



**FEASIBILITY FOUNDATION INVESTIGATION AND DESIGN  
REPORT 3 – GEOGRAPHICAL TOWNSHIP OF HARWICH  
for  
HIGHWAY 401 – CHATHAM-KENT  
FROM 0.9 KM EAST OF ESSEX COUNTY ROAD 42  
EASTERLY 66.1 KM TO THE ELGIN COUNTY BOUNDARY  
AGREEMENT NUMBER 3004-E-0001  
GWP NO. 80-00-00  
for  
MCCORMICK RANKIN CORPORATION**

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**Feasibility Foundation Investigation and Design  
Report 3 – Geographical Township of Harwich**  
for  
Highway 401 – Chatham-Kent  
From 0.9 Km East of Essex County Road 42  
Easterly 66.1 Km to the Elgin County Boundary  
Agreement Number 3004-E-0001  
GWP No. 80-00-00

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**1. INTRODUCTION**

This report presents the results of the foundation feasibility study carried out for the proposed widening of the Highway 401 section through the Geographical Township of Harwich, County of Kent. The study is being carried out for McCormick Rankin Corporation (MRC) on behalf of the Ministry of Transportation of Ontario (MTO).

MTO plans to widen the Highway 401 section extending from 0.9 km east of Essex County Road 42 easterly 66.1 km to the Elgin County Boundary from four to six lanes. Feasibility studies are required for the foundations of the existing bridge structures and structural culverts (span larger than 3.0 m) between the study limits. The freeway section traverses five geographical townships and the reporting was separated into five reports designated as follows:

- Report 1 – Geographical Township of Tilbury East/North
- Report 2 – Geographical Township of Raleigh
- Report 3 – Geographical Township of Harwich
- Report 4 – Geographical Township of Howard
- Report 5 – Geographical Township of Orford

This report concerns the Highway 401 section through the Geographical Township of Harwich which extends between the geographical boundaries of the Townships of Raleigh and Howard on the west and east, respectively for some 16.0 km. A key map for this section of Highway 401 is highlighted in Figure 3-1.





Within the limits of Harwich Township, there are three underpass bridge structures, including the underpass for one interchange, two railway overhead structures, six bridges and five structural culverts that are described in the following section.

All dimensions in this report are provided in metres except where indicated.

## 2. SITE DESCRIPTION

The Highway 401 through the Geographical Township of Harwich is currently a four-lane freeway.

The following table lists the MTO site numbers, locations and types of structures and structural culverts along this section of Highway 401.

**LIST OF STRUCTURES**

Structure Name	Site No.	Station (*)	Type
CSX Railway Overhead EBL	13-239/1	12+638.4	3-span steel girder structure
CSX Railway Overhead WBL	13-239/2	12+638.4	3-span steel girder structure
Highway 40 Underpass	13-238	14+322.7	4-span Concrete Tee interchange structure
McGregor Creek Bridge EBL	13-232/1	~14+625	Concrete Rigid Frame
McGregor Creek Bridge WBL	13-232/2	~14+625	Concrete Rigid Frame
Proctor Drain Bridge EBL	13-231/1	~16+445	Concrete Rigid Frame
Proctor Drain Bridge WBL	13-231/2	~16+445	Concrete Rigid Frame
White Drain Culvert	13-402-C	18+224	Conc. Open Footing (3.66 by 1.52 by 90.7)
Harwich Road Underpass	13-268	~18+625	Pre-stressed concrete beam structure
Tedford Drain Culvert	13-403-C	19+290.45	Conc. Open Footing (4.42 by 2.59 by 59.3)
McPhail Drain Culvert	13-404-C	20+779.35	Conc. Open Footing (4.42 by 2.44 by 62.0)
Enos Smith Drain Culvert	13-405-C	22+276.8	Conc. Open Footing (3.81 by 1.83 by 52.8)
Mull Road Underpass	13-237	~22+330	4-span steel girder structure
Culvert Site 13-406	13-406-C	22+715.6	Conc. Open Footing (3.66 by 2.44 by 55.2)
Taff Creek Drain Bridge EBL	13-230/1	~25+125	Concrete Rigid Frame
Taff Creek Drain Bridge WBL	13-230/2	~25+125	Concrete Rigid Frame

Notes: Culvert sizes taken from RFP documents as Span by Width by Length in metres.

(\*) – The chainage refers to Harwich Township. All chainages should be considered approximate.



The typical topography abutting the highway corridor within the Geographical Township of Harwich is typically flat or shows a gentle undulation. In general, the highway grades rise gradually to the east with an approximate maximum relief of 6.6 m, between the Raleigh/Harwich Township boundary (elevation 182.9) and Mull Road (elevation 189.5) based on inferred pavement surface elevations at the underpass locations except at the crest of the CSX overhead structure where the highway grades rise up about 9.9 m to elevation 192.8.

The pavement grade is essentially flat between Mull Road and the Harwich/Howard Township boundary showing an easterly drop in elevation of only 1.0 m.

The main land use is agricultural and the typical vegetation beyond the highway corridor comprises mostly of farming crops. Isolated stands of trees are also present along the highway corridor and some of the drainage ditches. The roadside ditches are typically covered with grasses. Scattered farm residences and facilities are located near Highway 401. A few commercial/industrial properties are present south of Highway 401 on Highway 40 (Kent Centre).

Steel towers from a Hydro corridor border the south shoulder of Highway 401 from the west boundary line of Harwich Township for about 2 km (to about Sta. 12+000) and continue near the north shoulder for an additional 200 m.

Natural drainage of the lands located along the highway is generally poor. The highway crosses the McGregor and Taff Creeks and also several smaller creeks and man-made drains that were constructed to enhance the natural drainage of the farmland and lower the perched groundwater that is typically encountered at depths close the ground surface along the highway corridor.

The MTO design frost depth for the Geographical Township of Harwich is 1.2 m.



### **3. INVESTIGATION PROCEDURES**

The foundation feasibility analysis for this report was based primarily on a review of existing data and literature. The data comprised five geological maps and literature, three physiographic maps, nineteen previous MTO construction contract documents and foundation investigation reports and three groundwater data documents, including 39 water well records. Other sources of documents were also used such as mosaics of aerial photographs, base maps and topographic maps and one Aggregate Resources Inventory Report. Table 3-1 provides a list of the reference documents reviewed for this study. A large number of these documents were in poor condition prior to scanning by MTO. The inferred data referred in this report was double-checked where possible. Chainages are approximate unless clearly provided on the reference documents. The majority of elevations and dimensions were converted to the metric system from imperial units. All dimensions and elevations provided in this report should be verified during detail design.

A summary of the stratigraphy encountered in the water wells is provided on the attached Table 3-2 and details of the measured groundwater levels and encountered bedrock levels in the wells were included on the attached Site Plans, Drawings 3-1 to 3-5. These water levels were in general agreement with those levels inferred from the published MOE website.

A site reconnaissance visit was also carried out at each of the bridge structures and culverts. Representative photographs showing relevant natural features and geomorphology are included in Appendix A.

Subsurface field explorations were not carried out for this report. Copies of the previous records of boreholes and associated location plans relevant to the existing structures that were available at the time of the investigation were included in Appendix B.



## **4. LITERATURE REVIEW**

### **4.1 Inferred Subsurface Conditions**

The reviewed geological and physiographic maps and literature indicated that Highway 401 through the Geographical Township of Harwich was constructed over the St. Clair Clay Plain deposits which occur over the western area of Kent County and extend over the Essex and Lambton Counties to the west and north, respectively. The St. Clair Clay Plain consists of a flat and relatively deep deposit of typically very stiff clayey silt and silty clay till deposits.

The bedrock underlying the Highway 401 alignment through the Geographical Township of Harwich comprises mostly of the black bituminous shale containing locally grey shale of the Kettle Point Formation.

The following tables provide a simplified summary of the site conditions that were previously encountered or inferred at the location of the three underpasses, two railway overhead, six bridge structures and five structural culverts within the Geographical Township of Harwich.

For the structures where previous reports were not prepared or were not available, the subsurface conditions were assumed to be similar to those encountered or inferred for the adjacent structures.

[illegible]



- Notes: (\*) From borehole data. Levels indicated are inferred depths and elevations of the bottom of the soil units. Topsoil and fill units were disregarded. Up to 9.2 m of fill is present in the CSX Railway overhead embankments.
- (\*\*) From records of boreholes and water wells. Locally, sand and gravel layers were found immediately above the bedrock.
- (\*\*\*) Groundwater levels were based on records of boreholes and water wells (circa 1950 to 1970).
- (\*\*\*\*) - Silt/sand deposits underlie the till soils at this location.
- Highway 40 - to termination depths of 10.2 to 15.2 m, elev. 168.0 to 171.9.
  - Mull Road - (One borehole) to termination depth of 11.3 m, elev. 175.9.

Topsoil and fill encountered during previous investigations and water well drilling were disregarded because present conditions will likely differ from those recorded. The fill in the existing CSX railway approach embankment was found to be up to 9.2 m thick and comprise mixed earth such as clayey silt and sandy silt with gravel. The typical soil stratigraphy encountered in the previous investigations indicate that discontinuous surficial sand deposits extend to depths between about 2.1 and 5.7 m, elevations 176.9 to 182.1 at the locations of the CSX Railway overhead and McGregor Creek bridges. Discontinuous layers of silt/sand were also encountered at the locations of the Highway 40 and Mull Road underpass structures underlying clayey silt/silty clay glacial till deposits.

Cohesive deposits of clayey silt till/silty clay till were typically found at the ground surface or underlying the upper sandy deposits. These cohesive soils extend typically beyond the 3.4 to 26.6 m termination depths of the boreholes.

Based on borehole and well records, the bedrock underlying the site was typically encountered/inferred at variable depths ranging between 21.9 and 26.6 m and at levels deeper than 29.0 and 30.2 m at the CSX Railway overhead and Proctor Drain Bridges. The bedrock surface level was found at a range of elevations varying from 158.2 to 167.1 and was deeper than elevation 153.9 at the CSX Railway overhead.

Perched groundwater was found at depths ranging from the surface (at creek crossing sites) to 7.3 m in the boreholes and well records. The regional groundwater was found between 3.7 and 15.2 m depths. Artesian conditions were encountered in boreholes drilled for the Highway 40 underpass structure. The present groundwater conditions may vary from those recorded during the geotechnical investigations and well drilling in the 1950 to 1970s.



## 4.2 Inferred Structure Foundations

Based on the construction drawings reviewed, the foundations of the abutments and piers of the underpass structures were founded on spread footings and/or 323 mm O.D. concrete-filled steel tube piles driven to relatively low capacities of 265 and 356 kN. The following table summarizes the foundation type and founding levels that were indicated for the spread footings and driven steel tube (pipe) piles.

**BRIDGE STRUCTURE - EXISTING FOUNDATIONS**

Structure	Abutments			Piers		
	Type	Elevation		Type	Elevation	
		Top Footing / Pile Cap	Bottom Footing / Pile Tip		Top Footing / Pile Cap	Bottom Footing / Pile Tip
CSX Railway Overhead EBL and WBL	Piles (356 kN)	188.4	181.1	Piles (356 kN)	181.7	174.4
Highway 40 Underpass	Piles (356 kN)	189.0	175.3	Spread Footing	182.1	181.5
McGregor Creek Bridges EBL and WBL	Spread Footing	180.1	178.6	—	—	—
Proctor Drain Bridges EBL and WBL	Spread Footing	180.1	179.5	—	—	—
Harwich Road Underpass	Piles (265 kN)	190.0	183.5	Spread Footing	185.9	184.1
Mull Road Underpass	Spread Footing	187.1	185.9	Spread Footing	187.1	185.9
Taff Creek Bridges EBL and WBL	Spread Footing	183.8	183.2	—	—	—

Note: Elevations were taken from reference contract drawings for top of spread footings, bottom of pile caps and pile tips. Pile capacities indicated in brackets were also taken from construction drawings.

The culverts over 3 m span being assessed are of the concrete frame open footing type. It is inferred that the culvert footings were founded on the native clayey deposits about 1.2 m below grade for frost protection.



## **5. SITE RECONNAISSANCE**

The site reconnaissance of the structures within this geographical township was carried out on January 26 and 27, 2006. Forty-six relevant photographs of the structure and culvert sites are presented in Appendix A for reference. The following notes were compiled.

- In general, the site visits confirmed that the structures and culverts are located on generally flat to gently undulating terrain (photographs 3-1, 3-5 to 3-8, 3-10 to 3-13, 3-17, 3-19, 3-24 to 3-26, 3-28, 3-29, 3-37 to 3-40, 3-43 and 3-44). Major creeks within the alignment are the McGregor and Taff Creeks.
- The visual inspection of the underpass structure foundations did not reveal signs of distress such as settlements or other distortion (photographs 3-7, 3-26, 3-27 and 3-38).
- It is inferred that the concrete wing walls of several culverts were removed and replaced with gabion basket walls (photographs 3-31, 3-33, 3-35 and 3-41). Displacement and rotation of the original concrete wing walls of some of the culverts was noted (photographs 3-32, 3-34, 3-36 and 3-42).
- The roadside ditches were typically covered with grass. Wet ground occurs locally at toe of embankment slopes and in the roadside ditches at the underpass structure and culvert locations (photographs 3-11, 3-28, 3-30, 3-35 and 3-36).
- It was judged that the bridge approach embankments and ramps are currently stable and without visible settlements. No major signs of distress such as erosion or sliding of the bridge approach embankments were noted (photographs 3-1, 3-2, 3-9 to 3-12, 3-26, 3-28, 3-29, 3-39 and 3-40).
- The embankments approaching the CSX Railway overhead structure were provided with an earth berm (photograph 3-2).
- Localized surficial erosion of the north foreslope and buckled concrete revetment at the Harwich Road underpass was noted (photograph 3-27).
- The channels at the inlet/outlet of the culverts and under bridges were locally narrowed by sandy soils (illustrated on photograph 3-22) sloughing off the earth banks (photographs 3-14, 3-16, 3-23, 3-31, 3-33, 3-34, 3-41 and 3-42).





- The channels of the Taff Creek bridges EBL and WBL are wide open (photographs 3-44 to 3-46).
- A system of water flow control is being used in the roadside ditches located at the Tedford and Taff Creek Drains to contain run-off waters in the drain channels (photographs 3-32 and 3-46).
- Swampy ground was not noted within or near the structures or culverts within the alignment. However, some areas were wet possibly due to poor drainage on the relatively flat terrain (photographs 3-11, 3-28 and 3-30).
- The exit and on-ramps of the Highway 40 interchange were constructed over terrain that is typically flat and free of swampy soils (photographs 3-8 to 3-12).
- Drainage ditches were constructed to the east of the north approach embankments of Highway 40 and Harwich Road underpass and under the north approach embankment of the Harwich Road underpass (photographs 3-9, 3-11, 3-28 and 3-30).
- The Enos Smith Drain and a line of hydro poles are located immediately west of the Mull Road Underpass (photograph 3-40).
- Construction of foundations for the McGregor Creek Bridges EBL and WBL involved the installation of a line of sheet piles in front of each abutment (photographs 3-14 to 3-16).

## **6. DISCUSSION AND RECOMMENDATIONS**

### **6.1 General**

The MTO is currently planning to widen Highway 401 through the County of Kent from four to six lanes of traffic. This report pertains to the section through the Geographical Township of Harwich. It is understood that the two widening alternatives being currently considered essentially comprise the following:

Alternative 1 – Adding one lane to the inside of the westbound and eastbound lanes

Alternative 2 – Adding one lane to the outside of the westbound and eastbound lanes



It is envisaged that Alternative 1 will require filling of the median ditch and construction of a barrier along the centreline of the median. Existing culvert and underpass structures would not require foundation modifications.

At the Highway 40 interchange, widening of the underpass to accommodate the terminals of the future S-W and N-E ramps, new crossings at the McGregor Creek for future N-W ramp and at Lucas Drain for future S-E ramp are planned.

In addition, removal of existing ramps and providing Parclo A interchange configuration ramps including closure of Pinehurst Road to Highway 40 are also proposed.

The bridges over the McGregor Creek and Taff Creek Drain as well as the railway overhead will require widening to the inside. Subject to structural verifications, the Proctor Drain Bridges may not need modifications because the structures were built as a continuous structure.

Construction of Alternative 2 will likely require the modification of the existing overhead, underpass and bridge structures or alternatively the construction of new structures. One option for modification of the underpass structures is to cut into the existing approach embankment foreslopes (in front of abutments) and construct permanent vertical retaining walls for abutment support. Widening to the outside will also require alterations to the interchange ramps and the extension of culverts. The alternatives for the construction of new underpass structures comprise constructing on the same alignment or on new alignment to the west or east of the existing structures.

The following sections of this report provide comments for planning purposes and an overview of the advantages and disadvantages, costs and risks/consequences of each alternate configuration from a foundation perspective.

#### 6.1.1 Structure Foundations

As indicated previously, it is envisaged that the widening alternative comprising the addition of traffic lanes to the inside will not require new foundations or modifications to existing foundation.



The alternative of widening to the outside of the existing lanes will likely require new construction or alteration of the existing structures in view of their currently narrow four-span configuration. It is noted that the structures may also require replacement or widening due to a separate possible requirement to increase their current number of traffic lanes over Highway 401.

Based on the available data, the following foundation levels and geotechnical resistances for shallow and deep foundations are anticipated.

**PRELIMINARY REFERENCE FOUNDING LEVELS AND GEOTECHNICAL RESISTANCES <sup>(1)</sup>**

Structure site	Shallow Foundations <sup>(2)</sup>				Deep Foundations <sup>(3)</sup>			
	Founding Levels <sup>(4)</sup>		Geotechnical Resistance		Founding Levels		Geotechnical Resistance <sup>(5)</sup>	
	Depth (m)	Elev.	ULS (kPa)	SLS (kPa)	Depth (m)	Elev.	ULS (kN)	SLS (kN)
CSX Railway Overhead EBL and WBL	N/A	N/A	N/A	N/A	> 29	< 154	2,000	N/A
Highway 40 Underpass	1.5	181.5	500	300	26	158	2,000	N/A
McGregor Creek Bridge EBL and WBL	≈ 2.7 below channel	178.6	350	200	26	158	2,000	N/A
Proctor Drain Bridge EBL and WBL	≈ 3.0 below channel	179.5	500	300	> 30	< 162	2,000	N/A
Harwich Road Underpass	3.2	184.1	500	300	27	160	2,000	N/A
Mull Road Underpass	3.6	185.9	350	200	24	163	2,000	N/A
Taff Creek Drain Bridge EBL and WBL	≈ 2.0 below channel	183.2	500	300	24	166	2,000	N/A

Notes: <sup>(1)</sup> Geotechnical resistances are to be confirmed during detailed design. Factored resistance at ULS used in the table.

<sup>(2)</sup> Abutments founded below the 1.2 m foundation frost depth on engineered fill may be designed for 900 kPa ULS (unfactored) and 350 kPa SLS for a granular pad thickness ≥ 2.0 m.

<sup>(3)</sup> Driven pile tips assumed to be established on the bedrock underlying the sites.

<sup>(4)</sup> Footing founding levels should match those of existing footings for widening alternatives and assumed to be minimum 1.5 m wide. Spread footings are not recommended at the CSX Railway Overhead site.

<sup>(5)</sup> Resistance for HP 310x110 piles. SLS resistance is not applicable to piles driven to refusal on unyielding bedrock.



Subject to structural analyses, existing underpass structure foundations may be reused for new structures constructed on the same alignment (such as, the centre pier foundations). The installation of new steel H-piles will be required for construction of new integral or semi-integral bridge abutments in addition to the other design items specific to these abutment types.

Extensions of the bridge abutments at the McGregor Creek, Proctor Drain and Taff Creek Drain bridges will require excavations below the respective channel beds. These excavations will likely need to be stabilized with sheet pile walls.

Where culvert extensions are required, it is envisaged that the extensions may be founded on the native typically stiff to hard silty clay/clayey silt/silty clay till that are inferred to exist at the founding subgrade level of the existing culverts. The extensions may be founded on the native soils and designed for preliminary geotechnical resistances of 300 kPa at ULS (factored) and 150 kPa at SLS.

#### 6.1.2 Embankment Stability

For the widening alternative comprising the addition of traffic lanes on the inside of the highway, the placement of fill on the existing median is not envisaged to cause slope instability problems.

The alternative of widening the highway to the outside the existing bridge structures will likely require replacement of the existing structures. Any new bridges built to the west or east of the existing alignments will require the construction of new approach embankments comprising about 6 to 7 m high fills at the abutments or widening of the existing embankments. Widening of the CSX Railway overpass to the outside would require widening of the existing about 10 m high embankment. It is envisaged that these embankments, if required, would comprise of earth fill, because rock fill is not readily available in the area of the project. The embankment subgrade typically comprises very stiff clay silt/silty clay till locally overlain by a layer of typically compact sand. The soils are typically wet containing a relatively high perched groundwater condition.

No signs of distress such as erosion, major sloughing or sliding were noted on the existing underpass structure approach embankments. Based on the condition of these existing earth



embankments, it is considered that the earth slopes will be stable at the standard earth slope configurations of 2H:1V. If rockfill is used, the stable slope configuration would be 1.25H:1V.

The subgrade of the approach embankments of the CSX Railway overpass is susceptible to local instability based on a 2001 occurrence investigated by Golder Associates Ltd. (Reference (3) of MTO Reports and Documents list in Table 3-1). The short and long-term slope stability of embankments on this site should be investigated during detail design if widening of these embankments is required. The planning should consider the requirement for local stabilizing berms. Elsewhere, it is considered that the existing native soils are capable of withstanding the additional loading of the new earth embankments or embankment widening, if required.

The widening of the embankments is not expected to cause stability problems at the location of the culvert and bridge extensions in view of the relatively low additional fills (estimated 2 to 3 m high) that would be required. The faces of the inlet and outlet channels of the culverts should be cut at 3H:1V slopes to minimize erosion or sloughing of the existing sandy subgrade at the ditch line.

#### 6.1.3 Embankment Settlement

It is estimated that the settlements of new embankments constructed separately from the existing fills are expected to be significant, and in the order of 50 to 70 mm at the location of the highest fills behind the abutments. Most of the settlements are expected to occur during construction because most of the native cohesive soils are heavily preconsolidated.

Where the embankments are widened the estimated magnitude of settlements is about half those indicated for separate embankments.

The requirement for management control of the settlements should be considered during detail design. Construction of new embankments in advance of installation of new piles would minimize post-construction effects such as potential drag down forces on piles for new or widened foundations.



Settlements of the stiff to hard clayey silt/silty clay till subgrade soils at the culvert or bridge extension sites under the anticipated 2 to 3 m high new embankment platform widenings are considered to be negligible and be completed during construction. Cambers are not considered a requirement to be incorporated during construction of extensions of these culverts.

#### 6.1.4 Construction Considerations

The construction of the alternative to widen to the inside is considered to be straightforward from a foundation point of view since new underpass structures or widening of the embankment of the existing CSX Railway overhead would not be required. Widening of the bridges over the McGregor Creek and Taff Creek Drain will be required for both alternatives. Widening to the outside option will be more complex, requiring the widening of the CSX Railway overhead structure and embankment, Proctor Drain Bridges as well as new or modified underpasses.

It is envisaged that the new underpass structures for the alternative comprising of the widening to the outside would be three-span. Widening for the CSX Railway overpasses will likely comprise four-span structures to match the existing configuration, subject to structural design considerations. Where the access to the existing underpass structures is temporarily closed during construction of the new structures, the installation of the new pier and abutment foundations is expected to be straightforward at all three underpass structures. The construction of new structures on the same alignment while maintaining through traffic on the existing structures will require shoring of the approach embankment fills (on longitudinal directions). This may be required for interchanges such as at Highway 40, and at the CSX Railway overpass.

Excavations for the installation of new pier foundations or footing foundations for abutments on native soils will require control of the perched groundwater in particular within the silty soils encountered locally near the ground surface at the CSX Railway overpasses site. Road protection as outlined in the SP 105S19 will likely be needed for the excavations required for new piers and abutment foundations. The performance level of the protection systems should be determined during detail design.



In addition, the widening or realignment of the approach embankments to the east of Highway 40 and Harwich Road and to the west of the Mull Road underpass structures will likely require the realignment of the existing drainage ditches and concrete culverts that cross the highway and the sideroads.

The existing foundations may be widened to accommodate new or wider structures (if structurally feasible). Where these existing foundations bear on driven pipe piles, the new piles should extend to the bedrock surface to prevent differential settlements. It is recommended that the need for pre-augering of the soil cover prior to the installation of new driven pipe piles be assessed at the detail design stage on a site specific basis. The depth of the pre-augering should be determined during detail design and consider that the existing low capacity pipe piles are installed at about 8 to 10 m depths (elevations 174 to 183) and the underlying bedrock surface is inferred at 22 to over 29 m depths (elevations 167 lower than 154), that is about 16 to 20 m deeper than the existing pile tips. This pre-augering will avoid/minimize lateral forces and drag-down loads on the existing piles due to displacement of soil surrounding the existing piles. These effects maybe mitigated by using steel H-piles instead of pipe piles for the foundation widening. For widening of the existing foundations with deep foundations, the existing structure should be monitored during pile driving to bedrock.

#### 6.1.5 Advantages and Disadvantages of Alternate Configurations

In view of the foregoing considerations the following table summarizes the advantages and disadvantages and inferred risks/consequences of each of the alternate configurations from a foundation perspective. This preliminary analysis is based on the currently planned widening of Highway 401 from four to six lanes. Other facets of the project that may need to be considered, such as future widening to eight lanes and the condition of existing underpass structures are to be addressed by others.



### ADVANTAGES AND DISADVANTAGES – BRIDGE STRUCTURES

Structure Name	Widening to Inside		Widening to Outside (*)			
	Advantages	Disadvantages	New Structure on Existing Alignment		New Structure on New Alignment	
			Advantages	Disadvantages	Advantages	Disadvantages
CSX Railway Overhead EBL and WBL	Use of existing approach embankment. Least costly and little disruption to highway traffic.	Temporary shoring required to construct foundations for bridge widenings	Partial use of existing embankments. Reuse of existing foundations	Structure and embankment widenings required. Shoring existing railway embankment or closing rail traffic.	None	New structure and approach embankments required. New railway line and embankment required. Most costly. Embankment stability concerns exist.
Highway 40 Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic.	None	Use of existing embankment. Possible reuse of existing foundations	New structure required. Shoring existing embankment or closing traffic on bridge needed.	None	New structure and approach embankments required. Drain culvert east of underpass needs relocation.
McGregor Creek Bridges EBL and WBL	Widening of existing bridge structures and median embankments. Least costly and little disruption to highway traffic.	Temporary shoring required to construct foundations for bridge widenings	Use of existing embankment. Possible reuse of existing foundations	Structure widenings required. Shoring existing embankment required.	Not Applicable	Not Applicable
Proctor Drain Bridges EBL and WBL	Use of existing structures and approach embankment. Least costly and little disruption to highway traffic.	Use of central section of structure is subjected to structural check.	Use of existing embankment. Possible reuse of existing foundations	Structure widenings required. Shoring existing embankment required.	Not Applicable	Not Applicable





### ADVANTAGES AND DISADVANTAGES – BRIDGE STRUCTURES

Structure Name	Widening to Inside		Widening to Outside (*)			
	Advantages	Disadvantages	New Structure on Existing Alignment		New Structure on New Alignment	
			Advantages	Disadvantages	Advantages	Disadvantages
Harwich Road Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic.	None	Use of existing embankment. Possible reuse of existing foundations	New structure required. Shoring existing embankment or closing traffic on bridge needed.	None	New structure and approach embankments required. Drain culvert east of underpass needs relocation.
Mull Road Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic.	None	Use of existing embankment. Possible reuse of existing foundations	New structure required. Shoring existing embankment or closing traffic on bridge needed.	None	New structure and approach embankments required. Drain culvert west of underpass needs relocation.
Taff Creek Bridges EBL and WBL	Widening of existing bridge structures and median embankments. Least costly and little disruption to highway traffic.	Temporary shoring required to construct foundations for bridge widenings	Use of existing embankment. Possible reuse of existing foundations	Structure widenings required. Shoring existing embankment required.	Not Applicable	Not Applicable

Notes: (\*) Assumes widening to the outside will require a new underpass structure or modifications to the existing underpass, overpass or bridge structure, including removal of the approach embankment foreslope and construction of permanent vertical retaining walls.



### ADVANTAGES AND DISADVANTAGES – CULVERTS

Structure Name	Widening to Inside		Widening to Outside	
	Advantages	Disadvantages	Advantages	Disadvantages
White Drain Culvert	Culvert extensions not required	None	None	Culvert extensions required
Tedford Drain Culvert	Culvert extensions not required	None	None	Culvert extensions required
McPhail Drain Culvert	Culvert extensions not required	None	None	Culvert extensions required
Enos Smith Drain Culvert	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-406	Culvert extensions not required	None	None	Culvert extensions required

Note: Use of centre section of culvert is subject to structural verification.

Since widening to the inside will not require extensions of the culverts this option will be considered less costly than the widening to outside alternative. Roadway protection maybe required for either alternative.

In general, widening to the inside for this section of the Highway 401 will involve the least risk since shoring of the approach embankments, construction of new embankments and bridges or widening of existing embankment will not be required or will be minimized when compared with the widening to the outside option.

## 6.2 Preferred Alternative Considerations

From the foundation point of view the preferred alternative to widen Highway 401 from four to six lanes of traffic is to widen to the inside (previously designated Alternative 1 - adding traffic on the inside of the existing lanes). The selected alternative depended on additional considerations, such as the potential future widening to eight traffic lanes that were addressed by others.

The preferred option plans provided by MRC are appended to this report as Drawings P3-1 to P3-5.



The preferred option for the highway widening will require replacement of the structure at the Highway 40 interchange to accommodate the terminals of the future S-W and N-E ramps in addition to new bridge crossings at McGregor Creek for future N-W ramp and Lucas Drain for future S-E ramp. In addition, widening of the existing McGregor Creek EB and WB Bridges on Highway 401 is planned to accommodate the future E-N/S and S-E ramps.

The construction of the Preferred Alternative is considered to be feasible from the foundations standpoint.

### **6.3 Foundation Investigation Areas For Detail Design**

The Preferred Alternative of widening Highway 401 from four to six lanes by adding traffic lanes to the inside will require foundation investigations at the underpass, overpass and culvert structures through the Geographical Township of Harwich.

Foundation investigations are required in the vicinity of the Highway 40 interchange because new structures, widening of an existing structure and extension of an existing culvert are proposed for the preferred option.

For the preferred option, the foundation investigations for structures, bridges and culverts that would be required for detailed design of the Highway 401 widening are listed on the following tables.



### FOUNDATION INVESTIGATION AREAS – BRIDGE STRUCTURES

Stations (*)	Proposed Works	Existing Data (**)
12+638.4	CSX Railway Overhead EBL and WBL	13 boreholes to depths from 3.5 to 18.7 m
14+322.7	Highway 40 Underpass	4 boreholes to depths from 10.2 to 15.2 m
14+625	McGregor Creek Bridges EBL and WBL	4 boreholes to depths from 2.7 to 5.7 m
16+445	Proctor Drain Bridges EBL and WBL	1 borehole to 18.3 m depth
25+125	Taff Creek Bridges EBL and WBL	4 boreholes to depths from 5.9 to 10.2 m

Notes: (\*) Stations are approximate.  
(\*\*) Relevant data from previous foundation investigation reports.  
Refer to Table 3-1 for list of reference documents.

### FOUNDATION INVESTIGATION AREAS –CULVERTS

Stations (*)	Proposed Works	Existing Data
18+224	White Drain Culvert	Data not available
19+290.45	Tedford Drain Culvert	Data not available
20+779.35	McPhail Drain Culvert	Data not available
22+276.8	Enos Smith Drain Culvert	Data not available
22+715.6	Culvert Site 13-406	Data not available

Notes: (\*) Stations provided in the RFP documents.



## 7. CLOSURE

This report was prepared by Mr. C. M. P. Nascimento, P. Eng. Senior Project Engineer and reviewed by Mr. B. R. Gray, M. Eng., P. Eng, MTO Designated Contact.

Yours very truly

Peto MacCallum Ltd.



Carlos M.P. Nascimento, P.Eng.  
Senior Project Engineer



Brian R. Gray, MEng, P.Eng.  
MTO Designated Contact

CN-cn:mi



## TABLE 3-1 LIST OF REFERENCE DOCUMENTS (TOWNSHIP OF HARWICH)

### A. Geological Maps

- Geological Map of the Province of Ontario, Map No. 1958B Ontario, Department of Mines, Compiled 1958. Scale 1:1,267,200.
- Quaternary Geology of Ontario, Southern Sheet, Map 2556 from Ontario Ministry of Northern Development and Mines, Compiled 1991. Scale 1:1,000,000.
- Drift - Thickness Contours, Kent County, Preliminary Map 52-4A, Prepared by J.F. Caley and B.V. Sanford, 1951, Published 1952 by Department of Mines and Technical Surveys of the Geological Survey of Canada.
- Bedrock Contours, Kent County, Preliminary Map 52-4B, Prepared by J.F. Caley and B.V. Sanford, 1951, Published 1952 by Department of Mines and Technical Surveys of the Geological Survey of Canada.
- Ontario Geological Map, Map No. 2196 from Ontario Department of Mines and Northern Affairs, Compiled 1970. Scale 1:1,013,760 (1 inch = 16 miles).

### B. Physiographic Maps

- Soil Map of the County of Kent, Soil Survey Report No. 3, Published by the Experimental Farms Branch, Ottawa, 1936, Scale 1/2 inch = 1 mile.
- Physiography of Southern Ontario Map P.2715 Ontario Geological Survey, 1984. Scale 1:600,000.
- Physiography of the Southwestern Portion of Southern Ontario, Map 2225 Ontario Department of Mines and Northern Affairs, Ontario Research Foundation, Published 1972, Scale 1:253,440 (1 inch = 4 miles).

### C. MTO Reports and Drawings

- (1) Contract drawings for Harwich Township Bridge No. 14 over the Chesapeake and Ohio Railway (currently the CSX Railway) overpass, WP 15-59, TWP 13-239, dated November 1959.
- (2) Site plan and soil cross-sections from Foundation Investigation Report No. 59-F-3, WP 15-59 for Chesapeake and Ohio Railway Crossing 2.5 miles southeast of Chatham, Geocres 40J8-3.



- (3) Geotechnical investigation for slope instability of Highway 401 westbound lanes at CSX Railway crossing, Contract 2000-0029, WP 62-99-00. Report by Golder Associates Ltd. Ref. 001-4087-1, dated August 17, 2001 (Geocres No. not found).
- (4) Contract Drawing for Harwich Township Bridge No. 13 (Highway 40 underpass) at Highway 401, WP 82-59, TWP No. 113-238 dated July 1960.
- (5) Foundation investigation report for Highway 401 and County Road No. 14 crossing at Kent Centre – District No. 1 (Highway 40 underpass). WP 82-59, W.J. F-59-76, dated February 1960, Geocres 40J8-15.
- (6) Foundation investigation report for County Road 14 (Highway 40) and McGregor Creek Diversion crossing at Kent Center, District No. 1, WP 304-59, W.J. F-59-74, dated February 2, 1960, Geocres 40J8-14.
- (7) Contract drawing for Harwich Township Bridge No. 12 (McGregor Creek EBL and WBL bridges), WP 16-59 dated November 2, 1959.
- (8) Foundation Investigation Report 59-F-73 dated August 1959 for the McGregor Creek Diversion crossing, WP 16-59, Geocres 40J8-13.
- (9) Foundation Investigation Report 60-F-228 dated April 1960 prepared by Dominion Soil Investigation Ltd. for proposed bridge across McGregor Creek, Kent County Road 14, WP 303-59, Geocres 40J8-24.
- (10) Foundation Investigation Report W.J. 62-F-42 dated May 30, 1962 for the Kent Center Patrol Yard, Geocres 40J8-25.
- (11) Contract drawing for Harwich TWP Bridge No. 8 (Proctor Drain Bridge EBL and WBL) WP 293-59, dated November 1959.
- (12) Foundation Investigation Report 59-F-60 at proposed crossing of Highway 401 and the Proctor Drain, WP 293-59, Geocres 40J8-10.
- (13) Contract drawings for Centerline Road (Harwich Road) Underpass, WP 83-59, dated June 1967.
- (14) Foundation Investigation Report Ref.: J476 dated March 18, 1960 prepared by William A. Trow & Associates Ltd. for proposed County Road Underpass, Highway 401, North of Blenheim (Harwich Road), WP 83-59, Geocres 40J8-38.
- (15) Contract drawings for Mull Side Road Underpass, WP 84-59 dated September 1960.
- (16) Foundation Investigation Report for proposed crossing road allowance between Lots 18 and 19 Highway 401 (Mull Road), WP 84-59 prepared by Dominion Soil Investigation Ltd. Ref. 60-F-221, dated April 1960, Geocres 40J8-23.



- (17) Contract drawings for Harwich Township Bridge No. 1A (Taff Creek Drain Bridges EBL and WBL), WP 17-59, dated November 1959.
- (18) Foundation Investigation Report on Highway 401 Line 'A' and Drainage Ditch Crossing Lot 15 Townline Range, Township of Harwich (Taff Creek Bridges EBL and WBL), WJ F-59-1, WP 17-59, dated March 18, 1959, Geocres 40I5-6.
- (19) Contract Drawings for grading, drainage, granular base, Hotmix paving and five structure rehabilitations, Contract No. 98-18, Part A, WP 603-93-01 from 0.8 km west of interchange 81 Bloomfield Road easterly to 0.4 km west of interchange 101, Kent Road 15 (Eastbound Lanes only) - (General Data only)

#### **D. Ground Water Data**

- Water Well Records for Ontario (Kent-Lambton) 1946-1974, Ministry of the Environment, Water Resources Bulletin 2-20 Ground Water Series Published 1977.
- Ground Water Probability, County of Kent, Water Resources Map 3117-1, Ontario Resources Commission 1970. Scale 1:100,000.
- Southern Ontario Drainage Basins, Map 3002-2, Ministry of the Environment, Water Quantity Management Branch, 1973, Scale 1:500,000.
- Essex-Chatham-Kent Groundwater Management Study, Ministry of Environment, [http://www.ene.gov.on.ca/envision/water/groundwater/essex\\_chatham\\_kent/index.htm](http://www.ene.gov.on.ca/envision/water/groundwater/essex_chatham_kent/index.htm). Last modified on October 21, 2008.

#### **E. Other Sources**

- Air Photo Mapping of existing conditions provided by MTO – digital files.
- Chatham – Kent Base Mapping and Mosaic provided by MTO and MRC – digital files.
- Topographic Map of Ontario, Chatham Sheet, Geographic Section of Department of National Defense 1913, Reprinted 1940. Scale: 1 inch = 1 mile.
- Aggregate Resources Inventory of Raleigh and Harwich Townships, Kent County, Southern Ontario published by the Ministry of Northern Development and Mines, Ontario Geological Survey Aggregates Resources Inventory Paper No. 126, dated 1991.





**TABLE 3-2**  
**WATER WELL RECORDS SUMMARY**  
**TOWNSHIP of HARWICH**

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (SOIL AND DEPTH TO BOTTOM OF UNIT)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
* TRSWB5	1	182.9	06/54	3.7	179.2	Sand 2.7; clay 19.5; sand 21.6	>21.6	<161.3
TRSWB5	1	182.0	07/49	3.7	178.3	Sand 3.1; clay 7.6; clay, gravel 15.5; sand, gravel 17.4	>17.4	<164.6
TRSWB5	1	181.3	05/49	3.7	177.6	Sand 3.1; clay 7.6; clay, gravel 21.0	>21.0	<160.3
TRSWB5	1	182.0	05/49	3.7	178.3	Sand 3.1; clay 7.6; clay, gravel 21.6; rock 21.9	21.6	160.4
TRSWB5	1	182.6	07/51	3.7	178.9	Sand 3.1; blue muck 14.6; gravel 15.2; blue muck 27.1; sand 27.7; hardpan 28.0	>28.0	<154.6
TRSWB5	1	182.6	11/65	Dry	-	Sand 3.1; clay 12.8; clay stones 32.0; sand 32.3; shale 36.0	32.3	150.3
TRSWB5	1	182.6	11/62	4.6	178.0	Clay 3.7; sand 4.9; clay, stones 23.8; gravel, clay 24.4; shale 25.0	24.4	158.2
TRSWB5	1	182.6	10/61	Dry	-	Sand 0.9; clay 35.1; shale 42.7	35.1	147.5
TRSWB5	1	182.6	10/61	4.3	178.3	Sand 1.2; clay 24.1; shale 24.4	24.1	158.5
TRSWB5	1	184.4	09/74	5.8	178.6	Clay, gravel 22.6; sand 24.4; shale 25.3	24.4	160.0
TRSWB5	2	182.9	04/57	3.7	179.2	Sand 4.6; clay, stones 23.2; gravel 23.5; shale 23.8	23.5	159.4
TRSWB5	2	182.9	08/67	Dry	-	Clay 6.1; clay, stones 23.5; sand 25.6; gravel 25.9 shale 26.5	25.9	157.0
TRSWB5	2	182.9	08/67	4.6	178.3	Clay 6.1; clay, stones 23.5; sand 25.6; gravel 25.9; shale 27.4	25.9	157.0



**TABLE 3-2**  
**WATER WELL RECORDS SUMMARY**  
**TOWNSHIP of HARWICH**

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (SOIL AND DEPTH TO BOTTOM OF UNIT)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
TRSWB5	2	182.0	08/67	Dry	-	Clay 6.1; clay, stones 23.5; sand 25.6; gravel 25.9; shale 30.5	25.9	156.1
TRSWB5	2	182.0	06/65	4.6	177.4	Clay 6.1; clay, stones 21.9; sand 25.6; shale 26.2	25.6	156.4
TRSWB5	2	182.9	07/53	Not Recorded	Not Recorded	Clay 21.6; sand, gravel 22.9; clay gravel 25.9	>25.9	<157.0
TRSWB5	4	182.9	05/58	3.7	179.2	Sand 2.7; blue muck 12.5; sand 17.7; sand 20.4	>20.4	<162.5
** CRW1	27	182.9	05/55	6.1	176.8	Sand 4.6; Medium sand 22.9; sand, gravel 29.0	>29.0	<153.9
CRW1	27	182.9	03/62	4.6	178.3	Clay 10.7; hardpan 20.7; sand, gravel 21.3	>21.3	<161.6
CRW1	27	182.9	11/63	6.4	176.5	Clay 4.3; clay stones, gravel 18.6; sand gravel 22.3; gravel, sand 22.6	>22.6	<160.3
CRW1	27	182.9	10/49	4.6	178.3	Hardpan 18.6; gravel 18.9	>18.9	<164.0
*** CRE1	24	184.7	06/68	4.3	180.4	Sand 1.2; clay 25.9; shale 26.5	25.9	158.8
CRE1	25	184.7	11/62	Dry	-	Clay 6.1; hardpan 16.8	>16.8	<167.9
CRE1	25	184.7	11/62	6.1	178.6	Clay 6.1; hardpan 18.2; clay 26.5; shale 28.0	26.5	158.2
CRE1	26	182.9	06/63	4.6	178.3	Sand 3.1; clay 9.1; hardpan 6.2; gravel 20.4	>20.4	<162.5
CRE1	26	182.9	06/51	4.6	178.3	Sand 4.6; gravel, sand 25.3	>25.3	<157.6
CRE1	26	182.9	09/58	3.1	179.8	Sand 2.4; blue muck 9.1; sand 16.8; shale (boulder) 17.7; sand 18.6	>18.6	<164.3
CRE1	26	182.9	09/58	Dry	-	Sand 3.1; blue muck 10.7; sand 15.8 sand 19.8; rock 21.3	19.8	163.1

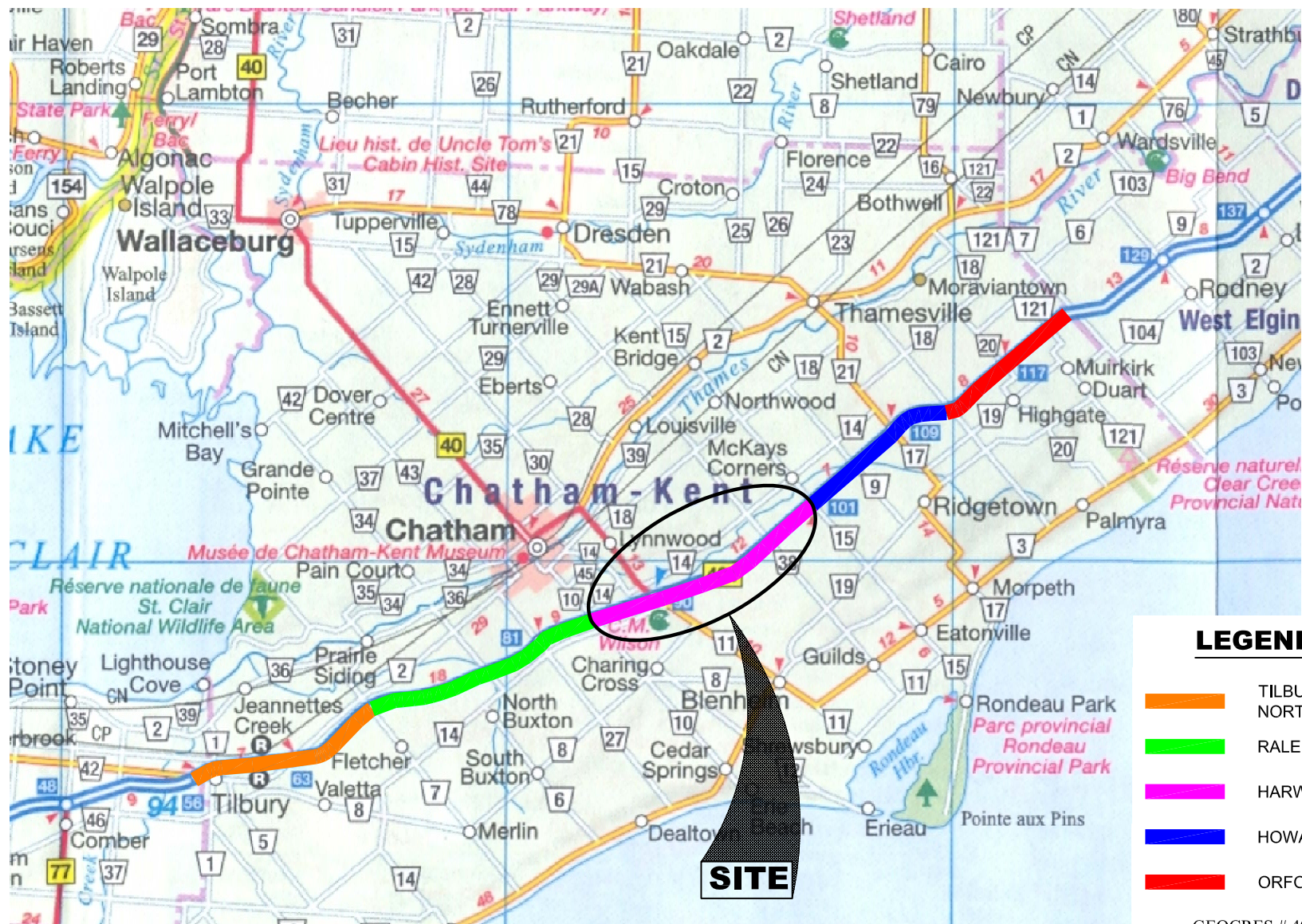


**TABLE 3-2**  
**WATER WELL RECORDS SUMMARY**  
**TOWNSHIP of HARWICH**

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (SOIL AND DEPTH TO BOTTOM OF UNIT)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
CRE1	27	183.5	11/68	7.3	176.2	Clay 3.4; clay 18.3; sand, gravel 18.9; hardpan 19.8	>19.8	<163.7
CRE2	23	192.0	04/69	15.2	176.8	Clay, stones 29.9; gravel 30.2	>30.2	<161.8
**** LES11	16	189.0	07/59	4.6	184.4	Sand, gravel 18.6; hardpan 21.9; slate 24.4	21.9	167.1
LES11	17	187.5	10/60	1.5	186.0	Clay 10.4; sand 18.9; hardpan 22.9 shale 24.1	22.9	164.6
LES11	18	187.5	10/60	2.1	185.4	Clay 18.9; hardpan 24.4; shale 25.9	24.4	163.1
LES11	21	190.5	09/70	7.9	182.6	Clay 2.4; clay, stones 21.3; gravel 21.6 hardpan, gravel 22.9, gravel 23.2	>23.2	<167.3
LES11	21	191.1	09/72	8.2	182.9	Clay 16.8; hardpan 18.3; clay 22.6; gravel, sand 23.8; shale 24.4	23.8	167.3
LES11	21	190.8	09/72	Dry	-	Clay 22.9; hardpan 24.4; shale 25.3	24.4	166.4
LES11	22	187.5	04/53	3.7	183.8	Sand 2.1; clay 15.2 hardpan 19.5; gravel, sand 20.1	>20.1	<167.4
LES11	22	187.5	04/53	Dry	-	Clay 0.6; sand 2.1; clay, stones 14.6; hardpan 21.0	>21.0	<166.5
LES11	22	187.5	04/53	Dry	-	Clay 4.6; clay, stones 14.6; hardpan 19.8	>19.8	<167.7

**NOTES:**

- \* TRSWB - Thames River Survey West Boundary
- \*\* CRW - Communication Road West Survey
- \*\*\* CRE - Communication Road East Survey
- \*\*\*\* LES - Lake Erie Survey



# LEGEND:

- TILBURY EAST / NORTH TWP
- RALEIGH TWP
- HARWICH TWP
- HOWARD TWP
- ORFORD TWP

GEOCRES # 4015-8

## REPORT # 3 - HARWICH TOWNSHIP

**FEASIBILITY FOUNDATION INVESTIGATION DESIGN REPORTS  
HIGHWAY 401 WIDENING - CHATHAM - KENT  
GWP 80-00-00**

## KEY MAP



**MCCORMICK RANKIN  
CORPORATION**

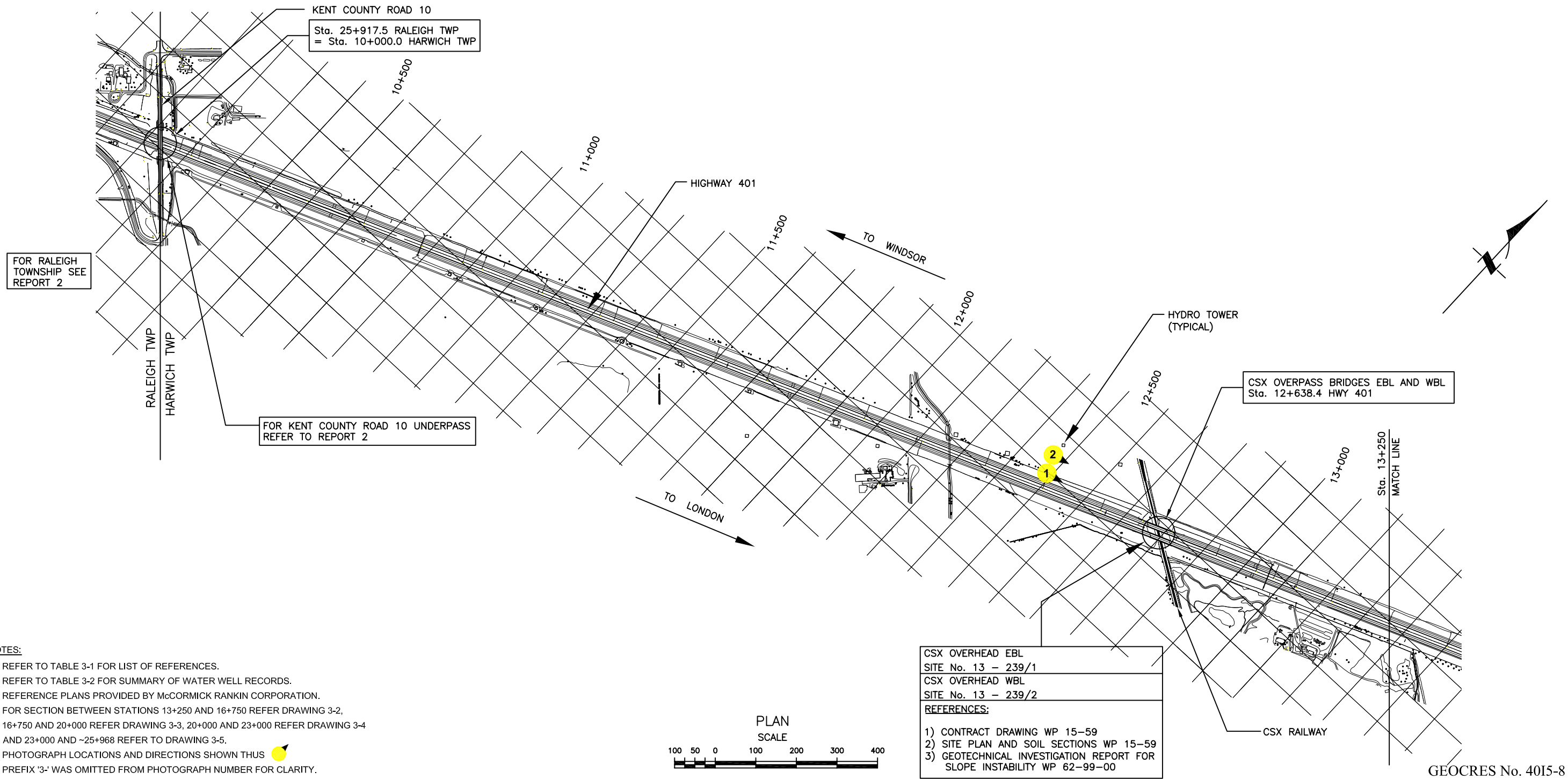



**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DRAWN: <b>N.A.</b>	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED: <b>C.N.</b>	<b>JAN. 2010</b>	<b>1 : 400,000</b>	<b>05TF060</b>	<b>3-1</b>
APPROVED: <b>B.R.G.</b>				



SUMMARY OF WATER WELL RECORDS				
T R S WB CONCESSION 5 LOT 1	T R S WB CONCESSION 5 LOT 2	T R S WB CONCESSION 5 LOT 3	T R S WB CONCESSION 5 LOT 4	C R W CONCESSION 1 LOT 27
GROUNDWATER DEPTH 3.7 to 5.8m (two wells dry) EL. 177.6 to 179.2	GROUNDWATER DEPTH 3.7 to 4.6m (two wells dry) EL. 177.4 to 179.2	NO DATA FOUND	GROUNDWATER DEPTH 3.7m EL. 179.2	GROUNDWATER DEPTH 4.6 to 6.4m EL. 176.5 to 178.3
BEDROCK DEPTH >17.4 to 35.1m EL. 147.5 to <164.6	BEDROCK DEPTH 23.5 to >25.9m EL. 156.1 to 159.4	NO DATA FOUND	BEDROCK DEPTH >20.4m EL. <162.5	BEDROCK DEPTH >18.9 to >29.0m EL. <153.9 to <164.0



- NOTES:
- REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  - REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  - REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  - FOR SECTION BETWEEN STATIONS 13+250 AND 16+750 REFER DRAWING 3-2, 16+750 AND 20+000 REFER DRAWING 3-3, 20+000 AND 23+000 REFER DRAWING 3-4 AND 23+000 AND ~25+968 REFER TO DRAWING 3-5.
  - PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

METRIC

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



DATE **JANUARY 2010**

CHECKED BY: **C.N.**

DRAWN BY: **N.A.**

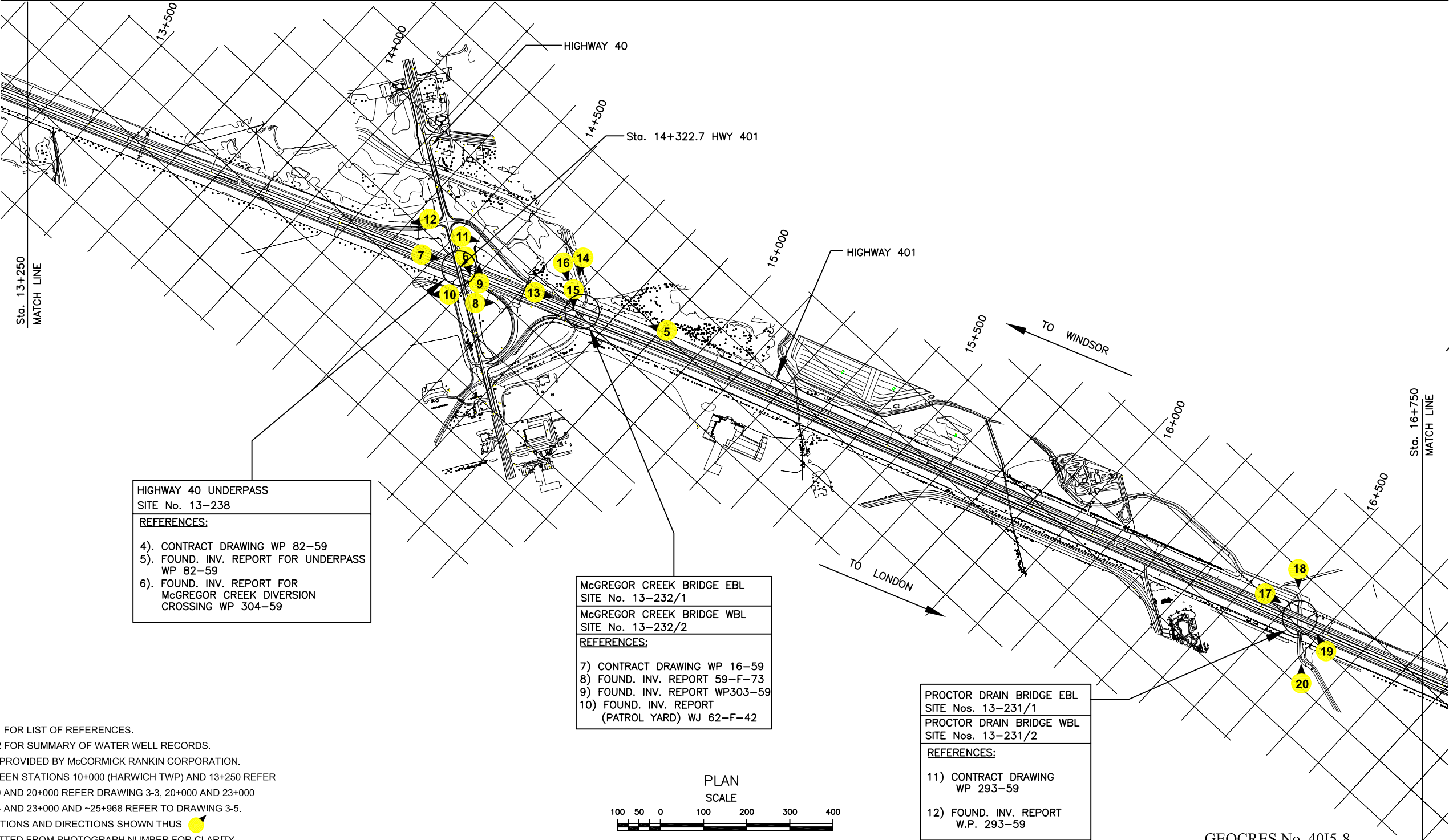
APPROVED BY: **B.R.G.**


CONT No  
GWP No 80-00-00

HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
HARWICH TOWNSHIP SECTION  
SITE PLAN

  
DRAWING  
3-1

SUMMARY OF WATER WELL RECORDS		
C R W CONCESSION 1 LOT 27	C R E CONCESSION 1 LOT 24 to 27	C R E CONCESSION 2 LOT 23
REFER DRAWING 3-1	GROUNDWATER DEPTH 3.1 to 7.3m (two wells dry) EL. 176.2 to 180.4	GROUNDWATER DEPTH 15.2m EL. 176.8
	BEDROCK DEPTH >16.8 to 26.5m EL. 158.2 to <167.9	BEDROCK DEPTH >30.2m, EL. <161.8



- NOTES:
- REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  - REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  - REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  - FOR SECTION BETWEEN STATIONS 10+000 (HARWICH TWP) AND 13+250 REFER DRAWING 3-1, 16+750 AND 20+000 REFER DRAWING 3-3, 20+000 AND 23+000 REFER DRAWING 3-4 AND 23+000 AND ~25+968 REFER TO DRAWING 3-5.
  - PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

METRIC

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

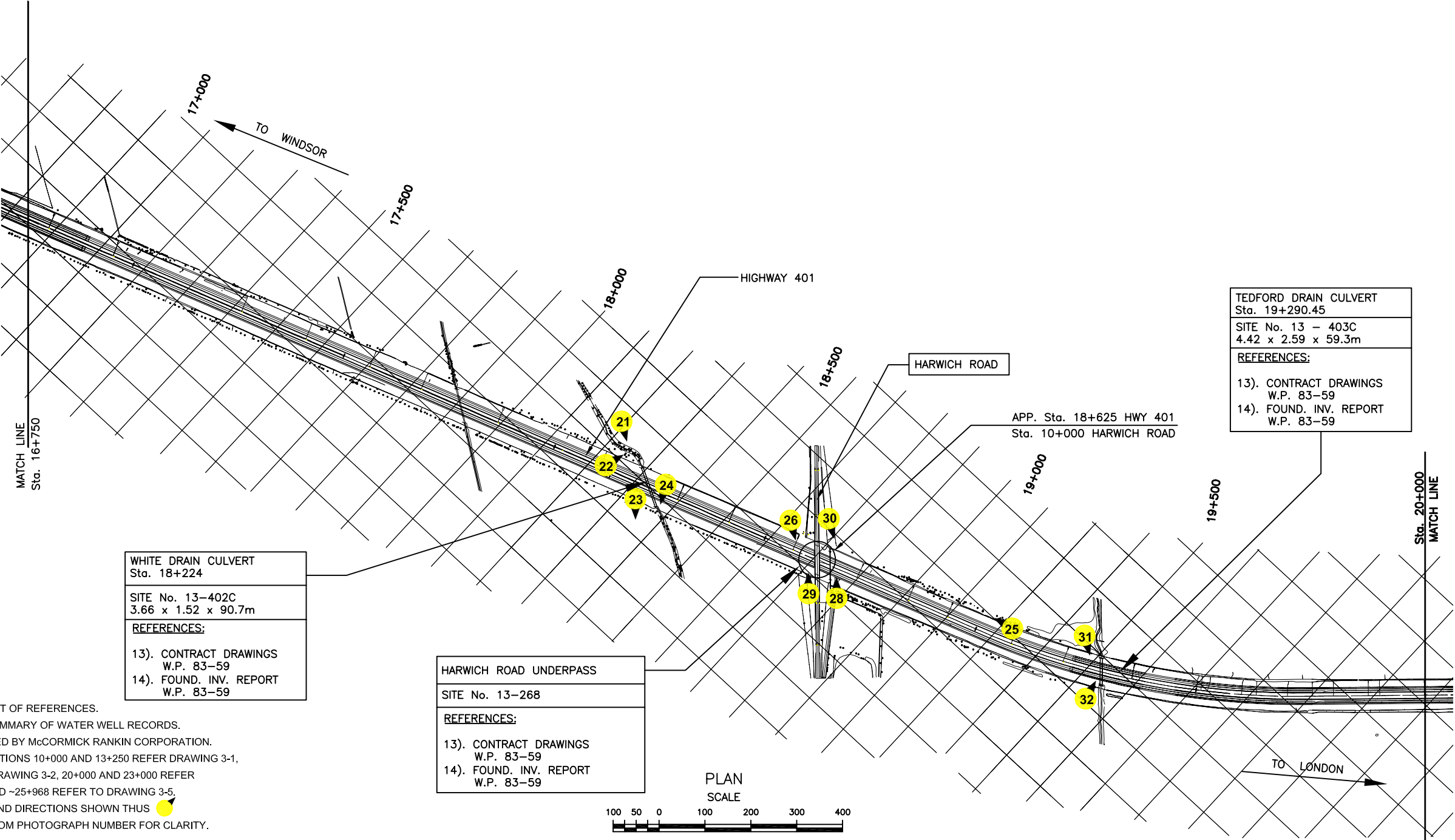



DATE **JANUARY 2010**  
CHECKED BY: **C.N.**  
DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**

CONT No  
GWP No 80-00-00  
HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
HARWICH TOWNSHIP SECTION  
SITE PLAN

DRAWING  
3-2

SUMMARY OF WATER WELL RECORDS			
C R E CONCESSION 2 LOT 23	C R E CONCESSION 3 LOT 22	L E S CONCESSION 11 LOT 13	L E S CONCESSION 11 LOT 14
REFER DRAWING 3-2	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND
	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND



- NOTES:
1. REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  2. REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  4. FOR SECTION BETWEEN STATIONS 10+000 AND 13+250 REFER DRAWING 3-1, 13+250 AND 16+750 REFER DRAWING 3-2, 20+000 AND 23+000 REFER DRAWING 3-4 AND 23+000 AND ~25+968 REFER TO DRAWING 3-5.
  5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

WHITE DRAIN CULVERT Sta. 18+224
SITE No. 13-402C 3.66 x 1.52 x 90.7m
REFERENCES: 13). CONTRACT DRAWINGS W.P. 83-59 14). FOUND. INV. REPORT W.P. 83-59

HARWICH ROAD UNDERPASS SITE No. 13-268
REFERENCES: 13). CONTRACT DRAWINGS W.P. 83-59 14). FOUND. INV. REPORT W.P. 83-59

TEDFORD DRAIN CULVERT Sta. 19+290.45
SITE No. 13 - 403C 4.42 x 2.59 x 59.3m
REFERENCES: 13). CONTRACT DRAWINGS W.P. 83-59 14). FOUND. INV. REPORT W.P. 83-59

GEOCRES No. 4015-8

METRIC

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



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CHECKED BY:	C.N.	APPROVED BY:	B.R.G.

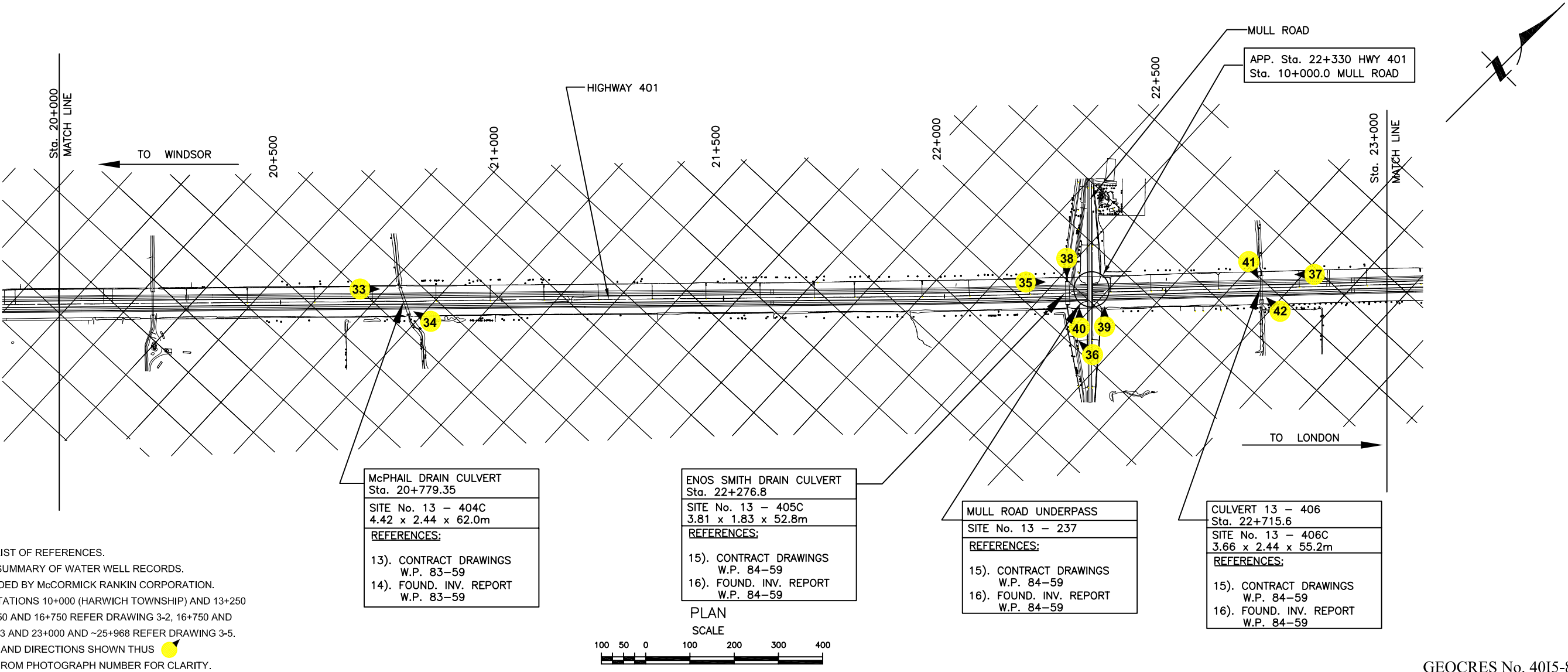
CONT No	GWP No
80-00-00	80-00-00
HIGHWAY 401 WIDENING THROUGH KENT COUNTY HARWICH TOWNSHIP SECTION SITE PLAN	




DRAWING  
3-3



SUMMARY OF WATER WELL RECORDS				
L E S CONCESSION 11 LOT 15	L E S CONCESSION 11 LOT 16	L E S CONCESSION 11 LOT 17	L E S CONCESSION 11 LOT 18	L E S CONCESSION 11 LOT 19
NO DATA FOUND	GROUNDWATER DEPTH 4.6m EL. 189.4	GROUNDWATER DEPTH 1.5m EL. 186.0	GROUNDWATER DEPTH 2.1m EL. 185.4	NO DATA FOUND
NO DATA FOUND	BEDROCK DEPTH 21.9m EL. 167.1	BEDROCK DEPTH 22.9m EL. 164.6	BEDROCK DEPTH 24.4m EL. 163.1	NO DATA FOUND




- NOTES:**
- REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  - REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  - REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  - FOR SECTION BETWEEN STATIONS 10+000 (HARWICH TOWNSHIP) AND 13+250 REFER DRAWING 3-1, 13+250 AND 16+750 REFER DRAWING 3-2, 16+750 AND 20+000 REFER DRAWING 3-3 AND 23+000 AND ~25+968 REFER DRAWING 3-5.
  - PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

**METRIC**  
DIMENSIONS ARE IN METRES  
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DATE **JANUARY 2010**  
CHECKED BY: **C.N.**  
DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**

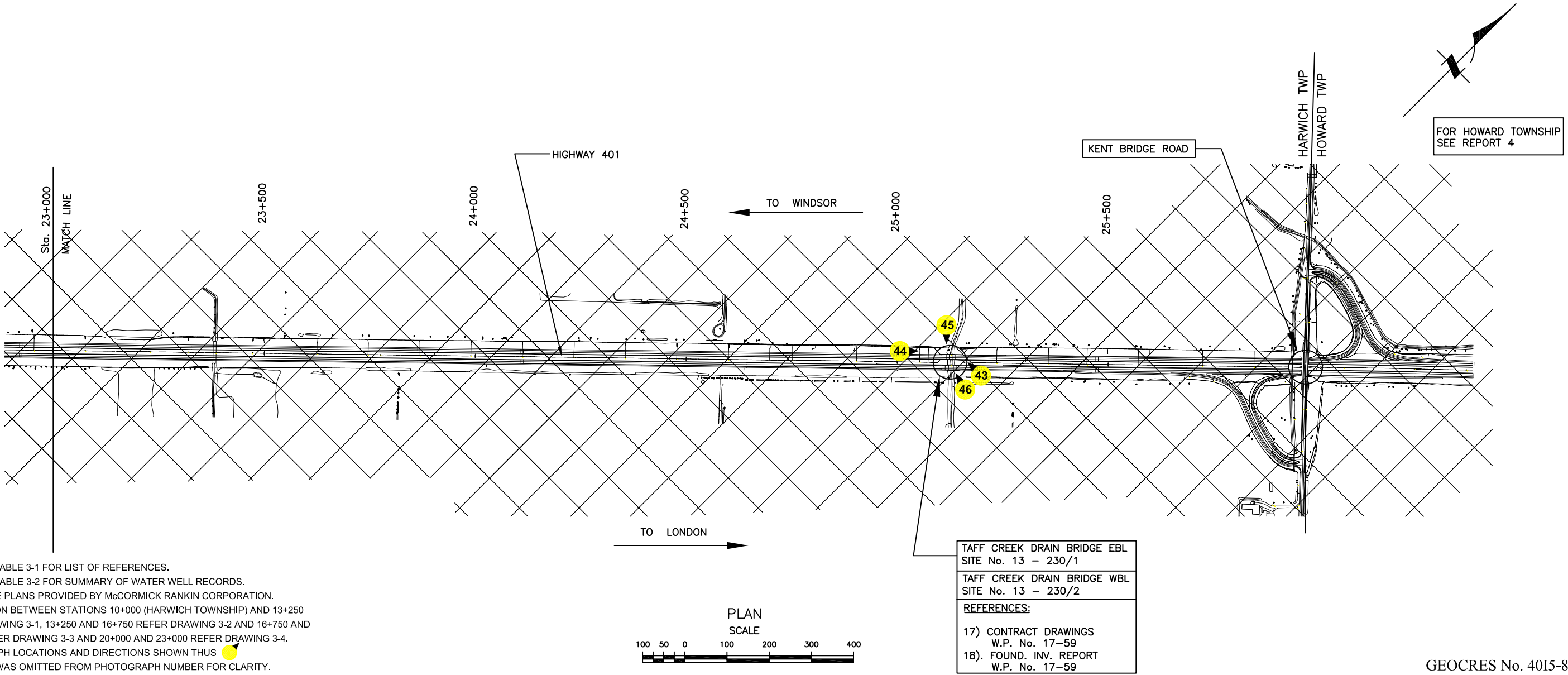
CONT No  
GWP No 80-00-00  
HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
HARWICH TOWNSHIP SECTION  
SITE PLAN

  
**DRAWING**  
**3-4**

GEOCRES No. 4015-8



SUMMARY OF WATER WELL RECORDS			
CONCESSION 11 LOT 20	L E S CONCESSION 11 LOT 21	L E S CONCESSION 11 LOT 22	TOWNLINERANGE
NO DATA FOUND	GROUNDWATER DEPTH 7.9 to 8.2m (one well dry) EL. 182.6 to 182.9	GROUNDWATER DEPTH 3.7m (two wells dry) EL. 183.8	NO DATA FOUND
NO DATA FOUND	BEDROCK DEPTH >23.2m to 24.4m EL. 166.4 to <167.3	BEDROCK DEPTH >19.8 to >21.0m EL. <166.5 to <167.7	NO DATA FOUND




- NOTES:
1. REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  2. REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  4. FOR SECTION BETWEEN STATIONS 10+000 (HARWICH TOWNSHIP) AND 13+250 REFER DRAWING 3-1, 13+250 AND 16+750 REFER DRAWING 3-2 AND 16+750 AND 20+000 REFER DRAWING 3-3 AND 20+000 AND 23+000 REFER DRAWING 3-4.
  5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

METRIC

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


**Ontario**

**McCORMICK RANKIN CORPORATION**  
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CONSULTING ENGINEERS

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CHECKED BY:	<b>C.N.</b>	APPROVED BY:	<b>B.R.G.</b>

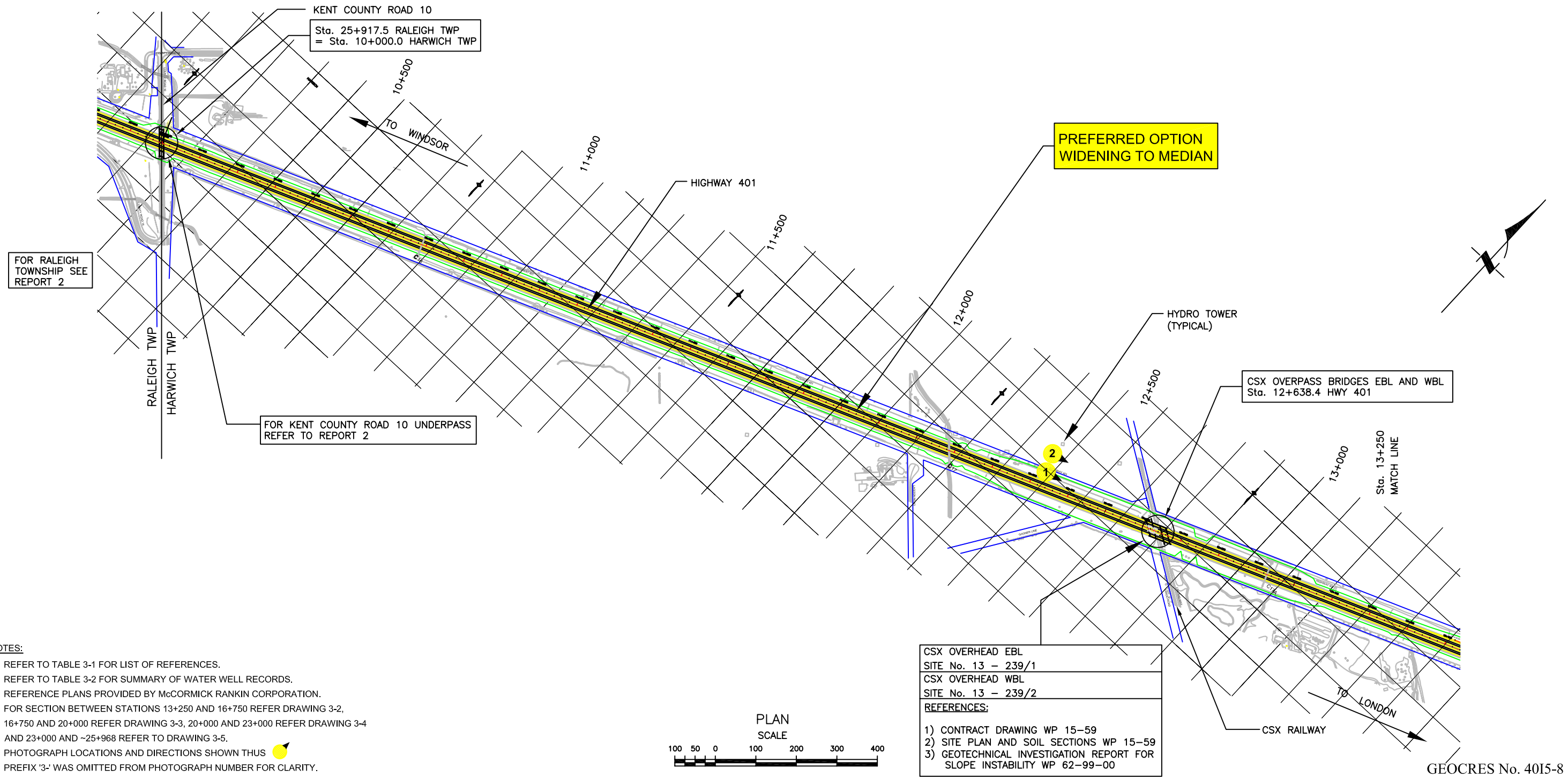
CONT No	<b>80-00-00</b>
GWP No	
HIGHWAY 401 WIDENING THROUGH KENT COUNTY HARWICH TOWNSHIP SECTION SITE PLAN	



**DRAWING**  
**3-5**

GEOCRES No. 4015-8

SUMMARY OF WATER WELL RECORDS				
T R S WB CONCESSION 5 LOT 1	T R S WB CONCESSION 5 LOT 2	T R S WB CONCESSION 5 LOT 3	T R S WB CONCESSION 5 LOT 4	C R W CONCESSION 1 LOT 27
GROUNDWATER DEPTH 3.7 to 5.8m (two wells dry) EL. 177.6 to 179.2	GROUNDWATER DEPTH 3.7 to 4.6m (two wells dry) EL. 177.4 to 179.2	NO DATA FOUND	GROUNDWATER DEPTH 3.7m EL. 179.2	GROUNDWATER DEPTH 4.6 to 6.4m EL. 176.5 to 178.3
BEDROCK DEPTH >17.4 to 35.1m EL. 147.5 to <164.6	BEDROCK DEPTH 23.5 to >25.9m EL. 156.1 to 159.4	NO DATA FOUND	BEDROCK DEPTH >20.4m EL. <162.5	BEDROCK DEPTH >18.9 to >29.0m EL. <153.9 to <164.0



- NOTES:
1. REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  2. REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  4. FOR SECTION BETWEEN STATIONS 13+250 AND 16+750 REFER DRAWING 3-2, 16+750 AND 20+000 REFER DRAWING 3-3, 20+000 AND 23+000 REFER DRAWING 3-4 AND 23+000 AND ~25+968 REFER TO DRAWING 3-5.
  5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.


CSX OVERHEAD EBL  
SITE No. 13 - 239/1  
CSX OVERHEAD WBL  
SITE No. 13 - 239/2  
REFERENCES:  
1) CONTRACT DRAWING WP 15-59  
2) SITE PLAN AND SOIL SECTIONS WP 15-59  
3) GEOTECHNICAL INVESTIGATION REPORT FOR  
SLOPE INSTABILITY WP 62-99-00

GEOCRES No. 4015-8

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

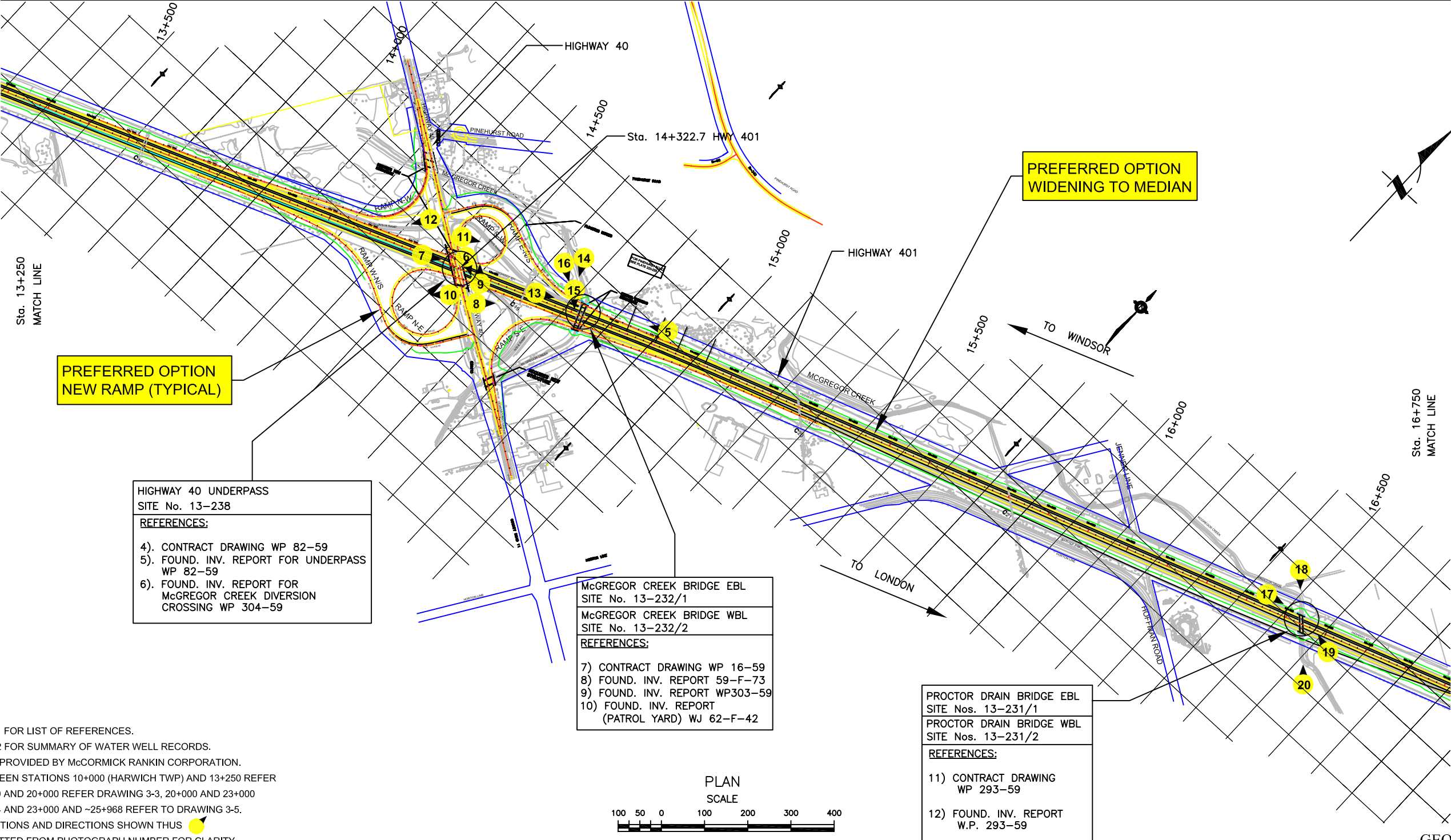
PREFERRED OPTION

  
**Ontario**  
MRC McCORMICK RANKIN CORPORATION  
A member of 

 **Peto MacCallum Ltd.**  
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DATE **JANUARY 2010**  
DRAWN BY: **N.A.**  
CHECKED BY: **C.N.**  
APPROVED BY: **B.R.G.**

CONT No  
GWP No 80-00-00  
HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
HARWICH TOWNSHIP SECTION  
SITE PLAN  
DRAWING  
P3-1

SUMMARY OF WATER WELL RECORDS		
C R W CONCESSION 1 LOT 27	C R E CONCESSION 1 LOT 24 to 27	C R E CONCESSION 2 LOT 23
REFER DRAWING 3-1	GROUNDWATER DEPTH 3.1 to 7.3m (two wells dry) EL. 176.2 to 180.4	GROUNDWATER DEPTH 15.2m EL. 176.8
	BEDROCK DEPTH >16.8 to 26.5m EL. 158.2 to <167.9	BEDROCK DEPTH >30.2m, EL. <161.8



- NOTES:
1. REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  2. REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  4. FOR SECTION BETWEEN STATIONS 10+000 (HARWICH TWP) AND 13+250 REFER DRAWING 3-1, 16+750 AND 20+000 REFER DRAWING 3-3, 20+000 AND 23+000 REFER DRAWING 3-4 AND 23+000 AND ~25+968 REFER TO DRAWING 3-5.
  5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

MCGREGOR CREEK BRIDGE EBL SITE No. 13-232/1
MCGREGOR CREEK BRIDGE WBL SITE No. 13-232/2
REFERENCES:
7) CONTRACT DRAWING WP 16-59
8) FOUND. INV. REPORT 59-F-73
9) FOUND. INV. REPORT WP303-59
10) FOUND. INV. REPORT (PATROL YARD) WJ 62-F-42

PROCTOR DRAIN BRIDGE EBL SITE Nos. 13-231/1
PROCTOR DRAIN BRIDGE WBL SITE Nos. 13-231/2
REFERENCES:
11) CONTRACT DRAWING WP 293-59
12) FOUND. INV. REPORT W.P. 293-59

GEOCRES No. 4015-8

METRIC

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

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Ontario



McCORMICK RANKIN  
CORPORATION

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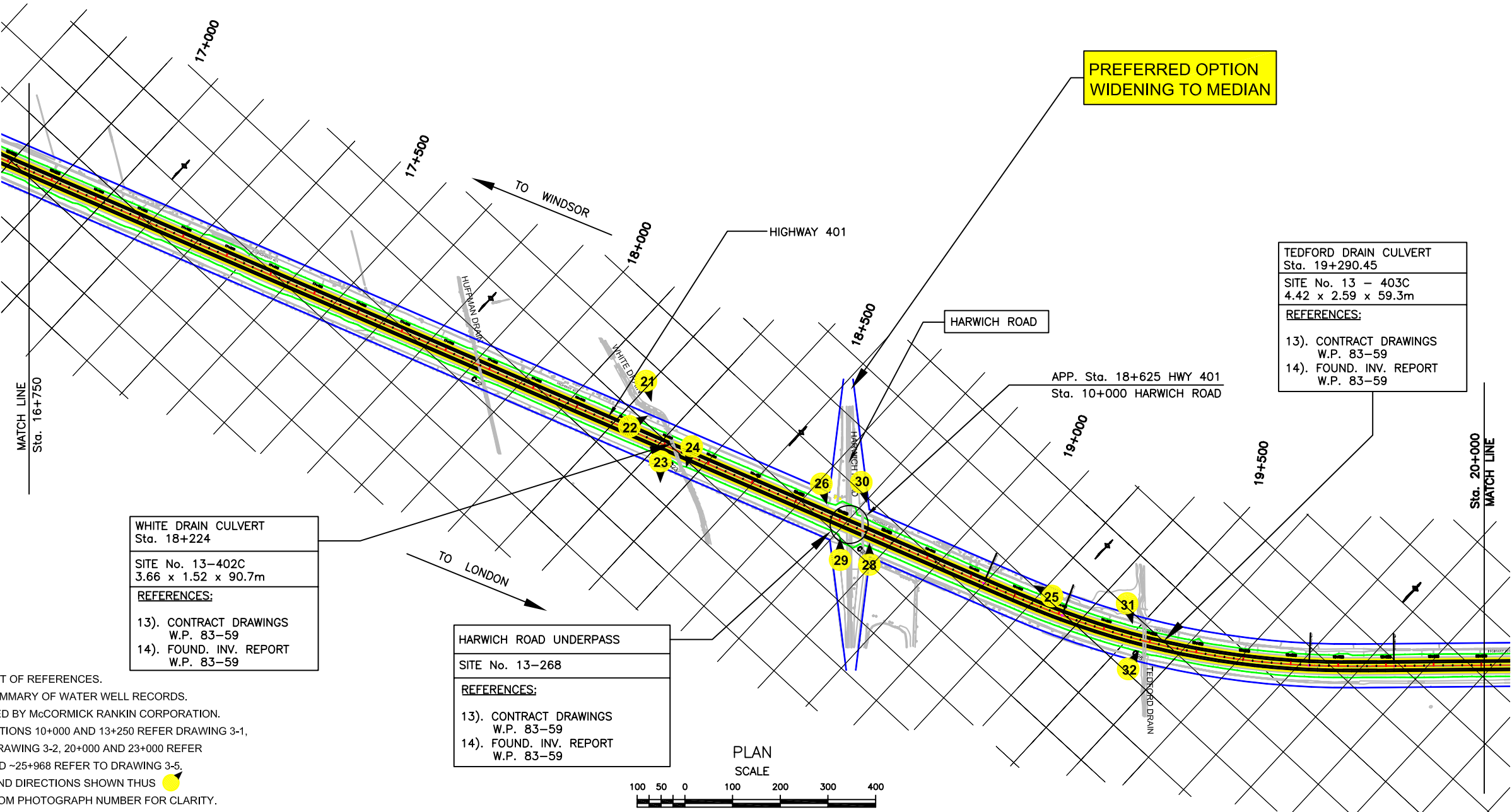
CONT No	GWP No 80-00-00
HIGHWAY 401 WIDENING THROUGH KENT COUNTY HARWICH TOWNSHIP SECTION SITE PLAN	




DRAWING  
P3-2



SUMMARY OF WATER WELL RECORDS			
C R E CONCESSION 2 LOT 23	C R E CONCESSION 3 LOT 22	L E S CONCESSION 11 LOT 13	L E S CONCESSION 11 LOT 14
REFER DRAWING 3-2	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND
	NO DATA FOUND	NO DATA FOUND	NO DATA FOUND



- NOTES:
1. REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
  2. REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
  3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
  4. FOR SECTION BETWEEN STATIONS 10+000 AND 13+250 REFER DRAWING 3-1, 13+250 AND 16+750 REFER DRAWING 3-2, 20+000 AND 23+000 REFER DRAWING 3-4 AND 23+000 AND ~25+968 REFER TO DRAWING 3-5.
  5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.

GEOCRES No. 4015-8

METRIC  
DIMENSIONS ARE IN METRES  
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IN KILOMETRES + METRES

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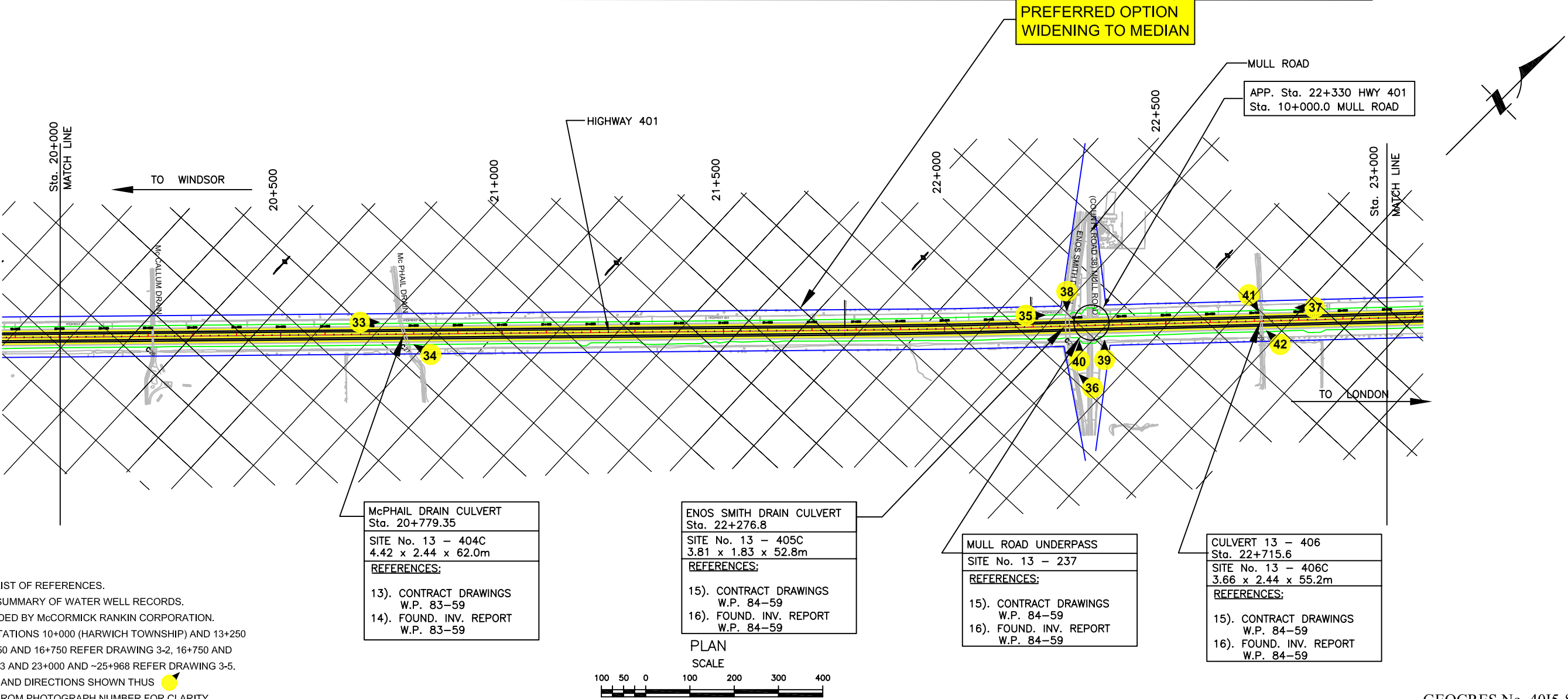


DATE **JANUARY 2010**  
CHECKED BY: **C.N.**  
DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**

CONT No  
GWP No 80-00-00  
HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
HARWICH TOWNSHIP SECTION  
SITE PLAN

DRAWING  
P3-3

SUMMARY OF WATER WELL RECORDS				
L E S CONCESSION 11 LOT 15	L E S CONCESSION 11 LOT 16	L E S CONCESSION 11 LOT 17	L E S CONCESSION 11 LOT 18	L E S CONCESSION 11 LOT 19
NO DATA FOUND	GROUNDWATER DEPTH 4.6m EL. 189.4	GROUNDWATER DEPTH 1.5m EL. 186.0	GROUNDWATER DEPTH 2.1m EL. 185.4	NO DATA FOUND
NO DATA FOUND	BEDROCK DEPTH 21.9m EL. 167.1	BEDROCK DEPTH 22.9m EL. 164.6	BEDROCK DEPTH 24.4m EL. 163.1	NO DATA FOUND



GEOCRES No. 4015-8

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


**PREFERRED OPTION**



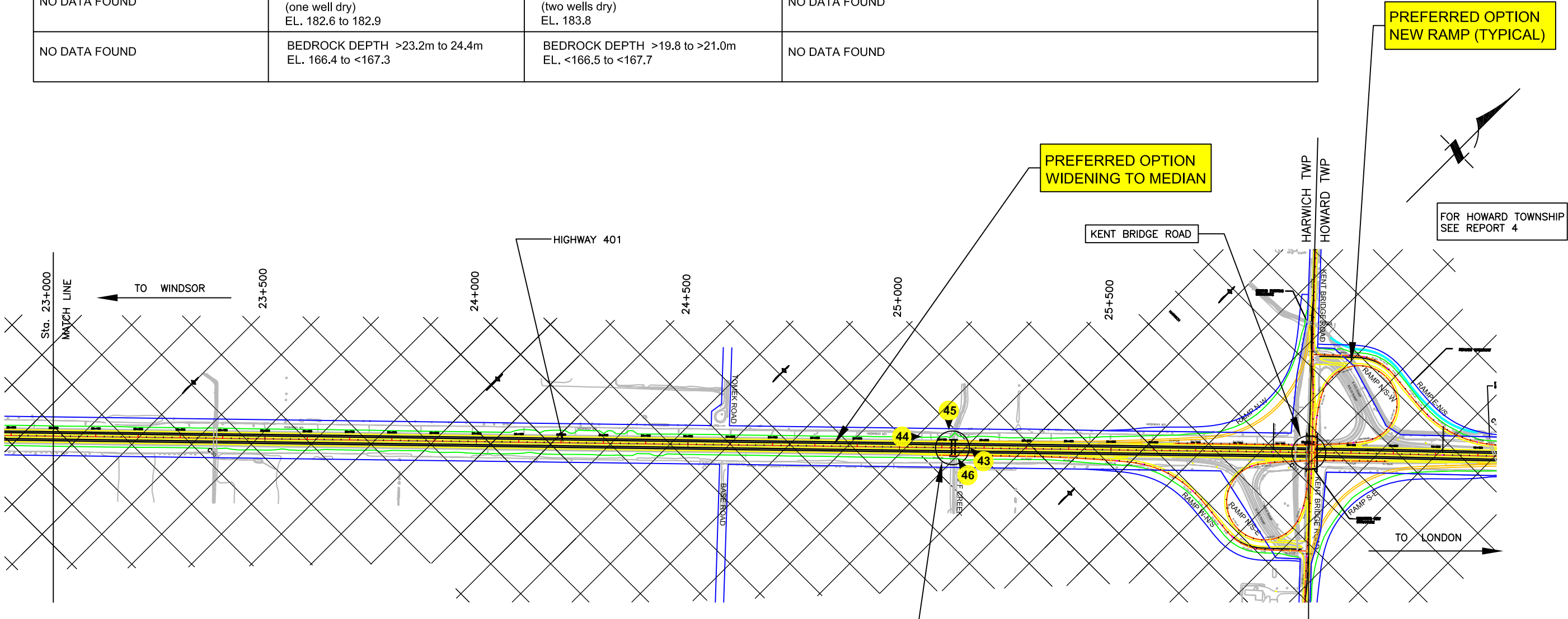
DATE **JANUARY 2010**  
CHECKED BY: **C.N.**  
DRAWN BY: **N.A.**  
APPROVED BY: **B.R.G.**

CONT No  
GWP No 80-00-00


HIGHWAY 401  
WIDENING THROUGH KENT COUNTY  
HARWICH TOWNSHIP SECTION  
SITE PLAN

  
**DRAWING  
P3-4**

SUMMARY OF WATER WELL RECORDS			
CONCESSION 11 LOT 20	L E S CONCESSION 11 LOT 21	L E S CONCESSION 11 LOT 22	TOWNLINE RANGE
NO DATA FOUND	GROUNDWATER DEPTH 7.9 to 8.2m (one well dry) EL. 182.6 to 182.9	GROUNDWATER DEPTH 3.7m (two wells dry) EL. 183.8	NO DATA FOUND
NO DATA FOUND	BEDROCK DEPTH >23.2m to 24.4m EL. 166.4 to <167.3	BEDROCK DEPTH >19.8 to >21.0m EL. <166.5 to <167.7	NO DATA FOUND



NOTES:

1. REFER TO TABLE 3-1 FOR LIST OF REFERENCES.
2. REFER TO TABLE 3-2 FOR SUMMARY OF WATER WELL RECORDS.
3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
4. FOR SECTION BETWEEN STATIONS 10+000 (HARWICH TOWNSHIP) AND 13+250 REFER DRAWING 3-1, 13+250 AND 16+750 REFER DRAWING 3-2 AND 16+750 AND 20+000 REFER DRAWING 3-3 AND 20+000 AND 23+000 REFER DRAWING 3-4.
5. PHOTOGRAPH LOCATIONS AND DIRECTIONS SHOWN THUS  PREFIX '3-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.



TAFF CREEK DRAIN BRIDGE EBL SITE No. 13 - 230/1
TAFF CREEK DRAIN BRIDGE WBL SITE No. 13 - 230/2
REFERENCES:
17) CONTRACT DRAWINGS W.P. No. 17-59
18). FOUND. INV. REPORT W.P. No. 17-59

GEOCRES No. 4015-8

METRIC  DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES	PREFERRED OPTION	 <b>Ontario</b>	 <b>Peto MacCallum Ltd.</b> <small>CONSULTING ENGINEERS</small>		CONT No	
				GWP No 80-00-00		
		 <b>McCORMICK RANKIN CORPORATION</b> <small>A member of  <b>MMM GROUP</b></small>	DATE <b>JANUARY 2010</b>	DRAWN BY: <b>N.A.</b>	HIGHWAY 401 WIDENING THROUGH KENT COUNTY HARWICH TOWNSHIP SECTION SITE PLAN	DRAWING <b>P3-5</b>
			CHECKED BY: <b>C.N.</b>	APPROVED BY: <b>B.R.G.</b>		

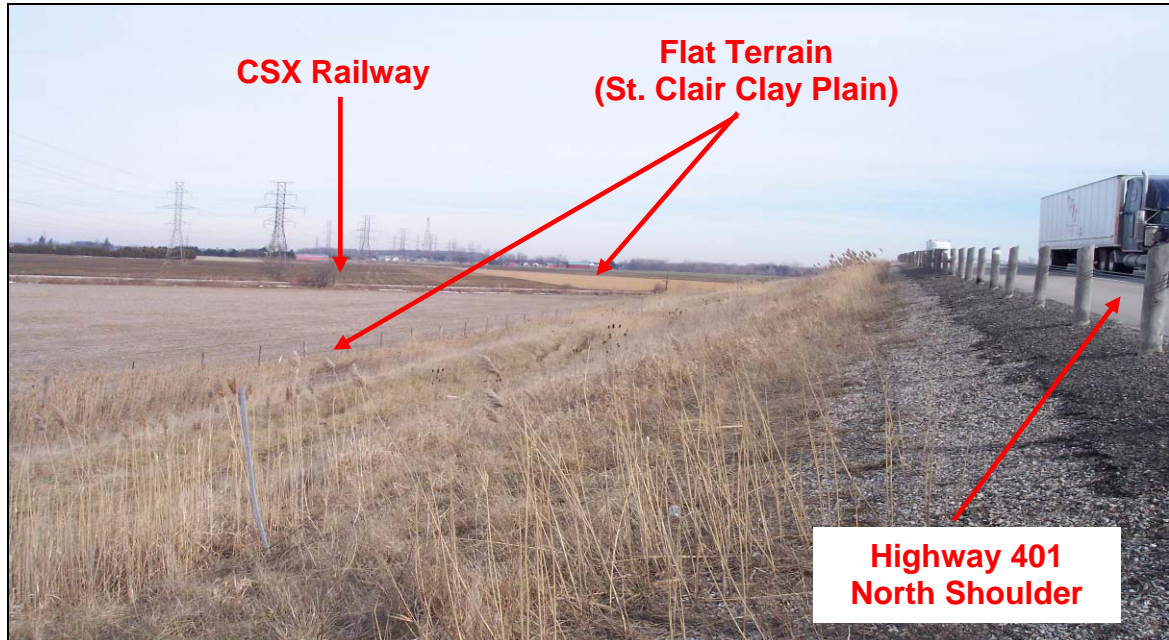


## **APPENDIX A**

### Site Photographs 3-1 to 3-46

Photographs 3-1 to 3-4	– CSX Railway Overhead Bridge EBL and WBL
Photographs 3-5 to 3-12	– Highway 40 Interchange
Photographs 3-13 to 3-16	– McGregor Creek Bridges EBL and WBL
Photographs 3-17 to 3-20	– Proctor Drain Bridges EBL and WBL
Photographs 3-21 to 3-24	– White Drain Culvert
Photographs 3-25 to 3-30	– Harwich Road Underpass
Photographs 3-31, 3-32	– Tedford Drain Culvert
Photographs 3-33, 3-34	– McPhail Drain Culvert
Photographs 3-35, 3-36	– Enos Smith Drain Culvert
Photographs 3-37 to 3-40	– Mull Road Underpass
Photographs 3-41, 3-42	– Culvert Site 13-406
Photographs 3-43 to 3-46	– Taff Creek Drain Bridges EBL and WBL



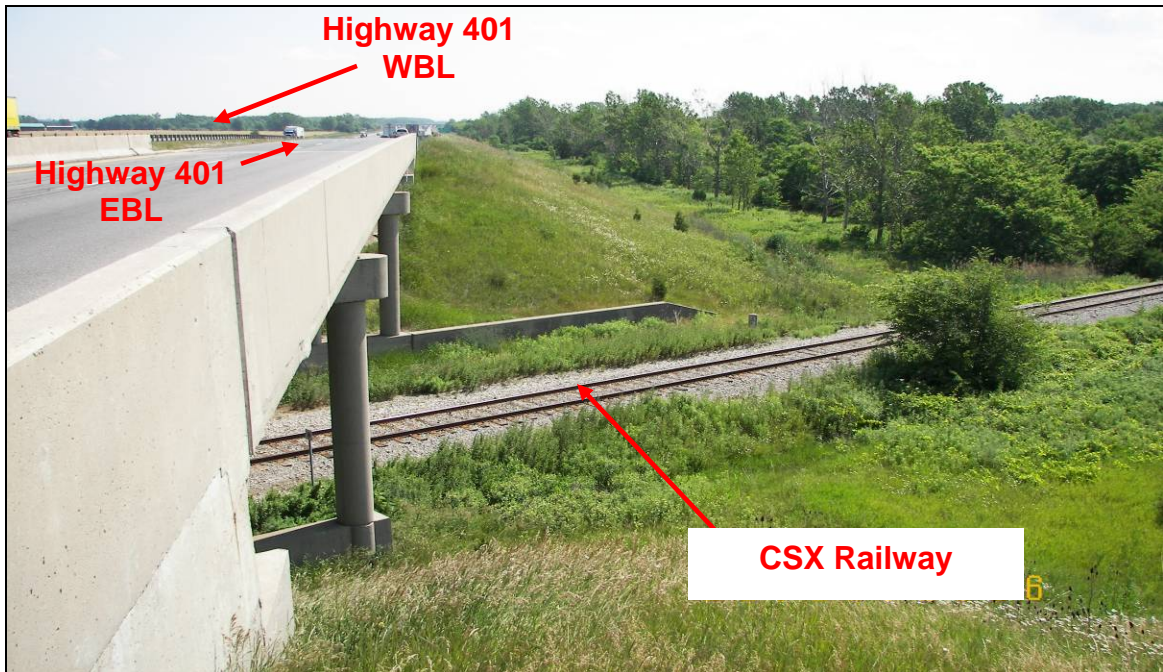


**PHOTOGRAPH 3-1:** CSX Railway Overhead. Looking east from north of shoulder of Highway 401 WBL, about 500 m west of CSX Railway overhead. Note flat terrain north of embankment of the St. Clair Clay Plain. (January 27, 2006)

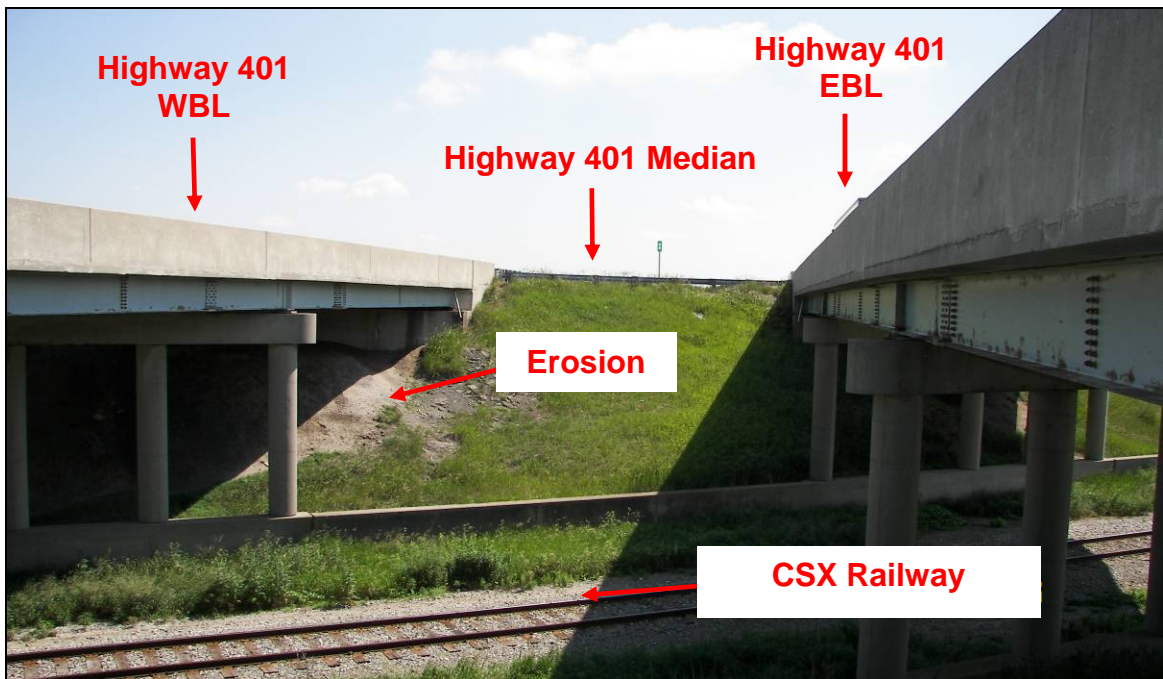


**PHOTOGRAPH 3-2:** CSX Railway Overhead. Zoom view looking east from north shoulder of Highway 401 WBL, 250 m west of CSX Railway overhead. Note grass covered berm at centre left of photograph. View is similar on south shoulder. (January 27, 2006)





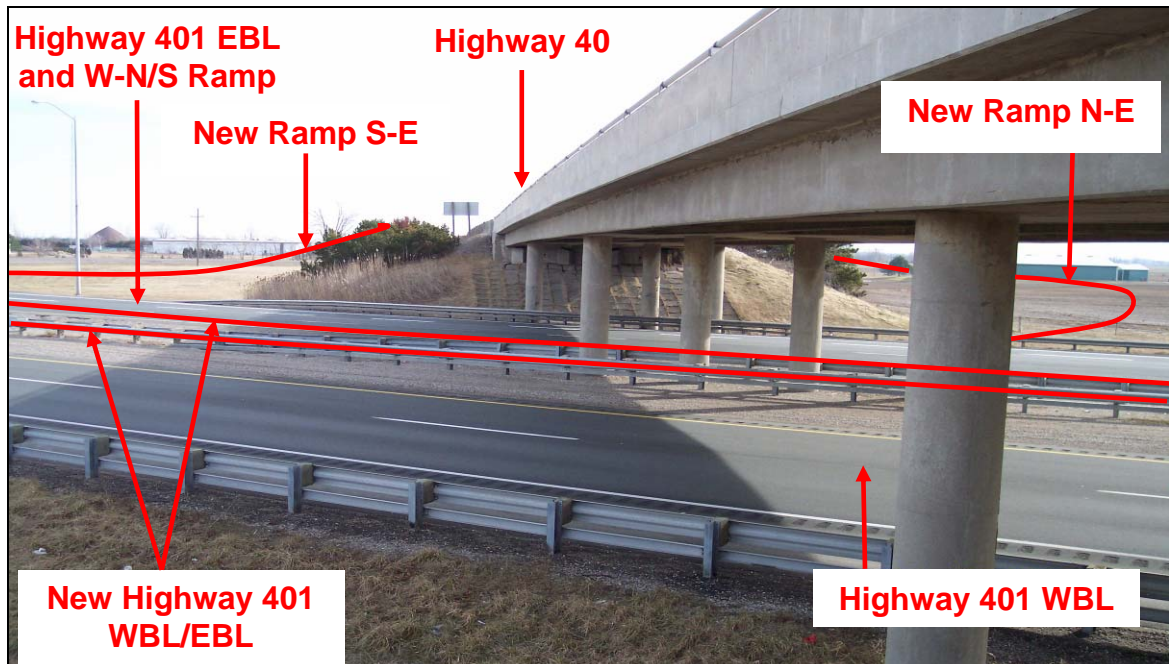
**PHOTOGRAPH 3-3:** CSX Railway. Looking easterly from southwest corner of EBL overhead. Note multispan structure piers. Embankment fill east of structure is about 8m high. (June 28, 2006)



**PHOTOGRAPH 3-4:** CSX Railway. Looking easterly at median between EBL and WBL of Highway 401. Note erosion of WBL overhead embankment foreslope. (June 28, 2006)

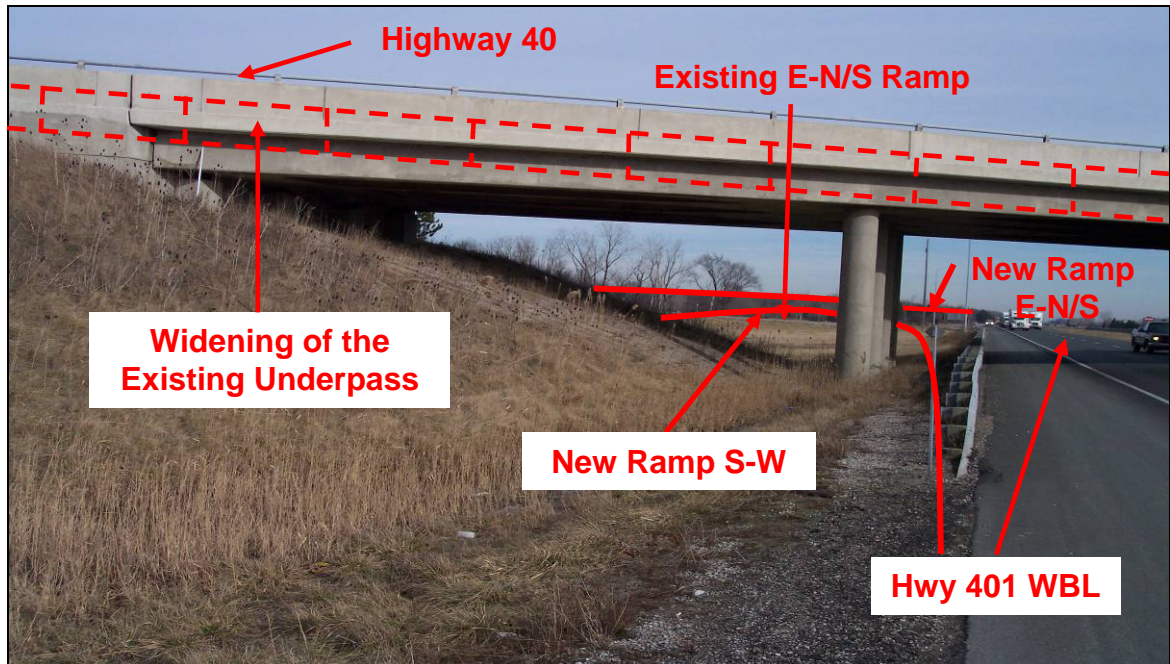


**PHOTOGRAPH 3-5:** Highway 40 I/C. Looking west at typically flat terrain at Highway 40 underpass from north shoulder of Highway 401. Start of E-N/S ramp in foreground. Note flat terrain beyond highway embankment. Preferred Option: Future S-E, S-W and E-N/S ramps are illustrated. (January 27, 2006)

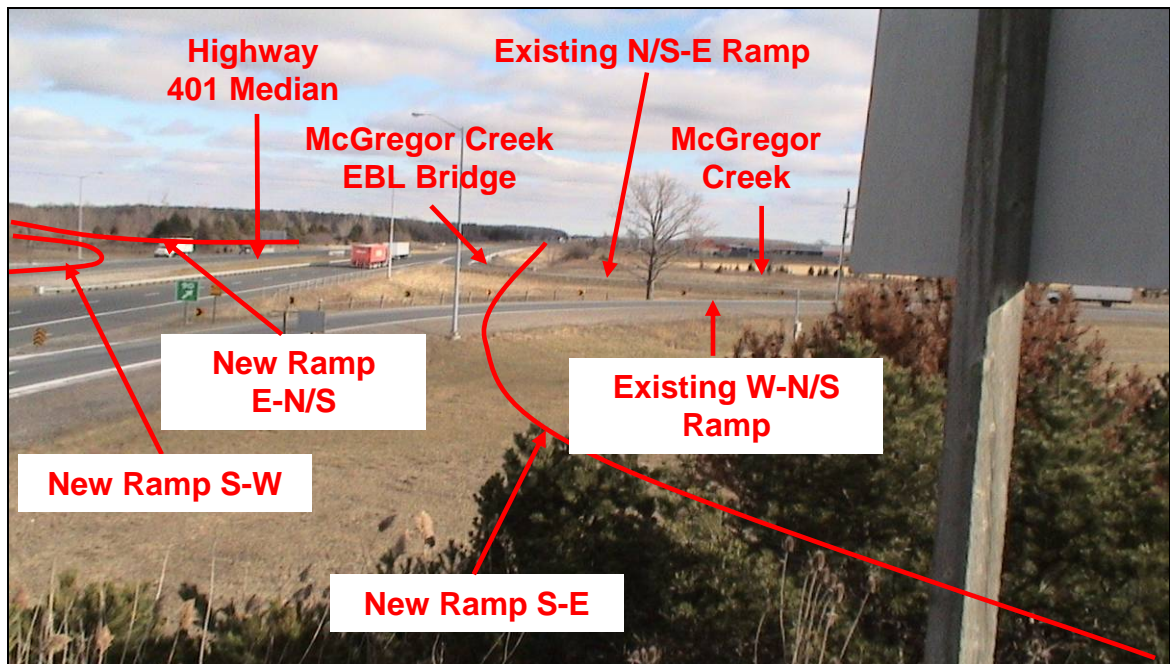


**PHOTOGRAPH 3-6:** Highway 40 I/C. Looking southeast along Highway 40 underpass structure. Note flat terrain from both sides of south approach embankment. Preferred Option: Future Highway 401 WBL and EBL and S-E and N-E ramps are depicted. (January 27, 2006)



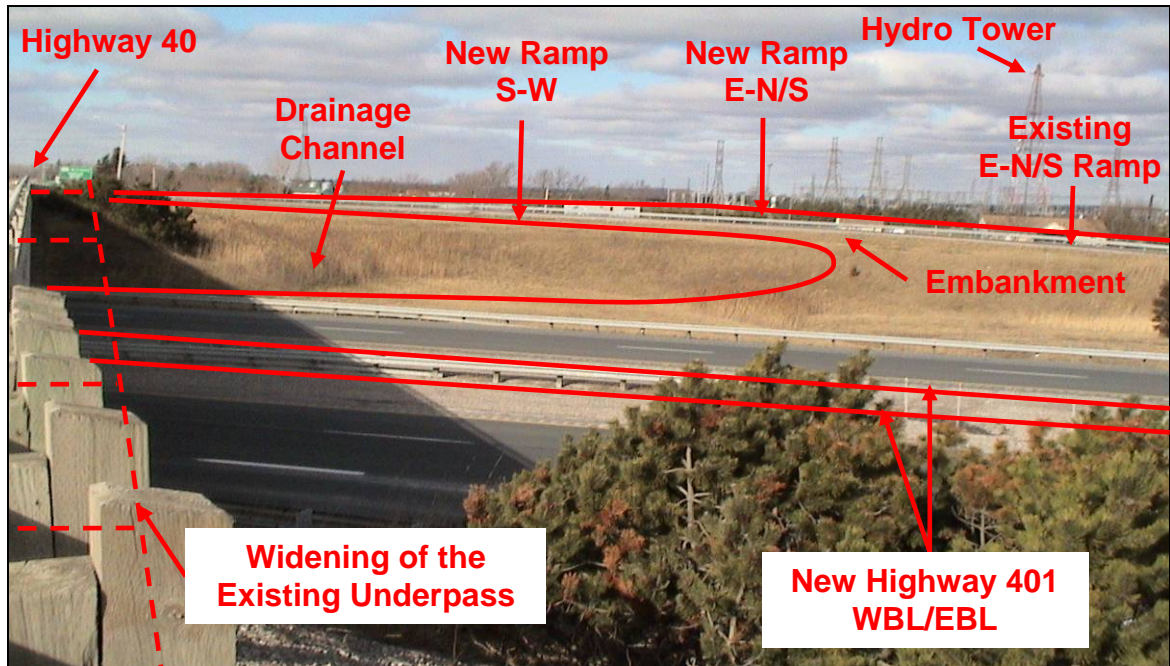


**PHOTOGRAPH 3-7** Highway 40 I/C. Looking east at north abutment and pier of Highway 40 underpass structure. Note flat terrain beyond abutment, existing E-N/S ramp in distance in front of tree line. Preferred Option: Future S-W and E-N/S ramps are shown. (January 27, 2006)

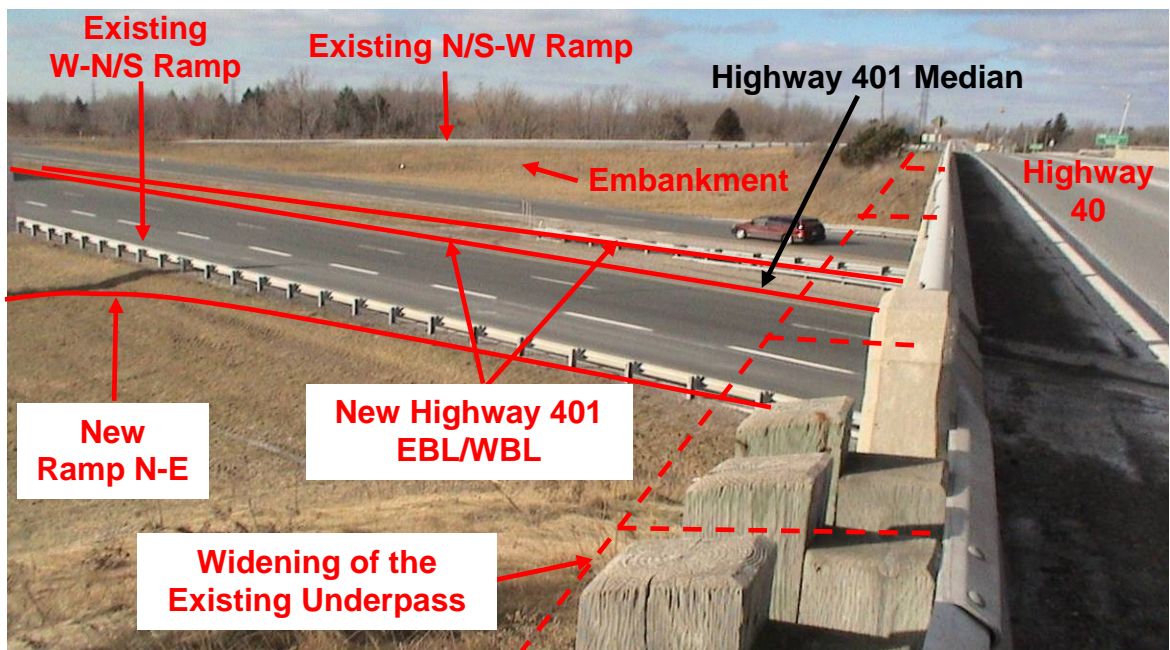


**PHOTOGRAPH 3-8:** Highway 40 I/C. Looking east from 100 m south of Highway 40 structure at existing W-N/S and N/S-E ramps. Note flat terrain. McGregor Creek runs along line of evergreens at centre right of photograph. Preferred Option: Future S-W, E-N/S and S-E ramps are illustrated. (January 26, 2006)



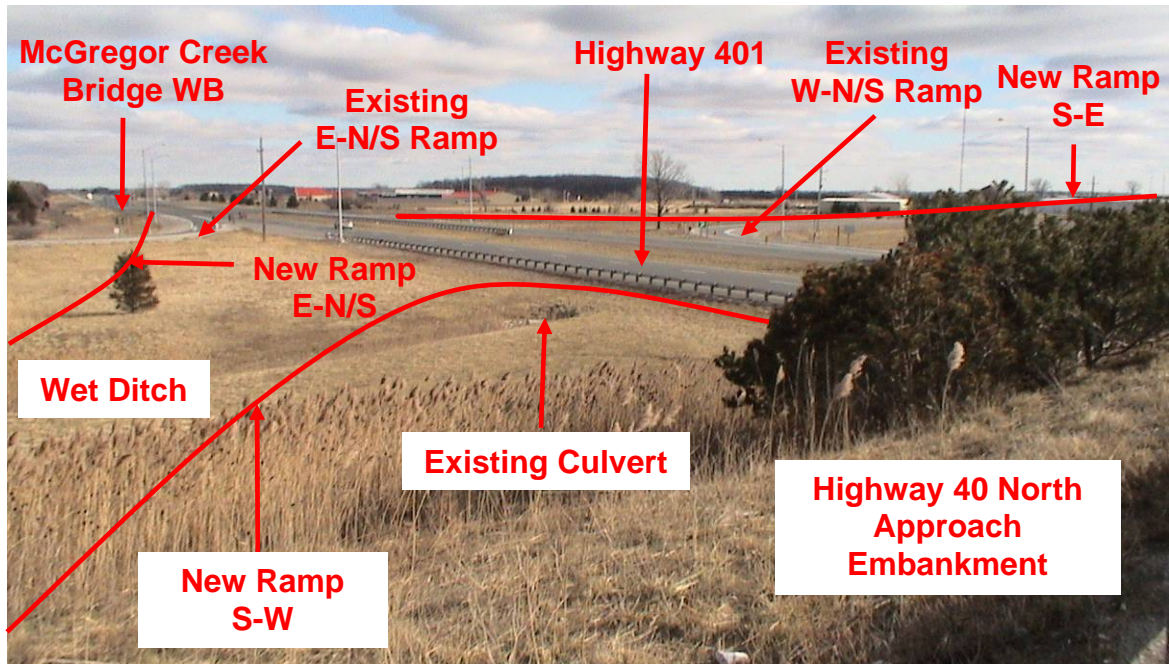


**PHOTOGRAPH 3-9:** Highway 40 I/C. Looking north at existing embankments of E-N/S ramp. Note drainage channel near the toe of the embankment to Highway 40 structure. Preferred Option: Future Highway 401 WBL and EBL, widening of the existing underpass and S-W and E-N/S ramps are depicted. (January 26, 2006)

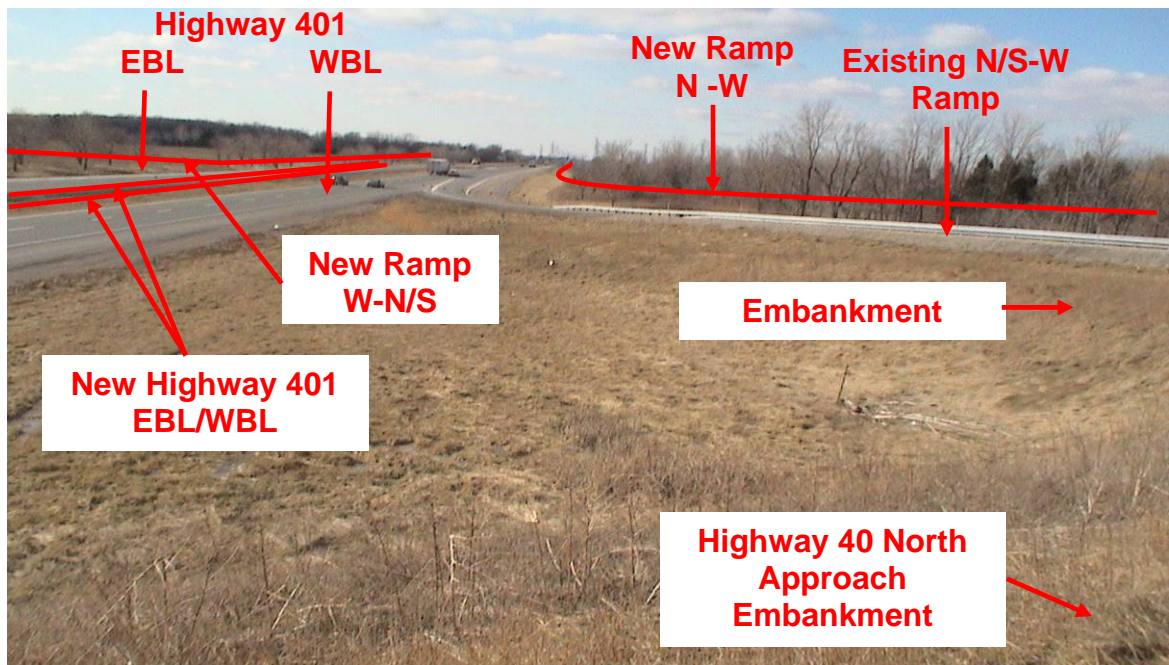


**PHOTOGRAPH 3-10:** Highway 40 I/C. Looking northwest from southwest corner of Highway 40 underpass structure. Note grassed embankment and flat terrain. Preferred Option: Future Highway 401 WBL and EBL, widening of the existing underpass and N-E ramp are shown. (January 26, 2006)



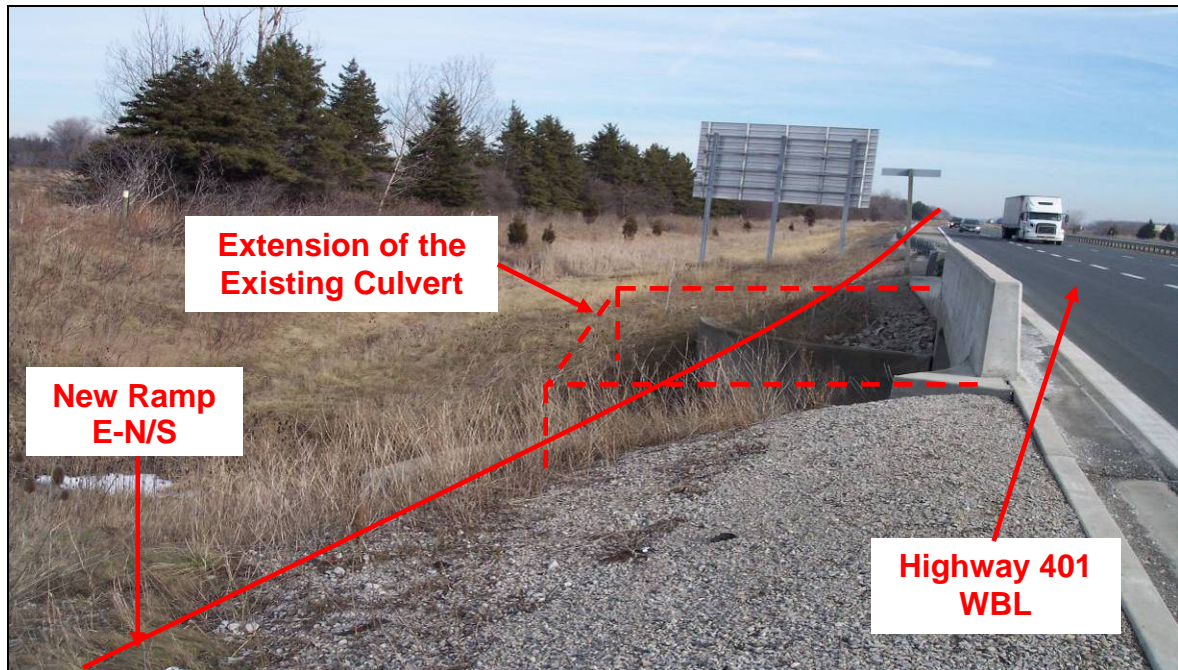


**PHOTOGRAPH 3-11:** Highway 40 I/C. Looking east from east shoulder of Highway 40 north of underpass structure. Note generally flat terrain. Wet ditch area at toe of slope of north approach embankment of Highway 40 underpass structure. Preferred Option: Future E-N/S, S-W and S-E ramps are illustrated. (January 26, 2006)

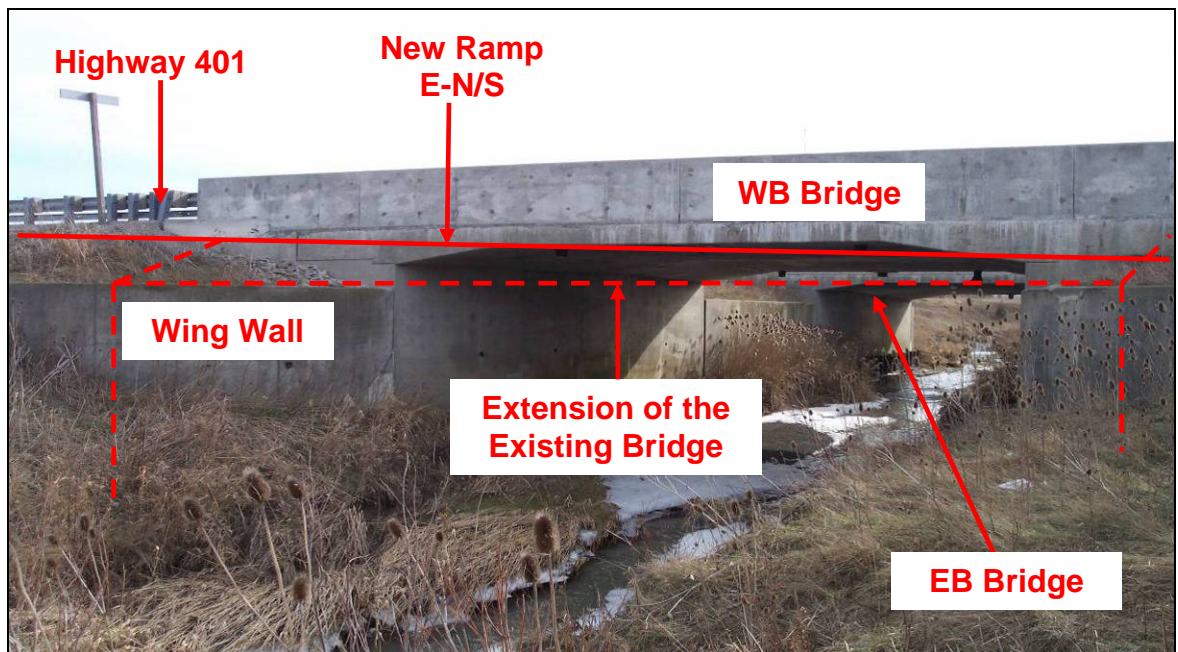


**PHOTOGRAPH 3-12:** Highway 40 I/C. Looking west from west shoulder of north approach embankment of Highway 40 underpass structure. Note generally flat terrain beyond N/S-W ramp and Highway 401 embankment. Preferred Option: Future Highway 401 EBL and WBL, N-W and W-N/S ramps are depicted. (January 26, 2006)





**PHOTOGRAPH 3-13:** McGregor Creek WB Bridge. Highway 401. Looking east from north shoulder of Highway 401 about 20 m west of McGregor Creek WB bridge. Note grassed roadside ditch and flat ground in the background. Preferred Option: Future E-N/S ramp and extension of the creek WB bridge are illustrated. (January 27, 2006)



**PHOTOGRAPH 3-14:** McGregor Creek Bridges. Looking south from north roadside ditch along McGregor Creek bridge crossings. Westbound bridge is in foreground and eastbound bridge behind. Note circular shaped wing walls. Refer to photograph 3-15 for close-up. Preferred Option: Future E-N/S ramp and extension of the bridge are depicted. (January 27, 2006)



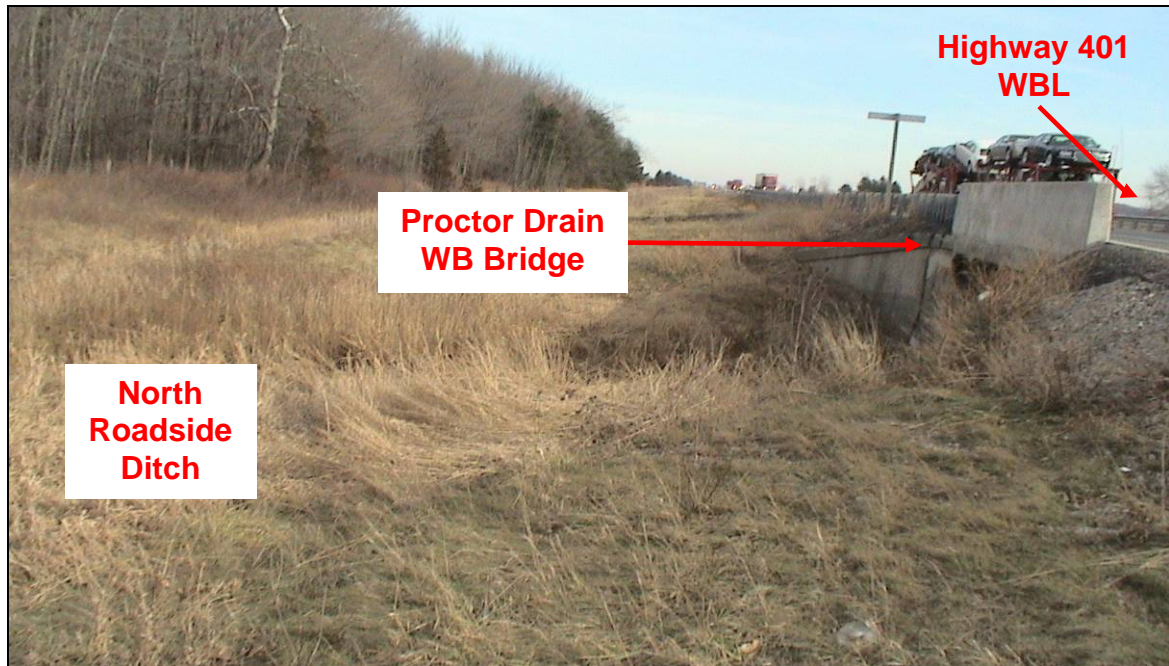


**PHOTOGRAPH 3-15:** McGregor Creek Bridges. Close-up of McGregor Creek EB and WB bridges. Note top of sheet-pile wall in front of abutment foundations. (January 27, 2006)



**PHOTOGRAPH 3-16:** McGregor Creek Bridges. Looking south along WB and EB Bridges over the McGregor Creek, from north roadside ditch. Note sloughing soil in creek in foreground left, potential erosion of channel under bridges. (January 27, 2006)



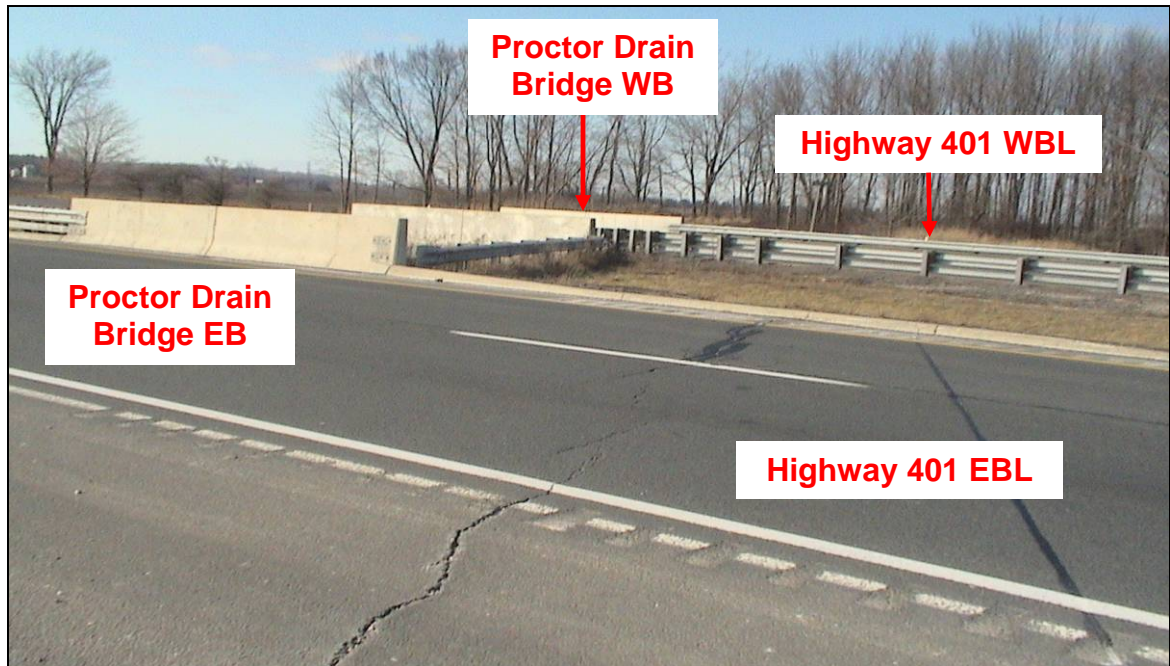


**PHOTOGRAPH 3-17:** Proctor Drain Bridges. Looking east at end of Proctor Drain WB Bridge from north shoulder of Highway 401. Note grassed roadside ditch and generally flat terrain in the distance. (January 27, 2006)



**PHOTOGRAPH 3-18:** Proctor Drain Bridges. Looking south along WB and EB Bridges crossing the Proctor Drain. Note continuous roof slab and meandering channel of drain. (January 27, 2006)





**PHOTOGRAPH 3-19:** Proctor Drain Bridges. Looking north from south shoulder of Highway 401 EBL at EB and WB Bridges crossing the Proctor Drain. Note generally flat terrain beyond Highway 401 R.O.W. (January 26, 2006)



**PHOTOGRAPH 3-20:** Proctor Drain Bridges. Looking north from south end of EB Bridge crossing Proctor Drain. Note single roof slab construction. Note meandering channel of drain under and north of bridges. (January 26, 2006)





**PHOTOGRAPH 3-21:** White Drain Culvert. Looking southwesterly at north end of White Drain Culvert. (January 27, 2006)

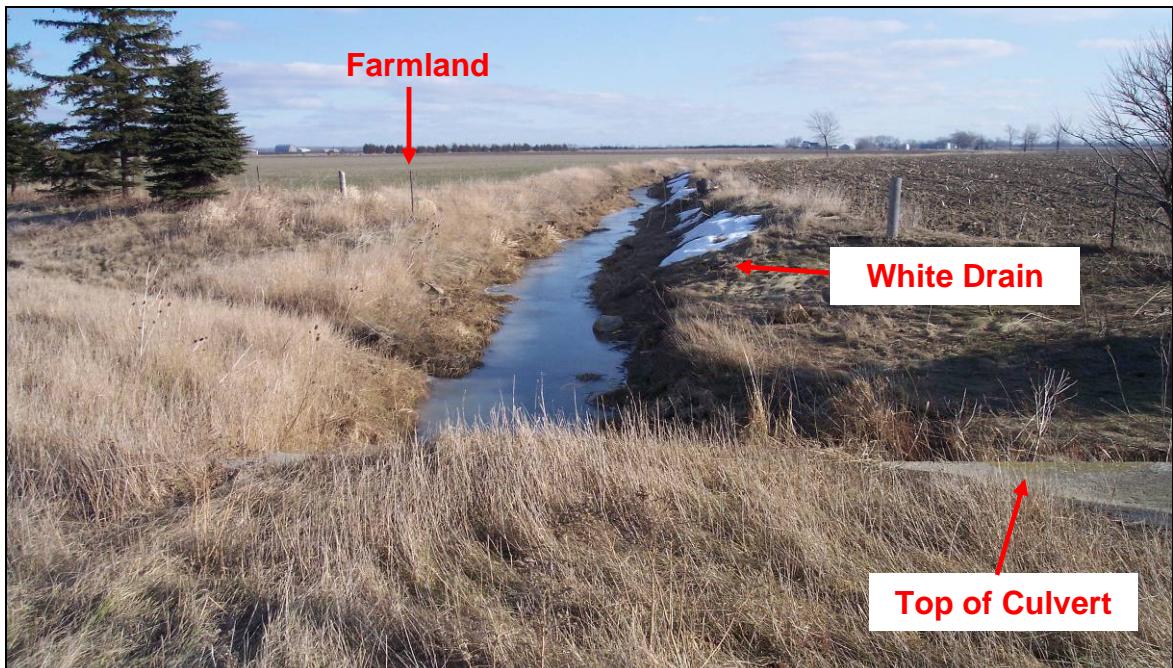


**PHOTOGRAPH 3-22:** White Drain Culvert. Looking at sandy soil exposure on bank of White Drain channel 15 m north of Highway 401. (January 27, 2006)





**PHOTOGRAPH 3-23:** White Drain Culvert. Looking east from west bank of White Drain channel to the north of Highway 401. Note narrowing of channel due to sloughing of soil into channel. (January 27, 2006)



**PHOTOGRAPH 3-24:** White Drain Culvert. Looking south from south shoulder of EBL across top of end of White Drain Culvert. Note grassed ditches and drain channel, farmland use beyond Highway 401 R.O.W. Generally flat terrain in background of photograph. (January 26, 2006)



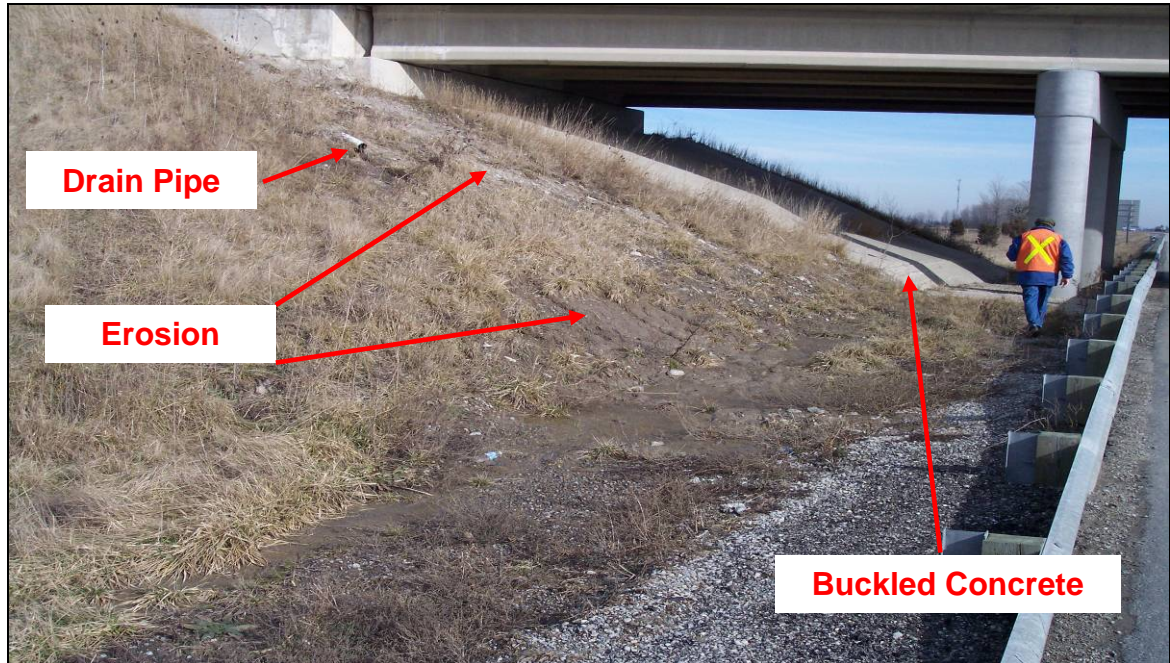


**PHOTOGRAPH 3-25:** Harwich Road Underpass. Looking west from north of shoulder of Highway 401 WBL, about 300 m east of structure. Note generally flat terrain and built-up approach embankments to the underpass structure. (January 27, 2006)

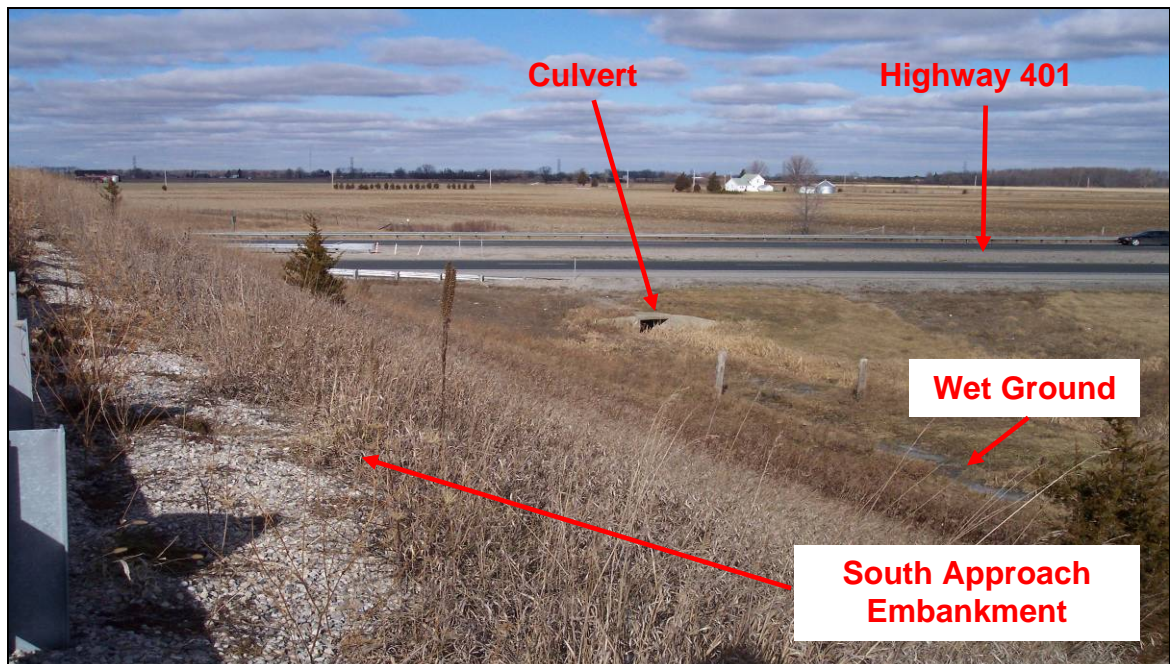


**PHOTOGRAPH 3-26:** Harwich Road Underpass. Looking southeast at south approach embankment from north shoulder of Highway 401 about 100 m west of underpass. Note flat to rolling terrain beyond embankment in the distance. (January 27, 2006)



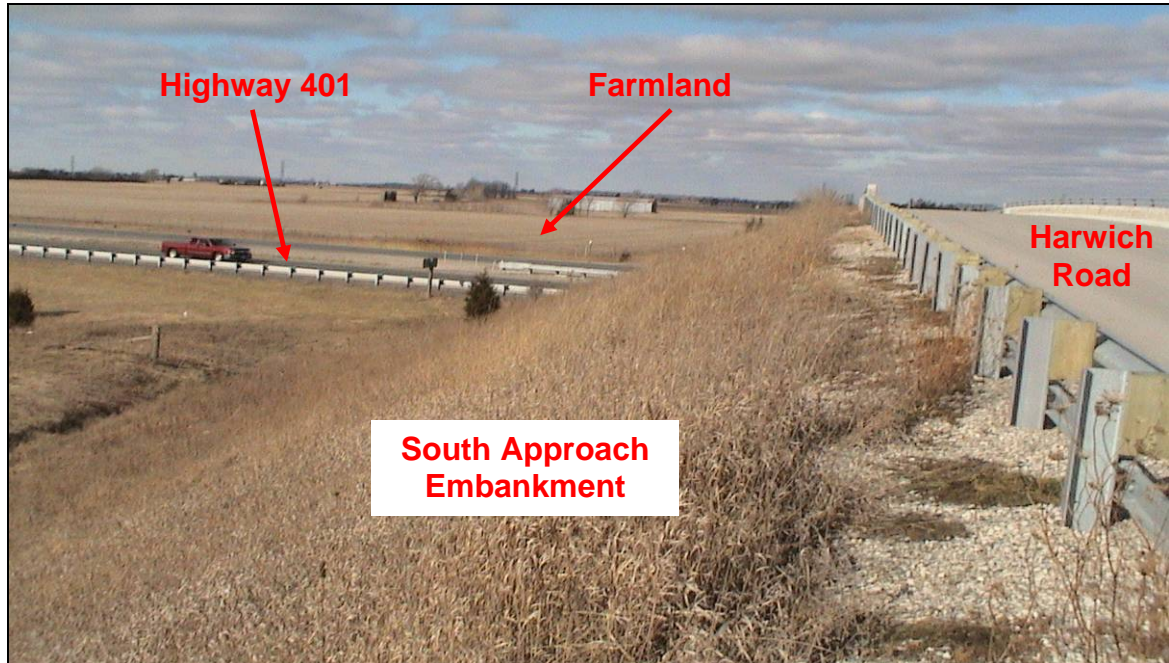


**PHOTOGRAPH 3-27:** Harwich Road Underpass. Looking easterly at north pier and abutment from about 30 m west of structure. Note erosion of embankment toe and buckled concrete slab revetment. (January 27, 2006)

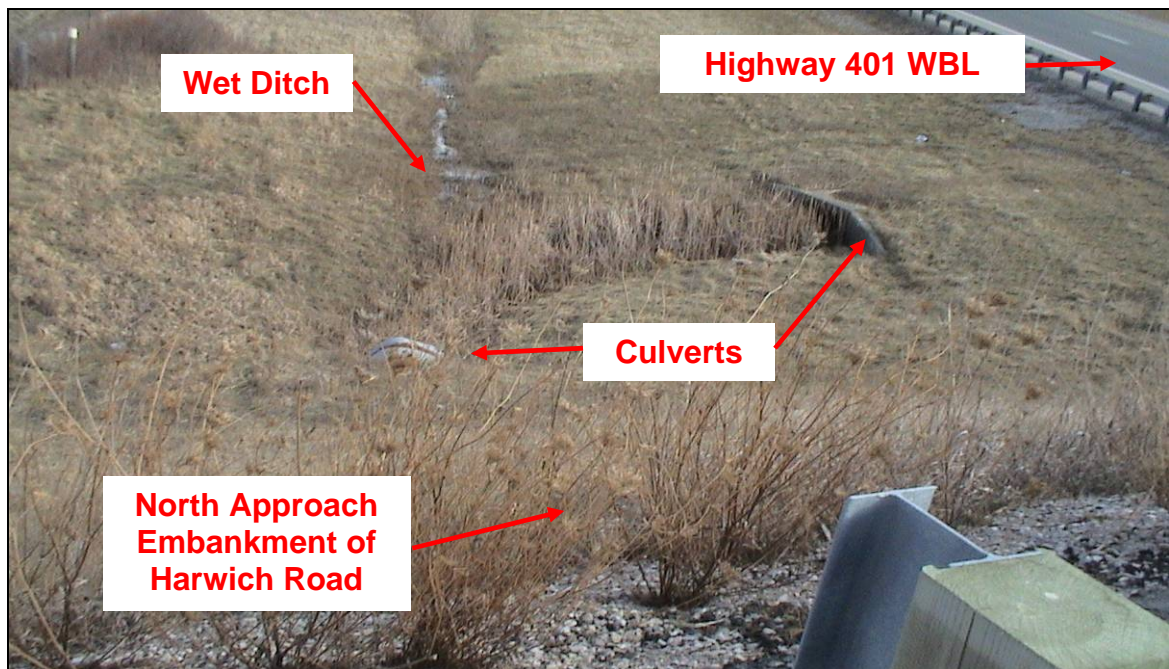


**PHOTOGRAPH 3-28:** Harwich Road Underpass. Looking northeast from shoulder of south approach embankment of Harwich Road Underpass. Note culvert under Highway 401, generally flat terrain and good condition of grassed embankment. (January 26, 2006)





**PHOTOGRAPH 3-29:** Harwich Road Underpass. Looking northwest from middle of south approach embankment. Note flat to rolling terrain and farmland use. Note stable condition of embankment. (January 26, 2006)



**PHOTOGRAPH 3-30:** Harwich Road Underpass. Looking southeasterly at ends of culverts north of Highway 401 from top of north approach embankment. Note wet ground condition in north ditch of Highway 401. (January 26, 2006)



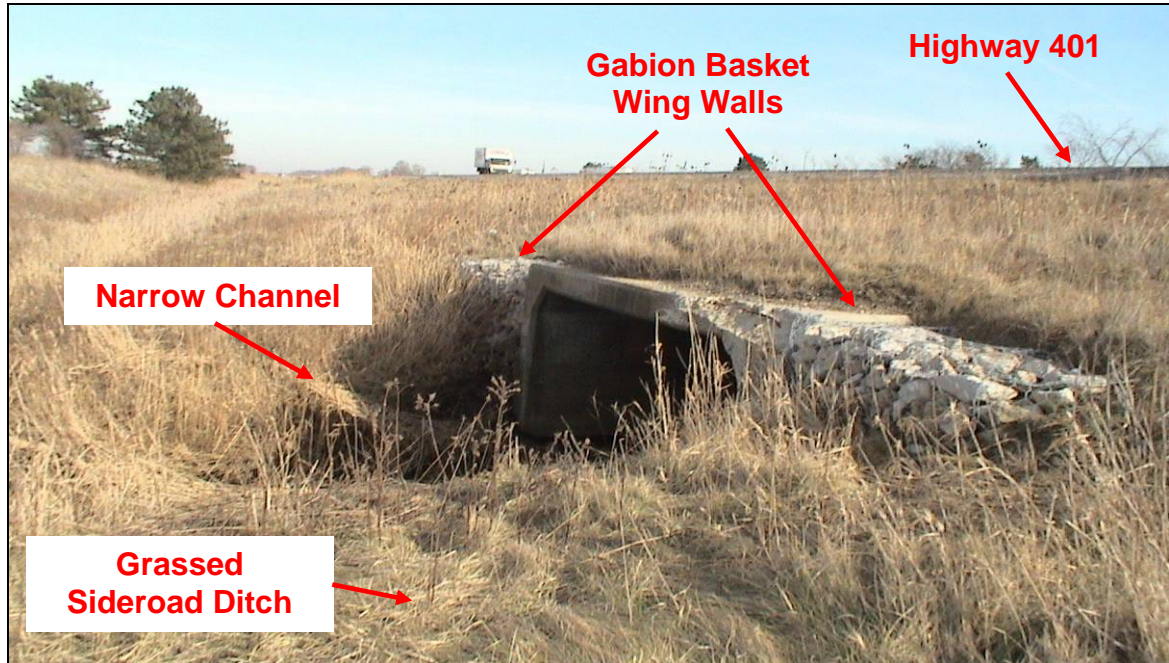


**PHOTOGRAPH 3-31:** Tedford Drain Culvert. Looking southeasterly at north end of Tedford Drain Culvert. Note grassed roadside ditch, gabion basket wing walls, sloughing of soil into channel. (January 27, 2006)

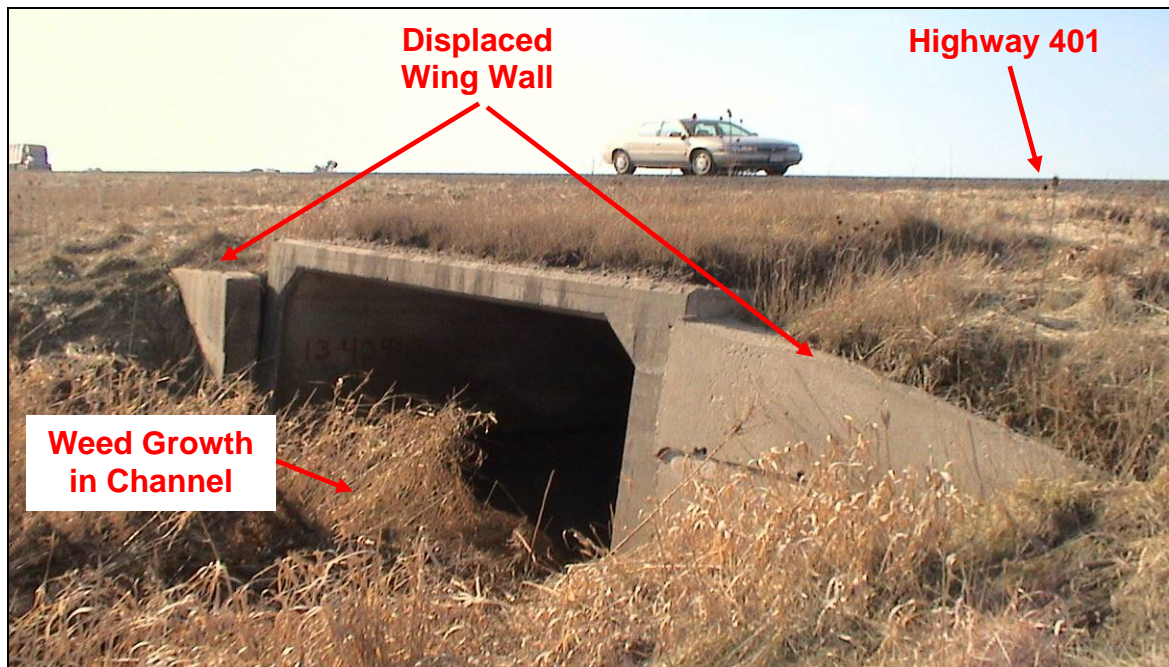


**PHOTOGRAPH 3-32:** Tedford Drain Culvert. Looking northerly at south end of Tedford Drain Culvert. Note displaced concrete wing walls, open channel, CSP for control of drain/roadside ditch flow. (January 26, 2006)





**PHOTOGRAPH 3-33:** McPhail Drain Culvert. Looking easterly from north roadside ditch of Highway 401 at north end of McPhail Drain Culvert. Note wing wall made of gabion baskets, heavily grassed sideroad ditch and narrow channel. (January 27, 2006)



**PHOTOGRAPH 3-34:** McPhail Drain Culvert. Looking northerly at south end of McPhail Drain Culvert. Note laterally displaced cast concrete wing walls and drainage channel narrowed by siltation (revealed by weed growth). (January 26, 2006)





**PHOTOGRAPH 3-35:** Enos Smith Drain Culvert. Looking easterly at north end of Enos Smith Drain Culvert with Mull Road underpass in the background. Note gabion basket wing walls, grass covered roadside ditch. (January 27, 2006)



**PHOTOGRAPH 3-36:** Enos Smith Drain Culvert. Looking westerly at south end of Enos Smith Drain Culvert from south approach embankment of Mull Road Underpass. Note concrete wing walls and grass covered roadside ditch. (January 27, 2006)



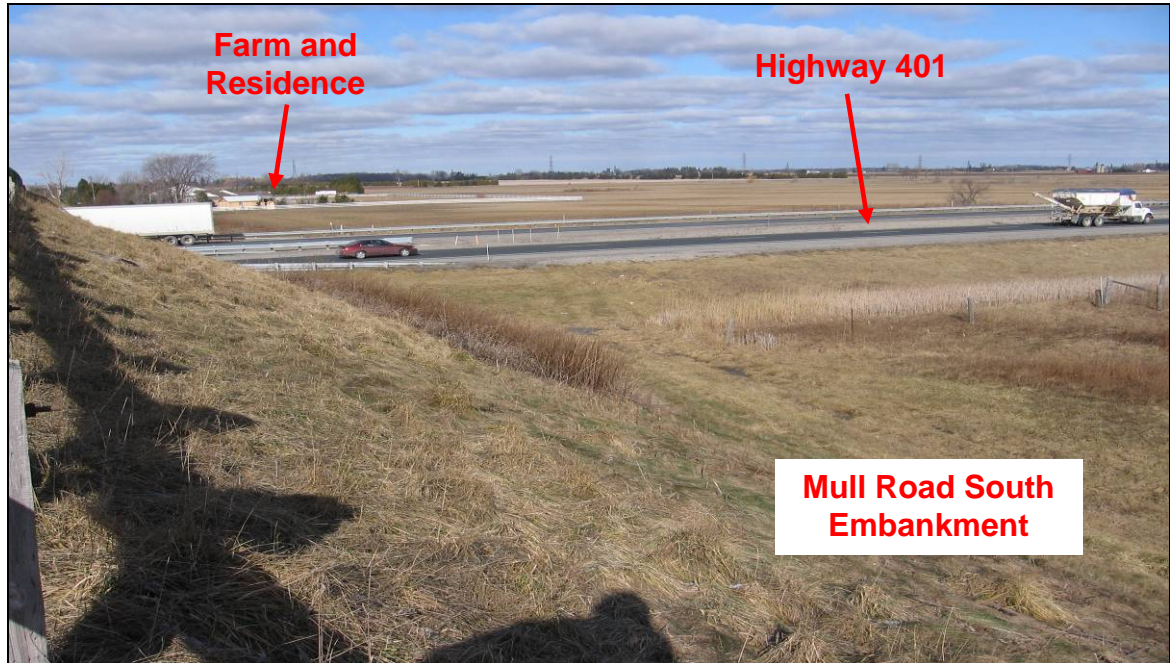


**PHOTOGRAPH 3-37:** Mull Road Underpass. Looking west from north shoulder of Highway 401 WBL at Mull Road Underpass. Note flat terrain beyond Highway 401 embankment and built-up approach embankments at structure. (January 27, 2006)

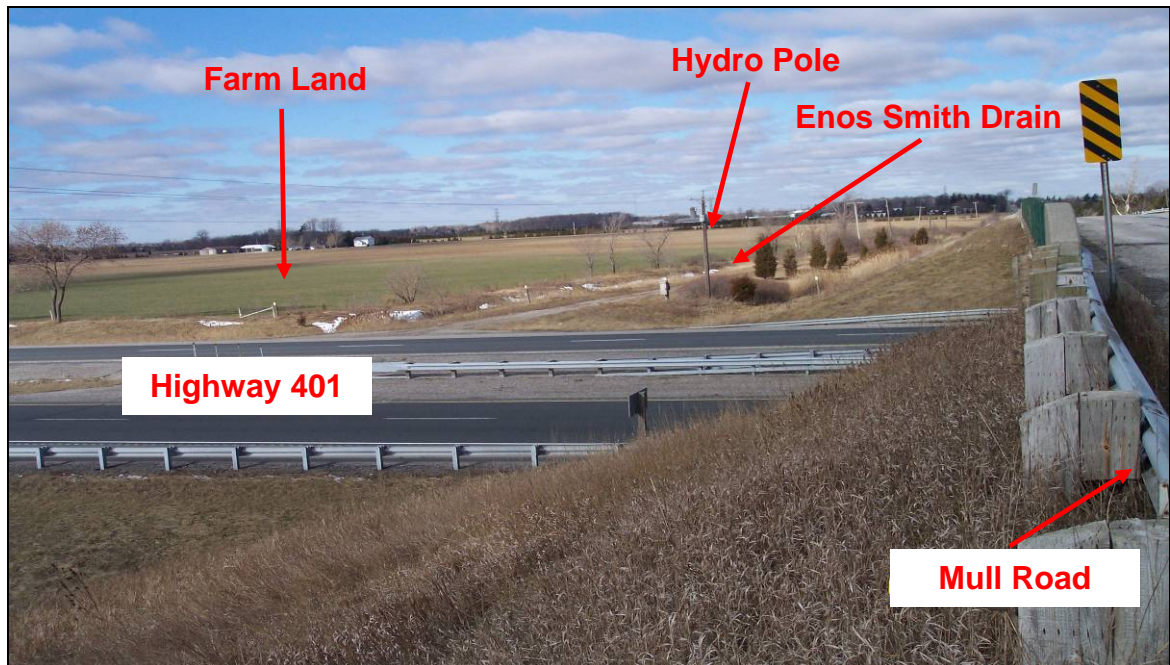


**PHOTOGRAPH 3-38:** Mull Road Underpass. Looking south from north side of Highway 401 at Mull Road underpass structure. Note flat terrain beyond structure in distance. (January 27, 2006)



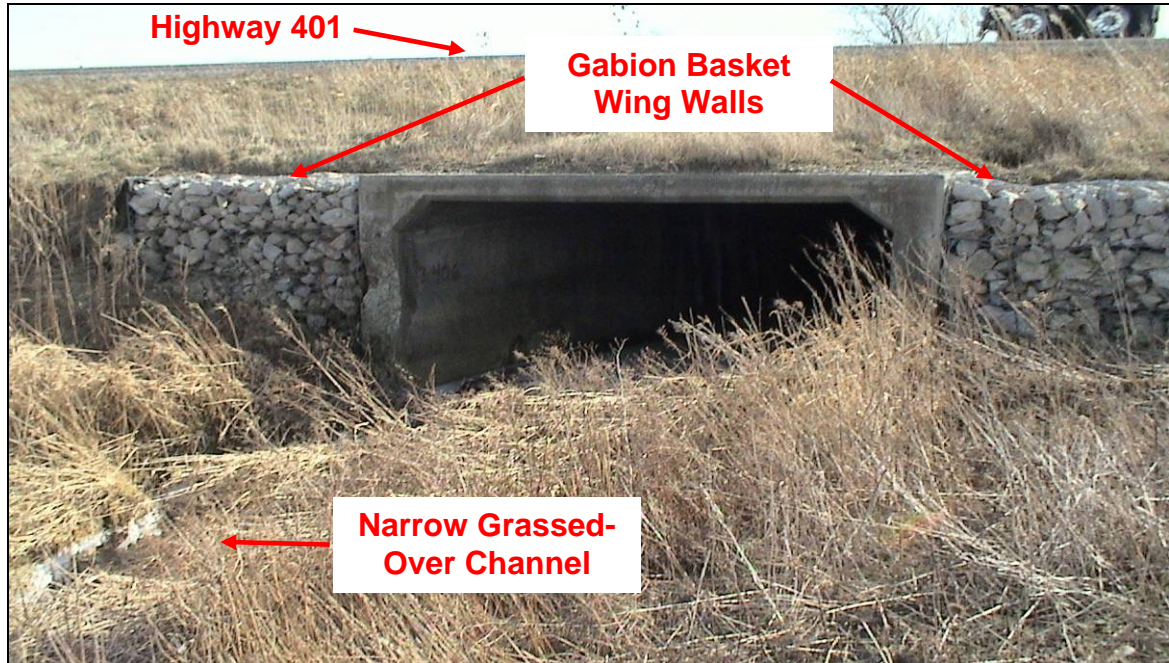


**PHOTOGRAPH 3-39:** Mull Road Underpass. Looking northeast from top of south approach embankment. Note flat terrain, farm and residence at left background of photograph, grass covered south approach embankment in foreground. (January 26, 2006)



**PHOTOGRAPH 3-40:** Mull Road Underpass. Looking northerly from south approach embankment. Note farmland use, flat terrain, Enos Smith Drain channel demarked by trees and Hydro pole line. (January 26, 2006)



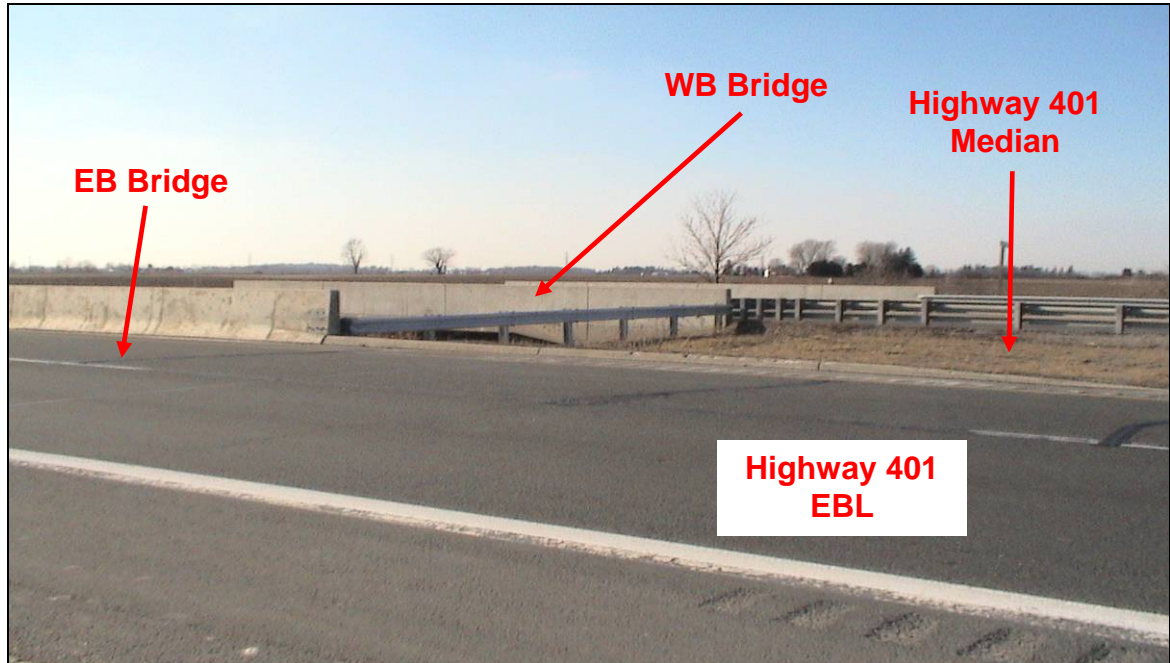


**PHOTOGRAPH 3-41:** Culvert Site 13-406. Looking southerly at north end of Culvert 13-406. Note gabion basket wing walls and narrow grassed over channel. (January 27, 2006)

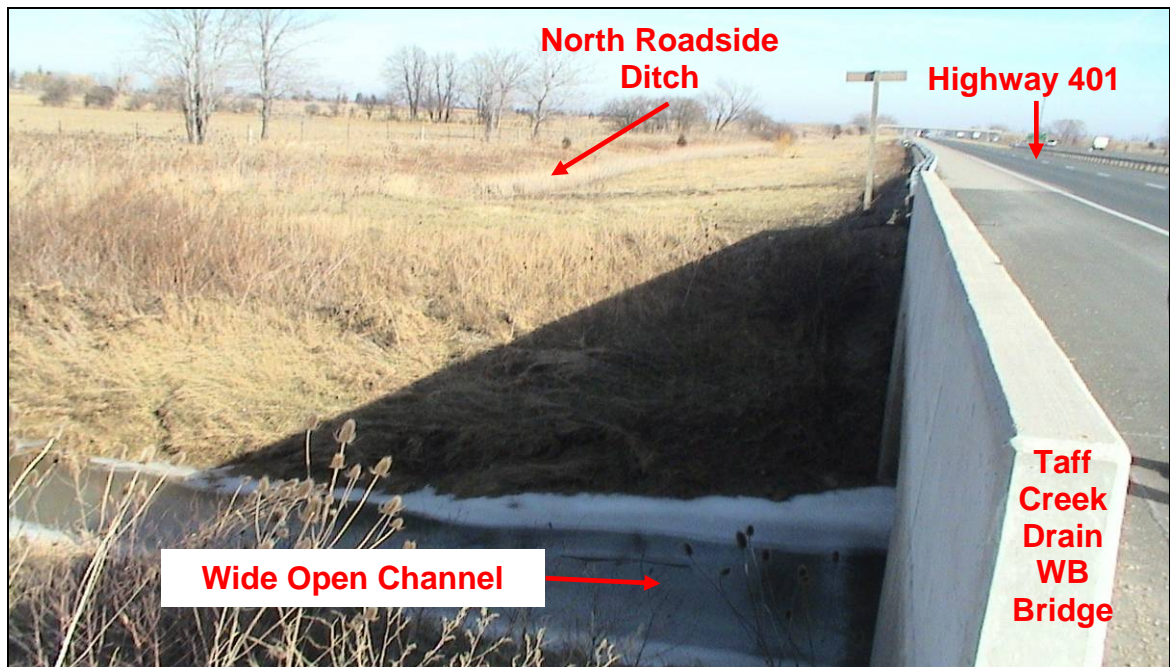


**PHOTOGRAPH 3-42:** Culvert Site 13-406. Looking north through south end of 13-406 culvert. Note leaning east concrete wing wall and collapsed west wing wall. Note silted-in narrowed channel with grass growth. (January 26, 2006)

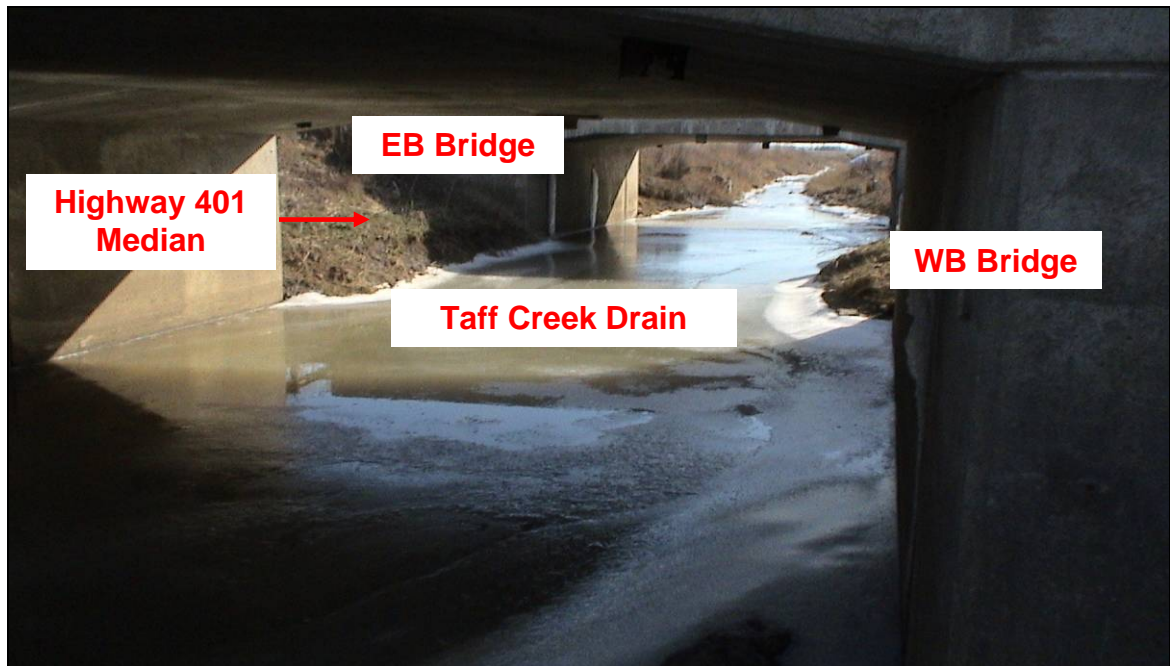




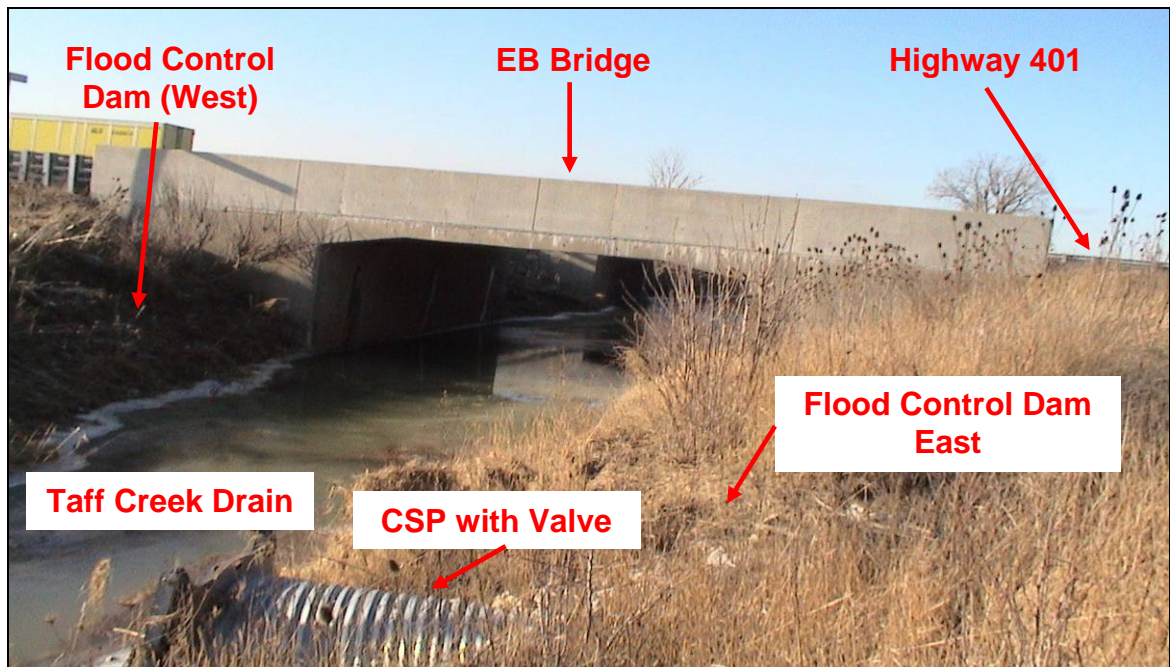
**PHOTOGRAPH 3-43:** Taff Creek Drain Bridges. Looking north west from south shoulder of Highway 401 at decks of WB and EB bridges over the Taff Creek Drain, and Highway 401 median. Note flat terrain in the background. (January 26, 2006)



**PHOTOGRAPH 3-44:** Taff Creek Drain Bridge WBL. Looking east from north shoulder of Highway 401 along north parapet wall of Taff Creek Drain West Bound Bridge. Note flat terrain in the distance, grassed north roadside ditch of Highway 401, wide open channel. (January 27, 2006)



**PHOTOGRAPH 3-45:** Taff Creek Drain Bridges. Looking south from north roadside ditch of Highway 401 through WB Bridge (in foreground), Highway 401 median and EB bridge. Note generally open channel below and beyond bridges. (January 27, 2006)



**PHOTOGRAPH 3-46:** Taff Creek Drain Bridge EBL. Looking north from east bank of Taff Creek Drain south of EB bridge. Note wide open channel, grass covered earth dam and CSP with one-way valve to contain water flow in creek channel. (January 27, 2006)



## **APPENDIX B**

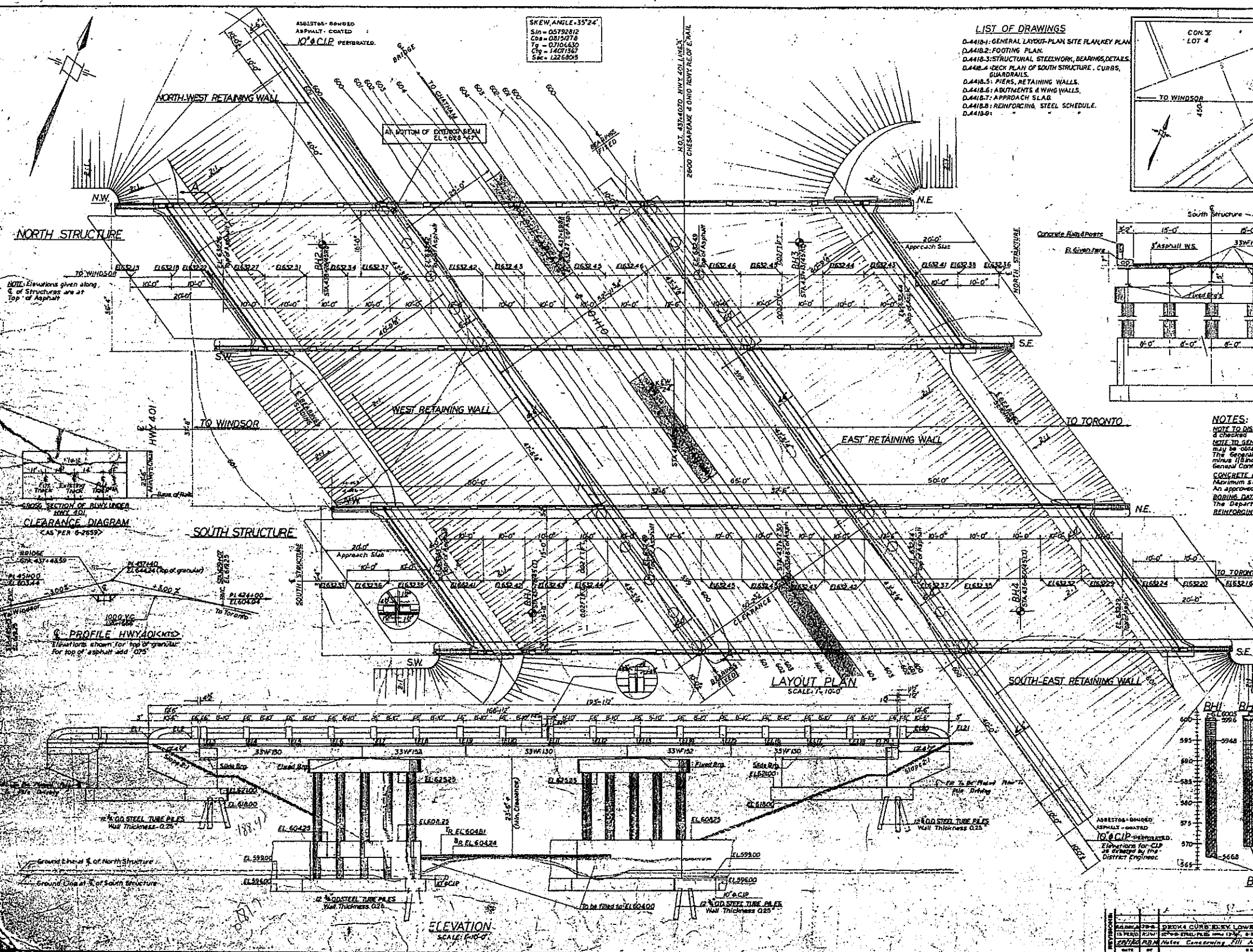
### Previous Soil Data and Records of Boreholes

- (1) Contract Drawing for WP 15-59 (CSX Railway Overhead EBL and WBL)
- (2) Foundation Investigation for WP 15-59 (CSX Railway Overhead EBL and WBL)
- (3) Slope Instability Investigation, WP 62-99-00 (CSX Railway Overhead EBL and WBL)
- (4) Contract Drawing for WP 82-59 (Highway 40 Underpass)
- (5) Foundation Investigation for WP 82-59 (Highway 40 Underpass)
- (6) Foundation Investigation for WP 304-59 (McGregor Creek/Highway 40 Crossing)
- (7) Contract Drawing for WP16-59 (McGregor Creek Bridges EBL and WBL)
- (8) Foundation Investigation for WP 16-59 (McGregor Creek Bridges EBL and WBL)
- (9) Foundation Investigation for WP 303-59 (McGregor Creek Bridges EBL and WBL)
- (10) Foundation Investigation for WJ 62-F-42 (Kent Centre Patrol Yard)
- (11) Contract Drawing for WP 293-59 (Proctor Drain Bridges EBL and WBL)
- (12) Foundation Investigation for WP 293-59 (Proctor Drain Bridges EBL and WBL)
- (13) Contract Drawings for WP 83-59 (Harwich Road Underpass)
- (14) Foundation Investigation for WP 83-59 (Harwich Road Underpass)
- (15) Contract Drawing for WP 84-59 (Mull Road Underpass)
- (16) Foundation Investigation for WP 84-59 (Mull Road Underpass)
- (17) Contract Drawing for WP 17-59 (Taff Creek Drain Bridges EBL and WBL)
- (18) Foundation Investigation for WP 17-59 (Taff Creek Drain Bridges EBL and WBL)
- (19) Contract Drawings for WP 603-93-1 (General data only)

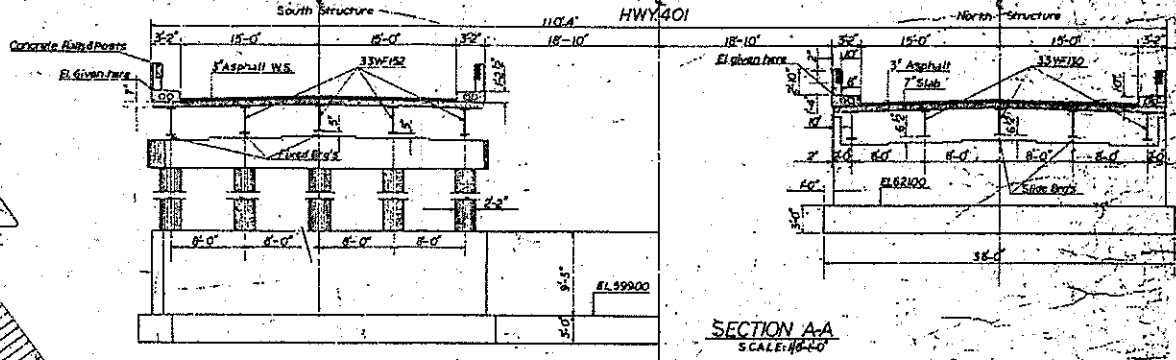
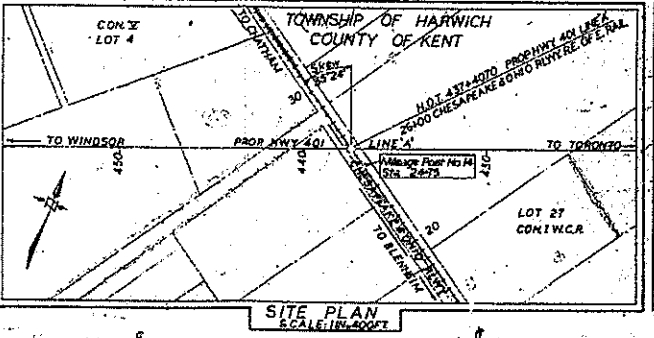


- (1) Contract drawings for Harwich Township Bridge No. 14 over the Chesapeake and Ohio Railway (currently the CSX Railway) overpass, WP 15-59, TWP 13-239, dated November 1959.





- LIST OF DRAWINGS**
- D-4418-1: GENERAL LAYOUT PLAN, SITE PLAN, KEY PLAN
  - D-4418-2: FOOTING PLAN
  - D-4418-3: STRUCTURAL STEELWORK, BEARINGS, DETAILS
  - D-4418-4: DECK PLAN OF SOUTH STRUCTURE, CURBS, GUARDRAILS
  - D-4418-5: PIERS, RETAINING WALLS
  - D-4418-6: ABUTMENTS & WING WALLS
  - D-4418-7: APPROACH SLAB
  - D-4418-8: REINFORCING STEEL SCHEDULE
  - D-4418-9: REINFORCING STEEL SCHEDULE



**NOTES:**

NOTE TO DISTRICT ENGINEER: Concrete work on this structure must not be commenced until monuments to the control points have been erected & checked by the District Engineer.

NOTE TO GENERAL CONTRACTOR: Structure to be built in accordance with Form "A" of the Special Provisions, extra copies of which may be obtained from the District Engineer. No concrete to be placed above bridge seat elevations until structural steel work is erected. The General Contractor shall be responsible for finishing the bridge seats dead level to the specified elevations with a tolerance of plus or minus 1/8 inch. If they are cast too high they shall be bush hammered down by the General Contractor if they are cast too low the General Contractor shall provide full bearing shims to bring them up to the correct elevations. The use of ground is prohibited.

CONCRETE MIX: Minimum Strength: 28 Days: Footings - 3000 PSI, Structure Deck - 3000 PSI, Retaining Walls - 3000 PSI, Piers - 3000 PSI.

Maximum size of aggregate: Footings - 1 1/2", Abutments - 2", Deck & Piers - 1 1/2", Retaining Walls - 1 1/2".

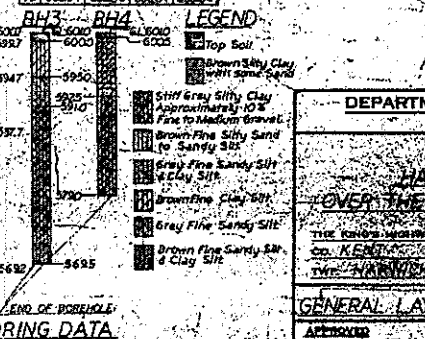
An approved admixture supplied by the Contractor will be added to all concrete as specified by the Engineer.

ROBING DATA: The complete soil investigation report BA898 may be examined at the Bridge Office, Downsview, Ontario. The Department does not guarantee the accuracy of this report as the bridges version shown on these plans.

REINFORCING STEEL: Clear Cover: Footings - 3", Abutments - 2", Deck & Piers - 2", Retaining Walls - 3", or as specified.

**LIST FOR ELEVATIONS**

Station	Elevation	Station	Elevation	Station	Elevation
1. 63290	63293	63292	63292	63294	63294
2. 63291	63291	63293	63293	63295	63295
3. 63292	63292	63294	63294	63296	63296
4. 63293	63293	63295	63295	63297	63297
5. 63294	63294	63296	63296	63298	63298
6. 63295	63295	63297	63297	63299	63299
7. 63296	63296	63298	63298	63300	63300
8. 63297	63297	63299	63299	63301	63301
9. 63298	63298	63300	63300	63302	63302
10. 63299	63299	63301	63301	63303	63303
11. 63300	63300	63302	63302	63304	63304
12. 63301	63301	63303	63303	63305	63305
13. 63302	63302	63304	63304	63306	63306
14. 63303	63303	63305	63305	63307	63307
15. 63304	63304	63306	63306	63308	63308



**DEPARTMENT OF HIGHWAYS - ONTARIO**

BRIDGE OFFICE - TORONTO

**HARWICH TWP BRIDGE #14**

**OVER THE CHESAPEAKE & OHIO RAILWAY**

THE ENGINEER: [Signature]

DATE: [Date]

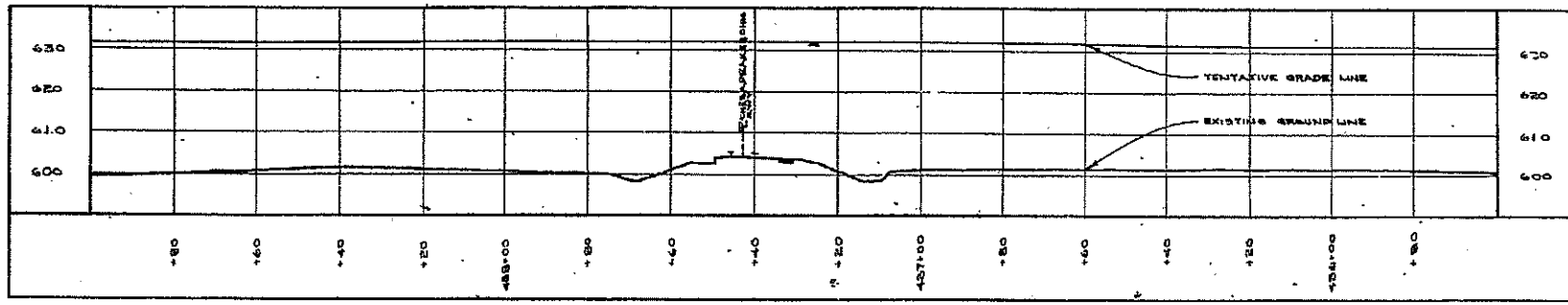
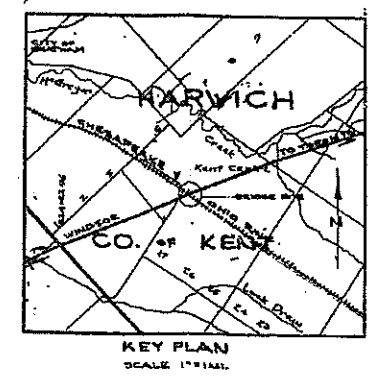
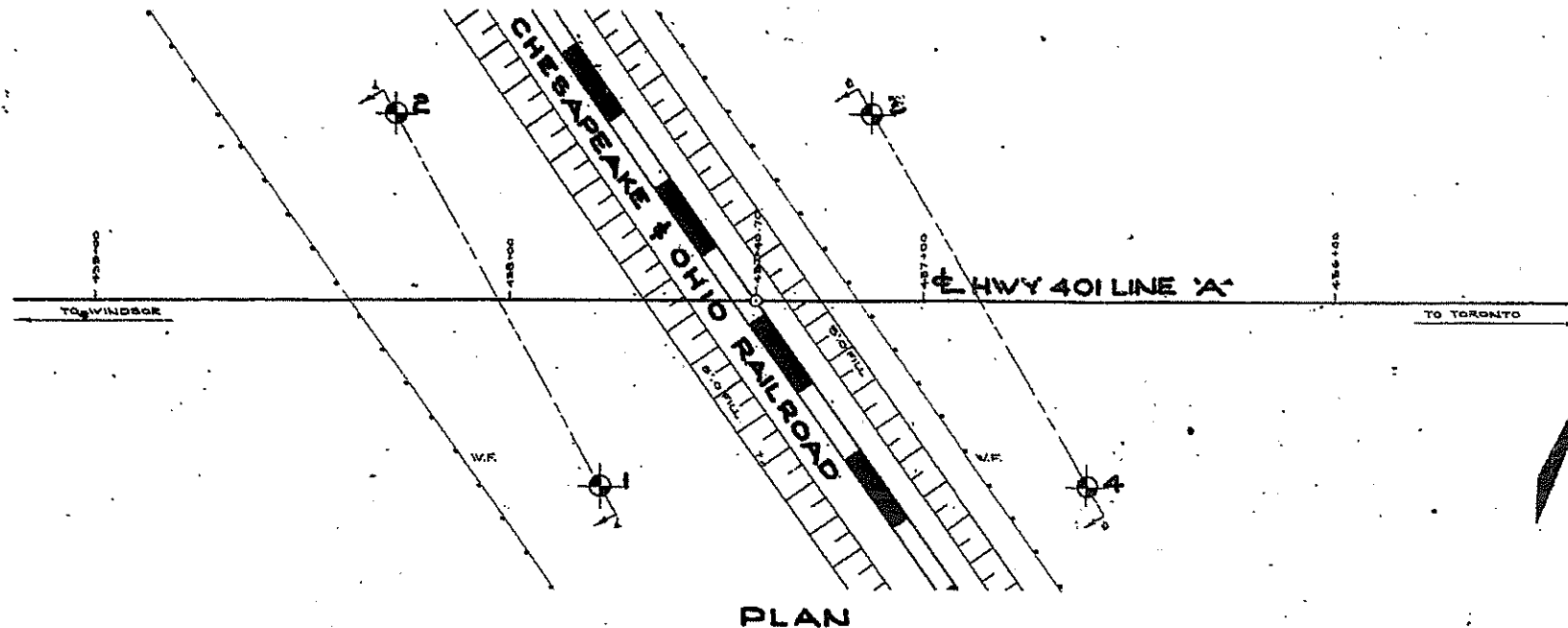
**GENERAL LAYOUT PLAN, SITE PLAN, KEY PLAN**

APPROVED: [Signature]

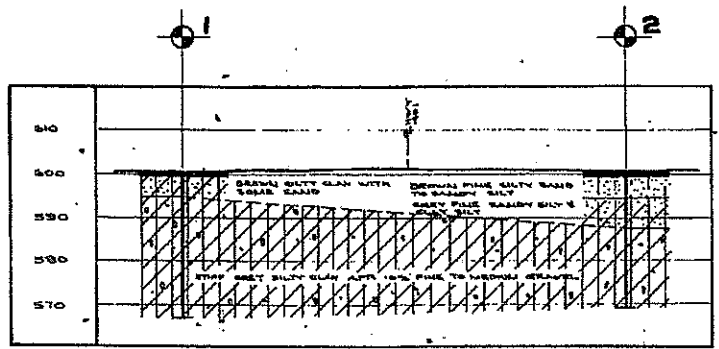
DATE: [Date]



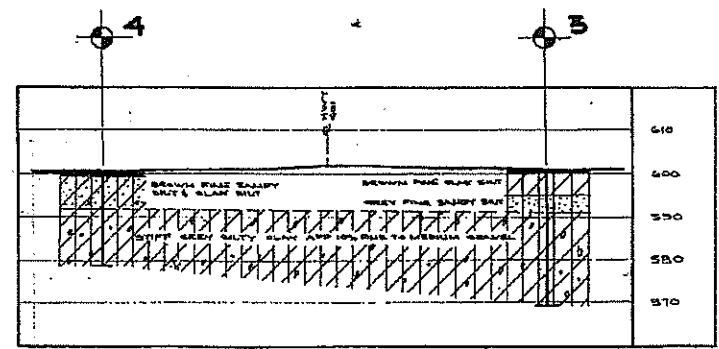
- (2) Site plan and soil cross-sections from Foundation Investigation Report No. 59-F-3, WP 15-59 for Chesapeake and Ohio Railway Crossing 2.5 miles southeast of Chatham, Geocres 40J8-3.



LEGEND			
BORE HOLE			
PENETRATION HOLE			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1	600.8'	427+18	45' LT.
2	600.7'	428+28	45' RT.
3	601.0	427+18	45' RT.
4	601.0'	436+60	45' LT.



A-A



B-B

**- NOTE -**  
THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
<b>CHESAPEAKE &amp; OHIO R.WY. PROPOSED CROSSING</b>			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
Hwy. 401	DISTRICT I	LOT 27	COUNTY KENT
TOWNSHIP HARWICH	LOCATION 2 1/2 MI. S.E. of CHATHAM		CON. II
DRAWN BY: T. MELLORS	CHECKED BY:	W.P. 15-59	
DATE: APR. 8, 1959	APPROVED BY:	DRAWING NO.	
SCALE: 1" = 20'		<b>F 59-3A</b>	



- (3) Geotechnical investigation for slope instability of Highway 401 westbound lanes at CSX Railway crossing, Contract 2000-0029, WP 62-99-00. Report by Golder Associates Ltd. Ref. 001-4087-1, dated August 17, 2001 (Geocres No. not found).

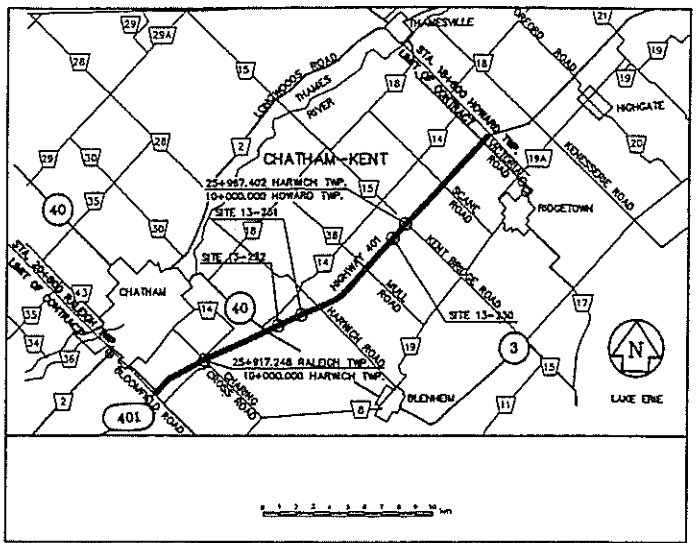
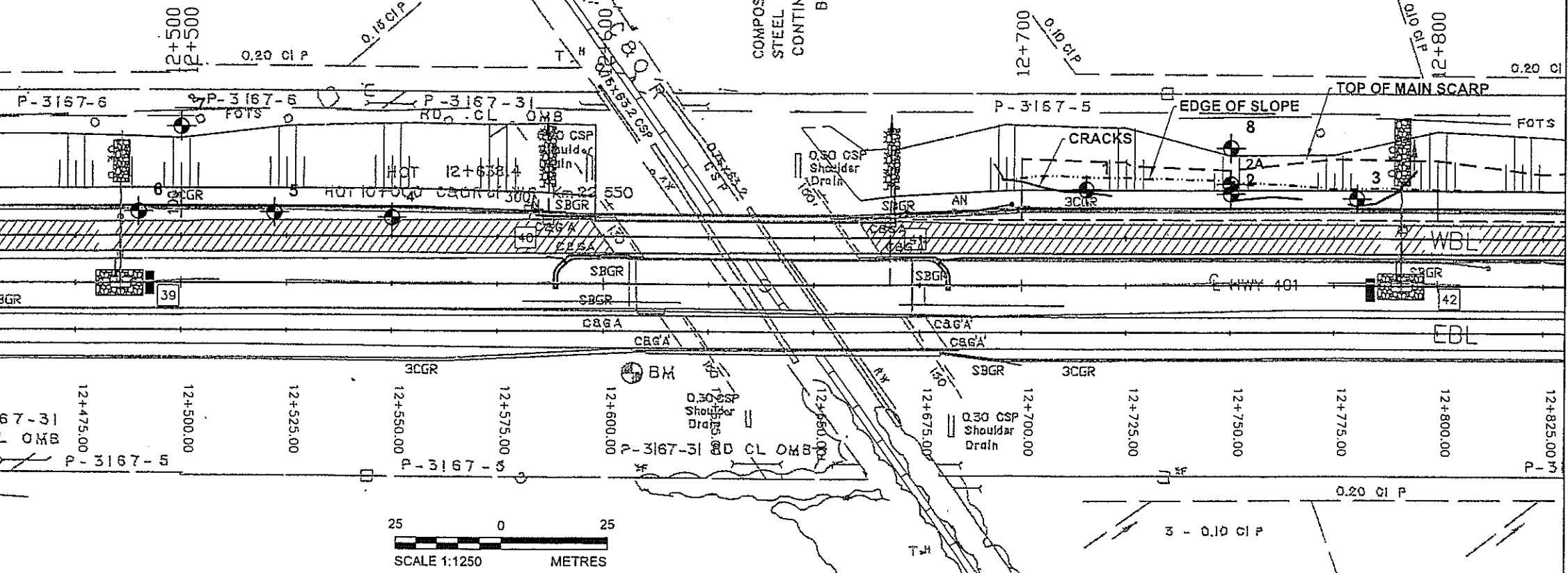


CON 5  
THE RIVER THAMES  
WESTERN BOUNDARY

LOT 4

LOT 5

COMPOSITE SECTION  
STEEL AND CONC  
CONTINUOUS BEAMS  
BRIDGE



KEY PLAN

PROJECT		HWY 401 SLOPE CHATHAM-KENT	
TITLE		BOREHOLE LOCATION PLAN	
PROJECT No.		001-4087-1	FILE No.
DESIGN		07/20/01	SCALE AS SHOWN
CADD		WDF	REV. 0
CHECK		07/20/01	
REVIEW			
Golder Associates LONDON, ONTARIO		FIGURE 1	

August 2001

001-4087-1

TABLE I  
SUMMARY OF MEASURED GROUNDWATER LEVELS

Contract 2000-0029, WP 62-99-00  
Highway 401 Westbound Lanes

BOREHOLE	INSTALLATION	GROUND SURFACE ELEVATION (m)	ENCOUNTERED WATER LEVEL (m)	MEASURED GROUNDWATER LEVEL (m)			
				July 25/01	July 30/01	July 31/01	Aug. 15/01
1		190.66	Dry				
2	Piezometer	190.61	181.82	181.98	181.92	181.92	181.92
2A	Piezometer	190.61	Dry	Dry	184.76	184.91	186.61
3	Piezometer	190.56	181.42	Dry	Dry	Dry	-
4	Standpipe	191.65	182.47	Dry	Dry	Dry	Dry
5	Piezometer			181.74	181.80	181.83	181.56
6	Piezometer	191.50	181.75	181.14	181.81	181.81	181.74
7	Standpipe	183.28	182.14	Dry	Dry	Dry	Dry
8	Standpipe	183.78	181.91			Dry	180.29
			181.17			180.52	-

- NOTES:
1. For borehole locations, see Plan, Figure 1.
  2. Table to be read in conjunction with accompanying report.

PROJECT <u>001-4087-1</u>		<b>RECORD OF BOREHOLE No 1</b>		1 OF 1 <b>METRIC</b>	
W.P. _____		LOCATION <u>Sta. 12+715.5 o/s 11.6m N of cl WBL</u>		ORIGINATED BY <u>GAA</u>	
DIST _____ HWY <u>HWY 401</u>		BOREHOLE TYPE <u>ATV Mounted CME 750</u>		COMPILED BY _____	
DATUM _____		DATE <u>20.7.01 - 23.7.01</u>		CHECKED BY <u>AM</u>	

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 ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
190.66	Ground Surface ( Cut Bench )							20 40 60 80 100	10 20 30						
0.00	FILL, silty clay some gravel some sand, occasional thin silt and sand seams Very soft to very stiff Grey		1	SS	3		190	5.5							
			2	SS	2		189		>>						
			3	SS	6		188		>>						
			4	SS	6		187		>>						
			5	SS	9		186								
			6	SS	7		185								
			7	SS	25		184								
184.32	FILL, layered clayey silt and silty clay, occasional thin sand seams Stiff to very stiff Brown and Grey		8	SS	8		183								
6.34			9	SS	18		182								
			10	SS	17		181								
182.28	FILL, silty clay, occasional sand partings Stiff Grey and Brown		11	SS	12		180								
8.38			12	SS	9		179								
181.49	CLAYEY SILT, with oxidized partings Stiff Brown and Grey		13	SS	19		178								
9.17			14	SS	12		177								
180.91	SILTY CLAY, trace sand, occasional gravel (TILL) Very stiff Grey		15	SS	9										
9.75			16	SS	15										
			17	SS	15										
			18	SS	15										
176.49	End of Borehole														
14.17	Note: Borehole dry during drilling July 20, 2001														

ON MOT 0014087 GPJ ON MOT GDT 14-8-01 DATA INPUT



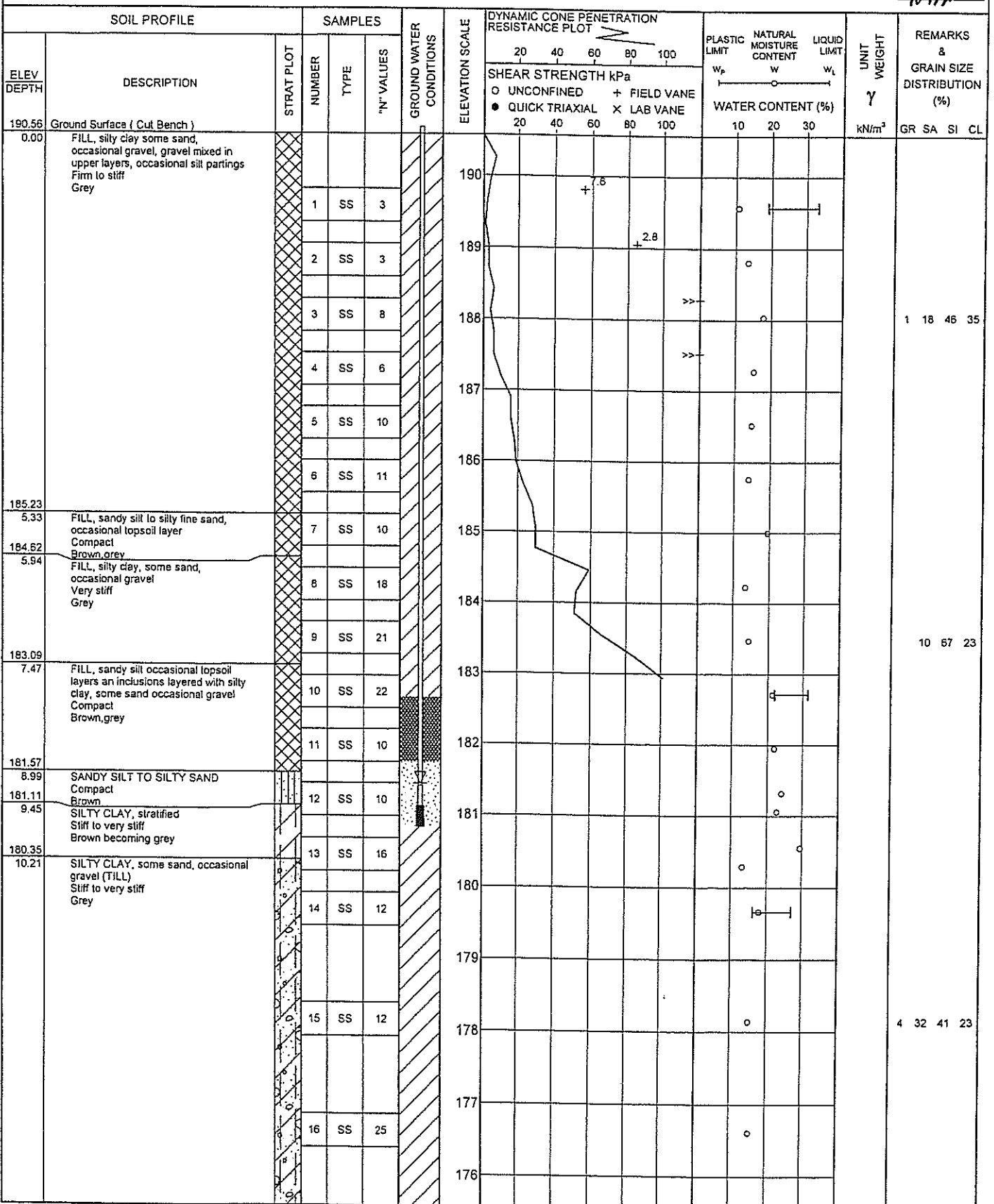
PROJECT 001-4087-1				RECORD OF BOREHOLE No 2				1 OF 1		METRIC					
W.P.		LOCATION Sta. 12+750 o/s 10.6m N of cl WBL				ORIGINATED BY GAA									
DIST		HWY HWY 401		BOREHOLE TYPE ATV Mounted CME 750				COMPILED BY							
DATUM		DATE 23.7.01 - 23.7.01				CHECKED BY <i>[Signature]</i>									
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE	W <sub>p</sub> — W — W <sub>L</sub>	WATER CONTENT (%)	γ	KN/m <sup>3</sup>	GR SA SI CL		
190.61	Ground Surface (Cut Bench)														
0.00	FILL, silty clay, some sand, occasional gravel, gravel mixed in at top of layer, occasional silt parting or thin sand seams at depth. Firm to very stiff Grey		1	SS	7		190	+							
			2	SS	6		189	+					3 18 44 35		
			3	SS	6		188	+							
			4	SS	8		187	+							
			5	SS	12		186	+							
			6	SS	12		185	+							
			7	SS	15		184	+							
			8	SS	20		183	+							
183.65	FILL, layered silty clay and silt to sandy silt. Very stiff / Compact Grey, Brown		9	SS	22		182	+							
182.69	TOPSOIL, silty Compact Black		10	SS	20		181	+							
182.38															
182.23															
182.08	FILL, silty clay, some sand occasional gravel. Very stiff Grey		11	SS	16										
181.53	SILTY CLAY AND SILT, layered. Very stiff / Compact Grey, Brown		12	SS	18								15 80 5		
181.69	SILT, some sandy silt layers and partings. Compact Brown to grey		13	SS	18										
180.31	SILTY CLAY, stratified. Stiff Grey														
10.36	End of Borehole														
<p>Note: Water level encountered in borehole at elev. 181.92m during drilling July 23, 2001</p> <p>Water level measured in Piezometer at elev. 181.92m July 31, 2001</p>															

ON MOT 0014087.GPJ ON MOT.GDT 14-8-01 DATA INPUT:

PROJECT 001-4087-1			RECORD OF BOREHOLE No 2A			1 OF 1			METRIC			
W.P. _____			LOCATION Sta. 12+750 o/s 12.3m N of cl WBL			ORIGINATED BY GAA						
DIST _____ HWY HWY 401			BOREHOLE TYPE ATV Mounted CME 750			COMPILED BY _____						
DATUM _____			DATE 25.7.01 - 25.7.01			CHECKED BY <i>[Signature]</i>						
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC NATURAL LIQUID UNIT REMARKS			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)	UNIT WEIGHT γ	GRAIN SIZE DISTRIBUTION (%)
190.61	Ground Surface (Cut Bench)											
0.00	FILL, sand and gravel mixed with silty clay, occasional roots		1	SS	6		190					
190.00	Loose / Firm Brown											
0.61	FILL, clayey silt to silty clay, some sand occasional gravel		2	SS	10		189					
	Stiff											
	Brown and grey		3	SS	9		188					
188.48	FILL, silty clay, some sand occasional gravel, occasional sandy silt layer		4	SS	9		187					
2.13	Stiff		5	SS	7		186					
	Grey and brown		6	SS	8		185					
			7	SS	8							
		8	SS	10								
184.06		9	SS	12								
6.55	End of Borehole											
	Note: Borehole dry during drilling July 25, 2001											
	Water level measured in Piezometer at elev. 184.91m July 31, 2001											

ON\_MOT 0014087.GPJ ON\_MOT.GDT 14-8-01 DATA INPUT:

PROJECT 001-087-1		<b>RECORD OF BOREHOLE No 3</b>		1 OF 2	<b>METRIC</b>
W.P. _____	LOCATION Sta. 12+780.5 of 9.5m N of cl WBL	ORIGINATED BY GAA			
DIST _____ HWY HWY 401	BOREHOLE TYPE ATV Mounted CME 750	COMPILED BY _____			
DATUM _____	DATE 23.7.01 - 23.7.01	CHECKED BY <i>[Signature]</i>			



ON\_MOT\_0014087.CPJ ON\_MOT\_GDT 14-8-01 DATA INPUT:

Continued Next Page

+ 3. X 3. Numbers refer to  
Sensitivity

○ 3% STRAIN AT FAILURE

PROJECT <u>001-4087-1</u>		<b>RECORD OF BOREHOLE No 3</b>		2 OF 2		<b>METRIC</b>	
W.P. _____		LOCATION <u>Sta. 12+780.5 o/s 9.5m N of d WBL</u>		ORIGINATED BY <u>GAA</u>			
DIST _____ HWY <u>HWY 401</u>		BOREHOLE TYPE <u>ATV Mounted CME 750</u>		COMPILED BY _____			
DATUM _____		DATE <u>23.7.01 - 23.7.01</u>		CHECKED BY <u>[Signature]</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								20 40 60 80 100										
			17	SS	27		175											
							174											
			18	SS	17		173											
171.81			19	SS	20		172											
18.75	End of Borehole																	
	Note: Water level encountered in borehole at elev. 181.42m during drilling July 23, 2001  Piezometer dry to elev. 180.81m July 31, 2001																	

ON\_MOT 0014087.GPJ ON\_MOT.GDT 14-8-01 DATA INPUT:



PROJECT 001-4087-1			RECORD OF BOREHOLE No 4			1 OF 1			METRIC								
W.P. _____			LOCATION Sta. 12+550 o/s 4.5m N of d WBL			ORIGINATED BY GAA											
DIST _____ HWY HWY 401			BOREHOLE TYPE ATV Mounted CME 750			COMPILED BY _____											
DATUM _____			DATE 24.7.01 - 24.7.01			CHECKED BY <i>AMM</i>											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)	γ	GR SA SI CL				
191.95	Ground Surface ( Partially Stripped Shoulder )																
0.00	FILL, sand and gravel																
191.55																	
0.40	FILL, silty clay, some sand, occasional gravel, occasional silt and sand partings with depth Stiff to very stiff Grey		1	SS	11		191										
			2	SS	19		190										
			3	SS	11												
			4	SS	9		189										
			5	SS	10		188										
			6	SS	29		187										
			7	SS	30		186										
			8	SS	12		185										
			9	SS	16		184										
			10	SS	21		183										
			11	SS	22		182										
182.78																	
9.17	TOPSOIL, silty		12	SS	12		181										
182.47	Compact Black																
9.48	SANDY SILT, some organic material																
181.74	Compact Brown / grey		13	SS	10												
10.21	SANDY SILT, mottled																
181.19	Compact Grey / brown																
10.76	SILTY CLAY, stratified		14	SS	18												
180.82	Very stiff																
11.13	Brown becoming grey																
	End of Borehole																
<p>Note: Water level encountered in borehole at elev. 182.47m during drilling July 24, 2001</p> <p>Water level measured in Piezometer at elev. 181.83m July 31, 2001</p> <p>Standpipe dry to elev. 186.45m July 31, 2001</p>																	

ON MOT 0014087.GPJ ON MOT.GDT 14-8-01 DATA INPUT:

PROJECT 001-4087-1				RECORD OF BOREHOLE No 5				1 OF 1		METRIC	
W.P. _____				LOCATION Sta. 12+522 o/s 5.6m N of cl WBL				ORIGINATED BY GAA			
DIST _____ HWY HWY 401				BOREHOLE TYPE ATV Mounted CME 750				COMPILED BY _____			
DATUM _____				DATE 24.7.01 - 24.7.01				CHECKED BY <i>[Signature]</i>			
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT W <sub>p</sub> W 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 X LAB VANE		WATER CONTENT (%)		
191.50	Ground Surface ( Partially Stripped Shoulder )										
0.00	FILL, sand and gravel										
191.20											
0.30	FILL, silty clay, some sand, occasional gravel, occasional silt seams and partings Firm to very stiff Grey		1	SS	11						
			2	SS	11						
			3	SS	10						
			4	SS	7						
			5	SS	8						
			6	SS	6						
			7	SS	8						
			8	SS	11						
			9	SS	14						
			10	SS	22						
			11	SS	15						
182.30											
9.20	CLAYEY SILT, some sand, trace topsoil Stiff Grey to mottled brown and grey		12	SS	10						
			13	SS	8						
180.59											
10.91	SILTY CLAY, stratified, occasional silt seam Stiff Mottled brown and grey End of Borehole		14	SS	9						
11.13											
<p>ON_MOT 0014087.GPJ ON_MOT.GDT 14-8-01 DATA INPUT:</p> <p>Note: Water level encountered in borehole at elev. 181.75m during drilling July 24, 2001</p> <p>Water level measured in Piezometer at elev. 181.81m July 31, 2001</p>											

PROJECT <u>001-4087-1</u>		<b>RECORD OF BOREHOLE No 6</b>		1 OF 1 <b>METRIC</b>	
W.P. _____		LOCATION <u>Sta. 12+490 o/s 5.9m N of cl WBL</u>		ORIGINATED BY <u>GAA</u>	
DIST _____ HWY <u>HWY 401</u>		BOREHOLE TYPE <u>ATV Mounted CME 750</u>		COMPILED BY _____	
DATUM _____		DATE <u>24.7.01 - 24.7.01</u>		CHECKED BY <u>[Signature]</u>	

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 ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
191.13	Ground Surface ( Cut Bench )						20 40 60 80 100	10 20 30							
0.00	FILL, sand and gravel														
190.52															
0.61	FILL, silty clay some sand, occasional gravel, occasional silt partings and seams, occasional rootlets and sandy silt seams Stiff to very stiff Grey		1	SS	13										
			2	SS	11										
			3	SS	8										
			4	SS	10										
			5	SS	12										
			6	SS	10										
			7	SS	12										
			8	SS	31										
			9	SS	14										
			10	SS	15										
182.51			11	SS	21										
8.62	TOPSOIL, silty														
8.84	Compact Black														
181.62	SILT, trace sand, occasional clay seam		12	SS	12										
9.51	Compact Brown to grey														
9.75	SILTY CLAY, stratified Stiff														
180.77	Mottled brown and grey		13	SS	22										
10.36	SILTY CLAY, trace sand occasional gravel (TILL) Very stiff Brown to grey End of Borehole														
Note: Water level encountered in borehole at elev. 182.14m during drilling July 24, 2001  Piezometer dry to elev. 185.03m July 31, 2001															

ON MOT 0014087.GPJ ON MOT GDT 14-8-01 DATA INPUT:

PROJECT 001-4087-1 RECORD OF BOREHOLE No 7 1 OF 1 METRIC

W.P. \_\_\_\_\_ LOCATION Sta. 12+500 o/s 26.0m N of cl WBL ORIGINATED BY GAA

DIST \_\_\_\_\_ HWY HWY 401 BOREHOLE TYPE Bombardier Mounted CME 55 COMPILED BY \_\_\_\_\_

DATUM \_\_\_\_\_ DATE 30.7.01 - 30.7.01 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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		W <sub>p</sub>	w	W <sub>L</sub>		
183.28	Ground Surface							20 40 60 80 100						
183.09	TOPSOIL, silty Brown SILT, trace sand Compact to loose Brown becoming grey		1	SS	15		183	20 40 60 80 100						
			2	SS	15		182							
			3	SS	4		181							
181.15	SILTY CLAY, stratified Stiff Grey		4	SS	11		180							
179.77	End of Borehole		5	SS	9									
3.51	Note: Water level encountered at elev. 181.91m during drilling July 30, 2001  Standpipe dry to elev. 179.77m July 31, 2001													



PROJECT 001-4087-1			RECORD OF BOREHOLE No 8			1 OF 1			METRIC								
W.P. _____			LOCATION Sta. 12+750 o/s 27.0m N of cl WBL			ORIGINATED BY GAA											
DIST _____ HWY HWY 401			BOREHOLE TYPE Bombardier Mounted CME 55			COMPILED BY _____											
DATUM _____			DATE 30.7.01 - 30.7.01			CHECKED BY <i>com</i>											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	WATER CONTENT (%)	γ	GR SA SI CL				
183.78	Ground Surface																
183.88	FILL, silty clay SILT, trace sand, some clay Compact to loose Brown		1	SS	12		183										
			2	SS	8												
182.10																	
1.65	SILTY CLAY, stratified, Stiff		3	SS	9		182										
181.65	Brown to grey																
2.13	SILTY CLAY, some sand occasional gravel Very stiff (TILL) Grey		4	SS	15		181										
180.27			5	SS	15												
3.51	End of Borehole																
<p>Note: Water level encountered at elev. 183.17m during drilling July 30, 2001</p> <p>Water level measured in Standpipe at elev. 180.52m July 31, 2001</p>																	

ON MOT 0014087.GPJ ON MOT.GDT 14-8-01 DATA INPUT:



- (4) Contract Drawing for Harwich Township Bridge No. 13 (Highway 40 underpass) at Highway 401, WP 82-59, TWP No. 113-238 dated July 1960.

[illegible]







- (5) Foundation investigation report for Highway 401 and County Road No. 14 crossing at Kent Centre – District No. 1 (Highway 40 underpass). WP 82-59, W.J. F-59-76, dated February 1960, Geocres 40J8-15.

TABLE NO. 1.

## SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-76

W.P. 82-59

[illegible]

TABLE NO. 1.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-76

W.P. 82-59

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETIN REPT. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH P.S.F.	UNIT WEIGHT P.C.F.	REMARKS
5	S1	5' - 6.5'	Dense grey fissured silty clay	14	27.2	-	-	-	123.6	Occasional boulders in the clay till throughout
	S2	10'-11.5'	till, some gravel.	20	16.1	-	-	-	137.1	
	S3	15'-16.5'	" " " "	24	-	-	-	-	136.1	
	S4	20'-21.5'	" " " "	28	13.2	-	-	-	136.1	
	S5	25'-26.5'	" " " "	32	15.2	-	-	-	127.5	
	S6	32.5'-33.5'	Water bearing clay sand	85	12.6	-	-	-	-	

S - Denotes Split Spoon  
T - Denotes Thin-Walled Shelby Sample  
C - Denotes Chunk Sample

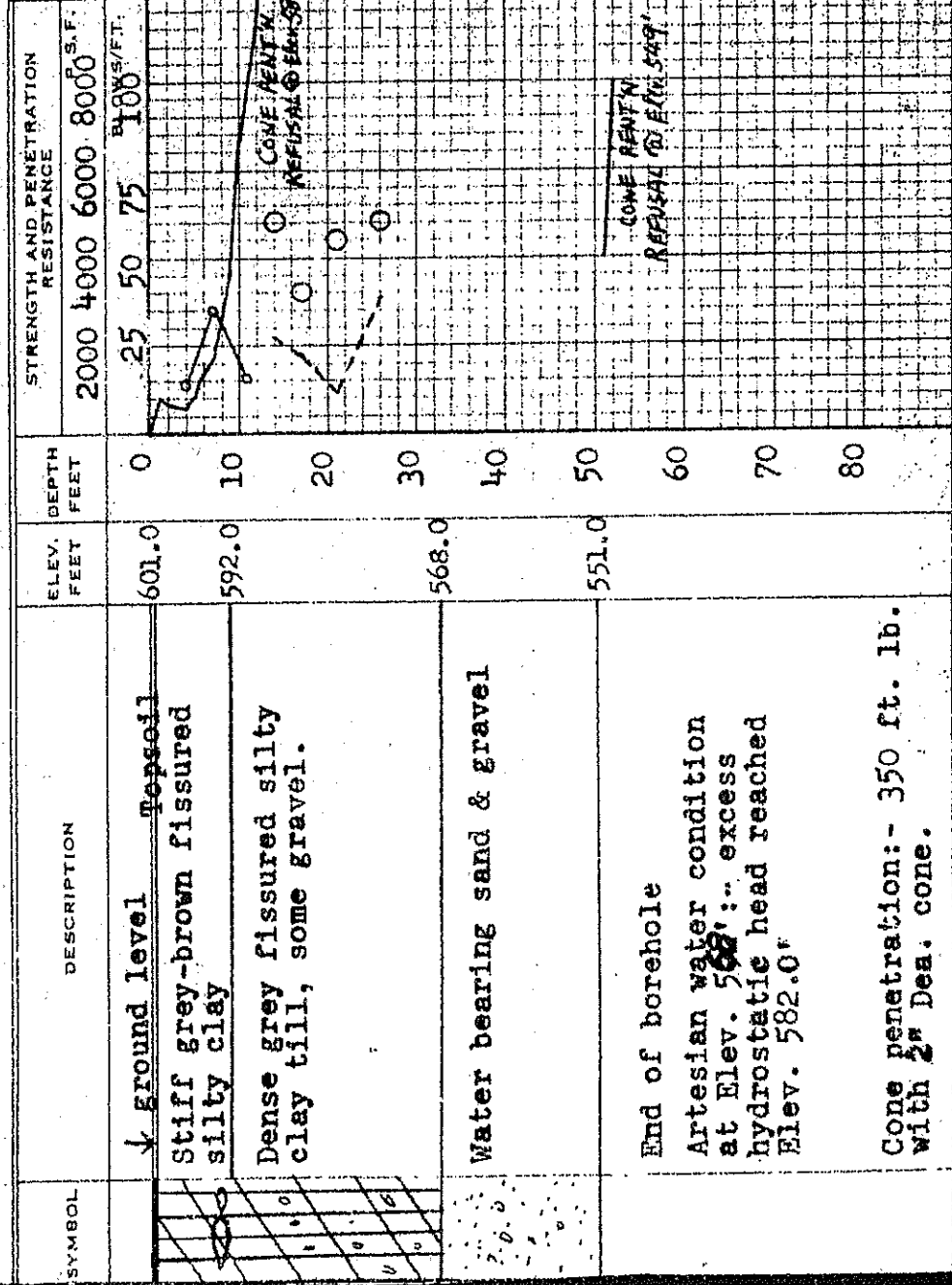
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-59 BORE HOLE NO. 1  
JOB F-59-76 STATION See Drawing  
DATUM 601.0' COMPILED BY BK  
BORING DATE July 14/59 CHECKED BY AL

LEGEND

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

1/2 UNCONFINED COMPRESSION (Qu)  
VANE TEST (C) AND SENSITIVITY (S)  
NATURAL MOISTURE AND  
LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30	S1	131.8
	S2	133.6
	S3	133.7
	T4	138.0
	T5	134.6
	T6	130.1
	T7	
	T8	



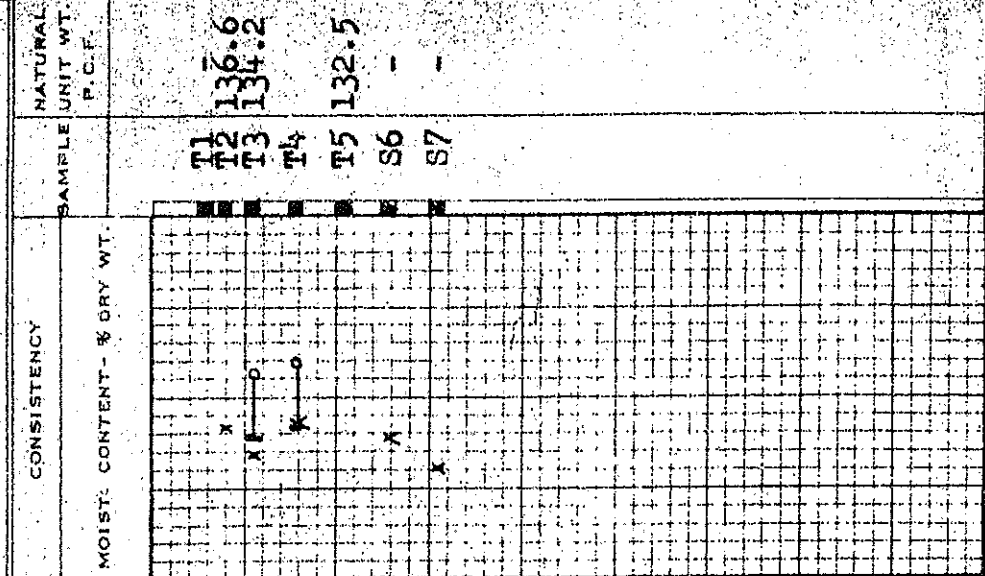
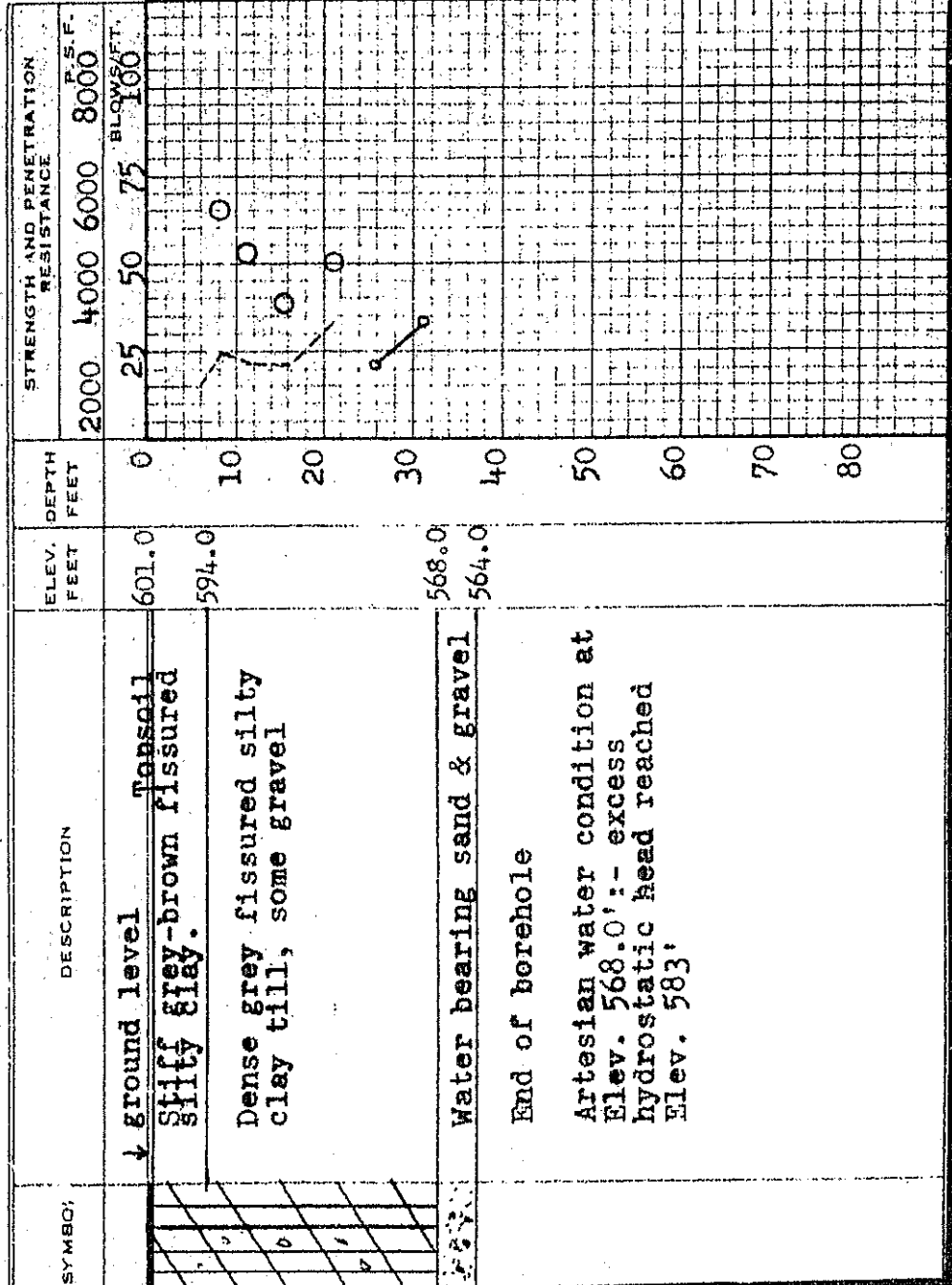
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-59 BORE HOLE NO. 2  
JOB F 59-76 STATION See Drawing  
DATUM 601.0' COMPILED BY BK  
BORING DATE JULY 15/59 CHECKED BY AL

LEGEND

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

1/2 UNCONFINED COMPRESSION (Qu)  
VANE TEST (C) AND SENSITIVITY (S)  
NATURAL MOISTURE AND LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-59 BORE HOLE NO. 3  
JOB F 59-76 STATION See Drawing  
DATUM 601.0' COMPILED BY BK  
BORING DATE July 16/59 CHECKED BY AL

**LEGEND**

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+
NATURAL MOISTURE AND LIQUIDITY INDEX	---	LI
LIQUID LIMIT	---	X
PLASTIC LIMIT	---	0

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	↓ ground level	601.0	0	25	75
			10	50	100
			20	REFUSAL	REFUSAL
			30		
			40		
			50		
			60		
			70		
			80		

Cone Penetration:  
 350 Ft. Lb. With 2" Dia.  
 cone.

@ Elev. 587'

Cone Penetration:  
350 Ft. Lb. With 2" Dia.  
cone.

[illegible]

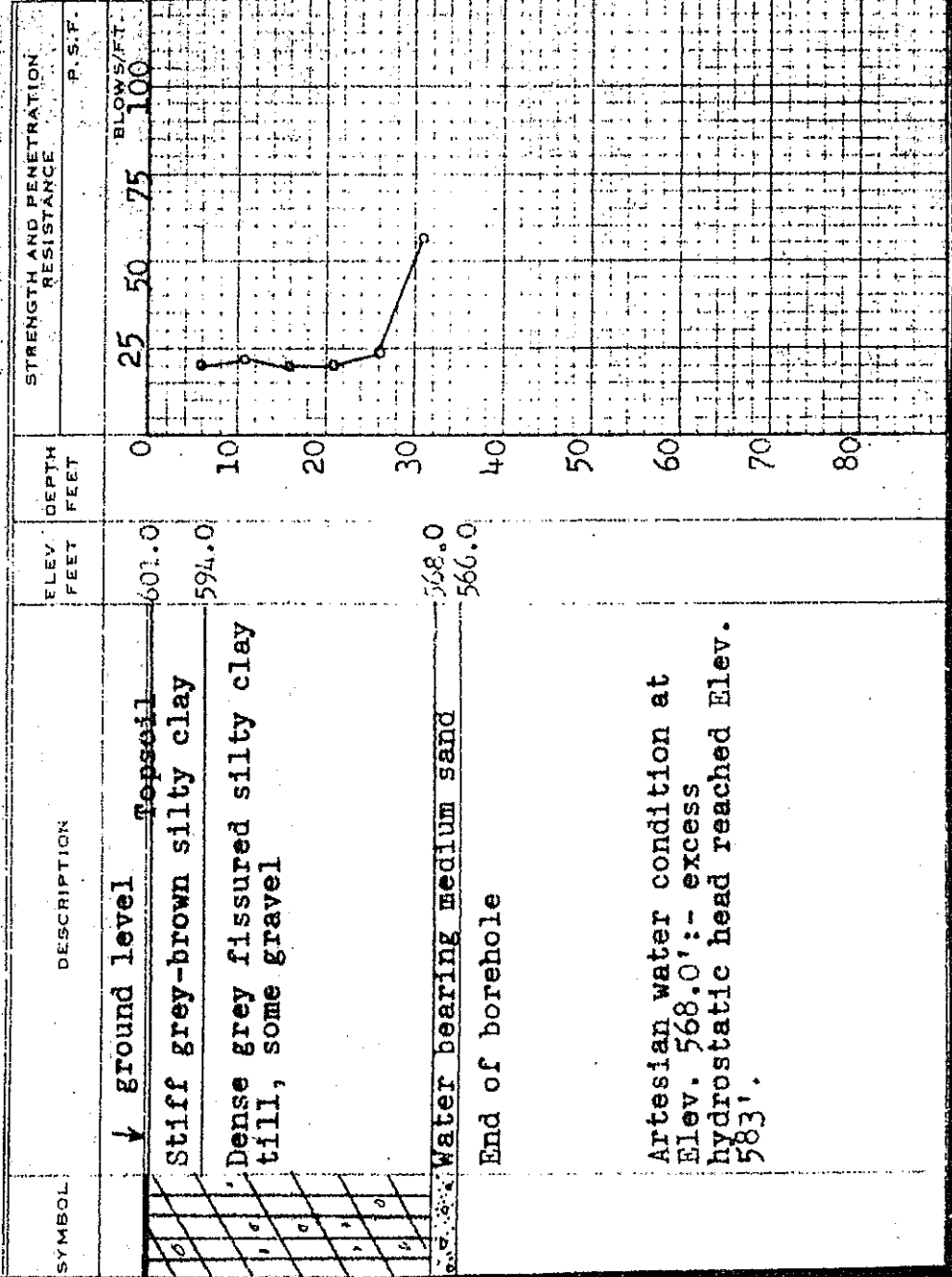
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 82-59  
JOB F 59-76  
DATUM 601.0'  
BORING DATE July 16/59  
BORE HOLE NO. 4  
STATION See Drawing  
COMPILED BY BK  
CHECKED BY AL

## LEGEND

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

1/2 UNCONFINED COMPRESSION (Qu)  
VANE TEST (C) AND SENSITIVITY (S)  
NATURAL MOISTURE AND  
LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT



B.H. No. F

CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT		
10 20 30	S1	132.7
	S2	134.1
	S3	132.6
	S4	140.0
	S5	132.4
	S6	-

## OFFICE REPORT ON SOIL EXPLORATION

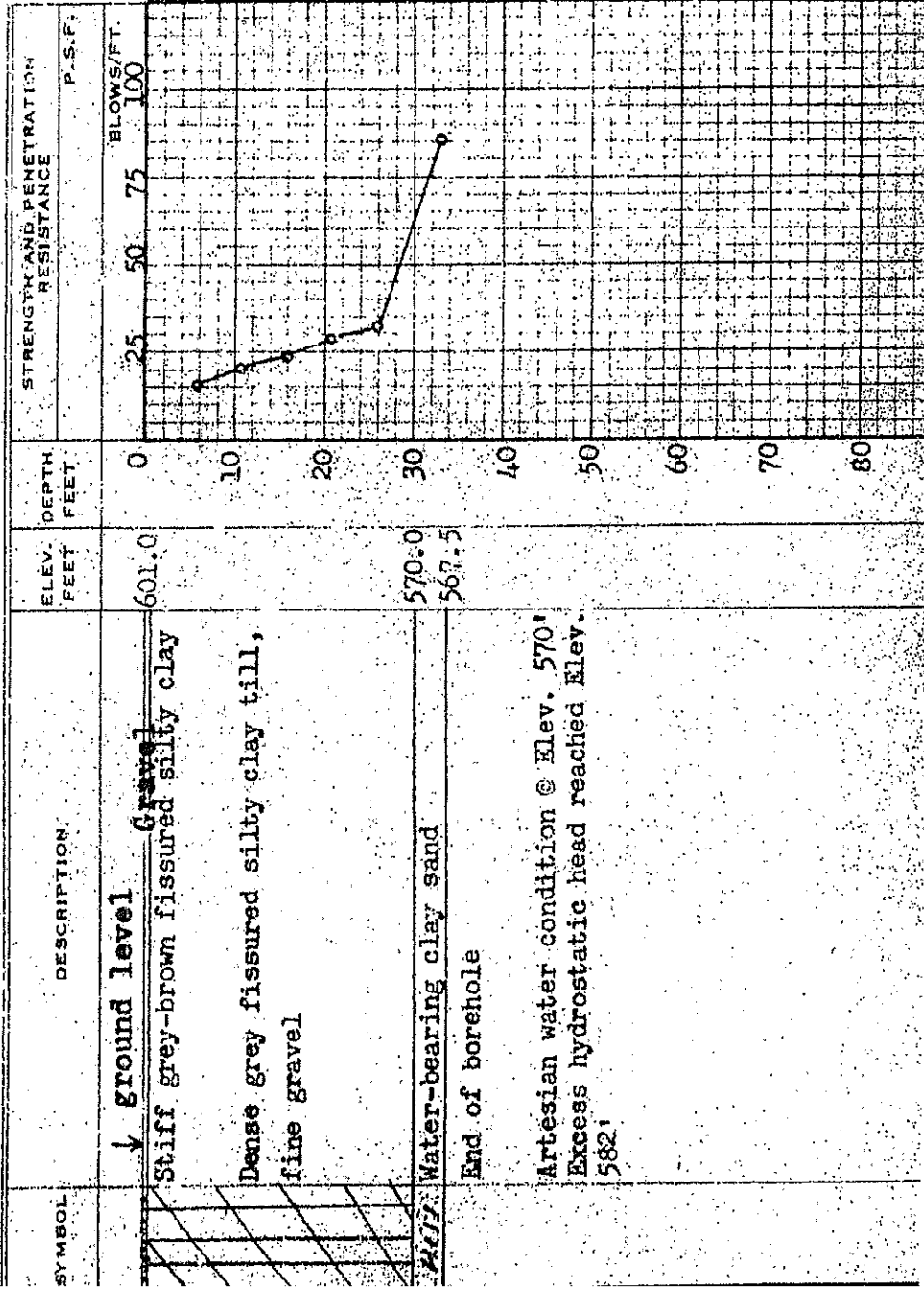
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 82-59 BORE HOLE NO. 5  
 JOB F 59-76 STATION See Drawing  
 DATUM 601.0' COMPILED BY BK  
 BORING DATE JULY 17/59 CHECKED BY AI

## LEGEND

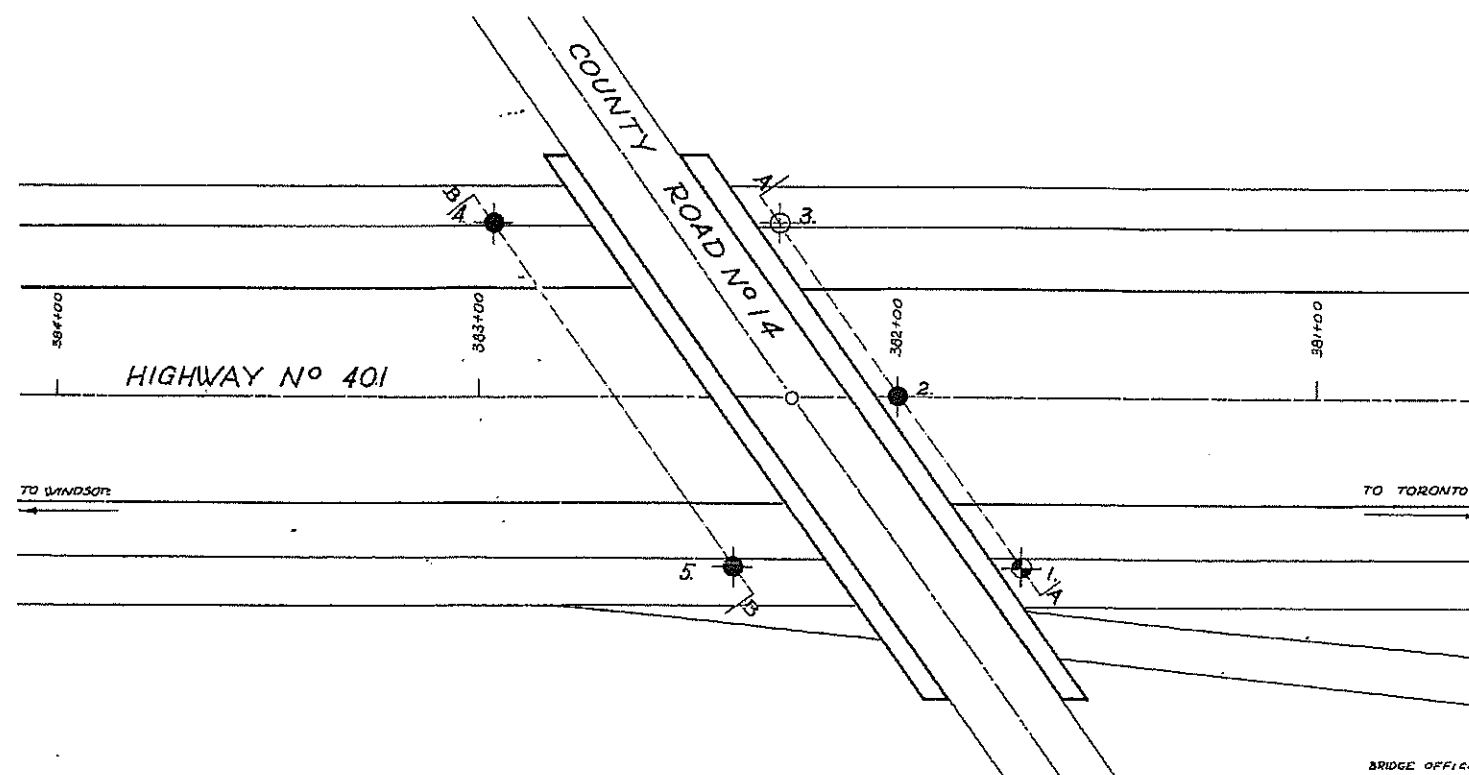
1/2 UNCONFINED COMPRESSION (Qu) --- O  
 VANE TEST (C) AND SENSITIVITY (S) --- + S  
 NATURAL MOISTURE AND LIQUIDITY INDEX --- LI  
 LIQUID LIMIT --- X  
 PLASTIC LIMIT --- ---

2" DIA. SPLIT TUBE --- [Symbol]  
 2" SHELBY TUBE --- [Symbol]  
 2" SPLIT TUBE --- [Symbol]  
 2" DIA. CONE --- [Symbol]  
 2" SHELBY CASING --- [Symbol]



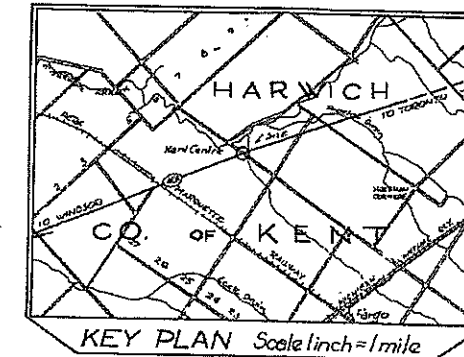
CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30	S1	123.6
	S2	137.1
	S3	136.1
	S4	136.1
	S5	127.5
	S6	--



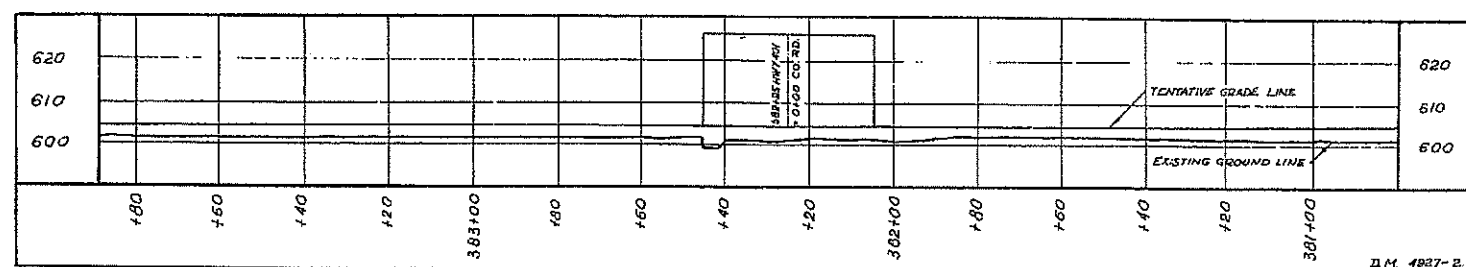


PLAN

BRIDGE OFFICE  
DRAWING BU 285

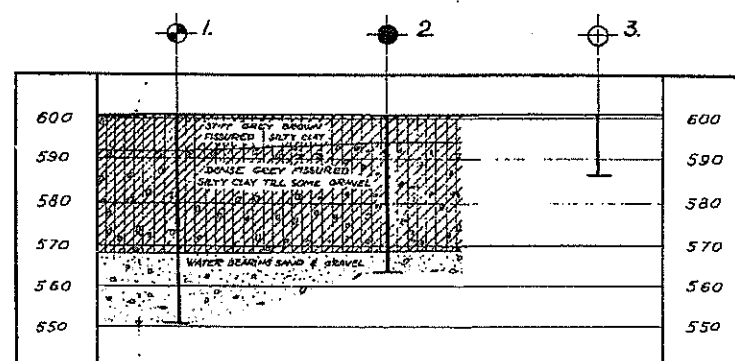


HWY 40 Underpass

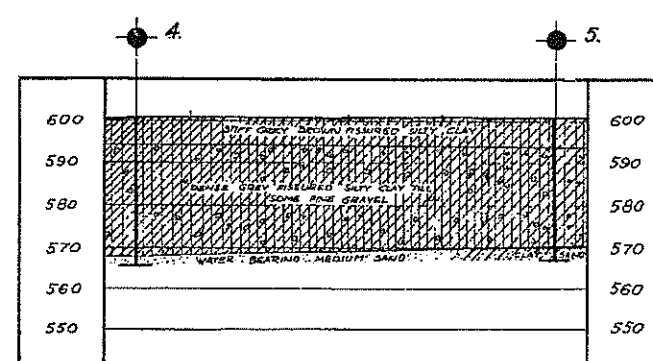


PROFILE

D.M. 4827-2



A - A



B - B

### LEGEND

BORE HOLE  
PENETRATION HOLE  
BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1.	601.0	381+70	40' LT.
2.	601.0	382+00	E
3.	601.0	382+26	41' RT.
4.	601.0	382+96	41' RT.
5.	601.0	382+30	40' LT.

### NOTE

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
COUNTY ROAD No 14 PROPOSED CROSSING			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY 401	DISTRICT 1	COUNTY KENT	
TOWNSHIP HARWICH		LOT 25-26	CON. I.W.C.R.-E.C.R.
LOCATION KENT CENTRE			
DRAWN BY T. Sargany	CHECKED BY	W.P. 82-58	
DATE 21 AUG. 1959	APPROVED BY	DRAWING NO.	
SCALE 1 inch = 20 feet		F 59-76 A.	



- (6) Foundation investigation report for County Road 14 (Highway 40) and McGregor Creek Diversion crossing at Kent Center, District No. 1, WP 304-59, W.J. F-59-74, dated February 2, 1960, Geocres 40J8-14.

Table No. 1

JOB F 59-74  
W.P. 304-59

# SUMMARY OF FIELD & LABORATORY TESTS

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	SHEAR STRENGTH (P.S.F.)	UNIT WEIGHT (P.C.F.)	REMARKS
1	S1	5' - 6.5'	Dense brown fissured silty clay till	16	17.4	-	-	129.1	
	S2	10' - 11.5'	Dense grey fissured silty clay till	20	16.3	-	-	133.1	
	S3	15' - 16.5'	" " " "	25	16.0	-	-	140.9	
	S4	20' - 21.5'	" " " "	22	17.0	-	-	134.8	
	T5	25' - 26.5'	" " " "	26	19.5	-	2710	1321	
	S6	30' - 31.5'	" " " "	22	17.9	24.9	2520	137.5	
	S7	35' - 36.5'	" " " "	20	18.1	-	1610	132.5	
	S8	40' - 41.5'	" " " "	20	16.5	-	2490	135.5	
2	S1	5' - 6.5'	Dense brown fissured silty clay till	28	15.4	-	-	133.2	
	S2	10' - 11.5'	Dense grey fissured silty clay till	24	16.4	-	-	144.2	
	S3	15' - 16.5'	" " " "	23	16.3	-	-	136.5	
	S4	20' - 21.5'	" " " "	24	17.0	-	-	146.2	
	S5	25' - 26.5'	" " " "	18	18.0	-	3630	133.9	
	S6	30' - 31.5'	" " " "	18	17.6	-	2020	139.0	
	S7	35' - 36.5'	" " " "	20	15.8	-	2660	138.0	
			S - Denotes Split Spoon Sample T - Denotes Thin-walled Shelby tube Sample.						

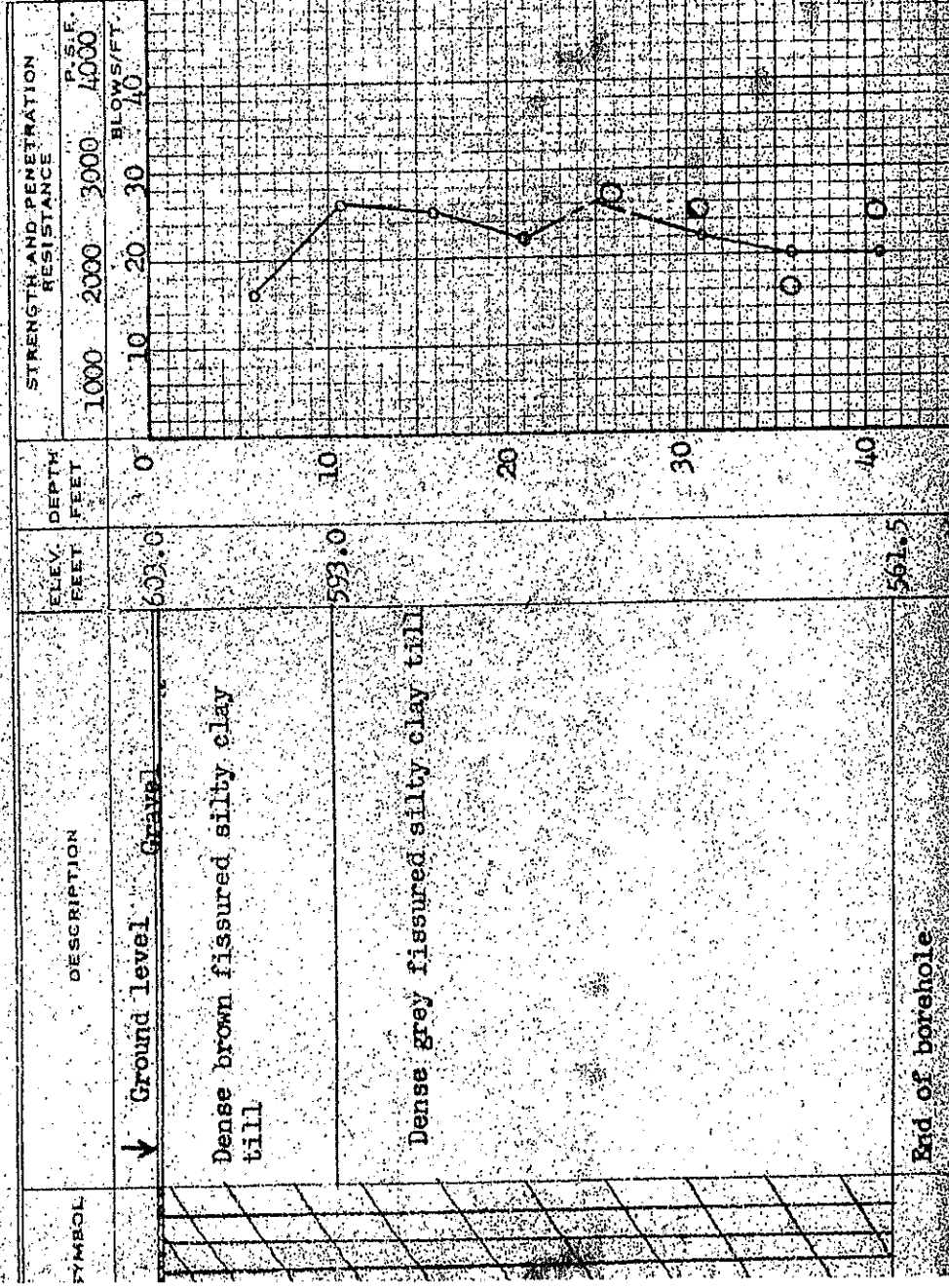
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

N.P. -- 304-52 BORE HOLE NO. 1  
 JOB P 59 - 74 STATION 9+00 (9' RT)  
 DATUM Elev. 603.1 COMPILED BY B.K.  
 BORING DATE July 24/59 CHECKED BY A.L.

## LEGEND

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

1/2 UNCONFINED COMPRESSION (Qu)  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND  
 LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT





# DEPARTMENT OF HIGHWAYS - ONTARIO

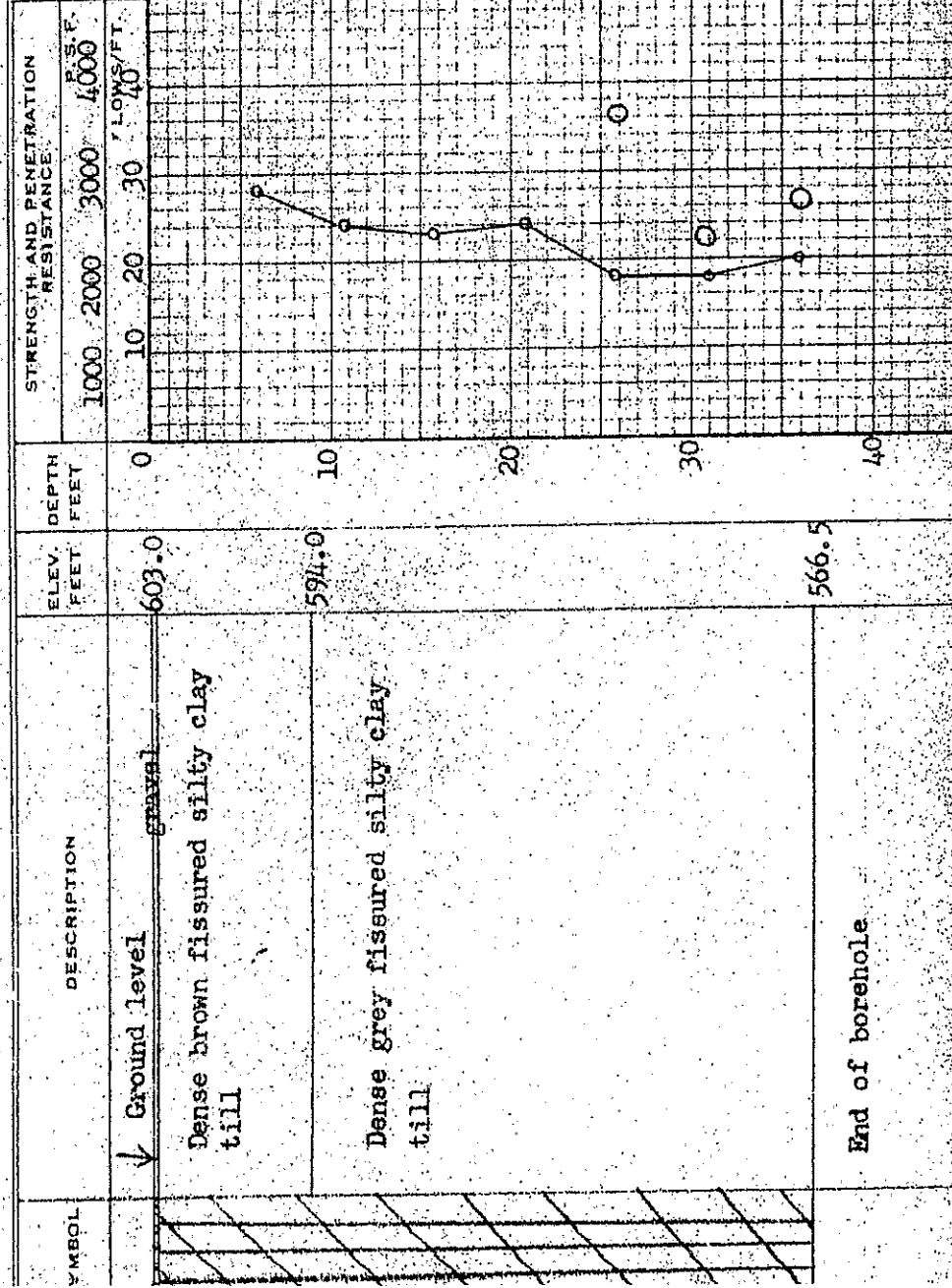
## MATERIALS AND RESEARCH SECTION

I.P. -- 304-59 -- BORE HOLE NO. -- 2 --  
 OB P 59 - 74 -- STATION 8+60 (6.5' LT)  
 LATUM Elev. 603.1 -- COMPILED BY B.K.  
 BORING DATE July 24/59 CHECKED BY A.L.

### LEGEND

2" DIA. SPLIT TUBE ---  
 2" SHELBY TUBE ---  
 2" SPLIT TUBE ---  
 2" DIA. CONE ---  
 2" SHELBY ---  
 CASING ---

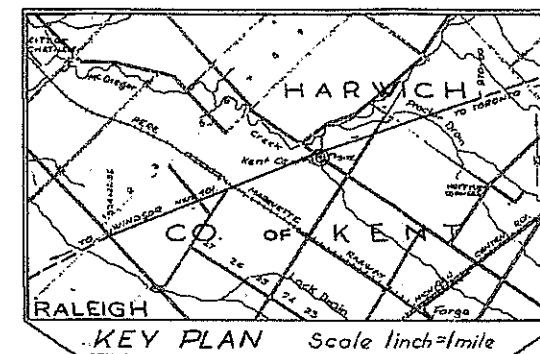
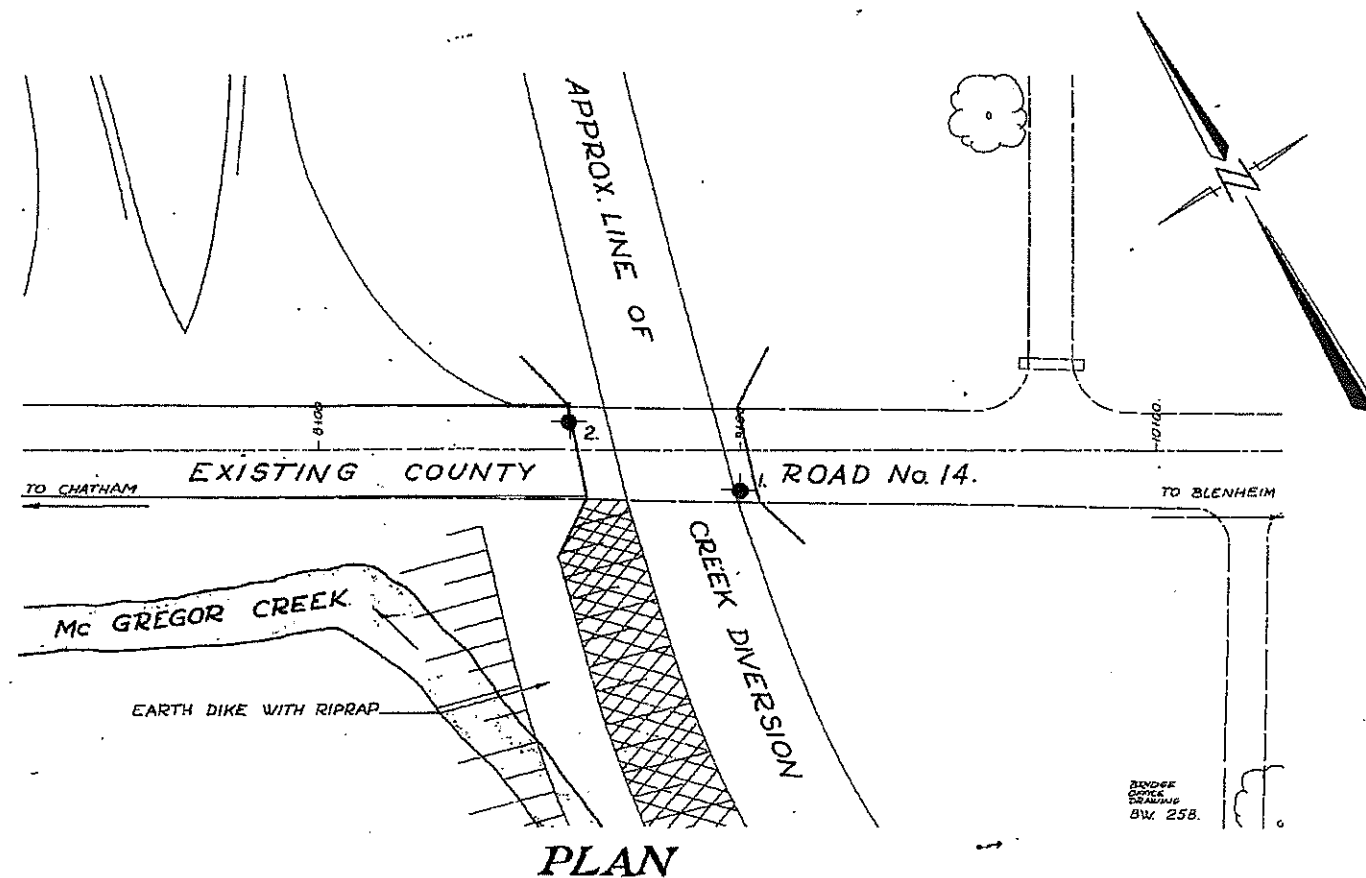
1/2 UNCONFINED COMPRESSION (Qu) ---  
 VANE TEST (C) AND SENSITIVITY (S) ---  
 NATURAL MOISTURE AND LIQUIDITY INDEX ---  
 LIQUID LIMIT ---  
 PLASTIC LIMIT ---



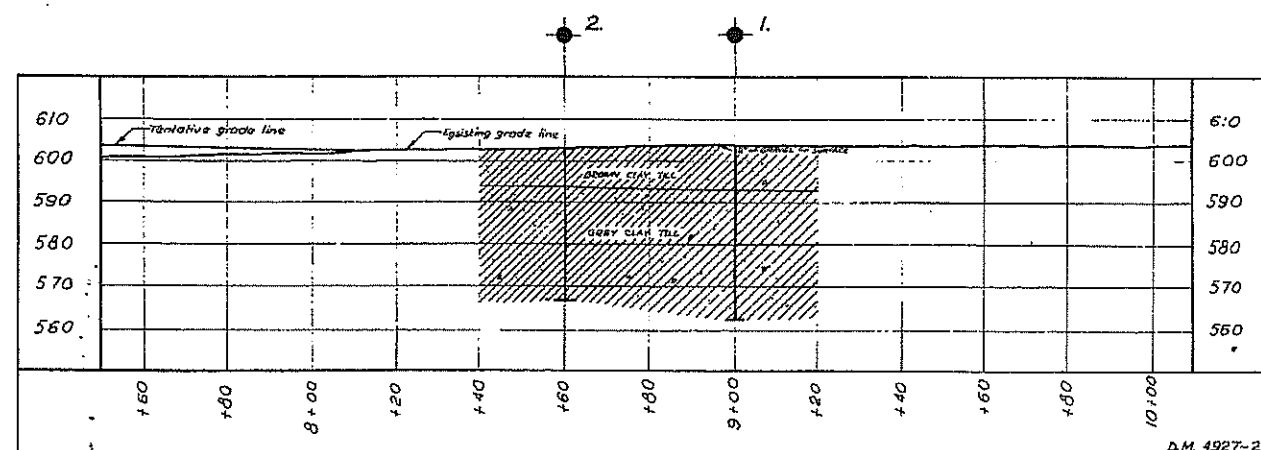
CONSISTENCY	SAMPLE	NATURAL UNIT WT. P. C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30	S1	133.2
	S2	144.2
	S3	136.5
	S4	146.2
	S5	--
	S6	139.0
	S7	138.0



- (7) Contract drawing for Harwich Township Bridge No. 12 (McGregor Creek EBL and WBL bridges), WP 16-59 dated November 2, 1959.



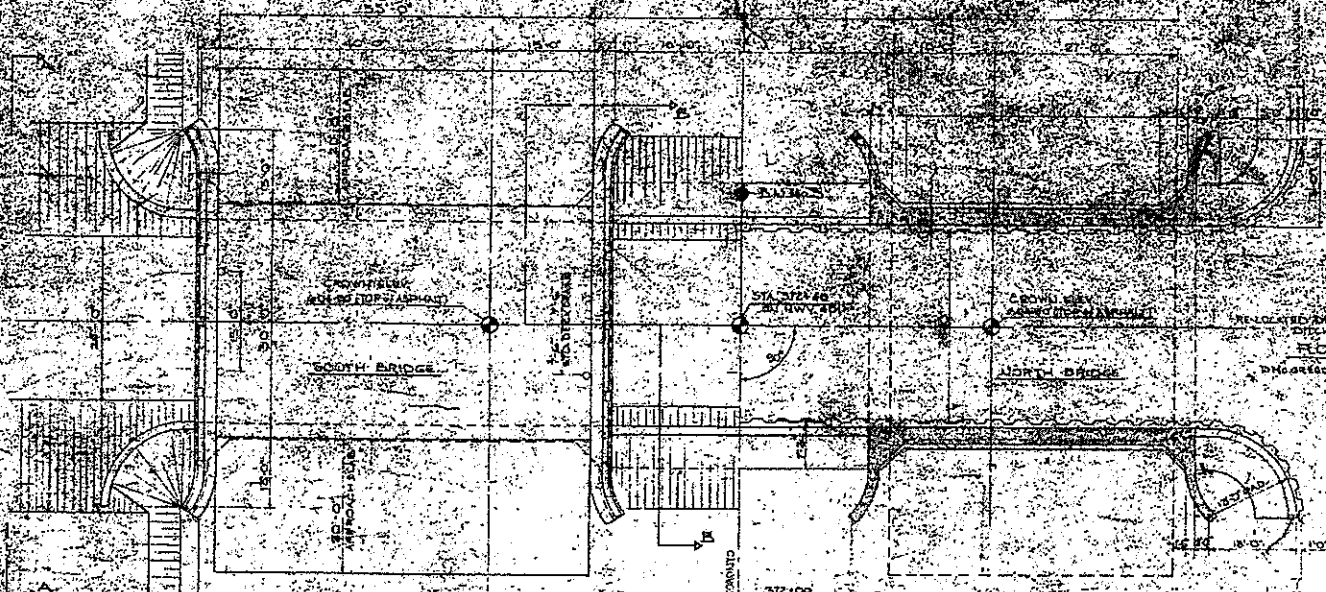
LEGEND			
Bore hole			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1.	6030	8 + 00	9' 2"
2.	6030	8 + 60	65' 12"



**NOTE**

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

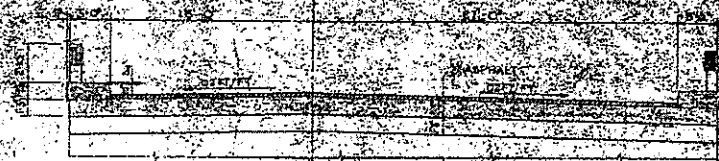
DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
COUNTY ROAD & MCGREGOR CREEK DIVERSION PROPOSED CROSSING			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY. 14	DISTRICT 1	COUNTY KENT	
TOWNSHIP HARVICH		LOT 25-26	CON. I.W.C.R.-E.C.R.
LOCATION KENT CENTRE			
DRAWN BY J. Segondy	CHECKED BY	W.P. 304-59	
DATE 11 AUG. 1954	APPROVED BY	DRAWING NO.	
SCALE 1 inch = 20 Feet		F 59-74 A.	



HALF PLAN (TOP VIEW)

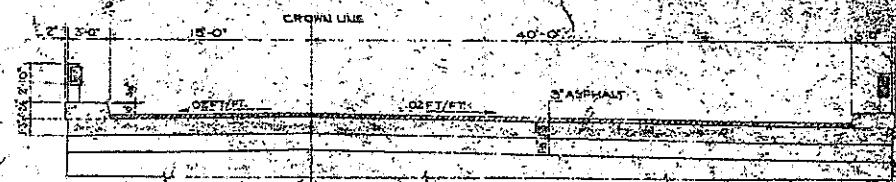
SCALE: 1/4" = 1'-0"

HALF PLAN (SECTION BELOW DECK)



CROSS SECTION A-A NORTH SPAN

SCALE: 1/4" = 1'-0"

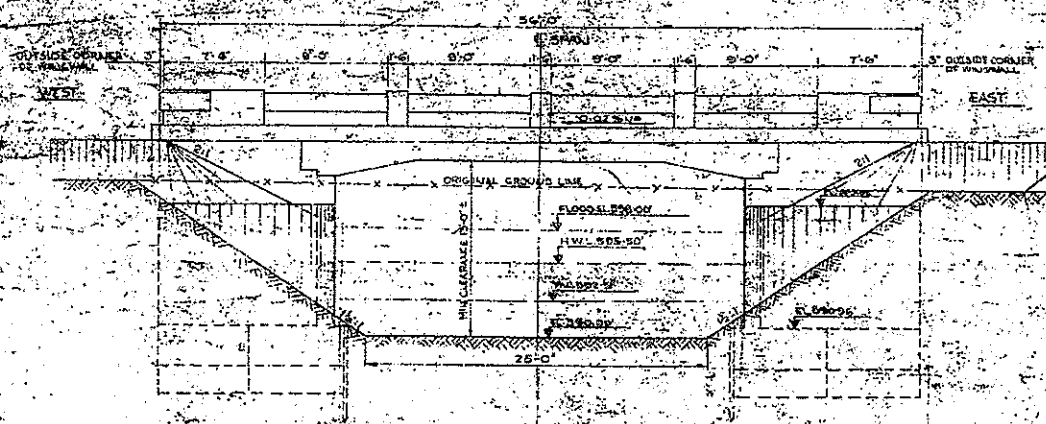


CROSS SECTION B-B SOUTH SPAN

SCALE: 1/4" = 1'-0"

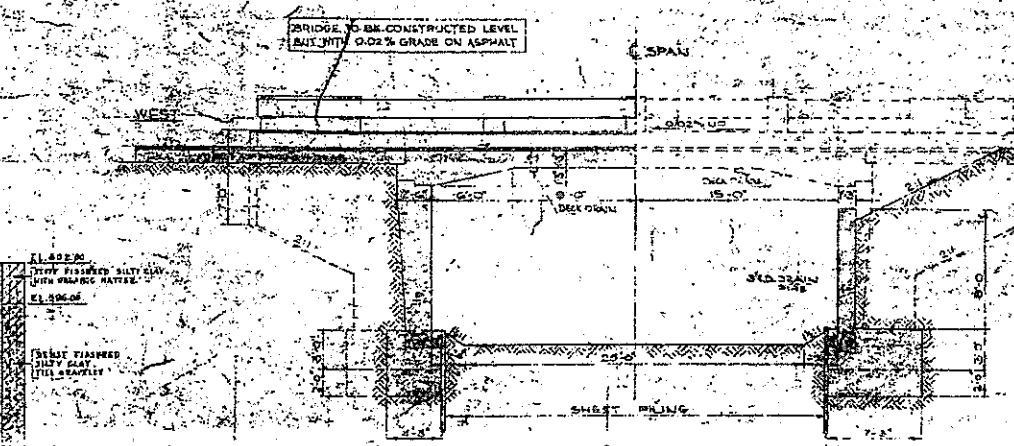
NOTES:

1. CONCRETE SHALL BE OF THE GRADE SPECIFIED IN THE SPECIFICATIONS.
2. ALL CONCRETE SHALL BE PLACED IN PLACE AND VIBRATED TO THE REQUIRED DENSITY.
3. THE BRIDGE SHALL BE CONSTRUCTED TO THE DESIGN SHOWN ON THESE PLANS.
4. THE BRIDGE SHALL BE MAINTAINED IN GOOD REPAIR AT ALL TIMES.
5. THE BRIDGE SHALL BE OPEN TO TRAFFIC AS SOON AS POSSIBLE AFTER COMPLETION OF THE WORK.



ELEVATION A-A

SCALE: 1/4" = 1'-0"



SECTION B-B

SCALE: 1/4" = 1'-0"

BORING LOG

(SHOWING BORING NO. 1 ONLY)

FEET SCALE: 1" = 10'

REMARKS: THE BRIDGE SHALL BE CONSTRUCTED TO THE DESIGN SHOWN ON THESE PLANS. THE BRIDGE SHALL BE MAINTAINED IN GOOD REPAIR AT ALL TIMES. THE BRIDGE SHALL BE OPEN TO TRAFFIC AS SOON AS POSSIBLE AFTER COMPLETION OF THE WORK.

DEPARTMENT OF TRANSPORTATION	
KENTON COUNTY	
HARWICK BRIDGE	
THE BRIDGE SHALL BE CONSTRUCTED TO THE DESIGN SHOWN ON THESE PLANS.	
CO. KENTON COUNTY	
TWP. HARWICK	
APPROVED:	
DATE:	

Mc Guffey Creek Bridge Lot 25  
Gone 1 ECR





- (8) Foundation Investigation Report 59-F-73 dated August 1959 for the McGregor Creek Diversion crossing, WP 16-59, Geocres 40J8-13.

JOB F 59 - 73

W.P. 16 - 59

S Denotes Split Spoon Sample

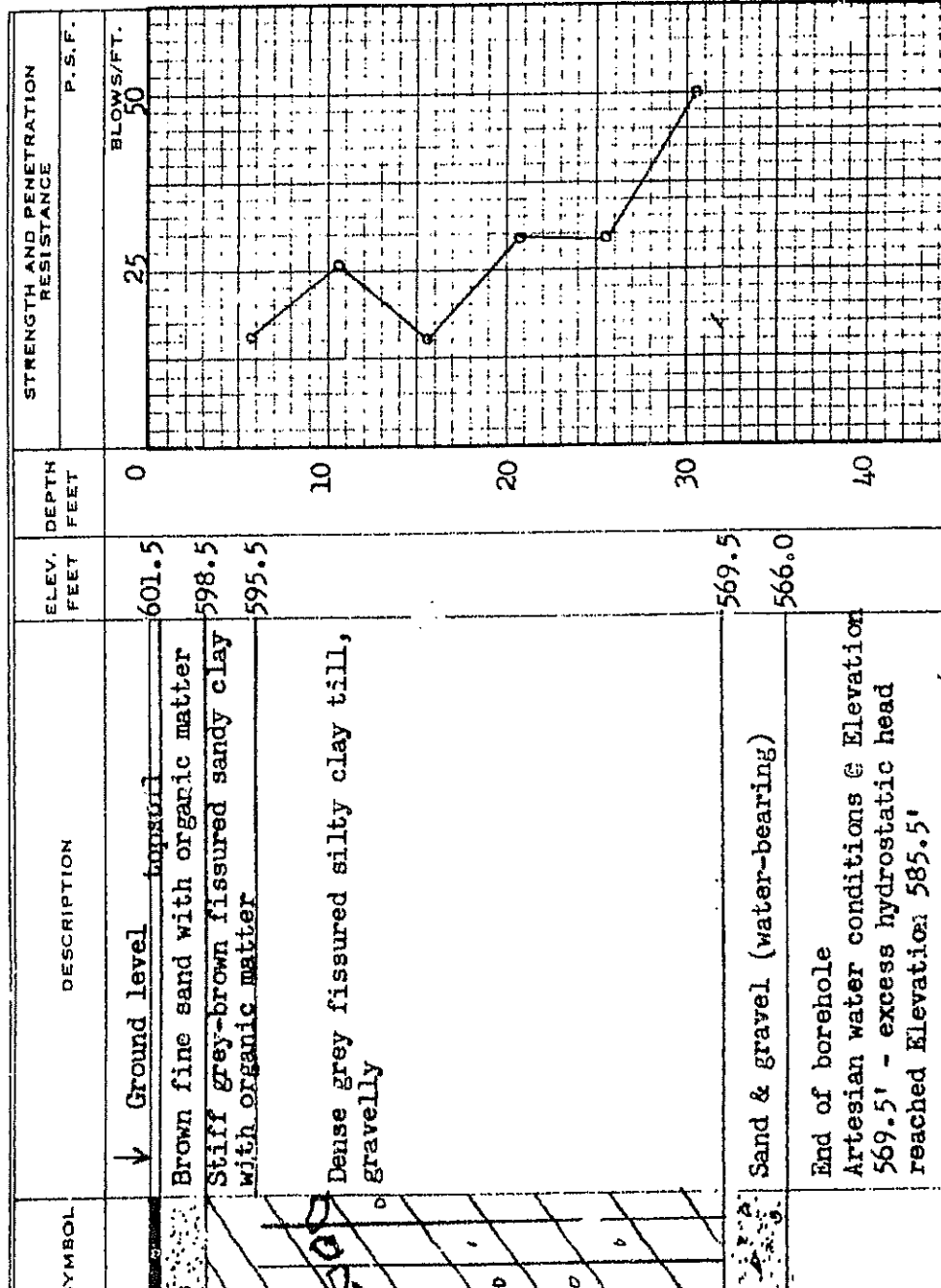
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. - 16 - 59 BORE HOLE NO. - 1  
 JOB - E 59 - 53 STATION 373+00 (50' RT.)  
 DATUM 601.5' COMPILED BY - B.K.  
 BORING DATE July 21/59 CHECKED BY - A.L.

## LEGEND

2" DIA. SPLIT TUBE  
 2" SHELBY TUBE  
 2" SPLIT TUBE  
 2" DIA. CONE  
 2" SHELBY  
 CASING

1/2 UNCONFINED COMPRESSION (Qu)  
 VANE TEST (C) AND SENSITIVITY (S)  
 NATURAL MOISTURE AND LIQUIDITY INDEX  
 LIQUID LIMIT  
 PLASTIC LIMIT



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30	S1	---
10 20 30	S2	143.0
10 20 30	S3	141.5
10 20 30	S4	137.7
10 20 30	S5	140.2
10 20 30	S6	---
10 20 30	S7	---

B.H. 1

## DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS AND RESEARCH SECTION

V.P. 16-59 BORE HOLE NO. 2

JOB F 59-73 STATION 373+00 (50' INT.)

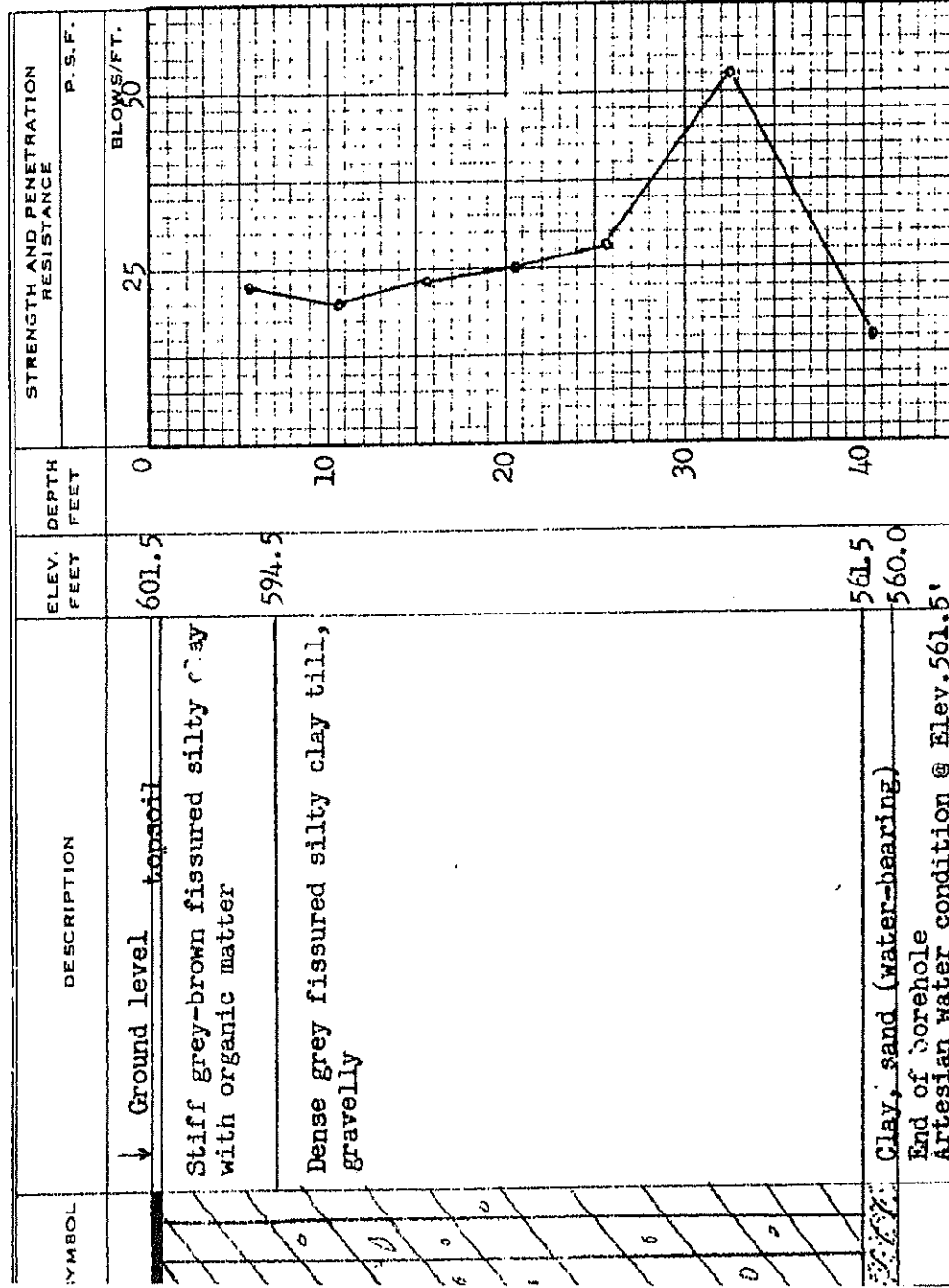
DATUM 601.5' COMPILED BY B.K.

BORING DATE July 21/59 CHECKED BY A.J.

## LEGEND

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

1/2 UNCONFINED COMPRESSION ( $Q_u$ )  
VANE TEST (C) AND SENSITIVITY (S)  
NATURAL MOISTURE AND  
LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT



B.H. 2

CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30	S1	130.0
	S2	144.2
	S3	135.9
	S4	136.9
	S5	--
	S6	137.6
	S7	--



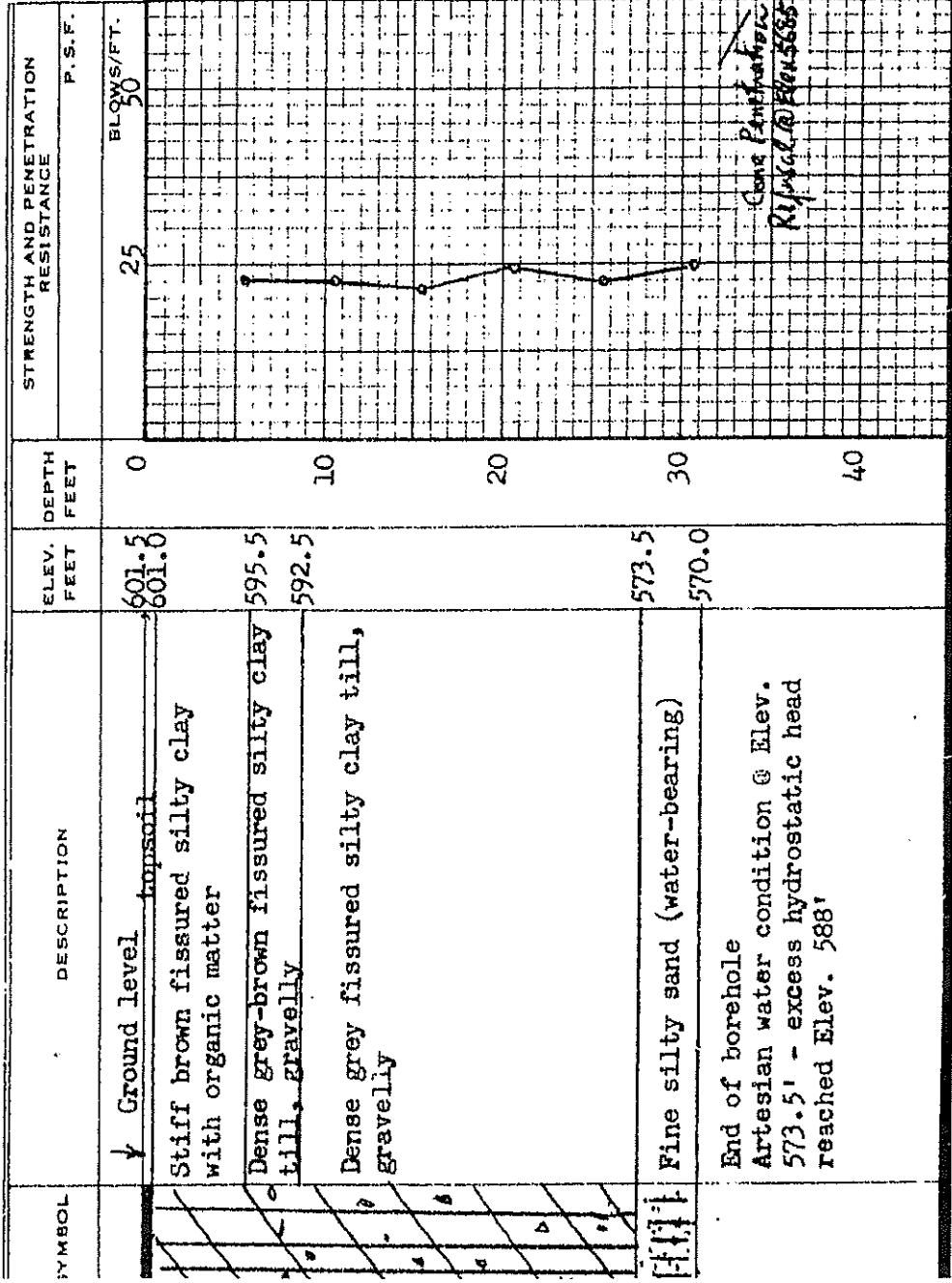
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 16 - 59 BORE HOLE NO. 3  
JOB F 59 - 73 STATION 372+59 (E)  
DATUM 601.5' COMPILED BY B.K.  
BORING DATE July 20/59 CHECKED BY A.L.

LEGEND

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

1/2 UNCONFINED COMPRESSION (Qu)  
VANE TEST (C) AND SENSITIVITY (S)  
NATURAL MOISTURE AND  
LIQUIDITY INDEX  
LIQUID LIMIT  
PLASTIC LIMIT



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30		
	S1	132.0
	S2	138.2
	S3	135.8
	S4	131.8
	S5	136.1
	S6	--

B.H. 3





- (9) Foundation Investigation Report 60-F-228 dated April 1960 prepared by Dominion Soil Investigation Ltd. for proposed bridge across McGregor Creek, Kent County Road 14, WP 303-59, Geocres 40J8-24.

Order No. 60-106

Prep. By P.L.

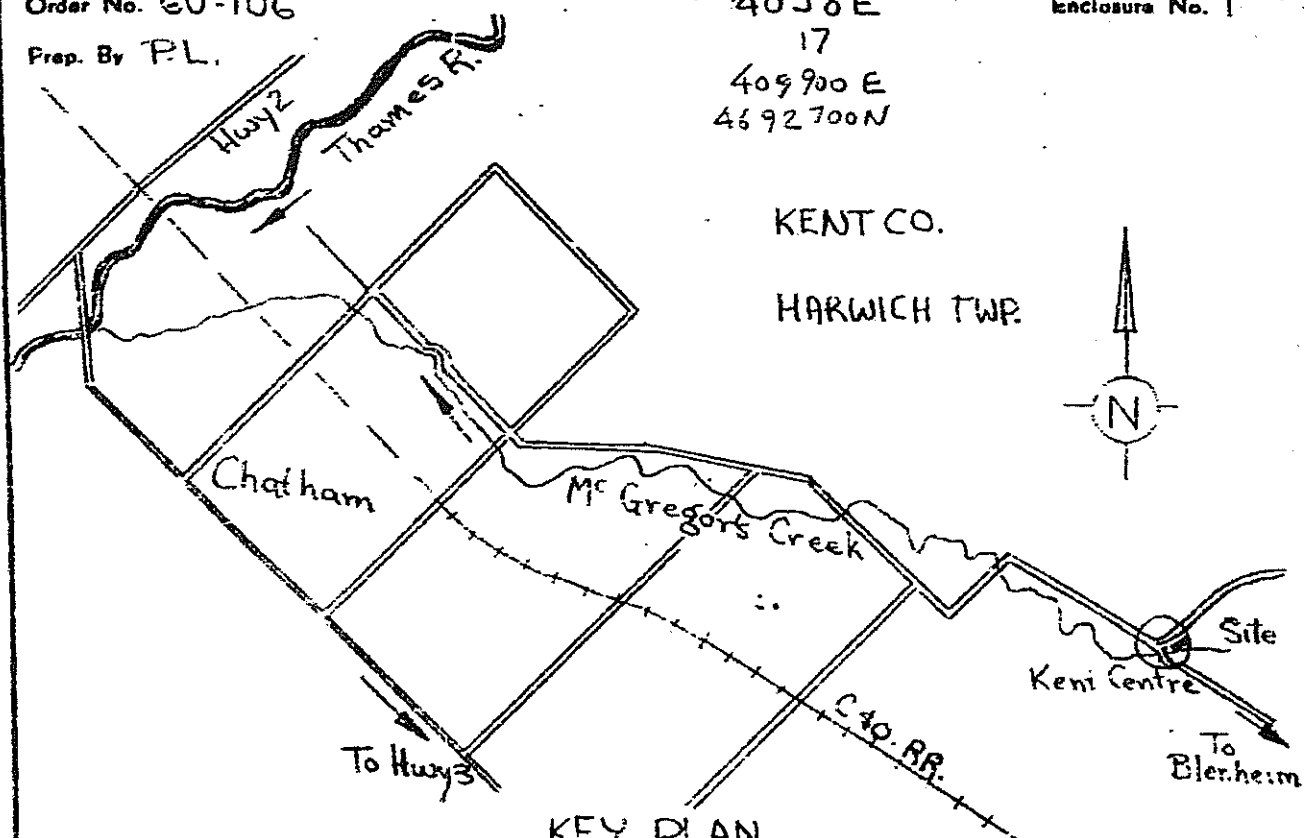
4038 E

17

409900 E

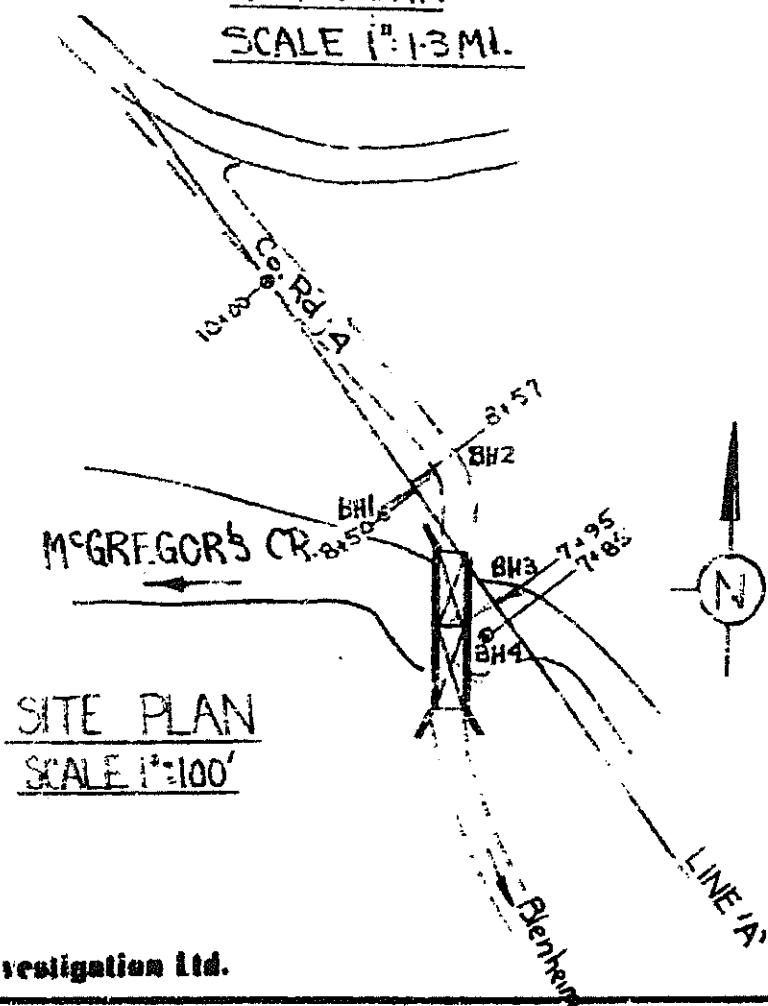
4692700 N

Enclosure No. 1



KEY PLAN

SCALE 1" = 13 MI.



SITE PLAN

SCALE 1" = 100'

Dominion Soil Investigation Ltd.



## Dominion Soil Investigation Ltd.

## Dominion Soil Investigation Ltd.

Engineering Data Sheet for Borehole:

Engineering Data Sheet for Borehole: 1 of 4 - Sheet 1 of 2

Date: Jan. 27, 1960.

## LEGEND

Project: Bridge across McGregor's Creek  
 Location: Co. Rd. 16, Harwich Twp., Kent  
 Hole Location: Sta. 8+60 - 25' Left  
 Hole Elevation and Datum: 591.3  
 Field Supervisor: P.L. & A.R. Prep.: P.L.  
 Miller: C.I. Checked:

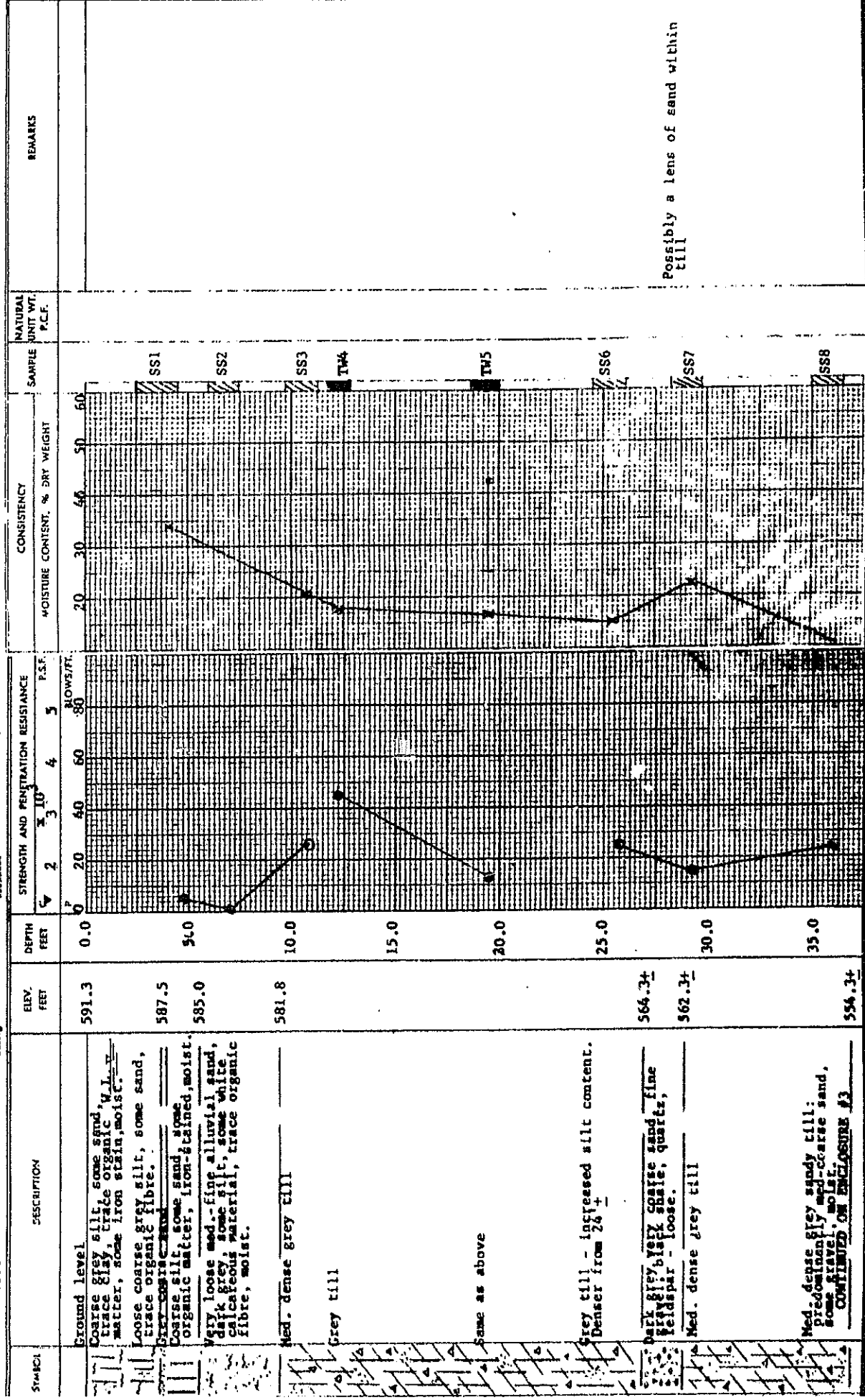
Unconfined compression  
 Vane test and sensitivity (S)  
 Penetration Resistance (P)  
 2" Split tube  
 2" Dia. Cone  
 Casing

## LEGEND

Consistency  
 Natural moisture and  
 Liquidity Index (LI)  
 Liquid limit  
 Plastic limit

Sampling Method  
 2" Dia. split tube  
 2" Shelby tube

Sampling Method  
 2" Dia. split tube  
 2" Shelby tube



**Dominion Soil Investigation Ltd.**

## Engineering Data Sheet for Boreholes:

Date: Jan. 27. 60.

Legend

Consistency
Natural Liquid
Liquid Plastic

17 x

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
				C	P	MOISTURE CONTENT, % DRY WEIGHT				
	CONTINUED FROM ENCLOSURE #2 Med. dense grey sandy fill: predominantly med.-coarse sand, some gravel, moist.	554.3	35.0							
	Dense grey fine sand. 2" layer of grey fill	552.3+	40.0							
	END OF B.B.	544.3+	45.0							

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole:

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole: 2 - Sheet 1 of 2

Date: Jan. 23, 60.

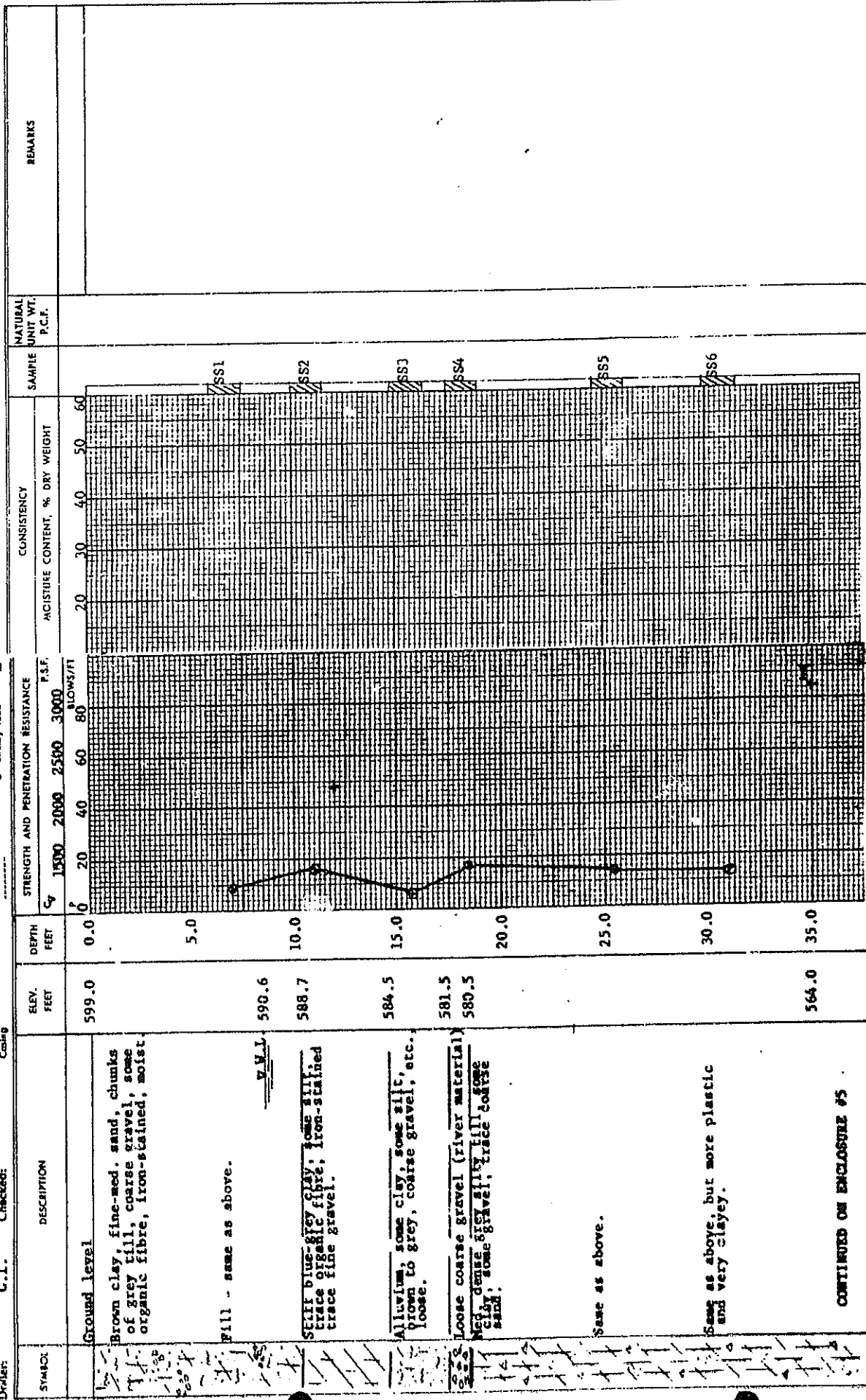
Project: McGregor's Creek Bridge  
 Location: Co. Ed. 14, Harwich  
 Hole Location: Sta. 8+57 - 21' R.C. Line 'A'  
 Hole Elevation and Datum: 599.0  
 Field Supervisor: PL & AK Prep.: P.L.  
 Driller: C.I. Checked:

LEGEND  
 Shear Strength (C)  
 Unconfined compression  
 Vane test and sensitivity (S)  
 Penetration Resistance (P)  
 2" Split tube  
 2" Dia. Cone  
 Coding

Consistency  
 Natural moisture and  
 Liquidity Index (LI)  
 Liquid limit  
 Plastic limit

Sampling Method  
 2" Dia. split tube  
 3" Shelby tube

Sampling Method  
 2" Dia. split tube  
 2" Shelby tube



CONTINUED ON ENCLOSURE #5



**Dominion Soil Investigation Ltd.**

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole: 3

Engineering Data Sheet for Borehole:

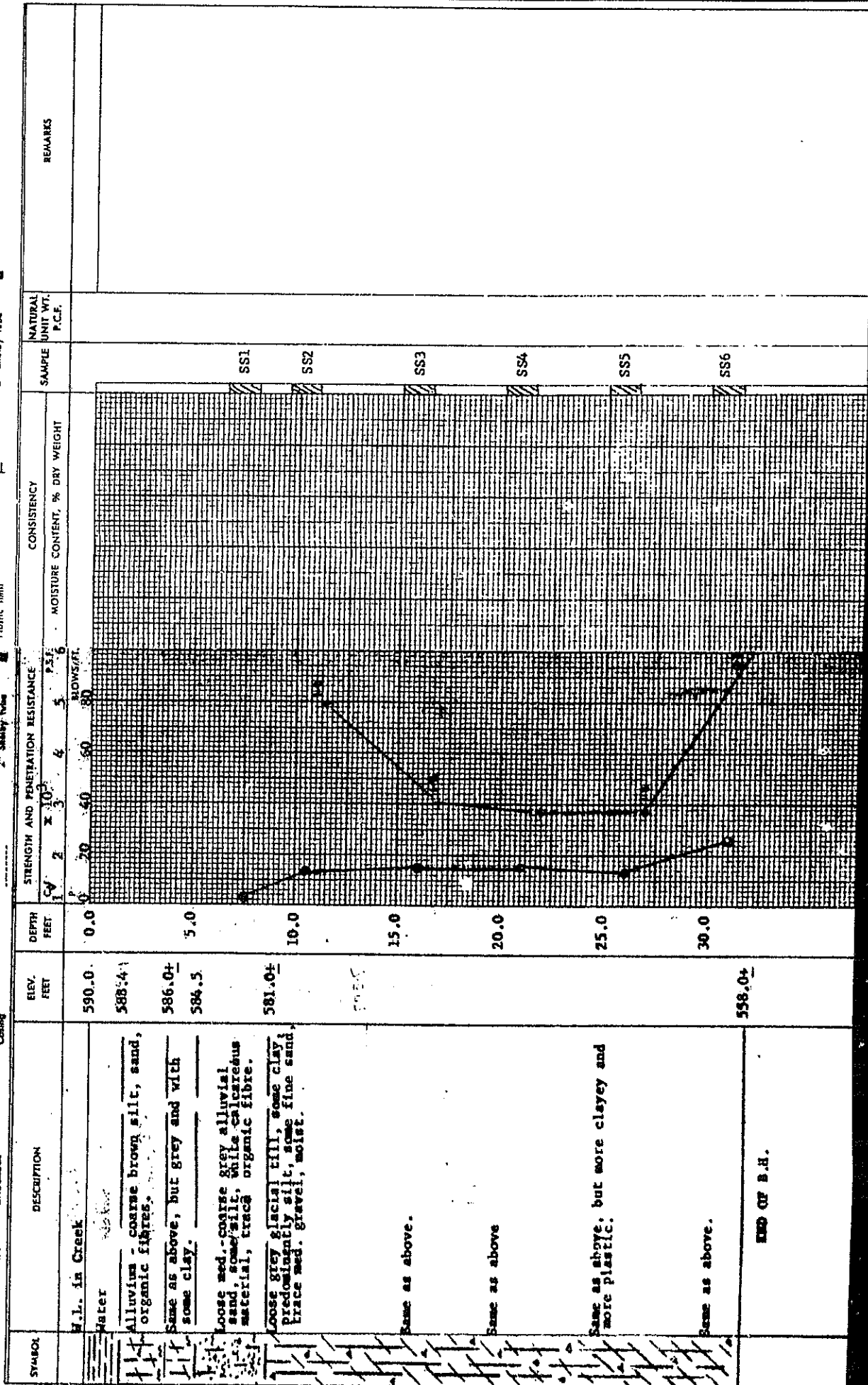
Date: Jan. 29, 60.

Project: McGregor's Creek Bridge  
Location: Co. Rd. 14, Harwich Township  
Hole Location: Sta. 7+85 - 15' left of center  
Hole Elevation and Datum: 590.0  
Field Supervisor: P.L. & A.E. Prep.: P.L.  
Driller: C.I. Check: C.I.

LEGEND:  
Shear Strength (C)  
Unit Shear Strength (C)  
Unit Cohesion (C)  
Unit Friction (C)  
Unit Vane test and sensitivity (S)  
Penetration Resistance (P)  
2" Split tube  
2" Dia. Cone  
Casing

LEGEND:  
Consistency  
Natural moisture and  
Liquid limit (LL)  
Liquid limit  
Plastic limit  
Sampling Method  
2" Dia. split tube  
2" Shelby tube

Sampling Method  
2" Dia. split tube  
2" Shelby tube





## Deminion Soil Investigation Ltd.

Engineering Data Sheet for Borehole 404

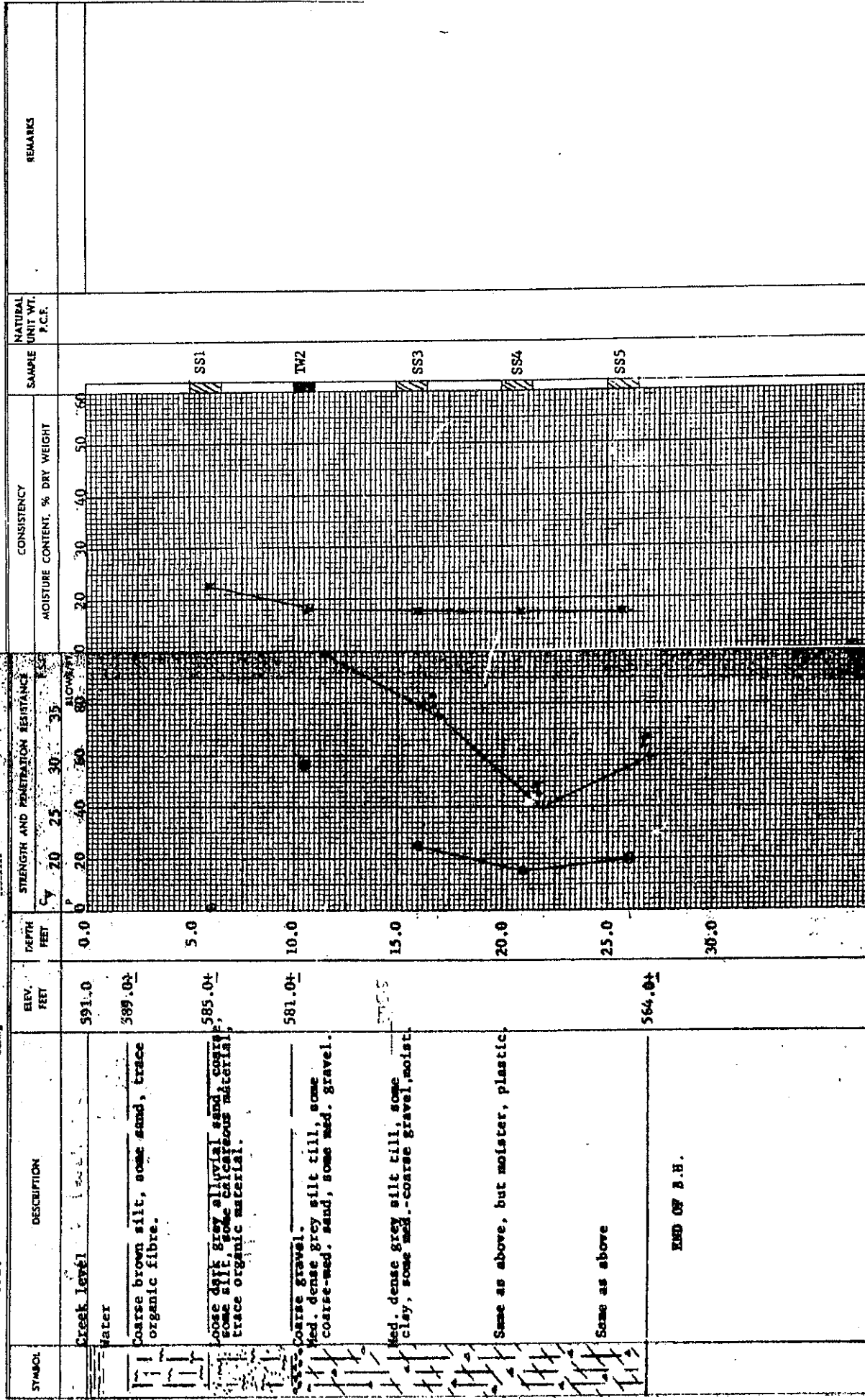
Project: McGregor's Creek Bridge  
 Location: Co. Rd. 14, Harvill, Ontario  
 Hole Location: Sta. 7+95 - 17' at left of bridge  
 Hole Elevation and Datum: 591.0  
 Field Supervisor: P.L. & A.K. Prep: P.L.  
 Driller: C.I. Checked:

Date: Jan. 30, 40.

LEGEND  
 Shear Strength (C)  
 Undrained compression  
 Vane test and sensitivity (S)  
 Penetration Resistance (P)  
 2" Split tube  
 2" Dia. Cone  
 Casing

Consistency  
 Natural moisture and  
 Liquidity Index (LI)  
 Liquid limit  
 Plastic limit

Sampling Method  
 2" Dia. split tube  
 2" Shelby tube



## Deminion Soil Investigation Ltd.

Engineering Data Sheet for Borehole:

Order No. 60-106

Enclosure 9

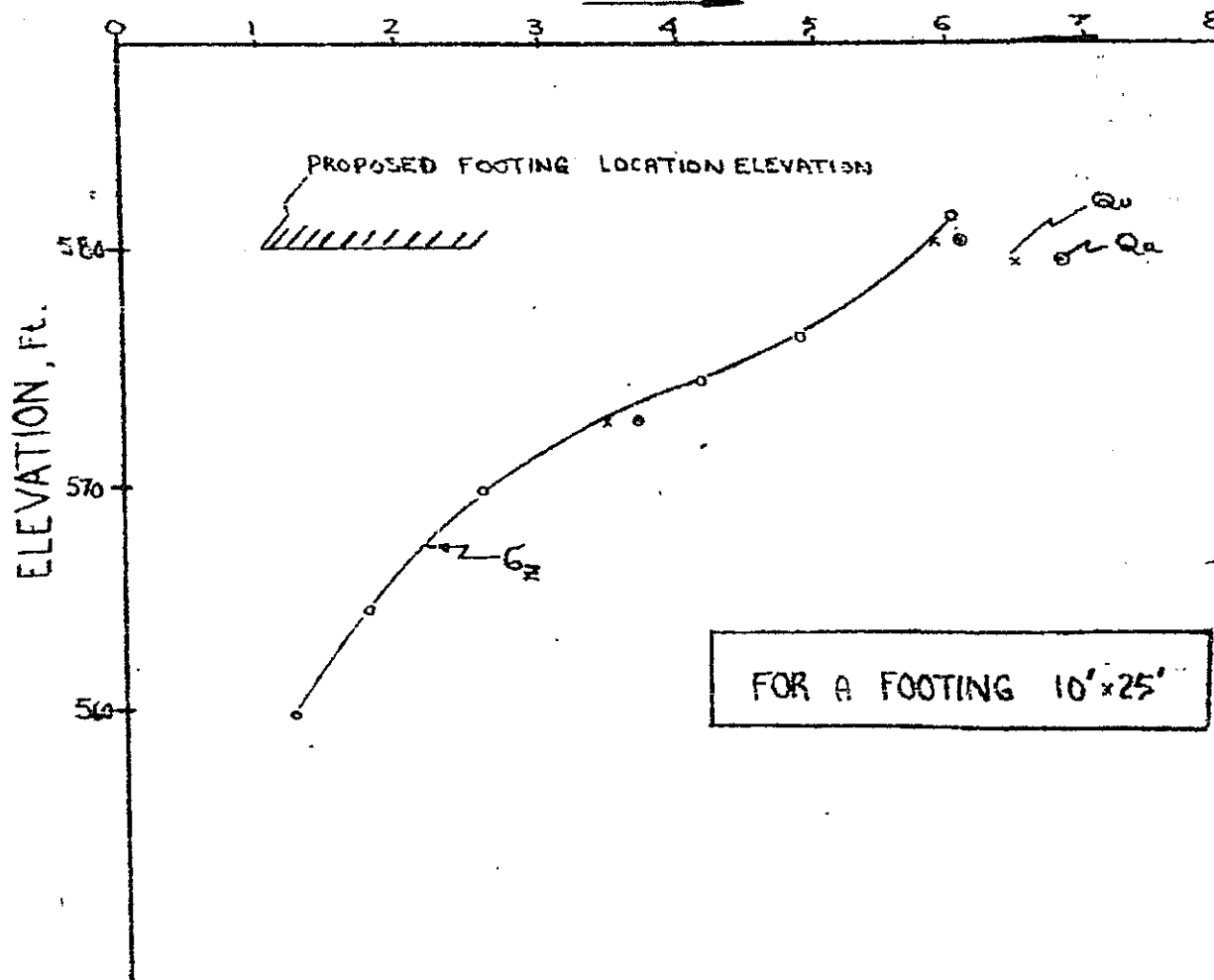
SUMMARY OF LABORATORY TEST RESULTS

Borehole & Sample No.	Elevation	Moisture Content%	W-pec	Uu (psf)	Strain	Liquid Limit	Plastic Limit	Plasticity Index
Borehole 1								
Sample 1	588.8	34.3						
" 2	585.3	52.0						
" 3	581.4	20.2						
" 4	579.55	17.4	133.0	6460	20%	42.3	25.1	17.2
" 5	572.80	18.1	130.6	3550	20%			
" 6	566.80	15.6						
" 7	563.05	22.8						
" 8	556.3	8.9						
Borehole 4								
Sample 1	586	22.7						
" 2	581	18.3	132.0	5825	20%			
" 3	576	17.7						
" 4	571	17.3						
" 5	566	17.9						

Prep. By

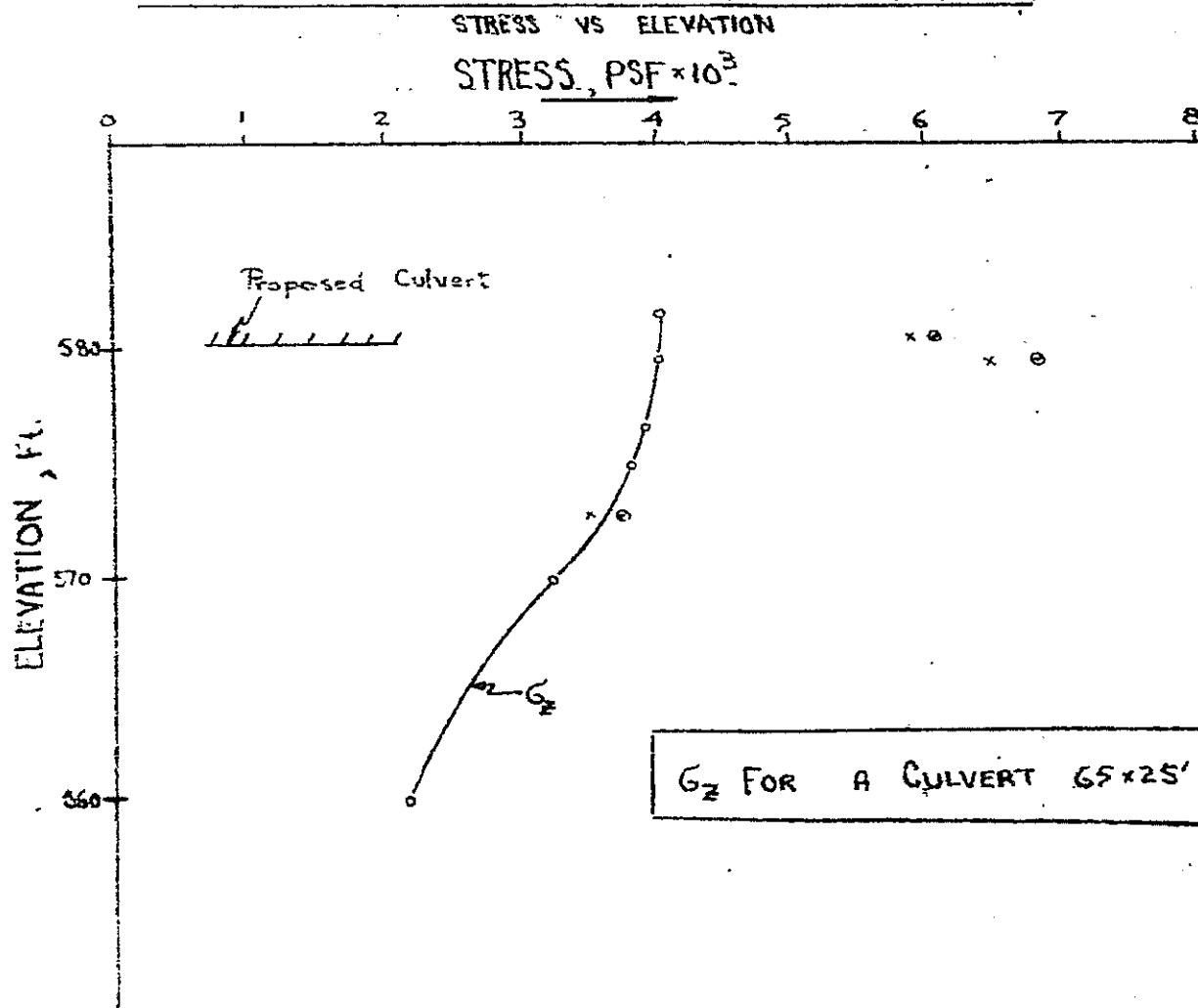
STRESS & CAPACITY DISTRIBUTION GRAPH

STRESS VS ELEVATION

STRESS, PSF  $\times 10^3$ LEGEND:

- o -  $G_z$  - Boussinesq, Vertical Stress Distribution Curve, psf.
- x  $Q_u$  - Unconfined Compression Results, psf.
- o  $Q_a$  - Safe Allowable Bearing Capacity  
 $= 0.95 Q_u (1 + 0.3 \frac{B}{L})$  where  $\frac{B}{L} = \frac{10}{25}$

Prep. By

STRESS & CAPACITY DISTRIBUTION GRAPHLEGEND:

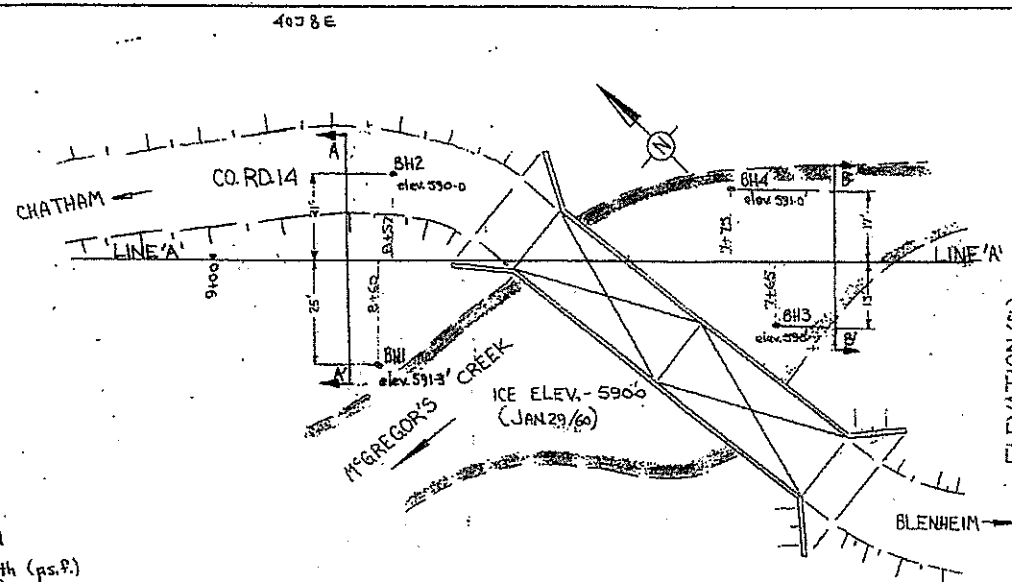
- o  $G_z$  - Boussinesq Vertical Stress Distribution Curve, psf.
- x  $Q_u$  - Unconfined Compression Results, psf.
- o  $Q_a$  - Safe Allowable Bearing Capacity  
 $= 0.95 Q_u (1 + 0.3 \frac{B}{L})$  where  $\frac{B}{L} = \frac{25}{65}$

# LEGEND:

○ BH Bore hole  
 — WL Free water table level  
 C<sub>v</sub> In situ vane shear strength (p.s.f.)  
 ELEVATION - Geodetic datum

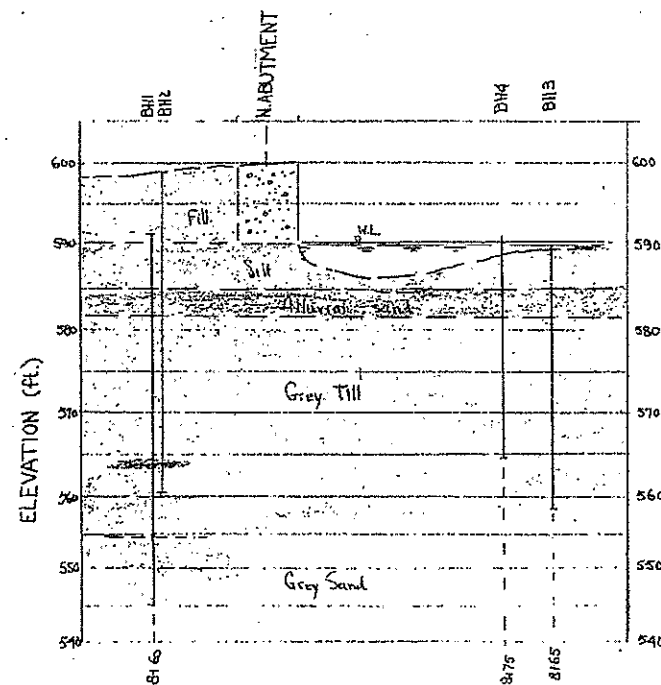
## SOILS LEGEND:

- Road fill: clay, grey fill, gravel, sand etc.
- Coarse grey silt (some brown at top), some sand, some organic material, iron stained.
- Loose, med., dark grey alluvial sand: some white calcareous material, traces of organic fibre.
- Mod. dense grey till: predom. silt, some clay, some med. to fine sand, black shaly gravel.
- Loose coarse sand & gravel, predom. black shale.
- Dense coarse grey sand, almost stratified.



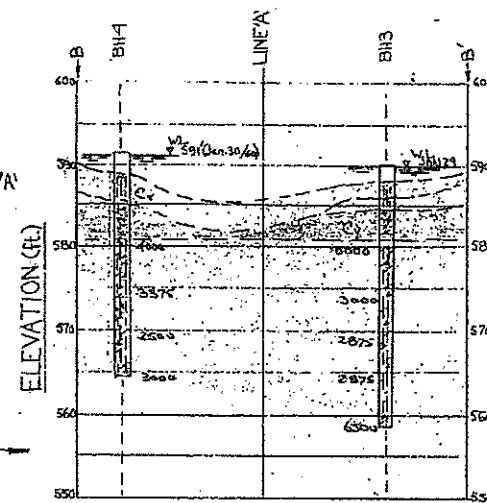
## LOCATION OF BOREHOLES

SCALE 1"=20'



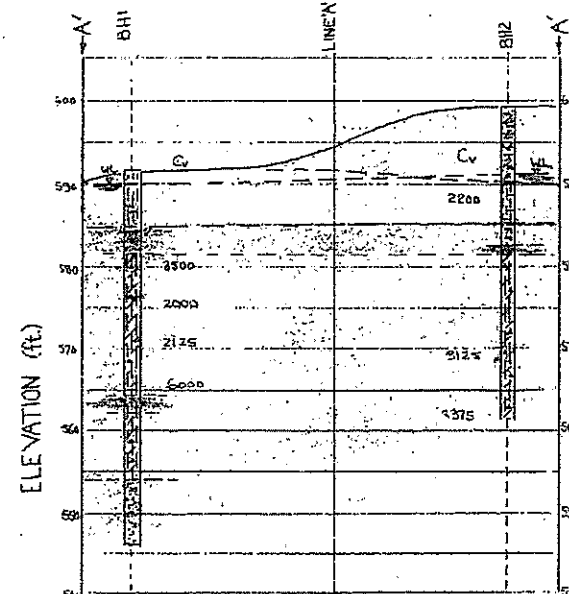
## SUBSURFACE PROFILE ALONG LINE 'A'

HORIZONTAL SCALE 1"=20'  
 VERTICAL SCALE 1"=10'



## SUBSURFACE SECTION ALONG B-B'

SCALE 1"=10'



## SUBSURFACE SECTION ALONG A-A'

SCALE 1"=10'

ONTARIO DEPARTMENT OF HIGHWAYS  
 MATERIALS & RESEARCH SECTION

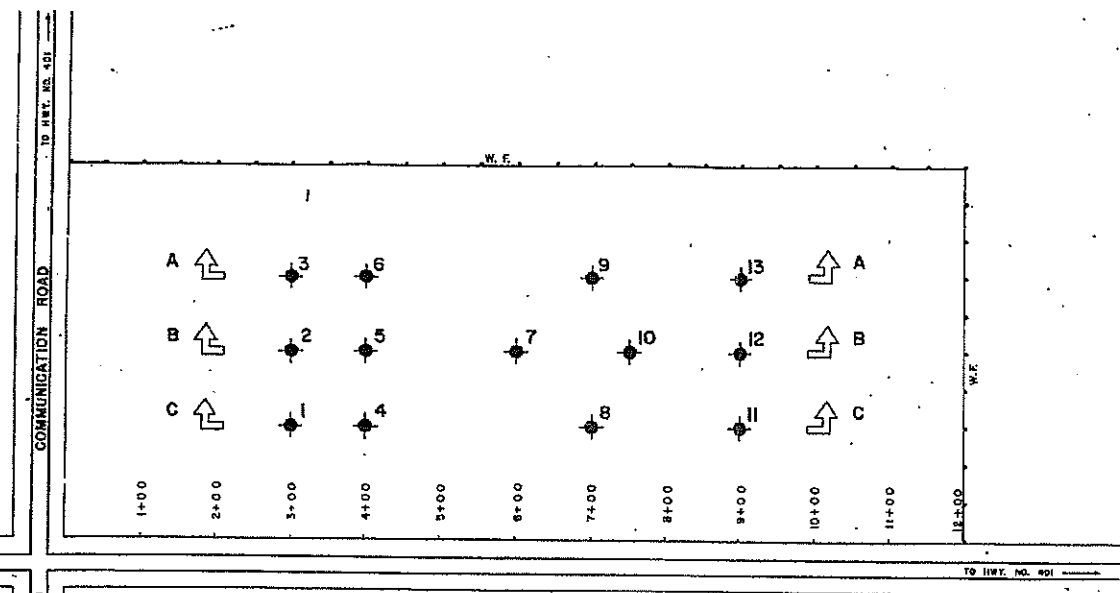
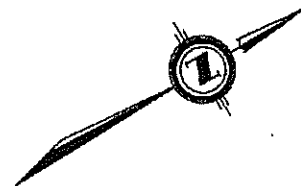
M<sup>c</sup> GREGORS CREEK BRIDGE - KENT CO. RD. 14  
 HARWICH TWP. BET'N. CON1-ECR & CON1(WCR) - LOT 26  
 WP-303-59

DOMINION SOIL INVESTIGATION LTD.  
 TORONTO  
 FIELD SUP. PL. JOB NO. 60-106 FEB. 18/60 ENCL. 3

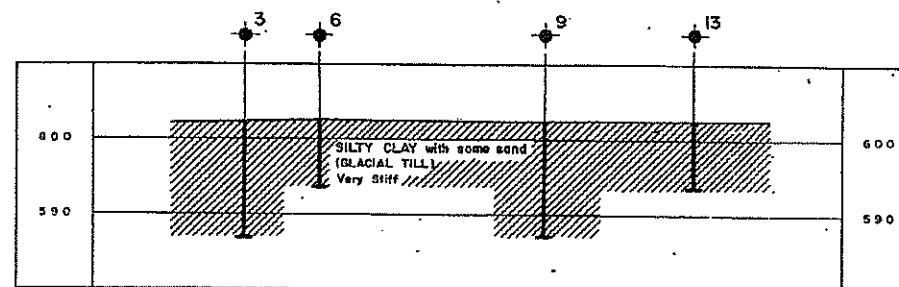




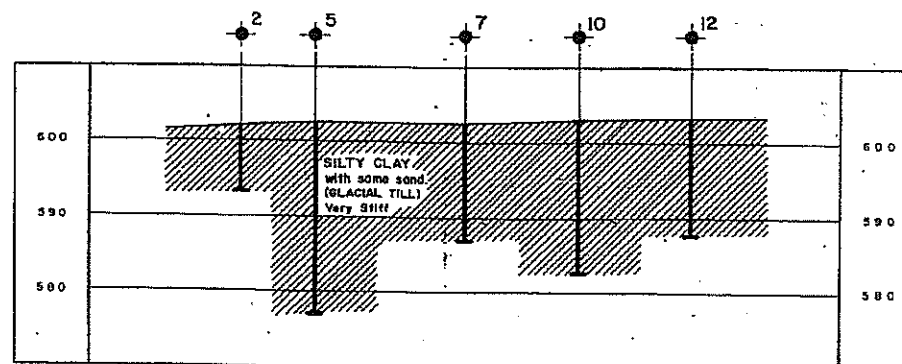
- (10) Foundation Investigation Report W.J. 62-F-42 dated May 30, 1962 for the Kent Center Patrol Yard, Geocres 40J8-25.



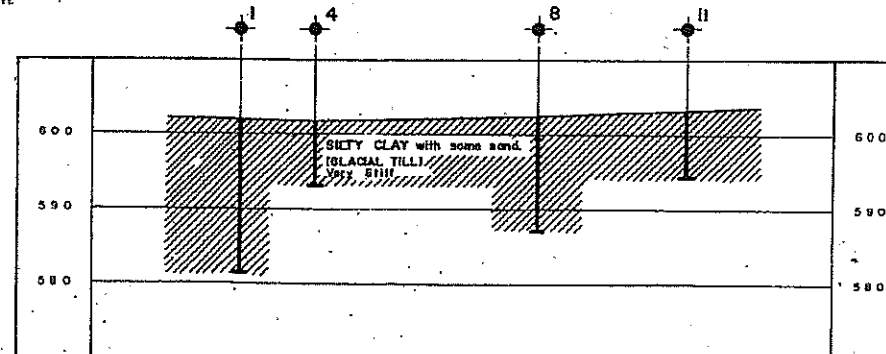
P L A N  
Scale: 1 in. = 100 feet



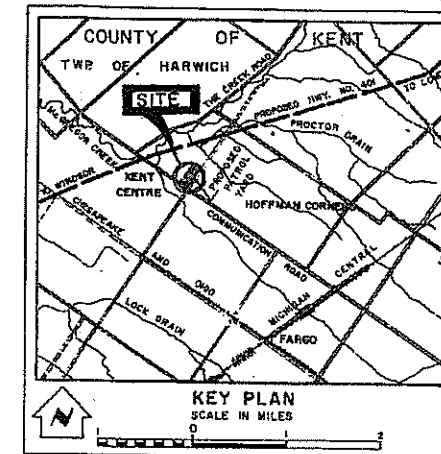
A - A  
Scale: Vert. 1 in. = 10 ft.  
Horiz. 1 in. = 100 ft.



B - B  
Scale: Vert. 1 in. = 10 ft.  
Horiz. 1 in. = 100 ft.



C - C  
Scale: Vert. 1 in. = 10 ft.  
Horiz. 1 in. = 100 ft.



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation

NO.	ELEVATION	STATION	OFFSET
1	602.0	3+00	150 L.T.
2	602.0	3+00	250 L.T.
3	601.9	3+00	350 L.T.
4	602.3	4+00	150 L.T.
5	602.3	4+00	250 L.T.
6	602.4	4+00	350 L.T.
7	602.3	6+00	250 L.T.
8	602.4	7+00	150 L.T.
9	602.4	7+00	350 L.T.
10	603.0	7+50	250 L.T.
11	603.3	9+00	150 L.T.
12	603.1	9+00	250 L.T.
13	602.5	9+00	350 L.T.

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

CHATHAM PATROL YARD

ORIGINATED I. HOLUBEC	DISTRICT NO. 1	DATE 24 MAY 1962
DRAWN A. SHOPOFF	W.A. NO.	JOB NO. 62-F-42
CHECKED R. J. H.	CONTRACT NO.	DRAWING NO.
APPROVED K. J. H.		62-F-42A



- (11) Contract drawing for Harwich TWP Bridge No. 8 (Proctor Drain Bridge EBL and WBL)  
WP 293-59, dated November 1959.





- (12) Foundation Investigation Report 59-F-60 at proposed crossing of Highway 401 and the Proctor Drain, WP 293-59, Geocres 40J8-10.



## SUMMARY OF FIELD & LABORATORY TESTS

BOI  
59-60

W.P. 293-59

QAS NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETR RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI	UNIT WEIGHT PCF	REMARKS
1	S 1	5'-6.5'	Brown silty clay with small stones (Glacial till).	20	-	-	-	-	-	
	T 2	10'-12'	"	34	17.5	20.2	-	6080	133.3	
	S 3	15'-16.5'	Grey Pebbly Silty Clay (Glacial till)	31	-	-	-	-	-	
	T 4	20'-22.0'	"	31	17.3	19.0	29.9	3820	132.2	
	T 5	30'-32'	"	21	19.5	11.9	27.0	1370	129.5	
	T 6	42'-44'	"	24	18.8	17.9	26.5	2290	133.3	
			S - Denotes Split-Spoon Sample. T - Denotes Thin-Walled Shelby Sample.							

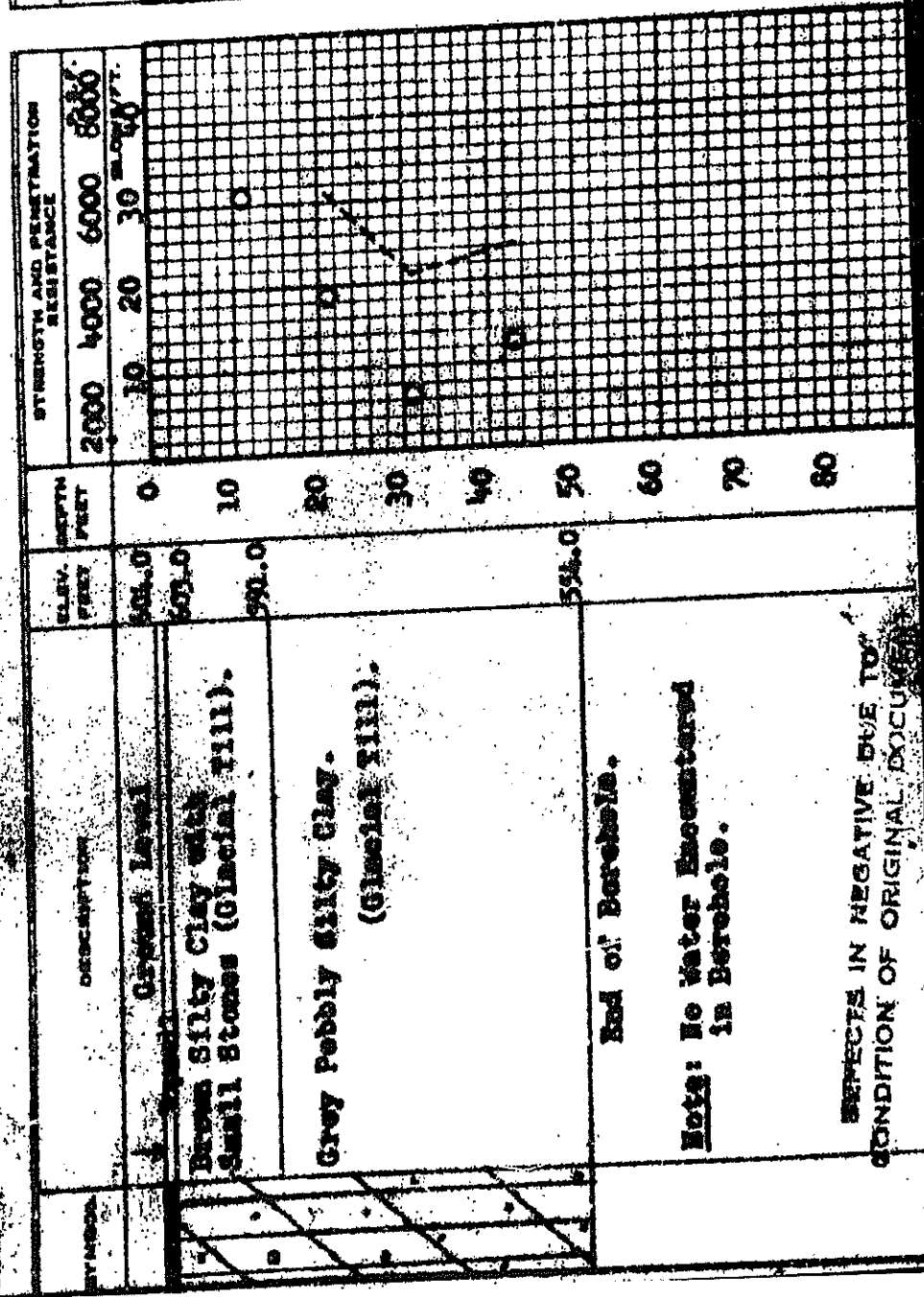
DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

M.P. 293-59. BORE HOLE NO. 1  
JOB 7/59-60 STATION 112+80 (S)  
DATE 604.0' COMPILED BY B.I.  
BORING DATE June 16/59. CHECKED BY K.P.

LEGEND

1/2 UNCONFINED COMPRESSION (QU) --- O  
VANE TEST (C) AND SENSITIVITY (S) --- +  
NATURAL MOISTURE AND LIQUIDITY INDEX --- X  
LIQUID LIMIT ---  
PLASTIC LIMIT ---

2" DIA. SPLIT TUBE ---  
2" SHELBY TUBE ---  
2" SPLIT TUBE ---  
2" DIA. CONE ---  
2" SHELBY ---  
CASING ---



Ground Level  
Brown Silty Clay with  
Small Stones (Glacial till).  
Grey Pebbly Silty Clay.  
(Glacial till).

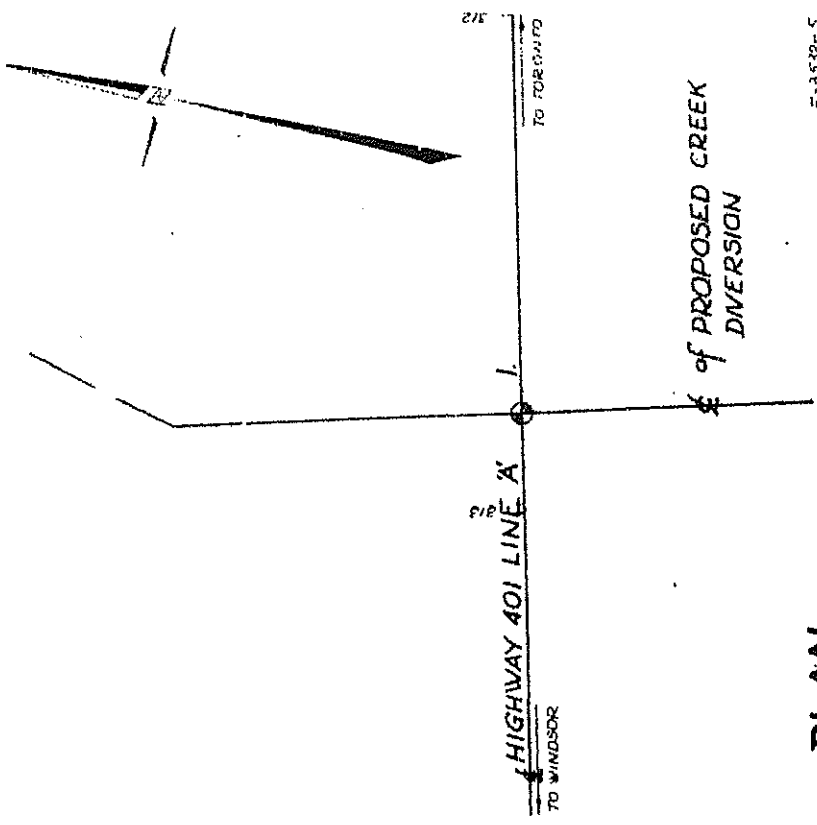
End of Borehole.

Note: No Water Encountered  
in Borehole.

DEFECTS IN NEGATIVE DUE TO  
CONDITION OF ORIGINAL DOCUMENT

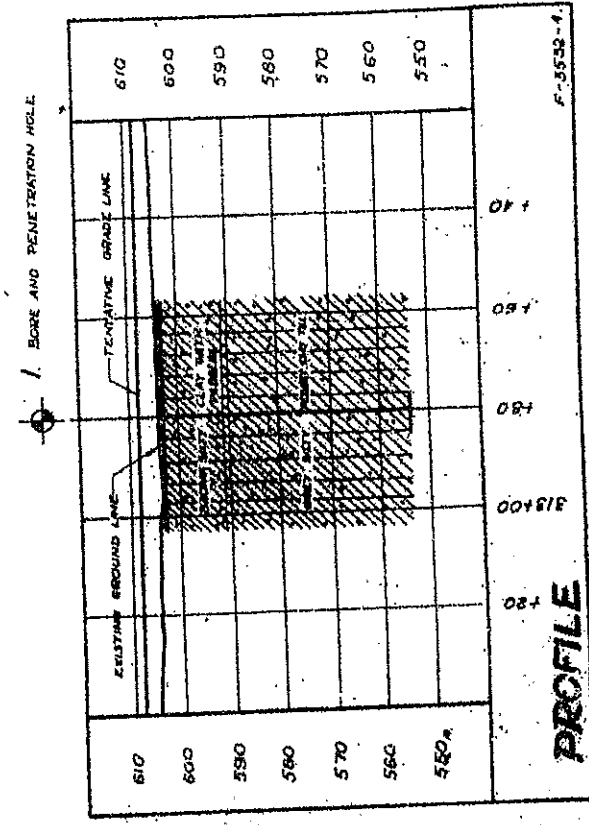
CONSISTENCY		SAMPLE		NATURAL UNIT WT. P.C.F.	
MOIST. CONTENT - % DRY WT.					
20	40	60			
			WT 1		-
			WT 2		133.3
			WT 3		-
			WT 4		132.2
			WT 5		129.5
			WT 6		133.3

Borehole No. 1.

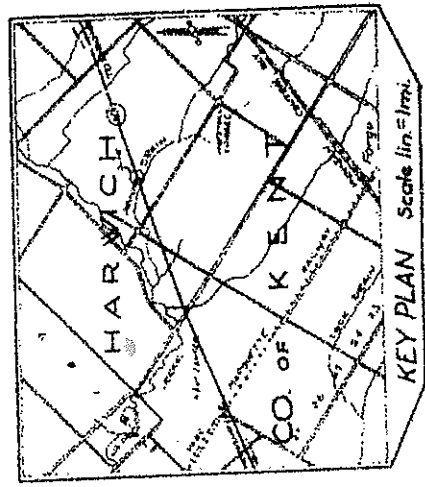


PLAN

F-3532-5



PROFILE



KEY PLAN Scale 1 in. = 1 mi.

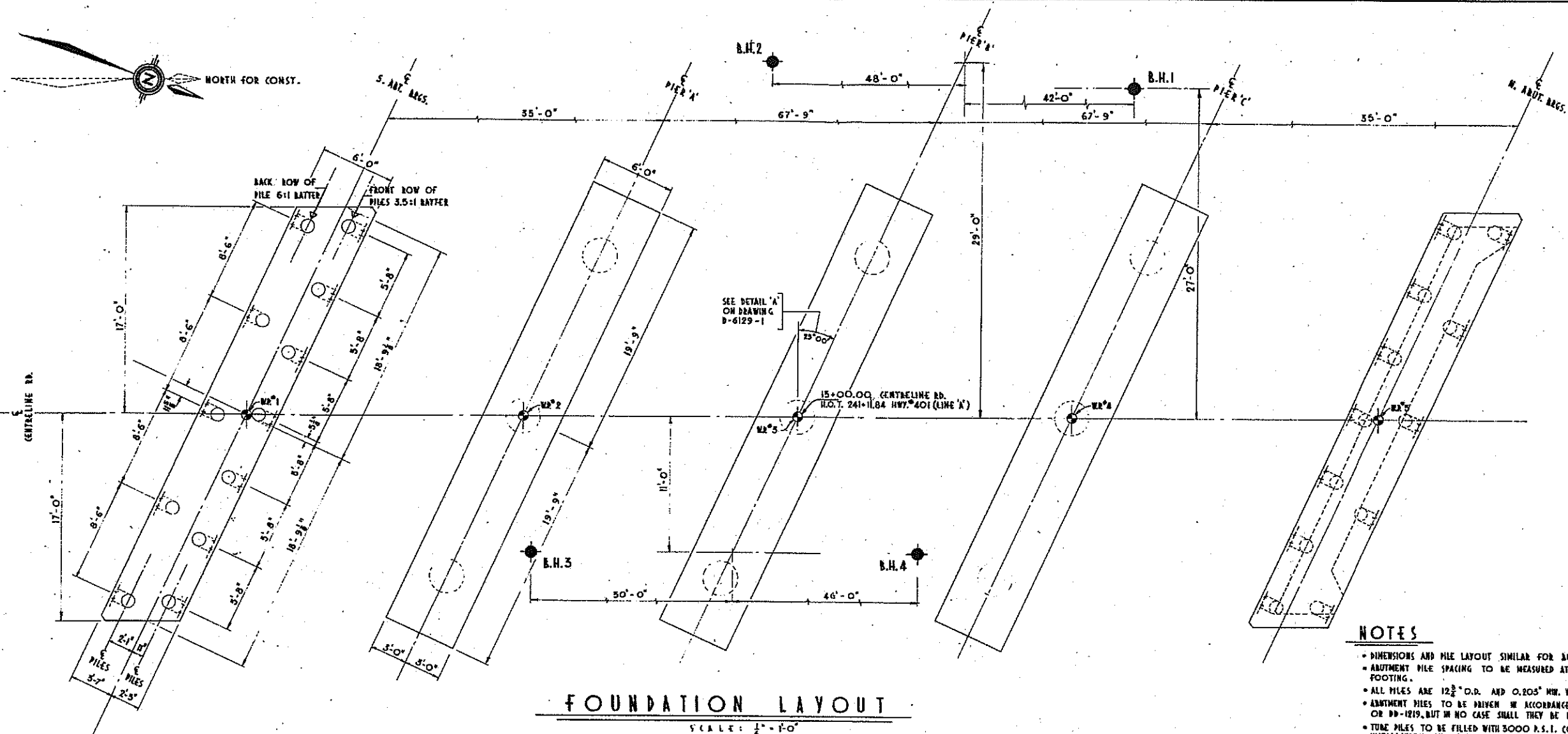
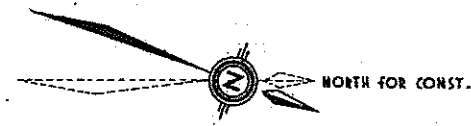
NOTE -  
THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DETERMINED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLE LOCATIONS THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
PROPOSED CREEK DIVERSION			
PROJECT NO.	PROJECT	COUNTY	KENT
LOCATION	1000000	SECTION	20
LOCATION	2000000	SECTION	20
DESIGNED BY	DESIGNED BY	DATE	203-59
DATE	4. 20. 1950	APPROVED BY	APPROVED BY
SCALE	1/4" = 20' HORIZ.	1/4" = 20' VERT.	F-359-60A

27-67-90-2

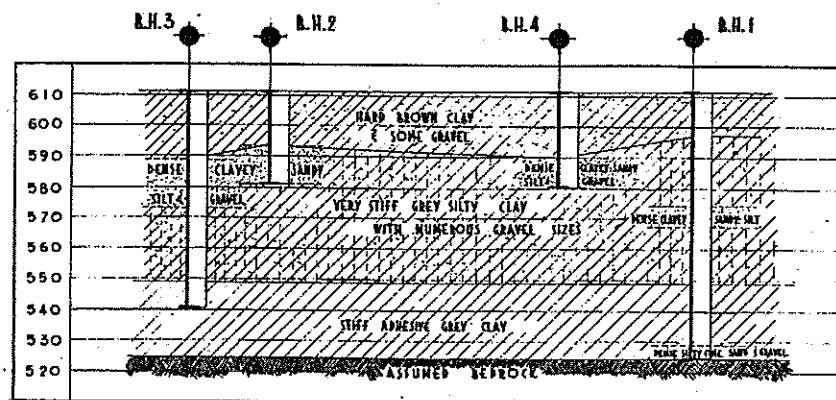


- (13) Contract drawings for Centerline Road (Harwich Road) Underpass, WP 83-59, dated June 1967.



### FOUNDATION LAYOUT

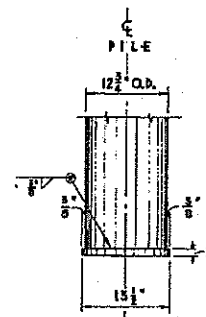
SCALE: 1/4" = 1'-0"



### PROFILE

### NOTES

- THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
- THE COMPLETE SOIL INVESTIGATION REPORT FOR THIS STRUCTURE MAY BE EXAMINED AT THE BRIDGE OFFICE AND FOUNDATION OFFICE, KENNEDY, AND AT THE KATHAM DISTRICT OFFICE.



### PILE SHOE

SCALE: 1/4" = 1'-0"

PILES SUPPLIED		
LOCATION	R.ABUT.	S.ABUT.
N° REQ'D	12	12
LENGTH	21'-0"	21'-0"
TYPE	STEEL TUBE PILES - 12 1/2" O.D.	
DESIGN LOAD	50 TONS/PILE	50 TONS/PILE

### NOTES

- DIMENSIONS AND PILE LAYOUT SIMILAR FOR BOTH ABUTMENTS.
- ABUTMENT PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTING.
- ALL PILES ARE 12 1/2" O.D. AND 0.203" MW. WALL THICKNESS.
- ABUTMENT PILES TO BE DRIVEN IN ACCORDANCE WITH STD. DD-1218 OR DD-1219, BUT IN NO CASE SHALL THEY BE DRIVEN BELOW EL. 602.00.
- TUBE PILES TO BE FILLED WITH 3000 P.S.I. CONCRETE AFTER INSTALLATION AND INSPECTION.

REVISION	DATE	BY	DESCRIPTION

### DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION

### CENTRELINE ROAD UNDERPASS

9.1 MILES WEST OF HWY# 21		DIST. No.	
KING'S HIGHWAY No. 401 - LINE 'A' (H.C. FREEWAY)			
CO. KENT		(FORMERLY HARWICH TWP. BRIDGE #6)	
TWP. HARWICH		LOT 15 & 21 CON. H. 1 & 2	
FOUNDATION LAYOUT, BORE HOLE LOCATIONS & SOIL STRATA			
APPROVED	DESIGNED	SITE No.	W.P. No.
		13-268	85-59
DESIGN	CHECK	CONTRACT	
		No.	68-150
DRAWING	CHECK	DRAWING	
		No.	D-6129-2
DATE		LOADING	







- (14) Foundation Investigation Report Ref.: J476 dated March 18, 1960 prepared by William A. Trow & Associates Ltd. for proposed County Road Underpass, Highway 401, North of Blenheim (Harwich Road), WP 83-59, Geocres 40J8-38.

PROJECT NO. J 475

## WILLIAM A. TROW &amp; ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT: Peconic County, N.Y. Interiors RP 83-85

LOCATION: Hwy. 471 - West of Mastic

HOLE LOCATION: Sec D .1

HOLE ELEVATION AND DATUM: 511.0 BM - Lee Dug. 1

BOREHOLE NO. 1

FIELD SUPERVISOR:

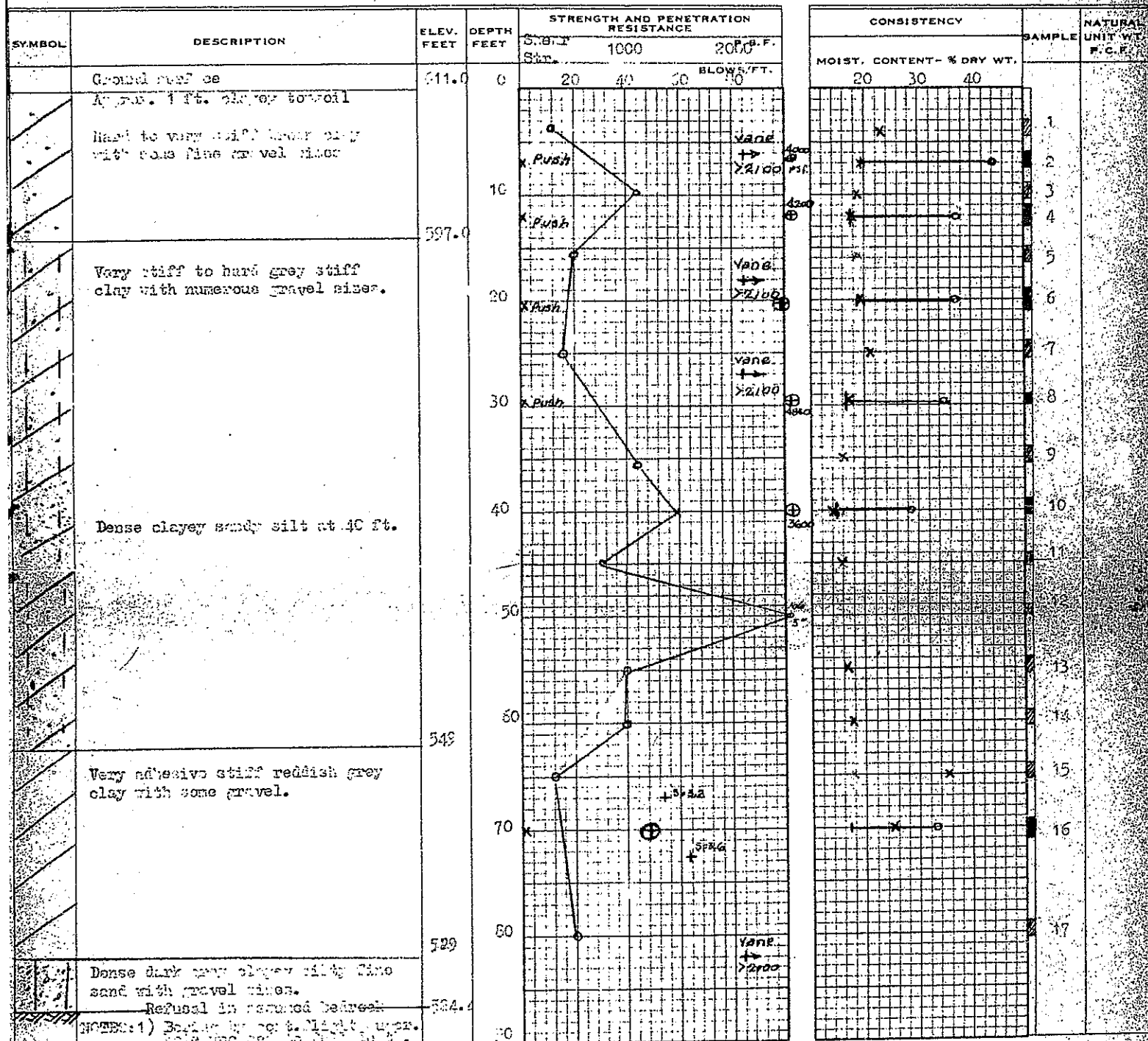
DRILLER:

PREP:

DRAWING NO. 2

## LEGEND

- 2" DIA. SPLIT TUBE
- 2" SHELBY TUBE
- 2" SPLIT TUBE
- 2" DIA. CONE
- CASING
- 2" SHELBY
- 1/2 UNCONFINED COMPRESSION (QU)
- VANE TEST (C) AND SENSITIVITY (SI)
- NATURAL MOISTURE AND
- LIQUIDITY INDEX
- LIQUID LIMIT
- PLASTIC LIMIT



PROJECT NO. J 476

# WILLIAM A. TROW & ASSOCIATES LTD.

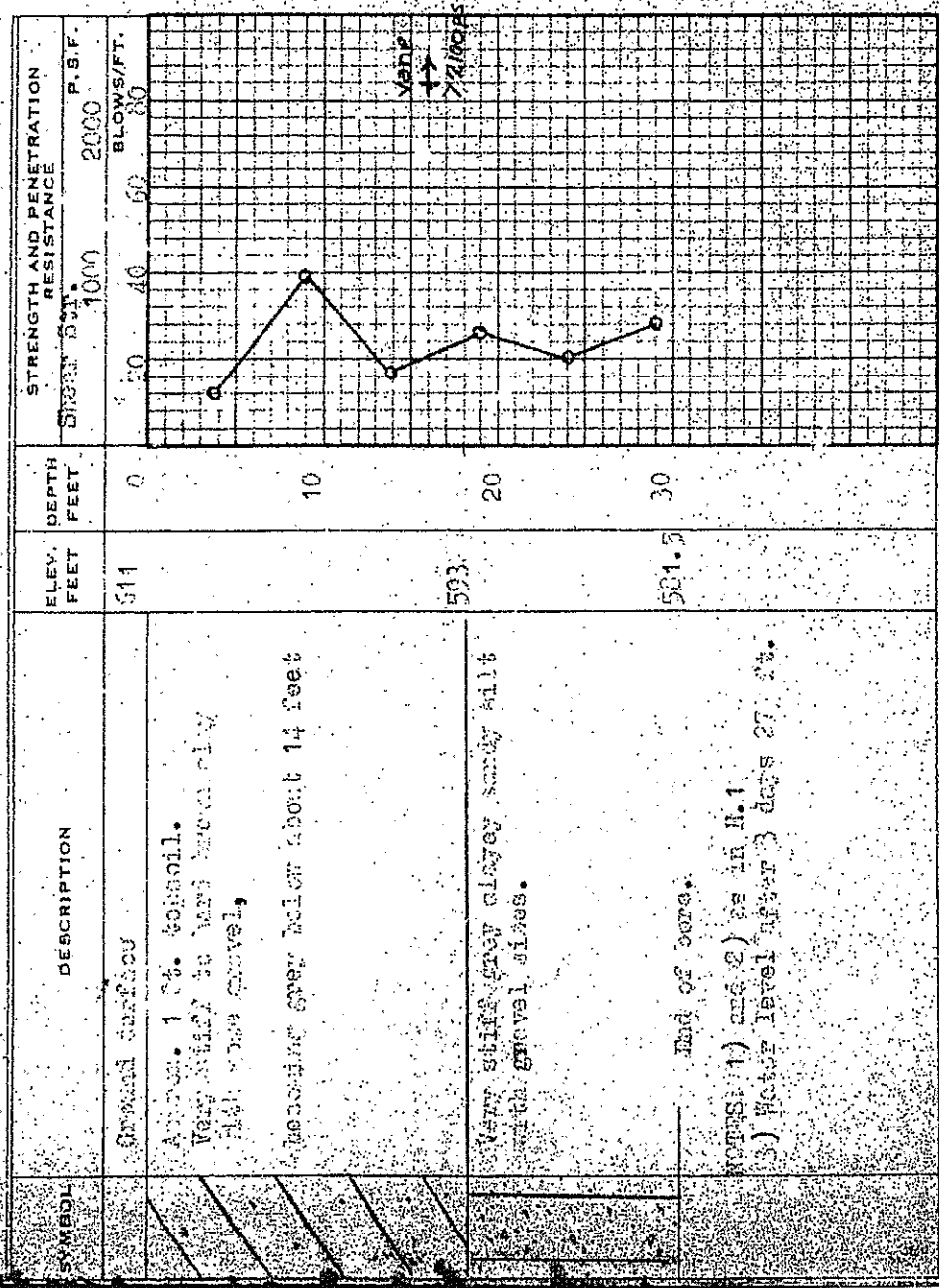
SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

DRAWING NO.

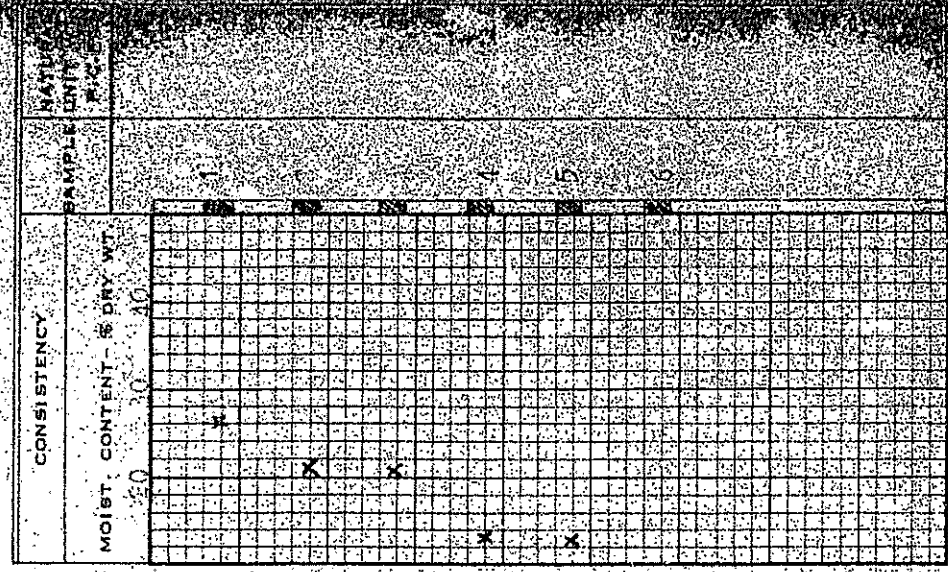
## LEGEND

- 2" DIA. SPLIT TUBE
- 2" SHELBY TUBE
- 2" SPLIT TUBE
- 2" DIA. CONE
- CASING
- 2" SHELBY
- 1/2 UNCONFINED COMPRESSION (QU)
- VANE TEST (C) AND SENSITIVITY (S)
- NATURAL MOISTURE AND LIQUIDITY INDEX
- LIQUID LIMIT
- PLASTIC LIMIT

PROJECT: PROCTOR COUNTY, MISSISSIPPI WP 63-70  
 LOCATION: Hwy. 401 - NORTH OF BLUEMOUNT  
 HOLE LOCATION: See Dwg. 1  
 HOLE ELEVATION AND DATUM: 11.0 ft See Dwg. 1  
 BOREHOLE NO.: 2  
 FIELD SUPERVISOR:  
 DRILLER:  
 PREP:



NOTES: (1) and (2) are in H. 1.  
 (3) Water level after 3 days 27 ft.



PROJECT NO. J 476

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

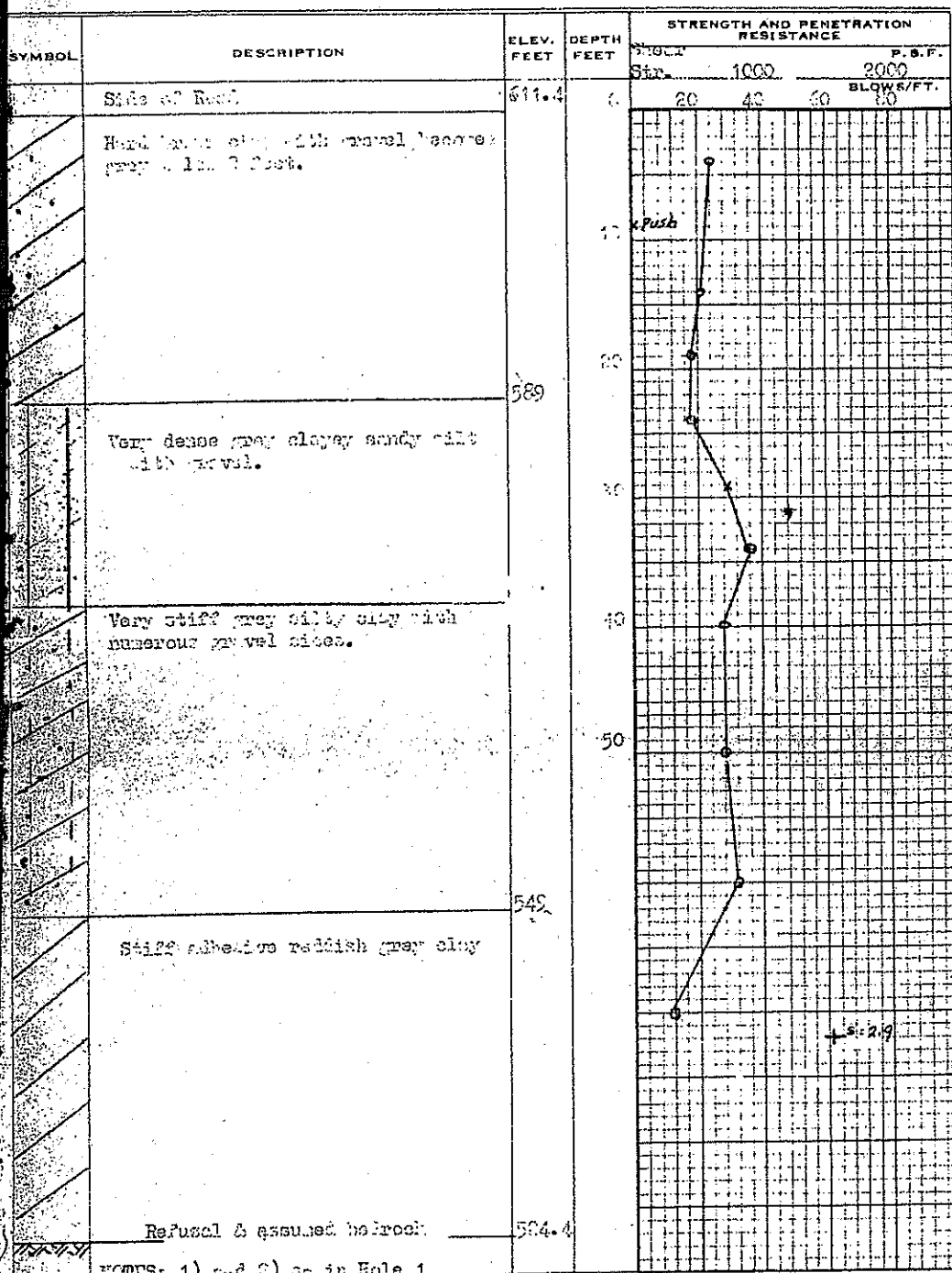
PROJECT Proposed Concrete Waterway WPA-59  
 LOCATION 101-101-101 of Elmwood  
 HOLE LOCATION Office Bldg. 1  
 HOLE ELEVATION AND DATUM C11.1. 20 - 1000 Dg. 1

BOREHOLE NO. 3  
 FIELD SUPERVISOR  
 DRILLER  
 PREP.

DRAWING NO. 4

LEGEND

- 2" DIA. SPLIT TUBE
- 2" SHELBY TUBE
- 2" SPLIT TUBE
- 2" DIA. CONE
- CASING
- 2" SHELBY
- 1/2 UNCONFINED COMPRESSION (QU)
- VANE TEST (C) AND SENSITIVITY (S)
- NATURAL MOISTURE AND LIQUIDITY INDEX
- LIQUID LIMIT
- PLASTIC LIMIT



PROJECT NO. 3 A70

# WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT

LOCATION 1700 101st St. N. W. 1000

HOLE LOCATION S.W. 1/4 Sec. 11, T. 102 N., R. 102 W.

HOLE ELEVATION AND DATUM 511.6

BOREHOLE NO. 1

FIELD SUPERVISOR

DRILLER

PREP

DRAWING NO.

## LEGEND

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA. CONE

CASING

2" SHELBY

1/2 UNCONFINED COMPRESSION (QU)

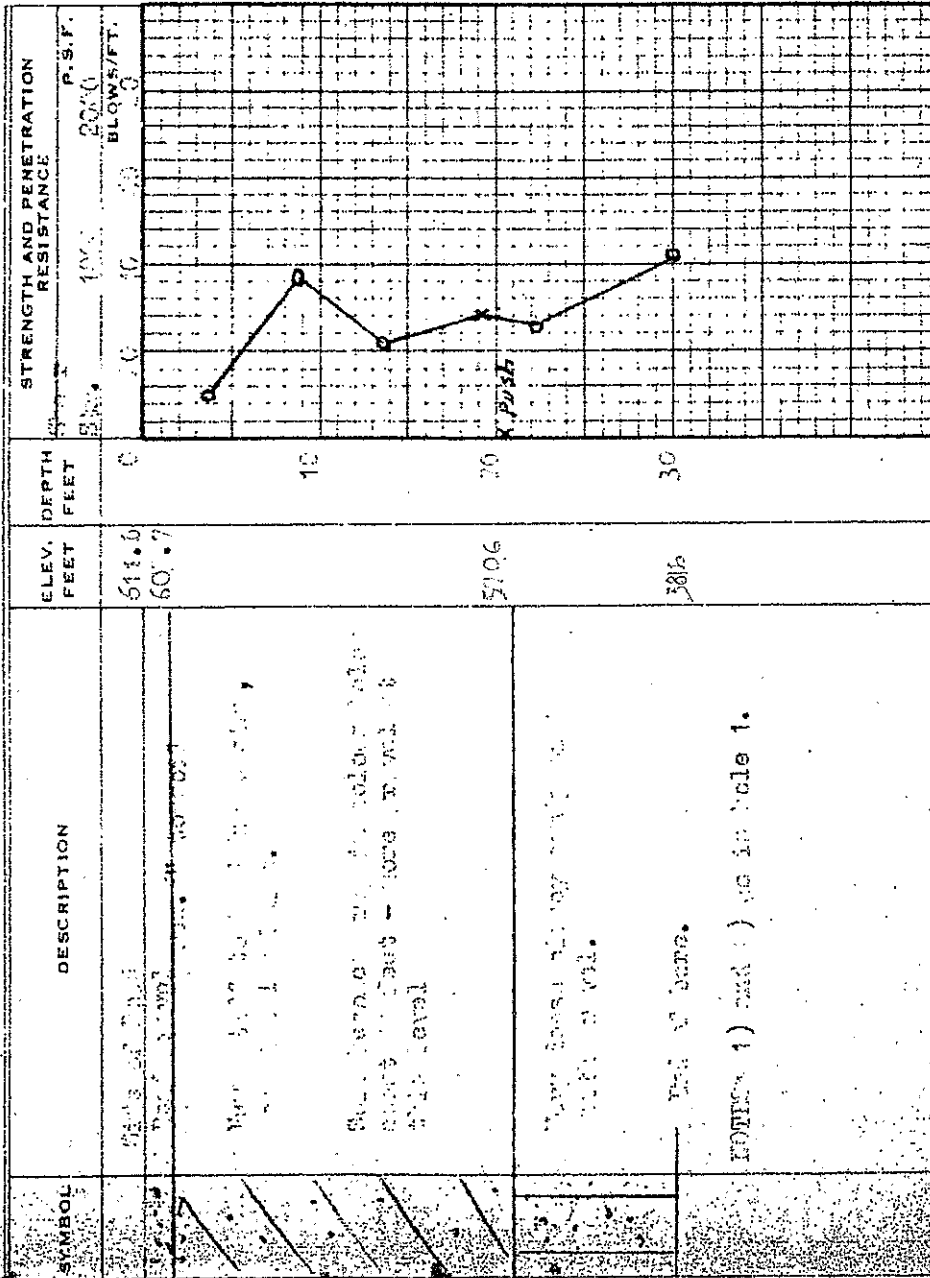
VANE TEST (C) AND SENSITIVITY (S)

NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT

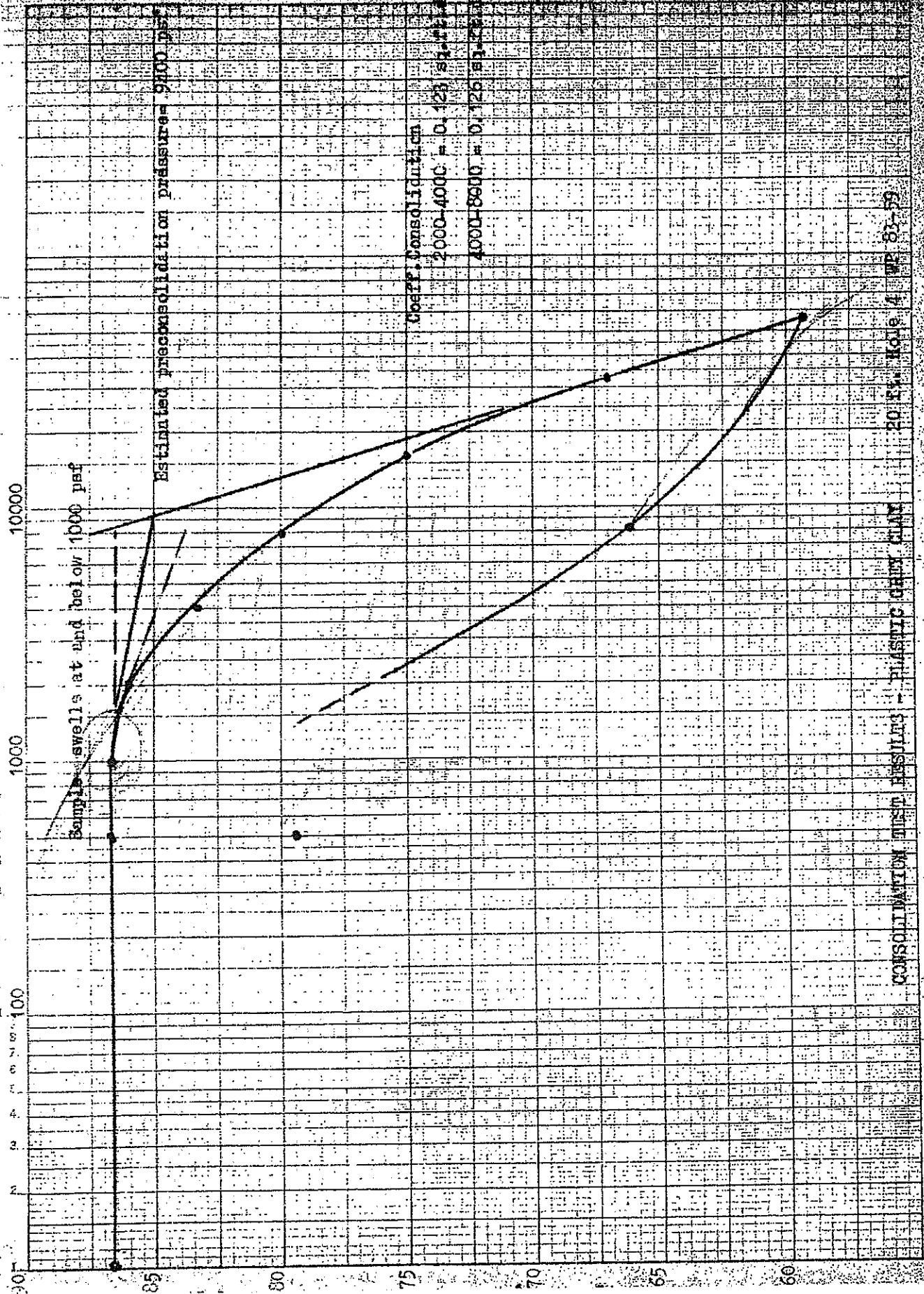


NOTES: 1) and 2) are in hole 1.



SEMI-LOGARITHMIC 359-91G  
 TENTH & EIGHT CO. DIVISION  
 5 CYCLES X 70 DIVISION

Pressure psf



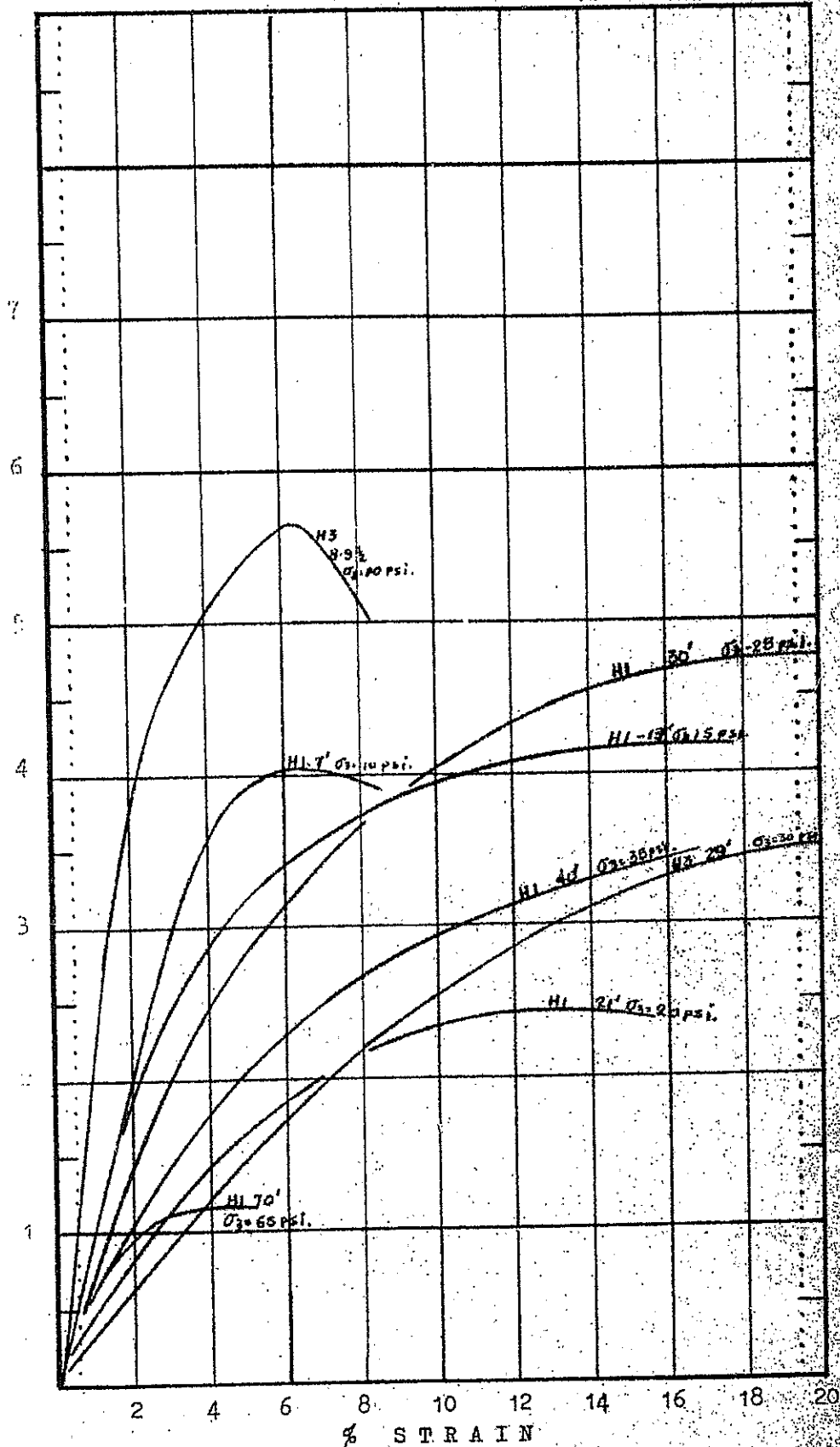
CONSOLIDATION TEST RESULTS - PLASTIC GRAY CLAY

20 ft. Hole 4 WP 81-59

PROJECT NO. J 476

DRAWING NO.

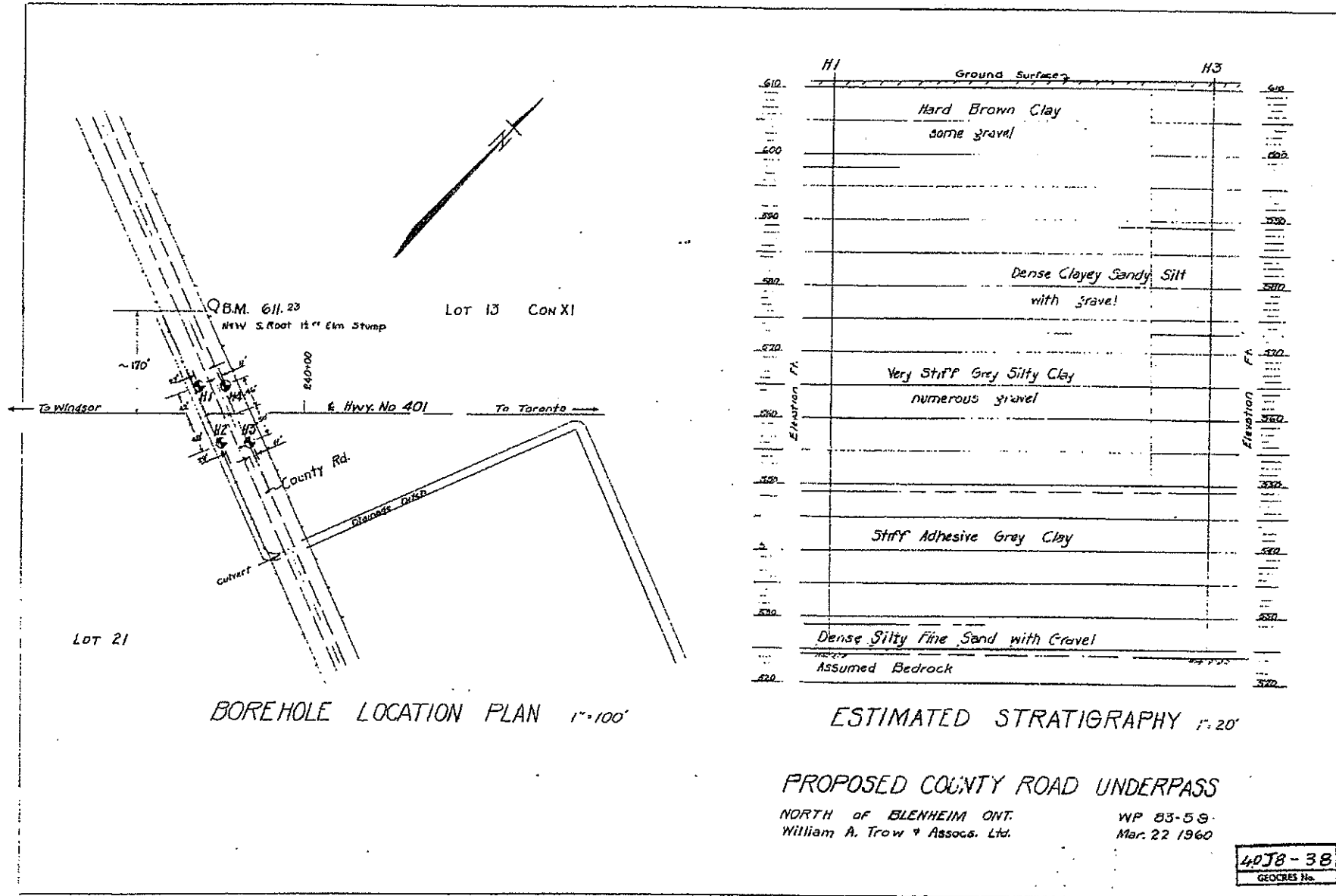
SHEAR STRESS ksf



STRESS STRAIN CURVES - UNDRAINED TRIAXIAL TEST RESULTS

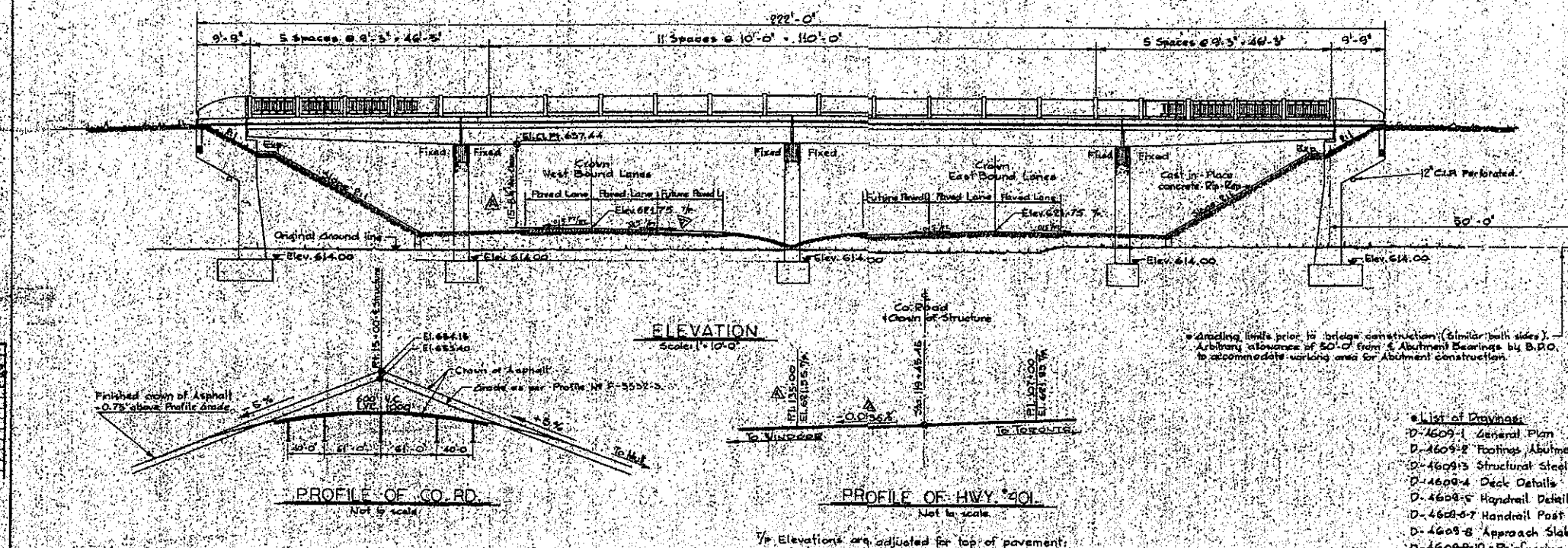
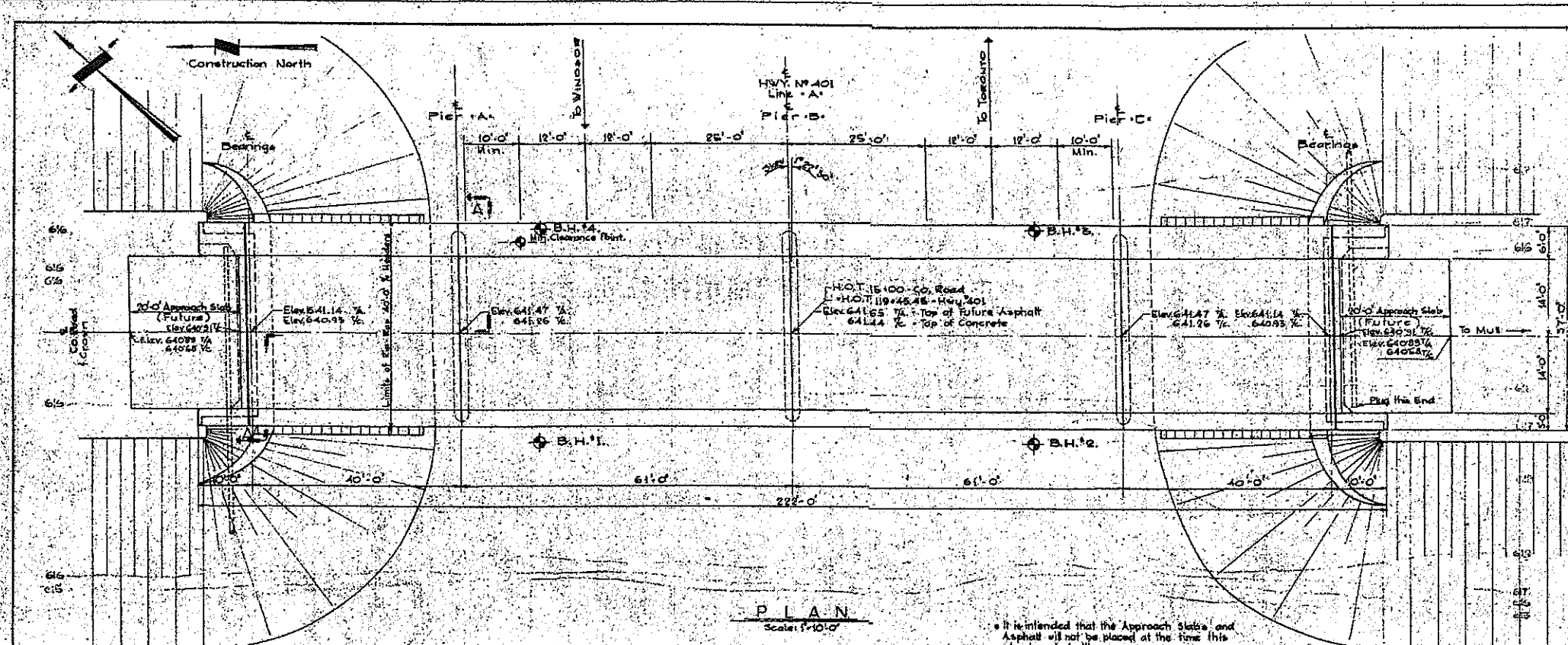
WILLIAM A. TROW AND ASSOCIATES HOLES 1 & 2.3 WP 83-59

Harwich Road U/Pass





- (15) Contract drawings for Mull Side Road Underpass, WP 84-59 dated September 1960.



Data for SKEW  $\alpha = 1^\circ 22' 30''$   
 Sin  $\alpha = 0.02396$   
 Cos  $\alpha = 0.99972$   
 Tan  $\alpha = 0.024003$   
 Cot  $\alpha = 41.661658$   
 Sec  $\alpha = 1.00028$

### SOIL DATA

#### Borehole #1

Elev. 616.4 - Ground Surface  
 Brown stiff clay, some fill some coarse gravel, some gray silt bands, trace coarse sand. - Elev. 612.00 -  
 Med. dense brown fill, some silt, some in gray bands, some clay, trace coarse sand, some med. gravel. - Elev. 607.00 -  
 Med. dense gray fill, texture and materials as above. - Elev. 602.00 -  
 Med. dense gray fill, some silt, some clay, trace coarse sand, trace med. gravel. - Elev. 600.00 -  
 Med. dense gray fill, some silt, some clay, trace coarse sand, trace med. gravel. - Elev. 598.00 -  
 Dense gray fill, some silt, some clay, trace coarse sand, trace med. gravel. - Elev. 588.00 - End of B.H.

#### Borehole #2

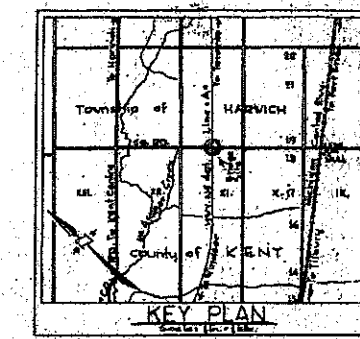
Elev. 616.4 - Ground Surface  
 Compact brown fill, some clay, some silt, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 612.00 -  
 Med. dense brown glacial fill, some silt, some clay, some gray silt bands, trace coarse sand, some med. gravel, trace med. gravel. - Elev. 607.00 -  
 Med. dense gray fill, some silt, some clay, some coarse sand, trace gray silt bands, some med. gravel, trace med. gravel. - Elev. 600.00 -  
 Med. dense gray fill, some silt, some clay, some coarse sand, trace gray silt bands, some med. gravel, trace med. gravel. - Elev. 598.00 -  
 Firm gray silt, trace coarse sand, trace med. coarse gravel, plastic, very moist. - Elev. 592.00 -  
 Dense gray glacial fill, predominantly silt, some clay, trace coarse sand, trace med. gravel, some coarse gravel. - Elev. 587.00 - End of B.H.

#### Borehole #3

Elev. 616.4 - Ground Surface  
 Loose, brown, unconsolidated coarse sand, trace med. gravel. - Elev. 612.00 -  
 Med. dense brown fill, some silt, some clay, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 607.00 -  
 Med. dense gray fill, some silt, some clay, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 600.00 -  
 Med. dense gray fill, some silt, some clay, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 598.00 -  
 Med. dense gray glacial fill, mostly silt, some clay, trace coarse sand, trace med. gravel, trace med. gravel. - Elev. 592.00 -  
 Loose coarse gravel, some med. gravel, trace fine coarse sand. - Elev. 577.00 - End of B.H.

#### Borehole #4

Elev. 616.4 - Ground Surface  
 Loose coarse sand, brown, unconsolidated. - Elev. 612.00 -  
 Med. dense brown fill, some silt, some clay, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 607.00 -  
 Med. dense gray fill, some silt, some clay, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 600.00 -  
 Med. dense gray fill, some silt, some clay, some coarse sand, trace coarse gravel, trace med. gravel. - Elev. 598.00 -  
 Med. dense gray glacial fill, mostly silt, some clay, trace coarse sand, trace med. gravel, trace med. gravel. - Elev. 592.00 -  
 Loose coarse gravel, some med. gravel, trace fine coarse sand. - Elev. 577.00 - End of B.H.



### NOTES

- Note to District Engineers:**  
Concrete work on this structure must not be commenced until monuments to fix control points have been erected and checked by the District Engineer.
- Note to General Contractor:**  
Structure to be built in accordance with Form N98 revised March 1967 and the Special Provisions, extra copies of which may be obtained from the District Engineer.  
No concrete to be placed above bridge seat elevations until concrete in Deck slabs has been placed.  
The General Contractor shall be responsible for finishing the bridge seats dead level to the specified elevations with a tolerance of plus or minus 1/8 inch. If they are cast too high they shall be bush hammered down by the General Contractor. If they are cast too low the General Contractor shall provide full bearing shims to bring them up to the correct elevations. The use of grout is prohibited.
- Concrete Mix:**  
Minimum strength @ 28 days: Footings, Structure & Deck: 5000 p.s.i.  
Maximum size aggregate: Footings, Structure & Deck: 3/4".  
An approved admixture supplied by the Department added to all concrete as specified by the Engineer.
- Boring Data:**  
The complete soil investigation report BA 1033, may be examined at the Bridge Division, Administration Bldg., Downsview, Ontario. The Department does not guarantee the accuracy of this report or the abridged version shown on these plans.
- Reinforcing Steel:**  
Clear cover 2", where in contact with ground 3", or as specified.
- Construction Notes:**
  - All exposed edges to be chamfered 1".
  - Contractor to seal puncture for anchor rods against leakage.
  - Do not pour Ballast Bed before backfill is placed in underside of abutment beam.

Site 13-237

W.P. 84-59

DEPARTMENT OF HIGHWAYS, ONTARIO BRIDGE OFFICE-TORONTO			
MULL SIDE RD. UNDERPASS 6.8 MI. W. OF HWY. NO. 21			
THE KING'S HIGHWAY NO. 401			
CO. KENT			
TWP. HARWICH LOT 16 1/2 CON. 16 1/2			
GENERAL PLAN			
APPROVED			
DATE: SEPT. 1960			

- List of Drawings:
- D-4609-1 General Plan
- D-4609-2 Footings, Abutments & Piers
- D-4609-3 Structural Steel
- D-4609-4 Deck Details
- D-4609-5 Handrail Details
- D-4609-6 Handrail Post Details
- D-4609-7 Approach Slabs & Rip-Rap
- D-4609-8 Reinforcing Bar Wks.

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
1960	W.B.S.	GENERAL NOTES REV. BACKSLOPE REMOVED	1960	W.B.S.	GENERAL NOTES REV. BACKSLOPE REMOVED
1960	W.B.S.	GENERAL NOTES REV. BACKSLOPE REMOVED	1960	W.B.S.	GENERAL NOTES REV. BACKSLOPE REMOVED





- (16) Foundation Investigation Report for proposed crossing road allowance between Lots 18 and 19 Highway 401 (Mull Road), WP 84-59 prepared by Dominion Soil Investigation Ltd. Ref. 60-F-221, dated April 1960, Geocres 40J8-23.

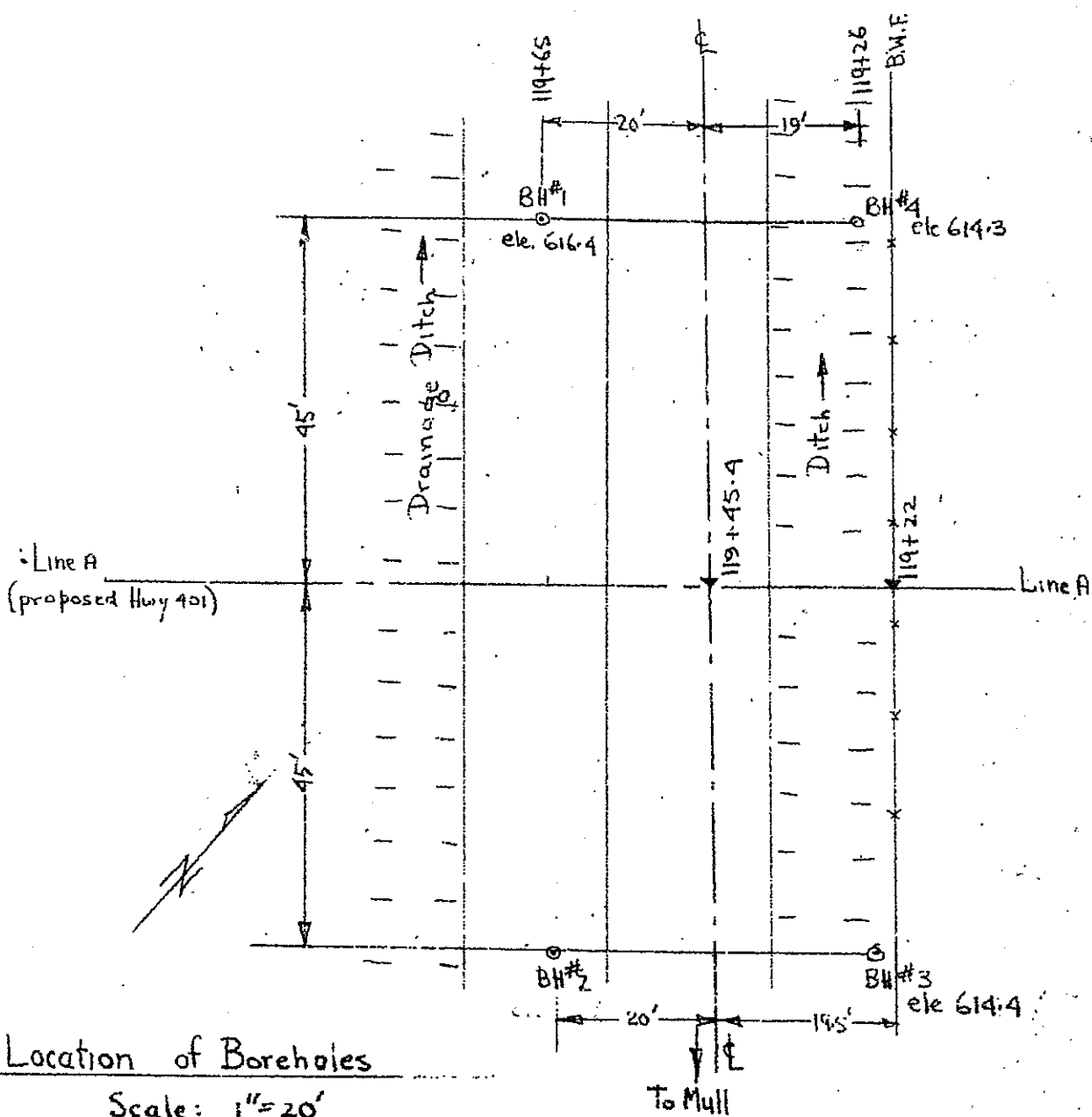
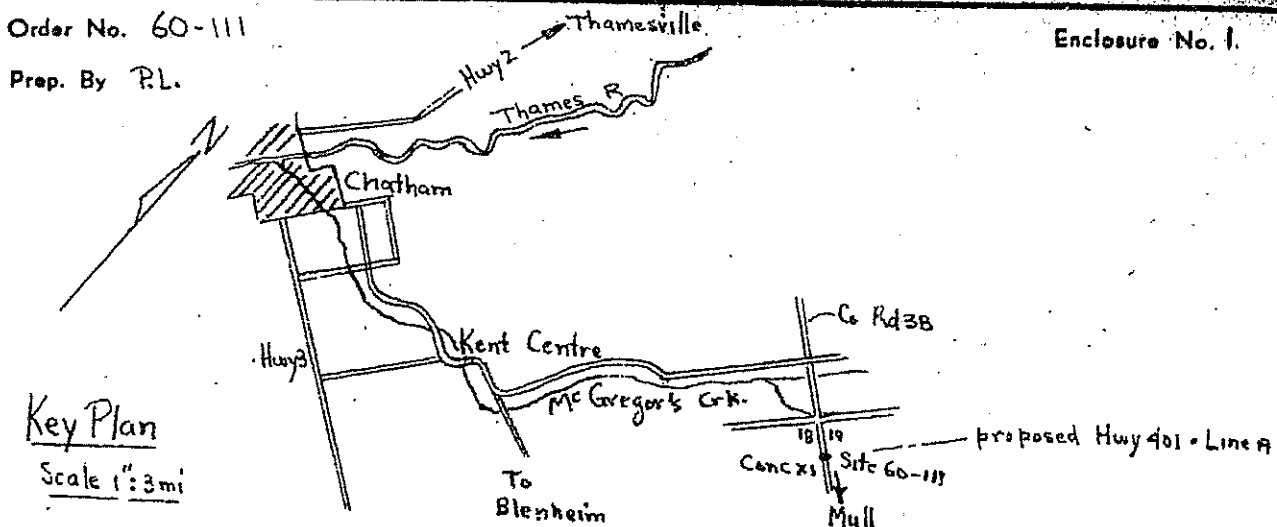
Order No. 60-111

Prep. By R.L.

Enclosure No. 1.

Key Plan

Scale 1"=3 mi



Location of Boreholes

Scale: 1"=20'

Dominion Soil Investigation Ltd.



Order No. 60-111

Enclosure No. 3

Enclosure No. 16

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole 2

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole 1

Project: 2401 Hwy. Bridge

Location: 401 Hwy., Kent Co., Rd. 38, Line 1

Hole Location: Sta. 119+65 - 45' Lft. of A

Hole Elevation and Datum: 616.6 Line A

Field Supervisor: P.L. Prep: P.L.

Driller: C.I. Checked:

**LEGEND**

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

2" Soil tube

2" Dia. Cone

Casing

Date: Feb. 3, 60

Sampling Method

2" Dia. split tube

2" Shallow tube

Consistency

Natural moisture and

Liquidity Index (LI)

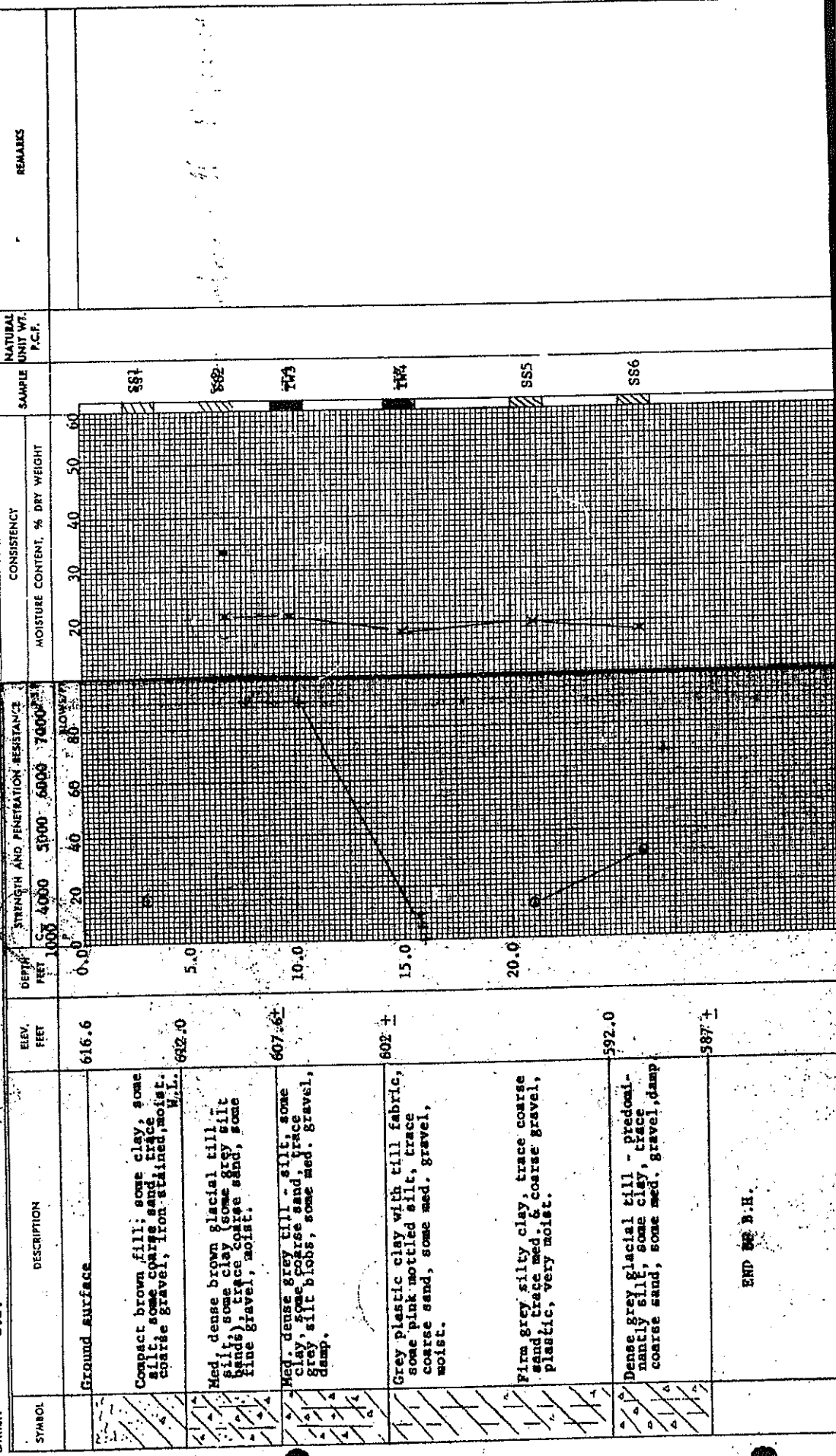
Liquid limit

Plastic limit

X LI

-0

1



END OF B.H.

Order No. 60-111

Enclosure No. 4

60-111-4

Enclosure No.

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole: 3

**Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole:

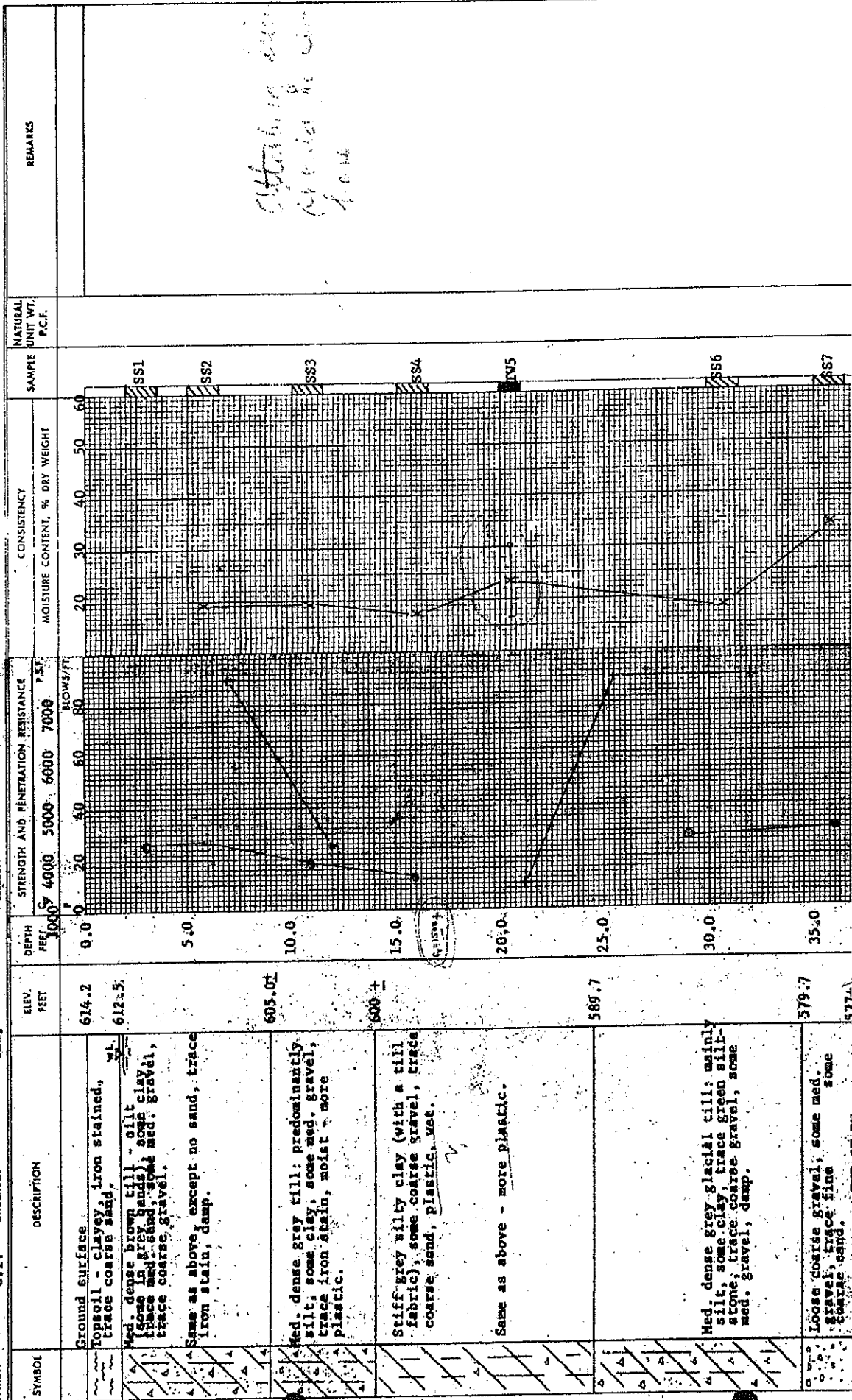
Date: Feb. 5, 1960.

Project: 401 Hwy. Bridge  
Location: 401 Hwy. Line 'A', Kent Co.  
Hole Location: S24 119+25.5 - 45' Lft.  
Hole Elevation and Datum: 614.2  
Field Supervisor: P.L. Prop.  
Driller: C.I. Checked:

LEGEND  
Shear Strength (C)  
Unconfined compression  
Vane test and sensitivity (S)  
Penetration Resistance (P)  
2" Split tube  
2" Dia. Cone  
Coring

LEGEND  
Consistency  
No. 101 moisture and  
Liquid limit (LL)  
Liquid limit  
Plastic limit

Sampling Method  
2" Dia. split tube  
2" Shelby tube



Attaching sheet to 60-111



Order No. 160-111

Enclosure No. 5

Enclosure No. 4

# **Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole

# **Dominion Soil Investigation Ltd.**

Engineering Data Sheet for Borehole

Project: 401 Hwy. Bridge

Location: Hwy. 401, Line 'A', Kent Co. 38

Hole Location: Sta. 119+26 - 45' E. of Line 'A'

Hole Elevation and Datum: 614.3

Field Supervisor: P.L. Prep: P.L.

Driller: C.I. Checked: [Signature]

Date: Feb. 5, 61

## **LEGEND**

Consistency  
Natural moisture and  
Liquidity Index (LI)  
Liquid limit  
Plastic limit

Sampling Method  
2" Dia. split tube  
2" Shelby tube

## **LEGEND**

Shear Strength (C)  
Unconsolidated compression  
Vane test and sensitivity (S)  
Vibration Resistance (R)  
2" Split tube  
2" Dia. Cone  
Casing

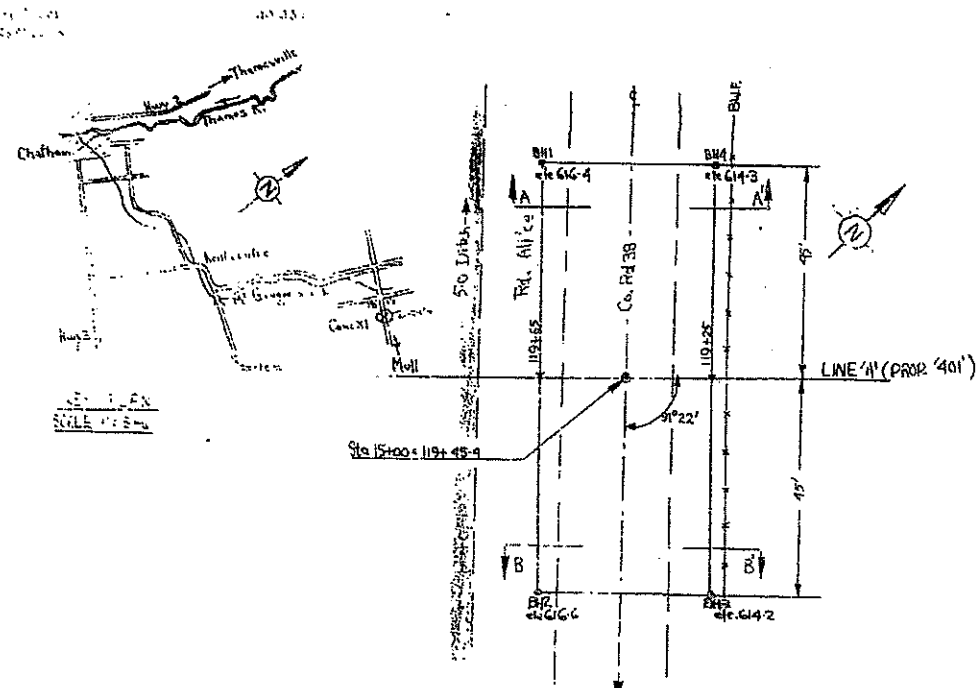
SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH, FEET	STRENGTH AND PENETRATION RESISTANCE	CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
				1000 2000 3000 4000 5000 6000 7000	MOISTURE CONTENT, % DRY WEIGHT			
	Ground surface	614.3	0.0					
	Clayey organic topsoil, brown, iron stained.	612.8	1.5					
	Med. dense brown till - some clay, some silt, some bands of grey silt, trace coarse sand, some med. gravel, trace coarse gravel, trace iron stain, moist.		5.0			SS1		
	Med. dense grey till; predominantly silt, some clay, trace coarse sand, some med. gravel, trace coarse gravel, bands of iron stain.	606.5	10.0			SS2		
	Same as above		15.0			SS3		
	Silt, silty clay, heavily banded, absence of gravel, not tappable.	599.5	20.0			SS4		
	Med. dense grey glacial till - silt, some clay, some med. gravel, trace coarse gravel.	595.3	25.0					
	Dense grey till - as above.	586.3	30.0			TW5		
	END OF B.H.							

*Handwritten:*  
Vibration  
Resistance

LAB TEST SUMMARY

Enclos. 7

<u>Borehole &amp; Sample No.</u>	<u>Moisture Content %</u>	<u>w - pcf</u>	<u>Qu(psf)</u>	<u>Strain</u>	<u>Liquid Limit</u>	<u>Plastic Limit</u>
BH#2 - S#2	21.4					
3	21.1	132.9	7,015	14.15%		
4	18.2	130.3	4,325	20%	33.4	17.45
5	20.0					
6	18.3					
BH#3 - S#2	19.2					
3	19.4					
4	17.3					
5	23.9	132.6	2,860	20%	30.1	16.7
6	18.1					
7	34.3					
BH#4 - S#5	17.9	134.6	5,720	20%		

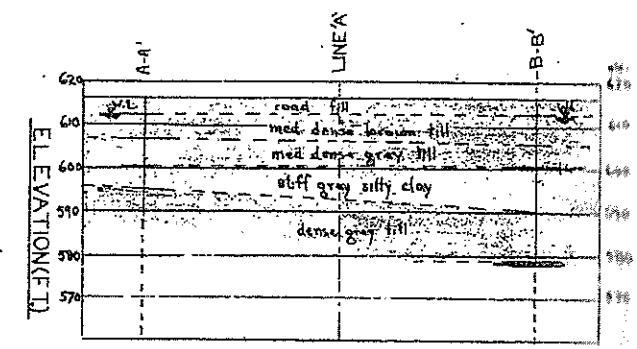


#### LEGEND

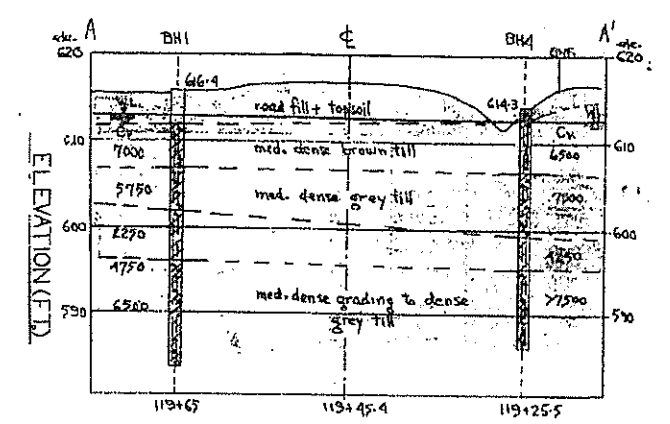
- W<sub>g</sub> - free water table level
- BH<sub>n</sub> - bore hole
- ± - construction line
- C<sub>v</sub> - insitu vane shear strength (psf.)
- Co.Rd - county road
- ELEVATION - geodetic datum ft.

#### SOILS LEGEND

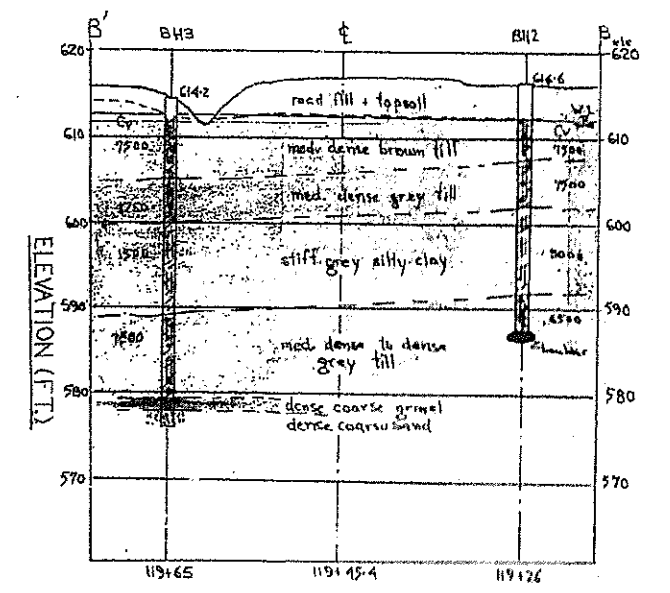
- ☐ Road fill: clay, sand, till, gravel
- ☒ Med dense till: grey, oxidizes to brown, silt, clay, sand, gravel
- ☐ Stiff grey silty clay
- ☐ Dense coarse black gravel: predom. shell, some sand
- ☐ Dense coarse grey sand, some silt



PROFILE ALONG ± OF CO. RD. NO. 38  
SCALE 1" = 20'



SUBSURFACE SECTION NORTHWARD A-A'  
SCALE 1" = 10'



SUBSURFACE SECTION SOUTHWARD B-B'  
SCALE 1" = 10'

ONTARIO DEPARTMENT OF HIGHWAYS  
MATERIALS & RESEARCH SECTION

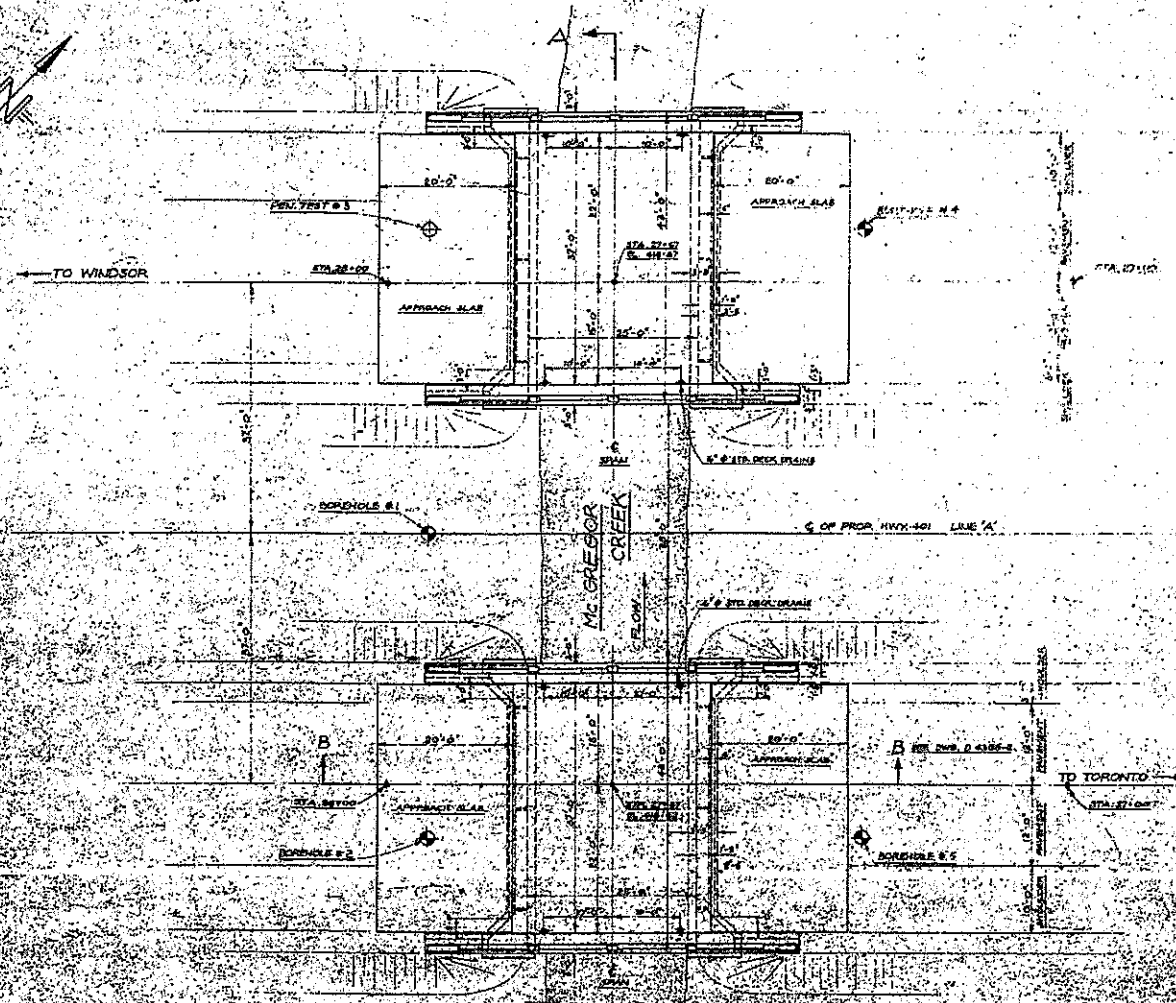
SUBSURFACE SECTIONS  
PROPOSED HWY 401 (LINE A') - KENT CO.  
HIGHWAY TRV RD. NO. 38 - CONC. XI  
V.P. 84-53

DOMINION SOIL INVESTIGATION LTD.  
60 EGLINTON AVE. E. - TORONTO  
FIELD SUR-RL  
DRAWN-RL  
JOB NO. 60-111 FEB 10/60 ENCL. 5

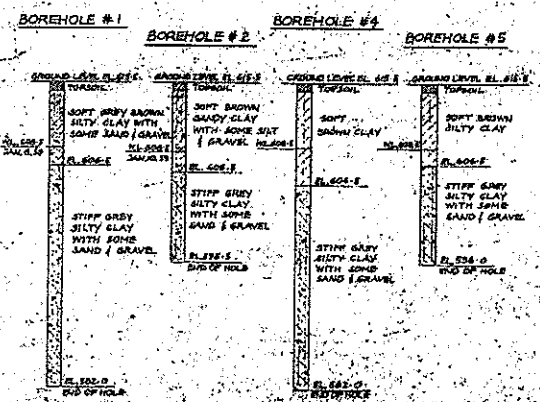


- (17) Contract drawings for Harwich Township Bridge No. 1A (Taff Creek Drain Bridges EBL and WBL), WP 17-59, dated November 1959.

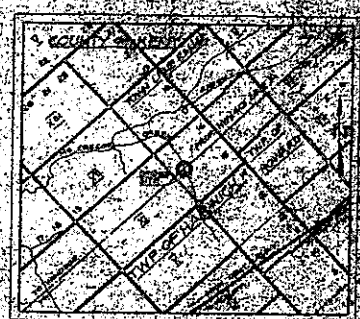




BRIDGE PLAN



SOIL PROFILE



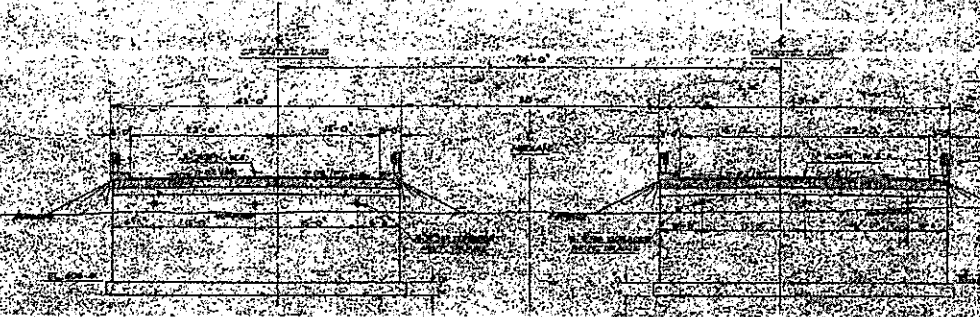
KEY PLAN

NOTE TO DISTRICT ENGINEER  
Concrete works of this structure have been completed and the control points have been erected and placed in the ground.

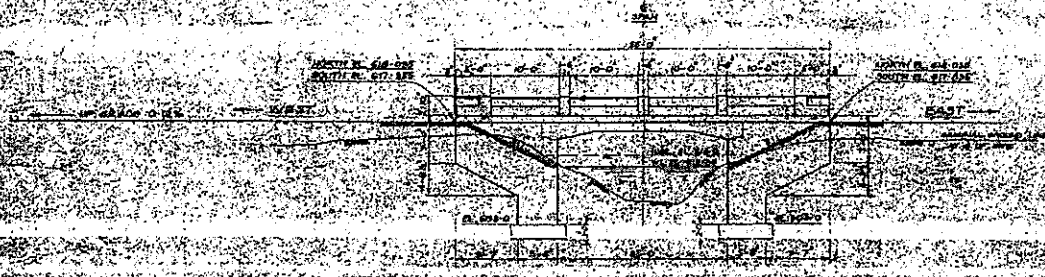
NOTE TO CONTRACTOR  
Structure to be built in accordance with the plans and specifications and extra copies of which may be obtained from the District Engineer. All construction work must be approved by the District Engineer.

CONCRETE  
Minimum strength 3,000 p.s.i. in testing. Concrete to be placed in approved formwork and compacted by the contractor. Concrete to be finished by the contractor. Maximum width of concrete to be 4 feet. Concrete to be placed in 4 foot wide forms.

CONSTRUCTION  
All exposed work shall be finished and painted. All work shall be done in accordance with the specifications and standards of the District Engineer.



SECTION A-A



BRIDGE ELEVATION

PROFILE

SCALE 1/2\"/>





- (18) Foundation Investigation Report on Highway 401 Line 'A' and Drainage Ditch Crossing Lot 15 Townline Range, Township of Harwich (Taff Creek Bridges EBL and WBL), WJ F-59-1, WP 17-59, dated March 18, 1959, Geocres 40I5-6.

TAFF CREEK BRIDGES

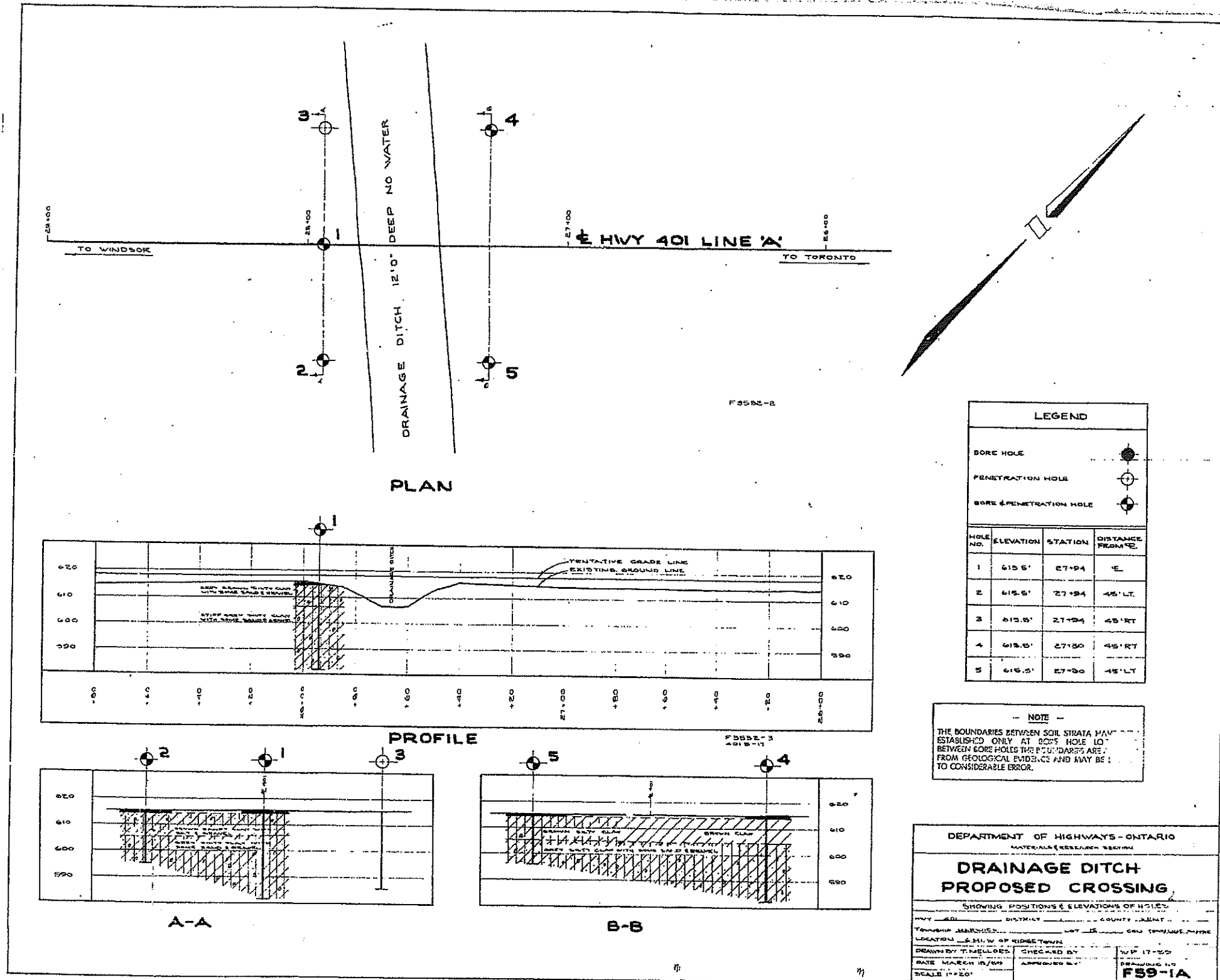


TABLE NO. I.

## SUMMARY OF FIELD &amp; LABORATORY TESTS

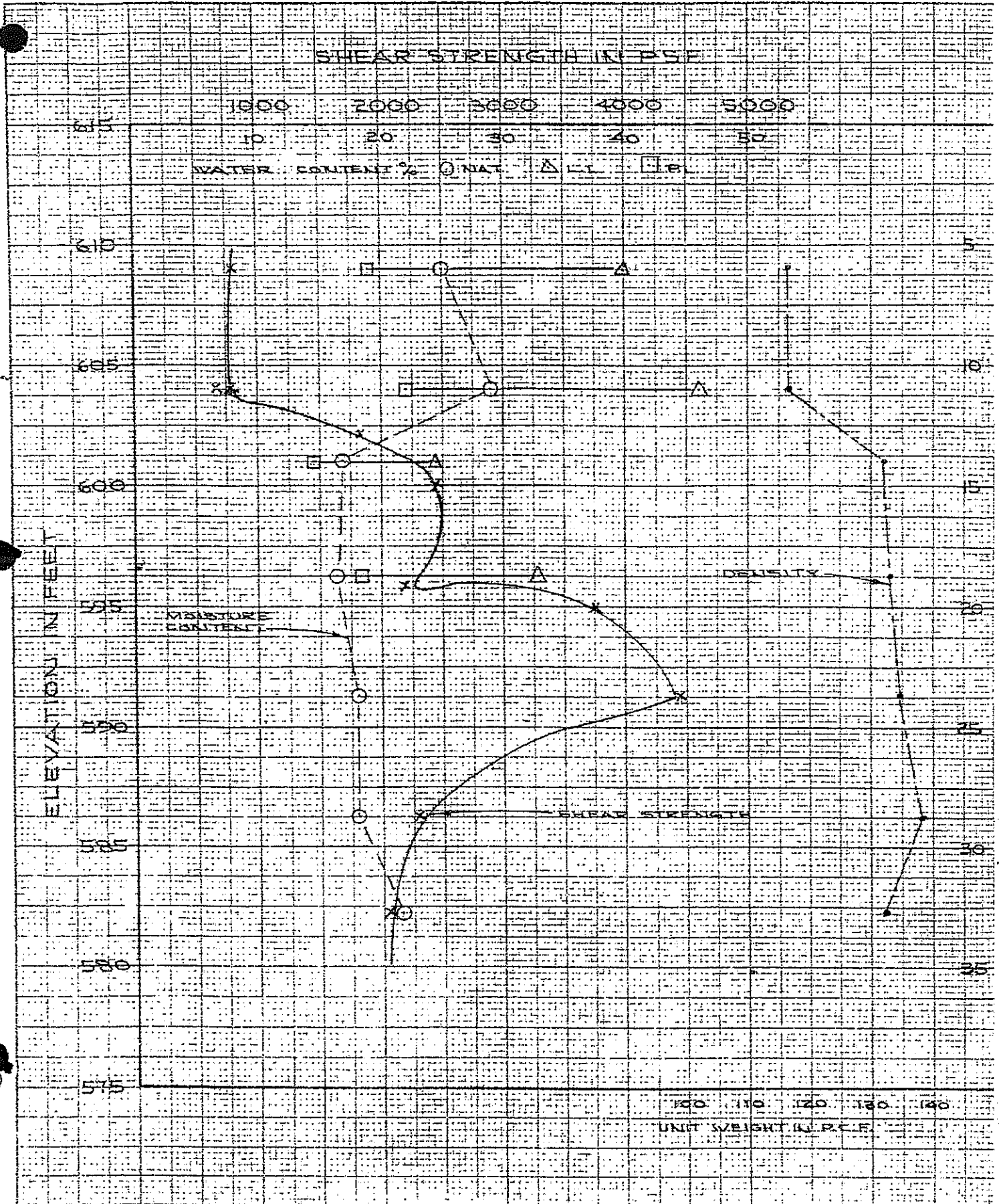
JOB F-59-1W.P. 17-59

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT D.C.F.	REMARKS
1	T1	5'-7'	Soft grey-brown silty clay.	7	24.6	27.3	43.5	792	118.3	
1	T2	10'-11'6"	Stiff grey silty clay.	18	28.6	-	-	-	-	
1		12'	Stiff grey silty clay.	-	-	-	-	1875	-	In-Situ Vane Test, S = 2.
1		15'	Stiff grey silty clay.	-	-	-	-	2438	-	In-Situ Vane Test, S = 2.
1	S3	18'-19'6"	Stiff grey silty clay.	24	18.6	14.1	24.2	2160	133.0	
1		20'	Stiff grey silty clay with some sand and fine gravel.	-	-	-	-	3750	-	In-Situ Vane Test, S = 1.
1	S4	23'-24'6"	Stiff grey silty clay.	20	18.1	-	-	-	-	Approximately 20% sand throughout.
1	S5	28'-29'6"	" " "	25	18.0	-	-	-	139.0	
1	S6	32'-33'6"	" " "	21	21.4	-	-	2050	142.3	
2	T1	5'-7'	Soft brown sandy clay with silt.	6	24.8	19.1	39.1	1585	123.8	Approximately 16% sand throughout.
2	T2	10'-12'	Soft to medium grey clay.	11	31.6	21.1	47.2	676	114.8	
2	T3	18'-20'	Stiff grey silty clay.	35	16.3	18.1	32.6	2420	132.3	
4	T1	5'-7'	Soft brown clay.	7	23.5	19.8	43.4	-	126.5	
4	T2	10'-12'	Soft to medium grey-brown silty clay.	18	28.6	22.2	46.3	764	118.3	Approximately 16% sand throughout.
4	S3	18'-19'6"	Stiff grey silty clay.	24	17.9	-	-	-	-	
4	S4	23'-24'6"	" " "	32	18.4	-	-	4450	134.5	
4	S5	28'29'6"	" " "	17	21.4	-	-	2300	137.5	
4	S6	32'-33'6"	" " "	13	20.	-	-	-	133.0	

cont'd. /2 ...

## SUMMARY OF FIELD & LABORATORY TESTS

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
5	T1	5'-7'	Soft to medium brown silty clay.	6	30.5	27.0	48.8	1224	114.8	Approximately 22% sand throughout.
5	T2	13'-15'	Stiff grey silty clay.	31	16.8	14.7	24.5	2810	131.8	
5	T3	18'-19'6"	" " "	31	17.5	-	-	-	-	
T1 - Denotes thin walled shelly sample. S1 - Denotes split spoon sample.										





DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BOREPENET'N JOB F-59-1 WP 17-59 BORING 1 STA. 27-94.5  
CASING EX-EX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 7 JAN 1959

### ABBREVIATIONS

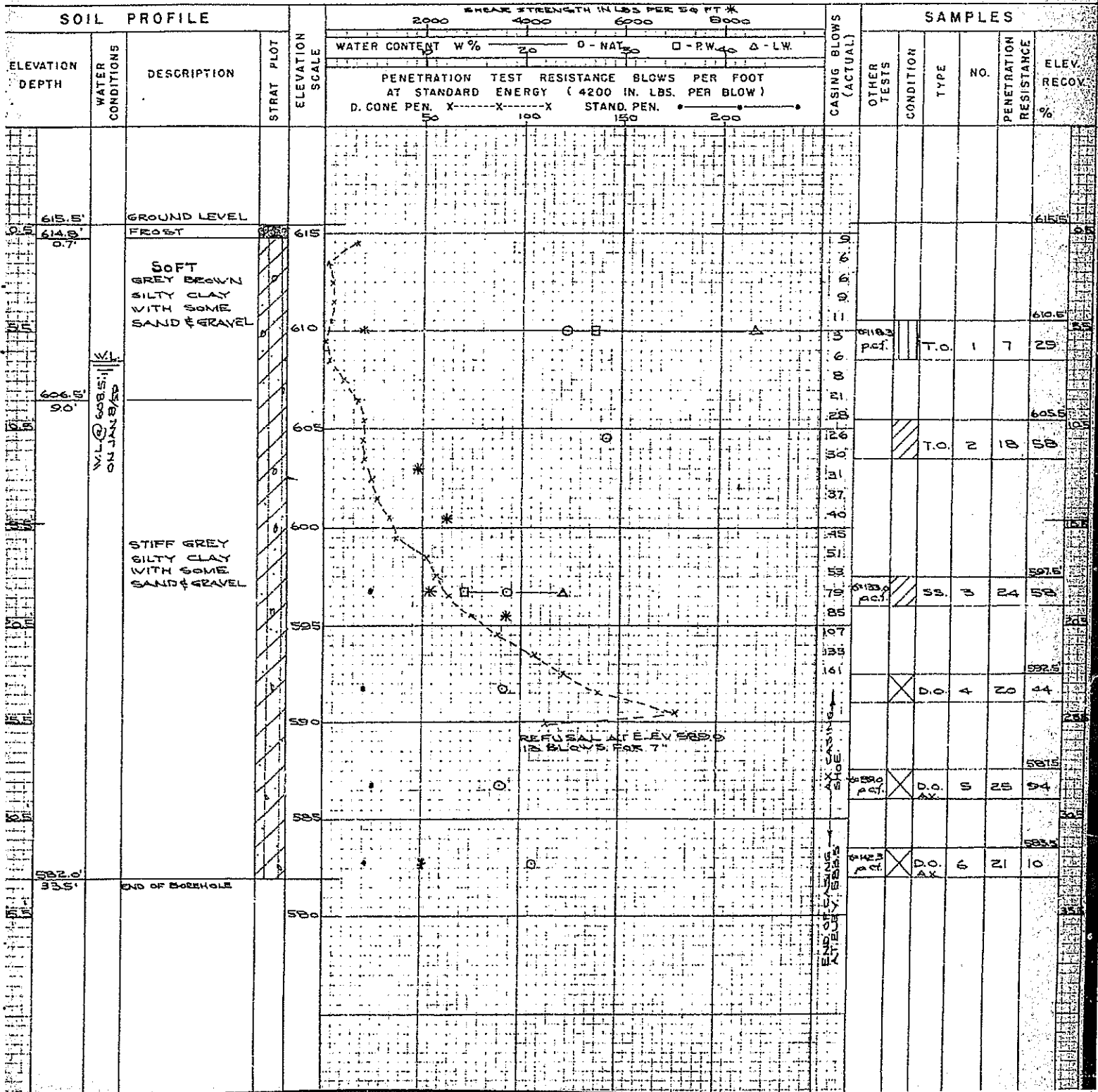
V - INSITU VANE SHEAR TEST	Q - TRIAXIAL QUICK	K - PERMIABILITY
M - MECHANICAL ANALYSIS	S - TRIAXIAL SLOW	C - CONSOLIDATION
U - UNCONFINED COMPRESSION	WL - WATER LEVEL IN CASING	CA - CASING
QC - TRIAXIAL CONSOLIDATED QUICK	WT - WATER TABLE IN SOIL	γ - UNIT WEIGHT

## SAMPLE TYPES

C.S. - CHUNK	S.S. - SLEEVE SAMPLE
D.O. - DRIVE OPEN	P.S. - PISTON SAMPLE
D.F. - DRIVE FOOT VALVE	W.S. - WASHED SAMPLE
T.O. - THIN WALLED OPEN	R.C. - ROCK CORE

SAMPLE CONDITION

4 DISTURBED  
 3 FAIR  
 2 GOOD  
 1 LOST



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG S4-S OPERATION BORE & PENETIN JOB F-59-1 WP. 17-59 BORING 2 STA 27+94 (4511)  
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MAR 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 15 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 9 JAN 1959

## ABBREVIATIONS

V - INSITU VANE SHEAR TEST O - TRIAXIAL QUICK K - PERMIABILITY  
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION  
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING  
Q<sub>c</sub> - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT

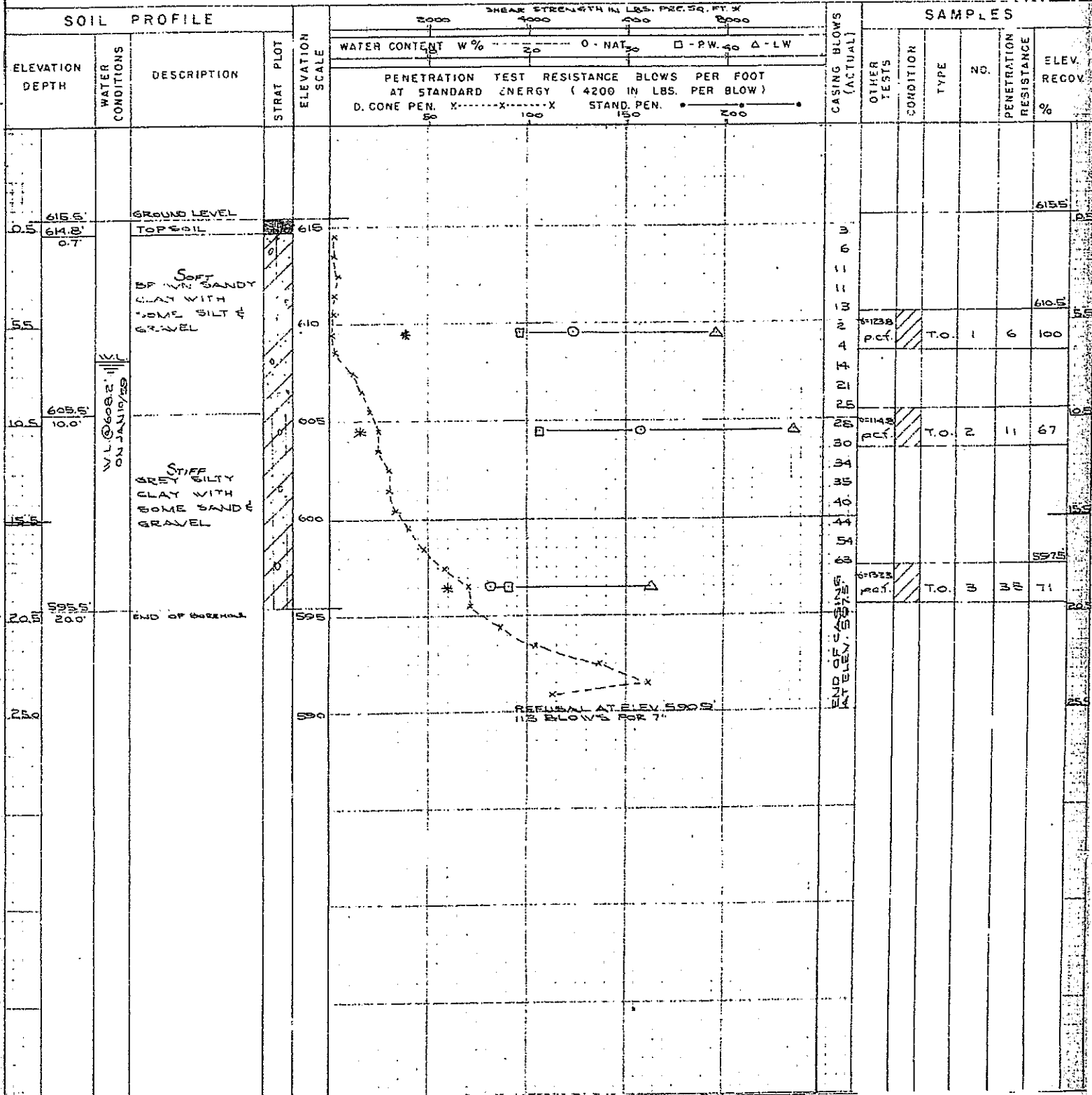
## SAMPLE TYPES

CS - CHUNK SS - SLEEVE SAMPLE  
DO - DRIVE OPEN PS - PISTON SAMPLE  
DF - DRIVE FOOT VALVE WS - WASHED SAMPLE  
TO - THIN WALLED OPEN RC - ROCK CORE

## SAMPLE CONDITION



- DISTURBED  
- FAIR  
- GOOD  
- LOST



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG 54-S OPERATIONS BORE & PENET. JOB F-59-1 WP 17-59 BORING 1 STA. 27+94.4  
CASING EX-AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY Y.K. DATE BORING 7 JAN 1959

**ABBREVIATIONS**

V - INSITU VANE SHEAR TEST    Q - TRIAXIAL QUICK    K - PERMIABILITY  
M - MECHANICAL ANALYSIS    S - TRIAXIAL SLOW    C - CONSOLIDATION  
U - UNCONFINED COMPRESSION    WL - WATER LEVEL IN CASING    CA - CASING  
Qc - TRIAXIAL CONSOLIDATED QUICK    WT - WATER TABLE IN SOIL    γ - UNIT WEIGHT

**SAMPLE TYPES**

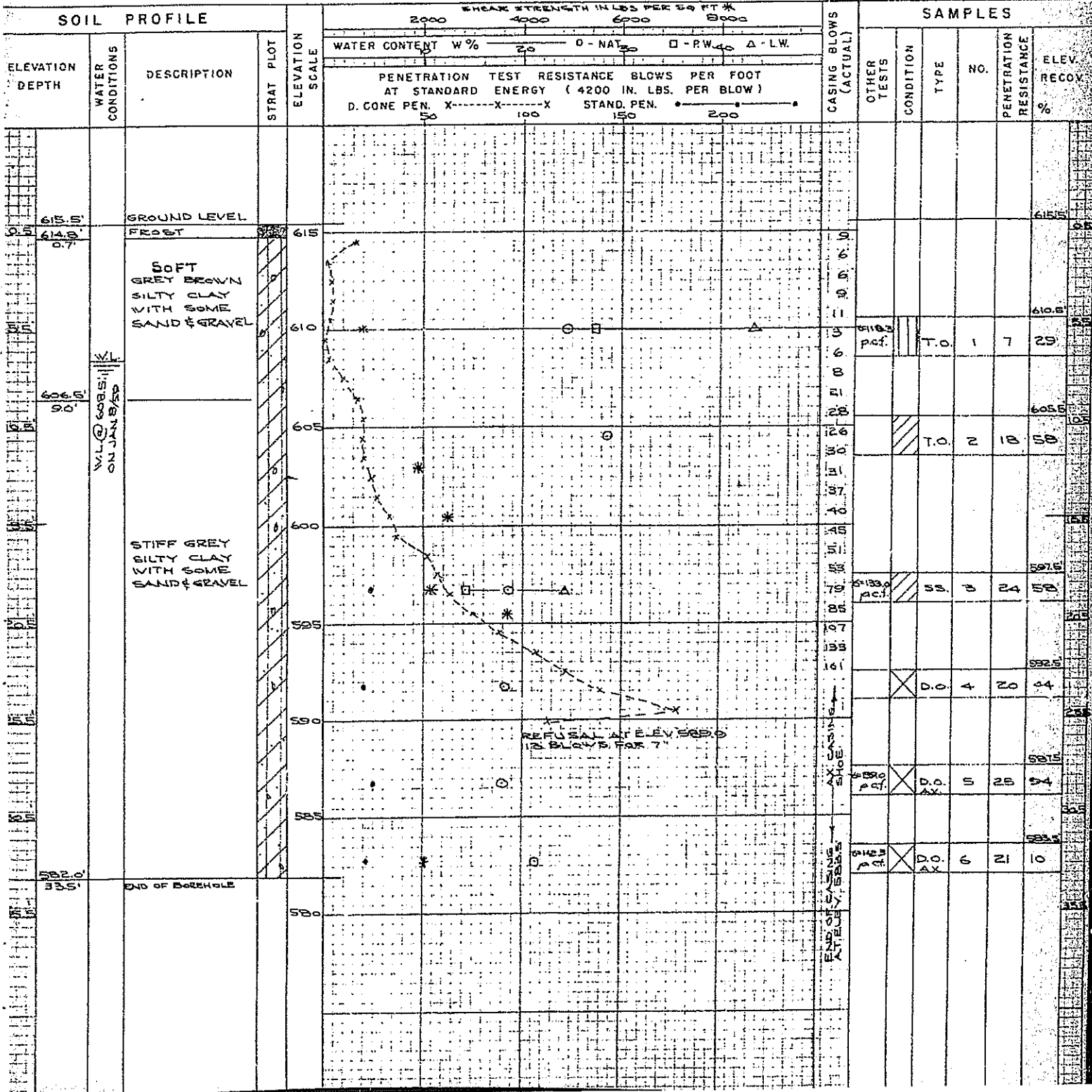
CS - CHUNK    SS - SLEEVE SAMPLE  
DO - DRIVE OPEN    PS - PISTON SAMPLE  
DF - DRIVE FOOT VALVE    WS - WASHED SAMPLE  
TO - THIN WALLED OPEN    RC - ROCK CORE

**SAMPLE CONDITION**



- DISTURBED  
- FAIR  
- GOOD  
- LOST

**SOIL PROFILE**



DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG S4-S OPERATION BORE & PENETIN JOB F-59-1 WP 17-59 BORING 2 STA 27+94 (ASLT)  
CASING BK (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT 1 MAR 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 18 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 2 JAN 1959

## ABBREVIATIONS

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY  
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION  
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING  
QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL  $\gamma$  - UNIT WEIGHT

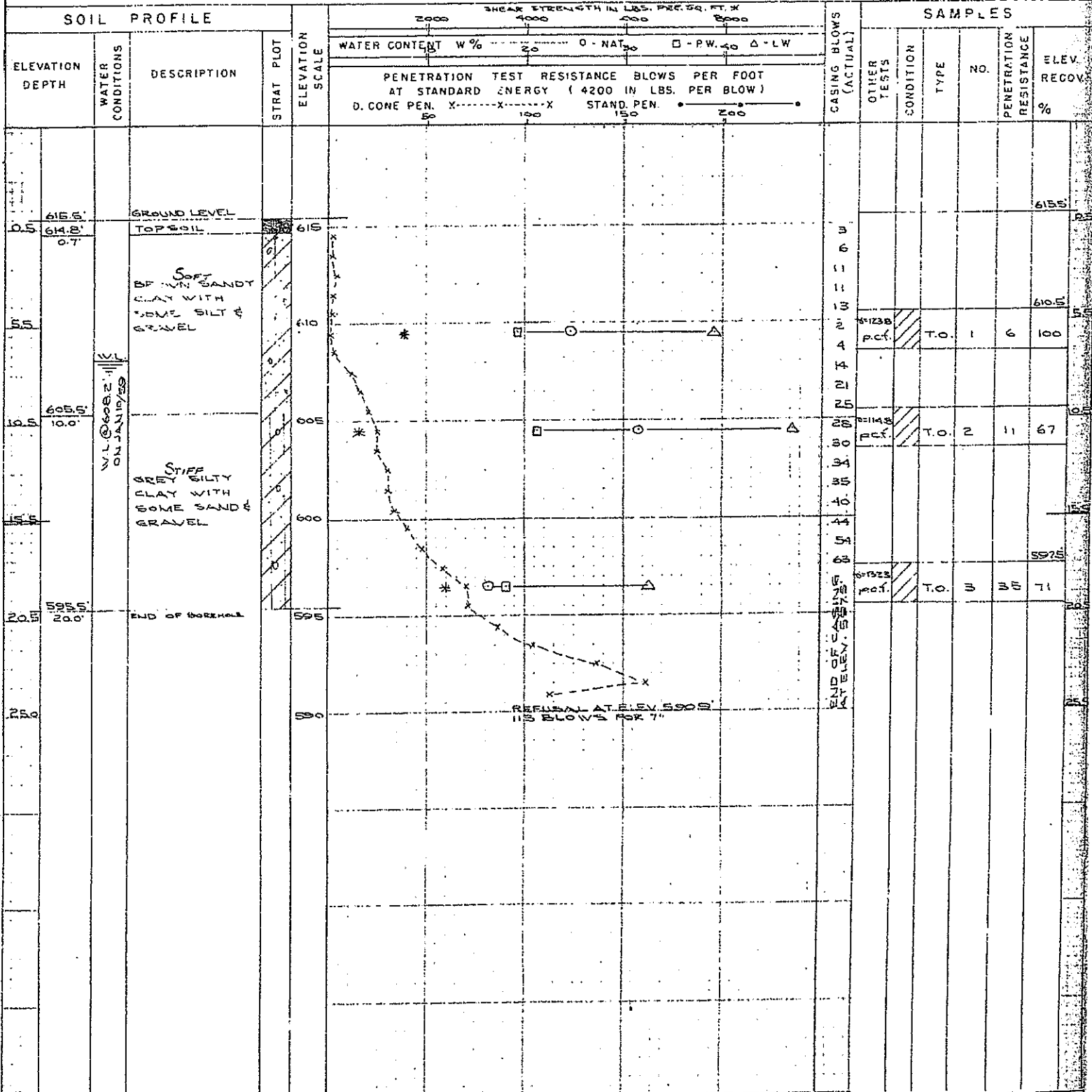
## SAMPLE TYPES

CS - CHUNK SS - SLEEVE SAMPLE  
DO - DRIVE OPEN PS - PISTON SAMPLE  
DF - DRIVE FOOT VALVE WS - WASHED SAMPLE  
TO - THIN WALLED OPEN RC - ROCK CORE

## SAMPLE CONDITION



- DISTURBED  
- FAIR  
- GOOD  
- LOST



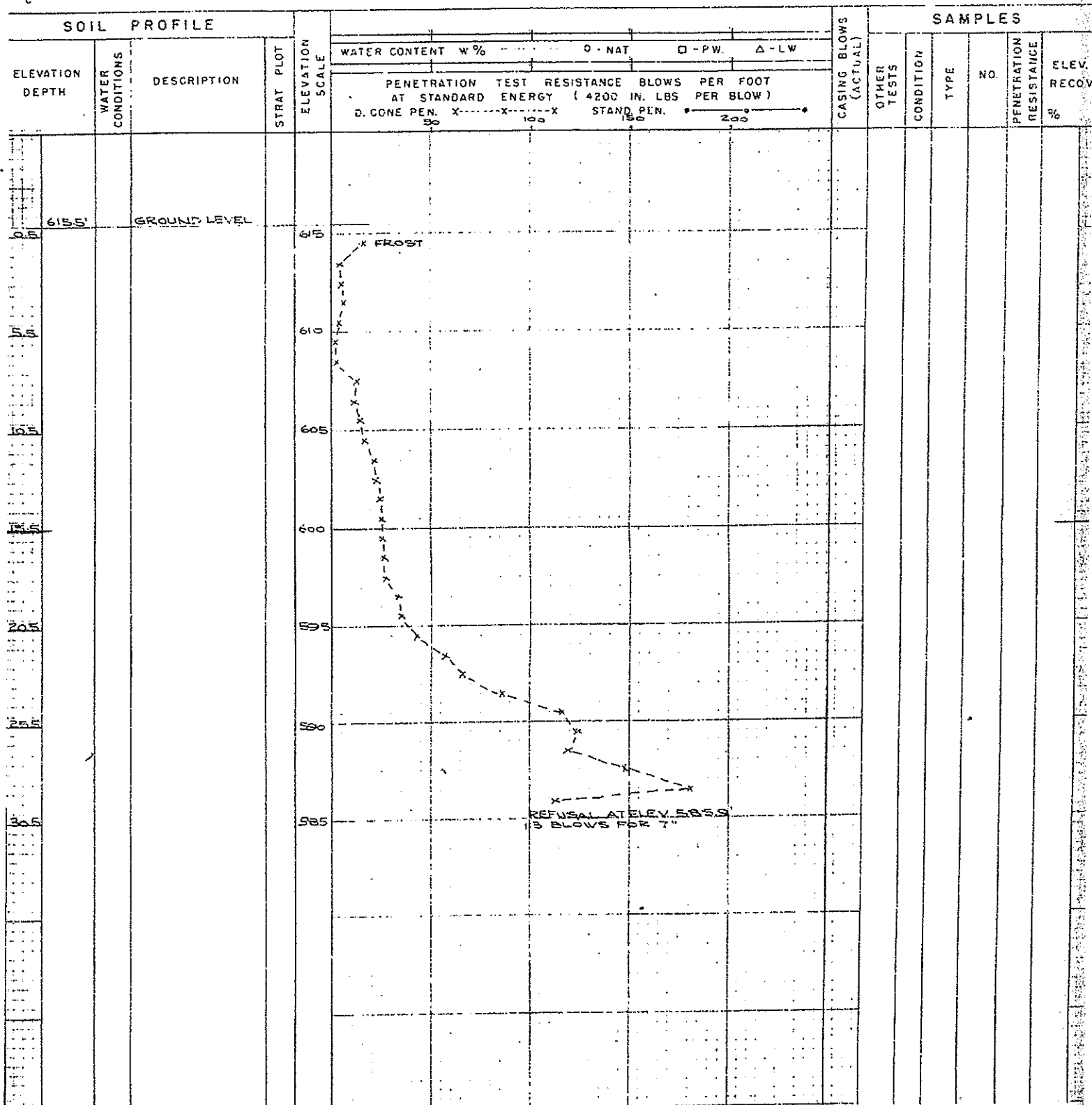
DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG S4-S OPERATION PENETRATION ONLY JOB F-59-1 W.P. 17-59 BORING 3 STA. 27+93.45  
 CASING Bx (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
 SAMPLER HAMMER WT. 250 LBS. DROP 9 INCHES COMPILED BY H.S. CHECKED BY Y.K. DATE BORING 9 JAN 1959

**ABBREVIATIONS**  
 V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY CS - CHUNK SS - SLEEVE SAMPLE  
 M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION DO - DRIVE OPEN PS - PISTON SAMPLE  
 U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING DF - DRIVE FOOT VALVE WS - WASHED SAMPLE  
 QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL  $\gamma$  - UNIT WEIGHT TO - THIN WALLED OPEN RC - ROCK CORE

**SAMPLE CONDITION**

- DISTURBED  
 - FAIR  
 - GOOD  
 - LOST





DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-501 WP 17-50 BORING 4 STA 27+30 (45 RT)  
CASING BY & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
SAMPLER HAMMER WT. 250 LBS. DROP 10 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 13 JAN 1959

## SAMPLE TYPES

SAMPLE CONDITION

S.S. - SLEEVE SAMPLE  
PS - PISTON SAMPLE  
WS - WASHED SAMPLE  
R.C. - ROCK CORE


 - DISTURBED  
 - FAIR  
 - GOOD  
 - LOST

SHEAR STRENGTH IN LBS. PER SQ. FT. \*

## SAMPLES

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW  
**OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG 54-5 OPERATION BORE & PENET. JOB F-59-1 W.P. 17-59 BORING 5 STA. 27+30 (45' LT)  
 CASING BY (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1959  
 SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY V.K. DATE BORING 12 JAN. 1959

## ABBREVIATIONS

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY  
 M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION  
 U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING  
 QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL  $\gamma$  - UNIT WEIGHT

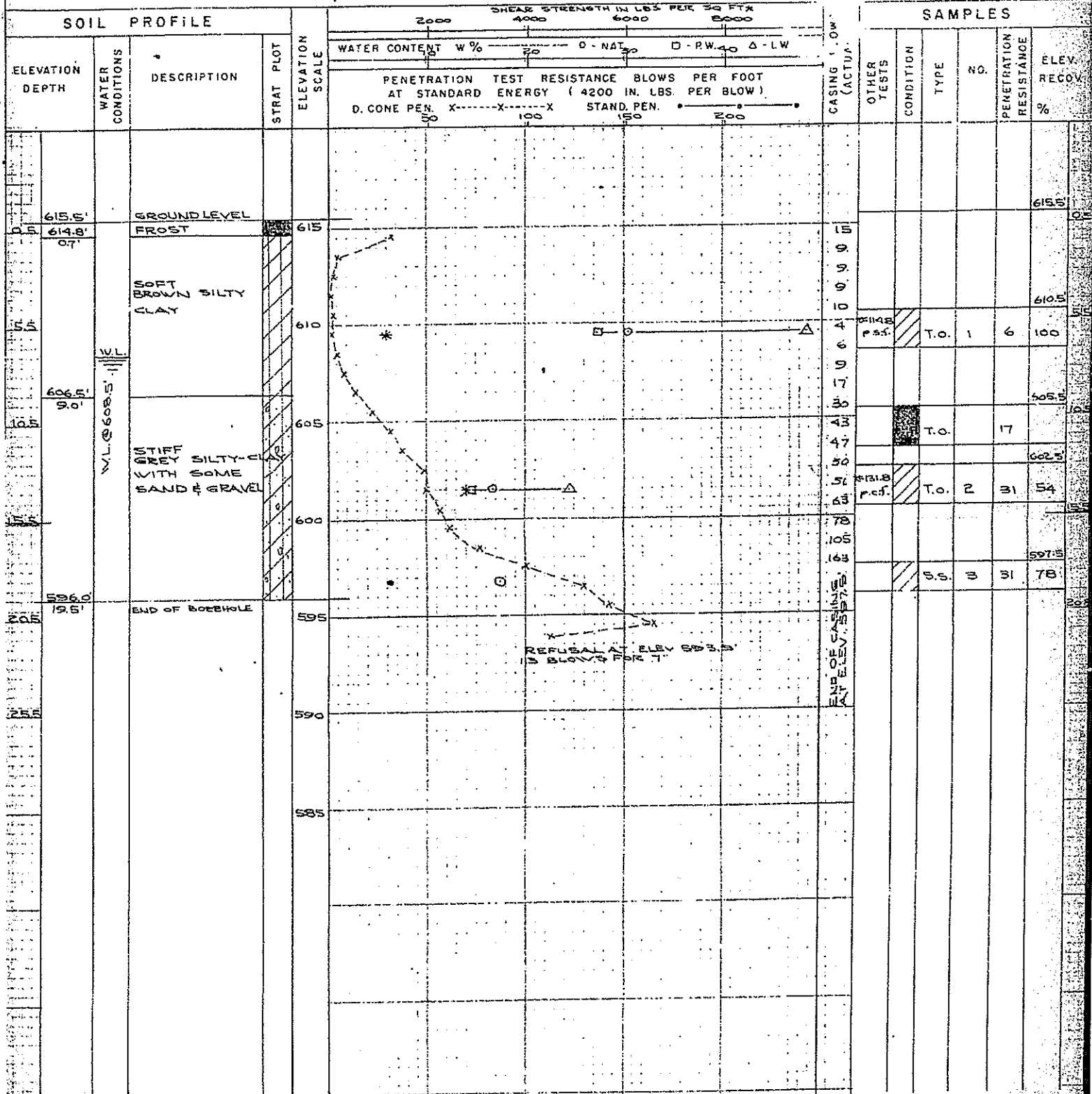
## SAMPLE TYPES

CS - CHUNK SS - SLEEVE SAMPLE  
 DO - DRIVE OPEN PS - PISTON SAMPLE  
 DF - DRIVE FOOT VALVE WS - WASHED SAMPLE  
 TO - THIN WALLED OPEN RC - ROCK CORE

## SAMPLE CONDITION



- DISTURBED  
 - FAIR  
 - GOOD  
 - LOST





- (19) Contract Drawings for grading, drainage, granular base, Hotmix paving and five structure rehabilitations, Contract No. 98-18, Part A, WP 603-93-01 from 0.8 km west of interchange 81 Bloomfield Road easterly to 0.4 km west of interchange 101, Kent Road 15 (Eastbound Lanes only) - (General data only – no soil data)