



**Foundation Investigation**  
**Argon Park Rest Area Washroom Facility**  
**Assignment #6 6019-E-0042**  
**District Thunder Bay**  
**Highway 17**

**Prepared for**  
**NWR Ministry of Transportation**  
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### APPENDICIES

Appendix A, Borehole Logs  
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## **Part A - FOUNDATION INVESTIGATION REPORT**

### **1 Introduction**

TBT Engineering Limited (TBTE) has been retained by the Ministry of Transportation (MTO) – North West Region to provide a foundation investigation and design services for the proposed new, year round, rest area washroom facility located at Argon Park rest area on Highway 17, in the district of Thunder Bay. It is understood that the final building footprint has not been finalized, however, sizing provided by MTO show that the proposed new washroom building footprint may be constructed up to 7.5 m x 7.5 m (56.25 m<sup>2</sup>). Currently, there is an existing building with two drop toilets at the proposed investigation area. The rest area is located approximately 40 km South East of Upsala, ON along Highway 17 and is approximately 104 km North West of Thunder Bay. The site co-ordinates for the site are as follows:

- Argon Park Rest Area, lat: 48.90278, lon: -90.02845

A foundation investigation was carried out to investigate subsurface conditions for the proposed new washroom facility. The investigation consisted of advancing four boreholes at the site. This report (Part A) describes the subsurface conditions encountered during the investigation.

MTO Foundations Section has assigned an assignment No. 6 6019-E0042 to this site.

### **2 Site Description**

Argon park rest area is located on Highway 17, approximately 104 km North West of Thunder Bay, ON and approximately 40 km South East of Upsala, ON. The existing rest area consists of a large asphalt parking lot, several picnic areas, and two privy/outhouse buildings (one located at the middle of the rest area and one at the back of the site).

Vegetation surrounding the rest area is dense. Several trees and other dense vegetation are located at the center of the rest area, to possibly act as a privacy/sound dampening barrier for the asphalt parking lot located at the back of the site. Trails leading around the back of the site were cleared and easily accessible. The terrain is gently sloping from South to North towards ditching adjacent to the highway.



*Figure 1: Existing privy at the rear of Argon park rest stop (area of investigation)*



*Figure 2: Area of investigation, looking towards Highway 17*



## **2.1 Surficial Geology**

As defined by the Ontario Ministry of Natural Resources' Northern Ontario Engineering Geology Terrain Study (NOEGTS), 1981, Map No. 52BNE "Lac des Mille Lacs", the site is located in an area which consists of sand/sandy outwash plain with valley terrain. A subordinate landform consisting of peat/muck organic terrain veneer, overlying sandy, sand outwash plain is also present. The terrain is plain, with low local relief, dry surface condition and wet subordinate terrain.

Sandy soils were encountered within the upper 1.5 m of the borehole investigation.

## **3 Investigation Procedures**

A geotechnical site investigation was undertaken from October 5, 2020 to October 6, 2020 and consisted of advancing four boreholes to depths of ranging from 7.0 m to 10.3 m. The boreholes were completed using a track mounted drill rig.

The drill rig was equipped for geotechnical testing and sampling. Hollow stem auger methods were utilized. Soil samples were obtained at the boreholes using a split spoon sampler as a part of the Standard Penetration Testing (SPT). The SPT involves driving a thick-walled sampler into the soils under a standardized energy (63.5 kg, falling 760 mm). The number of blows required to drive the sampler 0.3 m is known as the SPT blow count (N). In addition, thin walled tube samples were taken, and field vane test were carried out on cohesive soils. Auger refusal was not encountered in any of the boreholes.

Temporary standpipes were installed to 2.9 m within each borehole. All boreholes and temporary standpipes have been backfilled and/or decommissioned with auger cuttings and bentonite in accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the water well regulation under the Ontario Water Resources Act).

The location of boreholes was established in the field by TBTE personnel and service clearances were completed prior to mobilization the drill rig to site. Borehole locations were surveyed by TBTE and were referenced to North American Datum 1983 (NAD83 CSRS CBNv6-2010.0) 3 Degree Modified Transverse Mercator (MTM) Zone 15, Central Scale Factor 0.9999 Grid Coordinates. Borehole Locations and Soil Stratification drawings have been provided in Appendix C.

## **4 Laboratory Testing**

Samples which were obtained during the field investigation were subjected to routine laboratory testing. The routine testing included Atterberg limits, moisture content, and grain size analysis conducted on select samples. The results of these tests are shown on the Borehole Logs (Appendix A) and on the laboratory data reports (Appendix B).

## **5 Subsurface Conditions**

Details of the subsurface conditions are provided on the borehole logs (Appendix A), and on the Borehole Location and Soil Strata drawings (Appendix C).

The generalized subsurface soils at this site consists of topsoil and/or fill overlying sands which are underlain by clays with occasional silt layers.

### **5.1 Topsoil**

50 mm of topsoil was encountered at the surface of Boreholes BH-2, BH-3, and BH-4 beginning at elevations 465.1 m, 465.6 m, and 465.3 m, respectively.

### **5.2 Fill**

Variable fill consisting of brown silty sand to sand and gravel was observed at ground surface at Borehole 1, and below the topsoil at Borehole 3 and 4 and extends to depth of 0.2 m to 0.8 m (El. 463.8 m to 465.3 m).

### **5.3 Sands**

A layer of sand with some silt and a trace of gravel to sand and silt exists below the fills at Boreholes 1, 3 and 4, and below the topsoil at Borehole 2. The sands extend to depths of 0.9 m to 1.4 m (El. 463.2 m to 464.4 m). Based on grain size analyses (3 tests) completed on select samples, this material consists of 0 to 6 % gravel, 54 to 87 % sand and 7 to 46 % silt/clay sized particles. The condition of this material is loose to compact with SPT N values ranging from 5 to 12 blows / 0.3 m. This substratum is highly frost susceptible and capable of forming ice lenses and heaving upon freezing.

A 1.0 m thick lower layer of silty sand with some gravel was encountered within the varved clay substratum in Borehole 3 at a depth of 8.7 m (El. 456.9 m) and extended to a depth of 9.7 m (El. 455.9 m). Based on grain size analysis (1 test) this material consists of 24 % gravel, 43 % sand

and 33 % silt/clay sized particles. The condition of this material is compact with an SPT N value of 13 blows / 0.3 m.

#### **5.4 Silt Layers**

Two silt layers were identified at Borehole 1: the first at a depth of 1.4 m (El. 463.2 m) extending to a depth of 2.2 m (El. 462.4 m), and the second at depth of 5.7 m (El. 458.9 m) extending to a depth of 7.2 m (El. 457.4 m). Atterberg limit testing indicates that this material is non plastic. The condition of this material is loose with SPT N values ranging from 5 to 6 blows / 0.3 m. This substratum is highly frost susceptible and capable of forming ice lenses and heaving upon freezing.

#### **5.5 Clays**

Two distinct clay substrata have been identified. The upper substratum consists of a massive silty clay overlies a lower varved clay substratum.

##### **5.5.1 Silty Clay**

An upper clay substratum of silty clay exists below a silt layer at Borehole 1 and below the upper sands at Boreholes 2 to 4. The silty clay starts at depth of 0.9 to 2.2 m (El. 462.4 m to 464.4 m) and extends to depths of 2.2 m to 7.1 m (El. 458.5 m to 462.9 m). Occasional sand seams within the clay were observed at some locations. The silty clay has a firm to stiff consistency with SPT N values ranging from 4 to 10 blows / 0.3 m. Field vanes varied from 38 to 75 kPa indicating the clay is firm to very stiff; however, field vanes may have intercepted sand seams which can inflate the test results. Two lab vanes carried out on select thin walled tube samples indicate shear strengths of 50 to 55 kPa indicating a firm to stiff consistency. Two Atterberg limit tests completed on selected samples indicate this material is silty clay with the natural moisture content exceeding the liquid limit.

A lower silty, sandy clay stratum with trace gravel was observed below a lower sand layer at Borehole 3 at a depth of 9.7 m (El. 455.9 m) and extended to the limits of the borehole at a depth of 10.3 m (El. 455.3 m). This lower silty clay layer has a firm consistency and has an SPT N value of 5 blows / 0.3 m.

##### **5.5.2 Varved Clay**

A substratum of varved clay was observed below the upper silty clay substratum starting at depth of 2.2 m to 7.1 m (El. 458.5 m to 462.9 m) and extends the limits Boreholes 1, 2, and 4 and to a depth of 8.7 m (El. 456.9 m) at Borehole 3. The varved clay has a layered structure with

alternating layers varying in colour, plasticity, and silt content. The layers generally varied in thickness between 3-4 mm. The varved clay has a very soft to stiff consistency. SPT N values ranged from 1 to 7 blows / 0.3 m. Field vanes varied from 38 to 100+ kPa; however, field vanes may have intercepted silt varves which can inflate the test results.

Atterberg limit tests (two tests) carried out on samples with combined layers indicate that the combined material varies from silty clay to clay of low plasticity. The natural moisture contents are at or exceed the liquid limit.

## 5.6 Refusal

Auger refusal and/or bedrock was not encountered in any of the boreholes.

## 5.7 Groundwater

The groundwater levels were read upon completion of drilling and within temporary standpipe piezometers installed in each borehole. Measured groundwater levels have been provided below. Groundwater levels will vary from season to season and from the effects of heavy precipitation events.

*Table 1: Groundwater levels*

Location	Surface Elevation (m)	Groundwater Upon Completion of Drilling, Depth (m)	Groundwater Measured in Temporary Standpipes on October 6, 2020	
			Depth (m)	Days After Completion
BH-1	99.2	1.5	1.8	1
BH-2	99.7	5.7	2.5	1
BH-3	101.2	6.1	2.1	1
BH-4	99.8	5.8	1.6	1

## 6 Miscellaneous

Laboratory testing was carried out at the TBT Engineering laboratory in Thunder Bay. The drill equipment for this investigation was operated by TBT Engineering Limited. The field operations were supervised by Al Finke. Laboratory testing was supervised by Forch Valela, C.Tech. This report was prepared and reviewed by James Huber, E.I.T., Steven Seller, P.Eng. (TBTE designated principal contact identified for this MTO Foundation Engineering project) and Gordon Maki, P.Eng.



## **7 Limitations**

Conclusions and recommendations presented in this report are based on the information determined at a limited number of test hole locations. Subsurface and groundwater conditions between and beyond these locations may differ from those encountered. Conditions may become apparent during construction that were not detected and could not be anticipated at the time of the site investigation.

The comments given in this report on potential construction problems and possible methods of construction are intended only for the guidance of the designer.

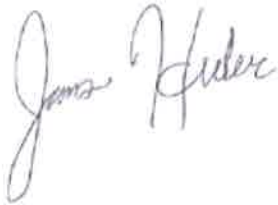
Groundwater levels indicated are based on the information described within the report. The presence of all conditions that could affect the type and scope of dewatering procedures which may be considered cannot readily be determined from boreholes. These include local and seasonal fluctuations of the groundwater level, changes in soil conditions between test locations, thin and/or discontinuous layers of highly permeable soils, etc.

The information contained within this report in no way reflects any environmental aspect of the site or soil.

## 8 Closure

We trust the above addresses your project requirements at this time. Should you have any questions or comments, please do not hesitate to contact us at your convenience.

Yours truly,  
For TBT ENGINEERING



James Huber, EIT.  
Project Manager



Gordon Maki, P.Eng  
Vice President of Engineering



Steven Seller, P.Eng.  
Senior Engineer  
Principal Contact for MTO Foundations

## **APPENDIX A**

### **Borehole Logs**

## EXPLANATION OF TERMS

**N Value:** The Standard Penetration Test (SPT) N value is the number of blows required to cause a standard 51mm O.D. split barrel sampler to penetrate 0.3m into undisturbed ground in a borehole when driven by a hammer with a mass of 63.5 kg, falling freely a distance of 0.76m. For penetrations of less than 0.3m N values are indicated as the number of blows for the penetration achieved. Average N value is denoted thus  $\bar{N}$ .

**Dynamic Cone Penetration Test:** Continuous penetration of a conical steel point (51mm O.D. 60° cone angle) driven by 475 J impact energy on 'A' size drill rods. The resistance to cone penetration is measured as the number of blows for each 0.3m advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency/condition.

**Consistency:** Cohesive soils are described on the basis of their undrained shear strength ( $c_u$ ) as follows:

$C_u$ (kPa)	0-12	12-25	25-50	50-100	100-200	>200
	Very Soft	Soft	Firm	Stiff	Very Stiff	Hard

**Condition:** Cohesionless soils are described on the basis of denseness as indicated by SPT N values as follows:

N (Blows/0.3m)	0-4	4-10	10-30	30-50	>50
	Very Loose	Loose	Compact	Dense	Very Dense

**Minor Soil Components:** Terminology used to represent the amount of minor components based on their percent of the sample by weight as follows:

% by weight	0-10	10-20	20-35	35-50
	Trace	Some	"ey" or "y"	And

## ABBREVIATIONS AND SYMBOLS

### Field Sampling, Insitu Testing, Laboratory Testing

S S	Split Spoon	T P	Thin Wall Piston
A S	Auger	O S	Osterberg
W S	Wash	R C	Rock Core
S T	Slotted Tube	P H	T W Advanced Hydraulically
B S	Block	P M	T W Advanced Manually
C S	Chunk	F S	Foil
V T	Vane Test (kPa)	P P	Pocket Penetrometer (kg/cm <sup>2</sup> )
T W	Thin Wall Shelby Tube		

## EXPLANATION OF TERMS Cont'd.

<u>Stress and Strain</u>			<u>Mechanical Properties of Soil</u>		
$u_w$	kPa	Pore Water Pressure	$m_v$	kPa <sup>-1</sup>	Coefficient of Volume Change
$u$		Pore Pressure Ratio	$C_c$		Compression Index
$\sigma$	kPa	Total Normal Stress	$C_s$		Swelling Index
$\sigma'$	kPa	Effective Normal Stress	$C_a$		Rate of Secondary Consolidation
$\tau$	kPa	Shear Stress	$c_v$	m <sup>2</sup> /s	Coefficient of Consolidation
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal Stress	$H$	m	Drainage Path
$\epsilon$	%	Linear Strain	$T_v$		Time Factor
$\epsilon_1, \epsilon_2, \epsilon_3$	%	Principal Strains	$U$	%	Degree of Consolidation
$E$	MPa	Young's Modulus	$P'_o$	kPa	Effective Overburden Pressure
$G$	kPa	Modulus of Shear Deformation	$P'_c$	kPa	Preconsolidation Pressure
$m$	MPa	Constrained Modulus	$\tau_f$	kPa	Shear Strength
$\mu$		Coefficient of Friction	$c'$	kPa	Effective Cohesion Intercept
			$\phi'$	°	Effective Angle of Internal Friction
			$c_u$	kPa	Undrained Shear Strength
			$s$		Sensitivity

<u>Physical Properties of Soil</u>					
$\rho_s$	kg/m <sup>3</sup>	Density of Solid Particles	$e$	%	Void Ratio
$\gamma_s$	kN/m <sup>3</sup>	Unit Weight of Solid Particles	$n$	%	Porosity
$\rho_w$	kg/m <sup>3</sup>	Density of Water	$w$	%	Water Content
$\gamma_w$	kN/m <sup>3</sup>	Unit Weight of Water	$s_r$	%	Degree of Saturation
$\rho$	kg/m <sup>3</sup>	Density of Soil	$w_L$	%	Liquid Limit
$\gamma$	kN/m <sup>3</sup>	Unit Weight of Soil	$w_P$	%	Plastic Limit
$\rho_d$	kg/m <sup>3</sup>	Density of Dry Soil	$w_S$	%	Shrinkage Limit
$\gamma_d$	kN/m <sup>3</sup>	Unit Weight of Dry Soil	$I_P$	%	Plasticity Index = $w_L - w_P$
$\rho_{sat}$	kg/m <sup>3</sup>	Density of Saturated Soil	$I_L$		Liquidity Index = $\frac{w - w_P}{I_P}$
$\gamma_{sat}$	kN/m <sup>3</sup>	Unit Weight of Saturated Soil	$I_C$		Consistency Index = $\frac{w_L - w}{I_P}$
$\rho'$	kg/m <sup>3</sup>	Density of Submerged Soil	$e_{max}$	%	Void Ratio in Loosest State
$\gamma'$	kN/m <sup>3</sup>	Unit Weight of Submerged Soil			

$e_{min}$	%	Void Ratio in Densest State
$I_D$		Density Index = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$D$	mm	Grain Diameter
$D_n$	mm	n Percent Diameter
$C_U$		Uniformity Coefficient
$h$	m	Hydraulic Head or Potential
$q$	m <sup>3</sup> /s	Rate of Discharge
$v$	m/s	Discharge Velocity
$i$		Hydraulic Gradient
$k$	m/s	Hydraulic Conductivity
$j$	kN/m <sup>3</sup>	Seepage Force


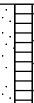


























# RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 6019-E-0042 LOCATION N:5418221.095; E:302672.813 MTM Zone:15 ORIGINATED BY AF  
 DIST NWR HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TG  
 DATUM Geodetic DATE 2020.10.03 LATITUDE 48.9022856 LONGITUDE -90.0290143 CHECKED BY SS




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 (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE							● QUICK TRIAXIAL	× LAB VANE	
464.6 0.0	FILL - SAND & GRAVEL													Water level @ 1.5 m on completion. Cave @ 6.5 m.				
463.8 0.8	- SAND - Silty, some gravel, brown		1	AS											3 81 16 Water level @ 1.8 m on October 06, 2020.			
463.2 1.4	SAND - some silt, trace gravel, grey, loose		2	AS										Non Plastic.				
462.4 2.2	SILT - layered, trace sand, grey, loose		3	SS	5										Standpipe installed to 2.9 m.			
461.6 3.0	CLAY - Silty, grey, stiff		4	SS	6									No Recover on TW. Took SS.				
460.8 3.8	CLAY - varved, grey/brown, firm to stiff		5	SS	9										Non Plastic.			
459.9 4.7	CLAY - varved, grey/brown, firm to stiff		6	SS	6													
459.0 5.6	CLAY - varved, grey/brown, firm to stiff		7	SS														
458.1 6.5	CLAY - varved, grey/brown, firm to stiff		8	SS														
457.2 7.4	CLAY - varved, grey/brown, firm to stiff		9	SS														
456.3 8.3	CLAY - varved, grey/brown, firm to stiff		10	SS														
455.4 9.2	CLAY - varved, grey/brown, firm to stiff																	
454.6 10.0	End of Borehole @ 10.0 m.																	

# RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 6019-E-0042 LOCATION N:5418210.38; E:302653.959 MTM Zone:15 ORIGINATED BY AF  
 DIST NWR HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TG  
 DATUM Geodetic DATE 2020.10.05 LATITUDE 48.9022035 LONGITUDE -90.0293194 CHECKED BY SS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ  kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub>	W	W <sub>L</sub>			WATER CONTENT (%)			
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE										
465.1								20	40	60	80	100						
465.1	TOPSOIL - 50 mm, Sandy		1	AS			465							○				Water level @ 5.7 m on completion. Water level @ 2.5 m on October 06, 2020. Cave @ 5.9 m.  PP = 2.5
	SAND - Silty, brown, compact		2	SS	12		464								○			
463.7	CLAY - Silty, grey, firm		3	SS	6	463								○				
462.9	CLAY - varved, light/dark grey seams 3 - 4 mm, soft to stiff		4	TW		462								⊕				
		5	SS	5	461									○				
		6	SS	2	460									⊕	○			
		7	SS	4	459									○				
458.1	End of Borehole @ 7.0 m.																	
7.0																		

+ 3, X 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

PP=Pocket Penetrometer (Kg/cm<sup>2</sup>)

# RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. 6019-E-0042 LOCATION N:5418229.012; E:302635.055 MTM Zone:15 ORIGINATED BY AF  
 DIST NWR HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TG  
 DATUM Geodetic DATE 2020.10.05 LATITUDE 48.9023436 LONGITUDE -90.0295158 CHECKED BY SS

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE								
								● QUICK TRIAXIAL	× LAB VANE								
							20	40	60	80	100	WATER CONTENT (%)					
465.6																	GR SA SI CL
465.3	TOPSOIL - 50 mm	⊗															Water level @ 6.1 m on completion. Cave @ 6.5 m.
0.3	FILL - SAND - trace silt, brown																0 54 46
	SAND & SILT - brown, loose		1	AS													Water level @ 2.1 m on October 06, 2020.
464.2																	
1.4	CLAY - Silty, grey, firm to stiff		2	SS	9												
			3	SS	7												
			4	SS	10												
			5	TW													Standpipe installed to 2.9 m. PP = 3.5

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

PP=Pocket Penetrometer (Kg/cm<sup>2</sup>)







ONTARIO MTO MOD 20-108-6 MTO UPSALA.GPJ ONTARIO MTO.GDT 10-28-20

# RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 6019-E-0042 LOCATION N:5418251.421; E:302642.044 MTM Zone:15 ORIGINATED BY AF  
 DIST NWR HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY TG  
 DATUM Geodetic DATE 2020.10.05 LATITUDE 48.9025474 LONGITUDE -90.0293946 CHECKED BY SS

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 (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)						
								○ UNCONFINED	+ FIELD VANE							● QUICK TRIAXIAL	× LAB VANE				
465.3	TOPSOIL - 50 mm		1	AS			20	40	60	80	100	○	20	40	60	6 87 7					
465.0	FILL - SAND & GRAVEL		2	AS									○					Water level @ 5.8 m on completion. Water level @ 1.6 m on October 06, 2020. Cave @ 6.0 m.			
465.1	SAND - trace silt, trace gravel, brown															PP = 3.75					
464.4	CLAY - Silty, grey, firm to stiff		3	SS	8								○				Standpipe installed to 2.9 m.				
0.9			4	TW														No Recovery, took SS.			
					5		SS	10													
462.4	CLAY - varved, grey/brown, soft to firm		6	SS	7								○								
2.9																					
			7	TW									○								

+ 3, X 3: Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

PP=Pocket Penetrometer (Kg/cm<sup>2</sup>)

## **APPENDIX B**

### **Laboratory Test Data**



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT		SAND			GRAVEL	
		Fine	Medium	Coarse	Fine	Coarse

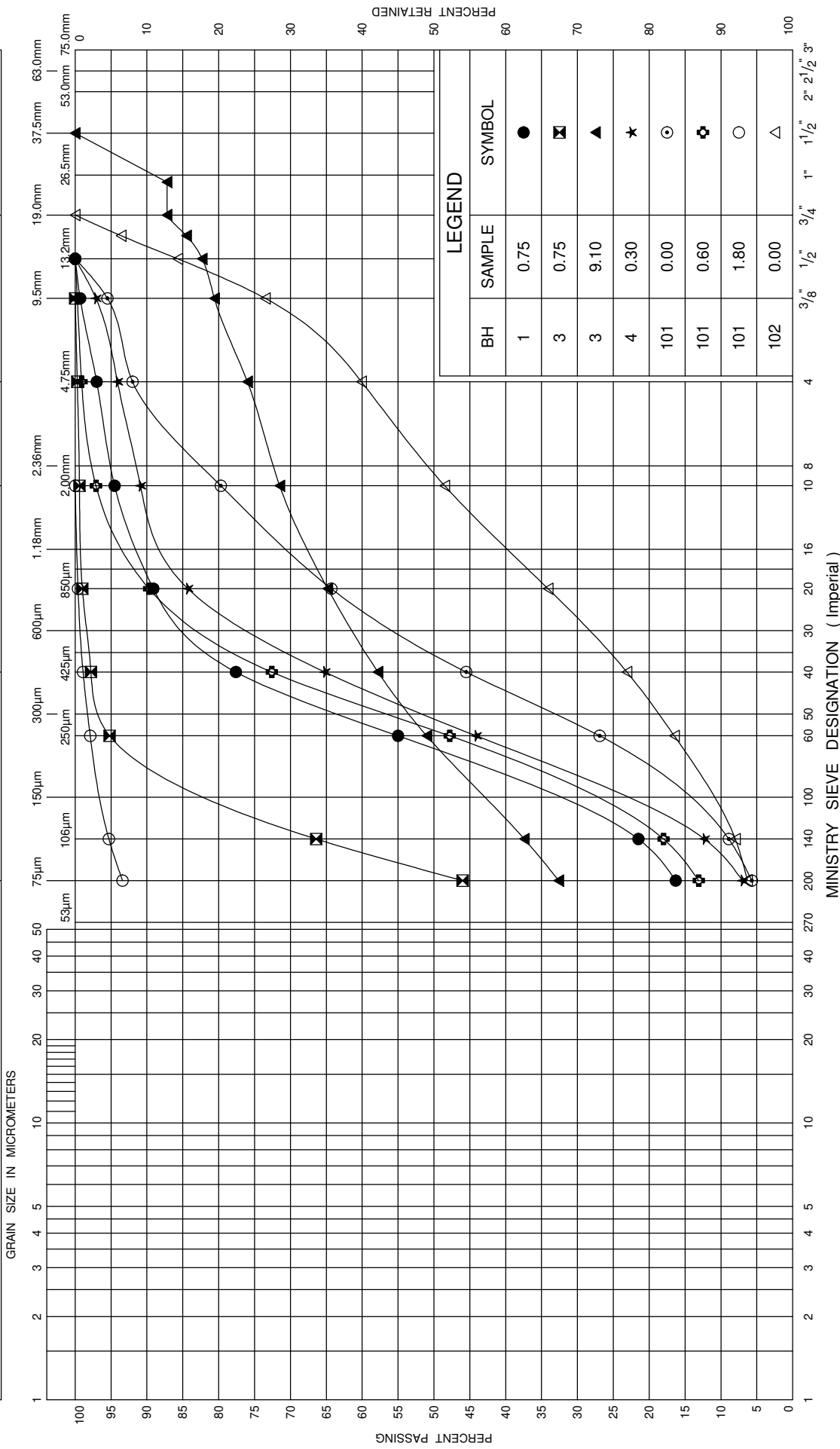


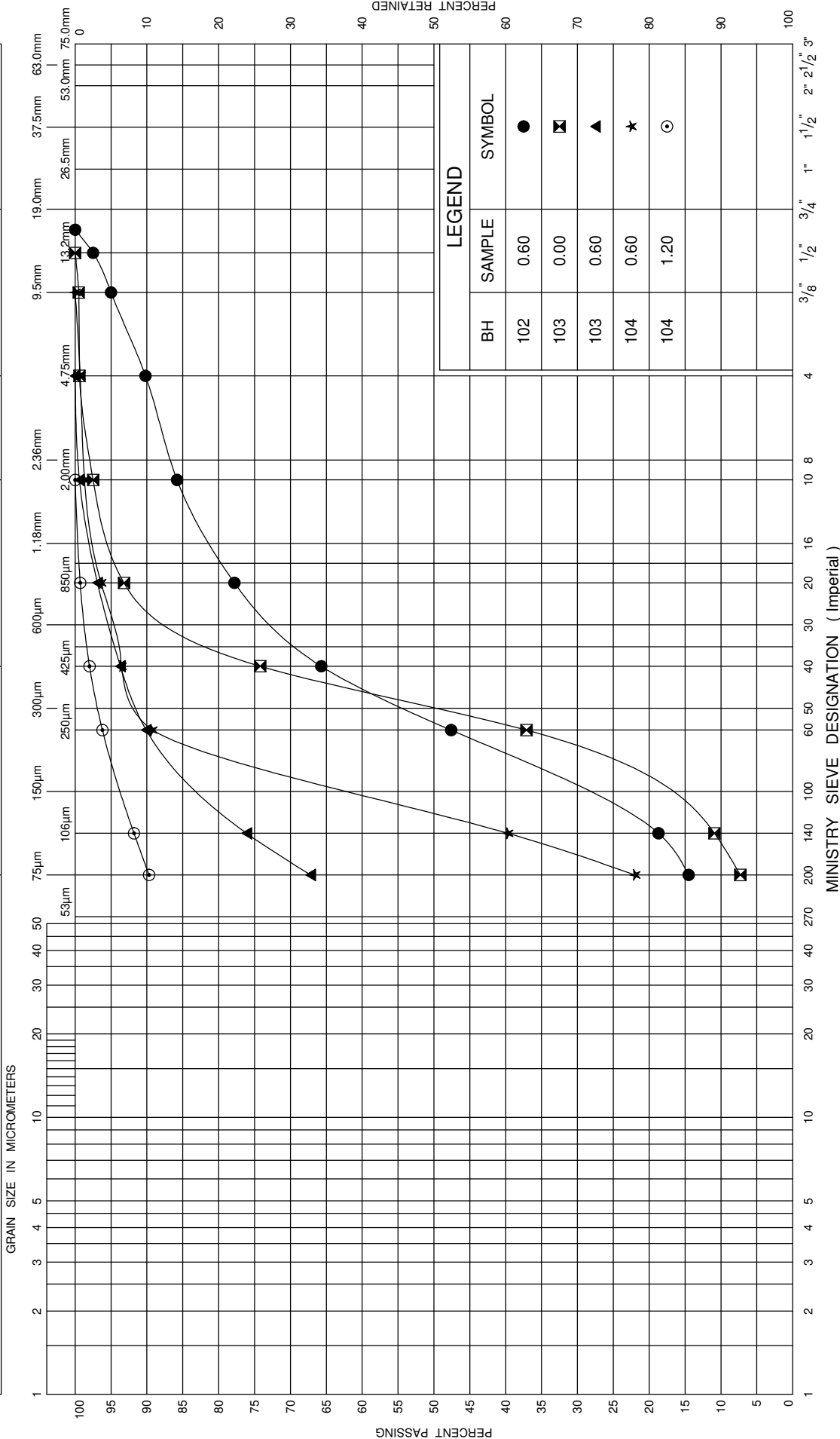
FIG No 1  
GRAIN SIZE DISTRIBUTION  
TILLS

W P 6019-E-0042

Argon Park

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT		SAND			GRAVEL	
		Fine	Medium	Coarse	Fine	Coarse



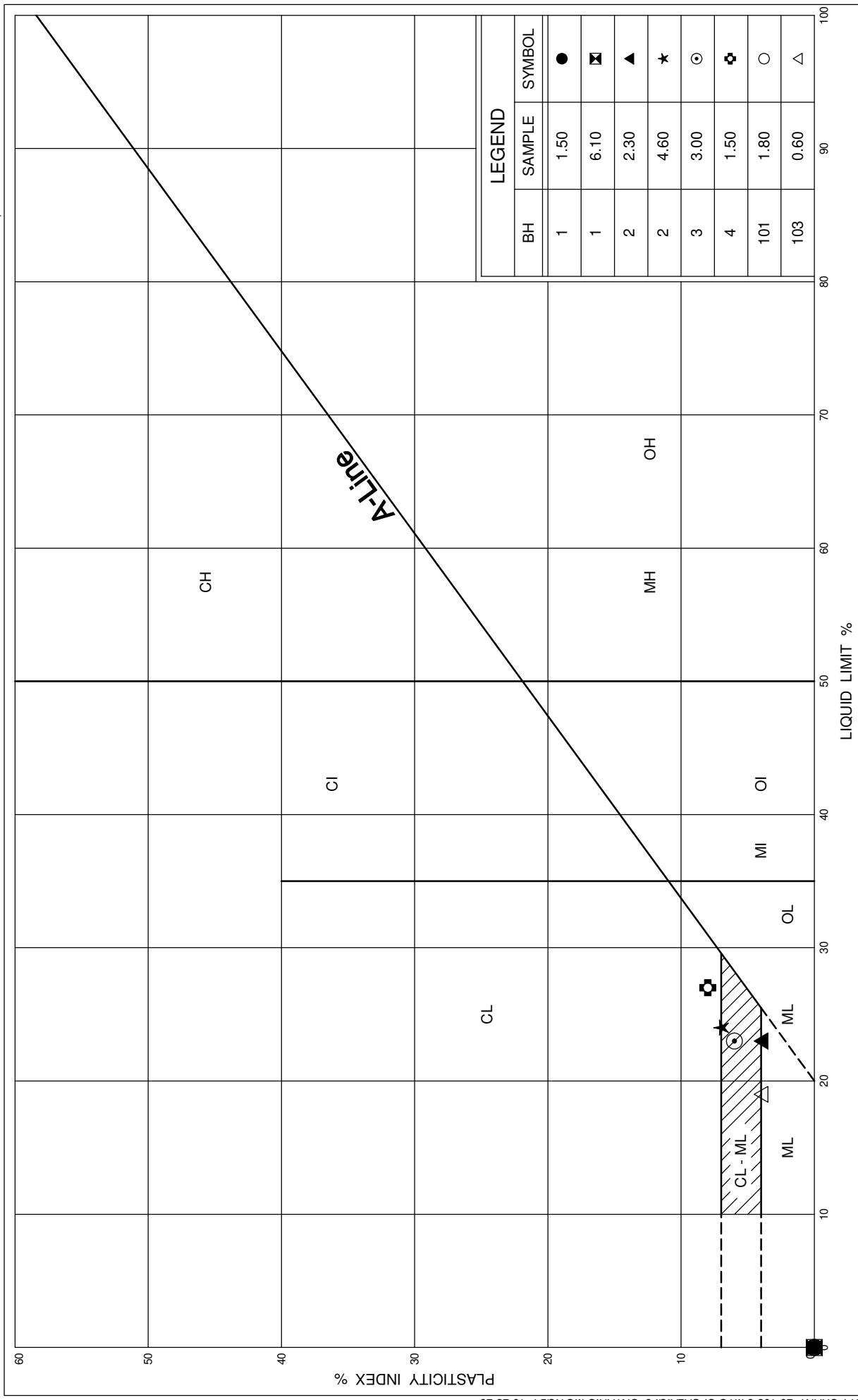
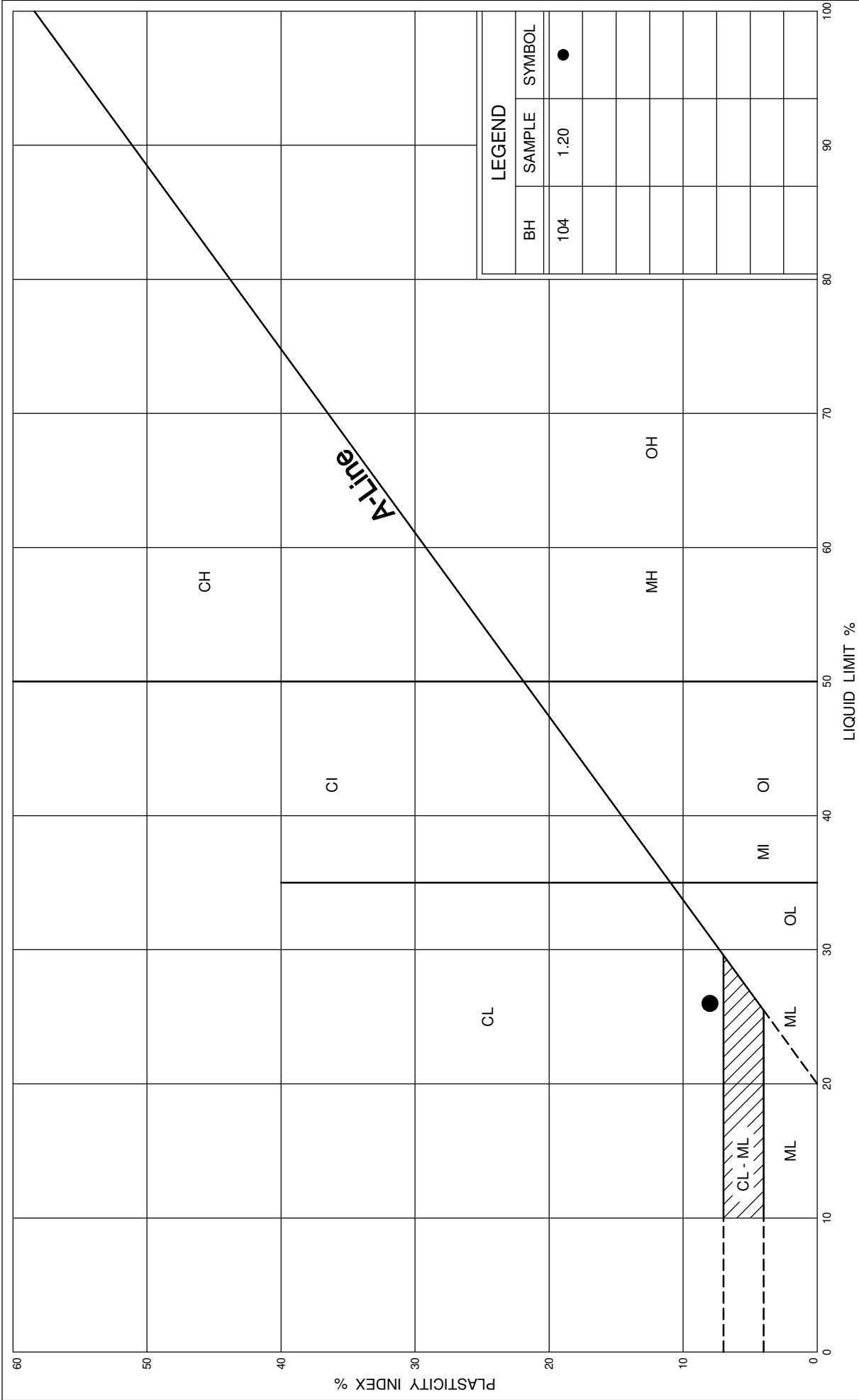


FIG No 3  
PLASTICITY CHART

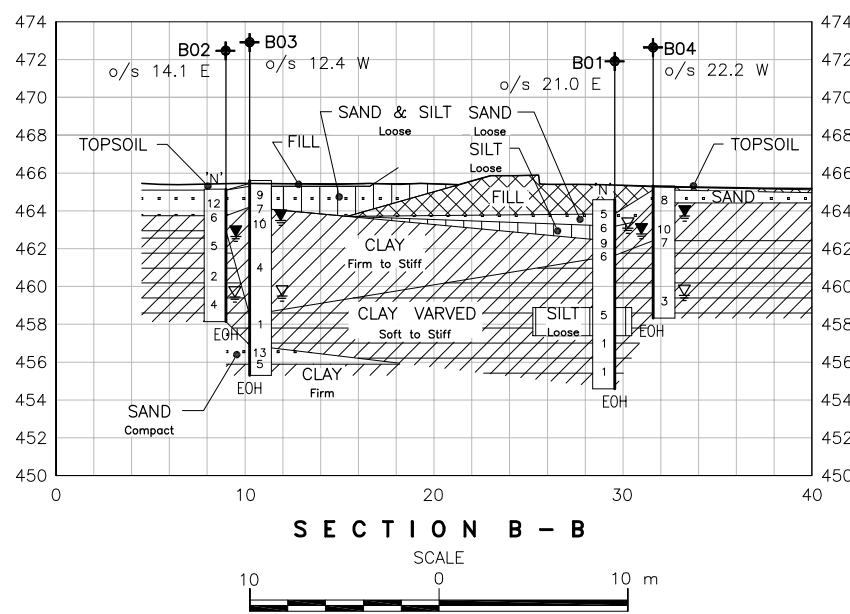
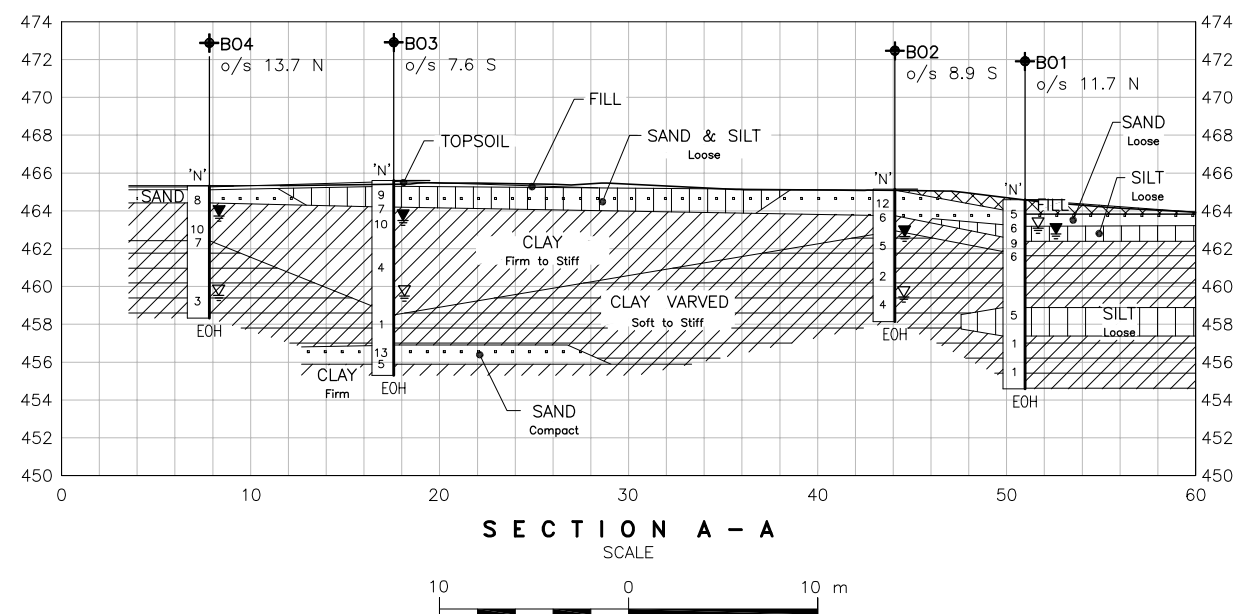
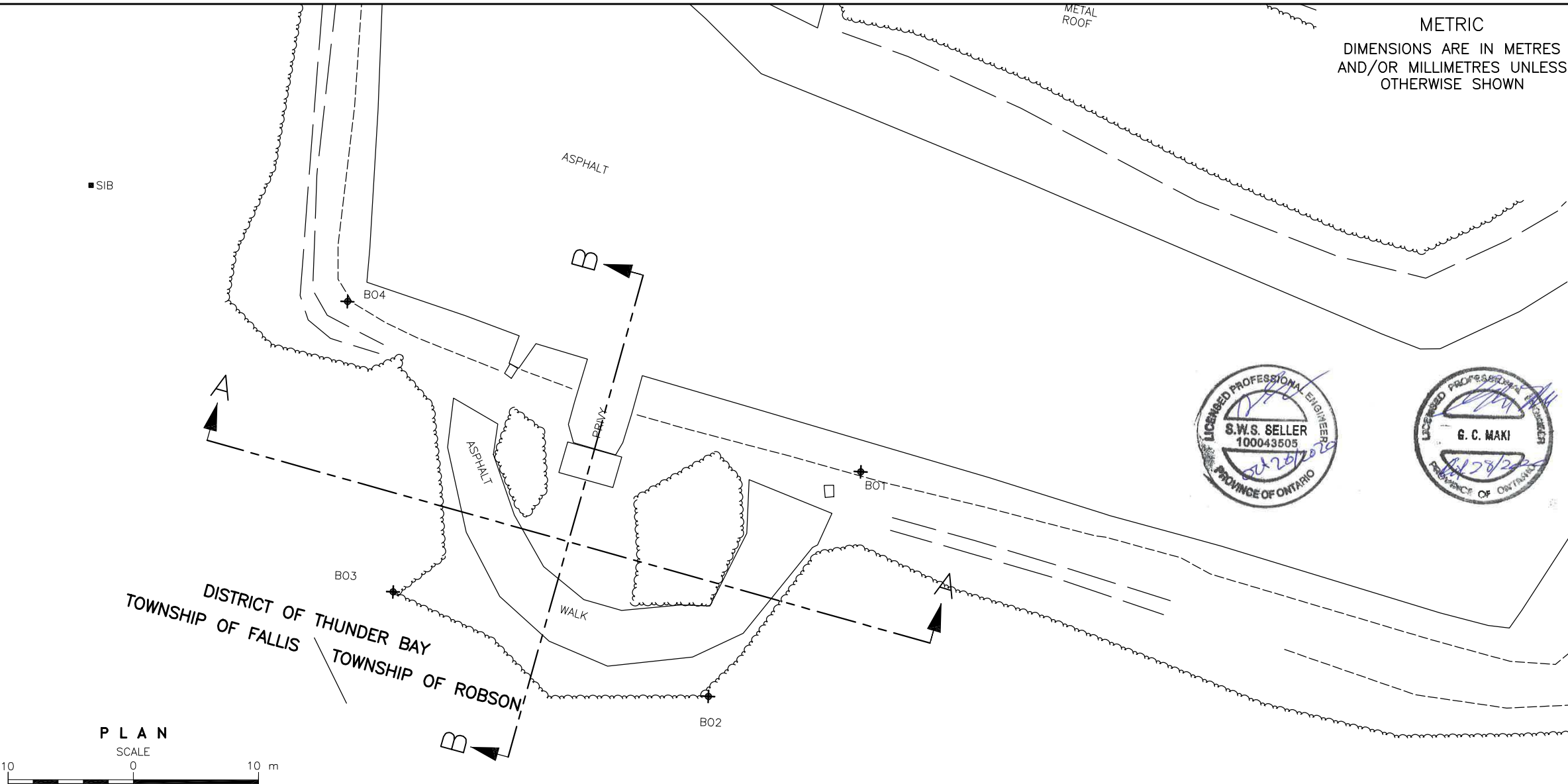


LEGEND		
BH	SAMPLE	SYMBOL
104	1.20	●

**APPENDIX C**  
**Borehole Locations and Soil Strata Drawing**



Oct 28, 2020 - 2:16pm  
Drawing Name: C:\Users\blunden\Desktop\Argon Park Rest Area Strat.dwg  
Login name: blunden  
PR-D-707 88-05  
MINISTRY OF TRANSPORTATION, ONTARIO



—NOTE—  
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

GEOCRES No. XXX-XXX

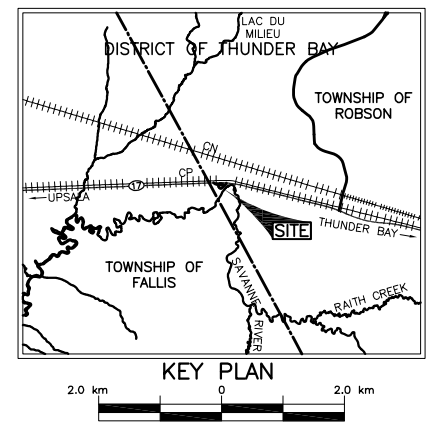
CONT No. 201x-xx

WP No. 6019-E-0042

SHEET

Ministry of Transportation  
Northwestern Region

TBT ENGINEERING  
CONSULTING GROUP



LEGEND				
+	Borehole			
'N'	Std Pen Test (Blows/0.3m)			
▽	Water Level			
▽	Water Level on Completion			
EOH	End of Hole			

No	ELEVATION	CO-ORDINATES (MTM)	
		NORTH	EAST
B01	464.6	15 5 418 221	302 673
B02	465.1	15 5 418 210	302 654
B03	465.6	15 5 418 229	302 635
B04	465.3	15 5 418 251	302 642

SOIL STRATA SYMBOLS			
	TOPSOIL/ ORGANICS		SAND & SILT
	FILL		CLAY
	SAND		CLAY - VARVED
	SILT		

REVISIONS		DATE		BY		ISSUED FOR REVIEW		DESCRIPTION	
28/10/20									
DESIGN	CHK	CODE	XXXXX-XX	LOAD	XX-XX-XX	DATE	28/10/20		
DRAWN	TB	CHK	SS	SITE	XXX-XXX	DWG			1