STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0016

JOHN ELIAS BALDACCI
GOVERNOR

DAVID A. COLE
COMMISSIONER

April 15, 2008
Subject: **Bethel**
Pin No.014448.10
Amendment No. 1

Dear Sir/Ms:

Please make the following changes to the Bid Documents:

In the Bid Book on the "Notice to Contractors" page, within the first paragraph, change the bid opening date from **April 16, 2008** to **April 23, 2008.** Make this change in pen and ink.

In the Bid Book on the "Notice to Contractors" page, within the sixth paragraph, **DELETE** the sentence beginning with "Questions received..." and **REPLACE** with the new updated sentence that reads "Questions received after 12:00 noon of **Thursday** prior to bid date will not be answered." Make this change in pen and ink.

IN THE SPECIFICATIONS:

1. **ADD** "Special Provision Section 103, Basis of Award" dated April 12, 2008 one page total.

2. **ADD** "Special Provision Section 103, Post Bid Qualifications" dated April 13, 2008 one page total.

3. **ADD** "Special Provision Section 105, Review Times" dated April 11, 2008 one page total.

4. **ADD** "Special Provision Section 107, Incentive/Disincentive" dated April 13, 2008 one page total.

5. In "Special Provision Section 815, Alternative Fuels, Basis of Payment", **ADD** the following words to the end of the paragraph "The design and construction of all modifications and changes to the existing design required by the alternative fuel will be considered incidental to Buildings – Alternative Fuel Option." Make this change in pen and ink.

6. In "Spec. Section 02741 - BITUMINOUS CONCRETE PAVING, in sub-section 3.4 – FIELD QUALITY CONTROL, A" **DELETE** "the following words "Method C " and **REPLACE** with the following updated words "Method D" . Make this change in pen and ink.

7. In "Special Provision, Section 401 and Special Provision, Section 403 **DELETE** "the following words "Method C " and **REPLACE** with the following updated words "Method D" . Make this change in pen and ink.

8. In "Spec. Section 03300 - CAST-IN-PLACE CONCRETE, in sub-section 2.8 - VAPOR RETARDERS, A - 8" **DELETE** "the following words "15 mil thick vapor barrier " and **REPLACE** with the following updated words "10 mil thick vapor barrier" . Make this change in pen and ink.

9. **DELETE** "Spec. Section 05400 – COLD FORMED METAL FRAMING" and **REPLACE** with new updated "Spec. Section 05400 – COLD FORMED METAL FRAMING", dated April 14, 2008, twelve pages total.

10. In "Spec. Section 05500 – METAL FABRICATIONS, 2.12, **DELETE** "the following words "Schedule 80" and **REPLACE** with the following updated words "Schedule 40". Make this change in pen and ink.

11. In Specification Section 15083 MECHANICAL SYSTEM INSULATION, 3.11 DUCT AND PLENUM APPLICATION SCHEDULE, A.; **DELETE** Part A. in its entirety and **REPLACE** with the following:

    "A. All Supply and Exhaust Plenums serving EFs, SFs, and ERU-1; FG Blanket, R10.2, 3" thickness, VR: Yes; Jacket: No.

    B. OA and EA from louver plenum to ERU-1 and Supply air ductwork (above Mezanine); FG Blanket, R5.1, 1 ½" thickness, VR: Yes; Jacket: No."

12. In Specification Section 15083, 3.10 INTERIOR PIPE INSULATION APPLICATION SCHDULE; **ADD** the following:

    "D. Service: Domestic Cold Water 305 Gallon Storage Tank.

    1. Operating Temperature: 35 to 65°F.
    2. Insulation Material: Flexible Elastomeric Thermal Insulation.
    3. Insulation Thickness: Apply with ½"thick sheet rolls.
    4. Vapor Retarder: All joints shall be sealed vapor tight per manufacturer's recommendations.
    5. Finish: None."

13. In Specification Section 15940 SEQUENCE OF OPERATIONS, Part 1.5 ENERGY RECOVERY UNIT (ERU-1) SEQUENCE; **ADD** The following: "C. ERU-1 OA and EA motor operated dampers shall open 100% when unit is enabled and close 100% when unit is disabled." (Refer to Sketch SKM-02, attached)

14. In Spec. Section 16000 – Basic Electrical Requirements, **DELETE** Paragraph 1.4, D. in its entirety. **ADD** in its place Paragraph 1.4, D. to read: "Provide 320-amp continuous rated 3-phase meter socket per utility requirements. Meter shall be provided by the utility company."

15. In Spec. Section 16000 – Basic Electrical Requirements, **ADD** Subparagraph 2.1, J., 5., a., to read: "Aluminum conductors shall be permitted in accordance with NEC for sizes 1/0 AWG and larger where conductor and, if required, conduit sizes are increased to provide at least the ampacity of indicated copper conductors. Aluminum conductors used for service entrance conductors shall also comply with utility company requirements."

16. **ADD** "Geotechnical Design Report for Bethel Highway Maintenance Garage" dated December 2007.

ON PLAN SHEETS:

1. On Plan Sheet C- 100 titled: "Site Layout Plan", in the notes, **ADD** the following words at the end of Note 8, "The Construction/Demolition Debris generated as a result of this project may be disposed at a landfill licensed in a state other than Maine, if the Department is provided with documentation demonstrating that the disposal facility can accept the waste."

2. On Plan Sheet C- 400 titled: "Details "on the "Bollard" Detail, **DELETE** the words "6" Schedule 40" and **REPLACE** with the following updated words "8" Schedule 40".

3. On Plan Sheet M-100, at Mechanical Room Part Plan E1, refer to Sketch SKM-01, attached for revisions.

4. On Plan Sheet M-102, at Mezzanine Plan A1, refer to Sketch SKM-02, attached for revisions.

5. On Plan Sheet M-102, at Boiler Room Piping Schematic A5, refer to Sketch SKM-03, attached for revisions.

6. On Plan Sheet E-000 titled "Electrical Legend and Details," at Detail A4 titled "Schedules," **DELETE** the 3-pole, 200-amp circuit breaker at circuits 38, 40, 42 of Panel P1. **ADD** in its place sub-feed lugs for connecting Panel P2.

7. Refer to "Pump Schedule" Drawing M-103 –**DELETE** Pump P-7 model and performance data and **REPLACE** with the following:

"P-7, Domestic Cold Water Service, Grundfos, model: CRIE 3-6, horizontal inline, 12 gpm @ 55psi, built in VFD, NPSH: 6, 1" x 1" Suction and Discharge, 1 ½ hp motor, 208v 3 ph."

THE FOLLOWING QUESTIONS HAVE BEEN RECEIVED:

1. **Question:** Spec. Section 03300 - CAST-IN-PLACE CONCRETE, 2.8 - VAPOR RETARDERS, A - 8 calls for a 15 mil. vapor barrier. Plan Sheet S-500, detail E9 calls for 10 mil vapor barrier. The under slab insulation has an integral 10 mil. Vapor barrier. What is required?

   Response: A 10 mil continuous vapor barrier is required. This can be achieved with the proposed insulation system which has an integral 10 mil VB. See revisions to Spec. Section 03300 - CAST-IN-PLACE CONCRETE made earlier in this amendment.

2. **Question:** Pipe Bollards: Plan C400 details 6" schedule 40. Plan S500 details 8" schedule 40. The specs call for schedule 80 pipe. Which is correct?

   Response: Provide schedule 40, 8" pipe filled per specifications. See revisions to Plan Sheet C- 400 and Spec Spec. Section 05500 made earlier in this amendment.

3. **Question:** Is the exterior of the garage to be painted?

   Response: The exterior metal building panels are factory painted per specification and F9-A200.

4. **Question:** Are the interior guardrails and handrails to receive paint finish in the field?

   Response: The interior guardrails and handrails are to be field painted in accordance with the drawings and sections 05521 & 09911 of the specifications.

5. **Question:** On drawing E-000, detail A4, panel P1 has a 200 amp circuit breaker feeding panel P2. P2 is shown as a main lug only (MLO). On drawing E5-100, detail A-1 shows a 400 amp set of conductors from P1 to P2. Could P1 and P2 be combined into a double sub panel so that the 200 amp breaker could be eliminated as they are currently mounted side by side?

   Response: Per Amendment #1, the Contract Documents will be changed as follows: On Plan Sheet E-000 titled "Electrical Legend and Details," at Detail A4 titled "Schedules," **DELETE** the 3-pole, 200-amp circuit breaker at circuits 38, 40, 42 of Panel P1. **ADD** in its place sub-feed lugs for connecting Panel P2.

6. **Question:** On drawing E-100, some branch circuits called out from Panel P-1 and P-2 pass by Panel P-3. Can branch circuits for receptacles, only beyond the

demising wall, at column line 4 be run to Panel P-3 as it would require less conduit and wire?

Response: No.

7. **Question:** It appears that Special Provision 815, Alternative Fuel System, is to be similar to a design/build project. There is currently no work shown on the electrical drawings. How is this alternate work to be handled for electrical requirements?

   Response: The design and construction of the extra work, changes and modifications are included in the bid item.

8. **Question:** Due to the high cost of copper, could aluminum conductors be substituted for the service conductors only if of similar ampacity as the copper specified?

   Response: Per Amendment #1, the Contract Documents will be changed as follows: In Spec. Section 16000 – Basic Electrical Requirements, ADD Subparagraph 2.1, J., 5., a., to read: "Aluminum conductors shall be permitted in accordance with NEC for sizes 1/0 AWG and larger where conductor and, if required, conduit sizes are increased to provide at least the ampacity of indicated copper conductors. Aluminum conductors used for service entrance conductors shall also comply with utility company requirements."

9. **Question:** Does the outside air intake associated with the ERU require insulation? If so, what type and thickness and type?

   Response: Per Amendment #1, the contract documents will be changed as follows:

   Refer to Specification Section 15083 MECHANICAL SYSTEM INSULATION, 3.11 DUCT AND PLENUM APPLICATION SCHEDULE, A.; **(DELETE)** Part A. in its entirety and **(REPLACE)** with the following:

   "A. All Supply and Exhaust Plenums serving EFs and ERU-1; FG Blanket, R10.2, 3" thickness, VR: Yes; Jacket: No.

   B. OA and EA ductwork from louver plenum to ERU-1; FG Blanket, R5.1, 1 ½" thickness, VR: Yes; Jacket: No."

10. **Question:** Does the supply duct associated with ERU require insulation? If so, what type and thickness?

    Response: Per Amendment #1, the contract documents will be changed as follows:

    Refer to Specification Section 15083 MECHANICAL SYSTEM INSULATION, 3.11 DUCT AND PLENUM APPLICATION SCHEDULE, A.; **(DELETE)** Part A. in its entirety and **(REPLACE)** with the following:

"A. All Supply and Exhaust Plenums serving EFs and ERU-1; FG Blanket, R10.2, 3" thickness, VR: Yes; Jacket: No.
B. OA and EA ductwork from louver plenum to ERU-1; FG Blanket, R5.1, 1 ½" thickness, VR: Yes; Jacket: No."

11. **Question:** A note on a drawing indicates a CW storage tank to be insulated, what type and thickness?
Response: Per Amendment #1, the contract documents will be changed as follows:

Refer to Specification Section 15083, 3.10 INTERIOR PIPE INSULATION APPLICATION SCHDULE; **(ADD)** the following:
"D. Service: Domestic Cold Water 305 Gallon Storage Tank.
6. Operating Temperature: 35 to 65°F.
7. Insulation Material: Flexible Elastomeric Thermal Insulation.
8. Insulation Thickness: Apply with ½"thick sheet rolls.
9. Vapor Retarder: All joints shall be sealed vapor tight per manufacturer's recommendations.
Finish: None."

12. **Question:** How are the heat pipes to the ERU run?
Response: Per Amendment #1, the contract documents will be changed as follows:
Refer to Sketches SKM-01, SKM-02, and SKM-03.

13. **Question:** The specs, section 02315, refer to the Soils Report. Is it available?
Response: A copy of the soils report of the site has been included in this amendment. The report is based on MaineDOT's interpretation of the information obtained for the subject site. No assurance is given that the information or the conclusion of the report will be representative of actual conditions at the time of construction.

14. **Question:** Are Details C3, D3, & 5, E3 suppose to be 1-1/2" scale?
Response: If this refers to Sheet A-401, yes the details are 1 ½"=1'-0".

15. **Question:** Is there a specification "equal to" the windows or PVC trim boards we can carry a price for?
Response: No

16. **Question:** Is there a requirement for the GC to carry engineering costs for the metal stud framing at the structure bearing walls?
Response: There is no requirement for the GC to carry engineering costs, just standard shop submittals...contract drawings cover required bearing wall framing and gage sizes.

17. **Question:** Is the plywood at the wall type 1A required to be pressure treated lumber?

    Response: No

18. **Question:** Does the bottom edge of any and all plywood used in the wall construction required to be sealed?

    Response: No, keep the plywood above the floor 1/2".

19. **Question:** It is our reading of Section 02832, that "off the shelf" Redi-Rock blocks can be used for this project. The normal MDOT spec for Redi-Rock blocks, 635.31, is not referred to. Are we correct?

    Response: It is the intention that "off the shelf' Redi-Rock blocks can be used for this project.

20. **Question:** C-100 calls for the existing building to be demolished. Is this scope of work for the GC to include in the bid and, if so, is there a Div. 2 demo. spec. forthcoming?

    Response: Demolition of the existing garage is included in the bid. No additional specification will be issued however many of the contract requirements are in the notes on plan sheet C-100.

21. **Question:** A-300 - Is wall at midspan of stairs to be wood or metal framed?

    Response: Wall shall be metal-stud framed.

22. **Question:** Can the blocking indicated be wood or metal?

    Response: All blocking shall be wood.

23. **Question:** Is there more information available to properly estimate the cost of demolition? Is the lead paint throughout? Is the environmental report available? The Mt. Carberry Landfill in Berlin would be the most economical location for disposal, but the drawings are specific about using a Maine facility. Is there some leeway here?

    Response: Laboratory testing is the responsibility of the Contractor as stated on Plan Sheet C- 100. The Construction/Demolition Debris generated as a result of this project may be disposed at a landfill licensed in a state other than Maine, if the Department is provided with documentation demonstrating that the disposal facility can accept the waste. See revisions to Plan Sheet C- 100.

24. **Question:** Please confirm the faded printing in spec section 05400 (ages 4-5) is the design criterion for MDOT specifications.

    Response: Yes, see reissued Spec Sect 05400.

25. **Question:** Please confirm catch basin on north side of building (referenced in note #3) is not in the GC's scope of work.

Response: Yes, the catch basin on north side of building (referenced in note #3) is not in the GC's scope of work. It is the responsibility of the Department.

26. **Question**: Specification section 02315/3.5/I. calls for all existing fill materials to be removed from beneath foundations. There are no quantities listed. What quantity of existing soil removal should be carried to meet the specifications?
    Response: Section 02315/3.5/I. should be revised to read:
    Remove all existing organic/fill material from beneath foundations, per the Geotechnical Report. Detail showing limits is also attached

27. Drawing A100 indicates that the building is to be designed with a Storage Use Group "Low Hazard". Drawing S-000 indicates load importance factors consistent with an "Essential Facility". We are assuming that the structural drawings supersede drawing A-100.
    Response: In this instance, both are correct. The structural frame system is to be designed as per S-000 requirements; Architectural systems are to be designed as per A-100 building classifications.

28. Is Kynar 500 finish as specified in Section 13125/2.8 and 2.9 an acceptable finish for both interior and exterior of wall and roof sheets? There appears to be a discrepancy as a different paint system (4 mil vinyl Plastisol) is called for under colors, textures, and glosses. Please confirm if either one is an acceptable finish.
    Response: Yes, Kynar 500 finish is an acceptable finish for interior and exterior surfaces. The Plastisol is only acceptable as an interior finish.

29. Are we to assume in our pricing that the existing structure has lead paint? The note on the plans said that there is an indication that it may have lead paint.
    Response: The Department painted some of their structures with paint containing lead in past years, possibly including the existing garage in Bethel. Laboratory testing is the responsibility of the Contractor as stated on Plan Sheet C- 100.

Consider these changes and information prior to submitting your bid on **April 23, 2008.**

Sincerely,

Scott Bickford
Contracts & Specifications Engineer

SPECIAL PROVISION
SECTION 103
AWARD AND CONTRACTING
(Basis of Award)

The basis of award for determining the Apparent Low Bidder will be the lump sum price given for Section 0001.

SECTION 103
AWARD AND CONTRACTING
(POST-BID QUALIFICATIONS)

After Bid Opening and as a condition for Award of a Contract, the Department may require an Apparent Successful Bidder to demonstrate to the Department's satisfaction that the Bidder is responsible and qualified to perform the Work. Each Bidder shall demonstrate to the satisfaction of the Department the experience of the firm and/or subcontractor who will be constructing the building specified in the contract documents. Written documentation of such experience shall be provided with the Bid to the Department. The Bidder shall furnish a list of its recent experience in similar building construction projects, including a) the name of the owner for whom the work was performed, b) the name and telephone number of a contact person, c) a description of the work performed, d) the total construction cost of each project, and e) the names(s) of the Bidder's subcontractor's, project superintendent(s) and foremen who had direct supervisory responsibility for the projects listed. Said experience shall include, as a minimum, at least one (1) project of equal or greater complexity as the work required by this Contract completed in the last (5) years.

A statement of the bidder's qualifications that includes 1) the Bidder's experience record in constructing the type of improvements embraced in the Contract as described above, and 2) the personnel and equipment available for the work contemplated, shall be included in the proposal.

The Department shall have the right to take such steps, as it deems necessary, to determine the ability of the Bidder to perform its obligations under the Contract. The bidder shall furnish the Department all such information and data for this purpose, as it may request. The Department reserves the right to reject any bid where an investigation of the available evidence or information does not satisfy the Department that the bidder is qualified to properly carry out the terms of the Contract.

SPECIAL PROVISION
SECTION 105
Review Times

105.7.2 Review Times Add the following to the end of the section:

"105.7.2 Review Times The Contractor's Schedule of Work shall allow the Department the following review and comment times for the submittals required by Section 13125 - Metal Building Systems, including those with design computations.

First Submission: 15 Calendar Days or 1 day per drawing, whichever is greater.

Second Submission: 10 Days or 1/2 day per drawing, whichever is greater.

Each subsequent submission: 10 Days or 1/2 day per drawing, whichever is greater."

SPECIAL PROVISION
SECTION 107
PROSECUTION AND PROGRESS
(Incentive/Disincentive)

Disincentive: The Contract amount shall be reduced by $10,000 for each week beyond October 31, 2008 if the project is not substantially complete and ready to be occupied by the Department before the end of the day, October 31, 2008.

Incentive: The Contractor shall provide a plan for the following incentive, which is acceptable to the Department, and which both the Department and the Contractor anticipate has a reasonable expectation of being completed by October 31, 2008. The contract amount shall be increased by $20,000 if the project is substantially complete before the end of the day, October 31, 2008.

Substantially Complete Substantially Complete is defined as the point at which the physical work is complete such that the building can be safely and effectively be used by the Department. The Department shall be the sole authority in determining when the work is substantially complete.

Adjustments for Incentive/Disincentive (I/D) Adjustments to the I/D time periods will be made based on the Critical Path method schedule submitted by the contractor in accordance with scheduling provisions found elsewhere in the contract documents. Delays due to extenuating circumstances beyond the control of the Contractor, as provided in Standard Specification Section 109.5 and Special Provision Contract Time will be considered when making time related adjustments. If the Department chose to compensate the Contractor for additional resources, additional men, additional hours, or both, or additional equipment needed to assure the timely completion of the work under Special Provision Contract Time then no adjustment to the I/D time periods will be made.

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. If the Contractor discovers any ambiguity, error, omission, conflict, or discrepancy, General Conditions Section 101.3.6 Priority of Conflicting Contract Documents shall control.

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.
2. State of Maine Department of Transportation, “Standard Specifications,” Revision December 2002, and any revisions thereto, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Interior load-bearing wall framing.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for masonry shelf angles and connections.
2. Division 6 Section "Rough Carpentry" for subflooring, wall sheathing, or roof sheathing using wood-based structural-use panels, particleboard, fibrous-felted board, and foam-plastic sheathing.
3. Division 9 Section "Gypsum Board Assemblies".

1.3 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As specified on drawings.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of **3/4 inch**.

B. Design exterior non-load-bearing curtain-wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Design roof trusses according to AISI's "Design Guide for Cold-Formed Steel Trusses."

1.5 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.

1. Submit letter of certification from the material fabricator sealed by a professional engineer who is legally qualified to practice in jurisdiction where Project is located attesting that the shop drawings were prepared under his direct supervision.

C. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Expansion anchors.

2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Engineering Responsibility: Engage a qualified professional engineer licensed to practice in the State of Maine, to prepare Shop Drawings, and other structural data.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Mill certificates signed by steel sheet producer indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

G. Comply with HUD's "Prescriptive Method for Residential Cold-Formed Steel Framing."

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

C. Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If it is necessary to store materials outside, they shall be stacked off the ground, properly supported on a level platform and fully protected from the weather as approved by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
1. Dietrich Industries, Inc.
2. MarinoWare; Div. of Ware Industries, Inc.
3. U.S. Gypsum
4. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: **33**.
2. Coating: **G60**.

B. Steel Sheet: ASTM A 570/A 570M, hot rolled or ASTM A 611, cold rolled; cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free, rust-inhibitive primer complying with performance requirements in FS TT-P-664, of grade as follows:

1. Grade: **33 or C, Type 1**.

2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: **0.0428 inch**.
2. Flange Width: **2-1/2 inches**.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: **0.0677 inch**.
2. Flange Width: 1-1/4 inches.

2.4 NON-LOAD-BEARING WALL FRAMING

A. Interior Studs: Heavy duty drywall studs, 1-5/8", 2-1/2", 3-5/8", 4", and 6", 1-1/4" minimum flange, 22 gauge minimum, with deflection not exceeding L/360 at 5 pounds per square foot wind load.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with ASTM C 955, and as follows:

1. **Matching steel studs**.
2. Flange Width: 1-1/4 inches

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:.

1. Minimum Uncoated-Steel Thickness: **0.0428 inch**.
2. Flange Width: **2 inches.**

D. Vertical Deflection Clips: Manufacturer's standard **head** clips, capable of accommodating upward and downward vertical displacement of primary structure of **1 inch.**

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with minimum yield strength of 33,000 psi (230 MPa).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. End clips.
5. Foundation clips.
6. Stud kickers, knee braces, and girts.
7. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade **36**, threaded carbon-steel **hex-headed** bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by **hot-dip process according to ASTM A 153/A 153M, Class**.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.

C. Provide stud walls at locations indicated on plans as "shear walls" for frame stability and lateral load resistance.

D. Provide insulation equal to that specified elsewhere in all double jamb studs and double header members which will not be accessible to the Insulation Contractor.

E. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

F. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

G. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

H. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

I. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

J. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

K. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

L. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: **As shown on Shop Drawings**.

B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: **As indicated**.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align floor framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in stud system, spaced **48 inches, unless noted otherwise on the drawings,** apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

I. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to **top and** bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: **As indicated**.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to infill studs and anchor to primary building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches (1370 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches** of single deflection track.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

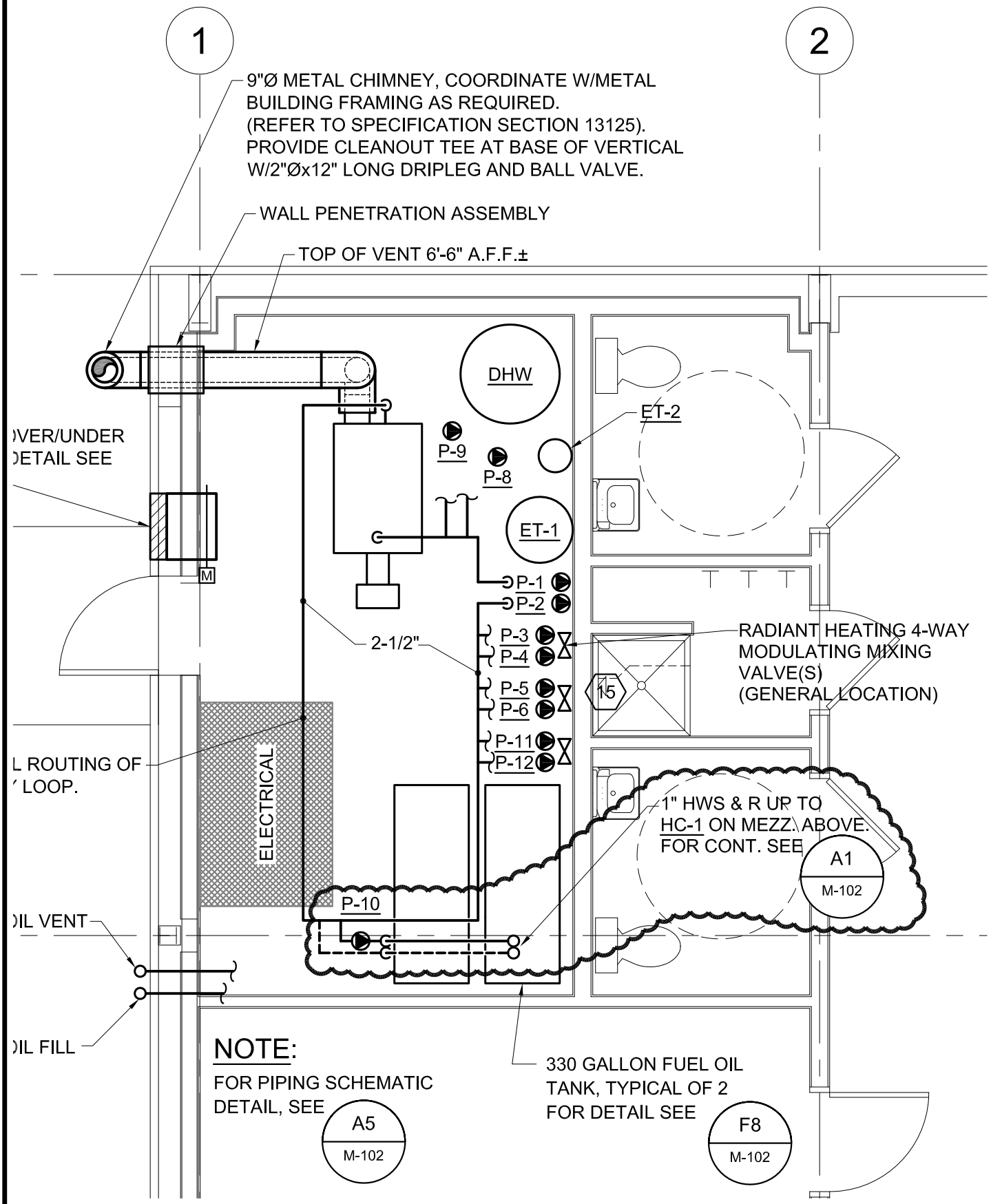
B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.

D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400



SKM-01

REVISED MECHANICAL PART PLAN ~ UTILITY ROOM A108 - E1, SHEET M-100

MDOT - REGION 3 ~ HIGHWAY MAINTENANCE GARAGE
BETHEL, MAINE

Scale: 1/4" = 1'-0"	Project No: 07072
Date: 04-10-2008	CAD File: 07072M.DWG

Allied Engineering
Structural Mechanical Electrical Commissioning

160 Veranda Street
Portland, Maine 04103
T: 207.221.2260
F: 207.221.2266
Web: www.allied-eng.com

GENERAL NOTES:

1. COORDINATE TANK LOCATION TO FACILITATE SERVICE CLEARANCE FOR ALL EQUIPMENT AT THE MEZZANINE AREA.

2. STORAGE TANK SHALL INCLUDE FACTORY MOUNTED LEVEL CONTROL SYSTEM WITH CONTROL PANEL AND ALARMING TO ACTIVATE (E)SUBMERSIBLE WELL PUMP, UPON DROP IN WATER LEVEL AND DE-ACTIVATION UPON SENSING FULL TANK. LEVEL CONTROL SHALL ALL NECESSARY RELAYS AND DEVICES REQUIRED TO PROVIDE NECESSARY INTERFACE BETWEEN LEVEL CONTROLLER AND PUMP STARTER. COORDINATE W/DIVISION 16.

KEYED NOTES:

1. PLYWOOD BASE CONSISTING OF (3)4'x6' 3/4" PLYWOOD SHEETS STACKED AND FASTENED TOGETHER AND FASTENED TO FLOOR SECURELY. SPAN 4 FRAMING MEMBERS. COVER BASE COMPLETELY WITH EPDM MEMBRANE PRIOR TO INSTALLING TANK.

2. 305 GALLON LOW PROFILE BLACK VERTICAL POLY TANK EQUAL TO AMERICAN TANK COMPANY MODEL No. 005-005. TANK SHALL BE LISTED AND APPROVED FOR POTABLE USE. INSULATE TANK PER SPECIFICATION SECTION 15083.

3. BASE MOUNTED BOOSTER VARIABLE SPEED PUMP.

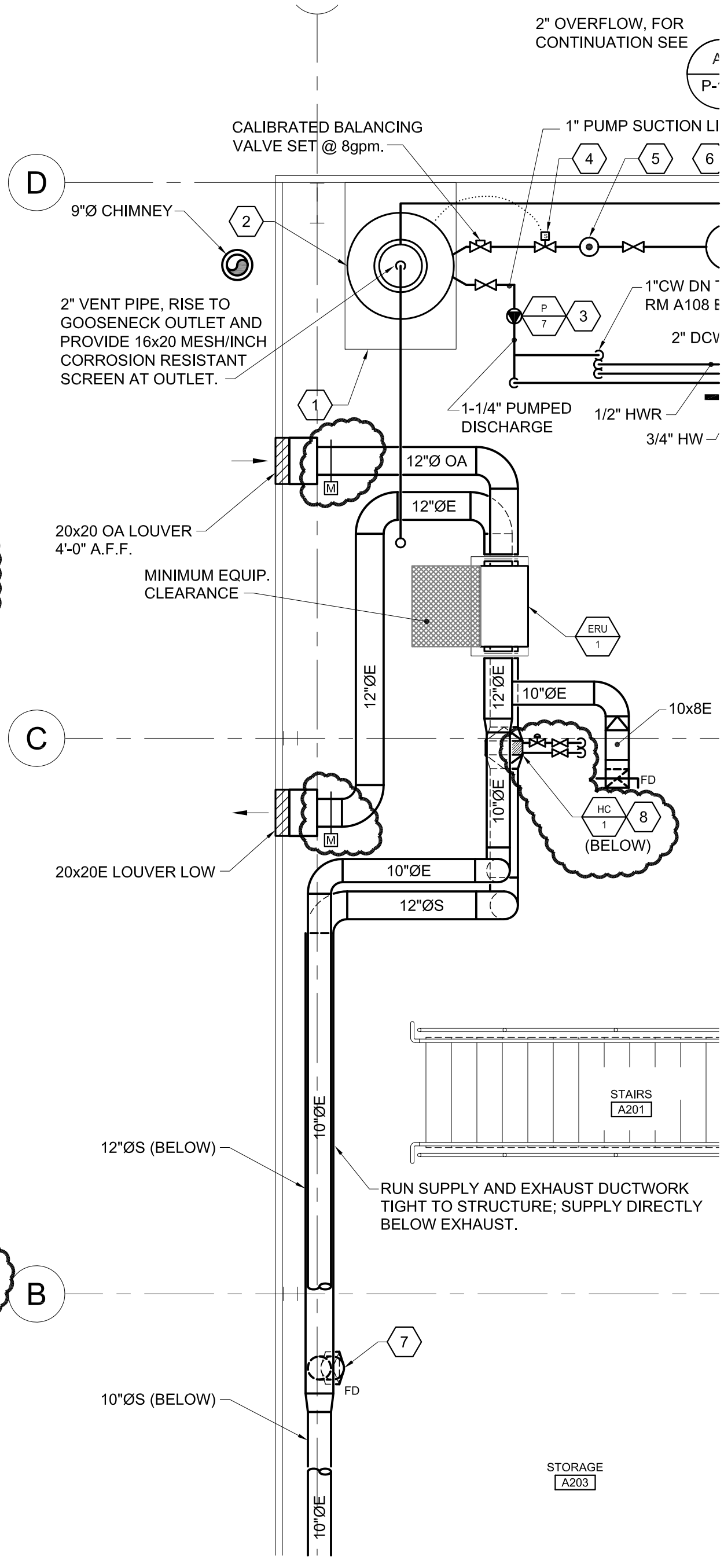
4. SOLENOID VALVE SHALL BE PIPE LINE SIZE, BRASS, EQUAL TO ASCO 8210 SERIES, NORMALLY CLOSED, 24v OR 120v ACTUATOR IS ACCEPTABLE. VALVE SHALL BE CONTROLLED VIA COMPACT RELAY CONTROLLER SUBMITTED W/"WELL BOOSTER PUMP & TANK" SUBMITTAL.

5. WATER HAMMER ARRESTOR SHALL BE EQUAL TO ZURN Z-1700, SIZE 200.

6. HYDROPNEUMATIC WELL TANK W/ CONTROLLER, FOR DETAIL SEE F3, SHEET P-101.

7. 10"ØS DROP. TRANSITION TO 14x6S AND PROVIDE VD IN VERTICAL, FD AT FLOOR.

8. PROVIDE SHUT-OFF VALVES WITH LOW POINT DRAIN AND HIGH POINT MANUAL AIR VALVE AT HC-1.



REVISED MECHANICAL PART PLAN ~ HVAC EQUIPMENT MEZZANINE A202
A1, SHEET M-102

SKM-02

MDOT - REGION 3 ~ HIGHWAY MAINTENANCE GARAGE
BETHEL, MAINE

Scale: 1/4" = 1'-0" | Date: 04-10-2008 | Project No: 07072 | Cad File: 07072M.DWG

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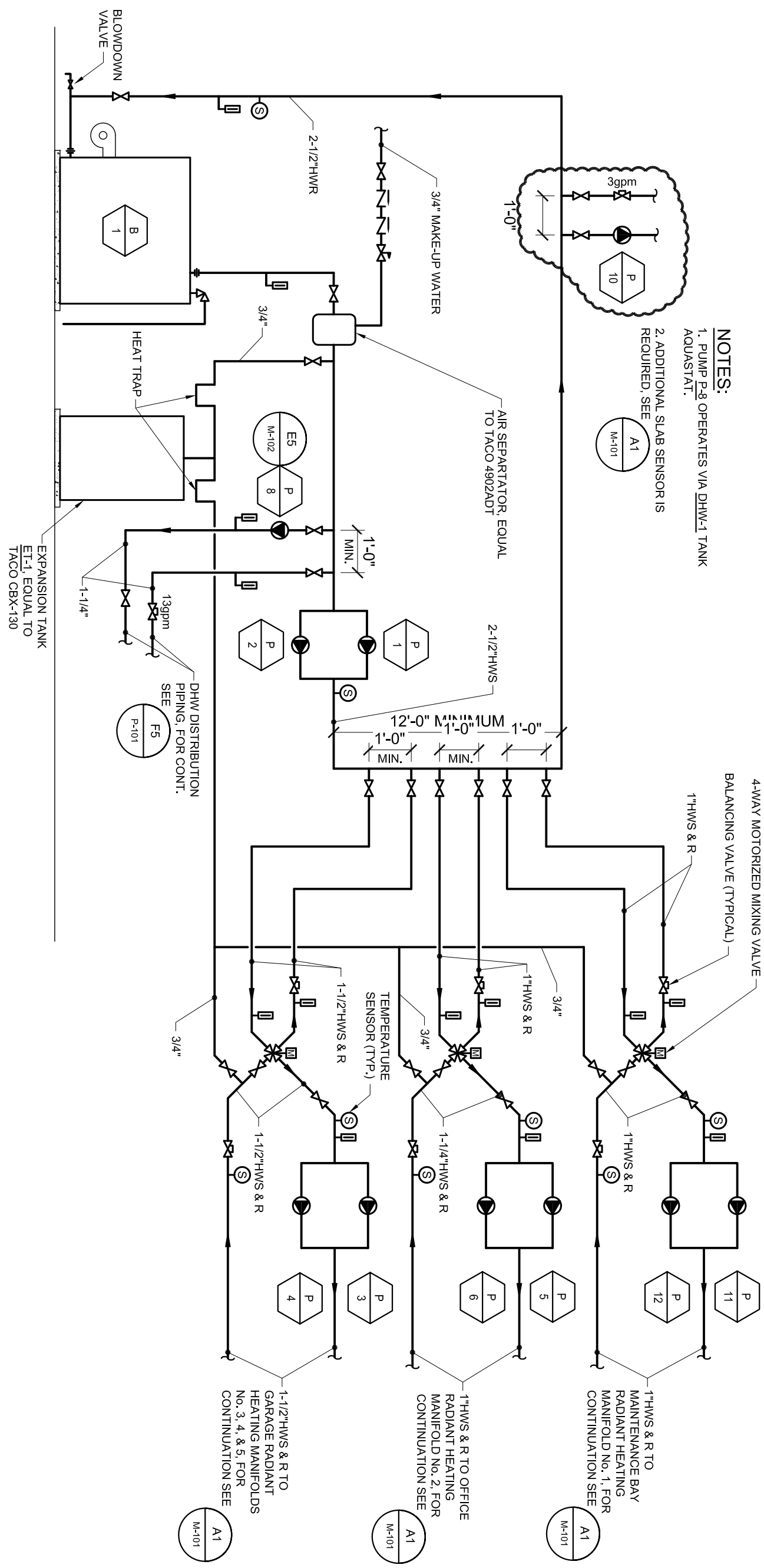

REVISED DETAIL ~ BOILER ROOM PIPING SCHEMATIC
A5, SHEET M-102

SKM-03

MDOT - REGION 3 ~ HIGHWAY MAINTENANCE GARAGE
BETHEL, MAINE

Scale: NONE	Date: 04-10-2008	Project No: 07072	Cad File: 07072M.DWG

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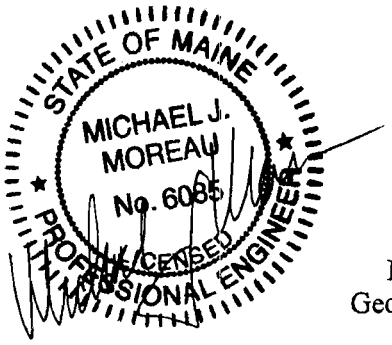
Maine Department of Transportation

Highway Program
Geotechnical Section

GEOTECHNICAL DESIGN REPORT
for
BETHEL HIGHWAY MAINTENANCE GARAGE
BETHEL, MAINE



Prepared by:

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Geotechnical Design Engineer

Oxford County PIN 14448.10 Soils Report 2007-15

December 2007

TABLE OF CONTENTS

Section Page

1.0 GEOTECHNICAL DESIGN AND CONSTRUCTION SUMMARY

This report summarizes our geotechnical engineering evaluations for the Bethel Highway Maintenance Garage in the Town of Bethel, Oxford County, Maine. The design and construction recommendations below are discussed in greater detail in Section 4.0, Evaluation and Recommendations.

1.1 Foundation and Floor Slab Design

- Spread footings may be used to support the structure. Proportion the footings using a maximum footing bearing pressure of 4000 psf. A bearing pressure of 4000 psf will satisfy both bearing capacity and settlement criteria provided the contractor follows the recommended site preparations.
- Foundation settlement will be negligible and less than ½-inch for foundations bearing on compacted native soil or structural fill and with bearing pressures less than or equal to 4000 psf.
- Minimum column and perimeter wall footing widths shall be 30 inches and 24 inches, respectively.
- Use a modulus of subgrade reaction of 200 pounds per cubic inch to design the soil-supported floor slab.
- Use a polyethylene vapor barrier beneath slabs that will be covered with impermeable floor finishes.
- No retaining walls are currently required for the project. Contact the MaineDOT project geotechnical engineer for wall design parameters if the need for retaining walls arises during design.
- Use Site Class D Stiff Soil Profile and 0.9 and 0.32 spectral response values as presented in the International Building Code (IBC) to develop seismic design parameters.

1.2 Site Preparation

- Control surface and groundwater so that all construction is performed in the dry. Use temporary ditches to divert surface water, and sumps with centrifugal pumps to remove accumulated surface or groundwater from the footing excavations.
- Strip the building site of topsoil, vegetation, old foundations, tree stumps, roots, construction debris, and surface soils containing organic material. Strip the planned building footprint and a strip at least 10 feet wide around the building and any future pavement areas.
- Excavate the floor slab area one foot below bottom of slab in native granular soil areas (northwest building half) and two feet below bottom of slab in native organic soil areas (southeast building half).
- Excavate all organic soils beneath perimeter and column footing locations as it occurs and replace with 703.20 Gravel Borrow compacted to at least 95 percent of modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180).

- Outside the organic soil areas, sample and test the native excavation base soils in the perimeter wall and floor slab areas and compact to at least 95 percent of modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180).
- All excavations shall conform to OSHA requirements.

1.3 Foundation and Floor Slab Construction

- Construct exterior column and perimeter wall footings 6.5 feet below the exterior finish grade at all locations to protect against frost action.
- Construct interior column footings a minimum of 2 feet below the Finish Floor elevation, unless the interior area will be exposed to freezing temperatures during use of the structure. In that case, construct interior column footings 6.5 feet below finish floor elevation.
- Construct all footings and the floor slab on compacted native soil or compacted structural fill meeting the requirements of 703.20 Gravel Borrow. Foundations constructed on soil containing organic material or frozen soil will not be allowed.
- Install foundation drainage as shown in Appendix A, Figure 3, Underdrain Pipe Detail.
- Backfill the perimeter walls using approved native soil material or structural fill meeting the requirements of MaineDOT Standard Specification 703.20, Gravel Borrow. Place and compact 703.20 Gravel Borrow beneath the floor slab area up to the bottom-of-slab elevation. All backfill soils should be placed in 8-inch thick loose lifts and compacted to 95 percent of the modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180). Use light walk-behind compactors near foundation walls and heavy vibratory compactors elsewhere. Bring fill levels up on both sides of foundation walls simultaneously.
- Perform field density tests in any compacted fill soil to verify the level of compaction.
- Floor slabs should be jointed around columns and along walls, and slab crack control joints should be used as appropriate.
- We do not recommend winter construction. If winter construction is required, excavate all frozen ground from the footing locations and replace it with structural fill or ¾-inch crushed stone (MaineDOT 703.22, Type C) up to the footing subgrade level. After excavation and filing, protect footing locations from frost penetration below footing level. Use blankets or heated shelter to prevent frost penetration into the footing subgrade until the foundation is backfilled and the building shell can be erected.
- Verify thawed floor slab subgrade by rod probing or hand auger borings. Compact floor subgrade to 95 percent of the modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180) before constructing the floor slab.

1.4 Final Plan Review and Construction Monitoring

- The MaineDOT project team geotechnical engineer should review final plans and specifications.
- During construction, the geotechnical engineer should observe:
  - Building site preparation and excavation activities
  - Foundation subgrade preparation prior to placement of footing form work, and
  - Placement and compaction of backfill soils along the perimeter walls and in the floor slab area.

2.0 INTRODUCTION

MaineDOT plans to construct a new 55 X 160 foot, 8-bay highway maintenance garage at the Bethel Maintenance Camp on Route 2 in Bethel, Maine. The site is shown on Figure 1, Site Location Map in Appendix A. The existing 5-bay garage will be demolished and removed from the site before the new garage is constructed at approximately the same location.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site is accessed from Route 2 by a gently upward sloping gravel road. The existing garage bay approach apron is paved. The existing garage is a combination wood and steel framing with a wood exterior. There are signs of vertical differential building settlement evidenced by out of plumb horizontal wood sheathing visible inside the structure along the southeast wall. There are several smaller wooden storage structures southwest of and across the approach apron from the existing maintenance garage. During preparation of this report, no information was available concerning the design and construction of the existing maintenance garage except that it was constructed in stages. The southeasterly most two bays were built first, probably 60 years ago, followed by the remaining three-bay area about 35 years ago. Also, about 15 years ago, the back end of the entire structure (opposite from the garage bay doors) was extended about 15 feet.

The area topography slopes downward moderately from the northwest and more gently downward from the north to the maintenance yard area and proposed garage site. The maintenance yard area is relatively flat. Closed storm drainage is used to capture surface water from the north-northwest directions and is piped to a drainage swale east of the existing garage.

Surficial geology maps of the region indicate that the proposed garage site is primarily underlain by Glacial Lake Bethel deposits which include sand, gravel, silt, and clay deposited in a glacial lake that occupied part of the Androscoggin River. However, the site is also close to a mapped soil unit contact with stream alluvium materials. Stream alluvium soils may include sand, silt, gravel and organic sediment.

3.2 Subsurface Conditions

We drilled four borings in the approximate proposed garage corner locations to investigate the subsurface conditions. The borings were drilled to a depth of approximately 25 to 27 feet below ground surface (bgs) at the locations shown on Figure 2, Boring Location Plan. The drillers detected a slight hydrocarbon odor while drilling at the B-102 location and subsequently drilled two additional borings B1-ENV and B2-ENV. Field photoionization devices did not detect contamination, nevertheless samples were taken for further lab analysis. All of the borings were drilled with the MaineDOT truck-mounted CME 45C. The geotechnical borings were drilled through the period 22 through 27 March 2007 and logged by the MaineDOT drill crew. The

environmental borings were drilled on 18 June 2007 and logged by MaineDOT environmental staff. The environmental logs and evaluation are not covered in this geotechnical report.

In general, the soil units we observed varied widely from one location to another, possibly a result of the close proximity to the contact between the mapped Glacial Lake Bethel deposits and stream alluvium materials. In the soil borings, we found two to four feet of sand with little to some gravel and silt over sandy silt, sand and organic sediments. In borings B-101 and B-102, the organic sediments were underlain by sand with varying amounts of gravel and silt. We observed granular materials for the full depth explored at the B-103 location. At the B-104 location, the sandy silt was underlain by a layer of sand followed by a layer of hard silt. We did not encounter bedrock in any of the borings to the depths explored.

We observed groundwater levels at 6.0 feet below ground surface (bgs) and 3.6 feet bgs in borings B-103 and B-104, respectively, and at about 14.6 feet bgs in both B-101 and B-102. However, the groundwater level will fluctuate with seasonal changes, runoff, and adjacent construction activities. For a more detailed description of the subsurface conditions, please refer to the boring logs in Appendix B, Field Exploration and Test Data.

3.3 Laboratory Testing

We conducted a laboratory soil testing program on selected samples recovered from the test borings to evaluate soil classification, material reuse, and subgrade soil properties. Laboratory testing consisted of 20 grain-size analyses and water content determinations, and 4 ignition tests. Results of laboratory testing are presented in Appendix C, Laboratory Test Data. The AASHTO and USCS soil classification and water content data are also presented on the boring logs in Appendix B.

4.0 EVALUATION and RECOMMENDATIONS

The site of the proposed new highway maintenance garage is suitable for the use of shallow spread footings. However, a portion of the building site is underlain by organic sands. Ignition tests we performed on several soil samples from B-101 and B-102 indicate that the soils in the southeast portion of the building contain five to ten percent organic material.

Constructing foundations on the organic sands would result in unacceptable and unpredictable differential building settlement. Consequently, we recommend excavating the full depth of the organic material (about 12 feet maximum depth) where it occurs beneath planned foundations and placing and compacting approved structural fill up to the footing subgrade level. The structural fill requirements should conform to 703.20 Gravel Borrow in the MaineDOT Standard Specifications.

4.1 Foundation and Floor Slab Design

Although the design loads for the new garage are currently unknown, we understand that loads for a pre-engineered building of this size may be on the order of 30 to 50 kips for column loads

and 15 kips per foot or less for perimeter wall loads. We are presently also unaware of any unusually heavy foundation loads such as elevators or vehicle lifts. The final building design loads will depend on the building manufacturer, wind and snow loads for the site, load and performance criteria, required factors of safety (FS), and any other pertinent code requirements. The building designer should include grade beams or continuous walls with footings on the exterior perimeter to provide for frost protection of the floor slab adjacent to the exterior walls.

4.1.1 Bearing Capacity

We anticipate that the building foundations will be built on compacted native granular soil or compacted structural fill. Based on our evaluation and the anticipated foundation subgrade conditions, we recommend that the building designer proportion the footings using an allowable maximum bearing pressure of 4000 psf or less.

We recommend minimum column and wall footing widths 30 inches and 24 inches, respectively, regardless of allowable bearing pressures. To verify that the foundation bearing conditions are consistent with our findings in the boring exploration, we recommend that the exposed footing subgrade be observed and approved by a geotechnical engineer.

4.1.2 Settlement

Based on our analysis, we estimate that total and differential foundation settlement will be less than ½-inch for foundations bearing on compacted native granular soil or compacted structural fill and with bearing pressures less than or equal to 4000 psf. Any anticipated settlement will occur rapidly as the foundations and building are constructed. We expect that post-construction settlements will be negligible.

4.1.3 Groundwater Table

We encountered the groundwater table at 3.6 to 14.6 feet bgs at the time of the boring exploration. Thus, we expect that groundwater levels will occur above the footing bearing level. We recommend that the contractor install a perimeter foundation drain connected to the planned site drainage systems. This underdrain will remove groundwater from under the building location which will help prevent groundwater accumulation and minimize frost action on the perimeter wall and column footings.

4.1.4 Frost Depth

We evaluated the potential frost depth considering the MaineDOT Design Freezing Index and the Modified Berggren equation as presented in the MaineDOT Bridge Design Guide, 2003. The design freezing index for Bethel, Maine, is 1580 F-degree days. Based on our evaluation, we estimate a frost depth of 6.5 feet for the project site.

4.1.5 Retaining Walls

We do not anticipate the need for retaining walls as part of the current project. However, depending on the final building location, the northerly building walls may require retaining wall design. The site topography rises in that area. If retaining walls become necessary, we recommend that the building designer contact us regarding retaining wall design parameters.

4.1.6 Floor Slab Design

We recommend that the building designer specify a soil supported grade slab for the proposed structure. The designer should use a modulus of subgrade reaction of 200 pounds per cubic inch to design the soil-supported floor slab. We recommend that the building designer use a polyethylene vapor barrier beneath any portion of the floor slab that will be covered with impermeable floor finishes.

4.1.7 Seismic Design Parameters

For seismic design considerations, we recommend that the building designer characterize the site as Site Class D, Stiff Soil Profile according to provisions in the IBC which is the basis for the Maine Model Building Code. The designer should use values of 0.09 and 0.32 for the 1.0 second and the 0.2 second site spectral response accelerations, respectively, as presented in the IBC to develop seismic design parameters.

4.2 Site Preparation

We recommend that the contractor strip the building site of topsoil, vegetation, old foundations, tree stumps, roots, construction debris, and surface soils containing organic material. The stripped area should include the planned building footprint and a strip at least 10 feet wide around the building and any future pavement areas.

The contractor should divert and control surface and groundwater throughout the period of construction so that all construction is performed in the dry. The contractor should use temporary ditches to divert surface water, and sumps with centrifugal pumps to remove accumulated surface or groundwater from the floor slab and footing excavations.

We recommend that the contractor excavate the floor slab area one foot below bottom of slab in native granular soil areas (northwest building half) and two feet below bottom of slab in native organic soil areas (southeast building half). In addition, the contractor must excavate all organic soils beneath the perimeter and column footing locations wherever it occurs. We estimate that these excavations will be on the order of 12 feet bgs or less. All excavations should conform to OSHA requirements.

We recommend that the contractor replace the excavated organic soils with compacted structural fill consisting of 703.20 Gravel Borrow. The contractor should place the fill in 8-inch thick lifts

loose measure and compact it to at least 95 percent of modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180).

In the perimeter wall and floor slab areas where the native granular soil does not contain organic material, the contractor should sample and test the native soil to determine the modified Proctor maximum dry density and optimum water content (ASTM D 1557, AASHTO T-180). Before placing structural fill or forming and casting foundations in these locations, we recommend that the contractor compact the native soil to 95 percent of the modified Proctor maximum dry density. We recommend that compaction levels be verified with field density tests in any compacted native soil or structural fill soil.

4.3 Foundation and Floor Slab Construction

4.3.1 Foundation Construction

After compacting the native soil or structural fill in the foundation base, we recommend that the contractor cast the perimeter wall footings and exterior column footings 6.5 feet below the planned exterior finish grade elevation to protect against frost action. Interior column footings may be constructed a minimum of 2 feet below the finish floor elevation, unless the interior area will be exposed to freezing temperatures during use of the structure. In that case, the contractor should construct the interior column footings 6.5 feet below finish floor elevation.

The contractor should construct all footings and the floor slab on compacted native soil or compacted structural fill meeting the requirements of 703.20 Gravel Borrow. Foundations constructed on soil containing organic material or frozen soil will not be allowed.

When underdrain installation is complete as described below, the contractor may backfill the perimeter wall and column locations using approved native soil material (non organic) or structural fill meeting the requirements described above, to a level two feet below the bottom of slab elevation. The contractor should place the fill in 8-inch thick lifts loose measure and compact it to at least 95 percent of the modified Proctor maximum dry density (ASTM D 1557, AASHTO T-180).

Small walk-behind compactors with a minimum static weight of 400 lbs should be used within three feet of the foundation wall to limit lateral stress on the wall. The contractor should also place and compact fill on both sides of the perimeter walls simultaneously to minimize lateral movement of the walls. We recommend that the contractor use large vibratory compaction equipment with a minimum static weight of 10000 lbs to compact fill soils away from the foundation walls.

4.3.2 Foundation Drainage

We recommend that the contractor install a foundation underdrain outside the perimeter wall footing as shown on Figure 3 in Appendix A. The underdrain should be embedded in a

minimum 6-inch thick layer of ¾-inch crushed stone all around the pipe and should be connected to planned closed drainage systems, or the outlet should be daylighted.

4.3.3 Floor Slab Construction

We recommend that the contractor compact the native soil subgrade in the floor slab area to 95 percent of the modified Proctor maximum dry density before placing any structural fill. The contractor may then place and compact structural fill using the previously described method and materials up to the bottom-of-slab elevation.

During construction, the contractor should joint the slab around columns and along walls, and provide slab crack control joints so that the slab and foundations may move differentially without damage. The contractor may use dowels or keys in the slab to permit rotational movement between parts of the slab while minimizing cracks and sharp vertical displacements. The contractor should install a polyethylene vapor barrier beneath any portion of the floor slab that will be covered with impermeable floor finishes.

4.3.4 Winter Construction

We do not recommend winter building construction and we presently do not anticipate the need for winter construction. Nevertheless, if winter construction is required, the contractor should excavate all frozen ground from the footing locations and replace it with structural fill or ¾-inch crushed stone (MaineDOT 703.22, Type C) up to the footing subgrade level. After excavation and fill placement, the footing locations must be protected from frost penetration below the footing level. This may require blankets or heated shelter to prevent frost penetration into the footing subgrade until the foundation is backfilled and the building shell can be erected.

The floor slab subgrade must be free of all frozen ground before casting the floor slab. Differential settlement and premature structural cracking of the floor slab will result in adjacent sections of the floor slab if any portion is built over frozen ground. We recommend rod probing and small test pits (hand augers) to determine whether or not the frost is gone out of the subgrade soil. After frost has thawed, the floor slab subgrade should be compacted to 95% of the T-180 maximum dry density.

4.4 Final Plan Review and Construction Monitoring

We recommend that the MaineDOT geotechnical engineer review the final drawings and specifications to confirm that the earthwork and foundation recommendations are properly interpreted and implemented in the design and specifications. We also recommend that the geotechnical engineer observe and evaluate the following building and foundation construction phases:

- Building site preparation and excavation activities
- Foundation subgrade preparation prior to placement of footing formwork, and

- Placement and compaction of backfill soils around the perimeter walls and in the floor slab area.

5.0 CLOSURE

This report has been prepared for use by the MaineDOT project team for specific application to the Bethel Highway Maintenance Garage replacement project. The report has been prepared in accordance with generally accepted soil and foundation engineering practices. No other intended use or warranty is expressed or implied.

In the event that any changes in the nature, design, or location of the proposed building are planned, this report should be reviewed by a geotechnical engineer to assess the appropriateness of the conclusions and recommendations and to modify the recommendations as appropriate to reflect the changes in design. Further, the analyses and recommendations are based in part upon limited soil explorations completed at discrete locations on the project site. If variations from the conditions encountered during the investigation appear evident during construction, it may also become necessary to re-evaluate the recommendations made in this report.

REFERENCES

Bowles, Joseph E. (1982), Foundation Analysis and Design, 3rd Edition, McGraw-Hill, New York, NY.

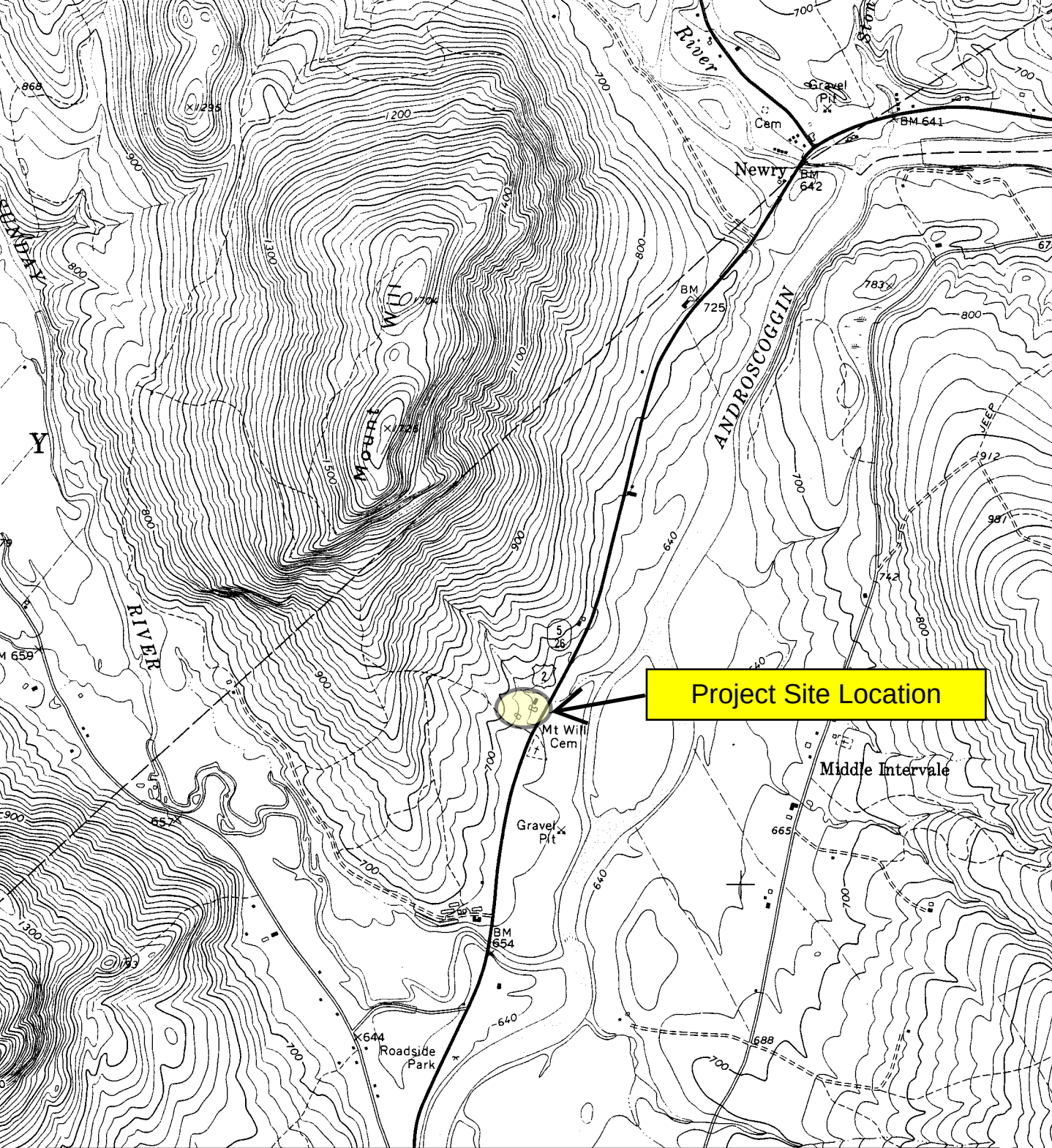
Fang, Hsai-Yang (1991), Foundation Engineering Handbook, Second Edition, Van Nostrand Reinhold, New York, NY.

International Code Council, Inc. (2006), International Building Code, International Code Council, Country Club Hills, IL.

MaineDOT, (2003) Bridge Design Guide, MaineDOT Bridge Program, Augusta, ME.

APPENDIX - A

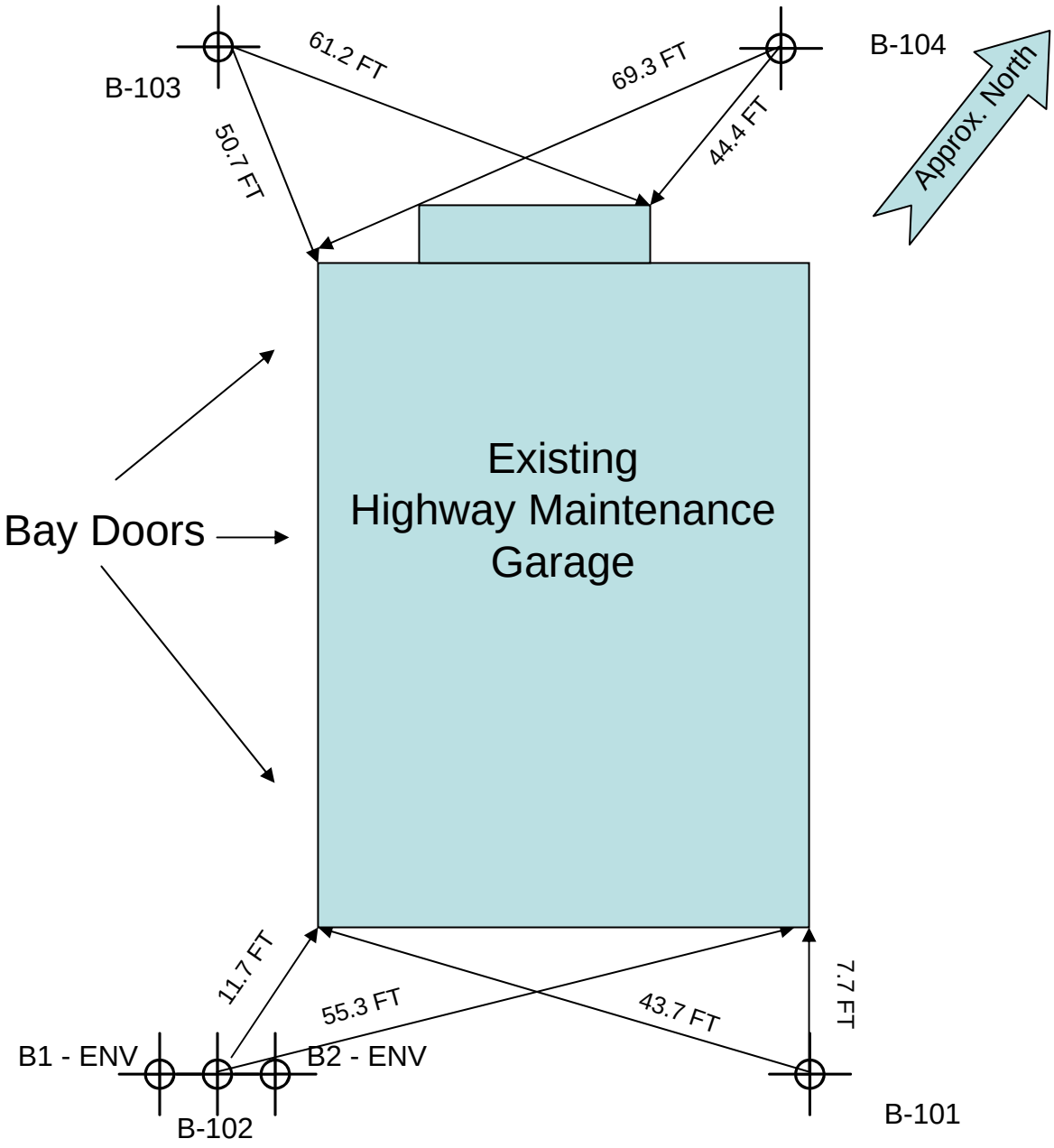
Figures



Site Location Map
Bethel Highway Maint. Garage

Maine Department Of Transportation

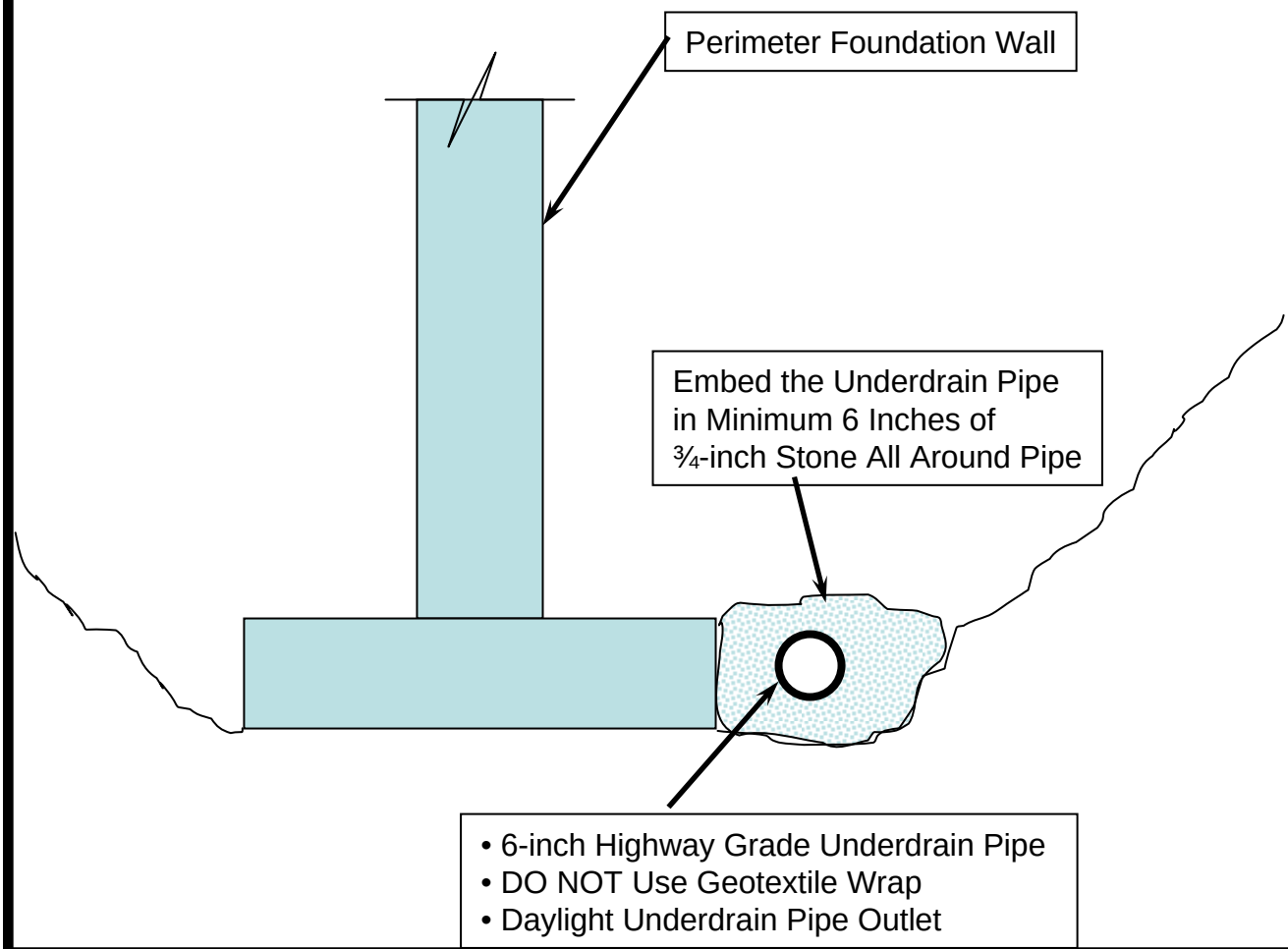
FIGURE 1



Boring Location Plan
Bethel Highway Maintenance Garage
PIN 14448.10

(Not To Scale)

Maine Department of Transportation	Figure 2



Underdrain Pipe Detail
Bethel Highway Maintenance Garage
PIN 14448.10

(Not To Scale)

Maine Department of Transportation	Figure 3

APPENDIX - B

Field Exploration and Test Data

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: New 8-Bay Highway Maintenance Garage
Location: Route 2, Bethel, Maine

Boring No.: B-101
PIN: 14448.10

Driller:	MaineDOT	**Elevation (ft.)**	98.52	**Auger ID/OD:**	2.5/6.25"
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/07; 10:30-14:00	**Drilling Method:**	Hollow Stem Auger	**Core Barrel:**	N/A
Boring Location:	Southeast Building Corner	**Casing ID/OD:**	N/A	**Water Level*:**	14.6' bgs.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1A		0.0 - 2.2			HSA			Brown, damp, fine to coarse SAND, little gravel and silt. Sample 1A was taken from auger flights.	G#176041 A-1-b, SM WC=11.2%
	1D	24/16	2.5 - 4.5	17/14/8/7	22		96.32		2.2 Dark brown, moist, medium dense, fine to medium SAND, trace coarse sand, little gravel, some silt, organic and wood materials present.	G#176042 A-2-4, SM WC=23.7%
5	2D	24/6	5.0 - 7.0	1/1/1/3	2		93.52		5.0 Brown, moist, very loose, silty fine to medium SAND, trace coarse sand and gravel.	
	3D	24/18	7.5 - 9.5	1/1/3/3	4		91.02		7.5 Grey-brown to dark brown, moist, very loose, fine to medium SAND, trace coarse sand and gravel, some silt, organic and wood materials present.	G#176043 A-2-4, SM WC=46.7%
10	4D	24/18	10.0 - 12.0	3/6/7/11	13		88.02		10.5 Light brown, damp, medium dense to dense, fine to coarse SAND, little gravel, trace silt.	G#176044 A-1-b, SP WC=3.8%
	5D	24/19	12.5 - 14.5	6/15/16/47	31		85.52		13.0 Reddish-brown, damp, dense, fine to coarse SAND, trace gravel and silt.	
15	6D	24/23	15.0 - 17.0	6/6/7/7	13		83.52		15.0 Grey-brown, saturated, medium dense, fine to medium SAND, trace coarse sand and gravel, some silt, dilatant.	G#176045 A-2-4, SM WC=16.3%
20	7D	24/24	20.0 - 22.0	45/14/19/22	33		78.52		20.0 Light brown, saturated, dense, fine to medium SAND, little gravel, trace silt dilatant,.	
							74.52		24.0 Light brown, wet, very dense, fine to medium silty SAND, trace coarse sand and gravel.	
25	8D	24/24	25.0 - 27.0	9/32/35/53	67					G#176046 A-4, SM

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: New 8-Bay Highway Maintenance Garage
Location: Route 2, Bethel, Maine

Boring No.: B-101
PIN: 14448.10

Driller:	MaineDOT	**Elevation (ft.)**	98.52	**Auger ID/OD:**	2.5/6.25"
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/07; 10:30-14:00	**Drilling Method:**	Hollow Stem Auger	**Core Barrel:**	N/A
Boring Location:	Southeast Building Corner	**Casing ID/OD:**	N/A	**Water Level*:**	14.6' bgs.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
							71.52			WC=16.3%
									Bottom of Exploration at 27.0 feet below ground surface. 27.0	
									NO REFUSAL	
30										
35										
40										
45										
50										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: New 8-Bay Highway Maintenance Garage
Location: Route 2, Bethel, Maine

Boring No.: B-102
PIN: 14448.10

Driller:	MaineDOT	**Elevation (ft.)**	98.75	**Auger ID/OD:**	HSA 2.5/6.25"
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/27/07; 07:00-10:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	Southwest Building Corner	**Casing ID/OD:**	NW	**Water Level*:**	14.5' bgs.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						HSA	98.35		PAVEMENT. 0.4	
	1D	24/14	1.0 - 3.0	6/7/5/7	12				Brown, damp, loose to medium dense, fine to coarse SAND, some gravel, little silt.	G#176047 A-1-b, SM WC=7.6%
	2D	24/14	3.0 - 5.0	3/3/3/2	6					
							94.25		4.5	
5	3D	24/18	5.0 - 7.0	3/9/5/5	14				Dark brown, moist, medium dense, fine to medium SAND, little to some gravel, trace to little silt, organic and wood materials present.	G#176048 A-1-b, SP-SM WC=23.5%
	4D	24/17	7.0 - 9.0	7/9/10/19	19					G#176049 A-1-b, SM WC=28.5%
	5D	24/20	9.0 - 11.0	2/2/2/5	4					
10							88.75		10.0	
									Grey-brown, moist, very loose, silty fine to medium SAND, organic and wood materials present.	
							87.25		11.5	
	6D	24/20	12.0 - 14.0	7/12/11/9	23				Light brown, wet, medium dense to dense, fine to coarse SAND, little gravel, trace silt.	
	7D	24/18	14.0 - 16.0	9/15/24/25	39	38				
15						49				
						80				
						73				
						64				
	8D	24/15	19.0 - 21.0	14/12/10/10	22	32	79.75		19.0	
20						24			Light brown, wet, medium dense, fine to coarse SAND, trace gravel and silt.	
						33				
						46				
						57				
	9D	24/18	24.0 - 26.0	20/20/33/52	53					
25							73.75		25.0	
									Grey-brown, wet, very dense, fine to medium SAND, trace silt.	

Remarks:

Used Auto Hammer on Casing, 140#/30".
Slight GAS ODOR.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: New 8-Bay Highway Maintenance Garage
Location: Route 2, Bethel, Maine

Boring No.: B-102
PIN: 14448.10

Driller:	MaineDOT	**Elevation (ft.)**	98.75	**Auger ID/OD:**	HSA 2.5/6.25"
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/27/07; 07:00-10:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	Southwest Building Corner	**Casing ID/OD:**	NW	**Water Level*:**	14.5' bgs.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
							72.75		26.0 **Bottom of Exploration at 26.0 feet below ground surface.** NO REFUSAL	

Remarks:

Used Auto Hammer on Casing, 140#/30".
Slight GAS ODOR.

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: New 8-Bay Highway Maintenance Garage
Location: Route 2, Bethel, Maine

Boring No.: B-103
PIN: 14448.10

Driller:	MaineDOT	**Elevation (ft.)**	100.43	**Auger ID/OD:**	2.5/6.25"
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/22/07-3/23/07	**Drilling Method:**	Hollow Stem Auger	**Core Barrel:**	N/A
Boring Location:	Northwest Building Corner	**Casing ID/OD:**	N/A	**Water Level*:**	6.0' bgs.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						HSA	100.26		PAVEMENT. 0.2	
	1D	24/18	1.0 - 3.0	29/23/6/6	29				Light brown, wet, loose to medium dense, fine to coarse SAND, little gravel, little to some silt.	G#176050 A-2-4, SM WC=14.7%
	2D	24/4	3.0 - 5.0	2/2/3/3	5				Similar to above, but saturated.	
5	3D	24/8	5.0 - 7.0	2/2/5/7	7					G#207701 A-1-b, SW-SM WC=15.7%
	4D	20/20	7.5 - 9.2	4/22/42/50(2.4")	64		92.43		8.0 Grey-brown, wet, very dense, fine to medium SAND, trace to little gravel, some silt. Cobble from 9.2-9.5' bgs.	G#207702 A-4, SM WC=16.5%
10	5D	18/18	10.0 - 11.5	20/47/50	97					G#207703 A-2-4, SM WC=15.3%
	6D	18/18	12.5 - 14.0	29/40/50	90		87.43		13.0 Grey-brown, wet, very dense, fine to medium SAND, trace silt. Cobbles from 14.0-14.2' bgs.	
15	7D	9/9	15.0 - 15.8	42/50(3.6")	---		85.43		15.0 Light brown, wet, very dense, fine to coarse SAND, little gravel, some silt.	G#207704 A-2-4, SM WC=12.4%
							81.43		19.0 Light brown to orange-brown, wet, very dense, fine to medium SAND, little silt, with several hard clay-silt layers approximately 1-inch thick.	
20	8D	24/23	20.0 - 22.0	10/29/34/46	63					
25							75.43		Similar to 8D on auger. Running sand in auger. Did not get sample, rod was stuck in auger. 25.0 **Bottom of Exploration at 25.0 feet below ground surface.** NO REFUSAL	

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: New 8-Bay Highway Maintenance Garage
Location: Route 2, Bethel, Maine

Boring No.: B-104
PIN: 14448.10

Driller:	MaineDOT	**Elevation (ft.)**	103.79	**Auger ID/OD:**	5" Solid Stem
Operator:	E. Giguere	**Datum:**	NAVD 88	**Sampler:**	Standard Split Spoon
Logged By:	B. Wilder	**Rig Type:**	CME 45C	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	3/26/07; 10:00-15:00	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	N/A
Boring Location:	Northeast Building Corner	**Casing ID/OD:**	NW	**Water Level*:**	3.6' bgs.

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
R = Rock Core Sample
V = Insitu Vane Shear Test
SSA = Solid Stem Auger

Definitions:
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WOH = weight of 140lb. hammer
WOR = weight of rods

Definitions:
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-value	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0						SSA	103.62		PAVEMENT. 0.2	
	1D/A	24/20	1.0 - 3.0	8/16/26/13	42		102.29		Brown, damp, fine to coarse SAND, little gravel and silt. (1D) 1.0-1.5' bgs. 1.5	G#207705 A-1-b, SW-SM WC=8.6%
									(1D/A) 1.5-3.0' bgs. Grey-brown, wet, dense, fine to medium SAND, trace coarse sand and gravel, some silt.	G#207706 A-2-4, SM WC=16.9%
	2D	24/13	3.0 - 5.0	12/10/8/8	18		100.29		3.5 Brown, saturated, medium dense, fine to medium SAND, trace coarse sand and gravel, little silt.	G#207707 A-2-4, SM WC=19.3%
5										
	3D	24/16	5.0 - 7.0	5/7/8/8	15	12				
						17				
	4D	18/16	7.5 - 9.0	18/19/28	47	39	96.29		7.5 Grey-brown, wet, hard, fine to coarse sandy SILT, trace gravel.	
						48				
	5D	16.8/16.8	9.0 - 10.4	31/39/60(4.8")	---	30				G#207990 A-4, SM WC=13.6%
10						53			Roller Coned ahead from 10.4-12.0' bgs.	
						36				
	6D	5/2	12.0 - 12.4	60(4.8")	---	39			Cobble from 12.4-12.6' bgs.	
						36				
	7D	12/5	14.0 - 15.0	47/55	---	37	89.79		14.0 Brown, wet, very dense, fine to coarse SAND, little silt, rock fragments.	G#207709 A-1-b, SP-SM WC=10.5%
15						31			Cobble from 15.0-15.3' bgs. Roller Coned ahead to 16.0' bgs.	
						72				
						166	86.79		17.0	
						142				
	8D	12/9	19.0 - 20.0	35/60	---	OPEN HOLE			Grey-brown, wet, hard, SILT, little sand, trace gravel, with silty fine sand seams, mottled. Glaciomarine	G#207710 A-4, CL-ML WC=23.3%
20										
	9D	12/6	24.0 - 25.0	27/57	---		78.79		25.0 **Bottom of Exploration at 25.0 feet below ground surface.** NO REFUSAL	
25										

Remarks:

Used Auto Hammer on Casing, 140#/30".

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.

* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

APPENDIX - C

Laboratory Test Data

State of Maine - Department of Transportation

~~Laboratory Testing Summary Sheet~~

Town(s): Bethel Project Number: 14448.10

Boring & Sample Identification Number	Station (Feet)	Offset (Feet)	Depth (Feet)	Reference Number	G.S.D.C. Sheet	W.C.	*Ign. Loss		Classification		
							Loss%	H2O%	Unified	AASHTO	Frost
B-101, 1A	SEBC		0.0-2.2	176041	1	11.2			SM	A-1-b	II
B-101, 1D	SEBC		2.5-4.5	176042	1	23.7	5.3	23.7	SM	A-2-4	II
B-101, 3D	SEBC		7.5-9.5	176043	1	46.7	10.6	46.7	SM	A-2-4	II
B-101, 4D	SEBC		10.0-12.0	176044	1	3.8			SP	A-1-b	0
B-101, 6D	SEBC		15.0-17.0	176045	1	16.3			SM	A-2-4	II
B-101, 8D	SEBC		25.0-27.0	176046	1	16.3			SM	A-4	III
B-102, 1D	SWBC		1.0-3.0	176047	2	7.6			SM	A-1-b	II
B-102, 3D	SWBC		5.0-7.0	176048	2	23.5	5.0	23.5	SP-SM	A-1-b	0
B-102, 4D	SWBC		7.0-9.0	176049	2	28.5	6.5	24.2	SM	A-1-b	II
B-103, 1D	NWBC		1.0-3.0	176050	3	14.7			SM	A-2-4	II
B-103, 3D	NWBC		5.0-7.0	207701	3	15.7			SW-SM	A-1-b	0
B-103, 4D	NWBC		7.5-9.2	207702	3	16.5			SM	A-4	III
B-103, 5D	NWBC		10.0-11.5	207703	3	15.3			SM	A-2-4	II
B-103, 7D	NWBC		15.0-15.8	207704	3	12.4			SM	A-2-4	II
B-104, 1D	NEBC		1.0-1.5	207705	4	8.6			SW-SM	A-1-b	0
B-104, 1D/A	NEBC		1.5-3.0	207706	4	16.9			SM	A-2-4	II
B-104, 2D	NEBC		3.0-5.0	207707	4	19.3			SM	A-2-4	II
B-104, 5D	NEBC		9.0-10.4	207990	4	13.6			SM	A-4	III
B-104, 7D	NEBC		14.0-15.0	207709	4	10.5			SP-SM	A-1-b	0
B-104, 8D	NEBC		19.0-20.0	207710	4	23.3			CL-ML	A-4	IV
							*Ign.=Ignition				

SEBC= Southeast Building Corner

SWBC= Southwest Building Corner

NWBC= Northwest Building Corner

NEBC= Northeast Building Corner

Classification of these soil samples is in accordance with AASHTO Classification System M-145-40. This classification is followed by the "Frost Susceptibility Rating" from zero (non-frost susceptible) to Class IV (highly frost susceptible). The "Frost Susceptibility Rating" is based upon the MDOT and Corps of Engineers Classification Systems.

GSDC = Grain Size Distribution Curve as determined by AASHTO T 88-93 (1996) and/or ASTM D 422-63 (Reapproved 1998)

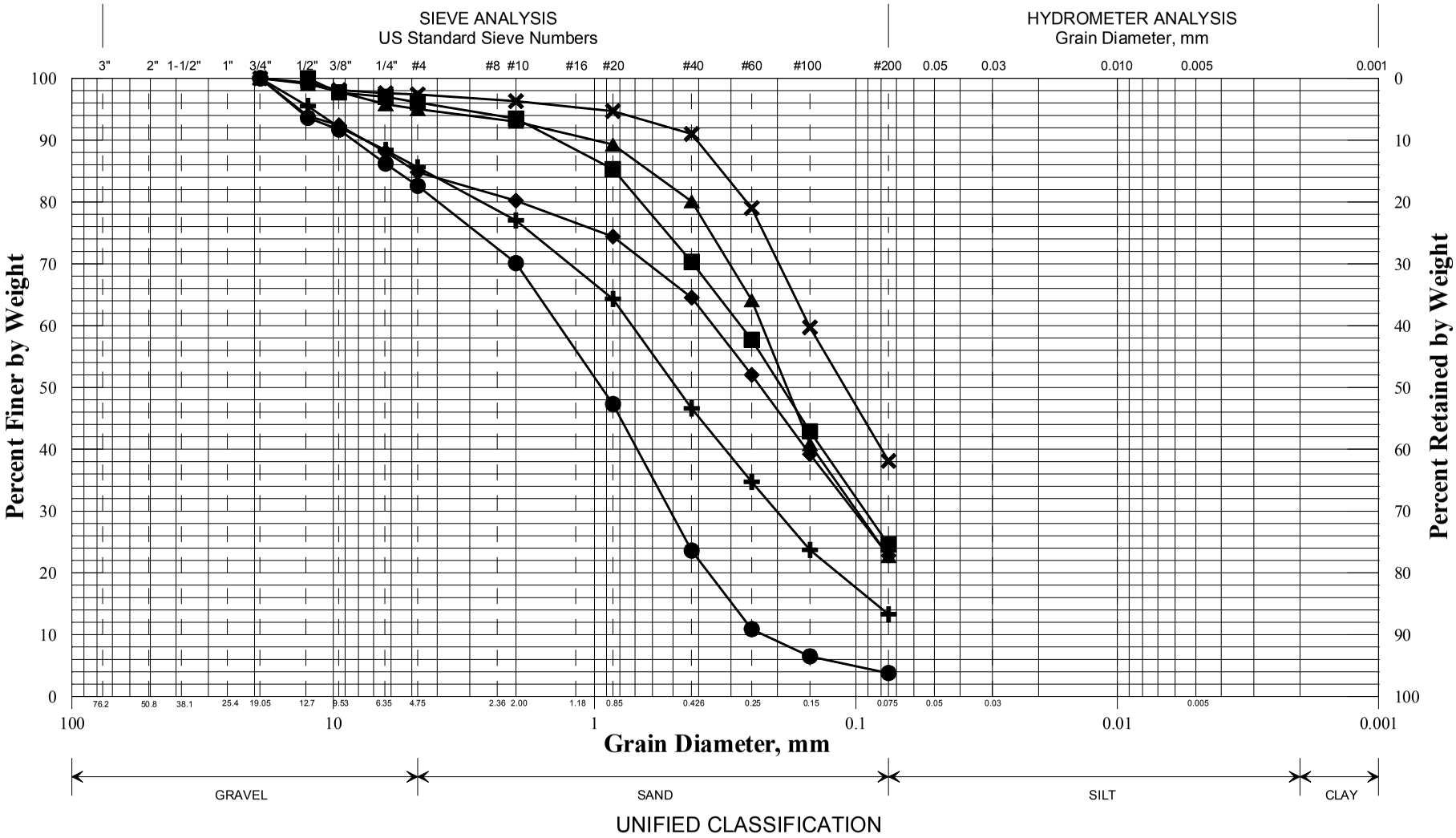
WC = water content as determined by AASHTO T 265-93 and/or ASTM D 2216-98

LL = Liquid limit as determined by AASHTO T 89-96 and/or ASTM D 4318-98

PI = Plasticity Index as determined by AASHTO 90-96 and/or ASTM D4318-98

State of Maine Department of Transportation

GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	B-101/1A	SEBC		0.0-2.2	SAND, little gravel, little silt.	11.2			
◆	B-101/1D	SEBC		2.5-4.5	SAND, some silt, little gravel.	23.7			
■	B-101/3D	SEBC		7.5-9.5	SAND, some silt, trace gravel.	46.7			
●	B-101/4D	SEBC		10.0-12.0	SAND, little gravel, trace silt.	3.8			
▲	B-101/6D	SEBC		15.0-17.0	SAND, some silt, trace gravel.	16.3			
✕	B-101/8D	SEBC		25.0-27.0	Silty SAND, trace gravel.	16.3			

PIN
014448.10
Town
Bethel
Reported by/Date
WHITE, TERRY A 5/16/2007

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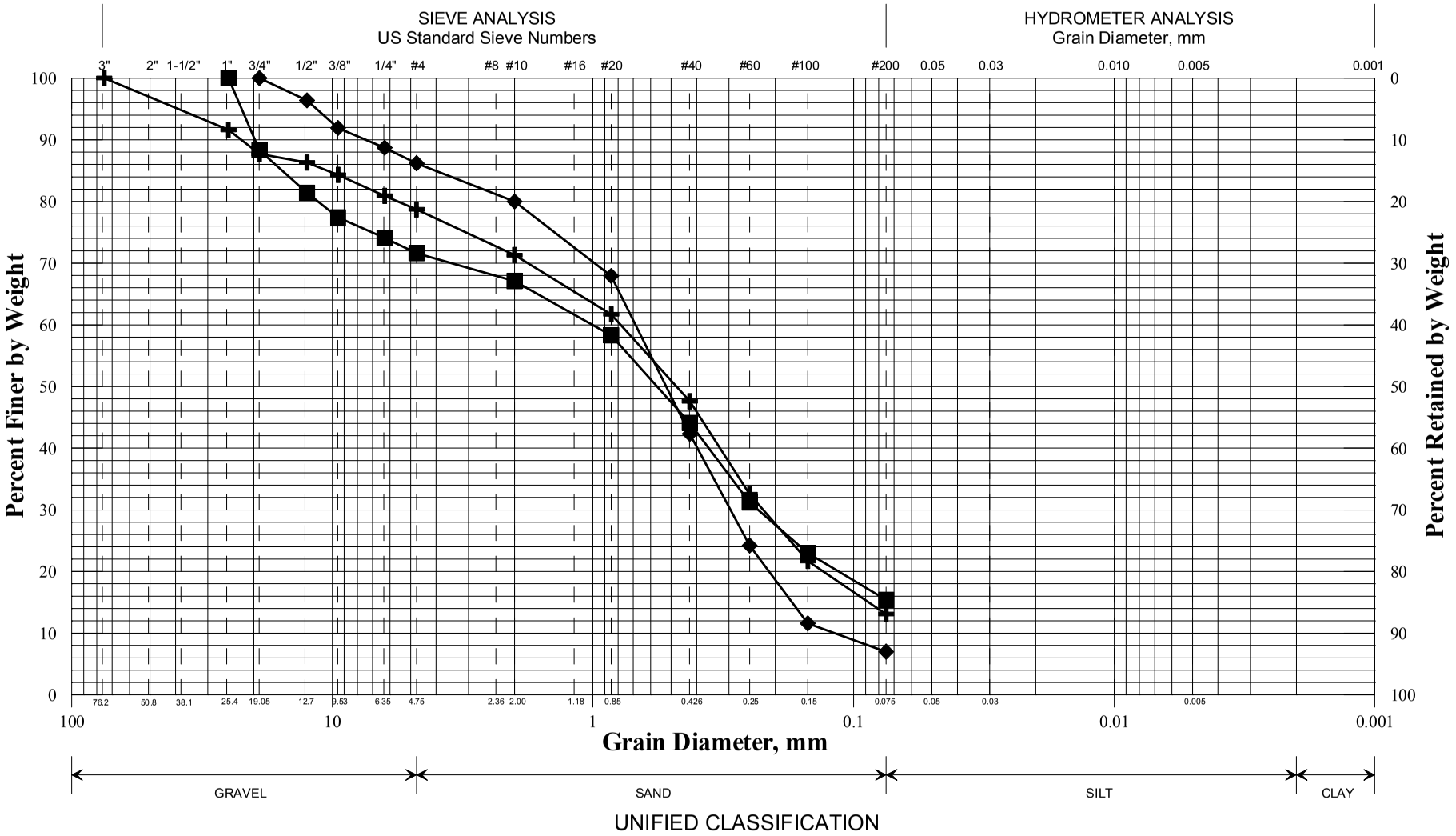
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	B-102/1D	SWBC		1.0-3.0	SAND, some gravel, little silt.	7.6			
◆	B-102/3D	SWBC		5.0-7.0	SAND, little gravel, trace silt.	23.5			
■	B-102/4D	SWBC		7.0-9.0	SAND, some gravel, little silt.	28.5			
●									
▲									
✖									

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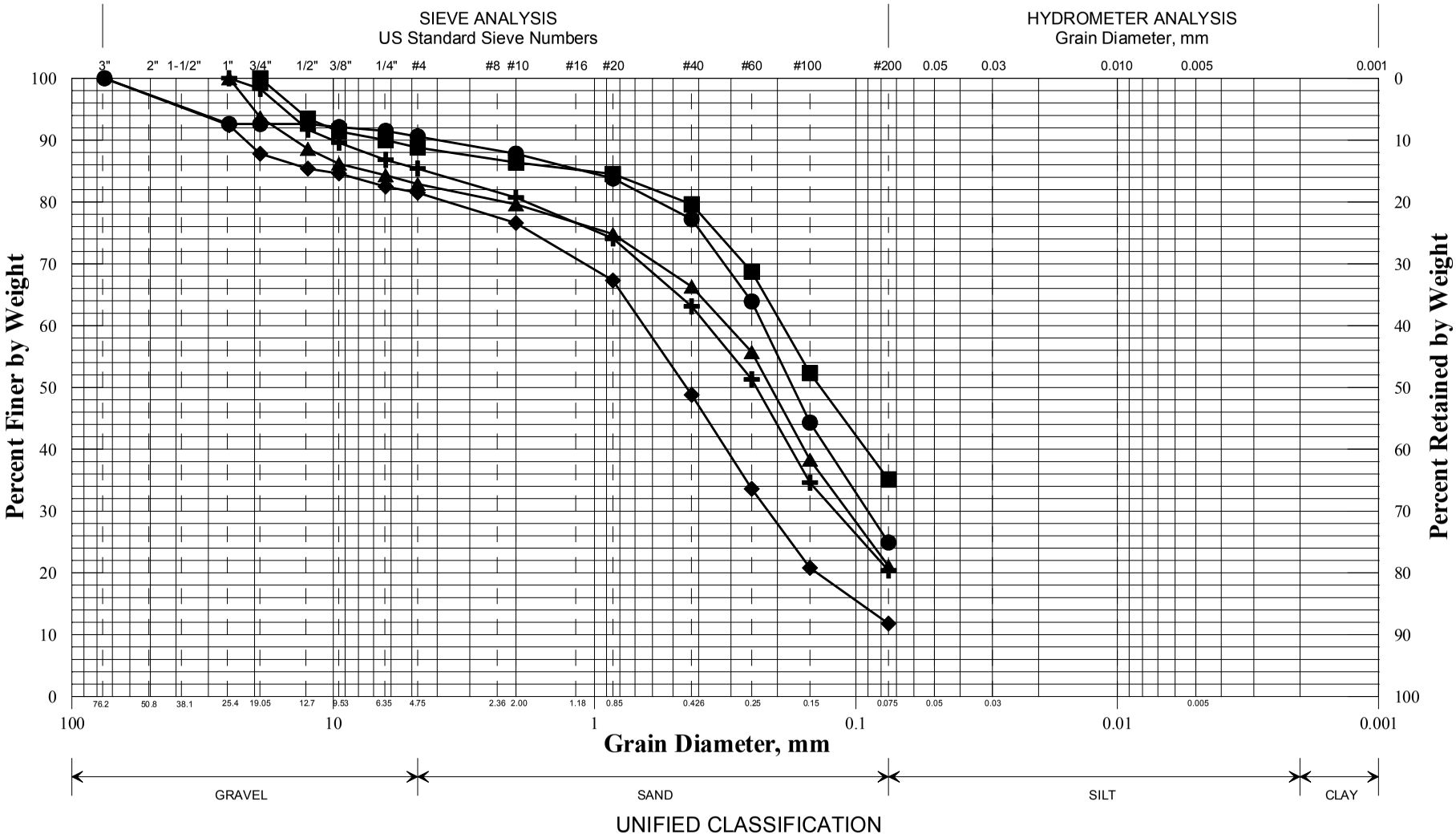
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	B-103/1D	NWBC		1.0-3.0	SAND, some silt, little gravel.	14.7			
◆	B-103/3D	NWBC		5.0-7.0	SAND, little gravel, little silt.	15.7			
■	B-103/4D	NWBC		7.5-9.2	SAND, some silt, little gravel.	16.5			
●	B-103/5D	NWBC		10.0-11.5	SAND, some silt, trace gravel.	15.3			
▲	B-103/7D	NWBC		15.0-15.8	SAND, some silt, little gravel.	12.4			
✖									

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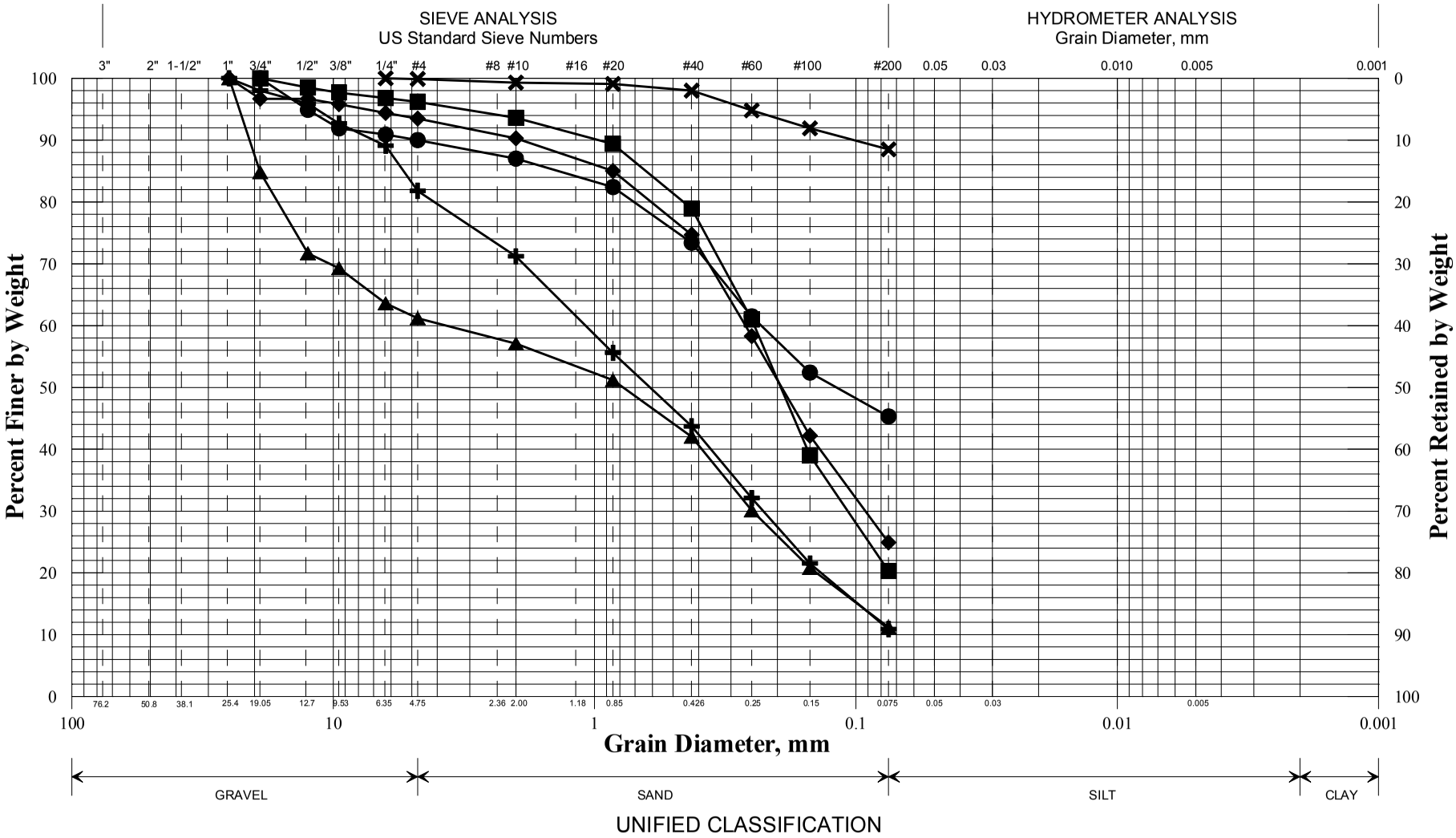
State of Maine Department of Transportation
GRAIN SIZE DISTRIBUTION CURVE



	Boring/Sample No.	Station	Offset, ft	Depth, ft	Description	W, %	LL	PL	PI
✚	B-104/1D	NEBC		1.0-1.5	SAND, little gravel, little silt.	8.6			
◆	B-104/1D(A)	NEBC		1.5-3.0	SAND, some silt, trace gravel.	16.9			
■	B-104/2D	NEBC		3.0-5.0	SAND, little silt, trace gravel.	19.3			
●	B-104(5D)	NEBC		9.0-10.4	Sandy SILT, trace gravel.	13.6			
▲	B-104/7D	NEBC		14.0-15.0	Gravelly SAND, little silt.	10.5			
✕	B-104/8D	NEBC		19.0-20.0	SILT, little sand, trace gravel.	23.3			

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APPENDIX - D

Calculations

Definition of Units:

$psf := \frac{lbf}{ft^2}$ $pcf := \frac{lbf}{ft^3}$ $Mg := 1000 \cdot kg$ $kN := 1000 \cdot newton$ $kPa := \frac{kN}{m^2}$ $tsf := g \cdot \left(\frac{ton}{ft^2}\right)$ $kip := 1000 \cdot lbf$

$ksf := \frac{kip}{ft^2}$ $ft = 0.305\ m$ $in = 0.025\ m$ $MPa := 1000 \cdot kPa$

Frost Protection:

From the Maine Design Freezing Index Map in 2003 Bridge Design Guide:

DFI = 1580 degree-days

Site has Granular Soils With W_n = 15% to 20%

From the 2003 Bridge Design Guide Table 5-1:

$$Frost\_depth := \frac{[0.8 \cdot (84.8in - 82.1in) + 82.1in] + [0.8 \cdot (70.2in - 67.9in) + 67.9in]}{2}$$

$Frost\_depth = 77\,in$

$Frost\_depth = 6.417\,ft$ **Use 6.5 feet**

Bearing Capacity, Granular Soils, c = 0 Case:

Use Terzaghi Bearing Capacity Equation: Bowles 3rd Ed., p. 134

$$q_{ult} = cN_c + qN_q + 0.5\gamma BN_\gamma$$

From field data, SPT N_{avg} (Native Soil at 103 and 104) at 6 foot Depth = 11
σ'_v = 120 pcf X 6.5 ft = 780 psf

$N1 = C_N N$ $C_N = 0.77 \log_{10} (40/\sigma'_v\ ksf)$ AASHTO LRFD, 4th Ed., p.10-16

$N1 := 0.77 \cdot \log\left(\frac{40}{0.78}\right) \cdot 11$ $N1 = 14.483$

For N1 = 14, $\phi = 32^o$ Sowers p. 318

When ϕ = 32 degrees: $N_c := 44.9$ $N_q := 29.5$ $N_\gamma := 27.9$ Bowles 3rd Ed., p. 134

Assume c = 0 for cohesionless soil
Assume γ = 120 pcf
Assume Footing Bearing at 6.5 feet for Frost Protection

$c := 0psf$

$d := 6.5ft$ $\gamma := 120pcf$

$q := d \cdot \gamma$ $q = 780\,psf$

$B := 2ft$ Minimum Footing Width

$q_{ult} := c \cdot N_c + q \cdot N_q + 0.5 \cdot \gamma \cdot B \cdot N_\gamma$

$q_{ult} = 2.636 \times 10^4\,psf$

$q_{allow} := \frac{q_{ult}}{3}$ $q_{allow} = 8.786 \times 10^3\,psf$ **OK, Say 4 ksf**

Settlement, Granular Soils Case 1:

$\Delta H = q_{contact} B \left[(1 - \mu^2) / E_s \right] I_w$ x 12in/ft

Equation, Poisson's Ratio μ, and Influence Factor I_w, from Bowles 3rd Ed., pp.67, 184, 189

E_S based on average N_{field}
Conservative since compacted fill below footing in southeast building end and dense natural soil below footing level in northwest building end have higher E_S and will help limit settlement

$N_{avg} := 11$

$q_{allow} := 4ksf$ Note: $q_{contact}$ = Max P/A

$B = 2\,ft$ Minimum Footing Width

$\mu := 0.2$

$E_s := 18000kPa + 750kPa \cdot N_{avg}$

$E_s = 2.625 \times 10^4\,kPa$ $E_s = 548.243\,ksf$

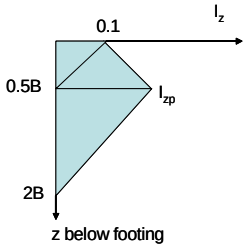
$I_w := 3.4$

$$\Delta H := \left[\frac{(q_{allow} \cdot B)\cdot\left(1-\mu^2\right)}{E_s}\right]\cdot I_w \cdot 12\,\frac{in}{ft}$$

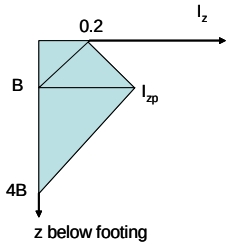
$\Delta H = 0.572\,in$ **OK**

Settlement, Granular Case 2:

Schmertmann's Method,
Foundation Engineering Handbook,
2nd Ed. p.179



Square Or Circular Footing



Rectangular Footing, For L/B > 10

$$S_e = C_1 C_2 (q_{contact} - q)\left[\sum (I_z/E_s) \times \Delta z\right]$$

$q_{allow} := 4ksf$ $B = 2\,ft$ $E_S = 548.243\,ksf$

$d := 6.5ft$ $\gamma := 120pcf$

$q := d\cdot\gamma$ $q = 780\,psf$

$$C_1 := 1 - 0.5\cdot\left(\frac{q}{q_{allow} - q}\right) \qquad C_1 = 0.879$$

$C_2 := 1$ For all Maine Soils

Note: $\sigma'_{vp} = \gamma B$ for Rectangular and $\gamma 0.5B$ for Square or Circular Footing
This case:

$\sigma'_{vp} := \gamma\cdot B$ $\sigma'_{vp} = 240\,psf$

$\Delta q := q_{allow} - q$ $\Delta q = 3.22 \times 10^3\,psf$

$$I_{zp} := 0.5 + 0.1\cdot\sqrt{\frac{\Delta q}{\sigma'_{vp}}} \qquad I_{zp} = 0.866$$

Calculate $\sum (I_z/E_s) \times \Delta z$

Assume this project has average uniform E_s, L/B>10
This is conservative b/c E_s increases with depth at this site

$E_{s1} := E_s$

$E_{s1} = 548.243\,ksf$ $E_{s2} := E_{s1}$ $E_{s3} := E_{s1}$ $E_{s4} := 0$ $E_{s5} := 0$

$I_{z1} := \frac{0.2 + I_{zp}}{2}$ $I_{z1} = 0.533$ $\Delta z1 := 1ft$ $IzEs\Delta z_1 := \frac{I_{z1}}{E_{s1}} \cdot \Delta z1$

$I_{z2} := \frac{\frac{0.2 + I_{zp}}{2} + I_{zp}}{2}$ $I_{z2} = 0.7$ $\Delta z2 := 2ft$ $IzEs\Delta z_2 := \frac{I_{z2}}{E_{s2}} \cdot \Delta z2$

$I_{z3} := \frac{I_{zp}}{2}$ $I_{z3} = 0.433$ $\Delta z3 := 5ft$ $IzEs\Delta z_3 := \frac{I_{z2}}{E_{s3}} \cdot \Delta z3$

Layer	z	Δz	I_z	E_s	$(I_z/E_s)\,\Delta z$
1	1 ft	1 ft	I_{z1}	$E_{s1} = 548.243\,ksf$	$IzEs\Delta z_1 = 9.725 \times 10^{-4}\,\frac{ft^3}{kip}$
2	3 ft	2 ft	I_{z2}	$E_{s2} = 548.243\,ksf$	$IzEs\Delta z_2 = 2.553 \times 10^{-3}\,\frac{ft^3}{kip}$
3	8 ft	5 ft	I_{z3}	$E_{s3} = 548.243\,ksf$	$IzEs\Delta z_3 = 6.381 \times 10^{-3}\,\frac{ft^3}{kip}$

Calculate Settlement

$S_e := \left[C_1 \cdot C_2 \cdot (q_{allow} - q) \cdot (IzEs\Delta z_1 + IzEs\Delta z_2 + IzEs\Delta z_3)\right] \cdot 12\,\frac{in}{ft}$

$S_e = 0.336\,in$

OK, Say 1/4 to 1/2 inch Settlement

GORRILL-PALMER
CONSULTING ENGINEERS, INC.
P.O. Box 1237
GRAY, MAINE 04039
(207) 657-6910
FAX (207) 657-6912

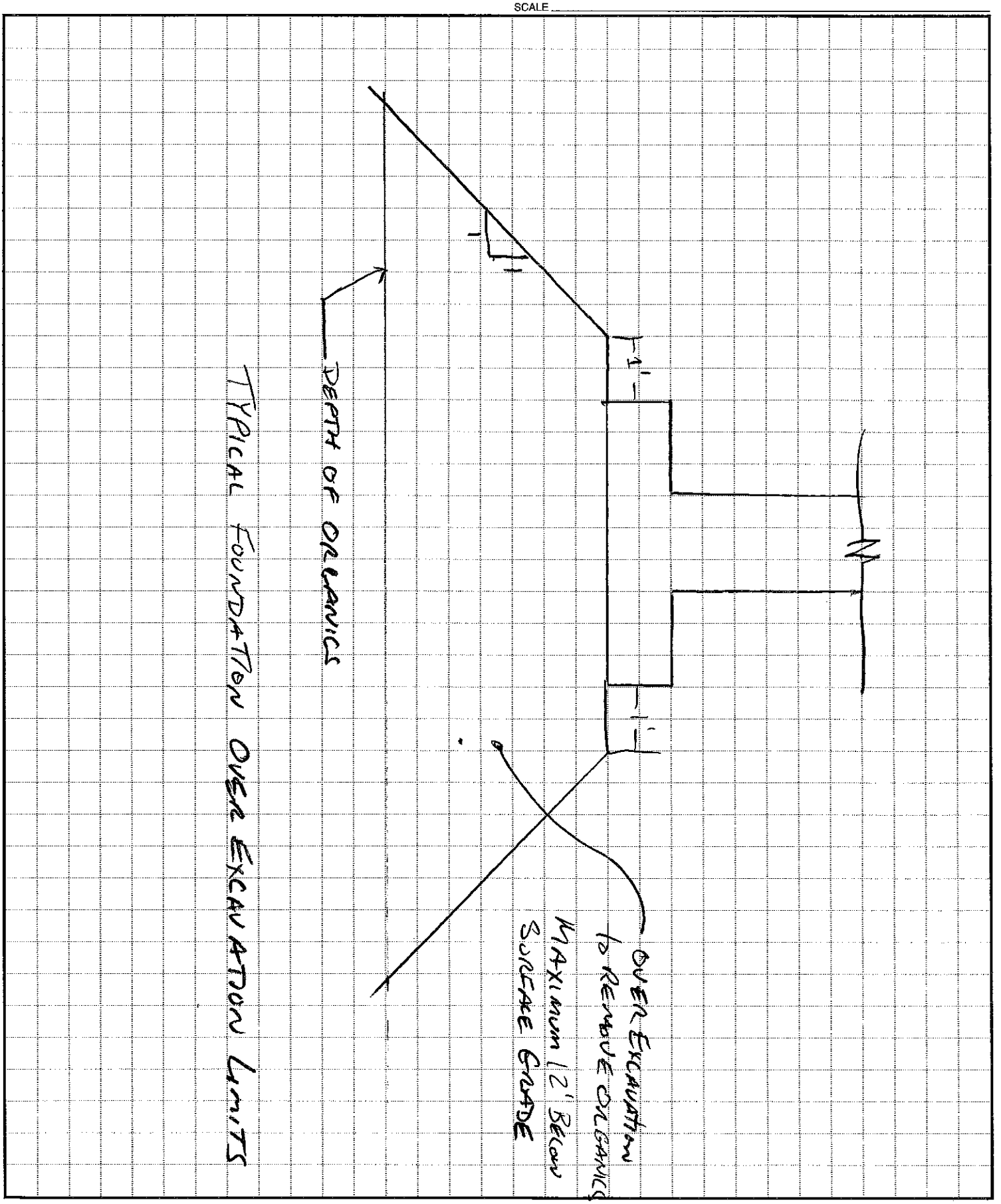
JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____



TYPICAL FOUNDATION OVER EXCAVATION LIMITS