MTO Agreement No. 5011-E-0010
WO No. 2011-11039
Proposed Sand/Salt Storage Facility
Whitney Patrol Yard
Foundation Investigation Report

Geocres No. 31E-320

November 2012

Prepared for:
Ontario Ministry of Transportation
Northeastern Region
447 McKeown Avenue
North Bay, Ontario
CANADA P1B 9S9

Prepared by:
GENIVAR Inc.
294 Rink Street, Suite 103
Peterborough, Ontario K9J 2K2

Project No. 121-17876-00

GENIVAR

Project No. 121-17876-00

November 13, 2012

Mr. Jean-Pierre Perron, P. Eng.
MTO Project Manager
Ontario Ministry of Transportation
Northeastern Region
447 McKeown Avenue
North Bay, Ontario P1B 9S9

Re: MTO Agreement No. 5011-E-0010 / WO No.: 2011-11039
Proposed Sand/Salt Storage Facility – Whitney Patrol Yard
Foundation Investigation Report (Geocres No. 31E-320)

Dear Mr. Perron:

We are pleased to submit our Foundation Investigation Report for the proposed Sand/Salt Storage Facility at the Ontario Ministry of Transportation Northeastern Region (MTO) Whitney Patrol Yard in Whitney, Ontario. A borehole and laboratory testing program was conducted to assess soil and groundwater conditions at the site and provide recommendations for foundation design for the proposed structure.

This report presents the investigation methodology and findings, and was completed in accordance with the Terms of Reference provided in MTO Agreement #5011-E-0010.

We trust that this report meets your current requirements. Please contact us if you have any questions.

Yours truly,
GENIVAR Inc.

J. Stephen Ash, P. Eng., P. Geo.
Director, Environment

294 Rink Street, Suite 103, Peterborough, Ontario K9J 2K2
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Table of Contents

Drawings

Tables

Appendices

1. Introduction

GENIVAR Inc. (GENIVAR) was retained by the Ontario Ministry of Transportation Northeastern Region (MTO) to undertake a foundation investigation for the proposed construction of a sand/salt storage facility at the Whitney Patrol Yard, located on Highway 60, eight kilometers west/north of the Highway 60 / Highway 127 intersection in the Township of Airy, north of the Town of Whitney, Ontario. The purpose of the investigation was to assess subsurface conditions at the site and provide recommendations for foundation design at the designated structure location.

The foundation investigation was conducted in accordance with MTO Agreement #5011-E-0010. This Foundation Investigation Report (FIR) is a factual report containing the results of the foundation investigation carried out at the Whitney site, including the field and laboratory testing information. Subsurface conditions encountered at the site are described in detail in this report.

2. Site Description and Regional Geology

2.1 Site Description

The Whitney Patrol Yard (site) is located on Highway 60 approximately 5.5 kilometres west of the Town of Whitney, Ontario. A Site Plan is included as Drawing 1 and colour photographs of the site are included in Appendix C.

The site is fairly level with a slight slope to the northeast and a natural ridge to the east and south. There is a drainage ditch located on the west side of the site, along Highway 60. Access to the site is from Highway 60 and the surrounding land is predominantly treed.

The site is an operational MTO Patrol Yard, and is currently occupied by a number of structures, including:

- 1 salt shed
- 1 storage shed
- 1 circular sand dome
- a 6-bay garage with office
- 1-4,000 L diesel fuel storage tank
- 1-8,000 L diesel fuel storage tank
- 3 tall cylindrical white tanks
- 1 onsite well

The perimeter of the site is generally grassed. The driving / parking area between the existing buildings and Highway 60 is paved while the area around the buildings is generally unpaved (gravel surface).

2.2 Regional Geology

Two different sources were consulted to determine the regional geology in the Whitney area: i) Map 2544 – Bedrock Geology of Ontario, Southern Sheet, published by the Ministry of Northern Development and Mines, and ii) Physiography of Southern Ontario, published by Ministry of Natural Resources, May 2011.

Based on the mapping information, the site is located in the Algonquin Highlands physiographic region, within a glacial spillway of predominantly sand and silt deposits. The soil profile is underlain by Precambrian bedrock formations that are part of the Central Gneiss Belt. Bedrock was not encountered in the current site investigation, so actual bedrock types below the site and the proposed structure are not known.

3. Historic Report Review

A previous report for Highway 60, approximately 1.5 kilometres south of the Whitney Patrol Yard site was obtained from the MTO Geocres Library in Downsview, Ontario. The report, titled '*Foundation Investigation Report for Highway 60 over a Swamp Area* and dated July 1966, included a geotechnical investigation to address the performance of fill material placed over a swampy section of Highway 60. (Geocres 31E-31)

Based on the report information, the terrain in the area consists of hills and valleys formed by undulating Precambrian bedrock, with the valleys being partially filled with sand and silt soils. In this specific section of Highway 60, the highway crosses a 120 m wide valley containing organic peat deposits overlying sands and silts. The geotechnical investigation consisted of sampling 12 boreholes supplemented by 6 dynamic cone penetration tests (DCPT's). Loose to compact sandy silt soils were encountered 4.6 m to 6.1 m below existing ground surface, beneath the organic peat layer. The maximum depth of penetration into the sandy silt layer was 10.4 m (15 m below ground surface) where augering was terminated on either bedrock or boulders.

4. Investigation Procedures

4.1 Subsurface Investigation

A borehole investigation was performed at the Whitney Patrol Yard (site) on September 5 and September 6, 2012. The investigation consisted of advancing five (5) exploratory boreholes, designated as BH12-1 through BH12-5, commencing from the existing ground level. Borehole locations are shown on Drawing 1 and were laid out as required by the Terms of Reference for the assignment. A borehole was located at each of the four corners of the proposed storage structure, and a fifth borehole was located as close to the centre of the proposed structure as possible, given the utility and space constraints.

MTO minimum requirements for the borehole investigation outlined a maximum drilling depth of 10.0 m, unless refusal was encountered at shallower depth, or justification for deeper drilling was authorized by the MTO Project Manager. Augering was terminated in very dense glacial till material at depths ranging between 3.5 metres below ground surface (mbgs) at borehole BH12-5 and 9.6 mbgs at borehole 12-3. Below the final depth of augering, Dynamic Cone Penetration Tests (DCPT's) were driven to practical refusal in each borehole, which occurred at depths ranging from 4.9 mbgs at BH12-5 and 11.0 mbgs at BH12-3.

The longitude and latitude of the individual borehole locations were obtained using a hand-held GPS unit in the WGS 84 reference system. These coordinates were subsequently converted to MTO standard coordinates (Northing and Easting). Borehole elevations were surveyed to a known benchmark: the Iron Bar (IB) in the footing of the existing sand/salt dome was used and has a reported geodetic elevation of 400.672 metres above sea level (mASL). Borehole elevations and coordinates are shown on Drawing 1, and are provided on the borehole logs included in Appendix A.

Drilling and soil sampling were completed using a truck-mounted drill rig operating under the supervision of an experienced GENIVAR soils technician. The boreholes were advanced to the sampling depths by means of continuous flight hollow stem augers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm (ASTM D1586 procedure). Refusal depth for the purposes of this investigation was generally defined in the MTO Terms of Reference as the depth at which SPT N values exceed 100 blows for 305 mm of penetration. Based on discussions with MTO Managers, some latitude in this refusal standard was given where consistently dense soil was penetrated, to prevent excessive machine damage. SPT N values are used in this report to assess consistency for cohesive soils and relative density for non-cohesive materials.

Soil samples were collected using SPT procedures at approximately 0.75 m intervals to 5.0 m depth, and at 1.5 m intervals thereafter to the termination depth. The sampled soil materials from discrete units were logged in the field using visual and tactile methods, and were then placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage. Soils for laboratory moisture content testing were placed in sealed laboratory jars for transport.

DCPT's were completed below 5.0 m depth in boreholes BH12-1 and BH12-2, and below 9.6 m, 9.2 m, and 3.5 m depth in boreholes BH12-3, BH12-4 and BH12-5, respectively. In the DCPT, a 51 mm diameter, 60° Apex cone point, screw-attached to the tip of A-size rods, is driven into the ground using the same driving energy as in the SPT method. By recording the number of blows to drive the cone/rod assembly into the soil every 305 mm, a qualitative record of relative density/consistency is obtained. Although the interpretation of the test results may be difficult because no soil samples are obtained through this method, and the penetration resistances are not necessarily equivalent to N values or undrained shear strengths, useful information is gained by the continuity of the results and by the elimination of unbalanced hydrostatic effects which may affect SPT N values.

Groundwater conditions within the boreholes were observed during drilling, prior to backfilling. Boreholes were backfilled with drill cuttings mixed with bentonite hole plug, and the top portion of the boreholes was sealed with emulsified asphalt. The backfill material was compacted with the drill rig. As such, the boreholes are abandoned in accordance with O. Reg. 903 requirements, as amended. Table 4.1 below summarizes the borehole numbers, final drilling depths, and the surveyed elevations.

Table 4-1: Borehole Numbers, Drilling Depths and Elevations

Borehole No.	Drilling Depth Below Existing Ground Surface (m) / Elevation (m)	Dynamic Cone Penetration Test Depth (m)
BH12-1	5.0 / 395.1	5.0 m to 7.6 m
BH12-2	5.0 / 395.0	5.0 m to 8.8 m
BH12-3	9.6 / 390.2	9.6 m to 11.0 m
BH12-4	9.2 / 390.8	9.2 m to 10.1 m
BH12-5	3.5 / 396.8	3.5 m to 4.9 m

4.2 Laboratory Testing

The following soil testing program, as summarized in Table 4.2, was completed on selected soil samples to confirm the textural classifications and provide geotechnical parameters for the encountered materials.

Table 4-2: Soil Testing Program – Whitney Patrol Yard

Test	ASTM Standard	Number of Samples
Natural Moisture Content	ASTM D2216	33
Particle Size Analysis	ASTM D422	10

The minimum number of laboratory tests was set at 25 percent of the samples, according to the MTO Terms of Reference. Low complexity soil tests were completed at GENIVAR's RAQ's certified laboratory in Peterborough. Laboratory testing results are presented on the borehole logs and in Appendix B.

5. Subsurface Conditions

The subsurface conditions were explored at the five (5) borehole locations designated as BH12-1 to BH12-5. Borehole locations are shown in Drawing 1 while the soil strata are indicated in two cross sections presented on Drawing 2. Detailed borehole logs are provided in Appendix A, and laboratory test results with the summary tables are included in Appendix B.

5.1 Soil Profile Summary

The boreholes encountered either a thin layer of asphalt overlying compact granular fill, or granular fill commencing at the surface (no asphalt). A compact silty sand to silt and sand layer was encountered beneath the fill, overlying dense to very dense sand glacial till material, extending to the borehole termination depths of 3.5 m to 9.6 m below ground surface. DCPT's advanced to depths ranging from 4.9 m in borehole BH12-5 to 11.0 m in borehole BH12-3 indicate the same very dense deposit (presumed till). Descriptions of the individual soil units are provided in the following subsections.

5.1.1 Asphalt Pavement

A 50 mm thick layer of asphaltic concrete (hot laid mix) was encountered at surface in boreholes BH12-1, BH12-3 and BH12-4.

5.1.2 Granular Fill

Granular fill was encountered at each of the five borehole locations, beneath the asphalt at boreholes BH12-1, BH12-3, and BH12-4 and commencing at surface at boreholes BH12-2 and BH12-5. The thickness of the granular fill varied from 0.8 m at boreholes BH12-1 and BH12-2 to 2.9 m at borehole BH12-4. In general the granular fill layer consisted of 0.15 m to 0.2 m of gravelly sand, underlain by sand with some gravel to sand with some silt and a trace of gravel, extending to the depths (metres below ground surface; mbgs) and elevations (geodetic) shown below:

Borehole No.	Depth to Bottom of Fill Layer (Elevation)
BH12-1	0.8 mbgs (399.4 mASL)
BH12-2	0.8 mbgs (399.3 mASL)
BH12-3	2.7 mbgs (397.2 mASL)
BH12-4	2.9 mbgs (397.1 mASL)
BH12-5	1.4 mbgs (398.9 mASL)

Laboratory particle size distribution analyses for three (3) samples from the fill layer were completed, and results according to the Unified Soil Classification System (USCS) are summarized below and shown on Figure B1 of Appendix B:

- Gravel (greater than 4.75 mm size) - 1 % to 29 %
- Sand (0.075 mm to 4.75 mm size) - 60 % to 96 %
- Silt and Clay (less than 0.075 mm size) - 3 % to 11 %

Standard Penetration Test results (N values) recorded in the fill layer ranged between 5 and 86 blows per 305 mm of penetration, indicating loose to very dense relative density (generally compact). It should be noted that the higher N-values are likely due to the presence of gravel particles greater than 4.75 mm in size.

Laboratory determined moisture contents ranged between 3 % and 10 % for samples of the fill, indicating generally moist material.

5.1.3 Silty Sand

Beneath the granular fill layer, a layer of silty sand with a trace of clay was encountered in boreholes BH12-1, BH12-2 and BH12-4, extending to depths (metres below ground surface; mbgs) and elevations (geodetic) shown below:

Borehole No.	Depth to Bottom of Silty Sand (Elevation)
BH12-1	2.1 mbgs (398.0 mASL)
BH12-2	3.7 mbgs (396.4 mASL)
BH12-4	4.4 mbgs (395.6 mASL)

The thickness of the silty sand layer varied from 1.3 m at borehole BH12-1 to 2.9 m at borehole BH12-2.

A laboratory particle size distribution analysis for one (1) sample of the silty sand was completed, and results according to USCS are summarized below and shown on Figure B2 of Appendix B:

- Gravel (greater than 4.75 mm size) - 1%
- Sand (0.075 mm to 4.75 mm size) - 62 %
- Silt (0.002 mm to 0.075 mm size) - 33 %
- Clay (less than 0.002 mm size) - 4 %

Standard Penetration Test results (N values) recorded in the silty sand layer ranged from 4 to 48 blows per 305 mm of penetration, indicating loose to very dense relative density (generally compact).

The natural moisture content of samples recovered from this layer ranged from 5 % to 26 % based on laboratory testing, indicating moist conditions at boreholes BH12-1 and BH12-4, and wet conditions at borehole BH12-2.

5.1.4 Silt

A layer of silt with a trace of sand and clay was encountered beneath the fill layer at a depth of 2.7 mbgs at borehole BH12-3. The silt layer is 1.3 m thick and extends to a depth of 5.6 mbgs (elevation 394.3 mASL).

A laboratory particle size distribution analysis for one (1) sample of the silt unit was completed, and results according to USCS are summarized below and shown on Figure B3 of Appendix B:

- Gravel (greater than 4.75 mm size) - 0 %
- Sand (0.075 mm to 4.75 mm size) - 6 %
- Silt (0.002 mm to 0.075 mm size) - 90 %
- Clay (less than 0.002 mm size) - 4 %

Standard Penetration Test results (N values) recorded for the silt layer ranged from 18 to 21 blows per 305 mm of penetration, indicating compact relative density.

Laboratory determined moisture content ranged between 23 % and 25 % for the silt samples, indicating moist to wet material.

5.1.5 Sand and Silt

A sand and silt layer was encountered beneath the silt layer at borehole BH12-3, extending to a depth of 7.1 mbgs (elevation 392.8 mASL).

A laboratory particle size distribution analysis for one (1) sample of the sand and silt unit was completed, and results according to USCS are summarized below and shown on Figure B4 of Appendix B:

- Gravel (greater than 4.75 mm size) - 2 %
- Sand (0.075 mm to 4.75 mm size) - 54 %
- Silt (0.002 mm to 0.075 mm size) - 42 %
- Clay (less than 0.002 mm size) - 2 %

A Standard Penetration Test result (N value) of 17 blows per 305 mm of penetration was recorded in the sand and silt layer, indicating compact relative density.

Laboratory determined moisture content of 24 % indicates wet conditions.

5.1.6 Till

Underlying the silty sand layer in boreholes BH12-1, BH12-2, and BH12-4, the sand and silt layer in BH12-3, and the surficial fill layer in BH12-5, a glacial till material was encountered extending to borehole termination depths (mbgs) and elevations (geodetic) shown below:

Borehole No.	Depth to Bottom of Till Layer (Elevation)
BH12-1	5.0 mbgs (395.1 mASL)
BH12-2	5.0 mbgs (395.0 mASL)
BH12-3	9.6 mbgs (390.2 mASL)
BH12-4	9.2 mbgs (390.8 mASL)
BH12-5	3.5 mbgs (396.8 mASL)

The texture of the till layer was predominantly fine sand with some gravel and some silt, to gravelly sand with some silt and a trace of clay.

Laboratory particle size distribution analyses for four (4) samples from the till deposit were completed, and results according to USCS are summarized below and shown in Figure B5 of Appendix B:

- Gravel (greater than 4.75 mm size) - 13 % to 28 %
- Sand (0.075 mm to 4.75 mm size) - 44 % to 67 %
- Silt (0.002 mm to 0.075 mm size) - 17 % to 25 %
- Clay (less than 0.002 mm size) - 2 % to 3 %

Standard Penetration Test results (N Values) recorded in the till deposit ranged between 35 and 76 blows per 305 mm of penetration, indicating dense to very dense relative density. It should be noted that frequent cobbles and boulders are presumed to be present within this layer, based on observations during augering and SPT sampling.

5.1.7 Dynamic Cone Penetration Testing

Dynamic cone penetration testing (DCPT) was performed below the borehole termination depths shown above, due to auger refusal and/or related difficulties advancing the equipment through the very dense till deposit. The DCPT's were terminated at depths between 4.9 mbgs at borehole BH12-5 and 11.0 mbgs at borehole BH12-3. The DCPT results indicate that very dense (presumed till) deposits extend to below the sampled zones (elevations ranging from 395.4 mASL at BH12-5 to 388.8 mASL at BH12-3).

5.2 Groundwater Conditions

Groundwater conditions were observed in the open boreholes upon completion of drilling. Results are summarized in Table 5.1.

Table 5-1: Summary of Groundwater Levels

Location	Measured Groundwater Depth mbgs (elevation mASL)	Date Measured	Soil Moisture
BH12-1	dry	5 September 2012	Moist throughout
BH12-2	dry	5 September 2012	Wet at 2.5 mbgs (397.5 mASL)
BH12-3	6.4 (393.4)	6 September 2012 (5 hours after completion)	Wet from 3.0 to 5.0 mbgs (397 to 395 mASL)
BH12-4	6.4 (393.6)	6 September 2012	Moist throughout
BH12-5	dry	6 September 2012	Moist throughout

Note: mbgs = metres below ground surface

Groundwater in the open boreholes was measured to be more than 6 m below the surface at the time of the investigation. However, soil sample inspections indicate that shallower, possibly perched zones of groundwater may exist in the fill material at 2 m to 3 m below grade. Groundwater levels will probably fluctuate seasonally at the site, in response to climate conditions and/or heavy infiltration events.

6. Miscellaneous Information

The following GENIVAR personnel and subcontractors responsible for completion of this foundation investigation are summarized in Table 6.1.

Table 6-1: Summary of Task Responsibilities and Personnel

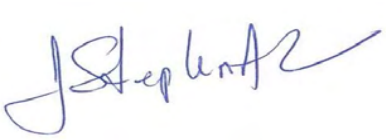
Task	Name	Address	Phone
Buried Utility Locates	Peter Flowerday Central Cable Contractors	Wanapitae, ON	705-694-5256
Drilling	Kyle Gilmore Abraflex Drilling	Lively, ON	705-222-2272
Field Supervision	Dave Lembke, C.E.T., rcji GENIVAR Inc.	Peterborough, ON	705-743-6850
Project Coordinator	Jennifer Wales, P. Eng. and Beverly Leno, C.E.T., rcji GENIVAR Inc.	Peterborough, ON	705-743-6850
Laboratory Low Complexity	Kelly Whitney, C.E.T. GENIVAR Inc.	Peterborough, ON	705-743-6850
Report Preparation	Raid Khamis, P. Eng. GENIVAR Inc.	Brampton, ON	905-799-8220
Report Review	Steve Ash, P. Eng., P. Geo. GENIVAR Inc.	Peterborough, ON	705-743-6850
RAQ's Key Contact	Jason Balsdon, M.A.Sc., P. Eng. GENIVAR Inc.	Newmarket, ON	905-853-3303

7. Closure

The data presented in this foundation investigation report, and the quality thereof, is based on a scope of work authorized by the Client. While we believe the borehole information to be representative of site conditions, subsurface conditions between and beyond the test hole locations may vary. GENIVAR accepts no liability for use of or reliance on the report information by third parties, without express written consent.

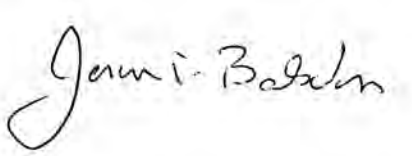
Prepared by:
GENIVAR Inc.

Raid Khamis, P. Eng.
Project Engineer



J. Stephen Ash, P. Eng., P. Geo.
Director, Environment

Reviewed by:



Jason Balsdon, M.A.Sc., P. Eng.
Director, Environment

Drawings

Drawing 1 – Borehole Location Plan

Drawing 2 – Soil Strata

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES

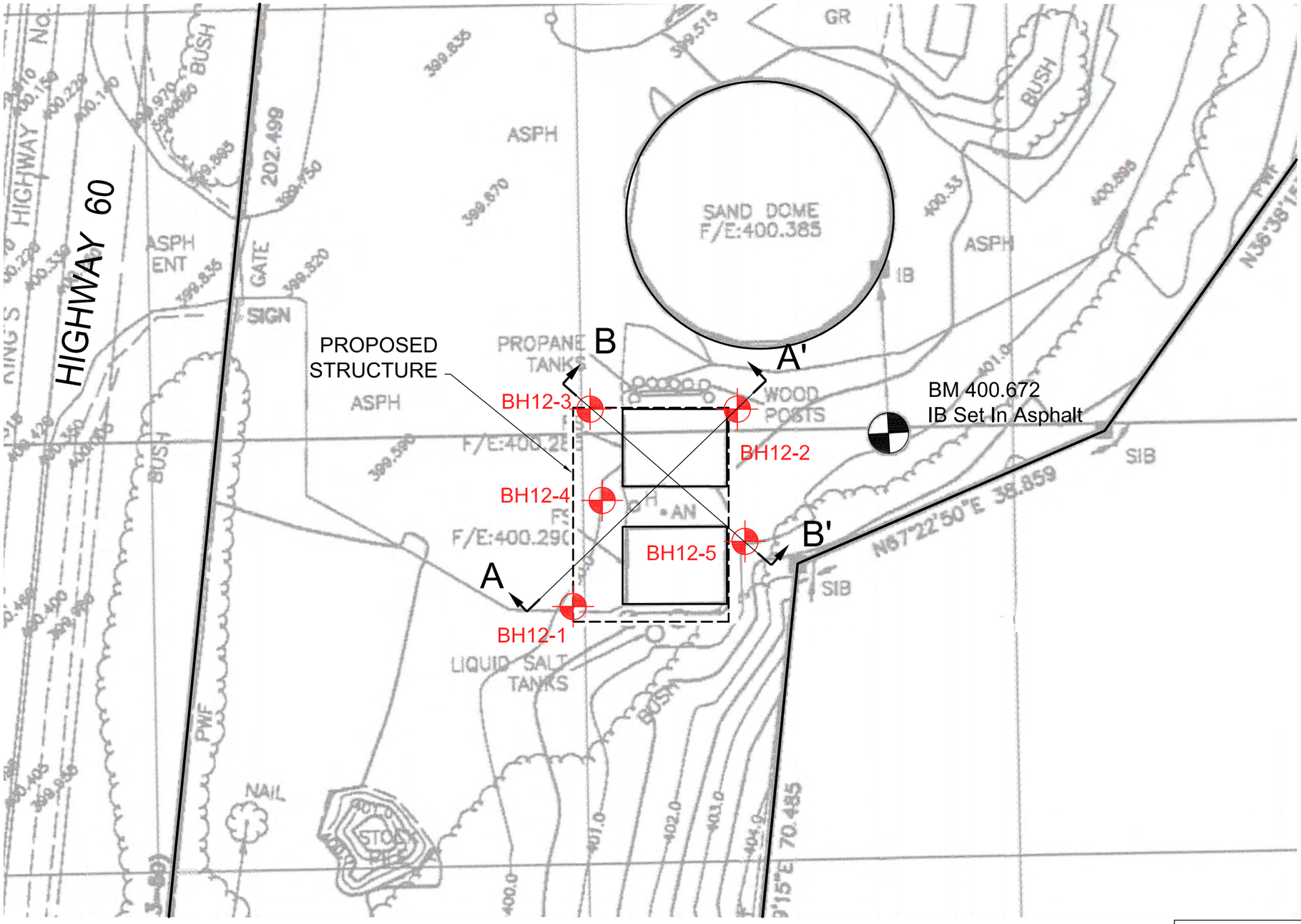
Agreement No.: 5011-E-0010
WO No.: 2011-11039

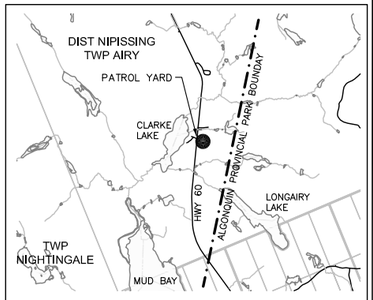
DRAWING 1

BOREHOLE LOCATION PLAN

PROPOSED SAND/SALT STORAGE FACILITY
WHITNEY PATROL YARD
HIGHWAY 60

Client: MTO - Northeastern Region





LEGEND

- Borehole and Cone
- Benchmark (400.672 mASL)
- Proposed Sand/Salt Storage Facility
- A A' Line of Cross Section (See Figure 2)

BH No	ELEVATION (mASL)	COORDINATES (NAD 83 Zone17) NORTHING	EASTING
12-1	400.176	5045812.8	713539.8
12-2	400.071	5045835.9	713559.0
12-3	399.845	5045835.9	713541.8
12-4	399.993	5045825.3	713543.2
12-5	400.262	5045820.5	713559.9

NOTES:

1. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
2. COORDINATES AT BOREHOLE LOCATIONS WERE BY HANDHELD GPS.
3. BOREHOLE ELEVATIONS WERE SURVEYED RELATIVE TO SIB IN THE EXISTING SAND / SALT DOME FOOTING (EL. 400.672 mASL).

PLAN VIEW

SCALE 1:500

5 0 5 10 m

– NOTE –
THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE BOREHOLE LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS.

PROJECT: 121-17876-00 111-12

GENIVAR

LICENSED PROFESSIONAL ENGINEER
J. S. Ash
PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER
J. T. Balsdon
PROVINCE OF ONTARIO

SITE PLAN MAPPING REF. NO.:
MTO PLAN H-328-60-1, SURVEY SEPT. 27, 2010.

REVISIONS

DATE	BY	DESCRIPTION

GEOCRES No. 31E-320

HWY No. 60			DIST NIPISSING
SUBM'D --	CHECKED JSA	DATE NOVEMBER 2012	SITE --
DRAWN PLB	CHECKED --	APPROVED --	DWG --

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES

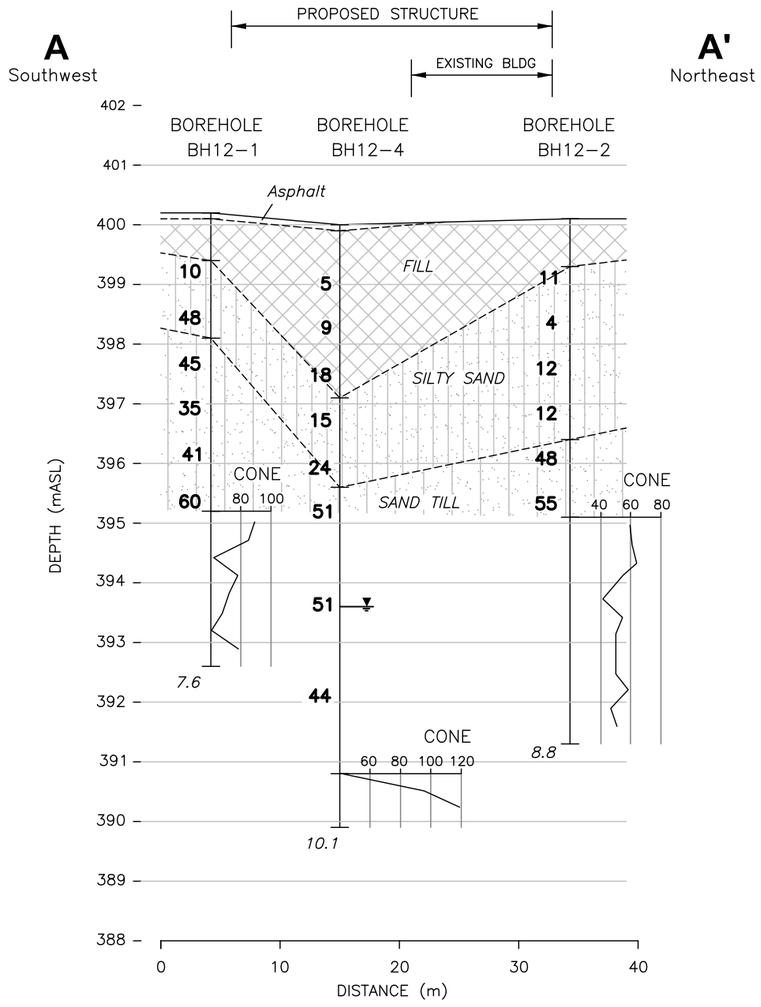
Agreement No.: 5011-E-0010
WO No.: 2011-11039

SOIL STRATA
PROPOSED SAND/SALT STORAGE FACILITY
WHITNEY PATROL YARD
HIGHWAY 60

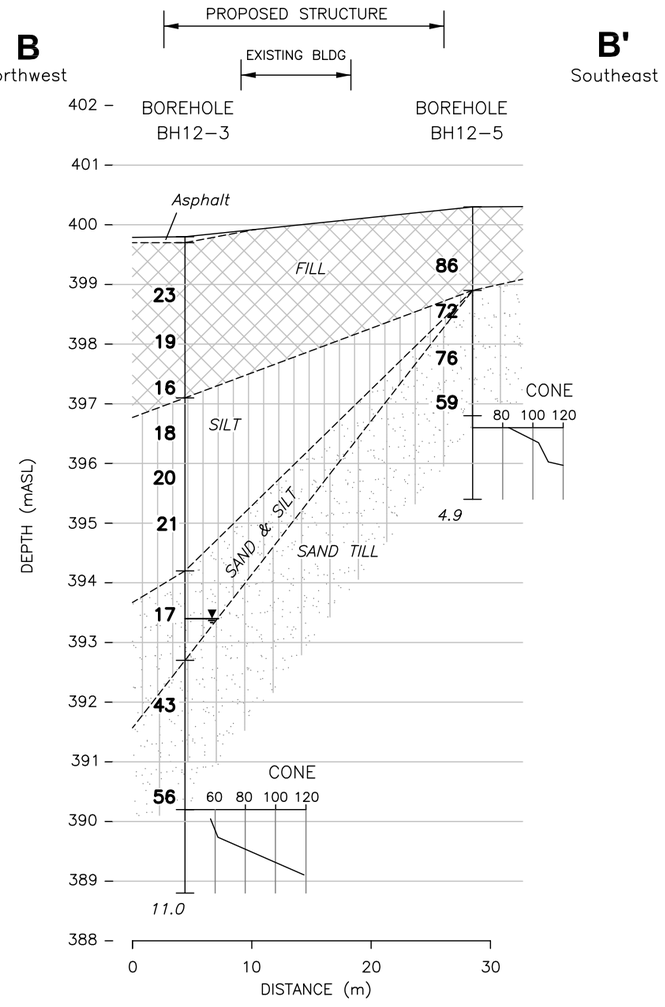
Client: MTO - Northeastern Region

DRAWING 2

CROSS SECTION A-A'



CROSS SECTION B-B'



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2. COORDINATES AT BOREHOLE LOCATIONS WERE BY HANDHELD GPS.
3. BOREHOLE ELEVATIONS WERE SURVEYED RELATIVE TO SIB IN THE EXISTING SAND / SALT DOME FOOTING (EL. 400.672 mASL).

LEGEND

N	Blows/0.3m (Std. Pen Test, 475 J / blow)
CONE	Blow/0.3m (60° Cone, 475 J / blow)
▼	Water Level At Time Of Investigation

BH No	ELEVATION (mASL)	COORDINATES (NAD 83 Zone17) NORTHING	EASTING
12-1	400.176	5045812.8	713539.8
12-2	400.071	5045835.9	713559.0
12-3	399.845	5045835.9	713541.8
12-4	399.993	5045825.3	713543.2
12-5	400.262	5045820.5	713559.9

– NOTE –
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LICENSED PROFESSIONAL ENGINEER
J. S. Ash
PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER
J. T. Balsdon
PROVINCE OF ONTARIO

PROJECT: 121-17876-00 111-12
GENIVAR

SITE PLAN MAPPING REF. NO.:
MTO PLAN H-328-60-1, SURVEY SEPT. 27, 2010.

REVISIONS

DATE	BY	DESCRIPTION

GEOCRES No. 31E-320

HWY No 60			DIST NIPISSING
SUBM'D --	CHECKED JSA	DATE NOVEMBER 2012	SITE --
DRAWN PLB	CHECKED --	APPROVED --	DWG --

Appendix A

Borehole Explanation Forms

Borehole Logs

BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

DEPTH

This column gives the depth of interpreted geologic contacts in metres below ground surface.

STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

Soil Classification*		Terminology	Proportion
Clay	<0.002 mm		
Silt	0.002 to 0.06 mm	"trace" (e.g. trace sand)	<10%
Sand	0.06 to 2 mm	"some" (e.g. some sand)	10% - 20%
Gravel	2 to 60 mm	adjective (e.g. sandy)	20% - 35%
Cobbles	60 to 200 mm	"and" (e.g. and sand)	35% - 50%
Boulders	>200 mm	noun (e.g. sand)	>50%

* Extension of MIT Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

COHESIONLESS SOIL		COHESIVE SOIL		
Compactness	Standard Penetration Resistance "N", Blows / 0.3 m	Consistency	Standard Penetration Resistance "N", Blows / 0.3 m	Undrained Shear Strength (cu) (kPa)
Very Loose	0 to 4	Very Soft	0 to 2	0 to 12
Loose	4 to 10	Soft	2 to 4	12 to 25
Compact	10 to 30	Firm	4 to 8	25 to 50
Dense	30 to 50	Stiff	8 to 15	50 to 100
Very Dense	Over 50	Very Stiff	15 to 30	100 to 200
		Hard	Over 30	Over 200

The moisture conditions of cohesionless and cohesive soils are defined as follows.

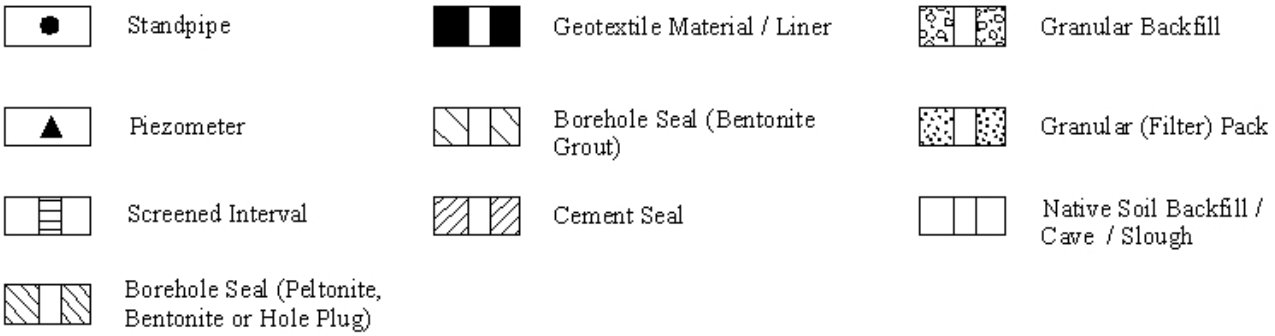
COHESIONLESS SOILS	COHESIVE SOILS		
Dry	DTPL	-	Drier Than Plastic Limit
Moist	APL	-	About Plastic Limit
Wet	WTPL	-	Wetter Than Plastic Limit
Saturated	MWTPL	-	Much Wetter Than Plastic Limit

STRATIGRAPHY

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

MONITOR DETAILS

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.



Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

SAMPLE

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

SS =	Split Spoon	GS =	Grab Sample
TW =	Thin Walled Shelby Tube	CS =	Channel Sample
AS =	Auger Flight Sample	WS =	Wash Sample
CC =	Continuous Core	RC =	Rock Core
PH =	TW Advanced Hydraulically		

$$\% \text{ Recovery} = \frac{\text{Length of Core Recovered Per Run}}{\text{Total Length of Run}} \times 100$$

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification	RQD (%)
Very poor quality	< 25
Poor quality	25 - 50
Fair quality	50 - 75
Good quality	75 - 90
Excellent quality	90 - 100

TEST DATA

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60º steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as $\frac{xBlows}{mm}$

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W_P - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W_L - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

REMARKS

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.

RECORD OF BOREHOLE No BH12-1

1 OF 1

METRIC

LOCATION WHITNEY PATROL YARD N 5045812.8 ; E 713539.8 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 9.5.12 - 9.5.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (30 60 90 120 150) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
400.2											
400.0 / 0.1	**ASPHALT:** 50 mm THICK						400				
	GRANULAR FILL: GRAVELLY SAND FILL, SOME SILT		1	AS							29 60 (11)
399.4 / 0.8	DARK BROWN, MOIST		2	SS	10		399		○		
	SILTY SAND: FINE SAND, SOME SILT ORANGE, COMPACT , MOIST		3	SS	48				○		
398.0 / 2.1	GRAVELLY SILTY SAND BROWN, DENSE, MOIST						398				
	SAND TILL: FINE SAND TILL, SOME GRAVEL, SOME SILT, TRACE CLAY BROWN, DENSE TO VERY DENSE, MOIST		4	SS	45				○		
			5	SS	35		397		○		
			6	SS	41		396		○		13 67 18 2
395.1			7	SS	60				○		
5.0	DYNAMIC CONE PENETRATION TEST BELOW 5.0 m DEPTH. NO SOIL SAMPLING COMPLETED.						395				
							394				
392.6							393				
7.6	END OF BOREHOLE BOREHOLE CAVED AT 4.0 m DEPTH ON COMPLETION, DRY.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT WHITNEY GINT.GPJ ONTARIO MOT.GDT 10/10/12

RECORD OF BOREHOLE No BH12-2

1 OF 1

METRIC

LOCATION WHITNEY PATROL YARD N 5045835.9 ; E 713559.0 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 9.5.12 - 9.5.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 30 60 90 120 150	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
400.1											
0.0	**FILL:** SILTY SAND FILL, BROWN, MOIST		1	AS							
399.3							399				
0.8	**SILTY SAND:** SILTY SAND, TRACE CLAY, TRACE GRAVEL BROWN, LOOSE TO COMPACT, MOIST		2	SS	11						
			3	SS	4		398				1 62 33 4
			4	SS	12						
			5	SS	12		397				
396.4											
3.7	**SAND TILL:** GRAVELLY SILTY SAND TILL, TRACE CLAY BROWNISH GREY, DENSE TO VERY DENSE, MOIST		6	SS	48		396				28 44 25 3
395.0			7	SS	55		395				
5.0	DYNAMIC CONE PENETRATION TEST BELOW 5.0 m DEPTH. NO SOIL SAMPLING COMPLETED.						394				
							393				
							392				
391.2											
8.8	END OF BOREHOLE BOREHOLE OPEN AND DRY ON COMPLETION.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT WHITNEY GINT.GPJ ONTARIO MOT.GDT 10/10/12

RECORD OF BOREHOLE No BH12-3

1 OF 1

METRIC

LOCATION WHITNEY PATROL YARD N 5045835.9 ; E 713541.8 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 9.5.12 - 9.6.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 30 60 90 120 150	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
399.8											
399.7	**ASPHALT:** 50 mm THICK		1	AS							
0.1	**FILL:** SAND FILL, SOME GRAVEL, SOME SILT BROWN, COMPACT, MOIST		2	SS	23		399		○		15 74 (11)
			3	SS	19		398		○		
397.2			4	SS	16				○		
2.7	**SILT:** SILT TO SANDY SILT, TRACE SAND, TRACE CLAY GREY, COMPACT, MOIST TO WET		5	SS	18		397		○		0 6 90 4
			6	SS	20		396		○		
			7	SS	21		395		○		
394.3											
5.6	**SAND AND SILT:** FINE SAND AND SILT, TRACE CLAY, TRACE GRAVEL BROWN, COMPACT, SATURATED		8	SS	17	▼	394		○		2 54 42 2
392.8							393				
7.1	**SAND TILL:** SILTY SAND TILL, SOME GRAVEL, TRACE TO SOME SILT BROWN, DENSE TO VERY DENSE, WET TO MOIST		9	SS	43		392		○		
			10	SS	56		391		○		
390.2											
9.6	DYNAMIC CONE PENETRATION TEST BELOW 9.6 m DEPTH. NO SOIL SAMPLING COMPLETED.						390				
388.8							389				
11.0	END OF BOREHOLE BOREHOLE CAVED AT 6.6 m DEPTH UPON COMPLETION. WATER LEVEL AT 6.4 m DEPTH.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT WHITNEY GINT.GPJ ONTARIO MOT.GDT 10/10/12

RECORD OF BOREHOLE No BH12-4

1 OF 1

METRIC

LOCATION WHITNEY PATROL YARD N 5045825.3 ; E 713543.2 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 9.6.12 - 9.6.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (30 60 90 120 150) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
400.0											
399.9 / 0.1	**ASPHALT:** 50 mm THICK		1	AS							
	FILL: SAND FILL, TRACE TO SOME GRAVEL, TRACE SILT BROWN, LOOSE TO COMPACT, MOIST		2	SS	5		399				
			3	SS	9		398				1 96 (3)
397.1 / 2.9			4	SS	18						
	SILTY SAND: SILTY SAND, SOME SILT GREY, COMPACT, MOIST		5	SS	15		397				
395.6 / 4.4			6	SS	24		396				
	SAND TILL: GRAVELLY SAND TILL, SOME SILT, TRACE CLAY BROWN, VERY DENSE, MOIST TO WET		7	SS	51		395				23 58 17 2
			8	SS	51	▼	394				
			9	SS	44		393				
390.8 / 9.2	DYNAMIC CONE PENETRATION TEST BELOW 9.2 m DEPTH. NO SOIL SAMPLING COMPLETED.						392				
389.9 / 10.1	END OF BOREHOLE BOREHOLE CAVED AT 7.6 m DEPTH UPON COMPLETION. WATER LEVEL AT 6.4 m DEPTH.						391				
							390				

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT WHITNEY GINT.GPJ ONTARIO MOT.GDT 10/10/12

RECORD OF BOREHOLE No BH12-5

1 OF 1

METRIC

LOCATION WHITNEY PATROL YARD N 5045820.5 ; E 713559.9 ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT COMPILED BY JW

DATUM GEODETIC DATE 9.6.12 - 9.6.12 CHECKED BY RK

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 30 60 90 120 150 (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
400.3											
0.0	**FILL:** FINE SAND FILL, SOME GRAVEL, TRACE SILT BROWN, VERY DENSE, MOIST		1	AS			400				
			2	SS	86				○		
398.9							399				
1.4	**SAND TILL:** GRAVELLY SILTY SAND TILL, TRACE CLAY BROWNISH GREY TO GREY, VERY DENSE, MOIST		3	SS	72				○		26 52 20 2
			4	SS	76		398		○		
396.8			5	SS	59		397		○		
3.5	DYNAMIC CONE PENETRATION TEST BELOW 3.7 m DEPTH. NO SOIL SAMPLING COMPLETED.						396				
395.4											
4.9	END OF BOREHOLE BOREHOLE CAVED AT 3.4 m DEPTH UPON COMPLETION, DRY.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MOT WHITNEY GINT.GPJ ONTARIO MOT.GDT 10/10/12

Appendix B

Summary of Particle Size Distribution Results (Table B1)

Particle Size Distribution Analyses (Figures B1 to B5)

Table B1: Summary of Grain Size Distribution and Hydrometer Tests

Borehole No.	Sample ID	Soil Description	Percentage Retained (%)			
			Gravel	Sand	Silt	Clay
BH12-1	AS1	Gravelly sand, some silt	29	60	11	
BH12-1	SS6	Sand, some gravel, some silt, trace clay	13	67	18	2
BH12-2	SS3	Silty sand, trace gravel, trace clay	1	62	33	4
BH12-2	SS6	Gravelly, silty sand, trace clay	28	44	25	3
BH12-3	SS1	Sand, some gravel, some silt	15	74	11	
BH12-3	SS5	Silt, trace sand, trace clay	0	6	90	4
BH12-3	SS8	Sand and silt, trace gravel, trace clay	2	54	42	2
BH12-4	SS3	Sand, trace gravel, trace silt	1	96	3	
BH12-4	SS7	Gravelly sand, some silt, trace clay	23	58	17	2
BH12-5	SS3	Gravelly sand, some silt, trace clay	26	52	20	2

Terminology	**Proportion**
"trace" (e.g. trace sand)	< 10%
"some" (e.g. some sand)	10% to 20%
adjective (e.g. sandy)	20% to 35%
"and" (e.g. and sand)	35% to 50%
Noun (e.g. sand)	> 50%

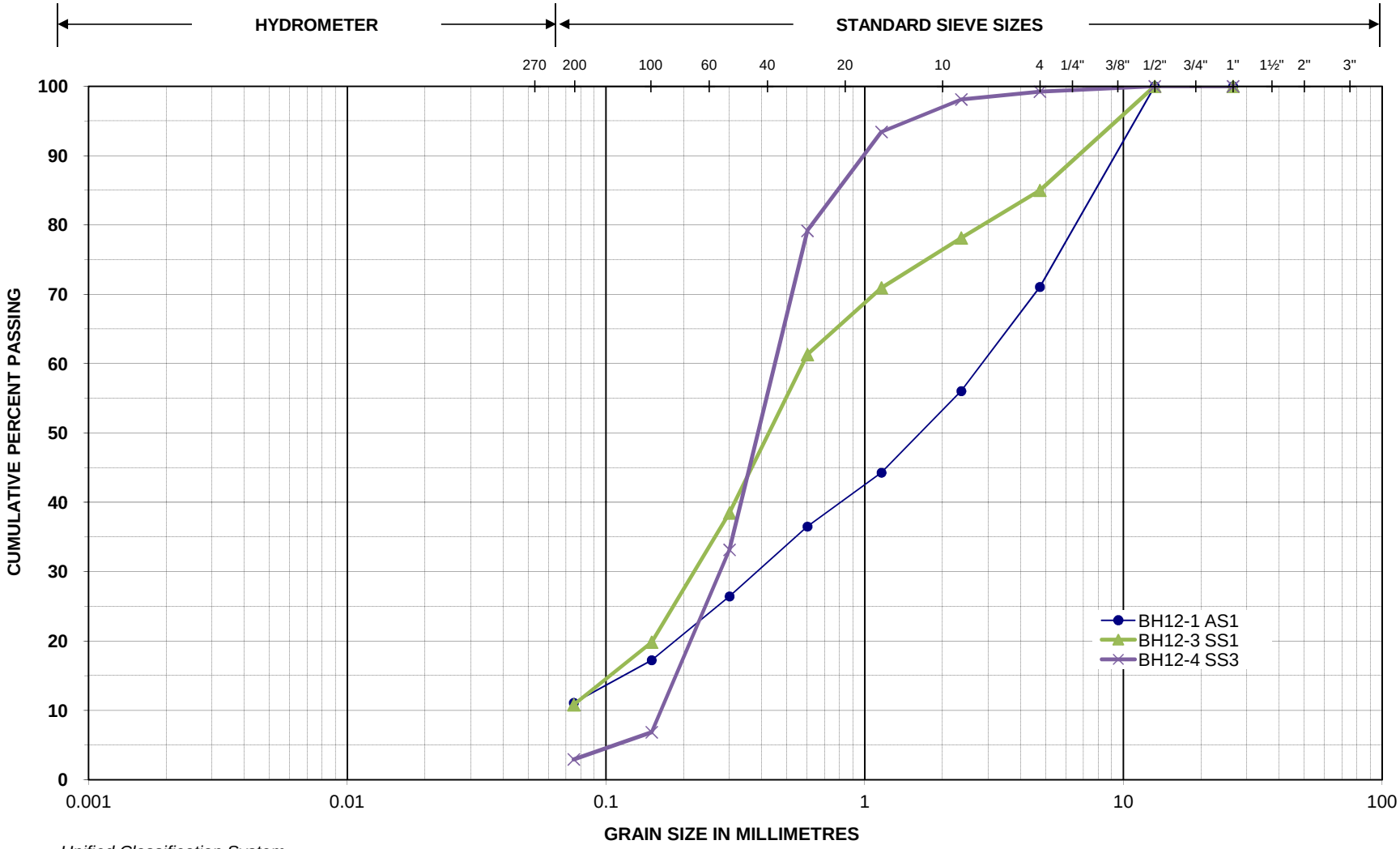
NOTE:

Division of Particle Sizes (USCS except clay based on MIT division)

- Gravel > 4.75 mm
- Sand 0.075 mm to 4.75 mm
- Silt 0.002 mm to 0.075 mm
- Clay < 0.002 mm

GENIVAR

PARTICLE SIZE DISTRIBUTION



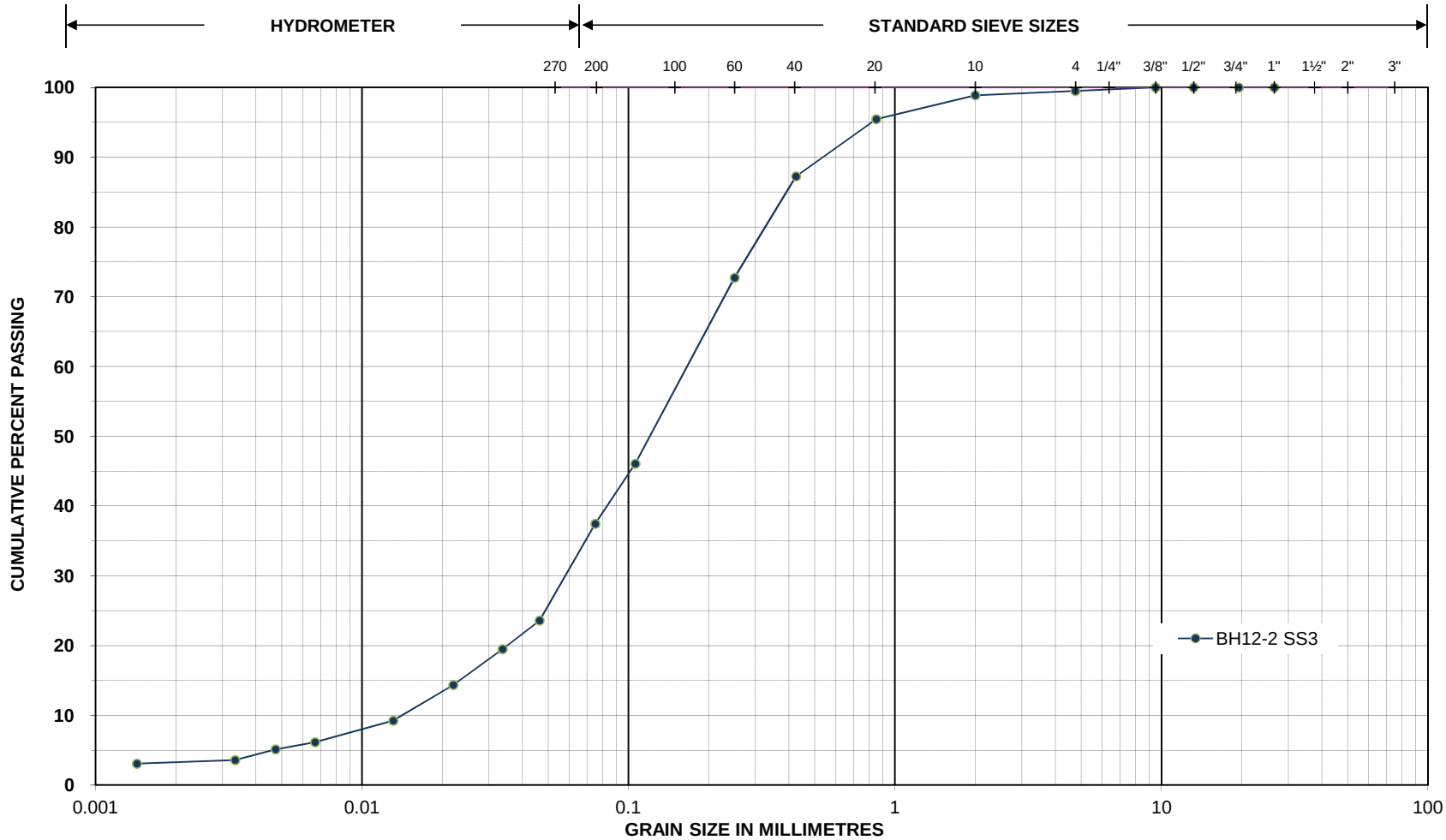
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	MTO Agreement # 5011-E-0010 (Whitney)	**Project No.:**	121-17876-00	**Figure No.:**	**B1**
Remarks:	Gravelly sand, some silt to sand, trace to some gravel, trace to some silt				

GENIVAR

PARTICLE SIZE DISTRIBUTION ASTM D422



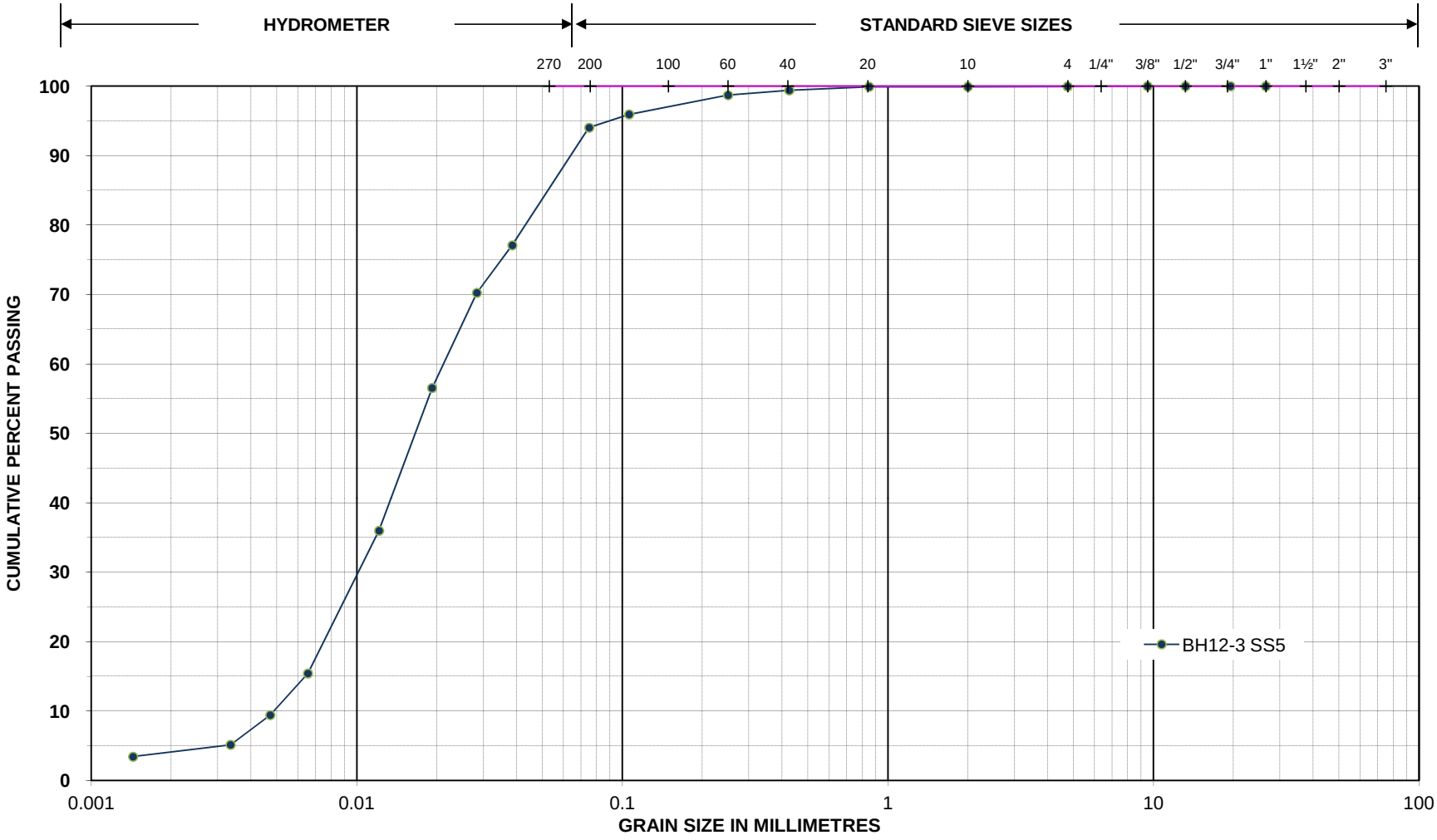
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	MTO Agreement # 5011-E-0010 (Whitney)	**Project No.:**	121-17876-00	**Figure No.:**	**B2**
Remarks:	Silty sand, trace clay, trace gravel				

GENIVAR

PARTICLE SIZE DISTRIBUTION ASTM D422



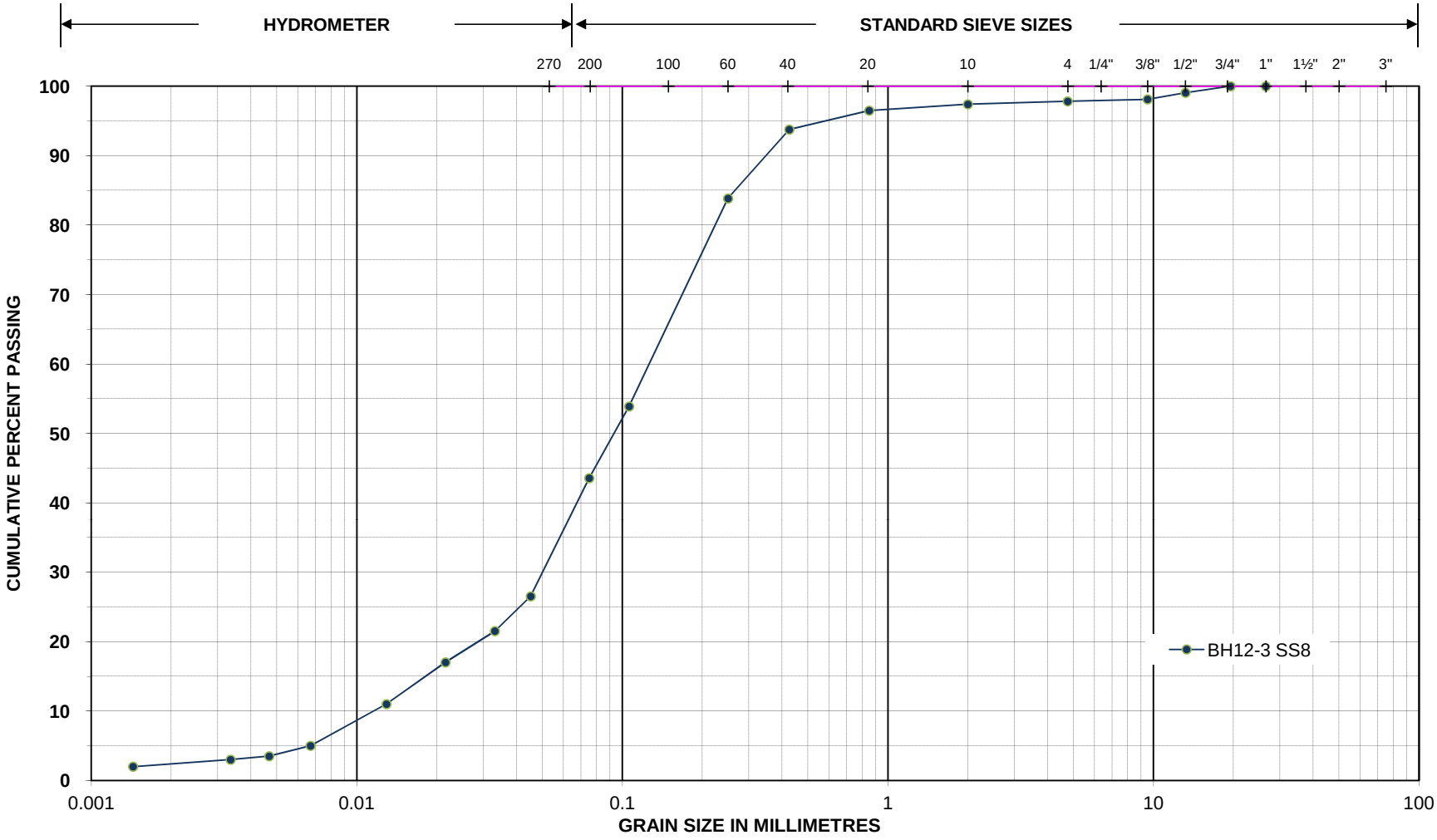
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	MTO Agreement # 5011-E-0010 (Whitney)	**Project No.:**	121-17876-00	**Figure No.:**	**B3**
Remarks:	Silt, trace sand, trace clay				

GENIVAR

PARTICLE SIZE DISTRIBUTION ASTM D422



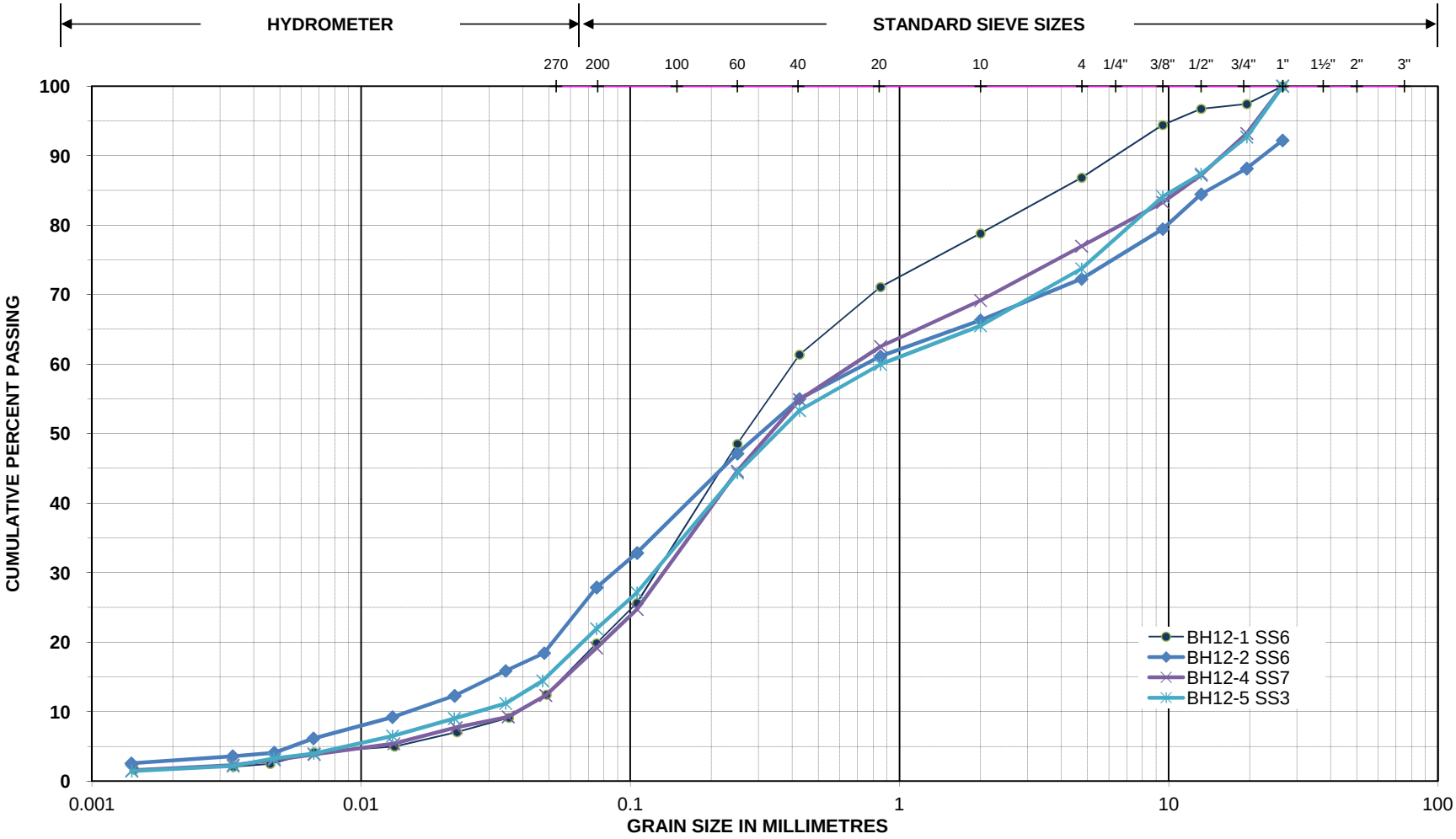
Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	MTO Agreement # 5011-E-0010 (Whitney)	**Project No.:**	121-17876-00	**Figure No.:**	**B4**
Remarks:	Sand and silt, trace clay, trace gravel				

GENIVAR

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

Project Name:	MTO Agreement # 5011-E-0010 (Whitney)	**Project No.:**	121-17876-00	**Figure No.:**	**B5**
Remarks:	Gravelly sand to sand, some gravel, some silt, trace clay				

Appendix C

Site Photographs

MTO AGREEMENT #5011-E-0010
WHITNEY PATROL YARD

Photograph 1: Existing sand/salt sheds, dome, and garage. Looking north.

Photograph 2: Existing sand/salt shed. Location of proposed sand/salt shed. Looking south.

Photograph 3: Borehole BH12-1. Southwest corner of proposed shed. Looking east.

Photograph 4: Borehole BH12-2. Northeast corner of proposed shed. Looking west.

Photograph 5: Borehole BH12-3. Northwest corner of proposed shed. Looking east.

Photograph 6: Borehole BH12-4. Middle of proposed shed. Looking east.