Technical Memorandum

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Prepared for: Maine Department of Environmental Protection (DEP)

Project Title: Study for Sustainable Management of Wastewater Solids, Septage & Leachate in the State of Maine

Project No.: 169895

Technical Memorandum

Subject: **Assessment of Landfill Capacity for Biosolids and Initial Evaluation of Leachate Treatment Approaches in Maine**

Date: February 26, 2024

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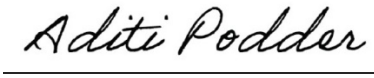
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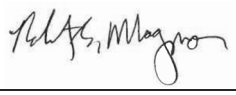
Reviewed by: 
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Abbreviation List

%, percent
> , less than
BC, Brown and Caldwell
BGS, Bureau of General Services within the Department of Administration and Financial Services
BOD, Biochemical Oxygen Demand
CDD, construction and demolition debris
COD, Chemical Oxygen Demand
DEP, Maine Department of Environmental Protection
DOD, U.S. Department of Defense
EAOP, Electrochemical Advanced Oxidation Process
EPA, U.S. Environmental Protection Agency
FF, Foam Fractionation
GAC, Granular Activated Carbon
gpd, gallons per day
IX, Ion Exchange
JRL, Juniper Ridge Landfill
MSW, municipal solid waste
N/A, not applicable
ng/l, nanograms per liter
NH3-N, ammonia, as nitrogen
NPDES, National Pollutant Discharge Elimination System
O&M, operations and maintenance
OBW, oversize bulky waste
PFAS, per- and polyfluoroalkyl substances
PFBS, perfluorobutane sulfonic acid
PFOA, perfluorooctanoic acid
PI, Presque Isle Landfill – Aroostook Waste Solutions
POTW, Publicly Owned Treatment Works
RO, Reverse Osmosis
SCWO, supercritical water oxidation
TCL, Tri-Community Landfill – Aroostook Waste Solutions
TDS, Total Dissolved Solids
TM, Technical Memorandum
TSS, Total Suspended Solids
UV, Ultraviolet
WM, Waste Management Disposal Services of Maine, Inc.

Executive Summary

Several factors have made the current situation for managing biosolids very challenging and uncertain for the Publicly Owned Treatment Works (POTW) who treat municipal wastewater and generate biosolids in Maine. Effective August 8, 2022, 38 M.R.S. §1306(7) banned the land application, sale, and distribution of "sludge and sludge-derived products" in Maine. POTWs were left with one option within the state to manage biosolids: disposal at landfills. This technical memorandum presents the results of an assessment of current and future landfill capacity for biosolids in Maine. It also provides an initial assessment of leachate treatment approaches for per- and polyfluoroalkyl substances (PFAS).

Based on analysis performed as part of this project, Publicly Owned Treatment Works (POTWs) providing wastewater treatment in Maine are estimated to generate approximately 88,500 wet-tons of biosolids per year. According to the National Biosolids Data Project (Beecher, et al. 2022), in 2018 around 40% of biosolids were beneficially reused, including in land application on agricultural lands (9%) or distributed as Class A products such as compost (29%). This was down from nearly 80% beneficial reuse in 2004. With the enactment of LD 1911, nearly all biosolids in Maine are landfilled (with a small amount being managed out of state), increasing dependency on the few landfills in Maine permitted to accept biosolids. The Maine Department of Environmental Protection (DEP) commissioned this study to assess the available capacity of landfills in the state to accept biosolids. DEP oversees wastewater treatment and biosolids management, and the Bureau of General Services within the Department of Administration and Financial Services (BGS), is charged with administering state-owned landfills.

Definition of terms as used in this document:

Biosolids: While neither Maine law nor DEP rule defines the term "biosolids", it is a commonly understood term. Here it is used to refer generally to the treated or untreated solids residual resulting from wastewater treatment at publicly owned treatment works (POTWs).

Septage: The residual removed from septic tanks, cesspools, portable toilets, and similar facilities. When septage is managed at POTWs, much of it is converted via treatment to biosolids.

Two landfills, Crossroads Landfill in Norridgewock and the state-owned Juniper Ridge Landfill (JRL) in Old Town, managed approximately 85,000 wet-tons or nearly 92% of the biosolids sent to landfill in 2022. JRL alone managed more than 78,000 wet-tons. However, BC estimates JRL will reach its currently permitted capacity in 2028. The last time JRL was expanded, it took nearly 6 years between submittal of the Public Benefit Determination and final approval with additional time then needed to construct the new area. If JRL is not expanded, the state faces a dire situation for solid waste in the state. For biosolids there is no current or proposed alternative outlet in the state that would be able to accept the tonnage currently handled at JRL.

Biosolids are typically mixed with bulking agents when landfilled to ensure slope stability. Much of the bulking agent that was used at JRL originated from a solid waste processing facility that handled a large amount of waste that originated from out of state. Not long after the land application ban took effect (February 2023), 38 M.R.S. §1310-N(5-A)(B) (Public Law 2021, Chapter 626) also went into effect, which set recycling deadlines that further exacerbated impacts to the overall management of sludge generated in Maine. Specifically, the operator of JRL asserted that there was consequently an insufficient amount of bulking agents—bulky materials that landfills mix with biosolids to achieve needed landfill stability—available to manage biosolids being added to the landfill and began turning away municipal biosolids. This left POTWs in a challenging situation in which they struggled to find an outlet to remove and manage the biosolids generated from the continued treatment of incoming wastewater flows. In some cases, this led to sludge piling up on site, which in turn placed some of the POTWs at risk of being out of compliance with their wastewater discharge permits.

Due to swift action from the POTW community, the Department of Environmental Protection (DEP), and the Hawk Ridge Composting Facility, emergency measures were put in place to store and transport sludge to a vendor in Canada. While this was intended as an emergency operation, it should be noted that hauling biosolids hundreds of miles out of the country resulted in greatly increased costs to POTWs (and ultimately ratepayers), and also increased greenhouse gas emissions. Virtually overnight, biosolids management costs for many POTWs doubled, which caused severe and unexpected strains on public utility budgets.

The following are suggested "levers"—tangible actions to address the underlying issues— available to Maine government to address the key challenges impacting biosolids landfill capacity in Maine and help avoid similar situations in the future.

1. Continuation of the Juniper Ridge Landfill. The state-owned Juniper Ridge Landfill (JRL) in Old Town was the outlet for nearly 90% of biosolids generated in Maine in 2022. The current permitted capacity of this facility is estimated to be fully used by 2028. For biosolids, there is no current or proposed alternative outlet in the state that would be able to accept the tonnage currently handled at JRL. It is Brown and Caldwell's understanding that the next step in the process to expand JRL is for the current operator to submit a Public Benefit Determination application to DEP for approval (38 M.R.S. §1310-AA). Given the severity of the implications if the facility is not expanded, it is recommended that **the State work with the current operator to ensure that an application is submitted as soon as possible** to ensure sufficient time to pursue alternatives if the expansion is not pursued by the current operator.
2. Availability and access to bulking agents. It is recommended that **DEP fund an independent study evaluating the availability of bulking agents**. Restrictions impacting the availability of bulking agents go into effect in 2024 and 2025, so this study should be completed as soon as possible. If the study finds that insufficient quantities of bulking agents are available, then the extension on the restrictions in P.L. 2021, ch. 626 may need to be extended (see Sections 2.1.2, 2.1.3 and 7.3).As noted in responses to a questionnaire distributed to landfill operators as part of this project, several landfills listed lack of bulking agents as a limitation to accepting more biosolids.
3. Increasing the amount of dried biosolids. Once dried, biosolids no longer fall under "wet waste" restrictions. Facilities such as the proposed biosolids dryer project under development at the Crossroads Landfill are crucial to decoupling biosolids disposal from the need for bulking agents. As Clean Water State Revolving Funds are already stretched, it is recommended to **issue a bond to provide state grants for volume reduction and drying projects**. This should include promising regional projects.
4. Increase the number of landfills permitted to accept biosolids. In a questionnaire sent to landfill operators in the state as part of this project, four facilities expressed interest in discussing with DEP the possibility of starting to accept biosolids (see Section 3.2). While smaller than JRL, **DEP should coordinate discussions with these regulated facilities** to provide supplemental or contingency capacity.
5. Increase recycling and waste diversion from existing landfills. Maine's overall solid waste capacity outlook is concerning, with most of the state's capacity to be filled by 2043. DEP's current efforts to update the current 2019 Waste Plan include **focusing on generating less waste and recovering materials that can be recycled**.

This study also estimated the current and future amount of leachate generated at facilities accepting biosolids and evaluated options for leachate management. Leachate volume from these landfills was relatively consistent in recent years in the range of 70 million to 80 million gallons per year and is estimated to grow to 115 million gallons by 2030.

In January 2023, a leachate treatment study for two state-owned landfills (Dolby and Juniper Ridge), funded by BGS, was published. The report identified PFAS treatment technologies and their effectiveness in reducing PFAS compounds regulated in Maine to below the state's Interim Drinking Water Standard (sum of the six PFAS compounds must be below 20 ng/l). Four technologies were identified (foam fractionation, reverse osmosis, electrochemical advanced oxidation process, and biological treatment followed by on-site

physical/chemical treatment including granular activated carbon, ion exchange, and sorption on alternative media such as modified clays). Foam fractionation topped the list given its current state of development and demonstrated ability to remove the sum of the six PFAS compounds to below 20 ng/l. The concentrated foam generated as a treatment byproduct must be managed for disposal by expensive destruction technologies (such as supercritical water oxidation (SCWO) or electrochemical advanced oxidation process) or via less expensive on-site solidification prior to landfilling.

The 2023 study concluded that reducing PFAS to interim drinking water standard levels using foam fractionation is predicted to be successful and was confirmed via bench-scale testing by two independent vendors. The study recommended advancing to pilot-scale testing of leachate using foam fractionation at both landfills. The study also recommended advancing pilot testing of leachate and foam fractionation concentrate using electrochemical advanced oxidation and evaluating super-loading concentrate onto adsorption media.

It is recommended that BGS move forward with pilot testing the technologies identified in the 2023 study at one or both landfills to support development of design criteria and confirm performance requirements for the selected on-site pre-treatment system. Ongoing work by DEP and the Anson-Madison Sanitary District to advance development of a regional PFAS treatment facility at the utility will allow landfill leachate and certain pre-treatment byproducts to be accepted for off-site treatment.

Section 1: Introduction

1.1 Project Background

In April of 2022 the State of Maine adopted LD 1911, "An Act to Prevent the Further Contamination of the Soils and Waters of the State with So-Called Forever Chemicals," which bans the land application, sale, and distribution of sludge biosolids and sludge derived soil amendments. The regulation of biosolids in Maine is a result of public concern and legislative action around per- and polyfluoroalkyl (PFAS) substances. The two most studied members of this group are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Current peer-reviewed scientific studies have been shown that exposure to certain PFAS chemicals may have adverse health effects (Fenton, 2021). The U.S. Environmental Protection Agency (EPA) has issued guidance and regulations to protect human health and the environment from PFAS, with more regulations expected in the future because of continued research.

Based on analysis performed as part of this project, publicly owned treatment works (POTWs) providing wastewater treatment in Maine are estimated to generate approximately 88,500 wet-tons of biosolids per year. According to the National Biosolids Data Project (Beecher, et al. 2022), in 2018 around 40% of biosolids were beneficially reused, including in land application on agricultural lands (9%) or distributed as Class A products such as compost (29%). This was down from nearly 80% beneficial reuse in 2004. With the enactment of LD 1911, nearly all biosolids in Maine are landfilled (with a small amount being managed out of state), increasing dependency on the few landfills in Maine permitted to accept biosolids. DEP commissioned this study, in part, to assess the available capacity of landfills in the state to accept biosolids.

Given the land application ban, POTWs are now mostly relying on two landfills (JRL and Crossroads) in the state for biosolids disposal. Due to limited management options, the costs to manage biosolids outside of Maine are high and may be logistically, politically, and regulatorily challenging.

The ability and cost to landfill biosolids is also impacted by a solid waste law, 38 M.R.S. §1310-N(5-A)(B), which went into effect in February 2023 and sets recycling deadlines that reduced the availability of bulking agents, such as construction and demolition debris (CDD). CDD waste can serve as blend materials for "wet wastes," such as biosolids, thus, a reduction in CDD volume triggers a corresponding reduction in the volume of biosolids that can be accepted at a given landfill. Landfill owners/operators have internal guidelines for waste acceptance and management that also must be considered. The inclusion of "wet wastes," such as biosolids, are limited both on a regulatory (permit) basis, as well as an operations basis, as acceptance of large volumes of wet wastes can contribute to operational issues such as slope failures, odors, increased leachate production, leachate breakouts (seeps), stronger leachate, and greater landfill gas production.

1.2 Scope of Work

This TM presents the results of Task 1 – Near Term Evaluation: Assessment of Landfill Capacity as identified in BC's March 27, 2023, proposal. In general, Task 1 can be described as the process of assessing the available landfill capacity in the State of Maine for biosolids specifically, and the timeline for landfills in Maine to reach their permitted capacity (Section 2). It also provides an initial assessment of leachate treatment approaches for per- and polyfluoroalkyl substances (PFAS) (Section 5).

1.3 Objectives

The desired outcome of these tasks is to provide an assessment to DEP prior to the next legislative session on the current and future status of landfill capacity in terms of biosolids acceptance.

Key efforts performed as part of this initial task are identified below:

- Review available information gathered by DEP.
- Develop a questionnaire to solicit input from operators at landfills that accept biosolids.
- Evaluate short- and long-term capacity of operational landfills.
- Evaluate current leachate volumes, characteristics, and disposal; and estimate future volumes.
- Identify leachate management technologies for PFAS treatment.

Section 2: Landfill Capacity for Biosolids

2.1 Historical Landfill Acceptance

Figure 2-1 shows the amount of biosolids disposed in landfills in Maine from 2010 to 2022 based on data provided by DEP (2023). Approximately 87,000 wet-tons per year of biosolids were landfilled in both 2021 and 2022. JRL, a state-owned landfill operated by NEWSME Landfill Operations LLC, a wholly owned subsidiary of Casella Waste Systems, Inc., and Crossroads Landfill, owned and operated by Waste Management Disposal Services of Maine, Inc. (WM), manage the vast majority of biosolids in Maine. These two facilities, the largest and second largest lined landfills in the state that accept municipal solid waste (MSW), accepted 90% and 2% of the biosolids landfilled in 2022, respectively.

Figure 2-1 also shows a significant increase in biosolids disposal at landfills between 2018 and 2019. In July 2018, the Solid Waste Management Rules for Beneficial Use of Solid Wastes (06-096 Code of Maine Rules, Chapter 418, Appendix A) were amended to include screening concentrations for three PFAS compounds (PFOA, PFOS, and PFBS). In March 2019, DEP issued a memorandum stating that biosolids agronomic utilization licensees and licensed sludge composters must first sample for three PFAS compounds (those identified in the recently updated 06-096 C.M.R. Chapter 418, Appendix A, Solid Waste Management Rules: Beneficial Use of Solid Wastes) prior to conducting any land application activity. Any PFAS samples above the screening concentrations and/or site-specific soil loading rate calculations would then result in restricted or no land application. In 2019, biosolids from only one POTW met the screening limits for all three PFAS compounds (without consideration of loading rate calculations), which either severely restricted the land application rate or, more commonly, pushed biosolids into landfill.

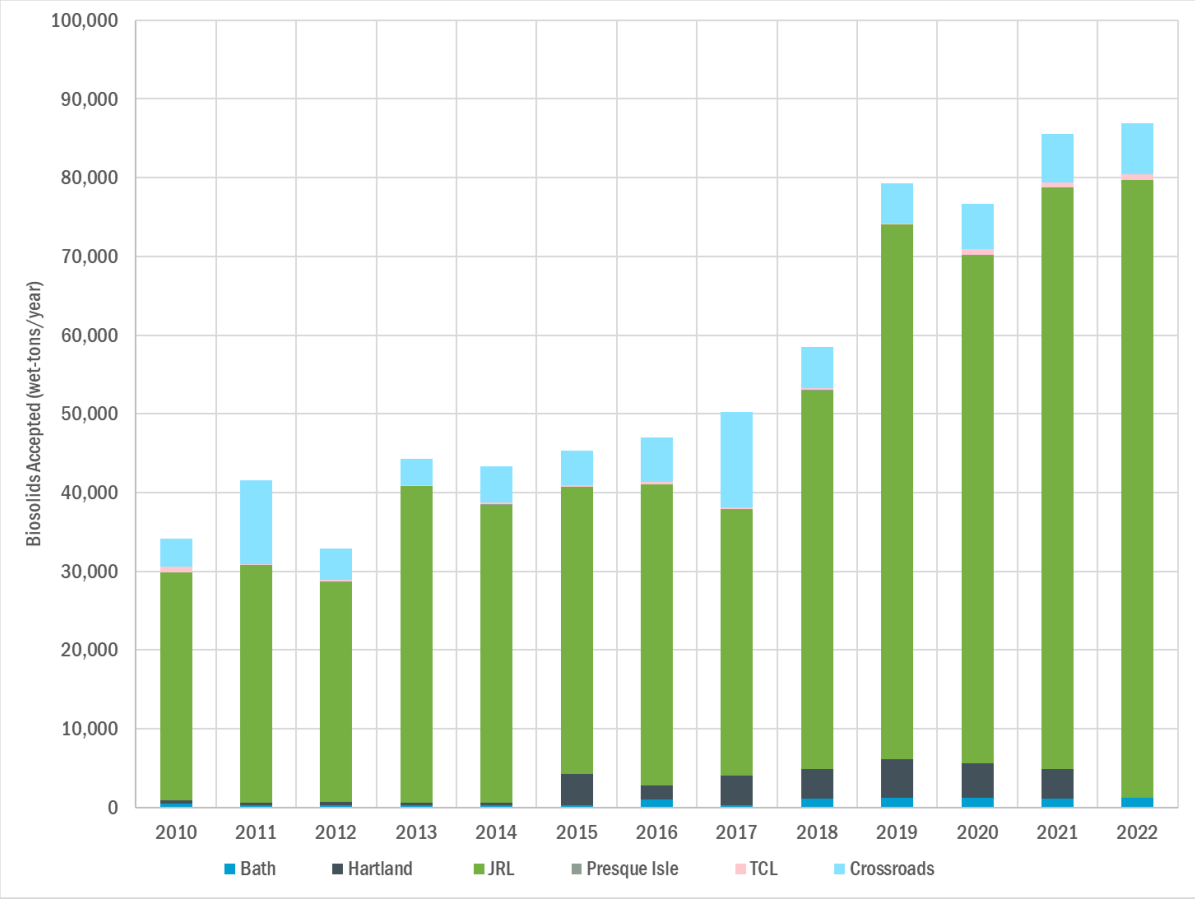


Figure 2-1. Historical Biosolids Disposal at Landfills in Maine

2.2 Bulking Agents

Biosolids and other wet wastes require management strategies to maintain compliance and safe operations. Acceptance of excess quantities of these materials without proper management may result in structural instability, increased leachate volume, and accumulation of liquids in the landfill gas system. Landfill operators typically employ bulking agents to control and counteract these potential impacts. Co-disposal of biosolids (mixing biosolids with bulking agents at the landfill working face) is the most common method in Maine.

In Maine, landfill operators have been using clean CDD (with minimal sheetrock due to potential hydrogen sulfide generation), bypass MSW (from MSW incinerators or MSW processing facilities in Maine), oversize bulky waste (OBW), incinerator/boiler ash, contaminated soil, and CDD processing fines as bulking agents. Based on questionnaire responses, some landfills with existing compost facilities are also using compost as a bulking agent. The ratio of bulking agents to biosolids can be 4:1 or greater depending on the moisture content of the biosolids, properties of the bulking agent, and the workability goals of the operator. Some bulking agents require a higher ratio, reducing the number of biosolids trucks that can be accepted per hour, and exacerbating logistical issues discussed below.

At the same time as the biosolids land application, sale, and distribution ban, the legislature passed P.L. 2021, ch. 626 (L.D. 1639), "An Act to Protect the Health and Welfare of Maine Communities and Reduce Harmful Solid Waste." This law became effective in February 2023 and limited the tonnage that certain solid waste processing facilities could send to landfills in Maine to no more than what the facility accepted from in-state sources, with the goal of preserving landfill space for waste generated in Maine. The law also required that at least 50% of the material that certain solid waste processing facilities (those that accepted more than 200,000 tons in 2018) accepted be reused or recycled through methods other than placement in a landfill, with a gradually increasing percentage of the recycled amount going to outlets other than landfills (as a bulking agent or alternate daily cover). While this law was in effect and CDD was not as readily available as a bulking agent for disposal of biosolids in landfills, reliance on more costly means for managing biosolids increased such as hauling to facilities in Canada. In short order, the cost to manage biosolids nearly doubled for some wastewater treatment utilities.

In June 2023, the Maine legislature passed P.L. 2023, ch. 283 (codified at 38 M.R.S. §1310-N(5-A)(B)), which allows certain solid waste processing facilities to continue sending up to 25,000 tons per 12-month period of oversized bulky waste that was originally generated out of state to state-owned landfills (i.e., JRL) until July 1, 2025. This was to ensure that enough bulky waste could be obtained throughout the year until better solutions were available for managing biosolids in Maine. The law also delays until July 1, 2024, the start date for when certain large solid waste processing facilities are required to ensure a portion of recycled material goes to an outlet other than landfills. These temporary measures helped alleviate the immediate challenge, but the underlying issues still need to be addressed.

2.3 Other Limitations on Biosolids Acceptance

There are several factors that landfill operators consider with respect to managing biosolids. The factors include operating strategies employed at the landfill and infrastructure related to environmental control systems as summarized below.

- Biosolids management at landfills can affect the stability of side slopes because of its water content. For this reason, landfill operators generally limit the volume of incoming biosolids to 10 percent or less of the total volume of waste accepted.

- Biosolids arriving for disposal at a landfill need to be promptly mixed with other solid waste and covered to minimize the potential for odors. Operators try to coordinate biosolids acceptance with the availability of sufficient waste available for mixing so trucks are able to enter and exit the facility as quickly as possible.
- Landfill gas and leachate production both have the potential to increase with the addition of biosolids to a landfill; therefore, additional attention to these systems is generally needed.
- Landfilling of biosolids has the potential to impact leachate quality, which may affect options for treating and managing the leachate.
- Landfills may at times have restrictions due to inclement weather (such as the heavy precipitation of summer 2023) or operational issues such as location and size of the working face that reduce the volume of biosolids that can be accepted.
- The potential requirement for PFAS treatment in leachate has made some landfill operators reluctant to accept biosolids.

Finally, a nationwide shortage of truck drivers and volatile fuel prices add uncertainty to the process of transporting biosolids to the landfill in the first place.

2.4 Estimated Future Landfill Capacity for Biosolids

This section provides an assessment of biosolids management capacity at Maine landfills for the short-term (through 2030) and the longer term (through 2043). The assessment is based on available permitted landfill capacity, permitted unconstructed capacity, and plans for future expansions. This analysis also incorporates the impact of a biosolids dryer project under development by WM for the Crossroads Landfill. According to WM, the incoming capacity of the dryer project is expected to be 200 wet-tons per day. WM reports that the facility will have three independent dryer trains and operate every day of the year, so they anticipate uptime to be 96%, for an annual throughput of 70,000 wet-tons per year.

2.4.1 Identification of Landfills for Further Analysis

There are forty active solid waste disposal facilities in Maine (DEP, 2023a), including seventeen active, lined landfills. Biosolids must be disposed of landfills that are properly lined and permitted. A detailed questionnaire (Attachment A) was sent to the seventeen active lined facilities to gather more detail on their operations and capacity to accept biosolids.

Responses to the questionnaire were received from fourteen of the seventeen facilities (see Attachment B for a summary). Three of the seventeen landfills did not respond: one that is closing, one that accepts ash only and one that only accepts biosolids generated on-site but is not open to accepting offsite biosolids. Eight of the remaining fourteen landfills identified as follows: seven of those facilities only accept on-site wastes and one facility is not licensed to accept biosolids (see Table B.2 in Attachment B for further details).

Six of the remaining fourteen facilities were identified as historically having received biosolids, as well as having a reasonable outlook for accepting biosolids for the state of Maine. These six landfills were evaluated for future biosolids acceptance in the following sections. Note that these six facilities are the same facilities identified in Section 2.1 and Figure 2-1. Locations of these six facilities are shown in Figure 2-2.

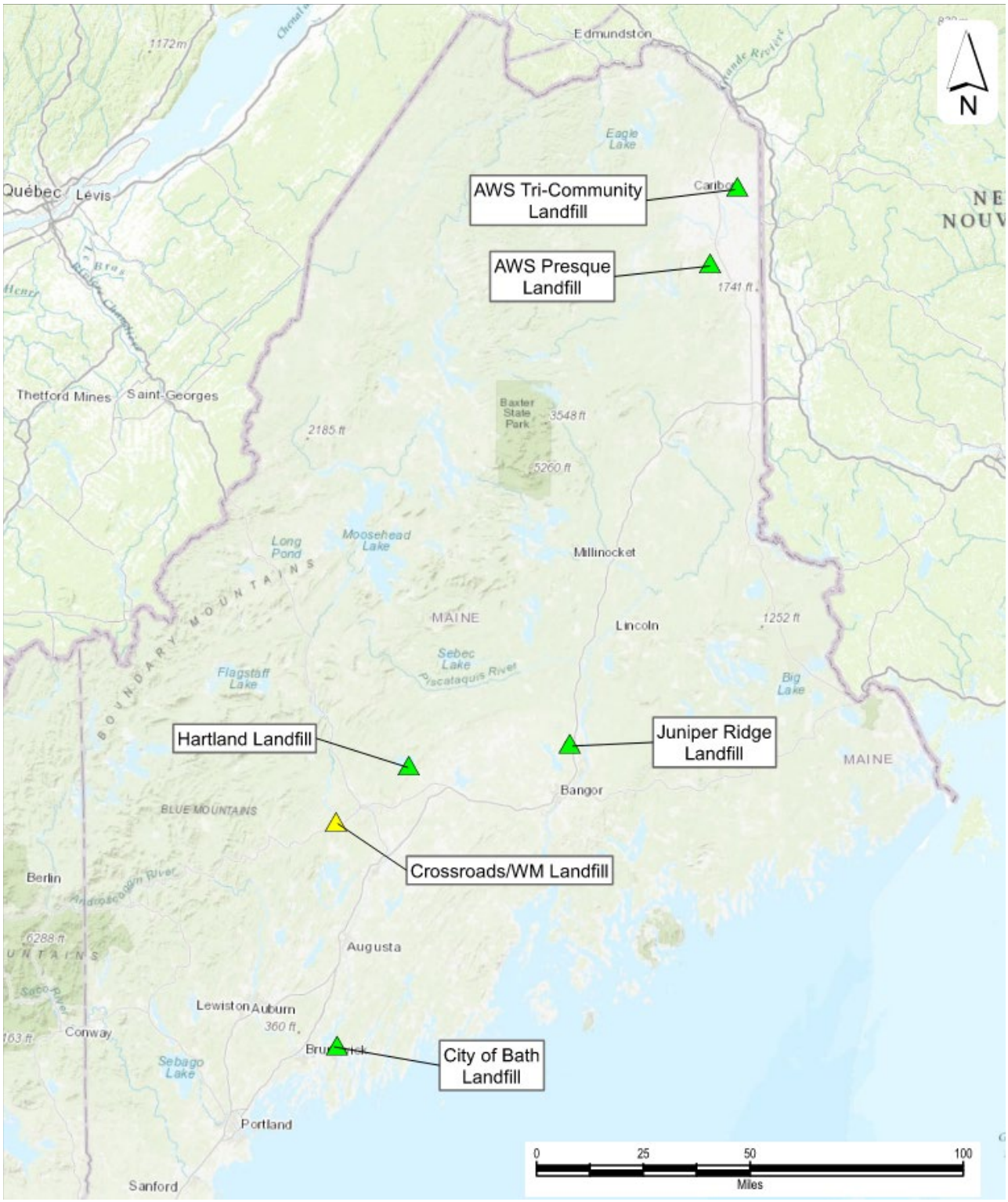


Figure 2-2. Locations of Landfills Identified for Further Analysis

Note: Privately owned facilities are shown in yellow.

Table 2-1 provides the biosolids and waste acceptance summary of the six identified landfills for 2022.

Table 2-1. Biosolids and Total Waste Acceptance for Six Identified Landfills in 2022[a]

Facility Name – Owner	Biosolids Accepted (tons)	Total Waste Accepted (tons)	Biosolids as Percent of Total Waste Accepted
Bath Landfill – City of Bath [b]	1,253	6,651	19%
Hartland Landfill – Town of Hartland	32	3,720	0.9%
Juniper Ridge Landfill – State of Maine	78,383	933,649	8.4%
Presque Isle Landfill - Aroostook Waste Solutions (PI)	0	15,502	0%
Tri-Community Landfill – Aroostook Waste Solutions (TCL)	785	47,381	1.7%
Crossroads Landfill – Waste Management [c]	6,478	274,749	2.4%
Total	**86,931**	**1,281,652**	**6.8%**

[a] *Biosolids acceptance data were taken from landfilled POTW sludge as reported by Maine DEP.*

[b] *Waste acceptance data were taken from respective annual reports*

A tabulation of the capacity of the six landfills is provided on Table 2.2. The six landfills can collectively accept approximately 16 million wet-tons of total additional solid waste based on their constructed space and permitted-but-not-yet constructed space. If expansion takes place at the JRL and TCL landfills, the six landfills can collectively accept nearly 26 million wet-tons in total additional solid waste.

Table 2-2 Landfill Capacity for the Six Identified Landfills Accepting Biosolids

Facility Name – Owner	Remaining Tons (Permitted plus Constructed)[a]	Expansion Tons [b, c]	Total Potential Future Tons
	Based on 2022 Data from Questionnaire Responses Received between June and August 2023		
Bath Landfill – City of Bath	147,000	0	147,000
Hartland Landfill – Town of Hartland	187,500	0	187,500
Juniper Ridge Landfill - State of Maine	5,610,000	9,341,500	14,951,500
Presque Isle Landfill – Aroostook Waste Solutions (PI)	800,000	0	800,000
Tri-Community Landfill – Aroostook Waste Solutions (TCL)	850,000	625,000	1,475,000
Crossroads Landfill – Waste Management	8,000,000	0	8,000,000
Total	**15,594,500**	**9,966,500**	25,561,000

[a] *Remaining Tons = current available tons constructed but not used plus permitted not yet constructed*

[b] *Expansion Tons = future tons that requires permitting and approvals from the state*

[c] *Depends on multiple factors including compaction.*

The data presented in this section and in Attachment B was utilized as a basis for the estimating landfill life/available airspace and is presented in further detail in Section 2.4.3 and 2.4.4.

2.4.2 Assumptions

The estimated biosolids landfill capacity assessment is based on several key assumptions:

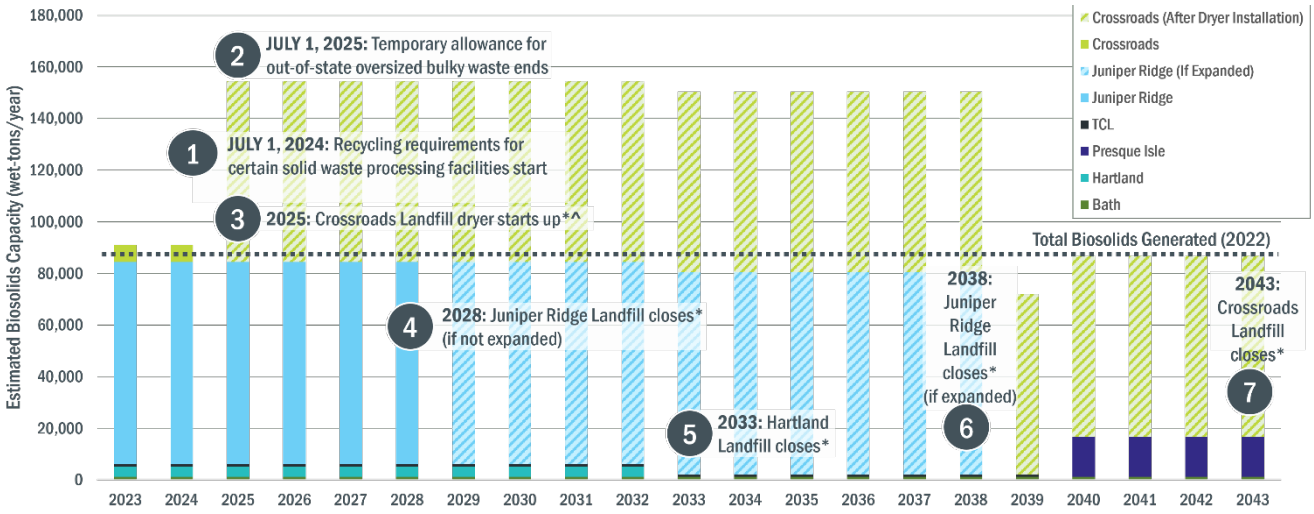
- Growth factors to address changes in population were not included. The state projects that population will increase a marginal amount (3.1%) between 2020 and 2040 (Maine Department of Administrative and Financial Services, 2023).
- No new landfills are anticipated in the planning period. Maine has had a moratorium on new commercial landfills since 1989. BC was not made aware of any plans for new or expanded state landfills, other than the possible expansion of JRL discussed below.
- Biosolids management capacity at landfills is limited to the amount of wet waste landfill owners are willing to accept per internal guidelines. This is typically no more than 10%, and other wet wastes (e.g., industrial sludges, industrial wastes) count toward this total. It is therefore assumed that the amount of biosolids accepted at each of the landfills in 2022 is the amount they will accept in future years, with two exceptions. The Crossroads and Hartland landfills accepted an abnormally low amount of biosolids in 2022. According to the operators, levels could rise back to historical levels so recent historical averages were used for both facilities.
- All biosolids going to the Crossroads dryer are assumed to originate in Maine. It is assumed the dryer will begin operation in 2025 and continue through 2043.
- If a decision is made to expand JRL, it is assumed the necessary planning, permitting, design and construction can be completed so it is available for operation in 2029 when the existing permitted capacity is estimated to be fully used. This effort must be performed in little more than five years.
- Landfills included in the study will continue to accept biosolids at the same rate as they did in 2022 until they close.

2.4.3 Estimated Landfill Capacity for Biosolids to 2030 and 2043

The estimated landfill capacity for biosolids at each of the six landfills in the near term (2030) and longer term (2043) is discussed below. Figure 2-3 illustrates the projected biosolids acceptance through 2043. Even with the JRL expansion and dryer project at Crossroads, both landfills will be filled and closed by 2043, leaving Maine with a significant solid waste capacity shortfall for both MSW and biosolids.

It is estimated that JRL currently has capacity to remain available through 2028. If an expansion is permitted at JRL, its capacity would be an additional 10 years through 2038.

Crossroads Landfill has accepted around 6,500 wet-tons per year of biosolids in recent years. This capacity will increase to approximately 70,000 wet-tons per year (as dewatered cake at around 20% total solids) in 2025 if the proposed biosolids dryer project is developed. It is assumed both the Bath Landfill and Hartland Landfill will remain available through 2030 based on their projected remaining life.



**Estimated dates*

^While other biosolids facilities have been proposed in Maine, including those discussed in Section 3.2, this is the only facility for which permit applications have been formally submitted to DEP and so is the only one included in this graphic.

Figure 2-3. Estimated biosolids management capacity in Maine

The Crossroads biosolids dryer project and the JRL expansion play a crucial role in the availability of biosolids management in Maine as highlighted in Figure 2-3. The Crossroads dryer project adds approximately 70,000 wet-tons per year of available capacity beginning in 2025. The JRL expansion maintains 80,000 wet-tons per year of capacity as long as sufficient bulking material is available that would otherwise not be able to made up elsewhere in the state.

Currently, biosolids management is highly dependent on landfill capacity and unless other alternatives become available, the ability to manage biosolids in Maine will be influenced by the following considerations:

1. Bath Landfill projected to close in 2044.
2. Hartland Landfill projected to close in 2033.
3. JRL projected to close in 2028 unless expansion plans are implemented soon.
4. Presque Isle Landfill remains closed currently; waste is sent to the Tri-Community Landfill until it is projected to close in approximately 17 years.
5. Operations at Presque Isle Landfill will begin once Tri-Community Landfill is closed and are expected to continue for the subsequent 20 years.
6. Crossroads Landfill projected to close in 2043.

Partially offsetting the landfill closures indicated above is the proposed biosolids dryer project at the Crossroads Landfill in 2025.

Section 3: Potential Improvements to Increase Biosolids Acceptance

3.1 Bulking Agents

A list of bulking agents and source location was identified by DEP (2023c) and is shown below in Table 3-1. Use of bulking materials depends on several factors including source location relative to the landfill. While other factors such as unit cost play a significant role, it is critical that there be ample supply and access to bulking agents.

Table 3-1. Bulking Material Options

Material Type	Source Location
Wood Chips	Lincoln
Rail Ties	Aroostook County
Demo Wood	Greenbush
Yard Scraps	Nashville Plantation
Wood Waste	Masardis
Auto Shredder Fluff	Auburn
Auto Shredder Fluff	Berwick
Sawdust	Lincoln
Solidification Chip	Various Locations
Ash	Lincoln

Any solution that requires the use of bulking agents should be carefully vetted such that the bulking agents being utilized are materials already intended for disposal and have the least impact to landfill airspace.

To avoid another "sludge crisis" in the coming 2 years when the restrictions on out-of-state waste and recycling requirements for certain large solid waste processing facilities go back into effect, the state can take several immediate and longer-term actions. Most pressing, the state needs to verify that ReSource Lewiston (the solid waste processing facility producing much of the bulking agent for JRL) and Casella anticipate having sufficient and consistent amounts of bulking agent available to support continued acceptance of the current levels of biosolids (and other wet wastes). **BC recommends that the state fund an independent study evaluating the availability of traditional and alternative bulking agents.** If the study finds that insufficient quantities of bulking agent are available, then the extension on the restrictions in P.L. 2021, ch. 626 may need to be extended until reliable alternatives are secured.

In the longer term, it is recommended that the state incentivize increased recycling of CDD produced in the state, including by supporting increased processing capacity in the state. This will also help extend the available landfill capacity generally in the state.

3.2 Considerations for Increasing Biosolids Acceptance

The opportunities for the six existing lined landfills discussed above to accept more biosolids (as wet waste) is limited, however the following opportunities should be considered:

- **Increasing the amount of dried biosolids**. Once dried, biosolids no longer fall under "wet waste" restrictions. Facilities such as the proposed biosolids dryer project under development at the Crossroads Landfill are crucial to decoupling biosolids disposal from the need for bulking agents. As Clean

Water State Revolving Funds are already stretched, it is recommended to **issue a bond to provide state grants for volume reduction and drying projects**. This should include promising regional projects.

- **Increase recycling and waste diversion from existing landfills.** Maine's overall solid waste capacity outlook is concerning, with most of the state's capacity to be filled by 2043. DEP's current efforts to update the current 2019 Waste Plan include focusing on generating less wastes and recovering materials that can be recycled. DEP should continue to work with local governments to implement a plan that Maine residents can support and execute.
- **Increase the number of landfills permitted to accept biosolids.** In the recent questionnaire, sites that do not currently accept biosolids expressed interest in discussing with DEP to modify or add terms and conditions to accept biosolids. While relatively small, DEP should coordinate discussions with these facilities to provide supplemental or contingency capacity.

In the questionnaire responses, a few landfill owners not currently permitted to accept biosolids (City of Augusta, City of Lewiston, and Twin Rivers Paper Company LLC) expressed interest in discussing with DEP the possibility of accepting biosolids in the future. In addition, the Pixelle Androscoggin facility, which includes a landfill, has recently been sold. While the proposed plan for the facility is to close the landfill, the possibility of using the remaining permitted capacity at the site for biosolids disposal could be explored with the new owners as an alternative action if the proposed activity complies with state statutes and rules.

While additional restrictions on the amount of biosolids that could be accepted at these "additional" facilities are likely, an approximate maximum tonnage that each facility could accept was calculated based on questionnaire responses and annual reports (Table 3-2). Collectively it is estimated that these facilities could accept a maximum of almost 10,000 wet-tons/year, or around 11% of all the biosolids currently generated in the state. These facilities could provide another outlet for biosolids, particularly for POTWs located nearby. They could also provide contingency backup in the event issues arise at the landfills currently accepting biosolids.

Table 3-2. Landfill Owners Indicating a Willingness to Discuss Starting to Accept Biosolids[a]

Owner	Landfill	Public/Private	Location (city/town)	Typical Waste Acceptance Rate (wet-tons/year)	Estimated Maximum Biosolids Acceptance[b] (wet-tons/year)
City of Augusta	Hatch Hill Landfill	Public	Augusta	71,000	7,100
City of Lewiston	Lewiston Landfill	Public	Lewiston	11,000	1,100
Pixelle Androscoggin LLC	Pixelle Androscoggin Landfill	Private	Jay	7,000	700
Twin Rivers Paper Company LLC	Frenchville Landfill	Private	Madawaska	8,600	860
				TOTAL:	**9,760**

[a] *in study questionnaire response.*

[b] *10% of total waste accepted based on questionnaire responses or annual reports.*

Section 4: Leachate Generation at Landfills Accepting Biosolids

4.1 Historical Leachate Generation

Landfill leachate is primarily generated as precipitation percolates through the waste, collecting various contaminates from the waste placed at a site. Some additional leachate is generated as a byproduct of waste decomposition. At a lined landfill, leachate drains to the bottom of the site and is typically collected through a series of pipes and pump stations, or gravity drains located at key locations often dictated by local topography and hydrogeologic conditions. Leachate generation can be measured with flowmeters located at pump stations or at storage tanks or a combination of locations depending on the complexity of the site and level of detail required for operational or regulatory purposes.

The quantity of leachate generated at a particular landfill will depend on several factors with the two most obvious factors being the size of the landfill and amount of annual precipitation; larger landfills that experience more rain will produce more leachate than smaller sites in drier climates. Additional factors that can impact the quantity of leachate generated are:

- **Waste Types and Volumes**. Wastes with higher moisture contents like biosolids and pond dredges will cause the landfill to generate more leachate than drier waste like kiln dust or wood waste.
- **Base Liner Development Plan**. Lined landfill areas that are not covered with waste generate larger amounts of leachate since the precipitation is not absorbed by any waste and quickly becomes leachate. Many landfills use techniques to limit leachate generation in newly constructed base liner areas like dividing the constructed base area with berms and tarps to keep upgradient rainwater as stormwater runoff and not leachate requiring collection.
- **Cover Type**. Waste is covered as required by regulations to control nuisance conditions like odors and litter as well as reduce leachate generation. Landfill cover is typically identified (in decreasing permeability) as daily, intermediate, and final cover. Landfill areas with more permeable daily cover will generate more leachate than areas that have received final cover which includes a low permeability layer consisting of a geomembrane liner. Many landfill operators now use an exposed geomembrane as an alternative to soil intermediate cover that performs better than soil for odor control and limits the percolation of rainwater thereby minimizing leachate generation.
- **Phased Capping/Final Cover Construction**. Final cover construction, or capping, is the last step at a landfill and consists of installation of a multi-layer system to isolate the underlying waste materials, control emissions of landfill gas, limit infiltration of precipitation, and promote stormwater run-off. Final cover construction is often done in phases and is well-proven in reducing leachate generation, particularly when a geomembrane liner is used as the low permeability layer of the system.

Landfills in Maine likely consider each of these factors during the design, construction, and operation of their sites with some factors receiving more attention depending on site-specific conditions.

Based on data provided by DEP (2023b), annual historical leachate volume trends for landfills accepting biosolids are shown in Figure 4-1. Combined leachate volume from these landfills ranged from 70 million gallons to 80 million gallons per year in the five years of historical data provided by DEP (Attachment C). Overall, the data suggest relatively consistent leachate volumes from each landfill. (Note: Leachate volume for the Hartland Landfill was not reported for 2019.)

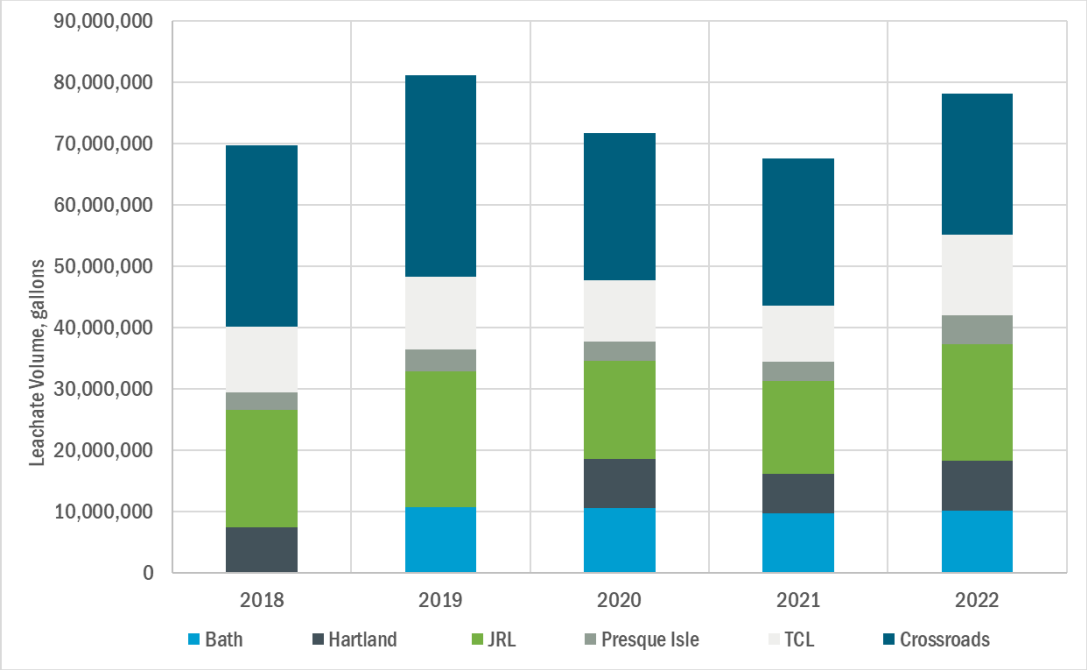


Figure 4-1. Historical Annual Leachate Generation for Landfills Accepting Biosolids

4.2 Estimation of Future Leachate Generation

Estimating future leachate generation is difficult without some detailed site evaluation considering each of the factors noted in Section 4.1. For presentational purposes, a 5% leachate volume increase each year was selected acknowledging the factors contributing to leachate volume increases; this translates to 115 million gallons by 2030. This increase is expected to be offset beyond 2030 as each landfill is built out and sequential installation of the final cover continues or steps up as an increasing amount of area reaches final permitted grades.

Any increase will have a direct impact on POTWs that are receiving leachate both from a quantity and quality (or loading) perspective. Figure 4-2 illustrates projected leachate volume in the future with a 5% increase each year. As per the questionnaire response, JRL, Hartland, TCL and PI can handle more leachate volume than present status. Therefore, the anticipated increase in leachate volume should not hinder normal landfill operation. However, additional consideration is required to include factors such as capacities of POTWs to accept additional leachate generated.

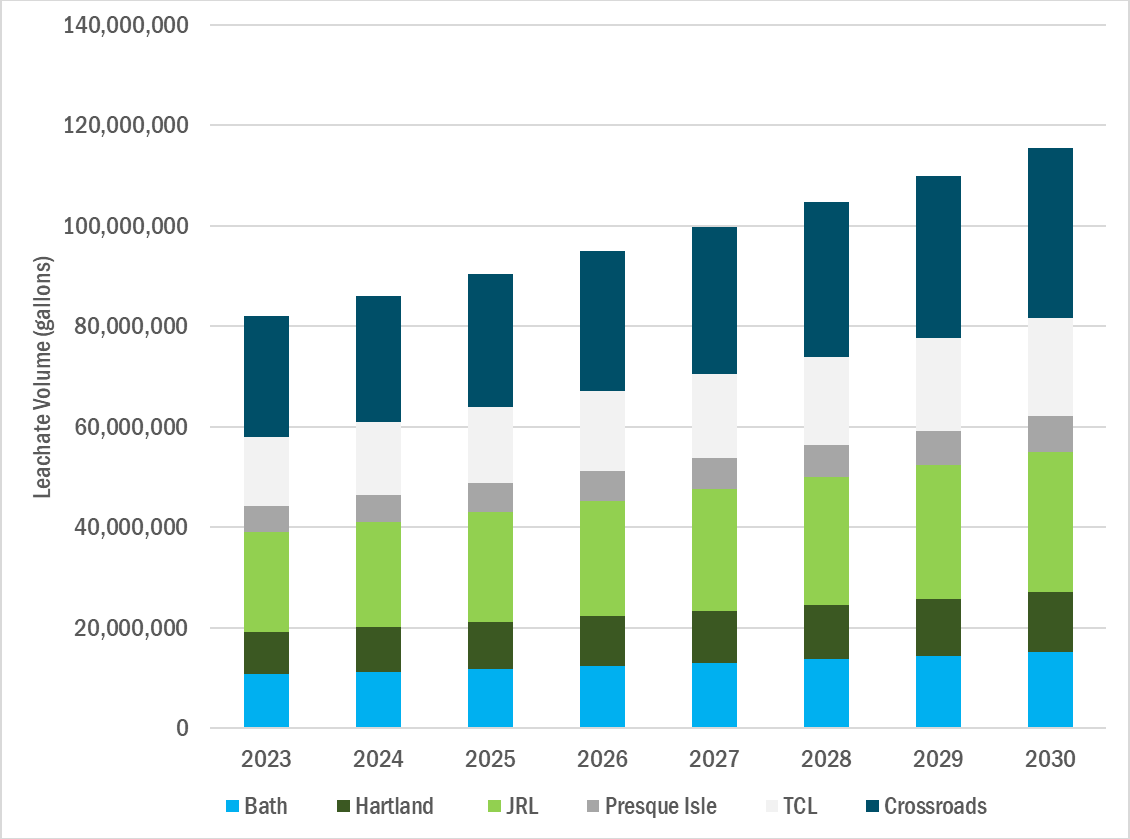


Figure 4-2. Projected Leachate Generation at Landfills Accepting Biosolids

Section 5: Evaluation of Leachate Management Approaches

Maine BGS conducted an initial but comprehensive study of leachate treatment methods for two of its state-owned landfills (Sevee and Maher Engineers, Inc. and Crawford Engineers, 2023). The study evaluated candidate treatment technologies and included bench scale testing to document viability to meet Interim Drinking Water Standards for PFAS. The sections below discuss leachate quality and characteristics, an overview of treatment technologies and selection criteria, and a brief overview and assessment of the Maine study.

5.1 Leachate Characteristics

Management of leachate generated by municipal solid waste (MSW) landfills poses significant challenges and costs to landfill operators. Leachate characteristics vary significantly over time because of changing conditions within the landfill driven by stages of anaerobic decomposition of the waste. Leachate is frequently discharged to local POTWs without pre-treatment; of the fourteen landfills that responded to the questionnaire, three of them implement pretreatment prior to discharge.

Additionally, some POTWs have stopped accepting leachate due to nutrient loadings, interference with UV disinfection, or capacity challenges. Currently relevant descriptive data is scarce that connect leachate quality and treatment challenges with landfill characteristics, such as: waste age, types of waste accepted and composition, and climate.

Table 5-1 presents typical leachate composition for general parameters based on unpublished BC project data from other states and state-owned landfill data in Maine (Sevee and Maher, 2023). Leachate characteristics vary significantly depending on weather, climate, waste composition etc., and therefore, a wide range is observed for these conventional wastewater parameters. Because leachate varies with landfill age, the table is divided into young (0 to 5 years), medium (6 to 10 years) and old (>10 years); data was compiled by Brown and Caldwell from various published and non-published sources. For comparison, the typical composition of leachate from Dolby and JRL landfills, as well as domestic wastewater is also shown. Leachate is often more than one order of magnitude higher than conventional domestic wastewater concentrations (e.g., NH3-N, COD, BOD, TDS). The leachate characteristics obtained from Maine reports fall within the composition range presented in Table 5-1, specifically representing medium to old leachate characteristics. The increase in the volume of landfill leachate discussed in Section 4.2 is expected to alter the leachate quality, but parameters should remain within the range presented in Table 5-1.

Table 5-1. Typical Leachate Characteristics from Literature and State Landfills vs. Domestic Wastewater					
	Young (0 to 5 years)	Medium (6 to 10 years)	Old (>10 years)	Dolby/JRL Landfills (Sevee and Maher, 2023)	Domestic Wastewater (Metcalf and Eddy, 2003)
Parameters (mg/L unless stated otherwise)	Average	Average	Average	N/A	
Biochemical Oxygen Demand (BOD)	28,510	1,409	18	<2.0 - 110	110 to 350
Chemical Oxygen Demand (COD)	76,070	3,372	360	Not Reported	250 to 1,000
Ammonia, as Nitrogen (NH_3-N)	1,690	784	167	7.5-7.7	12 to 50
Nitrate-Nitrite, as Nitrogen	0.13	43	-	0.27 – 1.9	0
Total Phosphorus	12	10.5	1	0.027 – 3.83	4 to 12
Total Suspended Solids	29	2,336	52	9.85 - 678	100 to 200
Total Dissolved Solids	2,620	6,110	-	910 – 12,000	160 to 520
Chloride	2,507	1,056	734	28 – 5,800	30 to 100
Sulfate	2,659	166	290	28 - 120	20 to 50

Metals are also present in leachate to a minor degree and in some cases, can be toxic to wastewater organisms and/or exceed discharge permit levels. Foam fractionation does not remove metals, only surfactants such as PFAS compounds.

Table 5-2 summarizes PFAS concentrations taken from Maine landfills during 2022 and early 2023. As with conventional leachate parameters, PFAS concentrations can vary widely over time.

Table 5-2. PFAS Concentrations in Maine Landfill Leachate			
Concentration (ng/L)	Median	Minimum	Maximum
PFOA	298	6.0	7,530
PFOS	197	6.0	51,400
Sum of 6 (PFOA, PFOS, PFHpA, PFNA, PHHxS, PFDA)	850	N/A	N/A

For reference, the drinking water interim standard in Maine is 20 ng/L for the sum of 6 regulated PFAS compounds. Based on a 2019 Vermont study regarding the potential flux of PFAS from contributing waste to leachate, PFAS compounds associated with biosolids and municipal solid wastes are largely “bound up” in the waste mass, resulting in a smaller fraction of the PFAS mass showing up in leachate (PFAS Waste Source Testing Report, New England Waste Services of Vermont, Inc., Sanborn Head, October 2019).

5.2 Leachate PFAS Management

A summary of PFAS treatment technologies is provided below in Table 5-3. Each of the technologies is evaluated based on the mechanism of treatment, implementation readiness, whether pre- or post-treatment is required, effectiveness, treatment byproducts generated, and sustainability considerations.

Table 5-3. Summary of Potential Technologies for PFAS in Leachate

Technology	Mechanism	State of Development	Pre-Post Treatment	Effectiveness	Treatment Byproducts Generated	Sustainability Considerations
Reverse Osmosis (RO)	Separation via semi-permeation	Demonstrated	Pre-treatment required (if Rochem® membrane is NOT used)	Variable depending on feed matrix and membrane technology	RO concentrate/reject	Energy intensive brine management
Foam Fractionation (FF)	Formation of air bubbles (addition of surfactants)	Demonstrated (Pilot Scale)	As pre or post treatment	Broad removal of PFAS	Foam	Management of foam fractionate (foamate)
Adsorbents (e.g., Ion Exchange (IX), Fluorosorb)	Adsorption and replacement	Demonstrated	As pre or post treatment	Broad removal of anionic PFAS	Brine residual, etc.	Media disposal (single-use) resin regeneration
Electrochemical Advanced Oxidation Process (EAOP)	Electro-chemical oxidation	Demonstrated	As pre or post treatment	Broad removal of PFAS and conventional WW parameters	None	Long term testing needed

The selection of a particular technology over another is based on several factors including pre-treatment limits or goals set by the receiving POTW for indirect discharges, or NPDES permit limits for direct to surface water discharges. Bench and/or pilot studies are typically required on a site-specific basis to document treatment efficacy, design parameters, operational considerations, and to develop cost projections for planning and permitting.

FF treatment, one of the more popular separation technologies is effective at removing the primary PFAS compounds of interest; FF can be used on raw leachate without pre-treatment. However, foam fractionation does not remove other constituents that can be problematic for POTWs and/or to receiving streams.

The primary benefit of using Reverse Osmosis compared to FF is significantly higher removal of a broader range of PFAS compounds along with conventional parameters (ammonia, COD, TSS, TDS, and UV quenching substances like humic and fulvic acids). RO is generally considered when the treatment goal is for NPDES discharge (direct to surface water) but may also require back-end polishing using other technologies such as EAOP.

The primary benefit of using FF compared to RO is a significantly higher volume reduction of the concentrate from treatment or foamate.

The primary benefit of using EAOP compared to RO or FF is there are no residual waste streams. The downside is that EAOP is still in development phase but shows promise although it is more suited to be utilized on concentrate from treatment.

The primary benefit of using IX over GAC is less media usage (GAC requires longer media contact time); IX would typically follow other technologies; certain IX resins can be regenerated repeatedly but overall removal may be less than single-use resins.

GAC is generally not considered a viable technology for leachate but could follow other technologies as a polishing step to remove organics and foulants common to leachate; these organics and foulants compete for (or block) adsorption sites and can result in shorter break-through times.

A critical step in evaluating PFAS treatment is to consider final disposal methods or technologies on a case-by-case basis. Several methods or technologies being used or considered include:

- Solidification/stabilization for placement back in a landfill.

- Super-loading adsorbent media with concentrates (requires disposal/landfilling/incineration).
- Super Critical Water Oxidation, Plasma: these technologies are still in development and while available, are better suited for destruction of small volumes such as FF foamate, RO concentrate, etc.
- Deep well injection is not cost effective, no commercial wells in region due to geology.
- Incineration - prohibitively expensive due to limited access/distance to approved facilities with high temperature; generally, only feasible for small volumes; DOD ended its temporary moratorium on PFAS wastes in July 2023; air emissions still being evaluated.
- EAOP is being considered for residuals management for concentrates.

Key take-aways from the leachate treatment study performed by BGS for state-owned landfills (Dolby and Juniper Ridge) and the corresponding report (Sevee and Maher Engineers, Inc. and Crawford Engineers, 2023) include the following:

a. The study objective was to identify PFAS treatment technologies and their effectiveness in reducing PFAS concentrations of Maine's 6 PFAS compounds to below the State of Maine Interim Drinking Water Standard of 20 ng/l. Four technologies were identified (foam fractionation, reverse osmosis, electro-chemical advanced oxidation process, and biological treatment followed by on-site physical/chemical treatment including granular activated carbon, ion exchange, and sorption on alternative media such as modified clays). Vetting of technologies is based on mechanism (i.e., separation, adsorption), state of development, pre and post treatment requirements, effectiveness, treatment by-products generated, and overall sustainability. Note that leachate is a complex matrix of constituents that some of these technologies and others are more advanced in terms of their commercial availability and applica-tion/effectiveness on leachate.

b. Foam fractionation topped the list given its current state of development and demonstrated ability to remove PFAS alone; foam fractionation concentrates PFAS into a small volume for further management and disposal. Foam fractionation and reverse osmosis (using proprietary membranes from Rochem) are separation technologies and do not require a pre-treatment step. Reverse osmosis generates as much as 15% concentrate or reject stream that requires further management, making this technology less attractive in this current regulatory situation.

c. The referenced study noted that reducing PFAS to interim drinking water standard levels using foam fractionation is predicted to be successful and was confirmed via bench scale study by two independ-ent vendors. Recommendations made in the study included advancing to foam fractionation pilot scale studies for both landfills.

d. Additional recommendations made in the study included advancing pilot testing of leachate and foam fractionation concentrate using electrochemical advanced oxidation as a stand-alone process and eval-uating super-loading of PFAS concentrate onto adsorption media.

e. Cost evaluations were performed for both landfills using foam fractionation as well as other treatment technologies, or combinations thereof.

BC generally agrees with the recommendations made in the report and believes that the costs developed in the report are in line with our experience.

Cost comparison for FF, EAOP, RO, GAC treatment are shown below in Table 5-4. Costs developed during the state-owned landfill study are compared to costs that have been developed by Brown and Caldwell.

Table 5-4. Cost for Different Leachate PFAS Treatment Technologies						
Reference	FF and Foamate onto IX and Disposal	EAOP	RO and EAOP for Concentrate	PFAS Pre Treatment and GAC Disposal	FF with Evaporation/Off-site Disposal (50,000 gpd plant)	RO with Evaporation/Solidification/Deep Well Injection (50,000 gpd plant)
	Maine BGS State-Owned Landfill Study				Example from BC Experience	
	Millions	Millions	Millions	Millions	Millions	Millions
Total CAPEX						
Dolby Landfill (127,000 gpd)	7.66	7.62	14.5	13.4 to 19.5	4.1	12 to 14.8
Juniper Ridge Landfill (42,000 gpd)	2.63	2.59	8.05	17		
Present Worth Cost/O&M Costs						
Dolby Landfill (127,000 gpd)	8.1 to 14.3	23	11.4	3.6	3.9	11 to 20
Juniper Ridge Landfill (42,000 gpd)	4.5 to 7.8	10.9	8.8	3.2		

Costs associated with management of treatment residuals can be 20-30% or more of operating expenditures.

Other sources of published cost information include “Evaluation of Current Alternatives and Estimated Cost Curves for PFAS Removal and Destruction from Municipal Wastewater, Biosolids, Landfill Leachate, and Compost Contact Water, Prepared for Minnesota Pollution Control Agency, Barr Engineering Co., Hazen and Sawyer”. The report concluded that removing PFAS at POTWs would be significantly higher than addressing higher concentrated sources like landfills. Estimated costs were provided for upstream removal at landfills at $400,000 per pound of PFAS removed.

Section 6: Conclusions and Recommendations

Based on analysis performed as part of this project, Publicly Owned Treatment Works (POTWs) providing wastewater treatment in Maine are estimated to generate approximately 88,500 wet-tons of biosolids per year. With the enactment of LD 1911, nearly all biosolids in Maine are landfilled (with a small amount being managed out of state), increasing dependency on the few landfills in Maine permitted to accept biosolids.

Two landfills, Crossroads Landfill and JRL, managed approximately 85,000 wet-tons or nearly 92% of the biosolids sent to landfill in 2022. JRL alone managed more than 78,000 wet-tons. However, JRL will reach its currently permitted capacity in 2028. For biosolids there is no current or proposed alternative outlet in the state that would be able to accept the tonnage currently handled at JRL.

Biosolids acceptance at landfills is limited by permitted capacities, availability of bulking agents, acceptance guidelines for wet wastes used by landfill operators, and several other factors.

The following are suggested "levers"—tangible actions to address the underlying issues— available to Maine government to address the key challenges impacting biosolids landfill capacity in Maine and help avoid similar situations in the future.

1. Continuation of the Juniper Ridge Landfill. The state-owned Juniper Ridge Landfill (JRL) in Old Town was the outlet for nearly 90% of biosolids generated in Maine in 2022. The current permitted capacity of this facility is estimated to be fully used by 2028. For biosolids, there is no current or proposed alternative outlet in the state that would be able to accept the tonnage currently handled at JRL. It is Brown and Caldwell's understanding that the next step in the process to expand JRL is for the current operator to submit a Public Benefit Determination application to DEP for approval (38 M.R.S. §1310-AA). Given the severity of the implications if the facility is not expanded, it is recommended that **the State work with the current operator to ensure that an application is submitted as soon as possible** to ensure sufficient time to pursue alternatives if the expansion is not pursued by the current operator.
2. Availability and access to bulking agents. It is recommended that **DEP fund an independent study evaluating the availability of bulking agents**. Restrictions impacting the availability of bulking agents go into effect in 2024 and 2025, so this study should be completed as soon as possible. If the study finds that insufficient quantities of bulking agents are available, then the extension on the restrictions in P.L. 2021, ch. 626 may need to be extended (see Sections 2.1.2, 2.1.3 and 7.3). As noted in responses to a questionnaire distributed to landfill operators as part of this project, several landfills listed lack of bulking agents as a limitation to accepting more biosolids.
3. Increasing the amount of dried biosolids. Once dried, biosolids no longer fall under "wet waste" restrictions. Facilities such as the proposed biosolids dryer project under development at the Crossroads Landfill are crucial to decoupling biosolids disposal from the need for bulking agents. As Clean Water State Revolving Funds are already stretched, it is recommended to **issue a bond to provide state grants for volume reduction and drying projects.** This should include promising regional projects.
4. Increase the number of landfills permitted to accept biosolids. In a questionnaire sent to landfill operators in the state as part of this project, four facilities expressed interest in discussing with DEP the possibility of starting to accept biosolids (see Section 3.2). While smaller than JRL, **DEP should coordinate discussions with these regulated facilities** to provide supplemental or contingency capacity.
5. Increase recycling and waste diversion from existing landfills. Maine's overall solid waste capacity outlook is concerning, with most of the state's capacity to be filled by 2043. DEP's current efforts to update the current 2019 Waste Plan include **focusing on generating less wastes and recovering materials that can be recycled**.

In January 2023, a leachate treatment study for two state-owned landfills (Dolby and Juniper Ridge) funded by BGS, was published. The report identified PFAS treatment technologies and their effectiveness in

reducing PFAS compounds regulated in Maine. Foam fractionation topped the list given its current state of development and demonstrated ability to remove the sum of the six PFAS compounds to below 20 ng/l. The study recommended advancing to pilot-scale testing of leachate using foam fractionation at both landfills. The study also recommended advancing pilot testing of leachate and foam fractionation concentrate using electrochemical advanced oxidation and evaluating super-loading concentrate onto adsorption media.

It is recommended that BGS **move forward with pilot testing the technologies identified in the 2023 study at one or both landfills** to support the development of design criteria and confirm performance requirements for the selected on-site pre-treatment system. Ongoing work by DEP and the Anson-Madison Sanitary District to advance the development of a regional PFAS treatment facility at the utility will allow landfill leachate and certain pre-treatment byproducts to be accepted for off-site treatment.

Section 7: General References Used

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Attachment A: Questionnaire and Responses

Questionnaire to Understand Landfill Operations and Biosolids Acceptance

The information requested in this questionnaire will assist the Maine Department of Environmental Protection (DEP) in developing a sustainable approach to managing biosolids, septage, and landfill leachate in Maine given concerns about PFAS. The questionnaire is intended to gather information to allow determination of available landfill capacity in the state for biosolids specifically, including both an assessment of a typical daily capacity, as well as the timeline for the point at which the landfill's permitted capacity will be reached. Additionally, this questionnaire will aid in identifying current leachate management approaches and specific constraints and requirements preventing landfills from accepting biosolids. Please note that not all the listed items will be applicable to all landfills. This list is meant to cover a number of different facilities.

* Required

General Information about the Landfill:

1. Please provide Name, Title, Contact email and phone number of the personnel filling out this Questionnaire. *

2. Please provide DEP License # for active/licensed landfill

3. Please identify Ownership of the landfill.

- ◯ Private
- ◯ City Government
- ◯ County government
- ◯ Other

4. Please provide the name of the identity identified above.

5. Please provide the name of the landfill operator.

6. Does the landfill have solid waste permit or license? If yes, who issued the permit or license? Please provide the license or permit no.?

7. What is the size of the existing constructed landfill footprint area in cubic yards, cubic yards in place and cubic yards of airspace remaining as of 01/01/23.

8. What is the size of the remaining permitted landfill area yet to be constructed in Acres and Cubic Yards of airspace.

9. Have expansion areas beyond that currently permitted been identified and if so, what is the size in Acres and Cubic Yards of airspace.

10. What is the landfill footprint area that is not lined, in acres? Please provide explanation for other instances.

11. What is the landfill footprint area that has received final cover, in acres?

12. Are future waste receipts (tons and waste types) expected to be similar to prior years, if not what changes are planned?

13. Expected years of site life remaining?

14. Does this landfill have separate disposal or management areas for specific wastes?

Leachate Volume and Quality

15. Does the landfill have a leachate collection system?

16. Does the leachate collection system include collection of groundwater for treatment?

17. How many gallons of leachate was generated in 2022?

18. Are the gas well liquids comingled in the collection system or collected and managed independently?

19. Is there storage capacity for leachate? What is the volume and type of storage?

20. Please provide chemistry data of typical leachate:

21. What are the current leachate management methods being utilized? Select all that apply

- [ ] Land Application
- [ ] Recirculation
- [ ] Hauled off/ Transfer through sewers to Publicly Owned Treatment Works (POTW)
- [ ] Hauled off to a Centralized Waste Treatment (CWT) facility
- [ ] Deep Well injection
- [ ] On-site physical, chemical and/or biological treatment
- [ ] Other

22. What are the approximate percentages for each of the leachate management methods being utilized selected above?

23. Is this pretreatment or for NPDES discharge?

24. What is the Discharge to Surface Water via NPDES permit percentage?

25. What is the NPDES permit Number?

26. If leachate is hauled, what is hauling distance and receiving facility (ies)

27. Does the landfill currently utilize any leachate pre-treatment methods, if so please describe?

28. Does the facility have strategies or capacity to handle more leachate generation than the current quantity?

Landfill Gas

29. Does the landfill have an active gas collection system?

30. If yes, is the landfill gas beneficially reused in any way, please describe

31. Is excess landfill gas available beyond that beneficially reused, if so what is the volume in SCFM and gas quality in %CH4, %CO2 and %O2?

Biosolids

The following questions apply if the facility accepts biosolids, otherwise go to Question 42 below.

32. What are the main issues that biosolids pose at your facility? Select all that apply

- [ ] Odors
- [ ] Significant increase in leachate volume or negative impact to quality
- [ ] Increase in gas production
- [ ] Gas collection
- [ ] Global Stability
- [ ] Slope Stability
- [ ] Reduction in construction and demolition (C&W) waste volume
- [ ] Bulking/Drying
- [ ] Drainage
- [ ] Other

33. What are the average tons of biosolids accepted each year?

34. Are biosolids mixed/co-mingled with waste, if so what types of waste and at what ratio?

35. Are biosolids monofilled at the facility?

36. What type of bulking and/or drying operations are present at the facility?

37. What type of bulking and/or drying operations are present at the facility?

- [ ] Solidification pits
- [ ] Composting
- [ ] Other

38. What are the sources, use and volume of bulking materials?

39. What is the primary limiting factor for acceptance of additional biosolids?

40. Briefly describe any limitations or restrictions to taking more biosolids?

41. Briefly describe the facility's current strategy to address emerging contaminant such as PFAS?

42. If the facility does not accept biosolids or has restrictions on accepting more biosolids, please indicate what measures would have to be taken and if this is something this facility would consider discussing with DEP.

43. Additional relevant information not covered in this Questionnaire.

	ID	1	2	2	3	4	5
	Start time	6/26/23 10:45:24	6/29/23 7:06:16	7/5/23 8:22:48	6/29/23 12:41:51	6/30/23 12:33:49	7/3/23 12:57:59
	Completion time	6/26/23 11:19:53	6/29/23 7:28:39	7/5/23 8:45:22	6/29/23 13:35:50	6/30/23 12:51:36	7/3/23 13:33:42
	Email	anonymous	anonymous	anonymous	anonymous	anonymous	anonymous
	Name						
	Last modified time						
1	Please provide Name, Title, Contact email and phone number of the personnel filling out this Questionnaire.	André Brousseau, Superintendent, abrousseau@sanfordsewerage.org. 207 324 5315	Chris Wallace, Deputy Public Works Director cwallace@cityofbath.com 207-443-8357 Ext. 6120	Chris Wallace, Deputy Director Public Works, cwallace@cityofbath.com, (207)-443-8357 Ext. 6120	Mark Draper, Solid Waste Director, mark@aroostookwaste.com, 207-473-7840	Mark Draper, Solid Waste Director, mark@aroostookwaste.com, 207-473-7840	Jeff McGown District Manager Waste Management 204-634-2714
2	Please provide DEP License # for active/licensed landfill	S-07972WD-A-R	S-004991-WD-I-R	S-04991-WD-J-A	#S-003707-WC-T-A; Tri-Community Landfill	#S-007501-WD-X-N	S-010735-WD-UW-N (Phase 8) ..... S-010735-WD-YB-N (Phase 14)
3	Please identify Ownership of the landfill.		City Government	City Government	quasi-municipal	quasi municipal	Private
4	Please provide the name of the identity identified above.	Sanford Sewerage District	City of Bath Municipal Solid Waste Landfill	City of Bath Solid Waste Facility	Aroostook Waste Solutions ("AWS")	Aroostook Waste Solutions	Waste Management
5	operator.	André Brousseau	Chris Wallace	Chris Wallace	Aroostook Waste Solutions - Tri Community Landfill	Aroostook Waste Solutions	Waste Management Disposal Service of Maine- Crossroads
6	license? If yes, who issued the permit or license? Please provide the license or permit no.?	S-07972-31230	State of Maine Department of Environmental Protection S-004991-WD-I-R	YES S-04991-WD-J-A	Maine DEP License #S-003707-WC-T-A	Yes, Maine DEP license ##S-007501-WD-X-N	Maine Department of Environmental Protection
7	What is the size of the existing constructed landfill footprint area in cubic yards, cubic yards in place and cubic yards of airspace remaining as of 01/01/23.	2106700 cubic yards, 2102700 as of 1/1/23. 1000 cubic yards of space remains.		(Cells 2-1, 2-2 193,000 CY,) (Cells 2-3, 3,4 201,000 CY) (Cell 3, 354,000 CY). (Used in place 443,600 CY). (Total 748,000 CY). (Remaining space 01/01/23 304,400 CY)	There are a total of 1,312,004 cubic yards of constructed capacity, of which 1,039,868 have been consumed, and 272,136 remain; as of September 2022.	17.4 acres; 950,000 cubic yards of constructed capacity. As of 7/1/2023; 100% of the constructed capacity has been consumed and active landfill operations will cease.	01/01/23 Phase 8 6,415,000 cubic yards 01/01/23 435,000 cubic yards remaining
8	What is the size of the remaining permitted landfill area yet to be constructed in Acres and Cubic Yards of airspace.	1/4 of an acre.		Zero	1,087,996 cubic yards of to-be-constructed capacity remain	12.9 acres and 1,190,000 cubic yards of licensed capacity remain, but not constructed.	Phase 14 (48.6 acres) 7,757,000 cubic yards
9	permitted been identified and if so, what is the size in Acres and Cubic Yards of airspace.	no		Zero	Tentatively yes. Approximately 1,000,000 cubic yards.	No	N/A
10	What is the landfill footprint area that is not lined, in acres? Please provide explanation for other instances.	Not applicable		10 Acres	Approximately 11 acres of the original, attenuation landfill are unlined, but capped.	0	41.1 acres unlined (Phase 14 / not constructed)
11	What is the landfill footprint area that has received final cover, in acres?	zero		11 Acres	Approximately 6 acres have received operational final cover.	13 acres.	56.5 acres have received final cover
12	Are future waste receipts (tons and waste types) expected to be similar to prior years, if not what changes are planned?	not applicable.		YES	Increasing waste receipts are expected to begin in mid-2023 due to the cessation of operations of the AWS-owned Presque Isle Landfill. It is anticipated that waste receipts will increase by about 30% at the AWS-owned Tri-Community Landfill in Fort Fairfield.	Active landfill operations have ceased at the Presque Isle Landfill until the capacity of the Tri-Community Landfill facility has been consumed, which is expected to take 17 years. It is unknown what the volume and type of waste will be managed at that time.	Yes, very similar
13	Expected years of site life remaining?	less than one year as we have an application into the department for closure.		21	17	approximately 20 years after operations at the site begin again in 17 years	Approx 20 years
14	Does this landfill have separate disposal or management areas for specific wastes?	no	Yes	NO	No	No	No
15	Does the landfill have a leachate collection system?	yes	Yes	YES	Yes	Yes	Yes
16	Does the leachate collection system include collection of groundwater for treatment?	no	No	NO	No	No	No
17	How many gallons of leachate was generated in 2022?	unknown because it flows gravity to a yard pump station that also has tertiary backwash water.		10,277,270 gallons	approximately 10 million gallons	4.9 million	24.5 million gallons
18	Are the gas well liquids comingled in the collection system or collected and managed independently?	Not applicable		YES	commingled	commingled	Comingled
19	Is there storage capacity for leachate? What is the volume and type of storage?	no			Yes. Two (2) lined lagoons with a total storage capacity of 2 million gallons.	Yes, there are two (2) lined lagoons with a total capacity of 4 million gallons.	Yes, glass lined aqua store tanks, tank 1 948,000 tank 2 91,000
20	Please provide chemistry data of typical leachate:	May 10, 2023 sample date: Alk- 890 mg/l, COD- 50 Mg/l, Chloride- 48 mg/l, Nitrate as N- 1.1 mg/l, Total phosphorus- <0.1 mg/l, Sulfate- 130 mg/l, TOC -17 mg/l		N/A			Provided to the MDEP tri-annually

	ID	1	2	6	3	4	5
21	What are the current leachate management methods being utilized? Select all that apply	On-site physical, chemical and/or biological treatment;		Hauled off/ Transfer through sewers to Publicly Owned Treatment Works (POTW);	Hauled off/ Transfer through sewers to Publicly Owned Treatment Works (POTW);	Land Application;	Recirculation;Hauled off/ Transfer through sewers to Publicly Owned Treatment Works (POTW);
22	What are the approximate percentages for each of the leachate management methods being utilized selected above?	100%		100%	100%	100%	Leachate recirculation minimal approx 500,000 annually
23	Is this pretreatment or for NPDES discharge?	NPDES discharge after secondary treatment		NO		NPDES discharge license for land application	No pretreatment at the site
24	What is the Discharge to Surface Water via NPDES permit percentage?	<.01%				0	N/A
25	What is the NPDES permit Number?	ME0100617				MEU508088	MER05B470
26	If leachate is hauled, what is hauling distance and receiving facility (ies)			N/A	The leachate is conveyed via pipeline 2.3 miles to the Caribou Utilities District treatment facility.	NA	less than 20 miles, Anson Madison Treatment, Madison, Me
27	Does the landfill currently utilize any leachate pre-treatment methods, if so please describe?	no		NO	No	No	NO
28	Does the facility have strategies or capacity to handle more leachate generation than the current quantity?	no			Under normal circumstances, less than 50% of the on-site storage capacity is utilized annually.	No	Yes, additional capacity is available
29	Does the landfill have an active gas collection system?	no		YES	An active gas extraction system is installed in the old, unlined, attenuation portion of the landfill only.	Yes, but it is not operable	Yes
30	If yes, is the landfill gas beneficially reused in any way, please describe			NO	No	No	Yes, LFGTE Plant
31	beneficially reused, if so what is the volume in SCFM and gas quality in %CH4, %CO2 and %02?	no			Approximately 75 scfm at less than 35% methane.	NA	Yes, approx 400SCFM to flare station , 52% CH4, 38% CO2, .5 02
32	What are the main issues that biosolids pose at your facility? Select all that apply	Bulking/Drying;		Odors;Slope Stability;	Slope Stability;Significant increase in leachate volume or negative impact to quality;	lack of constructed disposal capacity;	Odors;Global Stability ;Slope Stability;
33	What are the average tons of biosolids accepted each year?	zero		1,253 Ton	approximately 1,000 tons	0	15,000
34	Are biosolids mixed/co-mingled with waste, if so what types of waste and at what ratio?	no		YES, Municipal Waste, Demolition Debris, Daily Cover	Biosolids currently represent only about 2% of total waste receipts annually. They are mixed with other incoming waste streams (MSW, CDD) as received.		yes..... less than 10% biosolids
35	Are biosolids monofilled at the facility?	no		NO	No		No
36	What type of bulking and/or drying operations are present at the facility?	bulk with compost			None. Biosolids are mixed with other incoming wastes in the landfill as received.		Nothing at this time
37	What type of bulking and/or drying operations are present at the facility?	Composting;					N/A ;
38	What are the sources, use and volume of bulking materials?	internal compost					Other permitted waste streams
39	What is the primary limiting factor for acceptance of additional biosolids?	space		PFAS rules??, access, staff,	receipt of biosolids to less than 10% of the total volume of waste received. Biosolids must be dewatered to at least 20% solids content prior to delivery to the landfill.	lack of constructed disposal capacity	Stability
40	Briefly describe any limitations or restrictions to taking more biosolids?	no more space		Staff, small active area	Maine DEP license limits, which correctly consider slope stability.	lack of constructed disposal capacity	WM self-imposed for stability
41	Briefly describe the facility's current strategy to address emerging contaminant such as PFAS?	Compost is placed in the landfill for final disposal		Waiting for rules and how we will be effected.	AWS is participating with the various PFAS data collection efforts of the Maine DEP. AWS will be looking to the Maine DEP to provide guidance on how best to manage any levels of concern regarding PFAS. There is significant concern with regard to future costs and liability from accepting wastes that have known PFAS contamination.		Have had pilot Foam Fractionation .....
42	If the facility does not accept biosolids or has restrictions on accepting more biosolids, please indicate what measures would have to be taken and if this is something this facility would conside...	NA		Not at this time	AWS is not currently interested in accepting biosolids above the current license limit of 10% of total volume. Slope stability and PFAS contamination are significant concerns. If our consultant engineers determined that slope stability could be maintained with higher percentages of biosolids; AND, the State of Maine would provide assurance of funding to address any future PFAS issues, then AWS would consider accepting additional amounts of biosolids.	capital investment in constructed capacity	Through internal Market Area and Corporate approvals
43	Additional relevant information not covered in this Questionnaire.				Please be advised that Aroostook Waste Solutions ("AWS") owns two (2) landfills; the Tri-Community Landfill in Fort Fairfield, for which this questionnaire is submitted; and the Presque Isle Landfill in Presque Isle, for which a separate questionnaire will be completed.		N/A

ID	6	7	8
Start time	7/6/23 11:37:41	7/7/23 14:22:09	7/10/23 14:20:43
Completion time	7/6/23 12:00:13	7/7/23 15:09:20	7/10/23 14:42:59
Email	anonymous	anonymous	anonymous
Name			
Last modified time			
Please provide Name, Title, Contact email and phone number of the personnel filling out this Questionnaire.	John Kuchinski	Robert J Nadeau, Senior Process Engineer, robert.nadeau@sappi.com, 207-238-3291	Michelle Hamm, Environmental Engineer, (207) 369-2232
Please provide DEP License # for active/licensed landfill	S-005242-WD-C-N	S-007404-WD-AA-N	S-00686-W-A
Please identify Ownership of the landfill.	City Government	Private	Private
Please provide the name of the identity identified above.	City of Lewiston	Sappi North America	Farrington Mountain Landfill
Please provide the name of the landfill operator.	City of Lewiston	Ricky Toothacker	ND Paper Inc - Rumford Division
Does the landfill have solid waste permit or license? If yes, who issued the permit or license? Please provide the license or permit no.?	MEDEP S-005242-WD-C-N	Maine Department of Environmental Protection S-007404-WD-AA-N	Maine DEP license number S-00686-WD-W-A
What is the size of the existing constructed landfill footprint area in cubic yards, cubic yards in place and cubic yards of airspace remaining as of 01/01/23.	original volume: 1,063,803 CY filled as of 1/17/23: 661,561 remaining volume: 427,242	Existing Constructed Landfill Footprint 3,791,100 Cubic Yards Remaining Airspace 186,500 Cubic Yards	The existing landfill is about 35 acres with about 546,000 cubic yards of air space remaining. Remaining capacity as of January 2023 was estimated to be 8.2 years
What is the size of the remaining permitted landfill area yet to be constructed in Acres and Cubic Yards of airspace.	427,242 CY	13.5 Acres or 1,387,900 Cubic Yards	ND Paper does not have the remaining area of the permitted solid waste boundary calculated, however, the next constructed area will be phase III at 11.6 acres and 1,236,000 cubic yards
Have expansion areas beyond that currently permitted been identified and if so, what is the size in Acres and Cubic Yards of airspace.	none	No	The solid waste boundary has been identified but the size and volume have not yet been calculated
What is the landfill footprint area that is not lined, in acres? Please provide explanation for other instances.	15 acres	All of the landfill is lined. The old cells are lined with naturally occurring clay and the newer cells have double HDPE liners and clay.	Phase I & II (~ 35 ac) have a 10' thick sludge liner Phase III (11.6 ac) will have a liner system with a leak detection system.
What is the landfill footprint area that has received final cover, in acres?	none	38.5 acres	None of the landfill has final cover
Are future waste receipts (tons and waste types) expected to be similar to prior years, if not what changes are planned?	waste is expected to be the same in the immediate future	Yes	Similar plans for the future
Expected years of site life remaining?	28 years at current rate	20-25 years	8.2
Does this landfill have separate disposal or management areas for specific wastes?	no	No	yes
Does the landfill have a leachate collection system?	yes	Yes	yes
Does the leachate collection system include collection of groundwater for treatment?	no	Yes	no
How many gallons of leachate was generated in 2022?	3,788,886	16,853,485 gallons	27 million gallons
Are the gas well liquids comingled in the collection system or collected and managed independently?	gas wells separate from leachate collection	no gas wells on site	comingled
Is there storage capacity for leachate? What is the volume and type of storage?	Storage in lined pond	No storage capacity for leachate. the leachate is pumped directly to an on-site wastewater treatment plant.	3 million gallon surface impoundment with liner and leak detection
Please provide chemistry data of typical leachate:	extensive data submitted annually to MEDEP	Can be emailed to address of your choice.	this is available upon request and is submitted to DEP several times a year

ID	6	7	8
What are the current leachate management methods being utilized? Select all that apply	Hauled off/ Transfer through sewers to Publicly Owned Treatment Works (POTW);	On-site physical, chemical and/or biological treatment;	Pumped to the mils water treatment facility;
What are the approximate percentages for each of the leachate management methods being utilized selected above?	100% to POTW via sewer	100%	100%
Is this pretreatment or for NPDES discharge?	no	NPDES discharge	NPDES discharge
What is the Discharge to Surface Water via NPDES permit percentage?	runoff from intermediate cover	The leachate makes up approximately 0.15% of the total discharge.	0.4% of total discharge
What is the NPDES permit Number?	Maine MSGP MER05B530	ME0021521	ME0002054
If leachate is hauled, what is hauling distance and receiving facility (ies)	NA	NA	Not applicable
Does the landfill currently utilize any leachate pre-treatment methods, if so please describe?	no	No	No
Does the facility have strategies or capacity to handle more leachate generation than the current quantity?	capacity is limited by storage pond and pump station capacity	Yes	No
Does the landfill have an active gas collection system?	landfill gas vents	No	No
If yes, is the landfill gas beneficially reused in any way, please describe	landfill is ash monofill and generates minimal LFG	NA	No
Is excess landfill gas available beyond that beneficially reused, if so what is the volume in SCFM and gas quality in %CH4, %CO2 and %O2?	NA	NA	NA
What are the main issues that biosolids pose at your facility? Select all that apply	Odors;Increase in gas production;Global Stability ;Slope Stability;Bulking/Drying;Drainage;Significant increase in leachate volume or negative impact to quality;	Slope Stability;	
What are the average tons of biosolids accepted each year?	Landfill is not licensed to accept biosolids	We landfill biosolids that are mixed with primary sludges generated on-site. Total Combined Sludge Landfilled i 2022 was 17,696 Wet Tons	35,000 tons of mill generated biosolids only
Are biosolids mixed/co-mingled with waste, if so what types of waste and at what ratio?	no	Biosolids make up 25-30 % of Combined Sludge	Yes Paper sludge 30%, boiler ash 55%, lime kiln dregs 10%, other 5%
Are biosolids monofilled at the facility?	NA	No	No
What type of bulking and/or drying operations are present at the facility?	NA	We have three FKC Screw Presses.	field mixing with higher strength materials such as boiler ash
What type of bulking and/or drying operations are present at the facility?		Screw Presses only ;	
What are the sources, use and volume of bulking materials?	NA	Primary solids loss from process systems.	increase strength and stability
What is the primary limiting factor for acceptance of additional biosolids?	NA	We are only allowed to accept material that we generate on-site.	Increased volume consumption and lack of bulking materials for slope stability
Briefly describe any limitations or restrictions to taking more biosolids?	NA	see answer 39 above.	Same as question 39. this is a private landfill only permitted for company generated solid waste
Briefly describe the facility's current strategy to address emerging contaminant such as PFAS?	none	We do not knowingly use any products that contain PFAS.	The Rumford mill does not use materials containing PFAS and therefor does not intentionally generate PFAs contaminated waste
If the facility does not accept biosolids or has restrictions on accepting more biosolids, please indicate what measures would have to be taken and if this is something this facility would conside...	modification to existing license to accept biosolids with appropriate study and analysis	I don't believe this facility would consider accepting biosolids from off-site facilities.	NA
Additional relevant information not covered in this Questionnaire.		This is a private facility that handles only waste generated on-site.	

ID	9	10	11	12	13	14
Start time	7/11/23 15:38:09	7/13/23 11:12:27	7/14/23 7:08:43	7/26/23 7:28:26	8/23/23 13:39:31	8/24/23 9:55:30
Completion time	7/12/23 18:22:01	7/13/23 12:19:35	7/14/23 8:24:26	7/26/23 12:09:33	8/23/23 14:28:38	8/28/23 11:41:06
Email	anonymous	anonymous	anonymous	anonymous	anonymous	anonymous
Name						
Last modified time						
Please provide Name, Title, Contact email and phone number of the personnel filling out this Questionnaire.	Jeffrey Pelletier, Environmental Manger, jeffrey.pelletier@casella.com, 207-249-8025	Chuck Kraske, Site Manager, chuck.kraske@pixelle.com, 207-931-8636	Christopher Littlefield/Landfill Manager/hartlandmanager@gmail.com/2074168343	Jeff Strang, Project Engineer@Haley Ward, Inc., jstrang@haleyward.com, 207.989.4824	Jon Chalmers, Solid Waste Director, jon.chalmers@augustamaine.gov, 207.620.8154	Trevor Hinshaw, Environmental Manager, trevor.hinshaw@twinriverspaper.com, 207-728-5900
Please provide DEP License # for active/licensed landfill	MEDEP LIC. #S-020700-7A-A-N, Amendment #S-020700-WD-N-A, and MEDEP LIC. #S-020700-WD-BI-N	#S-022072-WD-A-N	#S-003463-wu-q-n	S-007713	S-007914-WD-AC-N, S-007914-WD-AJ-M	S-007843-WD-E-R
Please identify Ownership of the landfill.	State of Maine Bureau of General Services	Private	City Government	Private	City Government	Private
Please provide the name of the identity identified above.	Juniper Ridge Landfill	Pixelle Androscoggin LLC	Town of Hartland	Bucksport Mill, LLC	City of Augusta	Twin Rivers Paper Company LLC Frenchville Landfill
Please provide the name of the landfill operator.	NEWSME Landfill Operations LLC	Pixelle Androscoggin LLC; operations contracted to Integrated Waste Solutions of Sydney, ME	Clarence Chamberlain	Bucksport Mill, LLC	Jon Chalmers	Twin Rivers Paper Company LLC
Does the landfill have solid waste permit or license? If yes, who issued the permit or license? Please provide the license or permit no.?	MEDEP LIC. #S-020700-7A-A-N, Amendment #S-020700-WD-N-A, and MEDEP LIC. #S-020700-WD-BI-N	Yes - license; #S-022072-WD-A-N	License/ David Burns for the Commissioner Paul Mercer	Yes. Maine Department of Environmental Protection. S-007713	License. Maine DEP	Yes, Maine DEP, #S-007843-WD-E-R
What is the size of the existing constructed landfill footprint area in cubic yards, cubic yards in place and cubic yards of airspace remaining as of 01/01/23.	Existing Constructed Landfill footprint: 101.7 Acres Estimated Total Waste In-place: 13,589,119 CY Estimated Remaining Capacity of the Constructed Footprint: 1,289,872 CY	Size: 262,000 CY In-Place: 142,000 CY Remaining: 120,000 CY All volumes in-place.	300,000 =/-	906,000 cubic yards constructed. 583,000 cubic yards in place. 323,000 cubic yards remaining.	Initial capacity of 1,172,000 cubic yards. Remaining capacity 400,000 cubic yards estimated four years life remaining at current fill rate.	619,000 CY existing, 549,000 CY in place, 70,000 CY airspace
What is the size of the remaining permitted landfill area yet to be constructed in Acres and Cubic Yards of airspace.	19.8 Acres and 5,042,300 CY	Approximately 1.357 million cubic yards	5.3 acres	Vertical Increase (S-007713-WD-BB-A): 24 Acres and 700,000 cubic yards	NA	8.8 acres remaining, 381,000 CY airspace
Have expansion areas beyond that currently permitted been identified and if so, what is the size in Acres and Cubic Yards of airspace.	70 acres and 11.9 million cubic yards.	No	0	estimated to provide 3.6 million cubic yards of capacity. The license was surrendered in favor of a vertical expansion (S-	NA	None
What is the landfill footprint area that is not lined, in acres? Please provide explanation for other instances.	All areas have an approved liner system.	The active Phase I landfill is lined. Phases II-V (not constructed at this time) will be same lined design as Phase I.	0	Total landfill footprint is approximately 48 acres. The original landfill began operations in the 1930's. The original landfill area is unlined and estimated at approximately 20 acres. The original area was closed in the early 1980's. An additional 16 acre unlined papermill sludge disposal area was added along with a 12 acre lined boiler ash disposal area with leachate collection.	Current landfill is lined.	12.5 acres that are not geomembrane lined. They still a form of liner. No other areas that are unlined.
What is the landfill footprint area that has received final cover, in acres?	No final cover has been placed. Approximately 9 acres is scheduled to be placed in 2023.	None; currently a portion of the active Phase I landfill has intermediate cover.	8.7 acres	Approximately 23 acres.	None, either intermediate or open.	9.5 acres
Are future waste receipts (tons and waste types) expected to be similar to prior years, if not what changes are planned?	We assume similar volumes in the near future.	No. Volumes to be determined. The Pixelle Androscoggin paper mill has be closed, and will no longer manufacture wastes related to pulp & paper manufacturing. The site is in the process of being sold. Future landfill volumes will be determined by new site owner.	yes	The landfill has not been in operation accepting waste since 2021 when the demolition of the former Verso Paper Mill site was complete.	No change in waste receipts expected.	Yes
Expected years of site life remaining?	Approximately 6 years of permitted site capacity remains.	To be determined.	10 +/-	1,023,000 cubic yards of remaining permitted volume. Future use of this landfill has not been determined.	Four.	40+ years
Does this landfill have separate disposal or management areas for specific wastes?	Overall, wastes have been intermixed at JRL. However some special rules need to be followed for certain waste types.	No.	No	In the past it had separate disposal areas for ash and sludge.	No, MSW and CDD placed mixed.	No
Does the landfill have a leachate collection system?	Yes	Yes.	yes	Yes	Yes.	Yes
Does the leachate collection system include collection of groundwater for treatment?	No. The entire landfill has a liner system.	Yes.	yes/some	No	No.	Yes
How many gallons of leachate was generated in 2022?	18,917,490 gallons	Average 72,000 gallons per day.	8,000,000 +/-	35.4 million gallons	12,501,000	10,339,050 gallons
Are the gas well liquids comingled in the collection system or collected and managed independently?	Gas well liquids are comingled with landfill leachate.	The site utilizes passive gas vents only. Assumed low gas generation rates given types of waste landfilled (low	combined/no formal gas system	comingled in the collection system	Comingled.	Comingled system
Is there storage capacity for leachate? What is the volume and type of storage?	The leachate storage tank was manufactured by Statewide Aquastore and has roughly 950,000 gallons of capacity. It is a steel tank with cathodic anode protection. The model number from the manufacture is 8125.	Pixelle Androscoggin Mill has an on-site wastewater treatment plant, permitted for 26 MGD of effluent flow to the Androscoggin River. Given the size and capability of the treatment plant, no leachate storage was required. With the facility permanently idled, there a numerous options for leachate storage on-site, using various tanks.	250,000+/-	Yes. 2.1 million gallon lagoon.	Lagoon storage of 1.1 million gallons.	Yes, 1,000,000 gallons (estimate), lined leachate retention pond.
Please provide chemistry data of typical leachate:	Below are typical parameters from the last several years. Please contact me if additional parameters are needed. Thanks Specific Conductance Range: 10,000 to 30,000 µmhos/cm PH Range: 6 to 8 STU Temperature Range: 3 to 30 Degrees C Eh Range: -285 to 300 mV DO Range: 0-5 TKN Range: 400-1300 mg/L Ammonia Range: 300 to 1000 mg/L Turbidity: usually fairly dark and not able to determine Organic Nitrogen Range: 50-300 mg/L TDS Range: 9,000 to 15,000 mg/L TSS Range: 5 to 100 mg/L BOD Range 100 to 1200 mg/L Alkalinity Range: 1600 to 3500 mg/L	Average 2020-2022 Aluminum 3 mg/L Arsenic 0.02 mg/L Barium 0.10 mg/L Calcium 100 mg/L Chromium 0.02 mg/L Iron 10 mg/L Magnesium 40 mg/L Manganese 3 mg/L Potassium 220 mg/L Sodium 820 mg/L Alkalinity 1,900 mg/L Bicarbonate 1,840 mg/L Carbonate 34 mg/L Chloride 168 mg/L Nitrate-N 0.20 mg/L Ammonia-N 18 mg/L Sulfate 300 mg/L TDS 3,200 mg/L TOC 140 mg/L TSS 25 mg/L DO 5.25 mg/L pH 7.39 s.u. SpecCond 3,350 umhos/cm Temperature 12.8 Deg C		This data is provided to MDEP via EDD as part of the approved environmental monitoring plan.		Refer to 2022 water quality report submitted to Maine DEP.

ID	9	10	11	12	13	14
What are the current leachate management methods being utilized? Select all that apply	Hauled off to a commercially owned waste water treatment plant (Owned by ND Paper in Old Town, ME) ;	On-site physical, chemical and/or biological treatment;	Piped directly to treatment plant;	**Discharged via MEPDES/WDL#ME0002160;**	**Hauled off/ Transfer through sewers to Publicly Owned Treatment Works (POTW);**	Hauled off to privately owned wastewater treatment facility;
What are the approximate percentages for each of the leachate management methods being utilized selected above?	Currently 100% of leachate is hauled off to the ND Paper WWTP.	100% on-site treatment	100%	100 percent.	100%	100%
Is this pretreatment or for NPDES discharge?	Currently no pretreatment is performed onsite, the leachate is trucked to the ND Paper's WWTP for processing through their WWTP.	NPDES Discharge; Facility has a Maine Wastewater Discharge Permit & License (ME0001937; W000623-5N-P-R)	Yes	No	NPDES	NPDES discharge
What is the Discharge to Surface Water via NPDES permit percentage?	This information would need to be provided by ND Paper and is not currently known by the operator of Juniper Ridge Landfill.	100%	15 percent	100 percent of discharge goes to surface water	0%	100%
What is the NPDES permit Number?	ND Paper's MEPDES Permit: ME0002020, Waste Discharge License W002226-5N-S-M	MEPDES Permit ME0001937; Maine Waste Discharge License W000623-5N-P-R	me-0101443	#ME0002160	MEPDES#MER050000	ME0000159
If leachate is hauled, what is hauling distance and receiving facility (ies)	10 miles	NA	0	NA	Less than five miles to Greater Augusta Utility District.	2 miles, Twin Rivers Paper Company Madawaska Wastewater Treatment Plant
Does the landfill currently utilize any leachate pre-treatment methods, if so please describe?	No.	No	no	No	No.	None
Does the facility have strategies or capacity to handle more leachate generation than the current quantity?	Currently the leachate storage capacity is adequate for the permitted landfill capacity.	Previously not required due to size of wastewater treatment plant. Previous steps taken to reduce clean stormwater runoff from landfill area to wastewater treatment plant (stormwater detention pond construction for clean stormwater; off-site discharge).	yes	No, not as currently constructed.	No.	Yes
Does the landfill have an active gas collection system?	Yes	No, passive gas vents only.	no	No	Yes.	Yes, passive gas collection system
If yes, is the landfill gas beneficially reused in any way, please describe	come online in Q3 of 2023. The landfill gas plans to be treated to pipeline spec and introduced into a utility pipeline.	No.			Flare or 550 kW generator.	No
Is excess landfill gas available beyond that beneficially reused, if so what is the volume in SCFM and gas quality in %CH4, %CO2 and %O2?	After the RNG facility is online in Q3 of 2023, no excess landfill gas is expected. The facility was built oversized.	NA			Generator can handle all gas produced.	N/A
What are the main issues that biosolids pose at your facility? Select all that apply	Odors;Global Stability ;Slope Stability;Bulking/Drying;Reduction in construction and demolition (C&W) waste volume;	Slope Stability;Bulking/Drying;	Odors;Significant increase in leachate volume or negative impact to quality;Slope Stability;Bulking/Drying;Drainage;			Odors;Slope Stability;Increase in gas production;Significant increase in leachate volume or negative impact to quality;
What are the average tons of biosolids accepted each year?	2022 totals: Municipal WWTP Sludge (78,383 Tons)/Industrial Sludge (15,888 Tons) Similar totals are likely to continue in the future.	Prior to mill shutdown; 20,000 to 30,000 in-place CY/year.	17000 +/-			<200 tons
Are biosolids mixed/co-mingled with waste, if so what types of waste and at what ratio?	Yes, [(Ratio: Bulking material (tons) : Sludge (tons)], Oversized Bulky Waste (4:1), Bypass Municipal Solid Waste (5:1), CDD (5:1), Contaminated Soils (6:1), Ash (6:1)	No	3:1 cdd/contaminated soils/special wastes			No
Are biosolids monofilled at the facility?	No.	No	no			Yes
What type of bulking and/or drying operations are present at the facility?	Waste must pass a paint filter test and contain no free liquids. Incoming waste materials are used to bulk sludges if adequate. Since sludge can't be mixed on the landfill side slopes, not all incoming waste is used for bulking. No drying operations are done at the facility.	Currently sand; previously, bioash	mixing			None currently
What type of bulking and/or drying operations are present at the facility?	Mixing suitable incoming wastes with sludges to bulk.;	Bulking with sand during waste placement in operating area.;	bulking with CDD;			
What are the sources, use and volume of bulking materials?	In 2022, the approximate volumes were used for bulking sludges. OBW: 79,172 tons, Bypass MSW: 226,827 Tons, CDD:109,656 tons, Contaminated Soils: 10,489 tons, and Ash: 32,245 tons.	local sand supply, or inert fill from facility. one-to-one bulking ratio with biosolids.	Transfer stations and contractors			None
What is the primary limiting factor for acceptance of additional biosolids?	The amount of incoming suitable bulking material to mix with it and space to mix it.	(1) Private facility; limited by state rules. (2) Shutdown of mill operations.	CDD volume available			Capacity.
Briefly describe any limitations or restrictions to taking more biosolids?	Currently we doing our part by taking as much biosolids as the site can handle. As mentioned above, if we don't receive proper amounts of bulking materials than we have had to turn materials away. We can't jeopardize landfill stability and safety.	Private ownership limitations on accepting outside waste; future ownership plans for the facility (total landfill closure vs operations).				The landfill is privately owned by Twin Rivers, and the capacity is to be used for waste generated by Twin Rivers.
Briefly describe the facility's current strategy to address emerging contaminant such as PFAS?	Our company has done some research on PFAS leachate treatment and is currently operating a pilot program at a landfill in Vermont. We are hoping to take what we learn at that facility and relay the information across the company footprint.	To be determined; facility is being sold. Current available infrastructure exists for PFAS treatment facilities if dictated by science and regulatory requirements.	Waiting for the Department for guidance/making sure pfas isn't' more than our own with testing			Routine monitoring of sources of PFAS contamination. Full movement away from product lines containing PFAS by the end of 2023.
If the facility does not accept biosolids or has restrictions on accepting more biosolids, please indicate what measures would have to be taken and if this is something this facility would conside...	This does not apply to JRL. The Facility accepts plenty of biosolids.	Change in state law; I would assume new owners would be open to discussions with Maine DEP.	Always willing to talk with the DEP	Historically the landfill accepted papermaking sludge. Since the landfill ownership changed in 2015, sludge has not been accepted at the landfill. The landfill owner may be interested in discussing options for future acceptance of biosolids.	Residents use current tipping area, so second area needed for bulking and biosolids placement. Additional material would also reduce life expectancy of landfill. Would be willing to discuss acceptance with DEP.	Twin Rivers is not considering accepting additional biosolids at this time. Twin Rivers sends a majority of its biosolids (>98%) into Canada for use in composting by Envirem Organics Inc. The Frenchville Landfill does not receive a significant throughput of biosolids as result. Should circumstances change that Twin Rivers is no longer able to dispose of biosolids in Canada, we will utilize the remaining capacity of the Frenchville landfill for biosolids disposal. Current biosolids disposal rate to Canada is estimated at 25,000 CY annually. Having the extra capacity in the landfill available as a contingency for Twin River's use is the main restriction on accepting additional biosolids.
Additional relevant information not covered in this Questionnaire.	Please feel free to call me with questions. Survey form is difficult to relay large amounts of information. Thank you.	The current landfill (#S-022072-WD-A-N) is constructed on the side slope of the inactive landfill (#S-006247-WD-N-R). The area of the inactive landfill outside of the permitted footprint of the current landfill has received final closure cover. Final cover for the remaining portion of the inactive landfill will either be comprised of the liner system of the expanded current landfill, or by a dedicated final closure cover system. The design for that cover system has been submitted to the Maine DEP.				

Attachment B: Biosolids Acceptance at Existing Landfills - Evaluation of Questionnaire Responses

Section 1: Historical Data Review

1.1 Data Provided by Maine DEP

Data received from Maine DEP included:

- Most recent annual reports for the landfills that accept biosolids prepared by each facility.
- Maine solid waste generation and disposal capacity reports for calendar years 2017 through 2021, reported to the Joint Standing Committee on the Environment and Natural Resources
- Treatment alternatives to reduce PFAS in leachate from state-owned landfills- Dolby Landfill and Juniper Ridge Landfill, assessment study prepared for DEP and Financial Services, Bureau of General Services in January 2023
- List of lined active landfills in Maine
- List of landfills accepting biosolids
- Leachate volumes for landfills accepting biosolids.

The data resources provided by DEP were reviewed to facilitate assessment of landfill capacity and leachate generation in current and future terms.

1.1.1 Other Data Sources

BC also considered information from public sources including National Biosolids Data Project, Northeast Biosolids & Residuals Association (NEBRA), National Association of Clean Water Agencies (NACWA), Environmental Research and Education Foundation (EREF), public annual reports obtained for states such as Vermont, Massachusetts, Minnesota, etc. Data from these sources was evaluated and supplemented by BC's own experience in the field of biosolids, landfills, and leachate. The typical characteristics of leachate was developed, in part from characteristics data shared with BC by landfill managers via the questionnaire from DEP (see Section 2

1.1.2 Virtual and In-person Workshop

Two workshops were conducted between DEP and BC, attended by core project team members and staff from both entities, to discuss the results of our findings followed. The first workshop was carried out virtually on July 12, 2023, and was held in conjunction with the first Task 2 workshop. The second workshop was conducted in-person on July 2, 2023, and was held in conjunction with the second Task 2 workshop. Data assumptions and preliminary assessment analyses results were shared with DEP. This TM reflects the inputs and suggestions provided by DEP during the workshops.

Section 2: Questionnaire to Maine Landfill Operators

The primary intent of the questionnaire was to determine landfill capacity in the state for biosolids specifically, including both an assessment of a typical daily capacity, the timeline for the point at which the landfill's permitted capacity will be reached, and if the facility has existing permitted/un-permitted future capacity.

Additionally, the purpose of the questionnaire was to aid in identifying current leachate management approaches and specific constraints and requirements preventing the landfill from accepting biosolids. To achieve these objectives, a formal questionnaire was developed by BC and completed by each of the

operators of the 17 lined active landfills in Maine. The questionnaire was sent out by DEP on June 23, 2023, to 17 recipients, each representing a landfill site in the State of Maine, followed by two subsequent reminders on July 6 and July 13 of 2023.

BC acknowledges and appreciates each of the respondents for their efforts and contributions to helping achieve the goals of DEP. The questionnaire and general results are provided in Attachment A.

2.1.1 General Format

The electronic questionnaire was formulated around four broad categories including the following sub-categories,

- General information about the landfill
  - Ownership and permit information
  - Landfill size and remaining life
  - Landfill capacity (utilized or operational, permitted but not used, planned but not permitted, etc.)
- Leachate volume and quality
  - Leachate generation and characteristics
  - Leachate management
- Landfill gas
  - Gas collection system
  - Composition and beneficial reuse
- Biosolids
  - Biosolids accepted
  - Biosolids management in the facility
  - Issues in accepting biosolids.
  - Bulking/drying.

At the time this report was prepared, responses were received from 14 of the 17 facilities that were given the opportunity to respond to the questionnaire. Table B.1 summarizes the 17 lined landfills, response status and list of facilities that currently accept biosolids.

Table B.1 Lined Active Landfills in Maine and Status of Questionnaire Responses				
	Lined Landfills in Maine	Questionnaire Status		Biosolids Acceptance Status
		Sent	Responded	
1	Hatch Hill Landfill-City of Augusta	√	√	On-site waste receptor only
2	Presque Isle Landfill-Aroostook Waste Solutions (PI)	√	√	√
3	Tri-Community Landfill-Aroostook Waste Solutions (TCL)	√	√	√
4	Bath Landfill-City of Bath Solid Waste Facility	√	√	√
5	Bucksport Mill LLC (AIM)	√	√	On-site waste receptor only
6	Ecomaine	√		
7	Hartland Landfill	√	√	√
8	Juniper Ridge Landfill- State of Maine	√	√	√
9	Solid Waste Division- City of Lewiston	√	√	Not Licensed to accept biosolids
10	Farrington Mountain Landfill- ND Paper LLC	√	√	On-site waste receptor only
11	Pixelle Androscoggin LLC	√	√	On-site waste receptor only
12	Sanford Sewerage District	√	√	√
13	SD Warren Paper Mill- SAPPI	√	√	on-site generated sludge only
14	Dolby Landfill- State of Maine	Closed Permanently		
15	Twin Rivers Paper Company	√	√	On-site waste receptor only
16	Crossroads Landfill - Waste Management	√	√	√
17	Woodland Pulp LLC	√		On-site generated sludge only

The State of Maine claims three state-owned landfills: Juniper Ridge Landfill (JRL), Dolby, and Carpenter Ridge. JRL is the largest state-owned, Subtitle D lined facility in Maine to accept municipal solid waste (MSW) and therefore, one of the state's key sites for biosolids management. Dolby landfill is in the process of closing, and Carpenter Ridge is a licensed special waste landfill but still under development cooperatively between the Maine State Planning Office (SPO) and Lincoln Pulp and Paper Company. This landfill has been identified as a potential "safety net" or future new landfill. Carpenter Ridge landfill is not part of the assessment carried out by BC because of environmental justice concerns, which is identified by DEP. Dolby landfill was also excluded because it is undergoing closure and there is no possibility of accepting biosolids or any other wastes in future. This was confirmed by phone call with the landfill manager. Table B.1 includes all the landfills that currently accept biosolids as well.

2.1.2 Outcome

As outlined in Section 2.2.1, the questionnaire was designed around four broad categories aiming to facilitate fulfilling project objectives. The outcome of this questionnaire is summarized in the next sub-sections:

2.1.2.1 General Information About the Landfill

Table B.2 summarizes the current permitting status and ownership of the landfills obtained from the questionnaire.

Table B.2 Permit Status of Landfills in Maine

	Responses Received from Landfills	DEP License Number	Ownership of the Landfill
1	Presque Isle Landfill-Aroostook Waste Solutions (PI)	S-007501-WD-X-N	Quasi-municipal
2	Tri-Community Landfill-Aroostook Waste Solutions (TCL)	S-003707-WC-T-A; Tri-Community Landfill	Quasi-municipal
3	Bath Landfill-City of Bath	S-04991-WD-J-A	City Government
		S-004991-WD-I-R	City Government
4	Bucksport Mill LLC (AIM)	S-007713	Private
5	Hartland Landfill	S-003463-wu-q-n	City Government
6	Juniper Ridge Landfill- State of Maine	S-020700-7A-A-N, Amendment #S-020700-WD-N-A, and MEDEP LIC. #S-020700-WD-BI-N	State of Maine Bureau of General Services
7	Solid Waste Division- City of Lewiston	S-005242-WD-C-N	City Government
8	ND Paper LLC	S-00686-W-A	Private
9	Pixelle Androscoggin LLC	S-022072-WD-A-N	Private
10	Sanford Sewerage District	S-07972WD-A-R	Not identified in the Questionnaire
11	SD Warren Paper Mill- SAPPI	S-007404-WD-AA-N	Private
12	Crossroads Landfill - Waste Management	S-010735-WD-UW-N (Phase 8) S-010735-WD-YB-N (Phase 14)	Private
13	Hatch Hill Landfill-City of Augusta	S-007914-WD-AC-N S-007914-WD-AJ-M	City Government
14	Twin Rivers Paper Company	S-007843-WD-E-R	Private

Table B.3 summarizes the capacity and remaining lifetime resulting from review and analysis of the questionnaire and data from the other sources of information identified in Section 1.1.

Table B.3 Lined Landfill Capacity and Remaining Lifetime per Questionnaire

	Responses Received from Landfills	Remaining Airspace Constructed	Permitted, not yet constructed	Expansion Airspace	Total Airspace	Remaining Life
		(In cubic yards)				(In years)
1	Presque Isle Landfill-Aroostook Waste Solutions (PI)	0	1,190,000	0	1,190,000	20 [a]
2	Tri-Community Landfill-Aroostook Waste Solutions (TCL)	272,136	1,087,996	1,000,000	2,360,132	17
3	Bath Landfill-City of Bath	304,400	0	0	304,400	21
4	Bucksport Mill LLC (AIM)	323,000	700,000	3,600,000	4,623,000	Not identified
5	Hartland Landfill	300,000	0	0	300,000	10
6	Juniper Ridge Landfill- State of Maine	1,289,872	5,042,300	11,900,000	18,232,172	6 [b]
7	Solid Waste Division- City of Lewis-ton	427,242	427,242	0	854,484	28
8	ND Paper LLC	546,000	1,236,000	Size Not Identified	1,782,000	8.2
9	Pixelle Androscoggin LLC	120,000	1,357,000	0	1,477,000	To be Determined
10	Sanford Sewerage District	1,000	0	0	1,000	<1
11	SD Warren Paper Mill- SAPPI	186,500	1,387,900	0	1,574,400	0
12	Crossroads Landfill - Waste Management (does not include dryer)	435,000	7,757,000	0	8,192,000	20
13	Twin Rivers Paper Company	70,000	381,000	0	30,579,704	>40
14	Hatch Hill Landfill-City of Augusta	400,000	0	0		4
Total		4,675,150	20,566,438	16,500,000	41,741,588	

[a] 20 years after 17 years of TCL lifetime is exhausted

[b] JRL has an additional estimated 10 years of lifetime after the expansion identified in the questionnaire response

Key take-aways from Table B.3 are as follows:

The righthand column is an estimate of the remaining life (in years) for each of the landfills identified. The lefthand columns represent three categories of airspace: remaining airspace (already constructed), permitted but not yet constructed airspace, and future airspace associated with a planned expansion. The estimates provided below are a breakout of these three categories:

- 4.7 million cubic yards of airspace is currently available for the permitted landfills identified above.
- 20.6 million cubic yards of airspace will be available for the currently permitted landfills; however, that airspace has not yet been constructed (note that as landfills become filled, they build out new cells within their current permitted footprint without having to apply for a major modification to their permit)
- 16.5 million cubic yards of airspace may be available and is associated with the four facilities identified above that currently have expansion plans. Note that this estimate includes airspace associated with planned but not yet approved expansions.

Approximately 42 million cubic yards airspace is identified above and is referred to as the "total airspace" (sum of remaining, permitted but not constructed, identified expansion). Total airspace includes landfill expansions that have not been approved or permitted by the State of Maine.

Note that only 30 million cubic yards total airspace is available (remaining/ yet to be constructed/part of expansion plan) if we count only those landfills that currently accept biosolids, **the six facilities that have capacities to accept biosolids after 2022.**

Landfills with major capacity (remaining/ yet to be constructed/part of expansion plan) include JRL and Crossroads, which are anticipated to be exhausted in 6 and 20 years, respectively. Assuming JRL expansion plan is executed (given the permit application will be submitted ahead of time within six years of remaining lifetime), an additional 10 years of life is anticipated. Overall, in terms of landfill lifetime, in 30 years of time, most of the remaining and permitted capacity will be exhausted for most of the landfills identified in Table B.3. Sanford does not have any remaining lifetime and therefore, was excluded from landfill capacity evaluation.

2.1.2.2 Leachate Volume and Quantity

With execution of LD 1911, an increased amount of biosolids will be forwarded to landfills, therefore the capacity of landfills, both in short and long term, need to be evaluated. Also, with an increased amount of biosolids diverted to landfills, leachate generation is expected to increase due to the water content in biosolids. Therefore, landfill capacity evaluation and leachate volume are interconnected. Based on questionnaire responses, some of the points on leachate collection are identified below:

- All the landfills reported having leachate collection systems.
- All the landfills except SAPPI, Pixelle, and Hartland reported having no collection of groundwater as a contribution to the leachate collection system.
- Most of the facilities reported gas well liquids comingled in the collection system, except Sanford (not applicable), Lewiston (separate management), SAPPI (no gas wells on-site), Pixelle (utilizes passive gas vents only).
- All the landfills have on-site storage capacity, except SAPPI and Pixelle, which transfer leachate to on-site wastewater treatment plants without the need for additional storage capacity. Pixelle is not operable right now, so the treatment plant units can be utilized as storage units if required.

Leachate volume and management technologies identified from the questionnaire are elaborated in Section 5.1 and in Section 6.

2.1.2.3 Landfill Gas

With execution of LD 1911, an increase in biosolids increases the potential to generate more landfill gas. Most of the landfills reported no gas collection system at the facility and hence no beneficial reuse of the gas. The following sites have gas collection systems:

- Bath and TCL have gas collection systems, but beneficial reuse is not identified.
- Crossroads has a gas collection system and gas is beneficially reused at landfill gas to energy (LFGTE) systems. Approximately, 4,000 standard cubic feet per minute (SCFM) gas is diverted to flare station with methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) percentages of 52%, 38% and 0.5% respectively.
- Lewiston exhausts gas through vents; since the landfill is ash monofil, minimal gas is generated.
- JRL has a gas collection system but currently gas is not beneficially reused. However, a Renewable Natural Gas Facility (RNG) is currently under construction on-site and set to come online in the third quarter of 2023. The landfill gas plans to be treated to pipeline specifications and will be introduced into a utility pipeline. After the RNG facility comes online, no excess landfill gas is expected. The facility was built oversized.

2.1.2.4 Biosolids

Biosolids acceptance status and annual biosolids acceptance rates are provided in Table 2.1 and Table 2,3 respectively. Based on the questionnaire responses, some of the Bulking/Drying materials used in the facilities are below. The number of responses from site personnel are provided in parentheses.

- Use of compost as bulking agent
- Screw Presses
- Mixing with higher strength materials such as boiler ash
- Suitable incoming waste
- Sand, bio ash
- CDD waste

Based on the responses, issues posed by biosolids included the following,

- Slope Stability (6)
- Odor (3)
- Bulking/Drying (2)
- Global stability (2)
- Significant increase in leachate volume (2)
- Negative impact to leachate quality (2)
- Lack of constructed disposal capacity (1)
- Increase in gas production (2)
- Drainage (1)

Limiting factors to accept biosolids included the following.

- Space (3)
- Potential PFAS regulations (2)
- Staffing (1)
- Maine DEP license posed rule of <10% biosolids of total waste accepted (1)
- Dewatering of biosolids to at least 20% prior to delivery to landfill (1)

- Stability criteria posed by facility itself (1)

2.1.2.5 Potential Opportunities for Additional Biosolids Management

Landfills that do not accept biosolids currently but may present the opportunity to accept biosolids in the future are identified below. Note that additional follow-up with these respondents would be required to quantify the potential, if any, for biosolids acceptance.

- **SAPPI, ND Paper LLC, Twin Rivers and Woodland Pulp**: These facilities only accept biosolids that are generated on-site.
    - The site personnel of SAPPI and Woodland Pulp mentioned that none of the facilities would consider accepting biosolids from off-site facilities and therefore, were excluded from landfill capacity evaluation.
    - **Twin Rivers Paper** is limited by landfill capacity to accept future biosolids.
- **Bucksport Mill LLC:** The facility is identified at this facility as it has both remaining permitted airspace as well as expansion plan. The landfill owner may be interested in discussing options for future acceptance of biosolids.
- **Pixelle Androscoggin LLC**: The site historically used to accept biosolids until its shutdown. Although it does not have an expansion plan yet, the landfill has permitted airspace that has not yet been constructed. New ownership might be interested in a discussion with DEP regarding future acceptance of biosolids.
    - Since no data is available regarding current biosolids acceptance, Pixelle Androscoggin LLC was also excluded from the analysis.
- **City of Lewiston**, an ash landfill, does not have a license to accept biosolids; however, the site personnel expressed interest in future acceptance of biosolids if modifications to the existing permit is made with appropriate study and analysis.
- **Ecomaine Landfill/Ashfill** is one of the Maine's listed waste-to-energy facilities with annual 170,000 tons per year (2020) waste acceptance rate. did not respond to the questionnaire. Therefore, no data is available on biosolids acceptance.
- **Sanford** accepted biosolids until 2022 and currently it is exhausted.
- **Hatch Hill Landfill**, operated by City of Augusta and **ND Paper LLC** did not respond to the question related to future biosolids acceptance and does not currently accept biosolids.

Attachment C: Estimation of Leachate Volume

Source- Provided by Maine DEP, 2023

Leachate Volume (Gallons)					
Facility Name	2022	2021	2020	2019	2018
Bath	10,277,270	9,837,495	10,589,877	10,711,747	
Hartland	8,075,675	6,297,587	8,077,512	Not Reported	7,555,196
JRL	18,917,490	15,239,342	15,986,265	22,187,301	19,041,755
Presque Isle	4,836,678	3,127,530	3,068,203	3,617,248	2,894,812
TCL	13,111,741	9,144,473	10,030,928	11,815,908	10,776,416
Crossroads	22,915,433	24,030,715	23,991,130	32,805,084	29,559,273
Woodland Pulp	55,088,000	34,430,000	37,927,000	57,238,000	59,959,000
	133,222,287	102,107,142	109,670,915	138,375,288	129,786,452