



**THURBER** ENGINEERING LTD.



**FOUNDATION INVESTIGATION REPORT  
GABION WALL REMEDIATION  
HIGHWAY 400 NORTH OF 17<sup>TH</sup> SIDEROAD  
TOWNSHIP OF KING, ONTARIO  
G.W.P. 2085-15-00**

**GEOCRES NO. 30M13-221**

**Report**

to

**WSP / MMM Group**

Date: July 11, 2017  
File: 12187

**TABLE OF CONTENTS**

**PART 1: FACTUAL INFORMATION**

**1. INTRODUCTION ..... 1**

**2. PROJECT AND SITE DESCRIPTION ..... 1**

**3. INVESTIGATION PROCEDURES ..... 2**

**4. LABORATORY TESTING ..... 4**

**5. DESCRIPTION OF SUBSURFACE CONDITIONS ..... 4**

    5.1 Pavement Structure ..... 4

    5.2 Topsoil and Organics ..... 4

    5.3 Silty Clay to Clayey Silt Fill ..... 5

    5.4 Sandy Silt to Silty Sand Fill ..... 6

    5.5 Sands and Silts ..... 6

    5.6 Clayey Silt to Clayey Silt Till ..... 7

    5.7 Sand and Silt Till ..... 8

    5.8 Groundwater Conditions ..... 9

**6. MISCELLANEOUS ..... 9**

**APPENDICES**

Appendix A           Record of Borehole Sheets

Appendix B           Laboratory Test Results

Appendix C           Borehole Location and Soil Strata Drawing

Appendix D           Selected Photographs of the site



**FOUNDATION INVESTIGATION REPORT  
GABION WALL REMEDIATION  
HIGHWAY 400 NORTH OF 17<sup>TH</sup> SIDEROAD  
TOWNSHIP OF KING, ONTARIO  
G.W.P. 2085-15-00**

**GEOCRES NO. 30M13-221**

**PART 1: FACTUAL INFORMATION**

**1. INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted for the remediation of two gabion walls located along Highway 400 north of 17<sup>th</sup> Sideroad in the Township of King, Ontario. The gabion walls are aligned parallel to the highway and are located on top of the inlet and outlet of a 1.22 m span concrete rigid frame culvert.

The purpose of this investigation was to explore the subsurface conditions in the vicinity of the embankments adjacent to the gabion walls and, based on the data obtained, to provide a borehole location plan, stratigraphic profiles, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber was retained by WSP / MMM Group (MMM) to carry out this foundation investigation under the MTO Assignment Number 2015-E-0008.

**2. PROJECT AND SITE DESCRIPTION**

The two gabion walls showing signs of distress are located along Highway 400 at approximately 600 m north of 17<sup>th</sup> Sideroad (approximate Station 18+808) in the Township of King, Ontario. These gabion walls are located part way up the embankment slopes of the Highway 400 Northbound Lane (NBL) and Southbound Lane (SBL). The gabion basket retaining walls are the headwalls for the culvert which has a 1.22 m span, a 1.05 m height and a 60 m length crossing under the highway. The gabion walls are approximately 2 m in height on top of 1.22 m span concrete culvert. The highway embankment in this vicinity is up to about 7 m in height.

Client: WSP / MMM Group

File No.: 12187

E file: H:\12000-12999\12187 Highway 400 16th SR & Lloydtown-Aurora\Reports & Memos\Gabion Walls\FINAL\12187  
Gabion Walls Hwy 400 FIR jul 17.docx

Date: July 11, 2017

Page: 1 of 11

The area adjacent to the gabion walls is vegetated and treed. The terrain in the vicinity of the site is generally flat with the highway embankment slopes at an inclination of about 2H : 1V (horizontal to vertical). Selected photographs of the immediate surroundings are presented in Appendix D.

The project area is located within the transition zone between physiographic regions known as the South Slope and the Oak Ridges Moraine. The South Slope is comprised predominantly of the Halton Till which is an interbedded complex of clayey silt to silt till and sand. This till comprises a slightly hummocky till plain, into which the surface watercourses have eroded 10 to 15 m deep gullies. The Oak Ridges Moraine is comprised of till overlying sands and gravels.

### **3. INVESTIGATION PROCEDURES**

The site investigation and field testing for this project were carried out from March 7 to 16, 2017 and consisted of drilling and sampling six boreholes (numbered GW17-01 to GW17-06) located at the crest, slope and toe of the embankments. Boreholes GW17-01 to GW17-03 were drilled on the west side of Highway 400 NBL and Boreholes GW17-04 to GW17-06 were drilled on the east side of Highway 400 SBL. All the boreholes were terminated at depths ranging from 6.0 m to 15.7 m (Elevations 300.3 to 308.0).

Prior to the start of drilling, the borehole locations were marked in the field and utility clearances were obtained. The co-ordinates and elevations of the as-drilled boreholes were subsequently provided by MMM. The approximate locations of the boreholes are shown on Borehole Locations and Soil Strata drawings included in Appendix C. The coordinates and elevations of these boreholes are given on this drawing and on the individual Record of Borehole Sheets in Appendix A.

A track-mounted D50 drill rig and a tripod drill rig were used to drill and sample the boreholes. Hollow stem augers were used in conjunction with the D50 rig to advance the boreholes until the target depth was reached. Wash boring techniques were used in conjunction with the tripod. In general, soil samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with the Standard Penetration Testing (SPT).

The drilling and sampling operations were supervised on a full time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing. Results of field drilling and sampling are presented on the Record of Borehole sheets in Appendix A.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Four standpipe piezometers were installed in selected boreholes (Boreholes GW17-01, GW17-02, GW17-05, and GW17-06). Each piezometer consisted of a 19 mm Schedule 40 PVC pipe with a 1.5 m long slotted screen enclosed in filter sand column to permit groundwater level monitoring. Piezometer installation details, groundwater level observations and water level readings are shown on the Record of Borehole sheets. Upon completion of the drilling operations, the boreholes without piezometers were abandoned in general accordance with Ontario Regulation 903 (amended by Ontario Reg. 372) (O.Reg. 903). The piezometers will be decommissioned as per O.Reg. 903 after the final set of water level readings are taken. The details of standpipe piezometer installation and borehole completion are summarized in Table 3.1.

**Table 3.1 – Borehole Completion Details**

Approx. Station	Borehole No.	Borehole Depth / Base Elevation (m)	Piezometer Tip Elevation (m)	Completion Details
18+808	GW17-01	9.6/301.3	9.2/301.7	Borehole backfilled with sand filter from 9.2 m to 7.0 m, bentonite holeplug from 7.0 m to 6.1 m, then bentonite holeplug and auger cuttings from 6.1 m to surface.
	GW17-02	6.3/307.4	5.7/308.0	Borehole backfilled with sand filter from 5.7 m to 3.7 m, bentonite holeplug from 3.7 m to 3.1 m, then bentonite holeplug and auger cuttings from 3.1 m to surface.
	GW17-03	15.7/301.9	None installed	Borehole backfilled with bentonite holeplug and auger cuttings to surface.
	GW17-04	15.6/302.0	None installed	Borehole backfilled with bentonite holeplug and auger cuttings to surface.
	GW17-05	6.0/308.0	5.9/308.1	Borehole backfilled with sand filter from 5.9 m to 4.0 m, bentonite holeplug from 4.0 m to 2.6 m, then bentonite holeplug and auger cuttings from 2.6 m to surface.
	GW17-06	9.6/300.3	9.2/300.7	Borehole backfilled with sand filter from 9.2 m to 7.0 m, bentonite holeplug from 7.0 m to 6.1 m, then bentonite holeplug and auger cuttings from 6.1 m to surface.

#### **4. LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size analysis and Atterberg Limits testing. All the laboratory tests were carried out in accordance to MTO and/or ASTM Standards, as appropriate. The results of the laboratory testing are summarized on the Record of Borehole sheets in Appendix A and are presented on the figures included in Appendix B.

#### **5. DESCRIPTION OF SUBSURFACE CONDITIONS**

Reference is made to the Record of Borehole sheets in Appendix A for details of the encountered soil stratigraphy. Representative cross sections of embankment slopes with gabion walls are presented on the “Borehole Locations and Soil Strata” drawings in Appendix C. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole sheets governs any interpretation of the site conditions. It must be recognized that soil conditions may vary between and beyond borehole locations. More detailed descriptions of the individual strata are presented below.

In general, the subsurface conditions encountered in the boreholes drilled along the east side of the Highway 400 NBL and west side of the Highway 400 SBL consist of pavement structure and embankment fill overlying a deposit of typically compact sands and silts with stiff to very stiff clayey silt interlayers. A very dense sand and silt till underlies the above soils. Groundwater was measured at between 0.7 m and 1.5 m depths below the slope surface and the toe. More detailed descriptions of the individual stratum are presented below.

##### **5.1 Pavement Structure**

Boreholes on Highway 400, identified as GW17-03 and GW17-04, were drilled through an approximately 150 mm to 175 mm thick layer of asphalt and 0.6 to 0.9 m of sand fill containing trace gravel. The measured moisture contents of selected samples of the sand fill varied between 9 percent and 12 percent.

##### **5.2 Topsoil and Organics**

A layer of topsoil between 100 and 300 mm in thickness was encountered at ground surface in Boreholes GW17-01, GW17-02, GW17-05 and GW17-06.

The topsoil thickness may vary between and beyond the borehole locations, and the limited data is not suitable for estimating topsoil quantities.

In Boreholes GW17-01 and GW17-06, a 0.6 to 0.8 m thick layer of organics was encountered below the surficial sand to sandy silt fill. The organics were mixed with sandy silt to clayey silt and wood fibres. The SPT ‘N’ values indicated a compact condition or stiff consistency. The base of the organic layer was at 1.1 m and 1.8 m depths, or Elevations 309.8 and 308.1, in Boreholes GW17-01 and GW17-06, respectively. Measured moisture contents of samples of the organics varied from 15 percent to 32 percent.

### 5.3 Silty Clay to Clayey Silt Fill

Embankment fill consisting predominantly of silty clay to clayey silt fill was encountered below the topsoil, pavement structure or sandy silt fill in Boreholes GW17-02, GW17-03, GW17-04, and GW17-05. The thickness of this cohesive fill at the boreholes was between 2.5 m and 6.1 m. The base of this cohesive fill ranged between 3.7 m and 7.3 m depths, or Elevations 309.1 and 310.4.

SPT ‘N’ values recorded in the silty clay to clayey silt fill ranged from 9 blows to 111 blows per 0.3 m of penetration, indicating a stiff to hard consistency. The measured moisture contents of selected samples of this fill varied between 8 percent and 20 percent.

The results of grain size distribution analyses carried out on samples of this cohesive fill are presented on the Record of Borehole Sheets included in Appendix A and on Figure B1 of Appendix B. The results of the gradation testing from all the relevant boreholes are summarized below:

Soil Particles	Percentage (%)
Gravel	0 to 5
Sand	21 to 38
Silt	35 to 46
Clay	17 to 31

The result of Atterberg Limits testing results on a silty clay fill sample is presented in Figure B7 of Appendix B, and summarized below:

Index Property	Percentage (%)
Plasticity Index	9
Liquid Limit	22

The results of the Atterberg Limits testing indicate that this deposit has low plasticity with a group symbol of CL.

#### 5.4 Sandy Silt to Silty Sand Fill

In Boreholes GW17-01, GW17-03, GW17-05, and GW17-06, layers of brown to grey sand, silty sand to sandy silt fill containing trace to some clay, trace gravel, occasional roots and rootlets, were encountered below the topsoil or pavement. The thickness of this cohesionless fill at the boreholes was between 0.4 m and 2.3 m. The base of this cohesionless fill ranged between 0.5m and 2.4 m depths, or Elevations 316.5 and 308.5.

SPT 'N' values within the cohesionless fill ranged from 3 blows to 19 blows per 0.3 m of penetration, indicating very loose to compact conditions. The measured moisture contents of samples of the fill varied between 6 percent and 21 percent.

The results of grain size distribution analysis carried out on a sample of the silty sand fill is presented on the Record of Borehole Sheets included in Appendix A and on Figure B2 of Appendix B. The result of the gradation testing is summarized below:

Soil Particles	Percentage (%)
Gravel	8
Sand	47
Silt	32
Clay	13

#### 5.5 Sands and Silts

In all the boreholes, surficial brown to grey deposits with varying proportions of sands and silts, trace to some clay, trace gravel, occasional roots and rootlets and wood fibres, were encountered. Where fully penetrated, the thickness of the native sandy silt to silty sand was between 1.6 m and 6.1 m. The base of these cohesionless deposits ranged between 5.5 m and 13.3 m depths, or Elevations 306.0 and 304.3 in Boreholes GW17-01, GW17-03, GW17-04 and GW17-06. Boreholes GW17-02 and GW17-05 were terminated in the sands and silts at 6.3 to 6.0 m depths,

or Elevations 307.4 to 308.0.

SPT ‘N’ values recorded in these cohesionless soils were typically between 9 blows and 36 blows per 0.3 m penetration indicating a loose to dense state. In Borehole GW17-02 and GW17-05, ‘N’ values of 76 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m penetration indicated very dense conditions. Moisture content of the sands and silts ranged from 5 percent to 22 percent.

The results of grain size analyses conducted on samples of the sands and silts are presented on the Record of Borehole sheets in Appendix A, and are illustrated in Figures B3 and B4 of Appendix B. The laboratory test results are summarized in the following table.

Soil Particle	Percentage (%)
Gravel	0 to 14
Sand	3 to 58
Silt	36 to 87
Clay	5 to 13

## 5.6 Clayey Silt to Clayey Silt Till

Layers of brown to grey native clayey silt to clayey silt till with trace to some sand and trace gravel were encountered in Boreholes GW17-01, GW17-03 and GW17-06. Where fully penetrated in Boreholes GW17-03 and GW17-06, the thickness of the clayey silt ranged between 1.9 m and 2.2, and the base of the layers was encountered at Elevations 308.4 to 305.9. Borehole GW17-01 was terminated in the clayey silt till at 9.6 m depth, or Elevation 301.3.

SPT ‘N’ values obtained in the clayey silt ranged between 13 blows and 22 blows for 0.3 m penetration indicating stiff to very stiff consistency. Moisture contents of the native clayey silt ranged from 13 percent to 21 percent.

SPT ‘N’ values obtained in the clayey silt till were 87 to 90 blows for 0.3 m penetration indicating a hard consistency. A moisture content of 9 percent was measured in a sample.

The results of grain size analyses conducted on native clayey silt samples are presented on the Record of Borehole sheets in Appendix A, and are illustrated in Figure B5 of Appendix B. The laboratory test results are summarized in the following table.

Soil Particle	Percentage (%)
Gravel	0 to 3
Sand	3 to 40
Silt	40 to 77
Clay	17 to 20

The results of Atterberg Limits tests conducted on samples of the clayey silt are provided on the Record of Borehole sheets in Appendix A and illustrated in Figure B8 of Appendix B. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	21 to 22
Plasticity Index	5 to 8

The results of the Atterberg Limits testing indicate the deposit to be of slight to low plasticity with a group symbol CL/CL-ML.

### 5.7 Sand and Silt Till

A deposit of brown to grey sand and silt till underlies the above soils in Boreholes GW17-01, GW17-03, GW17-04 and GW17-06. Where fully penetrated in Boreholes GW17-01, this cohesionless till was 1.7 m thick with the base at 7.2 m depth, Elevation 303.7. Boreholes GW17-03, GW17-04 and GW17-06 were terminated in this till at 9.6 to 15.7 m depths, or Elevations 300.3 to 302.0.

SPT 'N' values obtained in the sand and silt till ranged from 61 per 0.3 m penetration to more than 100 blows for less than 0.3 m of penetration, indicating a very dense state throughout. Moisture contents of this till ranged from 7 percent to 10 percent.

The results of grain size analyses conducted on sand and silt till samples are presented on the Record of Borehole sheets in Appendix A, and are illustrated in Figure B6 of Appendix B. The laboratory test results are summarized in the following table.

Soil Particle	Percentage (%)
Gravel	2 to 4
Sand	44 to 48
Silt	38 to 44
Clay	8 to 12

## 5.8 Groundwater Conditions

Groundwater levels in the boreholes were observed during the drilling operations and measured upon completion of drilling. Standpipe piezometers were installed in Boreholes GW17-01, GW17-02, GW17-05 and GW17-06 to permit longer term monitoring. Water levels measured in the four installed standpipes and open boreholes are presented below.

**Table 5-1. Groundwater Level Measurements**

Borehole Number	Date	Groundwater Level		Comments
		Depth (m)	Elevation (m)	
GW17-01	March 13, 2017	3.2	307.7	Open borehole Piezometer (clayey silt till)
	March 28, 2017	0.7	310.2	
GW17-02	March 28, 2017	1.5	312.2	Piezometer (sands and silts)
GW17-03	March 7, 2017	8.7	308.9	Open borehole
GW17-04	March 8, 2017	11.4	306.2	Open borehole
GW17-05	March 28, 2017	1.5	312.5	Piezometer (fill/silt)
GW17-06	March 10, 2017	2.7	307.2	Open borehole Piezometer (sand and silt till)
	March 28, 2017	0.7	309.2	

The values shown in Table 5-1 are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant or prolonged precipitation.

## 6. MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. MMM provided the northing and easting coordinates and ground surface elevations.



Walker Drilling of Utopia, Ontario, supplied and operated a track-mounted D50 drill rig and Tripod to carry out the drilling, sampling and in-situ testing operations for the boreholes.

The drilling and sampling operations in the field were supervised on a full time basis by Ms. Eckie Siu of Thurber. Geotechnical laboratory testing was carried out by Thurber in its MTO-approved laboratory. Overall supervision of the field program was carried out by Mr. Stephane Loranger, CET.

Overall project management was provided by Dr. Sydney Pang, P.Eng. Interpretation of the field data and preparation of this report was completed by Mr. Pouya Pishgah, P. Eng. and Dr. Sydney Pang, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.



Thurber Engineering Ltd.

Pouya Pishgah, P.Eng.  
Geotechnical Engineer



Sydney Pang, P.Eng.  
Associate, Senior Foundations Engineer



P.K. Chatterji, P.Eng.  
Review Principal, Designated MTO Contact

Client: WSP / MMM Group  
File No.: 12187  
E file: H:\12000-12999\12187 Highway 400 16th SR & Lloydtown-Aurora\Reports & Memos\Gabion Walls\FINAL\12187  
Gabion Walls Hwy 400 FIR jul 17.docx

Date: July 11, 2017  
Page: 11 of 11



## **Appendix A**

### **Record of Borehole Sheets**

# SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

## 1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

## 2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

## 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer

## 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

## 5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level  
 $C_{pen}$  Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

## EXPLANATION OF ROCK LOGGING TERMS

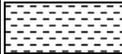
### ROCK WEATHERING CLASSIFICATION

<b>Fresh (FR)</b>	No visible signs of weathering.
<b>Fresh Jointed (FJ)</b>	Weathering limited to the surface of major discontinuities.
<b>Slightly Weathered (SW)</b>	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
<b>Moderately Weathered (MW)</b>	Weathering extends throughout the rock mass, but the rock material is not friable.
<b>Highly Weathered (HW)</b>	Weathering extends throughout the rock mass and the rock is partly friable.
<b>Completely Weathered (CW)</b>	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

### DISCONTINUITY SPACING

<b>Bedding</b>	<b>Bedding Plane Spacing</b>
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

### SYMBOLS

	CLAYSTONE
	SILTSTONE
	SANDSTONE
	COAL
	BEDROCK

### STRENGTH CLASSIFICATION

<b>Rock Strength</b>	<b>Approximate Uniaxial Compressive Strength</b>		<b>Field Estimation of Hardness*</b>
	<b>(MPa)</b>	<b>(psi)</b>	
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

### TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery:(SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation:(RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index:(FI)	Frequency of natural fractures per 0.3m of core run.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ( $W_L < 30\%$ ).
		CI	Inorganic clays of medium plasticity, silty clays. ( $30\% < W_L < 50\%$ ).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS	Pt	Peat and other highly organic soils.	
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			



**RECORD OF BOREHOLE No GW17-01**

2 OF 2

**METRIC**

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 171.4 E 298 318.0 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.13 - 2017.03.13 CHECKED BY PP

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)								
								20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>				
	Continued From Previous Page																		
	COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS DATE            DEPTH(m)    ELEV.(m) 2017.03.28      0.7            310.2																		

ONTMT4S\_MTO-12187.GPJ\_2015TEMPLATE(MTO).GDT\_4/4/17

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      20  
15 5  
10 (%) STRAIN AT FAILURE



**RECORD OF BOREHOLE No GW17-03**

1 OF 2

**METRIC**

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 177.6 E 298 336.1 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.07 - 2017.03.07 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE WATER CONTENT (%) 20 40 60								
317.6	GROUND SURFACE													
0.0	ASPHALT: (150mm)													
0.2	SAND, trace gravel Brown Moist (FILL)		1	GS										
316.8														
0.8	Sandy SILT, trace clay, trace gravel Compact Brown Moist (FILL)		1	SS	12									
			2	SS	13									
315.3														
2.3	Silty CLAY, some sand, trace gravel Very Stiff Brown Moist (FILL)		3	SS	18								5 21 46 28	
			4	SS	18									
313.0														
4.6	Stiff		5	SS	9									
			6	SS	11									
310.3														
7.3	Clayey SILT, some sand, trace gravel, trace organics, topsoil stained Very Stiff Dark Grey Moist		7	SS	22								3 40 40 17	
308.4														
9.2	SAND and SILT, some gravel, trace clay Compact Brown - Wet Gravelly sand seam (75mm) at 9.5m		8	SS	21									

ONTMT4S MTO-12187.GPJ 2015TEMPLATE(MTO).GDT 4/4/17

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No GW17-03**

2 OF 2

**METRIC**

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 177.6 E 298 336.1 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.07 - 2017.03.07 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
Continued From Previous Page							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) 20 40 60				
306.0	<b>SAND</b> and <b>SILT</b> , some gravel, trace clay Compact Brown Wet		9	SS	27										14 40 41 5	
11.6	<b>SAND</b> and <b>SILT</b> , some clay, trace gravel Very Dense Brown to Grey Moist (TILL)		10	SS	69										3 44 41 12	
301.9			11	SS	79											
			12	SS	61											
15.7	END OF BOREHOLE AT 15.7m. WATER LEVEL AT 8.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.6m, CEMENT TO 0.1m, THEN ASPHALT TO SURFACE.															

ONTMT4S MTO-12187.GPJ 2015TEMPLATE(MTO).GDT 4/4/17

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No GW17-04

1 OF 2

METRIC

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 171.4 E 298 369.3 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.08 - 2017.03.08 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa 20 40 60 80 100							
317.6	GROUND SURFACE														
0.0	ASPHALT: (175mm)														
0.2	SAND, trace gravel Compact Brown Moist (FILL)		1	GS											
316.5			1	SS	13										
1.1	Silty CLAY, some sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)		2	SS	9										
			3	SS	17										
			4	SS	17									1 27 41 31	
			5	SS	13										
			6	SS	13										
310.4			7	SS	18										
7.2	SILT, trace clay, trace sand, trace gravel, trace rootlets Compact Brown Moist		8	SS	20									0 6 87 7	

ONTMT4S\_MTO-12187.GPJ\_2015TEMPLATE(MTO).GDT\_4/4/17

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No GW17-04**

2 OF 2

**METRIC**

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 171.4 E 298 369.3 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.08 - 2017.03.08 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
304.3	Continued From Previous Page <b>SILT</b> , some clay, trace sand, trace gravel Compact Grey Wet		9	SS	22	i	307									1 3 83 13	
			10	SS	24		306										
							305										
13.3	<b>SAND and SILT</b> , some clay, trace gravel Very Dense Grey Moist (TILL)		11	SS	66		304									3 45 40 12	
							303										
302.0			12	SS	100/ 0.250		302										
15.6	END OF BOREHOLE AT 15.6m. WATER LEVEL AT 11.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO 0.6m, CEMENT TO 0.2m, THEN ASPHALT TO SURFACE.																

ONT/MT4S\_MTO-12187.GPJ\_2015TEMPLATE(MTO).GDT\_4/4/17

### RECORD OF BOREHOLE No GW17-05

1 OF 1

**METRIC**

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 172.4 E 298 380.0 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Tripod COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.16 - 2017.03.17 CHECKED BY PP

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa													
								20	40	60	80	100									
314.0	GROUND SURFACE																				
0.0	<b>TOPSOIL:</b> (125mm)																				
0.1	Sandy <b>SILT</b> , some gravel, trace roots Loose		1	SS	6																
313.4	Dark Brown Moist (FILL)		2	SS	11																
0.6	Silty <b>SAND</b> , some clay, trace gravel Compact Brown Wet (FILL)		3	SS	19													8	47	32	13
			4	SS	17																
311.6																					
2.4	Clayey <b>SILT</b> , some sand, trace gravel, trace organics and rootlets Hard to Very Stiff Brown Wet (FILL)		5	SS	38																
			6	SS	24																
			7	SS	33																
			8	SS	27																
309.1																					
4.9	<b>SILT</b> , some sand, trace clay, trace gravel, mixed with organics, occasional wood fibres Compact to Very Dense Brown Wet		9	SS	24																
			10	SS	129/																
			11	SS	0.150 116/																
308.0																					
6.0	END OF BOREHOLE AT 6.0m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.03.28 1.5 312.5					0.175															

ONTMT4S MTO-12187.GPJ 2015TEMPLATE(MTO).GDT 4/4/17

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  $\frac{20}{15 \pm 5}$  (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No GW17-06

1 OF 2

METRIC

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 173.4 E 298 389.0 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.10 - 2017.03.10 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60					
309.9	GROUND SURFACE													
0.0	<b>TOPSOIL</b> , trace roots and rootlets: (100mm)	1	SS	3										
0.1	Sandy <b>SILT</b> , trace clay, trace gravel, trace roots Very Loose to Compact													
308.9	Brown to Grey	2	SS	14										
1.0	Moist (FILL)													
308.1	<b>ORGANICS</b> , mixed with clayey silt, trace sand													
1.8	Stiff Dark Grey to Dark Brown	3	SS	12										
308.1	Moist													
	Clayey <b>SILT</b> , trace sand	4	SS	14									0 3 77 20	
	Stiff Grey													
	Moist	5	SS	13										
	Black sand seam													
305.9														
4.0	<b>SAND</b> and <b>SILT</b> , trace clay													
	Loose Grey	6	SS	9									0 53 40 7	
	Saturated													
304.3														
5.6	<b>SAND</b> and <b>SILT</b> , trace clay, trace gravel													
	Very Dense Grey	7	SS	51									2 46 44 8	
	Moist (TILL)													
		8	SS	75										
	Some clay to clayey	9	SS	93										
300.3														
9.6	END OF BOREHOLE AT 9.6m. WATER LEVEL AT 2.7m UPON													

ONTMT4S MTO-12187.GPJ 2015TEMPLATE(MTO).GDT 4/4/17

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No GW17-06

2 OF 2

**METRIC**

GWP# 2085-13-00 LOCATION Gabion Walls N 4 871 173.4 E 298 389.0 ORIGINATED BY ES  
 HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2017.03.10 - 2017.03.10 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
	Continued From Previous Page															
	COMPLETION. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS DATE            DEPTH(m)    ELEV.(m) 2017.03.28      0.7            309.2															

ONTMT4S\_MTO-12187.GPJ\_2015TEMPLATE(MTO).GDT\_4/4/17

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      20  
15 5  
10 (%) STRAIN AT FAILURE



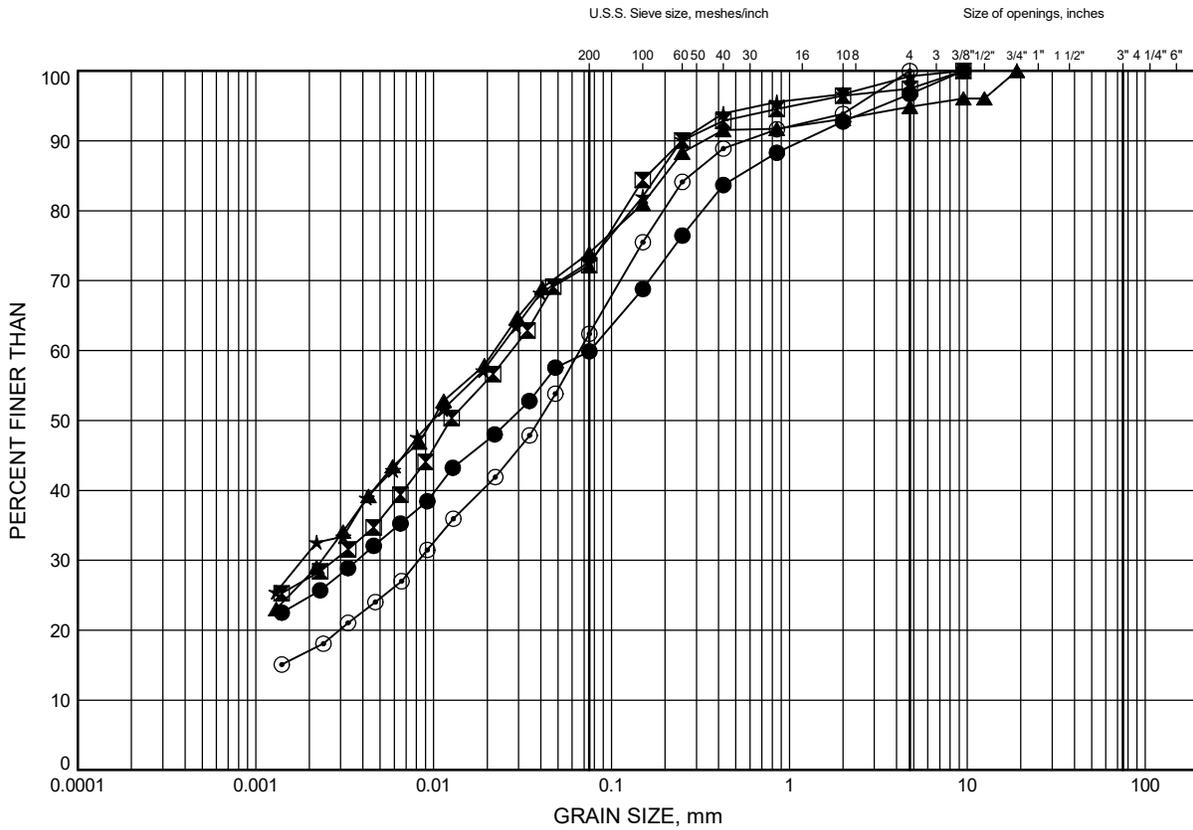
## Appendix B

### Laboratory Test Results

# Gabion Walls GRAIN SIZE DISTRIBUTION

FIGURE B1

## Silty Clay to Clayey Silt Fill



SILT and CLAY		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED		SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-02	1.75	311.95
⊠	GW17-02	3.35	310.35
▲	GW17-03	2.51	315.09
★	GW17-04	3.28	314.32
⊙	GW17-05	3.96	310.04

Date April 2017  
GWP# 2085-13-00

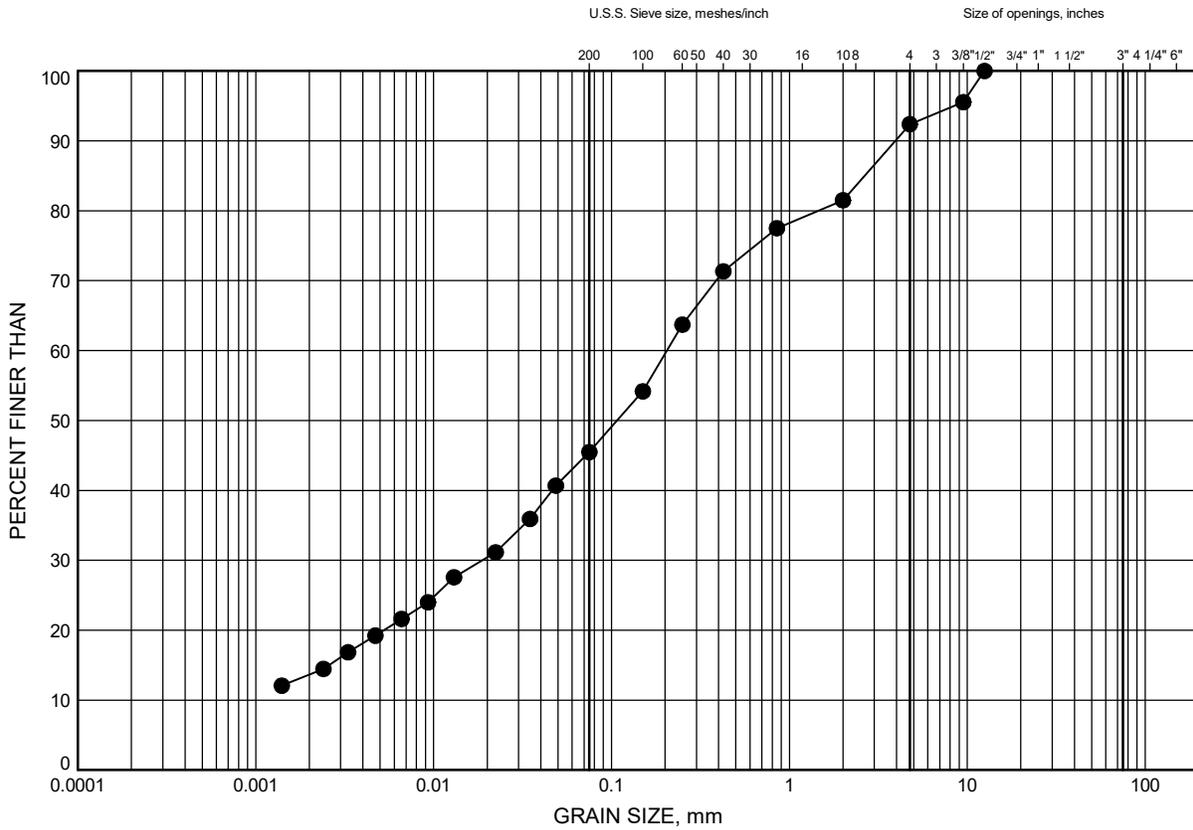


Prep'd MFA  
Chkd. SKP

Gabion Walls  
**GRAIN SIZE DISTRIBUTION**

FIGURE B2

**Silty Sand Fill**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-05	1.52	312.48

GRAIN SIZE DISTRIBUTION - THURBER MTO-12187.GPJ 4/3/17

Date April 2017  
 GWP# 2085-13-00

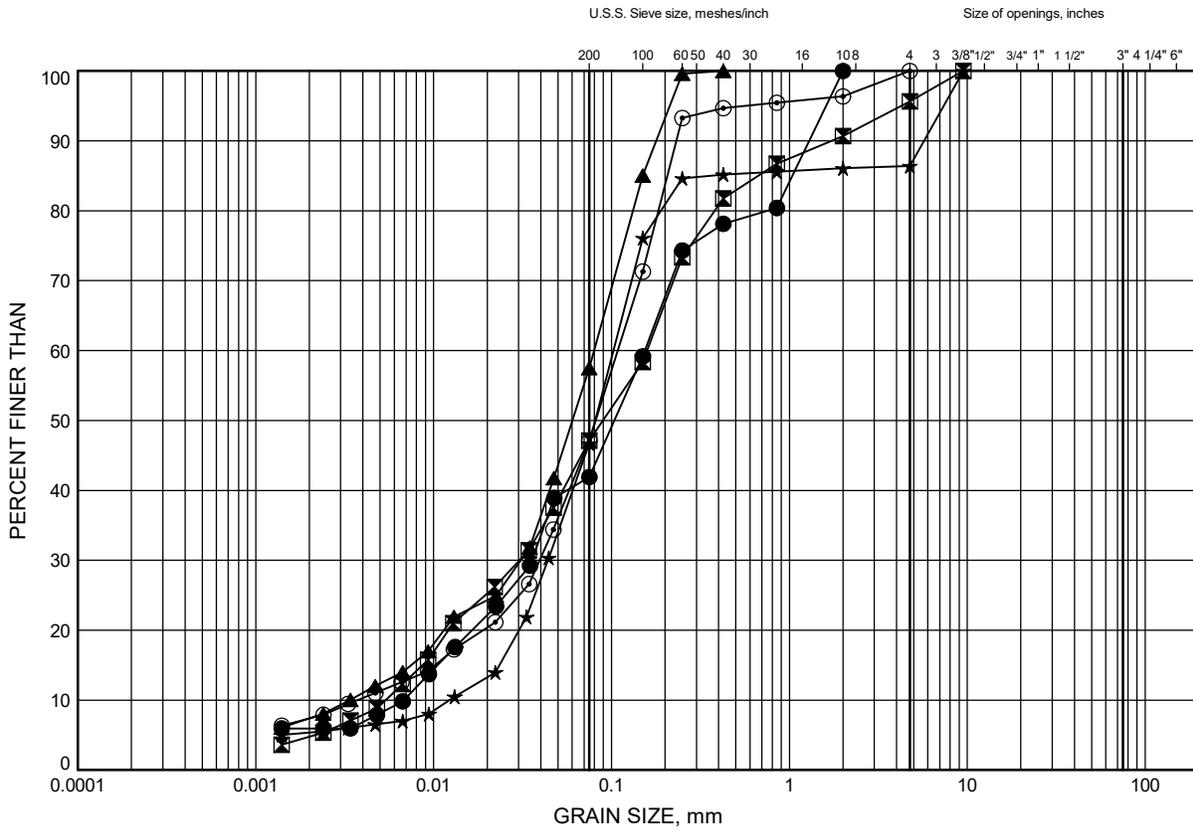


Prep'd MFA  
 Chkd. SKP

Gabion Walls  
**GRAIN SIZE DISTRIBUTION**

FIGURE B3

**Silty Sand to Sandy Silt**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-01	2.59	308.31
⊠	GW17-01	4.88	306.02
▲	GW17-02	6.18	307.52
★	GW17-03	10.90	306.70
⊙	GW17-06	4.88	305.02

GRAIN SIZE DISTRIBUTION - THURBER MTO-12187.GPJ 4/3/17

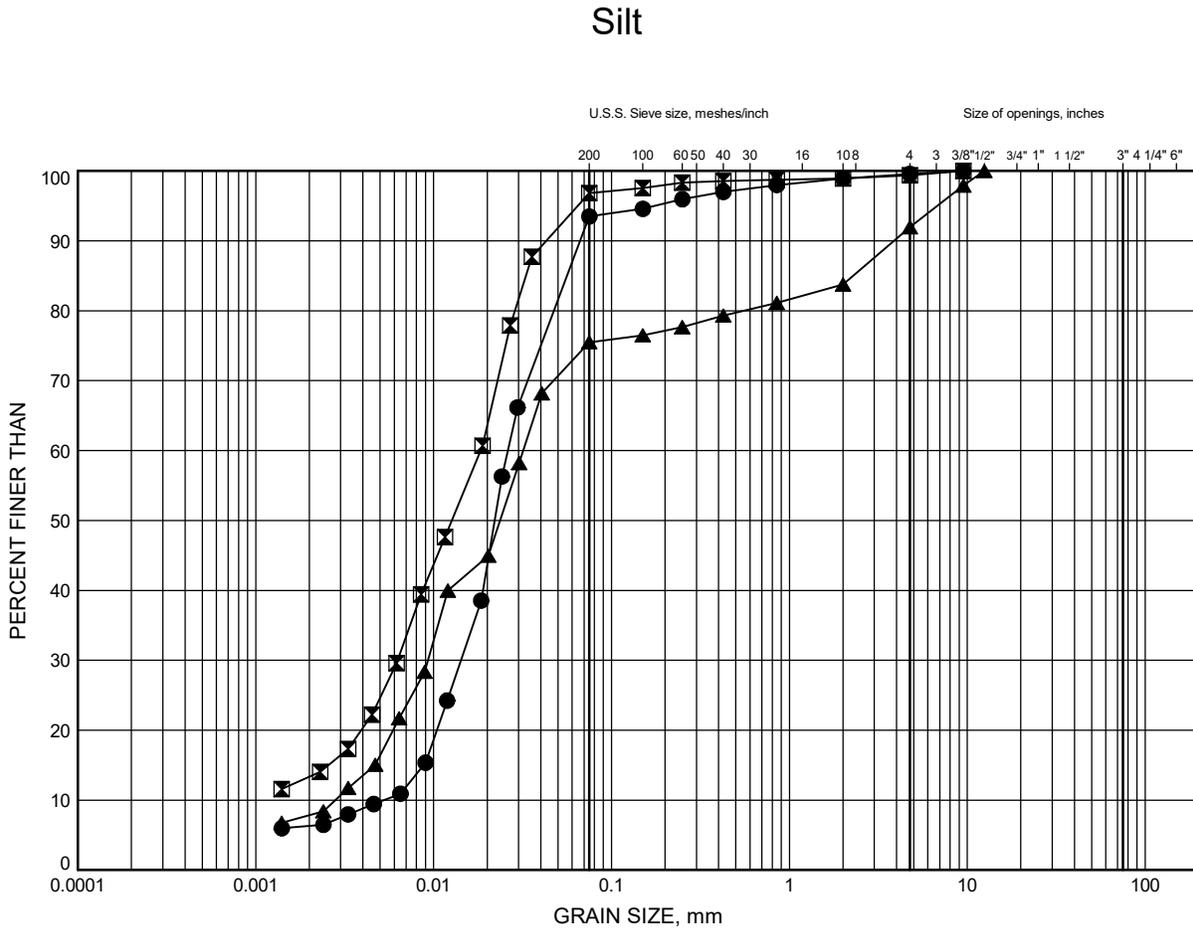
Date April 2017  
 GWP# 2085-13-00



Prep'd MFA  
 Chkd. SKP

# Gabion Walls GRAIN SIZE DISTRIBUTION

FIGURE B4



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-04	9.37	308.23
☒	GW17-04	10.90	306.70
▲	GW17-05	5.80	308.20

GRAIN SIZE DISTRIBUTION - THURBER MTO-12187.GPJ 4/3/17

Date April 2017  
GWP# 2085-13-00

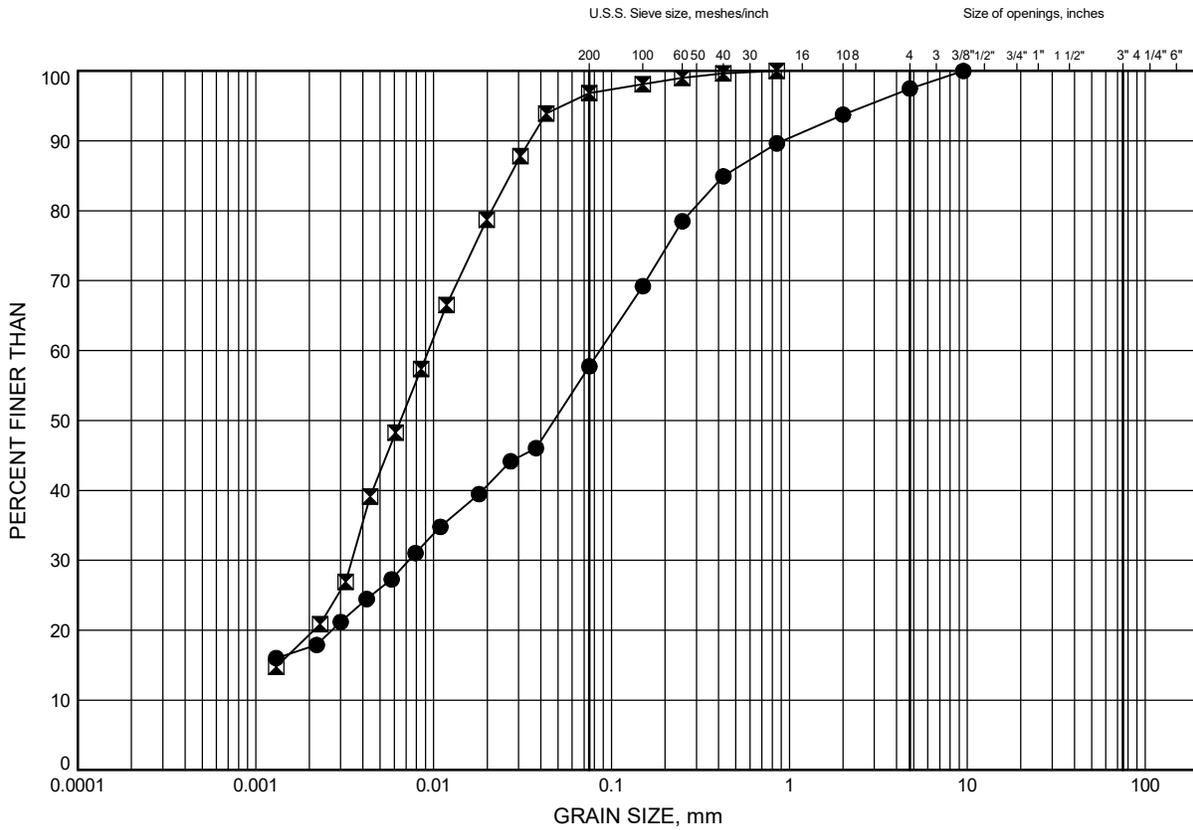


Prep'd MFA  
Chkd. SKP

Gabion Walls  
**GRAIN SIZE DISTRIBUTION**

FIGURE B5

Clayey Silt



SILT and CLAY		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED		SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-03	7.85	309.75
☒	GW17-06	2.51	307.39

GRAIN SIZE DISTRIBUTION - THURBER MTO-12187.GPJ 4/3/17

Date April 2017  
 GWP# 2085-13-00

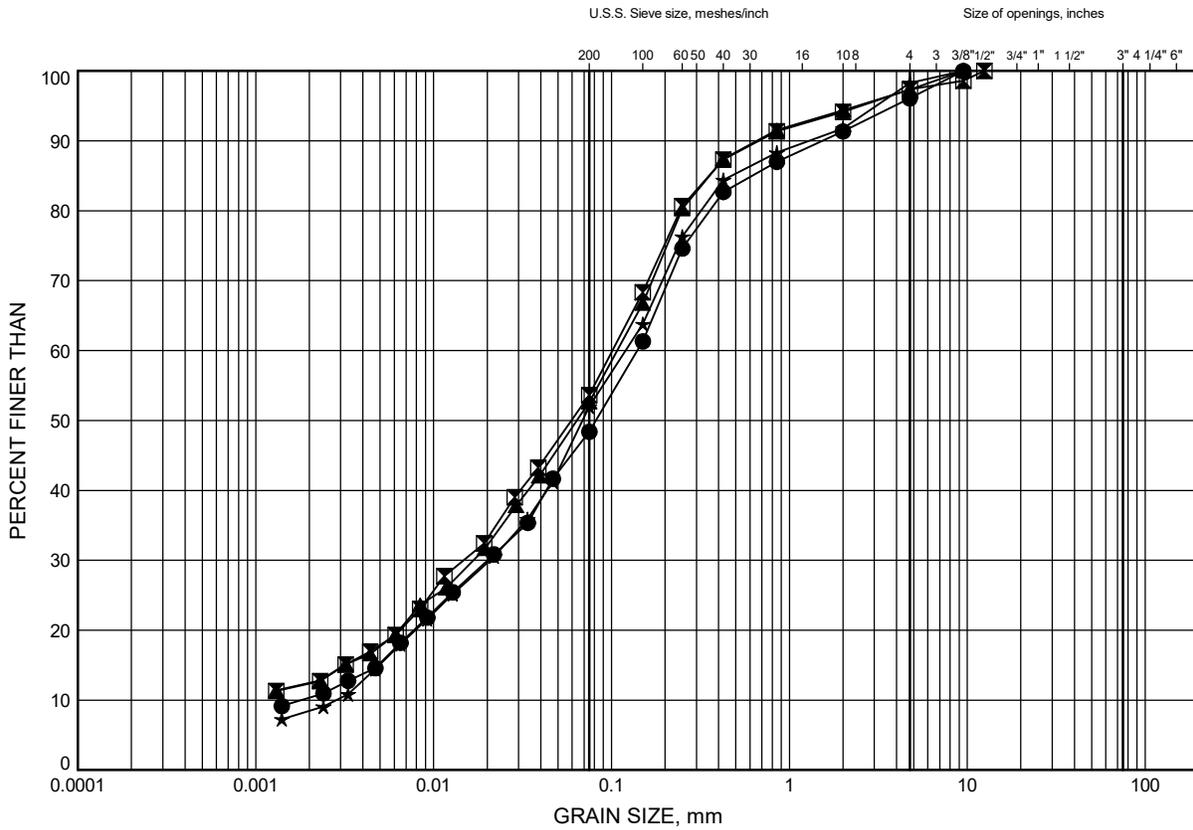


Prep'd MFA  
 Chkd. SKP

# Gabion Walls GRAIN SIZE DISTRIBUTION

FIGURE B6

## Sand and Silt Till



SILT and CLAY		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED		SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-01	6.32	304.58
☒	GW17-03	13.94	303.66
▲	GW17-04	13.94	303.66
★	GW17-06	6.32	303.58

GRAIN SIZE DISTRIBUTION - THURBER MTO-12187.GPJ 4/5/17

Date April 2017  
GWP# 2085-13-00

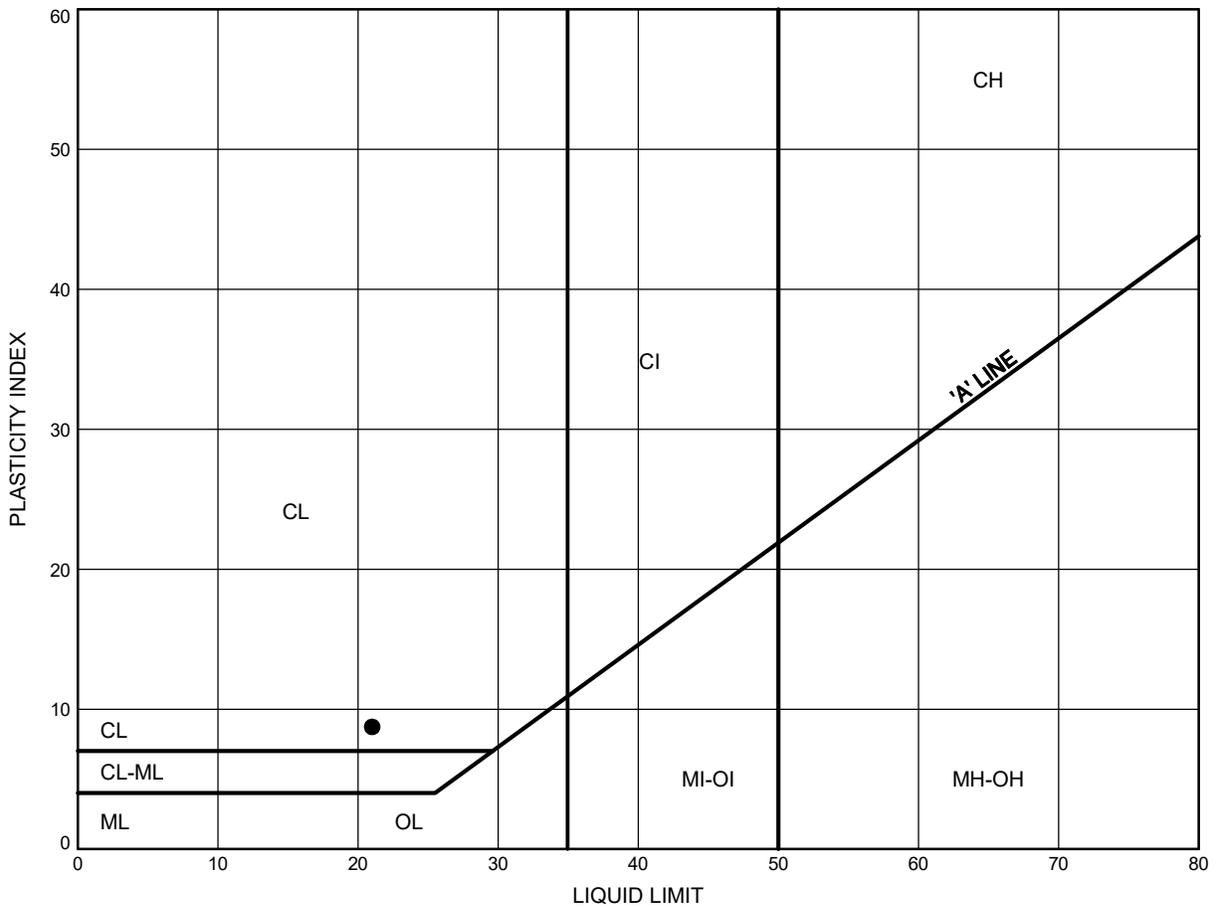


Prep'd MFA  
Chkd. SKP

Gabion Walls  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE B7

Silty Clay Fill



**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-02	3.35	310.35

Date April 2017  
 GWP# 2085-13-00

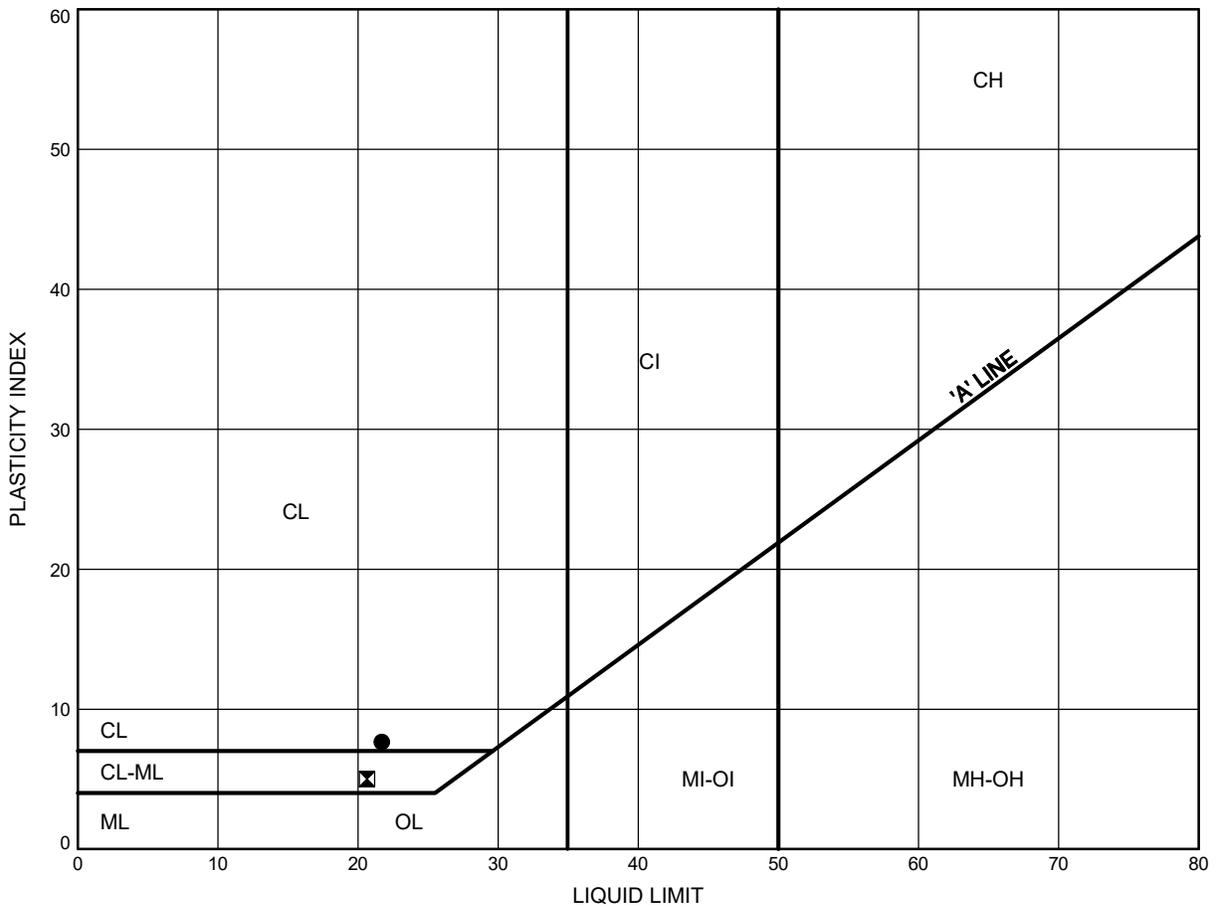


Prep'd MFA  
 Chkd. SKP

Gabion Walls  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE B8

Clayey Silt



**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	GW17-03	7.85	309.75
⊠	GW17-06	2.51	307.39

THURBALT\_MTO-12187.GPJ 4/3/17

Date April 2017  
 GWP# 2085-13-00



Prep'd MFA  
 Chkd. SKP



## Appendix C

### Borehole Locations and Soil Strata Drawing

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
GWP No 2085-13-00

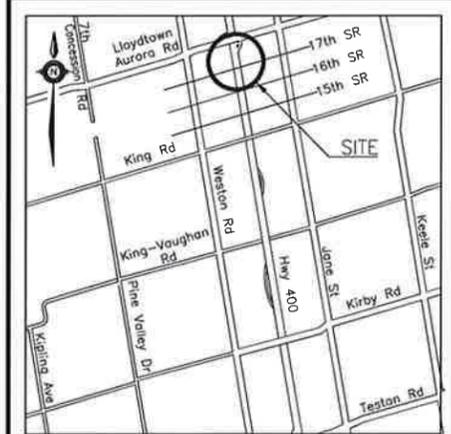


HIGHWAY 400  
NORTH OF 17th SIDEROAD  
GABION WALLS  
BOREHOLE LOCATIONS AND SOIL STRATA

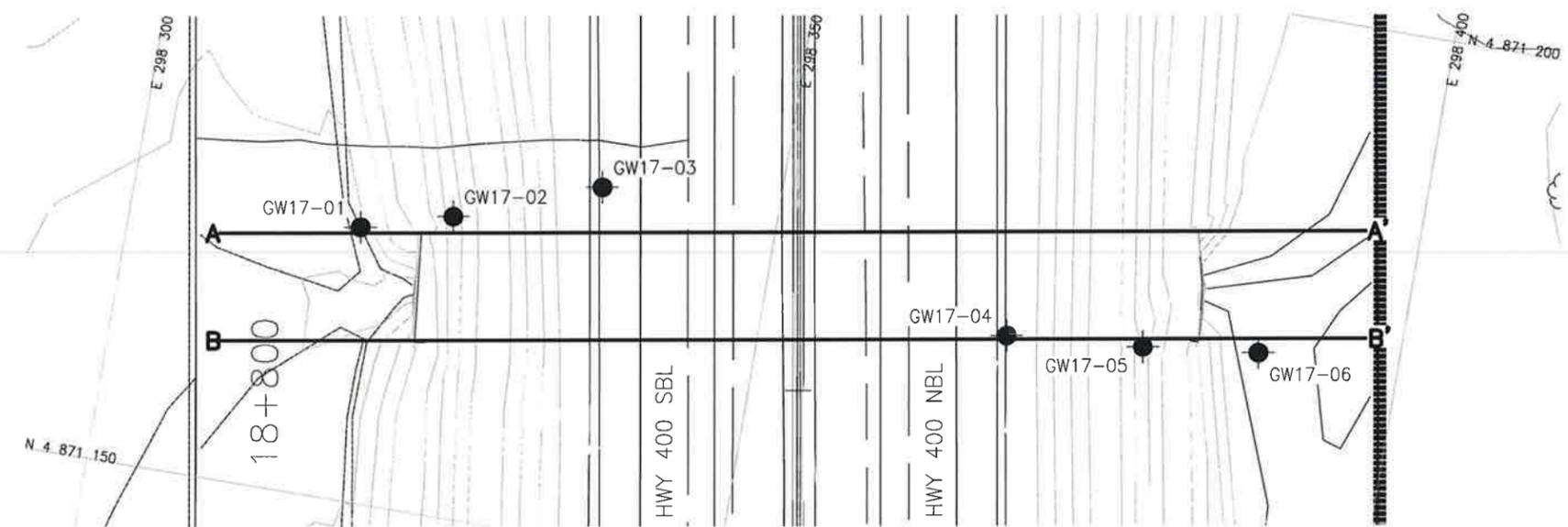
SHEET



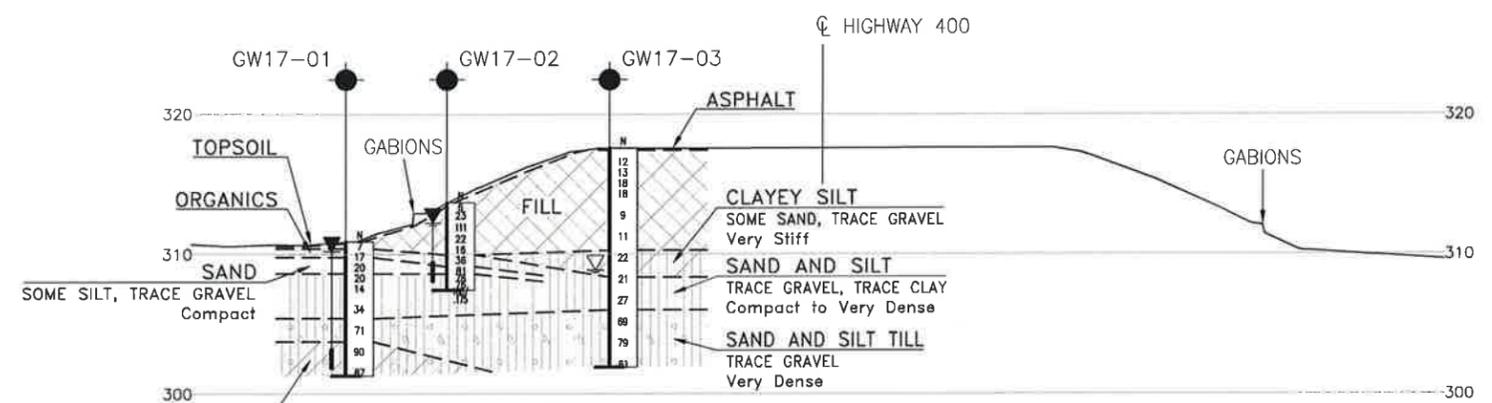
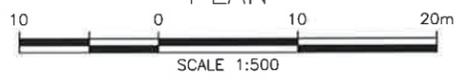
THURBER ENGINEERING LTD.



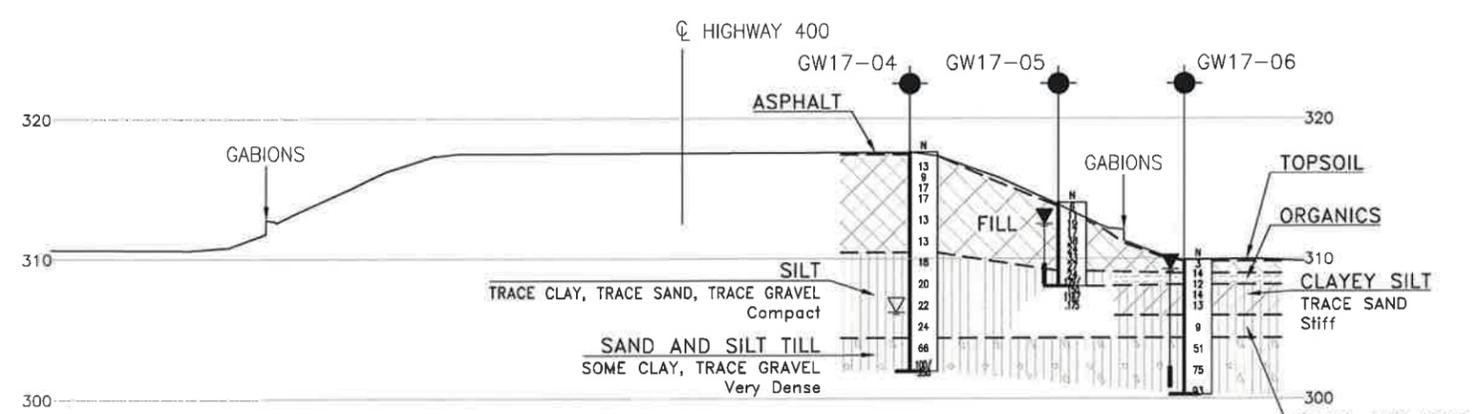
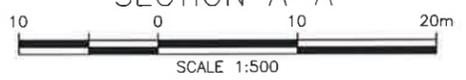
KEYPLAN



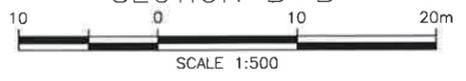
PLAN



SECTION A-A'



SECTION B-B'



LEGEND

- ◆ Borehole (Current Investigation)
- ◊ Borehole (Previous Investigation)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- ▽ Water Level
- ↑ Head Artesian Water
- ⊥ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
GW17-01	310.9	4 871 171.4	298 318.0
GW17-02	313.7	4 871 173.4	298 325.0
GW17-03	317.6	4 871 177.6	298 336.1
GW17-04	317.6	4 871 171.4	298 369.3
GW17-05	314.0	4 871 172.4	298 380.0
GW17-06	309.9	4 871 173.4	298 389.0

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 30M13-221

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	PP	CHK	PKC
DRAWN	MFA	CHK	PP

FILENAME: H:\Drafting\12000\12187\12187-TED-12187-P-PR-GW.dwg  
PLOTDATE: 6/27/2017 12:21 PM



## Appendix D

### Selected Site Photographs



**Photo 1      West Gabion Wall**



Photo 2 East Gabion Wall