GENERAL WASTE & RECYCLING, LLC
SW-620 INDUSTRIAL WASTE LANDFILL

Groundwater Monitoring System Certification for CCR Regulation

Prepared For:

GENERAL WASTE & RECYCLING, LLC

Prepared by:

Northeast Technical Services, Inc.
526 Chestnut Street
Virginia, Minnesota 55792

(218) 741-4290

October 11, 2017

Project Number: 6385CC

"I certify under penalty of law that this document and all attachments were prepared under my direct supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete." I certify that this groundwater monitoring system installed at the General Waste Industrial Waste Landfill described in this report meets all requirements put forth by 40 CFR §257.91 'Groundwater Monitoring Systems.'

10-13-17

Evan Johnson, P.E. Date
Geotechnical Engineer
Minnesota License No. 53648

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1.0 Purpose

Per CFR 257.91 Groundwater Monitoring System(the rule), CCR units a groundwater monitoring system must be installed that can accurately represent unaffected 'background' groundwater quality as well as adequately monitor for groundwater contamination that may occur in the uppermost aquifer from leakage of the CCR unit and be certified by a liscensed professional engineer (PE) as meeting CRF 257.91 requirements. The rule specifically identifies minimum requirements for hydrogeological site characterization and monitoring system requirements. This report has been prepared to demonstrate that previously conducted hydrogeological investigation and the installed groundwater monitoring system at the General Waste Industrial Waste Landfill (the landfill) site satisfy the requirements of the rule.

2.0 Site Investigation

While conducting permitting activities of the landfill in 2013, an extensive investigation was completed at the site to refine the hydrologic model of the site in preparation of the installation of a groundwater monitoring system as well as collect geotechnical data of the proposed industrial waste landfill subgrade.

2.1 Geologic Setting

2.1.1 Site Location and History

The landfill is located in the southeast quarter of Section 25, Township 57N, Range 22W, an area where the topography has been highly modified by historical iron mining. The site is bounded on the north by U. S. Highway 169, the west side of the site is bounded by a tailings basin containing hydraulic fill from Mesabi Chief Heavy Media plant which operated from 1928 to 1970 (end date is approximate) and more recently operated by Magnetation, LLC between approximate years 2011-2015. The east side of the site is bounded by Itasca County Road 571 with the south side of the containing a cell phone transmission tower, an automotive salvage yard, and other terrain that review of historical photography indicates to be native landform.

The landfill design intersects a historical mine overburden stockpile, the material for which was obtained from stripping overburden from one of the nearby iron ore open pit mines, likely the Mesabi Chief Mine located approximately 2 miles northeast of the landfill. Stripping operations in the Keewatin vicinity mines is believed to have been started circa 1913. Review of an air photo dated 1939 shows the stockpile was substantially completed by 1939.

2.1.2 Geologic Units

Three (3) stratigraphic units have been identified for the hydrogeological conceptual model as follows:

1. Mine overburden stockpile unit that varies across the landfill footprint in depths ranging from 5 to 80 feet and consists of sand, silty-clayey sand, and sandy silty clay.
2. Native soil unit which consists of fine sand and silty sand near the top of the unit and generally grades to a silty medium grained sand with abundant gravel.
3. Mine tailings unit which consists of interlayered grey and black silt and fine sand sized taconite tailings. The mine tailings are approximately range from 10 to 26 feet thick and were placed in the tailings basin constructed directly to the west of the mine overburden stockpile.

2.1.3 Hydrologic Setting

An unconfined aquifer exists below the landfill, with the water table near the contact of the mine overburden stockpile unit with the native soil unit, except on the western edge of the permitted landfill boundary where the water table is within the tailings. Groundwater flow is generally to the east and southeast.

2.2 Investigation Scope

The scope of the hydrogeologicinvestigation as it relates to development of the hydrogeological model included the following:

- Refine the depth to native ground surface;
- Refine the soil descriptions of the overburden stockpile including grain size distributions;
- Collect soil descriptions and hydraulic properties of the native soil unit; and,
- Refine the water table elevations and groundwater flow in the vicinity of the new proposed industrial cell.

2.3 Completed Field Work

Twenty four (24) soil borings were advanced at the proposed landfill for the joint purposes of collecting hydrogeological and geotechnical data.

Eleven borings were installed utilizing percussion hammer methods and conducting continuous macrocore sampling. Temporary piezometers to measure groundwater were installed in seven of these borings. Boring locations GP-17 and GP-21 consisted of two nested wells (shallow and deep) to aide in assessing vertical groundwater gradien.

An additional ten borings were installed utilizing hollow-stem auger (HSA) drill methods. Staggered split spoon sampling was conducted until the boring neared the expected native soil contact, where continuous split spoon sampling was implemented in order to accurately determine the overburden-native soil contact. Temporary piezometers were installed in seven of the HSA borings. Boring location SB-18 also consisted of two nested wells.

All obtained soil samples were visually examined to estimate the distribution of grain sizes, plasticity, organic content, moisture condition, color, presence of lenses or seams, and apparent geologic origin. In addition, laboratory testing was completed on select soil samples that included twenty-three moisture content analyses, eighteen Passing #200 sieve analyses, six grain size analyses, and two Atterberg tests. Soil samples selected for laboratory testing were taken from below the expected landfill liner subgrade elevation. The soil boring logs and laboratory testing results can be found in Appendix A and B, respectively.

Boring location, ground surface elevation, and temporary piezometer casing were surveyed. Static water levels in temporary piezometers were measured and shown to be stable.

Table 1 summarizes the coordinates, elevations, boring depth, depth to native soil, and depth to the water table obtained from the borings. The locations of the borings are presented on Figure 3 and soil boring logs are provided in Appendix B.

3.0 Hydrogeologic Model

3.1 Geologic Unit Verification

The borings completed during this investigation defined the same three lithologic units as the preliminary model with additional detail on the soil descriptions. In general, the majority of the Stockpile soils are very similar to the native soils, which is sensible given the close proximity of the stripping location.

Four (4) soil units were identified within the mine overburden stockpile as follows:

1. Undifferentiated mixture of clayey sands (SC), silty sands (SM) and occasional poorly graded sands (SP). This makes up the majority of the mine overburden stockpile and is characterized by two or more soil types in the same split spoon or macrocore sampler. The undifferentiated soils are probably a result of excavating, loading and dumping a glacial till that originally had some stratification of layering of the original soil types. Review of laboratory testing results indicated fines content ranging from 15-40%.

2. Red sandy clay (CL) with varying amounts of fine sand or gravel. This soil unit was generally encountered near the top of the mine overburden stockpile on the western portion of the stockpile (eg. SB-13, SB-16, SB-19).
3. Brown, poorly graded sand (SP) with varying amounts of fines. This soil unit was found in pockets throughout the stockpile.
4. Blackish brown silt (ML). This soil unit was only identified in SB-18D near the bottom of the stockpile.

Native soil was discernable by the presence of thin layers of organic silt (OL) or peat (PT) which transitioned to a dense to very dense inter-bedded silty clayey sand with gravel (SC-SM) and poorly graded sand with gravel (SP).

Two (2) soil borings were completed in the tailings basin. The tailings are described as black silty, clayey sand (SC-SM). The bottom of the tailings basin was encountered at a depth of approximately 26 feet.

3.2 Native Ground and Landfill Subgrade

The elevation of native soil appeared to be relatively consistent at elevation 1451 – 1461above mean sea level (MSL). After excavation to proposed landfill base grades, from soil boring information, underlie the majority of the landfill. In addition, based on soil boring information, proposed landfill base grades range from 8 to 20 feet above the native soil.

3.3 Groundwater Flow

The general direction of groundwater flow based on static water levels obtained from the temporary piezometers is easterly with a southerly component. A groundwater equipotential map (contour map) with groundwater flow direction indicated is presented as Figure 4

The three (3) temporary well nests that were installed to obtained to evaluate vertical groundwater flow which indicated an upward vertical component to groundwater flow.

Recharge to the unconfined aquifer is likely provided in part by flow from the adjacent tailings basin and from infiltration through the stockpile. Discharge occurs at the ditch at the eastern property boundary. The groundwater component from the tailing basin to the west and discharge to the ditch to the east creates a stable and predictable groundwater flow direction from which a reliable detection monitoring system has been designed and installed.

3.3.1 Seasonal Fluctuation

Evaluation of static water levels obtained from the groundwater monitoring system (MW-7, MW-3R, MW-8, and MW-9) (discussed below) have shown minimum variation over time. This is elevations of the western tailings basin and eastern ditch. The maximum change in static water level has been observed in MW-7 (upgradient well) with a variation of approximately three (3) feet. A total elevation change of approximately 35 feet occurring across the site minimizes the effect of this variation on overall groundwater flow direction.

3.4 Aquifer Thickness

Evaluation of soil boring information indicated a minimum aquifer thickness of 20-24 feet, with saturated overburden stockpile material ranging from 2 to 14 feet.

4.0 Groundwater Monitoring System

4.1 Upgradient Well

CFR 257.91 requires a minimum of one (1) upgradient well (when feasible) to monitor background groundwater quality. Monitoring well MW-7 has been installed directly west, upgradient with respect to groundwater flow, from the landfill.

4.2 Downgradient Wells

CFR 257.91 requires a minimum of three (3) downgradient wells to be installed to monitor for leakage from the CCR unit. The rule also requires justification for installing only the minimum required number of wells.

Monitoring wells MW-3R, MW-8, and MW-9 have been installed downgradient of the existing and planned CCR landfill units with the monitoring wells being located east and east-southeast of the landfill footprint. The minimum number of wells is acceptable in this occurrence due to the previously mentioned stable aquifer conditions that allow for a predictable groundwater flow direction. The existing groundwater monitoring system will remain adequate as the landfill is developed to the east, downgradient with respect to the groundwater flow. Monitoring well locations are presented on Figure 5.

Two cross sections through the landfill footprint that show the initial investigative borings, installed monitoring wells, and proposed landfill base grades have been prepared and are presented as Figures 6 and 7.

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4.3 Monitoring Frequency

CCR groundwater monitoring will be conducted semi-annually during the Spring and Fall of each year. Spring and Fall monitoring is typically performed during April and October, respectively. CCR groundwater monitoring will continue through the active life of the CCR Unit and post closure. CCR Unit post closure monitoring will be conducted for 30 years.

4.4 Future Development

As indicated above, the existing groundwater monitoring system will remain adequate as the landfill is developed. However, if future development of the landfill changes or necessitates removing an installed groundwater monitoring well, further investigation and assessment will be conducted to determine need for and locations of additional monitoring wells.

Tables

Table 1: Exploration Borehole Summary

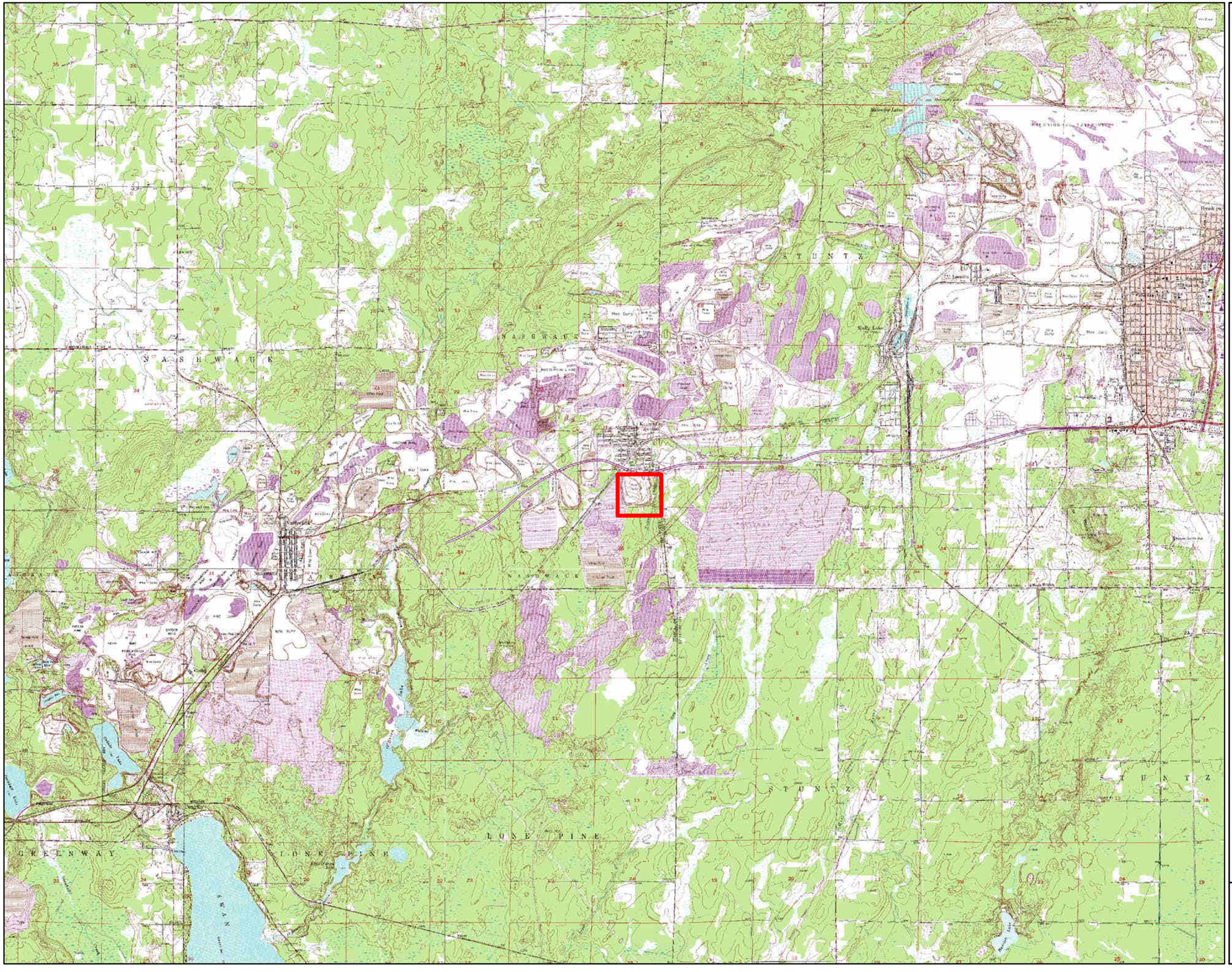
Boring Identification	Drilling method	X	Y	Z (Ground)	Z (Casing)	Borehole depth	Depth to Native soils	Native Soil Elevation	Static Water level (11/26/12)
Borings and piezometers completed during 2012									
SB 12-1	Not drilled								
SB 12-2	Geoprobe	1621035.1	17219254.1	1488	*na*	21	*na*	*na*	*na*
SB 12-3	HSA	1621374.9	17219572.4	1511	*na*	67	60	1451	*na*
SB 12-4	HSA	1621780.6	17219468.6	1513	*na*	72	61	1452	*na*
SB 12-5	Geoprobe	1622185.8	17219540.6	1481	1482.96	25	*na*	*na*	1462.76
SB 12-6	Geoprobe	1621024.9	17219120.8	1493	1495*	29	*na*	*na*	1471.50
SB 12-7	HSA	1621209.2	17219295.6	1521	1524.73	62	*na*	*na*	1472.04
SB 12-8	HSA	1621650.4	17219280.2	1534	*na*	82	67	1467	*na*
SB 12-9	Geoprobe	1622157.4	17219276.7	1485	*na*	24	*na*	*na*	*na*
SB 12-10	Not drilled								
SB 12-11	Geoprobe	1621080.7	17218995.9	1495	1497.23	27	*na*	*na*	1471.63
SB 12-12	HSA	1621312.5	17219181.3	1521	1523.88	59.5	*na*	*na*	1471.45
SB 12-13	HSA	1621804.4	17219141.8	1521	1524.17	66	62	1459	1464.55
SB 12-14	Geoprobe	1622208.1	17219085.3	1483	*na*	31	*na*	*na*	*na*
SB 12-15	HSA	1621230.7	17218896.7	1529	1532.99	77	76.5	1452.5	1473.77
SB 12-16	HSA	1622024.4	17218862	1521	*na*	77	65	1456	*na*
SB 12-17S	Geoprobe	1622413.6	17219760.7	1473	1477.52	20	*na*	*na*	1460.82
SB 12-17D	Geoprobe	1622413.6	17219760.7	1473	1477.84	32	17	1456	1460.91
SB 12-18S	HSA	1621731.5	17218778.2	1526	1533.09	*na*	*na*	*na*	1463.68
SB 12-18D	HSA	1621731.5	17218778.2	1526	1533.17	91	65	1461	1465.87
SB 12-19	HSA	1622049	17218675.9	1535	1533.46	94	83	1452	1461.92
SB 12-20	Geoprobe	1622245.9	17218682.3	1495	*na*	32	*na*	*na*	*na*
SB 12-21S	Geoprobe	1620791.5	17218390.8	1487	1489.32	15	na	na	1474.10
SB 12-21D	Geoprobe	1620791.5	17218390.8	1487	1489.45	41	26	1461	1474.93
SB 12-22	Not drilled								
SB 12-23	Geoprobe	1621155.6	17218242.7	1496	*na*	23	*na*	*na*	*na*
SB 12-24	Geoprobe	1622114.7	17218284.7	1481	*na*	29	*na*	*na*	*na*
SB 12-25	HSA	1621309	17219146		*na*	48.5	*na*	*na*	*na*
SB 12-26	HSA	1620984	17219085		*na*	21.5	*na*	*na*	*na*

X,Y Coordinates in UTM NAD 83 (feet)
Elevations in feet above mean sea level (NAVD88)
Depths in feet
* estimated rise relevation.

Table 2: Monitoring Well Details

	MW-3R		MW-7		MW-8		MW-9	
MDH Unique Well #	797239		817979		817978		817980	
Northing (UTM NAD83)	5248332.87		5248449.356		5248271.719		5248474.904	
Easting (Zone 15 Meters)	494267.27		494024.588		494451.676		494695.922	
Installation Date	9-Jul-15		9/30/2016		9/29/2016		9/30/2016	
Ground Elev. (ft)	1530.10		1493.62		1491.63		1452.93	
Riser Top Elev. (ft)	1532.29		1496.13		1494.41		1454.72	
Total Depth (ft)	75.0		26.6		41.3		18.9	
Screened Interval (ft)	65-75		16.6	26.6	31.3	41.3	8.9	18.9
Screened Elevation	1465.10 - 1455.10		1477.02 - 1467.02		1460.33 - 1450.33		1444.03 - 1434.03	
Date of Measurement	**Static Level**	**GW Elev.**	**Static Level**	**GW Elev.**	**Static Level**	**GW Elev.**	**Static Level**	**GW Elev.**
17-Apr-17	61.95	1470.34	17.93	1478.2	30.18	1464.23	10.98	1443.74
8-May-17	61.82	1470.47	16.16	1479.97	29.72	1464.69	10.62	1444.1
20-Jun-17	61.56	1470.73	17.97	1478.16	29.6	1464.81	11.11	1443.61
11-Jul-17	61.57	1470.72	18.32	1477.81	29.84	1464.57	11.4	1443.32
1-Aug-17	61.74	1470.55	18.95	1477.18	30.21	1464.2	11.5	1443.22
16-Aug-17	61.90	1470.39	19.34	1476.79	30.53	1463.88	11.53	1443.19
18-Sep-17	61.89	1470.40	18.85	1477.28	30.74	1463.67	10.84	1443.88

FIGURES



N

0 3,000 6,000 12,000

Feet

1 Inch = 6,000 Feet

Legend

Project Location

Notes:

-Background image has been provided by MNGEO Web Services

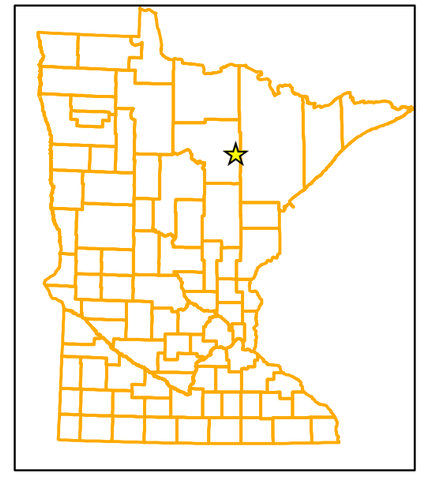


Figure 1
Site Location Map

General Waste Industrial Landfill
Groundwater Monitoring System Certification
Keewatin, MN (St. Louis)

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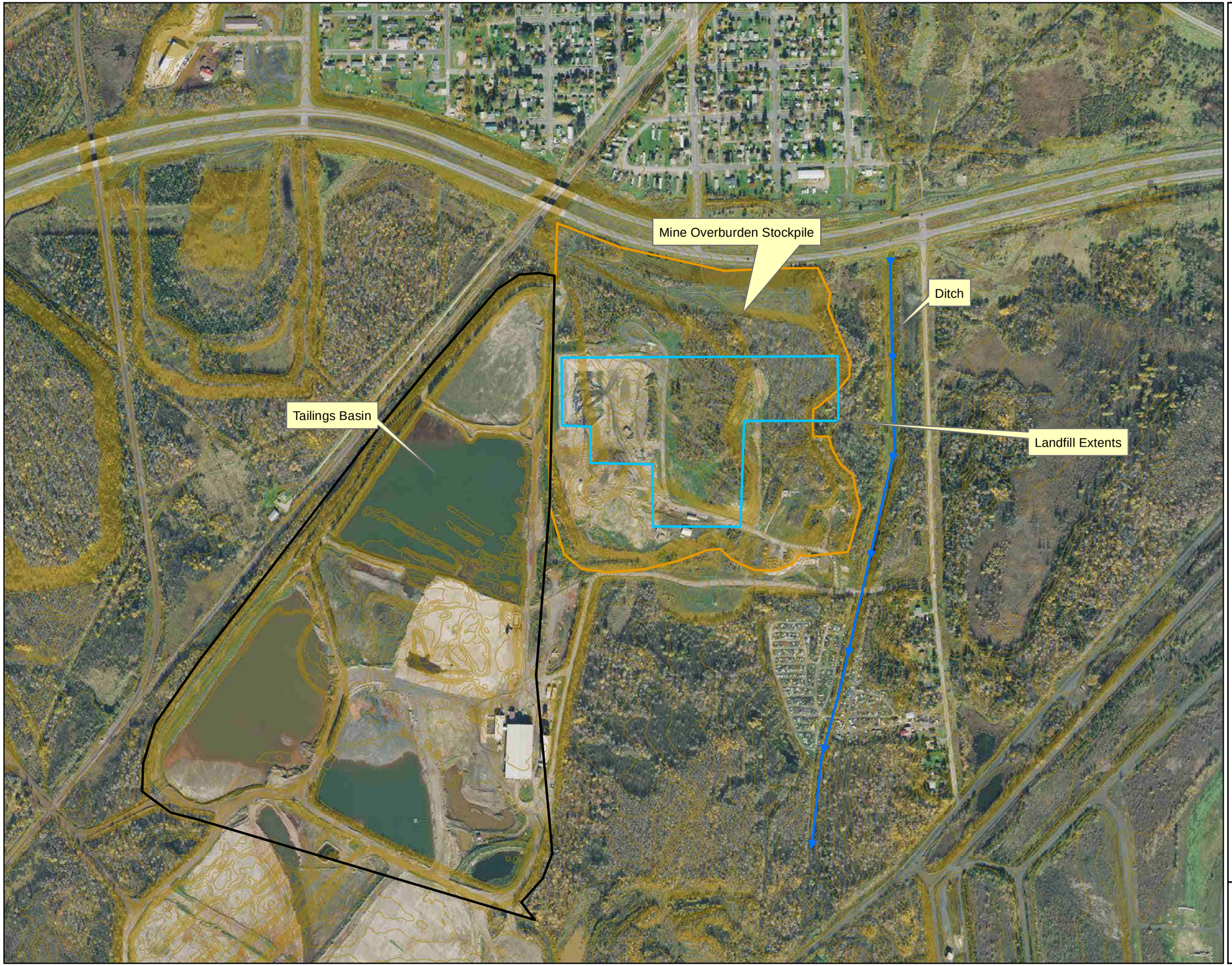
Date Drawn : October 4, 2017	
Drawn By : Evan Johnson	1
NTS Project #: 6385CC	



N

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Feet

1 Inch = 600 Feet

Legend

- Landfill Footprint
- Tailings Basin
- Mine Overburden Stockpile
- Ditch
- Contours

Notes:

-Background image has been provided by MNGEO Web Services, Image Date 2013

Figure 2
Geologic Unit Identification

General Waste Industrial Landfill
CCR Groundwater Monitoring System Certification
Keewatin, MN (Itasca)

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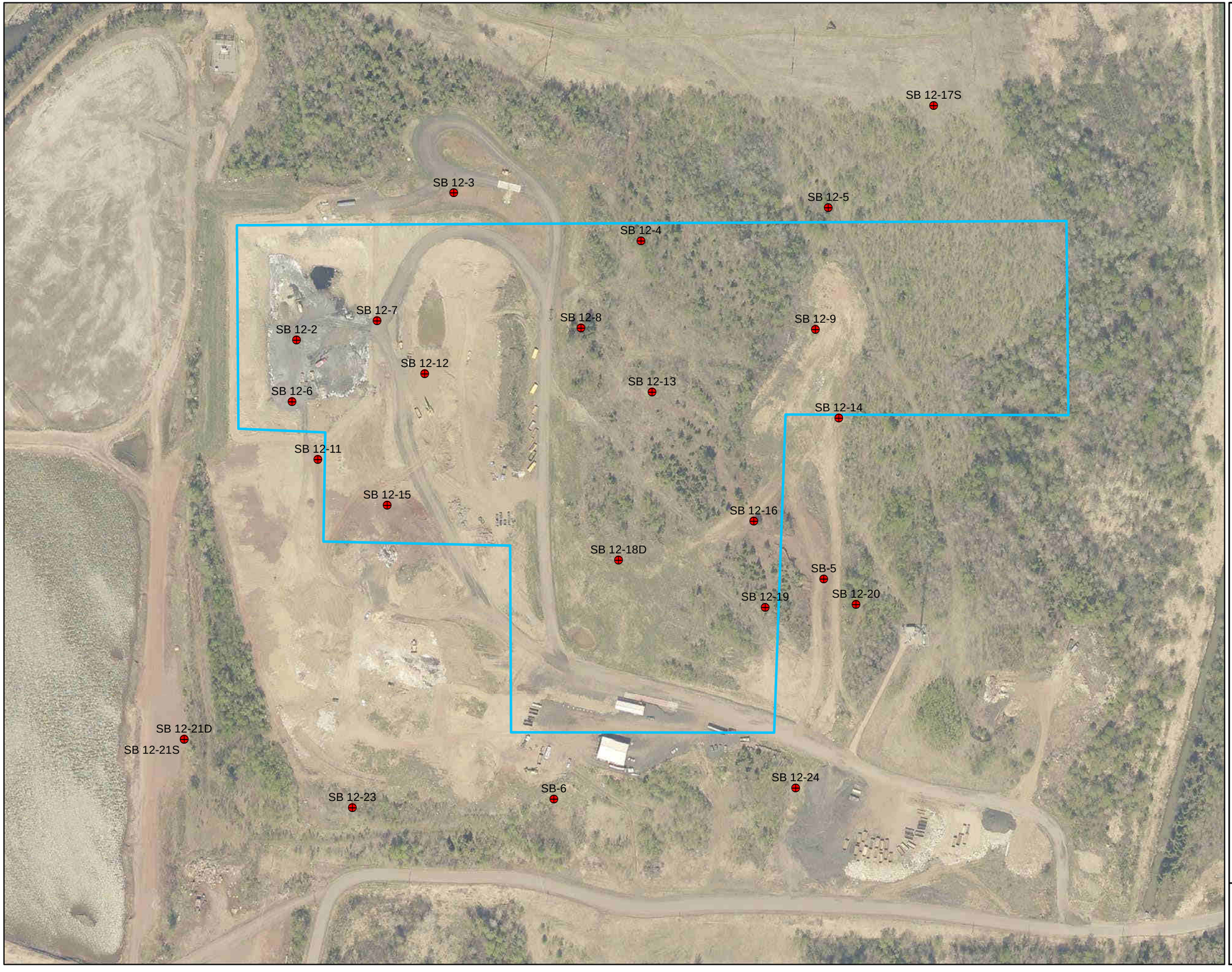

N

0 100 200 400

Feet

1 Inch = 200 Feet

Legend

- Soil Borings
- Landfill Footprint

Notes:

-Background image has been provided by St. Louis County Web Services, App Image Date: May, 2016

Figure 3
Soil Boring Locations

General Waste Industrial Landfill
CCR Groundwater Monitoring System Certification
Keewatin, MN (Itasca)

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3

N

0 140 280 560

Feet

1 Inch = 280 Feet

Legend

- Groundwater Contours
- Landfill Footprint
- Groundwater Flow Direction

Notes:

-Background image has been provided by St. Louis County Web Services, App Image Date: May, 2016

Figure 4
Groundwater Contour Map

General Waste Industrial Landfill
CCR Groundwater Monitoring System Certification
Keewatin, MN (Itasca)

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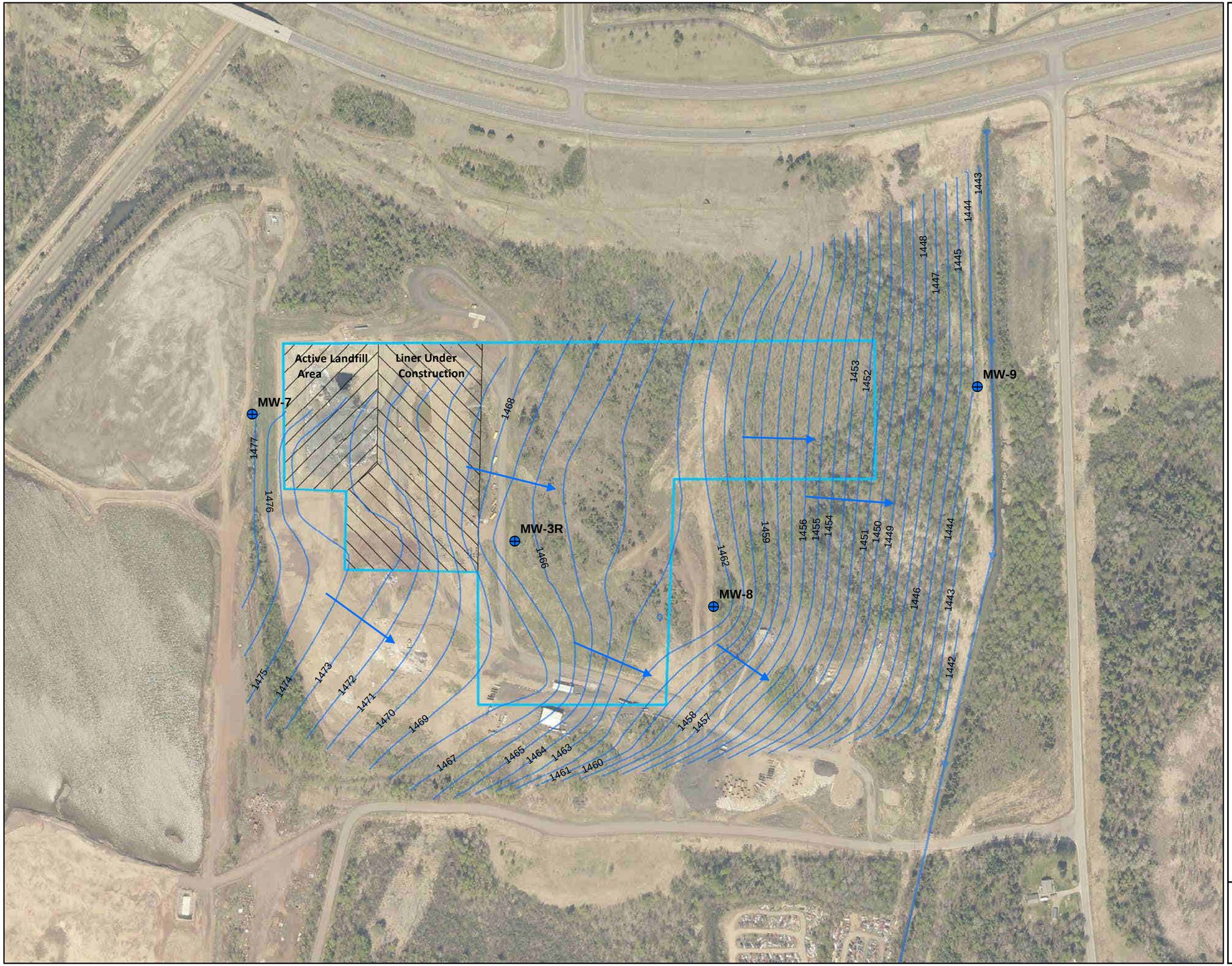

N

0 140 280 560

Feet

1 Inch = 280 Feet

Legend

- Monitoring Well
- Groundwater Contours
- Landfill Footprint
- Ditch

Notes:

-Background image has been provided by St. Louis County Web Services, App Image Date: May, 2016

Figure 5
Groundwater Monitoring Well Locations

General Waste Industrial Landfill
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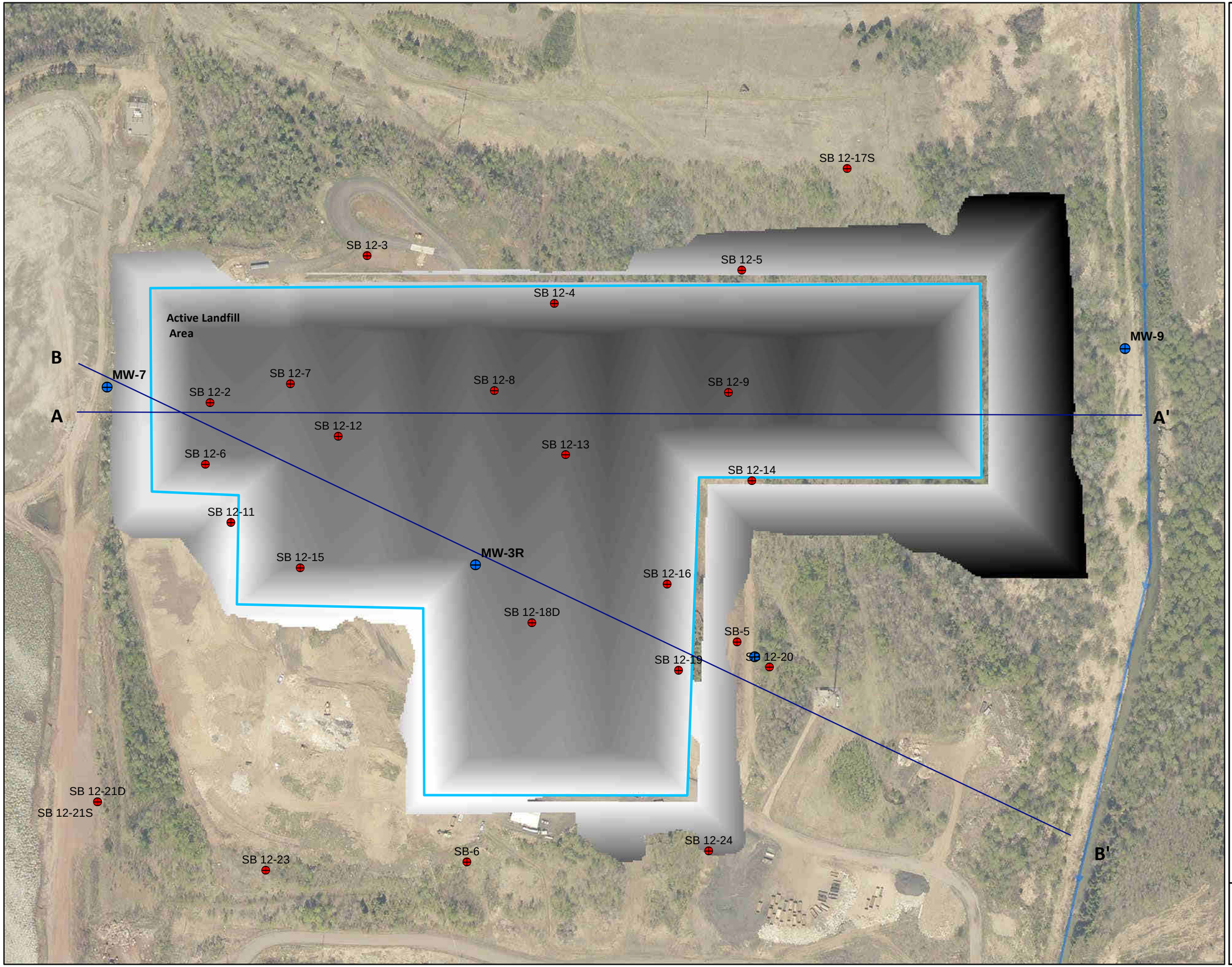

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Feet

1 Inch = 200 Feet

Legend

- Cross_sections
- Monitoring Well
- Soil Borings
- Landfill Footprint
- Ditch

Landfill basegrade

Notes:

-Background image has been provided by St. Louis County Web Services, App Image Date: May, 2016

Figure 6
Cross Section Layout

General Waste Industrial Landfill
CCR Groundwater Monitoring System Certification
Keewatin, MN (Itasca)

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Northeast Technical Services, Inc.
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SUBSURFACE DIAGRAM
Cross Section A - A'

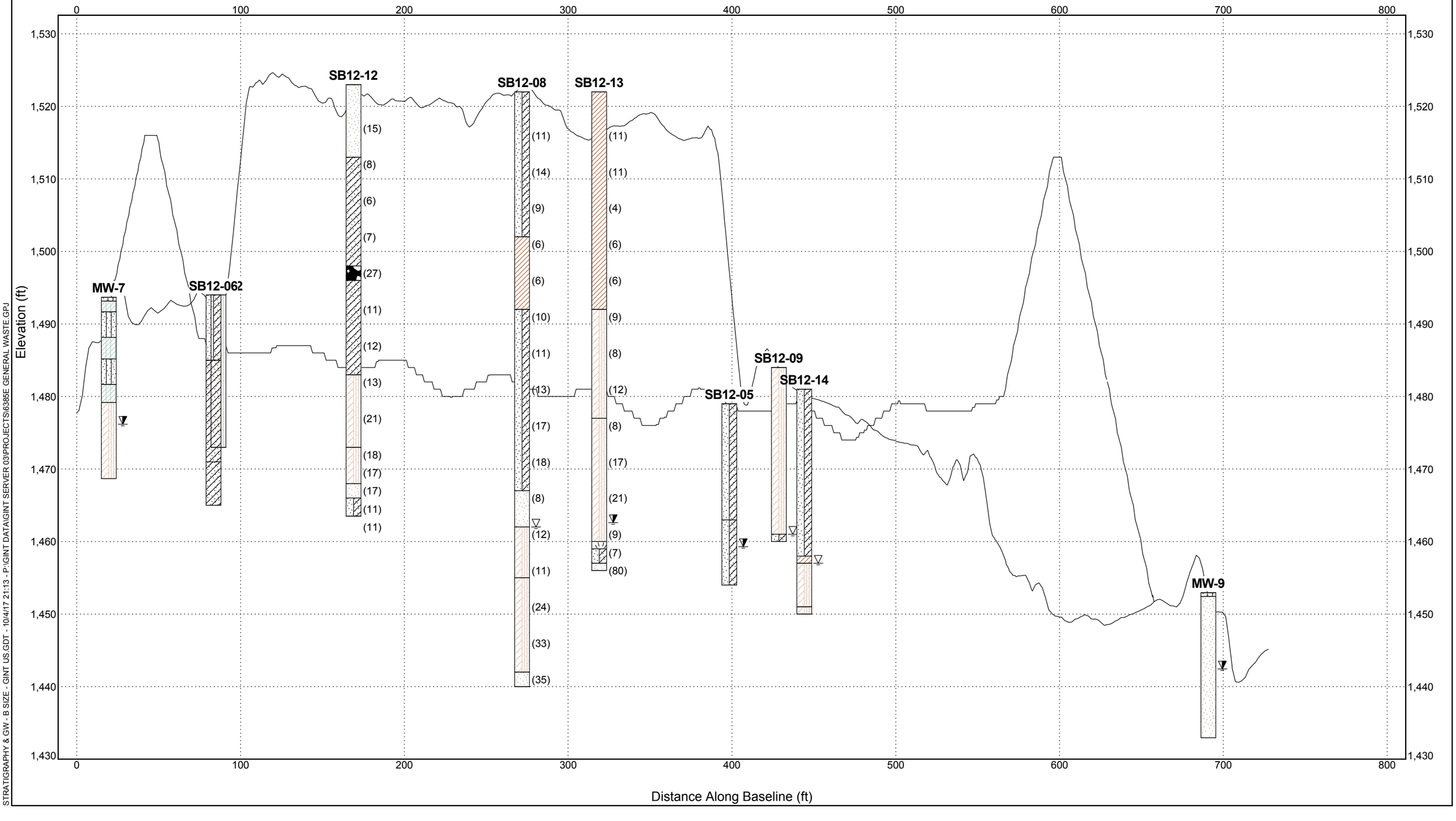
CLIENT General Waste Disposal & Recovery Services

PROJECT NUMBER 6385C

PROJECT NAME General Waste

PROJECT LOCATION Keewatin, Minnesota

- Topsoil
- USCS Clayey Sand
- USCS Clayey Sand
- USCS Peat
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand
- USCS Low Plasticity Clay
- USCS Silty Sand
- USCS Poorly-graded Sand with Clay
- Boulders and cobbles



STRATIGRAPHY & GW - B SIZE - GINT US.GDT - 10/4/17 21:13 - P:\GINT DATA\GINT SERVER 03\PROJECTS\6385E GENERAL WASTE.GPJ

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SUBSURFACE DIAGRAM
Cross Section B - B'

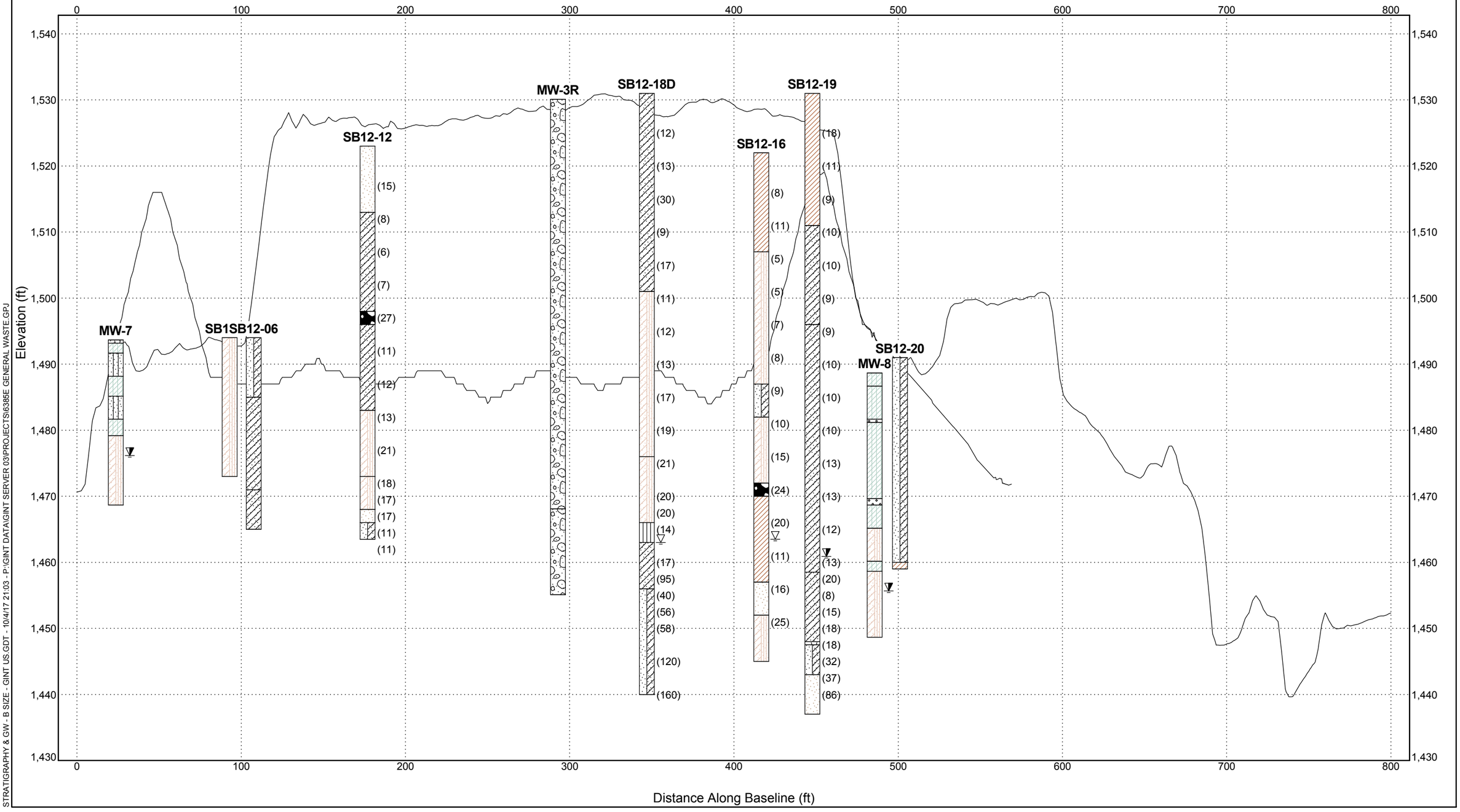
CLIENT General Waste Disposal & Recovery Services

PROJECT NUMBER 6385C

PROJECT NAME General Waste

PROJECT LOCATION Keewatin, Minnesota

- USCS Poorly-graded Sandy Gravel
- USCS Silty Sand
- USCS Poorly-graded Sand with Clay
- Boulders and cobbles
- Topsoil
- USCS Clayey Sand
- USCS Clayey Sand
- USCS Low Plasticity Clay
- USCS Low Plasticity Silty Clay
- USCS Well-graded Sand
- USCS Poorly-graded Sand
- USCS Silt



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APPENDIX A

BORING LOGS

Northeast Technical Services
526 Chestnut Street
Virginia, MN
Telephone: 1-218-741-4290
Fax: 1-218-741-4291

BORING NUMBER SB12-02

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/18/12 **COMPLETED** 10/18/12
GROUND ELEVATION 1494 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40's F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SC-SM) Silty clayey sand, medium stiff, brown to greyish brown, moist	50							
	MC			50		8				37	
10	MC			50							
	MC			50							
	MC			75							
20	MC			100							
			Bottom of borehole at 21.0 feet.								

Northeast Technical Services
526 Chestnut Street
Virginia, MN
Telephone: 1-218-741-4290
Fax: 1-218-741-4291

BORING NUMBER SB12-03

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/17/12 **COMPLETED** 10/17/12
GROUND ELEVATION 1512 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
▽ **AT TIME OF DRILLING** 45.50 ft / Elev 1466.50 ft
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 39 F; cloudy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0			(SM) Silty Sand with gravel, brown, dry, some fines, little gravel, Mine Overburden								
	SS			75	6-8-8-8 (16)						
10	SS			75	5-4-4-5 (8)	13				35	
	SS		(SP-SC) Sand with silty clay, brown, moist, fine to medium grained sand, Mine Overburden	88	3-4-4-4 (8)						
20	SS			88	4-5-5-6 (10)						
	SS		(SC-SM) Silty clayey sand, brown, moist, fine to medium grained sand, some fines, few gravel, Mine Overburden	75	5-5-6-7 (11)						
30	SS			88	4-5-5-6 (10)						
	SS			100	4-5-5-6 (10)	9				32	
40	SS			50	5-6-8 (14)						
	SS		▽ (SP-SM) Sand with silt, brown to 55 feet, gray from 55 to 60 feet, wet, fine to medium grained sand, few fines, few gravel	75	4-4-5-5 (9)						
50	SS			50	5-5-6 (11)						
	SS			63	3-2-1-1 (3)						
60	SS		(OL) Peat, black, wet, Native Ground Surface	88	5-8-9-11 (17)						
	SS		(SP-SC) Sand with silty clay, grey, wet, few fines, few gravel	100	4-11-23-27 (34)						
			Bottom of borehole at 67.0 feet.								

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BORING NUMBER SB12-04

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/17/12 **COMPLETED** 10/17/12
GROUND ELEVATION 1514 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
▽ **AT TIME OF DRILLING** 53.50 ft / Elev 1460.50 ft
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 51 F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0			(SP-SC) Sand with clay and gravel, red to brown, moist, Mine Overburden								
	SS			13	4-5-5-5 (10)						
10	SS			88	2-2-3-4 (5)						
	SS			88	2-3-3-3 (6)						
20	SS			100	2-3-3-3 (6)						
	SS		(SC-SM) 19 % gravel, 50 % sand, 31 % fines Silty clayey sand with gravel, grey to brown, moist, some fines, little gravel, Mine Overburden	100	3-4-6-8 (10)						
30	SS			13	4-6-9 (15)						
	SS			13	16-8-6 (14)						
40	SS			63	6-8-8 (16)						
	SS			75	9-9-9-9 (18)	10				31	
50	SS		No Recovery	13	6-8-8 (16)						
	SS		▽ (SC-SM) 12 % gravel, 59 % sand, 29 % fines Silty clayey sand, brown, wet, fine to medium grained sand, little fines, few gravel	75	3-6-6 (12)	13				29	
60	SS		(OL) Peat, black, wet, Native Ground Surface	75	5-15-15 (30)						
	SS		(SP-SC) Sand with silty clay, brownish grey, wet, medium to coarse grained sand	75	20-25-30 (55)						
70	SS		(SP) Sand, brown, wet, medium grained	100	6-7-7-8 (14)						
			Bottom of borehole at 72.0 feet.								

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BORING NUMBER SB12-05

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/17/12 **COMPLETED** 10/17/12
GROUND ELEVATION 1479 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40s F; overcast
AFTER DRILLING 19.70 ft / Elev 1459.30 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SP-SC) Sand with silty clay and gravel, brown, moist, few fines, little gravel	75							Casing Top Elev: 1482.96 (ft)
	MC			50							Grout
10	MC			0							
	MC			75							Bentonite Seal
	MC		(SP-SC) Sand with silty clay and gravel, brown, wet, few fines, little gravel	50							Sand Pack
20	MC			50							
	MC		Bottom of borehole at 25.0 feet.	25							

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BORING NUMBER SB12-06

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/18/12 **COMPLETED** 10/18/12
GROUND ELEVATION 1494 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40s F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1491.95 (ft)
	MC		(SP-SC) Sand with silty clay and gravel, brown to greyish brown, moist, few fines, little gravel, fill material	38							Grout
	MC			38							
10	MC		(SC) Clayey sand with gravel, brown to greyish brown, moist, some fines, little gravel, fill material	38							
	MC			75							Bentonite Seal
	MC			75		11				47	
20	MC			75							Sand Pack
	MC		(SC) Clayey sand with gravel, brown to greyish brown, wet, some fines, little gravel, fill material	100							
			Refusal at 29.0 feet. Bottom of borehole at 29.0 feet.								

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BORING NUMBER SB12-07

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION 1522 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 46 F; Cloudy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1524.73 (ft)
	SS		(SP) Sand with gravel, brown to red, dry, little gravel, trace fines, Mine Overburden	13	7-7-7-7 (14)						
10	SS			63	4-4-4-4 (8)						
	SS			88	3-3-3-4 (6)						
20	SS			88	3-3-3-3 (6)						Grout
	SS		(SC) Clayey sand with gravel, brown, dry, some fines, little gravel, Mine Overburden	75	4-18-28-18 (46)						
30	SS			13	7-7-7-7 (14)						
	SS			100	4-5-6-8 (11)						
40	SS		(SP) Sand with gravel, brown, moist, little gravel, trace fines, Mine Overburden	63	25-15-7-7 (22)						Bentonite Seal
	SS		(SC) Clayey sand with gravel, brown, moist, some fines, little gravel, Mine Overburden	88	8-7-15-9 (22)						
50	SS			63	15-8-7-7 (15)						Sand Pack
	SS			100	3-4-4-5 (8)						
	SS		(SP) Sand with gravel, brown, wet, trace fines, little gravel, Mine Overburden	100	3-4-4-4 (8)						
	SS			100	3-4-4-5 (8)	12				36	
60	SS			100	3-3-4-5 (7)						
	SS		(SP-SC) Sand with silty clay, brown, wet, few fines	100	4-4-5-6 (9)						
			Bottom of borehole at 62.0 feet.								

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BORING NUMBER SB12-08

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/17/12 **COMPLETED** 10/18/12
GROUND ELEVATION 1522 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
▽ **AT TIME OF DRILLING** 60.00 ft / Elev 1462.00 ft
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 46 F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0			(SP-SC) Sand with clay and gravel, red to brown, dry, Mine Overburden								
	SS			75	4-5-6 (11)						
10	SS			75	10-8-6-6 (14)						
	SS			63	4-4-5-5 (9)						
20	SS		(CL) Sandy clay, grey, moist, some sand, trace gravel, Mine Overburden	100	2-2-4-4 (6)						
	SS			100	3-3-3-3 (6)						
30	SS		(SP-SC) Sand with clay, brown to grey, moist, little gravel, few fines, Mine Overburden	88	3-4-6-7 (10)						
	SS			75	4-5-6-7 (11)						
40	SS			75	4-6-7-8 (13)						
	SS			50	5-8-9-11 (17)						
50	SS			100	5-8-10-11 (18)						
	SS		(SP) Sand with gravel, brown to grey, wet, fine to medium grained	75	4-4-4-6 (8)						
60	SS	▽	(SC-SM) Silty clayey sand, grey, wet, rock chips, little fines, few gravel	75	4-5-7-7 (12)						
	SS			100	4-5-6-7 (11)						
70			(SC-SM) Silty clayey sand, grey to brown, moist, some fines, Native Ground Surface encountered at 67 feet								
	SS			75	7-9-15 (24)	14				47	
	SS			88	11-15-18-25 (33)						
80	SS		(SP) Sand with gravel, brown, wet, fine to medium grained, trace fines, little gravel	75	13-16-19-25 (35)						
			Bottom of borehole at 82.0 feet.								

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BORING NUMBER SB12-09

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/17/12 **COMPLETED** 10/17/12
GROUND ELEVATION 1484 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
▽ **AT TIME OF DRILLING** 23.00 ft / Elev 1461.00 ft Approximate
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40s F; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SC-SM) Silty clayey sand with gravel, brown, moist, little fines, some gravel	50							
	MC			50							
10	MC			50							
	MC			38							
	MC			75							
20	MC		▽	0							
			(SP-SC) Sand with silty clay and gravel, brown, wet, few fines, some gravel								
			Refusal at 24.0 feet. Bottom of borehole at 24.0 feet.								

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BORING NUMBER SB12-11

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/18/12 **COMPLETED** 10/18/12
GROUND ELEVATION 1496 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40's F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SP-SC) Sand with silty clay and gravel, brown, moist, few fines, little gravel, fill material	38							Casing Top Elev: 1497.23 (ft)
	MC			25							Grout
10	MC		(SC) Clayey sand with gravel, brown, moist, stiff to very stiff, some fines, little gravel, fill material	63							
	MC			100							Bentonite Seal
	MC			88							
20	MC			75		11				47	Sand Pack
	MC		(SC) Clayey sand with gravel, brown, wet, some fines, little gravel, fill material	50							
			Bottom of borehole at 27.0 feet.								

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BORING NUMBER SB12-12

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION 1523 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 66 F; sunny
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1523.88 (ft)
	SS		(SP) Sand with gravel, brown, dry, little gravel, Mine Overburden	75	5-9-6-7 (15)						
10	SS		(SC) Clayey sand with gravel, brown, moist, little fines, little gravel, Mine Overburden	75	5-4-4-5 (8)						
	SS			50	3-3-3-4 (6)						
20	SS			50	3-4-3-3 (7)						
	SS		No Recovery; rock or cobbles	0	8-12-15-20 (27)						Grout
30	SS		(SC) Clayey sand with gravel, brown, moist, little fines, little gravel, Mine Overburden	50	4-5-6-8 (11)						
	SS			75	5-6-6-7 (12)						
40	SS		(SC-SM) 5 % gravel, 70 % sand, 25 % fines Silty sand with gravel, brown, moist, little fines, trace gravel, Mine Overburden	100	5-6-7-8 (13)						
	SS			100	8-9-12-15 (21)						
50	SS		(SC-SM) Silty clayey sand, brown, moist, fine to medium grained sand, little fines, trace gravel	75	8-11-7-7 (18)						Bentonite Seal
	SS			75	8-8-9-9 (17)						
	SS		(SP) Sand, brown, wet, fine to medium grained sand	100	8-8-9-9 (17)	10				25	Sand Pack
	SS		(SP-SC) Sand with silty clay, brown, wet, fine to medium grained sand, little fines	100	4-5-6-6 (11)						
	SS		Bottom of borehole at 59.5 feet.	75	5-5-6-7 (11)						

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BORING NUMBER SB12-13

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/18/12 **COMPLETED** 10/18/12
GROUND ELEVATION 1522 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 51 F; rainy
AFTER DRILLING 59.40 ft / Elev 1462.60 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0			(CL) Sandy clay with gravel, brown to red, dry, medium grained sand, some sand, little gravel, MIne overburden								Casing Top Elev: 1524.17 (ft)
	SS			100	4-5-6-7 (11)						
10	SS			100	4-5-6-7 (11)						
	SS			100	1-2-2-3 (4)						
20	SS			100	2-3-3-4 (6)						
	SS			100	4-3-3-4 (6)						Grout
30	SS		(SC-SM) Sand with silt, brown to grey, moist, fine grained, Mine overburden	75	3-4-5 (9)						
	SS			88	3-4-4-5 (8)						
40	SS			88	4-5-7-9 (12)						
	SS		(SC-SM) 7 % gravel, 65 % sand, 28 % fines Silty Clayey sand, brown to grey, moist, fine to medium grained sand, little fines, few gravel, Mine overburden	100	4-4-4-4 (8)						
50	SS			63	6-8-9 (17)	11				28	
	SS			50	6-12-9-9 (21)						Bentonite Seal
60	SS			50	11-4-5 (9)						Sand Pack
	SS		(OL) Peat, black, wet, Native surface	75	3-3-4-4 (7)						
	SS		(SP-SC) Sand with silty clay, grey, wet, fine to medium grained	50	15-30-50 (80)						
			(SP) Sand, gray, wet, medium grained								
			Refusal at 66.0 feet. Bottom of borehole at 66.0 feet.								

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BORING NUMBER SB12-14

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION 1481 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
▽ **AT TIME OF DRILLING** 24.00 ft / Elev 1457.00 ft Approximate
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 60s F; sunny
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SP-SC) Sand with silty clay and gravel, brown, moist	38							
	MC			0							
10	MC			25							
	MC			25							
	MC			38							
20	MC			63							
	MC		▽ (CL) Lean clay with sand, soft to medium stiff, brown to grey, moist	63							
	MC		(SC-SM) Silty clayey sand with gravel, brown, wet, little fines, little gravel	50							
30			(SC) Lean clay with sand, soft to medium stiff, brown to grey, moist								
			Refusal at 31.0 feet. Bottom of borehole at 31.0 feet.								

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BORING NUMBER SB12-15

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/15/12 **COMPLETED** 10/15/12
GROUND ELEVATION 1529 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING 57.40 ft / Elev 1471.60 ft
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 55 F; sunny
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1532.99 (ft)
	SS		(SP) Sand with gravel, brown to red, dry, some cobbles at 22 feet, Mine overburden	75	8-8-6-6 (14)						
10	SS			13	7-6-7-7 (13)						
	SS			63	4-4-4-4 (8)						
20	SS			50	5-4-4-4 (8)						
	SS			25	11-6-3-3 (9)						Grout
30	SS		(SC) 4 % gravel, 56 % sand, 40 % fines Clayey sand with gravel, light brown to 40 feet, gray from 40 to 50 feet, moist, some fines, trace gravel, Mine Overburden	13	20-10-13-13 (23)						
	SS			50	6-5-6-6 (11)	8				40	
40	SS			88	4-4-6-8 (10)						
	SS			63	4-6-7-12 (13)						
50	SS		(SP) Sand, light brown, dry, fine to medium grained	63	7-5-7-7 (12)						Bentonite Seal
	SS		(SC) Clayey sand, gray, moist, little fines	100	4-6-6-7 (12)						
60	SS		(SP) Sand, brown, wet, fine to medium grained	63	4-6-8-9 (14)						Sand Pack
	SS			88	5-5-7-7 (12)						
70	SS		(SP-SC) Sand with silty clay, brown, wet, fine to medium grained sand, little fines	100	7-8-8-9 (16)						
	SS		(CL) Clay with sand, gray, moist, little sand, cohesive	88	9-11-15-23 (26)						
			(OL) Peat, black, wet, Native Surface								
			Bottom of borehole at 77.0 feet.								

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BORING NUMBER SB12-16

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/18/12 **COMPLETED** 10/19/12
GROUND ELEVATION 1522 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
▽ **AT TIME OF DRILLING** 58.50 ft / Elev 1463.50 ft
LOGGED BY J. Holmes **CHECKED BY**
AT END OF DRILLING ---
NOTES 51 F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0			(CL) Clay with sand and gravel, red to brown, dry, little sand, little gravel, Mine Overburden								
	SS			50	3-4-4-5 (8)						
10	SS			100	4-5-6-6 (11)						
	SS		(SC-SM) Silty clayey sand, red to brown, moist, little fines, Mine Overburden	100	2-2-3-3 (5)						
20	SS			100	2-2-3-3 (5)						
	SS			100	2-3-4-4 (7)						
30	SS			100	4-4-4-4 (8)	19				24	
	SS		(SP-SC) Sand with clay, brown to gray, moist, fine to medium grained, Mine Overburden	75	4-4-5-5 (9)						
40	SS		(SC-SM) Silty clayey sand, gray, moist, some fines, Mine Overburden	88	5-5-5-6 (10)						
	SS			100	5-7-8-10 (15)	13				44	
50	SS		No recovery, rock	0	8-12-12 (24)						
	SS		(CL) Sandy lean clay with gravel, brown to gray, moist, fine to medium grained sand, some sand, little gravel ▽	88	8-10-10-10 (20)	15				53	
60	SS			75	4-5-6 (11)						
	SS		(SP) Sand, brown, wet, fine to medium grained, Native Ground Surface	75	7-8-8 (16)						
70	SS		(SC-SM) Silty clayey sand, grey, moist, some fines	50	11-12-13 (25)						
	SS			0	15-50	14				46	
			Refusal at 77.0 feet. Bottom of borehole at 77.0 feet.								

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BORING NUMBER SB12-17D

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 11/9/12 **COMPLETED** 11/9/12
GROUND ELEVATION 1475 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
▽ **AT TIME OF DRILLING** 15.00 ft / Elev 1460.00 ft Approximate
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 30s F; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1474.76 (ft)
	MC		(SC) 25 % gravel, 60 % sand, 15 % fines Silty clayey sand with gravel, brown, moist, coarse sand, little fines, some gravel, 6 inch grey clay lenses at 3 feet and 10 feet	75							
	MC			75							
10	MC			50		5				15	Grout
	MC		▽	25							
	MC		(OL) Peat, black, moist, Native Ground Surface	13							
20	MC		(SC-SM) Silty clayey sand with gravel, brown, wet, some fines, little gravel, 6 inch gray clay lense at 22 feet	50							Bentonite Seal
	MC			25							Sand Pack
30	MC		(SP-SC) Sand with silty clay and gravel, grey, wet, coarse grained sand, few fines, little gravel	13							
			Bottom of borehole at 32.0 feet.								

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BORING NUMBER SB12-18D

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 11/8/12 **COMPLETED** 11/9/12
GROUND ELEVATION 1531 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING 68.00 ft / Elev 1463.00 ft
LOGGED BY E. Johnson **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40s F; Overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1533.1 (ft)
	SS		(SC) Clayey Sand, brownish red, moist, Mine Overburden	50	6-6-6-6 (12)						
10	SS			50	5-7-6-6 (13)						
	SS			50	12-20-10-5 (30)						
20	SS			50	3-4-5-5 (9)						
	SS			13	6-9-8-6 (17)						
30	SS		(SC-SM) Silty clayey sand with gravel, brownish red, moist, some fines, little gravel, lenses of wet grey sand, Mine Overburden	13	9-6-5-5 (11)						
	SS			50	9-7-5-5 (12)	10				33	
40	SS			50	7-7-6-6 (13)						Grout
	SS			50	9-9-8-8 (17)						
50	SS			88	7-10-9-9 (19)	9				30	
	SS		(SC-SM) Silty clayey sand with gravel, brown, moist, some fines, little gravel, similiar to above but darker, Mine Overburden	63	7-10-11-15 (21)						
60	SS			88	5-10-10-10 (20)	9				31	
	SS			63	10-10-10-12 (20)						
	SS		(ML) Sandy Silt with gravel, blackish brown, moist, slight organic odor, possibly Native ground	75	7-7-7-9 (14)						
70	SS		(SC) Clayey sand with gravel, grey, wet, little fines, little gravel, cobbles encountered at 67.5 feet, no sample from 67.5-70	100	4-6-11-12 (17)						
	SS			75	32-45-50 (95)						
	SS		(SP-SC) Sand with silty clay and gravel, brown, wet, very dense, few fines, little gravel, difficult drilling, likely gravel and cobbles	75	11-18-22-22 (40)						
80	SS			88	18-28-28-30 (56)						Bentonite Seal
	SS			75	18-28-30-50 (58)						
	SS			50	35-70						Sand Pack
	SS			75	20-70-50 (120)						
90	SS			13	70						
	SS		Bottom of borehole at 91.0 feet.	50	40-80-80 (160)						

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BORING NUMBER SB12-19

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 11/7/12 **COMPLETED** 11/8/12
GROUND ELEVATION 1531 ft **HOLE SIZE** 4 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY E. Johnson **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40's F; overcast
48hrs AFTER DRILLING 70.12 ft / Elev 1460.88 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0			(CL) Sandy lean clay with gravel, moist, brown to red, some sand, little gravel, Mine Overburden							
	SS			88	9-9-9-10 (18)					
10	SS			88	8-5-6-7 (11)	21				52
	SS			13	4-4-5-6 (9)					
20	SS		(SC) Silty clayey sand with gravel, moist, brown to red, some fines, little gravel, Mine Overburden	100	4-5-5-6 (10)	16	38	14	24	43
	SS			63	5-5-5-6 (10)					
30	SS			75	5-4-5-5 (9)					
	SS		(SC) Clayey sand with gravel, moist, grey to brown, some fines, little gravel, Mine Overburden	100	4-4-5-6 (9)					
40	SS			100	4-5-5-6 (10)					
	SS			100	4-5-5-8 (10)	13	22	12	10	34
50	SS			88	5-5-5-6 (10)					
	SS			100	5-6-7-8 (13)					
60	SS			100	5-6-7-8 (13)					
	SS			100	4-5-7-7 (12)					
70	SS			100	5-6-7-8 (13)					
	SS		(SC) Clayey sand, grey, wet, little fines, few gravel	92	5-11-9-9 (20)					
	SS			13	3-3-5-7 (8)					
80	SS			100	4-7-8-11 (15)					
	SS			100	15-8-10-15 (18)					
	SS		(OL) Peat, black, wet, organic odor, Native Ground Surface	100	5-8-10-18 (18)					
	SS			100	6-12-20-28 (32)					
90	SS		(SP-SC) Sand with clay and gravel, gray, wet, few fines, little gravel	88	11-23-14-15 (37)					
	SS			100	10-40-46-46 (86)					
	SS		(SP) Sand with gravel, brown, wet, 3 feet of fine grained sand from 88 to 91 then 3 feet of coarse grained sand from 91 to 94, refusal on cobble/boulder	50	120					

Refusal at 94.0 feet.
Bottom of borehole at 94.0 feet.

WELL DIAGRAM
Casing Top Elev: 1533.47 (ft)
- Grout
- Bentonite Seal
- Sand Pack

EVANS - GINT US.GDT - 2/7/13 17:23 - P:\GINT\GINT SERVER 03\PROJECTS\6385E GENERAL WASTE.GPJ

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BORING NUMBER SB12-20

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/16/12 **COMPLETED** 10/16/12
GROUND ELEVATION 1491 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 50's F; sunny
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SP-SC) Sand with clay and gravel, moist, brown, few fines, little gravel	50							
	MC			50							
10	MC			0							
	MC			50							
	MC			25							
20	MC			25							
	MC			38							
	MC			25							
30			(CL) Lean clay with sand, soft to medium stiff, brown to grey, moist, little sand, trace gravel								
			Refusal at 32.0 feet. Bottom of borehole at 32.0 feet.								

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BORING NUMBER SB12-21D

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 11/13/12 **COMPLETED** 11/15/12
GROUND ELEVATION 1487 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 30's F; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											Casing Top Elev: 1489.4 (ft)
	MC		(SC-SM) Silty clayey sand, black to redish black, moist, fine grained sand, some fines, Mine Tailings	63							
	MC			63							
10	MC			50							- Grout
	MC		(SC-SM) Silty clayey sand, reddish black, wet, fine grained sand, some fines, Mine Tailings	50							
	MC			38							
20	MC			38							
	MC			50							- Bentonite Seal
	MC		(OL) Peat, black, wet, Native Soil contact								
30	MC		(SP) Sand, brown, wet, coarse grained, 2 inch peat lense at 32 feet	50							- Sand Pack
	MC			100							
40	MC		(CL) Lean clay, grey, moist, medium stiff	38							
			(SP) Sand, brown, wet, coarse grained								
			Bottom of borehole at 41.0 feet.								

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BORING NUMBER SB12-21S

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 11/13/12 **COMPLETED** 11/13/12
GROUND ELEVATION 1487 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 30s F; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0			(SM) Silty sand,black,moist, fine grained sand, Mine Tailings								Casing Top Elev: 1489.3 (ft)
10			(SM) Silty sand, reddish black, wet, fine grained sand, Mine Tailings								Grout; Bentonite Seal; Sand Pack
			Bottom of borehole at 15.0 feet.								

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BORING NUMBER SB12-23

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/18/12 **COMPLETED** 10/18/12
GROUND ELEVATION 1496 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 40s F; rainy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SC) Clayey sand with gravel, brown, moist, little fines, little gravel, Mine Overburden	50							
	MC			25							
10	MC			63							
	MC			50							
	MC			38							
20	MC			0							
			Refusal at 23.0 feet. Bottom of borehole at 23.0 feet.								

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BORING NUMBER SB12-24

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 10/17/12 **COMPLETED** 10/17/12
GROUND ELEVATION 1462 ft **HOLE SIZE** 2 inch
DRILLING CONTRACTOR NTS
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY R. Fossell **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 50s F; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0	MC		(SP-SC) Sand with silty clay and gravel, moderately stiff, brown, moist, few fines, little gravel, Mine Overburden	75							
	MC			75							
10	MC			75							
	MC			50							
	MC			75							
20	MC			50							
	MC			75							
	MC		Refusal at 29.0 feet. Bottom of borehole at 29.0 feet.	0							

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BORING NUMBER SB12-25

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 1/28/12 **COMPLETED** 2/7/12
GROUND ELEVATION 1523 ft **HOLE SIZE** 3 1/4 inch
DRILLING CONTRACTOR American Engineering
GROUND WATER LEVELS:
DRILLING METHOD 3 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY E. Johnson **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 20s F ; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											
10											
20											
30											
40	SS		(SM) Silty sand, medium stiff, light brown, some fines, trace gravel, medium grained sand, moist	100	3-6-5-5 (11)						
	SS			78	4-5-5 (10)						Pressure meter - failed
	SS				5-5 (10)						Pressure Meter 1
	SS		Bottom of borehole at 48.5 feet.								

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BORING NUMBER SB12-25A

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 1/29/12 **COMPLETED** 1/29/12
GROUND ELEVATION 1523 ft **HOLE SIZE** 3 1/4 inch
DRILLING CONTRACTOR American Engineering
GROUND WATER LEVELS:
DRILLING METHOD 3 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY E. Johnson **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 20s F ; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											
10											
20											
30	SS SS		(SM) Silty sand, brown, moist		5-5 (10)						Pressure Meter 2
			Bottom of borehole at 33.5 feet.								

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BORING NUMBER SB12-26

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME SW-620
PROJECT NUMBER 6385E
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 1/29/12 **COMPLETED** 1/29/12
GROUND ELEVATION 1494 ft **HOLE SIZE** 3 1/4 inch
DRILLING CONTRACTOR American Engineering
GROUND WATER LEVELS:
DRILLING METHOD 3 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY E. Johnson **CHECKED BY** J. Holmes
AT END OF DRILLING ---
NOTES 20s F ; overcast
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)	WELL DIAGRAM
0											
10	SS SS		(SC-SM) Silty clayey sand, brown, moist, some fines, little gravel		5-5 (10)						Pressure meter 3
20	SS SS		(SM) Silty sand, greyish brown, moist, some fines, trace gravel, fine to medium grained sand		7-7 (14)						Pressure meter 4
			Bottom of borehole at 21.5 feet.								

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BORING NUMBER MW-3R

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME General Waste
PROJECT NUMBER 6385C
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 7/9/15 **COMPLETED** 7/9/15
GROUND ELEVATION 1530.1 ft **HOLE SIZE** 8 inch
DRILLING CONTRACTOR STS
GROUND WATER LEVELS:
DRILLING METHOD 4 1 4" HSA
AT TIME OF DRILLING ---
LOGGED BY B.Frydenlund **CHECKED BY**
AT END OF DRILLING ---
NOTES 65 F; Coudy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					(GP-GC) Brown sandy gravel	Proctective Casing Cement Seal
10						
20						
30						Bentonite Grout
40						
50						
60					62.0 (1468.1) (GP-GC) Brown sandy gravel	Bentonite Seal 3/8" Chips
70						Filiter Pack Sand 2 in Slotted PVC
					75.0 (1455.1) Bottom of borehole at 75.0 feet.	Sand Pack Bottom

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BORING NUMBER MW-7

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME General Waste
PROJECT NUMBER 6385C
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 9/30/16 **COMPLETED** 9/30/16
GROUND ELEVATION 1493.67 ft **HOLE SIZE** 6
DRILLING CONTRACTOR Range Environmental
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY A. Smrekar **CHECKED BY** D. Schubbe
AT END OF DRILLING ---
NOTES Cloudy 50 deg F, wind SE 6 mph
AFTER DRILLING 17.50 ft / Elev 1476.17 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Top Elev: 1496.2 (ft)
					0.5 Topsoil, vegetation/organics	1493.2	Protective Casing Cement Seal
					2.0 (CL-ML) Brown to red silty clay with sand, damp, consolidated	1491.7	
					5.5 (SM) Red to brown, fine grained, silty sand, loose, saturated at 5 feet bgs	1488.2	Bentonite Slurry
					8.5 (CL-ML) Red to brown silty clay with some sand and gravel, consolidated, damp	1485.2	
10					12.0 (SM) Tan to brown silty sand with gravel, well graded, damp, tan clay lens approximately 2" thick at 9 feet bgs	1481.7	Bentonite Seal
					14.5 (CL-ML) Tan to brown silty clay with some silty sand, consolidated, damp	1479.2	
					(SC-SM) Tan to reddish brown clayey sand with some gravel, saturated		
20					25.0	1468.7	Filter Pack Sand PVC 0.1 Slot Screen

Bottom of borehole at 25.0 feet.

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BORING NUMBER MW-8

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME General Waste
PROJECT NUMBER 6385C
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 9/29/16 **COMPLETED** 9/29/16
GROUND ELEVATION 1488.66 ft **HOLE SIZE** 6
DRILLING CONTRACTOR Range Environmental
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY A. Smrekar **CHECKED BY** D. Schubbe
AT END OF DRILLING ---
NOTES Cloudy 55 deg F, wind ENE 3 mph
AFTER DRILLING 33.00 ft / Elev 1455.66 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0							Casing Top Elev: 1491.7 (ft)
					(CL-ML) Red to brown silty clay, consolidated damp	1486.7	Protective Casing Cement Seal
					2.0 (CL-ML) Red to brown silty clay with some sand and gravel, slightly consolidated, damp.		
					7.0	1481.7	
					7.5 (SW) Tan sand with gravel, well graded, loose, damp	1481.2	
10					(CL-ML) Red to brown silty clay with some sand and gravel, tan silty sand lenses approximately 2" thick throughout, damp		Bentonite Slurry
					19.0	1469.7	
20					20.0 (SW) Tan silty sand with some clay and gravel, loose, damp	1468.7	
					(CL-ML) Red to brown silty clay with some sand sand, tan silty sand lens approximately 2" thick at 21 feet bgs, loose, damp		
					23.5	1465.2	
					(SC-SM) Red to brown silty clayey sand with some gravel, red silty clay lens approximately 2" thick at 24 feet bgs		
					28.5	1460.2	Bentonite Seal
30					30.0 (CL-ML) Red to brown silty clay with some tan silty sand throughout, saturated at 30 feet bgs	1458.7	
					(SC-SM) Brown to gray silty clayey sand with some gravel, saturated		Filter Pack Sand PVC 0.1 Slot Screen
40					40.0	1448.7	
					Bottom of borehole at 40.0 feet.		

Northeast Technical Services, Inc.
526 Chestnut St.
Virginia, MN 55734
(218)-741-4290

BORING NUMBER MW-9

CLIENT General Waste Disposal & Recovery Services
PROJECT NAME General Waste
PROJECT NUMBER 6385C
PROJECT LOCATION Keewatin, Minnesota
DATE STARTED 9/30/16 **COMPLETED** 9/30/16
GROUND ELEVATION 1452.94 ft **HOLE SIZE** 6
DRILLING CONTRACTOR Range Environmental
GROUND WATER LEVELS:
DRILLING METHOD MC
AT TIME OF DRILLING ---
LOGGED BY A. Smrekar **CHECKED BY** D. Schubbe
AT END OF DRILLING ---
NOTES Cloudy 53 deg F, wind ESE 6 mph
AFTER DRILLING 10.50 ft / Elev 1442.44 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.5 Topsoil, organics/vegetation 1452.4 (SP) Tan to brown silty sand with little gravel, poorly graded, red to brown clay lens approximately 2" thick at 5.5 feet bgs, saturated at 9 feet bgs	Casing Top Elev: 1454.6 (ft) Protective Casing Cement Seal Bentonite Slurry Bentonite Seal Filter Pack Sand PVC 0.1 Slot Screen
10						
20					20.0 1432.9 Bottom of borehole at 20.0 feet.	

APPENDIX B

LABORATORY TESTING RESULTS

PASSING 200/ MOISTURE CONTENT

ASTM D 6913 AND D 2216

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e-mail: nts@netechnical.com

Project General Waste
Project # 6385E

Date Reported 11/30/2012
COC # 210788

Sample	COC #	Lab I.D.	% Moisture	% Fines
12-8 (70-72)	210788	M547512	13.7%	46.5%
12-3 (10-12)	210788	M547513	13.3%	34.5%
12-3 (35-37)	210788	M547514	8.8%	32.0%
12-7 (45-47)	210788	M547515	11.9%	36.2%
12-2 (4-8)	210788	M547516	8.4%	37.3%
12-11 (16-20)	210788	M547517	11.4%	46.5%
12-18 (60-62)	210788	M547520	8.5%	31.1%
12-18 (50-52)	210788	M547519	9.3%	30.4%
12-18 (35-37)	210788	M547518	9.7%	33.3%
12-16 (45-47)	210788	M547503	12.8%	44.3%
12-16 (55-57)	210788	M547504	15.0%	53.0%
12-16 (75-77)	210788	M547505	14.3%	45.8%
12-16 (30-32)	210788	M547506	18.9%	23.7%
12-19 (20-22)	210788	M547507	16.3%	43.3%
12-19 (10-12)	210788	M547508	20.5%	52.2%
12-19 (45-47)	210788	M547509	13.3%	33.5%
12-20 (28-32)	210788	M547510	14.6%	32.9%
12-17 (28-32)	210788	M547511	11.4%	30.0%

Comments:

GRAIN SIZE DISTRIBUTION REPORT

ASTM D 422

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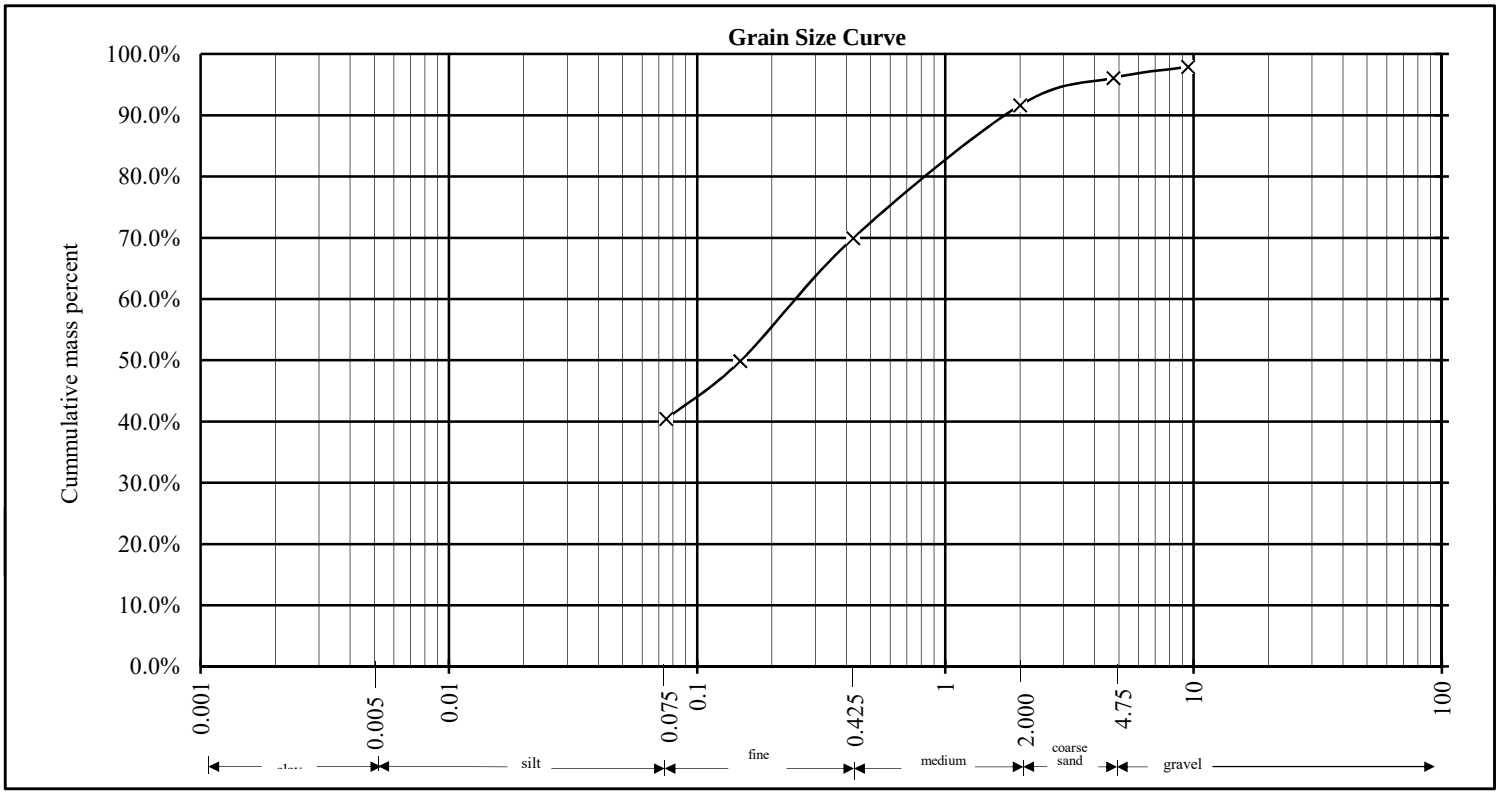
Project	General Waste	**Date Reported**	11/30/2012
Sample ID	SB 12-15 (35-37)	**Lab ID#**	M547498
Project #	6385E	**COC #**	210788
Date Collected	10/15/2012		



Size	Percentages	Specifications (% passing)	Percent Moisture	LL	PL	PI
			8.2%			
Silt/Clay	40.4%			**Specifications (LL and PI)**		
Fine Sand	29.5%					
Medium Sand	21.7%			**USCS Classification**		
Coarse Sand	4.5%					
Gravel	3.9%			(SC-SM) SILTY, CLAYEY SAND		

Coefficient of Uniformity (Cu)	N/A
Coefficient of Curvature (Cc)	N/A

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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Project #: 6385E **COC #:** 210788 **Lab ID #:** M547498

Project: General Waste

Architect/Engineer: -

Contractor: -

Sieve Size	Percent Passing	Required Specifications
3\8	98%	
#4	96%	
#10	92%	
#40	70%	
#100	49.9%	
#200	40.4%	

Tested in accordance with ASTM D 422

Sample ID: SB 12-15 (35-37)

Date Sampled: 10/15/2012

Date Received: 10/15/2012

Date Analyzed: 11/28/2012

Sample Location: SB 12-15 (35-37)

Intended Use:

Pit/Source:

Sampled By: J. Holmes

Lab Technician: EJ, JE

Reviewed By: JE

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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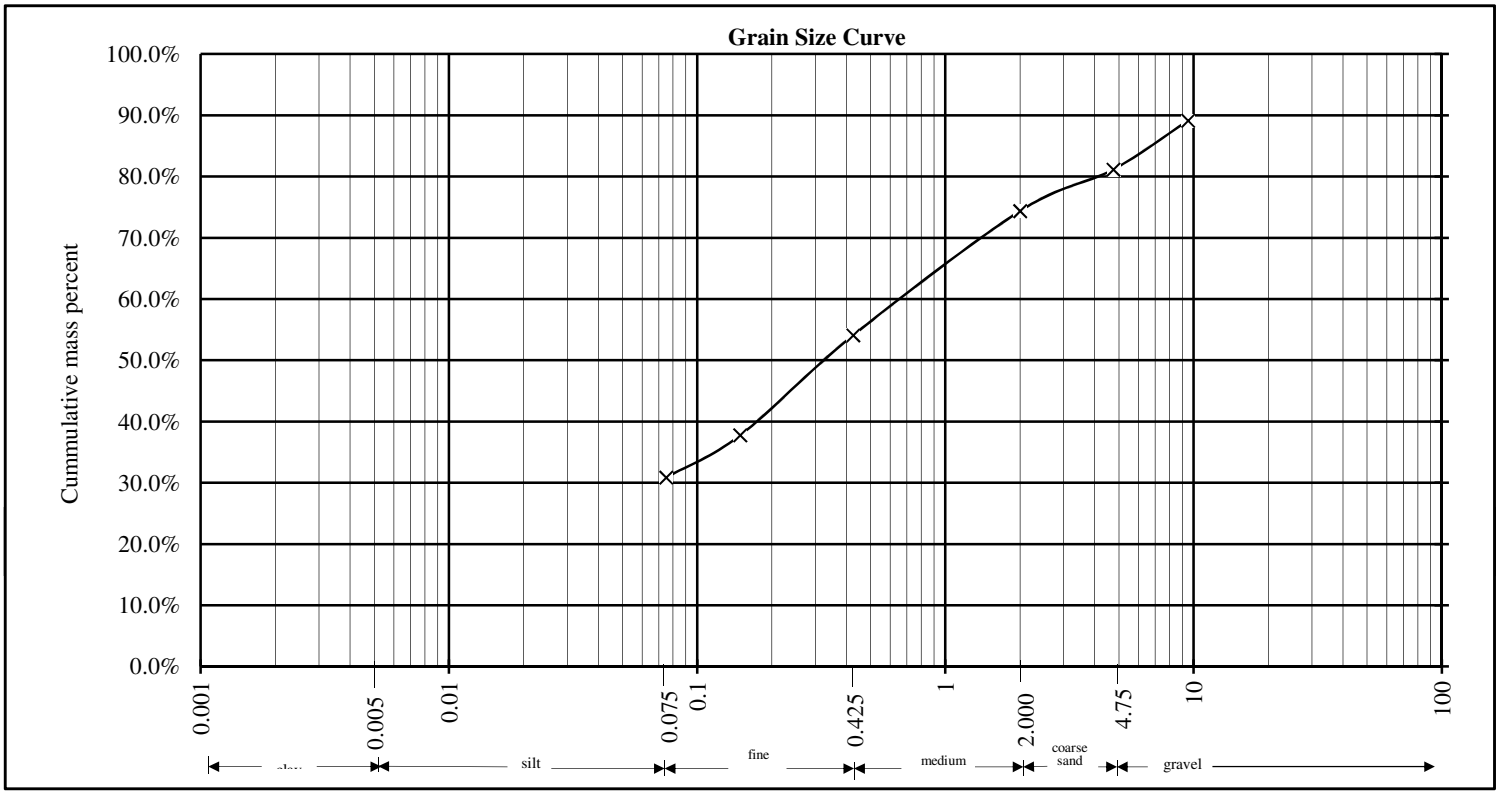
Project	General Waste	**Date Reported**	11/30/2012
Sample ID	SB 12-4 (45-47)	**Lab ID#**	M547499
Project #	6385E	**COC #**	210788
Date Collected	10/17/2012		



Size	Percentages	Specifications (% passing)	Percent Moisture	LL	PL	PI
			9.9%			
Silt/Clay	30.9%			**Specifications (LL and PI)**		
Fine Sand	23.2%					
Medium Sand	20.3%			**USCS Classification**		
Coarse Sand	6.8%			(SC-SM) SILTY, CLAYEY SAND WITH GRAVEL		
Gravel	18.9%					

Coefficient of Uniformity (Cu)	N/A
Coefficient of Curvature (Cc)	N/A

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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Project #: 6385E **COC #:** 210788 **Lab ID #:** M547499

Project: General Waste

Architect/Engineer: -

Contractor: -

Sieve Size	Percent Passing	Required Specifications
3\8	89%	
#4	81%	
#10	74%	
#40	54%	
#100	37.8%	
#200	30.9%	

Tested in accordance with ASTM D 422

Sample ID: SB 12-4 (45-47)

Date Sampled: 10/17/2012

Date Received: 10/17/2012

Date Analyzed: 11/28/2012

Sample Location: SB 12-4 (45-47)

Intended Use:

Pit/Source:

Sampled By: J. Holmes

Lab Technician: EJ, JE

Reviewed By: JE

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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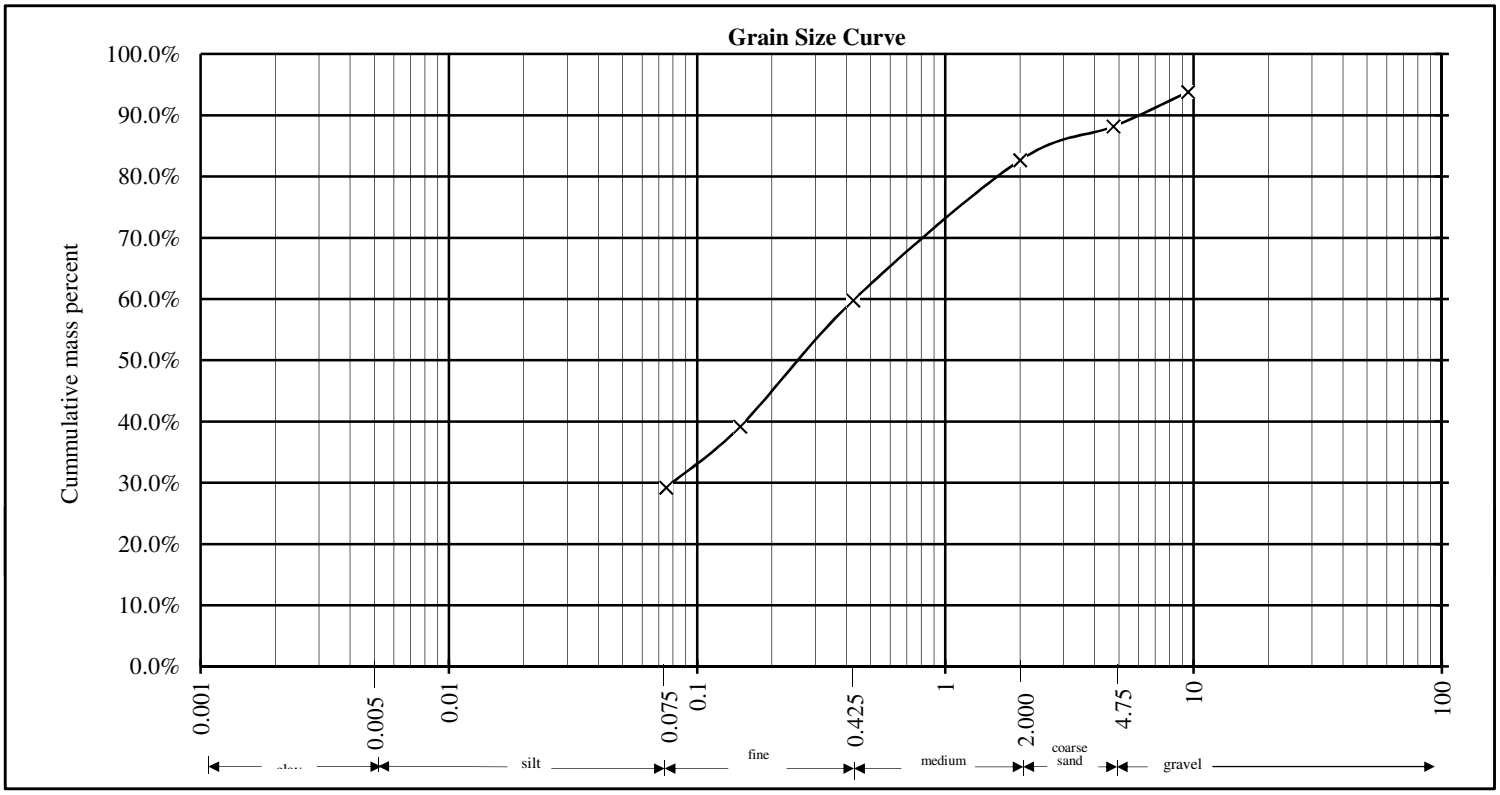
Project	General Waste	**Date Reported**	11/30/2012
Sample ID	SB 12-4 (55-57)	**Lab ID#**	M547500
Project #	6385E	**COC #**	210788
Date Collected	10/17/2012		



Size	Percentages	Specifications (% passing)	Percent Moisture	LL	PL	PI
			12.6%			
Silt/Clay	29.2%			**Specifications (LL and PI)**		
Fine Sand	30.6%					
Medium Sand	22.9%			**USCS Classification**		
Coarse Sand	5.5%					
Gravel	11.8%			(SC-SM) SILTY, CLAYEY SAND		

Coefficient of Uniformity (Cu)	N/A
Coefficient of Curvature (Cc)	N/A

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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Project #: 6385E **COC #:** 210788 **Lab ID #:** M547500

Project: General Waste

Architect/Engineer: -

Contractor: -

Sieve Size	Percent Passing	Required Specifications
3\8	94%	
#4	88%	
#10	83%	
#40	60%	
#100	39.2%	
#200	29.2%	

Tested in accordance with ASTM D 422

Sample ID: SB 12-4 (55-57)

Date Sampled: 10/17/2012

Date Received: 10/17/2012

Date Analyzed: 11/28/2012

Sample Location: SB 12-4 (55-57)

Intended Use:

Pit/Source:

Sampled By: J. Holmes

Lab Technician: EJ, JE

Reviewed By: JE

Comments:

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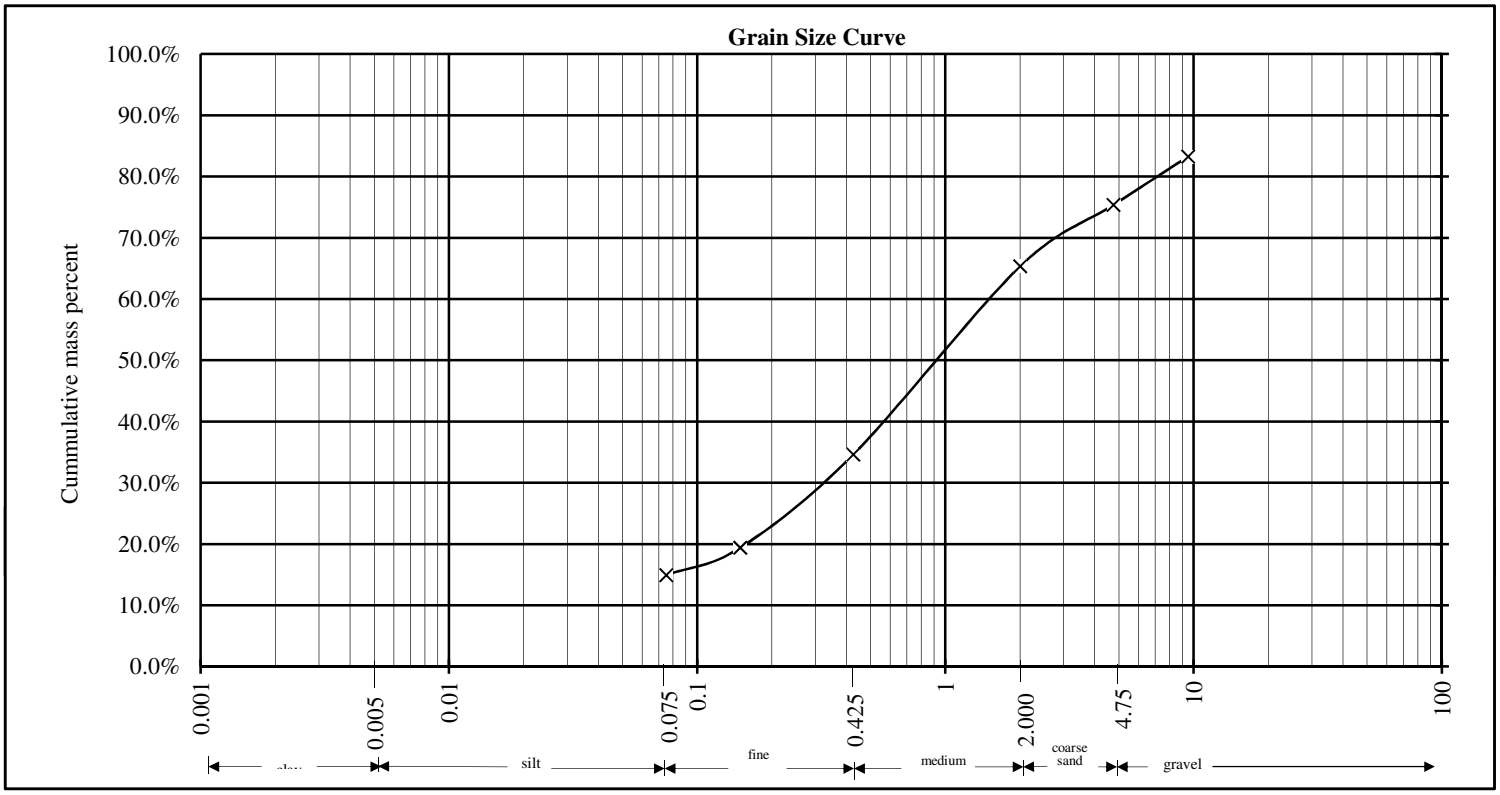
Project	General Waste	**Date Reported**	11/30/2012
Sample ID	SB 12-17 (8-12)	**Lab ID#**	M547501
Project #	6385E	**COC #**	210788
Date Collected	11/9/2012		



Size	Percentages	Specifications (% passing)	Percent Moisture	LL	PL	PI
			4.8%			
Silt/Clay	14.9%			**Specifications (LL and PI)**		
Fine Sand	19.7%					
Medium Sand	30.7%			**USCS Classification**		
Coarse Sand	10.0%			(SC-SM) SILTY, CLAYEY SAND WITH GRAVEL		
Gravel	24.6%					

Coefficient of Uniformity (Cu)	N/A
Coefficient of Curvature (Cc)	N/A

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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Project #: 6385E **COC #:** 210788 **Lab ID #:** M547501

Project: General Waste

Architect/Engineer: -

Contractor: -

Sieve Size	Percent Passing	Required Specifications
3\8	83%	
#4	75%	
#10	65%	
#40	35%	
#100	19.4%	
#200	14.9%	

Tested in accordance with ASTM D 422

Sample ID: SB 12-17 (8-12)

Date Sampled: 11/9/2012

Date Received: 11/9/2012

Date Analyzed: 11/28/2012

Sample Location: SB 12-17 (8-12)

Intended Use:

Pit/Source:

Sampled By: R. Fossel

Lab Technician: EJ, JE

Reviewed By: JE

Comments:

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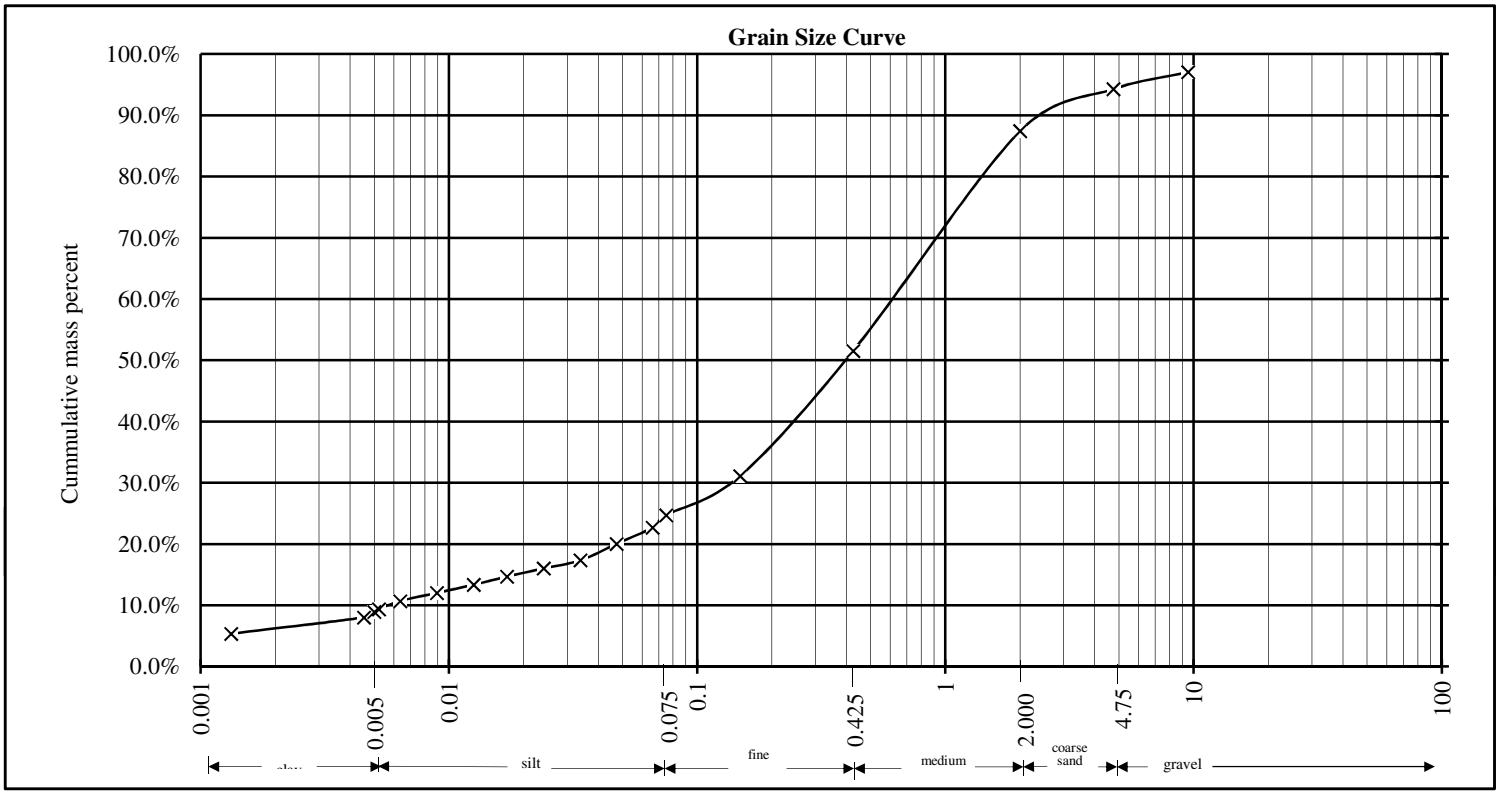
Project	General Waste	**Date Reported**	11/30/2012
Sample ID	SB 12-12 (45-47)	**Lab ID#**	M547502
Project #	6385E	**COC #**	210788
Date Collected	10/16/2012		



Size	Percentages	Specifications (% passing)	Percent Moisture	LL	PL	PI
Clay	8.9%		9.9%			
Silt	15.8%			**Specifications (LL and PI)**		
Fine Sand	26.8%					
Medium Sand	35.9%			**USCS Classification**		
Coarse Sand	6.8%					
Gravel	5.7%			(SC-SM) SILTY, CLAYEY SAND		

Coefficient of Uniformity (Cu)	106.45
Coefficient of Curvature (Cc)	4.97

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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Project #: 6385E **COC #:** 210788 **Lab ID #:** M547502

Project: General Waste

Architect/Engineer: -

Contractor: -

Sieve Size	Percent Passing	Required Specifications
3\8	97%	
#4	94%	
#10	87%	
#40	52%	
#100	31%	
#200	24.7%	
Clay (<.005mm)	8.9%	

Tested in accordance with ASTM D 422

Sample ID: SB 12-12 (45-47)

Date Sampled: 10/16/2012

Date Received: 10/16/2012

Date Analyzed: 11/28/2012

Sample Location: SB 12-12 (45-47)

Intended Use:

Pit/Source:

Sampled By: J. Holmes

Lab Technician: EJ, JE

Reviewed By: JE

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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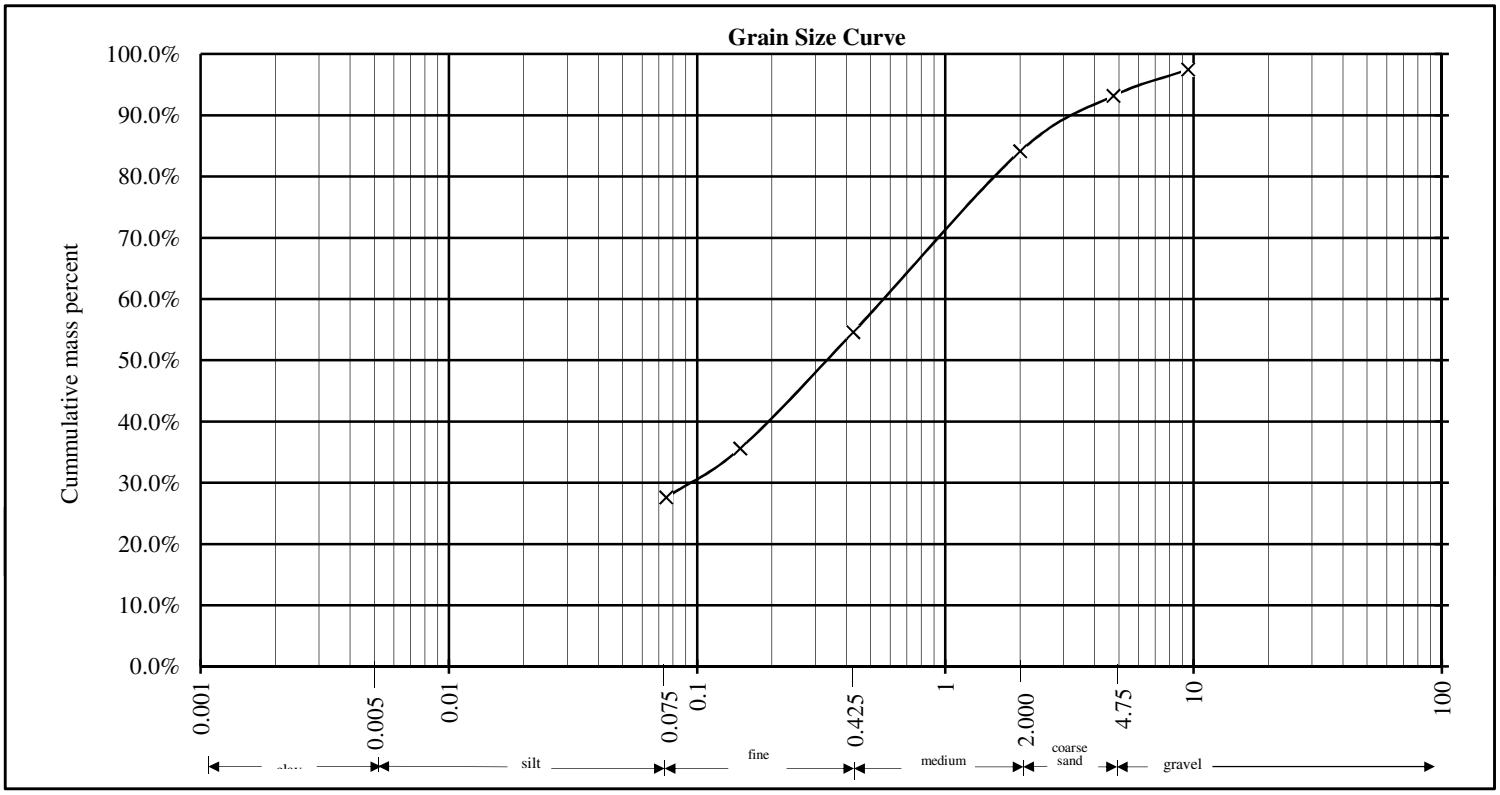
Project	General Waste	**Date Reported**	11/30/2012
Sample ID	SB 12-13 (50-52)	**Lab ID#**	M547503
Project #	6385E	**COC #**	210788
Date Collected	10/18/2012		



Size	Percentages	Specifications (% passing)	Percent Moisture	LL	PL	PI
			10.5%			
Silt/Clay	27.6%			**Specifications (LL and PI)**		
Fine Sand	27.0%					
Medium Sand	29.5%			**USCS Classification**		
Coarse Sand	9.1%					
Gravel	6.8%			(SC-SM) SILTY, CLAYEY SAND		

Coefficient of Uniformity (Cu)	N/A
Coefficient of Curvature (Cc)	N/A

Comments:

GRAIN SIZE DISTRIBUTION REPORT

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Project #: 6385E **COC #:** 210788 **Lab ID #:** M547503

Project: General Waste

Architect/Engineer: -

Contractor: -

Sieve Size	Percent Passing	Required Specifications
3\8	97%	
#4	93%	
#10	84%	
#40	55%	
#100	35.6%	
#200	27.6%	

Tested in accordance with ASTM D 422

Sample ID: SB 12-13 (50-52)

Date Sampled: 10/18/2012

Date Received: 10/18/2012

Date Analyzed: 11/28/2012

Sample Location: SB 12-13 (50-52)

Intended Use:

Pit/Source:

Sampled By: J. Holmes

Lab Technician: EJ, JE

Reviewed By: JE

Comments:

Atterberg Limits Report

ASTM D-4318

NORTHEAST TECHNICAL SERVICES, INC.
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P.O. BOX 1142
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e-mail: nts@netechnical.com

Project #: 6385E **COC #:** 210788 **Lab ID #:** M547507

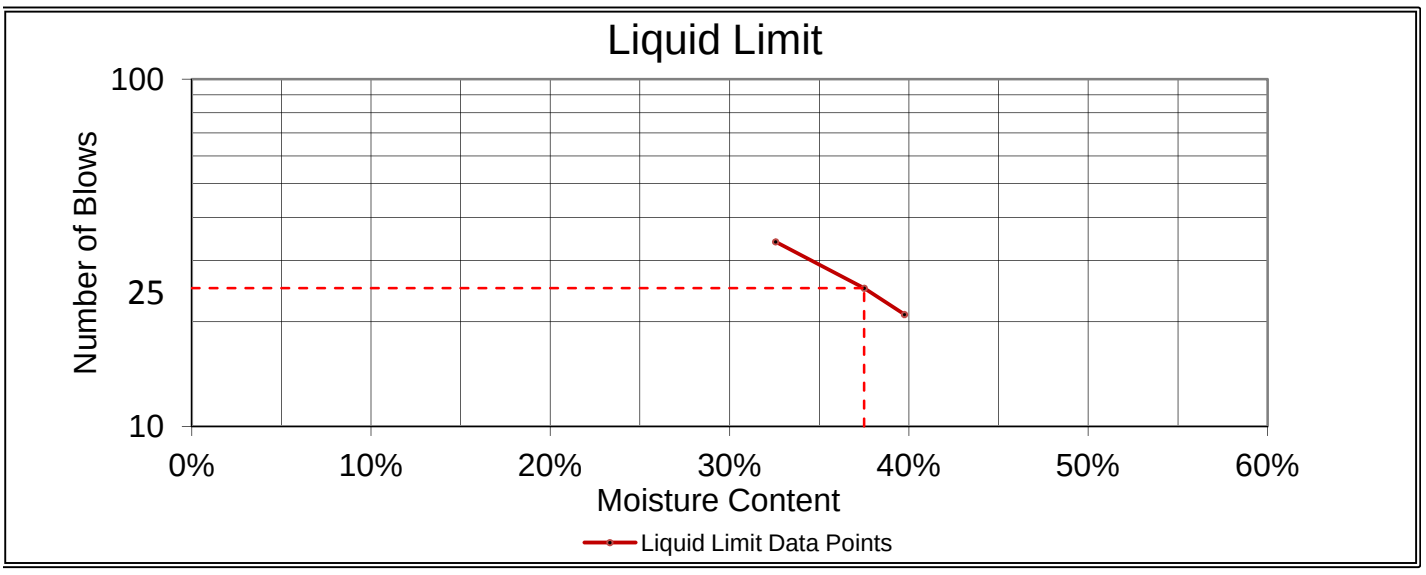
Project: General Waste

Architect/Engineer: -

Contractor: -

Sample ID: GP 12-19 (20-22ft)

Test Results:				Specifications:			
Liquid Limit:	38%	Plasticity Index:	24%	Liquid Limit:		Plasticity Index:	
Plastic Limit:	14%	% Moisture:	16.3%	Plastic Limit		% Moisture:	
Passing #200	43%			Passing #200			
Passing #4				Passing #4			



Summary of Methods:

Preperation: Wet Preperation Method
Liquid Limit: Method A
Plastic Limit: Hand Rolled Method

Comments:

Atterberg Limits Report

ASTM D-4318

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e-mail: nts@netechnical.com

Project #: 6385E **COC #:** 210788 **Lab ID #:** M547509

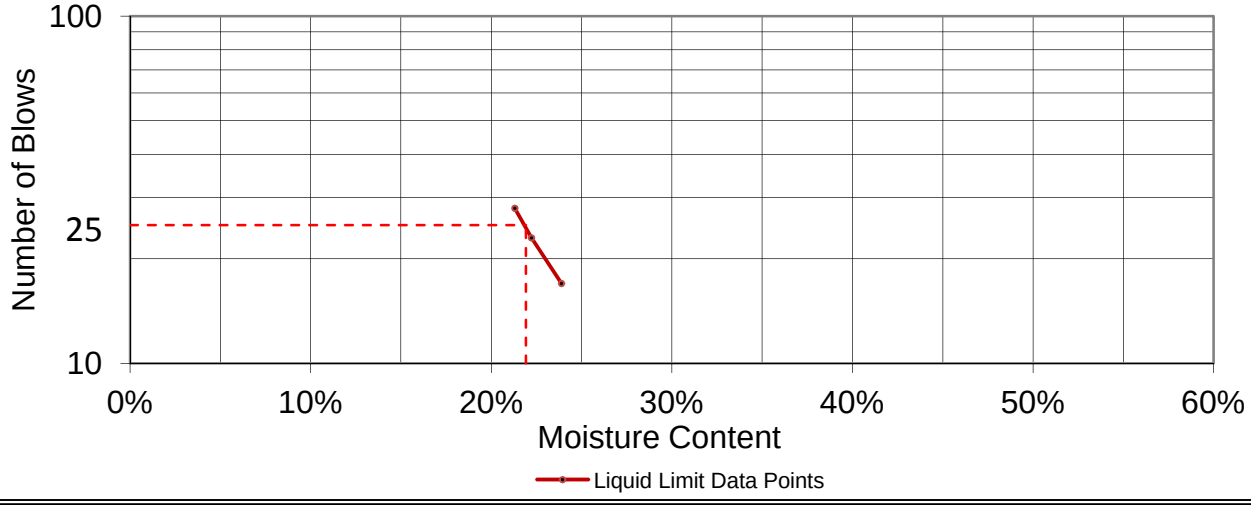
Project: General Waste

Architect/Engineer: -

Contractor: -

Sample ID: GP 12-19 (45-47ft)

Test Results:				Specifications:			
Liquid Limit:	22%	Plasticity Index:	10%	Liquid Limit:		Plasticity Index:	
Plastic Limit:	12%	% Moisture:	13.3%	Plastic Limit		% Moisture:	
Passing #200	34%			Passing #200			
Passing #4				Passing #4			



Summary of Methods:

Preperation: Wet Preperation Method
Liquid Limit: Method A
Plastic Limit: Hand Rolled Method

Comments: