

GEOCRES No. \_\_\_\_\_

DIST. 54 REGION \_\_\_\_\_W.P. No. 775-93-00

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. 11LOCATION  Hwy 11 Twinning - from  
1.3 Km N of Hwy 522 at TroutNo of PAGES - ~~Crete~~, N'ly 6.1 Km

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



# **Terraprobe**

*Consulting Geotechnical Engineers & Hydrogeologists  
Construction & Materials Inspection & Testing*

**FOUNDATION DESIGN REPORT  
WP775-93-00  
HIGHWAY 11 TWINNING  
FROM 1.3km NORTH OF HIGHWAY 522 AT  
TROUT CREEK NORTHERLY FOR 6.1 km  
CULVERTS AT 18+800 AND 18+180  
SOUTH HIMSWORTH TOWNSHIP  
DISTRICT OF PARRY SOUND, ONTARIO**

**OUR FILE NO. 971019  
NOVEMBER 26, 1997**

**DISTRIBUTION:**

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2 cc: Terraprobe Limited

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## **1.0 INTRODUCTION**

As part of this project, three (3) concrete box culverts will be constructed. This report presents the Foundation Investigation with respect to these structures.

This is the first of a series of projects to four lane Highway 11, between Huntsville and Powassan. It is part of an overall Highway 11, Burkes Falls to Powassan, Category A, Environmental Assessment which received environmental assessment approval on March 29, 1995. This Highway 11, GWP775-93-00, TPM ("project") improvement includes the four laning of Highway 11 (twinning and new construction) from 1.3 km north of Highway 522 at Trout Creek northerly for 6.1 km.

A pavement design report has been prepared to rehabilitate a section of the existing Highway 11 (approximately 3.5 km of the new southbound lanes) and the new construction. This report addresses the geotechnical aspects for two structures at south McGillvray Creek. Specifically, this entails removal and replacement of an existing Highway 11 structure, Site 44-41 and construction of a similar structure for the northbound lanes. These structures will be at approximately Station ~~18+800~~.

In addition, a new box culvert will be constructed at approximate ~~Station 18+180~~ below the proposed new north bound lanes which will effectively be an extension to the existing open footing culvert at this location.

## **2.0 SITE AND PROJECT DESCRIPTION**

The site is located in the vicinity of existing Highway 11 just immediately north of the community of Trout Creek (see Figure 1). Specifically, the existing rigid frame bridge beneath existing Highway 11 at approximate Station 18+800 will be subexcavated and replaced with a box culvert. A similar concrete box culvert will be placed for the new northbound lanes at this station.

In addition, another new concrete box culvert will be designed and constructed at approximately Station 18+180 below the new northbound lanes as an extension to the existing open footing culvert.

Traffic will be diverted onto the "new northbound" lanes during excavation and reconstruction of the culvert replacement at 18+800 southbound. Therefore, the McGillvray Creek structures will need no special provision for road protection/support during construction. The existing culvert at 18+180 will require repairs to the end of the culvert and existing wingwalls. It is anticipated that roadway protection will be required to carry out the repairs.

In reviewing proposed road profiles at these locations the new box culverts proposed at approximate Station 18+800 will require approximately 0.6 to 1.0 m of fill above the obvert of the culvert.

The new proposed box culvert at Station 18+180 will require placement of approximately 12m of fill above the obvert of the culvert. This culvert is proposed to be an extension to the existing open footing culvert.

Geotechnical investigation has been carried out via boreholes at all three proposed culvert locations. The Borehole Logs are appended.

### **3.0 FIELD WORK**

The field work for this project was conducted during July and August 1997 when four (4) boreholes were advanced in the area of the existing structure along Highway 11 at 18+800. In addition, four (4) new boreholes were advanced in the area of the new proposed box culvert (18+800) for the northbound lanes at the same chainage (see Figure 2).

Sampled boreholes as well as auger holes were also advanced in the area of the proposed culvert at Station 18+180 (see Figure 3).

### **4.0 SUBSURFACE CONDITIONS**

Details of the soil and ground water conditions are presented on the Borehole Logs. It should be noted that the conditions are confirmed at the test location only and could vary between and beyond these locations.

The soils conditions encountered at each location are similar being that of primarily a compact silt containing trace to some clay with sandier compaction conditions with depth. The ground water table is close to the ground surface at each culvert location. The investigation for the proposed culvert at Station 18+180 however, indicates bedrock approximately 2m below the proposed obvert.

#### **4.1 Soil**

The native soil conditions at the McGillvray Creek culverts (i.e. approximate Station 18+800) comprise primarily of a compact silt containing trace to some clay underlain by silty sand or silty sand layers.

The soil conditions encountered at Station 18+180 for the northbound lanes indicates approximately 100 mm of organic matter underlain by a compact sandy silt with bedrock encountered at a depth of approximately 0.7 to 0.8 m below existing ground surface. A borehole advanced at Station 18+182 northbound lane encountered similar compact silts to 1.2 m depth underlain by compact silty sand and gravel with auger refusal encountered at a depth of 2.6 m on probable bedrock along the centreline of the proposed northbound lane.

#### **4.2 Rock**

Bedrock was not encountered within the proposed excavation depths for the proposed McGillvray Creek culverts. As noted above however, rock was encountered at depths between 0.8 and 2.6 m below existing ground surface in the vicinity of the proposed new culvert at 18+180±.

#### **4.3 Ground Water**

Ground water was encountered at depths primarily between ground surface at the actual proposed culvert locations rising to 1.8 m below ground surface at short offset distances from the stream (18+180)

## **5.0 DISCUSSION AND RECOMMENDATIONS**

The following deiscussion and recommendations are provided for use by the design engineer only.

### **5.1 Excavation**

It is anticipated that at all three structure locations, excavation will be required into shallow overburden deposits below the ground water table. The native soil is expected to be primarily silts containing trace to some clay with a possibility of encountering some sand and sand and gravel layers.

The following is a summary of the proposed culvert sizes and invert elevations.

<u>Structure</u>	<u>Size</u>	<u>Invert</u>
McGillvray (SBL)	6000 x 2000 mm	258.5±
McGillvray (NBL)	6000 x 2000 mm	258.5±
18+180 (NBL)	1770 x 1350 mm	266.5±

It is recommended that ground water control be maintained during the excavation process to maintain a dry excavation base. This will likely require a diversion of South McGillvray Creek during this process, extra wide trenches, flatter side slopes on cuts and significant sump pumping. If sump pumping is proven not to be adequate then the use of positive dewatering with well points and/or strategically placed deep wells may also be required.

Temporary excavations for construction of the proposed concrete box precast culverts will be sloped at a minimum of 1 to 1 (horizontal to vertical) from the base of the excavation to ground surface. Flatter side slopes may be required in areas where local loose soil conditions are encountered and where local slumping or ground water ingress occurs and to meet OPSD 803 details.

## **5.2 Bedding**

It will be essential to maintain a dry stable base prior to placement of bedding for the proposed culverts. Bedding for the proposed culverts may comprise of a 19 mm clear stone or more preferably an HL 4 coarse aggregate wrapped in an approved non woven heavy geotextile fabric.

The subgrade should be stripped of all organic and loosened materials and a geotextile fabric being a Class I non woven fabric with an FOS opening size between 85 and 170 um placed.

The bedding material for the proposed culverts should comprise of either 600 mm of a 19 mm clear stone that is placed on top of the geotextile fabric or 600 mm of HL 4 coarse aggregate that is placed and tamped in place to densify it uniformly. This material should then be wrapped in the geotextile cloth ensuring that there is no opportunity for migration of fines into the stone.

In the case of the closed concrete box culvert, the upper surface of the stone that would be in contact with the concrete does not need to be wrapped. However, provisions must be made in the design to ensure that the migration of fines cannot enter from the edges or from the top surface of the stone that is placed.

## **5.3 Backfill**

The backfill for the proposed culvert may comprise of an OPSS Granular 'B' Type II material that is placed and compacted in uniform lifts of 200 mm or less uniformly to 95% of Standard Proctor Maximum Dry Density (SPMDD). An OPSS Granular 'A' material can also be considered around the culvert. Typically, OPSD 803 drawing specifications are applicable.

It would be recommended to achieve compaction adjacent to the structure using light compaction equipment to avoid damage. Opposite sides should be backfilled together to avoid unbalanced loading and possible movement of the precast units.

## **5.4 Lateral Earth Pressure Coefficient**

Based on the backfilling of the proposed culvert with the Granular 'B' or Granular 'A' material the following lateral earth pressure coefficient are provided.



		Granular 'A'	Granular 'B'
Effective Angle of Internal Friction (Phi), degrees, unfactored		35	30
Unit Weight (Gamma) kN/m <sup>3</sup>		22.8	21.2
Active Earth Pressure Coefficient, K <sub>a</sub>	(SLS) (ULS)	0.27 0.36	0.33 0.41
At Rest Earth Pressure Coefficient, K <sub>o</sub>	(SLS) (ULS)	0.43 0.53	0.50 0.58
Passive Earth Pressure Coefficient, K <sub>p</sub>	(SLS) (ULS)	3.7 2.8	3.0 2.4

It should be noted that the mobilization of the active earth pressure behind the wall will require an outward deflection of up to 0.5 percent of the wall height, as measured at the top of the wall. Since the culvert is assumed to be a rigid frame structure and is constrained so that this deflection cannot occur then the "at rest" earth pressure should be used in design.

Drainage from behind the culvert must be provided via adequate spaced and filtered weep holes or alternative measures, otherwise unbalanced hydrostatic pressures must be considered.

## 5.5 Bearing Capacity

Based on the compact silt soils anticipated in the founding strata at each of the three culvert locations, we would suggest a Serviceability Limit State bearing capacity of 200 kPa and an Ultimate Limit State capacity of approximately 350 kPa. The above associated values would result in anticipated settlement in the order of 25 mm.

Settlement of the culverts at the South McGillvray Creek crossings (south bound and north bound lanes) are not anticipated to be an issue. Minimal fill heights in the order of less than 2 m above these culverts is proposed.

Considerable fill will need to be placed above the proposed culvert at Station 18+180± which will be constructed as an extension to the existing culvert. The addition of approximately 12m of fill above the proposed culvert needs to be considered.

Based on the soil information provided at this culvert location, it is anticipated that less than 1 m of overburden soils will be in place below the bedding at this culvert location. It is also anticipated that the native subgrade soil will be a compact silt.

Some differential settlement should be anticipated at the connection to the existing culvert. However, at this location, less than 2 m of fill directly above the new culvert at this location is anticipated and therefore differential movement at this location is considered to be less than 19 mm.

If differential settlement is a concern from the designers perspective at this extension at Station 18+180 consideration could be given to removing all overburden soils down to the native bedrock surface and backfilling with the prescribed bedding materials or another approved engineered fill. However, we do not feel that this is necessary for the proposed precast box culvert sections. If a cast in place structure is chosen, an isolation joint will be required between the existing and new structures.


## **6.0 SUMMARY**

In summary, the two culverts being proposed at the south McGillvray Creek crossing for the north and southbound lanes are anticipated to encounter no significant geotechnical constraints. A native compact silt containing trace to some clay subgrade is anticipated with ground water control and diversion of the creek required prior to excavation. The excavation bases at this location will need to be kept dry during the placement of the granular bedding materials and during the backfill process.


The proposed culvert extension at approximate chainage 18+180 will ultimately require significant fill depths to be placed above the obvert (i.e. in the order of 12 m). Differential movement at the connection to the existing culvert is considered to be tolerable because the proposed fill depth at this location will be anticipated to be less than 2 m being at the toe of the proposed fill embankment.

If you should have any questions, please do not hesitate to contact the undersigned.

Sincerely,  
**TERRAPROBE LIMITED**

  
Tim Orpwood, P. Eng.  
Associate

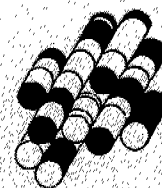


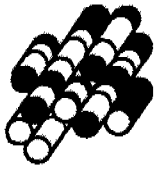
  
Kirk R. Johnson, P. Eng.  
Associate



# **BOREHOLE LOGS**

**TERRAPROBE LIMITED.**





# Terraprobe

PROJECT No: 97 - 1019

CLIENT: MTO c/o C.C. Parker

LOCATION: See Plan Figure

## LOG OF BOREHOLE 1

STATION 18 + 793, 3.8m Lt of Centreline

Boring Date: July 14, 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			SPT STATIC CONE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20 40 60 80					
								SHEAR STRENGTH kPa					
	0	GROUND SURFACE		260.0									
		ASPHALT for 235mm over Sand & Gravel—brown, fine to medium, moist, compact.		259.6									
		SAND— brown with some cobble, fine, moist, compact.		0.4									
	1	(FILL)			1	SS	26		X				
				258.6									
		SILT— grey with some clay and sand pockets, fine, moist to wet, loose.		1.4	2	SS	7		X				
	2												
					3	SS	15		X				
	3												
					4	SS	8		X				
	4												
					5	SS	3		X				
	5			254.6									
		CLAY— grey with sand seams and roots, wet, soft.		5.4	6	SS	2		X				
	6												
					7	SS	2		X				
	7												
	8												
				251.2									
	9	SILT— grey, fine, saturated, compact.		8.8	8	SS	15		X				
				250.4									
		END OF BOREHOLE		9.5									

NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

2) Water Level Records

Date W.L. Open to  
07/14/97 2.6m 7.5m

SHEET 1 OF 1

1879.3lt.dwg

NOTES:

- Borehole advanced by continuous flight hollow stem augers on July 14, 1997.
- Water Level Records

Date W.L. Open to  
07/14/97 2.6m 7.5m

SHEET 1 OF 1



# Terraprobe

PROJECT No: 97 - 1019

CLIENT: MTO c/o C.C. Parker

LOCATION: See Plan Figure

## LOG OF BOREHOLE 2

STATION 18 + 793, 4.1m Rt of Centreline

Boring Date: July 14, 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT STATIC CONE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N* VALUE	20 40 60 80					
								SHEAR STRENGTH kPa					
								net V - +	0 - ●	Packet Pen - *			U - ○
		GROUND SURFACE		260.5				30	100	150	200	10 20 30	
	0	ASPHALT for 280mm over Sand & Gravel—brown, fine to medium, moist, compact.		0.0									
				259.9									
	1	SAND— brown with some gravel, fine, moist, compact. (FILL)		0.6	1	SS	9	X			○		
				259.1									
	2	SILT— grey with some sand and wood, fine, moist to wet, loose. (possible fill)		1.4	2	SS	10	X					
	3				3	SS	8	X			○		
	4				4	SS	6	X			○		
	5				5	SS	6	X			○		
				255.2									
	6	SILTY CLAY— grey with wood and roots, wet, firm to stiff.		5.3	6	SS	2	X			○		
	7			253.3									
		SILT— grey with some wood, fine, saturated, compact.		7.2	7	SS	14	X *			○		
	8												
					8	SS	12	X			○		
	9			250.9									
		END OF BOREHOLE		9.6									

NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

2) Water Level Records

Date W.L. Open to  
07/14/97 2.1m 8.6m

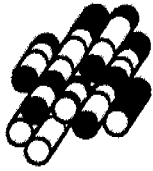
SHEET 1 OF 1

### NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

2) Water Level Records

Date W.L. Open to  
07/14/97 2.1m 8.6m



# Terraprobe

PROJECT No: 97 - 1019

CLIENT: MTO c/o C.C. Parker

LOCATION: See Plan Figure

## LOG OF BOREHOLE 3

STATION 18 + 803, 3.9m Rt of Centreline

Boring Date: July 14, 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT STATIC CONE PLOT - X				WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa					
								net V - +	Q - ●	Pocket Pen - *			U - ○
		GROUND SURFACE		260.5									
		ASPHALT for 300mm over Sand & Gravel-brown, fine to medium, moist, compact.		260.1									
		SAND- brown with some wood, fine, moist, loose.		0.4									
	1	(FILL)			1	SS	16	X					
					2	SS	7	X					
	2	SILT- grey with some sand and organic matter, fine, moist, compact.		258.4									
				2.1	3	SS	13	X					
				257.6									
	3	SAND- grey with some wood and trace of clay at lower level, wet, loose.		2.9	4	SS	3	X					
	4			256.1									
		CLAYEY SILT- grey with some roots and wood fragments, wet, firm.		4.4	5	SS	5	X *					
	5												
	6				6	SS	5	X *					
	7			253.1									
		SAND- grey with some cobbles and and wood, saturated, loose.		7.4	7	SS	4	X					
	8												
					8	SS	5	X					
	9			250.9									
		END OF BOREHOLE		9.6									

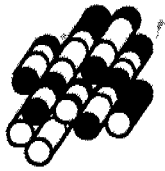
NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

2) Water Level Records

Date W.L. Open to  
07/14/97 2.0m 7.7m

SHEET-1 OF 1



# Terraprobe

PROJECT No: 97 - 1019

CLIENT: MTO c/o C.C. Parker

LOCATION: See Plan Figure

## LOG OF BOREHOLE 4

STATION 18 + 804, 3.8m Lt of Centreline

Boring Date: July 14, 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			SPT STATIC CONE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20 40 60 80						
							SHEAR STRENGTH kPa						
							netV - + 0 - ● Passive Pen- * U - ○ 50 100 150 200						
							10 20 30						
TRUCK MOUNT	0	GROUND SURFACE		206.5									
		ASPHALT for 210mm over Sand & Gravel-brown, fine to medium, moist, compact.		206.1									
		SAND- brown, fine, moist, compact.		0.4									
	1	(FILL)			1	SS	25	X					
				259.2									
		SILT- grey with some sand, fine, moist, compact.		1.3	2	SS	12	X					
	2			258.3									
		SAND- grey with some wood and trace of clay at lower level, moist, loose.		2.2	3	SS	7	X					
	3				4	SS	3	X					
	4												
				256.1									
	5	CLAYEY SILT- grey with some sand seams, saturated at tip, firm.		4.4	5	SS	3	X					
	6			254.6									
		CLAY- grey with some roots and wood, wet, firm.		5.9	6	SS	3	X					
7													
			252.6										
8	SILT- grey with some roots and wood, wet, loose.		7.9	7	SS	3	X						
			251.7										
9	SAND- grey with some cobbles, medium, saturated, compact.		8.8	8	SS	15	X						
			250.9										
	END OF BOREHOLE		9.6										

43%

NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

2) Water Level Records

Date W.L. Open to  
07/14/97 2.2m 7.1m

SHEET 1 OF 1

### NOTES:

1) Borehole advanced by  
continuous flight hollow  
stem augers on July 14,  
1997.

### 2) Water Level Records

Date W.L. Open to  
07/14/97 2.2m 7.1m





# Terraprobe

## LOG OF BOREHOLE 5

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+783, 4.0m a/s Lt. of C/L of NEB

CLIENT: MTD c/a C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE		WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	STATIC CONE PLOT -			
								20			40
BOMBARDIER B57	0	GROUND SURFACE		260.1							
		SILT - brown to grey, moist to wet, compact.		0.0							
	1										
		Trace of organics.			1	SS	10	X			24%
	2										
	3										
		Trace of sand.			2	SS	26		X		
	4										
		Auger grinding @ 4.0m.									
	5										
	Seams with trace of clay, 50mm seam of sand and gravel at 5.0m.				3	SS	17		X		
6											
	Trace of sand, trace to some clay.					4	SS	10		X	31%
7				253.4							
	END OF BOREHOLE			6.7							
8		NOTES:									
		1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97.									
		2) Water Level Records									
9		Date Aug. 5, 97	WL(m) 2.1	Cave to (m) 3.7							



# Terraprobe

## LOG OF BOREHOLE 6

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+783, 4.0m o/s Rt. of C/L of NBL

CLIENT: MTD c/o C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -		WATER CONTENT (%)	INSTALLATION INFORMATION			
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	20 40 60 80					
							SHEAR STRENGTH kPa					
							not V - +      0 - ● pocket pen -      U - ○					
0	GROUND SURFACE		260.0									
1	SILT - brown to grey, moist to wet, compact, trace of clay and organics.		0.0	1	SS	11	X					
2												
3												
4	Increased auger resistance at 2.3m.											
5	SAND AND GRAVEL - brown to grey, compact, wet, trace of silt.		254.9	2	SS	27	X					
6												
7												
8	Advanced augers to 6.1m, encountered heaving sands to 4.6m, end borehole.											
9	END OF BOREHOLE		253.3	3	SS	17	X					
10												
11												
12	NOTES:											
13	1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97.											
14	2) Water Level Records											
15	Date Aug. 5, 97	WL(m) 1.8	Cave to (m) 3.4									



# Terraprobe

## LOG OF BOREHOLE 7

PROJECT NAME: Four Lining of Hwy. # 11

STATION: 18+807, 4.0m a/s Lt. of C/L of NBL

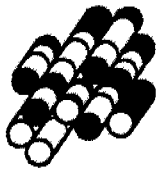
CLIENT: MTO c/o C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20 40 60 80							
							SHEAR STRENGTH kPa							
							net.V - + 0 - ●				pocket pen + U - ○			
0	GROUND SURFACE		260.1											
1	SILT - brown to grey, moist to wet, compact to loose.		0.0											
2	Trace of organics.			1	SS	10	X							
3														
4														
5	50mm Seam of sand and gravel at 5.0m.			2	SS	15	X					23%		
6														
7														
8				3	SS	19	X					12%		
9														
10														
11														
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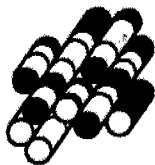
# Terraprobe

## LOG OF BOREHOLE 8

PROJECT NAME: Four Lining of Hwy. #11  
CLIENT: MTO c/o C.C. Parker  
LOCATION: Trout Creek, Ontario

STATION: 18+807, 4.0m a/s Rt. of C/L of NBH  
ELEVATION DATUM:  
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE				WATER CONTENT (%)			INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	STATIC CONE PLOT -				<div><div></div><div></div><div></div></div>			
								X							
								20 40 60 80							
							SHEAR STRENGTH kPa								
							not V - + 0 - ●								
							penetration per m U - ○								
							50 100 150 200				10 20 30				
BOMBARDIER B57	0	GROUND SURFACE		260.1											
		SILT - brown to grey, moist, compact, trace of sand, clay and organics.		0.0											
	1														
	2				1	SS	11	X							
	3														
	4														
	5				2	SS	11	X							
	6														
	7				3	SS	17	X							
	8														
	5	SILTY SAND AND GRAVEL - grey, wet, compact. Auger grinding @ 5.5m		255.0 5.1											
	6														
	7	END OF BOREHOLE		253.4 6.7											
	8	NOTES: 1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97. 2) Water Level Records Date Aug. 5, 97      WL(m) 2.1      Cave to (m) 4.6													
	9														



# Terraprobe

## LOG OF BOREHOLE 9

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+150, C/L of NBL

CLIENT: MTD c/o C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

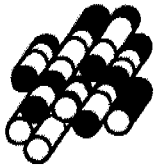
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES		SPT VALUE		STATIC CONE PLOT		WATER CONTENT (%)	INSTALLATION INFORMATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	SHEAR STRENGTH kPa			
								net V - +	q - ●		
BOMBARDIER B57	0	GROUND SURFACE		272.1							
	1	SANDY SILT - brown, moist, trace of clay.		270.9							
	2	SILT - brown, very moist to wet, compact, trace of sand and clay some silt.		1.2	1	SS	15	X			27%
	3	Grinding while augering, rock fragments.			2	SS	28	X			32%
	4	SAND - reddish brown, compact, moist, fine to medium, trace of gravel.		268.0							
	5			4.1	3	SS	26	X			2%
	6	SAND AND GRAVEL - reddish brown, dense, moist, grinding while augering.		266.4							
	7			5.7	4	SS	41	X			
	8	Auger Refusal - Probable Bedrock.		264.2							
	9	END OF BOREHOLE		7.9							

NOTES:  
1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on July 24, 1997.  
2) Water Level Records

Date July 24, 97      WL(m) NIL      Cave to (m) 4.9

18150NBL.DWG



# Terraprobe

## LOG OF BOREHOLE 10

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+182, NBL (Culvert)

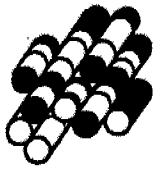
CLIENT: MTO c/o C.C. Parker

ELEVATION DATUM: Local

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -		WATER CONTENT (%)	INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa			
							net.V - +			0 - 0
0	GROUND SURFACE		255.0							
1	SILT - brown to grey, very moist, trace of sand.		254.8							
2	SILTY SAND AND GRAVEL - grey, wet, compact, trace of rock fragments, grinding while augering.		1.2	1	SS	23	X			
3	Auger Refusal - Probable Bedrock.		253.4							
4	END OF BOREHOLE		2.6							
5	NOTES: 1) Borehole advanced by continuous flight hollow stem augers on July 24, 1997.									
6	2) Water Level Records Date WL(m) Cave to (m) July, 24/97 1.8 1.8									
7										
8										
9										



# Terraprobe

## LOG OF BOREHOLE 11

PROJECT NAME: Four Lining of Hwy. #11  
 CLIENT: MTO c/o C.C. Parker  
 LOCATION: Trout Creek, Ontario

STATION: 18+200, 18.8m e/s of C/L (of med.) of NBL  
 ELEVATION DATUM: Local  
 SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -		WATER CONTENT (%)	INSTALLATION INFORMATION			
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa					
							20 40 60 80					
							not V - +      q - ● point test *      U - ○					
0	GROUND SURFACE		268.3 0.00									
1	SILTY SAND - brown, moist, some gravel and cobbles, grinding while augering.		265.1 1.2									
2	SILTY SAND AND GRAVEL - brown, dense, some rock fragments, grinding while augering.			1	SS	49		X				
3	Auger Refusal - Probable Bedrock.		263.4 2.9									
4	END OF BOREHOLE											
5	NOTES: 1) Borehole advanced by continuous flight hollow stem augers on July 24, 1997.											
6	2) Water Level Records Date      WL(m)      Cave to (m) July, 24/97      NIL      2.1											
7												
8												
9												

STA 17+730 C/L of NBL

0 - 170 Org M, Blk, Moist to Wet  
170 - 450 Sa & Si, Br, Moist, Compact  
450 NFP BR

STA 17+730 5.5m Rt of C/L of NBL

0 - 375 Org M, Blk, Moist to Wet  
160 - 375 Sa & Gr W Tr of Si, Br, Moist, Compact  
375 NFP BR

STA 17+750 C/L of NBL

0 - 180 Org M W Tr of Sa, Blk, Moist to Wet  
180 - 610 Sa & Si, Br, Moist, F, Compact  
610 NFP BR

STA 17+750 5.5m Rt of C/L of NBL

0 - 175 Org M, Blk, Moist to Wet  
175 - 450 Sa & Si, Br, Moist, Compact  
450 NFP BR

STA 17+775 C/L of NBL

0 - 1.80 Co(y) Gr, Br, Moist, Compact  
1.80 - 2.40 Sa & Si, Br to Gry, Moist, F, Comp  
2.40 - 3.00 Sa & Gr, Br, Moist, Compact

STA 17+825 C/L of NBL

0 - 3.00 Sa & Si, Br to Gry, Moist, Compact

STA 17+825 5.5m Rt of C/L of NBL

0 - 160 Org M, Blk, Moist to Wet  
160 - 950 Sa & Si, Br, Moist, Compact  
950 NFP BR

STA 17+875 Not accessible; steep rock face

STA 18+050 C/L of NBL

0 - 190 Org M, Blk, Moist to Wet  
190 - 4.30 Si W Tr of Cl, Br, Moist, Loose  
4.30 - 6.50 Cl & Si, Gry, Wet, Soft  
6.50 - 7.00 Si, Gry, Moist, Compact to Dense

STA 18+182 25.0m Rt of C/L of NBL  
(opposite box culvert)

**BH 12**

0 - 100 Org M, Blk, Wet  
100 - 690 Sa(y) Si, Br, Moist, Compact  
690 NFP BR



STA 18+182 25.0m Lt of C/L of NBL **BH 13**

0 - 100 Org M, Blk, Wet  
100 - 750 Sa(y) Si, Br, Moist, Compact  
750 NFP BR

STA 18+250 C/L of NBL

0 - 2.10 Sa & Gr W Tr of Org, Br, Moist Compact  
2.10 - 3.00 Si(y) Cl, Br to Gry, Moist, Stiff

STA 18+275 C/L of NBL

0 - 700 Sa & Si W Tr of Org, Br, Moist, Compact  
700 - 3.00 Si, Br to Gry, Moist to Wet, Compact

STA 18+275 5.5m Rt of C/L of NBL

0 - 1.00 Sa & Si W Tr of Org, Br, Moist, Compact  
1.00 - 3.00 Sa & Si, Br to Gry, Moist to Wet, Compact

STA 18+300 C/L of NBL

0 - 90 Org M, Blk, Moist, Loose  
90 - 2.0 Si, Br, Moist, Compact  
NOTE: 1 m of fill to be placed

STA 18+330 3.0m Rt of Existing Culvert

0 - 90 Org M, Blk, Wet  
90 - 340 Sa(y) Si, Br, Moist, Compact  
340 NFP BR

STA 18+340 5.0m Rt of C/L of NBL

0 - 90 Org M, Blk, Wet  
90 - 480 Sa(y) Si, Br, Moist, Compact  
480 NFP BR

STA 18+349 13.0m Rt of C/L of NBL  
(culvert location)

0 - 80 Org M, Blk, Wet  
80 - 800 Sa(y) Si, Br, Moist, Compact  
800 NFP BR

STA 18+350 C/L of NBL

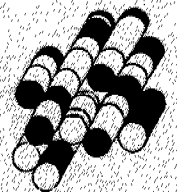
0 - 1.10 Sa & Gr W Tr of Si, Bro to Gry, Moist to Wet, Compact  
1.10 NFP BR

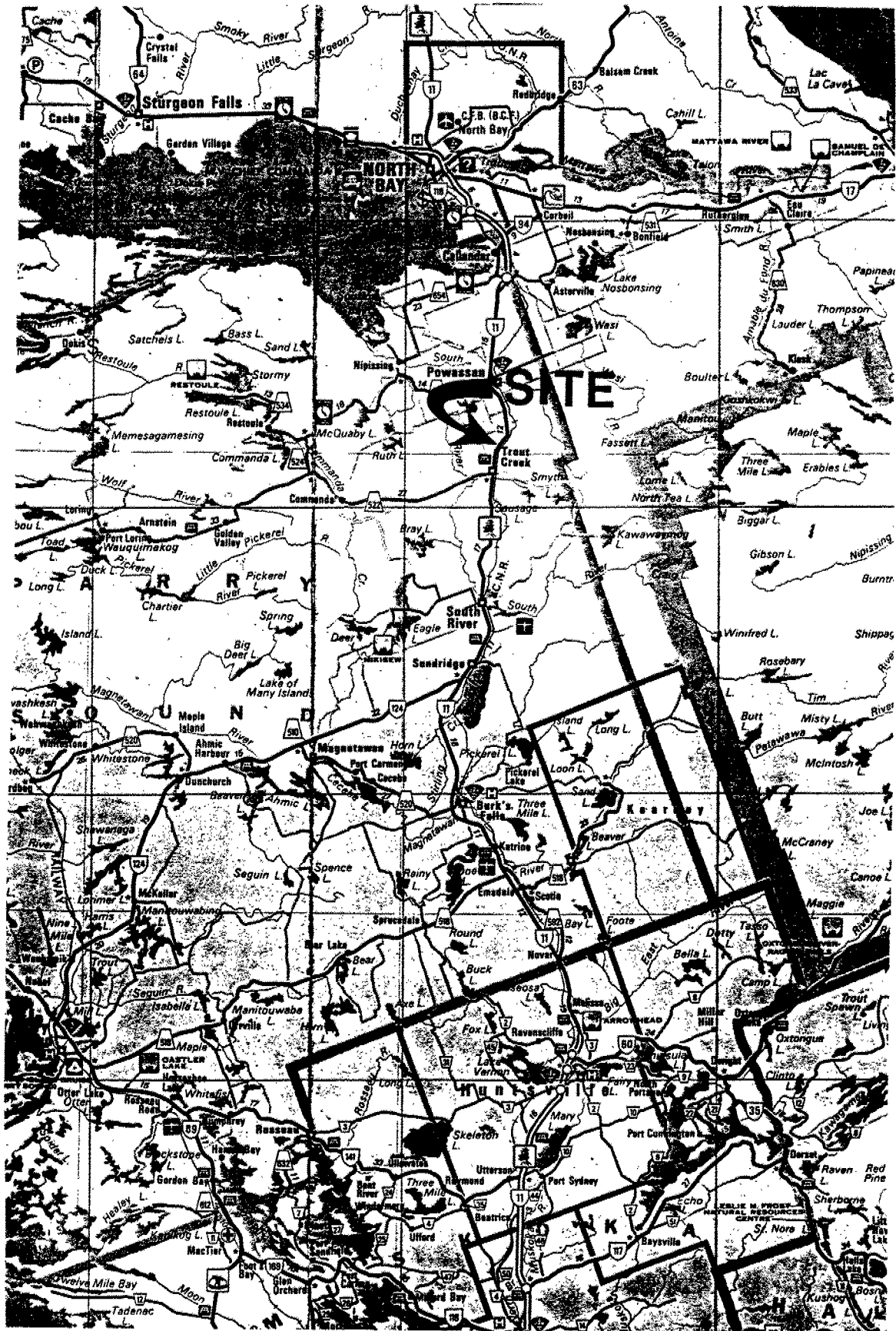
STA 18+375 C/L of NBL

0 - 1.20 Sa & Si W Tr of Org, Br to Gry, Moist to Wet, Compact  
1.20 NFP BR

# FIGURES

**TERRAPROBE LIMITED.**





Nov. 1997

# SITE LOCATION PLAN

971019

TERRAPROBE

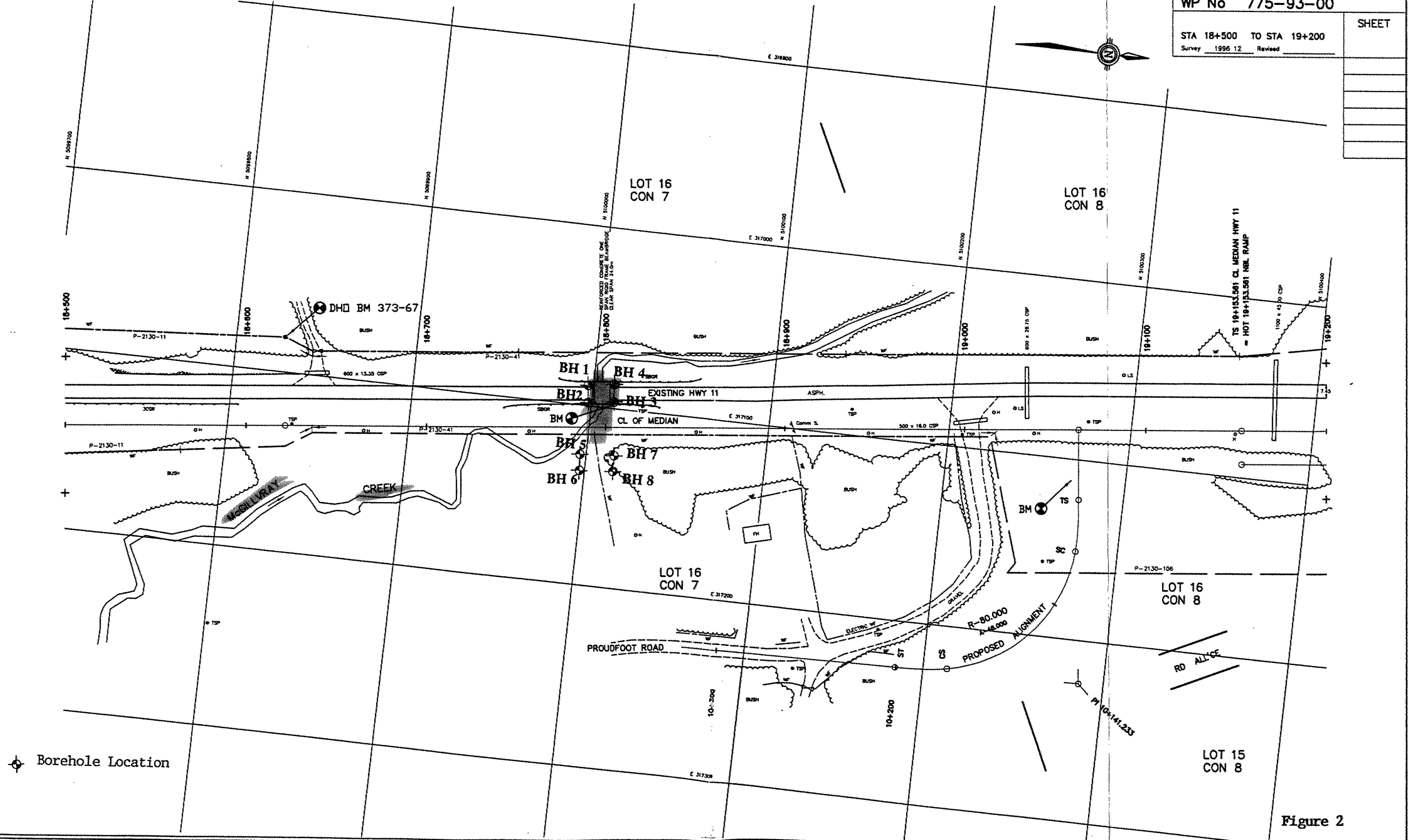
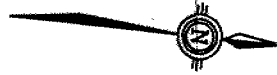
FIGURE 1

METRIC

PLATE No 509-11/23-0  
DRAWING No 05090011023  
CONT No  
WP No 775-93-00

STA 18+500 TO STA 19+200  
Survey 1996 12 Revised

SHEET



TERRAPROBE LIMITED

BOREHOLE LOCATION PLAN

SCALE  
10m 20m

METRIC

PLATE No 509-11/22-0  
DRAWING No 05090011022  
CONT No  
WP No 775-93-00

STA 17+800 TO STA 18+500  
Survey 1996 12 Revised

SHEET

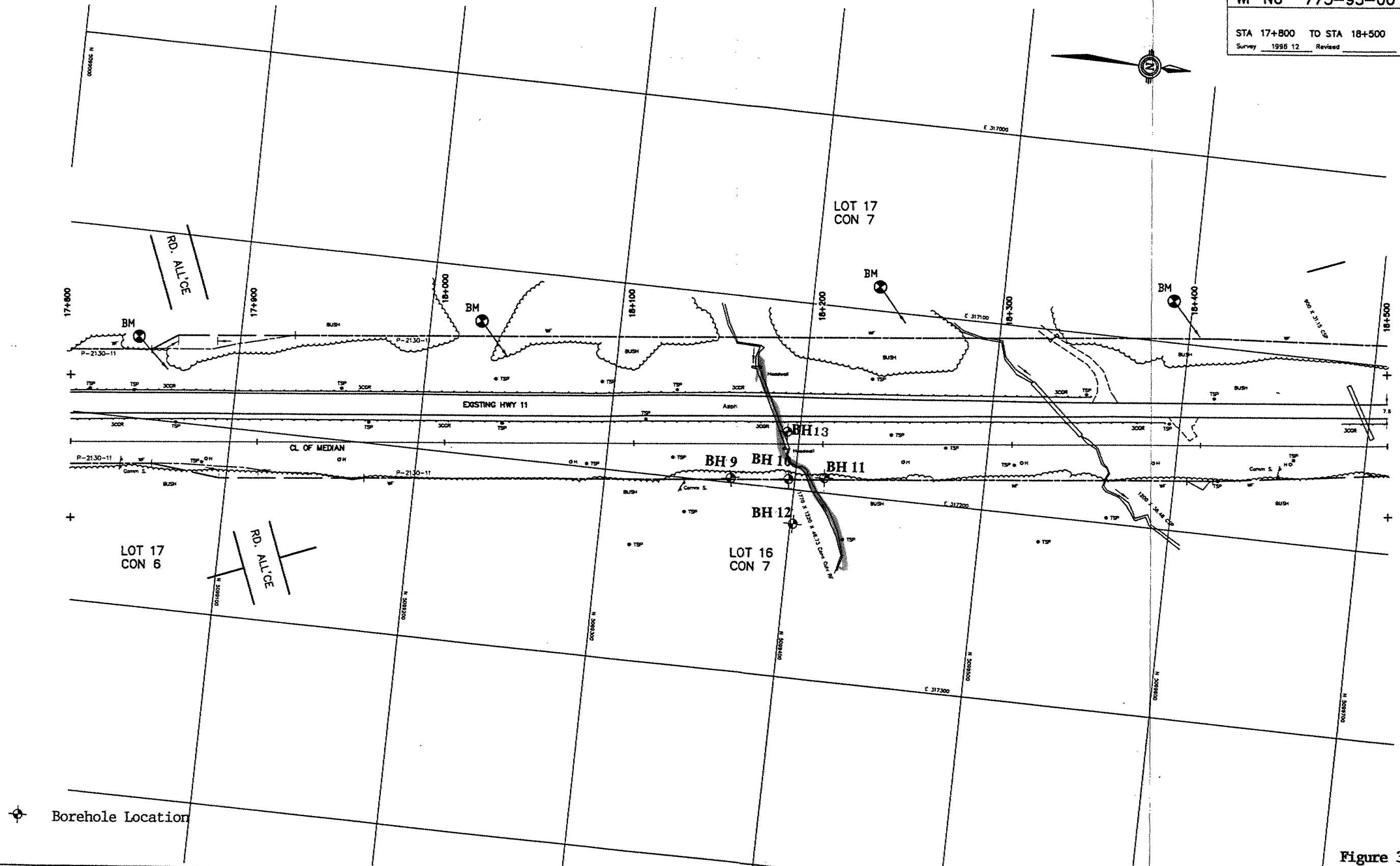


Figure 3

TERRAPROBE LIMITED

BOREHOLE LOCATION PLAN

SCALE  
10m 20m



Terraprobe

SIEVE & HYDROMETER ANALYSIS

TEST FORM

PROJECT Highway #11  
LOCATIO Trout Creek, Ontario  
CLIENT : C.C. Parker

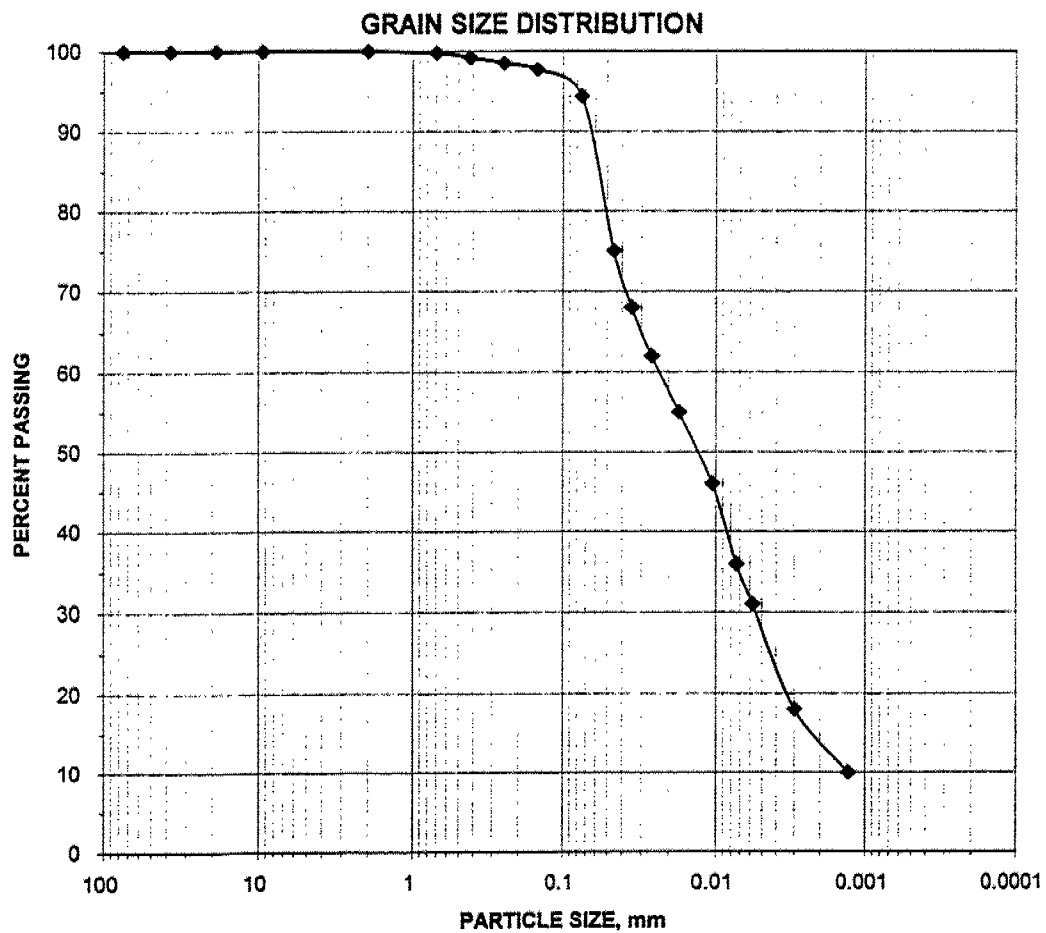
FILE No.: 97 - 1019  
SA DATE : Jul., 1997  
Figure 4

BH No. : 18+807 *NBL*

SA No. : 2

SAMPLE DESCRIPTION: SILT with trace of clay and sand

SA DEPTH:



M.I.T. SYSTEM	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE
	CLAY SIZE						
	GRAVEL	SIZE		SAND	SIZE		FINE

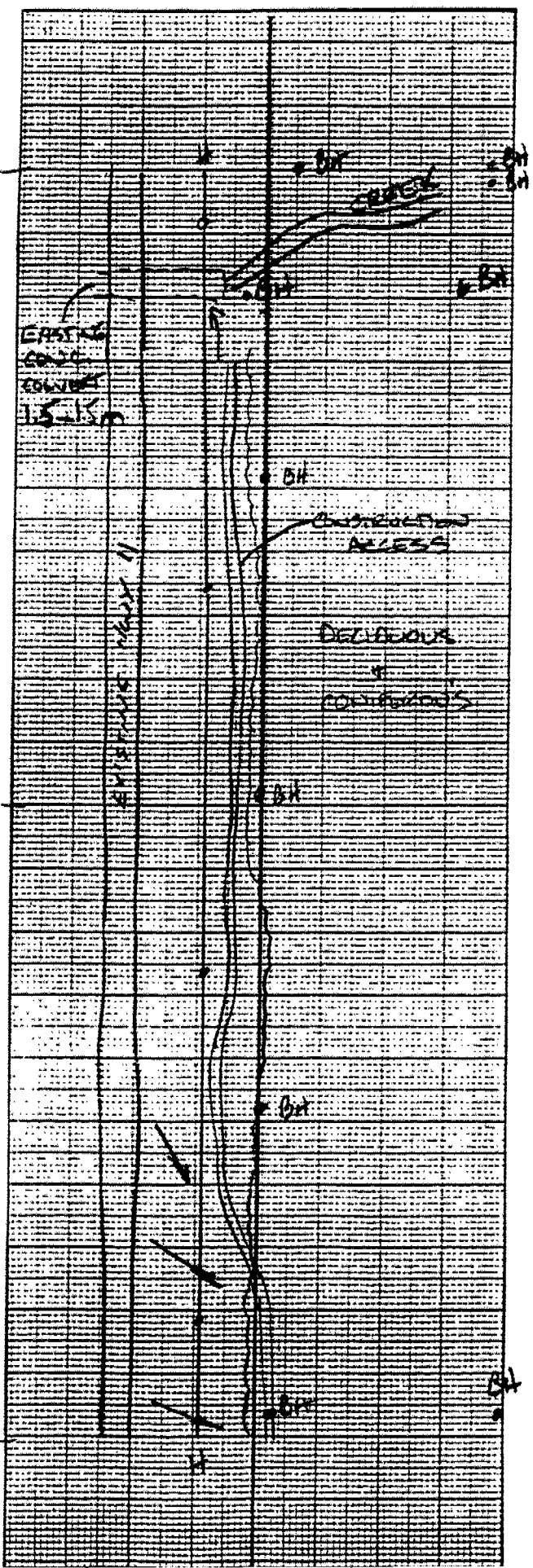
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT	OR	CLAY
	SIZE							
	GRAVEL	SIZE		SAND	SIZE		FINE	GRAINED

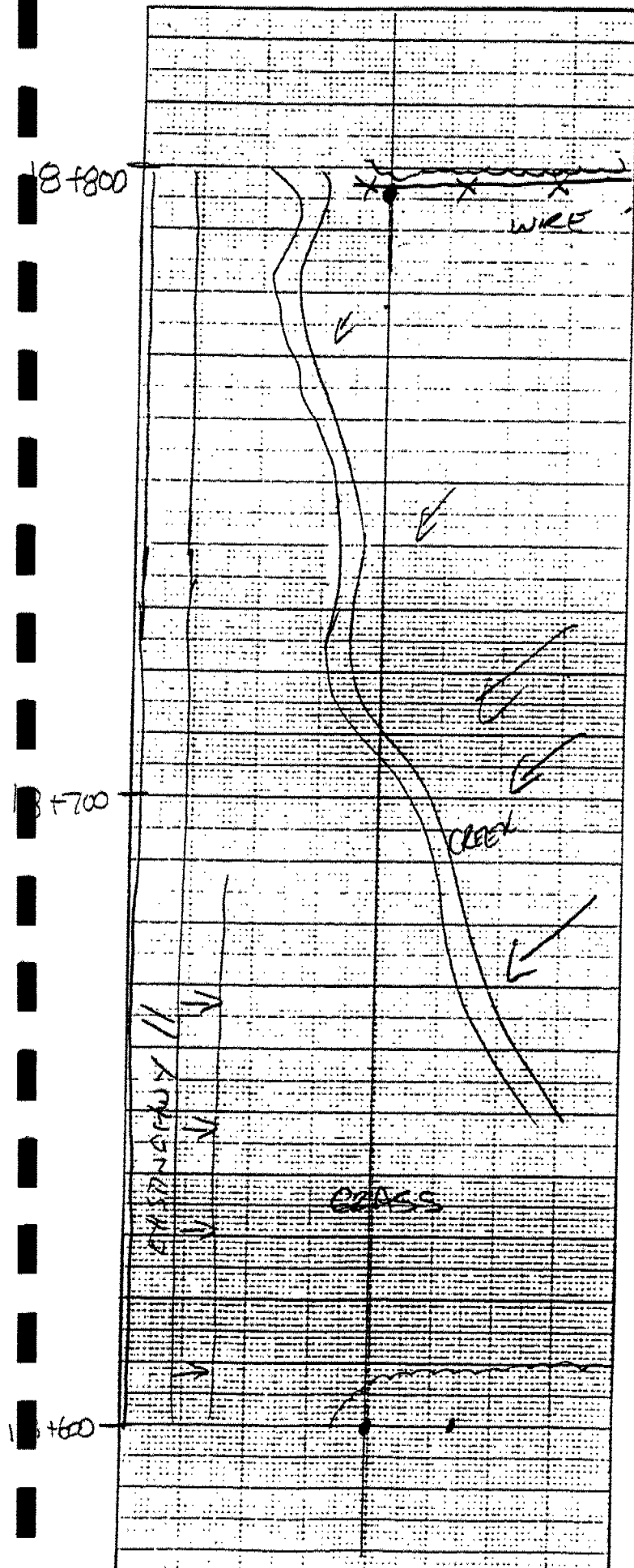
8+200

EXISTING  
CONCRETE  
CURB  
15-15m

8+100

8+00





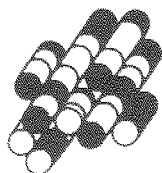


GEOCRES No. 31L-66DIST. 52 REGION                     W.P. No. 775-93-00CONT. No.                     W. O. No.                     STR. SITE No. 44-41HWY. No. 11

LOCATION Hwy 11 Twinning from 1.3 km  
N of Hwy 522 at Trout Creek N'ly 6.1 km  
No of PAGES - McGillivray Creek Culvert

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     REMARKS:



# Terraprobe

*Consulting Geotechnical Engineers & Hydrogeologists  
Construction & Materials Inspection & Testing*

**DRAFT  
FOUNDATION DESIGN REPORT  
WP775-93-00  
HIGHWAY 11 TWINNING  
FROM 1.3km NORTH OF HIGHWAY 522 AT  
TROUT CREEK NORTHERLY FOR 6.1 km  
CULVERTS AT 18+800 AND 18+180  
SOUTH HIMSWORTH TOWNSHIP  
DISTRICT OF PARRY SOUND, ONTARIO**

**OUR FILE NO. 971019  
OCTOBER 21, 1997**

**DISTRIBUTION:**

- 2 cc: Ministry of Transportation of Ontario, Northern Regions Geotechnical Section
- 1 cc: Ministry of Transportation of Ontario, Planning and Design Section
- 1 cc: Parker Consultants
- 2 cc: Terraprobe Limited

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## **1.0 INTRODUCTION**

As part of this project, three (3) concrete box culverts will be constructed. This report addresses the geotechnical recommendations with respect to design and construction of the these structures.

This is the first of a series of projects to four lane Highway 11, between Huntsville and Powassan. It is part of an overall Highway 11, Burkes Falls to Powassan, Category A, Environmental Assessment which received environmental assessment approval on March 29, 1995. This Highway 11, GWP775-93-00, TPM ("project") improvement includes the four laning of Highway 11 (twinning and new construction) from 1.3 km north of Highway 522 at Trout Creek northerly for 6.1 km.

A pavement design report has been prepared to rehabilitate a section of the existing Highway 11 (approximately 3.5 km of the new southbound lanes) and the new construction. This report addresses the geotechnical aspects for two structures at south McGillvray Creek. Specifically, this entails removal and replacement of an existing Highway 11 structure, Site 44-41 and construction of a similar structure for the northbound lanes. These structures will be at approximately Station 18+800.

In addition, another box culvert will be constructed at approximate Station 18+180 below the proposed new north bound lanes.

## **2. SITE AND PROJECT DESCRIPTION**

The site is located in the vicinity of existing Highway 11 just immediately north of the community of Trout Creek. Specifically, the existing rigid frame bridge beneath existing Highway 11 at approximate Station 18+800 will be subexcavated and replaced with a box culvert. A similar concrete box culvert will be placed for the new northbound lanes at this station.

In addition, another new concrete box culvert will be designed and constructed at approximately Station 18+180 below the new northbound lanes as an extension to the existing culvert.

In reviewing proposed road profiles at these locations the new box culverts proposed at approximate Station 18+800 will require approximately 0.6 to 1.0 m of fill above the obvert of the culvert.

The new proposed box culvert at Station 18+180 will require placement of approximately 12m of fill above the obvert of the culvert. This culvert is proposed to be an extension to the existing box culvert.

Geotechnical investigation has been carried out via boreholes at all three proposed culvert locations. The Borehole Logs are appended.

The soils conditions encountered at each location are similar being that of primarily a compact silt containing trace to some clay with sandier compaction conditions with depth. The ground water table is close to the ground surface at each culvert location. The investigation for the proposed culvert at Station 18+180 however, indicates bedrock approximately 2m below the proposed obvert.

### **3.0 FIELD WORK**

The field work for this project was conducted during July and August 1997 when four (4) boreholes were advanced in the area of the existing structure along Highway 11. In addition, four (4) new boreholes were advanced in the area of the new proposed box culvert for the northbound lanes at the same chainage.

Sampled boreholes as well as auger holes were also advanced in the area of the proposed culvert at Station 18+180.

### **4.0 SUBSURFACE CONDITIONS**

#### **4.1 Soil**

The native soil conditions at the McGillvray Creek culverts (i.e. approximate Station 18+800) comprise primarily of a compact silt containing trace to some clay underlain by silty sand or silty sand layers.

The soil conditions encountered at Station 18+180 for the northbound lanes indicates approximately 100 mm of organic matter underlain by a compact sandy silt with bedrock encountered at a depth of approximately 0.7 to 0.8 m below existing ground surface. A borehole advanced at Station 18+182 northbound lane encountered similar compact silts to 1.2 m depth underlain by compact silty sand and gravel with auger refusal encountered at a depth of 2.6 m on probable bedrock along the centreline of the proposed northbound lane.

## **4.2 Rock**

Bedrock was not encountered within the proposed excavation depths for the proposed McGillvray Creek culverts. As noted above however, rock was encountered at depths between 0.8 and 2.6 m below existing ground surface in the vicinity of the proposed new culvert at 18+180±.

## **4.3 Ground Water**

Ground water was encountered at depths primarily between ground surface at the actual proposed culvert locations rising to 1.8 m below ground surface at short offset distances from the stream (18+180)

# **5.0 DISCUSSION AND RECOMMENDATIONS**

## **5.1 Excavation**

It is anticipated that at all three structure locations, excavation will be required into shallow overburden deposits below the ground water table. The native soil is expected to be primarily silts containing trace to some clay with a possibility of encountering some sand and sand and gravel layers.

It is recommended that ground water control be maintained during the excavation process to maintain a dry excavation base. This will likely require a diversion of South McGillvray Creek during this process, extra wide trenches, flatter side slopes on cuts and significant sump pumping. If sump pumping is proven not to be adequate then the use of positive dewatering with well points and/or strategically placed deep wells may also be required.

Temporary excavations for construction of the proposed concrete box precast culverts will be sloped at a minimum of 1 to 1 (horizontal to vertical) from the base of the excavation to ground surface. Flatter side slopes may be required in areas where local loose soil conditions are encountered and where local slumping or ground water ingress occurs and to meet OPSD 803 details.

## **5.2 Bedding**

It will be essential to maintain a dry stable base prior to placement of bedding for the proposed culverts. Bedding for the proposed culverts may comprise of a 19 mm clear stone or more preferably an HL 4 course aggregate wrapped in an approved non woven heavy geotextile fabric.

The subgrade should be stripped of all organic and loosened materials and a geotextile fabric being a Class I non woven fabric with an FOS opening size between 85 and 170 um.

The bedding material for the proposed culverts should comprise of either 600 mm of a 19 mm clear stone that is placed on top of the geotextile fabric or 600 mm of HL 4 course aggregate that is placed and tamped in place. This material should then be wrapped in the geotextile cloth ensuring that there is no opportunity for migration of fines into the stone.

In the case of the closed concrete box culvert, the upper surface of the stone that would be in contact with the concrete does not need to be wrapped. However, provisions must be made in the design to ensure that the migration of fines cannot enter from the edges or from the top surface of the stone that is placed.

## **5.3 Backfill**

The backfill for the proposed culvert may comprise of an OPSS Granular 'B' Type II material that is placed and compacted in uniform lifts of 200 mm or less uniformly to 95% of Standard Proctor Maximum Dry Density (SPMDD). An OPSS Granular 'A' material can also be considered around the culvert. Typically, OPSD 803 drawing specifications are applicable.

It would be recommended to achieve compaction adjacent to the structure using light

compaction equipment to avoid damage. Opposite sides should be backfilled together to avoid unbalanced loading and possible movement of the precast units.

#### 5.4 Lateral Earth Pressure Coefficient

Based on the backfilling of the proposed culvert with the Granular 'B' or Granular 'A' material the following lateral earth pressure coefficient are provided.

	Granular 'A'	Granular 'B'
Effective Angle of Internal Friction (Phi), degrees, unfactored	35	30
Unit Weight (Gamma) kN/m <sup>3</sup>	22.8	21.2
Active Earth Pressure Coefficient, K <sub>a</sub> (SLS) (ULS)	0.27 0.36	0.33 0.41
At Rest Earth Pressure Coefficient, K <sub>o</sub> (SLS) (ULS)	0.43 0.53	0.50 0.58
Passive Earth Pressure Coefficient, K <sub>p</sub> (SLS) (ULS)	3.7 2.8	3.0 2.4

It should be noted that the mobilization of the active earth pressure behind the wall will require an outward deflection of up to 0.5 percent of the wall height, as measured at the top of the wall. Since the culvert is assumed to be a rigid frame structure and is constrained so that this deflection cannot occur then the "at rest" earth pressure should be used in design.

Drainage from behind the culvert must be provided via adequate spaced and filtered weep holes or alternative measures, otherwise unbalanced hydrostatic pressures must be considered.

#### 5.5 Bearing Capacity

Based on the compact silt soils anticipated in the founding strata at each of the three culvert locations, we would suggest a Serviceability Limit State bearing capacity of 200 kPa and an Ultimate Limit State capacity of approximately 350 kPa. The above associated values would result in anticipated settlement in the order of 25 mm.



Settlement of the culverts at the South McGillvray Creek crossings (south bound and north bound lanes) are not anticipated to be an issue. Minimal fill heights in the order of less than 2 m above these culverts is proposed.

Considerable filling will need to be placed above the proposed culvert at Station 18+180± which will be constructed as an extension to the existing culvert. The addition of approximately 12m of fill above the proposed culvert needs to be considered.

Based on the soil information provided at this culvert location, it is anticipated that less than 1 m of overburden soils will be in place below the bedding at this culvert location. It is also anticipated that the native subgrade soil will be a compact silt.

Some differential settlement should be anticipated at the connection to the existing culvert. However, at this location, less than 2 m of fill directly above the new culvert at this location is anticipated and therefore differential movement at this location is considered to be less than 19 mm.

If differential settlement is a concern from the designers perspective at this extension at Station 18+180 consideration could be given to removing all overburden soils down to the native bedrock surface and backfilling with the prescribed bedding materials or another approved engineered fill. However we do not feel that this is necessary for the proposed precast box culvert sections. If a cast in place structure is chosen an isolation joint may be required between the existing and new structures.

## **6.0 SUMMARY**

In summary, the two culverts being proposed at the south McGillvray Creek crossing for the north and southbound lanes are anticipated to encounter no significant geotechnical constraints. A native compact silt containing trace to some clay subgrade is anticipated with ground water control and diversion of the creek required prior to excavation. The excavation bases at this location will need to be kept dry during the placement of the granular bedding materials and during the backfill process.

The proposed culvert extension at approximate chainage 18+180 will ultimately require significant fill depths to be placed above the obvert (i.e. in the order of 12 m). Differential movement at the connection to the existing culvert is considered to be tolerable because the proposed fill depth at this location will be anticipated to be less than 2 m being at the toe of the proposed fill embankment.

If you should have any questions, please do not hesitate to contact the undersigned.

Sincerely,  
**TERRAPROBE LIMITED**

**DRAFT**

Tim Orpwood, P. Eng.  
Associate

**DRAFT**

Kirk R. Johnson, P. Eng.  
Associate

Appendix      Borehole Logs  
                 Figures 1 and 2  
                 Grain Size Analysis  
                 Pedologic Sketches



# Terraprobe

PROJECT No: 97 - 1019  
 CLIENT: MTO c/o C.C. Parker  
 LOCATION: See Plan Figure

## LOG OF BOREHOLE

STATION 18 + 793, 3.8m Lt of Centreline  
 Boring Date: July 14, 1997  
 SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES		SPT STATIC CONE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	SHEAR STRENGTH kPa					
								20	40			60	80
	0	GROUND SURFACE		260.0									
		ASPHALT for 235mm over Sand & Gravel—brown, fine to medium, moist, compact.		259.6									
	1	SAND— brown with some cobble, fine, moist, compact. (FILL)		0.4	1	SS	26	X					
				258.6									
	2	SILT— grey with some clay and sand pockets, fine, moist to wet, loose.		1.4	2	SS	7	X					
					3	SS	15	X					
	3				4	SS	8	X					
	4												
	5				5	SS	3	X					
				254.6									
	6	CLAY— grey with sand seams and roots, wet, soft.		5.4	6	SS	2	X					
	7												
	8				7	SS	2	X*					
				251.2									
	9	SILT— grey, fine, saturated, compact.		8.8	8	SS	15	X					
				250.4									
		END OF BOREHOLE		9.6									

NOTES:  
 1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.  
 2) Water Level Records  
 Date W.L. Open to  
 07/14/97 2.6m 7.5m



# Terraprobe

PROJECT No: 97 - 1019

CLIENT: MTO c/o C.C. Parker

LOCATION: See Plan Figure

## LOG OF BOREHOLE

STATION 18 + 793, 4.1m Rt of Centreline

Boring Date: July 14, 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES		SPT STATIC CONE PLOT				WATER CONTENT (%)		INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	20 40 60 80				10 20 30		
						SHEAR STRENGTH kPa not V - + 0 - ● Pocket Pen - * U - ○						
0	GROUND SURFACE	260.5										
	ASPHALT for 280mm over Sand & Gravel—brown, fine to medium, moist, compact.	0.0										
1	SAND— brown with some gravel, fine, moist, compact. (FILL)	259.9 0.6	1	SS	9	X						
2	SILT— grey with some sand and wood, fine, moist to wet, loose. (possible fill)	259.1 1.4	2	SS	10	X						
3			3	SS	8	X						
4			4	SS	6	X						
5			5	SS	6	X						
6	SILTY CLAY— grey with wood and roots, wet, firm to stiff.	255.2 5.3	6	SS	2	X						
7		253.3										
8	SILT— grey with some wood, fine, saturated, compact.	7.2	7	SS	14	X*						
9			8	SS	12	X						
	END OF BOREHOLE	250.9 9.6										

NOTES:  
1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.  
2) Water Level Records  
Date W.L. Open to  
07/14/97 2.1m 8.6m



# Terraprobe

PROJECT No: 97 - 1019  
 CLIENT: MTO c/o C.C. Parker  
 LOCATION: See Plan Figure

## LOG OF BOREHOLE

STATION 18 + 803, 3.9m Rt of Centreline  
 Boring Date: July 14, 1997  
 SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT STATIC CONE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	20 40 60 80					
								SHEAR STRENGTH kPa					
								net.V - +	q - ●	Packet Pen - *	U - ○		
								50 100 150 200			10 20 30		
	0	GROUND SURFACE		260.5									
		ASPHALT for 300mm over Sand & Gravel-brown, fine to medium, moist, compact.		260.1									
		SAND- brown with some wood, fine, moist, loose.		0.4									
	1	(FILL)			1	SS	16	X			○		
					2	SS	7	X			○		
	2			258.4									
		SILT- grey with some sand and organic matter, fine, moist, compact.		2.1	3	SS	13	X					
				257.6									
	3	SAND- grey with some wood and trace of clay at lower level, wet, loose.		2.9	4	SS	3	X			○		
	4			256.1									
		CLAYEY SILT- grey with some roots and wood fragments, wet, firm.		4.4	5	SS	5	X *			○		
	5												
	6				6	SS	5	X *			○		
	7			253.1									
		SAND- grey with some cobbles and and wood, saturated, loose.		7.4	7	SS	4	X			○		
	8												
					8	SS	5	X			○		
	9			250.9									
		END OF BOREHOLE		9.6									

NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

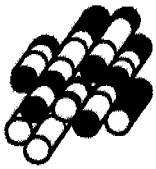
2) Water Level Records

Date            W.L.    Open to

07/14/97    2.0m    7.7m

SHEET -1 OF 1

NOTES:  
 1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.  
 2) Water Level Records  
 Date W.L. Open to  
 07/14/97 2.0m 7.7m



# Terraprobe

PROJECT No: 97 - 1019

CLIENT: MTO c/o C.C. Parker

LOCATION: See Plan Figure

## LOG OF BOREHOLE

STATION 18 + 804, 3.8m Lt of Centreline

Boring Date: July 14, 1997

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES		SPT STATIC CONE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION				
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N VALUE	20 40 60 80								
							SHEAR STRENGTH kPa								
TRUCK MOUNT							not V - + 0 - 0				Pocket Pen - + U - 0				
							50 100 150 200				10 20 30				
0	GROUND SURFACE		206.5												
	ASPHALT for 210mm over Sand & Gravel—brown, fine to medium, moist, compact.		206.1												
	SAND— brown, fine, moist, compact.		0.4												
1	(FILL)		259.2	1	SS	25									
	SILT— grey with some sand, fine, moist, compact.		1.3	2	SS	12	X								
2			258.3												
	SAND— grey with some wood and trace of clay at lower level, moist, loose.		2.2	3	SS	7	X								
3				4	SS	3	X								
4			256.1												
5	CLAYEY SILT— grey with some sand seams, saturated at tip, firm.		4.4	5	SS	3	X								
6			254.6												
	CLAY— grey with some roots and wood, wet, firm.		5.9	6	SS	3	X								43%
7			252.6	7	SS	3	X								
8	SILT— grey with some roots and wood, wet, loose.		7.9												
			251.7												
9	SAND— grey with some cobbles, medium, saturated, compact.		8.8	8	SS	15	X								
			250.9												
	END OF BOREHOLE		9.6												

NOTES:

1) Borehole advanced by continuous flight hollow stem augers on July 14, 1997.

2) Water Level Records

Date W.L. Open to  
07/14/97 2.2m 7.1m

SHEET 1 OF 1



# Terraprobe

## LOG OF BOREHOLE

PROJECT NAME: Four Lining of Hwy. #11  
 CLIENT: MTD c/o C.C. Parker  
 LOCATION: Trout Creek, Ontario

STATION: 18+783, 4.0m a/s Lt. of C/L of NBL  
 ELEVATION DATUM:  
 SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE		WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N-VALUE	STATIC CONE PLOT -			
								X			
								20 40 60 80			
	0	GROUND SURFACE		260.1							
	0.0	SILT - brown to grey, moist to wet, compact.									
	1										
	2	Trace of organics.			1	SS	10	X		24%	
	3										
	4	Trace of sand.			2	SS	26	X			
	5	Auger grinding @ 4.0m.									
	6	Seams with trace of clay. 50mm seam of sand and gravel at 5.0m.			3	SS	17	X			
	7	Trace of sand, trace to some clay.			4	SS	10	X		31%	
	8	END OF BOREHOLE		253.4							
	9	NOTES: 1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97. 2) Water Level Records Date Aug. 5, 97 WL(m) 2.1 Cave to (m) 3.7		6.7							



# Terraprobe

## LOG OF BOREHOLE

PROJECT NAME: Four Lining of Hwy. #11  
 CLIENT: MTD c/o C.C. Parker  
 LOCATION: Trout Creek, Ontario

STATION: 18+783, 4.0m o/s Rt. of C/L of NBL  
 ELEVATION DATUM:  
 SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -				WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	SHEAR STRENGTH kPa					
								20 40 60 80					
								net V - +      Q - ● point pen *      U - ○					
BOMBARDIER B57	0	GROUND SURFACE		260.0									
	0.0	SILT - brown to grey, moist to wet, compact, trace of clay and organics.											
	1												
	2												
	2.3	Increased auger resistance at 2.3m.											
	3												
	4												
	4.9	SAND AND GRAVEL - brown to grey, compact, wet, trace of silt.											
	5.1												
	5.7	Advanced augers to 6.1m, encountered heaving sands to 4.6m, end borehole.											
6													
6.7	END OF BOREHOLE												
7	NOTES: 1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97. 2) Water Level Records Date      WL(m)      Cave to (m) Aug. 5, 97      1.8      3.4												
8													
9													





# Terraprobe

## LOG OF BOREHOLE

PROJECT NAME: Four Lining of Hwy. # 11

STATION: 18+807, 4.0m o/s Lt. of C/L of NBL

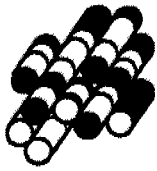
CLIENT: MTO c/o C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	20 40 60 80				10 20 30			
							SHEAR STRENGTH kPa							
							net V - +	0 - ●	pushed pan -	U - ○				
0	GROUND SURFACE		260.1											
0.0	SILT - brown to gray, moist to wet, compact to loose.													
1														
2	Trace of organics.			1	SS	10	X							
3														
4														
5	50mm Seam of sand and gravel at 5.0m.			3	SS	19	X					12%		
6														
7	Trace of sand, trace to some clay.			4	SS	8	X					28%		
7	END OF BOREHOLE		253.4											
8	NOTES: 1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97. 2) Water Level Records Date Aug. 5, 97      WL(m) 3.4      Cave to (m) 4.9		6.7											
9														



# Terraprobe

## LOG OF BOREHOLE

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+807, 4.0m a/s Rt. of C/L of NBH

CLIENT: MTO c/o C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE				WATER CONTENT (%)				INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N° VALUE	STATIC CONE PLOT -				<div><div></div><div></div><div></div></div>				
								X								
								20 40 60 80								
							SHEAR STRENGTH kPa									
							net V - +      0 - 0									
							point pen -      U - 0									
							50 100 150 200				10 20 30					
BOMBARDIER B57	0	GROUND SURFACE		260.1												
		SILT - brown to gray, moist, compact, trace of sand, clay and organics.		0.0												
	1															
	2				1	SS	11	X								
	3															
	4															
	5				2	SS	11	X								
	6															
	7				3	SS	17	X								
	8															
	5	SILTY SAND AND GRAVEL - grey, wet, compact. Auger grinding @ 5.5m		255.0 5.1												
	6															
	7	END OF BOREHOLE		253.4 6.7												
	8	NOTES: 1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on Aug. 5, 97. 2) Water Level Records Date      WL(m)      Cave to (m) Aug. 5, 97      2.1      4.6														
	9															



# Terraprobe

## LOG OF BOREHOLE

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+150, C/L of NEB

CLIENT: MTD c/o C.C. Parker

ELEVATION DATUM:

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE				WATER CONTENT (%)	INSTALLATION INFORMATION	
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N* VALUE	STATIC CONE PLOT -					
								SHEAR STRENGTH kPa					
								net V - +	Q - ●	point test * U - ○			
	0	GROUND SURFACE		272.1									
	1	SANDY SILT - brown, moist, trace of clay.		270.9									
	2	SILT - brown, very moist to wet, compact, trace of sand and clay some silt.		1.2	1	SS	15	X				27%	
	3	Grinding while augering, rock fragments.											
	4				2	SS	28	X				32%	
	5	SAND - reddish brown, compact, moist, fine to medium, trace of gravel.		268.0									
	6			4.1									
	7				3	SS	26	X				2%	
	8	SAND AND GRAVEL - reddish brown, dense, moist, grinding while augering.		266.4									
	9			5.7									
	10				4	SS	41	X					
	11	Auger Refusal - Probable Bedrock.		264.2									
	12	END OF BOREHOLE		7.9									
	13	NOTES: 1) Boreholes advanced by continuous flight hollow stem augers through soil overburden on July 24, 1997. 2) Water Level Records Date July 24, 97 WL(m) NIL Cave to (m) 4.9											

18150NBL.DWG



# Terraprobe

## LOG OF BOREHOLE

PROJECT NAME: Four Lining of Hwy. #11

STATION: 18+182, NBL (Culvert)

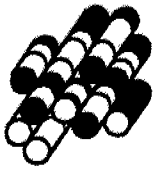
CLIENT: MTO c/o C.C. Parker

ELEVATION DATUM: Local

LOCATION: Trout Creek, Ontario

SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -				WATER CONTENT (%)	INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa					
							20 40 60 80					
							50 100 150 200					
0	GROUND SURFACE		266.0									
1	SILT - brown to grey, very moist, trace of sand.		264.8									
2	SILTY SAND AND GRAVEL - grey, wet, compact, trace of rock fragments, grinding while augering.		1.2	1	SS	23	X					
3	Auger Refusal - Probable Bedrock.		263.4									
4	END OF BOREHOLE		2.6									
5	NOTES: 1) Borehole advanced by continuous flight hollow stem augers on July 24, 1997. 2) Water Level Records Date WL(m) Cave to (m) July, 24/97 1.8 1.8											
6												
7												
8												
9												



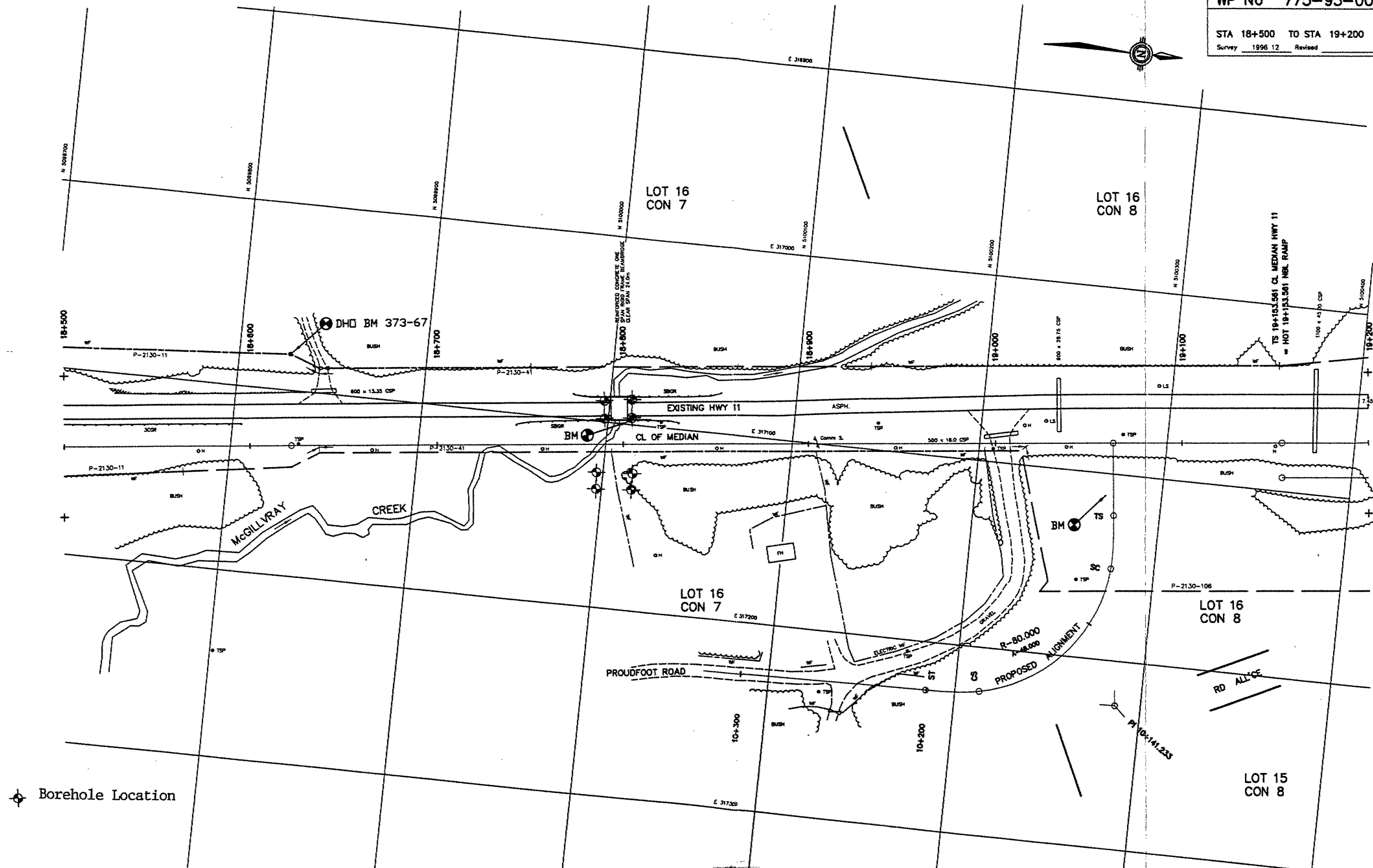
# Terraprobe

## LOG OF BOREHOLE

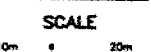
PROJECT NAME: Four Lining of Hwy. #11  
CLIENT: MTO c/o C.C. Parker  
LOCATION: Trout Creek, Ontario

STATION: 18+200, 18.8m e/s of C/L (of med.) of NBL  
ELEVATION DATUM: Local  
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			SPT VALUE STATIC CONE PLOT -		WATER CONTENT (%)	INSTALLATION INFORMATION			
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	N* VALUE	20 40 60 80					
							SHEAR STRENGTH kPa					
0	GROUND SURFACE		266.3									
0.66	SILTY SAND - brown, moist, some gravel and cobbles, grinding while augering.		265.1									
1.2	SILTY SAND AND GRAVEL - brown, dense, some rock fragments, grinding while augering.			1	SS	49						
2.9	Auger Refusal - Probable Bedrock.		263.4									
3	END OF BOREHOLE											
4	NOTES: 1) Borehole advanced by continuous flight hollow stem augers on July 24, 1997. 2) Water Level Records Date July, 24/97 WL(m) NIL Cave to (m) 2.1											
5												
6												
7												
8												
9												



SHEET



Terraprobe

SIEVE & HYDROMETER ANALYSIS  
TEST FORM

PROJECT Highway #11  
LOCATIO Trout Creek, Ontario  
CLIENT : C.C. Parker

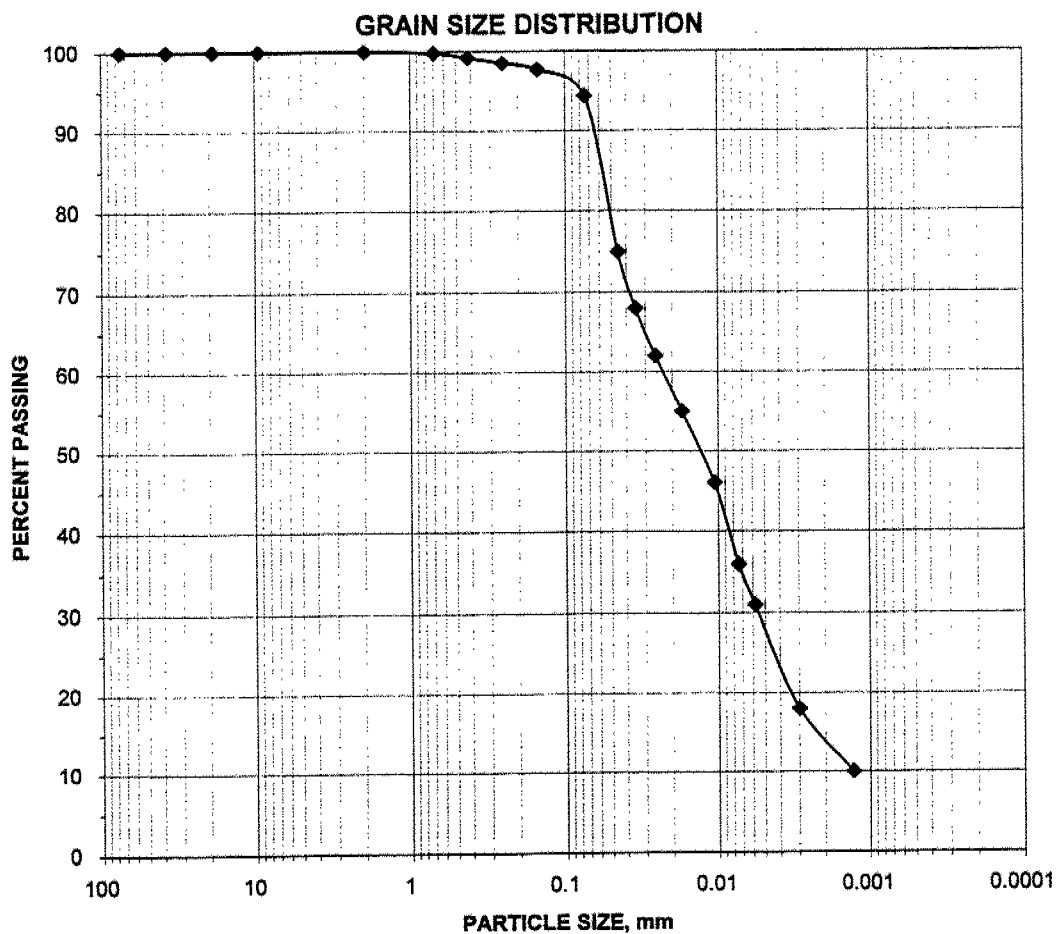
FILE No.: 97 - 1019  
SA DATE : Jul., 1997

BH No. : 18+807 *NBL*

SA No. : 2

SAMPLE DESCRIPTION: SILT with trace of clay and sand

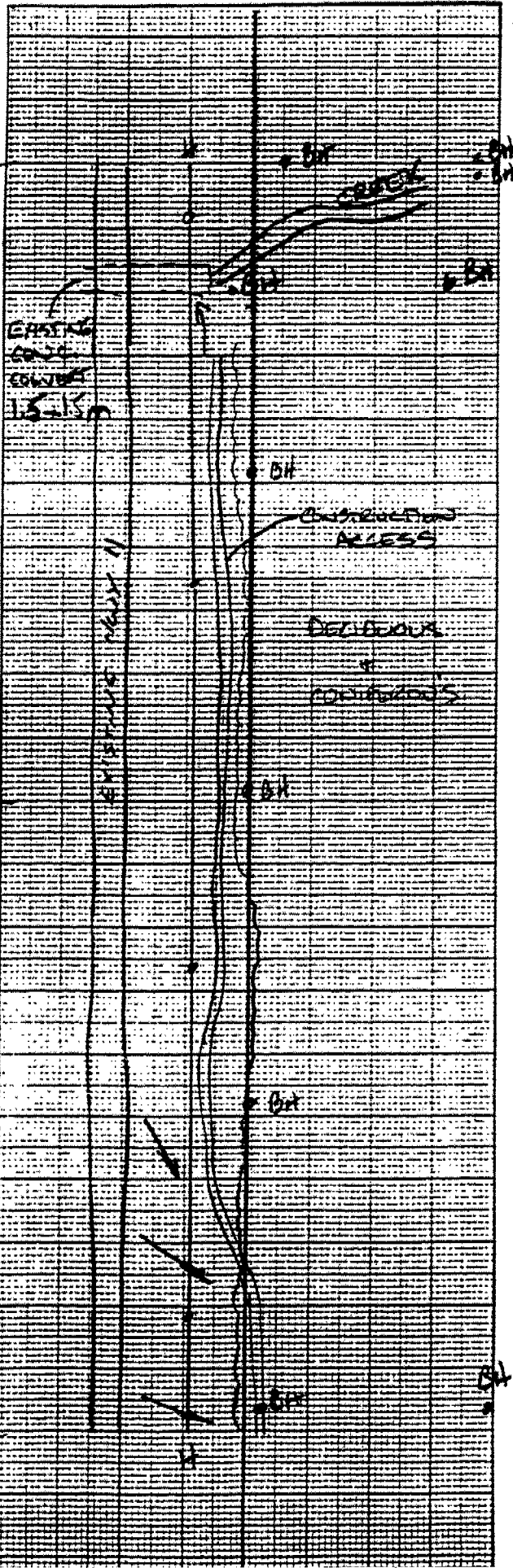
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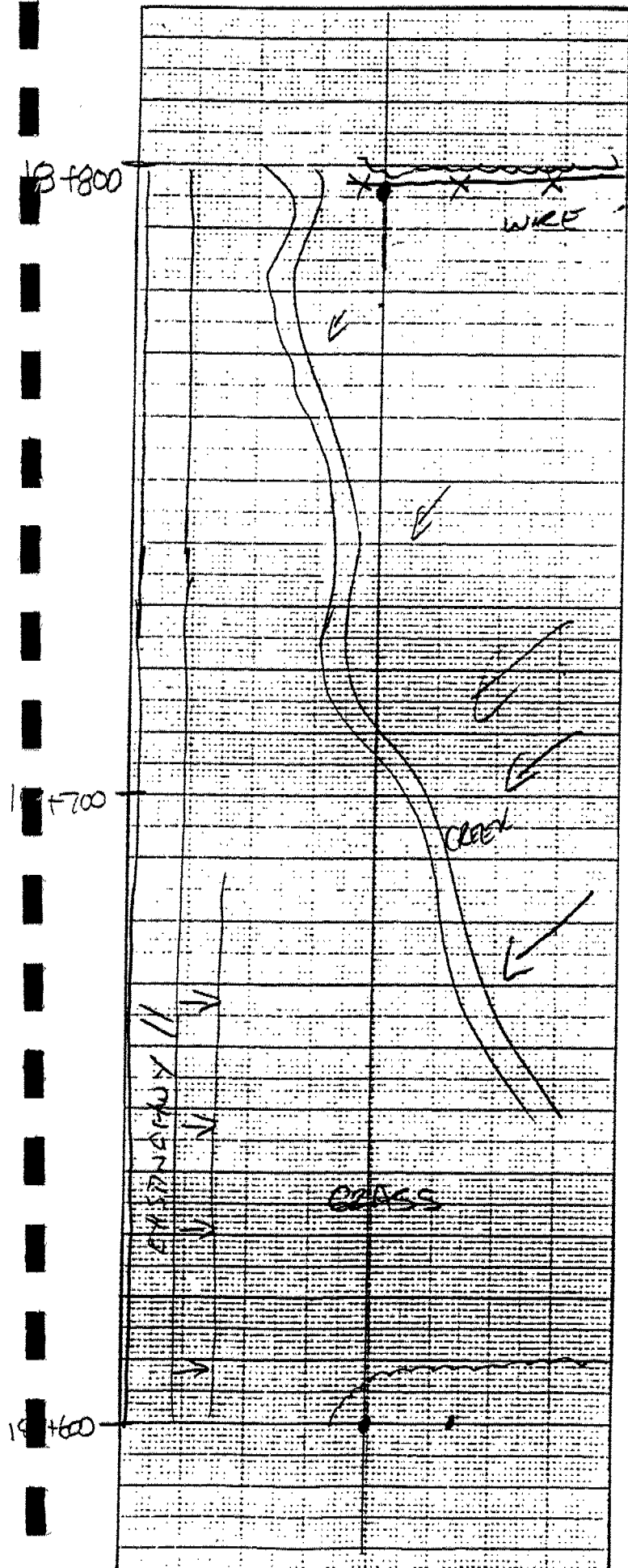


M.I.T. SYSTEM	COARSE			COARSE			SILT SIZE
	MEDIUM			MEDIUM			
	FINE			FINE			
	CLAY SIZE						
	GRAVEL SIZE			SAND SIZE			FINE

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT OR CLAY
	SIZE					
	GRAVEL SIZE		SAND SIZE			FINE GRAINED







STA 17+730 C/L of NBL

0 - 170 Org M, Blk, Moist to Wet  
170 - 450 Sa & Si, Br, Moist, Compact  
450 NFP BR

STA 17+730 5.5m Rt of C/L of NBL

0 - 375 Org M, Blk, Moist to Wet  
160 - 375 Sa & Gr W Tr of Si, Br, Moist, Compact  
375 NFP BR

STA 17+750 C/L of NBL

0 - 180 Org M W Tr of Sa, Blk, Moist to Wet  
180 - 610 Sa & Si, Br, Moist, F, Compact  
610 NFP BR

STA 17+750 5.5m Rt of C/L of NBL

0 - 175 Org M, Blk, Moist to Wet  
175 - 450 Sa & Si, Br, Moist, Compact  
450 NFP BR

STA 17+775 C/L of NBL

0 - 1.80 Co(y) Gr, Br, Moist, Compact  
1.80 - 2.40 Sa & Si, Br to Gry, Moist, F, Comp  
2.40 - 3.00 Sa & Gr, Br, Moist, Compact

STA 17+825 C/L of NBL

0 - 3.00 Sa & Si, Br to Gry, Moist, Compact

STA 17+825 5.5m Rt of C/L of NBL

0 - 160 Org M, Blk, Moist to Wet  
160 - 950 Sa & Si, Br, Moist, Compact  
950 NFP BR

STA 17+875 Not accessible; steep rock face

STA 18+050 C/L of NBL

0 - 190 Org M, Blk, Moist to Wet  
190 - 4.30 Si W Tr of Cl, Br, Moist, Loose  
4.30 - 6.50 Cl & Si, Gry, Wet, Soft  
6.50 - 7.00 Si, Gry, Moist, Compact to Dense

STA 18+182 25.0m Rt of C/L of NBL  
(opposite box culvert)

0 - 100 Org M, Blk, Wet  
100 - 690 Sa(y) Si, Br, Moist, Compact  
690 NFP BR

STA 18+182 25.0m Lt of C/L of NBL

0 - 100 Org M, Blk, Wet  
100 - 750 Sa(y) Si, Br, Moist, Compact  
750 NFP BR

STA 18+250 C/L of NBL

0 - 2.10 Sa & Gr W Tr of Org, Br, Moist Compact  
2.10 - 3.00 Si(y) Cl, Br to Gry, Moist, Stiff

STA 18+275 C/L of NBL

0 - 700 Sa & Si W Tr of Org, Br, Moist, Compact  
700 - 3.00 Si, Br to Gry, Moist to Wet, Compact

STA 18+275 5.5m Rt of C/L of NBL

0 - 1.00 Sa & Si W Tr of Org, Br, Moist, Compact  
1.00 - 3.00 Sa & Si, Br to Gry, Moist to Wet, Compact

STA 18+300 C/L of NBL

0 - 90 Org M, Blk, Moist, Loose  
90 - 2.0 Si, Br, Moist, Compact  
NOTE: 1 m of fill to be placed

STA 18+330 3.0m Rt of Existing Culvert

0 - 90 Org M, Blk, Wet  
90 - 340 Sa(y) Si, Br, Moist, Compact  
340 NFP BR

STA 18+340 5.0m Rt of C/L of NBL

0 - 90 Org M, Blk, Wet  
90 - 480 Sa(y) Si, Br, Moist, Compact  
480 NFP BR

STA 18+349 13.0m Rt of C/L of NBL  
(culvert location)

0 - 80 Org M, Blk, Wet  
80 - 800 Sa(y) Si, Br, Moist, Compact  
800 NFP BR

STA 18+350 C/L of NBL

0 - 1.10 Sa & Gr W Tr of Si, Bro to Gry, Moist to Wet, Compact  
1.10 NFP BR

STA 18+375 C/L of NBL

0 - 1.20 Sa & Si W Tr of Org, Br to Gry, Moist to Wet, Compact  
1.20 NFP BR