SWIFT Contract No. 43916

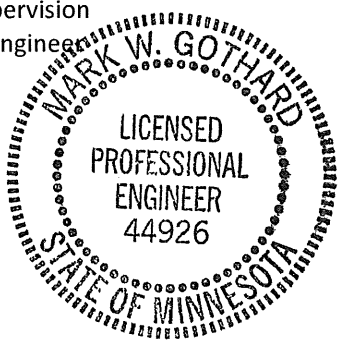
Geotechnical Evaluation Report

Lake Vermilion State Park
Campground and Water Access
Breitung Township, Minnesota

Prepared for

SRF Consulting Group, Inc.

Professional 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.



Mark W. Gothard, PE
Principal Engineer
License Number: 44926
February 11, 2013

Project HB-12-01280

Braun Intertec Corporation

Consultant's Report

BRAUN INTERTEC

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February 11, 2013

Project HB-12-01280

Mr. Ken Grieshaber, ASLA (MN,ND, IA)
SRF Consulting Group, Inc.
One Carlson Parkway North
Suite 150
Minneapolis, MN 55447-4443

Re: Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Breitung Township, Minnesota

Dear Mr. Grieshaber:

We are pleased to present this Geotechnical Evaluation Report for the proposed Lake Vermilion State Park Campground and Water Access. A summary of our results, and a summary of our recommendations in light of the geotechnical issues influencing design and construction are presented below. More detailed information and recommendations follow.

Summary of Results

The general geologic profile encountered at the site consists of silty sand topsoil with roots and organics over glacial silty sands. Glacial lean and fat clays were encountered in Test Pits TP-33, TP-34, TP-35, TP-69, and HAB-67. The shallower test pits, ranging in depth from 1 to 3 feet, encountered numerous cobbles and boulders. These test pits also contained fractured rock pieces and/or weathered bedrock, making excavation very difficult for the backhoe. Shallow bedrock was encountered in most test pits ranging from the ground surface to depths greater than 9 feet.

Groundwater was not observed as our test pits were excavated. Given the fine-grained nature of the geologic materials encountered, however, it is likely that insufficient time was available for groundwater to seep into the pits and rise to its hydrostatic level. Piezometers or monitoring wells would be required to confirm if groundwater was present within the depths explored.

Seasonal and annual fluctuations of groundwater should also be anticipated, and would likely correspond to fluctuations of the water elevation of Lake Vermilion.

Summary of Recommendations

The geotechnical issues influencing design of the proposed park appear to be limited. The geologic materials present at anticipated structure subgrade elevations generally appear suitable for support of conventional spread footings, grade-supported slabs, and pavements.

Due to the frost susceptible nature of the silt- and clay-rich soils present at anticipated exterior slab and pavement subgrade elevations however, consideration should also be given to incorporating a granular

subbase into the pavement sections. This will enhance subgrade drainage efforts and reduce the potential for pavement subgrades to become saturated and heave upon freezing; strength loss upon thawing will also be reduced.

Grade cuts are planned over the shallow bedrock and will need to be removed to a depth to provide a minimum pavement cross-section including aggregate base and bituminous surfacing. Pavement sections can be located directly above competent, intact rock with only a cushion/drainage layer, but the rock surface should ideally be gradually sloped to promote drainage. It is essential that the rock surface be generally consistent to provide a uniform bearing surface and prevent water from being trapped in local depressions if it is within the top five feet of the pavement surface. It is assumed that a select granular borrow material will be used as fill. This material will help provide subsurface drainage of the pavement system.

A well designed subsurface drainage system will be necessary to ensure that the pavement meets its design life. Due to the relatively shallow bedrock, any water trapped within approximately five feet below the pavement could likely lead to frost heaving. Any non-uniformity in the depth to bedrock could lead to differential frost heave.

Drains could be placed directly on the rock to help remove water, but rock removal would be necessary to cause the water to flow to a collection/discharge location. It is not uncommon to have some drainage pipe in a horizontal condition that helps water flow more quickly and avoid building up on the bedrock before the water flows into collection pipes that are below the rock surface.

Where utilities will exist below the rock surface, the water will likely flow into the utility trenches. It is anticipated that underground utilities will need to be installed in rock cut trenches unless pumping stations are used.

From a construction perspective, the project team should also be aware that:

- Debris and organic soils will have to be removed from the existing material before it can be reused; this will not only limit the reusable volume, but will also increase the time required to handle the existing fill. The fill is also wet and will need to be dried to facilitate compaction.

- Bedrock will be encountered at varying elevations within the site. While the upper foot of the bedrock can be fractured and can likely be dislodged and removed using dozers equipped with ripping teeth or backhoes equipped with toothed buckets, the bedrock present throughout most of the site will have to be removed using splitters, hammers or blasting.

- The transition from soil to bedrock can be erratic and highly variable. Weathered or fresh bedrock above the subgrade elevation will need to be removed or sloped (if possible) by ripping or blasting. Contractor experience in similar conditions will be important. We recommend that Contract provisions require the Contractor and site personnel to have a minimum amount of recent experience with similar practices and similar conditions, such as blasting, within a recent time frame.

- The clays present will need to be dried to facilitate compaction. Given the anticipated depths of the building area excavations, the thickness of clay placed in an excavation will also have to be restricted to limit the amount of post-construction settlement that occurs from the excavation backfill compressing under its own weight.

- Because there are no such resources on the site, sands or gravels will have to be imported to backfill the balance of deep excavations that can only be partially backfilled with clay, and facilitate drainage behind below-grade walls and below pavements.

- Haul roads and staging areas will be particularly sensitive to disturbance and strength loss. Subexcavation and recompaction or replacement of subgrade soils can be limited if these traffic areas are protected with crushed rock.

Remarks

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Mark Gothard at 218.263.8869 (office) or 218.259.5500 (cell) or by email at mgothard@braunintertec.com.

Sincerely,

BRAUN INTERTEC CORPORATION

Alex J. Peritz, EIT
Engineer-In-Training

Mark W. Gothard, PE
Principal Engineer

Attachment:
Geotechnical Evaluation Report

Table of Contents

Description **Page**

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A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the design and construction of the proposed Lake Vermilion State Park northeast of Soudan, Minnesota. SRF Consulting Group, Inc. (SRF) is the design consultant responsible for designing the roadways, utilities, and buildings throughout the park on behalf of the Minnesota Department of Natural Resources.

A.2. Purpose

The goals of our geotechnical evaluation are to characterize subsurface soil and groundwater conditions within the proposed construction area and provide geotechnical recommendations for the design and construction of the proposed buildings and roadways.

A.3. Background Information and Reference Documents

To facilitate our evaluation, we were provided with or reviewed the following information or documents:

- A boring location sketch prepared by Benchmark Engineering, Inc.
- A previous Geotechnical Engineering Report prepared by Gale-Tec Engineering, Inc. dated January 12, 2006.
- Previous evaluations Braun Intertec has performed in this area.
- A Geologic Map of Minnesota, by Howard C. Hobbs and Joseph E. Goebel, 1982.

A.3.a. Previous Exploration(s)

To facilitate our evaluation, we reviewed the Geotechnical Engineering Report prepared by Gale-Tec Engineering Inc. The report attempted to determine the potential of on-site aggregate resources for use in construction of roadways and buildings. A copy of that report is attached.

We identified other potential borrow sources in the area, including a pit owned by Breitung Township southwest of the site and a pit owned by the Minnesota Department of Transportation (MNDOT)

northeast of the site. These pit locations are shown on the attached sketch and were found on MNDOT's website describing aggregate resources throughout the state.

A.4. Site Conditions

Our referenced documents and past project experience in the general area indicate that the site is underlain with glacial sands and clays overlying shallow bedrock.

At the time of the field observations, the site was generally wooded with a rolling terrain and had several recreational trails throughout.

A.5. Scope of Services

Our scope of services for this project was originally submitted as a cost estimate to Mr. Ken Grieshaber of SRF Consulting Group, Inc., on March 12, 2012. SRF subsequently issued a professional services subconsultant agreement authorizing us to proceed. Tasks performed in accordance with our authorized scope of services and under the terms of our June 15, 2006, General Conditions included:

- Clearing exploration locations of underground utilities.
- Performing seventy (70) test pits to a depth of 10 feet, or refusal.
- Performing laboratory tests on selected test pit samples.
- Preparing this report containing a sketch, exploration logs, a summary of the geologic materials encountered, and recommendations for structure subgrade preparation and the design of the utility installation and roadways.

Due to access issues we performed hand auger borings at test pit locations 11, 31, 32, 38, 39, 40, 41, 67, and 68.

A.5.a. Reconnaissance

We attended a design meeting on October 16, 2012 and performed a reconnaissance of the site primarily to evaluate equipment access to exploration locations. We also observed and took notes regarding design and construction concerns of the design team.

A.5.b. Staking and Surveying

The desired boring locations were provided to us by SRF. The test locations were staked and the ground surface elevations at those locations were determined by Benchmark Engineering, Inc.

A.5.c. Subsurface Exploration

We performed nine hand auger borings at the locations shown on the sketch in the Appendix. The borings were extended to auger refusal.

We also observed the excavation of sixty one test pits at the locations shown on the sketch in the Appendix. The test pits were excavated by Low Impact Excavators, and extended to a maximum depth of 9 feet.

Bulk samples were taken of the geologic materials encountered at selected test pits.

Prior to commencing with our subsurface exploration activities, we cleared the exploration locations of underground utilities through Gopher State One Call.

A.5.d. Laboratory Testing

We performed moisture content, percent-passing-200-sieve, and Atterberg limits tests on the bulk samples obtained from the test pits.

B. Results

B.1. Exploration Logs

B.1.a. Log of Boring Sheets

Log of Boring sheets for our hand auger borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated, and present the results of groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

B.1.b. Log of Test Pit Sheets

Log of Test Pit sheets are also included in the Appendix. The logs classify and describe the geologic materials exposed in the sidewalls and bottoms of the pits, and present the results of laboratory tests performed on bulk samples obtained from them, and groundwater measurements.

B.1.c. Geologic Origins

Geologic origins assigned to the materials shown on the logs and referenced within this report were based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

B.2. Geologic Profile

The general geologic profile encountered at the site consisted (proceeding down from the ground surface) of up to 6 inches of topsoil consisting of silty sand with roots and organics. Beneath the topsoil, glacial silty sand (SM) was generally encountered to the termination depth of the test pits. Test Pit TP-33, however, encountered lean clay (CL) beneath the silty sand. Test Pit's TP-34 and TP-35 encountered lean clay and fat clay (CH), respectively, beneath the surficial topsoil. Test Pit TP-69 encountered fat clay over silty sand. Hand Auger Boring HAB-67 encountered topsoil underlain by silty sand and lean clay. The shallower test pits, ranging in depth from 1 to 3 feet, encountered numerous cobbles and boulders. These test pits also contained fractured rock pieces and/or weathered bedrock, making excavation very difficult for the backhoe.

The backhoe encountered refusal at depths ranging from the ground surface to greater than 9 feet. "Refusal" means that the backhoe could not be advanced further without excessive effort. Refusal can be caused by hardpan, boulders, detached rock pieces ("floats") as well as bedrock. Test pit refusal depths are summarized in the table below.

Table 1. Bedrock Depth Summary

Location	Surface Elevation (ft)	Measured Depth Bedrock (ft)	Corresponding Bedrock Elevation (ft)
TP-1	1412.3	7	1406
TP-2	1424.5	6 1/2	1418
TP-3	1432.9	4	1429
TP-4	1437.9	4 1/2	1433 1/2
TP-5	1464.2	1	1463

Location	Surface Elevation (ft)	Measured Depth Bedrock (ft)	Corresponding Bedrock Elevation (ft)
TP-6	1458.7	1	1458
TP-7	1467.4	0	1467.4
TP-8	1469.1	0	1469.1
TP-09	1453.2	4	1449 1/2
TP-10	1461.5	5	1456 1/2
HAB-11	1469.2	1/2	1469
TP-12	1470.8	0	1470.8
TP-13	1471.9	0	1471.9
TP-14	1473.3	0	1473.3
TP-15	1468.2	0	1468.2
TP-16	1464.8	3 1/2	1461 1/2
TP-17	1464.6	3 1/2	1461
TP-18	1462.6	4	1458 1/2
TP-19	1474.0	1	1473
TP-20	1477.6	1/2	1477
TP-21	1473.1	1/2	1472 1/2
TP-22	1475.4	1/2	1475
TP-23	1471.6	1/2	1471
TP-24	1458.2	1 1/2	1456 1/2
TP-25	1453.5	2 1/2	1451
TP-26	1452.7	1 1/2	1451
TP-27	1449.3	2 1/2	1446 1/2
TP-28	1440.3	2	1438
TP-29	1452.6	0	1452.6
TP-30	1445.4	0	1445.4
HAB-31	1428	1/2	1427 1/2
HAB-32	1406	1/2	1405 1/2
TP-33	1376.4	8	1368 1/2
TP-34	1378.6	8	1370 1/2
TP-35	1376.1	7	1369
TP-36	1369.8	2 1/2	1367 1/2
TP-37	1371.6	2 1/2	1369
HAB-38	1458	1	1457
HAB-39	1448.8	1	1448
HAB-40	1460.6	0	1460.6
HAB-41	1450.8	1	1450
TP-42	1423.8	>9	NA
TP-43	1423.1	>9	NA
TP-44	1404.7	2	1402 1/2
TP-45	1407.4	2	1405 1/2
TP-46	1403.9	6 1/2	1397 1/2
TP-47	1392.2	5	1387 1/2
TP-48	1401.5	5	1396 1/2
TP-49	1407.2	8	1399

Location	Surface Elevation (ft)	Measured Depth Bedrock (ft)	Corresponding Bedrock Elevation (ft)
TP-50	1405.4	2 1/2	1403
TP-51	1406.9	3	1404
TP-52	1406.4	1 1/2	1405
TP-53	1405.0	2	1403
TP-54	1402.7	6 1/2	1396 1/2
TP-55	1418.1	2 1/2	1415 1/2
TP-56	1422.5	0	1422.5
TP-57	1410.9	4 1/2	1406 1/2
TP-58	1400.6	2 1/2	1398
TP-59	1382.4	3 1/2	1379
TP-60	1389.3	2 1/2	1386 1/2
TP-61	1393.3	3	1390 1/2
TP-62	1394.9	3	1392
TP-63	1401.5	2 1/2	1399
TP-64	1401.2	2 1/2	1398 1/2
TP-65	1396.5	1	1395 1/2
TP-66	1391.1	5 1/2	1385 1/2
HAB-67	1374.3	2	1372 1/2
HAB-68	1377.0	1 1/2	1375 1/2
TP-69	1399.4	9	1390 1/2
TP-70	1377.6	5 1/2	1372

B.2.a. Groundwater

Groundwater was not observed as our test pits were excavated. Given the fine-grained nature of the geologic materials encountered, however, it is likely that insufficient time was available for groundwater to seep into the pits and rise to its hydrostatic level. Piezometers or monitoring wells would be required to confirm if groundwater was present within the depths explored.

Seasonal and annual fluctuations of groundwater should also be anticipated, and would likely correspond to fluctuations of the water elevation of Lake Vermilion.

B.3. Laboratory Test Results

The moisture content of the silty sands varied from approximately 5.2 to 17.6 percent, indicating that the material was at or above of its probable optimum moisture content.

Our mechanical analyses indicated that the silty sands contained 17.9 to 41.5 percent silt and clay by weight.

The Liquid limit determined for the clay was 89; the plastic limit was 31. These results indicate that the clay is fat clay.

C. Basis for Recommendations

C.1. Design Details

C.1.a. Building Structure Loads

We assume the buildings will generally be supported on conventional shallow spread footing foundations and the floors will be slab-on-grade or have crawl spaces.

We assume wall loads will be less than 5 kips (5,000 pounds) per linear foot, column loads will be less than 50 kips, distributed floor slab loads will be less than 125 pounds per square foot (psf), and concentrated floor loads will be less than 2,000 pounds.

C.1.b. Pavements and Traffic Loads

We have assumed the light-duty pavement areas will have a bituminous section. We have assumed that light-duty pavements will be subjected to no more than 50,000 equivalent 18-kip single axle loads (ESALs) over an assumed design life of 20 years.

We have assumed heavy-duty pavement areas will also have a bituminous section. We have assumed that heavy-duty pavements will be subjected to no more than 100,000 ESALs over an assumed design life of 20 years.

C.1.c. Precautions Regarding Changed Information

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. Depending on the extent of available information, assumptions may have been made based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, we should be notified. New or changed information could require additional evaluation, analyses and/or recommendations.

C.2. Design Considerations

The geotechnical issues influencing design of the park appear to be limited. The geologic materials

present at anticipated structure subgrade elevations generally appear suitable for support of conventional spread footings, grade-supported slabs, and pavements.

Due to the frost susceptible nature of the silt- and clay-rich soils present at anticipated exterior slab and pavement subgrade elevations, consideration should also be given to incorporating a granular subbase into the pavement sections. This will enhance subgrade drainage efforts and reduce the potential for pavement subgrades to become saturated and heave upon freezing; strength loss upon thawing will also be reduced.

Grade cuts are planned over the shallow bedrock and will need to be removed to a depth to provide a minimum pavement cross-section including aggregate base and bituminous surfacing. Pavement sections can be located directly above competent, intact rock with only a cushion/drainage layer, but the rock surface should ideally be gradually sloped to promote drainage. It is essential that the rock surface be generally consistent to provide a uniform bearing surface and prevent water from being trapped in local depressions if it is within the top five feet of the pavement surface. It is assumed that a select granular borrow material will be used as fill. This material will help provide subsurface drainage of the pavement system.

A well designed subsurface drainage system will be necessary to ensure that the pavement meets its design life. Due to the relatively shallow bedrock, any water trapped within approximately five feet below the pavement could likely lead to frost heaving. Any non-uniformity in the depth to bedrock could lead to differential frost heave.

Drains could be placed directly on the rock to help remove water, but rock removal would be necessary to cause the water to flow to a collection/discharge location. It is not uncommon to have some drainage pipe in a horizontal condition that helps water flow more quickly and avoid building up on the bedrock before the water flows into collection pipes that are below the rock surface.

Where utilities are located below the rock surface, the water will likely flow into the utility trenches. It is anticipated that underground utilities will need to be installed in rock cut trenches unless pumping stations are used.

C.3. Construction Considerations

From a construction perspective, the project team should also be aware that:

- Debris and organic soils will have to be removed from the existing material before it can be

reused; this will not only limit the reusable volume, but will also increase the time required to handle the existing fill. The fill is also wet and will need to be dried to facilitate compaction.

- Bedrock will be encountered at varying elevations within the site. While the upper foot of the bedrock can be fractured and can likely be dislodged and removed using dozers equipped with ripping teeth or backhoes equipped with toothed buckets, the bedrock present throughout most of the site will have to be removed using splitters, hammers or blasting.

- The transition from soil to bedrock can be erratic and highly variable. Weathered or fresh bedrock above the subgrade elevation will need to be removed or sloped (if possible) by ripping or blasting. Contractor experience in similar conditions will be important. We recommend that Contract provisions require the Contractor and site personnel to have a minimum amount of recent experience with similar practices and similar conditions, such as blasting, within a recent time frame.

- The clays present will need to be dried to facilitate compaction. Given the anticipated depths of the building area excavations, the thickness of clay placed in an excavation will also have to be restricted to limit the amount of post-construction settlement that occurs from the excavation backfill compressing under its own weight.

- Because there are no such resources on the site, sands or gravels will have to be imported to backfill the balance of deep excavations that can only be partially backfilled with clay, and facilitate drainage behind below-grade walls and below pavements.

- Haul roads and staging areas will be particularly sensitive to disturbance and strength loss. Subexcavation and recompaction or replacement of subgrade soils can be limited if these traffic areas are protected with crushed rock.

D. Recommendations

D.1. Building Subgrade Preparation

D.1.a. Excavations

We recommend removing the surficial topsoil from beneath proposed building areas. Based on our

limited site observations, excavation depths are expected to range up to 6 inches.

Portions of the excavations may also be deeper than indicated by our observations. Contractors should also be prepared to extend excavations in wet or fine-grained soils to remove disturbed bottom soils. To provide lateral support to replacement backfill, additional required fill and the structural loads they will support, we recommend oversizing (widening) the excavations 1 foot horizontally beyond the outer edges of the building perimeter footings for each foot the excavations extend below bottom-of-footing elevations.

D.1.b. Excavation Dewatering

We recommend removing groundwater from the excavations. Sumps and pumps can be considered for excavations in low-permeability silt- and clay-rich soils, or where groundwater can be drawn down 2 feet below the bottoms of excavations in more permeable sands. In large excavations, or where groundwater must be drawn down more than 2 feet, a well contractor should review our logs to determine if wells are required, how many will be required, and to what depths they will need to be installed.

In sands, we do not recommend attempting to dewater from within an excavation. Upward seepage will loosen and disturb the excavation bottom. Rather, groundwater should be drawn down at least 2 feet below the anticipated excavation bottom in advance of excavation.

D.1.c. Selecting Excavation Backfill and Additional Required Fill

We initially recommend backfilling over wet or submerged excavation bottoms with at least 2 feet of coarse sand having less than 50 percent of the particles by weight passing a #40 sieve, and less than 5 percent of the particles passing a #200 sieve. We anticipate that this material will need to be imported

On-site soils free of organic soil and debris can be considered for reuse as backfill and fill. The clays, however, being fine-grained, will be more difficult to compact if wet or allowed to become wet, or if spread and compacted over wet surfaces.

We recommend imported material needed to replace excavation spoils or balance cut and fill quantities consist of sand or sandy gravel with less than 12 percent by weight passing a number 200 sieve.

D.1.d. Rock Excavation

We recommend that rock excavation be defined according to MnDOT as follows:

- Rock excavation shall consist of all materials that cannot, in the Engineer's opinion, be

excavated without drilling and blasting or without the use of rippers, together with all boulders and other detached rock each having a volume of 1 cubic yard or more, but exclusive of those quantities that are to be paid for separately under the item of rock channel excavation.

- Blasting operations shall be controlled to produce a shattering effect on the rock that will not throw the material out of the excavation areas. Any rock blasted away from the excavation and embankment areas shall be recovered as directed.

D.1.e. Placement and Compaction of Backfill and Fill

We recommend spreading backfill and fill in loose lifts of approximately 8 inches. We recommend compacting backfill and fill in accordance with the criteria presented below in Table 2. The relative compaction of utility backfill should be evaluated based on the structure below which it is installed, and vertical proximity to that structure.

Table 2. Compaction Recommendations Summary

Reference	Relative Compaction, percent (ASTM D 698 – standard Proctor)	Moisture Content Variance from Optimum, percentage points
Below foundations	95	-1 to +3
Below slabs	95	-1 to +3
Below pavements, within 3 feet of subgrade elevations	100	-1 to +3
Below pavements, more than 3 feet below subgrade elevations	95	-1 to +3
Below landscaped surfaces	90	-1 to +3

D.2. Spread Footings

D.2.a. Embedment Depth

For frost protection, we recommend embedding perimeter footings 60 inches below the lowest exterior grade. Interior footings may be placed directly below floor slabs. We recommend embedding building footings not heated during winter construction, and other unheated footings associated with canopies, stoops or sidewalks 72 inches below the lowest exterior grade.

D.2.b. Subgrade Improvement

Based on our recent observations, it appears that footings for the proposed buildings may be supported on conventional spread footings situated on bedrock, on the native silty sand or clay soils or on structural fill if placed as described in this report. We recommend having a geotechnical engineer observe all

excavations related to subgrade preparation. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations, and the adequacy of required excavation oversizing.

Final preparation of the bedrock should include overexcavation and placement of a nominal 1 inch of sand. The sand serves as a bond break between the bottom of the footing and the bedrock. This break allows the concrete to shrink without adhering to the rock during the curing process. Otherwise, there is a risk that the concrete foundation element will crack. This break in bond does reduce the resistance of the concrete footings to lateral forces.

Furthermore, the bedrock is a non frost-active material. That is, it does not expand upon freezing. Thus, foundations can be placed directly atop the bedrock without the need for soil cover or insulation. The exposed footings, however, will transmit "the cold" through to the interior of a building. As a practical consideration, it may be necessary to provide insulation around the footings in occupied areas and where heat loss is a concern.

Where excavations for spread footings transition from soil to rock, we recommend a minimum transition of 4 horizontal to 1 vertical should be provided between footings that bear on rock and neighboring footings bearing upon soil.

D.2.c. Net Allowable Bearing Pressure

For foundations placed upon native sand or clay, or compacted engineered fill over the native soils, we recommend sizing footings to exert a net allowable bearing pressure up to 2,500 pounds per square foot (psf), including all transient loads.

For foundations bearing directly upon bedrock, we recommend sizing footings to exert a net allowable bearing pressure up to 10,000 psf. The geotechnical engineer should observe the footing areas to document that the rock surface has been adequately prepared. The bedrock can be leveled somewhat with the sand bond break, but the maximum thickness of sand should be no more than 6 inches. It may be necessary to level the footing with additional excavation on the high side of the footing. Footings to be constructed upon slopes steeper than 5 horizontal on 1 vertical (5:1) should be considered individually by the geotechnical engineer. Pinning of these footings to the slope is an option in some cases.

D.2.d. Settlement

We estimate that total and differential settlements among the footings will amount to less than 1 inch.

However, final settlement will be dependent upon the size of the foundation elements, the depth of fill, and the length of time the fill has been in place.

D.3. Interior Slabs

D.3.a. Subgrade Modulus

Floor slab subgrades are anticipated to consist of engineered granular fill suitable for slab support. We recommend using a modulus of subgrade reaction, k value, of 200 pounds per square inch per inch of deflection (PCI) to design the slabs.

If a minimum of 6 inches of compacted crushed aggregate base course (i.e., MnDOT Class 5) is placed immediately beneath the floor slabs, it is our opinion that the modulus may be increased by 50 PCI.

D.3.b. Moisture Vapor Protection

If floor coverings or coatings less permeable than the concrete slab will be used, consideration should be given to placing a vapor retarder or vapor barrier immediately beneath the slab. Some contractors prefer to bury the vapor retarder or barrier beneath a layer of sand to reduce curling and shrinkage, but this practice risks trapping water between the slab and vapor retarder or barrier.

Regardless of where the vapor retarder or barrier is placed, floor covering manufacturers should be consulted regarding the appropriate type, use and installation of the vapor retarder or barrier to preserve warranty assurances.

D.4. Exterior Slabs

Though not necessarily designed to accommodate dead and live load surcharges or vehicles, exterior slabs can be subjected to both. Settlement of exterior slabs on poorly compacted foundation backfill, utility backfill and other compressible naturally deposits soils or fills can also contribute to unfavorable surface drainage conditions and frost-related damage (see below) to the slabs and adjacent structures, including buildings and pavements. Subgrades supporting exterior slabs should therefore be prepared in accordance with the excavation, backfilling and compaction recommendations provided below in Section D.8. Additional commentary on the risks associated with frost, and recommendations for helping mitigate those risks, is provided in Section D.9.

D.5. Pavements

D.5.a. Pavement Subgrade Preparation

For construction of new paved areas, we recommend stripping surface vegetation, topsoil and other organic soils from below the pavement subgrade along with any cobbles and boulders encountered.

After stripping, we recommend the subgrade be surface-compacted with a large self-propelled compactor. We recommend the existing subgrade be surface compacted to a minimum of 100 percent of standard Proctor density if within 3 feet of the proposed pavement subgrade. If below 3 feet, surface compaction to 95 percent should be adequate.

To provide lateral support for the replacement backfill, additional required fill and curbs and gutters, we recommend oversizing (widening) the excavations 1 foot horizontally beyond the backs of the proposed curbs for each foot the excavations extend below the tops of the curbs. The 1:1 oversizing would also be applicable to road sideslopes, provided they are protected from erosion.

Fill and backfill below pavements should consist of non-organic, on or off-site soils with less than 10 percent by weight passing the number 200 sieve.

We recommend the initial lift of backfill over wet excavation bottoms consist of at least 2 feet of relatively coarse sand having less than 50 percent of its particles by weight passing a 40 sieve, and less than 5 percent of its particles passing a 200 sieve. We anticipate that this material will need to be imported.

We recommend spreading backfill and fill in loose lifts of approximately 12 inches. We recommend compacting backfill and fill to a minimum of 95 percent of it standard Proctor maximum dry density as determined in accordance with ASTM International Test Method D 698. In the upper 3 feet of subgrades, we recommend 100 percent.

D.5.b. Subgrade Proof-Roll

Prior to placing aggregate base material, we recommend proof-rolling pavement subgrades to determine if the subgrade materials are loose, soft or weak, and in need of further stabilization, compaction or subexcavation and recompaction or replacement. A second proof-roll should be performed after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

D.5.c. Design Sections

Laboratory tests to determine an R-value for pavement design were not included in the scope of this project. Based on our experience with similar projects in the area, however, it is our opinion that an R-value of 30 can be assumed for design purposes.

Based upon the aforementioned traffic loads and an R-value of 30, we recommend a light-duty pavement section that includes 3 inches of bituminous pavement (a 1 1/2-inch surface course over a 1 1/2-inch base course) over 8 inches of aggregate base material and 18 inches of sand sub-base material consisting of a select granular borrow.

For heavy-duty areas, we recommend 4 inches of bituminous pavement (a 2-inch surface course over a 2-inch base course) over 10 inches of aggregate base material and 2 feet of sand sub-base material. Other design sections of equivalent strength could also be considered.

Where concrete pavements may be utilized in heavy duty areas in lieu of bituminous, we recommend that at least 6 inches of aggregate base be placed over the subgrade to provide more uniform support for the concrete, and to provide a more stable working platform for construction. We recommend a minimum 7-inch thick concrete slab. These designs are based on a modulus of subgrade reaction (k) of 75 pci.

The above pavement designs are based upon a 20-year performance life. This is the amount of time before major reconstruction is anticipated. This performance life assumes maintenance, such as seal coating and crack sealing, is routinely performed. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

D.5.d. Materials and Compaction

We recommend specifying crushed aggregate base meeting the requirements of Minnesota Department of Transportation (Mn/DOT) Specification 3138 for Class 5. We recommend that the bituminous wear and base courses meet the requirements of Specifications 2360, Type SP. We recommend the aggregate gradations for the asphalt mixes meet Gradation B for the base course and Gradation B or A for the surface course. Gradation A contains a smaller aggregate size than Gradation B and will provide a surface with less visible aggregate which is desirable for some owners. We recommend the Performance Graded Asphalt cement be a PG 58-28. (If additional resistance to rutting, scuffing and dimpling is desired, we recommend utilizing a PG 64-28. If additional resistance to cold weather cracking is desirable, we recommend utilizing a PG 58-34.)

We recommend that the aggregate base be compacted to a minimum of 100 percent of its maximum standard Proctor dry density. We recommend that the bituminous pavement be compacted to at least 92 percent of the maximum theoretical Rice density.

We recommend specifying concrete for pavements that has a minimum 28-day compressive strength of 4,000 psi, and a modulus of rupture (M_r) of at least 600 psi. We also recommend Type I cement meeting the requirements of ASTM C 150. We recommend specifying 5 to 7 percent entrained air for exposed concrete to provide resistance to freeze-thaw deterioration. We also recommend using a water/cement ratio of 0.45 or less for concrete exposed to deicers.

D.5.e. Subgrade Drainage

We recommend installing perforated drainpipes throughout pavement areas at low points and about catch basins. The drainpipes should be placed in small trenches extended at least 8 inches below the granular subbase layer, or below the aggregate base material where no subbase is present.

A well designed subsurface drainage system will be necessary to ensure that the pavement meets its design life. Due to the relatively shallow bedrock, any water trapped within approximately five feet below the pavement could likely lead to frost heaving. Any non-uniformity in the depth to bedrock could lead to differential frost heave.

Drains could be placed directly on the rock to help remove water, but rock removal would be necessary to cause the water to flow to a collection/discharge location. It is not uncommon to have some drainage pipe in a horizontal condition that helps water flow more quickly and avoid building up on the bedrock before the water flows into collection pipes that are below the rock surface.

D.6. Frost Protection

D.6.a. General

All or some of the exterior slabs, as well as pavements, will be underlain with silty sands, which are considered to be moderately to highly frost susceptible. Soils of the type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated due to surface runoff or infiltration or are excessively wet is-situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could impact design drainage patterns and the performance of exterior slabs and pavements, as well as any isolated exterior footings and piers. To address most of the heave related issues, we recommend that general site grades and grades for exterior surface features be set to

direct surface drainage away from buildings, across large paved areas and away from walkways to limit the potential for saturation of the subgrade and any subsequent heaving. General grades should also have enough "slope" to tolerate potential larger areas of heave which may not fully settle when thawed.

It should be noted that general runoff and infiltration from precipitation are not the only sources of water that can saturate subgrade soils and contribute to frost heave. Roof drainage and the irrigation of landscaped areas in close proximity to exterior slabs, pavements, and isolated footings and piers, contribute as well.

D.6.b. Exterior Slabs and Pavements

Even small amounts of frost-related differential movement at walkway joints or cracks can create tripping hazards. Several subgrade improvement options can be explored to address this condition. The most conservative and potentially most costly subgrade improvement option to help limit the potential for heaving, but not eliminate it, would be to remove any frost-susceptible soils present below the exterior slabs' "footprint" down to the bottom-of-footing grades or to a maximum depth of 5 feet below subgrade elevations, whichever is less. We recommend the resulting excavation then be refilled with sand or sandy gravel having less than 50 percent of the particles by weight passing the #40 sieve and less than 5 percent of the particles by weight passing a #200 sieve. The bottom of the excavation should be sloped toward one or more collection points so that any water entering the backfill can be collected and removed. A series of perforated drainpipes will need to be installed to collect and dispose of the infiltrating water and/or groundwater that could accumulate within the backfill. The piping should be connected to a storm sewer or a sump to remove any accumulated water, or "daylighted" if grades permit. If the water is not removed, it is our opinion this option will not be effective in controlling heave.

Another subgrade improvement option would be to build in a transition zone between those soils considered to be frost-susceptible and those that are not to somewhat control where any differential movement may occur. Such transitions could exist between exterior slabs and pavements, between entry way slabs and sidewalks, and along the sidewalks themselves. For this option, the frost-susceptible soils in critical areas would be removed to a depth of at least 5 feet below grade as discussed above. The excavation below the footprint of the sidewalks or other slabs would then be sloped upward at a gradient no steeper than 3:1 (horizontal : vertical) toward the less critical areas. Provisions for draining the backfill in this case, too, would be required. If accumulating water is not removed, it is our opinion this option will also be ineffective in controlling heave.

Regardless of what is done to the walkway or pavement area subgrade, it will be critical the end-user develop a detailed maintenance program to seal and/or fill any cracks and joints that may develop during

the useful life of the various surface features. Concrete and bituminous will experience episodes of normal thermo-expansion and thermo-contraction during its useful life. During this time, cracks may develop and joints may open up, which will expose the subgrade and allow any water flowing overland to enter the subgrade and either saturate the subgrade soils or to become perched atop it. This occurrence increases the potential for heave due to freezing conditions in the general vicinity of the crack or joint. This type of heave has the potential to become excessive if not addressed as part of a maintenance program. Special attention should be paid to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

The on-going performance of pavements is impacted by conditions under which the pavement is asked to perform. These conditions include the environmental conditions, the actual use conditions and the level of ongoing maintenance performed. With regard to bituminous pavements in particular, because of normal thermo expansion and contraction, it is not unusual to have cracking develop within the first few years of placement and for the cracking to continue throughout the life of the pavement. A regular maintenance plan should be developed for filling cracks in bituminous pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade. It is also not unusual for bituminous pavements to require a seal coat within the first 5 to 10 years to increase the long-term performance.

D.6.c. Isolated Footing and Piers

Soils classifying as "silt" (USCS symbols ML or MH), "clay" (CL or CH), or as being "silty" or "clayey" (including but not limited to SP-SM, SC-SM, SM or SC), have the potential for adhering to poured concrete or masonry block features built through the normal frost zone. In freezing conditions, this soil adhesion could result in the concrete or masonry construction being lifted out of the ground. This lifting action is also known as heave due to adfreezing. The potential for experiencing the impacts of adfreezing increases with poor surface drainage in the area of below grade elements, in areas of poorly compacted clayey or silty soils and in areas of saturated soils. To limit the impacts of adfreeze, we recommend placing a low friction separation barrier, such as high density insulation board, between the backfill and the element. Extending isolated piers deeper into the frost-free zone, enlarging the bottom of the piers and then providing tension reinforcement can also be considered. Recommendations for specific foundation conditions can be provided as needed.

D.7. Utilities

D.7.a. Subgrade Stabilization

It is anticipated that underground utilities will need to be installed in rock cut trenches unless pumping

stations are used. As a result, utility trenches will likely encounter hard rock excavation conditions especially in deeper cut areas.

Utility contractors should be prepared to use special rock trenching equipment such as large excavators or blasting techniques, to achieve utility line grades. Water inflow into any excavation approaching hard rock surface is likely to be experienced in all but the driest summer and fall months. Pre-ripping during mass grading may be beneficial and should be considered with the Geotechnical Engineer prior to or during grading operations.

D.7.b. Selection, Placement and Compaction of Backfill

We recommend that utility pipes be laid on a 6-inch bed of granular material to ensure uniform bearing along the length of the pipe. Trenches should be backfilled with granular material to a depth of one foot above the top of the pipe.

Backfill material shall be compacted with hand operated equipment up to one foot above the pipe. The remainder of the backfilling should follow the recommendations provided above in Section D.1.

D.8. Construction Quality Control

D.8.a. Excavation Observations

We recommend having a geotechnical engineer observe all excavations related to subgrade preparation and spread footing, slab-on-grade and pavement construction. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations, and the adequacy of required excavation oversizing.

D.8.b. Materials Testing

We recommend density tests be taken in excavation backfill and additional required fill placed below spread footings, slab-on-grade construction, beside foundation walls behind basement walls, and below pavements.

We recommend Marshall tests on bituminous mixes to evaluate strength and air voids, and density tests to evaluate compaction.

We also recommend slump, air content and strength tests of Portland cement concrete.

D.8.c. Pavement Subgrade Proof-Roll

We recommend that proof-rolling of the pavement subgrades be observed by a geotechnical engineer to determine if the results of the procedure meet project specifications, or delineate the extent of additional pavement subgrade preparation work.

D.8.d. Cold Weather Precautions

If site grading and construction is anticipated during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading. No fill should be placed on frozen subgrades. No frozen soils should be used as fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed on frozen subgrades. Concrete should be protected from freezing until the necessary strength is attained. Frost should not be permitted to penetrate below footings.

E. Procedures

E.1. Hand Auger Borings

We used a hand auger to assist in evaluating the subsurface geologic conditions. The hand auger was approximately 3 1/4 inches in diameter and 4 feet long. It was used to explore soil stratification below the ground surface. The soils encountered were visually classified in accordance with American Society for Testing and Materials (ASTM) procedures by examining the hand auger cuttings.

E.2. Exploratory Test Pits

Test pits were excavated with a 435 Bobcat mini- excavator, under the direction and observation of Alex Peritz, EIT, between November 13 and 16, 2012 and on December 6, 2012. Logs of the test pits were made by visually examining the sidewalls of the test pits and classifying the materials brought to the surface by the backhoe bucket. Strata boundary depths were measured with a cloth tape and generally rounded to the nearest 1/2-foot.

E.3. Material Classification and Testing

E.3.a. Visual and Manual Classification

The geologic materials encountered were visually and manually classified in accordance with ASTM Standard Practice D 2488. A chart explaining the classification system is attached. Samples were placed in jars or bags and returned to our facility for review and storage.

E.3.b. Laboratory Testing

The results of the laboratory tests performed on geologic material samples are noted on or follow the appropriate attached exploration logs. The tests were performed in accordance with ASTM or AASHTO procedures.

E.4. Groundwater Measurements

Our field personnel observed the sides and bottoms of test pits as they were being advanced, and after they reached their termination depths, for evidence of groundwater seepage and accumulation.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

Our evaluation, analyses and recommendations were developed from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

F.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation periods were relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

F.2.b. Construction Observations and Testing

It is recommended that we be retained to perform observations and tests during construction. This will allow correlation of the subsurface conditions encountered during construction with those encountered by the borings, and provide continuity of professional responsibility.

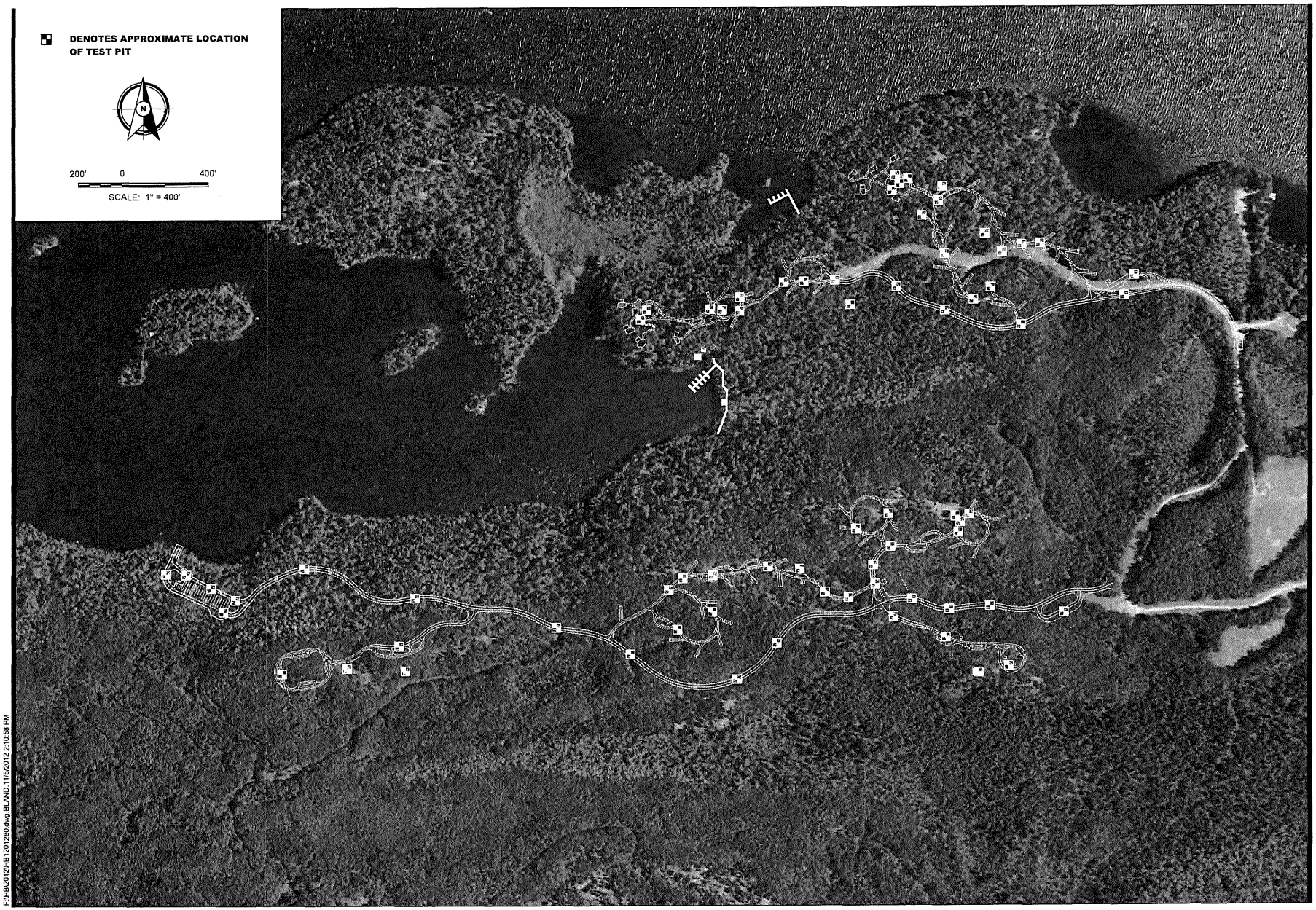
F.3. Use of Report

This report is for the exclusive use of the parties to which it has been addressed. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



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Base Dwg Provided By:
SRF

TEST PIT LOCATION SKETCH
GEOTECHNICAL EVALUATION
LAKE VERMILLION STATE PARK
CAMPGROUND AND WATER ACCESS
SAINT LOUIS COUNTY, MINNESOTA

Project No:	HB1201280
Drawing No:	HB1201280
Scale:	1" = 400'
Drawn By:	BJB
Date Drawn:	11/5/12
Checked By:	AP
Last Modified:	11/5/12
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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-01**

LOCATION: 10' North of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
1412.8	0.0							
1412.3	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)					Test Pit locations determined by SRF Consulting Group, Inc. Test Pit elevations determined by Benchmark Engineering, Inc.
		SM	SILTY SAND, fine- to medium-grained, with Gravel, brown, moist. (Glacial Till)			5.2	17.9	
1405.8	7.0		BOTTOM OF TEST PIT. Water not observed while digging. Test pit then backfilled.					

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-02**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1424.5	0.0					
1424.0	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
1418.0	6.5		BOTTOM OF TEST PIT - Refusal at 6 1/2 feet. No water observed while digging. Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-03**

LOCATION: 10' South of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1432.9	0.0					
1432.4	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
1428.9	4.0		BOTTOM OF TEST PIT - Refusal at 4 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN[SM] INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-04**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1437.9	0.0					
1437.4	0.5	FILL / SM	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, brown, moist.			
			SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
1433.4	4.5		BOTTOM OF TEST PIT - Refusal at 4 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-05**

LOCATION: 15' South of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1464.2	0.0					
1463.7	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1463.2	1.0	SM	SILTY SAND, fine- to medium-grained, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 1 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-06**

LOCATION: 30' West and 10' South of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1458.7	0.0					
1458.2	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1457.7	1.0	SM	SILTY SAND, fine- to medium-grained, with cobbles, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 1 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

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Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-07**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1467.4	0.0		Rock at surface with moss covering rock.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-08**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1469.1	0.0		Rock at surface with moss covering rock.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-09**

LOCATION: 10' West of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1453.2	0.0					
1452.7	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
1449.2	4.0		BOTTOM OF TEST PIT - Refusal at 4 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-10**

LOCATION: 10' West of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1461.5	0.0					
1461.0	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
1456.5	5.0		BOTTOM OF TEST PIT - Refusal at 5 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN[SM] INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-12**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator DATE: **11/13/12** SCALE: **1" = 4'**

Elev. feet 1470.8	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
			Rock at surface.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-13**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1471.9	0.0		Rock at surface.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN[SM] INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-14**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1473.3	0.0		Rock at surface.			

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-15**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1468.2	0.0		Rock at surface.			

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BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
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Brietung Township, Minnesota

TEST PIT: **TP-16**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1464.8	0.0					
1464.3	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
1461.3	3.5		BOTTOM OF TEST PIT - Refusal at 3 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-17**

LOCATION: 10' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1464.6	0.0					
1464.1	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist.			
1461.1	3.5		(Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 3 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-18**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/13/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1462.6	0.0					
1462.1	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel and cobbles, brown, moist. (Glacial Till)			
1458.6	4.0		BOTTOM OF TEST PIT - Refusal at 4 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
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TEST PIT: **TP-19**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1474.0	0.0					
1473.5	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1473.0	1.0	SM	SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 1 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-20**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1477.6	0.0					
1477.1	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			BOTTOM OF TEST PIT - Rock at 1/2 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

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BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-21**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1473.1	0.0					
1472.6	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			BOTTOM OF TEST PIT - Refusal at 1/2 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
Lake Vermilion State Park
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TEST PIT: **TP-22**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1475.4	0.0					
1474.9	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			BOTTOM OF TEST PIT - Refusal at 1/2 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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Brietung Township, Minnesota

TEST PIT: **TP-23**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1471.6	0.0					
1471.1	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			BOTTOM OF TEST PIT - Refusal at 1/2 foot.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
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Brietung Township, Minnesota

TEST PIT: **TP-24**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator DATE: **11/14/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1458.2	0.0					
1457.7	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1456.7	1.5	SM	SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 1 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN[SM] INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
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TEST PIT: **TP-25**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
1453.5	0.0							
1453.0	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist.					
1451.0	2.5		SILTY SAND, fine- to medium-grained, with Gravel, cobbles and boulders, brown. (Glacial Till)			13.8	21.0	
			BOTTOM OF TEST PIT - Refusal at 2 1/2 feet.					
			No water observed while digging.					
			Test pit then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
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TEST PIT: **TP-26**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1452.7	0.0					
1452.2	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1451.2	1.5	SM	SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 1 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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TEST PIT: **TP-27**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1449.3	0.0					
1448.8	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1446.8	2.5		SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
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Brietung Township, Minnesota

TEST PIT: **TP-28**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1440.3	0.0					
1439.8	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1438.3	2.0		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
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TEST PIT: **TP-29**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1452.6	0.0		Rock at surface.			

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BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-30**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1445.4	0.0		Rock at surface.			

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

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Geotechnical Evaluation
Lake Vermilion State Park
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TEST PIT: **TP-33**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1376.4	0.0					
1375.9	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1373.4	3.0		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
		CL	LEAN CLAY, brown, moist. (Glacial Till)			
1368.4	8.0		BOTTOM OF TEST PIT. Water not observed while digging. Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN[SM] INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
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TEST PIT: **TP-34**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1378.6	0.0					
1378.1	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
		CL	LEAN CLAY, brown, moist. (Glacial Till)			
1370.6	8.0		BOTTOM OF TEST PIT.			
			Water not observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN[SM] INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
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TEST PIT: **TP-35**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1376.1	0.0					
1375.6	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
		CH	FAT CLAY, with Sand, brown, moist. (Glacial Till)			
1369.1	7.0		BOTTOM OF TEST PIT - Refusal to excavator. Water not observed while digging. Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

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TEST PIT: **TP-36**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1369.8	0.0	TS				
1369.3	0.5	SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1367.3	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			END OF BORING - Refusal to excavator.			
			Water not observed while digging.			
			Test pit then backfilled.			

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
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Brietung Township, Minnesota

TEST PIT: **TP-37**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1371.6	0.0					
1371.1	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1369.1	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal to excavator.			
			Water not observed while digging.			
			BOTTOM OF TEST PIT.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
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Brietung Township, Minnesota

TEST PIT: **TP-42**

LOCATION: 5' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1423.8	0.0					
1423.3	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black ,moist. (Topsoil)			
		SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, brown, moist. (Glacial Till)			
1414.8	9.0		BOTTOM OF TEST PIT. No water observed while digging. Test pit then backfilled.			

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-43**

LOCATION: 20' West of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
1423.1	0.0							
1422.6	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)					
			SILTY SAND, fine- to medium-grained, brown, moist. (Glacial Till)			10.1	24.8	
1414.1	9.0		BOTTOM OF TEST PIT.					
			No water observed while digging.					
			Test pit then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:16

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-44**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1404.7	0.0					
1404.2	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1402.7	2.0		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-45**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1407.4	0.0					
1406.9	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1405.4	2.0		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN[SM] INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-46**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator DATE: **11/14/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1403.9	0.0					
1403.4	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
1397.4	6.5		BOTTOM OF TEST PIT.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-47**

LOCATION: 10' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1392.2	0.0					
1391.7	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
1387.2	5.0		BOTTOM OF TEST PIT - Refusal at 5 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-48**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1401.5	0.0					
1401.0	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			SILTY SAND, fine- to medium-grained, with Gravel, cobbles, boulders, brown, moist. (Glacial Till)			
1396.5	5.0		BOTTOM OF TEST PIT - Refusal at 5 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
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TEST PIT: **TP-49**

LOCATION: 5' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1407.2	0.0					
1406.7	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, brown, moist. (Glacial Till)			
1399.2	8.0		BOTTOM OF TEST PIT. No water observed while digging. Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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TEST PIT: **TP-50**

LOCATION: 10' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1405.4	0.0					
1404.9	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1402.9	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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TEST PIT: **TP-51**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1406.9	0.0					
1406.4	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM				
1403.9	3.0		SILTY SAND, fine- to medium-grained, with Gravel, cobbles, and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 3 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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TEST PIT: **TP-52**

LOCATION: 10' North of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1406.4	0.0					
1405.9	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1404.9	1.5	SM	SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 1 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

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LOG OF TEST PIT

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TEST PIT: **TP-53**

LOCATION: 15' Southeast of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1405.0	0.0					
1404.5	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM				
1403.0	2.0		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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TEST PIT: **TP-54**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/14/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
1402.7	0.0							
1402.2	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist.					
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles, adn boulders, brown, moist. (Glacial Till)			17.6	22.3	
1396.2	6.5		BOTTOM OF TEST PIT - Refusal at 6 1/2 feet.					
			No water observed while digging.					
			Test pit then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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TEST PIT: **TP-55**

LOCATION: 10' Northwest of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/15/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1418.1	0.0					
1417.6	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1415.6	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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TEST PIT: **TP-56**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator DATE: **11/15/12** SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1422.5	0.0		Rock at surface.			

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BRAUN INTERTEC

LOG OF TEST PIT

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TEST PIT: **TP-57**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/15/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1410.9	0.0					
1410.4	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
1406.4	4.5		BOTTOM OF TEST PIT - Refusal at 4 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

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TEST PIT: **TP-58**

LOCATION: 10' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/15/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1400.6	0.0					
1400.1	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1398.1	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

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BRAUN[SM] INTERTEC

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Braun Project HB-12-01280
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TEST PIT: **TP-59**

LOCATION: 15' Northwest of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1382.4	0.0					
1381.9	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
			SILTY SAND, fine- to medium-grained, with Gravel and cobbles, brown, moist.			
1378.9	3.5		(Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 3 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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TEST PIT: **TP-60**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1389.3	0.0					
1388.8	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
1386.8	2.5		SILTY SAND, fine- to medium-grained, with Gravel and cobbles, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 2 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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TEST PIT: **TP-61**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12** SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1393.3	0.0					
1392.8	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and oganics, black, moist. (Topsoil)			
1390.3	3.0		SILTY SAND, fine- to medium-grained, with Gravel and cobbles, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 3 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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Lake Vermilion State Park
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TEST PIT: **TP-62**

LOCATION: 10' East of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1394.9	0.0					
1394.4	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist.			
		SM	(Topsoil)			
			SILTY SAND, fine- to medium-grained, with Gravel and cobbles, brown, moist.			
1391.9	3.0		(Glacial Till)			
			BOTTOM OF TEST PIT - Refusal at 3 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

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LOG OF TEST PIT

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Geotechnical Evaluation
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Brietung Township, Minnesota

TEST PIT: **TP-63**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1401.5	0.0					
1401.0	0.5	TS / SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1399.0	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal to excavator.			
			Water not observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF TEST PIT

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Brietung Township, Minnesota

TEST PIT: **TP-64**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1401.2	0.0					
1400.7	0.5	TS SM	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1398.7	2.5		SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal to excavator.			
			Water not observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF TEST PIT

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Brietung Township, Minnesota

TEST PIT: **TP-65**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **12/6/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1396.5	0.0					
1396.0	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist.			
1395.5	1.0	SM	(Topsoil)			
			SILTY SAND, fine- to medium-grained, with cobbles and boulders, brown, moist. (Glacial Till)			
			BOTTOM OF TEST PIT - Refusal to excavator.			
			Water not observed while digging.			
			Boring immediately backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:17

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-66**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1391.1	0.0					
1390.6	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles and boulders, brown, moist. (Glacial Till)			
1385.6	5.5		BOTTOM OF TEST PIT - Refusal to excavator.			
			Water not observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:17

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-69**

LOCATION: See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	MC %	P200 %	Tests or Notes
1399.4	0.0							
1398.9	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)					
		CH	FAT CLAY with Sand, brown, moist. (Glacial Till)				83.7	LL= 89 PL= 31 PI = 58
1395.4	4.0							
		SM	SILTY SAND, fine- to medium-grained, brown, moist. (Glacial Till)			7.2	41.5	
1390.4	9.0							
			BOTTOM OF TEST PIT. No water observed while digging. Test pit then backfilled.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:17

BRAUN INTERTEC

LOG OF TEST PIT

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

TEST PIT: **TP-70**

LOCATION: 10' Northeast of stake. See attached sketch.

DRILLER: Low Impact Excavators METHOD: Bobcat Mini-Excavator

DATE: **11/16/12**

SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1377.6	0.0					
1377.1	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots and organics, black, moist. (Topsoil)			
		SM	SILTY SAND, fine- to medium-grained, with Gravel, cobbles, brown, moist. (Glacial Till)			
1372.1	5.5		BOTTOM OF TEST PIT - Refusal at 5 1/2 feet.			
			No water observed while digging.			
			Test pit then backfilled.			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 2/11/13 09:17

BRAUN[SM]
INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280 **Geotechnical Evaluation** **Lake Vermilion State Park** **Campground and Water Access** **Brietung Township, Minnesota**	HAND AUGER: **HAB-11** LOCATION: See attached sketch.

DRILLER: A. Peritz	METHOD: Hand Auger	DATE: 12/6/12	SCALE: 1" = 4'

Elev. feet 1469.2	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1468.7	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
			END OF HAND AUGER BORING - Refusal to hand auger. Water not observed while drilling. Boring immediately backfilled.			

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

HAND AUGER: **HAB-31**

LOCATION: See attached sketch.

DRILLER: A. Peritz | METHOD: Hand Auger | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1428.0	0.0					
1427.5	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
			END OF HAND AUGER BORING - Refusal to hand auger.			
			Water not observed while drilling.			
			Boring immediately backfilled.			

(See Description and Explanation of Symbols and Terminology sheet for explanation of abbreviations)

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CUSTOM.GDT 7/11/13 10:11:11

BRAUN INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

HAND AUGER: **HAB-32**

LOCATION: See attached sketch.

DRILLER: A. Peritz | METHOD: Hand Auger | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1406.0	0.0					
1405.5	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
			END OF BORING - Refusal to hand auger.			
			Water not observed while drilling.			
			Boring immediately backfilled.			

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CUSTOM.GDT 12/11/12 (See Description and Terminology sheet for explanation of abbreviations)

BRAUN℠ INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280 Geotechnical Evaluation Lake Vermilion State Park Campground and Water Access Brietung Township, Minnesota		HAND AUGER: **HAB-38** LOCATION: See attached sketch.	
DRILLER: A. Peritz	METHOD: Hand Auger	DATE: **12/6/12**	SCALE: **1" = 4'**

Elev. feet 1458.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1457.5	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1457.0	1.0	SM	SILTY SAND, fine- to medium-grained, with cobbles, brown, moist. (Glacial Till)			
			END OF HAND AUGER BORING - Refusal to hand auger. Water not observed while drilling. Boring immediately backfilled.			

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 1/14/13 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

HAND AUGER: **HAB-39**

LOCATION: See attached sketch.

DRILLER: A. Peritz | METHOD: Hand Auger | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1448.8	0.0					
1448.3	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1447.8	1.0	SM	SILTY SAND, fine- to medium-grained, with cobbles, brown, moist. (Glacial Till)			
			END OF HAND AUGER BORING - Refusal to hand auger.			
			Water not observed while drilling.			
			Boring immediately backfilled.			

(See Description and Terminology sheet for explanation of abbreviations)

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CUSTOM.GDT 2/11/13

BRAUN INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

HAND AUGER: **HAB-40**

LOCATION: See attached sketch.

DRILLER: A. Peritz | METHOD: Hand Auger | DATE: **12/6/12** | SCALE: **1" = 4'**

Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
0.0		Rock at surface.			

(See Description and Terminology sheet for explanation of abbreviations)

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT 12/11/13

BRAUN INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

HAND AUGER: **HAB-41**

LOCATION: See attached sketch.

DRILLER: A. Peritz | METHOD: Hand Auger | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1450.8	0.0					
1450.3	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1449.8	1.0	SM	SILTY SAND, fine- to medium-grained, with cobbles, brown, moist. (Glacial Till)			
			END OF HAND AUGER BORING - Refusal to hand auger.			
			Water not observed while drilling.			
			Boring immediately backfilled.			

(See Description Terminology sheet for explanation of abbreviations)

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CUSTOM.GDT 7/11/13

BRAUN INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280
Geotechnical Evaluation
Lake Vermilion State Park
Campground and Water Access
Brietung Township, Minnesota

HAND AUGER: **HAB-67**

LOCATION: See attached sketch.

DRILLER: A. Peritz | METHOD: Hand Auger | DATE: **12/6/12** | SCALE: **1" = 4'**

Elev. feet	Depth feet	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1374.3	0.0					
1373.8	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1373.3	1.0	SM	SILTY SAND, fine- to medium-grained, brown, moist. (Glacial Till)			
1372.3	2.0	CL	LEAN CLAY, brown, moist. (Glacial Till)			
			END OF HAND AUGER BORING - Refusal to hand auger.			
			Water not observed while drilling.			
			Boring immediately backfilled.			

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CUSTOM.GDT 7/11/13 (See Description and Terminology sheet for explanation of abbreviations)

BRAUN[SM]
INTERTEC

HAND AUGER BORING

Braun Project HB-12-01280 **Geotechnical Evaluation** **Lake Vermilion State Park** **Campground and Water Access** **Brietung Township, Minnesota**	HAND AUGER: **HAB-68** LOCATION: See attached sketch.

DRILLER: A. Peritz	METHOD: Hand Auger	DATE: **12/6/12**	SCALE: **1" = 4'**

Elev. feet 1377.0	Depth feet 0.0	ASTM Symbol	Description of Materials (ASTM D2488 or D2487)	BPF	WL	Tests or Notes
1376.5	0.5	TS	TOPSOIL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil)			
1375.5	1.5	SM	SILTY SAND, fine- to medium-grained, with cobbles, brown, moist. (Glacial Till)			
			END OF HAND AUGER BORING - Refusal to hand auger. Water not observed while drilling. Boring immediately backfilled.			

HAND AUGER BORING N:\GINT\PROJECTS\HIBBING\2012\01280.GPJ BRAUN_V8_CURRENT.GDT (See Descriptive Terminology sheet for explanation of abbreviations)

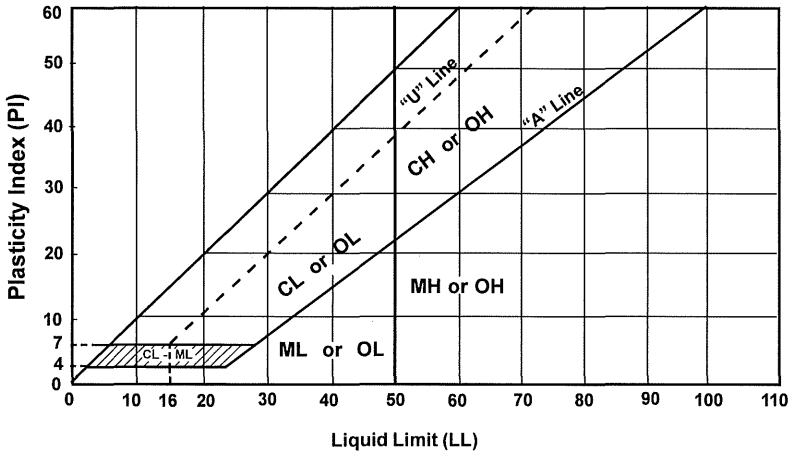
BRAUN
INTERTEC

Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification	
				Group Symbol	Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts 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 / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts 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 / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels 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
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. Sands 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
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 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.



Laboratory Tests

DD	Dry density, pcf	**OC**	Organic content, %
WD	Wet density, pcf	**S**	Percent of saturation, %
MC	Natural moisture content, %	**SG**	Specific gravity
LL	Liqiuid limit, %	**C**	Cohesion, psf
PL	Plastic limit, %	**∅**	Angle of internal friction
PI	Plasticity index, %	**qu**	Unconfined compressive strength, psf
P200	% passing 200 sieve	**qp**	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise, Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.

GEOTECHNICAL ENGINEERING REPORT

For

U.S. STEEL

NORTHEAST TECHNICAL SERVICES, INC.

AGGREGATE RESOURCE EXPLORATION
3 BAYS ON LAKE VERMILION

NEAR

TOWER, MINNESOTA

Prepared by

GALE-TEC ENGINEERING, Inc.

801 Twelve Oaks Center Dr., Suite 832
Wayzata, Minnesota 55391

January, 2006

GTE Project No. 95248-A

January 12, 2006

Mr. Rick Crum
Northeast Technical Services, Inc.
P.O. Box 1142
Virginia, MN 55792

GTE Project No. 95248-A

Re: Aggregate Resource Investigation for the 3 Bays
on Lake Vermilion development near Tower, MN

Dear Mr. Crum:

We are pleased to provide you with this report which summarizes our geotechnical recommendations of your subsurface exploration for aggregate resources for the 3 Bays on Lake Vermilion development near Tower, MN. Our report includes a summary of the investigation and laboratory tests. It has been our pleasure to work with you on this project. If you have any questions concerning our report, please do not hesitate to contact us.

Respectfully,

GALE-TEC ENGINEERING, INC.

Brent A. Theroux, P.E.
Project Engineer

Stephan M. Gale, P.E.
Principal Engineer

SMG/blm

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a registered professional engineer under Minnesota Statute, Sections 326.02 to 326.15.

_____
Stephan M. Gale

Date: _____ **Reg. No. 13854**

1.0 INTRODUCTION

U.S. Steel is presently considering the development of property (3 Bays on Lake Vermilion) on Lake Vermilion near Tower, Minnesota. As such, the company is requesting an evaluation of potential on-site aggregate resources for use in road construction, for use in septic system mounds and for other construction uses. The project area abuts along the south shore of Armstrong Bay on the east side of Lake Vermillion and lies within the Tower-Ely Glacial Drift and Bedrock Complex. In general, the soil morphology of the area consists of well drained cobbly and sandy soils overlying shallow bedrock (generally within 4 to 6 ft of the surface).

Gravel soils are typically described as being smaller than 3 inches and being retained on a U.S. No. 4 sieve. Sand soils are generally described as passing the No. 4 sieve and being retained on the No. 200 sieve. This report presents a summary of the subsurface investigation, a summary of the laboratory testing program and our evaluation of the site's potential as a sand and gravel aggregate resource.

We were provided with a boring location diagram, boring logs, and results for moisture content, P200 and gradation laboratory tests.

2.0 SUBSURFACE EXPLORATION

A subsurface exploration was performed between the dates of November 2 and December 5, 2005 at locations selected by Northeast Technical Services, Inc. (NTS). Prior to drilling, NTS contacted Gopher State One Call to check for underground utilities. Twenty-two (22) soil borings were originally proposed with a direct push geoprobe rig. Five (5) borings were not performed due to exposed bedrock at the selected field locations or inaccessibility to the geoprobe rig. These borings were GP-1, GP-4, GP-7, GP-8 and GP-12. Two (2) borings were added, GP-23 and GP-Road. Boring GP-23 was located off of the project site (shown in Appendix No. 4). Soil samples were collected using the split-spoon method and with a macro-core spoon. In the split-spoon method the number of blows required to advance the sampler in 6-inch increments is recorded. Macro-core spoon samples were collected by pushing a 3-inch diameter spoon into the ground using the direct push geoprobe rig. Refusal in the borings was determined to have occurred when the macro-core steel rod could no longer be advanced in the borehole. During the exploration, any groundwater that had collected in the borehole was measured and is noted on the logs.

Laboratory tests were conducted on selected soil samples. Fifteen (15) washed sieve analyses were performed to determine the grain size distribution of selected soil samples. Twenty-two (22) P200 tests were performed to determine the percent passing the U.S. No. 200 sieve. The soil passing the No. 200 sieve represents silt and clay sized particles. Laboratory test results are shown in the Appendix.

2.1 Site Conditions

The project area abuts the south shore of Armstrong Bay on the east side of Lake Vermilion. In general, the soil morphology of the area consists of well drained sandy soils overlying rock. The area is mostly tree-covered with areas of exposed bedrock and a few existing unpaved roads. The topography across the site varies greatly with elevations ranging from 1390 to 1476 ft. As such, some areas of the project site were not rig accessible.

2.2 Soil Conditions

The general geology of the region is described as the Tower-Ely Glacial Drift and Bedrock complex and is characterized by sandy and cobbly soil overlying shallow bedrock with the bedrock exposed in some areas. The driller reported encountering large gravel and cobbles throughout the site during the subsurface investigation.

The subsurface exploration identified areas of mostly granular soils, with some areas of shallow and exposed bedrock. The soils encountered were classified by NTS according to the Unified Soil Classification System in substantial accordance with ASTM D-2487. The soils were classified as mostly gravelly and cobbly poorly graded sands and silty sands. A few clay lenses were also encountered.

Ten (10) borings encountered refusal on apparent bedrock at depths of between 2.5 and 32 ft below the ground surface. These borings were located in the northern portion of the site (GP-2 and GP-3) and in the east central portion of the site (GP-11, GP-13, GP-Road, GP-14, GP-15, GP-16, GP-18 and GP-20). Two other borings, GP-21 and GP-22, met refusal on large boulders at 1 to 2 ft below the ground surface.

Sieve tests to determine the gradation of the granular soils were performed on samples selected by NTS. The results of these tests are provided in the Appendix. The granular soils were generally poorly graded fine and medium sands and silty sands as defined by ASTM, though there were isolated pockets of coarse sands and well graded sands and gravels.

Five (5) soil borings (GP-1, GP-4, GP-7, GP-8 and GP-12) were not drilled because of exposed bedrock at the proposed locations. Of these 5 borings, only GP-7 is shown on the Boring Location Diagram.

2.3 Groundwater Conditions

Static groundwater levels were encountered in 6 of the borings during drilling at depths between 6 and 12 ft. Surface elevations at the boring locations were not obtained. However, based on the boring locations and topographic contours shown on the Boring Location Diagram, it appears that the groundwater elevations are highest in the middle of the site (near the road) where the topography is greatest.

3.0 EVALUATION

Approximately 350 lineal feet was drilled among the 19 soil borings located on the project site. Of that amount, approximately 94%, or roughly 333 lineal feet, is estimated to consist of granular soils (i.e. silty sands, sands and gravels).

In general, most of the sandy soils encountered were classified (ASTM Unified Soil Classification System) as being poorly-graded sands (SP) with lesser amounts of poorly-graded silty sands (SP-SM). SP and SP-SM soils by Unified Soil Classification System definition have a silt- and clay-sized particle content of less than 12% by weight. Silt and clay particles (fines) are defined as those passing a US No. 200 Sieve. A chart with the breakdown of the soil types encountered is given in Table 1.

Table 1

USCS Soil Type	Soil Description	Lineal Feet	% of Total Lineal Feet	% Passing #200 Sieve by USCS Definition	% Passing #4 Sieve by USCS Definition
GM	Silty Gravel	12	2	<5	0-49
SP	Sand	196.5	57	<5	>50
SP-SM	Silty Sand	67	20	5-12	>50
SM	Silty Sand	57.5	15	12-49	>50
CL	Clay	17	6	>50	>50

3.1 Construction Borrow

According to Table 1, approximately 79% of the drilled soils are described as granular and have a silt-and clay-sized particles (fines) percentage of less than 12% by weight. These granular soils would meet the Mn/DOT standard specification criteria for Select Granular Borrow (Mn/DOT Specification 3149.2B2).

Table 2 includes the estimated quantities for three groups of soil types found on the site: granular soils with a fines content less than 12% (meeting Mn/DOT 3149.2B2 Select Granular Borrow), granular soils with a fines content greater than 12% (meeting Mn/DOT 3149.2B3 Granular Borrow) and non-granular soils. The quantities are given for each boring based on the "assumed" influence area shown in Appendix No. 4.

Select Granular Borrow and Granular Borrow are acceptable for road embankment construction provided the larger cobbles and boulders are removed.

Table 2
Estimated Soil Quantities in Cubic Yards

Boring	Mn/DOT Select Granular Borrow[1]	Mn/DOT Granular Borrow[2]	Silt, Clay (ML, CL)
GP-2	62,000		2000
GP-3	2570	5140	15,420
GP-5	183,333		
GP-6	24,300	16,200	
GP-9	35,700	19,833	
GP-10	42,400	14,133	14,133
GP-11		11,000	
GP-13	2500		1667
GP-Road	61,100	4073	
GP-14	13,333	24,000	13,333
GP-15	9625	17,325	
GP-16	24,000	6000	
GP-17	65,333		
GP-18	11,688		
GP-19	32,500		
GP-20	58,330		
GP-21, GP-22	4125		
Total	632,838	117,705	46,553

[1] Less than 12% passing No. 200 Sieve, meets Mn/DOT 3149.2B2
[2] Between 12% and 20% passing No. 200, meets criteria for MN/DOT 3149.2B1

We recommend that on-site test pits be performed to help estimate the existence, frequency and relative size of large cobbles and boulders in the upper portions of the subgrade.

3.2 Septic Systems

According to the Minnesota Pollution Control Agency (MPCA), a minimum of 3 ft of clean sand is required for pathogen treatment in a mound septic system. Generally, clean sands are thought to be granular soils with less than 5% fines (particles passing the U.S. No. 200 sieve). Within the Unified Soil Classification System, poorly graded sands (SP) can be thought of as clean sands. As shown in Table 1, approximately 57% of the soils encountered were classified as SP sands.

3.3 Summary

Please note that the quantities shown in Table 2 are based, in part, on soil borings advanced at discreet locations and are intended to be estimates only. As mentioned in

Section 2.1 the topography of the site varies greatly. Consequently, soil conditions can also vary greatly from boring to boring even over relatively short distances.

4.0 GENERAL CONDITIONS

This report has been prepared in order to assist the Owner in its assessment of the property. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to site soil characteristics. In the event that any changes in the intent for site use as outlined in this report are planned, we should be informed so that changes can be reviewed and the conclusions of this report modified or approved in writing. As a check, we recommend that we be authorized to review final project plans and specifications to confirm that our report recommendations have been interpreted in accordance with our intent. Without this review, we will not be responsible for misinterpretations of our data, our analysis, and\or our recommendations nor how these are incorporated into the final design.

It is recommended that all construction operations dealing with earthwork be reviewed by us to provide information on which to base a decision whether the design requirements are fulfilled in actual construction. We would welcome the opportunity to provide field monitoring services for you during construction.

We recommend that a test-pit investigation program be implemented to ascertain the site characteristics with respect to large cobbles and boulders, as well as the lateral extent of near-surface soil types.

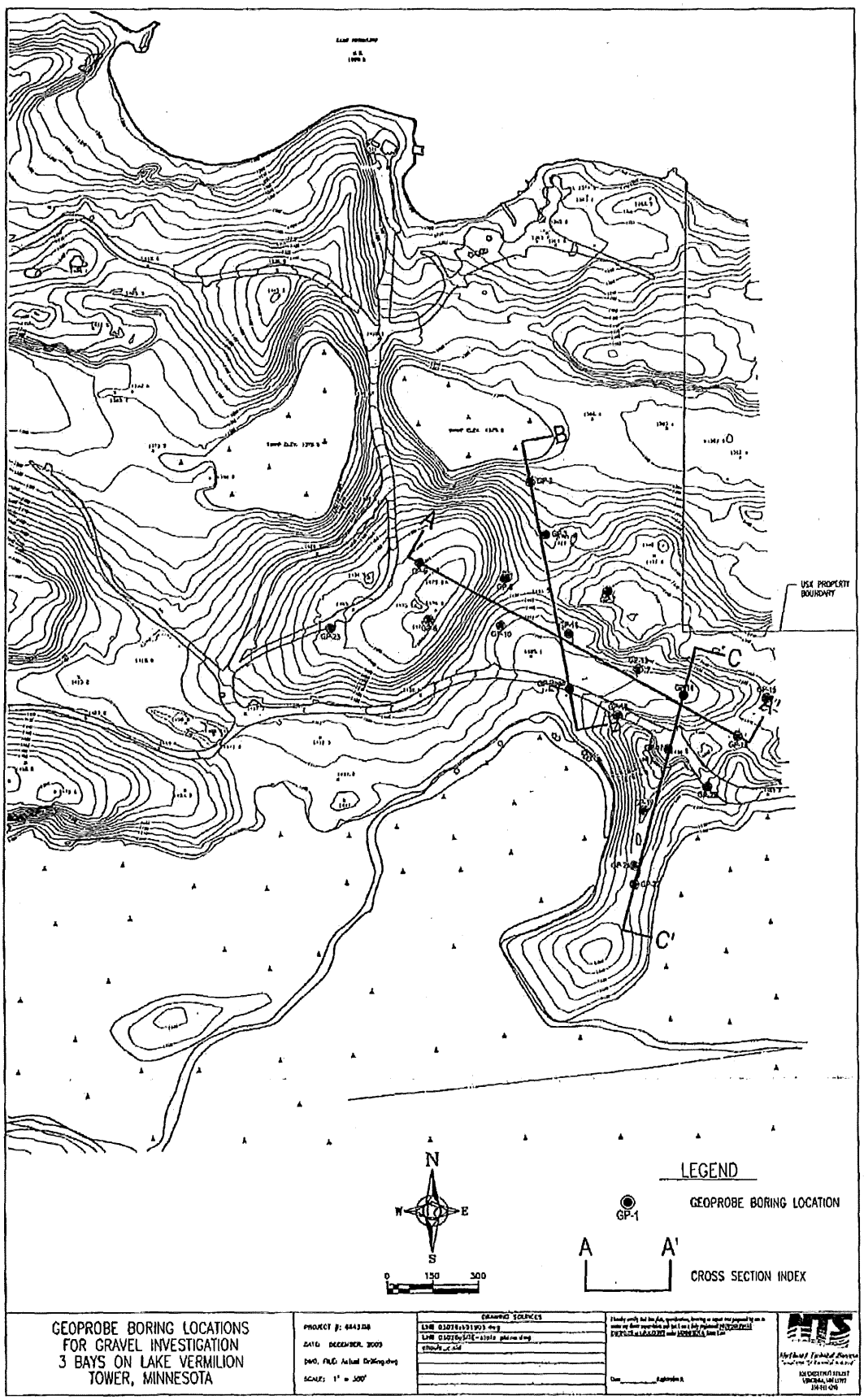
The analysis and recommendations submitted in this report are based on the data obtained from specific soil borings drilled on-site and from other information discussed in this report. This report does not reflect any variations which may occur between these borings or variations which may occur into the out-lying areas. During a subsurface exploration, specific information is obtained at specific locations and at specific times. However, it is a well-known fact that variations in soil conditions may not become evident until the course of construction. If variations then become evident, it will be necessary for a re-evaluation of the recommendations of this report after performing on-site observations during construction and noting the characteristics of any variations.

Because of the possibility of these unanticipated subsurface conditions occurring, we recommend that a "changed condition" clause be provided in the contract both with the general contractor and in the contract with subcontractors involved in earthwork construction. It is felt that the inclusion of this clause will permit contractors to give lower prices because they will not need to provide as much in contingencies as they normally would. Equitable adjustment of changed conditions will reduce conflicts and litigation with the attendant delays and costs. Furthermore, by the immediate recognition and adjustment in contract price at the time any changed conditions are encountered, the immense problem of trying to recreate facts when a dispute develops later is eliminated.

APPENDICES:

APPENDIX 1: SOIL BORING LOCATION MAP
APPENDIX 2: SOIL BORING LOGS
APPENDIX 3: SOIL BORING CROSS SECTIONS
APPENDIX 5: LABORATORY RESULTS

APPENDIX 1:
SOIL BORING LOCATION MAP



GEOPROBE BORING LOCATIONS
FOR GRAVEL INVESTIGATION
3 BAYS ON LAKE VERMILION
TOWER, MINNESOTA

PROJECT #: 4843258
DATE: DECEMBER, 2003
DWG. FILE: Actual Drilling.dwg
SCALE: 1" = 300'

DRAWING SOURCES

APPENDIX 2:
SOIL BORING LOGS

NORTHEAST TECHNICAL SERVICES, INC.
526 CHESTNUT STREET / PO BOX 1142
VIRGINIA, MINNESOTA 55792
COMPANY TELEPHONE: 218/741-4290 FAX: 218/741-4291

Northeast Technical Services
"solutions for technical concerns"

BORING NUMBER GP-02
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Rich Bober

Date: 12/02/05
Weather: Cloudy 10 F

Boring Started: 1000
Boring Completed: 1530

Boring Number: GP-02

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1						CL	0-1: Brown, SANDY CLAY, moist.
2							
3							
4	40	MC				SP	1-4: Brown, coarse grained, poorly sorted, GRAVELLY SAND, moist.
5							
6							
7							
8	48	MC				SP	Brown, medium grained, moderately sorted, GRAVELLY SAND with cobbles, moist
9							
10						SP	8-10: Brown, medium grained, well sorted, SAND, moist.
11							
12	48	MC				SP	10-12: Brown, fine/medium grained, moderately sorted, SAND with gravel, saturated.
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							Pushed pre-probe to 32 feet with refusal.
33							
34							**END OF BORING AT 32 FEET - REFUSAL ON BEDROCK.**
35							**STATIC WATER LEVEL = 12 FEET.**
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

NORTHEAST TECHNICAL SERVICES, INC.
526 CHESTNUT STREET / PO BOX 1142
VIRGINIA, MINNESOTA 55792
COMPANY TELEPHONE: 218/741-4290 FAX: 218/741-4291

Northeast Technical Services
solutions for technical concerns

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/28/05
Weather: Cloudy 15 F

Boring Started: 1000
Boring Completed: 1130

Boring Number: GP-3

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2	24	SS				CL	Brown, SANDY CLAY trace gravel, moist.
3							
4	24	SS				CL	Brown CLAY, moist.
5							
6						CL	4-6: Gray CLAY, moist.
7							
8	48	MC				SM	6-8: Gray, fine grained, well sorted, SILTY SAND, saturated.
9							
10	6	MC				SP	Gray, coarse grained, poorly sorted, GRAVELLY SAND, saturated.
11							
12							
13							
14							END OF BORING AT 9 FEET - REFUSAL ON BEDROCK. STATIC WATER LEVEL = 6 FEET.
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

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BORING NUMBER GP-05
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 12/05/05
Weather: Cldy 11 F

Boring Started: 0900
Boring Completed: 1400

Borig Number: GP-5

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	24	SS				SP	Brown, medium/coarse grained, poorly sorted, SAND with gravel, moist.
3 4	24	SS				SM	Brown, fine grained, well sorted, SILTY SAND trace gravel, moist.
5 6	24	SS				SP	Same As Above (S.A.A.).
7 8							
9 10 11 12	40	MC				SP	Brown, fine/medium grained, moderately sorted, SAND with gravel, moist.
13 14 15 16	36	MC				SP	Brown, fine/medium grained, moderately sorted, SAND trace gravel and silt, moist.
17 18 19 20	40	MC				SP	S.A.A.
21 22 23 24	40	MC				SP	Brown, medium/coarse grained, moderately sorted, GRAVELLY SAND trace silt, moist.
25 26 27 28	36	MC				SP	Brown, fine/medium grained, well sorted, SAND, moist.
29 30 31 32							
33 34 35 36							
37 38 39 40	40	MC				SP	Gray, fine/medium grained, poorly sorted, GRAVELY SAND trace silt, moist.
41 42 43 44 45 46							
47 48 49 50	42	MC				SM	Brown, fine/medium grained, poorly sorted, SILTY SAND trace gravel, moist.

MC = macro core *LB = large bore* *SS = 3" split spoon*

END OF BORING AT 50 FEET. NO GROUNDWATER ENCOUNTERED IN BORING.

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VIRGINIA, MINNESOTA 55792
COMPANY TELEPHONE: 218/741-4290 FAX: 218/741-4291

Northeast Technical Services
"solutions for technical concerns"

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/28/05
Weather: Rain 33 F

Boring Started: 1000
Boring Completed: 1400

Boring Number: GP-6

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND with gravel, moist.
3 4	24	SS				SP	Brown, fine grained, well sorted, SILTY SAND trace gravel, moist.
5 6	24	SS				SP	Same As Above (S.A.A.).
7 8	24	SS				SP	S.A.A.
9 10	24	SS				SP	S.A.A. trace cobbles.
11 12	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND with gravel, moist.
13 14	24	SS				SP	S.A.A.
15 16	24	SS				SP	S.A.A.
17 18	24	SS					
19 20	24	SS					
21 22 23 24	40	MC				SM	Brown, fine grained, well sorted, SILTY SAND, moist.
25 26							
27 28 29 30	40	MC				SM	S.A.A.
31 32							
33 34 35 36							END OF BORING AT 30 FEET. NO GROUNDWATER ENCOUNTERED IN BORING.
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
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BORING NUMBER GP-7
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/28/05
Weather: Rantu 30 F

Boring Started: 1100
Boring Completed: 1130

Boring Number: GP-7

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2							NO SOIL BORING COMPLETED - EXPOSED BEDROCK
3 4 5 6							
7 8							
9 10							
11 12							
13 14							
15 16							
17 18							
19 20							
21 22 23 24							
25 26 27 28							
29 30 31 32							
33 34 35 36							
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 12/05/05
Weather: Cloudy 11 F

Boring Started: 1400
Boring Completed: 1530

Boring Number: GP-9

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2	24	SS				SM	Brown, fine/medium grained, moderately sorted, SILTY SAND with gravel, moist.
3							
4	24	SS				SP	Brown, fine/medium grained, well sorted, SAND, moist.
5							
6	24	SS				SP	Same As Above (S.A.A.).
7							
8	24	SS				SP	S.A.A.
9							
10	24	SS				SP	S.A.A.
11							
12	24	SS				SM	Brown, fine grained, well sorted, SILTY SAND, moist.
13							
14	24	SS				SM	S.A.A.
15							
16	24	SS				SM	S.A.A.
17							
18	24	SS				SM	S.A.A.
19							
20	24	SS				SP	Brown, fine/medium grained, poorly sorted, SILTY SAND with cobbles and gravel, moist.
21							
22							
23							
24	48	MC				SP	Brown, fine/medium grained, moderately sorted, SILTY SAND with gravel, moist.
25							
26							
27							
28	48	MC				SP	Brown, medium/coarse grained, poorly sorted, SAND trace silt and gravel, moist.
29							
30							
31							**END OF BORING AT 28 FEET. NO GROUNDWATER ENCOUNTERED IN BORING.**
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

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BORING NUMBER GP-10
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/28/05
Weather: Rain 33 F

Boring Started: 1400
Boring Completed: 1530

Boring Number: GP-10

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1						SP	0.0-1.5: Brown, medium/coarse grained, moderately sorted, SAND trace gravel, moist.
2	24	SS				CL	1.5-2.0: Brown, CLAY, moist.
3							
4	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND trace gravel, moist.
5							
6	24	SS				SP	Same As Above (S.A.A.).
7							
8	24	SS				SM	Brown, fine grained, well sorted, SILTY SAND, saturated at 7 feet.
9							
10	24	SS				SP	Brown, medium/coarse grained, poorly sorted, SAND with gravel and silt, saturated.
11							
12	24	SS				SP	S.A.A.
13						SP	12.0-13.5: Brown, coarse grained, poorly sorted, GRAVELLY SAND, saturated.
14						CL	13.5-14.0: Gray CLAY, moist.
29							
16	40	MC				SP	14-16: Brown, coarse grained, poorly sorted, GRAVELLY SAND with silt, saturated.
17						SP	16-17: S.A.A.
18							
29							
20	36	MC				CL	17-20: Gray CLAY, moist.
21							
22							**END OF BORING AT 20 FEET. STATIC WATER LEVEL = 7.0 FEET.**
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

NORTHEAST TECHNICAL SERVICES, INC.
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Northeast Technical Services
"solutions for technical concerns"

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/28/05
Weather: Rain 30 F

Boring Started: 0900
Boring Completed: 0930

Boring Number: GP-11

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	24	SS				SM	Brown, fine grained, moderately sorted, SILTY/CLAYEY SAND with gravel, moist.
3 4 5 6	40	MC				SM	2.0-3.5: Brown CLAY with sand and gravel, moist. 3.5-5.5: Brown, medium/coarse grained, poorly sorted, SAND with silt/clay/gravel/cobbles, moist.
7 8							
9 10							END OF BORING AT 5.5 FEET - REFUSAL ON BEDROCK NO GROUNWATER
11 12							
13 14							
15 16							
17 18							
19 20							
21 22 23 24							
25 26 27 28							
29 30 31 32							
33 34 35 36							
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
"solutions for technical concerns"

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 12/02/05
Weather: Prtly cldy 10 F

Boring Started: 1200
Boring Completed: 1300

Boring Number: GP-13

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0						CL	0-1: Brown Clay, moist.
1						SP	1-2: Brown, coarse grained, poorly sorted, GRAVELLY SAND, moist.
2	12	SS					
3							END OF BORING AT 2.5 FEET - REFUSAL ON BEDROCK. NO GROUND WATER ENCOUNTERED
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
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26							
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29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

NORTHEAST TECHNICAL SERVICES, INC.
526 CHESTNUT STREET / PO BOX 1142
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Northeast Technical Services
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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 12/02/05
Weather: Cloudy 25 F

Boring Started: 1300
Boring Completed: 1430

Boring Number: GP-14

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2							
3							
4	48	MC				SM	Brown, fine grained, well sorted, SILTY SAND trace gravel, moist.
5							
6						CL	4-6: Brown CLAY, moist.
7							
8	40	MC				SM	6-8: Brown, fine grained, well sorted, SILTY SAND trace gravel, saturated.
9							
10							
11							
12	36	MC				SM	Same As Above (S.A.A.).
13							
14						SM	12-14: S.A.A.
15							
16	36	MC				SP	14-16: Brown, fine/medium grained, poorly sorted, GRAVELLY SAND with clay and cobbles.
17							
18							
19							
20	40	MC				SP	16-19: Brown, medium/coarse grained, poorly sorted, GRAVELLY SAND, saturated.
21							
22							END OF BORING AT 19 FEET - REFUSAL ON BEDROCK.
23							
24							STATIC WATER LEVEL = 6.0 FEET.
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
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BORING NUMBER GP-15
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Brian Gunderson

Date: 11/23/05
Weather: Cldy 15 F

Boring Started: 1100
Boring Completed: 1230

Boring Number: GP-15

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2	24	SS				SP	Brown, fine/medium grained, moderately sorted, GRAVELLY SAND with cobbles and silt, moist.
3							
4	24	SS				SP	Brown, medium/coarse grained, poorly sorted, GRAVELLY SAND, moist.
5							
6							
19							
8	48	MC				SP	Brown, medium/coarse grained, poorly sorted, GRAVELLY SAND trace cobbles and silt, moist.
9							
10							
19							
12	36	MC				SM	Gray, fine/medium grained, moderately sorted, SILTY SAND with gravel, moist.
13							
14							
15							
16	2	MC				SM	12-14: Orangish brown, fine grained, moderately sorted, SILTY SAND with cobbles and clay, moist.
17							
18							**END OF BORING AT 14 FEET - REFUSAL ON BEDROCK. NO GROUNWATER**
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
35							
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
"solutions for technical concerns"

BORING NUMBER GP-16
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/03/05
Weather: Cloudy 25 F

Boring Started: 1500
Boring Completed: 1630

Boring Number: GP-16

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2 3 4	36	MC				SM	Brown, fine/coarse grained, poorly sorted, SILTY SAND with gravel and cobbles.
5 6 7 8	36	MC				SM	Brown, fine/medium grained, poorly sorted, SILTY SAND with gravel and cobbles.
9 10 11 12	36	MC				SM	Same As Above (S.A.A.).
13 14 15 16	36	MC				SM	S.A.A.
17 18 19 20	36	MC				SM	S.A.A.
21 22 23 24							END OF BORING AT 20 FEET - REFUSAL ON BEDROCK. NO GROUNDWATER ENCOUNTERED
25 26 27 28							
29 30 31 32							
33 34 35 36							
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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BORING NUMBER GP-17
PAGE 1 0F 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Rich Bober

Date: 11/02/05
Weather: Cloudy 25 F

Boring Started: 1000
Boring Completed: 1530

Boring Number: GP-17

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2	24	SS				SP	Brown, medium/coarse grained, moderately sorted, GAVELLY SAND with cobbles, moist.
3							
4	24	SS				SP	Brown, coarse grained, moderately sorted, GRAVELLY SAND, moist.
5							
6	24	SS				SP	Same As Above (S.A.A.).
7							
8	24	SS				SP	S.A.A.
9							
10	24	SS				SP	S.A.A.
11							
12	24	SS				SP	S.A.A.
13							
14	24	SS				SP	S.A.A.
15							
16	24	SS				SP	S.A.A.
17							
18	24	SS				SP	S.A.A.
19							
20							
21							
22							
23							
24	36	MC				SP	Gray, coarse grained, GRAVELLY SAND, trace cobbles, moist.
25							
26							
27							
28	48	MC				SP	S.A.A.
29							
30							
31							**END OF BORING AT 28 FEET. NO GROUNDWATER ENCOUNTERED IN BORING.**
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Rich Bober

Date: 11/23/05
Weather: Cloudy 25 F

Boring Started: 1500
Boring Completed: 1630

Boring Number: GP-18

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2	24	SS				SP	Brown, fine grained, well sorted, SAND with silt, moist.
3							
4	24	SS				SP	Brown, fine grained, well sorted, Sand, saturated.
5						SP	4-5: Brown, coarse grained, poorly sorted, GRAVELL SAND with silt and cobbles, saturated.
6	12	SS					
7						SP	5-8.5: Brown, medium/coarse grained, moderately sorted, GRAVELLY SAND with silt and
8	36	MC					
9							
10							
11							END OF BORING AT 8.5 FEET - REFUSAL ON BEDROCK.
12							STATIC WATER LEVEL = 4 FEET.
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Rich Bober

Date: 11/19/05
Weather: Cloudy 15 F

Boring Started: 1000
Boring Completed: 1530

Boring Number: GP-19

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	24	SS				SP	Brown, fine/medium grained, moderately sorted, GAVELLY SAND trace cobbles, moist.
3 4							
5 6	24	SS				SP	Gray, coarse grained, poorly sorted, GRAVELLY SAND trace cobbles, dry.
7 8							
9 10	24	SS				SP	Brown, medium/coarse grained, moderately sorted, SAND with gravel, moist.
11 12							
13 14	24	SS				SP	Brown, medium/coarse grained, poorly sorted, GRAVELLY SAND, moist.
15 16							
17 18	24	SS				SP	Gray, coarse grained, poorly sorted, GRAVELLY SAND trace cobbles, moist.
19 20							
21 22 23 24							END OF BORING AT 20 FEET. NO GROUNDWATER ENCOUNTERED IN BORING.
25 26 27 28							
29 30 31 32							
33 34 35 36							
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Brian Gunderson

Date: 11/22/05
Weather: Cldy 15 F

Boring Started: 1000
Boring Completed: 1230

Boring Number: GP-20

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	24	SS				SP	Brown, medium/coarse grained, moderately sorted, SAND trace gravel, moist.
3 4	24	SS				SP	Same As Above (S.A.A.).
5 6	24	SS				SP	Brown, medium/coarse grained, moderately sorted, SAND with gravel and cobbles, moist.
7 8	24	SS				SP	S.A.A.
9 10	24	SS				SP	Brown, fine/medium grained, SAND with gravel, moist.
11 12							
13 14 15 16	36	MC				SP	S.A.A.
17 18	42	MC				SP	Brown, fine/medium grained, moderately sorted, SAND with gravel, moist.
21 22 23 24	48	MC				SP	Brown, fine/medium grained, poorly sorted, GRAVELLY SAND, moist.
25 26 27 28	36	MC				sp	S.A.A.
29 30 35 32							END OF BORING AT 28.5 FEET - REFUSAL ON BEDROCK. NO GROUNDWATER
33 34 35 36							
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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BORING NUMBER GP-21
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/03/05
Weather: Prtly cldy 25 F

Boring Started: 1200
Boring Completed: 1300

Boring Number: GP-21

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	12	SS				SP	Brown, coarse grained, moderately sorted, GRAVELLY SAND with cobbles/boulders, moist.
3 4 5 6							END OF BORING AT 1 FEET - REFUSAL ON BOULDERS. NO GROUNDWATER
7 8							
9 10							
11 12							
13 14							
15 16							
17 18							
19 20							
21 22 23 24							
25 26 27 28							
29 30 31 32							
33 34 35 36							
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 11/03/05
Weather: Prtly cldy 25 F

Boring Started: 1200
Boring Completed: 1300

Boring Number: GP-22

Groundwater Elevation:

Depth (feet)	Recov. (Inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	12	SS				SP	Brown, coarse grained, moderately sorted, GRAVELLY SAND with cobbles/boulders, moist.
3 4 5 6							**END OF BORING AT 2 FEET - REFUSAL ON BOULDERS. NO GROUNDWATER**
7 8							
9 10							
11 12							
13 14							
15 16							
17 18							
19 20							
21 22 23 24							
25 26 27 28							
29 30 31 32							
33 34 35 36							
37 38 39 40							

MC = macro core LB = Large bore SS = 3" split spoon

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BORING NUMBER GP-Road
PAGE 1 OF 1

Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Rich Bober

Date: 12/01/05
Weather: Cloudy 10 F

Boring Started: 1000
Boring Completed: 1530

Boring Number: GP-Road

Groundwater Elevation:

Depth (feet)	Recov. (inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0 1 2	24	SS				SM	Brown, fine/medium grained, moderately sorted, SILTY SAND trace gravel, moist.
3 4	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND trace gravel and cobbles, moist.
5 6	24	SS				SP	Brown, coarse grained, poorly sorted, GRAVELLY SAND trace cobbles, moist.
7 8	24	SS				SP	Same As Above - saturated at 7 feet.
9 10							
11 12							
13 14							
15 16							
17 18							
19 20							
21 22 23 24							
25 26 27 28							
29 30 31 32							Pushed pre-probe to 32 feet with refusal.
33 34 35 36							**END OF BORING AT 32 FEET - REFUSAL ON BEDROCK. STATIC WATER LEVEL = 7 FEET.**
37 38 39 40							

MC = macro core LB = large bore SS = 3" split spoon

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Northeast Technical Services
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Client: US Steel
Project: 3 Bays Gravel Exploration
Project Number: 6643.08A

Geologist: Todd J. Knuckey
Geoprobe Operator: Mike Wattunen

Date: 12/1/05
Weather: Cloudy 15 F

Boring Started: 1400
Boring Completed: 1530

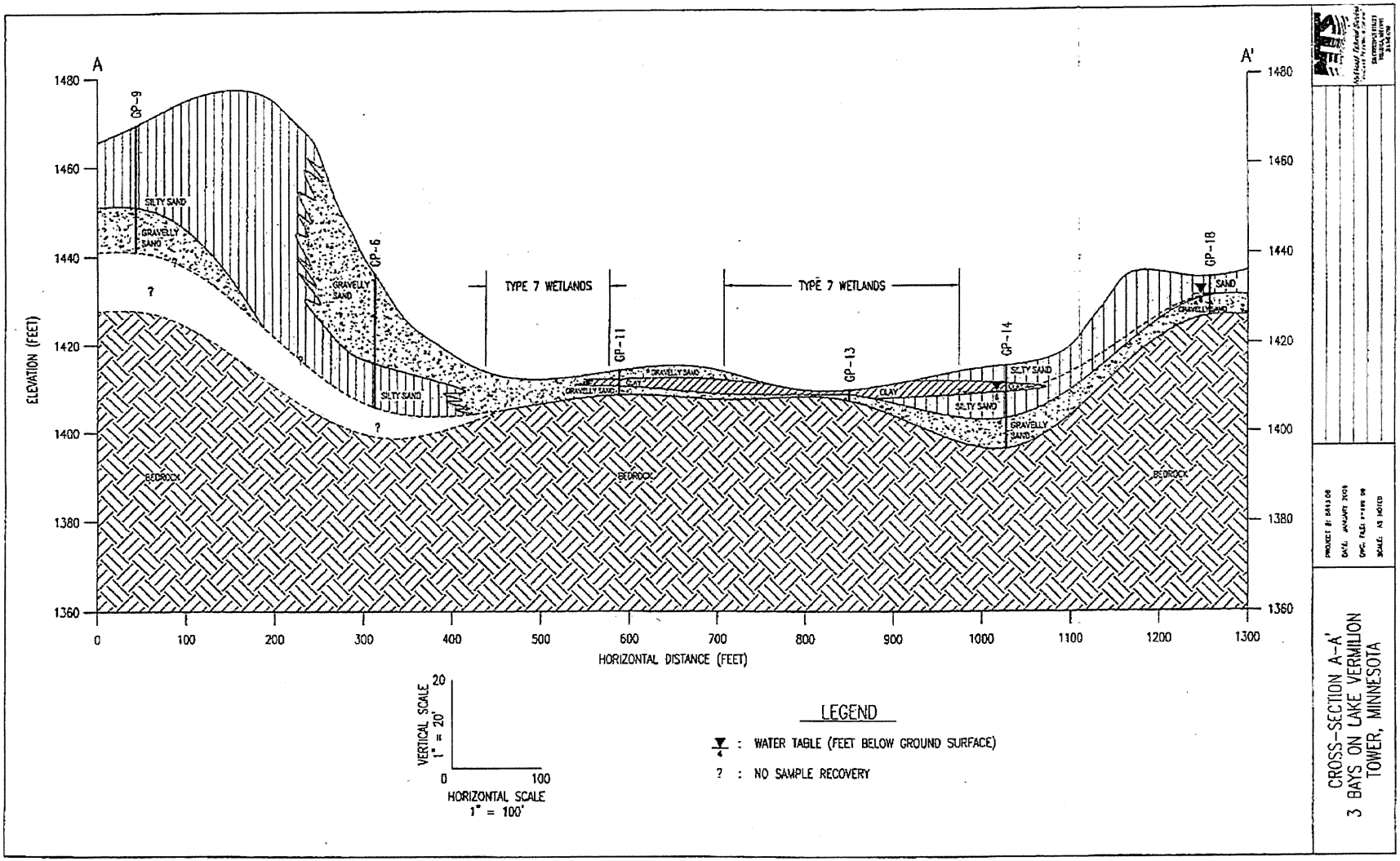
Boring Number: GP-23

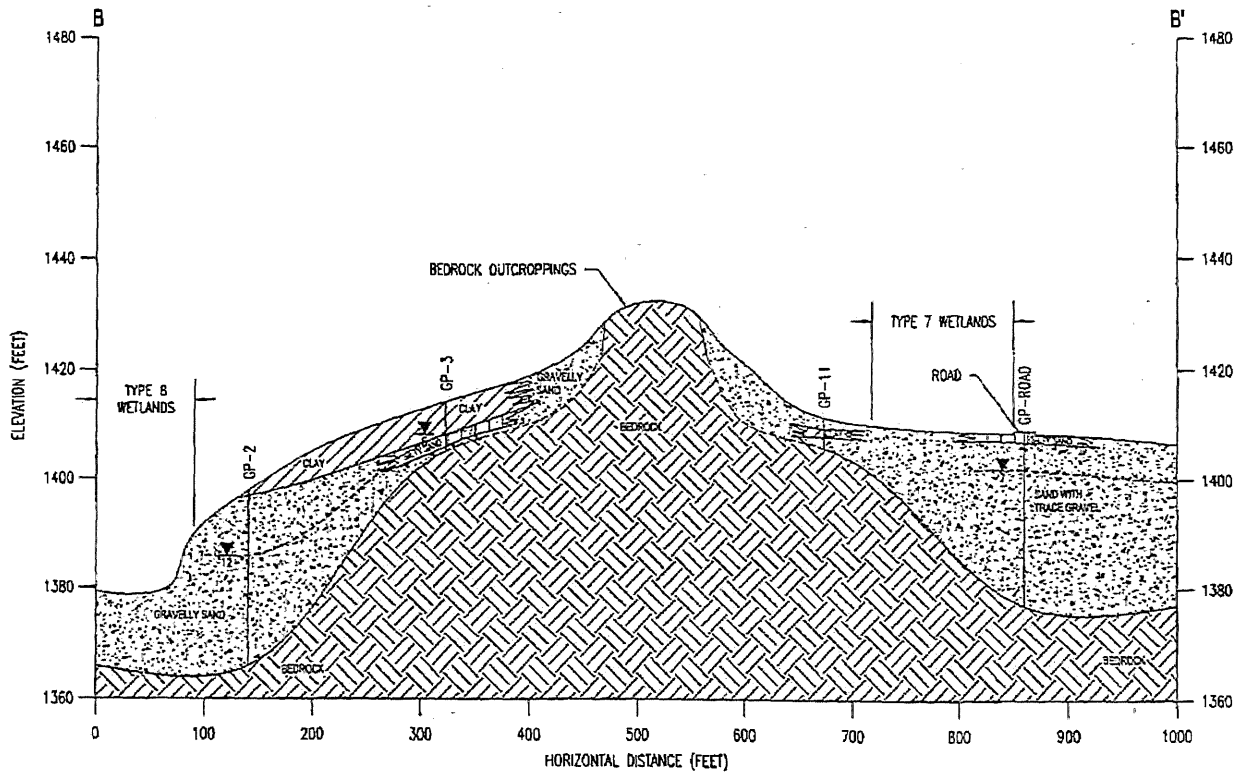
Groundwater Elevation:

Depth (feet)	Recov. (Inch)	Sample Method	Well Diagram	Graphic Log	PID (ppm)	USCS	MATERIAL DESCRIPTION
0							
1							
2	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND trace gravel, moist.
3							
4	24	SS				SP	Same As Above (S.A.A.)
5							
6	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND, moist.
7							
8	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND with gravel, moist.
9							
10	24	SS				SP	S.A.A.
11							
12	24	SS				SP	S.A.A.
13							
14	24	SS				SP	S.A.A.
15							
16	24	SS				SP	Brown, fine/medium grained, moderately sorted, GRAVELLY SAND, moist.
17							
18	24	SS				SP	S.A.A.
19							
20	24	SS				SP	Brown, fine/medium grained, moderately sorted, SAND with cobbles and gravel, moist.
21							
22							END OF BORING AT 20 FEET. NO GROUNDWATER ENCOUNTERED IN BORING.
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

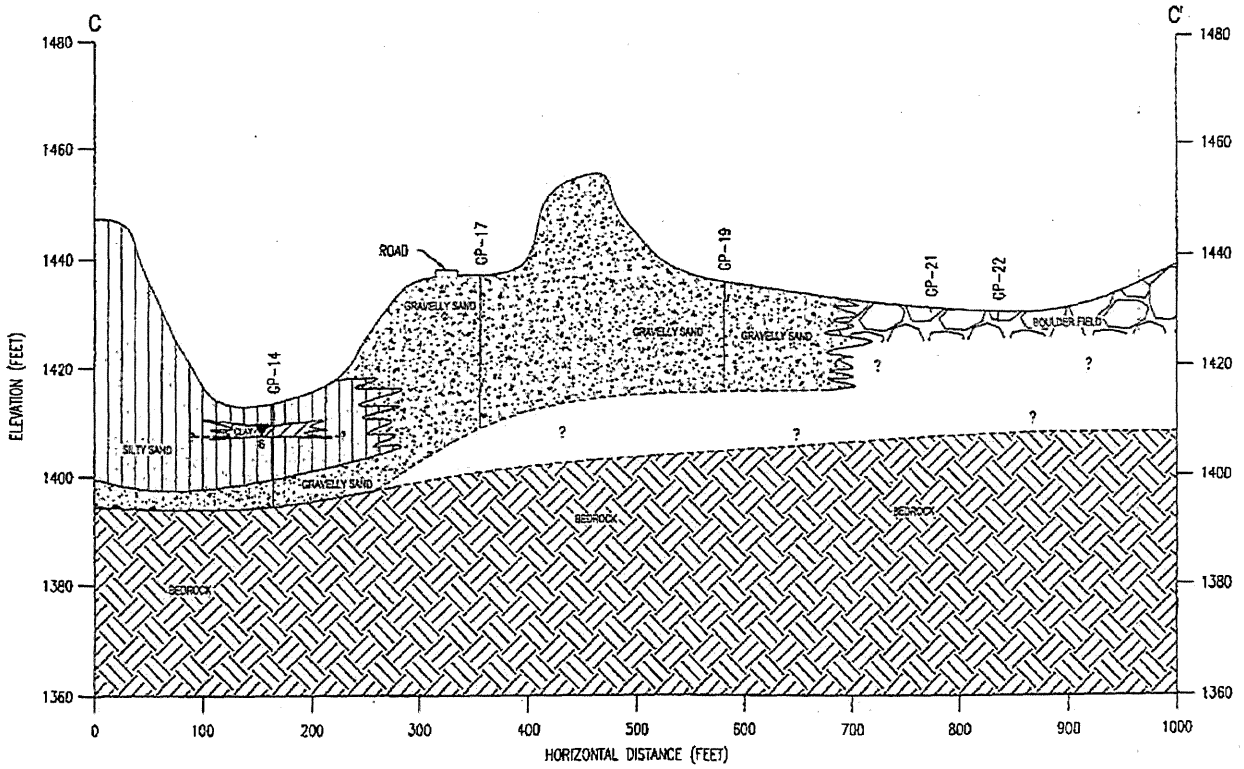
MC = macro core LB = large bore SS = 3" split spoon

APPENDIX 3:
SOIL BORING CROSS SECTIONS


A
A'
GP-9
GP-6
GP-11
GP-13
GP-14
GP-18
TYPE 7 WETLANDS
TYPE 7 WETLANDS
SILTY SAND
GRAVELLY SAND
CLAY
SAND
BEDROCK
ELEVATION (FEET)
1480
1460
1440
1420
1400
1380
1360
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
HORIZONTAL DISTANCE (FEET)
VERTICAL SCALE
1" = 20'
20
0
HORIZONTAL SCALE
1" = 100'
100
LEGEND
: WATER TABLE (FEET BELOW GROUND SURFACE)
? : NO SAMPLE RECOVERY
CROSS-SECTION A-A'
3 BAYS ON LAKE VERMILION
TOWER, MINNESOTA



CROSS-SECTION B-B'
3 BAYS ON LAKE VERMILION
TOWER, MINNESOTA



CROSS-SECTION C-C'
3 BAYS ON LAKE VERMILION
TOWER, MINNESOTA

APPENDIX 5:
LABORATORY RESULTS

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-167

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	95	
3/8"	93	
#4	86	
#10	78	
#40	40	
#100	12	
#200	6.8	

Tested in accordance with ASTM C-136

Sample Number: GP-2 (8'-12')

Lab ID Number: 05-353

Date Sampled:

Date Received:

Date Analyzed: 12/12/05

Sample Location: GP-2 (8' - 12')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments: Moisture was 10.9%

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-165

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	98	
3/4"	92	
5/8"	89	
1/2"	83	
3/8"	75	
#4	56	
#10	39	
#40	21	
#100	9	
#200	5.6	

Tested in accordance with ASTM C-136

Sample Number: GP-5 (20'-24')

Lab ID Number: 05-343

Date Sampled: 12/5/05

Date Received: 12/5/05

Date Analyzed: 12/9/05

Sample Location: GP-5 (20' - 24')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Doug Fossell

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-167

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	89	
1/2"	89	
3/8"	85	
#4	80	
#10	74	
#40	44	
#100	10	
#200	4.1	

Tested in accordance with ASTM C-136

Sample Number: GP-6 (8'-10')

Lab ID Number: 05-357

Date Sampled: 11/28/05

Date Received: 11/28/05

Date Analyzed: 12/12/05

Sample Location: GP-6 (8' - 10')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments: Moisture was 6.0%

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-165

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	98	
3/8"	97	
#4	95	
#10	88	
#40	29	
#100	9	
#200	5.7	

Tested in accordance with ASTM C-136

Sample Number: GP-9 (20'-24')

Lab ID Number: 05-344

Date Sampled: 12/5/05

Date Received: 12/5/05

Date Analyzed: 12/9/05

Sample Location: GP-9 (20' - 24')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Doug Fossell

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-166

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	99	
3/4"	97	
5/8"	95	
1/2"	92	
3/8"	88	
#4	79	
#10	68	
#40	47	
#100	31	
#200	15.1	

Tested in accordance with ASTM C-136

Sample Number: GP-10 (10'-12')

Lab ID Number: 05-351

Date Sampled: 11/28/05

Date Received: 11/28/05

Date Analyzed: 12/12/05

Sample Location: GP-10(10' - 12')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-167

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	98	
3/8"	95	
#4	90	
#10	79	
#40	39	
#100	8	
#200	3.2	

Tested in accordance with ASTM C-136

Sample Number: GP-13 (2'-4')

Lab ID Number: 05-359

Date Sampled: 12/1/05

Date Received: 12/1/05

Date Analyzed: 12/12/05

Sample Location: GP-13(2' - 4') Road

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments: Moisture was 19.4%

NORTHEAST TECHNICAL SERVICES, INC.
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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-167

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	100	
3/8"	100	
#4	100	
#10	99.8	
#40	94	
#100	52	
#200	24.1	

Tested in accordance with ASTM C-136

Sample Number: GP-14 (9'-12')

Lab ID Number: 05-361

Date Sampled: 12/1/05

Date Received: 12/1/05

Date Analyzed: 12/12/05

Sample Location: GP-14(9' - 12') Road

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments: Moisture was 17.5%

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-166

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	88	
3/8"	83	
#4	71	
#10	56	
#40	37	
#100	25	
#200	19.7	

Tested in accordance with ASTM C-136

Sample Number: GP-15 (4'-7')

Lab ID Number: 05-346

Date Sampled: 11/23/05

Date Received: 11/23/05

Date Analyzed: 12/12/05

Sample Location: GP-15 (4' - 7')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Mike Wattunen

Reviewed By: Doug Fossell

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-158

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
1 1/2"	100	
1"	79	
3/4"	73	
5/8"	69	
1/2"	64	
3/8"	56	
#4	44	
#10	34	
#20	-	
#40	23	
#100	19	
#200	15.2	

Tested in accordance with ASTM C-136

Sample Number: GP-16 (4 - 16')

Lab ID Number: 05-326

Date Sampled: 11/2/05

Date Received: 11/3/05

Date Analyzed: 11/4/05

Sample Location: GP-16 (4 - 16')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Mike Wattunen

Reviewed By: Nadine Miller

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-158

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
6"		
2"		
1"		
1/2"	100	
3/8"	97	
#4	89	
#10	79	
#20	-	
#40	19	
#100	6	
#200	3.9	

Tested in accordance with ASTM C-136

Sample Number: GP-17 (8 - 10')

Lab ID Number: 05-324

Date Sampled: 11/2/05

Date Received: 11/3/05

Date Analyzed: 11/4/05

Sample Location: GP-17 (8 - 10')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Mike Wattunen

Reviewed By: Nadine Miller

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-167

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	69	
3/8"	64	
#4	52	
#10	40	
#40	24	
#100	15	
#200	10.9	

Tested in accordance with ASTM C-136

Sample Number: GP-18 (4'-5')

Lab ID Number: 05-362

Date Sampled: 11/23/05

Date Received: 11/23/05

Date Analyzed: 12/12/05

Sample Location: GP-13(2' - 4') Road

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments: Moisture was 5.0%

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-331

Project: U.S. Steel - 3 Bays

Architect/Engineer: Northeast Technical Services

Contractor: NA

Sieve Size	Percent Passing	Required Specifications
1 1/2"	100	
1"	100	
3/4"	96	
5/8"	95	
1/2"	92	
3/8"	81	
#4	66	
#10	44	
#40	16	
#100	8	
#200	5.1	

Tested in accordance with ASTM C-136

Sample Number: GP-19 (12' - 14')

Lab ID Number: 05-331

Date Sampled:

Date Received:

Date Analyzed: 11/25/05

Sample Location: Boring GP-19

Intended Use: Informational

Pit/Source: U. S. Steel-3-Bays

Sampled By: Todd Knuckey

Lab Technician: Mike Wattunen

Reviewed By: Doug Fossell

Comments:

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-167

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	86	
3/8"	85	
#4	80	
#10	69	
#40	17	
#100	7	
#200	4.9	

Tested in accordance with ASTM C-136

Sample Number: GP-20 (8'-10')

Lab ID Number: 05-349

Date Sampled: 11/22/05

Date Received: 11/22/05

Date Analyzed: 12/12/05

Sample Location: GP-20 (8' - 10')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Mike Wattunen

Reviewed By: Doug Fossell

Comments: Moisture was 2.1%

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SOIL GRADATION REPORT

Project Number: 6643A.08

COC #: 05-168

Project: U.S. Steel

Architect/Engineer: Unknown

Contractor: Northeast Technical Services, Inc.

Sieve Size	Percent Passing	Required Specifications
11/4"	100	
1"	100	
3/4"	100	
5/8"	100	
1/2"	88	
3/8"	85	
#4	75	
#10	60	
#40	24	
#100	7	
#200	4.2	

Tested in accordance with ASTM C-136

Sample Number: GP-23 (14'-16')

Lab ID Number: 05-365

Date Sampled: 12/1/05

Date Received: 12/1/05

Date Analyzed: 12/12/05

Sample Location: GP-23(14' - 16')

Intended Use: Informational

Pit/Source: U. S. Steel

Sampled By: Todd Knuckey

Lab Technician: Rich Bober

Reviewed By: Mike Wattunen

Comments: Moisture was 4.7%

"Solutions for Technical Concerns"

Moisture Content/P200 Worksheet

Project Name: U. S. Steel
Date: December 12, 2005
Project #: 6643A.08
Technician: Rich Bober

Lab ID #:	05-352	05-354	05-355
Sample #:	GP-2(4'-8')	GP-3(6'-8')	GP-6(2'-4')
wet wt.:			
dry wt.:	831.1	569.5	583
washed wt.:	764.3	342.7	457.6
loss by wash:	66.8	226.8	125.4
water wt.:			
% moist.:	9.9%	20.2%	
% passing #200:	3.8%	20.3%	21.5%

Lab ID #:	05-356	05-358	05-360
Sample #:	GP-6(20'-24')	GP10(8'-10')	GP-14(8'-9')
wet wt.:			682.5
dry wt.:	832.5	686.3	550.2
washed wt.:	730.1	625.4	225.5
loss by wash:	102.4	60.9	324.7
water wt.:			132.2
% moist.:	29.4%	12.2%	24.0%
% passing #200:	12.3%	8.9%	59.0%

Lab ID #:	05-363	05-364	
Sample #:	GP-23(6'-8')	GP-23(18'-20')	
wet wt.:		1469.6	
dry wt.:	675.5	1451.1	
washed wt.:	659.2	1424.5	
loss by wash:	16.3	26.6	
water wt.:		18.5	
% moist.:	6.1	1.3	
% passing #200:	2.4%	1.9%	

"Solutions for Technical Concerns"

Moisture Content/P200 Worksheet

Project Name: U. S. Steel
Date: December 6, 2005
Project #: 6643A.08
Technician: Rich Bober

Lab ID #:	05-339	05-340	05-341
Sample #:	GP-5(2'-4')	GP-5(46'-50')	GP-9(4'-6')
wet wt.:	841.2	1270.5	996.1
dry wt.:	805.7	1230.2	941.4
washed wt.:	782.6	1150	920.9
loss by wash:	23.1	80.2	20.5
water wt.:	35.5	70.3	54.7
% moist.:	4.4%	3.3%	5.8%
% passing #200:	**2.9%**	**6.5%**	**2.2%**

Lab ID #:	05-342		
Sample #:	GP-9(24'-28')		
wet wt.:	698.7		
dry wt.:	678		
washed wt.:	642.6		
loss by wash:	35.4		
water wt.:	20.7		
% moist.:	3.1%		
% passing #200:	**5.5%**		

Lab ID #:			
Sample #:			
wet wt.:			
dry wt.:			
washed wt.:			
loss by wash:			
water wt.:			
% moist.:			
% passing #200:			

Lab ID #:			
Sample #:			
wet wt.:			
dry wt.:			
washed wt.:			
loss by wash:			
water wt.:			
% moist.:			
% passing #200:			

"Solutions for Technical Concerns"

Moisture Content/P200 Worksheet

Project Name: U. S. Steel
Date: December 12, 2005
Project #: 6643A.08
Technician: Rich Bober

Lab ID #:	05-345	05-347	05-348
Sample #:	GP-15(11'-12')	GP-20(20'-24')	GP-20(16'-20')
wet wt.:	368.2	1883.9	1227.6
dry wt.:	270.5	1861.9	1192.4
washed wt.:			1117.6
loss by wash:			74.8
water wt.:	97.7	22	35.2
% moist.:	26.5%	1.2%	3.0%
% passing #200:			6.3%

Lab ID #:	05-350		
Sample #:	GP-10(2'-4')		
wet wt.:	615		
dry wt.:	534.1		
washed wt.:	80.9		
loss by wash:			
water wt.:			
% moist.:			
% passing #200:	15.1%		

Lab ID #:			
Sample #:			
wet wt.:			
dry wt.:			
washed wt.:			
loss by wash:			
water wt.:			
% moist.:			
% passing #200:			

"Solutions for Technical Concerns"

Moisture Content/P200 Worksheet

Project Name: U. S. Steel
Date: November 4, 2005
Project #: 6643A.08
Technicain: Mike Wattunen

Lab ID #:	05-323	Lab ID #:	05-325	Lab ID #:	05-328
Sample #:	GP-17 (20-22')	Sample #:	GP-17 (4-6')	Sample #:	GP-16 (16-20')
wet wt.:	500	wet wt.:	503.6	wet wt.:	511.3
dry wt.:	492.1	dry wt.:	480.8	dry wt.:	491.4
washed wt.:	475.1	washed wt.:	464.9	washed wt.:	407.6
loss by wash:	17	loss by wash:	15.9	loss by wash:	83.8
water wt.:	7.9	water wt.:	22.8	water wt.:	19.9
% moist.:	1.6%	% moist.:	4.7%	% moist.:	4.0%
% passing #200:	**3.5%**	% passing #200:	**3.3%**	% passing #200:	**17.1%**

Lab ID #:	05-327	Lab ID #:		Lab ID #:	
Sample #:	GP-16 (0-4')	Sample #:		Sample #:	
wet wt.:	515	wet wt.:		wet wt.:	
dry wt.:	487	dry wt.:		dry wt.:	
washed wt.:	433.6	washed wt.:		washed wt.:	
loss by wash:	53.4	loss by wash:		loss by wash:	
water wt.:	28	water wt.:		water wt.:	
% moist.:	5.7%	% moist.:		% moist.:	
% passing #200:	**11.0%**	% passing #200:		% passing #200:	

Lab ID #:		Lab ID #:		Lab ID #:	
Sample #:		Sample #:		Sample #:	
wet wt.:		wet wt.:		wet wt.:	
dry wt.:		dry wt.:		dry wt.:	
washed wt.:		washed wt.:		washed wt.:	
loss by wash:		loss by wash:		loss by wash:	
water wt.:		water wt.:		water wt.:	
% moist.:		% moist.:		% moist.:	
% passing #200:		% passing #200:		% passing #200:	

"Solutions for Technical Concerns"

Moisture Content/P200 Worksheet

Project Name: U. S. Steel
Date: November 30, 2005
Project #: 6643A.08
Technicain: Mike Wattunen

Lab ID #:	05-332	Lab ID #:	05-333	Lab ID #:	
Sample #:	GP-19(4'-6')	Sample #:	GP-19(16'-18')	Sample #:	
wet wt.:	1456.2	wet wt.:	535.5	wet wt.:	
dry wt.:	1412	dry wt.:	530	dry wt.:	
washed wt.:	1341	washed wt.:	512	washed wt.:	
loss by wash:	71	loss by wash:	18	loss by wash:	
water wt.:	44.2	water wt.:	5.5	water wt.:	
% moist.:	3.1%	% moist.:	1.0%	% moist.:	
% passing #200:	5.0%	% passing #200:	3.4%	% passing #200:	

Lab ID #:		Lab ID #:		Lab ID #:	
Sample #:		Sample #:		Sample #:	
wet wt.:		wet wt.:		wet wt.:	
dry wt.:		dry wt.:		dry wt.:	
washed wt.:		washed wt.:		washed wt.:	
loss by wash:		loss by wash:		loss by wash:	
water wt.:		water wt.:		water wt.:	
% moist.:		% moist.:		% moist.:	
% passing #200:		% passing #200:		% passing #200:	

Lab ID #:		Lab ID #:		Lab ID #:	
Sample #:		Sample #:		Sample #:	
wet wt.:		wet wt.:		wet wt.:	
dry wt.:		dry wt.:		dry wt.:	
washed wt.:		washed wt.:		washed wt.:	
loss by wash:		loss by wash:		loss by wash:	
water wt.:		water wt.:		water wt.:	
% moist.:		% moist.:		% moist.:	
% passing #200:		% passing #200:		% passing #200:	

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