATE STEEL POSTS (NON-SPLICE POSTS).
6. ALL PARTS SHALL CONFORM TO CURRENT MAINE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS.
7. WHEN GUARDRAIL IS CONSTRUCTED AT UP TO FOUR FEET FROM THE EDGE OF PAVEMENT, THE GUARDRAIL WILL BE SET FROM THE GRADE AT THE FACE OF RAIL.
8. END SECTIONS TO BE IN ACCORDANCE WITH MAINE DEPARTMENT OF TRANSPORTATION STANDARDS.
9. GUARDRAIL SET ON A RADIUS OF 150 FEET OR LESS TO BE CIRCULAR.

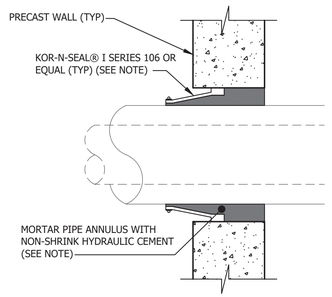
GUARDRAIL
NTS



PIPE TRENCH
NTS



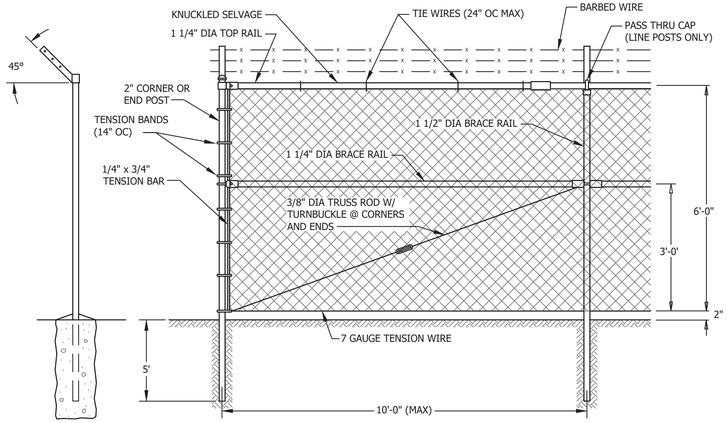
PRESSURE GAUGE AND TRANSMITTER
NTS



NOTE:

THE JOINTS FOR THE PIPES THROUGH PRECAST WALLS SHALL BE WEDGE STYLE KOR-N-SEAL® I SERIES 106 AS MANUFACTURED BY TRELLEBORG OR EQUAL. THE ANNULUS SHALL BE FILLED WITH NON-SHRINK HYDRAULIC CEMENT. THE CONTRACTOR SHALL FOLLOW THE MANUFACTURERS INSTRUCTIONS TO MIX AND APPLY THE CEMENT. THE FINAL PLUG SHALL YIELD A STRONG AND RIGID SEAL BETWEEN THE PIPE AND STRUCTURE. COMPLETE VACUUM TESTING PRIOR TO THE INSTALLATION OF CEMENT.

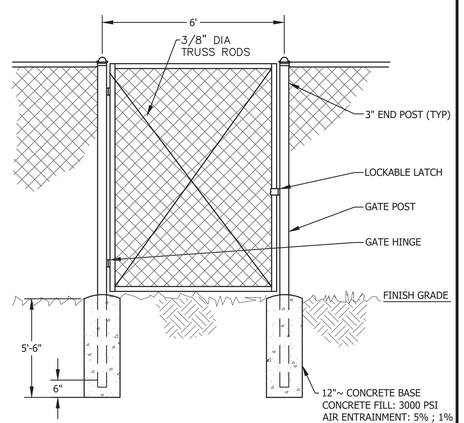
PRECAST WALL PENETRATION
NTS



NOTES:

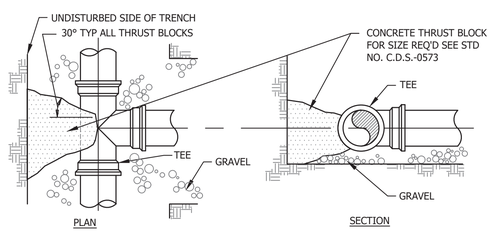
1. END OR CORNER POSTS: NOM 2" DIA GALV STL PIPE, MIN 3.65 LB/LF OR 2 1/4" x 2" "H" SECTION, 4.10 LB/LF, OR 3 1/2" x 3 1/2" "L" SECTION WITH INTEGRAL FABRIC LOOPS 5.14 LB/LF.
2. LINE POSTS: NOM 1 1/2" DIA GALV STL PIPE, MIN 2.72 LB/LF OR 1 7/8" x 1 5/8" "H" SECTION, 2.70 LB/LF, OR 1 7/8" x 1 5/8" "C" SECTION, 2.28 LB/LF.
3. TOP & BRACE RAILS: NOM 1 1/4" DIA GALV STL PIPE, MIN 2.27 LB/LF OR 1 5/8" x 1 1/4" " " SHAPED, ROLLED FORMED SECTION.
4. STRETCHER BARS: LENGTH TO BE 1" LESS THAN FULL HEIGHT OF FABRIC. ONE STRETCHER BAR FOR EACH GATE AND END POST, AND TWO STRETCHER BARS FOR CORNER AND BRACING.
5. CLEARING LIMIT 15 FEET EACH SIDE OF FENCE.

CHAIN LINK FENCE
NTS

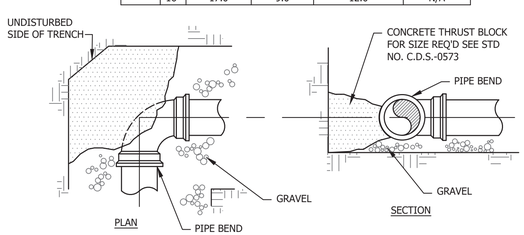


CHAIN LINK FENCE PEDESTRIAN GATE
NTS

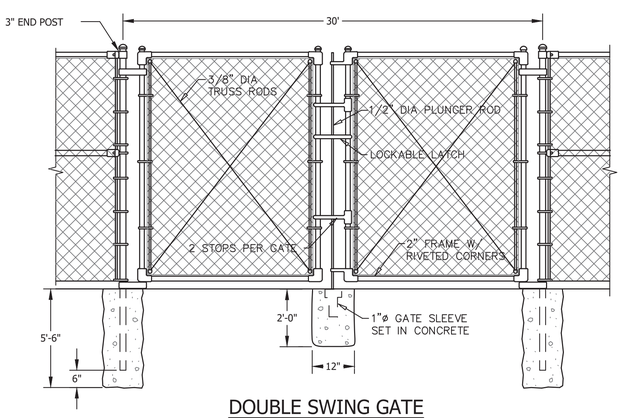
SIZE REQUIREMENTS FOR CONCRETE THRUST BLOCKS					
		BEARING ON UNDISTURBED SOIL (SQ FT)			
FITTINGS		90° BENDS	45° BENDS	TEES & PLUGS	HYDRANTS
PIPE SIZE	4"	2.0	1.0	1.0	N/A
	6"	3.0	2.0	2.0	6.0
	8"	5.0	3.0	4.0	N/A
	10"	7.0	4.0	5.0	N/A
	12"	10.0	6.0	7.0	N/A
	14"	13.0	7.0	10.0	N/A
	16"	17.0	9.0	12.0	N/A



TYPICAL THRUST BLOCK PLACEMENT ON TEES
NTS



TYPICAL THRUST BLOCK PLACEMENT ON BENDS
NTS



DOUBLE SWING GATE
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE — BRIAN P. PIERCE — 5609 — LICENSED PROFESSIONAL ENGINEER — 11/14/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB
JOB NO.	250278
DWG FILE	DETAILS
	C-306

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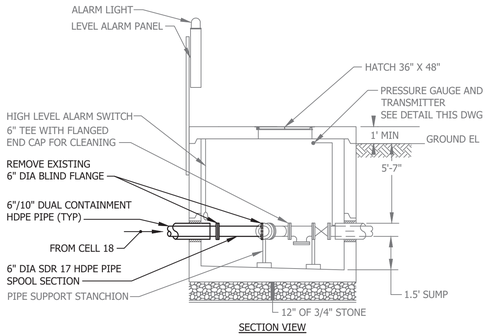
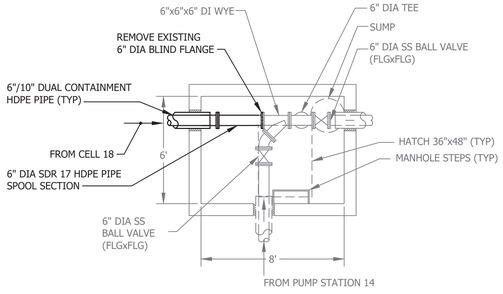


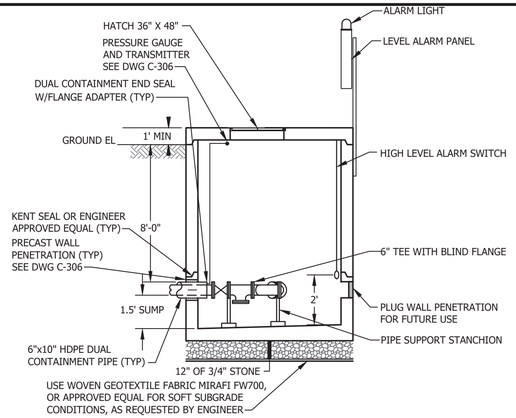
SECTION VIEW



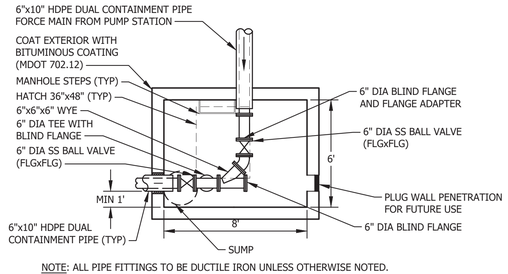
PLAN VIEW

SMH #27 CONNECTION

NTS



SECTION VIEW

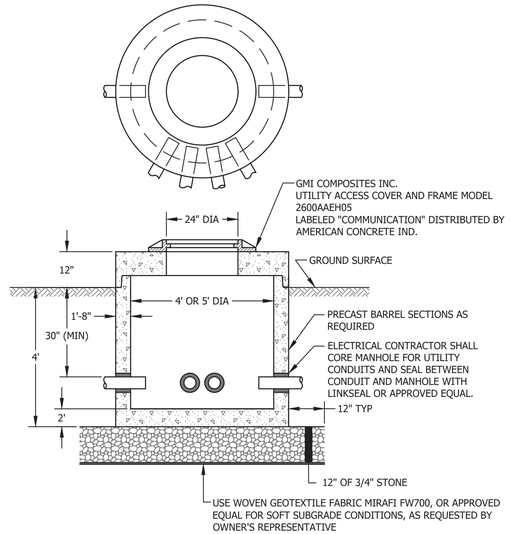


NOTE: ALL PIPE FITTINGS TO BE DUCTILE IRON UNLESS OTHERWISE NOTED.

PLAN VIEW

SMH TIE-IN VAULT (SMH #34)

NTS



NOTES:

1. 4' DIA MANHOLE AS MANUFACTURED BY AMERICAN CONCRETE INDUSTRIES OR ENGINEER APPROVED EQUAL.
2. 4000 PSI CONCRETE AT 28 DAYS.
3. DESIGNED FOR H-20 WHEEL LOADING.
4. CONFORMS TO ASTM C-478 SPECIFICATIONS.
5. REINFORCED TO 0.12 IN SQ/LF.
6. SHIPLAP JOINTS SEALED WITH BUTYL RUBBER.
7. EXTERIOR COATED WITH ASPHALTIC PROTECTIVE DAMPROOFING.
8. BOTTOM MIN 5'-0" BELOW FINISH GRADE.
9. PRECAST CONCRETE VAULT MANUFACTURER TO PROVIDE ANTI-FLOATATION EXTENDED BASE SLAB AS NECESSARY. ANTI-FLOATATION DESIGN AND SHOP DRAWINGS SHALL BE PREPARED BY THE MANUFACTURER AND SUBMITTED TO THE ENGINEER FOR APPROVAL.

ELECTRIC AND COMMUNICATIONS MANHOLE (EMH)

NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
13609
REGISTERED PROFESSIONAL ENGINEER
11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

SECTIONS AND DETAILS

SME
SEVEE & MAHER ENGINEERS
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DESIGN BY:	NMT
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DATE:	11/2025
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LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-307

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A. GENERAL

1. All soil erosion and sediment control will be done in accordance with: (1) the Maine Erosion and Sediment Control Handbook: Best Management Practices, Maine Department of Environmental Protection (MEDEP), October 2016.

2. The site contractor (to be determined) will be responsible for the repair/replacement/maintenance of all erosion control measures until all disturbed areas are stabilized.

3. Disturbed areas will be permanently stabilized within 7 days of final grading. Disturbed areas not to be worked upon within 14 days of disturbance will be temporarily stabilized within 7 days of the disturbance.

4. In all areas, removal of trees, bushes and other vegetation, as well as disturbance of topsoil will be kept to a minimum while allowing proper site operations.

5. Any suitable topsoil will be stripped and stockpiled for reuse as directed by the owner. Topsoil will be stockpiled in a manner such that natural drainage is not obstructed and no off-site sediment damage will result. In any event, stockpiles will not be located within 100 feet of wetlands and will be at least 50 feet upgradient of the stockpile's perimeter silt fence. The sideslopes of the topsoil stockpile will not exceed 2:1. Silt fence will be installed around the perimeter of all topsoil stockpiles. Topsoil stockpiles will be surrounded with siltation fencing and will be temporarily seeded with Aroostook rye, annual or perennial ryegrass within 7 days of formation, or temporarily mulched.

B. TEMPORARY MEASURES

1. STABILIZED CONSTRUCTION ENTRANCE/EXIT

A crushed stone stabilized construction entrance/exit will be placed at any point of vehicular access to the site.

2. SILT FENCE

a. Silt fence will be installed prior to all construction activity, where soil disturbance may result in erosion. Silt fence will be erected at locations shown on the plans and/or downgradient of all construction activity.

b. Silt fences will be removed when they have served their useful purpose, but not before the upgradient areas have been permanently stabilized.

c. Silt fences will be inspected immediately after each rainfall and at least daily during prolonged rainfall. They will be inspected if there are any signs of erosion or sedimentation below them. Any required repairs will be made immediately. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind them, they will be replaced with a temporary crushed stone check dam.

d. Sediment deposits will be removed after each storm event if significant build-up has occurred or if deposits exceed half the height of the barrier.

3. STONE CHECK DAMS

Stone check dams will be installed in grass-lined swales and ditches during construction.

4. BARK MULCH SEDIMENT BARRIER

a. Where approved, bark mulch sediment barriers may be used as a substitute for silt fence. See the details in this drawing set for specifications.

b. Rock Filter Berms: To provide more filtering capacity or to act as a velocity check dam, a berm's center can be composed of clean crushed rock ranging in size from the french drain stone to riprap.

5. TEMPORARY SEEDING

Stabilize disturbed areas that will not be brought to final grade for a year or less and reduce problems associated with mud and dust production from exposed soil surface during construction with temporary vegetation.

6. TEMPORARY MULCHING

Use temporary mulch in the following locations and/or circumstances:

- In sensitive areas (within 100 feet of streams, wetlands and in lake watersheds) temporary mulch will be applied within 7 days of exposing spill or prior to any storm event.
- Apply temporary mulch within 14 days of disturbance or prior to any storm event in all other areas.
- Areas which have been temporarily or permanently seeded will be mulched immediately following seeding.
- Areas which cannot be seeded within the growing season will be mulched for over-winter protection and the area will be seeded at the beginning of the growing season.
- Mulch can be used in conjunction with tree, shrub, vine, and ground cover plantings.
- Mulch anchoring will be used on slopes greater than 5 percent in late fall (past September 1), and over-winter (September 1 - April 25).

The following materials may be used for temporary mulch:

a. Hay or Straw material shall be air-dried, free of seeds and coarse material. Apply 2-3 tons/acre or 3 bales (90-130 lbs per 1,000 sf).

b. Erosion Control Mix: It can be used as a stand-alone reinforcement:

- on slopes 2 horizontal to 1 vertical or less;
- on frozen ground or forested areas; and
- at the edge of gravel parking areas and areas under construction.

c. Erosion control mix alone is not suitable:

- on slopes with groundwater seepage;
- at low points with concentrated flows and in gullies;
- at the bottom of steep perimeter slopes exceeding 100 feet in length;
- below culvert outlet aprons; and around catch basins and closed storm systems.

d. Chemical Mulches and Soil Binders: Wide ranges of synthetic spray-on materials are marketed to protect the soil surface. These are emulsions that are mixed with water and applied to the soil. They may be used alone, but most often are used to hold wood fiber, hydro-mulches or straw to the soil surface.

e. Erosion Control Blankets and Mats: Mats are manufactured combinations of mulch and netting designed to retain soil moisture and modify soil temperature. During the growing season (April 25 to August 31) use mats indicated on drawings or North American Green (NAG) C125 BN (or mulch and netting) on:

- the base of grassed waterways;
- steep slopes (15 percent or greater); and
- any disturbed soil within 100 feet of lakes, streams, or wetlands.

During the late fall and winter (September 1 to April 25) use heavy grade mats indicated on drawings for NAG SC250 on all areas noted above plus use lighter grade mats NAG C125BN (or mulch and netting) on:

- sideslopes of grassed waterways; and
- moderate slopes (between 8 and 15 percent).

7. TEMPORARY DUST CONTROL

To prevent the blowing and movement of dust from exposed soil surfaces, and reduce the presence of dust, use water to control dusting by preserving the moisture level in the road surface materials. The use of calcium chloride or any other chemicals for dust control is prohibited

8. CONSTRUCTION DE-WATERING

a. Water from construction de-watering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams or site boundaries. Utilize temporary sediment basins, erosion control soil filter berms backed by staked hay bales, or other approved Best Management Practices (BMP's).

b. In sensitive areas near streams or ponds, discharge the water from the de-watering operation into a temporary sediment basin created by a surrounding filter berm of uncompacted erosion control mix immediately backed by staked hay bales (see the site details). Locate the temporary sediment basin at lease 100 feet from the nearest water body, such that the filtered water will flow through undisturbed vegetated soil areas prior to reaching the water body or property line.

A. PERMANENT MEASURES

1. Riprapped Aprons: All storm drain pipe outlets and the inlet and outlet of culverts will have riprap aprons to protect against scour and deterioration.

2. Topsoil, Seed, and Mulch: All areas disturbed during construction, but not subject to other restoration (paving, riprap, etc.) will be loamed, limed, fertilized, seeded, and mulched.

a. Seeded Preparation: Use stockpiled materials spread to the depths shown on the plans, if available. Approved topsoil substitutes may be used. Grade the site as needed.

b. Seeding will be completed by August 31 of each year. Late season seeding may be done between September 1 and April 25. Areas not seeded or which do not obtain satisfactory growth by August 31, will be seeded with Aroostook Rye or mulched. After November 1, or the first killing frost, disturbed areas will be seeded at double the specified application rates, mulched, and anchored.

PERMANENT SEEDING SPECIFICATIONS

Mixture:	Grassed areas (lbs/acre)
Tall Fescue	54
Creeping Red Fescue	25
Red Top	5
Ladino Clover	13
Annual Ryegrass	8
Birdsfoot Trefoil	5
Timothy	10

c. Mulch in accordance with specifications for temporary mulching.

d. If permanent vegetated stabilization cannot be established due to the season of the year, all exposed and disturbed areas not to undergo further disturbance are to have dormant seeding applied and be temporarily mulched to protect the site.

3. Ditches and Channels: All ditches on-site will be lined with North American Green S75 erosion control mesh (or an approved equal) upon installation of loam and seed.

B. WINTER CONSTRUCTION AND STABILIZATION

1. Winter excavation and earthwork will be completed so as to minimize exposed areas while satisfactorily completing the project. Limit exposed areas to those areas in which work is to occur during the following 15 days and that can be mulched in one day prior to any snow event. All areas will be considered denuded until the subbase gravel is installed in roadway areas or the areas of future loam and seed have been loamed, seeded, and mulched.

Install any added measures necessary to control erosion/sedimentation. The particular measure used will be dependent upon site conditions, the size of the area to be protected, and weather conditions.

To minimize areas without erosion control protection, continuation of earthwork operations on additional areas will not begin until the exposed soil surface on the area being worked has been stabilized.

2. Natural Resource Protection: During winter construction, a double-row of sediment barriers (i.e., silt fence backed with hay bales or erosion control mix) will be placed between any natural resource and the disturbed area. Projects crossing the natural resource will be protected a minimum distance of 100 feet on either side from the resource.

3. Sediment Barriers: During frozen conditions, sediment barriers may consist of erosion control mix berms or any other recognized sediment barriers as frozen soil prevents the proper installation of hay bales or silt fences.

4. Mulching: All areas will be considered to be denuded until seeded and mulched. Hay and straw mulch will be applied at a rate of twice the normal accepted rate.

Mulch will not be spread on top of snow.

After each day of final grading, the area will be properly stabilized with anchored hay or straw or erosion control matting.

Between the dates of September 1 and April 25, all mulch will be anchored by either mulch netting, emulsion chemical, tracking or wood cellulose fiber.

5. Soil Stockpiling: Stockpiles of soil or subsoil will be mulched for over-winter protection with hay or straw at twice the normal rate or with a 4-inch layer of erosion control mix. This will be done within 24 hours of stocking and re-established prior to any rainfall or snowfall. Any soil stockpiles shall not be placed (even covered with mulch) within 100 feet from any natural resources.

6. Seeding: Dormant seeding may be placed prior to the placement of mulch or erosion control blankets. If dormant seeding is used for the site, all disturbed areas will receive 4 inches of loam and seed at an application rate of three times the rate for permanent seeding. All areas seeded during the winter will be inspected in the spring for adequate catch. All areas insufficiently vegetated (less than 85 percent catch) will be revegetated by replacing loam, seed, and mulch.

If dormant seeding is not used for the site, all disturbed areas will be revegetated in the spring.

7. Maintenance: Maintenance measures will be applied as needed during the entire construction season. After each rainfall, snow storm, or period of thawing and runoff, the site contractor will perform a visual inspection of all installed erosion control measures and perform repairs as needed to ensure their continuous function.

Following the temporary and/or final seeding and mulching, the contractor will, in the spring, inspect and repair any damages and/or bare spots. An established vegetative cover means a minimum of 90 percent of areas vegetated with vigorous growth.

A. OVER-WINTER CONSTRUCTION EROSION CONTROL MEASURES

1. Stabilization of Disturbed Soil: By August 31, all disturbed soils on areas having a slope less than 15 percent will be seeded and mulched. If the contractor fails to stabilize these soils by this date, then the contractor shall stabilize the soil for late fall and winter, by using either temporary seeding or mulching.

2. Stabilization of Disturbed Slopes: All slopes to be vegetated will be completed by August 31. The owner will consider any area having a grade greater than 15 percent (6.5H:1V) to be a slope. Slopes not vegetated by August 31 will receive one of the following actions to stabilize the slope for late fall and winter:

a. Stabilize the soil with temporary vegetation and erosion control mesh.
b. Stabilize the slope with erosion control mix.
c. Stabilize the slope with stone riprap.

3. Stabilization of Ditches and Channels: All stone-lined ditches and channels to be used to convey runoff through the winter will be constructed and stabilized by November 15. Grass-lined ditches and channels will be complete by September 15. Grass-lined ditches not stabilized by September 15 shall be lined with either sod or riprap.

E. MAINTENANCE PLAN

1. Routine Maintenance: Inspection will be performed as outlined in the project's Erosion Control Plan. Inspection will be by a qualified person during wet weather to ensure that the facility performs as intended. Inspection priorities will include checking erosion controls for accumulation of sediments.

A. Housekeeping

1. Spill prevention. Controls must be used to prevent pollutants from being discharged from materials on site, including storage practices to minimize exposure of the materials to stormwater, and appropriate spill prevention, containment, and response planning and implementation.

2. Groundwater protection. During construction, liquid petroleum products and other hazardous materials with the potential to contaminate groundwater may not be stored or handled in areas of the site draining to an infiltration area. An "infiltration area" is any area of the site that by design or as a result of soils, topography and other relevant factors accumulates runoff that infiltrates into the soil. Dikes, berms, sumps, and other forms of secondary containment that prevent discharge to groundwater may be used to isolate portions of the site for the purposes of storage and handling of these materials.

3. Fugitive sediment and dust. Actions must be taken to ensure that activities do not result in noticeable erosion of soils or fugitive dust emissions during or after construction. Oil may not be used for dust control.

4. Debris and other materials. Litter, construction debris, and chemicals exposed to stormwater must be prevented from becoming a pollutant source.

5. Trench or foundation de-watering. Trench de-watering is the removal of water from trenches, foundations, coffer dams, ponds, and other areas within the construction area that retain water after excavation. In most cases the collected water is heavily silted and hinders correct and safe construction practices. The collected water must be removed from the ponded area, either through gravity or pumping, and must be spread through natural wooded buffers or removed to areas that are specifically designed to collect the maximum amount of sediment possible, like a cofferdam sedimentation basin. Avoid allowing the water to flow over disturbed areas of the site. Equivalent measures may be taken if approved by the department.

6. Non-stormwater discharges. Identify and prevent contamination by non-stormwater discharges.

7. Additional requirements. Additional requirements may be applied on a site-specific basis.

B. CONSTRUCTION SEQUENCE

It is anticipated that construction will commence upon receipt of all necessary permits and approvals. The following outlines the preliminary construction sequence:

a. Install silt fence and other temporary erosion control measures for the construction of Cell and accessory facilities such as berms, and service roads;

b. Construct upslope stormwater diversion berms, ditches, culvert outlets, and control structures:

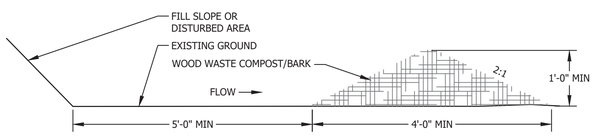
c. Perform stormwater upgrades;

d. Construct service road;

e. Construct Cell base grade;

f. Construct Cell liner system;

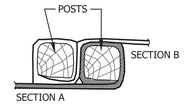
g. As permanent erosion control measures become stabilized, remove temporary measures (e.g., silt fence, stone check dams).



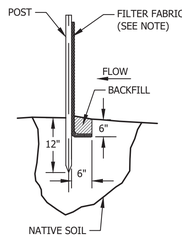
NOTE:
BARK MULCH SEDIMENT BARRIERS MAY BE USED AS AN ALTERNATE TO SILT FENCE WHEN APPROVED BY THE ENGINEER.

EROSION CONTROL MIX BERM
NTS

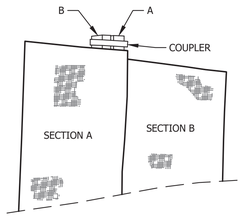
NOTE: SILTATION FENCE SHALL BE ENVIROFENCE AS MANF. BY MIRAFI INC., PROPEX SILT STOP AS MANF. BY AMOCO FABRICS CO. OR EQUAL



TOP VIEW

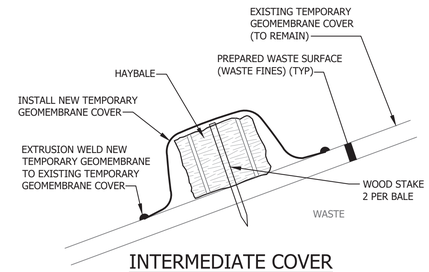


TOE-IN DETAIL

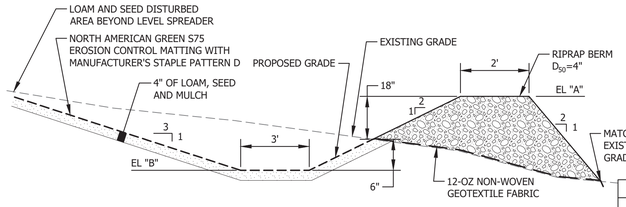


JOINING SECTIONS

SILT FENCE
NTS



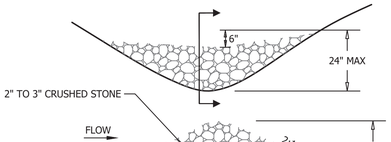
INTERMEDIATE COVER STORMWATER DIVERSION BERM
NTS



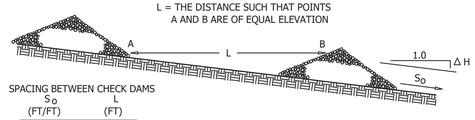
NOTES:
1. CONSTRUCT LEVEL LIP AND SPREADER ON ZERO PERCENT GRADE.
2. STORM RUNOFF CONVERTED TO SHEET FLOW SHALL OUTLET ONTO STABILIZED AREA. WATER SHALL NOT BE CHANNELIZED IMMEDIATELY BELOW POINT OF DISCHARGE.

LEVEL SPREADER NO.	EL "A"	EL "B"	LENGTH (FT)
DP-11R	151.5	150.0	15.0
DP-14	154.0	152.5	25.0

LEVEL SPREADER
NTS



SECTION

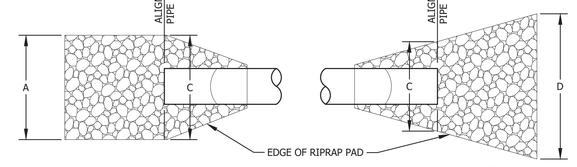


SPACING BETWEEN CHECK DAMS

So (FT/FT)	L (FT)
0.020	75
0.030	50
0.040	40
0.050	30
0.080	20
0.100	10

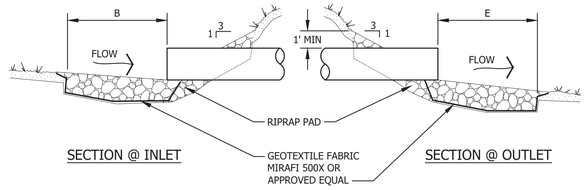
STONE CHECK DAM
NTS

CROSS SECTION



PLAN @ INLET

PLAN @ OUTLET



SECTION @ INLET

SECTION @ OUTLET

RIPRAP PAD MUST BE INSTALLED WITHIN 48 HOURS OF INSTALLING NEW PIPE OR CULVERT.

PIPE	PIPE DIA (IN)	C (FT)	D (FT)	E (FT)	PAD DEPTH (IN)	D50 (IN)
DP-11R	24	6	15	20	20	10
DP-14	24	6	15	20	20	10
A	24	6	15	20	20	10
B	24	6	15	20	20	10

PIPE INLET/OUTLET DETAILS
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE BRIAN J. PIERCE 9606 REGISTERED PROFESSIONAL ENGINEER 11/17/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

EROSION CONTROL NOTES AND DETAILS

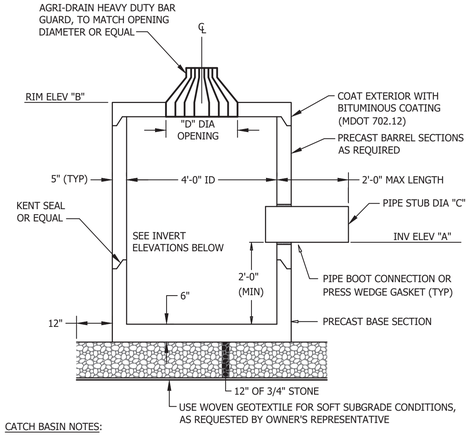
SME
SEVEE & MAHER ENGINEERS
ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE
4 Blanchard Road, PO Box 85A, Cumberland, Maine 04021
Phone 207.829.5016 • Fax 207.829.5692 • sme-engineers.com

DESIGN BY:	NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-308

\\Maine\civil\Cells\Cell7\ownLandfill\Cell7Raw\Plans\ESTAILS.dwg, C-308, 11/14/2025 9:48:11 AM, sjm



CATCH BASIN NOTES:

THE CONTRACTOR SHALL PROVIDE SUBMITTALS TO THE ENGINEER FOR APPROVAL. SUBMITTALS SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

PRODUCT DATA: SUBMIT PRODUCT DATA FOR ALL MATERIALS USED ON THE JOB FOR REVIEW FOR LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND DESIGN CONCEPT EXPRESSED IN CONTRACT DOCUMENTS.

SHOP DRAWINGS: SUBMIT FOR REVIEW SHOP DRAWINGS OF ALL PRECAST UNITS. MANUFACTURER'S INFORMATION SHALL BE SUBMITTED FOR JOINT SEALANTS AND WATERPROOFING. MANUFACTURER SHALL PROVIDE ANTI-FLOTATION DESIGN SHOP DRAWINGS AND CALCULATIONS, INCLUDING ANY EXTENDED BASE SLABS AS NECESSARY, FOR PROPOSED MANHOLES. MANUFACTURER SHALL ASSUME GROUNDWATER LEVELS EQUAL TOP OF GROUND ELEVATIONS AND PROVIDE FOR A 1.2 FACTOR OF SAFETY AGAINST FLOTATION.

CATCH BASIN SCHEDULE A

CATCH BASIN DESIGNATION	PIPE INV EL	RIM EL	PIPE DIA	TOP OPENING
	"A" (FT)	"B" (FT)	"C" (IN)	DIA "D" (IN)
CB-4G	161.00	167.2	24	30
CB-4H	174.0	180.3	24	30

CATCH BASIN
NTS

OUTLET CONTROL STRUCTURE NOTES:

THE CONTRACTOR SHALL PROVIDE SUBMITTALS TO THE ENGINEER FOR APPROVAL. SUBMITTALS SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

PRODUCT DATA: SUBMIT PRODUCT DATA FOR ALL MATERIALS USED ON THE JOB FOR REVIEW FOR LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH INFORMATION GIVEN AND DESIGN CONCEPT EXPRESSED IN CONTRACT DOCUMENTS.

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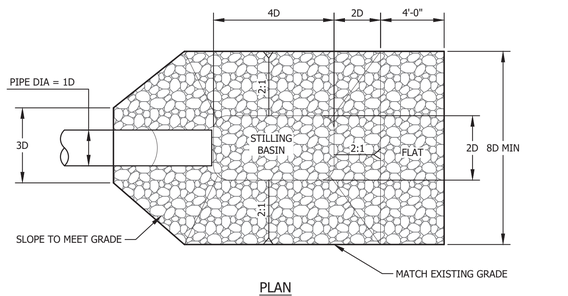
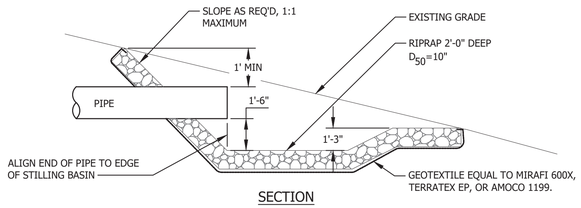
STRUCTURE DESIGNATION	OUTLET INV EL	ORIFICE DIA	ORIFICE INV EL	ORIFICE DIA	ORIFICE INV EL	RIM EL	OUTLET (C) CULVERT	CULVERT	CULVERT SLOPE
	"C" (FT)	"D" (IN)	"E" (FT)	"F" (IN)	"G" (FT)	"H" (FT)	DIAMETER (IN)	LENGTH (FT)	(FT/FT)
DP-11R	155.3	6.0	159.0	4.0	156.50	161.00	24 (CORR PE)	55.00	0.02
DP-14	157.0	6.0	159.0	4.0	158.00	159.80	24 (CORR PE)	55.00	0.02

OUTLET CONTROL STRUCTURE
NTS



PLAN

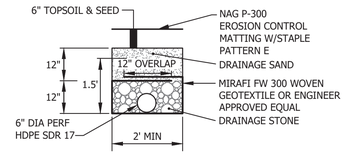


SECTION

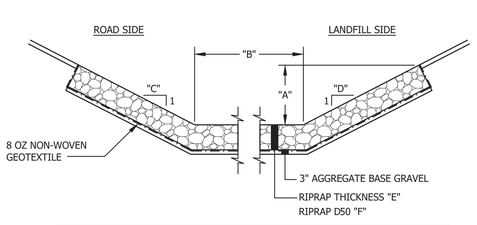
NOTES:

1. INSTALL SILT FENCE DOWNSTREAM PRIOR TO EXCAVATION.
2. LOAM AND SEED ALL AREAS DISTURBED BY CONSTRUCTION OF PLUNGE POOL.

PLUNGE POOL
NTS



POND UNDERDRAIN
NTS

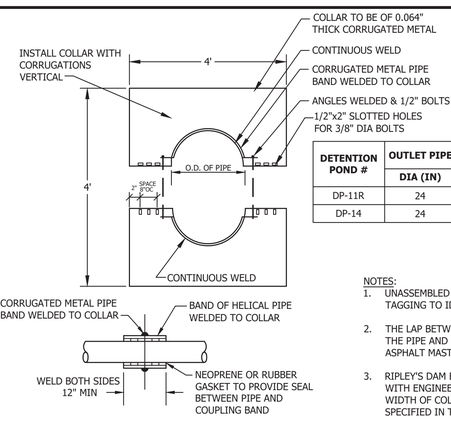


DITCH	A	B	C	D	E	F
	(FT)	(FT)			(IN)	(IN)
TOE DITCH	3	3	2	2	22	10

RIPRAP DITCH
NTS

STORM DRAIN	DIAMETER	MATERIAL	LENGTH	SLOPE	INV IN	INV OUT
	(in.)		(ft.)	(%)		
SD-4G	24	CORR PE	115.0	0.008	161.00	160.00
SD-4H	24	CORR PE	65.0	0.030	174.00	172.00

STORM DRAIN PIPES
NTS

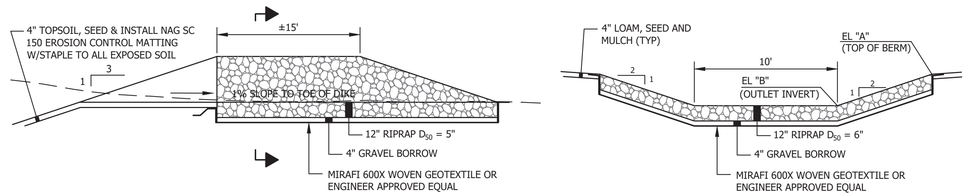


DETENTION POND #	OUTLET PIPE	PIPE LENGTH	SATURATED LENGTH	# OF	SPACING
	DIA (IN)	(FT)	(FT)	COLLARS	(FT)
DP-11R	24	55	45.9	3	11
DP-14	24	55	14.1	2	7

NOTES:

1. UNASSEMBLED COLLAR SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PARTS.
2. THE LAP BETWEEN THE TWO HALF SECTIONS AND BETWEEN THE PIPE AND CONNECTING BAND SHALL BE CAULKED WITH ASPHALT MASTIC AT TIME OF INSTALLATION.
3. RIPLEY'S DAM BY MCRIP MANUFACTURING MAY BE USED WITH ENGINEERS APPROVAL PROVIDING THAT LENGTH AND WIDTH OF COLLAR IS EQUAL TO OR GREATER THAN THAT SPECIFIED IN THE DETAIL.

ANTI-SEEP COLLAR
NTS



ELEVATION

SECTION

STRUCTURE DESIGNATION	BOTTOM WIDTH (FT)	LENGTH (FT)	EL "A" (FT)	D_{50} (IN)	THICKNESS (IN)	EL "B" (FT)
DP-11R	10	±15	168.0	6	12	166.5
DP-14	10	±15	162.0	6	12	160.5

EMERGENCY SPILLWAY
NTS

REV.	BY	DATE	STATUS
	BDP	11/2025	ISSUED FOR MEDEP SOLID WASTE PERMIT APPLICATION

STATE OF MAINE
BRIAN D. PIERCE
12609
REGISTERED PROFESSIONAL ENGINEER
11/19/2025

CELL 18 CONSTRUCTION
NEWSME LANDFILL OPERATIONS LLC
JUNIPER RIDGE LANDFILL
OLD TOWN, MAINE

EROSION CONTROL NOTES AND DETAILS

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DESIGN BY:	NMT
DRAWN BY:	SJM
DATE:	11/2025
CHECKED BY:	BDP
LMN:	NONE
CTB:	SME-STD.CTB

JOB NO. 250278 DWG FILE DETAILS

C-309

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