

ADDENDUM #1

HIGHLAND 1,000,000 GALLON ELEVATED WATER STORAGE TANK

City of Duluth, Minnesota

SUBMITTAL CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: Mark D. Wallis, P.E.

Signature: *Mark D. Wallis*

Date: 6/17/2010 License #: 19145

**ADDENDUM #1
HIGHLAND 1,000,000 GALLON ELEVATED WATER STORAGE TANK
CITY OF DULUTH
PROJECT 0768WA
BID NUMBER 10-0314
JUNE 17, 2010**

NOTICE

Page 2 of 6

This Addendum is issued to modify, explain or correct the original drawings, specifications and/or previous addendums and is hereby made a part of the Contract Documents. Please note receipt of this Addendum on the Request for Bid. The bid date remains unchanged.

PROJECT MANUAL

REQUEST FOR BIDS

REPLACE EXHIBIT A with the attached EXHIBIT A – REVISED.

SPECIAL PROVISIONS

SP-21 (2451) STRUCTURE EXCAVATION AND BACKFILLS

Page 5, in the first paragraph of SP-21

CHANGE the words “including compacted 4 foot thick zone under interior concrete slabs (for both water tower and SCADA building)” to “including compacted 5 foot thick zone under interior concrete slabs (for both water tower and SCADA building).”

TABLE OF CONTENTS TECHNICAL SPECIFICATIONS

ADD Section 02 25 00 Remedial Soil Stabilization

ADD Section 02 61 13 Excavating and Handling of Contaminated Fill

DIVISION 01 – GENERAL REQUIREMENTS

Section 01 31 19 - Project Meetings

Page 01 31 19-1, Paragraph 1.03.B

REPLACE “Brief weekly meetings, as deemed necessary by the Engineer, will be held and shall be attended by all Contractors.” with “Brief weekly meetings, as deemed necessary by the Engineer, will be held and shall be attended by the construction supervisors of all subcontractors working on the Site that week. Construction superintendent/Project Manager for the Contractor shall attend routine weekly meetings via teleconference, and shall attend weekly meetings in person when major work elements are mobilized (such as foundation/Site work, erection, painting, and SCADA building).”

2.02 LADDER SAFETY SYSTEM

- A. Interior Dry Ladders: Provide ladder safety devices as required by OSHA and other governing agencies. Base Bid: DBI/Sala Lad-SAF. Stainless steel cable and climbing sleeve. Provide spare climbing sleeve.

DIVISION 02 – EXISTING CONDITIONS

ADD the attached Section 02 55 00 – Remediation Soil Stabilization.

ADD the attached Section 02 61 13 – Excavating and Handling of Contaminated Material.

DIVISION 33 – UTILITIES

Section 33 16 13.23 - Fall Protection Equipment

Page 33 16 13.23-2, Part 2-Products and Materials, Paragraph 2.02

REPLACE Article 2.02 in its entirety with the following.

2.02 LADDER SAFETY SYSTEM

- B. Interior Dry Ladders: Provide ladder safety devices as required by OSHA and other governing agencies. Base Bid: DBI/Sala Lad-SAF.

Stainless steel cable and climbing sleeve. Provide spare climbing sleeve.

- C. Interior Wet Ladder: Provide hook at access hatch for connecting lifeline. Provide hook in access tube for storing lifeline. Provide ANSI Z359 Compliant Retractable Lifeline, French Creek Production Z Series with stainless steel wire rope of sufficient length to reach from standing on roof to standing on floor of bowl, steel snap hook with impact indicator, and steel carabiner.

SECTION 33 16 19 ELEVATED STEEL WATER RESERVOIR – SPHEROID

Page 33 16 19-5, Part 2-Products and Materials, Paragraph 2.03.A, Item 7:

REPLACE the words “no part of the structure shall exceed 1578” with “no part of the structure shall exceed 1585.”

Page 33 16 19-6, Part 2-Products and Materials, Paragraph 2.03.C:

REPLACE this paragraph with the following:

- C. Overflow
1. Overflow with anti-vortex entrance capable of passing 5000 gpm. Provide overflow calculations to Engineer.
 2. One 8-inch diameter welded steel overflow pipe with a minimum wall thickness of 0.50 inch within the wet portion of the tank and a minimum wall thickness of 0.25 inch thick in the interior dry portion of the tank. Overflow shall extend down the pedestal and discharge at a point one foot above the overflow basin as shown on the Drawings. The end of the overflow shall 90 degree elbow down and be screened with No. 4 mesh galvanized screen.

Page 33 16 19-6, Part 2-Products and Materials, Paragraph 2.03.D, Item 1:

REPLACE the words “4 inch Schedule 40 galvanized” with “3 inch Kuri Tec hose.”

Page 33 16 19-7, Part 2-Products and Materials, Paragraph 2.03 E

ADD the following:

- “2. Provide 60 inch diameter access tube extension, extending 10 feet above roof, consisting of access tube, 36” x 84” door, ladder with fall protection, access hatch, and 12’ 6” triangular grating deck with pipe style handrail

for mounting antenna. Entire access tube assembly shall be bolted to access tube for removal during painting operations.”

Page 33 16 19-7, Part 2-Products and Materials, Paragraph 2.03.G, Item 5:

ADD the words “Inside tank ladder shall be extra heavy duty with repads, to protect against ice damage.”

Page 33 16 19-8, Part 2-Products and Materials, Paragraph 2.03.I, Item 1.b:

DELETE the words “above the inspection platform.”

Page 33 16 19-10, Part 2-Products and Materials, Paragraph 2.03.N, Item 1.b:

REPLACE the words “4-inches” with “6-inches.”

CONTRACTING SUPPORTING DOCUMENTS

PREVAILING WAGE RATES – US DOL, HEAVY

REPLACE the General Decision Number: MN100139 dated 05/07/2010, Construction Type: Heavy, in its entirety with the attached General Decision Number: MN100139 dated 06/04/2010, Construction Type: Heavy.

APPENDIX

APPENDIX A: GEOTECHNICAL REPORT

REPLACE the GEOTECHNICAL REPORT draft soil boring in its entirety with the attached Report of Geotechnical Exploration and Review - Proposed Highland Pump Station Improvements, dated June 10, 2010, by American Engineering Testing, Inc.

APPENDIX B: REGULATED MATERIALS REPORT

ADD the attached regulated materials reports:

EMSL Analytical Test Report: Asbestos Analysis (100,000 gallon EST riser pipe insulation)

ESC Lab Sciences Report Dated May 28, 2010 Soils Samples (Total Solids, Lead)

ESC Lab Sciences Report Dated June 08, 2010 TCLP Extraction - Soil

DRAWINGS

DRAWING G-2

CHANGE Change Note 2 to read "Communications equipment in concrete block building will be removed by Owner prior to construction. Antenna, equipment, and cable will be removed from existing 100,000 gallon tank and placed on existing 400,000 gallon tank prior to construction. After Substantial Completion, Owner will remove antenna equipment from existing 400,000 gallon tank, install equipment on new tank, and remove the temporary SCADA trailer."

MOVE the Note 3 designation to the northwest corner of the fence (near the words "Remove Existing 6.5' x 6.5' Conc."). The Owner's temporary SCADA trailer is installed parallel to the fence (oriented north-south), with the north end of the trailer roughly even with the north fence line.

ADD New Note 5, "Existing Fence may be removed at any time after the Notice to Proceed."

DRAWING G-5

ADD attached Water Main Lowering Detail.

DRAWING G-7

CHANGE In the Plan View, near water main station 0+00, change the words "Reroute existing 6" CI watermain..." to "Reroute and lower existing 6" CI watermain..."

DRAWING G-10

ADD the attached Drawing G-10 Environmental Soils Information.

DRAWING A-1

CHANGE In the Foundation Plan View, change the spread footing to 20 inch wide.

DRAWING A-3

CHANGE the spread footing width from 16 inches to 20 inches in Section 7/A-3 and in Section 10/A-3.

DRAWING PM-1

CHANGE In the Single Pedestal Elevation View, Change the words “Class 52, 16” D.I.W.M. (7’ Min Cover above Pipe to Finished Grade)” to “Class 52, 16” D.I.W.M. (7.5’ Min Cover above Pipe to Finished Grade)”

CHANGE In Note 7, change the words “Provide 7’ Min. Cover” to “Provide 7.5’ Min. Cover.”

LIST OF ATTACHMENTS

1. Exhibit A
2. Section 02 55 00 – Remediation Soil Stabilization
3. Section 02 61 13 – Excavating and Handling of Contaminated Material
4. Prevailing Wage Rates – US DOL, Heavy, dated 06/04/2010
5. Appendix A – Report of Geotechnical Exploration and Review, dated 06/10/2010, by American Engineering and Testing
6. Appendix B – Regulated Materials Reports
 - i. EMSL Analytical Test Report, Asbestos Analysis
 - ii. ESC Lab Sciences Report, dated 05/28/2010
 - iii. ESD Lab Sciences Report, dated 06/08/2010
7. Water Main Lowering Detail (Drawing G5)
8. Drawing G10 Environmental Soils Information

END OF ADDENDUM

EXHIBIT A - REVISED ADDENDUM 1						
BID NO. 10-0314 JOB NO. 0768WA						
HIGHLAND 1,000,000 GALLON ELEVATED WATER STORAGE TANK						
Item No.	Spec No.	Description	Unit	Est. Quantity	Unit Price	Total Price
1	SP-11	Mobilization	LS	1		
2	SP-32	Building Permit Allowance -Water Tower	LS	1	\$ 5,000.00	\$ 5,000.00
3	SP-31	Electrical Service Allowance	LS	1	\$ 10,000.00	\$ 10,000.00
4	02 41 16.23	Demolition - 100,000 gal Water Tower	LS	1		
5	02 41 16.23	Demolition - 400,000 gal Water Tower	LS	1		
6	SP-13	Demolition - Conc. Block Building	LS	1		
7	SP-12	Clear & Grub Trees	Ea	10		
8	SP-12	Clear Brush	LS	1		
9	SP-14	Remove Concrete Pad	LS	3		
10	SP-14	Remove Conc. Vault & Valves	LS	1		
11	SP-14	Remove Chain Link Fence	LS	1		
12	SP-14	Remove Drain & Overflow Piping	LS	1		
13	SP-24	Abandon 10" Watermain	LS	1		
14	SP-24	Locate, Cut-off, & Plug 10" Watermain	LS	1		
15	SP-24	Abandon 6" Watermain	LS	1		
16	SP-24	Remove & Transfer Service to New Watermain	LS	1		
17	SP-18	Site Grading/Final Shaping	LS	1		
18	SP-23	12" RCP Culvert	LF	52		
19	SP-23	12" FE	Ea	2		
20	SP-23	Overflow Drain Inlet	LS	1		
21	SP-23	15" PE Overflow Piping	LF	50		
22	SP-23	15" FE	EA	1		
23	SP-23	Concrete Utility Chase	LF	84		
24	SP-23	Concrete Utility Chase 4'x4' Riser Manholes	EA	2		
25	SP-23	Concrete Utility Chase 24" Diam. Riser Manhole	EA	1		
26	SP-27	Bollard	EA	2		

27	SP-24	Cut-in 16 inch Tee	Ea	1	
28	SP-24	16" BV & Box	Ea	4	
29	SP-24	Connect to 16 inch Watermain	EA	1	
30	SP-24	16" DIP	LF	424	
31	SP-24	16" 45 deg. Elbow	EA	1	
32	SP-24	16" Tee	EA	1	
33	SP-24	16"x6" Tee	EA	1	
34	SP-24	Hydrant Assembly	EA	1	
35	SP-15	Rock Excavation for Utility Construction	CY	90	
36	SP-20	Street Patching	SY	85	
37	SP-19	MnDOT Class 5 Aggregate Base Material (Driveway)	CY	135	
38	SP-26	Conc. Sidewalk	SY	165	
39	SP-22	4" Draintile	LF	400	
40	SP-22	Filter Pipe	LF	90	
41	SP-22	Drain Tile Cleanouts	Ea	5	
42	SP-22	Subsurface Drain Headwalls	Ea	2	
43	SP-18	Retention Pond	LS	1	
44	SP-28	Silt Fence, Machine Sliced	LF	900	
45	SP-28	Erosion Control Blanket	SF	1715	
46	SP-28	Vehicle Tracking Pad	LS	1	
47	SP-29	Topsoil	LS	1	
48	SP-29	Seed	LS	1	
49	SP-25	Rip-Rap, Class III	CY	10.0	
50	1404	Traffic Control	LS	1	
51	02 55 00	Remediation Soil Stabilization	LS	1	
52	02 61 13	Remove Contaminated Soil	TON	800	
53	SP-38	SCADA Building	LS	1	
54	SP-39	1,000,000 gallon Elevated Water Storage Tank, remainder of Work	LS	1	
					TOTAL

1 SECTION 02 55 00

2
3 REMEDIATION SOIL STABILIZATION

4 PART 1 GENERAL

5 1.01 APPLICABLE PROVISIONS

6 A. Applicable provisions of Division 01 shall govern the work of this section.

7 1.02 APPLICABLE PUBLICATIONS

8 A. The following publications of the issues listed below, but referred to thereafter by
9 basic designation only, form a part of this specification to the extent indicated by the
10 reference thereto.

- 11 1. American Society for Testing and Materials (ASTM), Annual Book of ASTM
12 Standards, Current Edition.
- 13 2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational
14 Safety and Health Administration (OSHA), Department of Labor, Parts
15 1910.120 and 1926 Regulations, Current Edition.
- 16 3. American National Standards Institute (ANSI), Standards, Current Edition.
- 17 4. Minnesota Rules
- 18 5. State of Minnesota, Department of Transportation, (MN/DOT), Standard
19 Specifications for Construction, Current Edition.

20 1.03 DESCRIPTION OF WORK

21 A. The physical conditions indicated on the drawings and in the specifications is the
22 result of site investigations. While the site investigation data is representative of
23 subsurface conditions at a specific location, variations in the contaminated materials
24 are to be expected to exist.

25 B. See Section 02 61 13 for additional site information, history, definitions and site
26 safety requirements.

27 C. The work under this section shall include use of in situ soil stabilization (S/S) system
28 that provides a safe, reliable method to treat contaminated material so that the treated
29 material conforms to specified performance requirements. A system, or procedure,
30 other than described in this section, may be used if the approved submittals
31 demonstrate equivalent capabilities. Such approval does not relieve the Contractor of
32 responsibility for meeting specified requirements for safety, reliability and
33 performance.

34 D. The work will involve treatment and handling of soil containing Lead as part of a
35 voluntary clean-up operation associated with this construction project. The
36 documented concentrations of lead in the contaminated fill require this excavated

1 material to be handled as either a regulated waste or a hazardous waste. The purpose
 2 of this specification is to stabilize lead contaminated soil in situ so that a stable,
 3 treated material can be disposed at a non-hazardous waste facility.

4 E. This one (1) confirmed location of the site shown to exceed limits and soil is
 5 classified as a hazardous waste. This location has an estimated 30 to 100 cubic yards
 6 of soil exceeding TCLP lead limits shall be treated in situ and rendered non
 7 hazardous prior to hauling and disposal at a licensed facility. MSA has proposed to
 8 the MPCA to treat a twenty foot by twenty foot area within the target zone around the
 9 following area:
 10
 11

Location	Depth Range (feet below ground surface)	Estimated Quantity* (cubic yards)	Lead Concentration (mg/kg)	TCLP Result (mg/l)
SS-2	0-2	30	1200	8.7
Total Quantity		30		

12 Estimated quantities are based on the assumption of a 20 foot by 20 foot area of soil treated for
 13 the length of the depth range.

14 F. All work shall be completed in conformance with federal, state and local regulations.

15 1.04 RELATED WORK ELSEWHERE

- 16 A. Procurement and Contracting Requirements – Division 00 (all sections).
- 17 B. Structure excavation and backfill – Special Provisions
- 18 C. Permits – Division 01
- 19 D. Quality Control – Division 01
- 20 E. Submittals – Division 01
- 21 F. Excavation and Handling of Contaminated Soil – Division 02
- 22 G. Erosion and Sedimentation Controls – Special Provisions

23 1.05 SUBMITTALS

- 24 A. Preparation of submittals shall be in conjunction with requirements in Submittals -
 25 Division 1 of these specifications.

1 B. Submit in-situ remediation S/S work plan to Engineer within 14 days of Notice to
2 Proceed. No soil stabilization work shall proceed without written approval of the
3 plan. A period of 30 days shall be allowed in the schedule for regulatory review and
4 approval of the work plan. The work plan shall address the technical requirements
5 for safety, reliability and performance of the remediation S/S product.

6 The work plan shall include: stabilization product information; information to
7 demonstrate Contractor's experience with S/S projects of comparable size and scope
8 in accordance with local, state, and federal requirements using the proposed system
9 or similar system; key personnel to be used for S/S work and their resumes listing
10 their experience with projects of similar size and scope; chemical composition of the
11 mix; mix design and method of mixing to be used in treating the contaminated
12 material; proposed detailed schedule of activities, the proposed source of water to be
13 used (if required) for the treatment shall be identified; the equipment that will be used
14 with process flow diagrams, mixing times, and processing rates; drawings (to scale)
15 indicating the dimensions and layout of the S/S system on the site; document
16 compliance with regulatory agencies in regards to emissions, dust and noise;
17 document quality control that addresses control and documentation of batch
18 proportions; mixing time, mixing speed, sample curing and post-treatment testing,
19 estimated schedule of sample collection by engineer; isolation and storage of
20 materials during lag time for sample results (7 day minimum); a post treatment
21 cleanup and sampling plan for the treatment area.

22 C. Post treatment report including documenting items included in the post-treatment
23 plan.

24 1.06 OPERATION/MAINTENANCE MANUALS AND INSTRUCTIONS (NONE)

25 PART 2 PRODUCTS AND MATERIALS

26 2.01 ACCEPTABLE MANUFACTURERS

27 A. Manufacturer of remediation S/S product shall be EnviroBlend® or equal.

28 2.02 OPERATING CRITERIA

29 A. The treatment areas are shown on Sheet No. G-4. These areas would be classified as
30 hazardous waste if excavated before treatment. The volume of soil exceeding the
31 TCLP for lead was estimated to be 30 cubic yards using a 20 ft by 20 ft area around
32 each of the soil borings.

33 B. The Toxicity Characteristic Leaching Procedure (TCLP) as specified in EPA SW-
34 846.3-3 shall be performed post-treatment on representative sample from each
35 treatment zone. The extract from the chemical post-treatment testing shall be below
36 the EPA hazardous waste classification criteria for lead which is 0.5 mg/l.

- 1 C. If testing results performed in accordance with the work plan do not pass the
2 hazardous waste classification criteria, the contaminated material treated with the
3 failing mix design shall be reprocessed with a working mix design at no additional
4 cost to the Owner.
- 5 D. Additionally, sidewall and bottom samples of the untreated soil on the edges of each
6 planned treatment area will be collected by the Engineer and analyzed for TCLP Lead
7 to ensure the entire extent of the hazardous soils were included by the stabilization
8 treatment.
- 9 E. If additional soil, beyond the 20 foot square area at each treatment location, is
10 determined to hazardous waste, additional treatment will be required prior to
11 disposal.

12 PART 3 CONSTRUCTION METHODS

13 3.01 MATERIALS

- 14 A. Reagents shall be shipped in properly labeled containers with instruction for handling
15 and storage. The Contractor will be responsible for acceptance of shipments,
16 handling and storage of materials.
- 17 B. Select a mix design which meets the performance criteria listed in Table 1 for use
18 during full scale treatment. No previous treatability studies have been performed.

19 3.02 EQUIPMENT

- 20 A. Mixing equipment shall have a minimum capacity adequate to meet performance and
21 schedule requirements and shall be equipped with positive means for controlling the
22 mix proportions, maintaining the time of mixing constant, and maintaining the
23 appropriate speed of rotation of the mixer.
- 24 B. Satisfactory means, incorporating weighing, metering or volumetric measurement
25 shall be provided to separately batch the required amount of each reagent. Silos and
26 feeders shall be equipped and operated so that no caking of material or variation in
27 feed occurs. Provisions shall be made so that each reagent can be easily sampled.
- 28 C. Scales, meters, and volumetric measuring devices used for measuring contaminated
29 material, reagents, and water for S/S processing shall be accurate to plus or minus
30 0.1% of the quantity being measured. A check of calibration of measuring equipment
31 shall be performed once every 5 working days.

1 3.03 METHODS

2 A. Mixing time, mixing speed, and amounts of contaminated material, reagents, and
3 water added to each batch shall be recorded. Mixing time, mixing speed, and batch
4 proportions shall be maintained within the limits specified in the approved work plan.

5 3.04 SAMPLING

6 A. Post stabilization sampling shall be done by the Engineer. The Contractor shall
7 notify the Engineer 48 hours before the zone are ready for sampling so that the
8 Engineer will be available to collect the sample. The Owner will be responsible for
9 sampling costs. If a second treatment is required, the Contractor will be responsible
10 for costs associated with additional treatment and sampling, including but not limited
11 to laboratory costs and costs incurred by the Engineer for sampling supervision.

12 3.05 EXCAVATION

13 A. Excavation shall proceed in accordance with Section 02 61 13.

14 3.06 MEASUREMENT AND PAYMENT

15 A. A Bid itme has been provided for Remediation Soil Stabilization. No measurement
16 will be made. Payment at the Lump Sum Bid unit price will be payment for all work
17 of this Section.

18
19
20

END OF SECTION

SECTION 02 61 13

EXCAVATING AND HANDLING OF CONTAMINATED MATERIAL

PART 1 GENERAL

1.01 APPLICABLE PROVISIONS

A. Applicable provisions of Division 01 shall govern work of this section.

1.02 APPLICABLE PUBLICATIONS

A. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto.

1. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
2. Code of Federal Regulations (CFR), Title 29, Chapter XVII - Occupational Safety and Health Administration (OSHA), Department of Labor, Parts 1910.120 and 1926 Regulations, Current Edition.
3. OSHA "Hazardous Waste Operations & Emergency Response Compliance" OSHA Part 1910.120.
4. NIOSH "Pocket Guide to Chemical Hazards" publication No. 97-140.
5. "Emergency Response Guidebook" published by the U.S. Department of Transportation.
6. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards, Current Edition.
7. American National Standards Institute (ANSI), Standards, Current Edition.
8. Minnesota Rules, Parts 4620.3410, 4620.3415 and 4620.3420.
9. State of Minnesota, Department of Transportation, (MN/DOT), Standard Specifications for Construction, Current Edition.

1.03 DESCRIPTION OF WORK

A. The work under this section shall include all excavating, trenching, stockpiling, and backfilling for soil remediation projects, including the removal of contaminated soil for disposal or treatment as indicated on the contract drawings and specified herein.

Site History. The property and surrounding land been utilized as an elevated water tower storage site for over 40 years. The paint on the two water tower structures has tested positive for lead. Previous sand-blasting, scraping and re-painting of the towers has resulted in contamination of the soil below the tanks. The surrounding property is residential.

1

2 B. MSA collected soil samples below the elevated tanks in May and June 2010 and has
3 defined the magnitude and extent of the contamination. Contaminated soil will be
4 encountered with the construction of the elevated tower, associated infrastructure and
5 buildings. **In addition, a small area of the contaminated soil has been classified**
6 **as HAZARDOUS WASTE if removed without stabilization.**

7 C. Response Action Plan. The MPCA Voluntary Investigation and Cleanup (VIC)
8 program must approve our response action plan prior to implementation. The
9 response includes hauling all contaminated soil to an approved off-site disposal
10 facility and the remaining site soil (low-impact fill) is to be reused on site or hauled
11 off site for use as controlled fill (except near residences, recreational areas, within 10
12 feet of the water table or near wetlandslakes or streams)

13 D. The Phase II Environmental Site Assessment (ESA) and Development Response
14 Action Plan (DRAP) completed by MSA in June 2010 is available for review at the
15 City of Duluth Engineering Office.

16 1.04 RELATED WORK ELSEWHERE

17 A. Procurement and Contracting Requirements – Division 00 (all sections).

18 B. MN Permits – Division 01

19 C. Quality Control – Division -01

20 D. Erosion and Sedimentation Controls – Division 31

21 E. **Dewatering – Division 31**

22 1.05 DEFINITIONS

23 A. Hazardous Waste. “Hazardous Waste” means untreated and excavated soil as
24 designated on the contract drawings.

25 B. Contaminated Soil. “Contaminated Soil” means soil with concentrations exceeding
26 MPCA Teir 1 standards for Lead, as designated in the contract drawings

27 C. Low-Impact Fill. “Low-Impact Fill” means soil to be encountered within the
28 construction limits which has contaminant concentrations below MPCA Teir 1
29 standards for Lead as designated in the contract drawings.

1 D. Unclassified Soil. "Unclassified Soil" means soil outside the contaminated soil and
2 /or low impact fill boundary as designated on the contract drawings or determined in
3 the field by the Engineer.

4 E. Unauthorized Excavation. Unauthorized excavation consists of removal of materials
5 beyond indicated elevations or dimensions without specific direction of the Engineer.
6 The Contractor is to immediately notify the Engineer when unauthorized excavations
7 are made.

8 1.06 ENVIRONMENTAL MANAGMENT

9 A. General. This work will involve handling of soil containing lead as part of a
10 voluntary clean-up operation associated with this construction project. The
11 documented concentrations of these compounds in the designated contaminated soil
12 area require this material to be handled as a regulated waste and a hazardous waste
13 (if material is not treated prior to excavation). The work also includes handling of
14 stabilized soil (see Section 02 55 00). The Contractor shall ensure compliance with
15 the Occupational Safety and Health's (OSHA) Hazardous Waste Operations and
16 Emergency Response Standard (29 CFR 1910.120) otherwise known as the
17 HAZWOPER Standard.

18 Contractor shall comply with all Health and Safety Regulations that apply in the
19 construction of this project. All materials and equipment shall comply with current
20 OSHA safety standards. Contractor is warned that workers may come into contact
21 with HAZARDOUS SUBSTANCES during the construction of this project.

22 B. Health and Safety Program. Each Contractor working on site during removal of the
23 contaminated soil shall have a Health and Safety Program (HASP) that complies with
24 the Code of Federal Regulations, Chapter 29 Part 1910.120. This plan should be
25 prepared or reviewed and approved by an American Board Industrial Hygiene
26 (ABIH[®]) Certified Industrial Hygienist (CIH).

27 The Contractor HASP shall implement a site control program to protect employees
28 against exposure to hazardous substances. At a minimum it must have a site map,
29 site work zones, site communication, safe work practices and identification of the
30 nearest medical assistance. Also required is the use of a "buddy system" as a
31 protective measure in particularly hazardous situations so that employees can keep
32 watch on one another to provide quick aid if needed. The Contractor shall provide
33 training to all employees before they are allowed to engage in hazardous waste
34 operations or emergency response that could expose them to safety and health
35 hazards.

36 The contractor HASP shall also provide Medical Surveillance for all employees
37 exposed to any particular hazardous substance at or above established exposure levels

1 and/or those who wear approved respirators for 30 days or more on site. Any
2 recommended Medical Surveillance provisions shall be reviewed and approved by a
3 Board Certified Occupational Health Physician

4 The Contractor shall establish an informational program with the names of key
5 personnel and their alternates responsible for site safety and health; and the listing of
6 these requirements of the standard.

- 7 C. Hazardous Evaluation Plan. The Contractor shall have a trained person prepare and
8 submit a Hazard Evaluation Plan outlining the site's characteristics prior to entry.
9 This plan will be used to identify potential site hazards to the satisfaction of the
10 contractor and to aid in the selection of appropriate employee protection and air
11 monitoring methods. Information on the existing conditions of the site, including
12 laboratory / analytical data on all contaminated soil and water, will be provided to the
13 contractor prior to the start of the project.

14 The Contractor's shall establish and implement engineering controls, work practices
15 and personal protective equipment, or a combination of these methods, to reduce
16 exposure below established exposure levels for the hazardous substance(s) involved.

17 The Contractor shall derive appropriate "action levels" for identified contaminants
18 on-site, and conduct air monitoring to identify and quantify levels of hazardous
19 substances with periodic monitoring to assure that proper protective equipment is
20 being used.

21 The Contractor shall implement a decontamination procedure before any employee or
22 equipment may leave an area of potential hazardous exposure; operating procedures
23 to minimize exposure through contact with exposed equipment, other employees, or
24 used clothing; and showers and change rooms where needed.

25 The Contractor's Hazard Evaluation Plan shall detail how these requirements will be
26 implemented.

- 27 D. Site Contingency Plan. The Contractor shall prepare a Site Contingency Plan to
28 handle possible on- site emergencies prior to beginning hazardous waste operations.
29 This plan must address: personnel roles; lines of authority, training and
30 communications; emergency recognition and prevention; safe places of refuge; site
31 security; evacuation routes and procedures; emergency medical treatment; and
32 emergency alerting.

33 1.07 SUBMITTALS

- 34 A. Contractor is to document all contaminated and low-impact soil disposal at
35 substantial completion. Include the date of removal, type of waste removed, quantity

1 by weight and volume, final destination and use (recycled, reused or landfilled) and
2 net cost or income. Submit all landfill disposal documentation, recycling receipts,
3 invoices and manifests.

4 B. Landfill disposal tickets and manifests shall be submitted with the application for
5 payment.

6 C. Contractor must submit all OSHA Hazardous Waste Operations and Emergency
7 Response (40 CFR 1910.120) training certificates for Contractor personal and all
8 subcontractors involved in work associated with contaminated soil removal within
9 three (3) working days of bid opening. Persons completing specific training for
10 hazardous waste operations shall be certified, and documentation of training
11 submitted to the Engineer; those not certified nor with proper experience shall be
12 prohibited from engaging in those operations specified by the Standard.

13 D. Contractor must submit a Health and Safety Plan, Hazardous Evaluation Plan and
14 Site Contingency Plan for the site to the Engineer prior to starting contaminated soil
15 excavation.

16 PART 2 PRODUCTS AND MATERIALS (NONE)

17 PART 3 CONSTRUCTION METHODS

18 3.01 GENERAL REQUIREMENTS

19 A. Excavation and disposal of contaminated soils and low-impact fill soil shall be
20 governed by this section. Construction of the new water tower, utility corridors and
21 footings for the building will require excavation of contaminated soils and low-
22 impact fill soils.

23 B. The Contractor shall remove contaminated soils as defined by the Engineer.

24 C. All contaminated soils will be hauled to a permitted landfill

25 D. All low-impact fill soil not re-used as backfill on-site shall be hauled off site and
26 used as controlled fill (except near residences, recreational areas, within 10 feet of the
27 water table or near wetlands, lakes or streams)

28 E. Avoid placing low-impact fill at residential properties. Low-impact fill is most
29 suitable for use at industrial or commercial properties.

30 F. Final disposition of low-impact fill soil must reported to the Engineer and will be
31 inspected to ensure compliance with the identified restrictions.

1 G. The engineer will make the final determination in the field as to the limits of
2 contaminated soil excavation. The contract drawings include the estimated areas of
3 contaminated soil and low-impact fill.

4 3.02 EXCAVATION

5 A. Contractor shall provide continuous air monitoring at the active contaminated soils
6 excavation zone with functional, accurate, and reliable monitoring equipment and
7 personnel trained for its use. Records of all such monitoring shall be kept daily and
8 made available for review by the Engineer on request. Contractor shall suspend
9 excavation operations when unsafe work conditions are identified as indicated by
10 monitoring equipment or other indicators as described in the Contractor's site
11 specific safety plan. If visible emissions are documented during constructions
12 activities, adequate wetting and/or covering of stockpiled soil may be required by the
13 Engineer to prevent dispersion of the contaminated soil.

14 B. The Contractor shall notify the Engineer 14 days prior to excavation of soil for new
15 utility trenches.

16 C. All excavated contaminated soil shall be placed directly into trucks and covered for
17 disposal to the landfill. If necessary, temporary contaminated soil stockpiles shall be
18 placed on 6 mil plastic sheeting, covered with 6 mil plastic sheeting, and secured to
19 prevent wind or rain erosion and to reduce human exposure. Stockpile locations shall
20 be directed by the Owner and Engineer.

21 D. All excavations of every description and of whatever substances encountered shall be
22 performed to the depths indicated on the contract drawings or as specified herein.
23 Engineer shall designate excavated material as either contaminated soil / low-impact
24 fill for stockpiling purposes.

25 E. Following completion of all on site excavation activities and prior to initiating site
26 grading work within the excavated area the remaining exposed fill / soil on bottom of
27 the excavation and/or sidewall must be sampled by the engineer to determine if
28 residual contamination remains.

29 F. Sheeting and shoring shall be placed as necessary for the protection of the work and
30 for the safety of personnel.

31 G. During excavation, material suitable for backfill shall be piled in an orderly manner a
32 sufficient distance from the banks of the excavation to avoid overloading and to
33 prevent slides or cave-ins.

34 H. Material excavated for slope stabilization purposes and site grading that is identified
35 as suitable for backfill will be may be used for site grading as directed by Engineer.

- 1 I. Grading shall be done as necessary to prevent surface water from flowing into
2 trenches or the excavation. Contractor shall remove any water accumulated in the
3 excavation by pumping or by other approved methods. Water accumulated in the
4 excavation shall be assumed to be contaminated and disposed of in accordance with
5 MPCA Rules.
- 6 J. Contractor shall provide sufficient barricades and protective devices adjacent to
7 excavations to safeguard against injury. Contractor shall provide and maintain
8 sufficient safety lanterns at walks, roadways and parking areas to provide safety at
9 night.
- 10 K. Protection and Removal of Utility Lines. Contractor shall notify all affected utility
11 companies at least three consecutive working days preceding construction operations
12 to coordinate any work regarding poles, wires, valve boxes, and other surface
13 obstructions and to determine the location of gas, water main, power, light, telephone
14 or telegraph conduit or service connection thereto or any other subsurface structure
15 that crosses or passes through the space occupied by any of the proposed
16 improvements. The Contractor shall make advance arrangements with the utility
17 companies for any relocation of interfering utilities so as not to delay construction.
- 18 L. Interruptions of Services. Interruptions of utility services to existing enclosures or
19 facilities which become necessary either directly or indirectly due to work required
20 under this contract shall be coordinated with the Owner through the Engineer. If the
21 down time for connections is limited by them as to duration and time (weekend,
22 nights or holidays), Contractor shall perform the work during the designated period at
23 no additional cost to the Owner.

24 3.03 UNAUTHORIZED EXCAVATION

- 25 A. Unauthorized excavation consists of removal of materials beyond indicated
26 elevations or dimensions without specific direction of the Engineer. Notify the
27 Engineer when unauthorized excavations are made.

28 3.04 STABILITY OF EXCAVATION

- 29 A. Slope sides of excavations to comply with local codes and ordinances having
30 jurisdiction. Provide shoring and bracing to retain banks and prevent collapse of
31 excavations as necessary to safeguard workmen, prevent movement of adjacent
32 ground, and avoid damage to existing improvements.
- 33 B. Additional excavation of soil for slope stabilization must be done in accordance with
34 the provisions of this specification. This work will be considered incidental and no
35 additional payment will be made other than cost associated with hauling and disposal
36 of any contaminated soil.

1 3.05 MATERIAL DISPOSAL

2 A. Material Disposal and Responsibility Disposal of all excavated material on this
3 project, whether designated as contaminated soil or low-impact fill will be the
4 responsibility of the Contractor. All excavated contaminated soil material shall be
5 loaded and hauled to an approved permitted landfill. The Waste Management
6 Landfill located in Canyon, Minnesota has conditionally approved this contaminated
7 soil for disposal.

8

Contact	Landfill Location
Waste Management Landfill Sales Group 12448 Pennsylvania Avenue South Savage, MN 55378 Ph: 952.882.2332. Fax: 952.894.8928 Contact: Tom Lance	Voyager Disposal Landfill 6830 Highway 53 Canyon, MN 55717 Monday – Friday: 7am – 5 pm Saturday: Closed. Sunday: Closed

- 9 B. All required testing for contaminated soil disposal will be completed by the Engineer.
10 If additional testing is required, it will be completed at the expense of the Owner.
- 11 C. Any required waste application permits for material disposal will be completed by the
12 Engineer prior to commencement of material disposal activities.
- 13 D. Weight tickets shall be submitted with application for payment.
- 14 E. Final disposition of low-impact fill removed from the site must be reported to the
15 Engineer and will be inspected to ensure compliance with the specified restrictions.

16 3.06 TRUCKING

17 A. Each vehicle providing off-site transportation of contaminated soil shall have any
18 required collection and transportation service licensing. All trucks must be properly
19 covered to prevent dispersion during transport.

20 3.07 MEASUREMENT & PAYMENT

21 A. A Bid item has been provided for removal of contaminated soil. Measurement will be
22 by the ton, as documented by weight tickets from the landfill. Payment at the Bid unit
23 price shall constitute payment for all work and costs of this Section

24

25

END OF SECTION



AMERICAN
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- ENVIRONMENTAL
- GEOTECHNICAL
- MATERIALS
- FORENSICS

REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

Proposed Highland Pump Station
Improvements
Duluth, Minnesota

AET #07-04601

Date:

June 10, 2010

Prepared For:

Mr. Mark Wallis, PE
MSA Professional Services
301 W. First Street, Suite 408
Duluth MN 55802

www.amengtest.com





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· GEOTECHNICAL
· MATERIALS
· FORENSICS

June 10, 2010

Mr. Mark Wallis, PE
MSA Professional Services
301 West First Street, Suite 408
Duluth, MN 55802

Re: Geotechnical Exploration/Review
Proposed Highland Pump Station Improvements
Duluth, Minnesota
AET Project #07-04601

Dear Mr. Wallis,

American Engineering Testing, Inc. (AET) has completed a subsurface exploration and geotechnical engineering review for the above referenced project. We are sending you three copies of our report. Our report documents the exploration/review results and provides our opinions and recommendations to aid you and your design team in planning and construction of the project.

AET appreciates this opportunity to serve you. As your project proceeds, we remain interested in providing additional consulting or testing services. If you have questions about the report, or if we can provide additional services for you, I can be reached at (218) 628-1518 or sleow@amengtest.com.

Sincerely,
American Engineering Testing, Inc.

A handwritten signature in black ink, appearing to read 'SLL', is written over a light blue horizontal line.

Sara L. Leow, PE
Geotechnical Engineer

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- Basement/Retaining Wall Backfill and Water Control
- Floor Slab Moisture/Vapor Protection
- Standard Recommendations for Utility Trench Backfilling
- Bedding/Foundation Support of Buried Pipe
- Freezing Weather Effects on Building Construction

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- Figure 1 – Approximate Test Boring Locations
- Logs of Test Borings
- Boring Log Notes
- Unified Soil Classification System
- Geologic Terminology

**GEOTECHNICAL EXPLORATION/REVIEW
PROPOSED HIGHLAND PUMP STATION IMPROVEMENTS
DULUTH, MINNESOTA
AET #07-04601**

SUMMARY

Purpose

We understand improvements are planned for the Highland Pump Station in Duluth, Minnesota. The purpose of our work on this project is to explore the subsurface conditions in the area of proposed construction and provide geotechnical engineering recommendations for a new water reservoir, SCADA building, and pipeline.

Scope

You authorized AET to perform a total of ten test borings within proposed construction areas to explore the subsurface conditions, and to provide a geotechnical engineering report.

Findings

In general, the test borings indicate a soil profile of existing fill overlying native soils consisting of till. Topsoil was also encountered at the ground surface in one test boring.

Recommendations

These recommendations are in a condensed form for your convenience. It is important that you study our entire report for a more comprehensive explanation of our recommendations.

- Based on a foundation base elevation approximately 12 to 15 feet below the existing ground surface, the proposed elevated water reservoir can be supported on the till using a conventional ring foundation designed for a maximum allowable bearing pressure of 4,000 psf.
- The proposed SCADA building can be supported on a spread footing foundation system designed for a maximum allowable bearing pressure of 3,000 psf when constructed on undisturbed till, or on compacted engineered fill overlying undisturbed till.
- Grading for the new water reservoir and SCADA building should include removing all existing fill and organic soils from the planned foundation areas. Any soft, wet, or disturbed soils in foundation areas should also be removed. If excavations extend below the bottom-of-footing depth, the removal of unsuitable soils should include sufficient excavation oversize to accommodate the lateral distribution of the foundation loads.

- Bottom-of-footing grade for the water reservoir foundation should be re-attained with concrete or engineered fill. Engineered fill placed for support of the water reservoir should be placed in thin lifts and compacted to 98% of the Modified Proctor density (ASTM D1557).
- Engineered fill should also be used to re-attain bottom-of-footing grade for the SCADA building. Engineered fill placed for support of the SCADA building foundation should be placed in thin lifts and compacted to 95% of the Modified Proctor density.

INTRODUCTION

MSA Professional Services (MSA) is providing design services for improvements to the Highland Pump Station in Duluth, Minnesota. You authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration and provide geotechnical engineering recommendations for this project. This report presents the field information we obtained at the site and our engineering recommendations.

To protect you, AET, and the public, we authorize use of opinions and recommendations in this report only by you and your project team for this specific project. Contact us if other uses are intended. Even though this report is not intended to provide sufficient information to accurately determine quantities and locations of particular materials, we recommend that your potential contractors be advised of the report availability.

Scope of Services

Our authorized scope of services for this project, outlined in AET Proposal #07-04601, consisted of:

- Arranging for the location of existing public underground utilities through the Gopher State One-Call Service.
- Performing four standard penetration test (SPT) borings in planned water reservoir and SCADA building foundation areas, and six flight auger (FA) borings along the planned water main alignment. The SPT borings were performed in general accordance with ASTM designation D1586.
- Providing a geotechnical report that includes logs of the test borings and our geotechnical recommendations for foundation support for the new water reservoir and SCADA building.

The scope of our work is intended for geotechnical purposes only. This scope is not intended to explore for the presence or extent of chemical contamination at the site.

PROJECT INFORMATION

Proposed Project

We understand MSA is providing design services for improvements to the Highland Pump Station in Duluth, Minnesota. The pump station is located between Arlington Avenue and Basswood Avenue, just north of Olive Street. The pump station presently consists of two existing water reservoirs and a SCADA building at the west end of the site, two large tanks near the central portion of the site, and a pump station building at the east end of the site. You have indicated the existing water towers will be demolished and replaced by a new water reservoir.

We understand the new water reservoir will be a pedestal-spherical reservoir supported by a ring foundation. The tank for the new reservoir will be supported by a 142-foot tall tower having an approximate base diameter of 30 feet. The foundation will extend approximately 10 to 15 feet below existing grade and 13.5 feet below final grade; the top of the foundation wall will be at elevation 1415.5 feet, and the base of the foundation will be at elevation 1402.0 feet. Some fill may be added to achieve final grade surrounding the reservoir base. MSA informed AET that preliminary plans include an allowable bearing pressure of 4,000 pounds per square foot for the water reservoir.

The pump station improvements will also include constructing a new SCADA building and installing a section of water main. The new SCADA building will be constructed south of the existing SCADA building, and will be a one-story structure with a footprint of 25 feet square. The new SCADA building is planned to be supported by a spread footing foundation system. A section of water main will also be constructed between Basswood Avenue and Arlington Avenue.

Project Assumptions

The recommendations contained in this report are based on attaining a factor of safety of at least 3 with respect to localized shear or base failure of the foundations. For the SCADA building, we have assumed allowable foundation settlements of 1 inch total and ½ inch differential are acceptable.

Allowable settlement for the water reservoir will likely be governed by the flexibility of pipe connections. We assume allowable total settlement should be 1 inch or less. Differential settlement in the form of tilt across the reservoir base diameter typically should not exceed 0.001 inches per inch. Therefore, differential settlement across the water reservoir base should be no more than 3/8 inches.

The presented project information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

SITE CONDITIONS

Surface Observations

On the dates of the test borings, the ground surface at the site was observed to gradually increase in elevation to the north and west. The site was mainly covered in grass, with the exception of the area near test boring FA-10-06; FA-10-06 was performed in the paved driveway area for the existing pump station building. The existing water reservoirs and SCADA building had not yet been demolished on the dates of the test borings.

Subsurface Soils/Geology

Logs of the test borings are included in the Appendix. Please refer to the logs for general information concerning soil sampling, soil layering, soil classification, geologic description, and moisture. Relative density or consistency is also noted, which is based on the standard penetration resistance (N-value).

The boring logs only indicate the subsurface conditions at the sampled locations. Variations often occur between and beyond borings.

The general soil profile indicated by the test borings is existing fill overlying native soils comprised of till. Topsoil was also encountered in test boring SPT-10-02.

The existing fill consists of organic silt, organic sandy silt, organic silt with sand, slightly organic silt, silty sand, and a mixture of silty sand with a little gravel and sandy silt. Glass rubble was also encountered in the existing fill in test boring FA-10-04. The topsoil encountered in test boring SPT-10-02 consists of organic to slightly organic silt with sand.

The till consists of silty sand, silty sand with gravel, and gravelly silty sand. Sandy silty lean clay till was also encountered in FA-10-01. The N-values recorded for the SPT borings indicate the till is mainly medium dense to dense. Apparent cobbles were encountered in the till in test borings SPT-10-01, SPT-10-03, and FA-10-02.

Water Level Measurements

Groundwater was initially encountered in test boring FA-10-04 at a depth of 8.5 feet. After the borehole was left open for approximately 7 hours, groundwater was observed at a depth of 3.7 feet. Groundwater was not encountered in the other test borings prior to abandonment.

The soils at the site are considered slow draining to relatively impermeable, and groundwater may not have had enough time to stabilize in the boreholes prior to abandonment. Water level measurements from the test borings may not be a reliable indication of the static groundwater level in the area. Piezometer(s) would need to be installed to record groundwater fluctuations. A discussion of the water level measurement methods is presented in the SUBSURFACE EXPLORATION section of this report.

Ground water levels usually fluctuate. Fluctuations occur due to varying seasonal and yearly rainfall and snow melt, as well as other factors.

GEOTECHNICAL CONSIDERATIONS

The following considerations are the basis for the recommendations presented in this report.

Review of Soil Properties

Strength/Stability

The existing fill is considered to have low strength and stability under the proposed structural loads, due to the uncontrolled nature in which it was placed and the presence of organics. The topsoil is also considered to have low strength and stability due to the presence of organics. The till is considered to have high strength and stability for supporting the anticipated structural loads.

Compressibility

The existing fill and topsoil are considered highly compressible beneath the anticipated structural loads. The till is considered to have low compressibility potential.

Frost Susceptibility

The soils encountered at the site are considered highly frost susceptible if within 6 feet of final grade.

Drainage Properties

The soils encountered at the site are judged to have low to very low permeability properties, and are considered slow to very slow draining.

RECOMMENDATIONS

Foundation Recommendations

Water Reservoir

You have indicated the base of the water reservoir foundation will be constructed at an elevation of approximately 1402 feet. The soil encountered at this elevation consists of silty sand till. It is our opinion that a typical ring spread footing foundation bearing directly on these till soils, or on engineered fill overlying these till soils, can be designed for a maximum allowable bearing pressure of 4,000 psf.

It is our judgment that this foundation design will include a factor of safety of greater than 3 against shear or base failure. It is also our judgment that total and differential (tilt) settlements should be less than 1/2 inch and 3/8 inch, respectively.

SCADA Building

It is our judgment that wall loads and column loads for the new SCADA building can be supported by a shallow foundation system consisting of spread footings bearing on undisturbed native soils, or engineered fill placed directly on undisturbed native soils. It is our opinion that strip footings and column footing pads placed on competent till, or engineered fill placed directly on till, can be designed for a maximum allowable soil bearing pressure of 3,000 psf.

Strip footings should have a minimum width of 20 inches and column pad footings should have a minimum dimension of 3 feet. Perimeter footings supporting heated structures, and all footings supporting unheated structures, should extend at least 72 inches below final grade for frost protection. Interior column footings for heated structures should be embedded at least 12 inches below the bottom of the floor slab. A structure is considered heated if the indoor temperature is maintained above 40 degrees Fahrenheit year-round.

It is our judgment that this foundation design will include a factor of safety of greater than 3 against shear or base failure. It is also our judgment that total and differential building settlement should be less than 1 inch and 1/2 inch, respectively.

Foundation Support

Excavation

All existing fill, topsoil, soils containing organics, and elements of the existing structures should be removed from the water reservoir and building footprint areas. Any disturbed, wet, or soft soils should also be removed from foundation areas. If excavation of unsuitable material extends below the bottom-of-footing grade, the excavation of unsuitable material should extend out laterally at least 1 foot from the outside edge of footings for every foot of new fill placed below the base of the

footings (i.e. 1H:1V excavation oversize). This excavation oversize is to be measured at the base of the excavation, not at the surface.

The actual required depth of excavations may be different than indicated by the test borings. Suitable excavation depths should be reviewed by a geotechnical engineer or engineering technician performing full-time observation and testing during site preparation.

Filling/Compaction for Foundation Support – Water Reservoir

If over-excavation is needed below the water reservoir foundation base, grades can be re-established with engineered fill. Engineered fill should be a non-organic, granular material void of cobbles, boulders, and placed in thin lifts and compacted to 98% of the Modified Proctor density (ASTM D1557). Grades could also be re-established with additional foundation concrete.

Excavated on-site soils void of organics, boulders, and debris can be used as engineered fill if these soils have a moisture content suitable for meeting compaction requirements. Moisture conditioning will likely be required to obtain sufficient compaction for excavated soils used as engineered fill. Conditioning of silty and clayey soils to reduce soil moisture can be difficult under the climatic conditions typical for the Duluth area, and in some cases it is not possible.

A layer of gravel can be used to provide a stable working surface at the excavation bottom, if needed. The gravel should consist of 1" to 2" crushed stone placed on a geotextile fabric to keep the crushed stone separate from underlying native soils. After the gravel working surface is no longer required, the gravel layer should also be covered with geotextile fabric to prevent fill soils from migrating into the crushed stone layer.

Filling/Compaction for Foundation Support – SCADA Building

Fill placed to attain foundation grades for the SCADA building should consist of engineered fill. The engineered fill should be a non-organic, granular material void of cobbles, boulders, and debris.

Engineered fill placed for foundation support should be placed in thin loose lifts and compacted to at least 95% of the maximum Modified Proctor dry density. Please refer to the attached standard data sheets entitled "Excavation and Refilling for Structural Support" for general information regarding excavation and fill placement for foundation support.

Water Reservoir Backfill

You have indicated the interior portion of the water reservoir ring foundation will be filled to support a floor slab or gravel layer. For a floor slab, the interior area of the foundation will need to be backfilled with compacted engineer fill, unless the floor will be a structurally supported slab. If the space within the interior of the ring foundation will not be heated, the soils used in the upper 6-foot zone of backfill should be limited to sandy soils with 100% material passing the #4 sieve and having less than 7% by weight passing the #200 sieve. We recommend the backfill soils below interior slabs be uniformly compacted in thin lifts to a minimum of 95% of the Modified Proctor density.

If a valve vault or other below grade space is constructed within the ring foundation and backfill is placed against the walls, lateral loads will need to be resisted. For information concerning lateral pressures, soil types, and drainage considerations for this case, we refer you to the attached standard sheet entitled "Basement/Retaining Wall Backfill and Water Control."

Inorganic excavated soils can be used as exterior backfill around foundation elements and foundation stem walls. Moisture conditioning of these soils may be needed to attain compaction. Organic soils can be placed in the upper 1 foot of backfill in green areas, but should not be considered for lateral resistance. Exterior backfill should be compacted in thin lifts to a minimum of 90% of the Modified Proctor density.

We recommend the lateral earth pressure of the foundation be developed with an equivalent fluid density of 50 lbs/ft³. The at-rest condition should govern for lateral pressures; deformation of the foundation cannot be allowed to develop a passive resistance.

Floor Slab Support

Excavation of unsuitable soils from the SCADA building area, as previously recommended, will also prepare this area for floor slab support. If the floor slab is constructed over the existing fill, there is a potential for cracking to occur in the slab. The risk of cracking can be reduced by removing the existing fill from floor slab areas.

The SCADA building floor slab should be constructed on a layer of clean sand fill having less than 5% material by weight passing the #200 sieve size, and 100% material passing the #4 sieve. The clean sand layer should have a thickness of at least 6 inches to provide a capillary break for moisture. If the building is to be unheated, an increased thickness of clean sand fill will reduce the risk of frost heave in the floor slab area. Engineered fill supporting the floor slab should be compacted to a minimum of 90% of Modified Proctor density. This includes utility and foundation trench backfill in floor slab areas.

If moisture sensitive floor coverings are used, a polyethylene vapor membrane can provide added moisture protection beneath the floor slab. For standard recommendations pertaining to moisture and vapor protection of the building floor slab, we refer you to the attached standard sheet entitled "Floor Slab Moisture/Vapor Protection."

Sidewalks and Doorway Aprons

All topsoil and soils containing organics should be removed from any sidewalk and doorway apron construction areas. Sidewalks and aprons will likely be aligned over silty soils that are highly frost susceptible. To reduce the potential for frost heaving, we recommend sidewalk and apron sections have a sand base thickness ranging from 2 feet to 3 feet. The sand should have 100% material passing the #4 sieve and having less than 7% by weight passing the #200 sieve. Fill placed below sidewalks should be uniformly compacted in thin lifts to a minimum of 90% of the Modified Proctor density.

Site Drainage

We recommend that site grades be established that promote positive drainage of surface water away from the water reservoir and SCADA building. The building should be equipped with a sufficient collection system that collects precipitation from the roof and directs it away from the building and water reservoir.

Utility Construction

Excavation

We recommend the new water main be supported by inorganic, undisturbed native soils or engineered fill overlying inorganic native soils. Cobbles and/or boulders may be encountered during trench excavation, and should be removed from the trench base as necessary to help prevent point loading along the pipeline. Any soft or wet soils at the bottom of the pipeline trench should also be removed.

Support Fill

Bedding material should be used to level the bottom of the trench for installing the water main. Bedding material and engineered fill placed for pipeline support and/or trench backfill should consist of an inorganic, non-frozen, granular material void of boulders, cobbles, and debris. As discussed previously, if excavated soils are to be used as engineered fill, moisture conditioning may be required. Engineered fill for water main support should be placed in thin loose lifts and compacted to 95% of the Standard Proctor density (ASTM D698).

Frost Considerations

The water main pipeline, and any other utilities that can freeze, should be provided with a minimum of 7 feet of soil cover for protection from frost. If the pipeline is to be placed at shallower depths, insulation should be placed over the pipeline for frost protection.

Backfill

In pavement areas, the critical subgrade zone is considered the zone within three vertical feet of the pavement surface. Trench backfill within the critical subgrade zone should be compacted to 100% of the Standard Proctor density, and below the critical subgrade zone can be compacted to 95% of the Standard Proctor density. In green areas, the trench backfill should be compacted to 90% of the Standard proctor density, or compacted per the Mn/DOT Quality Compaction Method (Mn/DOT Specification 2105.3F2) to avoid depressions at the surface of the backfilled trench. Standard data sheets entitled "Standard Recommendations for Utility Trench Backfilling" and "Bedding/Foundation Support of Buried Pipe" are also attached to this report. These standard sheets provide recommendations for backfill materials and placement.

CONSTRUCTION CONSIDERATIONS

Potential Difficulties

Cobbles and Boulders

Apparent cobbles were encountered in three of the test borings. Cobbles and boulders are common in till soils and may be encountered in foundation and water main excavations at the site. The presence of cobbles and boulders can cause difficult conditions for excavating in foundation and utility areas.

Runoff Water in Excavation

The silty soils encountered in the borings are likely to perch water during periods of wet weather. To allow observation of the excavation bottom, reduce the potential for soil disturbance, and to facilitate filling operations, we recommend that all free-standing water within excavations be removed prior to proceeding with construction.

Soil Disturbance

The soils encountered in the test borings are highly susceptible to disturbance and weakening when exposed to construction equipment and/or foot traffic, especially when moist or saturated. If soils do

become disturbed, they should be carefully excavated and be replaced with compacted, engineered fill.

Cold Weather Construction

If construction occurs during freezing temperatures, there are certain precautions that should be considered for placement of fill and backfilling around structures. We refer you to the attached sheet entitled "Freezing Weather Effects on Building Construction" for information regarding cold weather precautions.

Excavation Sidesloping

If unretained, excavations should maintain sideslopes in accordance with OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations" (can be found on www.osha.gov). Even with the required OSHA sloping, water can potentially induce side slope erosion which could require slope maintenance.

Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observations by a geotechnical engineer, or the engineer's representative, during construction to evaluate the effect of these potential changes.

We recommend that all foundation excavations be observed by a geotechnical engineer immediately prior to placing engineered fill and concrete. The soils at the site are susceptible to disturbance from moisture or construction traffic, and should be protected until a final observation can be made immediately prior to placing engineered fill or concrete. Soil density testing should also be performed on all fill placed at the site to document that project recommendations or specifications for compaction and moisture have been satisfied. Where fill material type is important, sieve analysis tests should be performed to document the actual fill meets the recommended gradation criteria.

SUBSURFACE EXPLORATION

General

Our subsurface exploration program included performing 4 SPT borings and six FA borings at the site on May 7 and 10, 2010. The test boring locations and elevations, as provided by MSA, are shown on Figure 1 in the Appendix.

Drilling Methods

The standard penetration test borings were advanced using 3¼-inch inside diameter hollow stem augers. Flight auger borings were performed using 6 inch diameter flight augers. The boreholes were backfilled in compliance with Minnesota Department of Health regulations.

Sampling Methods

Split-Spoon Samples (SS)

Standard Penetration (split-spoon) samples were collected in general accordance with ASTM D1586. This method consists of driving a 2" O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30". The sampler is driven a total of 18" into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the Standard Penetration resistance or N-value.

Hand Samples

Hand samples were collected from the flights of the auger for FA borings.

Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Classification Methods

Soil classifications shown on the boring logs are generally based on the Unified Soil Classification System (USCS). The USCS is described in ASTM D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, classifications per ASTM D2487 are possible. Otherwise, soil classifications shown on the boring logs are visual-manual judgments. We have attached charts in the Appendix illustrating the USCS, the descriptive terminology, and the symbols used on the boring logs.

The boring logs include judgments of the geologic depositional origin. This judgment is primarily based on observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation and development can sometimes aid this judgment.

Water Level Observations

The water level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

Sample Storage

We will retain representative samples of the soils recovered from the borings for a period of 30 days.

The samples will then be discarded unless you notify us otherwise.

LIMITATIONS

The data derived through the exploration program have been used to develop our opinions about the subsurface conditions at your site. However, because no exploration program can reveal totally what is in the subsurface, conditions between borings and between samples and at other times, may differ from conditions described in this report. The exploration we conducted identified subsurface conditions only at those points where we took samples or observed ground water conditions. Depending on the sampling methods and sampling frequency, every soil layer may not be observed, and some materials or layers which are present in the ground may not be noted on the boring logs.

If conditions encountered during construction differ from those indicated by our borings, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

The extent and detail of information about the subsurface condition are directly related to the scope of the exploration. It should be understood, therefore, that information can be obtained by means of additional exploration.

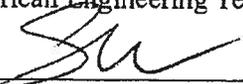
STANDARD OF CARE

Our services for your project have been conducted to those standards considered normal for services of this type at this time and location. Other than this, no warranty, express or implied, is intended.

SIGNATURES

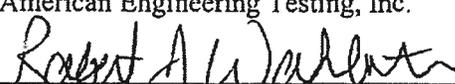
We have appreciated the opportunity to provide our services for this project. If you have questions regarding this report, or if we may provide additional assistance, please contact us.

Report Prepared by:
American Engineering Testing, Inc.



Sara L. Leow, PE
Geotechnical Engineer
MN License No. 47103

Report Reviewed by:
American Engineering Testing, Inc.



Robert J. Wahlstrom, PE, PG
Senior Geotechnical Engineer
MN License Nos. 17773/30006

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am duly Licensed Professional Engineer under the laws of the State of Minnesota.



Sara L. Leow

Date 6/10/10 License # 47103

EXCAVATION AND REFILLING FOR STRUCTURAL SUPPORT

EXCAVATION

Excavations for structural support at soil boring locations should be taken to depths recommended in the geotechnical report. Since conditions can vary, recommended excavation depths between and beyond the boring locations should be evaluated by geotechnical field personnel. If ground water is present, the excavation should be dewatered to avoid the risk of unobservable poor soils being left in-place. Excavation base soils may become disturbed due to construction traffic, ground water or other reasons. Such soils should be subcut to underlying undisturbed soils. Where the excavation base slopes steeper than 4:1, the excavation bottom should be benched across the slope parallel to the excavation contour.

Soil stresses under footings spread out with depth. Therefore, the excavation bottom and subsequent fill system should be laterally oversized beyond footing edges to support the footing stresses. A lateral oversize equal to the depth of fill below the footing (i.e., 1:1 oversize) is usually recommended. The lateral oversize is usually increased to 1.5:1 where compressible organic soils are exposed on the excavation sides. Variations in oversize requirements may be recommended in the geotechnical report or can be evaluated by the geotechnical field personnel.

Unless the excavation is retained, the backslopes should be maintained in accordance with OSHA Regulations (Standards - 29 CFR), Part 1926, Subpart P, "Excavations" (found on www.osha.gov). Even with the required OSHA sloping, ground water can induce sideslope raveling or running which could require that flatter slopes or other approaches be used.

FILLING

Filling should proceed only after the excavation bottom has been approved by the geotechnical engineer/technician. Approved fill material should be uniformly compacted in thin lifts to the compaction levels specified in the geotechnical report. The lift thickness should be thin enough to achieve specified compaction through the full lift thickness with the compaction equipment utilized. Typical thicknesses are 6" to 9" for clays and 12" to 18" for sands. Fine grained soils are moisture sensitive and are often wet (water content exceeds the "optimum moisture content" defined by a Proctor test). In this case, the soils should be scarified and dried to achieve a water content suitable for compaction. This drying process can be time consuming, labor intensive, and requires favorable weather.

Select fill material may be needed where the excavation bottom is sensitive to disturbance or where standing water is present. Sands (SP) which are medium to coarse grained are preferred, and can be compacted in thicker lift thicknesses than finer grained soils.

Filling operations for structural support should be closely monitored for fill type and compaction by a geotechnical technician. Monitoring should be on a full-time basis in cases where vertical fill placement is rapid; during freezing weather conditions; where ground water is present; or where sensitive bottom conditions are present.

EXCAVATION/REFILLING DURING FREEZING TEMPERATURES

Soils that freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density loss depends on the soil type and moisture condition; and is most pronounced in clays and silts. Foundations, slabs, and other improvements should be protected from frost intrusion during freezing weather. For earthwork during freezing weather, the areas to be filled should be stripped of frozen soil, snow and ice prior to new fill placement. In addition, new fill should not be allowed to freeze during or after placement. For this reason, it may be preferable to do earthwork operations in small plan areas so grade can be quickly attained instead of large areas where much frost stripping may be needed.

BASEMENT/RETAINING WALL BACKFILL AND WATER CONTROL

DRAINAGE

Below grade basements should include a perimeter backfill drainage system on the exterior side of the wall. The exception may be where basements lie within free draining sands where water will not perch in the backfill. Drainage systems should consist of perforated or slotted PVC drainage pipes located at the bottom of the backfill trench, lower than the interior floor grade. The drain pipe should be surrounded by properly graded filter rock. A filter fabric should then envelope the filter rock. The drain pipe should be connected to a suitable means of disposal, such as a sump basket or a gravity outfall. A storm sewer gravity outfall would be preferred over exterior daylighting, as the latter may freeze during winter. For non-building, exterior retaining walls, weep holes at the base of the wall can be substituted for a drain pipe.

BACKFILLING

Prior to backfilling, damp/water proofing should be applied on perimeter basement walls. The backfill materials placed against basement walls will exert lateral loadings. To reduce this loading by allowing for drainage, we recommend using free draining sands for backfill. The zone of sand backfill should extend outward from the wall at least 2', and then upward and outward from the wall at a 30° or greater angle from vertical. As a minimum, the sands should contain no greater than 12% by weight passing the #200 sieve, which would include (SP) and (SP-SM) soils. The sand backfill should be placed in lifts and compacted with portable compaction equipment. This compaction should be to the specified levels if slabs or pavements are placed above. Where slab/pavements are not above, we recommend capping the sand backfill with a layer of clayey soil to minimize surface water infiltration. Positive surface drainage away from the building should also be maintained. If surface capping or positive surface drainage cannot be maintained, then the trench should be filled with more permeable soils, such as the Fine Filter or Coarse Filter Aggregates defined in Mn/DOT Specification 3149. You should recognize that if the backfill soils are not properly compacted, settlements may occur which may affect surface drainage away from the building.

Backfilling with silty or clayey soil is possible but not preferred. These soils can build-up water which increases lateral pressures and results in wet wall conditions and possible water infiltration into the basement. If you elect to place silty or clayey soils as backfill, we recommend you place a prefabricated drainage composite against the wall which is hydraulically connected to a drainage pipe at the base of the backfill trench. High plasticity clays should be avoided as backfill due to their swelling potential.

LATERAL PRESSURES

Lateral earth pressures on below grade walls vary, depending on backfill soil classification, backfill compaction and slope of the backfill surface. Static or dynamic surcharge loads near the wall will also increase lateral wall pressure. For design, we recommend the following ultimate lateral earth pressure values (given in equivalent fluid pressure values) for a drained soil compacted to 95% of the Standard Proctor density and a level ground surface.

Soil Type	Equivalent Fluid Density	
	Active (pcf)	At-Rest (pcf)
Sands (SP or SP-SM)	35	50
Silty Sands (SM)	45	65
Fine Grained Soils (SC, CL or ML)	70	90

Basement walls are normally restrained at the top which restricts movement. In this case, the design lateral pressures should be the Aat-rest@ pressure situation. Retaining walls which are free to rotate or deflect should be designed using the active case. Lateral earth pressures will be significantly higher than that shown if the backfill soils are not drained and become saturated.

FLOOR SLAB MOISTURE/VAPOR PROTECTION

Floor slab design relative to moisture/vapor protection should consider the type and location of two elements, a granular layer and a vapor membrane (vapor retarder, water resistant barrier or vapor barrier). In the following sections, the pros and cons of the possible options regarding these elements will be presented, such that you and your specifier can make an engineering decision based on the benefits and costs of the choices.

GRANULAR LAYER

In American Concrete Institute (ACI) 302.1-96, a "base material" is recommended, rather than the conventional cleaner "sand cushion" material. The manual maintains that clean sand (common "cushion" sand) is difficult to compact and maintain until concrete placement is complete. ACI recommends a clean, fine graded material (with at least 10% to 30% of particles passing a #100 sieve) which is not contaminated with clay, silt or organic material. We refer you to ACI 302.1-96 for additional details regarding the requirements for the base material.

In cases where potential static water levels or significant perched water sources appear near or above the floor slab, an underfloor drainage system may be needed wherein a draitile system is placed within a thicker clean sand or gravel layer. Such a system should be properly engineered depending on subgrade soil types and rate/head of water inflow.

VAPOR MEMBRANE

The need for a vapor membrane depends on whether the floor slab will have a vapor sensitive covering, will have vapor sensitive items stored on the slab, or if the space above the slab will be a humidity controlled area. If the project does not have this vapor sensitivity or moisture control need, placement of a vapor membrane may not be necessary. Your decision will then relate to whether to use the ACI base material or a conventional sand cushion layer. However, if any of the above sensitivity issues apply, placement of a vapor membrane is recommended. Some floor covering systems (adhesives and flooring materials) require a vapor membrane to maintain a specified maximum slab moisture content as a condition of their warranty.

VAPOR MEMBRANE/GRANULAR LAYER PLACEMENT

A number of issues should be considered when deciding whether to place the vapor membrane above or below the granular layer. The benefits of placing the slab on a granular layer, with the vapor membrane placed **below** the granular layer, include **reduction** of the following:

- Slab curling during the curing and drying process.
- Time of bleeding, which allows for quicker finishing.
- Vapor membrane puncturing.
- Surface blistering or delamination caused by an extended bleeding period.
- Cracking caused by plastic or drying shrinkage.

The benefits of placing the vapor membrane **over** the granular layer include the following:

- The moisture emission rate is achieved faster.
- Eliminates a potential water reservoir within the granular layer above the membrane.
- Provides a "slip surface", thereby reducing slab restraint and the associated random cracking.

If a membrane is to be used in conjunction with a granular layer, the approach recommended depends on slab usage and the construction schedule. The vapor membrane should be placed above the granular layer when:

- Vapor sensitive floor covering systems are used or vapor sensitive items will be directly placed on the slab.
- The area will be humidity controlled, but the slab will be placed before the building is enclosed and sealed from rain.
- Required by a floor covering manufacturer's system warranty.

The vapor membrane should be placed below the granular layer when:

- Used in humidity controlled areas (without vapor sensitive coverings/stored items), with the roof membrane in place, and the building enclosed to the point where precipitation will not intrude into the slab area. Consideration should be given to slight sloping of the membrane to edges where draitile or other disposal methods can alleviate potential water sources, such as pipe or roof leaks, foundation wall damp proofing failure, fire sprinkler system activation, etc.

There may be cases where membrane placement may have a detrimental effect on the subgrade support system (e.g., expansive soils). In these cases, your decision will need to weigh the cost of subgrade options and the performance risks.

STANDARD RECOMMENDATIONS FOR UTILITY TRENCH BACKFILLING

GENERAL

Clayey and silty soils are often difficult to compact, as they may be naturally wet or may become wet due to ground water or surface/rain water during construction. Soils will need to be placed within a certain range of water (moisture) content to attain desired compaction levels. Moisture conditioning to within this range can be time consuming, labor intensive, and requires favorable weather.

The degree of compaction and the soil type used for backfill within open cut utility trenches depends on the function of the overlying land surface. Details are as follows:

ROADWAYS

Where trenches are located below roadways, we recommend using inorganic fill and compacting these soils per Mn/DOT Specification 2105.3F1 (Specified Density Method). This specification requires 100% of the Standard Proctor density in the upper one meter subgrade zone, and 95% below this. Note that this specification includes moisture content range requirements which are important for proper subgrade stability.

Where available soils are wet or of poor quality, it may be possible to use the "Quality Compaction Method" (Mn/DOT Specification 2105.3F2) for soils below the upper one meter subgrade zone if you can tolerate some subsidence. However, a high level of stability is still important within the upper subgrade zone and recommend that the "Specified Density Method" be used in this upper subgrade area. We caution that if backfill soils in the lower trench area are significantly unstable, it may be difficult or even impossible to properly compact soils within the upper one meter subgrade zone. In this case, placing a geotextile fabric directly over the unstable soils can aid in offsetting the instability.

STRUCTURAL AREAS

If fill is placed beneath or within the significant zone of influence of a structure (typically a 1:1 lateral oversize zone), the soil type and minimum compaction level will need to be evaluated on an individual basis. Because trenches result in variable fill depths over a short lateral distance, higher than normal compaction levels and/or more favorable (sandy) soil fill types may be needed. If this situation exists, it is important that special geotechnical engineering review be performed.

NON-STRUCTURAL AREAS

In grass/ditch areas, backfill soils should be placed in reasonable lift thicknesses and compacted to a minimum of 90% of the Standard Proctor density (ASTM:D698) and/or per the Mn/DOT "Quality Compaction Method." If lower compaction levels are attained, more noticeable subsidence at the surface can occur. Steep or high slopes require special consideration.

BEDDING/FOUNDATION SUPPORT OF BURIED PIPE

GENERAL

This page addresses soil bedding and foundation support of rigid pipe, such as reinforced concrete, and flexible pipe, such as steel and plastic. This does not address selection of pipe based on loads and allowable deflections, but rather addresses the geotechnical/soil aspects of uniform pipe support. Bedding/foundation support needs relate to local conditions directly beneath and to the sides of the pipe zone, which may be influenced by soft in-situ ground conditions or by soil disturbance due to soil sensitivity or ground water. Bedding relates to granular materials placed directly beneath the bottom of the pipe (usually 4" to 6" thick), which is intended to provide increased support uniformity. We refer to foundation soils as thicker layers of sands and/or gravels (beneath the bedding zone) intended to provide increased foundation strength support, usually needed due to soft, unstable and/or waterbearing conditions.

GRANULAR BEDDING

With circular pipes, high local loads (approaching point loads) develop if pipes are placed on hard surfaces. Load distribution is improved by placing granular bedding materials beneath the pipe, which are either shaped to match the pipe bottom or are placed without compaction to allow "settling in." The bedding should be placed in such a manner that the pipe will be at the proper elevation and slope when the pipe is laid on the bedding. Common bedding material is defined in Mn/DOT Specification 3149.2F, Granular Bedding. Published documents recommend rigid pipes having a diameter of 12" to 54" be placed on a bedding thickness of 4", which increases to 6" of bedding for pipe diameters ranging from 54" to 72". Beyond a 72" diameter, the bedding thickness can be equal to the pipe outside diameter divided by 12. Typically, the need for bedding under small diameter pipes (less than 12") depends on the pipe designer's specific needs, although in obvious point loads situations (bedrock, cobbles, significant coarse gravel content), bedding is recommended. Note that bedding should also account for larger diameter bells at joints.

FOUNDATION FILL

Positive uniform strength is usually compromised in soft or unstable trench bottom conditions. In this case, deeper subcuts and foundation fill placement is needed beneath the pipe. In moderate instability conditions, improvement can likely be accomplished with a thicker bedding layer. However, in more significant instability situations, particularly where ground water is present, coarser materials may be needed to provide a stronger foundation. Thicker gravel layers can also be a favorable media from which to dewater. The following materials would be appropriate for stability improvement, with the coarser materials being appropriate for higher instability/ground water cases.

- Fine Filter Aggregate – Mn/DOT Specification 3149.2J
- Coarse Filter Aggregate – Mn/DOT Specification 3149.2H

When using a coarser material which includes significant void space, we highly recommend enveloping the entire gravel layer within a geotextile fabric. The gravel material includes open void space, and the fabric acts as a separator which minimizes the intrusion of fines into the open void space. If an additional granular bedding sand is used above foundation gravel, the fabric would also prevent downward infiltration of bedding sand into the rock void space.

Although it is preferred to not highly compact thin granular bedding zones directly beneath the pipe center, it is desirable to compact the foundation materials to prevent more significant pipe settlement. We recommend foundation fill be compacted to a minimum of 95% of the Standard Proctor density (ASTM:D698). It is not possible to test coarse rock fill, although this material should still be well compacted/ tamped.

Often, pipes entering structures such as catch basins, lift stations, etc., enter the structure at a higher elevation than the structure bottom, and are therefore placed on the structure backfill. Fill beneath these pipes should be considered foundation fill. Depending on the flexibility of the connection design, it may be necessary to increase the minimum compaction level to reduce differential settlements, particularly with thicker fills.

SIDE FILL SUPPORT

If the pipe designer requires support from the side fill, granular bedding should also be placed along the sides of the pipe. In poor soil conditions, the sand fill may need to be placed laterally up to two pipe diameters on both sides of the pipe. With rigid pipe, compacted sand placement up to the spring line (within the haunch area) is usually sufficient. With flexible pipe, side fill should be placed and compacted at least to the top of the pipe. For positive support, it is very important to properly compact the sands within the haunch area.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 12% passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

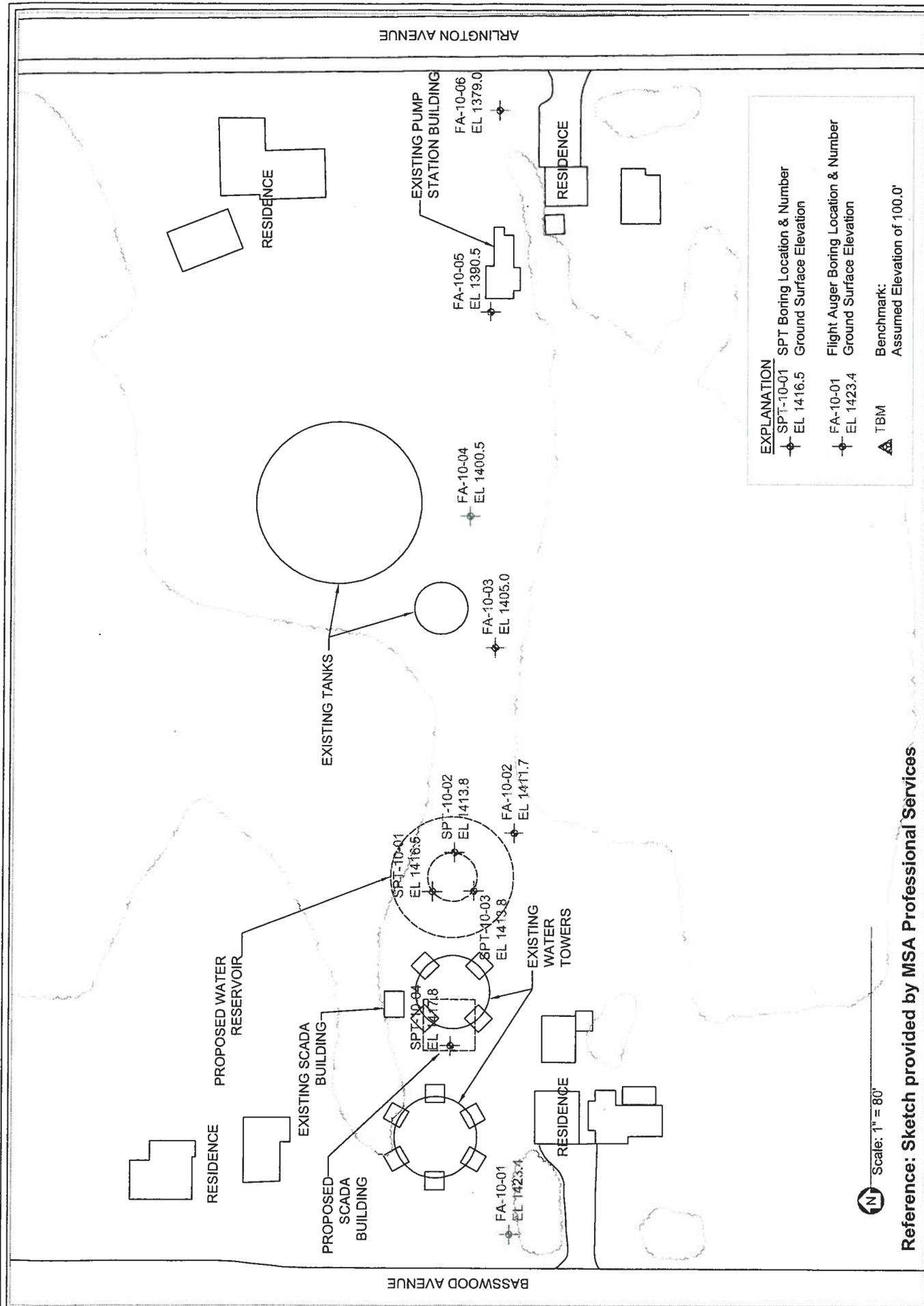
Adfreezing can occur on exterior piers (such as deck, fence or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

Appendix

Figure 1 – Approximate Test Boring Locations
Logs of Test Borings
Boring Log Notes
Unified Soil Classification System
Geologic Terminology



ARLINGTON AVENUE

RESIDENCE

EXISTING PUMP STATION BUILDING

RESIDENCE

RESIDENCE

RESIDENCE

EXISTING TANKS

PROPOSED WATER RESERVOIR

EXISTING SCADA BUILDING

PROPOSED SCADA BUILDING

EXISTING WATER TOWERS

RESIDENCE

RESIDENCE

RESIDENCE

BASSWOOD AVENUE

AMERICAN ENGINEERING TESTING, INC.

HIGHLAND PUMP STATION
Duluth, Minnesota

APPROXIMATE BORING LOCATIONS

PROJECT NO. 07-04601
 ALTERED BY: DWA
 CHECKED BY: SLL
 DATE: 06/08/10

FIGURE NO. **1**



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SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601

LOG OF BORING NO. SPT-10-01 (p. 1 of 1)

PROJECT: Highland Pump Station Improvements; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1416.5</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DD	LL	PL	%-#200	
1	FILL, organic sandy silt with roots, dark brown/ FILL, silty sand, a little gravel, brown	FILL		M	SU							
2												
3												
4	FILL, silty sand with gravel, trace roots, brown	FILL	10	M	SS	4						
5			26	M	SS	14						
6	SILTY SAND, a little gravel, brown, moist, medium dense (SM)											
7			17	M	SS	5						
8												
9												
10			23	M	SS	9						
11												
12	SILTY SAND WITH GRAVEL, apparent cobbles, brown, moist, dense to medium dense (SM)	TILL										
13			34	M	SS	10						
14												
15			50/0.1'	M	SS	1						
16												
17												
18												
19												
20												
21												
22												
23												
24	SILTY SAND WITH GRAVEL, dark brown, moist, dense (SM)											
25			42	M	SS	10						
26	END OF BORING AT 26.0 FEET Borehole backfilled with auger cuttings											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-24½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/7/10	10:25	26.0	24.5	24.5	---	None	
BORING COMPLETED: 5/7/10									
DR: LA LG: TDD Rig: 51									



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ENGINEERING
TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601		LOG OF BORING NO. SPT-10-02 (p. 1 of 1)													
PROJECT: Highland Pump Station Improvements; Duluth, MN															
DEPTH IN FEET	SURFACE ELEVATION: 1413.8		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS							
	MATERIAL DESCRIPTION							WC	DD	LL	PL	%-#200			
1	ORGANIC TO SLIGHTLY ORGANIC SILT WITH SAND AND ROOTS, dark brown (OL)		TOPSOIL		M	SU									
2	SILTY SAND, a little gravel, brown, moist, dense (SM)			34	M	SS	3								
3															
4															
5															
6	SILTY SAND WITH GRAVEL, brown, moist, medium dense (SM)				26		SS	0							
7															
8				28	M	SS	8								
9	SILTY SAND, a little gravel, brown, moist, medium dense (SM)		TILL	28	M	SS	13								
10															
11															
12	SILTY SAND WITH GRAVEL, brown to dark brown, dense to very dense (SM)				35	M	SS	9							
13															
14															
15				51	M	SS	17								
16															
17															
18															
19															
20															
21				11/0.5' 41/0.5' 50/0.4'	M	SS	15								
22															
23															
24															
25				21/0.5' 32/0.5' 50/0.4'	M	SS	12								
26	END OF BORING AT 26.0 FEET Borehole backfilled with auger cuttings														
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG						
0-24½' 3.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL							
		5/7/10	12:45	26.0	24.5	24.5	---	None							
BORING COMPLETED: 5/7/10															
DR: LA LG: TDD Rig: 51															



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ENGINEERING
TESTING, INC.

SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601 LOG OF BORING NO. SPT-10-03 (p. 1 of 1)
 PROJECT: Highland Pump Station Improvements; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1413.8</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, organic silt with roots, dark brown	FILL		M	SU						
2	FILL, organic to slightly organic silt with sand, trace roots, dark brown										
3	SILTY SAND WITH GRAVEL, brown, moist, loose to dense (SM)		9	M	SS	14					
4											
5											
6											
7											
8											
9											
10		TILL	31	M	SS	13					
11											
12	GRAVELLY SILTY SAND, brown, moist, dense (SM)										
13											
14	SILTY SAND WITH GRAVEL, apparent cobbles, dark brown, moist, medium dense to dense (SM)		41	M	SS	8					
15											
16											
17											
18											
19											
20			27	M	SS	2					
21											
22											
23											
24			32	M	SS	10					
25											
26			50/0.1	M	SS	1					
27											

END OF BORING AT 24.6 FEET
 Borehole backfilled with auger cuttings
 Boring offset 3 feet south of staked location due to utility line

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'	3.25" HSA	5/10/10	14:55	24.6	24.5	24.6	---	None	
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601

LOG OF BORING NO. SPT-10-04 (p. 1 of 1)

PROJECT: Highland Pump Station Improvements; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1417.8</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DD	LL	PL	%-#200
1	FILL, organic to slightly organic silt with roots, dark brown to brown	FILL		M	SU						
2	FILL, silty sand, a little gravel, brown		8	M	SS	14					
4	SILTY SAND, a little gravel, brown, moist with wet lenses, medium dense, lens of wet sand at about 7' (SM)	TILL	30	M	SS	18					
5			15	M/W	SS	16					
6			19	M/W	SS	16					
7			18	M	SS	16					
8			18	M	SS	17					
12	SILTY SAND WITH GRAVEL, brown, moist, medium dense (SM)										
16	END OF BORING AT 16.0 FEET Borehole backfilled with auger cuttings										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-14½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		5/10/10	16:15	16.0	14.5	14.5	---		None
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601

LOG OF BORING NO. FA-10-01 (p. 1 of 1)

PROJECT: Highland Pump Station Improvements; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1423.4</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DD	LL	PL	%-#200	
1	FILL, sand with silt and gravel, brown	FILL		M								
2	FILL, organic sandy silt with roots and gravel, dark brown			M								
3	FILL, a mixture of silty sand, a little gravel, and sandy silt, brown and light brown			M								
4	SANDY SILTY LEAN CLAY, a little gravel, brown, moist (CL)	TILL		M								
5	SILTY SAND, a little gravel, brown, moist (SM)			M								
6												
7												
8												
9												
10	END OF BORING AT 10.0 FEET Borehole backfilled with auger cuttings											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-10'	6" FA	5/10/10		10.0	None		---		None
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601

LOG OF BORING NO. FA-10-02 (p. 1 of 1)

PROJECT: Highland Pump Station Improvements; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1411.7</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DD	LL	PL	%-#200	
1	FILL, organic sandy silt with roots, dark brown	FILL		M								
2	FILL, sand with silt and gravel, brown											
3	SANDY SILT, a little gravel, brown, moist (ML)			M								
4												
5	SILTY SAND, a little gravel, apparent cobbles, brown, moist (SM)	TILL										
6												
7				M								
8												
9												
10	END OF BORING AT 10.0 FEET Borehole backfilled with auger cuttings Boring offset 10 feet southwest of staked location due to utility line											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-10'	6" FA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/10/10		10.0	None		---	None	
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601**

LOG OF BORING NO. **FA-10-03 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: <u>1405.0</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DD	LL	PL	%-#200	
1	FILL, organic silt with sand and roots, dark brown	FILL										
2	FILL, slightly organic sandy silt, a little gravel, brown											
3	FILL, silty sand, a little gravel, brown, moist (SM)											
4	SILTY SAND, a little gravel, brown, moist with wet lenses (SM)	TILL										
5												
6												
7												
8												
9												
10	END OF BORING AT 10.0 FEET Borehole backfilled with auger cuttings											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-10'	6" FA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/10/10		10.0	None		---	None	
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601**

LOG OF BORING NO. **FA-10-04 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: <u>1400.5</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS							
							WC	DD	LL	PL	%-#200			
1	FILL, organic sandy silt with roots	FILL												
2	FILL, a mixture of sandy silt, a little gravel, silty sand, and rubble (glass), brown													
3				M										
4				▼										
5	SILTY SAND, a little gravel, brown, moist to wet (SM)	TILL												
6														
7														
8				M/W										
9				▼										
10	SILTY SAND WITH GRAVEL, brown, wet (SM)													
11														
12														
13					W									
14														
15	END OF BORING AT 15.0 FEET Borehole backfilled with auger cuttings													

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-15'	6" FA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/10/10	8:50	15.0	None	9.0	---	8.5	
		5/10/10	16:20	15.0	None	9.0	---	3.7	
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: **07-04601**

LOG OF BORING NO. **FA-10-05 (p. 1 of 1)**

PROJECT: **Highland Pump Station Improvements; Duluth, MN**

DEPTH IN FEET	SURFACE ELEVATION: <u>1390.5</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DD	LL	PL	%#200		
1	FILL, organic silty sand with roots, dark brown	FILL											
2	FILL, silty sand with gravel, brown												
3	SILTY SAND WITH GRAVEL, brown, moist with wet lenses (SM)	TILL											
4													
5	SILTY SAND, a little gravel, brown, moist with wet lenses (SM)												
6													
7													
8													
9													
10	END OF BORING AT 10.0 FEET Borehole backfilled with auger cuttings												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-10'	6" FA	5/10/10		10.0	None		---	None	
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									



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SUBSURFACE TEST BORING LOG

AET JOB NO: 07-04601

LOG OF BORING NO. FA-10-06 (p. 1 of 1)

PROJECT: Highland Pump Station Improvements; Duluth, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>1379.0</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DD	LL	PL	%-#200		
1	Bituminous Pavement - 1 1/4" thickness	PAVEMENT											
2	FILL, silty sand with gravel, brown	FILL		M									
3	SILTY SAND, a little gravel, brown, moist (SM)			M									
4													
5	SILTY SAND, a little gravel, brown, moist with wet lenses (SM)												
6		TILL											
7													
8				M/W									
9													
10	END OF BORING AT 10.0 FEET Borehole backfilled with auger cuttings												

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-10'	6" FA	5/10/10		10.0	None		----	None	
BORING COMPLETED: 5/10/10									
DR: LA LG: TDD Rig: 51									

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1 3/8" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level measured in borehole prior to abandonment
▽:	Interim water level measurement or estimated water level based on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q _p :	Pocket Penetrometer strength, tsf (<u>approximate</u>)
q _c :	Static cone bearing pressure, tsf
q _u :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remoulded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

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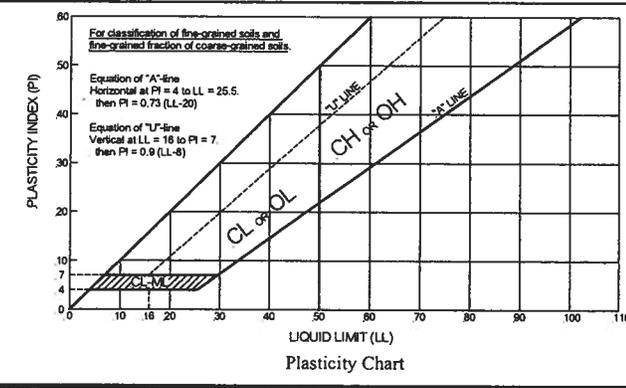
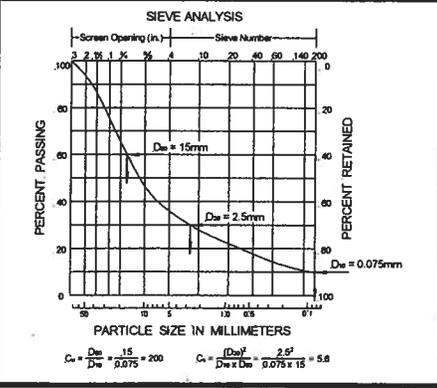


Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A			Soil Classification	
			Group Symbol	Group Name ^B
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 < Cc < 3$ ^E	GW Well graded gravel ^F
			$Cu < 4$ and/or $1 > Cc > 3$ ^E	GP Poorly graded gravel ^F
	Sands 50% or more of coarse fraction passes No. 4 sieve	Gravels with Fines more than 12% fines ^C	Fines classify as ML or MH	GM Silty gravel ^{F,G,H}
			Fines classify as CL or CH	GC Clayey gravel ^{F,G,H}
		Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 < Cc < 3$ ^E	SW Well-graded sand ^I
			$Cu < 6$ and $1 > Cc > 3$ ^E	SP Poorly-graded sand ^I
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silt and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL Lean clay ^{K,L,M}
			$PI < 4$ or plots below "A" line ^J	ML Silt ^{K,L,M}
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OL Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}
	Silt and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH Fat clay ^{K,L,M}
			PI plots below "A" line	MH Elastic silt ^{K,L,M}
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OH Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,Q}
Highly organic soil		Primarily organic matter, dark in color, and organic in odor	PT Peat ^R	

Notes
^ABased on the material passing the 3-in (75-mm) sieve.
^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
^CGravels with 5 to 12% fines require dual symbols:
 GW-GM well-graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly graded gravel with silt
 GP-GC poorly graded gravel with clay
^DSands with 5 to 12% fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay

$$C_u = D_{60} / D_{10}, \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.
^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
^HIf fines are organic, add "with organic fines" to group name.
^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
^JIf Atterberg limits plot is hatched area, soils is a CL-ML silty clay.
^KIf soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
^LIf soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.
^N $PI \geq 4$ and plots on or above "A" line.
^O $PI < 4$ or plots below "A" line.
^P PI plots on or above "A" line.
^Q PI plots below "A" line.
^RFiber Content description shown below.



ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size		Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
Term	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
				Hard	Greater than 30		
Moisture/Frost Condition		Layering Notes		Fiber Content of Peat		Organic/Roots Description (if no lab tests)	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations:	Layers less than 1/2" thick of differing material or color.	Term	Fiber Content (Visual Estimate)	Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. <i>Slightly organic</i> used for borderline cases.	
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").	Lenses:	Pockets or layers greater than 1/2" thick of differing material or color.	Fibric Peat:	Greater than 67%	With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
W (Wet/Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.			Hemic Peat:	33 - 67%	Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.
F (Frozen):	Soil frozen			Sapric Peat:	Less than 33%		

GEOLOGIC TERMINOLOGY (SOILS)

General categories of geologic deposits used, descriptive information and common soil types is as follows:

FILL (F): Soils, rock and/or waste products placed or disturbed by man rather than through geologic processes. Mixed soils are usually easy to identify. Uniform material is more difficult, and signs such as small inclusions, underlying topsoil, topography or knowledge of below grade improvements (e.g., basement backfill, utility trenches, etc.) may be needed to properly judge. When mixed condition is stratified horizontally, the soil may be a weathered natural soil rather than fill.

TOPSOIL (TS): Upper darker colored layer formed by weathering of inorganic soil and accumulation of organic material. Usually black, dark brown, dark gray or dark grayish brown. Often transitions from darker to lighter color.

SLOPEWASH (SW): Organic and/or inorganic materials (sometimes interlayered) washed from slopes and redeposited. Usually stratified. Will be located in depressed areas where they can be washed in from slopes. When topsoil layers are thick in depressed areas, there is a good chance the soil is slopewash.

SWAMP DEPOSITS (SD): Highly organic material (peats and organic clays) which are formed through accumulation of organic material under water. **Peat, Organic clay**

COARSE ALLUVIUM (CA): Sandy (and gravelly). Stratified. Deposited from fast moving waters in streams and rivers. Includes glacial outwash. **Sand, Sand with silt, Silty sand, Gravels**

FINE ALLUVIUM (FA): Clayey and/or silty. Stratified. Deposited from slow moving waters in streams, rivers, lakes and ponds. Includes glacial outwash. **Lean clay, Fat clay, Silty clay, Silt, Sandy silt**

MIXED ALLUVIUM (MA): Combination of Fine and Coarse Alluvium. **Clayey sand, Sandy lean clay, interlayered CA/FA**

LACUSTRINE (LAC): Fine grained lake bed deposits (lakes may or may not still be in existence). Usually in very flat topography. **Fat clay, Lean clay, Silty clay, Silt**

LOESS (LOESS): Uniform, non-stratified, silty material (or very fine sand) which is deposited by wind. Can include significant clay content, and grain contacts may be cemented by clay or calcareous (limestone/chalky) material. **Silt, Sandy silt, Silty clay, Lean clay**

TILL (T): Normally contains a wide range of grain sizes, from boulders through clay. Usually non-stratified (not sorted through water action). Deposited directly from glaciers. **Silty sand, Clayey sand, Sandy lean clay, usually contains gravel**

WEATHERED TILL (WT): Tills which have been altered by exposure to the action of frost, water, or chemicals. Often softer than underlying soils. May be stratified with varying colors/soil types due to filling in or other changes in frost lensed zones.

COLLUVIUM (COL): Dominantly gravel, boulders and rock slabs, sometimes intermixed or layered with soils. Deposited from gravity flow down hills or cliffs.

Construction Type: **Heavy** County: St Louis County in Minnesota.

HEAVY CONSTRUCTION PROJECTS

Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date	Mod Nbr	Publ Date
0	03/12/2010										
1	05/07/2010										
2	06/04/2010										

BOIL0647-004 07/01/2009 Boilermaker \$ 33.84 18.53

CARP0361-020 05/01/2009 ST LOUIS CO (southern 1/3 including Cotton, Floodwood, Fond Du Lac, and Proctor)
CARPENTER (including Form Work) \$ 30.12 14.65

	Rate	Fringe
CARP0361-021 05/01/2009 ST LOUIS (Duluth) Carpenter (including Form Work)	\$ 30.52	14.65

CARP0606-010 05/01/2009 ST LOUIS CO (northeast 2/3 including Cook, Cusson, Ely, and western part including Chisholm, Greaney, and Orr)
Carpenter (including Form Work) \$ 30.12 14.65

ELEC0242-012 05/31/2009 ST. LOUIS (south part bounded on the north by the north line of Kelsey Township extended east & west)
Electrician \$ 31.24 63.5%

* ELEC0294-006 06/01/2010 ST. LOUIS (north part bounded on the south by the south line of Ellsburg Township, extended east & west)
Electrician \$ 33.62 58.75%

ENGI0049-064 05/01/2009 Power Equipment Operator
Grp 2 \$ 30.57 15.25 Grp 3 \$ 30.02 15.25 Grp 4 \$ 29.72 15.25 Grp 5 \$ 26.68 15.25 Grp 6 \$ 25.47 15.25

Power Equipment Operator Classifications:

GRP 2: Crane with over 135' Boom, excluding jib; Dragline & Hydraulic Backhoe with shovel-type controls, 3 cubic yards and over; Grader/Blade finishing earthwork and bituminous.

GRP 3: Dragline & Hydraulic Backhoe with shovel-type controls up to 3 cubic yards; Loader 5 cu yd and over; Mechanic; Tandem Scraper; Truck Crane; Crawler Crane

GRP 4: Bituminous Roller 8 tons & over; Crusher/Crushing Plant; Drill Rig; Elevating Grader; Loader over 1 cu yd; Grader; Pump; Scraper up; to 32 cu yd; Farm Tractor with Backhoe attachment; Skid Steer Loader over 1 cu yd with Backhoe attachment; Bulldozer over 50 hp.

GRP 5: Bituminous Roller under 8 tons; Bituminous Rubber Tire Roller; Loader up to 1 cu yd; Bulldozer 50 hp or less.

GRP 6: Oiler; Self-Propelled Vibrating Packer 35 hp and over.

CRANE OVER 135' BOOM, EXCLUDING JIB - \$.25 PREMIUM; CRANE OVER 200' BOOM, EXCLUDING JIB - \$.50 PREMIUM

UNDERGROUND WORK: TUNNELS, SHAFTS, ETC. - \$.25 PREMIUM UNDER AIR PRESSURE - \$.50 PREMIUM

HAZARDOUS WASTE PROJECTS (PPE Required): LEVEL A - \$1.25 PREMIUM LEVEL B - \$.90 PREMIUM LEVEL C - \$.60 PREMIUM

	Rate	Fringe
IRON0512-028 05/01/2009 Ironworker, Reinforcing & Structural	\$ 29.76	19.50

	Rate	Fringe
LABO0132-038 05/01/2009 LABORER Common or General (Natural Gas Pipeline only)	\$ 16.70	10.49

LABO0563-034 05/01/2009 ST LOUIS CO (south of T. 55 N)

	Rate	Fringe
(1) Common or General	\$ 27.14	11.54
(2) Mason Tender Cement/Concrete	\$ 27.34	11.54
(6) Pipe Layer	\$ 29.14	11.54

	Rate	Fringe
LABO0563-035 05/01/2009 ST LOUIS CO (north of T. 55 N) Laborers: (1) Common or General	\$ 26.10	12.58
(2) Mason Tender Cement/Concrete	\$ 26.30	12.58
(6) Pipe Layer	\$ 28.10	12.58

PLAS0633-036 05/01/2008 ST. LOUIS CO (north of T 55N) Cement Mason/Concrete Finisher \$ 25.40 12.45

PLAS0633-039 05/01/2009 ST. LOUIS CO (south of T 55N) Cement Mason/Concrete Finisher \$ 29.63 15.45

	Rate	Fringe
SUMN2009-072 09/28/2009 Laborer: Landscape	\$ 12.88	4.61

	Rate	Fringe
* TEAM0160-018 05/01/2010 TRUCK DRIVER (DUMP)		
(1) Articulated Dump Truck	\$ 26.60	13.15
(2) 3 Axles/4 Axles; 5 Axles receive \$0.30 additional per hour	\$ 26.05	13.15
(3) Tandem Axles; & Single Axles	\$ 25.95	13.15

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

- 1) Has there been an initial decision in the matter? This can be: * an existing published wage determination * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2. and 3) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations.

Write to: Branch of Construction Wage Determinations Wage and Hour Division U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

2) If the answer to the question in 1) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to: Wage and Hour Administrator U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to: Administrative Review Board U.S. Department of Labor 200 Constitution Avenue, N.W. Washington, DC 20210

4) All decisions by the Administrative Review Board are final.

===== END OF GENERAL DECISION



EMSL Analytical, Inc.

14375 23rd Avenue North, Minneapolis, Mn 55447

Phone: (763) 449-4922 Fax: (763) 449-4924 Email: minneapolislab@emsl.com

Attn: **Phillip Lockett**
MSA Professional Services
301 W. 1st Street
Suite 408
Duluth, MN 55802

Customer ID: MSAP62
Customer PO:
Received: 06/07/10 11:40 AM
EMSL Order: 351002767

Fax: (218) 722-4548 Phone: (180) 077-77380
Project: **Highland WT**

EMSL Proj:
Analysis Date: 6/7/2010

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
WT-2 351002767-0001	water tower riser pipe	Gray Fibrous Homogeneous	95% Min. Wool	5% Non-fibrous (other)	None Detected
WT-3 351002767-0002	water tower riser pipe	Gray Fibrous Homogeneous	95% Min. Wool	5% Non-fibrous (other)	None Detected

Analyst(s)

Mark Erickson (2)

Rachel Travis, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc. 14375 23rd Avenue North, MinneapolisMn NVLAP Lab Code 200019-0



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Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
Duluth, MN 55802

Report Summary

Friday May 28, 2010

Report Number: L460679

Samples Received: 05/22/10

Client Project: 616022

Description: Highland Water Tower

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By:

John Hawkins , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375/DW21704, ND - R-140
NJ - TN002, NJ NELAP - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032008A

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Note: The use of the preparatory EPA Method 3511 is not approved or endorsed by the CA ELAP.

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REPORT OF ANALYSIS

May 28, 2010

Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
Duluth, MN 55802

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-1 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:20

ESC Sample # : L460679-01
Site ID :
Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	83.6			%		2540G	05/28/10	1
Lead	1300	0.090	0.30	mg/kg		6010B	05/26/10	1

Results listed are dry weight basis.

U = ND (Not Detected)

MDL = Minimum Detection Limit = LOD

RDL = Reported Detection Limit = LOQ = PQL = EQL

Note:

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Reported: 05/28/10 14:21 Printed: 05/28/10 14:21



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REPORT OF ANALYSIS

Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
Duluth, MN 55802

May 28, 2010

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-2 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:25

ESC Sample # : L460679-02
Site ID :
Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	74.3			%		2540G	05/28/10	1
Lead	1200	0.090	0.34	mg/kg		6010B	05/26/10	1

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REPORT OF ANALYSIS

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301 West First St. Ste 408
Duluth, MN 55802

May 28, 2010

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-3 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:30

ESC Sample # : L460679-03

Site ID :

Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	73.3			%		2540G	05/28/10	1
Lead	44.	0.090	0.34	mg/kg		6010B	05/26/10	1

Results listed are dry weight basis.

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REPORT OF ANALYSIS

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May 28, 2010

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-4 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:35

ESC Sample # : L460679-04

Site ID :

Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	81.1			%		2540G	05/28/10	1
Lead	43.	0.090	0.31	mg/kg		6010B	05/26/10	1

Results listed are dry weight basis.

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REPORT OF ANALYSIS

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 301 West First St. Ste 408
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May 28, 2010

Date Received : May 22, 2010
 Description : Highland Water Tower
 Sample ID : SS-5 0.5FT
 Collected By : LMC
 Collection Date : 05/21/10 08:40

ESC Sample # : L460679-05
 Site ID :
 Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	68.7			%		2540G	05/28/10	1
Lead	33.	0.090	0.36	mg/kg		6010B	05/26/10	1

Results listed are dry weight basis.

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REPORT OF ANALYSIS

May 28, 2010

Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
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Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-6 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:45

ESC Sample # : L460679-06

Site ID :

Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	74.4			%		2540G	05/28/10	1
Lead	24.	0.090	0.34	mg/kg		6010B	05/26/10	1

Results listed are dry weight basis.

U = ND (Not Detected)

MDL = Minimum Detection Limit = LOD

RDL = Reported Detection Limit = LOQ = PQL = EQL

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REPORT OF ANALYSIS

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May 28, 2010

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-7 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:50

ESC Sample # : L460679-07
Site ID :
Project # : 616022

Parameter	Dry Result	MDL	RDL	Units	Qualifier	Method	Date	Dil.
Total Solids	67.7			%		2540G	05/28/10	1
Lead	32.	0.090	0.37	mg/kg		6010B	05/26/10	1

Results listed are dry weight basis.

U = ND (Not Detected)

MDL = Minimum Detection Limit = LOD

RDL = Reported Detection Limit = LOQ = PQL = EQL

Note:

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The reported analytical results relate only to the sample submitted

Reported: 05/28/10 14:21 Printed: 05/28/10 14:21

Summary of Remarks For Samples Printed
05/28/10 at 14:21:50

TSR Signing Reports: 341
R5 - Desired TAT

Sample: L460679-01 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21
Sample: L460679-02 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21
Sample: L460679-03 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21
Sample: L460679-04 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21
Sample: L460679-05 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21
Sample: L460679-06 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21
Sample: L460679-07 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 05/28/10 00:00 RPT Date: 05/28/10 14:21



YOUR LAB OF CHOICE

MSA Professional Services
Lynette M. Carney, P.G.
301 West First St. Ste 408

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Quality Assurance Report
Level II

L460679

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May 28, 2010

Analyte	Result	Laboratory Blank		Limit	Batch	Date Analyzed
		Units	% Rec			
Lead	< .25	mg/kg			WG480140	05/26/10 20:52
Total Solids	< .1	%			WG480688	05/28/10 11:05

Analyte	Units	Result	Duplicate		RPD	Limit	Ref Samp	Batch
			Duplicate	RPD				
Lead	mg/kg	29.0	23.0	24.4*	20	L460690-19	WG480140	
Total Solids	%	67.0	67.7	1.00	5	L460679-07	WG480688	

Analyte	Units	Laboratory Control Sample		Limit	Batch
		Known Val	Result		
Lead	mg/kg	113	127.	112.	77.3-122.1 WG480140
Total Solids	%	50	50.0	100.	85-115 WG480688

Analyte	Units	Matrix Spike			% Rec	Limit	Ref Samp	Batch
		MS Res	Ref Res	TV				
Lead	mg/kg	67.2	23.0	50	88.4	75-125	L460690-19	WG480140

Analyte	Units	MSD	Matrix Spike Duplicate		Limit	RPD	Limit	Ref Samp	Batch
			Ref	%Rec					
Lead	mg/kg	73.9	67.2	102.	75-125	9.50	20	L460690-19	WG480140

Batch number /Run number / Sample number cross reference

WG480140: R1235190: L460679-01 02 03 04 05 06 07
WG480688: R1236639: L460679-01 02 03 04 05 06 07

** Calculations are performed prior to rounding of reported values .
* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'



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MSA Professional Services
Lynette M. Carney, P.G.
301 West First St. Ste 408

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Quality Assurance Report
Level II

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May 28, 2010

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.



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Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
Duluth, MN 55802

Report Summary
Tuesday June 08, 2010
Report Number: L462061
Samples Received: 05/22/10
Client Project: 616022
Description: Highland Water Tower

The analytical results in this report are based upon information supplied by you, the client, and are for your exclusive use. If you have any questions regarding this data package, please do not hesitate to call.

Entire Report Reviewed By:

T. Alan Harvill , ESC Representative

Laboratory Certification Numbers

A2LA - 1461-01, AIHA - 100789, AL - 40660, CA - I-2327, CT - PH-0197, FL - E87487
GA - 923, IN - C-TN-01, KY - 90010, KYUST - 0016, NC - ENV375/DW21704, ND - R-140
NJ - TN002, NJ NELAP - TN002, SC - 84004, TN - 2006, VA - 00109, WV - 233
AZ - 0612, MN - 047-999-395, NY - 11742, WI - 998093910, NV - TN000032008A

Accreditation is only applicable to the test methods specified on each scope of accreditation held by ESC Lab Sciences.

Note: The use of the preparatory EPA Method 3511 is not approved or endorsed by the CA ELAP.

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REPORT OF ANALYSIS

Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
Duluth, MN 55802

June 08, 2010

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-1 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:20

ESC Sample # : L462061-01

Site ID :

Project : 616022

Parameter	Result	Det. Limit	Units	Limit	Method	Date/Time	By	Dil
TCLP Extraction	-				1311	06/04/10 0742	MVE	1
Lead	2.8	0.050	mg/l	5.0	6010B	06/07/10 0948	DMM	1

BDL - Below Detection Limit
Det. Limit - Estimated Quantitation Limit (EQL)
Limit - Maximum Contaminant Level as established by the US EPA
Note:

The reported analytical results relate only to the sample submitted.
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Reported: 06/08/10 10:51 Printed: 06/08/10 10:52



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REPORT OF ANALYSIS

Lynette M. Carney, P.G.
MSA Professional Services
301 West First St. Ste 408
Duluth, MN 55802

June 08, 2010

Date Received : May 22, 2010
Description : Highland Water Tower
Sample ID : SS-2 0.5FT
Collected By : LMC
Collection Date : 05/21/10 08:25

ESC Sample # : L462061-02

Site ID :

Project : 616022

Parameter	Result	Det. Limit	Units	Limit	Method	Date/Time	By	Dil
TCLP Extraction	-				1311	06/04/10 0742	MVE	1
Lead	8.7	0.050	mg/l	5.0	6010B	06/07/10 0952	DMM	1

BDL - Below Detection Limit

Det. Limit - Estimated Quantitation Limit (EQL)

Limit - Maximum Contaminant Level as established by the US EPA

Note:

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Reported: 06/08/10 10:51 Printed: 06/08/10 10:52

Attachment A
List of Analytes with QC Qualifiers

Sample Number	Work Group	Sample Type	Analyte	Run ID	Qualifier
L462061-01	WG481677	SAMP	TCLP Extraction	R1244048	W2

Attachment B
Explanation of QC Qualifier Codes

Qualifier	Meaning
W2	(ESC) - Insufficient sample amount to perform method as required. Sample amount approved per client instruction.

Qualifier Report Information

ESC utilizes sample and result qualifiers as set forth by the EPA Contract Laboratory Program and as required by most certifying bodies including NELAC. In addition to the EPA qualifiers adopted by ESC, we have implemented ESC qualifiers to provide more information pertaining to our analytical results. Each qualifier is designated in the qualifier explanation as either EPA or ESC. Data qualifiers are intended to provide the ESC client with more detailed information concerning the potential bias of reported data. Because of the wide range of constituents and variety of matrices incorporated by most EPA methods, it is common for some compounds to fall outside of established ranges. These exceptions are evaluated and all reported data is valid and useable "unless qualified as 'R' (Rejected)."

Definitions

- Accuracy** - The relationship of the observed value of a known sample to the true value of a known sample. Represented by percent recovery and relevant to samples such as: control samples, matrix spike recoveries, surrogate recoveries, etc.
- Precision** - The agreement between a set of samples or between duplicate samples. Relates to how close together the results are and is represented by Relative Percent Difference.
- Surrogate** - Organic compounds that are similar in chemical composition, extraction, and chromatography to analytes of interest. The surrogates are used to determine the probable response of the group of analytes that are chemically related to the surrogate compound. Surrogates are added to the sample and carried through all stages of preparation and analyses.
- TIC** - Tentatively Identified Compound: Compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates.

Summary of Remarks For Samples Printed
06/08/10 at 10:52:05

TSR Signing Reports: 341
R5 - Desired TAT

Sample: L462061-01 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 06/09/10 00:00 RPT Date: 06/08/10 10:51
Relogged from L460679-01
Sample: L462061-02 Account: MSAPRODMN Received: 05/22/10 09:00 Due Date: 06/09/10 00:00 RPT Date: 06/08/10 10:51
Relogged from L460679-02



YOUR LAB OF CHOICE

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Est. 1970

Quality Assurance Report
Level II

L462061

June 08, 2010

Laboratory Blank							
Analyte	Result	Units	% Rec	Limit	Batch	Date Analyzed	
Lead	< .05	mg/l			WG482129	06/07/10 08:22	

Duplicate							
Analyte	Units	Result	Duplicate	RPD	Limit	Ref Samp	Batch
Lead	mg/l	0	0	0	20	L462763-01	WG482129

Laboratory Control Sample							
Analyte	Units	Known Val	Result	% Rec	Limit	Batch	
Lead	mg/l	1.13	1.15	102.	85-115	WG482129	

Matrix Spike								
Analyte	Units	MS Res	Ref Res	TV	% Rec	Limit	Ref Samp	Batch
Lead	mg/l	0.882	0	1.13	78.0	75-125	L462763-01	WG482129

Matrix Spike Duplicate									
Analyte	Units	MSD	Ref	%Rec	Limit	RPD	Limit	Ref Samp	Batch
Lead	mg/l	0.987	0.882	87.3	75-125	11.2	20	L462763-01	WG482129

Batch number /Run number / Sample number cross reference

WG481677: R1244048: L462061-01 02
WG482129: R1247249: L462061-01 02

* * Calculations are performed prior to rounding of reported values .
* Performance of this Analyte is outside of established criteria.
For additional information, please see Attachment A 'List of Analytes with QC Qualifiers.'



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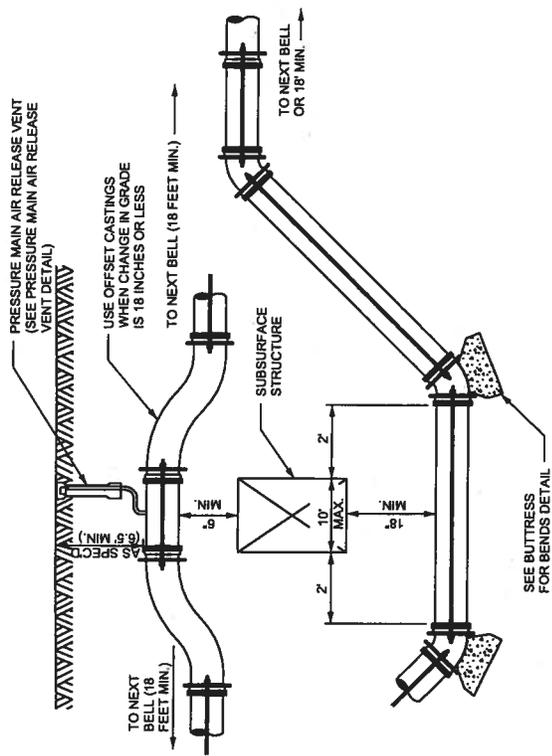
June 08, 2010

The data package includes a summary of the analytic results of the quality control samples required by the SW-846 or CWA methods. The quality control samples include a method blank, a laboratory control sample, and the matrix spike/matrix spike duplicate analysis. If a target parameter is outside the method limits, every sample that is effected is flagged with the appropriate qualifier in Appendix B of the analytic report.

Method Blank - an aliquot of reagent water carried through the entire analytic process. The method blank results indicate if any possible contamination exposure during the sample handling, digestion or extraction process, and analysis. Concentrations of target analytes above the reporting limit in the method blank are qualified with the "B" qualifier.

Laboratory Control Sample - is a sample of known concentration that is carried through the digestion/extraction and analysis process. The percent recovery, expressed as a percentage of the theoretical concentration, has statistical control limits indicating that the analytic process is "in control". If a target analyte is outside the control limits for the laboratory control sample or any other control sample, the parameter is flagged with a "J4" qualifier for all effected samples.

Matrix Spike and Matrix Spike Duplicate - is two aliquots of an environmental sample that is spiked with known concentrations of target analytes. The percent recovery of the target analytes also has statistical control limits. If any recoveries that are outside the method control limits, the sample that was selected for matrix spike/matrix spike duplicate analysis is flagged with either a "J5" or a "J6". The relative percent difference (%RPD) between the matrix spike and the matrix spike duplicate recoveries is all calculated. If the RPD is above the method limit, the effected samples are flagged with a "J3" qualifier.

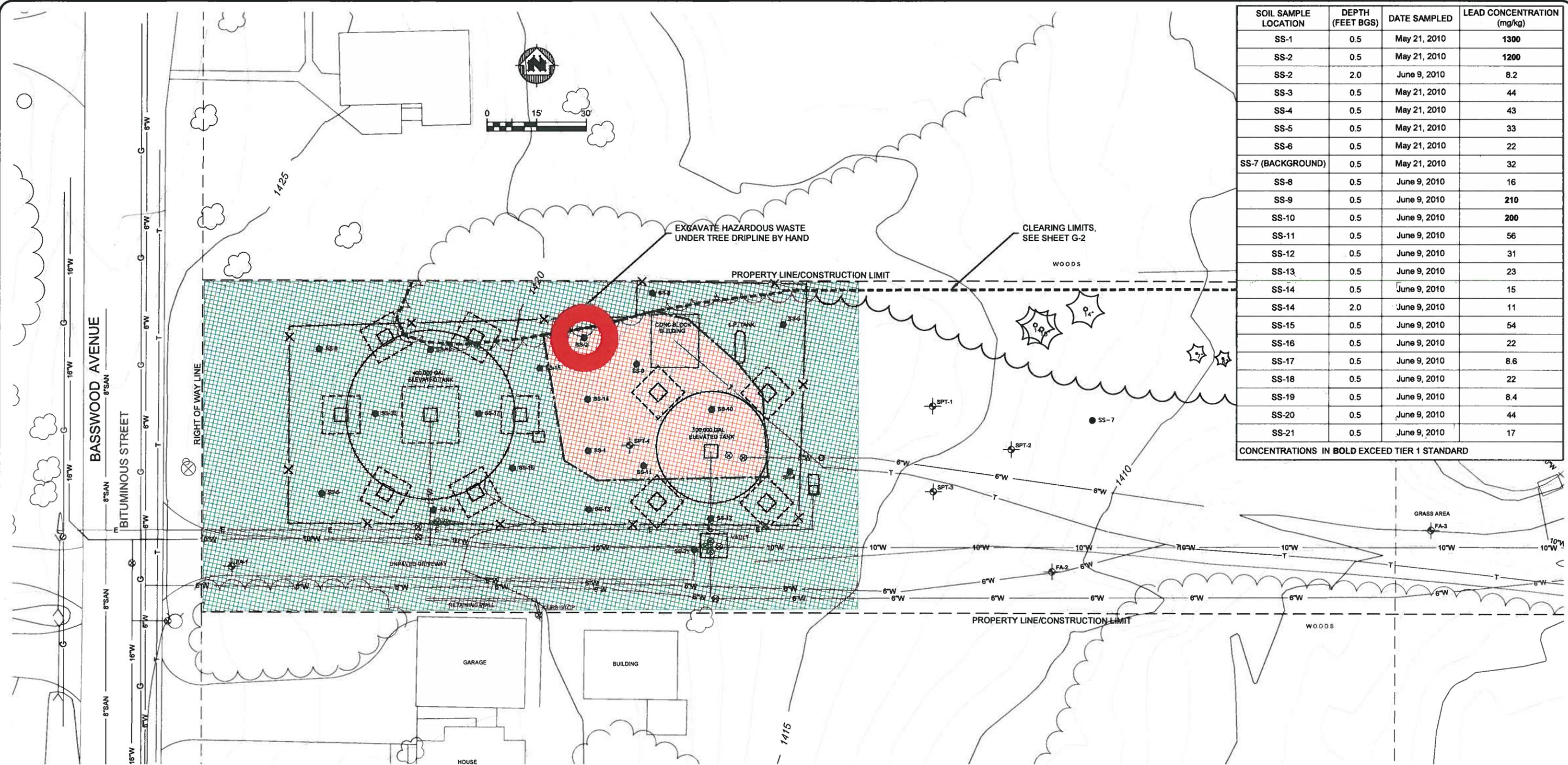


GENERAL NOTES:

1. FITTINGS TO BE WRAPPED WITH POLYETHYLENE BEFORE PLACEMENT OF RODDING AND BUTTRESSES.
2. ALL FITTINGS SHALL BE RODDED OR CONNECTED TO THE PIPE WITH AN APPROVED WEDGE ACTION THRUST RESTRAINING GLAND. RODS SHALL BE STAINLESS STEEL OR BITUMINOUS COATED, AND A MINIMUM OF 1 INCH IN DIAMETER.
3. LOCATIONS OF EXISTING MAINS ARE APPROXIMATE. LENGTH REQUIRED TO BE LOWERED WILL BE DETERMINED IN THE FIELD.
4. MAINS SHALL BE INSULATED IF COVER IS LESS THAN 6.5 FEET.

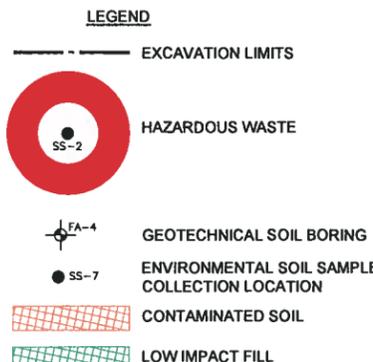
WATERMAIN LOWERING DETAIL

SCALE: NONE



SOIL SAMPLE LOCATION	DEPTH (FEET BGS)	DATE SAMPLED	LEAD CONCENTRATION (mg/kg)
SS-1	0.5	May 21, 2010	1300
SS-2	0.5	May 21, 2010	1200
SS-2	2.0	June 9, 2010	8.2
SS-3	0.5	May 21, 2010	44
SS-4	0.5	May 21, 2010	43
SS-5	0.5	May 21, 2010	33
SS-6	0.5	May 21, 2010	22
SS-7 (BACKGROUND)	0.5	May 21, 2010	32
SS-8	0.5	June 9, 2010	16
SS-9	0.5	June 9, 2010	210
SS-10	0.5	June 9, 2010	200
SS-11	0.5	June 9, 2010	56
SS-12	0.5	June 9, 2010	31
SS-13	0.5	June 9, 2010	23
SS-14	0.5	June 9, 2010	15
SS-14	2.0	June 9, 2010	11
SS-15	0.5	June 9, 2010	54
SS-16	0.5	June 9, 2010	22
SS-17	0.5	June 9, 2010	8.6
SS-18	0.5	June 9, 2010	22
SS-19	0.5	June 9, 2010	8.4
SS-20	0.5	June 9, 2010	44
SS-21	0.5	June 9, 2010	17

CONCENTRATIONS IN BOLD EXCEED TIER 1 STANDARD



GENERAL SOIL NOTES

1. SEE SHEET G-1 FOR ADDITIONAL LEGEND.
2. EXCAVATE SOILS CONTAINING LEAD ABOVE TIER 1 STANDARDS, HEREAFTER REFERRED TO AS CONTAMINATED SOIL. CONTRACTORS AND EMPLOYEES INVOLVED IN THE LOADING, TRANSPORT, AND UNLOADING OF THE CONTAMINATED SOILS WILL BE SUBJECT TO HEALTH AND SAFETY REQUIREMENTS AS SPECIFIED IN THE OCCUPATIONAL SAFETY AND HEALTHS (OSHA) HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE STANDARD (29 CFR 1910.120), OTHERWISE KNOWN AS THE HAZWOPER STANDARD AND IN 29 CFR 1926.20.
3. SOIL WITHIN 20 FT RADIUS OF DESIGNATED BORINGS IS CLASSIFIED AS HAZARDOUS WASTE.
4. EXCAVATE ALL CONTAMINATED SOIL TO A DEPTH OF 2.0' AND TRANSPORT TO A PERMITTED WASTE DISPOSAL FACILITY.
5. SOILS THAT DO NOT CONTAIN LEAD ABOVE TIER 1 STANDARDS ARE HEREAFTER REFERRED TO AS LOW IMPACT FILL
6. SEE SPECIFICATION SECTION 02 61 13 EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL.
7. SEE SPECIFICATION SECTION 02 55 00 REMEDIATION SOIL STABILIZATION.
8. ALL HAZARDOUS WASTE TO BE STABILIZED IN-SITU PRIOR TO EXCAVATION AND DISPOSAL.
9. FOLLOWING STABILIZATION, ADDITIONAL TCLP TESTING WILL BE REQUIRED TO RECLASSIFY SOIL AS CONTAMINATED SOIL.
12. LOW IMPACT FILL MAY BE REUSED ON SITE OR HAULED OFF SITE FOR USE AS CONTROLLED FILL AT A LOCATION WHICH MEETS THE FOLLOWING CRITERIA: NON-RESIDENTIAL, NON-RECREATIONAL, NOT WITHIN 10 FEET OF THE WATER TABLE, OR IN CLOSE PROXIMITY TO A WETLAND, LAKE OR STREAM.
13. NO UNAUTHORIZED EXCAVATIONS WILL BE ALLOWED BEYOND THESE PREDETERMINED LIMITS WITHOUT PRIOR APPROVAL BY THE ENGINEER.
14. CONTRACTOR SHALL ESTABLISH AND IMPLEMENT ENGINEERING CONTROLS, WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPMENT, OR A COMBINATION OF THESE METHODS, TO REDUCE EXPOSURE TO BELOW ESTABLISHED EXPOSURE LEVELS FOR THE SUBSTANCES INVOLVED.