



**FEASIBILITY FOUNDATION INVESTIGATION AND DESIGN
REPORT 4 – GEOGRAPHICAL TOWNSHIP OF HOWARD
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 4 – Geographical Township of Howard**
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

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 Howard, 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 Howard which extends between the geographical boundaries of the Townships of Harwich and Orford on the west and east, respectively for some 11.1 km. A key map for this section of the Highway 401 is highlighted in Figure 4-1.



Within the limits of Howard Township, there are three underpass bridge structures, including underpasses for two interchanges and nine 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 Howard is currently a four-lane freeway.

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

LIST OF STRUCTURES

Structure Name	Site No.	Station (*)	Type
Kent Bridge Road Underpass	13-236	10+000	4-span steel girder interchange structure
Culvert Site 13-407	13-407-C	10+441.95	Conc. Open Footing (4.28 by 2.45 by 63.2)
Culvert Site 13-408	13-408-C	12+113.95	Conc. Open Footing (4.27 by 2.43 by 71.9)
Culvert Site 13-409	13-409-C	12+869.75	Conc. Open Footing (4.27 by 2.43 by 61.0)
Culvert Site 13-410	13-410-C	13+373.0	Conc. Open Footing (4.88 by 3.05 by 67.4)
Scane Road Underpass	13-265	13+644	4-span steel girder structure
Culvert Site 13-412	13-412-C	14+220.25	Conc. Open Footing (4.27 by 1.83 by 64.1)
Culvert Site 13-413	13-413-C	15+305.9	Conc. Open Footing (4.88 by 2.44 by 70.7)
Culvert Site 13-414	13-414C	16+723.5	Conc. Open Footing (6.71 by 3.35 by 71.9)
Victoria Road Underpass	13-266	17+288.5	4-span steel girder interchange structure
Culvert Site 13-415	13-415-C	19+579.25	Conc. Open Footing (5.49 by 2.44 by 62.8)
Culvert Site 13-416	13-416-C	20+737.25	Conc. Open Footing (3.05 by 1.83 by 58.5)

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

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



The typical topography abutting the highway corridor within the Geographical Township of Howard is typically flat or shows a gentle undulation. The highway grades rise gradually to the east with an approximate total relief of 14.1 m, based on inferred pavement surface elevations at the underpass locations. The rise is shallower west of Victoria Road (between Kent Bridge Road and Victoria Road the relief is 4.6 m) than between Victoria and Kenesserie Roads (where the relief is 9.5 m).

The 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.

Natural drainage of the lands located along the highway is generally poor. The highway crosses several creeks and 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 Howard 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, eight previous MTO construction contract documents and foundation investigation reports, three groundwater data documents, including 45 water well records and other sources of documents such as mosaics of aerial photographs and base maps and topographic maps. Table 4-1 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 4-2 and details of the measured groundwater levels and encountered bedrock levels in the wells were included on the attached Site Plans, Drawings 4-1, 4-2, and 4-3. 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 Howard was constructed over the sandy delta deposits (Bothwell Sand Plain) laid within the glacial Lake Warren by the precursor of the Thames River. The Bothwell Sand Plain consists of a wide and relatively shallow deposit of typically compact sand that overlies deep typically very stiff clay and silty clay till deposits.

The bedrock underlying the Highway 401 alignment through the Geographical Township of Howard 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 three bridge structures and nine culverts within the Geographical Township of Howard.

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. The subsurface conditions inferred at Kenesserie Road underpass (refer to Report 5 for Orford Township) were assumed for culverts 13-415 and 13-416.

SUMMARIZED INFERRED/ASSUMED SUBSURFACE CONDITIONS

Structure Name	Soil Cover Levels (*)		Bedrock (**)		Groundwater (***)	
	Silt, Sand, Layered Sand/clay	Clay, Silty Clay Till	Depth (m)	Elev.	Depth (m)	Elev.
Kent Bridge Road Underpass	0.9 to 1.6 m (elev. 185.9 to 186.7)	Very stiff with stiff zones. Depths 19.0 and 21.8 m (elev. 166.4 and 166.7)	21.8 and 22.4 m	165.3 and 165.7	Perched: 1.2 Regional: 3.4 to 11.9	Perched: 193.5 Regional: 184.1 to 190.8
Culvert Site 13-407						
Culvert Site 13-408						
Culvert Site 13-409	2.6 to 4.2 m (elev. 185.6 to 187.1)	Very stiff with stiff zones. Depths 23.3 and 23.3 m (elev. 166.4)	27.4	162.3	Perched: 0.5 Regional: 4.3 to 10.1	Perched: 189.3 Regional: 185.3 to 188.0
Culvert Site 13-410						
Scane Road Underpass						
Culvert Site 13-412						
Culvert Site 13-413	Compact. 2.1 m (elev. 189.6)	Very stiff with stiff zones. Depths 22.9 m (elev. 168.9)	26.8	164.9	Perched: N/A Regional: 3.7 to 12.2	Perched: N/A Regional: 184.4 to 192.6
Culvert Site 13-414						
Victoria Road Underpass						



SUMMARIZED INFERRED/ASSUMED SUBSURFACE CONDITIONS

Structure Name	Soil Cover Levels (*)		Bedrock (**)		Groundwater (***)	
	Silt, Sand, Layered Sand/clay	Clay, Silty Clay Till	Depth (m)	Elev.	Depth (m)	Elev.
Culvert Site 13-415	Compact. 1.4 to 2.6 m (elev. 198.7 to 199.9)	Very stiff to hard. To termination depths 19.8 and 29.6 m	43.0 to 43.6	162.7 to 165.2	Perched: 0.6	Perched: 200.7
Culvert Site 13-416					Regional: 12.5 to dry	Regional: 191.4 to 192.0

Notes: (*) From borehole data. Levels indicated are inferred depths and elevations of the bottom of the soil units. Topsoil and fill units were disregarded.
(**) From borehole data. 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).

Topsoil and fill encountered during previous investigations were disregarded because present conditions will likely differ from those recorded.

The typical soil stratigraphy encountered in the previous investigations indicate that the sand deposits extend to depths between about 0.9 and 4.2 m, elevations 185.6 to 199.9. The underlying cohesive deposit of clay/silty clay till extends to depths ranging between 19.0 and 23.3 m between Kent Bridge Road and Victoria Road and deeper than 29.6 m east of Victoria Road (based on Kenesserie Road underpass data).

The bedrock underlying the site was encountered/inferred at depths ranging between 21.8 and 26.8 m between Kent Bridge Road and Victoria Road and at deeper levels of 43.0 to 43.6 m to the east. The bedrock surface level was typically found at a range of elevations varying about 3.4 m from 162.3 to 165.7.

Perched groundwater was encountered or inferred at depths ranging from 0.5 to 1.2 m in the boreholes and well records. The regional groundwater was found or inferred between 3.4 and 12.5 m depths. The present condition may vary from those recorded during the geotechnical investigations and well drilling in the 1950 and 1970's).



4.2 Inferred Structure Foundations

Based on the construction drawings reviewed, the abutments and piers of the underpass structures were founded on spread footing and/or concrete-filled driven steel tube piles. 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	Bottom Footing
Kent Bridge Road Underpass	Spread Footing	187.5	186.3	Spread Footing	187.5	186.3
Scane Road Underpass	Piles (178 kN)	194.6	184.1	Spread Footing	189.0-189.5	187.8-188.3
Victoria Road Underpass	Piles (222 kN)	~196.0	189.6	Spread Footing	190.2-191.1	189.0-189.9

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 sandy deposits about 1.2 m below grade for frost protection.

5. SITE RECONNAISSANCE

The site reconnaissance of the structures within this geographic township was carried out on January 26 and 27, and June 29, 2006. Forty-two 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 three bridge structures and nine culverts are located on generally flat to gently undulating terrain (photographs 4-1, 4-2, 4-14, 4-15, 4-19, 4-20, 4-21, 4-24, 4-31, 4-32, 4-34, 4-35 and 4-42). There are no major stream crossings within the alignment.



- The visual inspection of the underpass structure foundations did not reveal signs of distress such as settlements or other distortion (photographs 4-2, 4-20 and 4-32).
- It is inferred that the concrete wing walls of several culverts were removed and replaced with gabion basket walls (photographs 4-12, 4-13, 4-14, 4-17, 4-26, 4-28 and 4-30). Displacement and rotation of the original concrete wing walls of some of the culverts was noted (photographs 4-16 and 4-25).
- 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 4-6, 4-13, 4-24, 4-33, 4-34, 4-35, 4-36, 4-40 and 4-42).
- It was judged that the bridge approach embankments 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 4-2, 4-3, 4-21, 4-24 and 4-38).
- Localized surficial sloughing of the southeast approach embankment at the Scane Road underpass was noted (photographs 4-22 and 4-23).
- Gabion basket retaining walls were erected atop the approach embankments of the Kent Bride Road underpass (photographs 4-3, 4-6, 4-7).
- The channels at the inlet/outlet of the culverts were locally narrowed by sandy soils sloughing off the earth banks (photographs 4-11, 4-18, 4-25, 4-41 and 4-39). Erosion control of the roadside ditches and of the highway embankment near the ends of culverts where the wing walls were removed is being accomplished with rock fill cover (photographs 4-13, 4-16 and 4-27).
- 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 4-5, 4-6, 4-24, 4-33, 4-35 and 4-36).
- The exit and on-ramps of the Kent Bridge Road and Victoria Road interchanges were constructed over terrain that is typically flat and free of swampy soils (photographs 4-5, 4-6, 4-8, 4-33, 4-34 and 4-37).
- Drainage ditches and hydro pole lines were constructed to the west of the approach embankments of Kent Bridge Road underpass and the south approach embankment of the Scane Road underpass (photograph 4-4, 4-7 and 4-21).



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 Howard. 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.

At the Kent Bridge Road interchange, approximate Sta. 10+000 (Howard Township), replacement of the existing underpass is planned. In addition, it is planned to replace the existing ramp configuration with a Parclo A configuration interchange requiring extension of the existing culvert 13-407 and three new ramp culverts. Sequencing of construction staging is required for the reconfiguration of the interchange. Further, realignment and filling of the existing McKoy Drain waterway is planned to construct the E-N/S ramp with a minimum number of culverts.

At the Victoria Road interchange, approximate Sta. 17+289, closure of the Spence Line, realignment of the existing E-N/S and W-N/S ramps and adding two future ramps, N-W and S-E ramps to provide a Parclo A configuration interchange are considered.



In addition, a new structure at the new W-N/S ramp alignment, and extending existing Bullen Drain WBL Bridge structure, approximate Sta. 14+220, on Hwy 401 and on County Road 17, south of underpass, are also proposed. Further, a new crossing structure at the Bullen Drain EBL for future W-N/S ramp is planned.

Construction of Alternative 2 will likely require the modification of the existing bridge structures or alternatively the construction of new structures. One option for modification of the existing underpass structures is to cut into the existing approach embankment foreslopes (in front of the abutments) and construct permanent vertical retaining wall 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 foundations. 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 ⁽¹⁾

Structure site	Shallow Foundations ⁽²⁾				Deep Foundations ⁽³⁾			
	Founding. Levels ⁽⁴⁾		Geotechnical Resistance		Founding. Levels		Geotechnical Resistance ⁽⁵⁾	
	Depth (m)	Elev.	ULS (kPa)	SLS (kPa)	Depth (m)	Elev.	ULS (kN)	SLS (kN)
Kent Bridge Road Underpass	2.2	186.3	400	200	22	165	2,000	N/A
Scane Road Underpass	2.3 - - 2.8	187.8 - - 188.3	400	150	27	162	2,000	N/A
Victoria Road Underpass	3.2 - - 4.1	189.0 - - 189.9	550	300	27	165	2,000	N/A

Notes: ⁽¹⁾ Geotechnical resistances are to be confirmed during detailed design.

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

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

⁽⁴⁾ Footing founding levels should match those of existing footings and assumed to be minimum 1.2 m wide.

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

Subject to structural analyses, existing 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.

Where culvert extensions are required, it is envisaged that the extensions may be founded on the native typically compact sandy soils 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 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. 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 of a layer of compact sand overlying typically very stiff clay/silty clay till. 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 bridge approach embankments. Based on the condition of the 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.

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. Furthermore, the sandy soil units are considered to have relatively high permeability characteristics and are typically not considered susceptible to short term instability problems due to potential high pore water pressures induced by loading from the new fill. This facet of the construction should, however be checked further during detail design.



The widening of the embankments is not expected to cause stability problems at the location of the culvert 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 100 to 140 mm at the location of the highest fills (behind the abutments). About 80 mm of the settlements (25 mm contributed by the compact sand units and 55 mm by the underlying very stiff clay/ silty clay till) are expected to occur during construction. The remaining 20 to 60 mm settlements from the underlying very stiff clay/silty clay till units are expected to be completed within 1 to 10 years after fill construction.

Where the embankments are widened the magnitude of settlements is estimated at about 50 to 70 mm (about half those indicated for separate embankments).

The anticipated settlements will not be completed during the estimated construction period of new structures. Management control of the settlements with surcharging is recommended to accelerate the consolidation of the clays and to minimize post-construction effects including negative skin friction on driven piles. In addition, during the surcharge period, it is also recommended to monitor settlements and pore water pressures as a part of the management control (program to be developed during detail design).

Settlements of the compact sand and very stiff to hard subgrade soils at the culvert extension sites under the anticipated 2 to 3 m high new embankment platforms 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 bridges would not be required.

It is envisaged that the new structures for the alternative comprising of the widening to the outside would be three-span. Where the access to the existing 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 bridge 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 Kent Bridge Road and Victoria Road.

Excavations for the installation of new centre pier foundations or footing foundations for abutments on native soils will require control of the perched groundwater within the sandy soils encountered near the ground surface. Road protection as outlined in the SP 105S19 will likely be needed for the excavations required for new centre pier and abutment foundations located within the wet sand deposit. 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 west at the Kent Bridge Road and Scane Road bridges structures will likely require the realignment of the existing drainage ditches and concrete culverts that cross the highway and the sideroads.

Where existing foundations bearing on driven pipe piles are widened to accommodate new or wider structures (if structurally feasible) 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. This precaution will avoid/minimize lateral forces and drag-down loads on the existing pipe piles due to displacement of soil surrounding the existing piles. These effects may be mitigated by using steel H-piles instead of pipe piles for the foundation widenings. For widening of the existing foundations with deep foundations, the existing structure should be



monitored during pile driving to bedrock. 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
Kent Bridge Road Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic	None	Use of existing embankment. Reuse of existing foundations	New structure required Shoring existing embankment or closing traffic on bridge	None	New structure and approach embankments required. Drainage ditch west of bridge needs relocation.
Scane Road Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic	None	Use of existing embankment. Reuse of existing foundations	New structure required Shoring existing embankment or closing traffic on bridge	None	New structure and approach embankments required. Drainage ditch west of bridge needs relocation.



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
Victoria Road Underpass	Use of existing structure and approach embankment. Least costly and little disruption to local traffic	None	Use of existing embankment. Reuse of existing foundations	New structure required Shoring existing embankment or closing traffic on bridge	None	New structure and new approach embankments required.

Notes: (*) Assumes widening to the outside will require a new bridge structure or modifications to the existing structure.

ADVANTAGES AND DISADVANTAGES – CULVERTS

Structure Name	Widening to Inside		Widening to Outside	
	Advantages	Disadvantages	Advantages	Disadvantages
Culvert Site 13-407C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-408C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-409C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-410C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-412C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-413C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-414C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-415C	Culvert extensions not required	None	None	Culvert extensions required
Culvert Site 13-416C	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 may be required for either alternative.

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.

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 P4-1 to P4-3.

The preferred option at the Kent Bridge Road interchange includes a replacement of the structure at the interchange with a wider structure and provision of Parclo A configuration interchange ramps to replace the existing ramps. The existing culvert 13-407 is planned for extension to the outside to accommodate future E-N/S and S-E ramps.

At the Victoria Road interchange, the preferred option includes closure of Spence Line to protect the existing and future traffic operations. The existing entrance terminal of E-N/S and W-N/S ramps and exit terminal of N/S-E and N/S-W ramps are planned to be realigned to modify the existing horizontal curves and speed change lanes for future traffic operations. Changes are not anticipated for the existing underpass.

Two new ramps, N-W and S-E, are proposed at the opposite quadrants, southwest and northeast, respectively of the existing ramps to provide a Parclo A interchange configuration. However, sequencing of construction staging is required.



A new Bullen Drain crossing structure is required for future W-N/S ramp.

The preferred option is considered to be feasible to design and construct from the foundations standpoint. The filling of the McKoy Drain waterway should be straightforward since this man-made trench is cut into the native soils.

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 bridge and culvert structures through the Geographical Township of Howard.

Foundation investigations are required at the Kent Bridge Road and Victoria Road interchanges where replacing, widening and extending existing structures are required to accommodate new planned ramp lanes. The Scane Road structure site should also be investigated if the site will be widened or replaced. In addition, foundation investigations for the new culvert structures will also be required for new existing interchange ramps.

For the preferred alternative, the foundation investigations for new bridges and culvert structures 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 (**)
10+000	Kent Bridge Road Underpass structure replacement	5 boreholes to depths from 10.1 to 22.3 m
13+644	Scane Road Underpass widening or replacement	4 boreholes to depths from 7.3 to 27.4 m
17+288.5	Victoria Road Underpass widening or replacement	2 boreholes to depths 25.9 and 26.2 m

Notes: (*) Stations refer to Howard Township chainage.

(**) Relevant data from previous foundation investigation reports. Refer to Table 4-1 for list of reference documents.

(***) Foundation investigations required for widening or replacement of existing structures.



FOUNDATION INVESTIGATION AREAS –CULVERTS

Stations (*)	Proposed Works	Existing Data
10+441.95	Culvert Site 13-407 extensions	Data not available
12+113.95	Culvert Site 13-408 extensions	Data not available
12+869.75	Culvert Site 13-409 extensions	Data not available
13+373.0	Culvert Site 13-410 extensions	Data not available
14+220.25	Culvert Site 13-412 extensions	Data not available
15+305.9	Culvert Site 13-413 extensions	Data not available
16+723.5	Culvert Site 13-414 extensions	Data not available
19+579.25	Culvert Site 13-415 extensions	Data not available
20+737.25	Culvert Site 13-416 extensions	Data not available
Kent Bridge Road I/C	Culvert at McKoy Drain extension	Data not available
Victoria Road I/C	Culvert bridge at Bullen Drain (new)	Data not available

Notes: (*) Stations refer to Howard Township chainage.



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 4-1
LIST OF REFERENCE DOCUMENTS
(TOWNSHIP OF HOWARD)

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 WP No. 86-59, Kent County Road No. 15 (Kent Bridge Road) Interchange Drawing D-4596-1, September 1960.
- (2) Contract Drawings for Contract No. 80-03 for Highway 401 from 0.6 km west of interchange No. 12 (Kent Bridge Road) easterly to 1.1 km west of interchange No. 14 (Kenesserie Road), August 1979.



- (3) Contract Drawings for Contract No. 98-18 for Highway 401 eastbound lanes, from 0.8 km west of Bloomfield Road easterly to 1.8 km west of Kent Road 20 (Kenesserie Road), February 1998.
- (4) Contract Drawings for Contract No. 99-104 for Highway 401 from 1.1 km west of Bloomfield Road easterly to 1.8 km west of Orford Road, April 1999.
- (5) Drawings for W.P. No. 87-59 for Scane Road Underpass (TWP 112-265) November 1960.
- (6) Foundation Investigation Report for Scane Road Underpass by William A. Trow & Associates Ltd., Project J477 dated March 25, 1960, W.P. No. 87-59, Geocres file 40I5-2.
- (7) Drawings for W.P. No. 88-59 for Highway 21 Interchange (Victoria Road) (TWP 112-266), January 1964.
- (8) Construction Drawings for W.P. No. 89-59, Highway 401 Underpass at Co. Road 16 (Kenesserie Road) Site 13-267, dated November 1960.

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. 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.



TABLE 4-2
WATER WELL RECORDS SUMMARY
(HOWARD TOWNSHIP)

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (*)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
TLR	17	198.1	06/64	4.6	193.5	Clay 18.2; gravel/stones 18.9; shale 20.4	18.9	179.2
TLR	17	190.5	10/66	DRY	-	Sand 1.8; clay/hard pan 22.9; sand, gravel 24.1; hard pan 27.4; shale 29.9	27.4	163.1
TLR	17	192.0	05/57	1.2	190.8	Sand 5.5; clay 21.3; gravel/slate 22.9	21.3	170.7
5	4	190.5	04/52	3.4	187.1	Sand 6.1; clay 18.3; sand 21.3; gravel 24.7	> 24.7	< 165.8
5	4	190.5	08/65	6.1	184.4	Clay 21.9; black shale 26.5	21.9	168.6
5	5	190.5	10/69	4.6	185.9	Clay 23.5; sand, gravel 24.1; black shale 25.9	24.1	166.4
5	5	190.5	10/63	3.0	187.5	Sand 2.7; clay 18.3; hard pan 23.5; black shale 28.3	23.5	167.0
5	5	190.5	09/66	4.6	185.9	Sand 1.8; clay 21.3; hard pan 22.9; sand, gravel 27.7; rock 28.3	27.7	162.8
5	6	190.5	10/66	5.2	185.3	Yellow clay 2.4; clay 21.9; rock shale 27.4	21.9	168.6
5	6	190.5	10/66	DRY	-	Sand 2.4; clay 21.3; hard pan/shale 22.3; rock shale 25.9	22.3	168.2
5	6	190.5	06/54	4.3	186.2	Sand 3.4; clay 23.1; sand 23.5; sand, gravel 24.1	> 24.1	< 166.4
6	7	190.5	07/60	4.3	186.3	Clay 20.7; hard pan 23.2; gravel 23.5	> 23.5	< 167.0

NOTES:

- (*) Soil and Depth (m) to Bottom of Unit
- Data taken from MOE Water Well Records for Ontario (Kent-Lambton) 1946-1974, Water Resources Bulletin 2-20 Groundwater Series.



TABLE 4-2
WATER WELL RECORDS SUMMARY
(HOWARD TOWNSHIP)

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (*)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
6	8	192.0	03/70	DRY	-	Sand 6.1; clay, gravel 26.8; gravel 29.3; hard pan, gravel 30.8; slate 36.6	30.8	161.2
6	8	192.0	04/70	27.1 (FOUND)	164.9	Sand 5.8; clay, gravel 25.6; gravel 28.0; hard pan, clay 29.0; gravel 31.1; slate 39.6	31.1	160.9
6	8	192.0	03/70	DRY	-	Sand 5.8; clay, gravel 26.2; gravel 30.5; slate 35.1	30.5	161.5
6	8	192.0	07/69	4.3	187.7	Sand 4.6; clay 25.3; gravel 25.6; hard pan 31.1; sand 36.6; limestone shale 37.2	36.6	155.4
6	8	192.0	12/74	DRY	-	Sand 4.6; clay 30.2; hard pan 31.1; black rock 33.5	31.1	160.9
6	10	190.5	03/63	5.5	185.0	Sand 4.6; clay 30.2; hard pan 31.9; black rock 33.5	31.9	158.6
6	10	190.5	03/63	6.1	184.4	Sand 3.1; clay 9.1; hard pan 21.3; clay 27.4; gravel 27.7; shale 29.3	27.7	162.8
6	10	190.5	04/63	3.7	186.8	Sand 3.1; clay 17.4; sand 25.0; sand/clay 28.7; shale/limestone 102.4	28.7	161.8
6	10	190.5	05/63	3.7	186.8	Sand 3.1; clay 21.3; sand/clay 26.2; sand 27.4; shale 28.7	27.4	163.1
6	12	195.1	02/74	4.6	190.5	Clay 22.3; sand, gravel 22.6; gravel 22.9	> 22.9	< 172.2
6	12	197.5	04/71	4.9	192.6	Clay 22.9; gravel 27.4; rock 31.4	27.4	170.1

NOTES:

- (*) Soil and Depth (m) to Bottom of Unit
- Data taken from MOE Water Well Records for Ontario (Kent-Lambton) 1946-1974, Water Resources Bulletin 2-20 Groundwater Series.



TABLE 4-2
WATER WELL RECORDS SUMMARY
(HOWARD TOWNSHIP)

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (*)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
6	12	196.6	03/71	DRY	-	Clay 28.7; hard pan 29.3; sand 35.4; shale 35.7	35.4	161.2
6	12	196.6	04/71	DRY	-	Clay 28.7; hard pan clay 29.3; rock 34.1	29.3	167.3
6	12	196.6	03/71	DRY	-	Sand 0.9; clay 28.0; hard pan 29.6; rock 30.5	29.6	167.0
6	12	195.1	07/72	7.6	187.5	Sand 2.7; clay 15.2; hard pan 18.0; clay 29.3; gravel 30.8; shale 31.4	30.8	164.3
6	12	196.6	03/71	6.1	190.5	Clay 28.7; hard pan 29.6; black rock 33.5	29.6	167.0
6	12	196.6	03/71	DRY	-	Clay 28.7; hard pan 29.3; black rock 32.0	29.3	167.3
6	12	196.6	08/71	7.0	189.6	Clay, stones 28.0; clay 29.6; sand, gravel 29.9; rock 31.4	29.9	166.7
6	12	196.6	07/71	11.3	185.3	Sand 2.1; clay, stones 26.5; clay, sand 29.9; rock 33.5	29.9	166.7
6	13	190.5	03/65	6.1	184.4	Sand 1.5; clay 24.7; hard pan, sand 28.7; gravel 29.0; black rock 30.5	29.0	161.5
6	13	196.6	07/71	9.4	187.2	Sand 1.8; clay 27.4; hard pan, gravel 30.5; sand 30.8	> 30.8	< 165.8
6	13	196.6	07/71	DRY	-	Sand 2.4; clay 26.8; hard pan, gravel 28.0; blue shale 35.7	28.0	168.6

NOTES:

1. (*) Soil and Depth (m) to Bottom of Unit
2. Data taken from MOE Water Well Records for Ontario (Kent-Lambton) 1946-1974, Water Resources Bulletin 2-20 Groundwater Series.



TABLE 4-2
WATER WELL RECORDS SUMMARY
(HOWARD TOWNSHIP)

CONCESSION NO.	LOT NO.	GROUND ELEV. (m)	DATE DRILLED	STATIC WATER		STRATIGRAPHY DESCRIPTION (*)	BEDROCK	
				DEPTH (m)	ELEV. (m)		DEPTH (m)	ELEV. (m)
6	14	192.0	06/63	5.5	186.5	Sand 2.1; clay 25.6; hard pan, sand, gravel, clay 29.3; grey rock 30.5	29.3	162.7
6	14	190.5	06/63	6.1	184.4	Clay 22.6; clay, sand 27.4; hard pan, gravel, clay 29.6; rock 32.0	29.6	160.9
7	3	198.4	01/69	11.9	186.5	Clay 25.9; clay, sand 29.3; sand 30.2; shale 30.8	30.2	168.2
7	6	198.1	12/57	10.1	188.0	Sand 1.2; clay 24.4; sand 29.9; gravel 30.5	> 30.5	< 167.6
7	14	198.1	05/70	9.4	188.7	Clay 12.2; hard pan 24.4; sand 27.4	> 27.4	< 170.7
7	14	207.3	04/74	12.2	195.1	Clay 21.9; sand 24.1; clay 25.3	> 25.3	< 182.0
8	16	208.8	08/74	DRY	-	Sand 4.6; clay 30.5; sand 38.1; clay 43.3; hard pan 43.6; rock 57.0	43.6	165.2
8	18	205.7	06/64	DRY	-	Clay 31.4; sand 37.8; hard pan 38.1	> 38.1	< 167.6
8	18	205.7	07/64	DRY	-	Sand 6.4; clay 11.2; hard pan, clay 37.4; sand, stones, hard pan 42.7; shale 44.2	42.7	163.0
8	18	205.7	05/64	DRY	-	Sand 3.1; clay 31.4; sand, hard pan 42.4; rock 43.6	42.4	163.3
8	18	205.7	03/67	37.8	167.9	Clay 27.4; sand 35.1; clay 37.8; hard pan 42.7; rock 43.6	42.7	163.0

NOTES:

1. (*) Soil and Depth (m) to Bottom of Unit
2. Data taken from MOE Water Well Records for Ontario (Kent-Lambton) 1946-1974, Water Resources Bulletin 2-20 Groundwater Series.



LEGEND:

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

GEOCRES # 4015-9

REPORT # 4 - HOWARD TOWNSHIP

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

KEY MAP



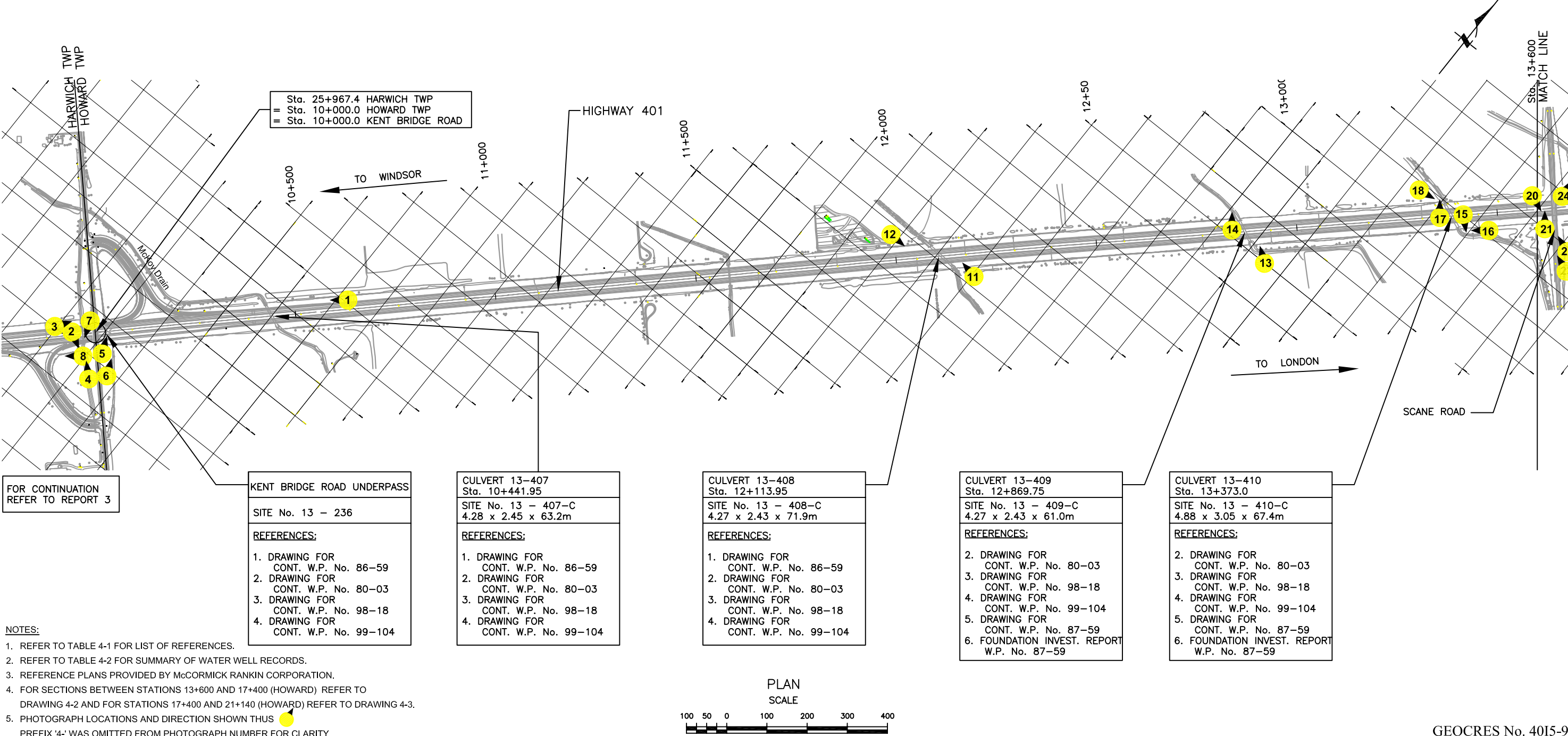
**MCCORMICK RANKIN
CORPORATION**



Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN: N.A.	DATE	SCALE	JOB NO.	FIGURE NO.
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APPROVED: B.R.G.				

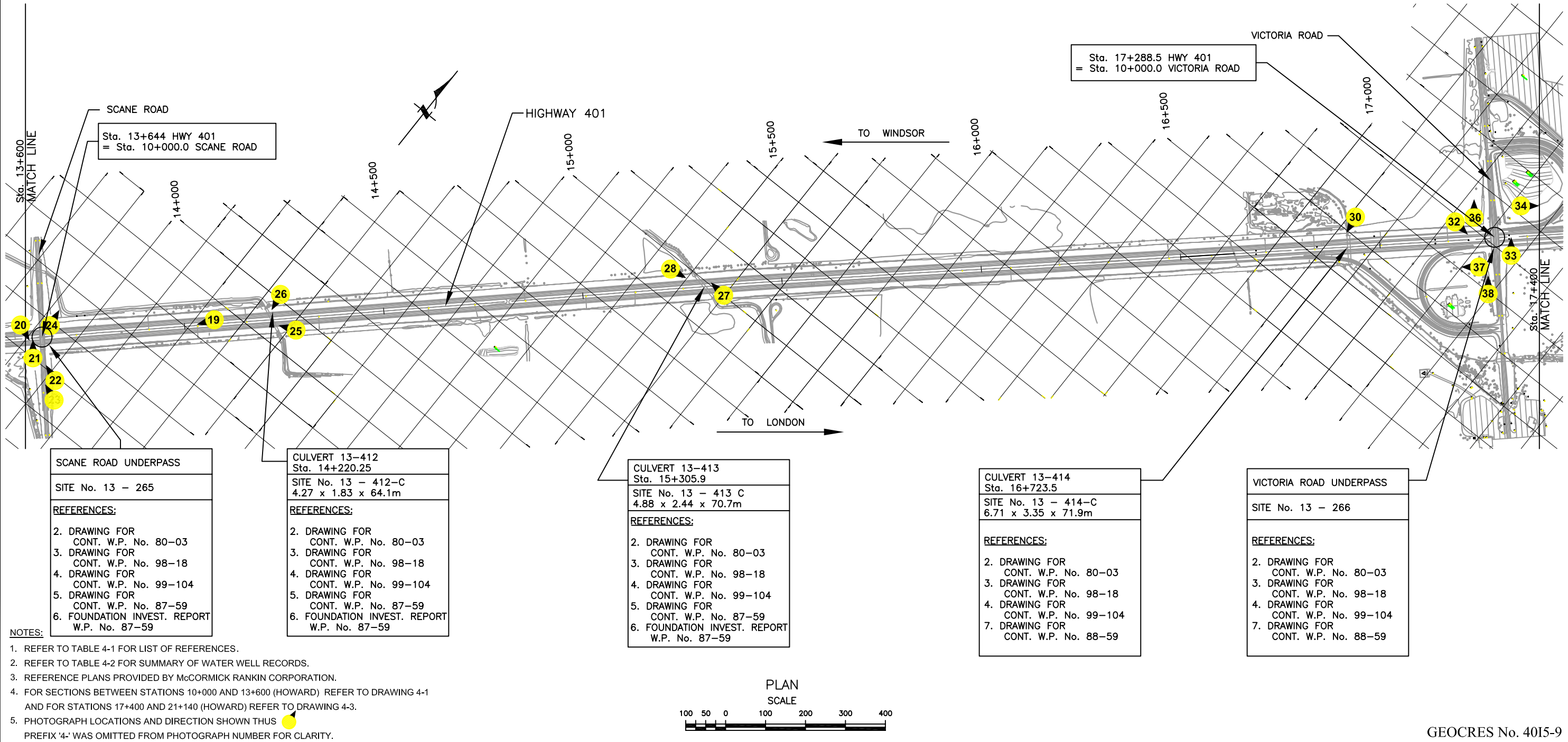
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TOWNLINERANGE LOT 17	CONCESSION 7 LOT 3	CONCESSION 5 LOT 4	CONCESSION 5 LOT 5	CONCESSION 5 LOT 6	CONCESSION 7 LOT 6
GROUNDWATER DEPTH 1.2 TO 4.6m EL. 190.8 TO 193.5	GROUNDWATER DEPTH 11.9m EL. 186.5	GROUNDWATER DEPTH 3.4 TO 6.1m EL. 184.1 TO 187.1	GROUNDWATER DEPTH 3.0 TO 4.6m EL. 185.9 TO 187.5	GROUNDWATER DEPTH 4.3 TO 5.2m EL. 185.3 TO 186.2	GROUNDWATER DEPTH 10.1m EL. 188.0
BEDROCK DEPTH 18.9 TO 27.4m EL. 163.1 TO 179.2	BEDROCK DEPTH 30.2m EL. 168.2	BEDROCK DEPTH 21.9 TO >24.7m EL. <165.8 TO 168.6	BEDROCK DEPTH 23.5 TO 27.7m EL. 162.8 TO 167.0	BEDROCK DEPTH 21.9 TO >24.1m EL. <166.4 TO 168.6	BEDROCK DEPTH >30.5m EL. <167.6



GEOCRES No. 4015-9

METRIC		 Peto MacCallum Ltd. CONSULTING ENGINEERS		CONT No	
				GWP No 80-00-00	
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES	 McCORMICK RANKIN CORPORATION A member of 	DATE JANUARY 2010	DRAWN BY: N.A.	HIGHWAY 401 WIDENING THROUGH KENT COUNTY HOWARD TOWNSHIP SECTION SITE PLAN	DRAWING 4-1
		CHECKED BY: C.N.	APPROVED BY: B.R.G.		

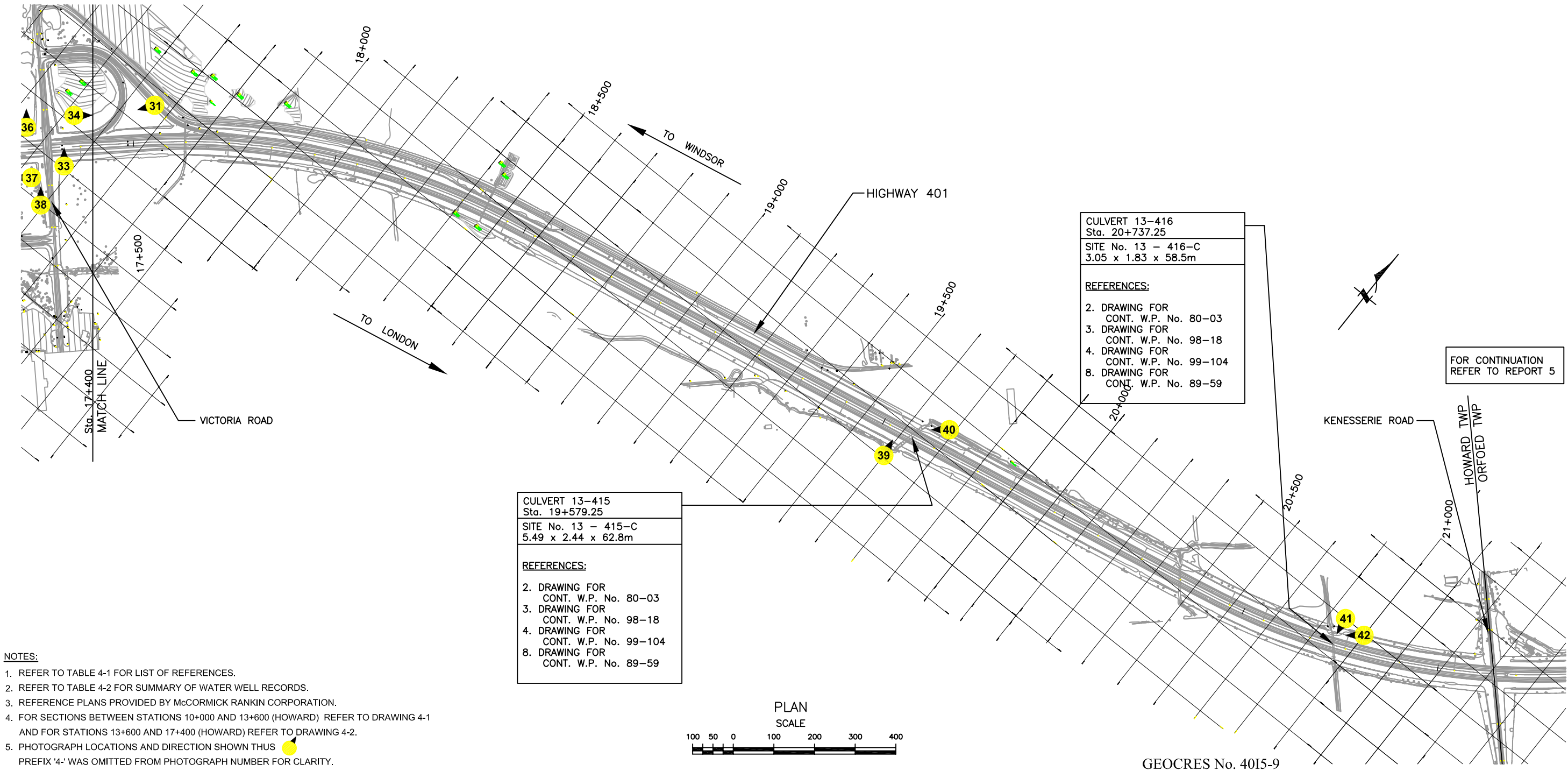
SUMMARY OF WATER WELL RECORDS					
CONCESSION 6 LOT 7	CONCESSION 6 LOT 8	CONCESSION 6 LOT 9	CONCESSION 6 LOT 10	CONCESSION 6 LOT 11	CONCESSION 6 LOT 12
GROUNDWATER DEPTH 4.3m EL. 186.3	GROUNDWATER DEPTH 4.3m EL. 187.7	NO DATA FOUND	GROUNDWATER DEPTH 3.7 TO 6.1m EL. 184.4 TO 186.8	NO DATA FOUND	GROUNDWATER DEPTH 4.6m TO 11.3m EL. 185.3 TO 192.6
BEDROCK DEPTH >23.5m EL. <167.0	BEDROCK DEPTH 30.5 TO 36.6m EL. 155.4 TO 161.5	NO DATA FOUND	BEDROCK DEPTH 27.4 TO 31.9m EL. 158.6 TO 163.1	NO DATA FOUND	BEDROCK DEPTH 27.4 TO 35.4m EL. 161.2 TO 170.1



METRIC DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES		 Peto MacCallum Ltd. <small>CONSULTING ENGINEERS</small>		CONT No GWP No 80-00-00	
	 McCORMICK RANKIN CORPORATION <small>A member of  MMM GROUP</small>	DATE JANUARY 2010	DRAWN BY: N.A.	HIGHWAY 401 WIDENING THROUGH KENT COUNTY HOWARD TOWNSHIP SECTION SITE PLAN	DRAWING 4-2
		CHECKED BY: C.N.	APPROVED BY: B.R.G.		

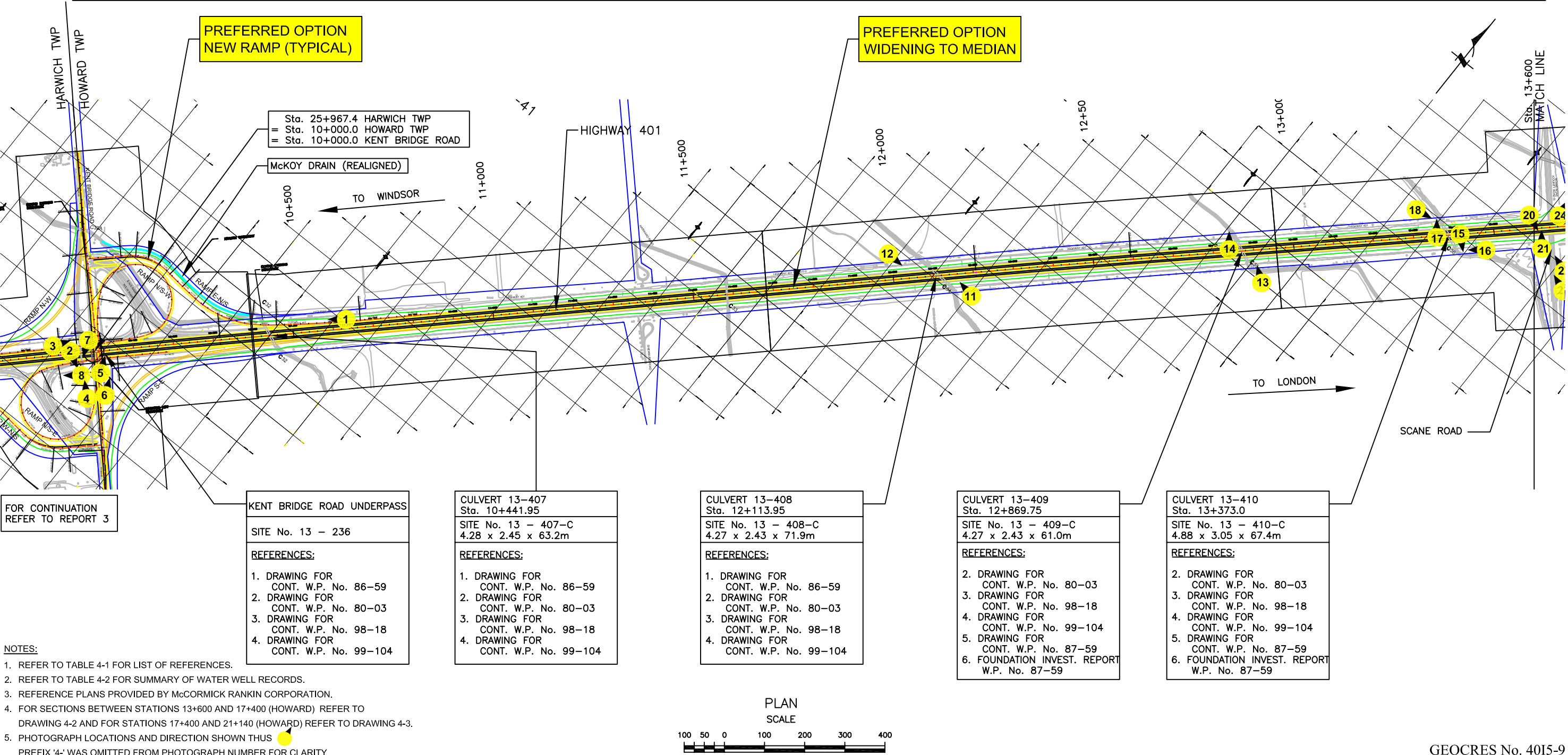
GEOCRES No. 4015-9

SUMMARY OF WATER WELL RECORDS						
CONCESSION 6 LOT 13	CONCESSION 6 LOT 14	CONCESSION 7 LOT 14	CONCESSION 7 LOT 15	CONCESSION 8 LOT 16	CONCESSION 7 LOT 17	CONCESSION 8 LOT 18
GROUNDWATER DEPTH 6.1 TO 9.4m EL. 184.4 TO 187.2	GROUNDWATER DEPTH 5.5 TO 6.1m EL. 184.4 TO 186.5	GROUNDWATER DEPTH 9.4 TO 12.2m EL. 188.7 TO 195.1	NO DATA FOUND	GROUNDWATER DEPTH: WELL DRY	NO DATA FOUND	GROUNDWATER DEPTH 37.8m EL. 167.9
BEDROCK DEPTH 28.0 TO >30.8m EL. 161.5 TO 168.6	BEDROCK DEPTH 29.3 TO 29.6m EL. 160.9 TO 162.7	BEDROCK DEPTH >25.3 TO >27.4m EL. <170.7 TO <182.0	NO DATA FOUND	BEDROCK DEPTH 43.6m EL. 165.2	NO DATA FOUND	BEDROCK DEPTH >38.1 TO 42.7m EL. 163.0 TO <167.6



METRIC DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES	 McCORMICK RANKIN CORPORATION A member of 	DATE JANUARY 2010	DRAWN BY: N.A.	CONT No GWP No 80-00-00	 DRAWING 4-3
		CHECKED BY: C.N.	APPROVED BY: B.R.G.	HIGHWAY 401 WIDENING THROUGH KENT COUNTY HOWARD TOWNSHIP SECTION SITE PLAN	

SUMMARY OF WATER WELL RECORDS					
TOWNLINERANGE LOT 17	CONCESSION 7 LOT 3	CONCESSION 5 LOT 4	CONCESSION 5 LOT 5	CONCESSION 5 LOT 6	CONCESSION 7 LOT 6
GROUNDWATER DEPTH 1.2 TO 4.6m EL. 190.8 TO 193.5	GROUNDWATER DEPTH 11.9m EL. 186.5	GROUNDWATER DEPTH 3.4 TO 6.1m EL. 184.1 TO 187.1	GROUNDWATER DEPTH 3.0 TO 4.6m EL. 185.9 TO 187.5	GROUNDWATER DEPTH 4.3 TO 5.2m EL. 185.3 TO 186.2	GROUNDWATER DEPTH 10.1m EL. 188.0
BEDROCK DEPTH 18.9 TO 27.4m EL. 163.1 TO 179.2	BEDROCK DEPTH 30.2m EL. 168.2	BEDROCK DEPTH 21.9 TO >24.7m EL. <165.8 TO 168.6	BEDROCK DEPTH 23.5 TO 27.7m EL. 162.8 TO 167.0	BEDROCK DEPTH 21.9 TO >24.1m EL. <166.4 TO 168.6	BEDROCK DEPTH >30.5m EL. <167.6



GEOCRES No. 4015-9

METRIC

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

PREFERRED OPTION


McCORMICK RANKIN CORPORATION
A member of 

 **Peto MacCallum Ltd.**
CONSULTING ENGINEERS

DATE **JANUARY 2010**

CHECKED BY: **C.N.**

DRAWN BY: **N.A.**

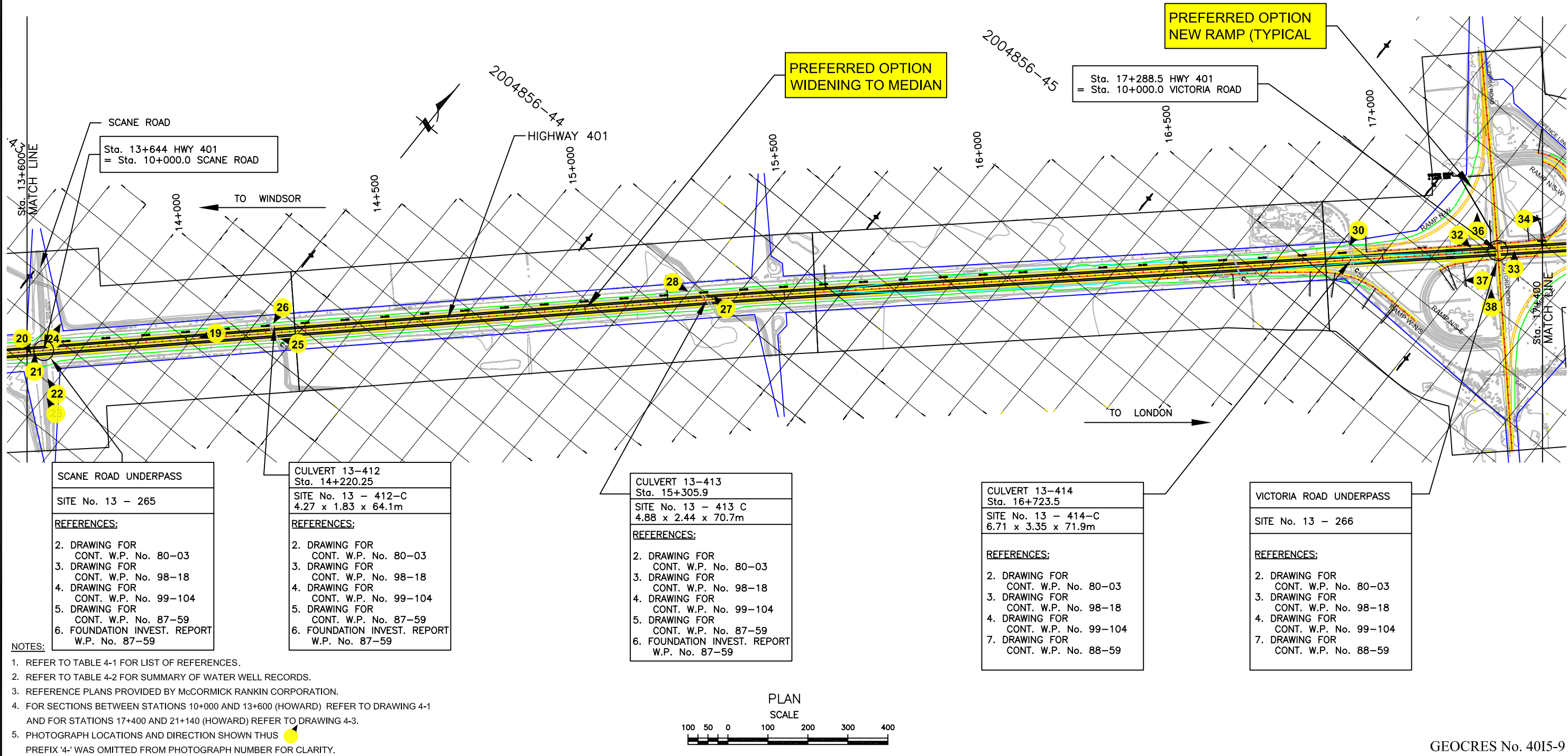
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GWP No 80-00-00

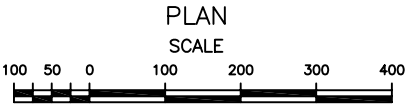
HIGHWAY 401
WIDENING THROUGH KENT COUNTY
HOWARD TOWNSHIP SECTION
SITE PLAN

DRAWING
P4-1


SUMMARY OF WATER WELL RECORDS					
CONCESSION 6 LOT 7	CONCESSION 6 LOT 8	CONCESSION 6 LOT 9	CONCESSION 6 LOT 10	CONCESSION 6 LOT 11	CONCESSION 6 LOT 12
GROUNDWATER DEPTH 4.3m EL. 186.3	GROUNDWATER DEPTH 4.3m EL. 187.7	NO DATA FOUND	GROUNDWATER DEPTH 3.7 TO 6.1m EL. 184.4 TO 186.8	NO DATA FOUND	GROUNDWATER DEPTH 4.6m TO 11.3m EL. 185.3 TO 192.6
BEDROCK DEPTH >23.5m EL. <167.0	BEDROCK DEPTH 30.5 TO 36.6m EL. 155.4 TO 161.5	NO DATA FOUND	BEDROCK DEPTH 27.4 TO 31.9m EL. 158.6 TO 163.1	NO DATA FOUND	BEDROCK DEPTH 27.4 TO 35.4m EL. 161.2 TO 170.1



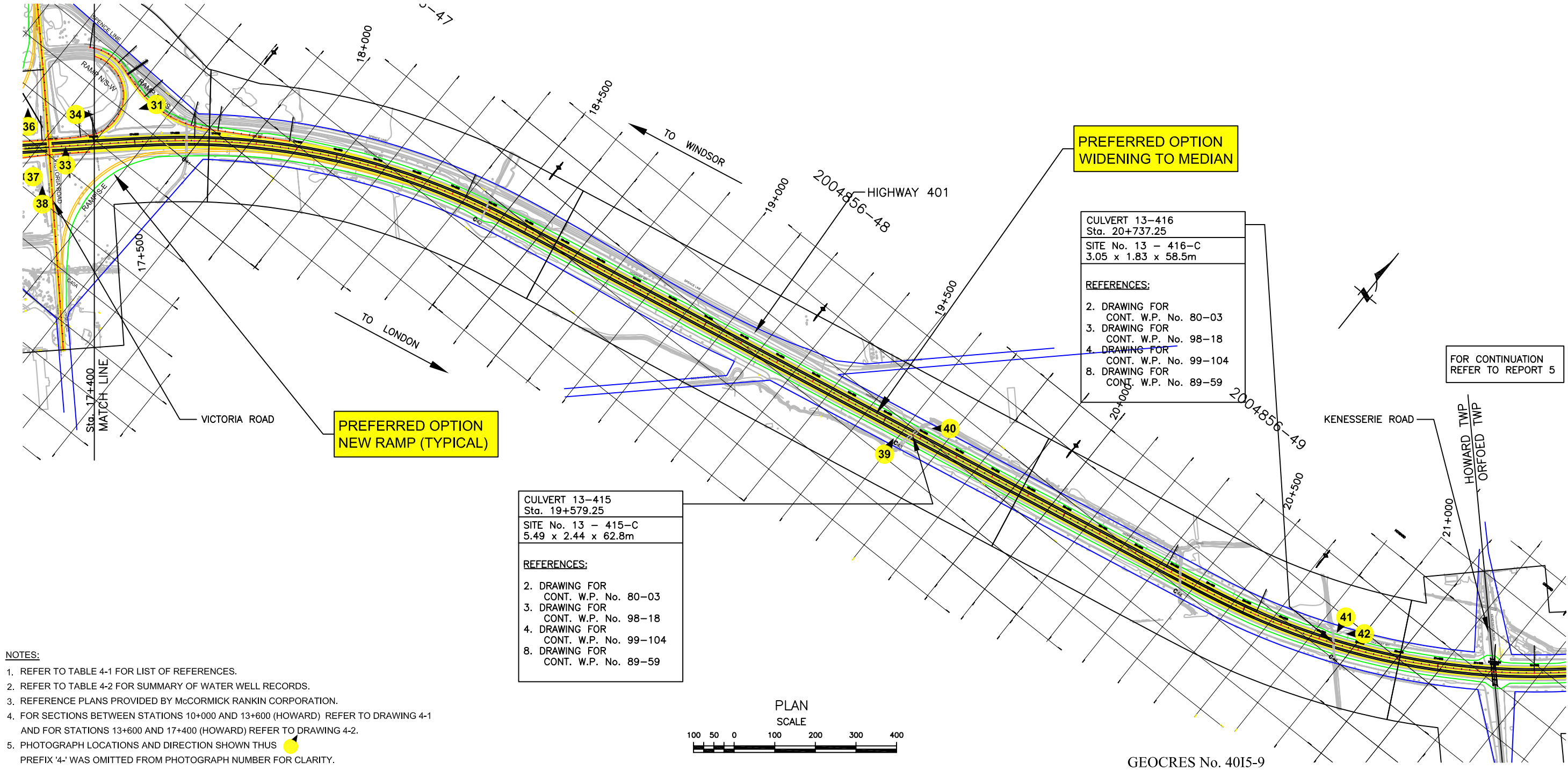
- NOTES:
1. REFER TO TABLE 4-1 FOR LIST OF REFERENCES.
 2. REFER TO TABLE 4-2 FOR SUMMARY OF WATER WELL RECORDS.
 3. REFERENCE PLANS PROVIDED BY McCORMICK RANKIN CORPORATION.
 4. FOR SECTIONS BETWEEN STATIONS 10+000 AND 13+600 (HOWARD) REFER TO DRAWING 4-1 AND FOR STATIONS 17+400 AND 21+140 (HOWARD) REFER TO DRAWING 4-3.
 5. PHOTOGRAPH LOCATIONS AND DIRECTION SHOWN THUS  PREFIX '4-' WAS OMITTED FROM PHOTOGRAPH NUMBER FOR CLARITY.



GEOCRES No. 4015-9

METRIC DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES	PREFERRED OPTION		 Peto MacCallum Ltd. CONSULTING ENGINEERS		CONT No	
				GWP No 80-00-00		
		 McCORMICK RANKIN CORPORATION A member of 	DATE JANUARY 2010	DRAWN BY: N.A.	HIGHWAY 401 WIDENING THROUGH KENT COUNTY HOWARD TOWNSHIP SECTION SITE PLAN	DRAWING P4-2
			CHECKED BY: C.N.	APPROVED BY: B.R.G.		

SUMMARY OF WATER WELL RECORDS						
CONCESSION 6 LOT 13	CONCESSION 6 LOT 14	CONCESSION 7 LOT 14	CONCESSION 7 LOT 15	CONCESSION 8 LOT 16	CONCESSION 7 LOT 17	CONCESSION 8 LOT 18
GROUNDWATER DEPTH 6.1 TO 9.4m EL. 184.4 TO 187.2	GROUNDWATER DEPTH 5.5 TO 6.1m EL. 184.4 TO 186.5	GROUNDWATER DEPTH 9.4 TO 12.2m EL. 188.7 TO 195.1	NO DATA FOUND	GROUNDWATER DEPTH: WELL DRY	NO DATA FOUND	GROUNDWATER DEPTH 37.8m EL. 167.9
BEDROCK DEPTH 28.0 TO >30.8m EL. 161.5 TO 168.6	BEDROCK DEPTH 29.3 TO 29.6m EL. 160.9 TO 162.7	BEDROCK DEPTH >25.3 TO >27.4m EL. <170.7 TO <182.0	NO DATA FOUND	BEDROCK DEPTH 43.6m EL. 165.2	NO DATA FOUND	BEDROCK DEPTH >38.1 TO 42.7m EL. 163.0 TO <167.6



METRIC

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

PREFERRED OPTION



A member of 



Peto MacCallum Ltd.
CONSULTING ENGINEERS

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
HOWARD TOWNSHIP SECTION
SITE PLAN



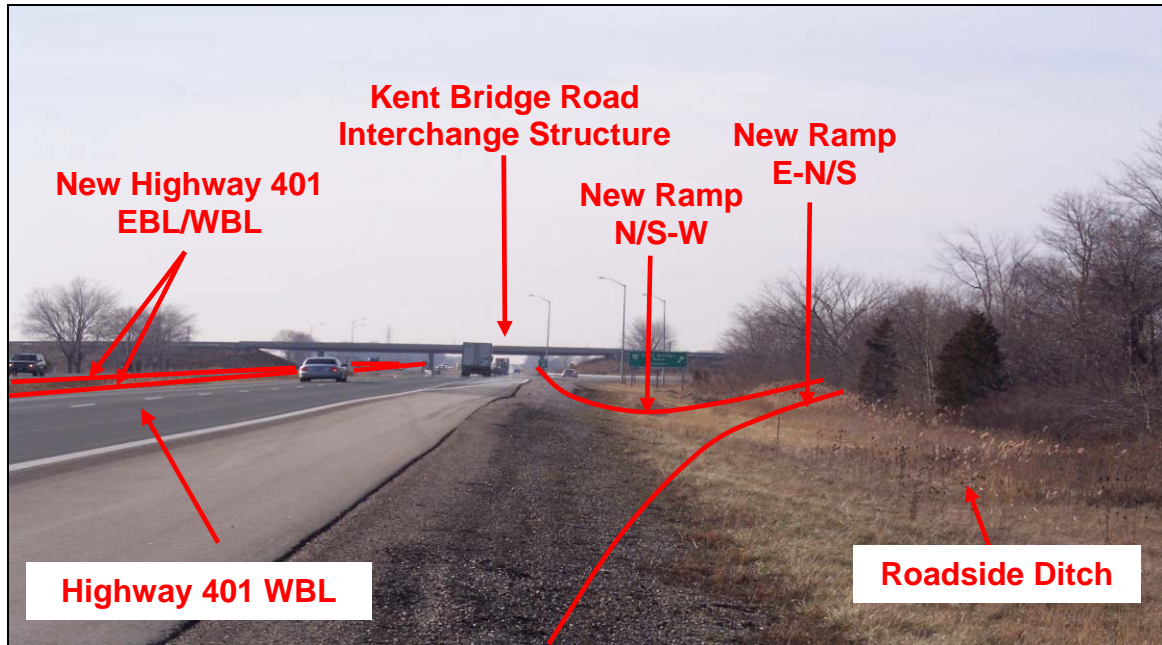
DRAWING
P4-3



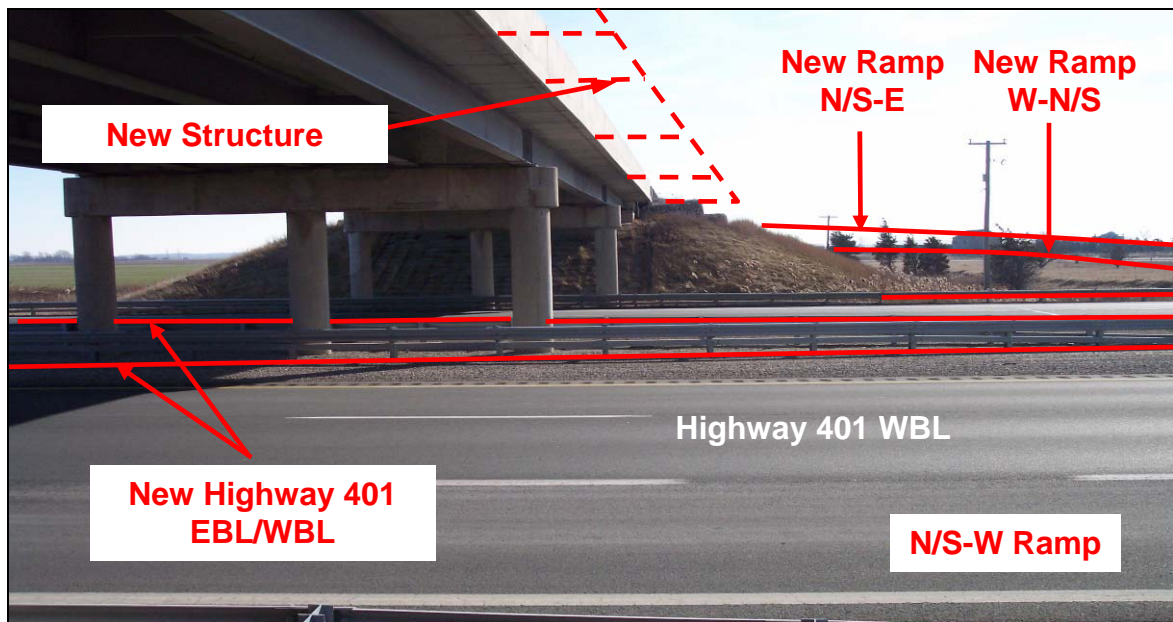
APPENDIX A

Site Photographs 4-1 to 4-42

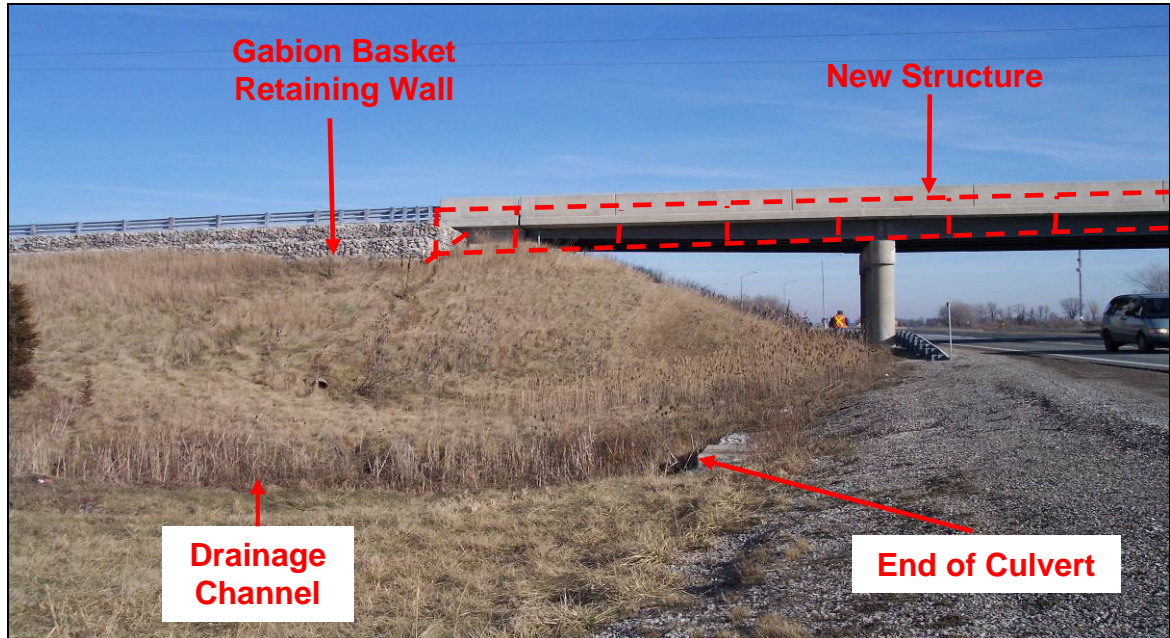
Photographs 4-1 to 4-8	–	Kent Bridge Road I/C
Photographs 4-9, 4-10	–	Culvert Site 13-407
Photographs 4-11, 4-12	–	Culvert Site 13-408
Photographs 4-13, 4-14	–	Culvert Site 13-409
Photographs 4-15 to 4-18	–	Culvert Site 13-410
Photographs 4-19 to 4-24	–	Scane Road Underpass
Photographs 4-25, 4-26	–	Culvert Site 13-412
Photographs 4-27, 4-28	–	Culvert Site 13-413
Photographs 4-29, 4-30	–	Culvert Site 13-414
Photographs 4-31 to 4-38	–	Victoria Road I/C
Photographs 4-39, 4-40	–	Culvert Site 13-415
Photographs 4-41, 4-42	–	Culvert Site 13-416



PHOTOGRAPH 4-1: Kent Bridge Road I/C Underpass. Looking west from north shoulder of Highway 401. Note generally flat terrain, built-up approach embankments to four-span structure. Preferred Option: Future Highway 401 EBL and WBL, N/S-W and E-N/S ramps are depicted. (January 27, 2006)



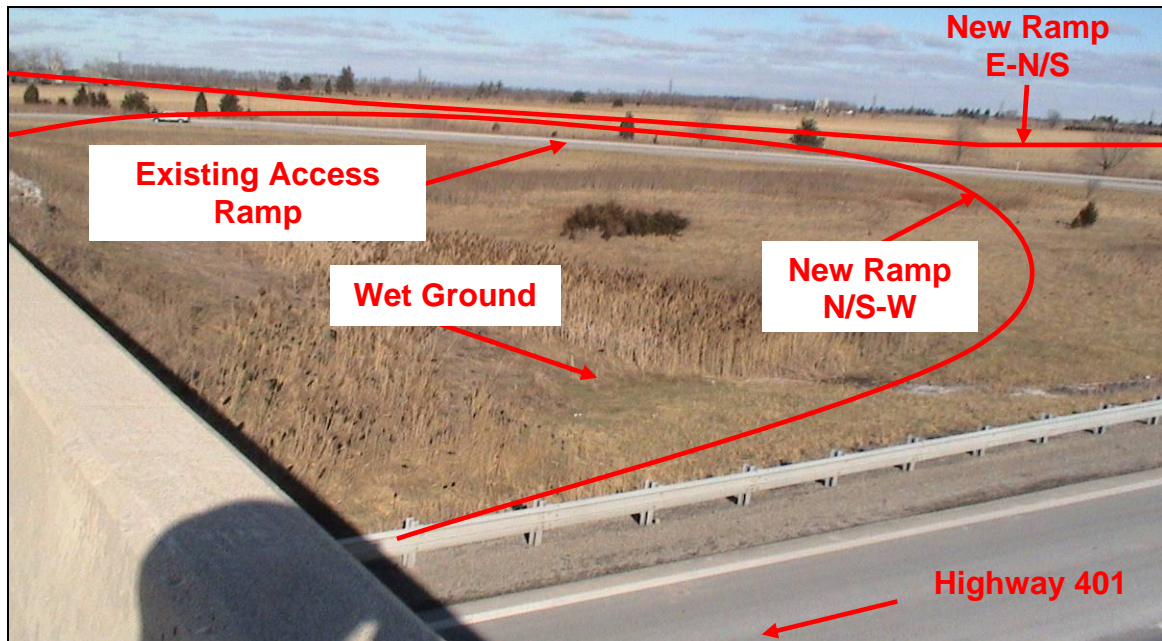
PHOTOGRAPH 4-2: Kent Bridge Road I/C Structure. Looking south along west side of structure. Note flat terrain beyond embankment, hydro pole line. Evergreens demark drainage ditch. Preferred Option: Future structure at the underpass in addition to new Highway 401 EBL and WBL, N/S-E and W-N/S ramps are depicted. (January 27, 2006)



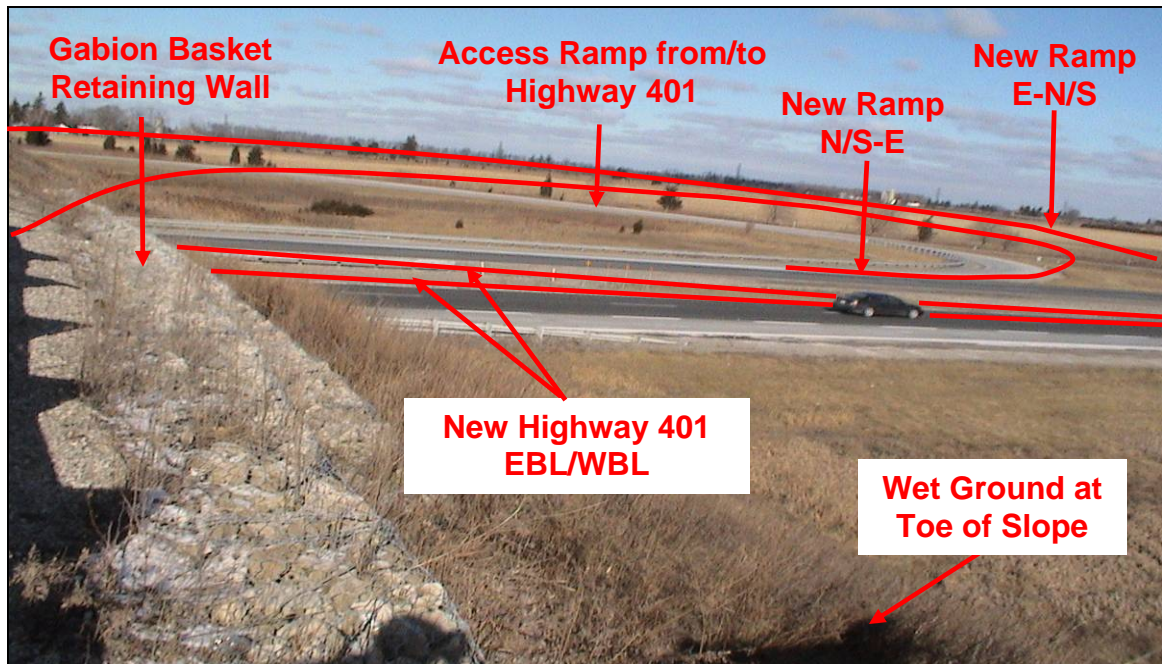
PHOTOGRAPH 4-3: Kent Bridge Road I/C Structure. Looking east from north shoulder of Highway 401. Note gabion basket retaining wall atop embankment, end of culvert in foreground. Preferred Option: Future structure at the underpass is depicted. (January 27, 2006)



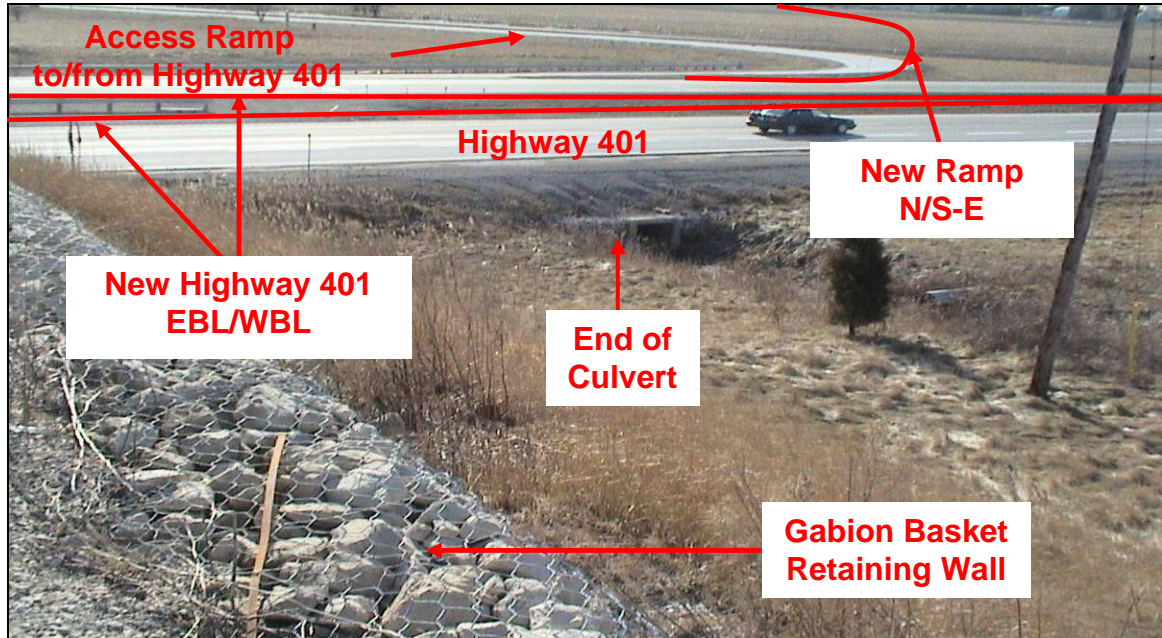
PHOTOGRAPH 4-4: Kent Bridge Road Interchange. Looking northwesterly from mid slope of south approach embankment. Note flat terrain, drainage ditch along evergreens south of Highway 401. Snow demarks drainage ditch north of highway. Preferred Option: Future N-W ramp is depicted. (January 26, 2006)



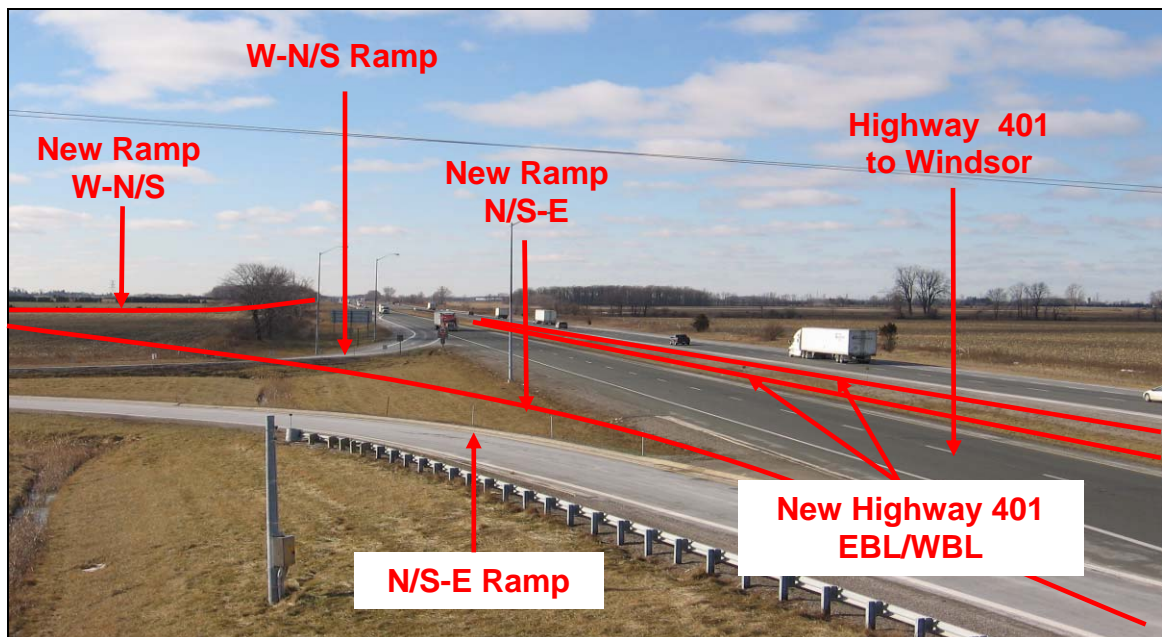
PHOTOGRAPH 4-5: Kent Bridge Road Interchange. Looking northeasterly at south end of north approach embankment and N/S-W and E-N/S ramp. Note flat terrain with no visible wetland except at toe of approach embankment likely due to poor drainage. Preferred Option: Future N/S-W and E-N/S ramps are depicted. (January 26, 2006)



PHOTOGRAPH 4-6: Kent Bridge Road Interchange. Looking northeasterly from east end of underpass structure at existing N/S-W and E-N/S access ramps. Note the wet ground near toe of south approach embankment. Preferred Option: Future Highway 401 EBL and WBL, N/S-W and E-N/S ramps are depicted. (January 26, 2006)



PHOTOGRAPH 4-7: Kent Bridge Road Interchange. Looking southwesterly at W-N/S and N/S-E ramps from top of north approach embankment. Note flat terrain without wetlands, end of culvert under Highway 401 and hydro pole. Gabion basket retaining wall in the foreground is atop of approach embankment. Preferred Option: Future Highway 401 EBL and WBL and N/S-E ramp are depicted. (January 26, 2006)



PHOTOGRAPH 4-8: Kent Bridge Road Interchange. Looking west at W-N/S and N/S-E access ramps. Note flat areas within and beyond ramps. Preferred Option: Future Highway 401 EBL and WBL , W-N/S and N/S-E ramps are depicted. (January 26, 2006)



PHOTOGRAPH 4-9: Culvert 13-407. Looking westerly at south end of culvert 13-407. Note flat terrain beyond culvert ditch and south approach embankment to Kent Bridge Road underpass. (June 29, 2006)



PHOTOGRAPH 4-10: Culvert 13-407. View through culvert from south end. Note continuous construction. (June 29, 2006)



PHOTOGRAPH 4-11: Culvert 13-408. Looking northwesterly at south end of culvert. Note partial blockage of channel on west side. (January 26, 2006)



PHOTOGRAPH 4-12: Culvert 13-408. Looking southeasterly at north end of culvert. Note wide channel and gabion baskets used for wing walls. (January 27, 2006)



PHOTOGRAPH 4-13: Culvert 13-409. Looking north at south end of culvert. Note east wing wall replaced with rock fill cover. Shallow road embankment over top of culvert, grass covered roadside ditches. (January 26, 2006)



PHOTOGRAPH 4-14: Culvert 13-409. Looking north across top of north end of culvert. Note gabion basket used for east wing wall (same for west side). Note gently undulating terrain beyond Highway 401 R.O.W. and farming land use. (January 27, 2006)



PHOTOGRAPH 4-15: Culvert 13-410. Looking south across top of south end of culvert. Note flat to gently undulating terrain and farming land use, deep culvert channel. (January 26, 2006)



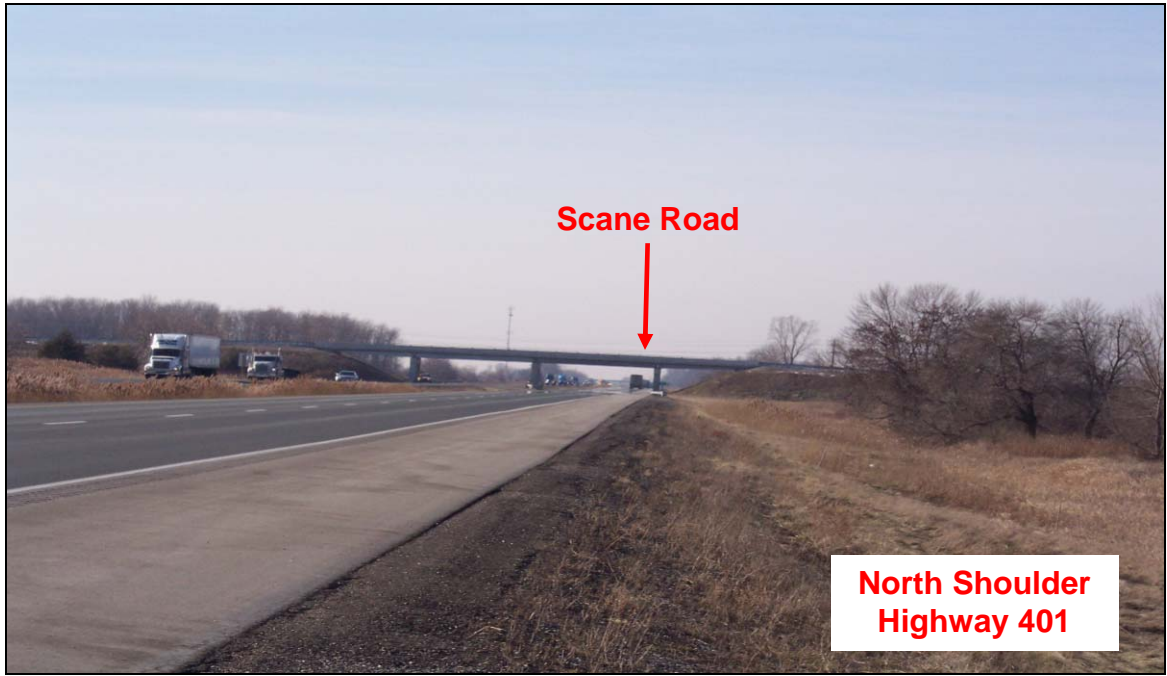
PHOTOGRAPH 4-16: Culvert 13-410. Looking west at west wing wall of south end of culvert. Note leaning wall, erosion at bottom of wall and rock fill cover placed for erosion protection. (January 26, 2006)



PHOTOGRAPH 4-17: Culvert 13-410. Looking north across top of north end of culvert. Note gabion baskets used for wing walls, deep drainage channel. (January 27, 2006)



PHOTOGRAPH 4-18: Culvert 13-410. Looking east at north end of culvert. Note sloughing soil partially blocking the drainage channel. (January 27, 2006)



PHOTOGRAPH 4-19: Scane Road Underpass. Looking west from north shoulder of Highway 401. Note generally flat terrain and built-up approach fill embankments. (January 27, 2006)



PHOTOGRAPH 4-20: Scane Road Underpass. Looking southeasterly from north shoulder of Highway 401. Note good condition of foundations, typically flat terrain in background. (January 27, 2006)



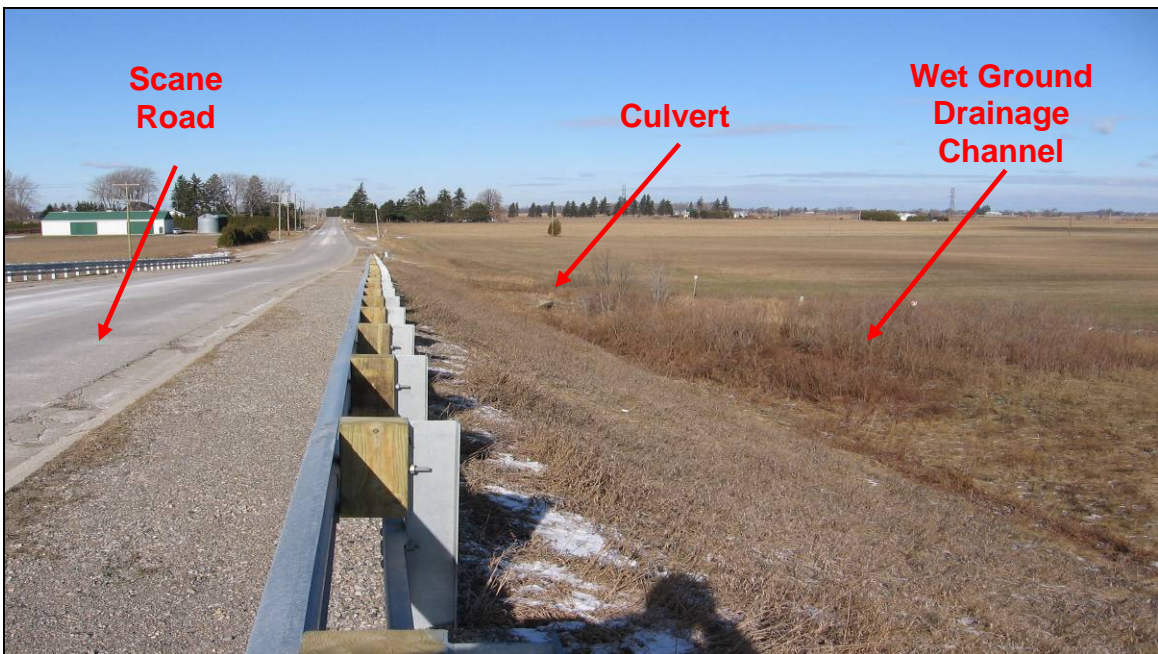
PHOTOGRAPH 4-21: Scane Road Underpass. Looking north along west side of south approach embankment. Note gravel cover on top of slope from 2005 bridge rehabilitation work in foreground. Note flat terrain beyond bridge and culvert end at left centre of photograph. (January 26, 2006)



PHOTOGRAPH 4-22: Scane Road Underpass. Looking north at east slope of south approach embankment. Note possible surficial soil sloughing in foreground. (January 26, 2006)



PHOTOGRAPH 4-23: Scane Road Underpass. Looking at east slope of south approach embankment. Note rough appearance indicating possible surficial sloughing. (January 26, 2006)



PHOTOGRAPH 4-24: Scane Road Underpass. Looking north east of Highway 401 and Scane Road. Note wet ground at drainage channel at toe of slope of north approach embankment, flat terrain in distance. (January 26, 2006)



PHOTOGRAPH 4-25: Culvert 13-412. Looking west at south end of culvert. Note leaning west wing wall and soil sloughing into channel. (January 26, 2006)



PHOTOGRAPH 4-26: Culvert 13-412. Looking southeasterly at north end of culvert. Note wing walls made up of gabion basket walls. (January 27, 2006)



PHOTOGRAPH 4-27: Culvert 13-413. Looking northwesterly at south end of culvert. Note rock fill cover placed on roadside ditch and beside culvert to control erosion. (January 26, 2006)



PHOTOGRAPH 4-28: Culvert 13-413. Looking southeasterly at north end of culvert. Note gabion basket wing walls. (January 27, 2006)



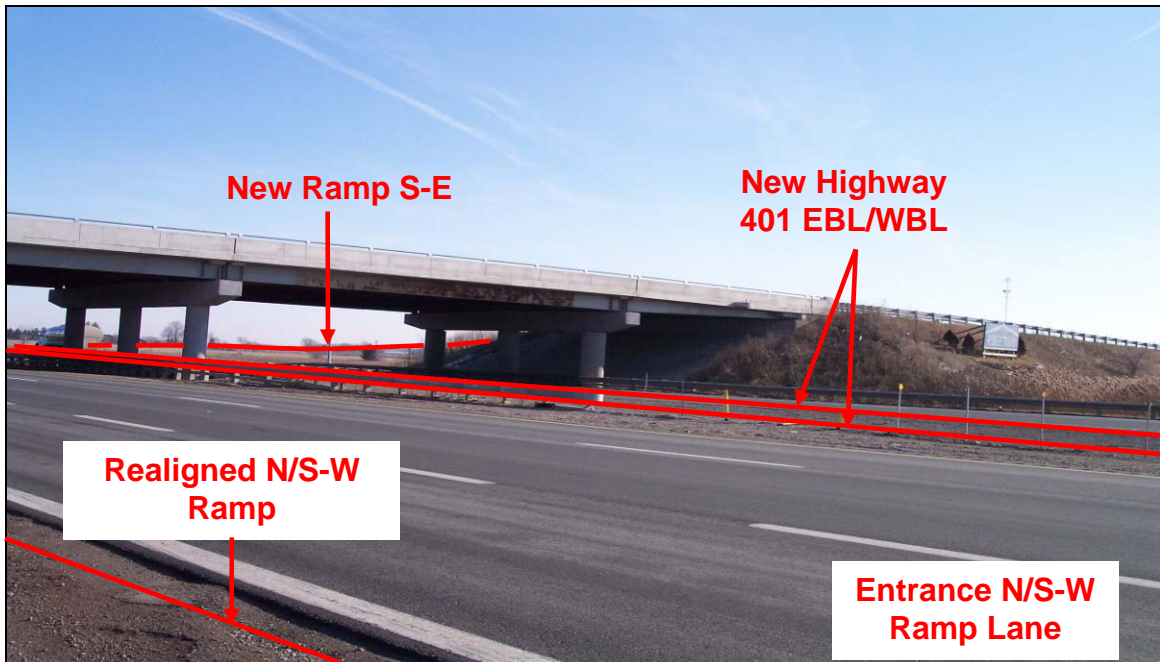
PHOTOGRAPH 4-29: Culvert 13-414. Looking southwesterly at north end of culvert. Note gabion basket used for wing walls. (January 27, 2006)



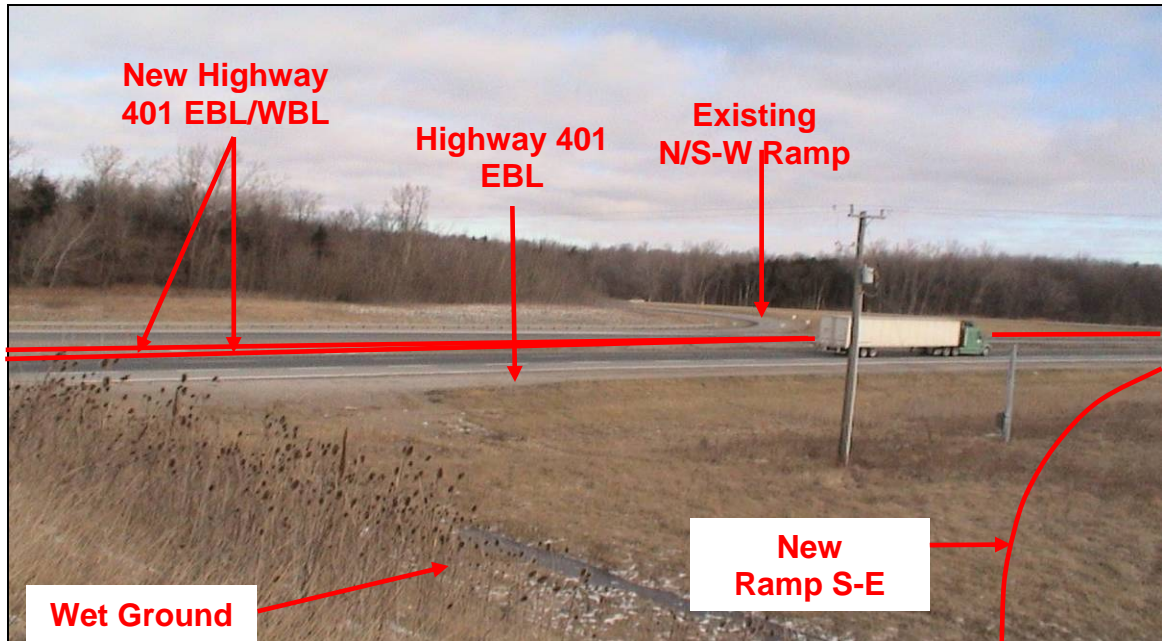
PHOTOGRAPH 4-30: Culvert 13-414. Looking southerly at north end of culvert. Note gabion basket detail and low Highway 401 embankment over top of culvert. (January 27, 2006)



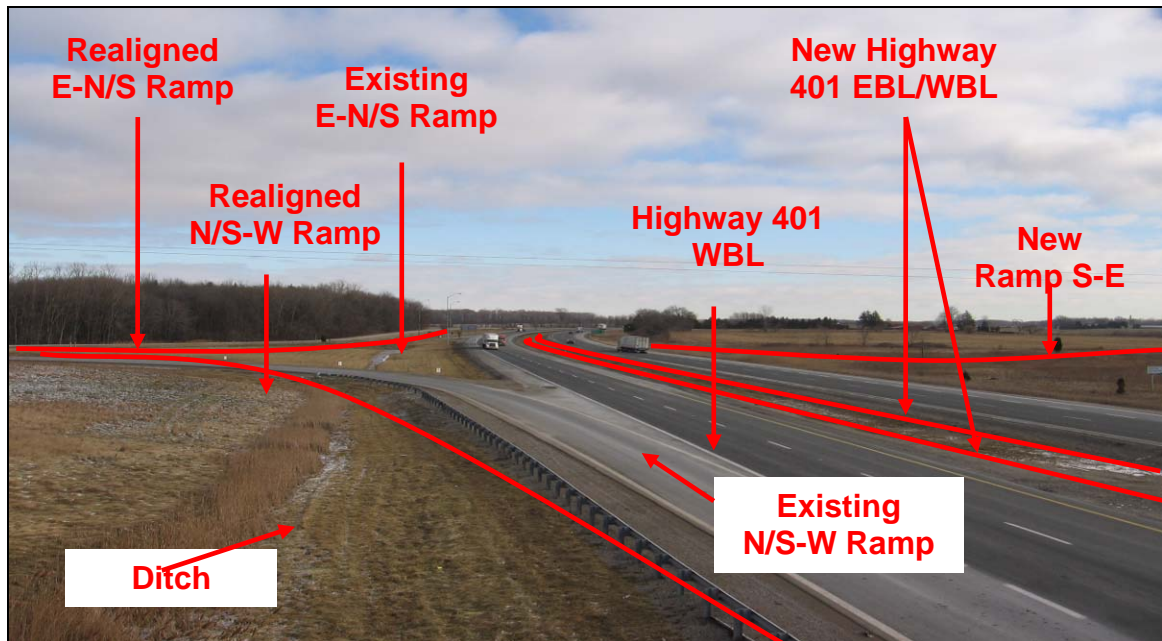
PHOTOGRAPH 4-31: Victoria Road Interchange. Looking west from E-N/S ramp from Highway 401. Note flat to gently rolling terrain beyond bridge. Future S-E ramp and realigned E-N/S ramp are depicted. (January 27, 2006)



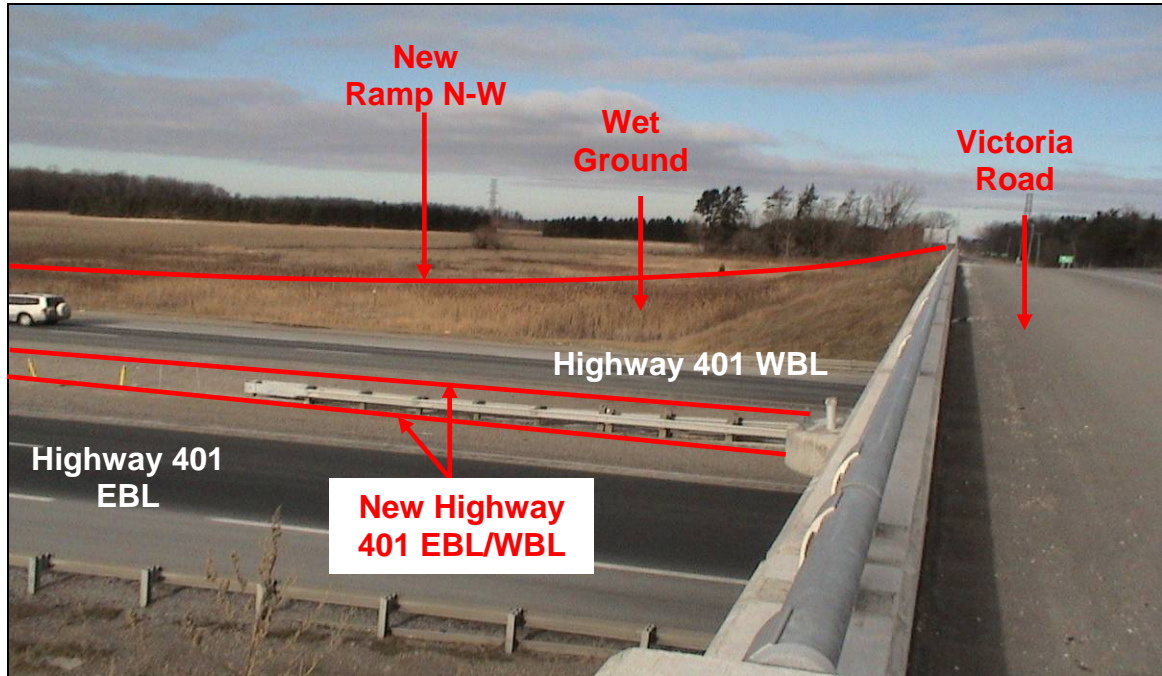
PHOTOGRAPH 4-32: Victoria Road Interchange. Looking southeasterly from north shoulder of Highway 401. Note N/S-W on-ramp on foreground, built-up south approach embankment and typically flat terrain beyond bridge. Future Highway 401 EBL and WBL, S-E ramp and realigned N/S-W ramp are depicted. (January 27, 2006)



PHOTOGRAPH 4-33: Victoria Road Interchange. Looking northeast from south approach embankment. N/S-W ramp start behind treed area. Note also wet ground at toe of south approach embankment in foreground. Future Highway 401 EBL and WBL and S-E ramp are depicted. (January 26, 2006)



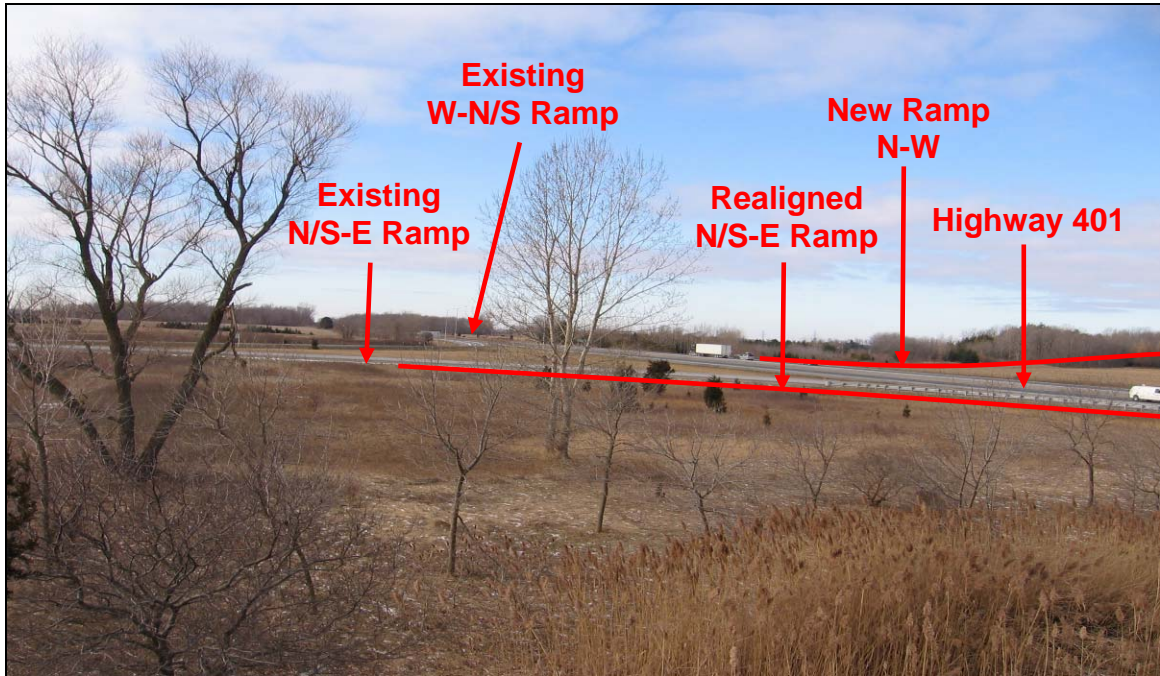
PHOTOGRAPH 4-34: Victoria Road Interchange. Looking east from north end of underpass structure. Note E-N/S and N/S-W ramps at Highway 401. Note grassed ditches in foreground and gently undulating terrain. Future Highway 401 EBL and WBL, S-E ramp and realigned N/S-W and E-N/S ramps are depicted. (January 26, 2006)



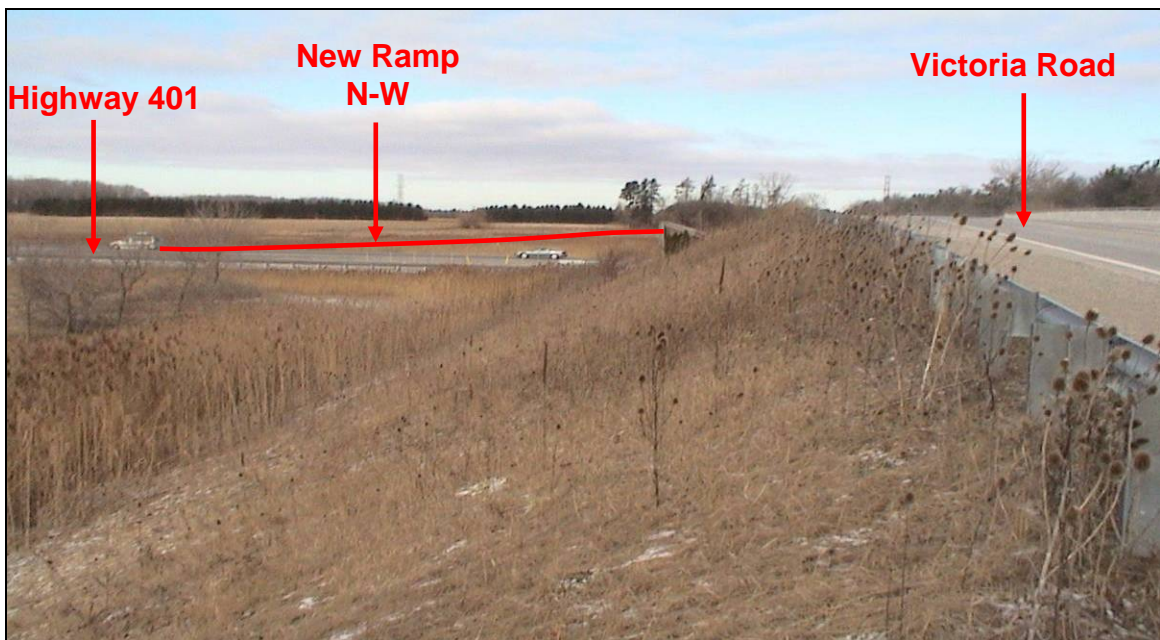
PHOTOGRAPH 4-35: Victoria Road Interchange. Looking north from southwest corner of bridge deck. Toe of slope area of north approach has open water. Note also flat to gently undulating terrain. Future Highway 401 EBL and WBL and N-W ramp are depicted. (January 26, 2006)



PHOTOGRAPH 4-36: Victoria Road Interchange. Close-up of surface water in ditch located at the west toe of slope of the north approach embankment. (January 27, 2006)



PHOTOGRAPH 4-37: Victoria Road Interchange. Looking west at W-N/S and N/S-E ramps from south of underpass. Note gently undulating terrain generally free of wet areas except at toe of slope (foreground right). Future N-W ramp and realigned N/S-E ramp are depicted. (January 26, 2006)



PHOTOGRAPH 4-38: Victoria Road Interchange. Looking north along west side from south approach embankment. Note typical grass cover and generally good condition of embankment, flat terrain beyond. Future N-W ramp is depicted. (January 26, 2006)



PHOTOGRAPH 4-39: Culvert 13-415. Looking northeasterly at south end of culvert. Note partially blocked channel due to siltation at end of culvert. (January 26, 2006)



PHOTOGRAPH 4-40: Culvert 13-415. Looking westerly at north end of culvert. Note grass covered roadside ditch. (January 27, 2006)



PHOTOGRAPH 4-41: Culvert 13-416. Looking westerly at north end of culvert. Note minor sloughing of bank in foreground. (January 27, 2006)



PHOTOGRAPH 4-42: Culvert 13-416. Looking west along sideroad ditch. Note heavy grass cover of ditches, flat terrain in background. (January 27, 2006)



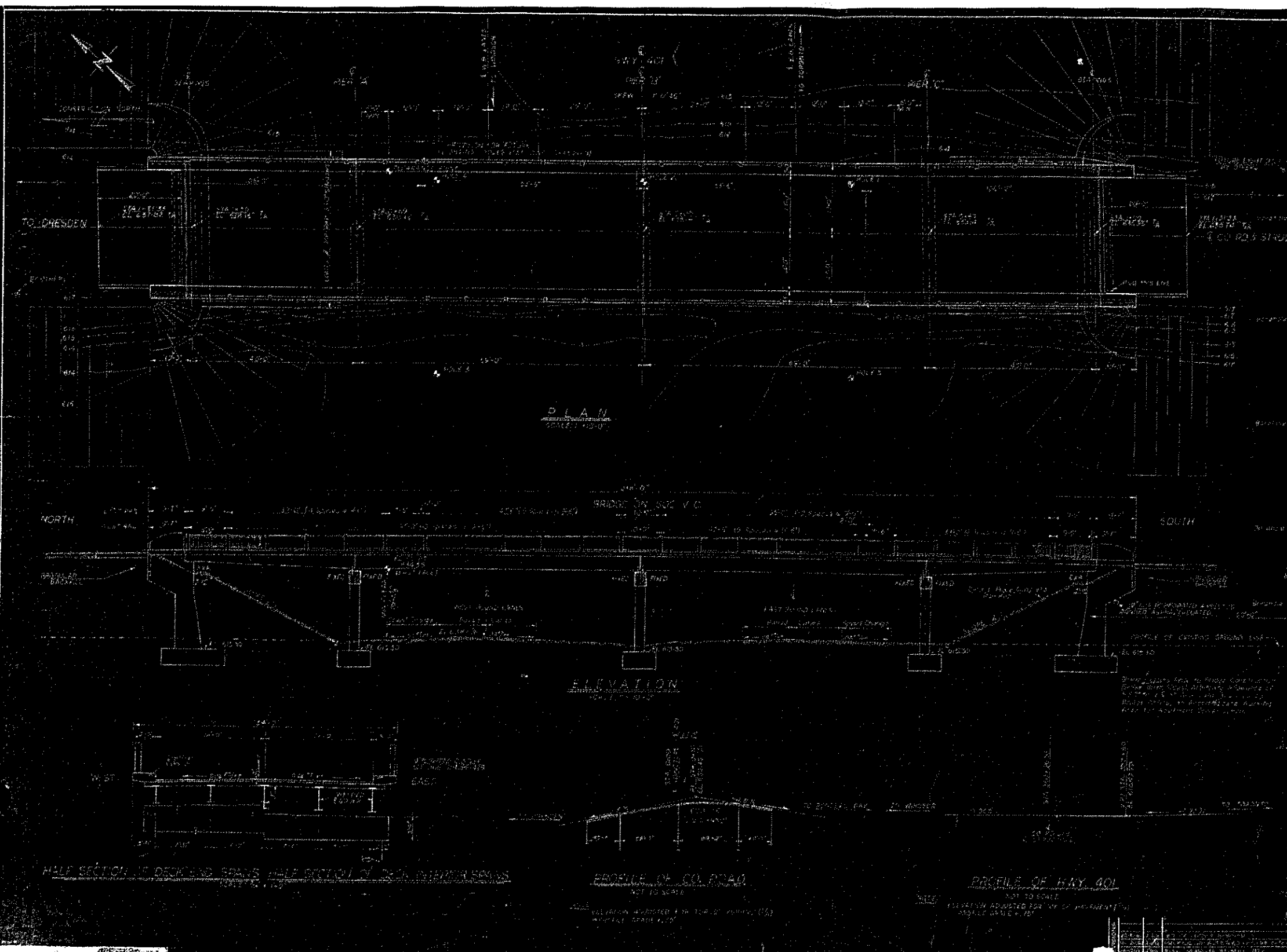
APPENDIX B

Previous Soil Data and Records of Boreholes

- (1) Contract Drawings for WP No. 86-59 (Kent Bridge Road)
- (2) Contract Drawings for Contract No. 80-03 (Kent Bridge Road and Scane Road)
- (3) Contract Drawings for Contract No. 98-18 (Soil Data)
- (4) Contract Drawings for Contract No. 99-104 (Soil Data)
- (5) Drawings for W.P. No. 87-59 (Scane Road)
- (6) Foundation Investigation Report for Scane Road
(Record of borehole sheets and borehole location plan)
- (7) Drawings for W.P. No. 88-59 (Victoria Road)
- (8) Construction Drawings for W.P. No. 89-59 (Kenesserie Road)



- (1) Contract Drawings for WP No. 86-59, Kent County Road No. 15 (Kent Bridge Road) Interchange Drawing D-4596-1, September 1960.



DATA FOR SKEW NO. 14-12-16

SIN θ =	0.239893
COS θ =	0.970808
TAN θ =	0.247036
CO θ =	47.74-12
TAN θ =	1.000000

D-2086-1 Garage, 1964
 D-2086-2 Garage, 1964
 D-2086-3 Garage, 1964
 D-2086-4 Garage, 1964
 D-2086-5 Garage, 1964
 D-2086-6 Garage, 1964

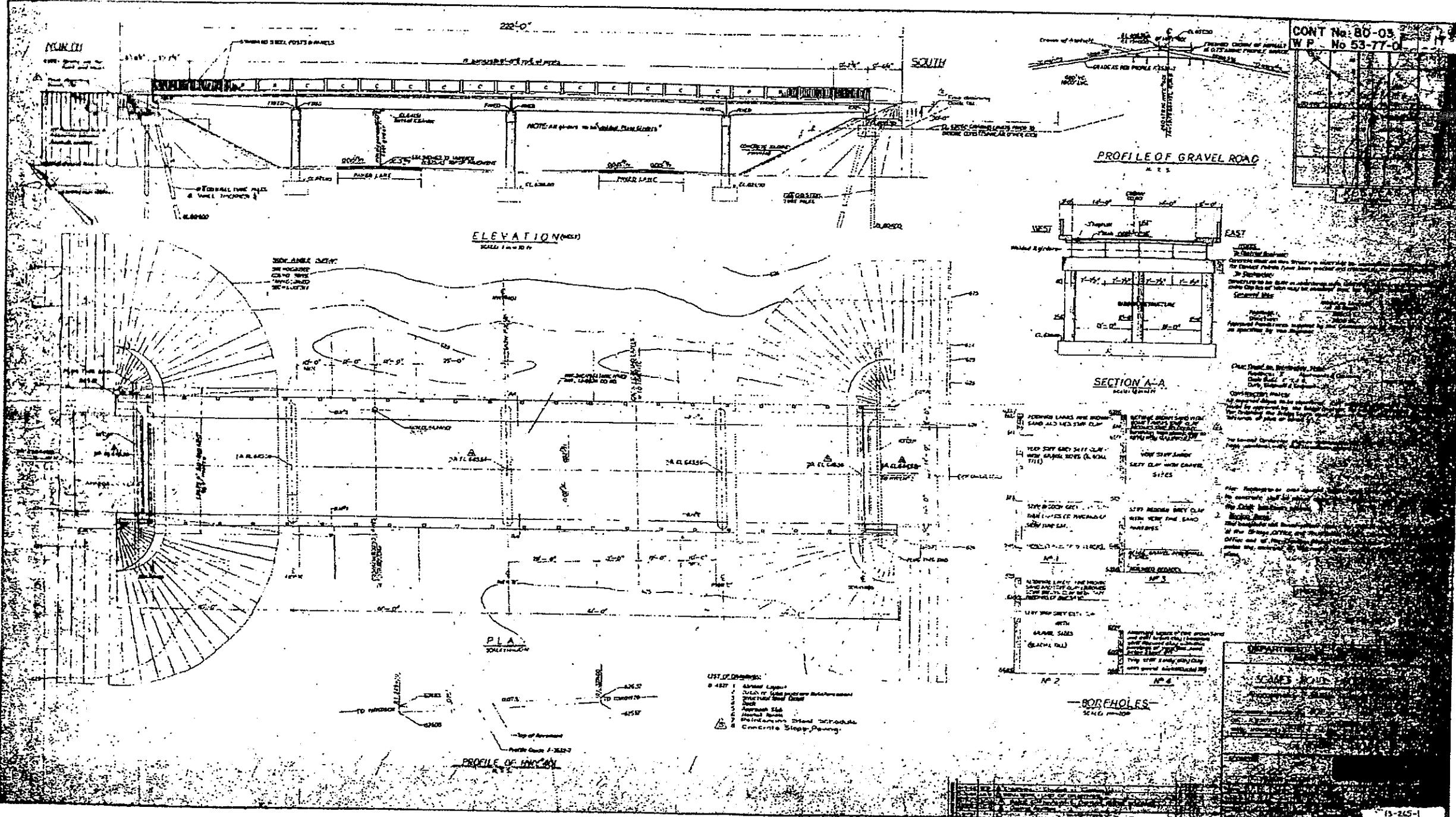
[illegible][illegible][illegible]

CITY RU
 2
 MILES W OF R
 HWAY 25
 44-38861-44-38861
 GENERAL L.A.
 44-38861-44-38861

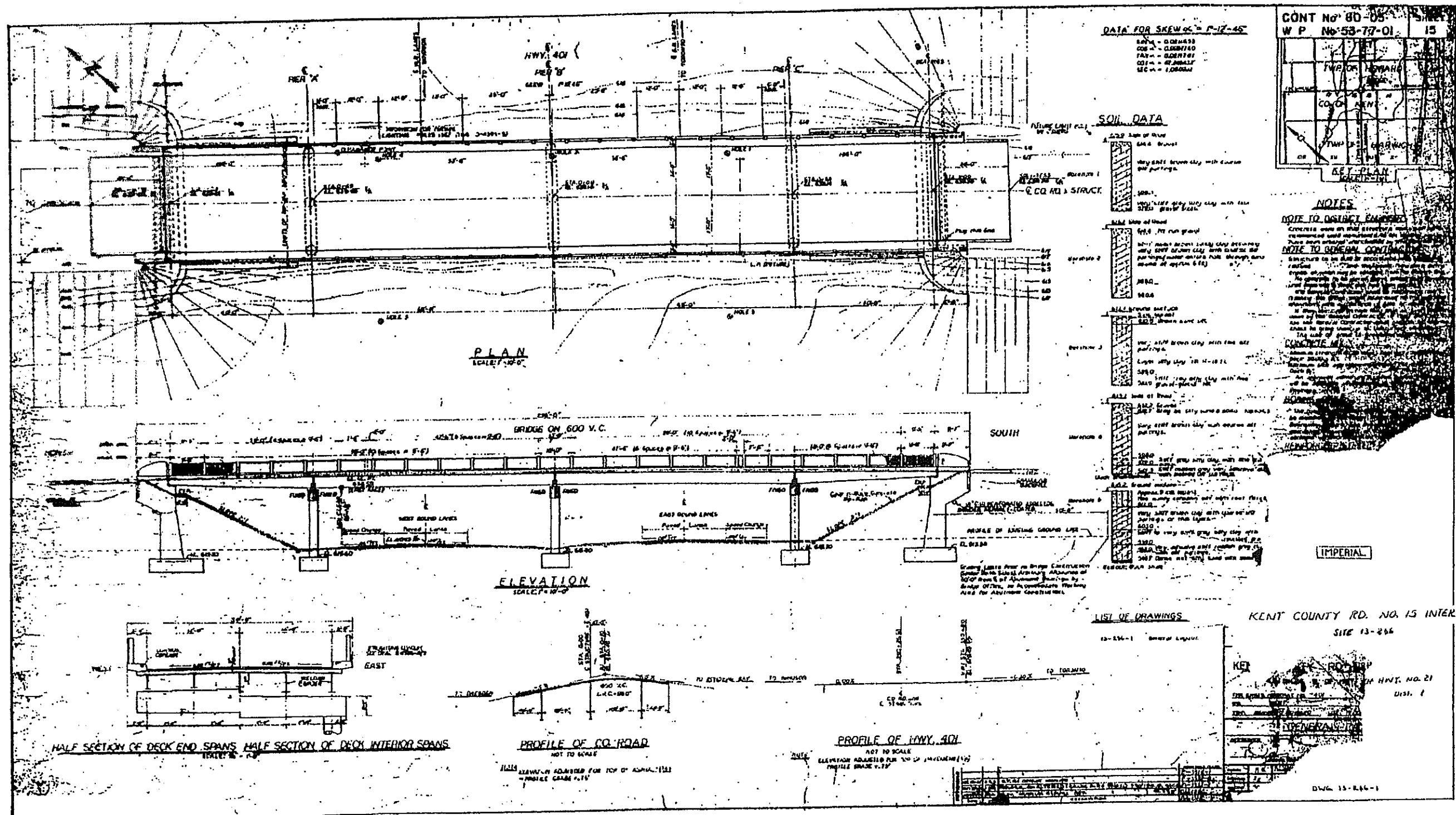
3-256
D 4576-1



- (2) Contract Drawings for Contract No. 80-03 for Highway 401 from 0.6 km west of interchange No. 12 (Kent Bridge Road) easterly to 1.1 km west of interchange No. 14 (Kenesserie Road), August 1979.



CONT No: 80-03
W.P. No 53-77-0





- (3) Contract Drawings for Contract No. 98-18 for Highway 401 eastbound lanes, from 0.8 km west of Bloomfield Road easterly to 1.8 km west of Kent Road 20 (Kenesserie Road), February 1998.

METRIC

PLATE No		CONT No 98-18		WP No 603-93-00		SHEET	
SOIL DATA		DEPTH OF TOPSOIL		DEPTH (mm)		89	
HIGHWAY 401 EBL		STATION		TOWNSHIP		OFFSET (m) (from centre of	
						roadway)	



- (4) Contract Drawings for Contract No. 99-104 for Highway 401 from 1.1 km west of Bloomfield Road easterly to 1.8 km west of Orford Road, April 1999.

METRIC

194000, 72 LT	194000, 42 LT	204000, 68 LT
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350	350	350
500	500	500
650	650	650
800	800	800
950	950	950
1100	1100	1100
1250	1250	1250
1400	1400	1400
1550	1550	1550
1700	1700	1700
1850	1850	1850
2000	2000	2000
2150	2150	2150
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3950	3950	3950
4100	4100	4100
4250	4250	4250
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4550	4550	4550
4700	4700	4700
4850	4850	4850
5000	5000	5000
5150	5150	5150
5300	5300	5300
5450	5450	5450
5600	5600	5600
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7700	7700	7700
7850	7850	7850
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8150	8150	8150
8300	8300	8300
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8900	8900	8900
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9200	9200	9200
9350	9350	9350
9500	9500	9500
9650	9650	9650
9800	9800	9800
9950	9950	9950

Lot	Tree	REMARKS
20	Gravel	Reinforcing Steel with 20
25	Gravel	Four foot, lower 20 are concrete below 40, remaining steel.
30	Gravel	Lane 28 are concrete median 40, remaining Lower 15 are in 4' increments.

LINE	ITEM	QTY	UNIT PRICE	AMOUNT	TAXES	TOTAL	DATE
1	1.00	1.00	1.00	1.00	0.00	1.00	01/01/01
2	2.00	2.00	2.00	2.00	0.00	2.00	01/01/01
3	3.00	3.00	3.00	3.00	0.00	3.00	01/01/01
4	4.00	4.00	4.00	4.00	0.00	4.00	01/01/01
5	5.00	5.00	5.00	5.00	0.00	5.00	01/01/01
6	6.00	6.00	6.00	6.00	0.00	6.00	01/01/01
7	7.00	7.00	7.00	7.00	0.00	7.00	01/01/01
8	8.00	8.00	8.00	8.00	0.00	8.00	01/01/01
9	9.00	9.00	9.00	9.00	0.00	9.00	01/01/01
10	10.00	10.00	10.00	10.00	0.00	10.00	01/01/01
11	11.00	11.00	11.00	11.00	0.00	11.00	01/01/01
12	12.00	12.00	12.00	12.00	0.00	12.00	01/01/01
13	13.00	13.00	13.00	13.00	0.00	13.00	01/01/01
14	14.00	14.00	14.00	14.00	0.00	14.00	01/01/01
15	15.00	15.00	15.00	15.00	0.00	15.00	01/01/01
16	16.00	16.00	16.00	16.00	0.00	16.00	01/01/01
17	17.00	17.00	17.00	17.00	0.00	17.00	01/01/01
18	18.00	18.00	18.00	18.00	0.00	18.00	01/01/01
19	19.00	19.00	19.00	19.00	0.00	19.00	01/01/01
20	20.00	20.00	20.00	20.00	0.00	20.00	01/01/01
21	21.00	21.00	21.00	21.00	0.00	21.00	01/01/01
22	22.00	22.00	22.00	22.00	0.00	22.00	01/01/01
23	23.00	23.00	23.00	23.00	0.00	23.00	01/01/01
24	24.00	24.00	24.00	24.00	0.00	24.00	01/01/01
25	25.00	25.00	25.00	25.00	0.00	25.00	01/01/01
26	26.00	26.00	26.00	26.00	0.00	26.00	01/01/01
27	27.00	27.00	27.00	27.00	0.00	27.00	01/01/01
28	28.00	28.00	28.00	28.00	0.00	28.00	01/01/01
29	29.00	29.00	29.00	29.00	0.00	29.00	01/01/01
30	30.00	30.00	30.00	30.00	0.00	30.00	01/01/01
31	31.00	31.00	31.00	31.00	0.00	31.00	01/01/01
32	32.00	32.00	32.00	32.00	0.00	32.00	01/01/01
33	33.00	33.00	33.00	33.00	0.00	33.00	01/01/01
34	34.00	4					

[illegible][illegible]

1000. 4.2 RT	1000. 5.2 RT	1000. 4.1 RT	1000. 4.2 RT
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
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97	97	97	97
98	98	98	98
99	99	99	99
100	100	100	100

201200, 43 LT	0	100	Age
0	100	0	0
0	100	250	0
0	100	500	0
0	100	750	0
0	100	800	0
201400, 73 LT	0	200	0
0	0	400	0
0	0	600	0
0	0	800	0
0	0	1,37	0
0	0	1,37	0
201600, 72 LT	0	200	0
0	0	400	0
0	0	600	0
0	0	800	0
0	0	1,37	0
0	0	1,37	0
201800, 57 LT	0	200	0
0	0	400	0
0	0	600	0
0	0	750	0
0	0	1,40	0
0	0	1,40	0
201900, 42 LT	0	200	0
0	0	400	0
0	0	600	0
0	0	750	0
0	0	1,40	0
0	0	1,40	0

[illegible]

RESIDUAL DOLLARS DATE	
OFFSET FROM Q. WESTBROOK	
17-400, 6.5 LT	
0	200
200	200
800	200
1.22	1.22
17-400, 8.8 LT	
0	200
200	200
800	200
1.60	1.60
17-400, 9.5 LT	
0	200
200	200
2.44	2.44
3.05	3.05
3.46	3.46
18-400, 10.2 LT	
0	200
200	200
700	200
1.52	1.52
18-400, 12.7 LT	
0	200
200	200
700	200
1.52	1.52

[illegible][illegible]

STATION	07928 [m]
WESTBOUND LANE	
TOWNSHIP OF HO-	
DONING LAKE	
17+600	2.7
18+218	1.8
18+428	2.8
19+616	2.3
19+218	3.8

100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900	10000
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100, 5.0 RT	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900	7000	7100	7200	7300																											


TOWNSHIP OF HOWARD		WESTWARD PASSING LANE		EFFECT FROM CL. WESTWARD LINES	
100 FT		100 FT		100 FT	
0	160	0	250	0	250
10	150	10	240	10	240
20	140	20	230	20	230
30	130	30	220	30	220
40	120	40	210	40	210
50	110	50	200	50	200
60	100	60	190	60	190
70	90	70	180	70	180
80	80	80	170	80	170
90	70	90	160	90	160
100	60	100	150	100	150
110	50	110	140	110	140
120	40	120	130	120	130
130	30	130	120	130	120
140	20	140	110	140	110
150	10	150	100	150	100
160	0	160	90	160	90
170		170	80	170	80
180		180	70	180	70
190		190	60	190	60
200		200	50	200	50
210		210	40	210	40
220		220	30	220	30
230		230	20	230	20
240		240	10	240	10
250		250	0	250	0

[illegible][illegible][illegible]

Y 160	-	66	40
Y 160	35	65	50
Y 40	-	-	-
Y 210	70	130	50
1969			
Y 125	-	68	30
Y 130	-	-	-
Y 90	-	-	-
Y 125	-	80	40
Y 125	-	15	30
Y 80	-	-	-
Y 210	-	70	70
Y 235	75	120	60

204100	13 11 11	204100	24 01 11	204100	21 01 11
204776	25 15 11	204705	24 01 11	204705	23 01 11
204776	41 11 11	204705	40 01 11	204705	39 01 11
214150	25 15 11	214960	20 01 11	214960	20 01 11

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																	
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
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500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600
600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700
700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800
800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900
900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100
1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200
1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300
1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400
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713	-	2.44	6 3 9 1 56
17800	5.2 RT		
0	-	480	B-5 F & C, Comand, 5108
0	-	158	B-5 F, Deane, 5000, 5078
16100	3.9 RT		
0	-	700	G 8th S, W 12
0	-	1.82	15 15 58 87

1997年12月25日

[illegible]

220	Coarser	Finishing Steel	Lower 20 mm
		Reinforcing Steel	
220	Coarser	Reinforcing Steel	
220	Coarser	Reinforcing Steel	

100	210	85	135	50
200	200	85	135	40
300	200	85	130	40

NUMBER OF DROPPING LANE	10+500	2.4	13
114+500	2.5 <td>13</td> <td></td>	13	
114+700	2.2 <td>13</td> <td></td>	13	



- (5) Drawings for W.P. No. 87-59 for Scane Road Underpass (TWP 112-265)
November 1960.



- (6) Foundation Investigation Report for Scane Road Underpass by William A. Trow & Associates Ltd., Project J477 dated March 25, 1960, W.P. No. 87-59, Geocres file 40I5-2.

PROJECT NO. J-477

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT: County Road Underpass SP 87-55

LOCATION: North of Ridgeway, Ont.

HOLE LOCATION: See Dwg. 1

HOLE ELEVATION AND DATUM: 623.2 BM, see Dwg. 1

BOREHOLE NO. 1

FIELD SUPERVISOR:

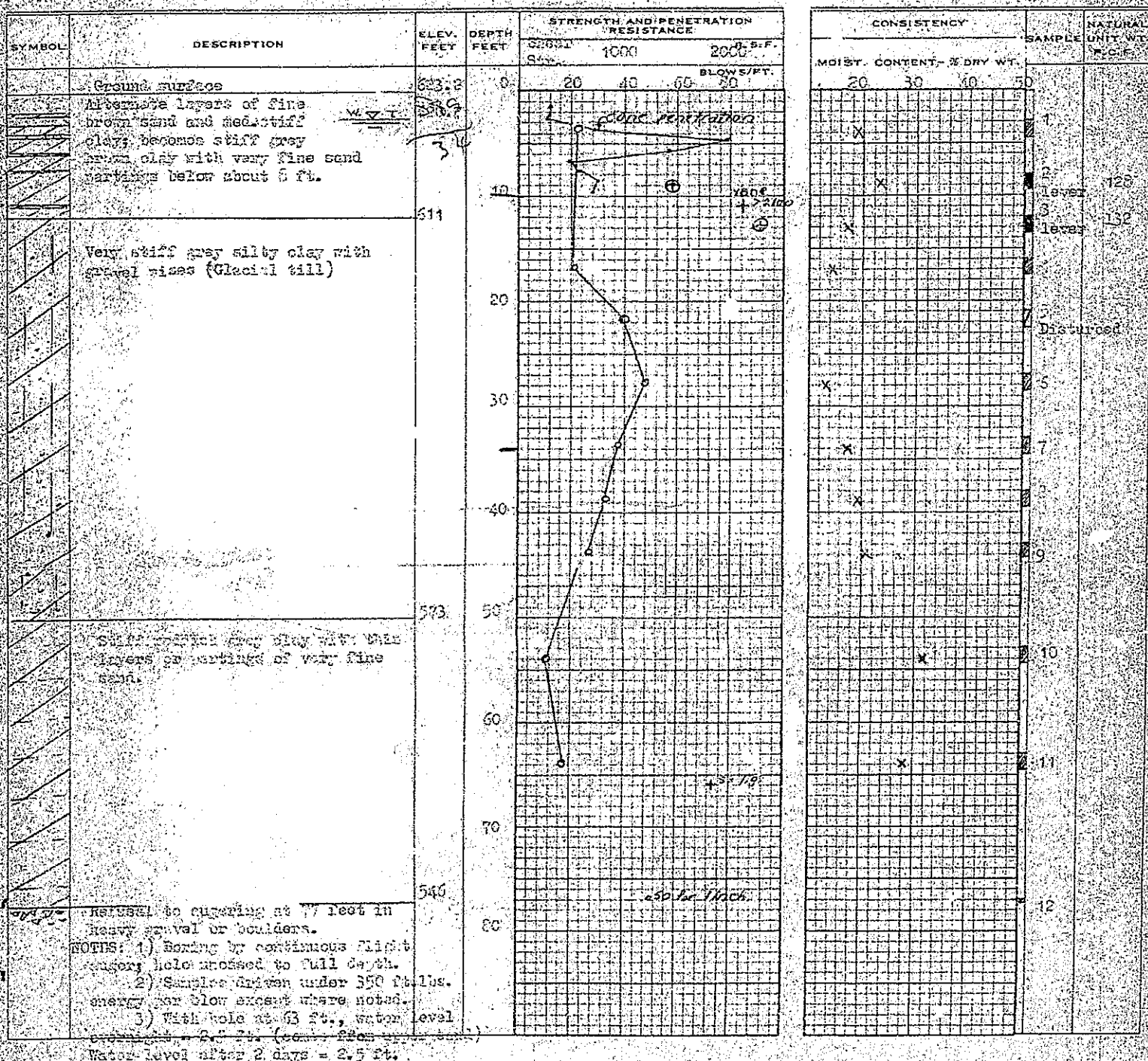
DRILLER:

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 (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

PROJECT NO. 3477

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT LOCATION: 1000 W. 10th St. S. W. 10th St. S. W.

LOCATION: 1000 W. 10th St. S. W. 10th St. S. W.

HOLE LOCATION: 1000 W. 10th St. S. W. 10th St. S. W.

HOLE ELEVATION AND DATUM: 1000 W. 10th St. S. W. 10th St. S. W.

BOREHOLE NO. 1

FIELD SUPERVISOR

DRILLER

PREP

DRAWING NO. 3

LEGEND

1" DIA. SPLIT TUBE

2" DIA. SHELBY TUBE

3" DIA. SPLIT TUBE

4" DIA. CONE

CASING

5" SHELBY

1/2 UNCONFINED COMPRESSION (QU)

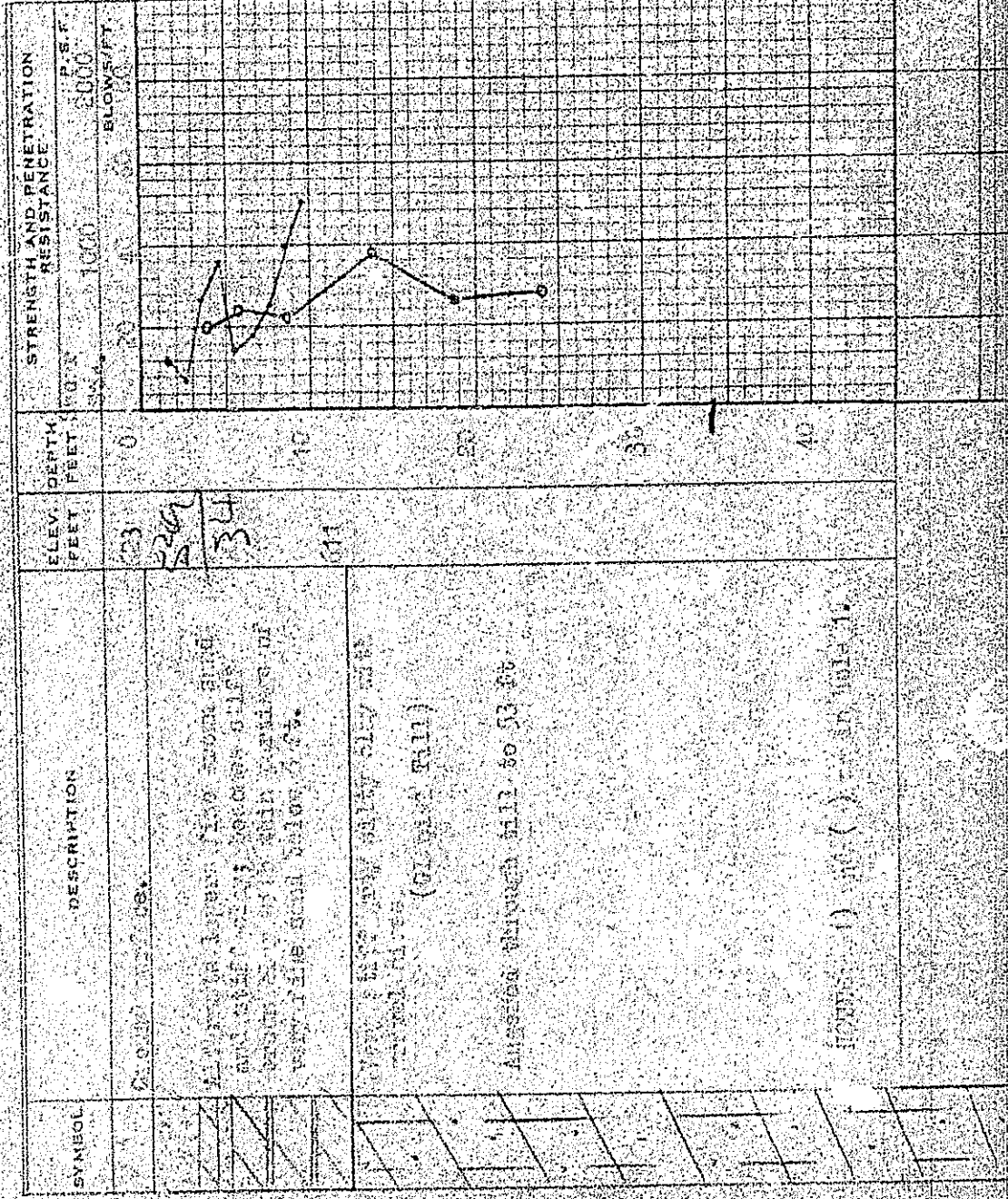
VANE TEST (C) AND SENSITIVITY (S)

NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT



NOTES: (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100)

PROJECT NO. J 177

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT County Road Underpass P 84-59

LOCATION North of Ringtown

HOLE LOCATION See Inv. 1

HOLE ELEVATION AND DATUM 622.6

BOREHOLE NO. 3

FIELD SUPERVISOR

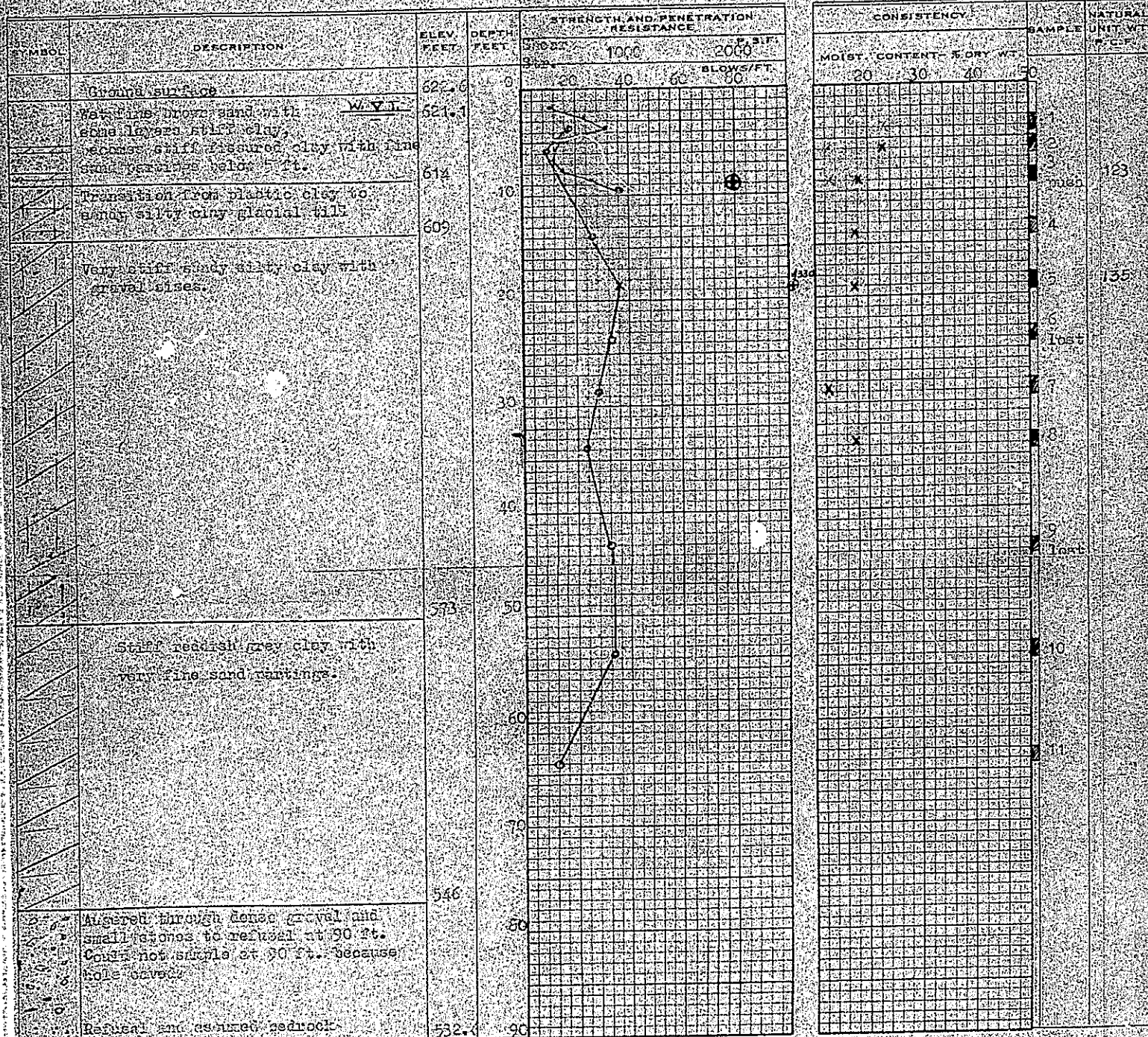
DRILLER

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



DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

PROJECT NO.

DRAWING NO.

WILLIAM A. TROW & ASSOCIATES LTD.

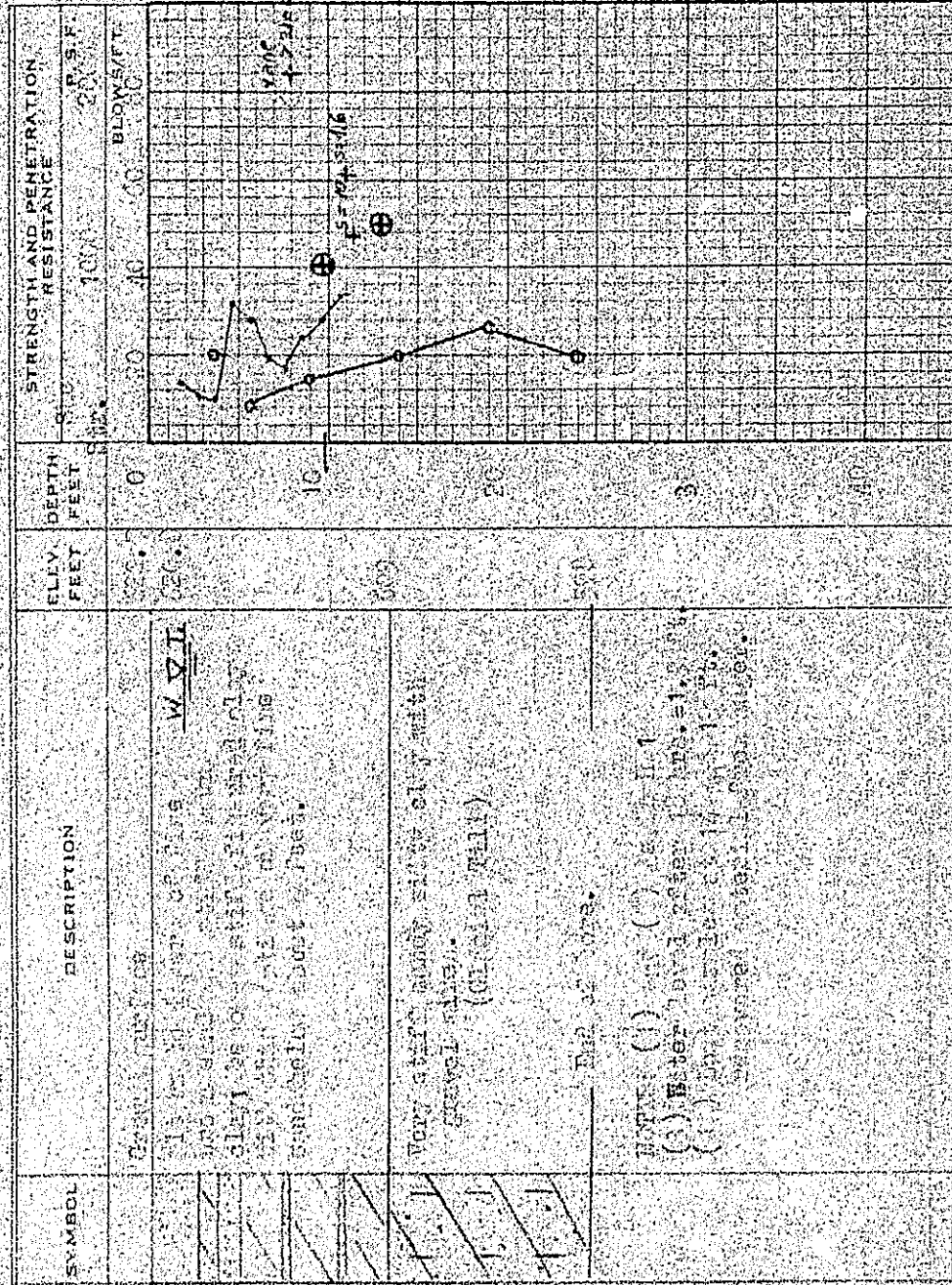
SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

LEGEND

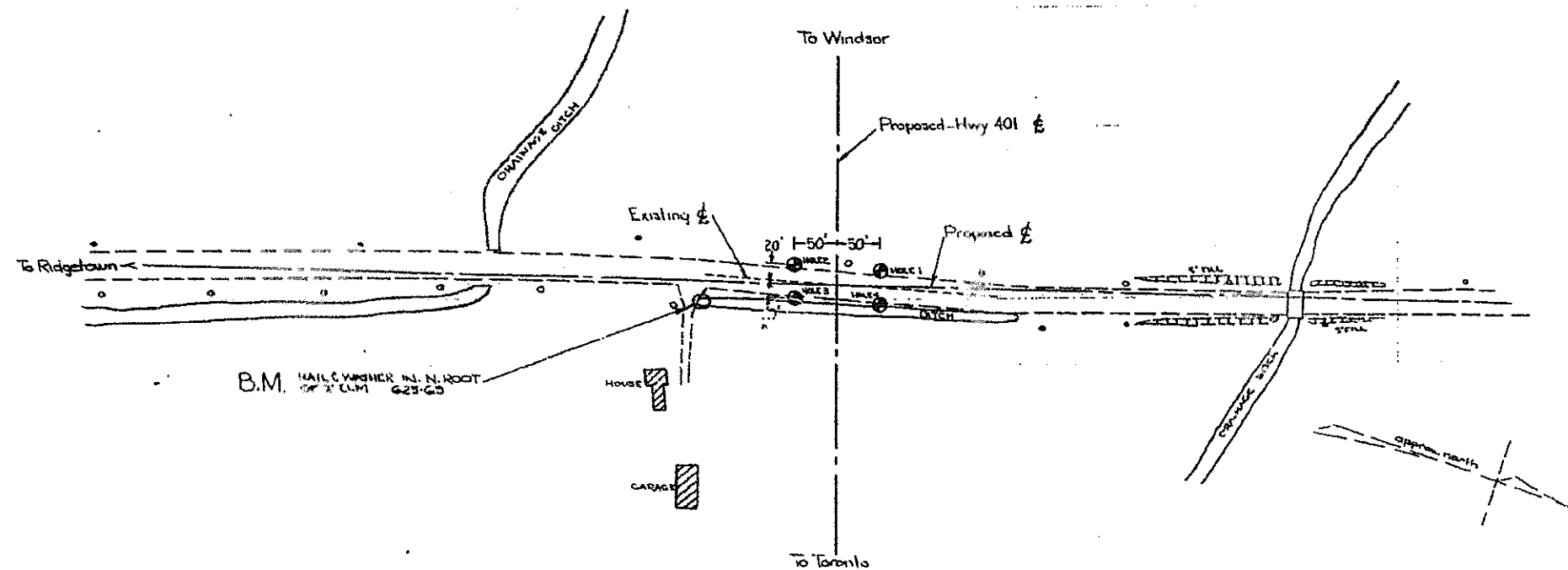
- 2" DIA. SPLIT TUBE
- 2" SHELBY TUBE
- 2" SPLIT TUBE
- 1" DIA. CONE
- CASING
- 2" SHELBY

PROJECT LOCATION: BOREHOLE NO. 1
FIELD SUPERVISOR: DRILLER: PREP:
HOLE LOCATION: SEE LOG
HOLE ELEVATION AND DATUM: 100.0

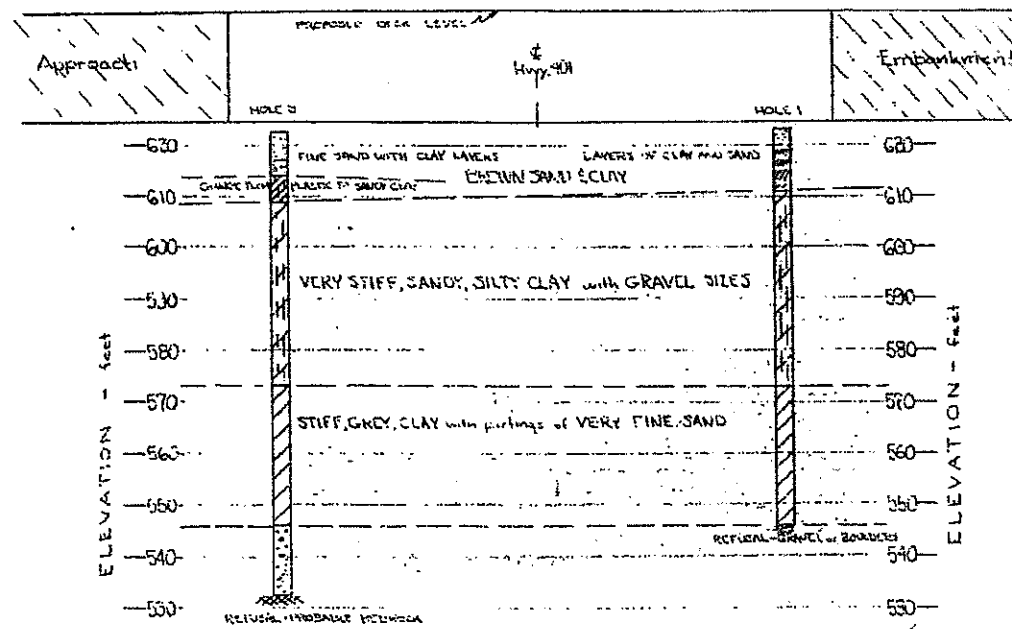
1/2 UNCONFINED COMPRESSION (QU)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT



NOTE: (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19) (20) (21) (22) (23) (24) (25) (26) (27) (28) (29) (30) (31) (32) (33) (34) (35) (36) (37) (38) (39) (40) (41) (42) (43) (44) (45) (46) (47) (48) (49) (50) (51) (52) (53) (54) (55) (56) (57) (58) (59) (60) (61) (62) (63) (64) (65) (66) (67) (68) (69) (70) (71) (72) (73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87) (88) (89) (90) (91) (92) (93) (94) (95) (96) (97) (98) (99) (100)



BOREHOLE LOCATION PLAN SCALE 1"=100'



ESTIMATED STRATIGRAPHY SCALE 1"=20'

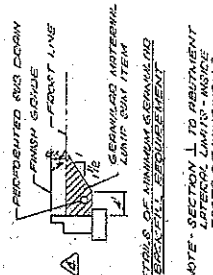
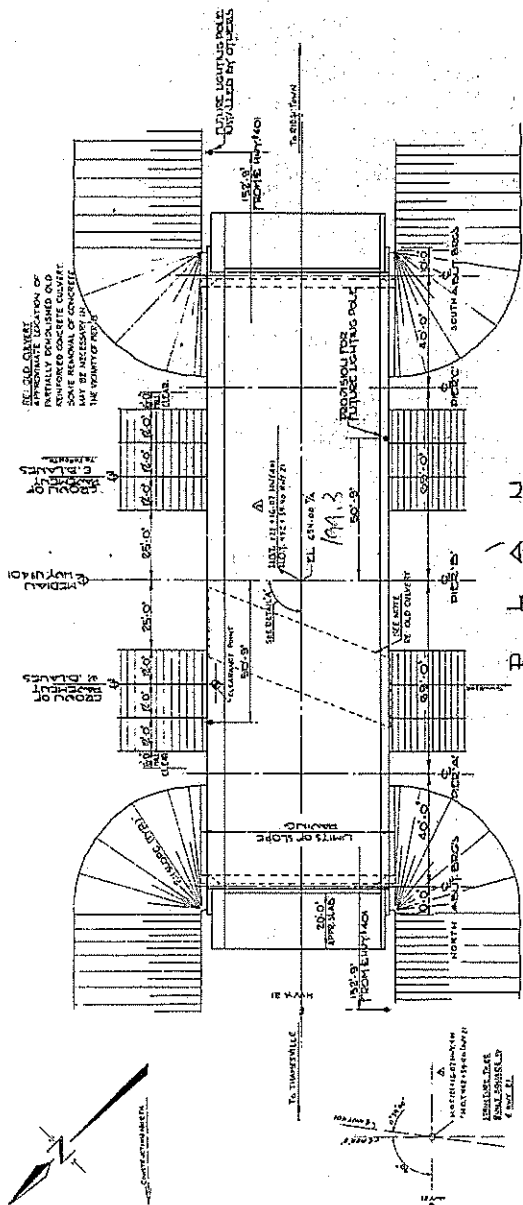
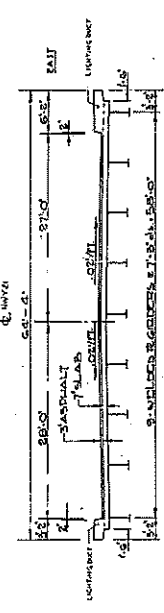
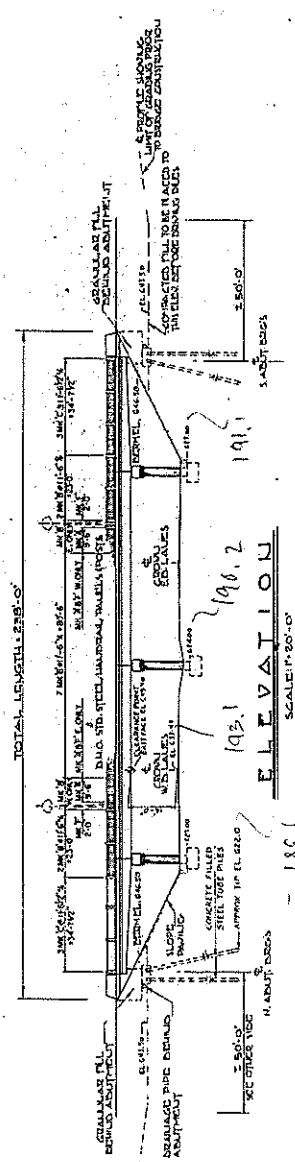
PROPOSED UNDERPASS
W.P. 87-59

FOUNDATION INVESTIGATION
WM. A. TROY & ASSOCIATES LTD.



- (7) Drawings for W.P. No. 88-59 for Highway 21 Interchange (Victoria Road)
(TWP 112-266), January 1964.

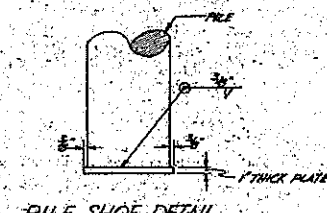
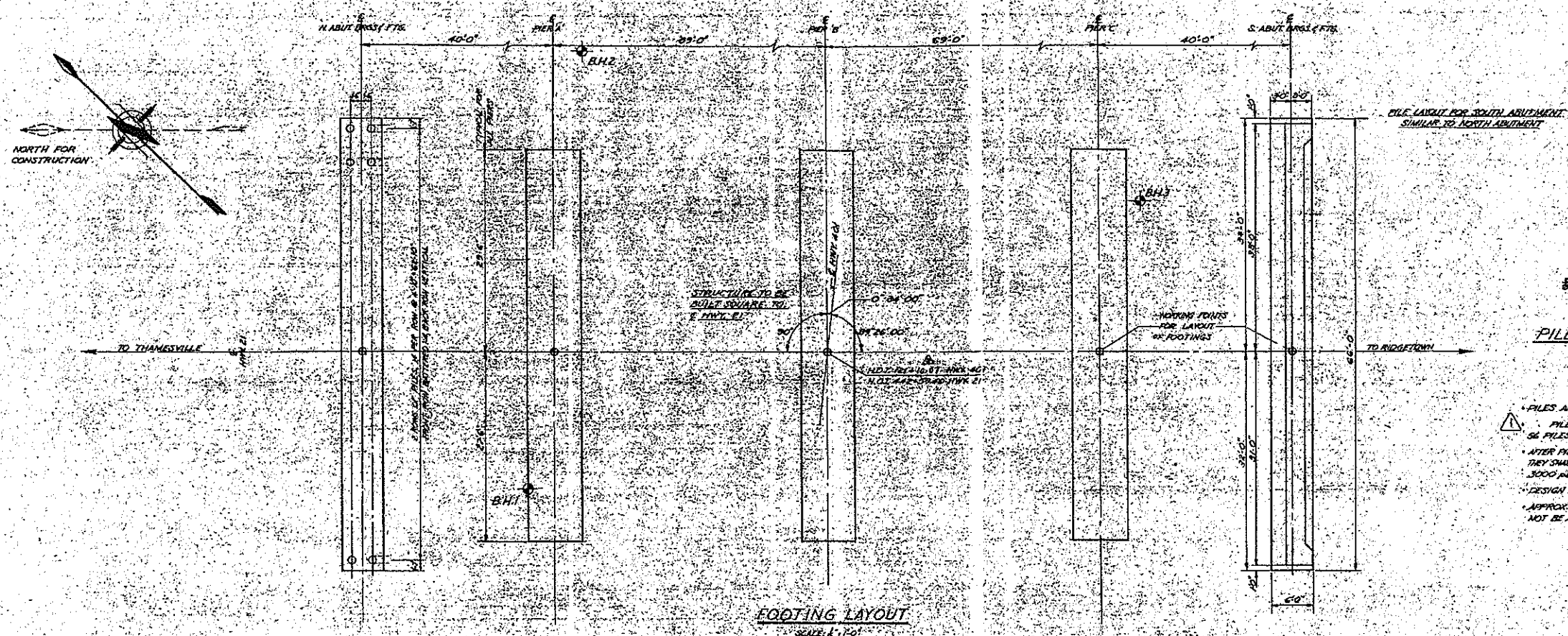
VICTORIA ROAD

[illegible]

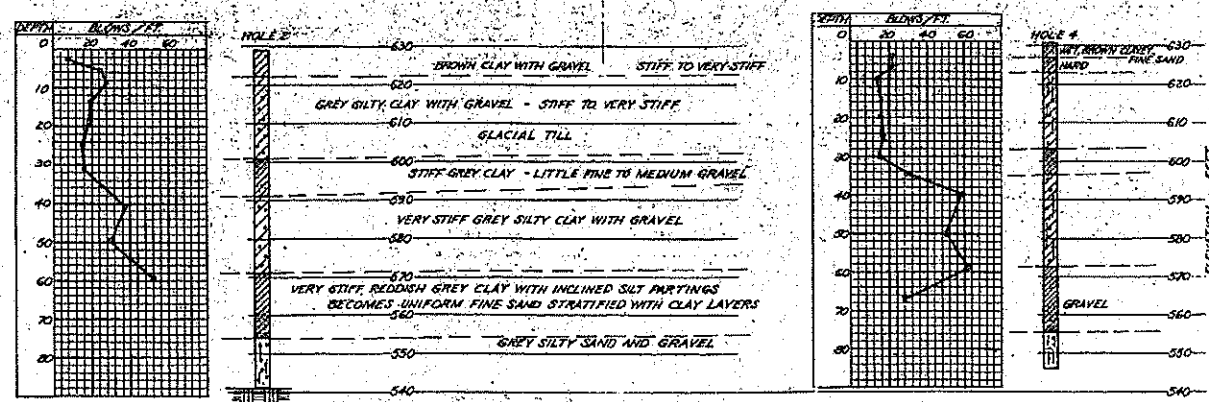
- | LIST OF DRAWINGS | |
|------------------|---------------------------------------|
| 1 | GENERAL PLAN |
| 2 | FOOTING LAYOUT AND SOIL DATA |
| 3 | FOUNDATIONS, WALLS AND EXPOSITS |
| 4 | PIERS |
| 5 | STRUCTURAL STEEL |
| 6 | BEARINGS |
| 7 | DECK |
| 8 | APPROACH SLAB |
| 9 | SLOPE ROVING |
| 10 | BRIDGE LIGHTING DETAILS |
| 11 | STEEL, WOODWORK, DETAILS |
| 12 | REINFORCING STEEL, SCHEDULE NUMBER 34 |
| 13 | REINFORCING STEEL, SCHEDULE |

[illegible]

DEPARTMENT OF HIGHWAYS ONTARIO	
HIGHWAY	
HWY. 21 INT. <u>100-100</u>	
ENCL. HIGHWAY No. <u>304</u>	REF. No. <u>1</u>
CON. ACCT. <u>100-100</u>	REMARKS <u>SEE FILE 100-100</u>
TRK. HOURS <u>100-100</u>	CON. YR. <u>100-100</u>
DATE <u>100-100</u>	
APPROVED <u>100-100</u>	
GENERAL PLAN	
APPROVED <u>100-100</u>	DATE <u>100-100</u>
CON. ACCT. <u>100-100</u>	REMARKS <u>SEE FILE 100-100</u>
TRK. HOURS <u>100-100</u>	CON. YR. <u>100-100</u>
DATE <u>100-100</u>	



- FILES ARE 12" O.D. STEEL TUBE, 0.250" THICK WALL.
- PILE LENGTH TO BE SUPPLIED - 24'-0" 56 FILES REQUIRED.
- AFTER FILES HAVE BEEN INSTALLED AND INSPECTED THEY SHALL BE FILLED WITH CONCRETE OF 3000 P.S.I. @ 28 DAYS STRENGTH.
- DESIGN LOAD FOR PILE 25 TONS.
- APPROX. PILE TIP ELEVATION 622.0 - THE FILES SHALL NOT BE ADVANCED BEYOND EL. 622.0.



BORING DATA
SCALE: VERT. 1" = 20'

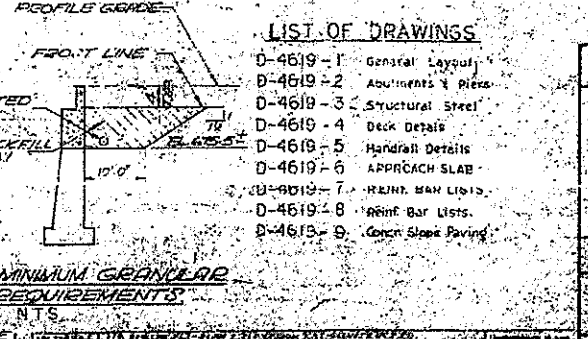
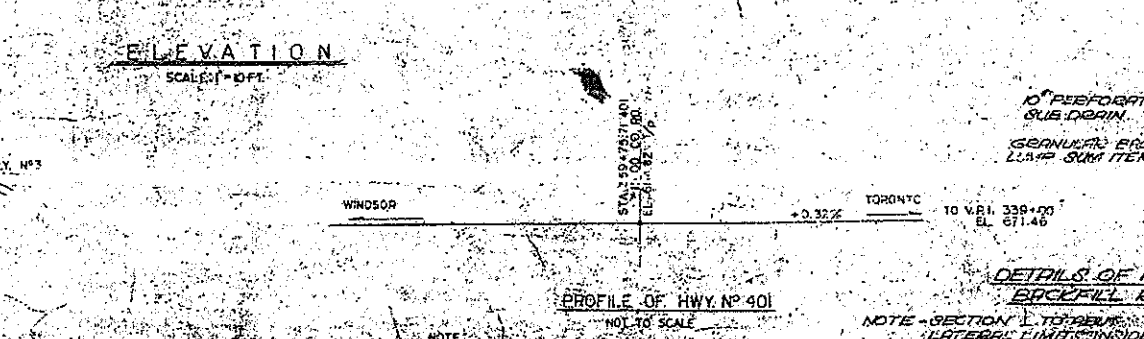
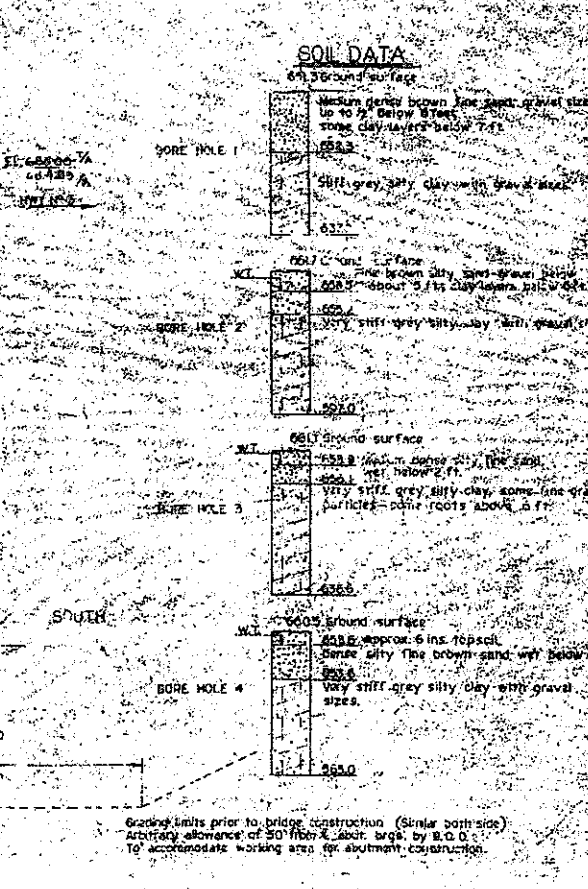
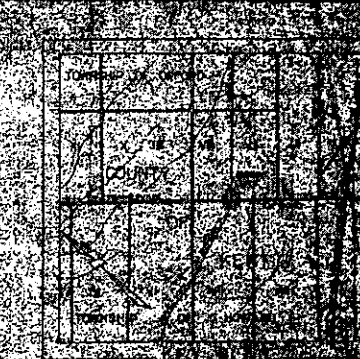
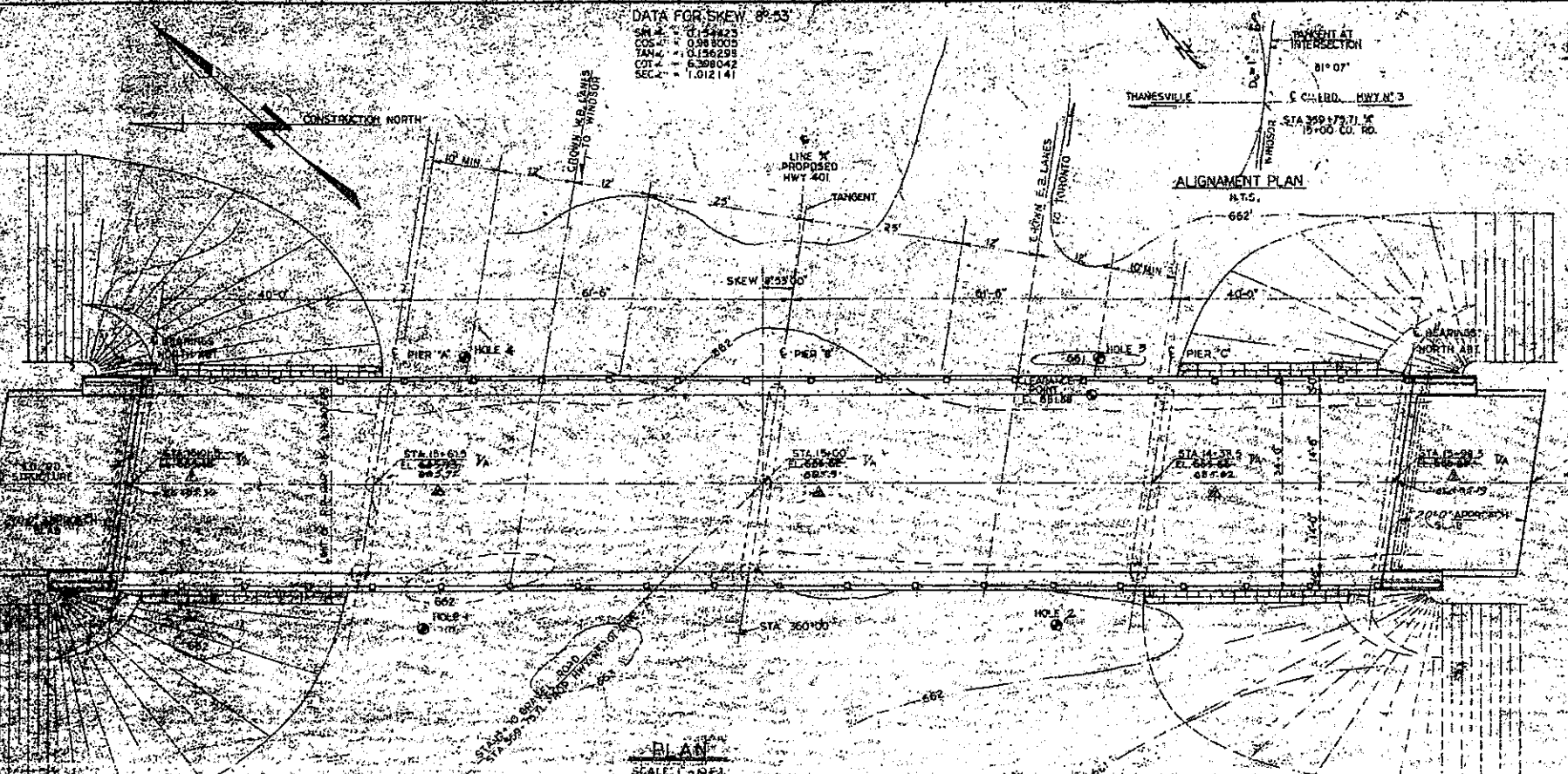
RECORD	DATE

REVISIONS	DATE	BY	DESCRIPTION
1	10/20/59	J.L.E.	REVISED AS CONSTRUCTED.
2	11-6-64	J.L.E.	CHANGE CORRECTION TO H.O.S. HWY. 401
3	12-24-64	J.L.E.	REV. NOTE - FILES

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
HWY. 21 INTERCHANGE			
KING'S HIGHWAY No. 401		DIST. No. 1	
CD. KENT		HOWARD TWP. BRIDGE #3	
TWP. HOWARD		LOT 12 & 13 CON. VI	
FOOTING LAYOUT AND SOIL DATA			
APPROVED	J.L.E.	DATE	12-26-59
DESIGN	J.L.E.	CHECK	B.C.
DRAWING	G.R. M.	CHECK	J.L.E.
DATE	JAN/64	LOADING	1120 T/L
DRAWING No.		D5403-2	



- (8) Construction Drawings for W.P. No. 89-59, Highway 401 Underpass at Co. Road 16 (Kenesserie Road) Site 13-267, dated November 1960.

[illegible]