



**PART A - FOUNDATION INVESTIGATION REPORT**

**for**

**HIGHWAY 400 UPGRADING - LATERAL SEWERS  
NORTHERN PART APPROXIMATELY FROM MAPLEVIEW DRIVE TO  
ESSA ROAD**

**RETAINER ASSIGNMENT – TASK NO. 2013-E-0039-010**

**WP 2184-10-00**

**TOWN OF INNISFIL AND CITY OF BARRIE, SIMCOE COUNTY,  
ONTARIO**

**PREPARED FOR MINISTRY OF TRANSPORTATION OF ONTARIO**

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PML Ref.: 15TF020-2  
Index No.: 028FIR  
GEOCRES No.: 31D-648  
June 14, 2016



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**PART A**  
**FOUNDATION INVESTIGATION REPORT**

For  
Highway 400 Upgrading – Lateral Storm Sewers  
Northern Part from Maplevue Drive to Essa Road  
Retainer Assignment – Task No. 2013-E-0039-010, WP2184-10-00  
Town of Innisfil and City of Barrie, Simcoe County, Ontario

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**1. INTRODUCTION**

This report presents the factual findings obtained from the geotechnical investigation carried out at the above mentioned site along the median of Highway 400 from Maplevue Drive to Essa Road, for the installation of lateral storm sewers, replacement of existing sewer line along the median, and inspection holes (manhole). The field work was carried out between February 23 and 27, 2016. The purpose of this investigation was to explore the subsurface conditions at this site to provide anticipated subsurface conditions influencing the design and installation of the lateral storm sewer lines.

Peto MacCallum Ltd. (PML) carried out the investigation and prepared this report for the Ministry of Transportation of Ontario (MTO) as part of the Retainer Assignment task No. 2013-E-0039-010.

The assignment includes preparation of five (5) geotechnical investigation reports for the following locations:

<b>PML REF. No.</b>	<b>FIR AND FIDR DESCRIPTION</b>
15TF020-1	Highway 400 Upgrading Median Sewers Northern Part from Maplevue Drive to Essa Road
15TF020-2	Highway 400 Upgrading Lateral Sewers Northern Part from Maplevue Drive to Essa Road
15TF020-3	Highway 400 Upgrading Median Sewers Southern Part from Innisfil Beach Road to Maplevue Drive
15TF020-4	Highway 400 Upgrading Lateral Sewers Southern Part from Innisfil Beach Road to Maplevue Drive
15TF020-5	Highway 400 Culvert Headwalls for Culvert 96 and Inlet Headwall for Culvert 107

This report provides subsurface conditions for the northern part of the assignment covering from Maplevue Drive to Essa Road (Sta. 26 + 297 to Sta. 28 + 905). The southern part of the assignment



covers from Innisfil Beach Road to Maplevue Drive and the reports for southern part are provided under a separate cover.

It should be noted that the window for carrying out the field work for this investigation was limited. As a result, boreholes were strategically located to obtain an approximate model of subsurface conditions covering the project area. A limited number of boreholes were advanced due to constraints for carrying out the field work. The Contractor shall be advised to carry out further field investigation, such as to excavate test pits, to confirm the depth of cover or backfill, especially in the area where there are existing storm sewer lines, which are proposed to be replaced.

## **2. SITE DESCRIPTION**

The topography of the project area is generally flat to gently undulating, except for the highway embankments. The interchange of Highway 400 and Maplevue Drive is in a commercial and industrial area and was modified to the present condition by cutting approximately 6.0 m below the present grade of highway 400. Several commercial developments are also located north of Maplevue Drive along Highway 400 and residential area are located on the north side of Essa Road. The site is generally lined by farmland and heavily wooded area along Highway 400.

## **3. FIELD INVESTIGATION PROCEDURES**

A Key Plan of the project site is provided on Drawing 400WM-A. The investigation included advancing ten (10) boreholes numbered 11 to 20 to maximum depths ranging from 5.0 m to 5.2 m. Borehole locations are shown on the attached Drawing Nos. 17/25 to 25/25.

The underground services at the borehole locations were cleared by the respective utility companies and then the locations were established in the field by portable GPS device. Boreholes were strategically located to provide a minimum safe distance from the existing sewer pipes. PML carried out the survey of the borehole locations and elevations, and provided the co-ordinates for locations



in MTM NAD 83 northing and easting. All elevations reported in this report are referred to Geodetic and expressed in metres.

All of the boreholes were advanced from the shoulder adjoining the median of the Highway 400 NBL, with the exception of Borehole 13 that was drilled on the S-E/W ramp at Maplevue Drive. Boreholes were advanced using continuous flight solid stem augers, powered by a track-mounted CME-75 drill rig. The drill rig used for drilling was owned and operated by Tri-Phase of Mississauga, Ontario. Tri-Phase is a specialist drilling contractor, was working under the full-time supervision of a member of PML's engineering staff.

Representative soil samples were recovered from the boreholes at 0.75 m intervals using a conventional 51 mm O.D split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. Standard penetration tests were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata.

The groundwater conditions at the borehole locations were observed during drilling by visual examination of the soil samples, sampler and drill rods as the samples were retrieved. In addition, water level measurements were taken in open boreholes. A total of four (4) piezometer were installed in Boreholes 11, 15, 17, and 20 for continuous monitoring of groundwater level. The installation details of the piezometers are provided on the Record of Borehole Sheets. Upon completion of drilling, the boreholes were backfilled with bentonite/cement grout in accordance with the MTO guidelines and MOE Regulation 903 for borehole abandonment procedures. The piezometers were not decommissioned and are still in place for monitoring of groundwater during construction.

The recovered soil samples were returned to our laboratory for detailed visual examination, and index tests.



#### **4. LABORATORY TEST PROCEDURES**

Laboratory tests on representative SPT samples recovered during the field work were carried out by the laboratory owned by PML, located in Toronto. The laboratory testing program included the following:

- Natural moisture content determinations (63)
- Grain size distribution analyses (17)
- Atterberg Limits Tests (4)

The laboratory tests to determine the index properties were performed in accordance with the MTO test procedures, which follow American Society for Testing Materials (ASTM) test procedures, with the exception of hydrometer test (LS-702). The results of the grain size distribution analyses and Atterberg limits tests are presented in Figures SR-GS-1 to SR-GS-3 and SR-PC-1, respectively. All of the test results are summarized on the attached Record of Borehole sheets.

#### **5. SITE GEOLOGY AND SUBSURFACE CONDITIONS**

##### **5.1 Site Geology**

The project site is located within the Simcoe Lowlands Physiographic Region of Southern Ontario. The physiographic region of Simcoe Lowlands is bordered by Georgian Bay and Lake Simcoe. This region falls into two major divisions separated by the uplands of Simcoe County. The plains to the west of Simcoe County are draining into Nottawasaga Bay by way of the Nottawasaga River and this area is called “Nottawasaga Basin”. The low lying area to the east of Simcoe County is referred to as the “Lake Simcoe” basin.

The Nottawasaga basin and Lake Simcoe basin are connected at Barrie by a flat-floored valley. Both of these low lands and transverse valleys were flooded by Lake Algonquin and are bordered by shore cliffs, beaches and boulder terraces. Thus these basins are floored by sand, silt and clay. The surficial soils of these sections of the Simcoe lowlands consist primarily of sand although silt, clay or peat may be found in low-lying areas.



## **5.2 Subsurface Conditions**

In general, the subsoil conditions consist of 400 mm to 800 mm pavement structure consisting of asphalt ranging in thickness from 100 mm to 200 mm, followed by 300 mm to 670 mm of sand with varying proportions of gravel (granular base). Pavement structure is underlain by 400 mm to as thick as 3.2 m sand to silty sand fill. The granular fill is underlain by sand to sandy silt with varying proportions of gravel and silt. For classification purposes, the soils encountered at this site can be divided into four distinct zones.

- a) Pavement Structure
- b) Sand to Silty Sand, Trace Gravel, Trace Clay (Fill)
- c) Silty Sand to Sandy Silt, Trace Gravel, Trace Clay
- d) Gravelly Sand, Trace Silt and Clay

The subsurface conditions encountered during the course of the investigation, together with the field and laboratory test results are shown on the attached Record of Borehole Sheets. The borehole locations and stratigraphic profile sections are shown on Drawings 17/25 to 25/25. The boundaries between soil strata have been established at the borehole locations only. Between and beyond the boreholes, the boundaries are assumed and may vary. Description of the soil strata encountered are summarised below.

### **5.2.2 Pavement Structure**

Asphalt layer ranging in thickness from 100 mm to 200 mm was encountered in all the boreholes. Pavement structure consists of compact to very dense sand with varying proportions of gravel. This granular base layer ranges in thickness from 300 mm to 670 mm and extends to a depth of 300 mm to 800 mm (El. 297.1 to El. 258.3). The moisture content of the granular base layer ranged from 2% to 8%.

### **5.2.3 Sand to Silty Sand, Trace Gravel, Trace Clay (Fill)**

The pavement structure is immediately followed by sand to silty sand fill layer in all of the boreholes located on the median, with the exception of SR-BH-16. This fill layer ranges in thickness



from 400 mm to as high as 3.6 m and extends to a depth ranging from 900 mm to 4.1 m (El. 294.7 to El. 256.1) below the asphalt surface. The SPT values in this fill layer varies widely and range from as low as 2 blows/300 mm to 31 blows/300 mm, indicating very loose to dense state of compaction.

The moisture content of this fill material varies from 1% to as high as 17%. The results of the grain size distribution analyses of four representative samples from this fill layer are shown on Figure SR-GS-1. The test results reveal that the sand to silty sand fill consists of 1% to 5% gravel, 61% to 77% sand, 20% to 25% silt and 2% to 10% clay.

This fill layer was also found in Borehole SR-BH-13 that was located on the S-E/W ramp at Maplevue Drive. The thickness of fill in SR-BH-13 was about 3.2 m and extend to a maximum depth of 4.0 m (El. 286.1). The SPT values in this fill vary from 5 blows/300 mm to 31 blows/300 mm, indicating loose to dense state of compaction. The moisture content of the samples from this fill varies 2% to 18%. The high moisture content value of 18% corresponds to the sample with a blow count of 5/300 mm.

#### 5.2.4 Sand to Silty Sand, Trace Gravel, Trace Clay

The embankment fill in all of the boreholes, with the exception of SR-BH-13 and SR-BH-15, is underlain by sand to silty sand deposit at a depth ranging from 0.8 m to 4.1 m (El. 256.1 to El. 294.7) below the asphalt surface. In SR-BH-13 and 15, the embankment fill is underlain by gravelly sand. This sandy deposit extends to the maximum depth of investigation of 5.2 m (El. 253.9). Occasional cobble layers were encountered in SR-BH-12 and SR-BH-15, which is reflected by the high SPT values. In general, SPT values in this deposit range from 14 blows/300 mm to as high as 56 blows/300 mm, indicating compact to very dense state of compaction.

Moisture content of this deposit, with the exception of Sample SS6 from SR-BH-11 (Silt) varies from 3% to 19%. The sand and silt contents of this deposit vary widely. The results of the sieve analysis test performed on ten representative samples from this deposit are provided on Figure SR-GS-2. The test results indicate that the sand to silty sand deposit consists of 0% to 12% gravel, 54% to 90% sand, 9% to 36% silt and 1% to 13% clay. However, the Sample SS6 from SR-BH-11 consisted of 9% sand, 83% silt and 8 % clay.



### 5.2.5 Gravelly Sand, Trace to Some Silt, Trace Clay

The sandy fill in Boreholes SR-BH-13 and SR-BH-15 are immediately followed by gravelly sand layer, which extends to the maximum depth of investigation of 5.2 m (El. 283.0). The SPT values in this layer vary from 26 blows/300 mm to as high as 56 blows/300 mm, indicating compact to very dense state of compaction.

The moisture content of the gravelly sand deposit varied from 2 to 8%. Grain size distribution analysis was performed on three representative samples from this layer and the results are providing on Figure SR-GS-3. The test results indicate that this layer consists of 23% to 33% gravel, 51% to 59% sand, 6% to 17% silt, and 2% to 6% clay.

## 5.3 Groundwater

In BH-12, groundwater was observed at a depth of 1.7 m (El. 293.1) while advancing the borehole. Upon completion of drilling, groundwater level was measured at a depth of 2.4 m (El. 292.4), which indicates the existence of a perched groundwater. Groundwater was not observed in any of the boreholes other than BH-12 during or upon completion of drilling.

The groundwater levels were monitored from February 24 to April 19, 2016. The groundwater levels measured in the piezometers installed in Boreholes BH-11, BH-15, BH-17 and BH-20 are provided in the Table 5.3.

**Table 5.3 – Piezometer Water Level**

Borehole No.	February 24 – 27, 2016		April 19, 2016	
	Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
11	Dry	Dry	3.6	294.1
15	Dry	Dry	3.7	284.5
17	Dry	Dry	3.2	267.3
20	Dry	Dry	Dry	Dry

The groundwater level may be expected to fluctuate due to the influence of precipitation and seasonal changes.



## 6. CLOSURE

Mr. D. Woodcock and Mr. S. Aziz carried out the field investigation for this study under the supervision of Mr. M. Khorsand, BSc, E.I.T., and Mr. C. M. P. Nascimento, P. Eng., Project Manager. Tri-Phase Drilling Inc. supplied the drill rig for the subsurface exploration. The laboratory testing of the selected samples was carried out in the PML laboratory in Toronto.

This report was prepared by Mr. M. Khorsand, BSc, E.I.T., and reviewed by Mr. M. Vasavithasan, M.Sc.Eng., P.Eng.. Senior Engineer, Geotechnical Services, Mr. C. M. P. Nascimento, P. Eng., MTO Designated Principal Contact, conducted an independent review of the report.

Yours very truly

Peto MacCallum Ltd.

A handwritten signature in blue ink, appearing to read "Mansoor", is written over a circular stamp.

Mansoor Khorsand, BSc, EIT  
Project Supervisor, Geotechnical Services

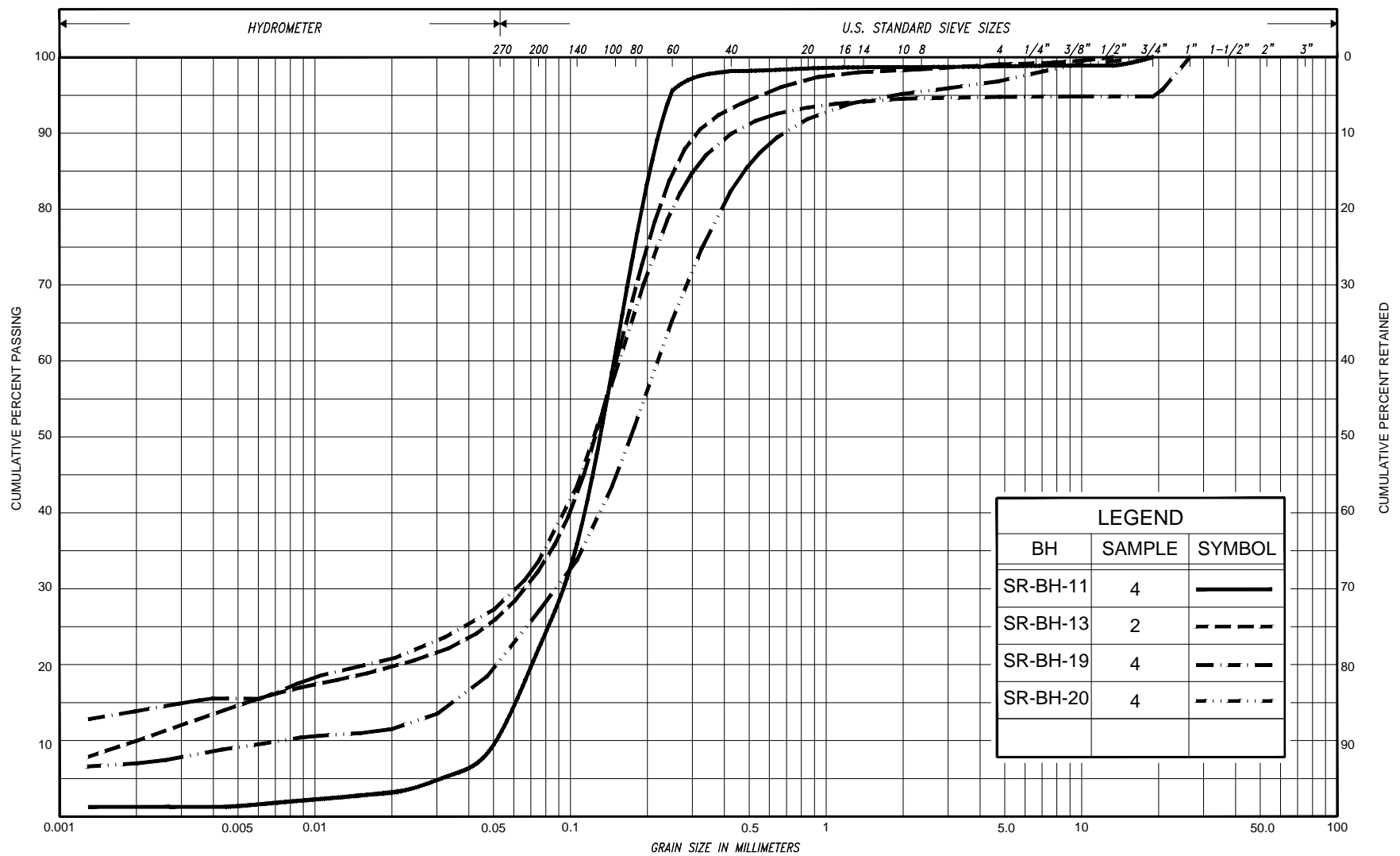


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Senior Engineer, Geotechnical Services



Carlos M.P. Nascimento, P.Eng.  
Project Manager and  
MTO Designated Principal Contact

MKH/MV/CN:jk



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL				COB BLES	UNIFIED		
					SAND													
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL				COBBLES	M.I.T.
	SILT																	
CLAY		SILT			V. FINE	FINE		MED.	COARSE		GRAVEL							U.S. BUREAU
					SAND													



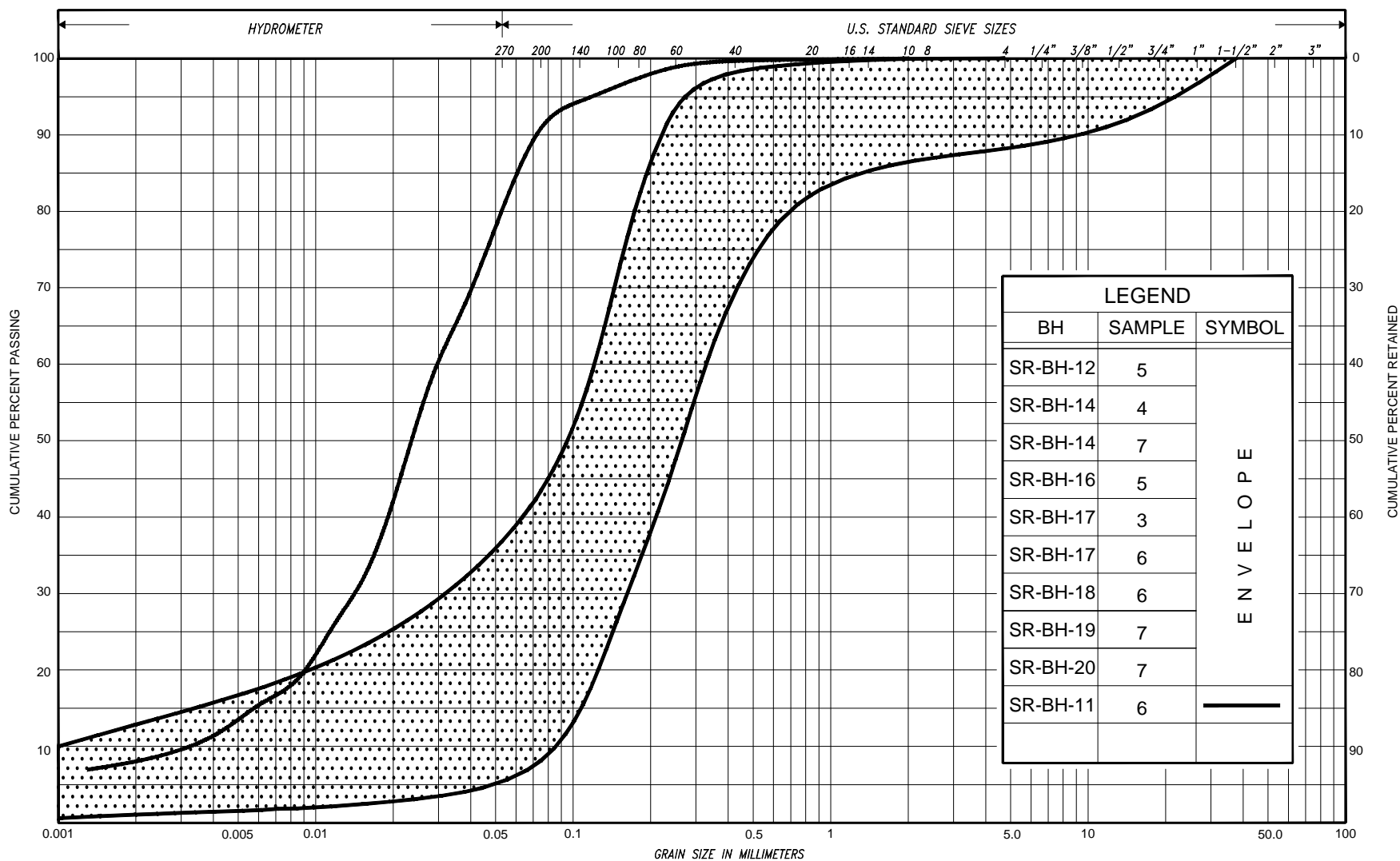
## GRAIN SIZE DISTRIBUTION

SAND to SILTY SAND, trace clay, trace to some gravel (FILL)

FIG No. SR-GS-1

HWY: 400

Project No. 15TF020



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE		FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
						SAND											



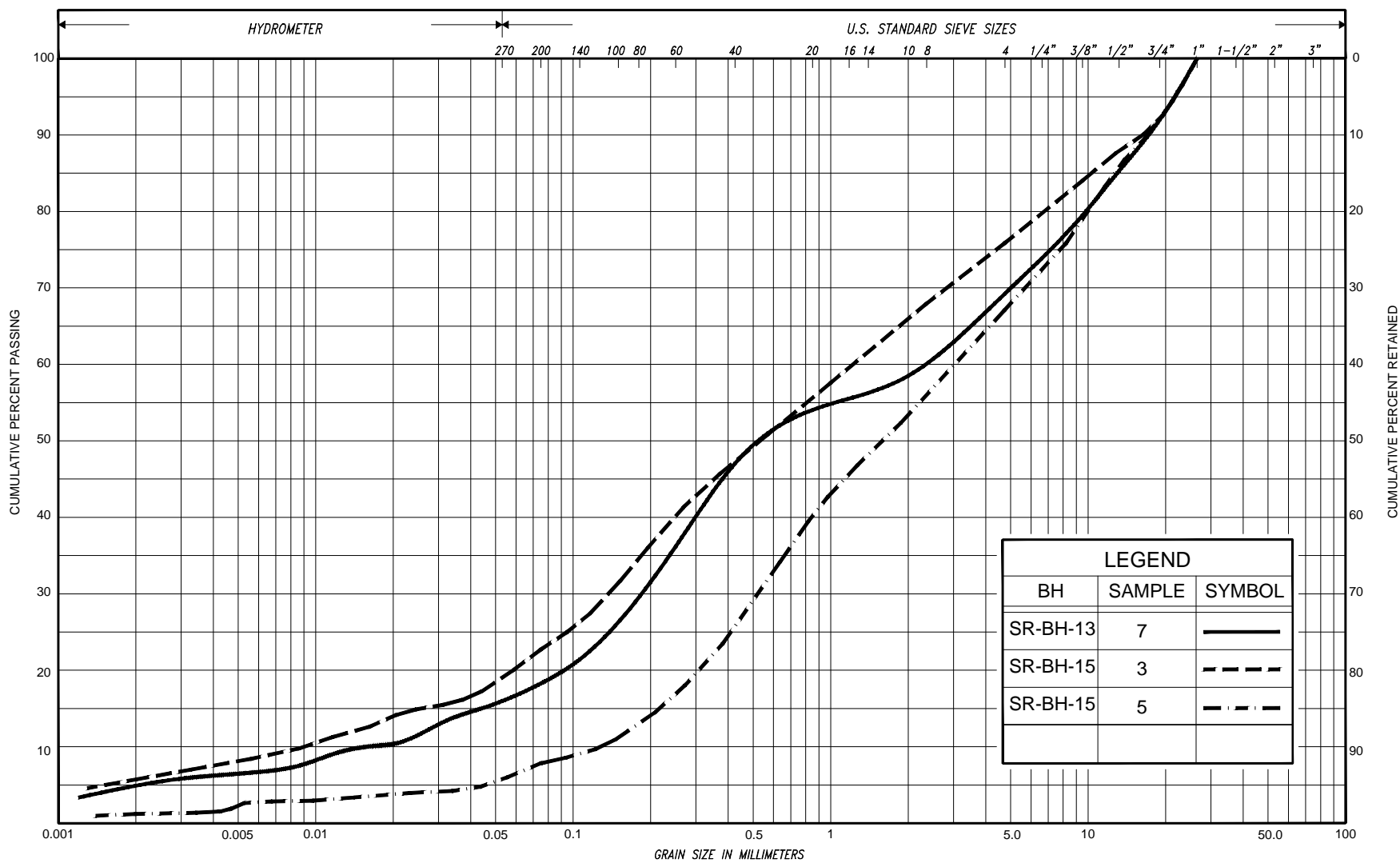
## GRAIN SIZE DISTRIBUTION

SAND to SILTY SAND to SANDY SILT, trace to some clay, trace gravel

FIG No. SR-GS-2

HWY: 400

G.W.P. No. 15TF020



SILT & CLAY					FINE		MEDIUM		COARSE		GRAVEL			COBBLES	UNIFIED		
					SAND												
CLAY	FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
	SILT																
CLAY			SILT			V. FINE		FINE	MED.	COARSE		GRAVEL					U.S. BUREAU
						SAND											



## GRAIN SIZE DISTRIBUTION

GRAVELLY SAND, trace to some silt, trace clay

FIG No. SR-GS-3

HWY: 400

Project No. 15TF020

## EXPLANATION OF TERMS USED IN REPORT

**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 63.5kg, 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 OR DENSENESS.

**COMPOSITION:** SECONDARY SOIL COMPONENTS ARE DESCRIBED ON THE BASIS OF PERCENTAGE BY MASS OF THE WHOLE SAMPLE AS FOLLOWS:

PERCENT BY MASS	0 - 10	10 - 20	20 - 30	30 - 40	> 40
	TRACE	SOME	WITH	ADJECTIVE (SILTY)	AND (AND SILT)

**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

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

S S SPLIT SPOON	T P THINWALL PISTON
W S WASH SAMPLE	O S OSTERBERG SAMPLE
S T SLOTTED TUBE SAMPLE	R C ROCK CORE
B S BLOCK SAMPLE	P H T W ADVANCED HYDRAULICALLY
C S CHUNK SAMPLE	P M T W ADVANCED MANUALLY
T W THINWALL OPEN	F S FOIL SAMPLE
F V FIELD VANE	

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{v0}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_i$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL






$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE
$\gamma_s$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	$S_r$	%	DEGREE OF SATURATION	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\gamma_w$	kN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$w_L$	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_p$	%	PLASTIC LIMIT	$D_n$	mm	n PERCENT - DIAMETER
$\gamma$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_s$	%	SHRINKAGE LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
$\gamma_d$	kN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
$\gamma_{sat}$	kN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	i	1	HYDRAULIC GRADIENT
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL	WTP		WETTER THAN PLASTIC LIMIT	j	kN/m <sup>3</sup>	SEEPAGE FORCE
e	1, %	VOID RATIO						

**RECORD OF BOREHOLE No SR-BH-11**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 911 625.3 N; 289 892.1 E ORIGINATED BY S.A.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 23 and 24, 2016 CHECKED BY C.N.

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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
297.7	Ground Surface					*	20	40	60	80	100									
0.0	150mm asphalt over gravelly sand																			
297.1	Dense (PAVEMENT FILL)		1	SS	33							○								
0.6	Silty sand trace gravel, trace clay		2	SS	14							○								
	Compact Grey/ brown Moist (FILL)		3	SS	10							○								
			4	SS	10							○				1 77 20 2				
294.7	Sandy silt to silt trace clay																			
3.0	Dense Brown/ grey Moist to wet		5	SS	32							○								
			6	SS	40							○				0 9 83 8				
292.5	End of borehole																			
5.2																				
	* Borehole dry																			
	Water level measured in piezometer																			
	Upon completion of augering, no cave-in																			
	<u>Piezometer Readings:</u>																			
	Date Depth Elev.																			
	(m)																			
	Feb. 24/'16 Dry -----																			
	Apr. 19/'16 3.6 294.1																			
	<u>Piezometer Legend:</u>																			
	 Flush cover and concrete																			
	 Bentonite seal																			
	 Filter sand																			
	 Screen																			
	 Backfill																			

**RECORD OF BOREHOLE No SR-BH-12**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 911 801.9 N; 289 862.8 E ORIGINATED BY S.A.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 23 and 24, 2016 CHECKED BY C.N.

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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
294.8	Ground Surface						20	40	60	80	100									
0.0	180mm asphalt over gravelly sand					▽*										First water strike at 1.7m				
294.3	Compact Grey/ Moist brown (PAVEMENT FILL)		1	SS	24															
0.5	Silty sand		2	SS	5															
	Very loose Brown Moist to compact (FILL)		3	SS	2															
	topsoil rootlets organics																			
292.2	Silty sand to sandy silt trace clay, trace gravel		4	SS	15															
2.6	Compact to Brown/ Wet very dense grey		5	SS	28	▽*										7 55 27 11				
	cobbles and boulders																			
289.8			6	SS	96/28cm	▽										Second water strike at 4.6m				
5.0	End of borehole																			
	<div>* 2016 02 23 and 24</div> <div>▽ Water level observed during drilling</div> <div>▽ Water level measured after drilling</div> <div>Upon completion of augering, free water at 2.4m cave-in at 4.1m</div>																			

**RECORD OF BOREHOLE No SR-BH-13**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 912 122.6 N; 289 841.7 E ORIGINATED BY D.W.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE March 08, 2016 CHECKED BY C.N.

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										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						× LAB VANE		
290.1	Ground Surface						20	40	60	80	100									
0.0	200mm asphalt over sand, trace gravel						290													
289.3	Compact Brown (PAVEMENT FILL)		1	SS	23															
0.8	Sand, some to trace gravel		2	SS	15											1 66 23 10				
	Compact Brown Moist to dense (FILL)		3	SS	31															
			4	SS	29															
	Gravelly sand to sand Loose Wet		5	SS	5															
286.1	Gravelly sand, some silt, trace clay		6	SS	44															
4.0	Dense to Brown Wet very dense		7	SS	56											31 51 13 5				
284.9	End of borehole						285													
5.2																				
	* Borehole dry																			
	Upon completion of augering, no cave-in																			

**RECORD OF BOREHOLE No SR-BH-14**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 912 116.8 N; 289 809.3 E ORIGINATED BY D.W.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 23, 2016 CHECKED BY C.N.





















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									
					WATER CONTENT (%)												
290.3	Ground Surface						20	40	60	80	100						
0.0	100mm asphalt over sand and gravel																
289.7	Compact Brown (PAVEMENT FILL)		1	SS	26												
0.6	Sand to silty sand																
289.2	Compact Brown Moist (FILL)		2	SS	21												
1.1	Sand to silty sand trace clay, trace gravel																
	Compact Brown/ Moist to dense grey to wet		3	SS	14												
			4	SS	29												
			5	SS	35												
			6	SS	14												
			7	SS	33												
285.1	End of borehole																
5.2																	
	* Borehole dry																
	Upon completion of augering, no cave-in																

**RECORD OF BOREHOLE No SR-BH-15**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 912 535.6 N; 289 728.7 E ORIGINATED BY S.A.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 26 and 27, 2016 CHECKED BY C.N.

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									
288.2	Ground Surface					*		20	40	60	80	100					
0.0	150mm asphalt over gravelly sand		1	SS	18		288										
287.7	Compact Grey/ brown																
0.5	(PAVEMENT FILL)																
287.3	Gravelly sand, some silt		2	SS	18		287										
0.9	Compact Brown (FILL) Moist																
	Gravelly sand, trace to some silt, trace clay		3	SS	44		286										24 53 17 6
	Compact to Brown/ very dense grey Moist																
			4	SS	45		285										
	cobbles		5	SS	55		284										33 59 6 2
																	
																	
																	
																	
																	
			6	SS	26		283										
283.0	End of borehole																
5.2																	
	* Borehole dry																
	Water level measured in piezometer																
	Upon completion of augering, no cave-in																
	<u>Piezometer Readings:</u>																
	Date Depth Elev.																
	(m)																
	Feb. 27/'16 Dry -----																
	Apr. 19/'16 3.7 284.5																
	<u>Piezometer Legend:</u>																
	 Flush cover and concrete																
	 Bentonite seal																
	 Filter sand																
	 Screen																
	 Backfill																

**RECORD OF BOREHOLE No SR-BH-16**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 912 886.4 N; 289 591.2 E ORIGINATED BY S.A.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 26 and 27, 2016 CHECKED BY C.N.

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										WATER CONTENT (%)		
279.3	Ground Surface						20	40	60	80	100									
0.0	180mm asphalt over gravelly sand						279													
278.5	Dense Grey/ brown (PAVEMENT FILL)		1	SS	33															
0.8	Sand to silty sand trace clay, trace gravel		2	SS	23		278													
	Compact Brown/ Moist to dense grey		3	SS	22															
			4	SS	34		277													
			5	SS	34		276									0 88 9 3				
			6	SS	40		275													
274.1	End of borehole																			
5.2																				
	* Borehole dry.  Upon completion of augering, no cave-in																			

**RECORD OF BOREHOLE No SR-BH-17**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 913 134.3 N; 289 440.4 E ORIGINATED BY S.A.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 26 and 27, 2016 CHECKED BY C.N.

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 (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
270.5	Ground Surface					*		20	40	60	80	100					
0.0	150mm asphalt over gravelly sand																
270.1	0.4		1	SS	26		270										
269.5	1.0		2	SS	20												
	Compact (PAVEMENT FILL)																
	Silty sand trace gravel, trace clay																
	Compact Grey/ Moist brown (FILL)		3	SS	32		269										
	Sand to silty sand trace clay, trace gravel																2 90 7 1
	Compact Brown/ Moist to dense grey		4	SS	33		268										
			5	SS	42		267										
			6	SS	44		266										0 73 26 1
265.3	5.2																
	End of borehole																
	* Borehole dry																
	Water level measured in piezometer																
	Upon completion of augering, no cave-in																
	<u>Piezometer Readings:</u>																
	Date	Depth (m)	Elev.														
	Feb. 27/'16	Dry	-----														
	Apr .19/'16	3.3	267.2														
	<u>Piezometer Legend:</u>																
		Flush cover and concrete															
		Bentonite seal															
		Filter sand															
		Screen															
		Backfill															

**RECORD OF BOREHOLE No SR-BH-18**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 913 206.3 N; 289 378.0E ORIGINATED BY D.W.  
 DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
 DATUM Geodetic DATE February 26, 2016 CHECKED BY C.N.

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									
267.8	Ground Surface																
0.0	130mm asphalt over sand and gravel																
267.2	Compact Brown (PAVEMENT FILL)		1	SS	27		267						○				
0.6	Sand to silty sand, some gravel organic inclusions		2	SS	12								○				
	Compact to Brown Moist very loose to wet (FILL)		3	SS	3		266						○				
265.8	Sand to silty sand trace clay, some gravel																
2.0	Compact Brown/ Moist to dense grey		4	SS	15		265						○				
			5	SS	22								○				
							264										
			6	SS	32		263						○			12 74 10 4	
262.6	End of borehole																
5.2	<div>* Borehole dry</div> <div>Upon completion of augering, no cave-in</div>																

**RECORD OF BOREHOLE No SR-BH-19**

1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 913 306.3 N; 289 295.9 E ORIGINATED BY D.W.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 26, 2016 CHECKED BY C.N.

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										WATER CONTENT (%)		
								20 40 60 80 100										20 40 60		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
264.0	Ground Surface																			
0.0	200mm asphalt over sand and gravel																			
263.5	Very dense Brown (PAVEMENT FILL)		1	SS	55															
0.5	Sand to silty sand trace clay, trace gravel		2	SS	20		263													
	Compact Brown Moist to loose																			
	(FILL)		3	SS	25		262													
			4	SS	5		261									5 61 25 9				
	silty sand layer		5	SS	6															
259.9	Silty sand trace clay, trace gravel		6	SS	14		260													
4.1	Compact Brown/ Moist grey		7	SS	24		259									8 70 18 4				
258.8	End of borehole																			
5.2																				
	* Borehole dry																			
	Upon completion of augering, no cave-in																			

**RECORD OF BOREHOLE No SR-BH-20**

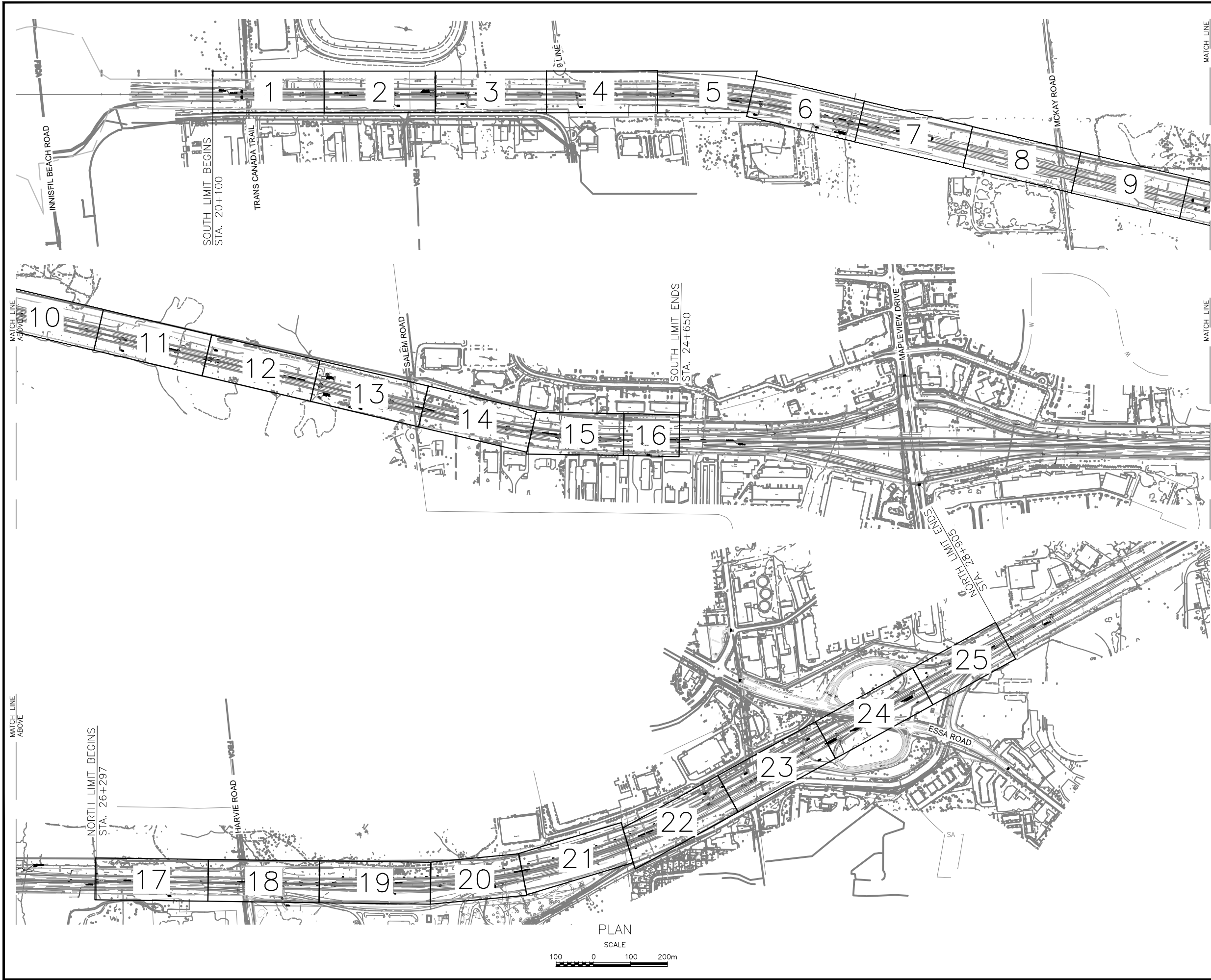
1 of 1

**METRIC**

W.P. 2184-10-00 LOCATION Co-ords: 4 913 426.7 N; 289 194.8 E ORIGINATED BY D.W.  
DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY M.Kh.  
DATUM Geodetic DATE February 26, 2016 CHECKED BY C.N.

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/m³	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									

259.1	Ground Surface					*	259										
0.0	130mm asphalt over sand, some gravel to silty sand		1	SS	22		259										
258.3	Compact Brown (PAVEMENT FILL)		2	SS	22		258										
0.8	Silty sand trace clay, trace gravel						258										
	Compact Brown Moist to dense (FILL)		3	SS	31		257										
			4	SS	19		257										3 70 20 7
256.1	Silty sand trace gravel, trace clay						256										
3.0	Very loose to compact Wet		5	SS	3		256										
			6	SS	9		255										
	Brown/ Moist grey						255										
			7	SS	22		254										2 54 31 13
253.9	End of borehole						254										
5.2																	



TASK No 2013-E0039-010  
WP No 2184-10-00

HIGHWAY 400 SEWER REPLACEMENT  
KEY PLAN

SHEET

CONSULTING ENGINEERS

KEY PLAN  
SCALE  
5 0 5 10 15km

LEGEND	
<div>25</div>	Site Plan Sheet Number

BH No	BOREHOLE LOCATION PLAN
SR-BH-11	Refer to Sheet No. 400WM-17/25
SR-BH-12	Refer to Sheet No. 400WM-17/25
SR-BH-13	Refer to Sheet No. 400WM-18/25
SR-BH-14	Refer to Sheet No. 400WM-18/25
SR-BH-15	Refer to Sheet No. 400WM-20/25
SR-BH-16	Refer to Sheet No. 400WM-21/25
SR-BH-17	Refer to Sheet No. 400WM-22/25
SR-BH-18	Refer to Sheet No. 400WM-22/25
SR-BH-19	Refer to Sheet No. 400WM-23/25
SR-BH-20	Refer to Sheet No. 400WM-23/25

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

REVISIONS  
DATE BY DESCRIPTION

Geocres No. 31D-648

HWY No 400

SUBM'D NA

DRAWN NL

CHECKED M.KH

CHECKED MV

DATE JUNE 14, 2016

APPROVED CN

DIST CENTRAL

SITE

DWG 400WM-A



LEGEND				
	Borehole Location			
	Blows/0.3m (Std. Pen Test, 475 J / blow)			
	Piezometer			
	WL at time of investigation (March 2016)			
	WL in Piezometer			
	Existing Sewer			
	Replacement/New Sewer			
	FILL			
	SAND TO SANDY SILT			

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
SR-BH-11	297.7	4 911 625.3	289 892.1
SR-BH-12	294.8	4 911 801.9	289 862.8

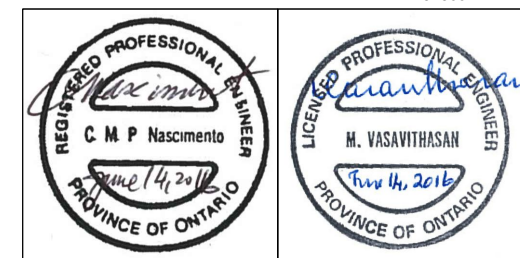
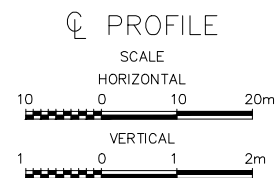
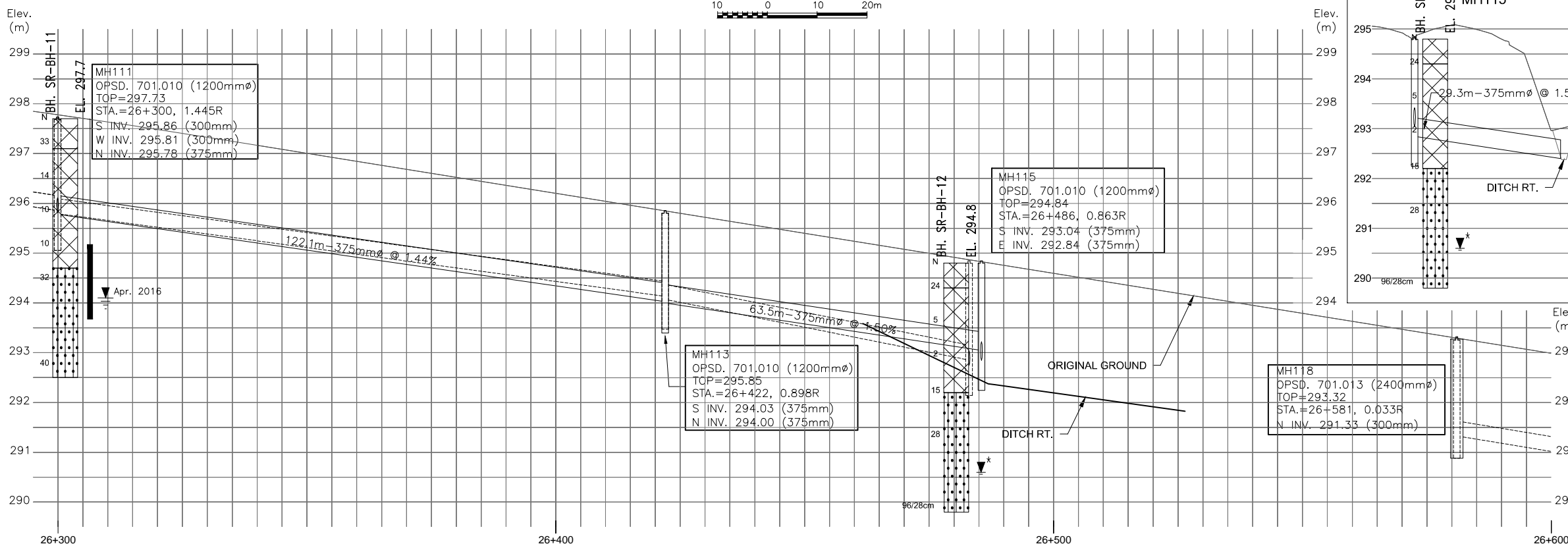
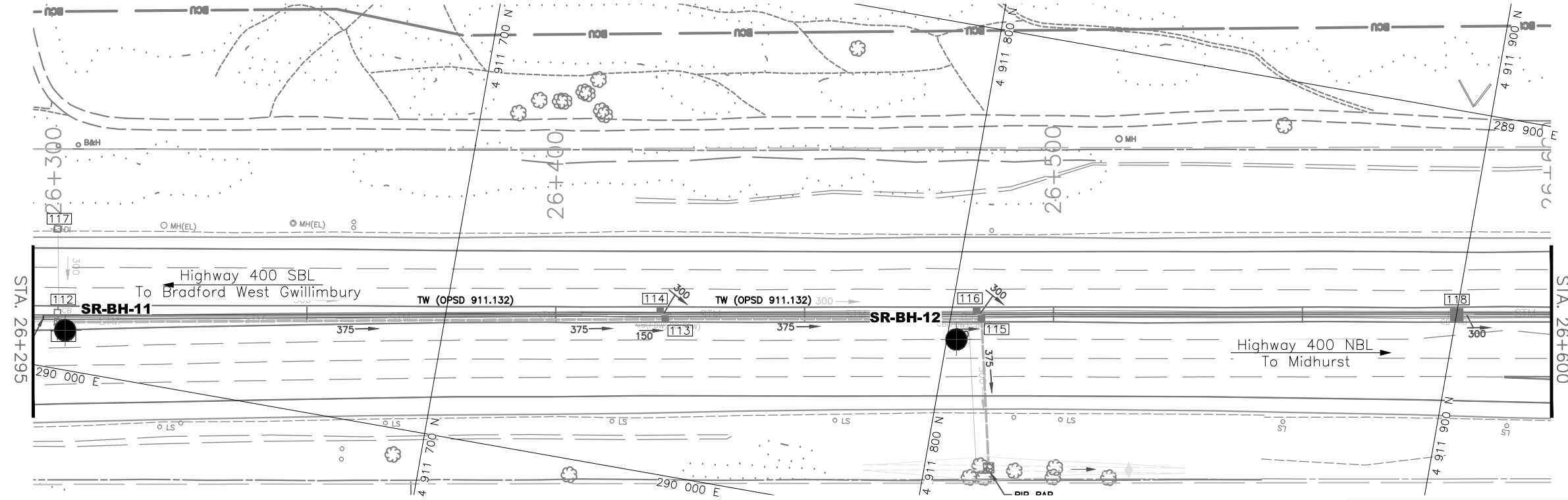
— NOTE —  
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS		
DATE	BY	DESCRIPTION

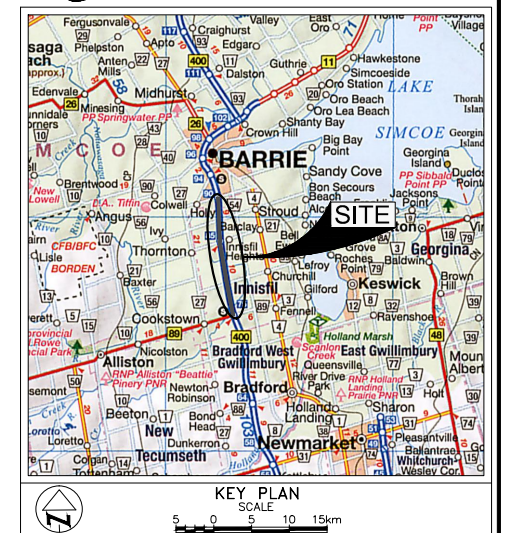
Geocres No. 31D-648

HWY No	400	DIST	CENTRAL
SUBM'D	NA	CHECKED M.KH	DATE JUNE 14, 2016
DRAWN	NL	CHECKED MV	APPROVED CN










DWG 400WM-17/25



REF MTO Drawings; 09.NEWCONS-For FDN.dwg & 10.PROFILES.dwg;  
dated January 13, 2016 & January 12, 2016, respectively.



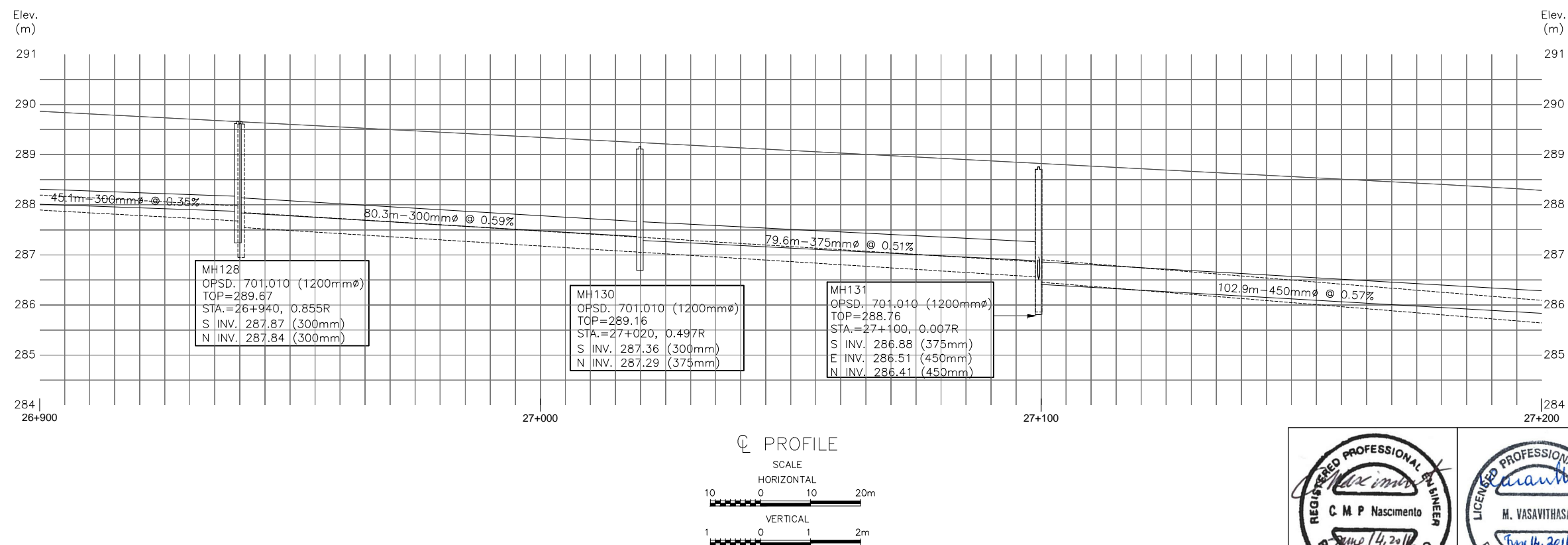
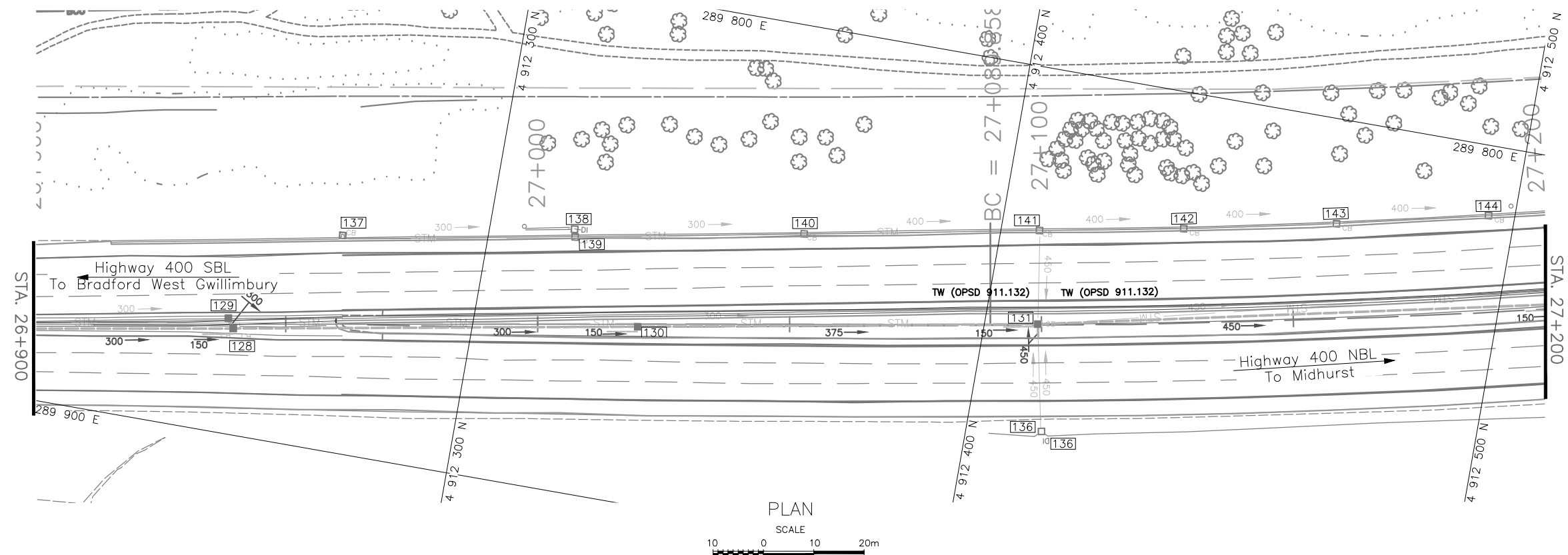
**LEGEND**

 Borehole Location  
  
 Piezometer  
  
 WL at time of investigation (March 2016)  
  
 WL in Piezometer  
  
 Existing Sewer  
  
 Replacement/New Sewer  
  
 FILL  
  
 GRAVELLY SAND  
  
 SAND TO SILTY SAND

Blows/0.3m (Std. Pen Test, 475 J / blow)

BH No	ELEVATION	CO—ORDINATES	
		NORTHINGS	EASTINGS
SR—BH—13	290.1	4 912 122.6	289 841.7
SR—BH—14	290.3	4 912 116.8	289 809.3

REF MTO Drawings; 09.NEWCONS-For FDN.dwg & 10.PROFILES.dwg;  
dated January 13, 2016 & January 12, 2016, respectively.



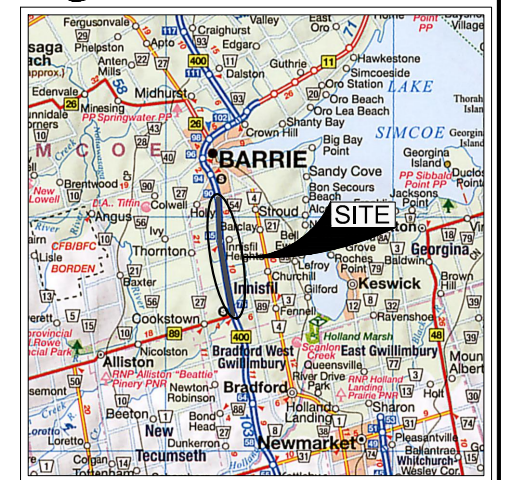
TASK No 2013-E0039-010
WP No 2184-10-00



HIGHWAY 400 SEWER REPLACEMENT

SHEET

BOREHOLE LOCATIONS AND SOIL STRATA



KEY PLAN  
SCALE  
5 0 5 10 15km

LEGEND	
-----	Existing Sewer
=====	Replacement/New Sewer

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS

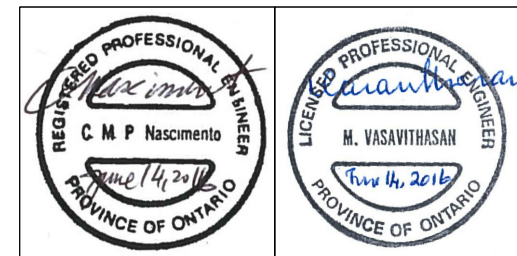
- NOTE -

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

REVISIONS			
	DATE	BY	DESCRIPTION

Geocres No. 31D-648

HWY No 400				DIST CENTRAL	
SUBM'D	NA	CHECKED M.Kh	DATE JUNE 14, 2016		SITE
DRAWN	NL	CHECKED MV	APPROVED CN		DWG 400WM-19/25



REF MTO Drawings; 09.NEWCONS-For FDN.dwg & 10.PROFILES.dwg; dated January 13, 2016 & January 12, 2016, respectively.	HWY No 400	DIST CENTRAL
	SUB/D NA CHECKED M.K.H	DATE JUNE 14, 2016 SITE
	DRAWN NL CHECKED MV	APPROVED CN DWG 400WM-19/29



BH No		ELEVATION	CO-ORDINATES	
			NORTHINGS	EASTINGS
SR-BH-15		288.2	4 912 535.6	289 728.7

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

REVISIONS	DATE	BY	DESCRIPTION

Geocres No. 31D-648

HWY No 400

SUBM'D NA

DRAWN NL

CHECKED M.KH

CHECKED MV

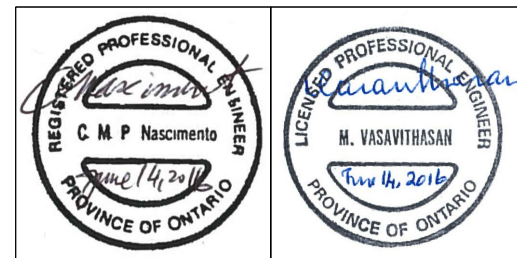
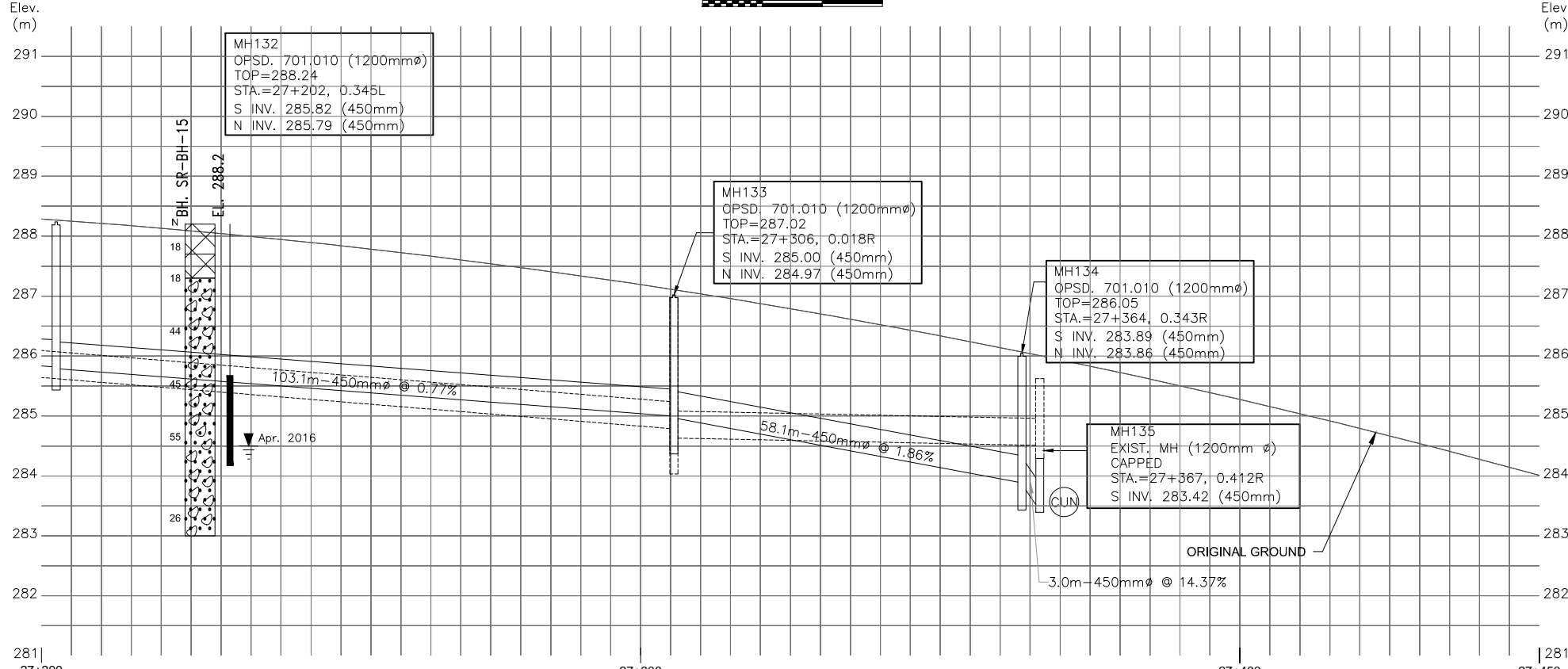
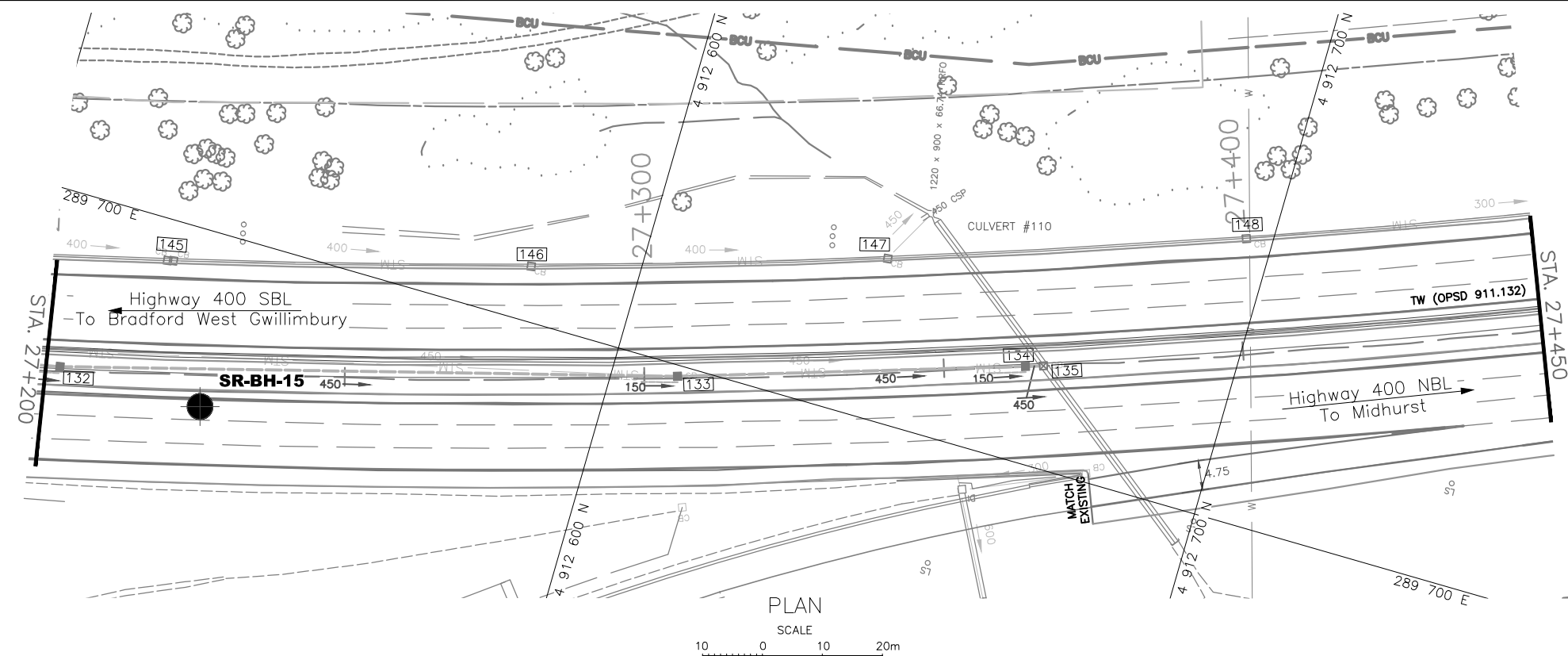
APPROVED CN

DATE JUNE 14, 2016

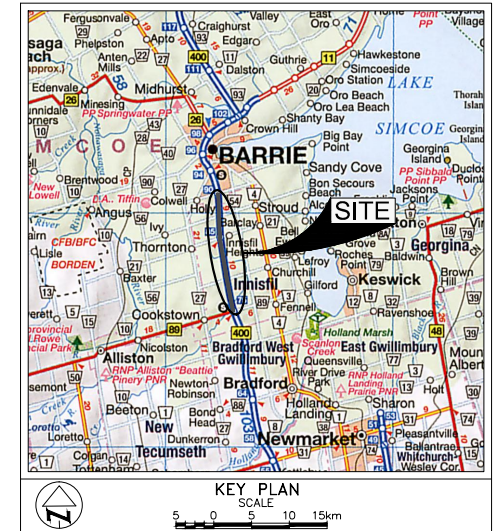
SITE






DWG 400WM-20/25

DIST CENTRAL



REF MTO Drawings; 09.NEWCONS-For FDN.dwg & 10.PROFILES.dwg;  
dated January 13, 2016 & January 12, 2016, respectively.



LEGEND			
	Borehole Location		
N	Blows/0.3m (Std. Pen Test, 475 J / blow)		
	Existing Sewer		
	Replacement/New Sewer		
	FILL		
	SAND TO SILTY SAND		
BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
SR-BH-16	279.3	4 912 886.4	289 591.2

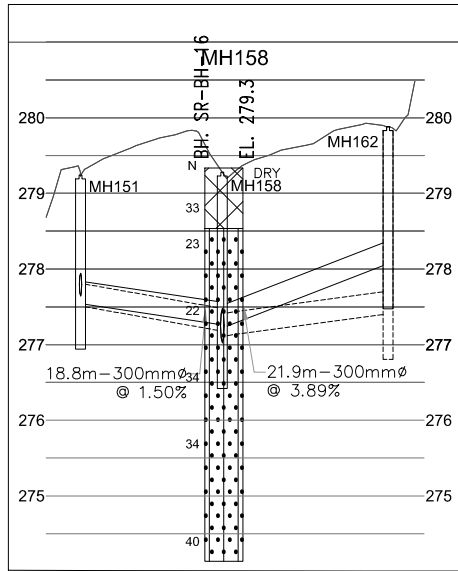
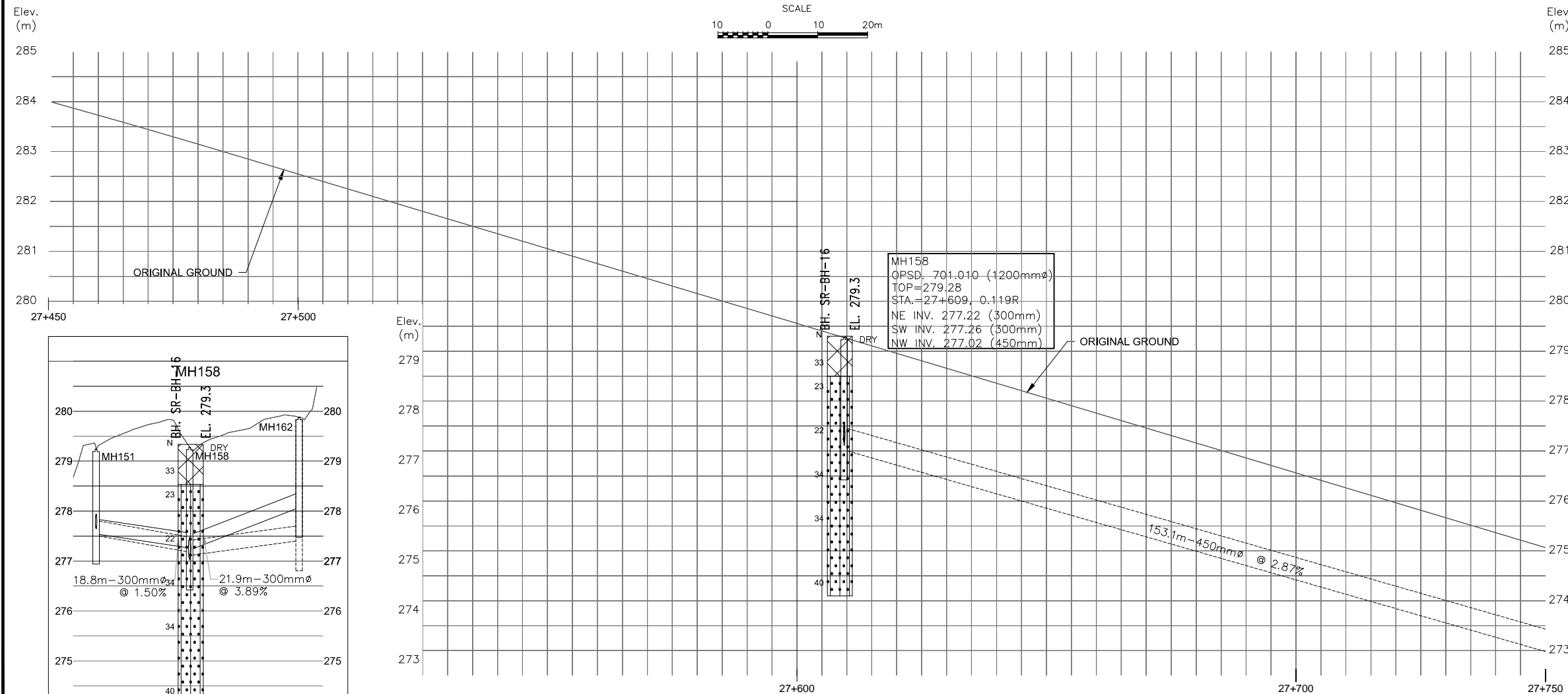
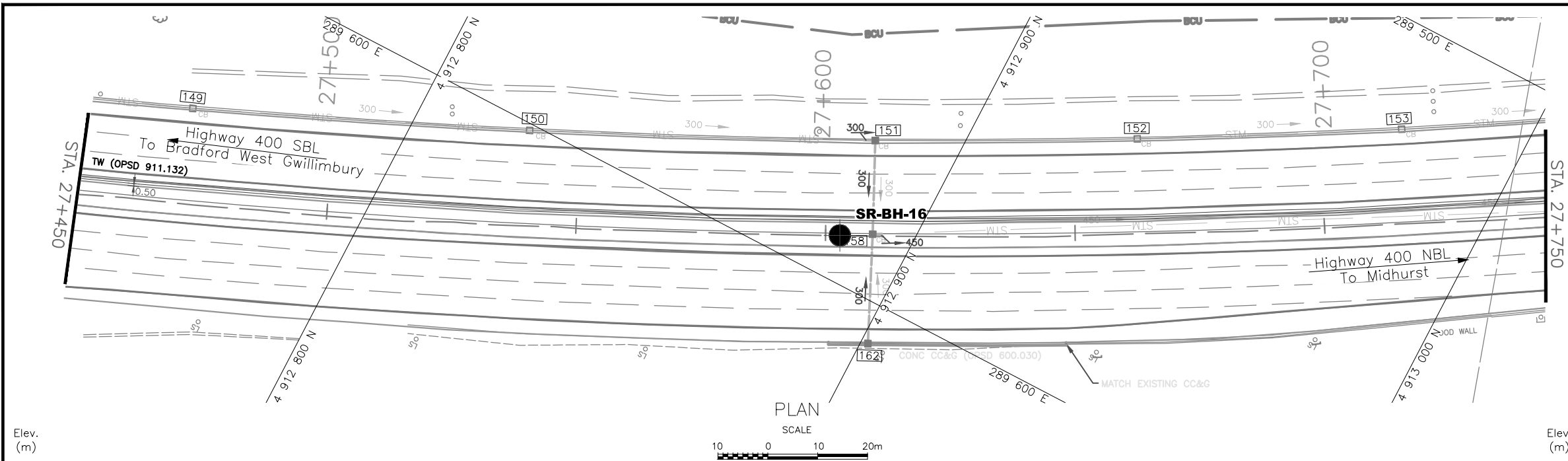
- NOTE -

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

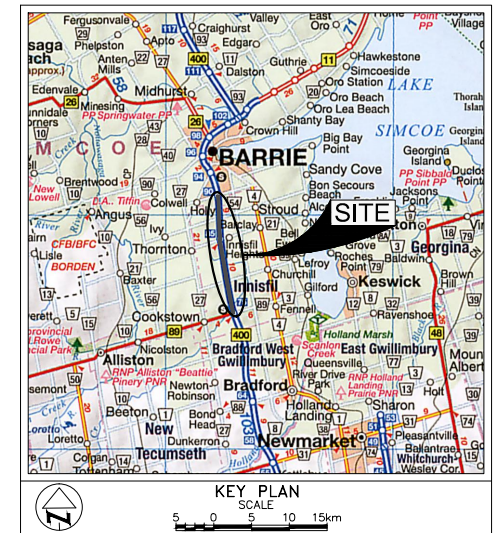
REVISIONS				
DATE	BY	DESCRIPTION		

Geocres No. 31D-648

HWY No	400		DIST	CENTRAL
SUBM'D	NA	CHECKED M.KH	DATE JUNE 14, 2016	SITE
DRAWN	NL	CHECKED MV	APPROVED CN	DWG 400WM-21/25

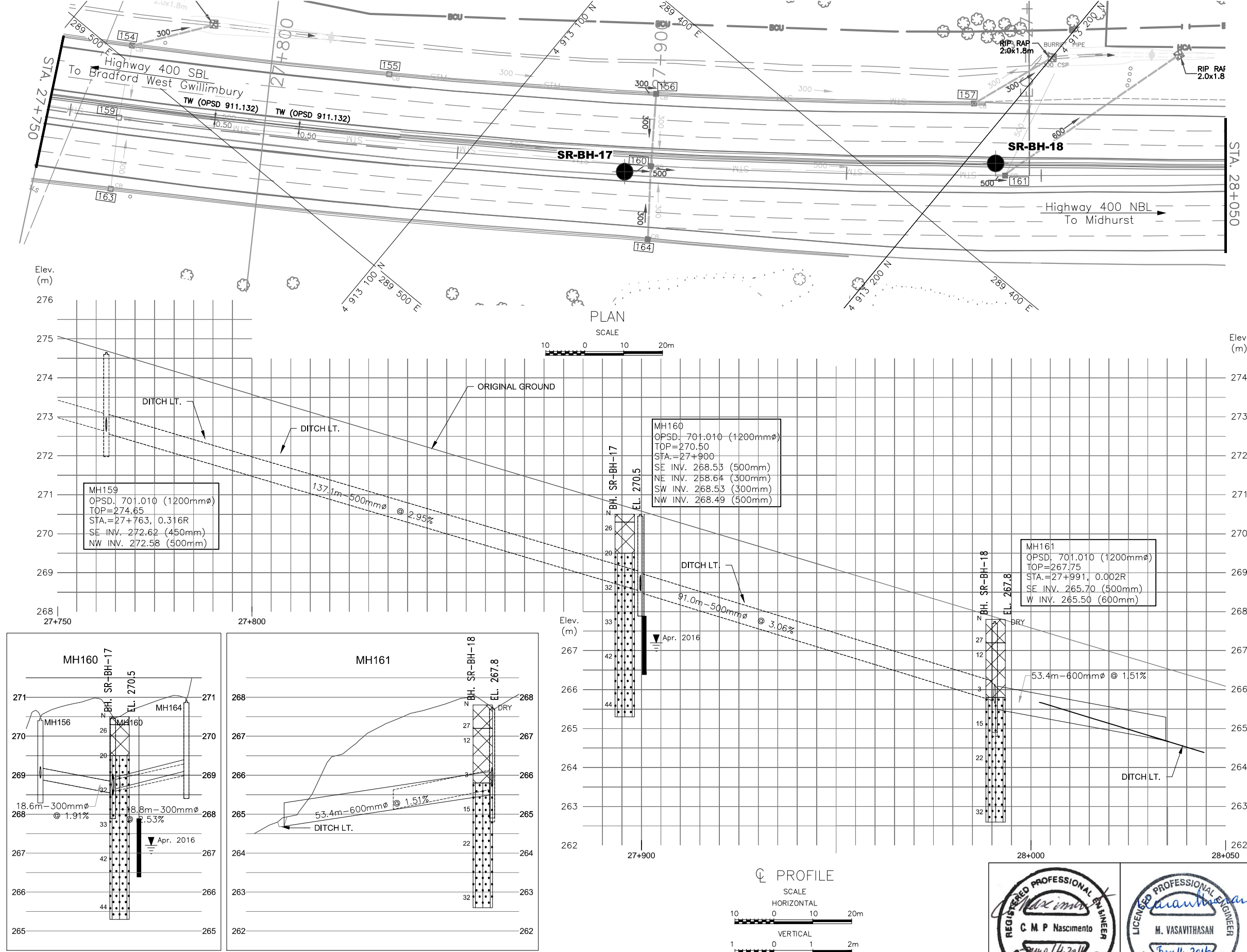


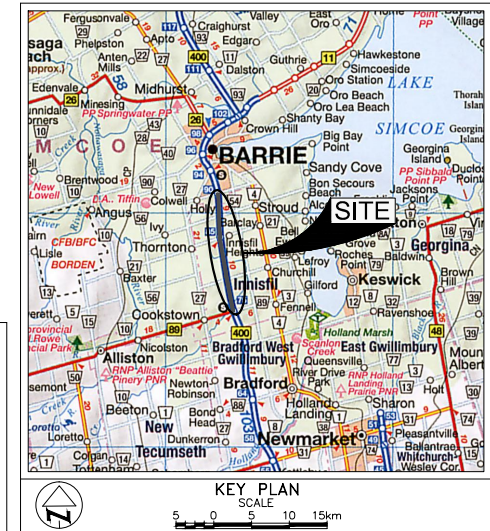
REF MTO Drawings; 09.NEWCONS-For FDN.dwg & 10.PROFILES.dwg; dated January 13, 2016 & January 12, 2016, respectively.










LEGEND				
	Borehole Location			
	Blows/0.3m (Std. Pen Test, 475 J / blow)			
	Piezometer			
	WL in Piezometer			
	Existing Sewer			
	Replacement/New Sewer			
	FILL			
	SAND TO SILTY SAND			
BH No		ELEVATION	CO-ORDINATES	
			NORTHINGS	EASTINGS
SR-BH-17		270.5	4 913 134.3	289 440.4
SR-BH-18		267.8	4 913 206.3	289 378.0

REVISIONS		
DATE	BY	DESCRIPTION
Geocres No. 31D-648		
HWY No	400	DIST CENTRAL
SUBM'D NA	CHECKED M.KH	DATE JUNE 14, 2016
DRAWN NL	CHECKED MV	APPROVED CN
DWG 400WM-22/25		





LEGEND			
	Borehole Location		
	Blows/0.3m (Std. Pen Test, 475 J / blow)		
	Piezometer		
	Existing Sewer		
	Replacement/New Sewer		
	FILL		
	SILTY SAND		
BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
SR-BH-19	264.0	4 913 306.3	289 295.9
SR-BH-20	259.1	4 913 426.7	289 194.8

- NOTE -

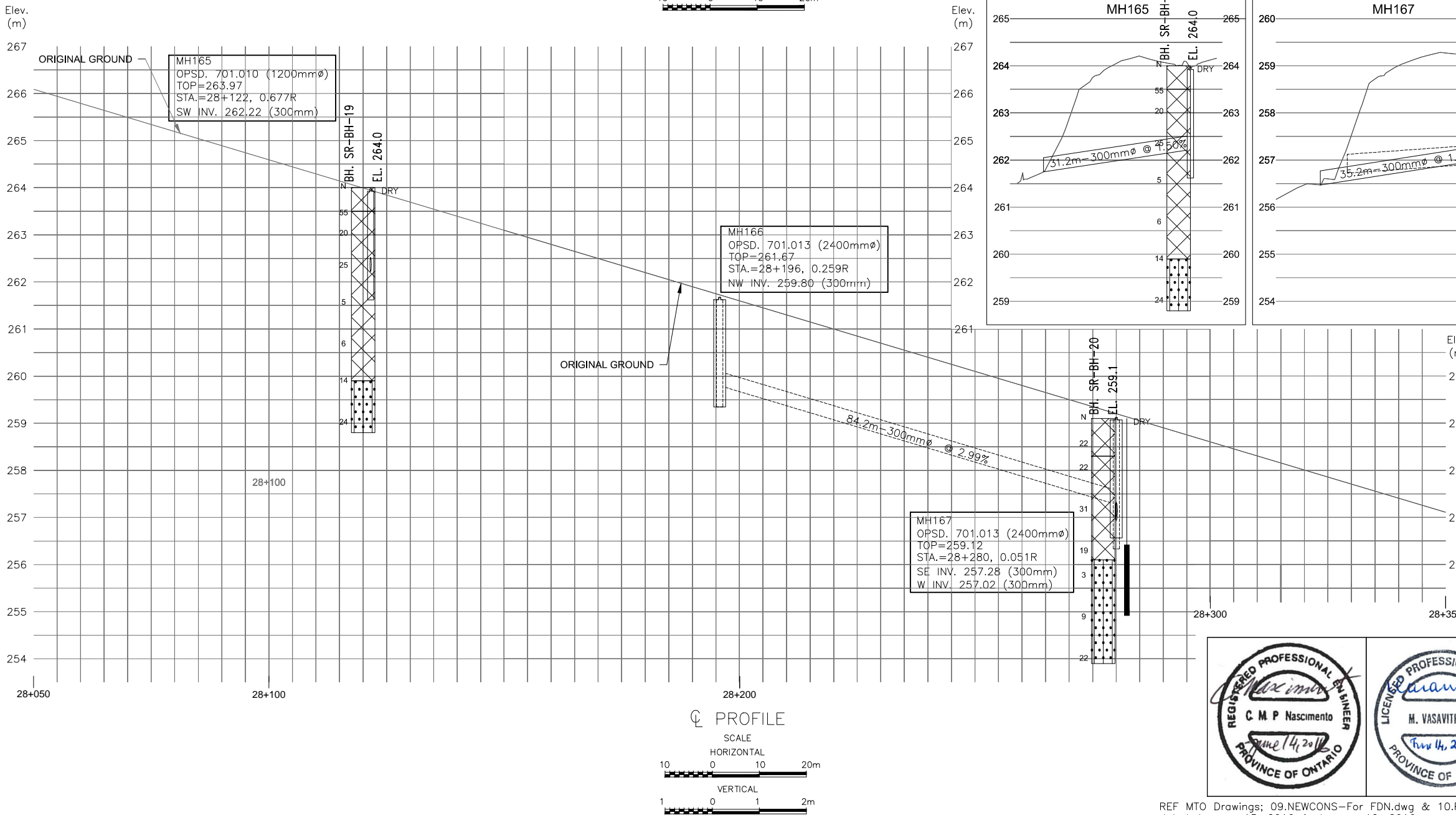
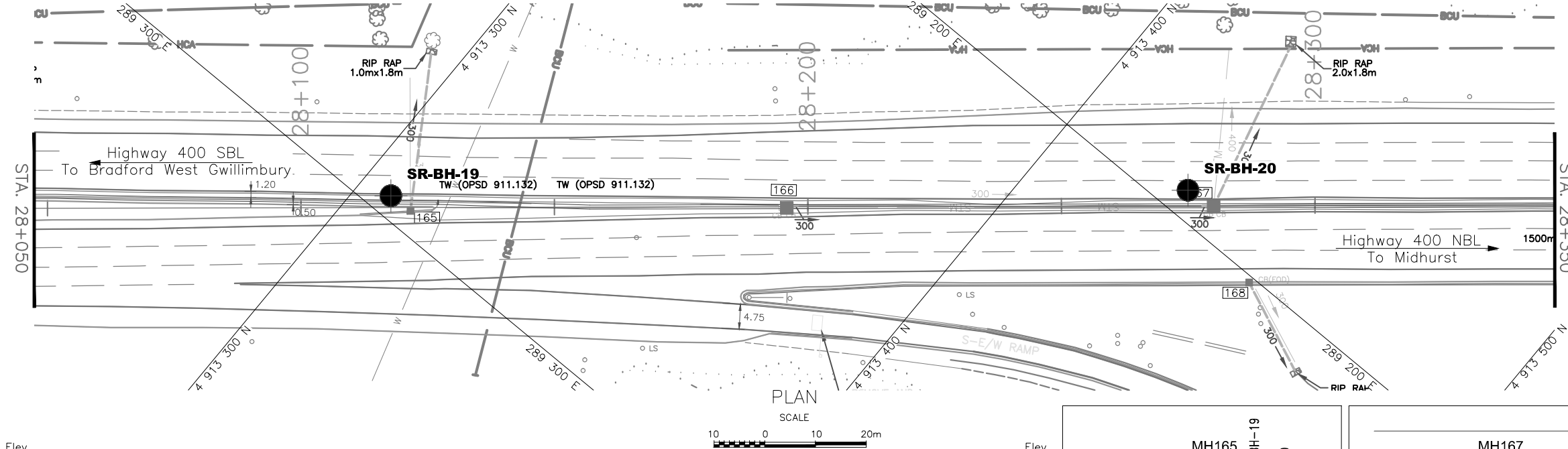
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

REVISIONS

DATE	BY	DESCRIPTION

Geocres No. 31D-648

HWY No	400	DIST	CENTRAL
SUBM'D	NA	CHECKED M.Kh	DATE JUNE 14, 2016
DRAWN	NL	CHECKED MV	APPROVED CN
		DWG 400WM-23/2	

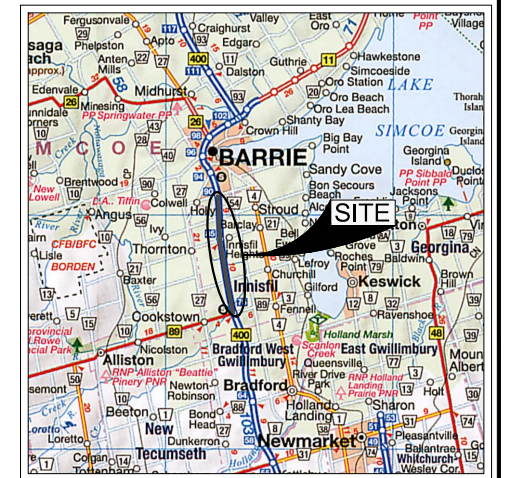


REF MTO Drawings; 09.NEWCONS-For FDN.dwg & 10.PROFILES.dwg;  
dated January 13, 2016 & January 12, 2016, respectively.



SHEET

1000



----- Existing Sewer  
 \_\_\_\_\_ Replacement/New Sewer

- NOTE -

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

Geocres No. 31D-648

