

PRELIMINARY
FOUNDATION INVESTIGATION AND DESIGN REPORT
LONGWOOD CHANNEL REHABILITATION
HIGHWAY 403, HAMILTON, ONTARIO

G.W.P. No. 2054-14-00

GEOCRES Number: 30M5-322

Report to

AECOM

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual data obtained from a foundation investigation conducted by Thurber Engineering Ltd. (Thurber) for the preliminary design of the rehabilitation of the Longwood Drainage Channel located along Highway 403 in Hamilton, Ontario.

The purpose of this investigation was to obtain subsurface information at select locations along the channel and, based on the data obtained, to provide a borehole location plan, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber was retained by AECOM to carry out the preliminary foundation investigation under the MTO Assignment Number 2013-E-0052.

2 SITE DESCRIPTION

The Longwood Drainage Channel is a trapezoidal open concrete channel that carries the Chedoke Creek along the Highway 403 corridor from the CP (former TH&B) railway subway easterly approximately 1.6 km to a culvert inlet approximately 50 m west of the Main Street West underpass. Municipal drainage culverts feed into the channel at several locations.

The general channel alignment is shown on the Borehole Locations Drawings in Appendix D. The channel runs along the north side of Highway 403 from a culvert outlet on the east side of the CP railway, then along the north side of the Highway 403 westbound ramp from Aberdeen Avenue, before entering a culvert under the ramp from Main Street West to eastbound Highway 403. The channel daylights for a short section between the Main Street West ramp and Highway 403, before crossing under Highway 403 to an approximate 200 m long section on the south side of the highway,

where it is joined by a municipal drain. The channel then crosses back under Highway 403 and Longwood Road, and runs along the north side of Highway 403 to the culvert under Main Street West.

The existing concrete channel was constructed in 1964. Photographs showing the current condition of the channel are presented in Appendix C. The channel is typically in fair condition with sections of deterioration, cracking, vegetation intrusion and possible undermining by erosion. Significant deterioration and collapse/displacement of the channel lining has occurred in the section on the south side of Highway 403 where the municipal drain connects. Further details are provided with the photographs in Appendix C.

The channel and Highway 403 follow the alignment of the former Chedoke Creek ravine. The table lands above the north side of the ravine generally comprise a mix of residential subdivisions and commercial development. The table lands to the south of the ravine are occupied by commercial and industrial properties.

The site is generally situated within the physiographic region known as the Iroquois Plain, and is characterized by glaciolacustrine sands and silts deposited in proglacial Lake Iroquois which formerly inundated the lowlands bordering Lake Ontario. The sand deposits are discontinuously underlain by silts, clays and glacial tills, which overlie reddish brown shale bedrock of the Queenston Formation. Highway 403 ascends the Niagara Escarpment immediately west of the site.

3 SITE INVESTIGATION AND FIELD TESTING

The borehole investigation and field testing program was carried out between July 2 and 10, 2015, and consisted of drilling and sampling 10 boreholes (numbered 15-01 to 15-10) at accessible locations along the length of the drainage channel. In general, the boreholes were advanced to depths ranging from 6.1 to 14.3 m including recovery of 3.6 to 4.0 m of bedrock core from two locations (Boreholes 15-09 and 15-10). One borehole (Borehole 15-07) was terminated at 2.0 m depth upon encountering an obstruction refusing further penetration during two attempts to advance the borehole using portable equipment.

Six of the boreholes (Boreholes 15-01 to 15-03, 15-06, 15-09, and 15-10) were located along the westbound shoulder of Highway 403 and associated access ramps, and were advanced using solid stem augers powered by a truck-mounted CME-55 drill rig. The remaining boreholes (Boreholes 15-04, 15-05, 15-07 and 15-08) were located in areas inaccessible to conventional drilling equipment and were advanced using portable tripod equipment and NW casing/wash boring techniques.

The approximate borehole locations are shown on the Borehole Locations drawings included in Appendix D. The borehole locations were established in the field relative to site features and confirmed using a Trimble Pathfinder ProXRT differential GPS Unit. The GPS coordinates were subsequently cross-referenced with the contour drawings provided by AECOM to determine borehole elevations.

Prior to the start of drilling, underground utility clearances were obtained at the borehole locations and applicable road occupancy permits were acquired.

Soil samples were obtained from the boreholes at selected intervals using a 50 mm diameter split spoon sampler in conjunction with Standard Penetration Testing (SPT). A 3.6 to 4.0 m length of rock core was recovered from Boreholes 15-09 and 15-10 using NQ rock coring equipment. The groundwater conditions in the open boreholes were observed throughout the drilling operations.

A member of Thurber's technical staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, secured the recovered soil samples in labelled containers, and transported the samples to Thurber's laboratory for further examination and testing. All rock cores were logged, and the Total Core Recovery (TCR), Solid Core Recovery (SCR), Rock Quality Designation (RQD) and the Fracture Indices (FI) were determined.

Standpipe piezometers consisting of 19 mm PVC pipe with a slotted screen were installed in each of the boreholes (except Borehole 15-07) upon completion of drilling. Details of the piezometer installations are summarized in Table 3.1. Following measurement of the groundwater levels, the piezometers were decommissioned in general accordance with O.Reg. 903.

Table 3.1 - Borehole Completion and Backfilling Details

Borehole No.	Piezometer Tip Depth/Elevation (m)	Completion Details
15-01	7.6 / 72.5	Cave from 9.8 to 7.6 m, filter sand from 7.6 to 4.0 m, bentonite from 4.0 to 1.2 m, cuttings from 1.2 to 0.3 m, and concrete to surface.
15-02	9.1 / 73.5	Filter sand from 9.8 to 5.5 m, bentonite from 5.5 to 0.3 m, and concrete to surface.
15-03	13.7 / 71.9	Filter sand from 14.3 to 10.1 m, bentonite from 10.1 to 0.6 m, cuttings from 0.6 to 0.3 m, and concrete to surface.
15-04	9.1 / 73.0	Filter sand from 9.8 to 7.0 m, bentonite and cuttings from 7.0 m to surface.
15-05	9.1 / 73.0	Filter sand from 9.8 to 7.0 m, bentonite and cuttings from 7.0 m to surface.
15-06	9.1 / 75.8	Filter sand from 9.8 to 5.5 m, bentonite from 5.5 to 0.3 m, and concrete to surface.
15-07	None installed	Bentonite and cuttings from 2.0 m to surface.
15-08	9.1 / 75.7	Filter sand from 9.8 to 6.4 m, bentonite and cuttings from 6.4 m to surface.
15-09	7.3 / 79.6	Cave from 8.5 to 7.3 m, filter sand from 7.3 to 3.7 m, bentonite from 3.7 to 0.3 m, and concrete to surface.
15-10	6.1 / 84.6	Filter sand from 6.1 to 1.8 m, bentonite from 1.8 to 0.3 m, and concrete to surface.

The results of the field drilling and sampling are presented on the Record of Borehole sheets in Appendix A.

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected soil samples were subjected to grain size distribution analyses (sieve and hydrometer) and plasticity testing (Atterberg Limits). The results of this laboratory testing program are shown on the Record of Borehole sheets in Appendix A and on the figures in Appendix B.

Point load tests (PLT) were performed on selected intact rock core samples. Unconfined compressive strengths (UCS) of the rock cores correlated from the PLT results are shown on the Record of Borehole sheets in Appendix A.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

5.1 General

Reference is made to the Record of Borehole sheets included in Appendix A for details of the soil stratigraphy encountered in the boreholes, and to the “Borehole Locations” drawings in Appendix D for the borehole locations. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general, the subsurface conditions encountered in the boreholes consisted of a surficial pavement structure or topsoil layer overlying various cohesionless and cohesive fill layers, underlain by alluvial deposits, silty clay and/or silty clay till with discontinuous sand layers. Shale bedrock was encountered below the clay till in Boreholes 15-09 and 15-10 at the west end of the channel. More detailed descriptions of the individual strata are presented below.

It must be noted that conditions may vary over short distances subject to the position of the original ravine slopes, former watercourse alignments, the presence of alluvial/organic deposits, historical fill placement in the ravine, and extensive earthworks carried out for construction of Highway 403 and associated facilities.

5.2 Pavement Structure

An asphalt pavement structure was encountered in Boreholes 15-01 to 15-03, 15-06, 15-09 and 15-10 drilled on the shoulder of Highway 403 and the westbound ramp from Aberdeen Avenue. The pavement structure comprised 40 to 125 mm of asphalt overlying granular fill material (sand and gravel to gravelly sand) extending to depths of 1.2 to 1.6 m.

SPT N-values obtained in the granular fill material ranged from 5 to 19 blows per 0.3 m penetration, indicating as loose to compact condition. Moisture contents varied from 2 to 13%.

The results of grain size analyses conducted on granular fill samples are provided on the Record of Borehole sheets in Appendix A, and are illustrated in Figure B1 of Appendix B. The results are summarized as follows:

Gravel %	26 to 43
Sand %	43 to 59
Silt & Clay %	14 to 22

5.3 Topsoil

A layer of topsoil was encountered at the ground surface in Boreholes 15-05, 15-07 and 15-08. The topsoil thickness ranged from 100 to 125 mm. The topsoil thickness may vary between and beyond the borehole locations, and the limited data is not adequate for estimating topsoil quantities.

5.4 Fill

Fill was encountered below the pavement structure in Boreholes 15-01 to 15-03, 15-06 and 15-09, below the topsoil in Boreholes 15-05, 15-07 and 15-08, and at the ground surface in Borehole 15-04. The fill typically consisted of brown to reddish brown silty clay with a trace to some sand and a trace of gravel. Locally, the full thickness of fill in Borehole 15-01 consisted of dark brown to black sandy silt, and the lower part of the fill in Borehole 15-02 consisted of dark brown to black sand with some silt. Zones of sand and gravel fill (granular material) were encountered in Borehole 15-07.

The fill thickness encountered in the boreholes (excluding the pavement components) ranged from 0.9 to 5.6 m, with a lower boundary at depths of 2.2 to 4.5 m (Elev. 76.3 to 84.7), locally 7.2 m (Elev. 78.4) in Borehole 15-03. Borehole 15-07 was terminated in the fill at 2.0 m depth upon refusal on an obstruction.

SPT N-values measured in the silty clay fill typically ranged from 6 to 20 blows per 0.3 m penetration, indicating a firm to very stiff consistency. Several N-values of 30 to 42 blows per 0.3 m were obtained in off-road Boreholes 15-04, 15-05, 15-07 and 15-08, indicating a hard consistency. One lower N-value of 2 blows per 0.3 m, indicating a soft consistency, was recorded near the base of the fill in Borehole 15-03. Measured moisture contents ranged between 9% and 24%.

SPT N-values recorded in the cohesionless fill in Boreholes 15-01, 15-02 and 15-07 ranged from 4 blows per 0.3 m to 90 blows per 0.125 m of penetration, indicating a variable loose to very dense condition. The higher N-values may reflect the presence of cobbles, asphalt fragments or wood within the fill. Moisture contents ranged between 2% and 28%.

The results of grain size analyses conducted on silty clay fill samples are provided on the Record of Borehole sheets in Appendix A, and are illustrated in Figure B2 of Appendix B.

Atterberg Limits test results are presented in Figure B9 in Appendix B. The results are summarized as follows:

Gravel %	0
Sand %	7 to 12
Silt %	54 to 63
Clay %	27 to 39
Liquid Limit	33
Plastic Limit	21

The results of the Atterberg Limits tests indicate that the cohesive fill is typically of low plasticity (CL).

5.5 Clayey Silty Sand to Clayey Silt and Sand

Localized deposits of dark grey clayey silty sand and grey clayey sand and silt were encountered below the fill in Boreholes 15-02 and 15-05. These possible alluvial layers were 1.6 and 0.6 m thick with a lower boundary at depths of 6.1 and 2.8 m (Elev. 76.5 and 79.3) in Boreholes 15-02 and 15-05, respectively.

SPT N-values of 7 and 24 blows per 0.3 m were recorded in the clayey silt/sand, indicating a consistency of firm and very stiff. Moisture contents of 62% and 24% were measured. The results of grain size analyses conducted on this material are provided on the Record of Borehole sheets in Appendix A and in Figure B3 of Appendix B. The results are summarized as follows:

Gravel %	5 to 8
Sand %	38 to 53
Silt %	26 to 39
Clay %	15 to 16

5.6 Silty Clay

Brown to grey silty clay with trace sand was encountered below the fill in Boreholes 15-01, 15-04, 15-06 and 15-08, below the clayey silt and sand in Borehole 15-05, and below the fill and silty sand layers in Borehole 15-02.

The silty clay layer was fully penetrated in Boreholes 15-04, 15-05 and 15-08, and the thickness of the layer ranged from 1.2 to 5.7 m with a lower boundary at depths of 5.5 to 8.7 m (Elev. 79.3 to 73.4). Boreholes 15-01, 15-02 and 15-06 were terminated within the silty clay at a depth of 9.8 m (Elev. 75.1 to 70.3).

SPT N-values obtained in the silty clay varied between 1 and 18 blows per 0.3 m penetration, indicating a very soft to very stiff consistency. Measured moisture contents ranged from 12% to 37%, typically about 20% to 32%.

The results of grain size analyses conducted on silty clay samples are provided on the Record of Borehole sheets in Appendix A, and are illustrated in Figures B4 and B5 of Appendix B. Atterberg Limits test results are presented in Figure B10 in Appendix B. The results are summarized as follows:

Gravel %	0
Sand %	0 to 14
Silt %	40 to 70
Clay %	30 to 56
Liquid Limit	27 to 37
Plastic Limit	17 to 21

The results of the Atterberg Limits tests indicate that the silty clay is of low to intermediate plasticity (CL to CI).

5.7 Silty Sand

A layer of brown silty sand with trace to some gravel and trace clay was encountered within the silty clay deposit in Borehole 15-01, between the clayey silty sand and silty clay layers in Borehole 15-02, and within an underlying till deposit in Borehole 15-03. The silty sand layer was 0.7 to 1.8 m thick with a lower boundary at depths of 7.2 to 10.2 m (Elev. 72.9 to 75.4).

SPT N-values of 4 and 10 blows per 0.3 m were obtained in the silty sand, indicating a typically loose condition. Measured moisture contents of samples recovered from the silty sand ranged from 2% to 38%.

The results of grain size analyses conducted on silty sand samples are provided on the Record of Borehole sheets in Appendix A, and are illustrated in Figure B6 of Appendix B. The results are summarized as follows:

Gravel %	4 to 20
Sand %	52 to 63
Silt %	21 to 27
Clay %	6 to 8

5.8 Silty Clay Till to Sandy Clayey Silt Till

Till deposits varying from silty clay till, some sand to sandy, to sandy clayey silt till were encountered below the fill and silty clay in Boreholes 15-03 to 15-05 and 15-08 to 15-10. The silty clay till in Boreholes 15-04, 15-05 and 15-08 was described as grey, and the sandy clayey silt till was described as brown in Borehole 15-03 and reddish brown in Boreholes 15-09 and 15-10.

Boreholes 15-03 to 15-05 and 15-08 were terminated in the till at depths of 9.8 to 14.3 m (Elev. 71.3 to 75.0). The till layer was 2.7 and 0.6 m thick in Boreholes 15-09 and 15-10, and was underlain by shale at depths of 4.9 and 1.9 m (Elev. 82.0 and 88.8). The lower part of the till in Borehole 15-09 resembled residual shale, indicating a transitional zone from till to weathered bedrock.

SPT N-values measured within the till generally varied between 4 and 51 blows per 0.3 m penetration, indicating a variable firm to hard consistency. Higher N-values of 50 and 102 blows for less than 0.3 m penetration were recorded in the till in Borehole 15-09. Measured moisture contents ranged from 5% to 30%.

The results of grain size analyses conducted on till samples are provided on the Record of Borehole sheets in Appendix A, and are illustrated in Figures B7 and B8 of Appendix B. Atterberg Limits test results are presented in Figure B11 in Appendix B. The results are summarized as follows:

	<u>Clay Till</u>	<u>Clayey Silt Till</u>
Gravel %	0 to 5	0 to 3
Sand %	14 to 26	16 to 37
Silt %	43 to 53	47 to 67
Clay %	28 to 34	11 to 18
Liquid Limit	30	34
Plastic Limit	18	21

The results of the Atterberg Limits tests indicate that the till is typically of low plasticity (CL). Glacial tills inherently contain cobbles and boulders.

5.9 Shale Bedrock

Shale bedrock of the Queenston Formation was encountered below the till in Boreholes 15-09 and 15-10. The depths and elevations of the bedrock surface encountered in the boreholes are summarized in Table 5.1. The boreholes were terminated in the shale at depths of 8.5 and 6.1 m (Elev. 78.4 and 84.6) after coring to depths of 3.6 and 4.2 m below the shale surface.

Table 5.1 – Bedrock Depths and Elevations

Borehole	Top of Bedrock	
	Depth (m)	Elevation (m)
15-09	4.9	82.0
15-10	1.9	88.8

Photographs of the recovered rock cores are included in Appendix B. Total Core Recovery (TCR) in the bedrock ranged from 67% to 97%. The measured RQD of the rock cores ranged

from 58% to 80%, indicating a fair to good rock quality. The Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, ranged from 0 to 8.

The unconfined compressive strength of the rock interpreted from point load tests conducted on the recovered rock cores ranged from 7.5 to 19.7 MPa, indicating a weak rock strength classification. The interpreted unconfined compressive strengths are indicated on the Record of Borehole sheets in Appendix A.

5.10 Groundwater Conditions

Groundwater conditions were observed in the open boreholes during and upon completion of the drilling operations. Standpipe piezometers were installed in all boreholes except Borehole 15-07 to measure water levels after completion of drilling. The water levels observed in the open boreholes and measured in the piezometers are summarized in Table 5.2.

Table 5.2 – Groundwater Level Measurements

Borehole	Date of Reading	Water Level		Comment
		Depth (m)	Elevation (m)	
15-01	July 5, 2015	2.1	78.0	Open Borehole Piezometer
	Oct 4, 2015	2.4	77.7	
15-02	July 5, 2015	4.3	78.3	Open Borehole Piezometer
	Oct 4, 2015	4.2	78.4	
15-03	Oct 4, 2015	5.0	80.6	Piezometer
15-04	July 5, 2015	0.5	81.6	Open Borehole Piezometer
	Oct 6, 2015	3.7	78.4	
15-05	Oct 6, 2015	3.3	78.8	Piezometer
15-06	Oct 4, 2015	2.8	82.1	Piezometer
15-08	Oct 6, 2015	3.6	81.2	Piezometer
15-09	Oct 4, 2015	3.9	83.0	Piezometer
15-10	Oct 4, 2015	5.0	85.7	Piezometer

The recorded groundwater levels are considered short-term readings and seasonal fluctuations of the groundwater level are to be expected, particularly after spring snowmelt as well as periods of prolonged and/or significant precipitation.

6 EXISTING GEOCREs DATA

A number of foundation investigations were completed within the Highway 403 corridor prior to construction of the highway and associated facilities. The following reports were obtained from the MTO Geocres files for review:

1. GEOCREs No. 30M5-29: Foundation Report on Hwy. 403 (Chedoke Expressway) and Main St. Crossing in Hamilton, Dist. 4. May 1960.
2. GEOCREs No. 30M5-30: Foundation Conditions at Ramps G, J, H & K, King-Main Interchange, Chedoke Expressway. March 1961.

3. GEOCRES No. 30M5-31: Foundation Investigation for West Hamilton Storm Sewer, Hwy. Chedoke Expressway, Dist. #4. November 1960.
4. GEOCRES No. 30M5-35: Chedoke Expressway – between Sta. 453+00 and 472+00, District #4, Hamilton, Ontario. July 1961.
5. GEOCRES No. 30M5-36: Foundation Investigation for Proposed Aberdeen Avenue Interchange, Hwy. #403, Hamilton, Ont., District #4. July 1960.
6. GEOCRES No. 30M5-37: Foundation Investigation Report for Slope Failure – Hwy. 403, Culvert Sta.'s 105+10 – 106+70, District 4. July 1964.
7. GEOCRES No. 30M5-38: Foundation Investigation for the Proposed Railway Underpass on the Ancaster Bypass, District No.4, Ontario. July 1957.
8. GEOCRES No. 30M5-39: Foundation Report on Proposed Subway at Chedoke Expressway and T.H.&B. Railway Crossing in Hamilton, Twp. Of Ancaster, Dist. #4. January 1960.

The borehole logs and the borehole location and soil profile drawings from the previous reports are reproduced in Appendix E. It is noted that Geocres No. 30M5-31 specifically addresses the foundation conditions along the Longwood Channel.

In general, the stratigraphy revealed in the previous boreholes consisted of localized fill materials overlying organic and alluvial deposits associated with the former watercourse, underlain primarily by clay of low plasticity. In the boreholes drilled along the channel alignment (Geocres 30M5-31), fill was encountered between Longwood Road and Main Street, and was 1.8 to 3.6 m thick at the borehole locations. The organic/alluvial materials were generally about 3.6 to 4.6 m thick between Longwood Road and Main Street, and 1.0 to 3.0 m thick (typically less than 2.0 m) south of Longwood Road. The consistency of the native clay varied from soft to hard.

Shale bedrock was encountered at depths of 1.2 to 2.1 m at the west end of the channel, from the railway bridge to approximately halfway between the railway and Aberdeen Avenue. Shale was also encountered below the clay at depths of 13.6 to 16.9 m in several boreholes located immediately north of Aberdeen Avenue.

In general, the groundwater level was assumed to be near the ground surface at the borehole locations, reflecting the creek water levels. An artesian condition was identified in the bedrock where encountered north of Aberdeen Avenue.

7 MISCELLANEOUS

In general, the borehole locations were positioned in the field by Thurber staff relative to site features. The coordinates at the borehole locations were determined using a Trimble Pathfinder ProXRT differential GPS Unit. The coordinates were subsequently cross-referenced with the contour drawings provided by AECOM to determine the borehole elevations.

DBW Drilling Limited of Ajax, Ontario supplied and operated a truck-mounted CME-55 drill rig to carry out the drilling, sampling and in-situ testing operations on the highway and ramp shoulders. Walker Drilling Ltd. of Utopia, Ontario supplied and operated portable tripod drilling equipment to advance the boreholes drilled off of the highway in areas inaccessible to a conventional drill rig.

The drilling and sampling operations were supervised in the field on a full time basis by Ms. Eckie Siu, Mr. Amir Fereidouni, and Abdul Nasri, EIT of Thurber. Overall supervision of the field program was conducted by Mr. Stephane Loranger, CET.

Interpretation of the field data and preparation of the report were carried out by Ms. Deanna Pizycki, EIT, and Mr. Murray Anderson P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

THURBER ENGINEERING LTD.

Deanna Pizycki
Apr 15/16

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PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

8 GENERAL

This report presents interpretation of the geotechnical data in the factual report and provides preliminary foundation recommendations regarding rehabilitation of the Longwood Drainage Channel along Highway 403 in Hamilton, Ontario.

The Longwood Drainage Channel is a trapezoidal open concrete channel that carries the Chedoke Creek along the north side of Highway 403 from east of the CP rail subway easterly approximately 1.6 km to a storm sewer inlet approximately 50 m west of the Main Street West underpass. The channel crosses under Highway 403 to the south side of the highway for an approximate 200 m long section between Aberdeen Avenue and Longwood Road. Municipal drainage culverts feed into the channel at several locations.

The existing concrete channel was constructed in 1964. Currently, the channel is generally in fair condition with sections of deterioration, cracking, vegetation intrusion and possible undermining by erosion. Significant deterioration and collapse/displacement of the channel lining has occurred in the section on the south side of Highway 403 where a municipal drain connects. Photographs showing the general condition of the channel are presented in Appendix C.

Restoration of the channel is expected to include repair and/or replacement of deteriorated and failed sections of the concrete lining. Other options such as enclosing sections of the channel in culverts or naturalization of the channel may also be considered.

The discussions and recommendations presented in this report are based on information provided by AECOM and on the factual data obtained during the course of the current and previous investigations.

Additional site-specific investigation will be required for detailed design.

9 CHANNEL FOUNDATION CONDITIONS

9.1 General

Contour plans of the site indicate that the base of the concrete channel falls from approximate Elev. 86.5 at the railway crossing to Elev. 76.0 at the entrance to the culvert under Main Street West. The approximate invert elevation of the channel adjacent to the borehole locations and the subgrade material encountered at that level are summarized in Table 9.1. Drawings showing the design of the channel structure and any bedding material are not available.

Table 9.1 – Channel Invert and Subgrade Conditions at Boreholes

Borehole	Approx. Elev. of Channel Invert	Subgrade Material
15-01	76.0	Very soft silty clay
15-02	77.6	Firm clayey silty sand
15-03	78.3	Firm to stiff sandy clayey silt (till)
15-04	78.9	Stiff silty clay
15-05	79.5	Very stiff clayey silt and sand over firm silty clay
15-06	80.5	Stiff to firm silty clay
15-07	80.9	-
15-08	81.5	Stiff silty clay fill over firm silty clay
15-09	82.9	Hard sandy clayey silt till (residual shale)
15-10	86.5	Shale bedrock

Based on the previous and current borehole data, the subgrade at the level of the channel base generally varies from alluvial material between Main Street and Longwood Road, native silty clay from Longwood Road to west of the Aberdeen Avenue interchange, and shale bedrock from west of Aberdeen Avenue to the railway crossing. Further details of the conditions in each section are presented below.

9.2 Main Street West to Longwood Road

The information from Boreholes 15-01 to 15-03 and from the Geocres data indicates that the channel base is generally founded on soft to stiff alluvial materials comprising various proportions of sand, silt, clay and/or organic matter. Very soft silty clay was encountered at the channel base level locally in Borehole 15-01.

The geotechnical resistance available in the clay and alluvial materials is typically low. Depending upon the location, elevation and geometry of structure foundations, geotechnical resistances of 75 to 150 kPa at factored ULS and geotechnical reactions of 50 to 100 kPa at SLS are available. Preliminary resistance values to be anticipated at each current borehole location are as follows:

Table 9.2 – Preliminary Geotechnical Resistance at Boreholes 15-01 to 15-03

Borehole	Approx. Elev. of Channel Invert	Subgrade Material	Resistance (kPa)	
			ULS _f	SLS
15-01	76.0	Very soft silty clay	75	50
15-02	77.6	Firm clayey silty sand	120	80
15-03	78.3	Firm sandy clayey silt (till)	120	80

The limited support capability does not appear to have impacted the performance of the existing concrete channel, and rehabilitation of the channel by repairing or replacing slabs is considered to be feasible.

Design modifications such as enclosing the channel, installation of culverts, or construction of any new structures which increase the foundation loads on the subgrade soils will require further location-specific investigation to develop geotechnical parameters for foundation design.

Further, the clay and organic soils are susceptible to consolidation settlement if subjected to additional loading. Assessment of ground settlement and the potential impacts on new and existing structures will be required if additional structural or embankment loads are applied.

9.3 Longwood Road to West of Aberdeen Avenue

The information from Boreholes 15-04 to 15-08 and from the Geocres data indicates that the channel base from Longwood Road to approximately 200 m west of the Aberdeen Avenue Underpass is generally founded on firm to stiff silty clay, potentially on soft alluvial materials locally.

The native silty clay at the channel base level is considered suitable for support of the channel concrete lining and potential channel enclosure modifications or box culvert installation. In general, a geotechnical resistance of 150 kPa at factored ULS and a geotechnical reaction of 100 kPa at SLS are available. Preliminary resistance values to be anticipated at each current borehole location are as follows:

Table 9.3 – Preliminary Geotechnical Resistance at Boreholes 15-04 to 15-08

Borehole	Approx. Elev. of Channel Invert	Subgrade Material	Resistance (kPa)	
			ULS _f	SLS
15-04	78.9	Stiff silty clay	150	100
15-05	79.5	Firm silty clay	120	80
15-06	80.5	Stiff to firm silty clay	120	80
15-07	80.9	Refusal encountered	-	-
15-08	81.5	Silty clay fill / firm silty clay	75	50

Support of any new structural loads such as from open-footing culverts will require further location-specific investigation to develop geotechnical parameters for foundation design and assess potential ground settlement.

9.4 West of Aberdeen Avenue to CP Rail Crossing

The information from Boreholes 15-09 and 15-10 and from the Geocres data indicates that the channel base is founded in shale bedrock from the CP Rail structure to approximately 350 m east.

The shale is considered to be a competent founding material and no issues with respect to geotechnical resistance or settlement are anticipated for channel rehabilitation in this section. Preliminary resistance values to be anticipated at each current borehole location are as follows:

Table 9.4 – Preliminary Geotechnical Resistance at Boreholes 15-09 and 15-10

Borehole	Approx. Elev. of Channel Invert	Subgrade Material	Resistance (kPa)	
			ULS _r	SLS
15-09	82.9	Hard sandy clayey silt till/shale	450	300
15-10	86.5	Shale bedrock	750	500

10 CHANNEL REHABILITATION CONSIDERATIONS

In general, the channel is currently in fair condition with sections of deterioration, cracking, vegetation intrusion and possible undermining by erosion. Of note is the deterioration of the concrete lining at the joint between the walls and base of the channel, probable erosion of the soils along this interface, and vegetation that has developed along the joints. Noteworthy areas of lining failure, loss of ground and seepage were also observed (as outlined in Sections 10.2 to 10.4, below).

A detailed examination of the channel lining will be required to carefully document the various distress features and determine the recommended extent and method of repair or replacement. Particular geotechnical conditions to take into consideration when developing the rehabilitation program are discussed in the following sections.

10.1 Slope Stability

No evidence of slope instability was observed on the ravine slopes or the highway embankment during the site work. It must be noted however that the majority of the slopes were heavily vegetated and close visual inspection was not possible.

A fill berm is present adjacent to the south side of the west approach embankment to the Main Street West underpass, extending from the toe of the embankment to the channel culvert inlet. Review of Geocres No. 30M5-29 indicates that the fill berm was placed to improve the stability of the embankment. In addition, stability berms were required along the

embankment ramp from Main Street West to eastbound Highway 403, over the area of the channel and culvert (Geocres No. 35M-36). The stabilizing berms must not be removed during any remediation work.

Historical information also indicates that a slope failure occurred on the west side of the ravine above the channel opposite the Aberdeen Avenue ramps (Geocres No. 30M5-37; refer to Drawing 1 in Appendix D for location). The slope failure was attributed to high spring water levels as well as saturation of the slope by water from seepage zones on the upper part of the slope. Recommendations for repair were provided. Any channel rehabilitation work to be implemented in this area must not impact the current slope conditions by blocking potential seepage zones emanating on the slope face or by increasing the existing slope inclination.

10.2 Seepage

During the site examination, seepage and soft/wet ground were observed above the channel lining at three notable locations:

- Seepage and wet ground was observed above the north side of the channel along an approximate 100 m section immediately east of Longwood Road. Green discolouration present in the wet areas may indicate that services are improperly discharging onto the slope at this location. The source of the seepage should be confirmed and appropriately diverted or drained to minimize lateral pressures and potential instability of the channel lining due to saturated soils and hydrostatic pressures behind the sloped wall.
- An area of wet ground and tall reeds was observed above the north channel wall in an approximate 50 m long section just west of the inlet to the culvert under Main Street. Installation of drains into the slope (buried subdrains or gravel trenches) should be considered in this area to minimize lateral pressures and potential instability of the channel lining due to saturated soils and hydrostatic pressures behind the sloped wall.
- Wet ground was noted behind the culvert wingwall and seepage was observed on top of the culvert at the outlet from the culvert under Highway 403 east of Aberdeen Avenue (Photograph 13). Historical information (letter dated July 1965 included in Geocres No. 30M5-31) indicates that surface water and groundwater were an issue at this location shortly after construction. It was reported that a crack developed along the south channel wall between the outlet of the culvert and the Y-junction with the municipal drain. The crack was attributed to hydrostatic pressures acting on the wall due to surface water and corresponding high groundwater levels behind the lining. Recommendations for backfilling of the lining with granular material and drainage of the water were presented at that time. As drainage appears to remain poor in this area, it is recommended that further measures (subdrains, granular backfill as per OPSD 3121.150) be implemented to improve drainage from behind the wingwall and appropriately discharge surface water to the channel.

It was also noted that the existing weepholes in the walls of the channel lining are commonly blocked by vegetation growth, potentially hampering drainage from behind the walls. The drains must be re-established to prevent build-up of hydrostatic pressures on the walls. Further, a granular drainage layer should be provided behind any replacement sections of channel wall.

10.3 Failure Area

Failure and collapse of the channel lining has occurred in the section of the channel on the south side of Highway 403 where the municipal drain connects in a Y-junction (Photographs 15 and 16). The borehole information indicates that the soil behind the channel walls consists primarily of silty clay fill and the subgrade below the base consists of native silty clay. These soils are considered to have a relatively low sensitivity to erosion due to their high clay content and cohesive nature, and therefore the channel failure is indicative of periodic highly turbulent flows. Replacement of the channel lining at the junction must include measures to dissipate energy and reduce turbulence where the flows combine.

Also noted was an erosion gully opposite the Y-junction, created by surface runoff flows concentrating at this location and discharging uncontrolled into the channel. The erosion gully should be repaired and appropriate measures provided to direct runoff to appropriately designed outlets into the channel and prevent uncontrolled runoff flows causing erosion.

10.4 Culvert Inlets

Significant voids and loss of ground were noted behind the channel lining and walls at the inlets to the culverts under Main Street West (Photograph 23), Highway 403 east of Aberdeen Avenue (Photograph 11), and the Main Street West ramp to eastbound Highway 403 (Photograph 8). The cause of the ground loss should be further assessed and subject to the findings, restoration of the backfill and measures to prevent erosion or piping adjacent to the walls should be provided.

11 WALL BACKFILL AND LATERAL EARTH PRESSURES

It is recommended that backfill to repaired sections of the channel lining, any new culverts and wingwalls consists of free-draining, non-frost susceptible granular materials such as Granular A or B Type II conforming to the requirements of OPSS.PROV 1010. Reference should be made to the backfill arrangements stipulated in the OPSD 802 and 803 series as appropriate.

All fills must be placed in regular lifts and be compacted in accordance with OPSS.PROV 501. The backfill must be placed and compacted in simultaneous lifts on both sides of a culvert, and the top of backfill elevation should be the same on both sides of the culvert at all times. Heavy compaction equipment must not be used adjacent to the channel lining, wingwalls, and walls or roof of the culvert.

Earth pressures acting on the walls may be assumed to impose a triangular distribution. For a fully drained backfill, the pressures should be computed in accordance with the CHBDC 2010 but are generally given by the expression:

$$p_h = K (\gamma h + q)$$

where	p_h	=	horizontal pressure on the wall at depth h (kPa)
	K	=	earth pressure coefficient (see table below)
	γ	=	bulk unit weight of retained soil (see table below)
	h	=	depth below top of fill where pressure is computed (m)
	q	=	value of any surcharge (kPa)

Earth pressure coefficients for backfill to the walls are dependent on the material used as backfill. Recommended unfactored values are shown in the following Table 11.1.

Table 11.1 - Earth Pressure Coefficients (K)

Wall Condition	Earth Pressure Coefficient (K)			
	OPSS Granular A or OPSS Granular B Type II $\phi = 35^\circ; \gamma = 22.8 \text{ kN/m}^3$		OPSS Granular B Type I $\phi = 32^\circ; \gamma = 21.2 \text{ kN/m}^3$	
	Horizontal Surface Behind Wall	Sloping Surface Behind Wall (2H:1V)	Horizontal Surface Behind Wall	Sloping Surface Behind Wall (2H:1V)
Active (Unrestrained Wall)	0.27	0.40	0.31	0.48
At rest (Restrained Wall)	0.43	0.62	0.47	0.70
Passive (Movement Towards Soil Mass)	3.7	-	3.3	-

Active pressure coefficients should be used for any unrestrained channel walls or wingwalls. For rigid structures such as concrete box culverts, it is recommended that at-rest horizontal earth pressures be used for design.

In accordance with Clause 6.9.3 of the CHBDC, a compaction surcharge should be added. The magnitude should be 12 kPa at the top of fill and decreasing to 0 kPa at a depth of 2.0 m for Granular B Type I, or at a depth of 1.7 m for Granular A or Granular B Type II.

12 EROSION CONTROL

Erosion protection must be provided at culvert inlet and/or outlet areas not protected by the concrete lining. Design of the erosion protection measures must consider hydrologic and hydraulic factors and should be carried out by specialists experienced in this field. The silty clay soils in the corridor generally have a low susceptibility to erosion, however the alluvial materials and localized silty sand deposits may possess a moderate to high erodibility.

Typically, rock protection should be provided over any unlined sections of the channel with which water flow is likely to be in contact. Treatment at the outlets should be in accordance with OPSD 810.010. A vegetation cover should be re-established on all other exposed earth surfaces to protect against surficial erosion in general accordance with OPSS.PROV 804.

A clay seal or a concrete cut-off wall should be used at any new culvert locations to minimize the potential for erosion or piping around the culvert. The clay seal must extend in the order of 0.3 m above the high water level and laterally for the width of the granular material, and have a minimum thickness of 0.5 m. The material requirements should be in accordance with OPSS.PROV 1205. A geosynthetic clay liner may be used in place of a compacted clay seal.

13 EXCAVATION AND GROUNDWATER CONTROL

All excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). For the purposes of the OHSA, the existing fill, alluvial materials and native silty clay at the site are classified as Type 3 soils above the water level. Alluvial materials and any cohesionless soils below the water level are considered to be a Type 4 soil.

Excavation and backfilling for construction of any structures must be carried out in accordance with OPSS 902.

The groundwater level is expected to be at or slightly above the invert of the channel and will be largely governed by the water level in the channel. The use of stream diversion measures and pumping from filtered sumps will generally be adequate to maintain dry excavations during shallow excavations for channel rehabilitation. Additional pumps may be required if higher flow volumes are experienced from permeable alluvial layers or sand layers in the clay.

14 SCOPE OF WORK FOR DETAILED INVESTIGATION

As design progresses, additional geotechnical investigation and analysis will be required to prepare geotechnical design recommendations for the detail design phase of the project. The recommended scope of work for detail design should include the following:

- Further investigation along the base and sidewalls of any channel sections to be replaced or reconstructed, to determine existing backfill conditions, confirm geotechnical resistance values, assess requirements for slab subgrade preparation, and evaluate potential construction issues;
- Foundation investigation at the locations of any proposed culvert extensions or replacement;
- Boreholes along the alignments of any new or replacement retaining walls to determine recommendations for foundation design and assess constructability;
- Investigation and analysis to assess the stability of temporary and permanent slopes in areas where temporary excavation and/or modification of the channel works will be carried out adjacent to existing slopes;

- Further investigation in areas of seepage or ground loss to determine recommendations for repair.

It is noted that most of the channel alignment is located within the confined area between the existing highway embankment and steep ravine slopes. The presence of steep slopes, heavy vegetation cover, private properties, noise walls, and fences may restrict access to preferred borehole locations using conventional drilling equipment. Detailed field investigation may require means such as use of portable drilling equipment, excavation of test pits, drilling through the channel base from within the channel itself, and acquiring permission to access adjacent private properties.

15 CLOSURE

Preparation of this foundation design report was carried out by Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng.

THURBER ENGINEERING LTD.

Murray R. Anderson, P.Eng., M.Eng.
Senior Foundations Engineer



P.K. Chatterji, P.Eng., Ph.D.
Review Principal, Designated MTO Contact



Appendix A

Record of Borehole Sheets

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction







- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS	Split Spoon Sample	WS	Wash Sample	AS	Auger (Grab) Sample
	TW	Thin Wall Shelby Tube Sample	TP	Thin Wall Piston Sample		
	PH	Sampler Advanced by Hydraulic Pressure	PM	Sampler Advanced by Manual Pressure		
	WH	Sampler Advanced by Self Static Weight	RC	Rock Core	SC	Soil Core

 C _{pen}	Sensitivity =	$\frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$	<u>Piezometer Backfill</u>	
	Water Level Shear Strength Determination by Pocket Penetrometer		 Concrete  Cuttings  Bentonite	 Filter Sand  Cave

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

EXPLANATION OF ROCK LOGGING TERMS


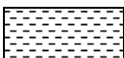



ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

SYMBOLS

	CLAYSTONE
	SILTSTONE
	SANDSTONE
	COAL
	BEDROCK

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
	(MPa)	(psi)	
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery:(SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation:(RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index:(FI)	Frequency of natural fractures per 0.3m of core run.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS W _L < 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. (W _L < 30%).
		CI	Inorganic clays of medium plasticity, silty clays. (30% < W _L < 50%).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS W _L > 50%	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

RECORD OF BOREHOLE No 15-01

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 791 172.2 E 272 687.0 ORIGINATED BY ES
 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.07.05 - 2015.07.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
80.1	GROUND SURFACE							<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
80.0	ASPHALT: (40mm)							<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
	Gravelly SAND , some silt Brown Damp (FILL)		1	GS				<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					26 59 15 (SI+CL)
78.9	Loose		1	SS	5			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
1.2	Sandy SILT , trace to some gravel, trace to some clay, asphalt fragments, occasional cobbles Dense Dark Brown to Black Wet (FILL) Loose		2	SS	32			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
			3	SS	6			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
			4	SS	4			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
76.3	becoming clayey							<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
3.8	Silty CLAY , some sand, trace rootlets Very Soft Brown		5	SS	1			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
			6	SS	1			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
74.0								<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
6.1	Silty SAND , some gravel, trace clay, trace rootlets Loose Brown Wet		7	SS	4			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					10 55 27 8
72.9								<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
7.2	Silty CLAY , trace sand Firm Grey		8	SS	5			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					0 5 48 47
								<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
			9	SS	6			<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
70.3								<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					
9.8	END OF BOREHOLE AT 9.8m.							<div>20406080100</div> <div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL × LAB VANE</div> <div>20406080100</div>					

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-01

2 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 791 172.2 E 272 687.0 ORIGINATED BY ES
 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.07.05 - 2015.07.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
	Continued From Previous Page BOREHOLE OPEN TO 7.6m AND WATER LEVEL AT 2.1m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2015.10.04 2.4 77.7																

RECORD OF BOREHOLE No 15-02

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 791 075.9 E 272 466.2 ORIGINATED BY ES
HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2015.07.05 - 2015.07.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
82.6	GROUND SURFACE							20 40 60 80 100						
0.0 0.1	ASPHALT: (75mm)							20 40 60 80 100						
	Gravelly SAND Brown Moist (FILL) Loose		1	GS			82							
			1	SS	5									
81.3														
1.3	Silty CLAY , trace sand, trace gravel Very Stiff Brown (FILL)		2	SS	20		81							
			3	SS	19		80							
79.6														
3.0	SAND , some silt, trace to some gravel, with some clayey pockets, occasional cobbles Compact Dark Brown to Black Moist (FILL) Occasional wood fibres		4	SS	68		79							
			5	SS	19									
78.1														
4.5	Clayey, silty SAND , trace gravel Firm Dark Grey		6	SS	7		78							5 53 26 16
							77							
76.5														
6.1	Silty SAND , some gravel, trace clay Compact Brown Wet		7	SS	10		76							20 52 21 7
							75							
74.7														
7.9	Silty CLAY , trace sand Soft Grey		8	SS	10		74							
							73							
72.8			9	SS	9									
9.8	END OF BOREHOLE AT 9.8m.													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-02

2 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 791 075.9 E 272 466.2 ORIGINATED BY ES
 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.07.05 - 2015.07.05 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page																
	BOREHOLE OPEN AND WATER LEVEL AT 4.3m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.																
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2015.10.04 4.2 78.4																

RECORD OF BOREHOLE No 15-03

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 791 001.8 E 272 226.3 ORIGINATED BY ES
HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2015.07.06 - 2015.07.07 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
85.6	GROUND SURFACE							20	40	60	80	100								
0.0 0.1	ASPHALT: (75mm)							20	40	60	80	100								
	Gravelly SAND Brown Moist (FILL)		1	GS			85													
	Compact		1	SS	13															
84.0							84													
1.6	Silty CLAY , trace to some sand, trace gravel Stiff to Very Stiff Reddish Brown Moist (FILL) occasional organic matter		2	SS	9															
			3	SS	19		83													
			4	SS	11		82													
	becoming Brown		5	SS	15															
			6	SS	19		81													
							80													
	Soft Reddish Brown		7	SS	2		79													
78.4																				
7.2	Sandy, clayey SILT , trace gravel, trace rootlets Firm to Stiff Brown (TILL)						78													
			8	SS	6															
							77													
76.1			9	SS	13		76													
9.5	Silty SAND , trace clay, trace gravel Compact Brown																			

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-03

2 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 791 001.8 E 272 226.3 ORIGINATED BY ES
 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.07.06 - 2015.07.07 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
Continued From Previous Page																				
75.4	Sandy, clayey SILT , trace gravel Very Stiff to Stiff Brown (TILL)		10	SS	21		75									2 37 47 14				
74																				
73																				
72																				
71.3			11	SS	9															
			12	SS	19															
14.3	END OF BOREHOLE AT 14.3m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2015.10.04 5.0 80.6																			

RECORD OF BOREHOLE No 15-04

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 790 862.1 E 272 079.8 ORIGINATED BY AHF
 HWY 403 BOREHOLE TYPE Tripod/NW Wash Boring COMPILED BY AN
 DATUM Geodetic DATE 2015.07.02 - 2015.07.02 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
82.1	GROUND SURFACE													
0.0	Silty CLAY , some topsoil, trace to some sand, occasional cobble, occasional roots and rootlets Stiff to Hard Brown to Reddish Brown Moist (FILL)		1	SS	10									
			2	SS	30									
			3	SS	36									
			4	SS	40									
79.1														
3.0	Silty CLAY , trace sand Stiff Grey		5	SS	14									
			6	SS	11									0 10 50 40
			7	SS	8									
			8	SS	14									0 4 40 56
	Very Stiff													
			9	SS	18									
73.4														
8.7	Silty CLAY , trace sand, trace gravel Very Stiff Grey (TILL)		10	SS	25									
72.3														
9.8	END OF BOREHOLE AT 9.8m.													

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-04

2 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 790 862.1 E 272 079.8 ORIGINATED BY AHF
 HWY 403 BOREHOLE TYPE Tripod/NW Wash Boring COMPILED BY AN
 DATUM Geodetic DATE 2015.07.02 - 2015.07.02 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
	Continued From Previous Page Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2015.07.07 0.5 81.6 2015.10.06 3.7 78.4																

RECORD OF BOREHOLE No 15-05

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 790 819.6 E 272 029.4 ORIGINATED BY AHF
 HWY 403 BOREHOLE TYPE Tripod/NW Wash Boring COMPILED BY AN
 DATUM Geodetic DATE 2015.07.06 - 2015.07.07 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
82.1	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL: (100mm)							20	40	60	80	100						
0.1	Silty CLAY , trace sand and gravel, roots and rootlets Stiff to Hard Reddish Brown Dry to Moist (FILL)		1	SS	11		82											
			2	SS	42		81											
			3	SS	38		80											
79.9							80											
2.2	Clayey SILT and SAND , trace gravel Very Stiff Grey Moist		4	SS	24		79										8	38 39 15
79.3																		
2.8	Silty CLAY , trace sand Firm Grey		5	SS	6		79											
							78											
			6	SS	7		77											
76.2																		
5.9	Silty CLAY , some sand to sandy, trace gravel Hard Grey Moist (TILL)		7	SS	51		76										5	15 46 34
							75											
	Very Stiff		8	SS	28		74										3	26 43 28
	Some sand and gravel		9	SS	16		73											
72.3																		
9.8	END OF BOREHOLE AT 9.8m.																	

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

[illegible]

RECORD OF BOREHOLE No 15-06

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 790 761.2 E 271 825.0 ORIGINATED BY ES
HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2015.07.07 - 2015.07.07 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
84.9	GROUND SURFACE							20 40 60 80 100					
0.0	ASPHALT: (65mm)							20 40 60 80 100					
0.1	Gravelly, silty SAND Brown Moist (FILL) Loose		1	GS				20 40 60 80 100					31 47 22 (SI+CL)
83.6			1	SS	8		84	20 40 60 80 100					
1.3	Silty CLAY, trace sand, trace gravel Stiff Reddish Brown (FILL)		2	SS	10		83	20 40 60 80 100					
82.7								20 40 60 80 100					
2.2	Silty CLAY, trace sand, trace gravel, topsoil stained Stiff to Firm Brown		3	SS	14		82	20 40 60 80 100					0 0 70 30
			4	SS	7			20 40 60 80 100					
			5	SS	9		81	20 40 60 80 100					0 8 53 39
			6	SS	7		80	20 40 60 80 100					
								20 40 60 80 100					
							79	20 40 60 80 100					
	Grey		7	SS	4		78	20 40 60 80 100					
								20 40 60 80 100					
			8	SS	18		77	20 40 60 80 100					0 0 63 37
	Very Stiff						76	20 40 60 80 100					
			9	SS	6			20 40 60 80 100					
75.1								20 40 60 80 100					
9.8	END OF BOREHOLE AT 9.8m.							20 40 60 80 100					

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-06

2 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 790 761.2 E 271 825.0 ORIGINATED BY ES
 HWY 403 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.07.07 - 2015.07.07 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page							20	40	60	80	100					
	Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2015.10.04 2.8 82.1																

RECORD OF BOREHOLE No 15-07

1 OF 1

METRIC

W.P. 2054-14-00 LOCATION N 4 790 792.8 E 271 747.0 ORIGINATED BY AHF
 HWY 403 BOREHOLE TYPE Tripod/NW Wash Boring COMPILED BY MFA
 DATUM Geodetic DATE 2015.07.08 - 2015.07.08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa												
86.8	GROUND SURFACE							20	40	60	80	100								
0.0	TOPSOIL: (125mm)																			
0.1	SAND and GRAVEL, some silt Dense Brown Dry to Moist (FILL)		1	SS	39														39 42 19 (SI+CL)	
86.2																				
0.6	Silty CLAY, some sand Hard Brown (FILL)		2	SS	32		86												0 12 57 31	
85.4																				
1.4	SAND and GRAVEL, some silt, occasional cobble or boulder Very Dense Brown Wet (FILL)		3	SS	90/ 0 125		85													
84.8																				
2.0	END OF BOREHOLE AT 2.0m UPON CASING REFUSAL. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE. MOVED 3.0m SOUTH AND REFUSAL AT 2.5m.																			

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-08

1 OF 2

METRIC

W.P. 2054-14-00 LOCATION N 4 790 771.3 E 271 669.2 ORIGINATED BY AN
 HWY 403 BOREHOLE TYPE Tripod/NW Wash Boring COMPILED BY MFA
 DATUM Geodetic DATE 2015.07.10 - 2015.07.10 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
84.8	GROUND SURFACE							20 40 60 80 100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
0.0	TOPSOIL: (100mm)							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
0.1	Silty CLAY , trace sand, trace gravel, trace rootlets Hard Brown Moist (FILL) trace wood chips Stiff to Very Stiff		1	SS	30								○																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC[illegible]

RECORD OF BOREHOLE No 15-09

1 OF 1

METRIC

W.P. 2054-14-00 LOCATION N 4 790 645.2 E 271 487.6 ORIGINATED BY ES
 HWY 403 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2015.07.08 - 2015.07.08 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)						
86.9	GROUND SURFACE							20	40	60	80	100						
0.0	ASPHALT: (125mm)							20	40	60	80	100						
0.1	SAND and GRAVEL, some silt Brown Moist (FILL) Compact		1	GS													43 43 14 (SI+CL)	
			1	SS	10													
85.6																		
1.3	Silty CLAY, trace to some sand, trace gravel Firm Brown Moist (FILL)		2	SS	6													
84.7																		
2.2	Sandy, clayey SILT, trace gravel, with rootlets Very Stiff to Hard Reddish Brown (TILL)		3	SS	15												3 33 49 15	
			4	SS	50/ 0.125													
	becoming residual shale with siltstone interbeds																	
			5	SS	102/ 0.225													
82.0																		
4.9	SHALE, weathered, thinly bedded, horizontally laminated, reddish brown, occasional siltstone interbeds		1	RUN													RUN #1 TCR=67% SCR=67% RQD=58% UCS=11.2MPa (Shale Avg.)	
	Limestone interbed from 5.8m to 6.2m		2	RUN													RUN #2 TCR=95% SCR=93% RQD=68% UCS=14.1MPa (Shale Avg.)	
	Occasional sub-vertical fractures																	
	Siltstone interbed (75mm) at 6.9m																RUN #3 TCR=92% SCR=92% RQD=58% UCS=9.2MPa (Shale Avg.)	
			3	RUN														
	Rubble zone from 8.1 to 8.2m																	
78.4																		
8.5	END OF BOREHOLE AT 8.5m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen.																	
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2015.10.04 3.9 83.0																	

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 15-10

1 OF 1

METRIC

W.P. 2054-14-00 LOCATION N 4 790 471.9 E 271 182.6 ORIGINATED BY ES
HWY 403 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2015.07.09 - 2015.07.09 CHECKED BY MRA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
90.7	GROUND SURFACE													
0.0	ASPHALT: (100mm)													
0.1	Gravelly SAND Compact Brown Moist (FILL)		1	GS										
			1	SS	19									
89.4														
1.3	Sandy, clayey SILT, with shale fragments Very Stiff Reddish Brown													
88.8	Dry (TILL)		2	SS	30									
1.9	SHALE, weathered, thinly bedded, horizontally laminated, reddish brown, occasional siltstone interbeds (25 to 175mm)		1	RUN										0 16 66 18
	Occasional sub-vertical fractures													RUN #1 TCR=82% SCR=82% RQD=66% UCS=19.7MPa (Shale Avg.)
			2	RUN										RUN #2 TCR=97% SCR=97% RQD=80% UCS=7.5MPa (Shale Avg.)

ONTMT4S 0628.GPJ 2015TEMPLATE(MTO).GDT 4/14/16

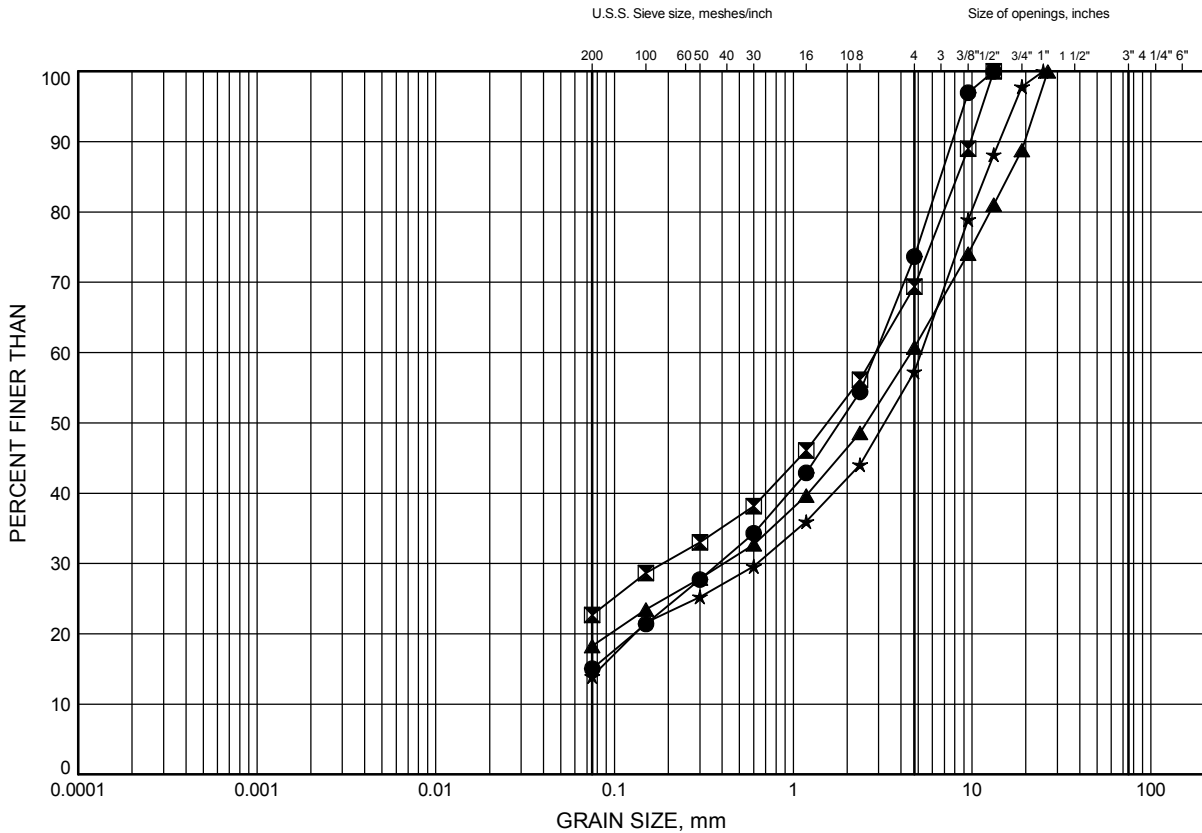
Appendix B

Laboratory Test Results

Longwood & Upper Cascade GRAIN SIZE DISTRIBUTION

FIGURE B1

GRANULAR FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-01	0.34	79.76
⊠	15-06	0.34	84.56
▲	15-07	0.30	86.50
★	15-09	0.38	86.52

Date August 2015
W.P. 2054-14-00

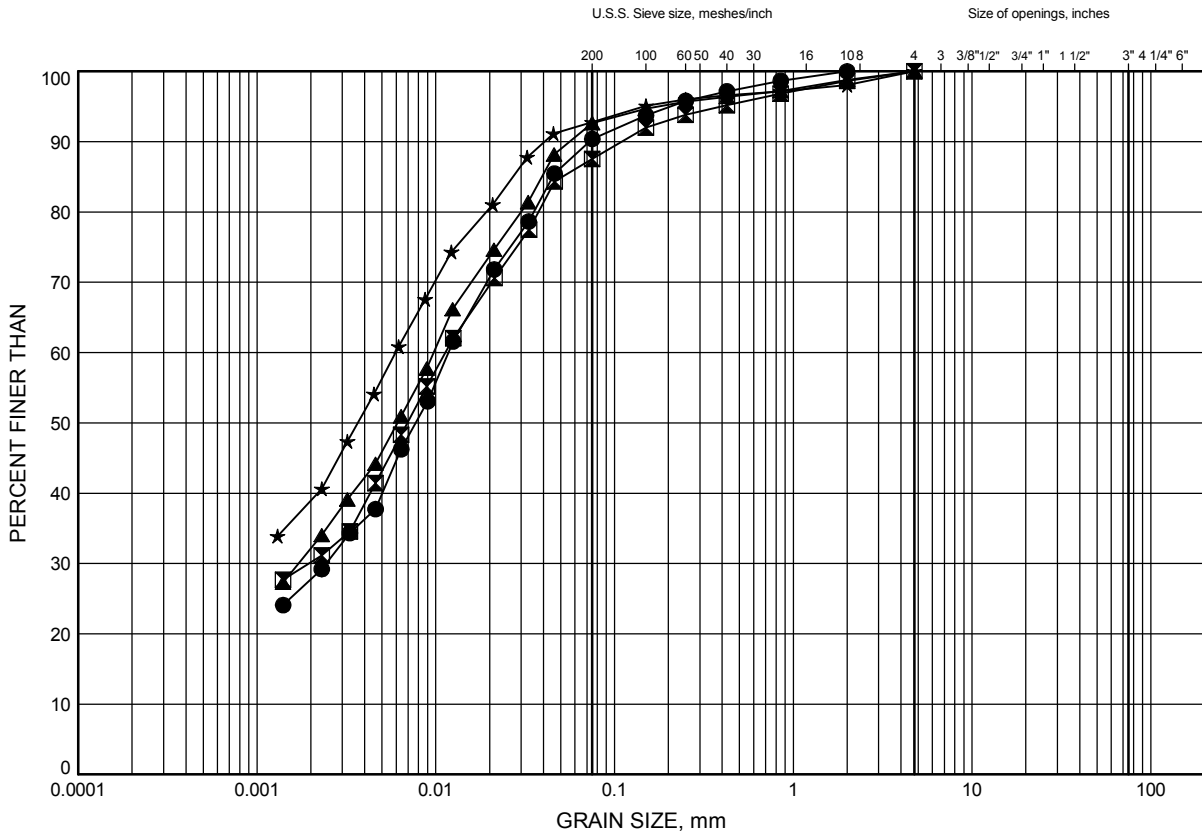


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-03	4.88	80.72
⊠	15-07	1.07	85.73
▲	15-08	1.07	83.73
★	15-08	2.59	82.21

Date August 2015
W.P. 2054-14-00

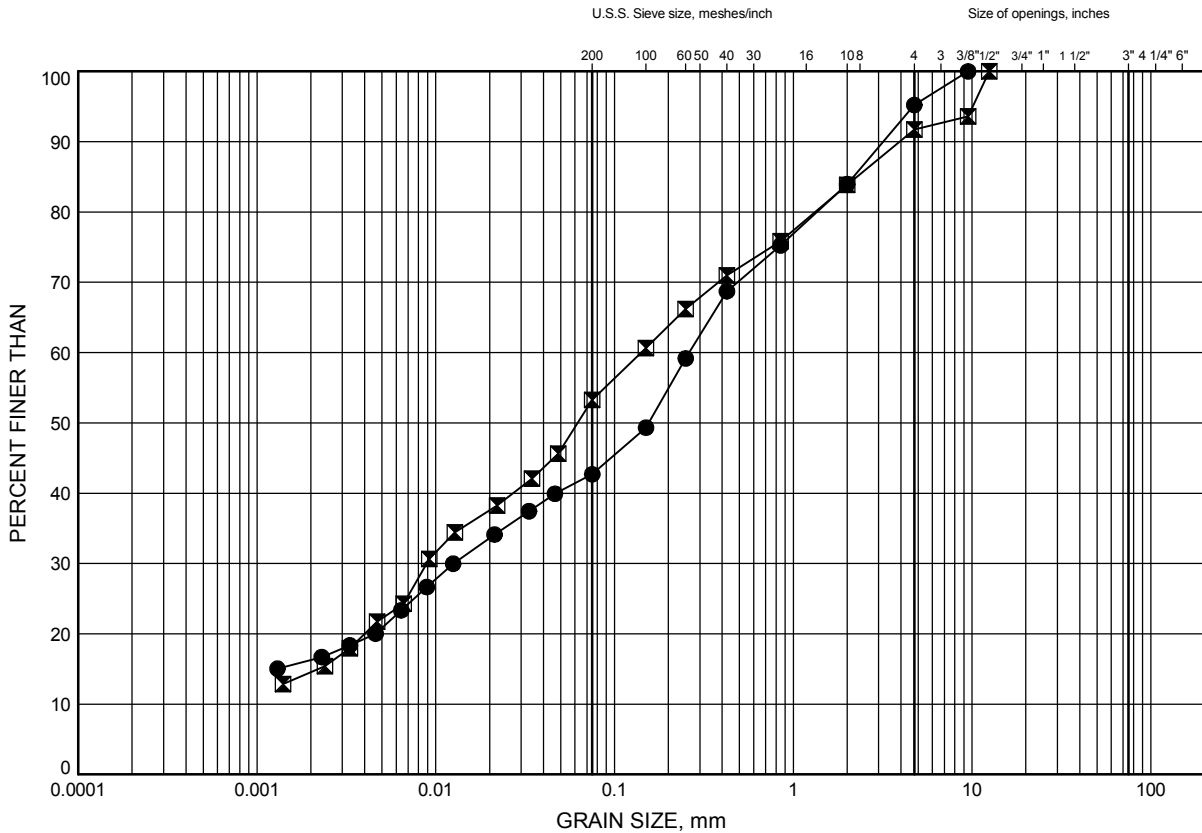


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade
GRAIN SIZE DISTRIBUTION

FIGURE B3

CLAYEY SILTY SAND TO CLAYEY SILT AND SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-02	4.88	77.72
◻	15-05	2.59	79.51

Date August 2015
W.P. 2054-14-00

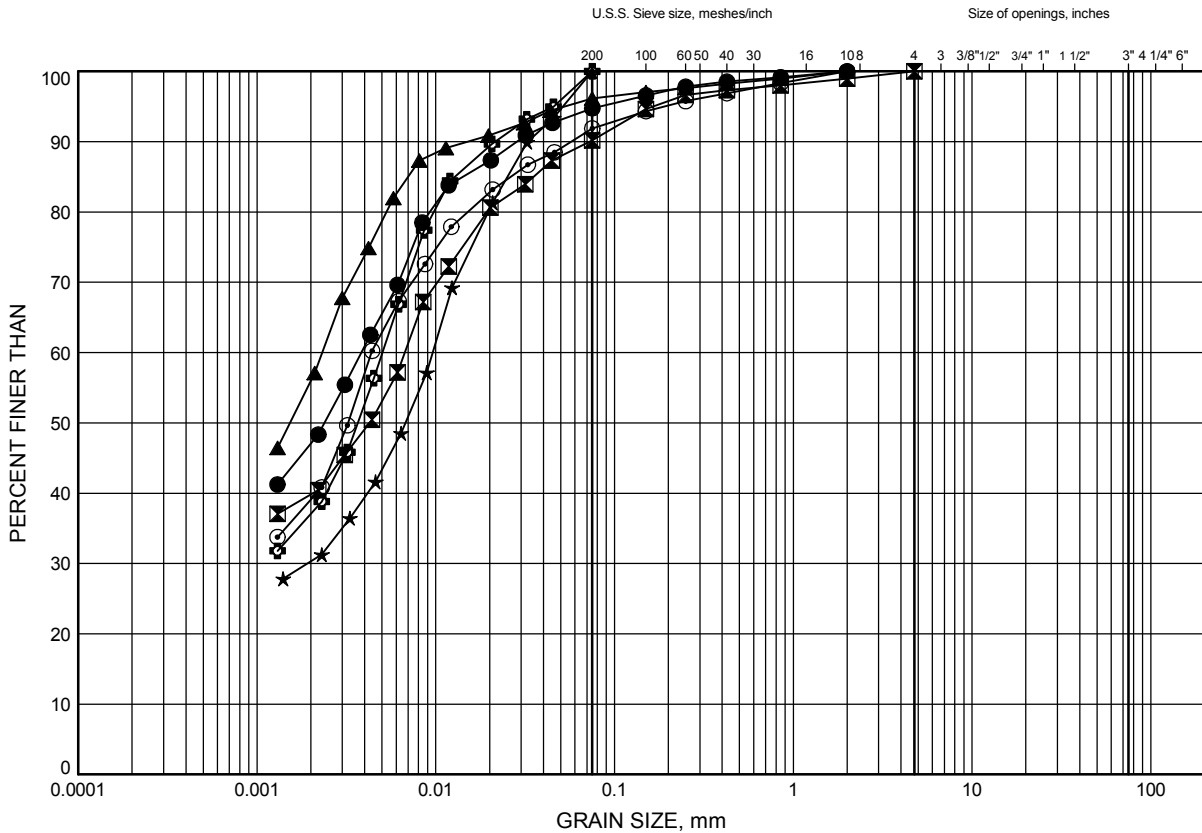


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade GRAIN SIZE DISTRIBUTION

FIGURE B4

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-01	7.92	72.18
⊠	15-04	3.96	78.14
▲	15-04	6.40	75.70
★	15-06	2.59	82.31
⊙	15-06	4.11	80.79
⊕	15-06	7.92	76.98

Date August 2015
W.P. 2054-14-00

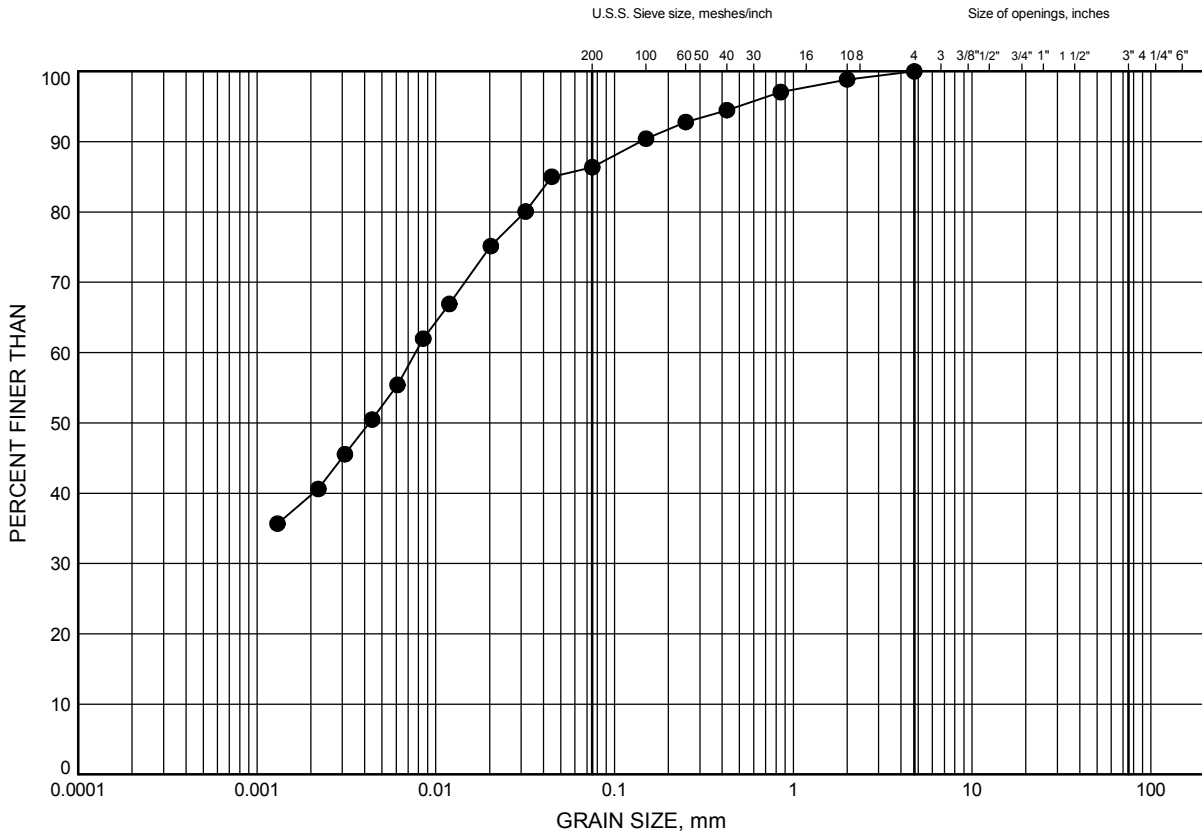


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade GRAIN SIZE DISTRIBUTION

FIGURE B5

SILTY CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-08	4.88	79.92

Date August 2015
W.P. 2054-14-00

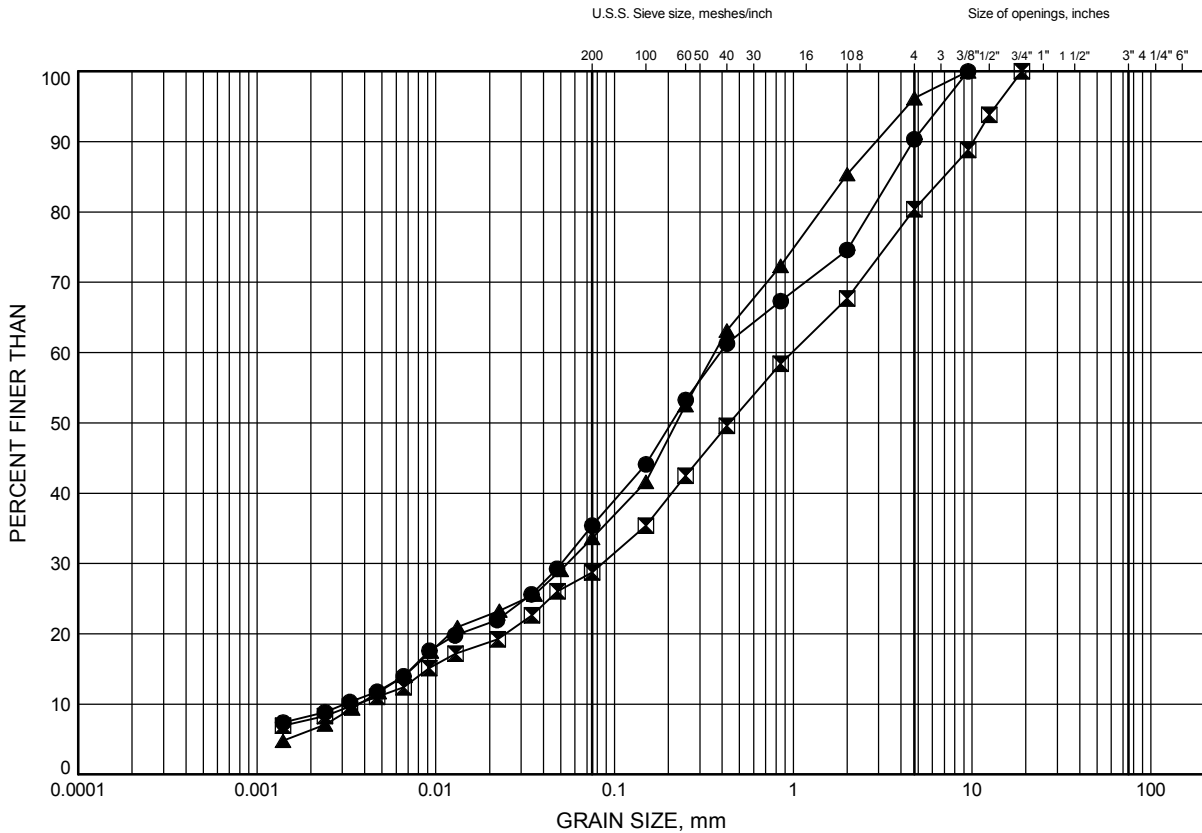


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade GRAIN SIZE DISTRIBUTION

FIGURE B6

SILTY SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-01	6.40	73.70
⊠	15-02	6.40	76.20
▲	15-03	9.65	75.95

Date August 2015
W.P. 2054-14-00

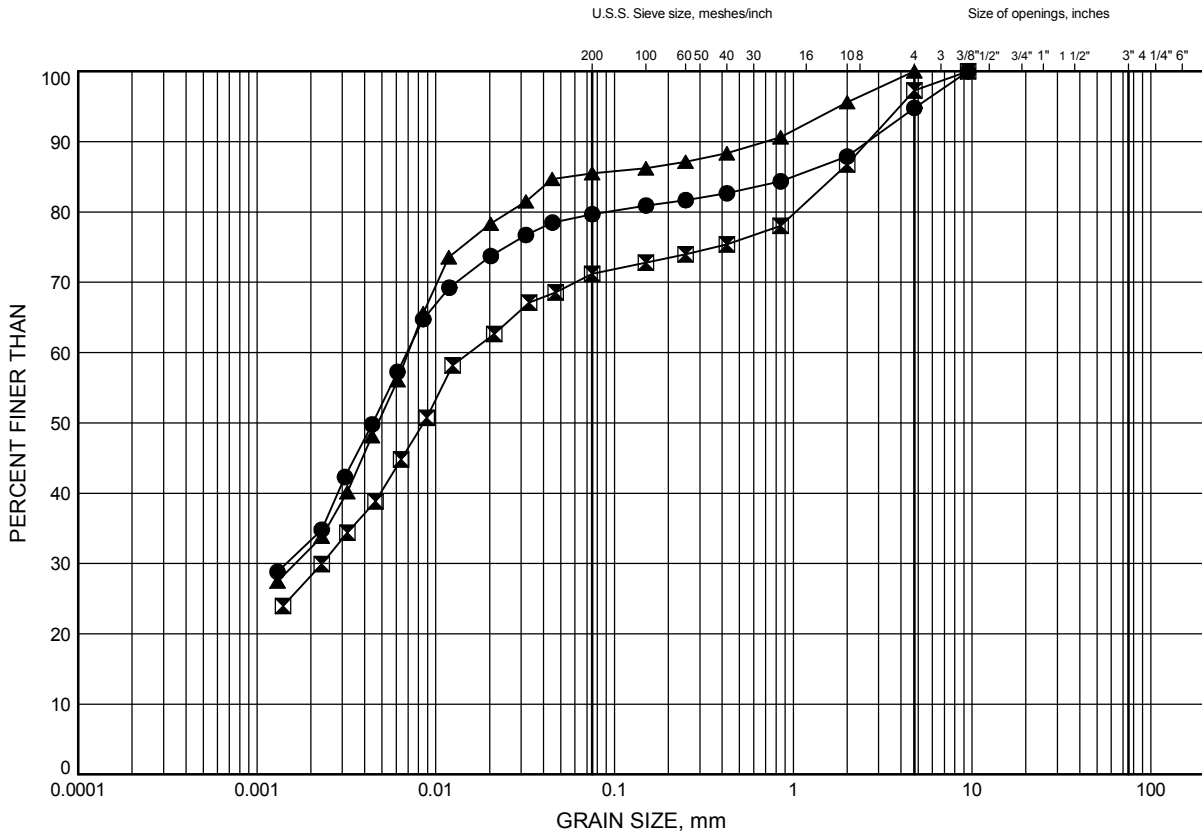


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Longwood & Upper Cascade
GRAIN SIZE DISTRIBUTION

FIGURE B7

SILTY CLAY TILL, SOME SAND TO SANDY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-05	6.40	75.70
⊠	15-05	7.92	74.18
▲	15-08	9.45	75.35

Date August 2015
W.P. 2054-14-00

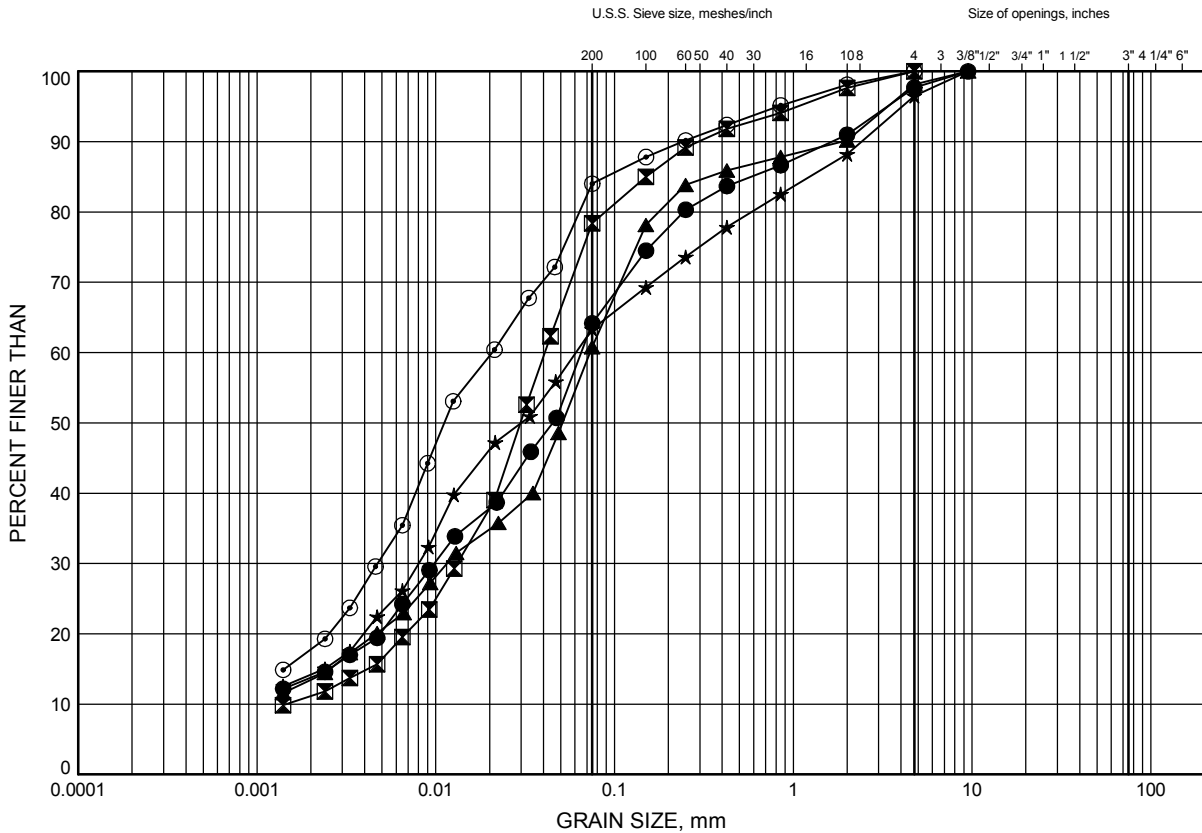


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade GRAIN SIZE DISTRIBUTION

FIGURE B8

SANDY CLAYEY SILT TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-03	7.92	77.68
⊠	15-03	9.35	76.25
▲	15-03	12.50	73.10
★	15-09	2.59	84.31
⊙	15-10	1.82	88.88

Date August 2015
W.P. 2054-14-00

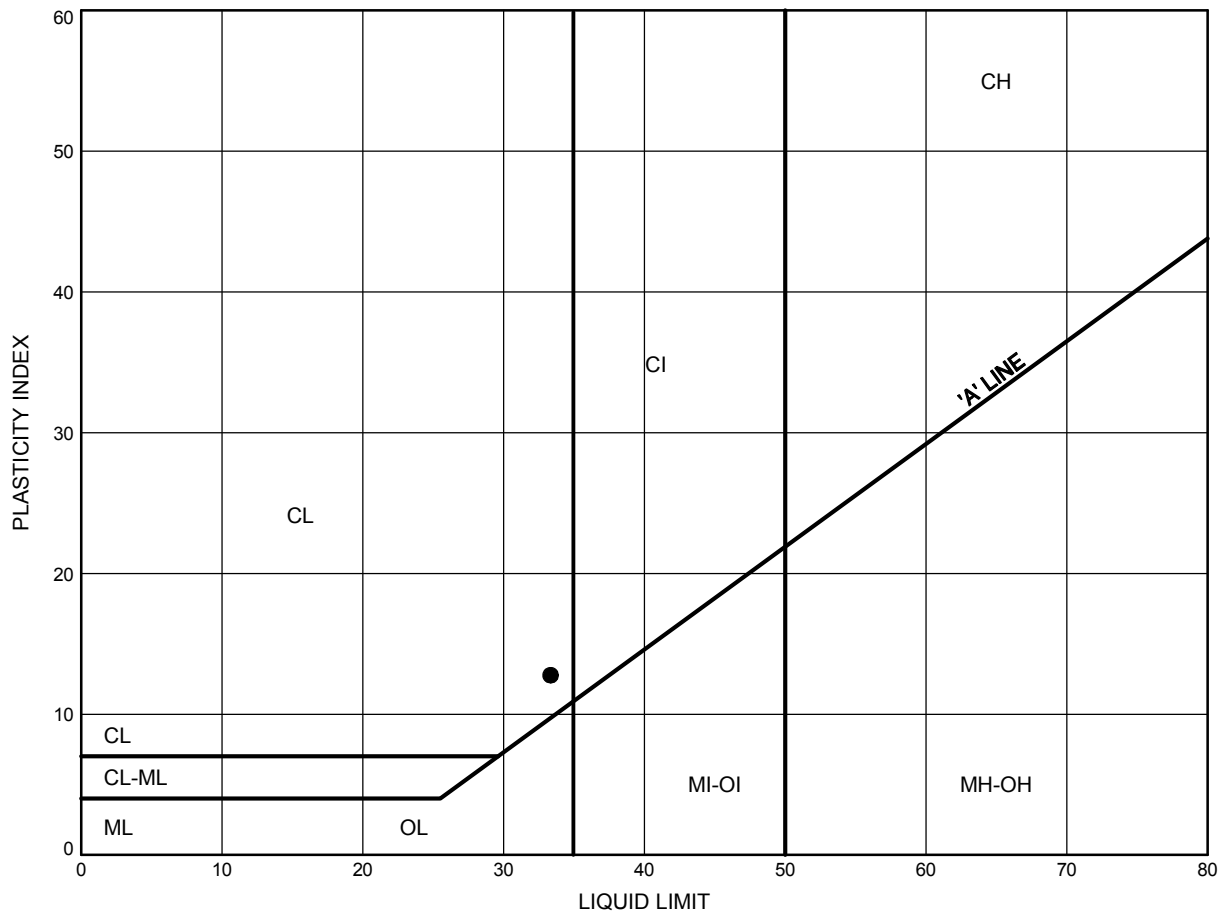


Prep'd MFA
Chkd. MRA

Longwood & Upper Cascade
ATTERBERG LIMITS TEST RESULTS

FIGURE B9

SILTY CLAY FILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-08	2.59	82.21

Date August 2015
W.P. 2054-14-00

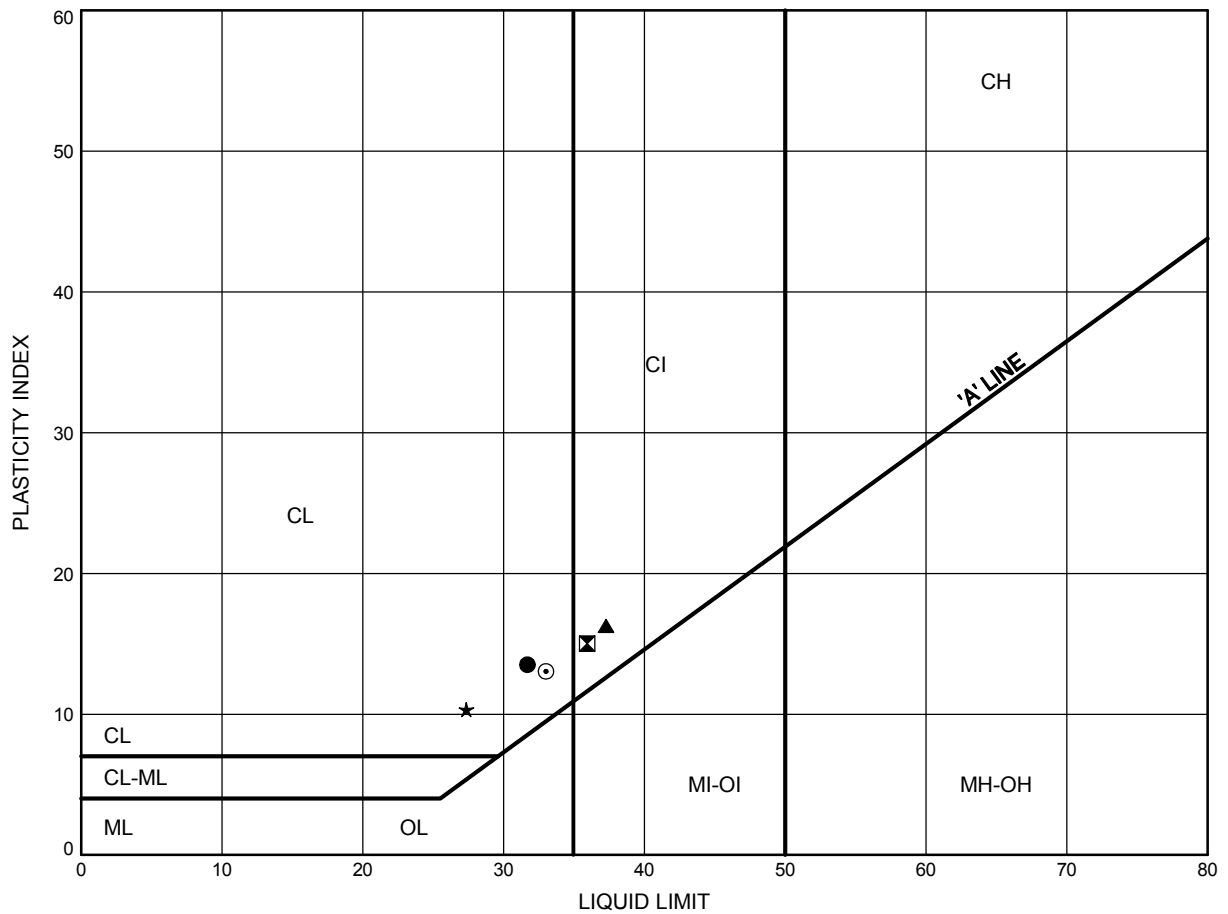


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Chkd. MRA

Longwood & Upper Cascade
ATTERBERG LIMITS TEST RESULTS

FIGURE B10

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-01	7.92	72.18
⊠	15-04	6.40	75.70
▲	15-06	4.11	80.79
★	15-06	7.92	76.98
⊙	15-08	4.88	79.92

Date August 2015
 W.P. 2054-14-00

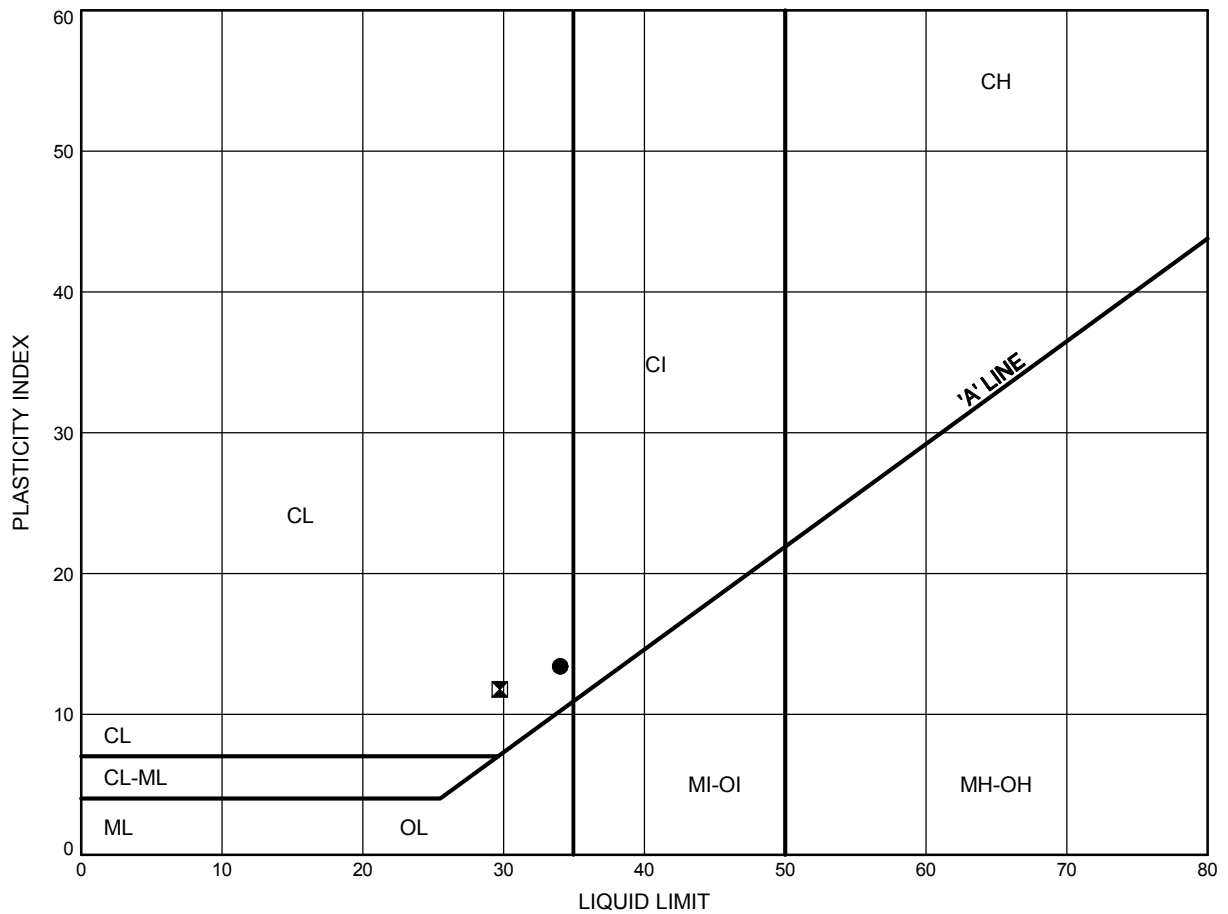


Prep'd MFA
 Chkd. MRA

Longwood & Upper Cascade
ATTERBERG LIMITS TEST RESULTS

FIGURE B11

SILTY CLAY TILL TO SANDY CLAYEY SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15-03	7.92	77.68
⊠	15-05	6.40	75.70

Date August 2015
 W.P. 2054-14-00



Prep'd MFA
 Chkd. MRA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES **LONGWOOD CHANNEL REHABILITATION**

BH 15-09



RUN #1 (4.85 – 5.46 m)

RUN #2 (5.46 – 6.99 m)

RUN #3 (6.99 – 8.51 m)

BH 15-10



RUN #1 (2.13 – 3.10 m)

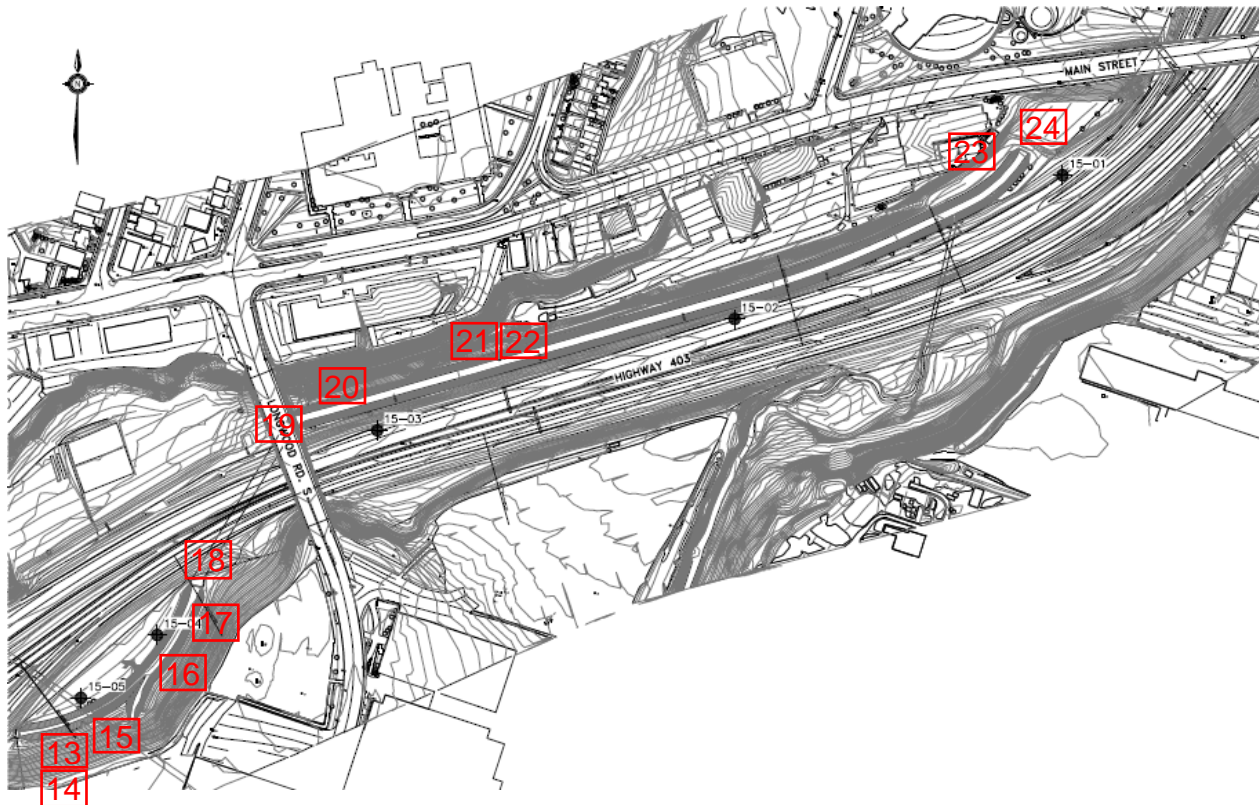
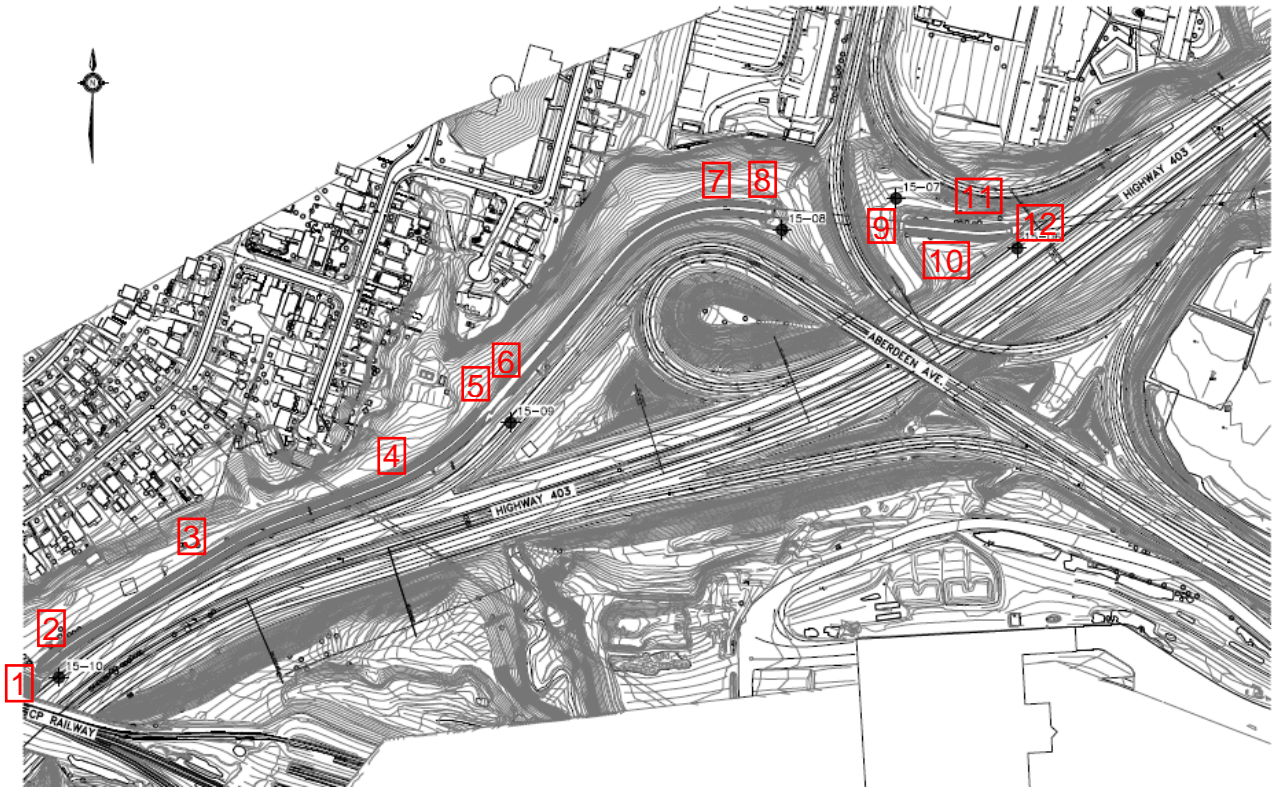
RUN #2 (3.10 – 4.62 m)

RUN #3 (4.62 – 6.15 m)

Appendix C

Site Photographs

Key Plan to Photograph Locations





Photograph 1 – Channel looking east from culvert outlet on east side of TH&B subway



Photograph 2 – Outlet from culvert under TH&B subway



Photograph 3 – Channel looking east from east of TH&B subway



Photograph 4 – Channel looking south, east of TH&B subway



Photograph 5 – Channel looking east from municipal drain outlet near east end of noise barrier wall on north side of Highway 403



Photograph 6 – Outlet from municipal drain looking west near east end of noise barrier wall on north side of Highway 403



Photograph 7 – Channel looking west from just west of inlet to culvert under ramp from Main Street to Highway 401. Aberdeen Avenue ramp embankment on left



Photograph 8 – Inlet to culvert under ramp from Main Street to Highway 403 east. Note void behind wingwall.



Photograph 9 – Channel looking downstream from culvert outlet on east side of ramp from Main Street to eastbound Highway 403



Photograph 10 – Outlet from culvert under ramp from Main Street to eastbound Highway 403



Photograph 11 – Inlet to culvert under Highway 403 east of Aberdeen Avenue. Note void under lining.



Photograph 12 – Channel looking upstream from inlet to culvert under Highway 403 east of Aberdeen Avenue



Photograph 13 – Culvert outlet on south side of Highway 403 between Aberdeen Avenue and Longwood Road. Note wet ground behind wingwall (upper left of photo) and seepage on top of culvert.



Photograph 14 – Channel looking east from north of culvert outlet on south side of Highway 403



Photograph 15 – Failed channel looking northeast from municipal drain outlet



Photograph 16 – Failed channel looking west towards municipal drain outlet on left



Photograph 17 – Inlet to culvert under Highway 403 west of Longwood Road



Photograph 18 – Channel looking west from inlet to culvert under Highway 403 west of Longwood Road



Photograph 19 – Channel looking downstream from culvert outlet on east side of Longwood Road underpass structure



Photograph 20 – Outlet on east side of Longwood Road underpass structure



Photograph 21 – Channel looking southwest between Longwood Road and Main Street



Photograph 22 – Channel looking southeast between Longwood Road and Main Street



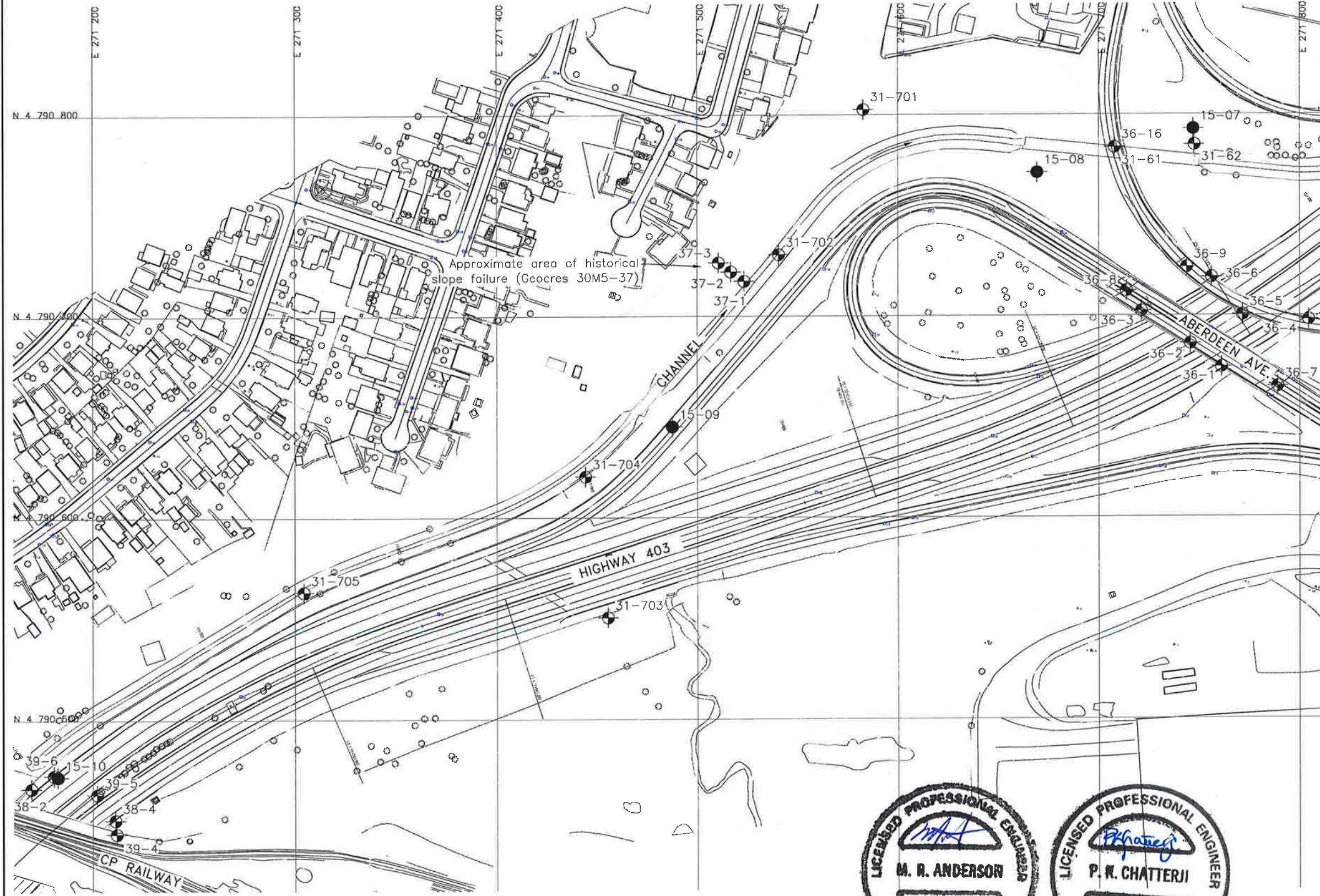
Photograph 23 – Inlet to culvert under Main Street West. Note void behind channel lining.



Photograph 24 – Channel looking west from inlet to culvert under Main Street West. Note wet area on right side of channel.

Appendix D

Borehole Locations Drawings



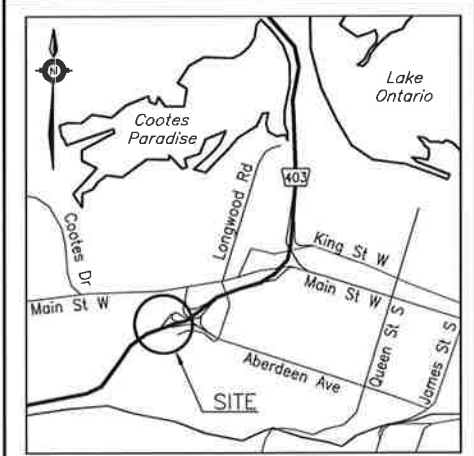
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

HIGHWAY 403
LONGWOOD ROAD
AND UPPER CASCADE
BOREHOLE LOCATION PLAN

AECOM

SHEET



KEYPLAN
LEGEND

- Borehole from Current Investigation
- ◆ Borehole from Geocres Files (ie, BH 35-2 from Geocres No. 30M5-35)

NO	ELEVATION	NORTHING	EASTING
15-07	86.8	4 790 792.8	271 747.0
15-08	84.8	4 790 771.3	271 669.2
15-09	86.9	4 790 645.2	271 487.6
15-10	90.7	4 790 471.9	271 182.6
31-61	0.0	4 790 783.7	271 707.7
31-62	0.0	4 790 784.9	271 747.5
31-701	0.0	4 790 802.6	271 582.7
31-702	0.0	4 790 730.6	271 540.6
31-703	0.0	4 790 550.5	271 455.5
31-704	0.0	4 790 620.4	271 444.4
31-705	0.0	4 790 563.1	271 304.4
36-1	0.0	4 790 674.5	271 761.1
36-2	0.0	4 790 686.1	271 745.5
36-3	0.0	4 790 702.3	271 721.2
36-4	0.0	4 790 697.9	271 804.4
36-5	0.0	4 790 700.3	271 771.5
36-6	0.0	4 790 719.1	271 756.1
36-7	0.0	4 790 664.7	271 789.0
36-8	0.0	4 790 712.4	271 713.6
36-9	0.0	4 790 724.1	271 743.7
36-16	0.0	4 790 783.7	271 707.7
37-1	0.0	4 790 717.4	271 523.3
37-2	0.0	4 790 722.1	271 516.7
37-3	0.0	4 790 726.6	271 510.5
38-2	0.0	4 790 466.2	271 169.6
38-4	0.0	4 790 450.5	271 211.1
39-4	0.0	4 790 443.7	271 211.8
39-5	0.0	4 790 463.3	271 202.1
39-6	0.0	4 790 472.6	271 180.8

GEOCRES No. 30M5-322

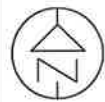


REVISIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
WP No

HIGHWAY 403
LONGWOOD ROAD
AND UPPER CASCADE
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET

AECOM

THURBER ENGINEERING LTD.



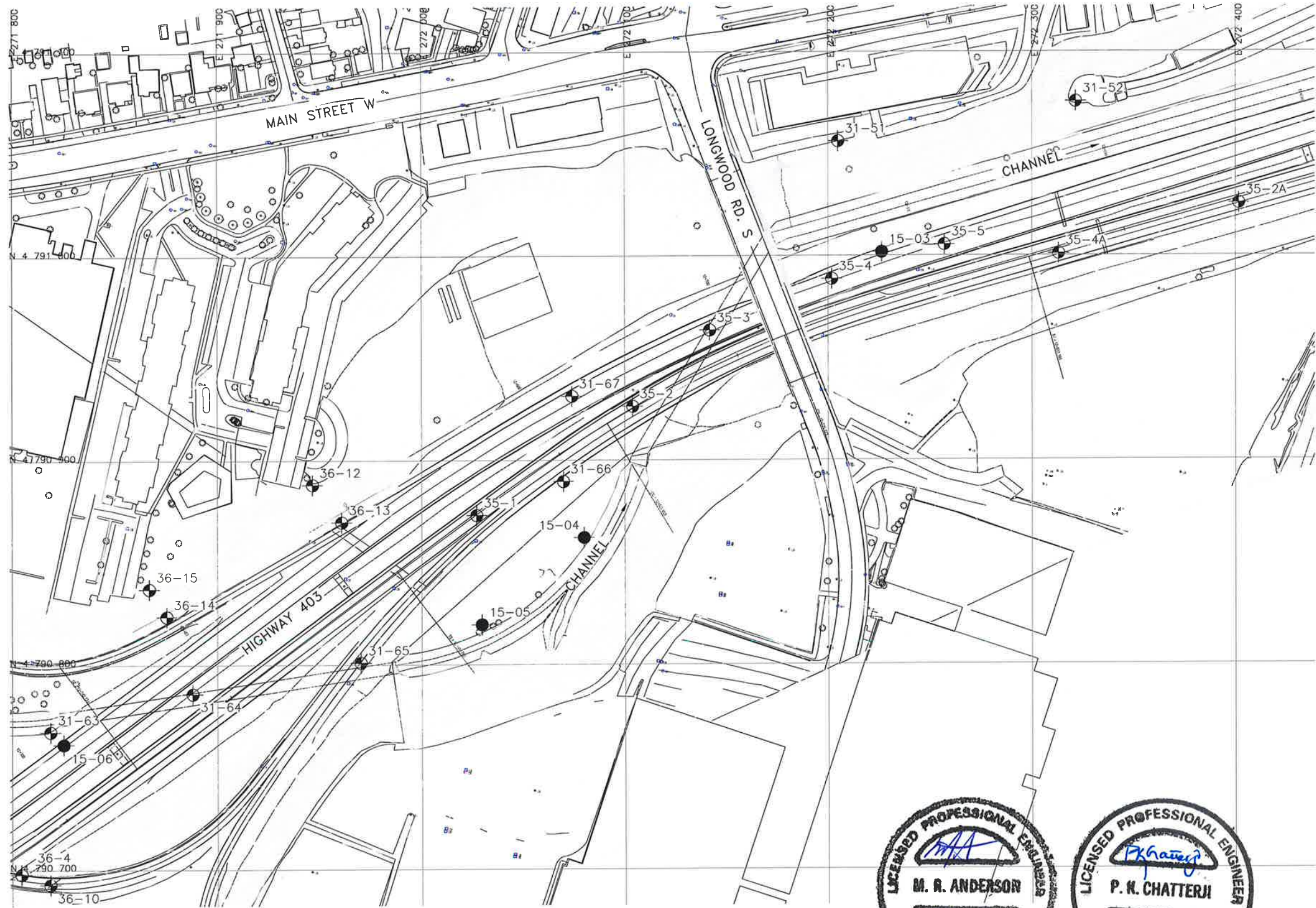
KEYPLAN

LEGEND

- Borehole from Current Investigation
- ◐ Borehole from Geocres Files
(ie, BH 35-2 from Geocres No. 30M5-35)

NO	ELEVATION	NORTHING	EASTING
15-03	85.6	4 791 001.8	272 226.3
15-04	82.1	4 790 862.1	272 079.8
15-05	82.1	4 790 819.6	272 029.4
15-06	84.9	4 790 761.2	271 825.0
31-51	0.0	4 791 056.1	272 204.9
31-52	0.0	4 791 075.5	272 321.6
31-63	0.0	4 790 767.4	271 818.5
31-64	0.0	4 790 785.8	271 887.8
31-65	0.0	4 790 801.0	271 970.1
31-66	0.0	4 790 889.6	272 069.6
31-67	0.0	4 790 931.4	272 073.8
35-1	0.0	4 790 873.1	272 026.9
35-2	0.0	4 790 926.4	272 103.9
35-2A	0.0	4 791 025.5	272 401.6
35-3	0.0	4 790 963.6	272 141.7
35-4	0.0	4 790 988.6	272 201.8
35-4A	0.0	4 791 000.9	272 313.2
35-5	0.0	4 791 005.4	272 256.9
36-4	0.0	4 790 697.9	271 804.4
36-10	0.0	4 790 692.9	271 818.4
36-12	0.0	4 790 888.1	271 946.5
36-13	0.0	4 790 869.8	271 960.8
36-14	0.0	4 790 823.6	271 875.1
36-15	0.0	4 790 837.1	271 866.7

GEOCRES No. 30M5-322



REVISIONS											
	DATE	BY	DESCRIPTION							DATE	APR 2016
DESIGN	MRA	CHK	PKC	CODE	LOAD						
DRAWN	MFA	CHK	MRA	SITE	STRUCT	DWG 2					

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

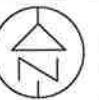
CONT No
WP No

HIGHWAY 403
LONGWOOD ROAD
AND UPPER CASCADE
BOREHOLE LOCATIONS AND SOIL STRATA

AECOM



THURBER ENGINEERING LTD.



SHEET

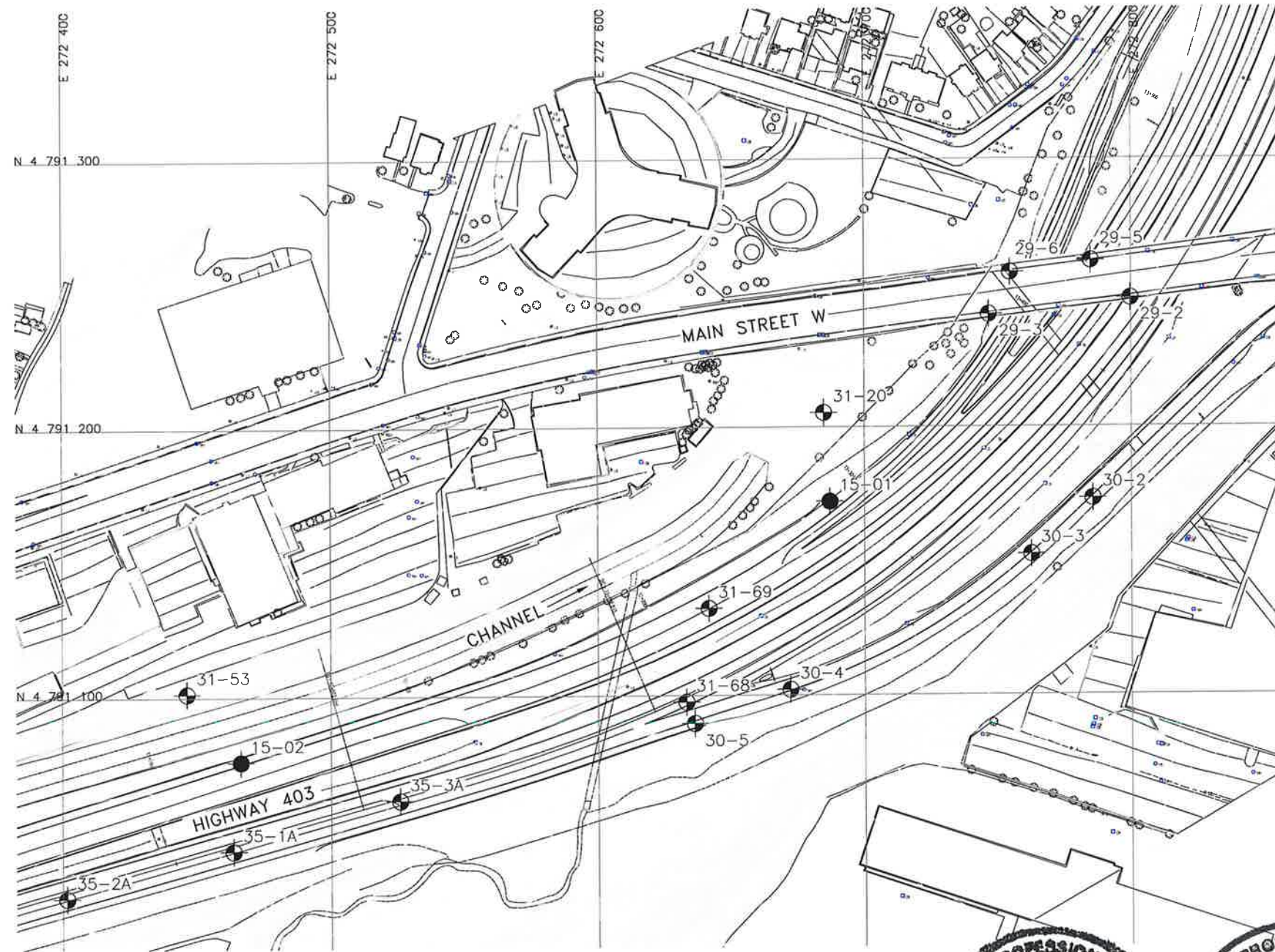


KEYPLAN
LEGEND

- Borehole from Current Investigation
◆ Borehole from Geocres Files
(ie, BH 35-2 from Geocres No. 30M5-35)

NO	ELEVATION	NORTHING	EASTING
15-01	80.1	4 791 172.2	272 687.0
15-02	82.6	4 791 075.9	272 466.2
29-2	0.0	4 791 247.8	272 799.8
29-3	0.0	4 791 241.9	272 746.7
29-5	0.0	4 791 261.9	272 784.9
29-6	0.0	4 791 257.6	272 754.7
30-2	0.0	4 791 173.1	272 785.5
30-3	0.0	4 791 152.4	272 762.5
30-4	0.0	4 791 102.1	272 672.0
30-5	0.0	4 791 089.7	272 636.2
31-20	0.0	4 791 205.3	272 684.7
31-53	0.0	4 791 101.4	272 446.3
31-68	0.0	4 791 097.6	272 633.1
31-69	0.0	4 791 132.5	272 641.6
35-1A	0.0	4 791 042.8	272 463.4
35-2A	0.0	4 791 025.5	272 401.6
35-3A	0.0	4 791 061.3	272 525.8

GEOCRES No. 30M5-322



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK PKC	CODE
DRAWN	MFA	CHK MRA	SITE
LOAD	DATE	APR 2016	
STRUCT	DWG	3	

Appendix E

Borehole Logs and Drawings from Geocres Files

Geocres No. 30M5-29

Hwy. 403 (Chedoke Expressway) and Main St. Crossing

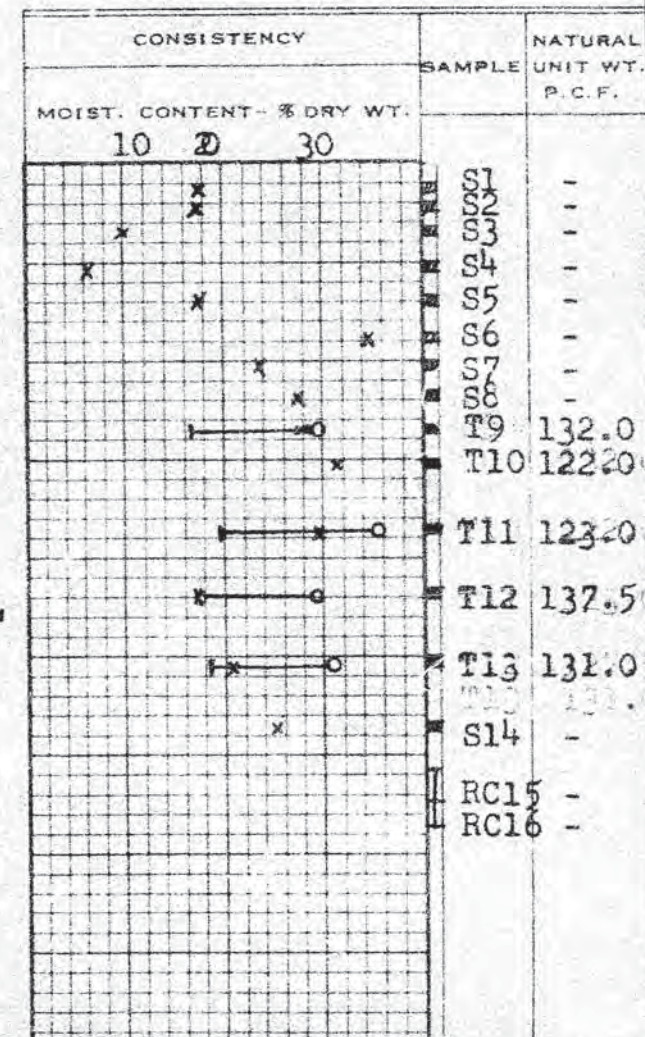
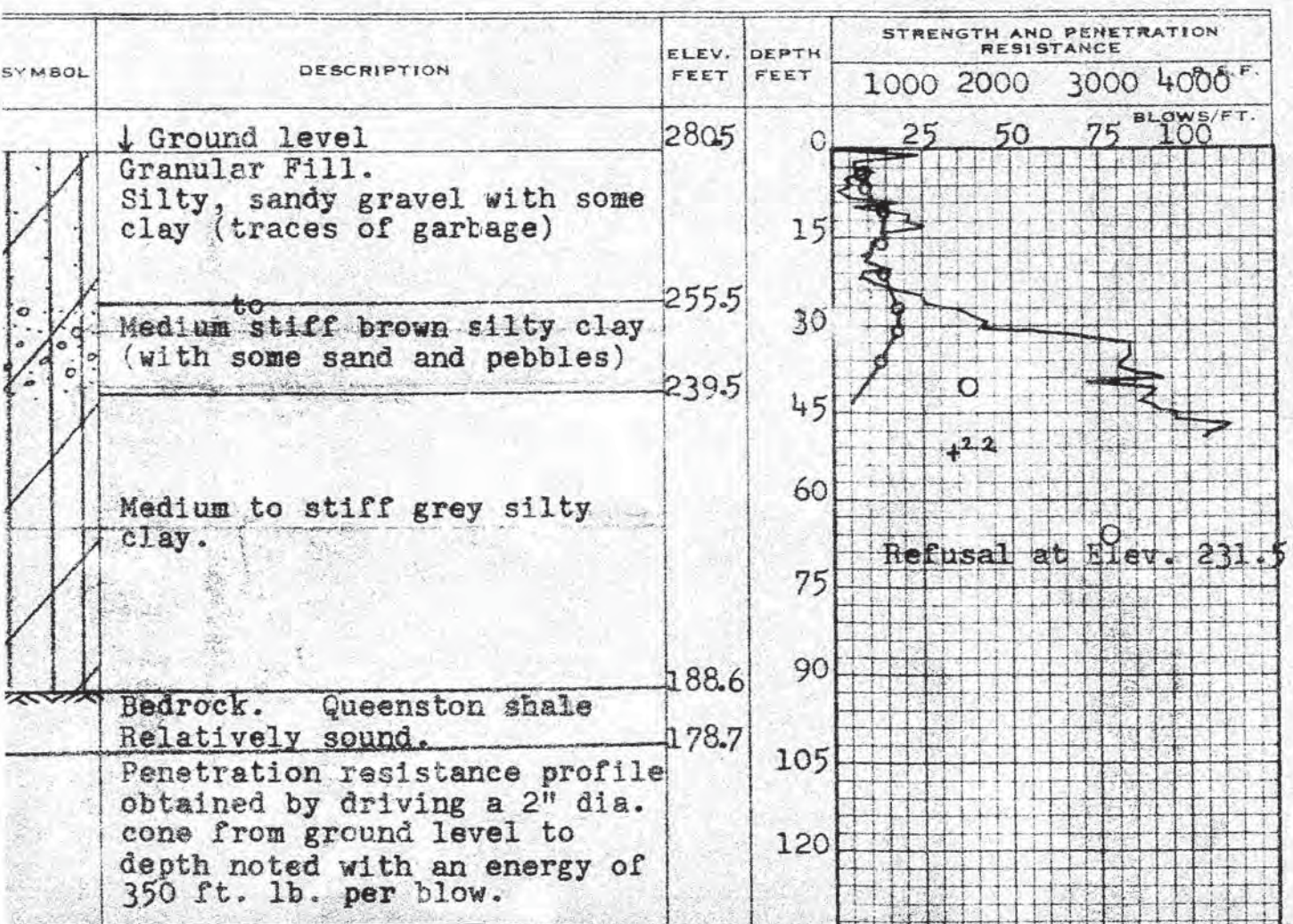
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 1
JOB F59-116 STATION 13+09 (33' Lt.)
DATUM 280.5' COMPILED BY B.K.
BORING DATE Jan. 7/59 CHECKED BY N.K.

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

LEGEND

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



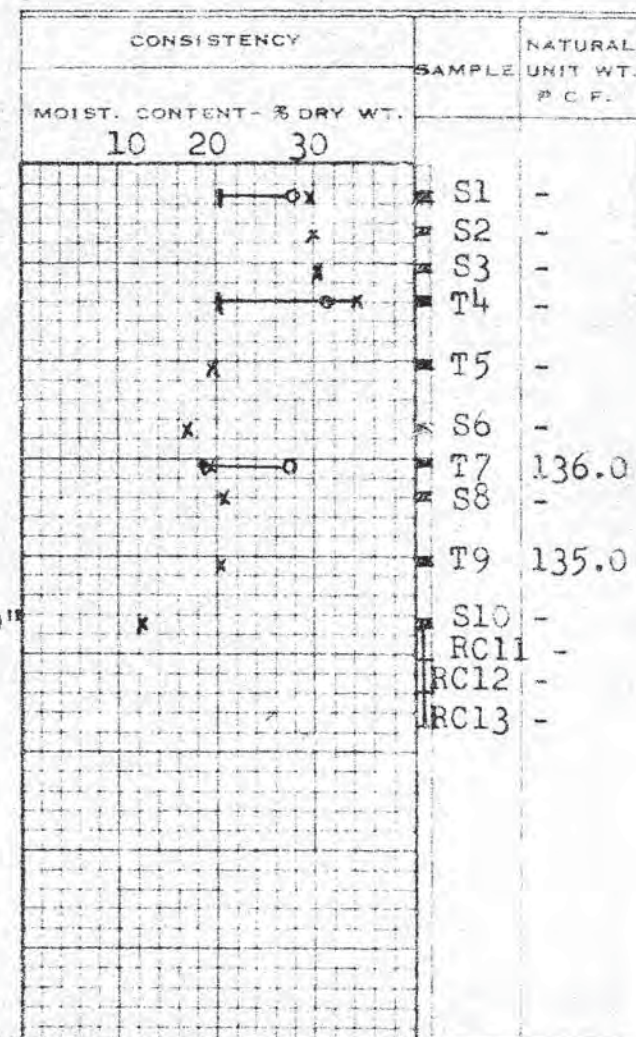
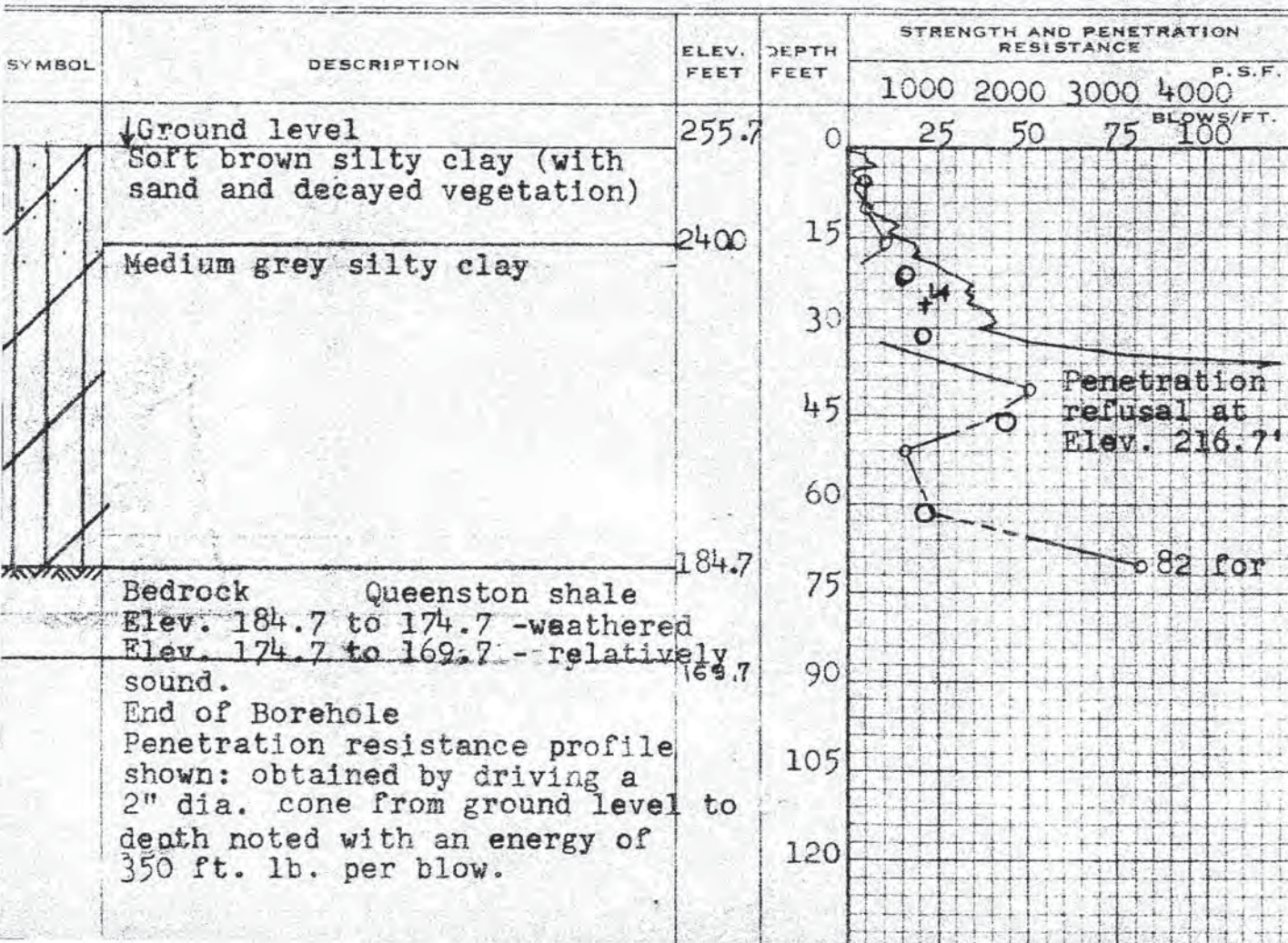
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 2
JOB F59-116 STATION 13+85 (33' Lt.)
DATUM 255.7' COMPILED BY B.K.
BORING DATE Dec. 17/59 CHECKED BY V.K.

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

LEGEND

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



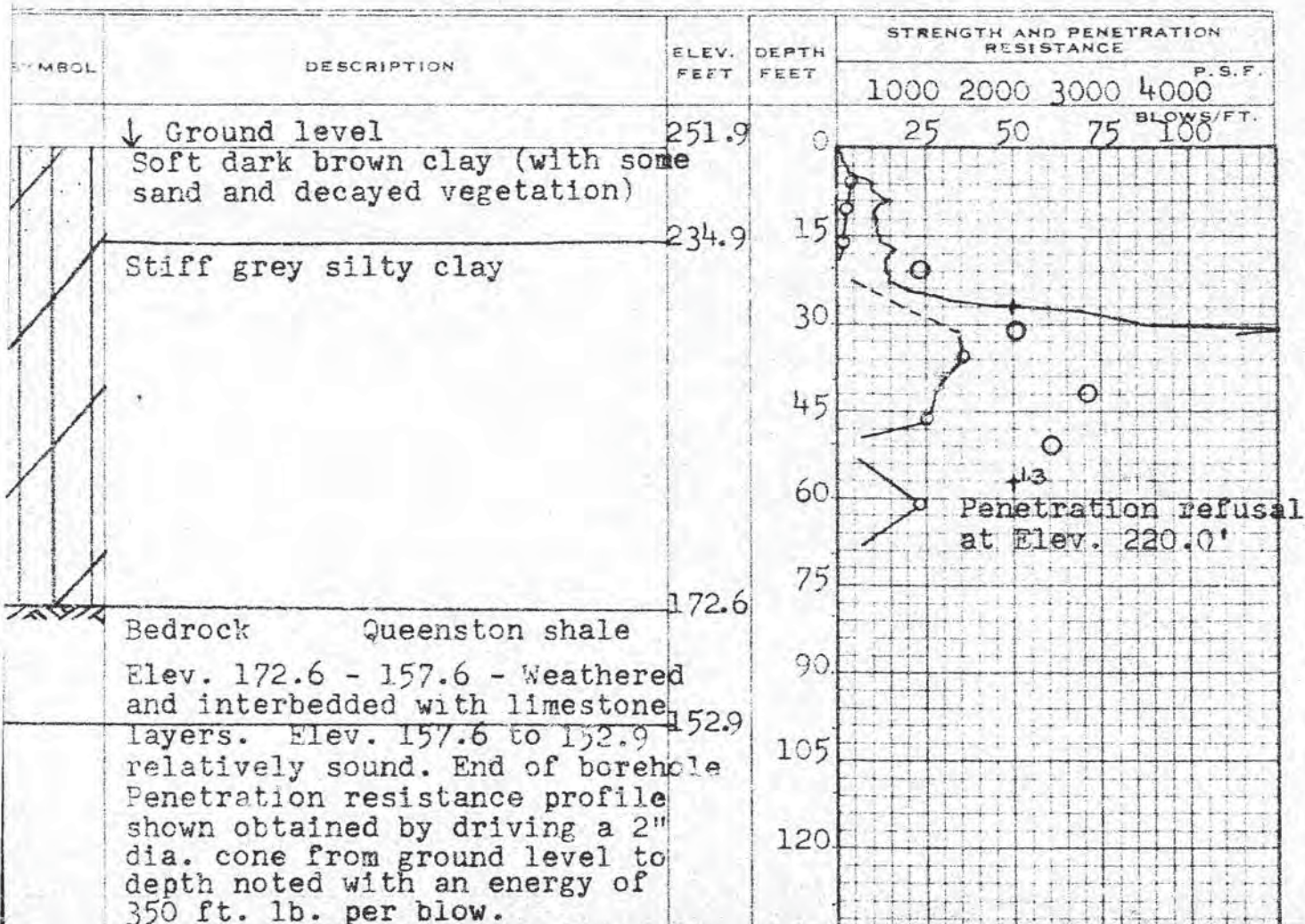
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 3
JOB F59-116 STATION 15+46 (24' Lt.)
DATUM 251.9' COMPILED BY B.K.
BORING DATED Dec. 8/59 CHECKED BY V.K.

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

LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.				
10	20	30		
			S1	-
			S2	-
			S3	-
			T4	122.0
			T5	133.0
			S6	-
			T7	133.0
			S8	-
			T9	133.0
			S10	-
			T11	132.0
			RC12	-
			RC13	-
			RC14	-

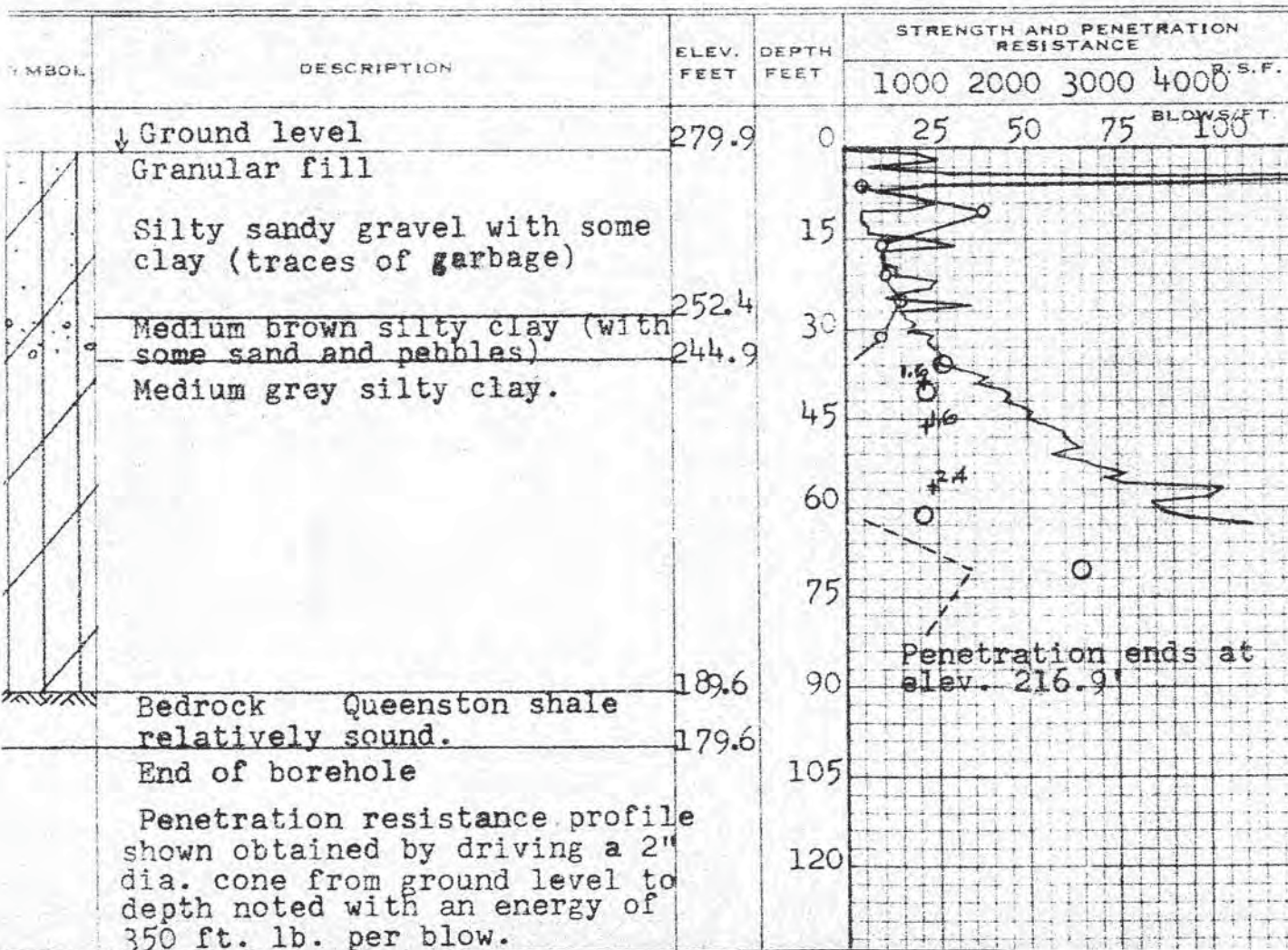
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

I.P. 180-60 BORE HOLE NO. 4
OB F59-116 STATION 12+77 (19' Lt.)
ELEV. 279.9' COMPILED BY B.K.
BORING DATE Dec. 22/59 CHECKED BY V.K.

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

LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			S1	-
			S2	-
			S3	-
			S4	-
			S5	-
			S6	-
			T7	131.0
			T8	131.0
			T9	-
			T10	136.0
			T11	133.0
			T12	-
			RC13	-
			RC14	-

DEPARTMENT OF HIGHWAYS - ONTARIO

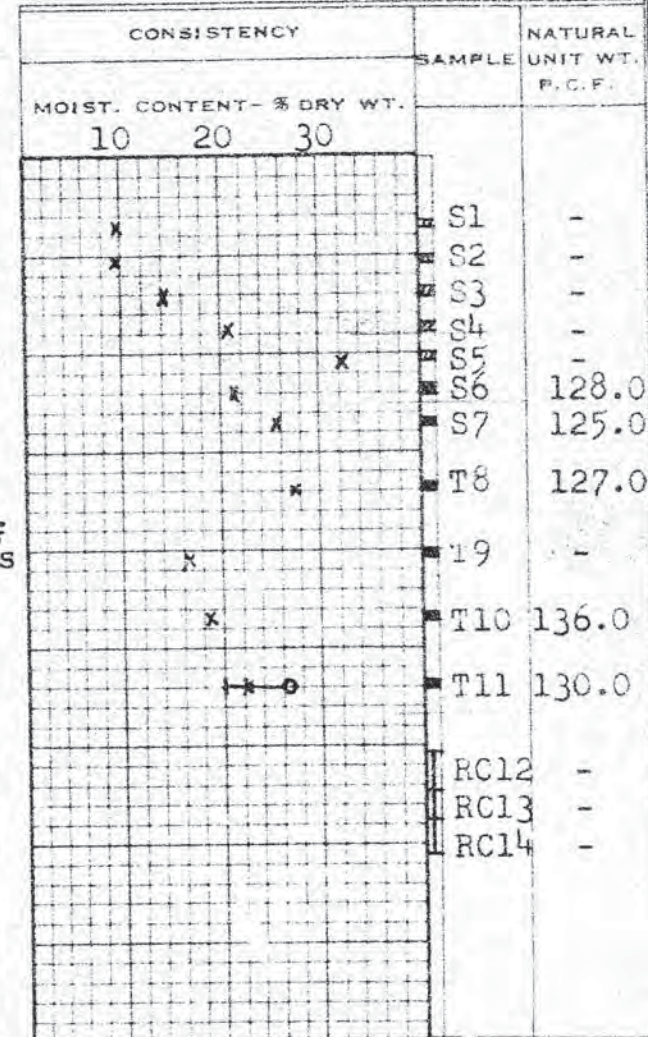
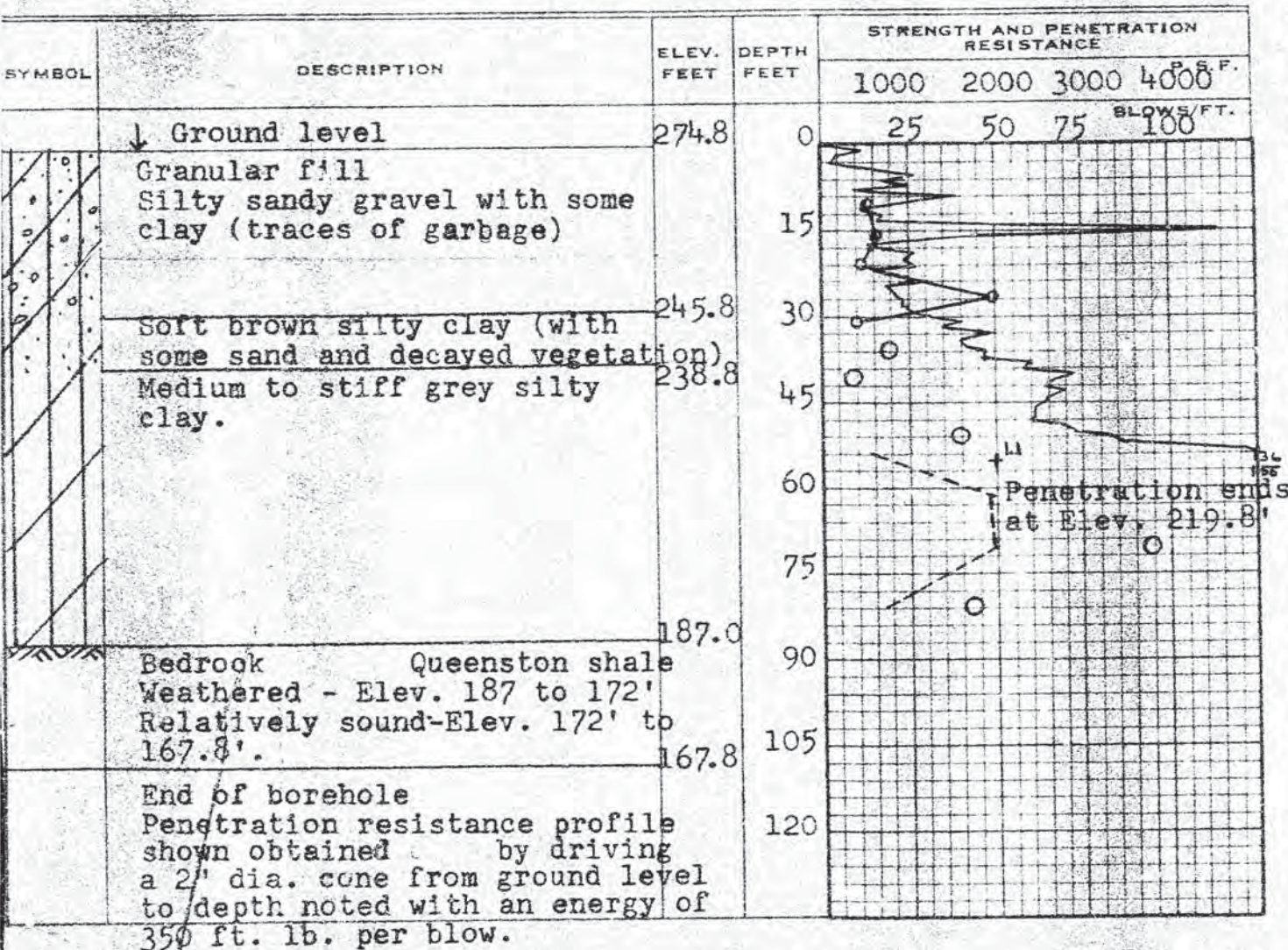
MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 5
 JOB 559-116 STATION 14+20 (19' Rt.)
 DATUM 274.8' COMPILED BY B.K.
 BORING DATE Dec. 15/59 CHECKED BY V.K.

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

LEGEND

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



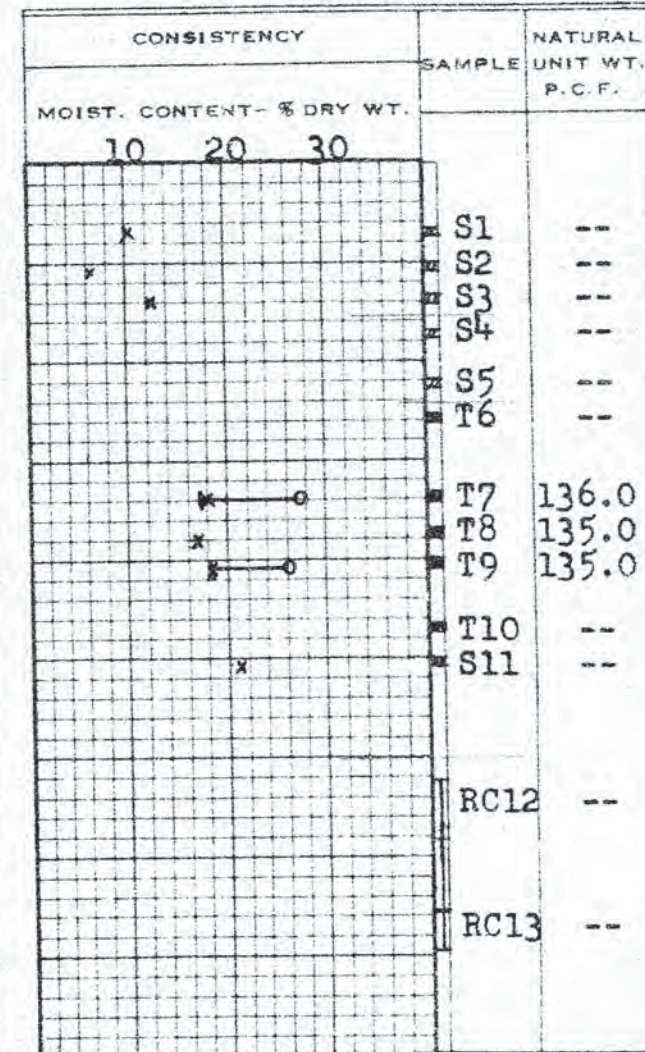
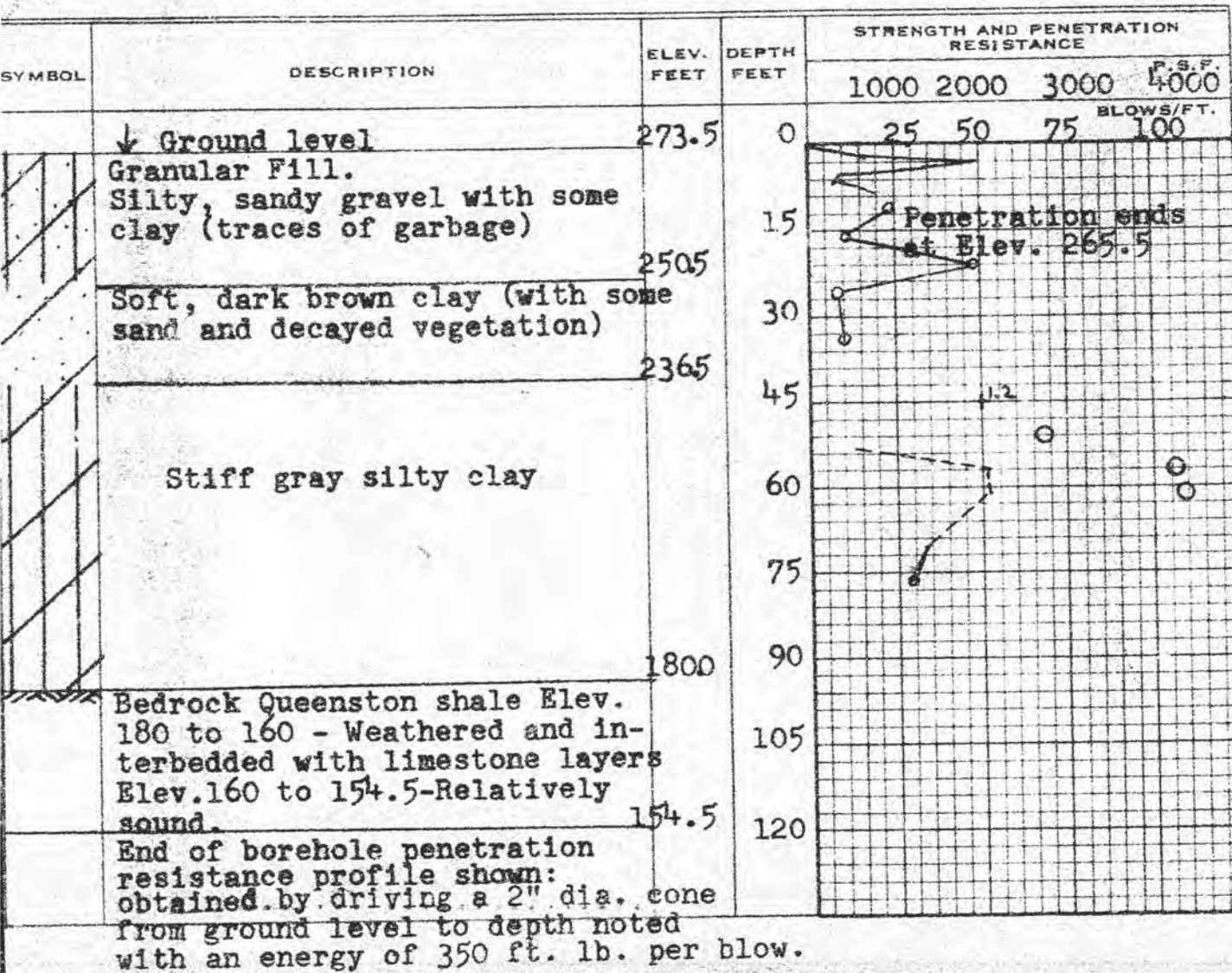
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

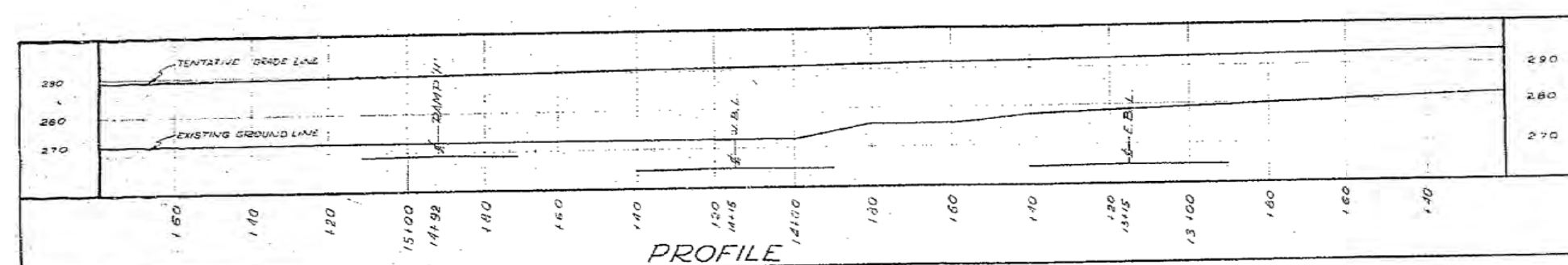
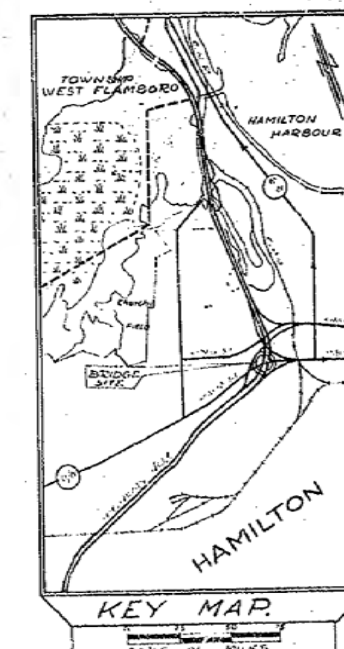
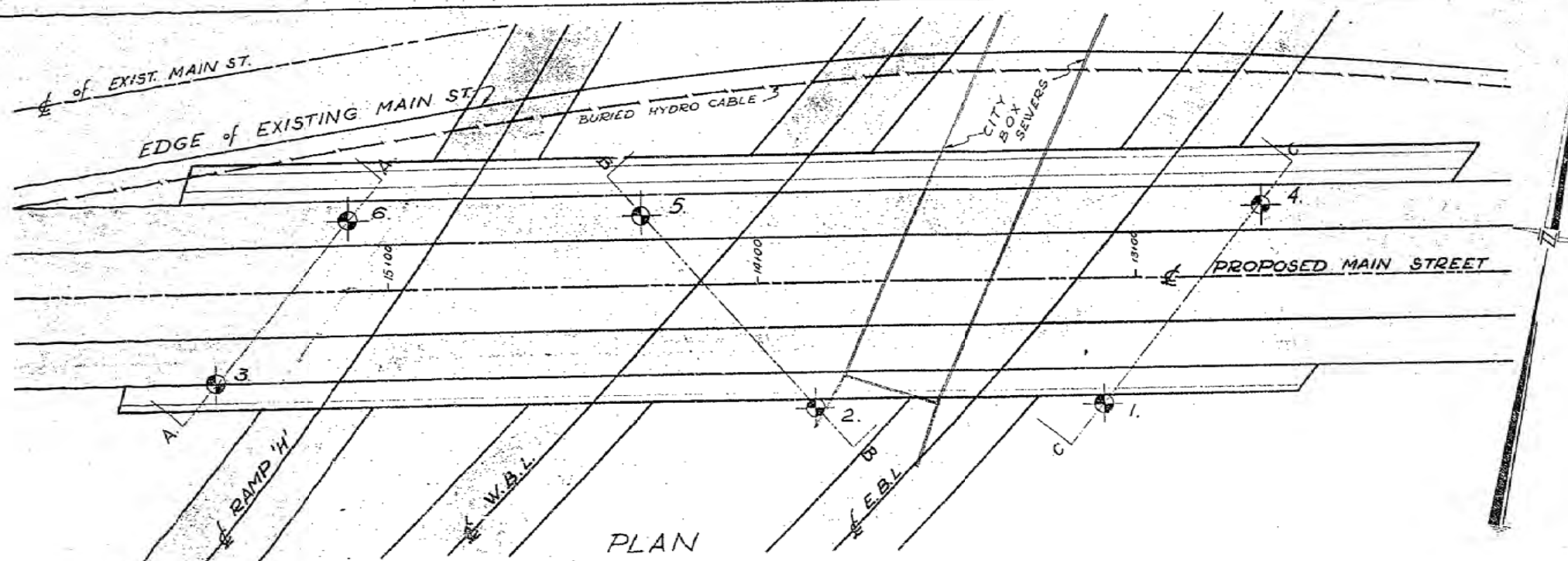
W.P. 180-60 BORE HOLE NO. 6
JOB F 59-116 STATION 15+10 (19' Rt.)
DATUM 273.5' COMPILED BY B.K.
BORING DATE Dec. 7/59. CHECKED BY N.K.

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

LEGEND

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

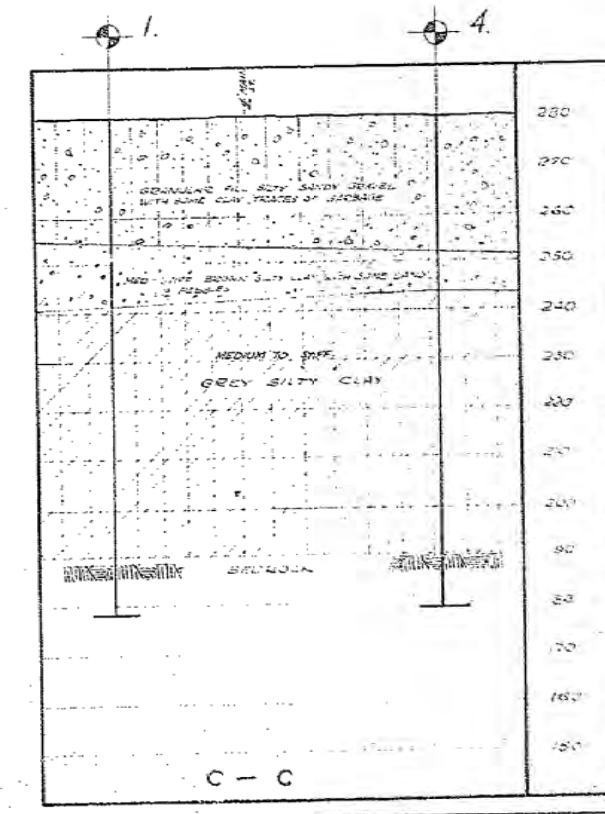
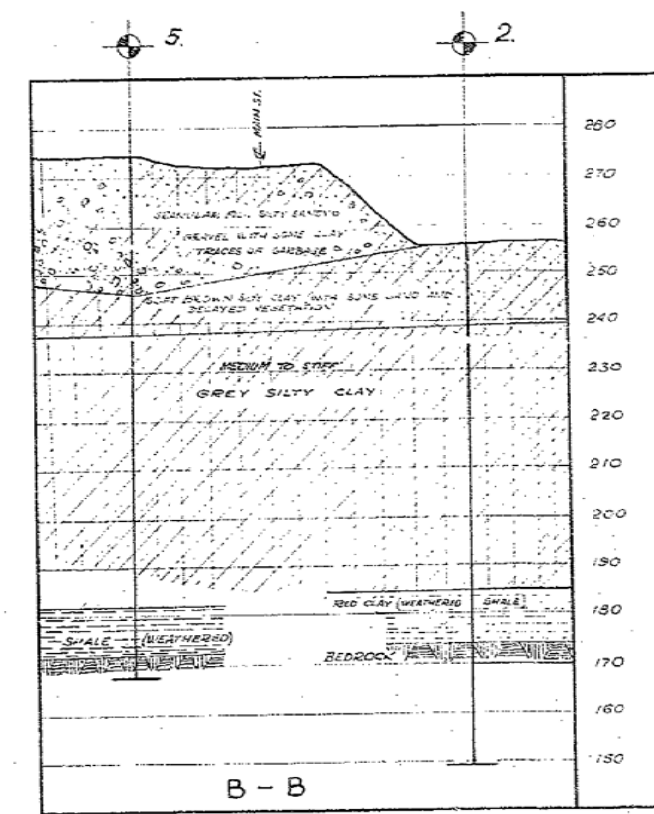
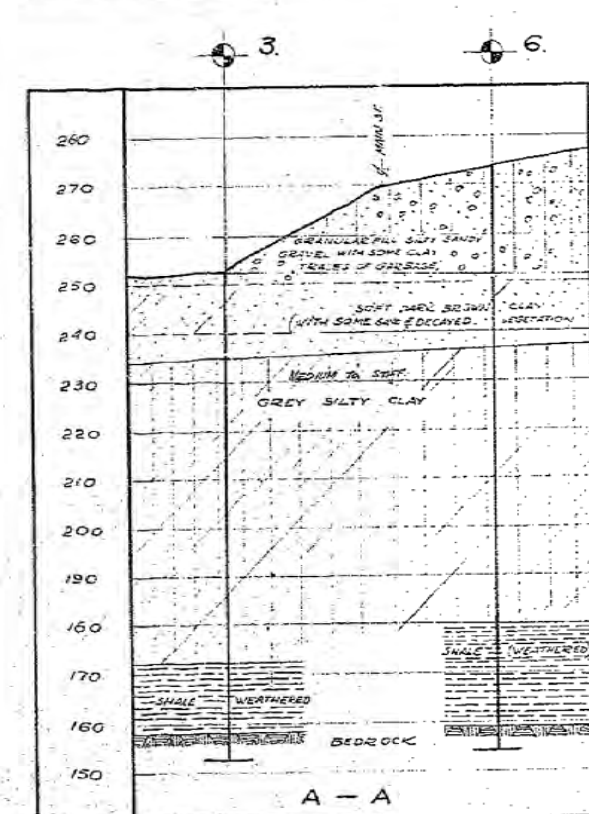




LEGEND

BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM E
1.	280.5	13+09	33' LT
2.	255.7	13+85	33' LT
3.	251.9	15+46	24' LT
4.	278.9	12+77	19' RT
5.	274.8	14+20	19' RT
6.	273.5	15+10	19' RT



NOTE

The boundaries between the strata have been estimated only at bore hole locations. Between these points the boundaries are assumed from geological evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO
MAINTENANCE & REPAIR SECTION

MAIN STREET PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

FILE 403 DISTRICT 4 COUNTY WENTWORTH

LOCATION AT HAMILTON

DESIGNED BY [Signature] DATE 22 JAN 1960

APPROVED BY [Signature] DATE 1960

SCALE 1 inch = 20 feet

PROJECT NO. 180-60

FIGURE NO. F-59-116 A

Geocres No. 30M5-30

Ramps G, J, H & K, King-Main Interchange, Chedoke Expressway

FOUNDATION COPY

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 _____ BORE HOLE NO. _____ 1 _____

JOB 59-E-125 STATION Ramp K. 13/25 CL.

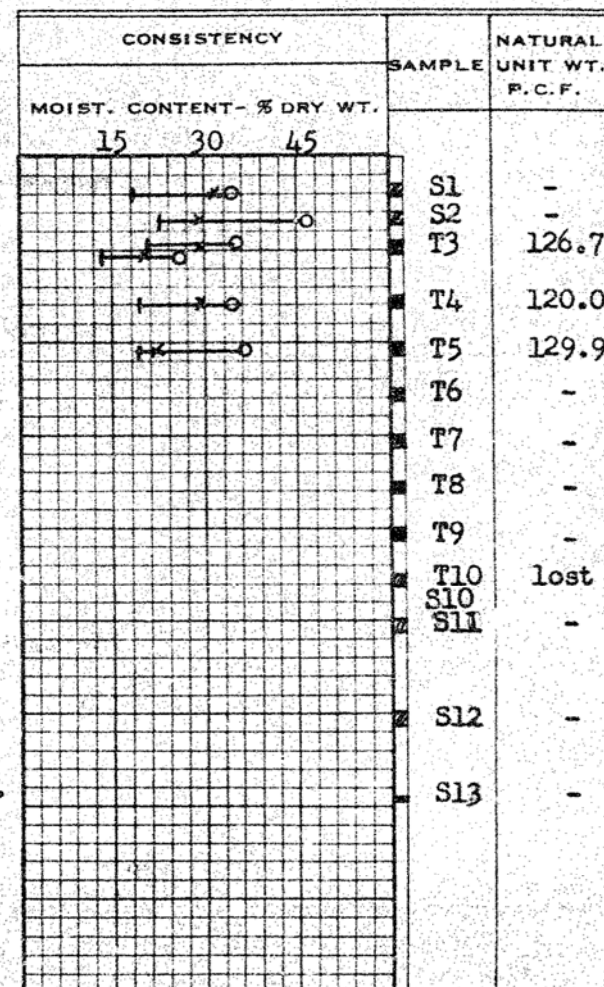
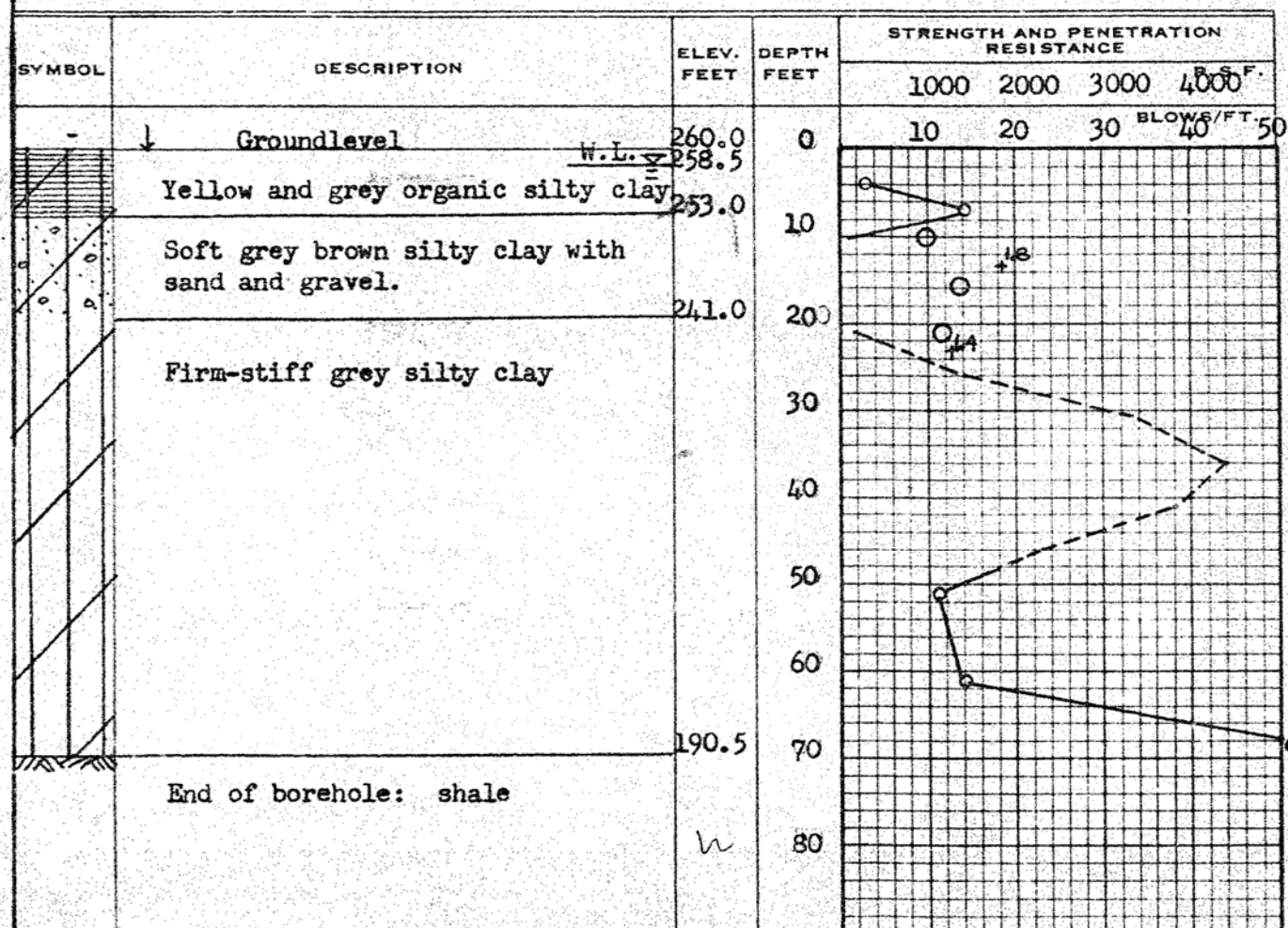
DATUM G.S.C. COMPILED BY B.K.

BORING DATE Feb. 8/60 CHECKED BY J.B.

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

LEGEND

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



W.P. 231-58-3 BORE HOLE NO. 2
JOB 59-F-125 STATION Ramp K. 15400 CL.
DATUM G.S.C. COMPILED BY B.K.
BORING DATE Feb. 10/60 CHECKED BY J.B.

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

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				1000	2000	3000	4000
	↓ Groundlevel W.L. =	259.5	0	10	20	30	40 50
	Soft grey brown silty clay with sand and gravel and organic matter.	239.5	20				
	Firm to stiff grey silty clay with scattered gravel and sand seams.	211.5	40				
	End of borehole.		50				

CONSISTENCY		SAMPLE	NATURAL		
MOIST. CONTENT - % DRY WT.			UNIT WT. P.C.F.		
15	30	45			
x	1	x	o	S1	
x	1	x	o	T2	132.4
1	x	o		T3	128.2
x	1	o		T4	-
x	1	o		S5	-
1	x	o		T6	lost
1	x	o		S6	-
1	x	o		T7	-
1	x	o		T8	-
1	x	o		S9	-
1	x	o		T10	-

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 3

JOB 59-F-125 STATION Ramp K. 16400

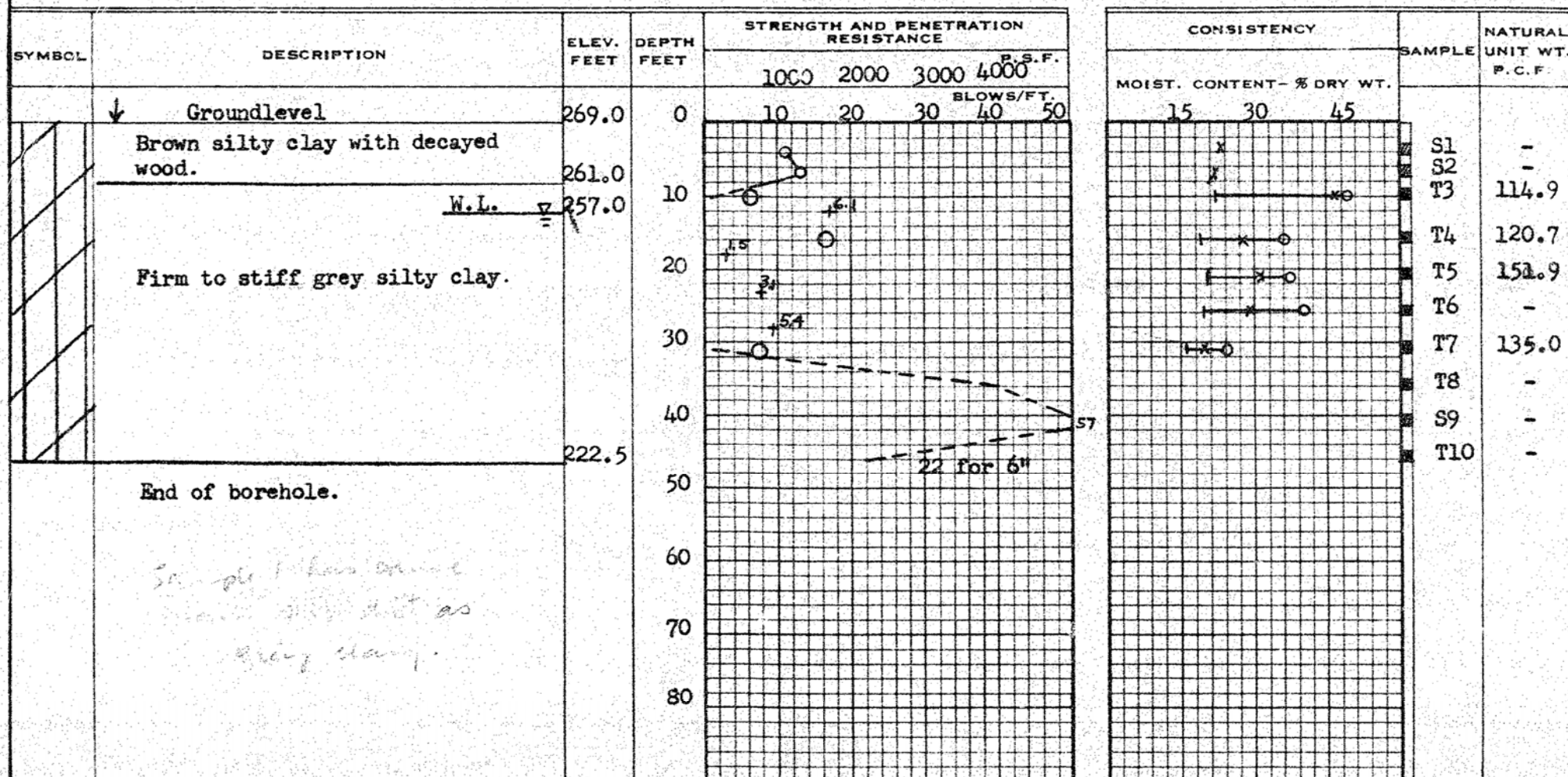
DATUM G.S.C. COMPILED BY B.K.

BORING DATE Feb. 12/60 CHECKED BY J.B.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 4
JOB 59-E-125 STATION Ramp K. 19/50 CL.
DATUM G.S.C. COMPILED BY B.K.
BORING DATE Feb. 15/60. CHECKED BY J.B.

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

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				
				1000	2000	3000	4000	P.S.F.
	↓ Groundlevel	280.0	0	10	20	30	40	50
	yellowish brown organic silt becoming silty clay with sand and gravel layers.		10					
		261.0	20					
	Stiff grey silty clay.	252.0	30					
	End of borehole.		40					
			50					
			60					
			70					
			80					

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
15	30	45		
			S1	-
			S2	-
			S3	-
			S4	-
			T5	134.5
			T6	128.8

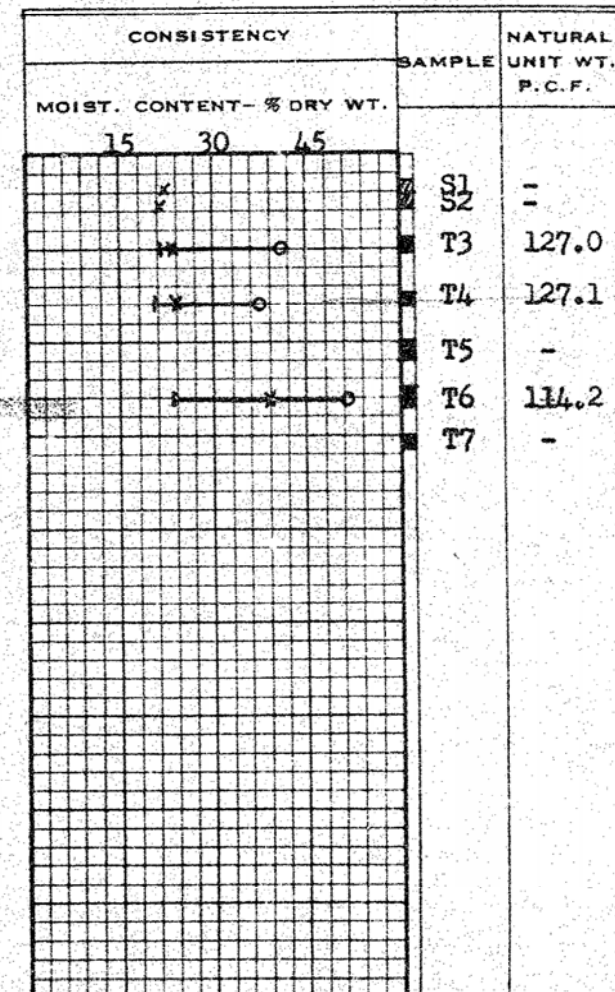
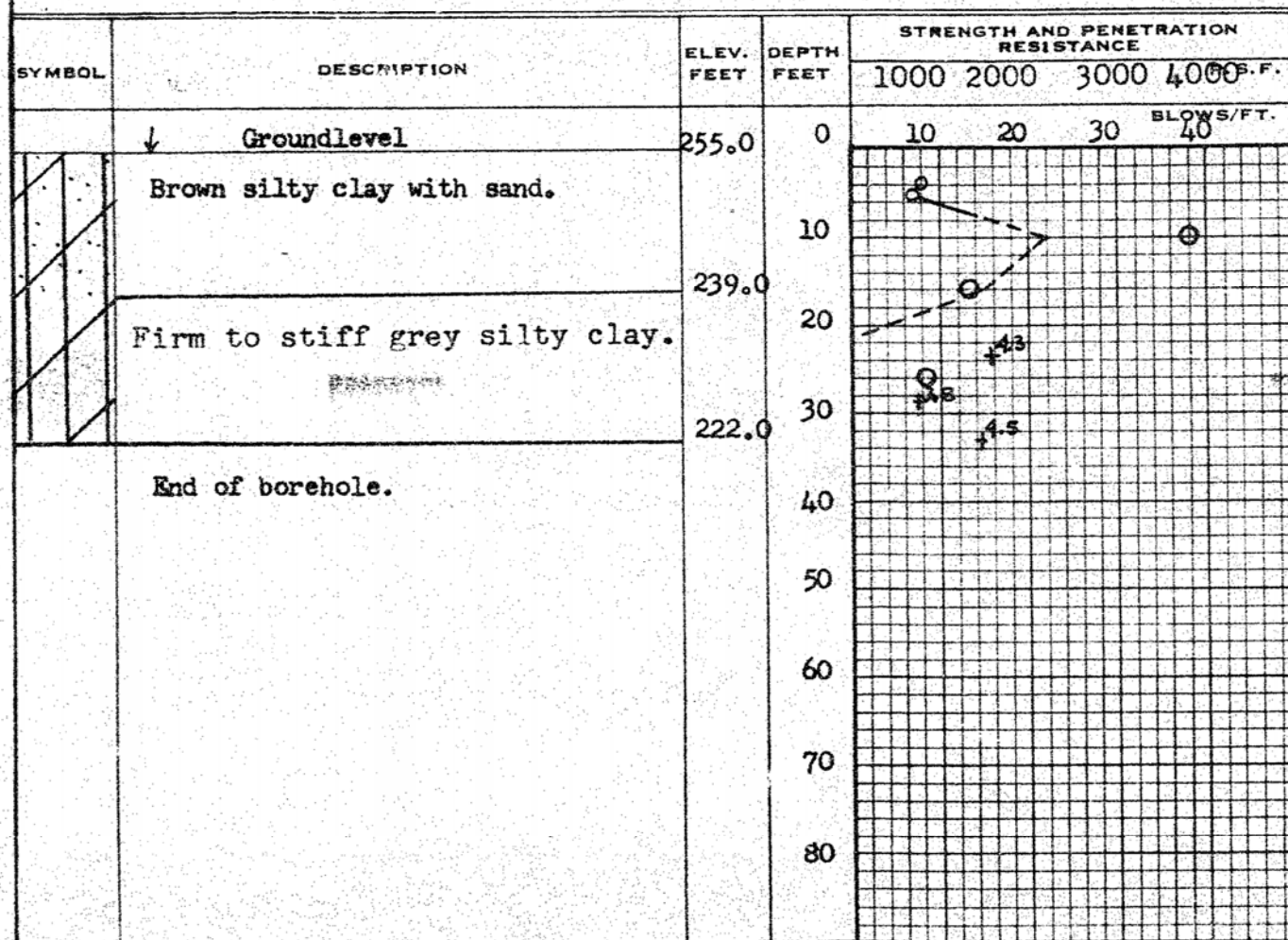
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

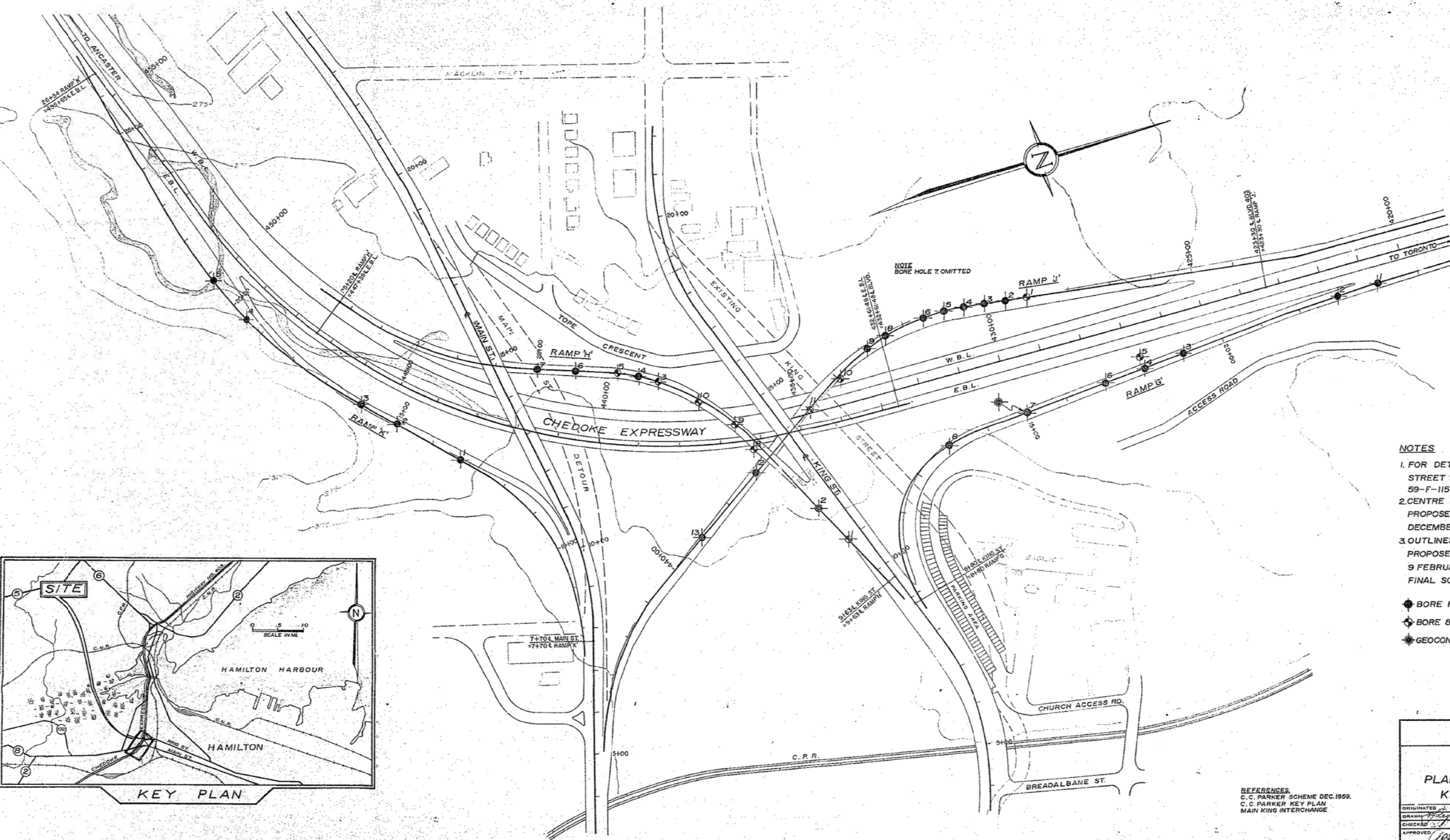
W.P. 231-58-3 BORE HOLE NO. 5
 JOB 59-F-125 STATION Ramp K. 20/80
 DATUM G.S.C. COMPILED BY B.K.
 BORING DATE Feb. 17/60 CHECKED BY J.B.

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

LEGEND

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





NOTES

1. FOR DETAILS OF BORE HOLES AT KING STREET AND MAIN STREET SEE REPORTS 59-F-115 AND 59-F-116 RESPECTIVELY.
2. CENTRE LINES SHOWN ARE THOSE PROPOSED AT TIME OF INVESTIGATION DECEMBER 1959 - FEBRUARY 1960.
3. OUTLINES OF RAMPS ARE THOSE PROPOSED ON DRAWING OBTAINED 9 FEBRUARY 1961. SHOWING PROBABLE FINAL SCHEME

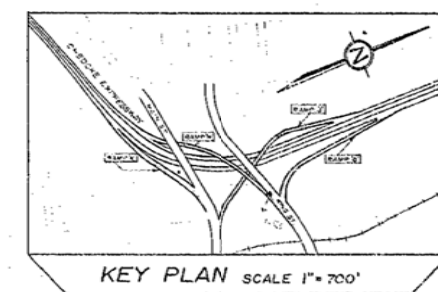
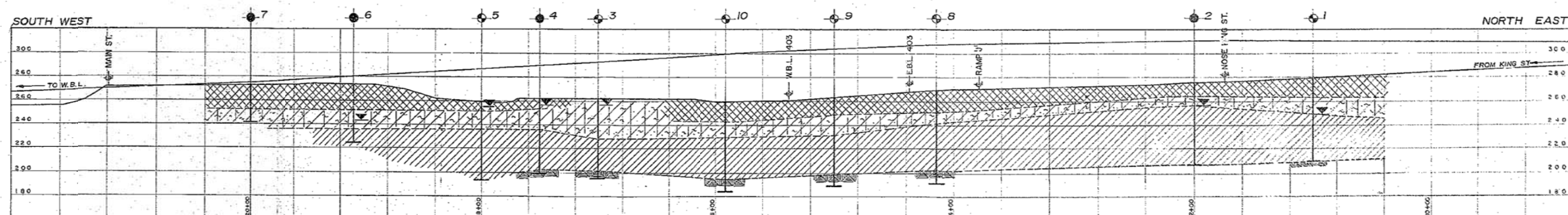
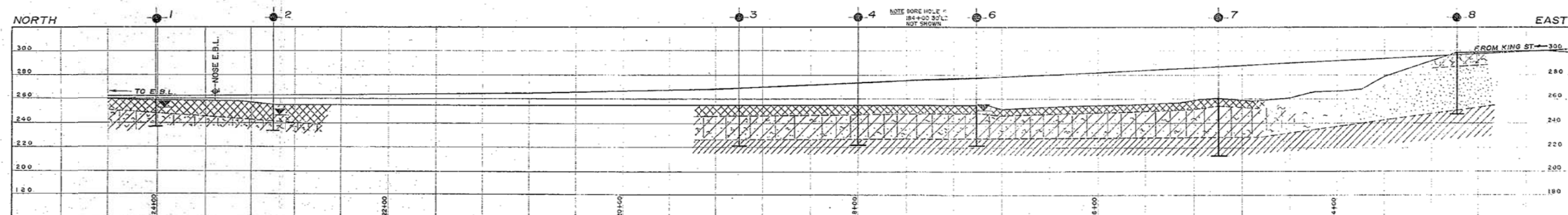
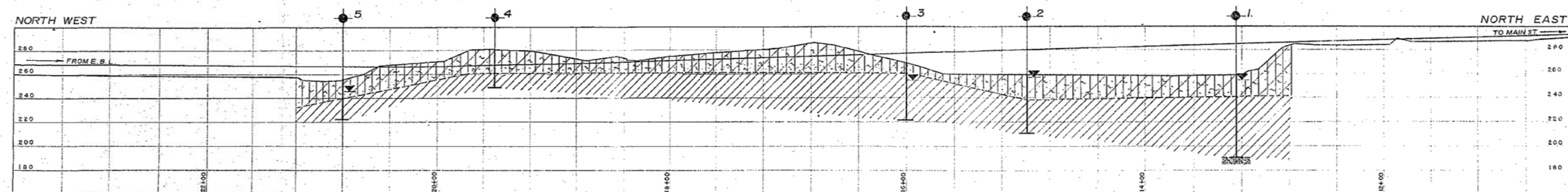
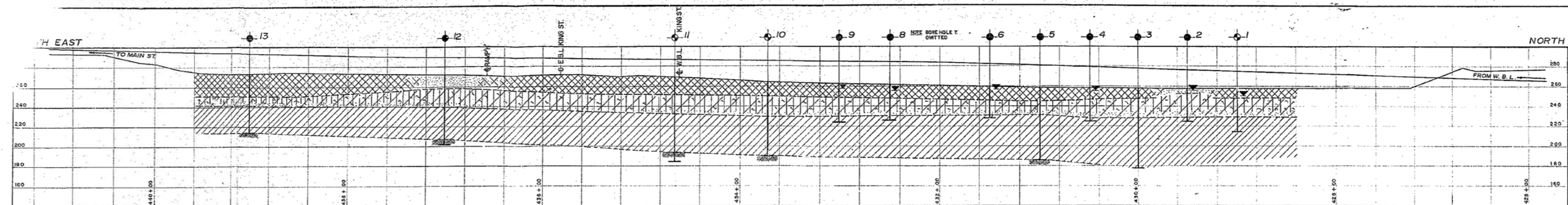
- BORE HOLE
- BORE & PENETRATION HOLE
- GEOCON BORE HOLE (SWEDISH FOIL SAMPLER)

REFERENCES:
C. C. PARKER SCHEME DEC. 1959.
C. C. PARKER KEY PLAN
MAIN KING INTERCHANGE

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

CHEDOKE EXPRESSWAY PLAN SHOWING BORE HOLES AT KING-MAIN INTERCHANGE

ORIGINATED J. BROWN	DISTRICT NO. 4	DATE 20 FEB. 1960
DRAWN J. BROWN	W.P. NO. 231-58-3	JOB NO. 59-F-125
CHECKED J. BROWN	SCALE	DRAWING NO.
APPROVED J. BROWN	1 INCH = 100 FEET	59-F-125 A.



LEGEND	
	BORE AND PENETRATION HOLE
	BORE HOLE
	GROUND WATER LEVEL
	HETEROGENEOUS MIXTURE OF ASH RUBBLE & LOCALLY GRAVEL SAND ETCETERA
	SILTY CLAY WITH VARIABLE AMOUNTS OF ORGANIC MATTER
	GREY SILTY CLAY
	BEDROCK

DEPARTMENT OF HIGHWAYS - ONTARIO		
MATERIALS & RESEARCH SECTION		
CHODOKE EXPRESSWAY		
PROFILES SHOWING SOIL CONDITIONS BELOW		
RAMPS AT KING MAIN INTERCHANGE		
ORIGINATED J. BROWN	DISTRICT NO. 4	DATE 17, MARCH 1961
DRAWN J. BROWN	W.F. NO. 231-58-3	JOB NO. 59-F-125
CHECKED J. BROWN	SCALE 1" = 40'	DRAWING NO.
APPROVED J. BROWN		59-F-125 B

RAMP 'H' REVISED 18 JULY 1961.

Geocres No. 30M5-31

West Hamilton Storm Sewer, Hwy. Chedoke Expressway

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1

231-58-2

W.P. 231-58-3

JOB 60-F-14

DATUM 257.3'

BORING DATE May 12/60

BORE HOLE NO. 20

STATION 446/88 (170ft of E)

COMPILED BY B.K.

CHECKED BY H.D.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

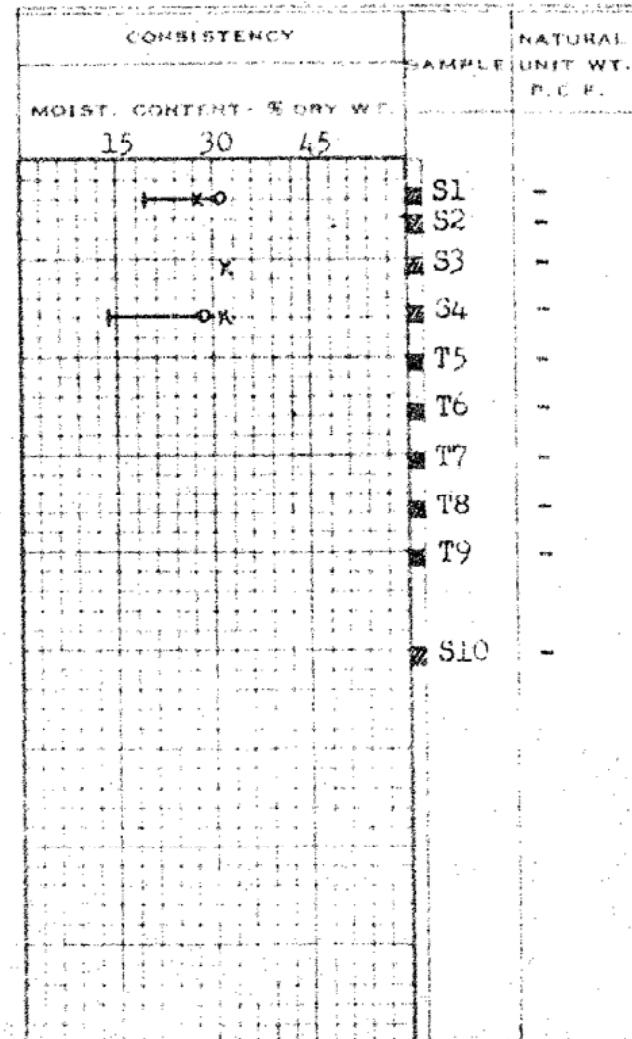
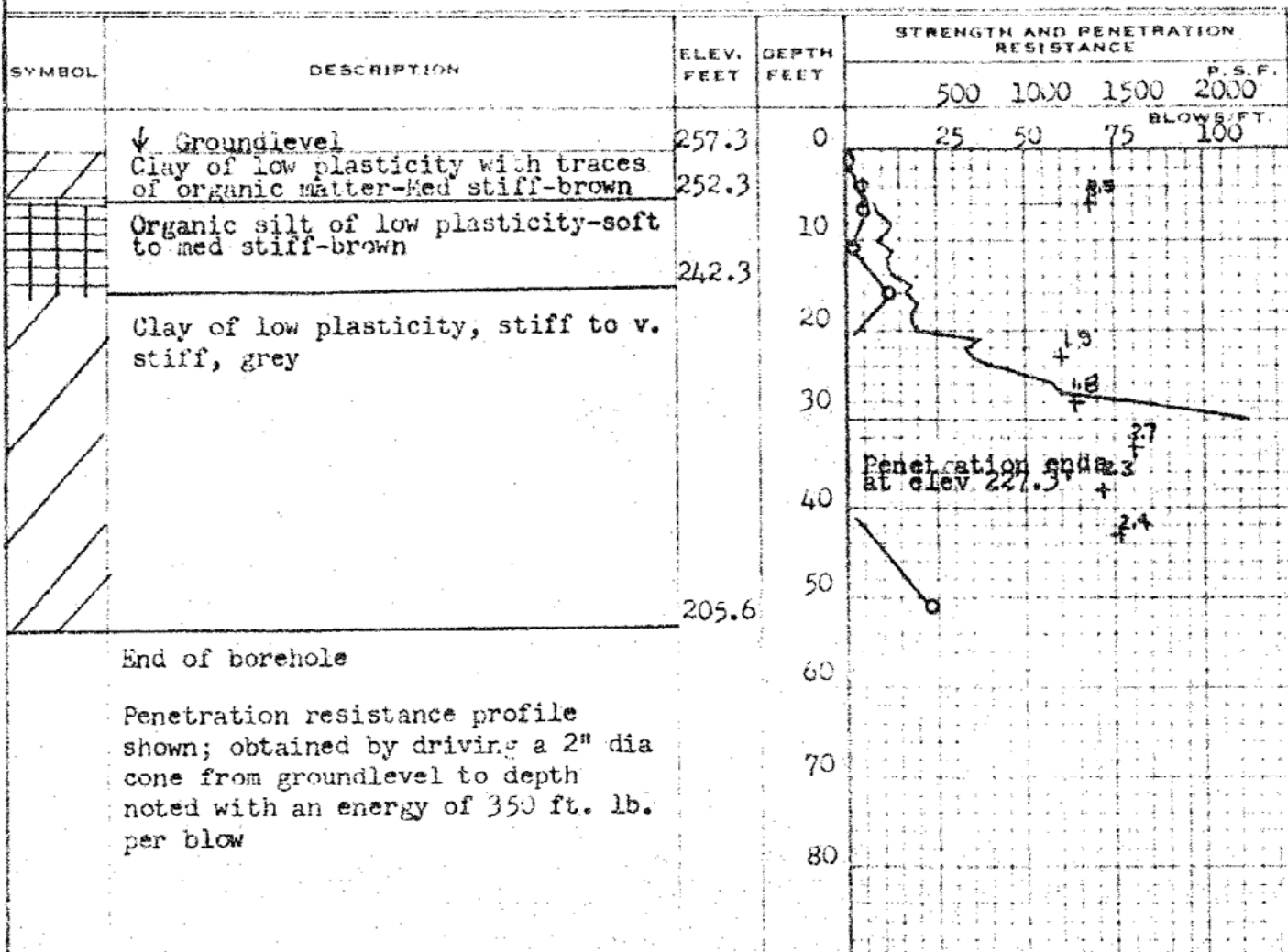
2" DIA. CONE

2" SHELBY

CASING

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
231-58-3

W.P. BORE HOLE NO. 51

JOB 60-F-14 STATION 463+85 (250' ht.)

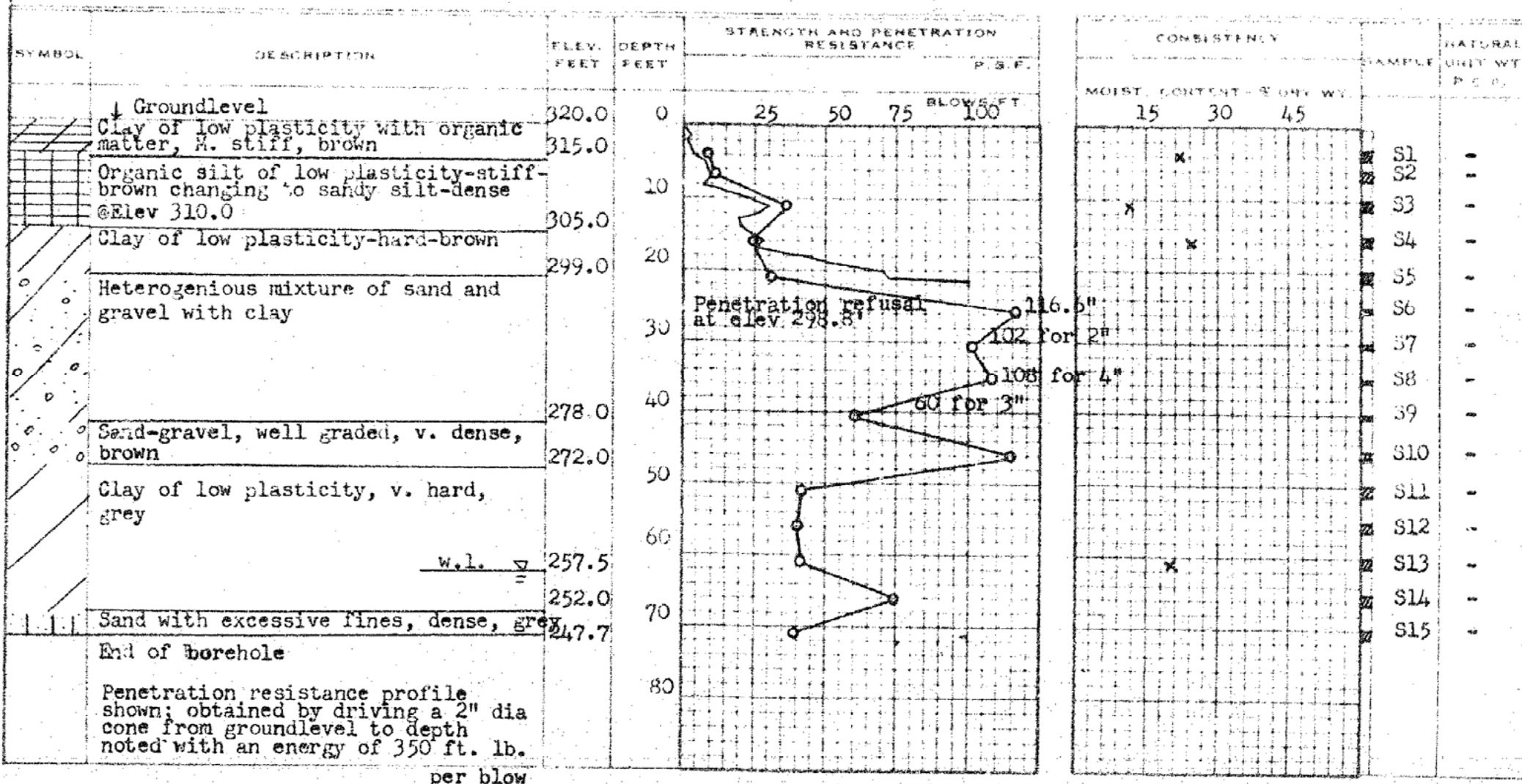
DATUM 320.0' E.B.L. COMPILED BY B.K.

BORING DATE May 18/60 CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

JOB 60-F-14

DATUM 282.5'

BORING DATE May 17/60

BORE HOLE NO. 52

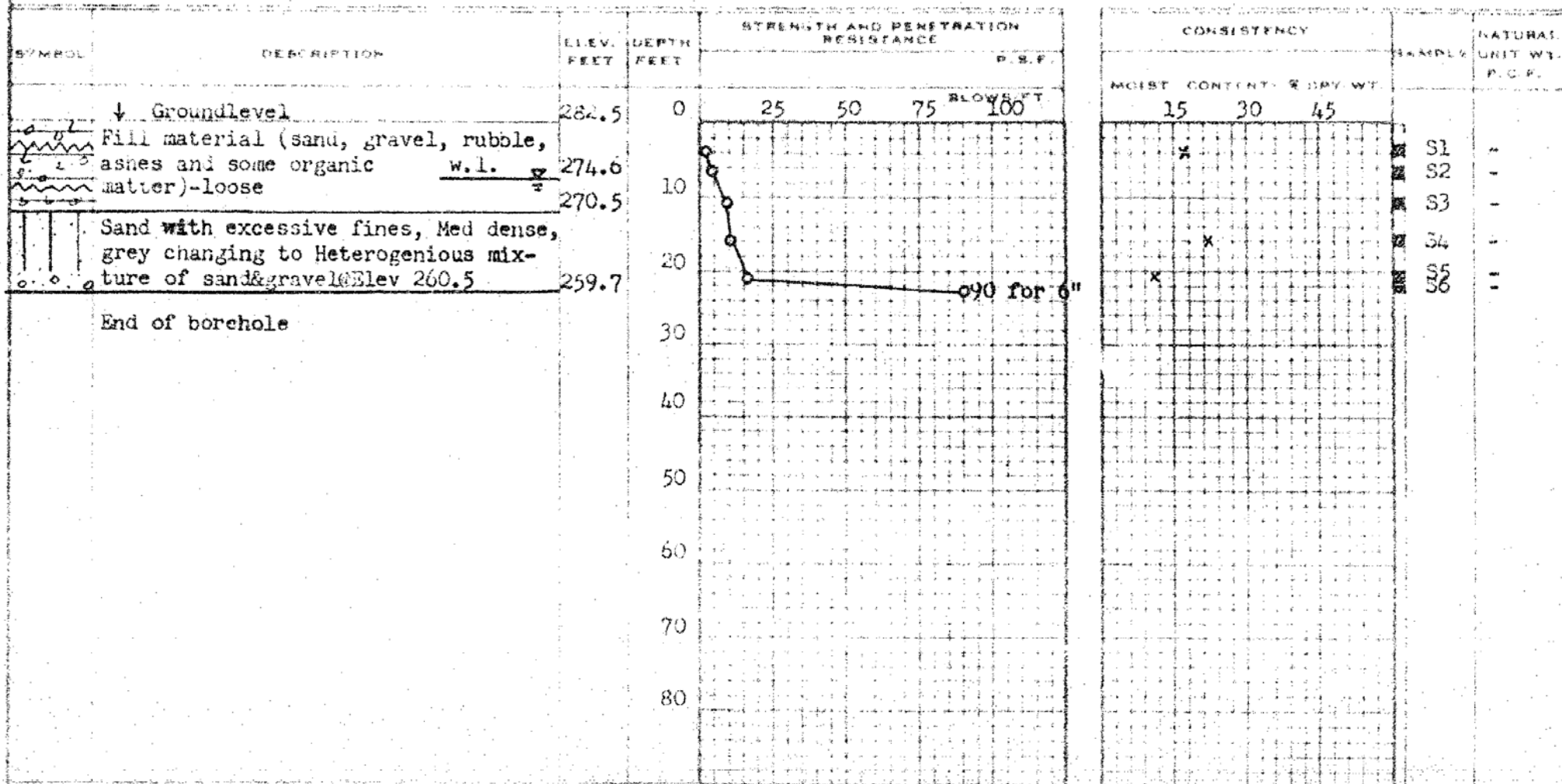
STATION 460+00 (220' Rt.)
E.E.S.L.

COMPILED BY B.K.

CHECKED BY H.D.

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) — O
VANE TEST (C) AND SENSITIVITY (S) — +
NATURAL MOISTURE AND LIQUIDITY INDEX — LI
LIQUID LIMIT — Y
PLASTIC LIMIT — P



140-57-1

231-58-2

W.P. 231-58-3

BORE HOLE NO. 53

100-60-F-14

STATION 456700 (180' Rt.)
E.B.L.

DATUM 262.0'

COMPILED BY B.K.

LOGGING DATE May 16/60

CHECKED BY M.D.

2" DIA. SPLIT TUBE

2" SHELBY TUBE -

2" SPLIT TUBE

2" DIA CONE

2 SHELBY
5-1-60

CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) _____ 0

YANE TEST(C)AND SENSITIVITY(S) 100 10 10

NATURAL MOISTURE AND

	LIQUIDITY INDEX	1960	1970	1980	1990	2000	Y
1. LIQUIDITY INDEX							

LIQUID LIMIT
PLASTIC LIMIT

PLEASED WITH: ☐ YES ☐ NO ☐ NOT SURE ☐ NO ANSWER

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

BORE HOLE NO. 61

JOB 60-F-14

STATION 8+35 Ramp 'D' 20' Rt

DATUM G.S.C.

COMPILED BY B.K.

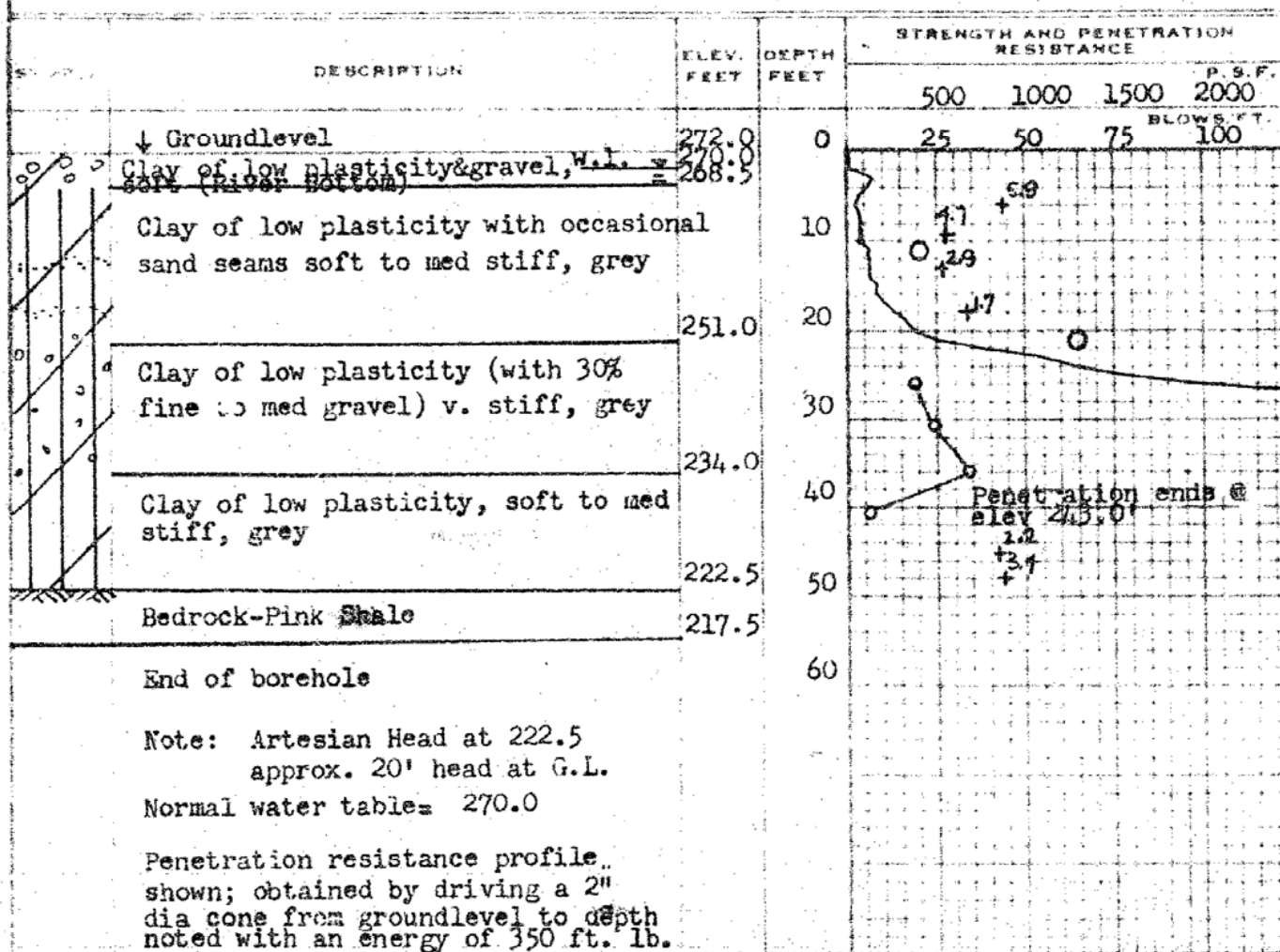
BORING DATE Apr. 4/60

CHECKED BY K.S. & MD

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

LEGEND

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



CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT	FLUID WT.		
15	30	45	
		S1	-
		T2	-
		T3	126
		T4	-
		T5	133.0
		S6	-
		S7	-
		S8	-
		S9	-
		T10	-
		RC11	-

DEPARTMENT OF HIGHWAYS - ONTARIO

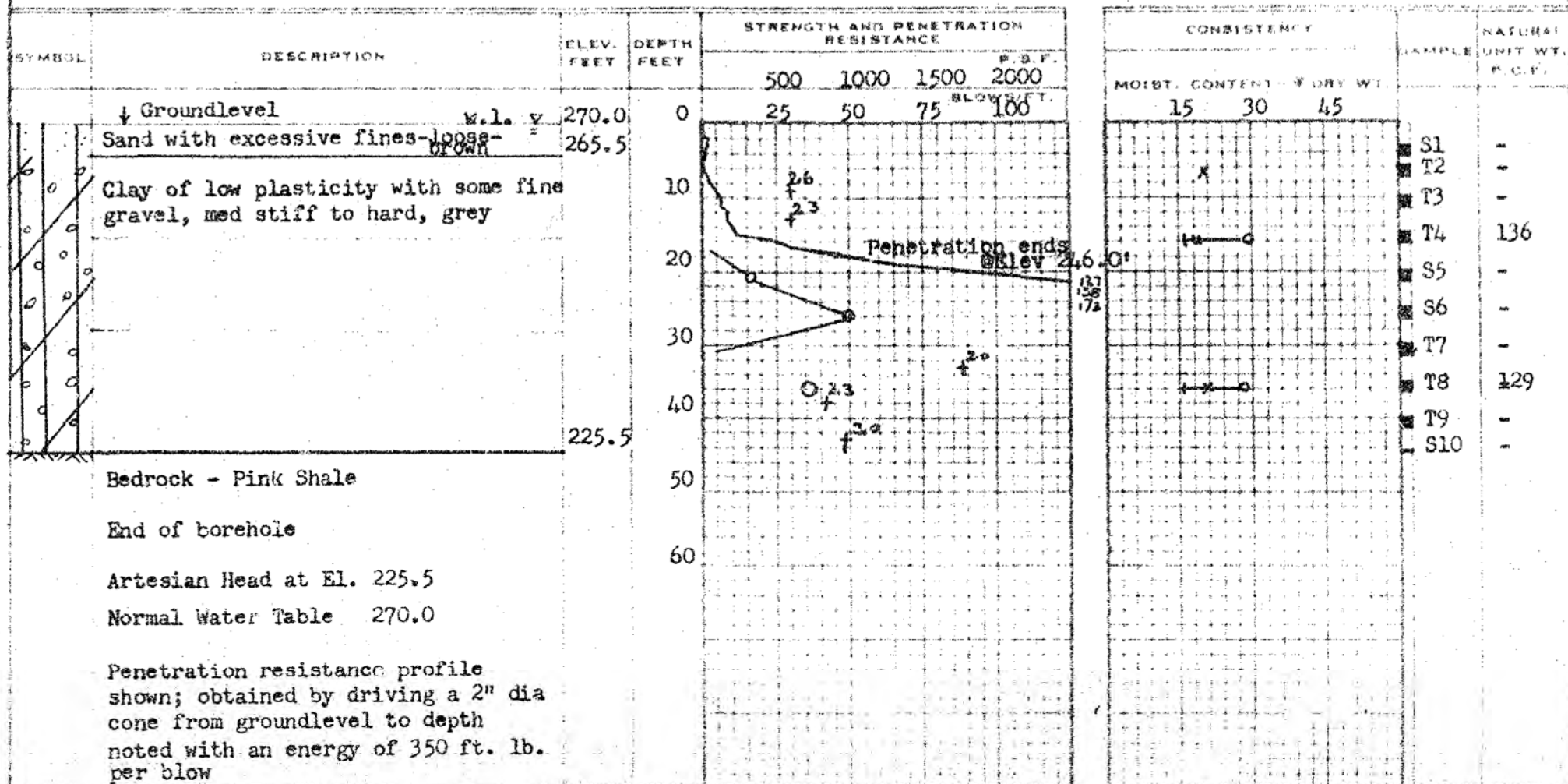
MATERIALS AND RESEARCH SECTION

140-57-1
231-58-3
W.P. 231-58-2 BORE HOLE NO. 62
JOB 60-F-14 STATION 9+00 Ramp 'D' 90' Lt
DATUM G.S.C. COMPILED BY B.K.
BORING DATE Apr. 7/60 CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1

231-58-2

W.P. 231-58-3

JOB 60-F-14

DATUM G.S.C.

BORING DATE Apr. 22/60

BORE HOLE NO. 64

STATION 476+60 E.B.L. 40' Rt

COMPILED BY B.K.

CHECKED BY M.D. & K.S.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

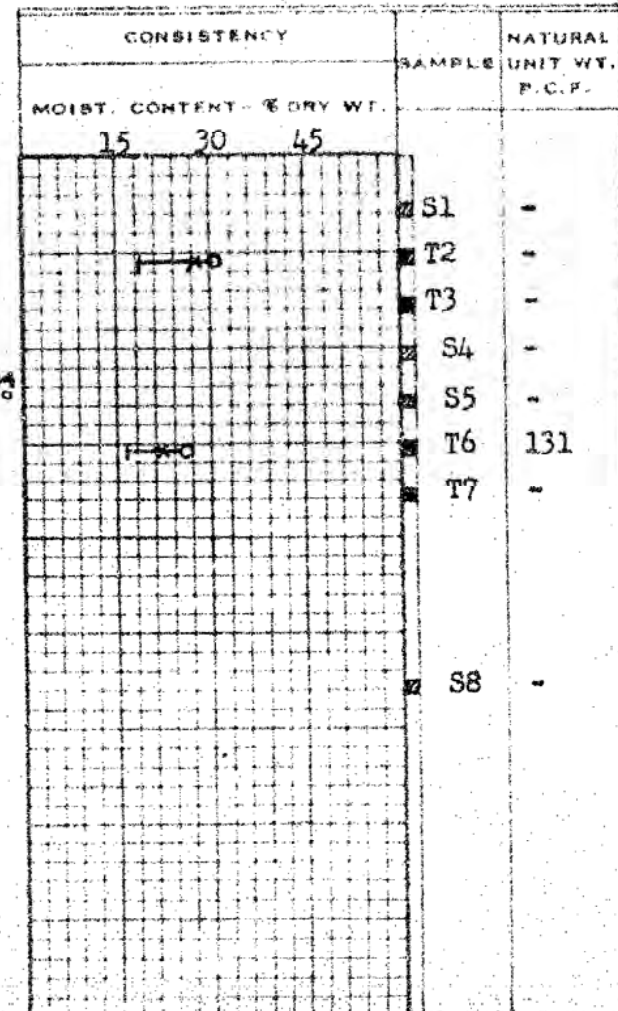
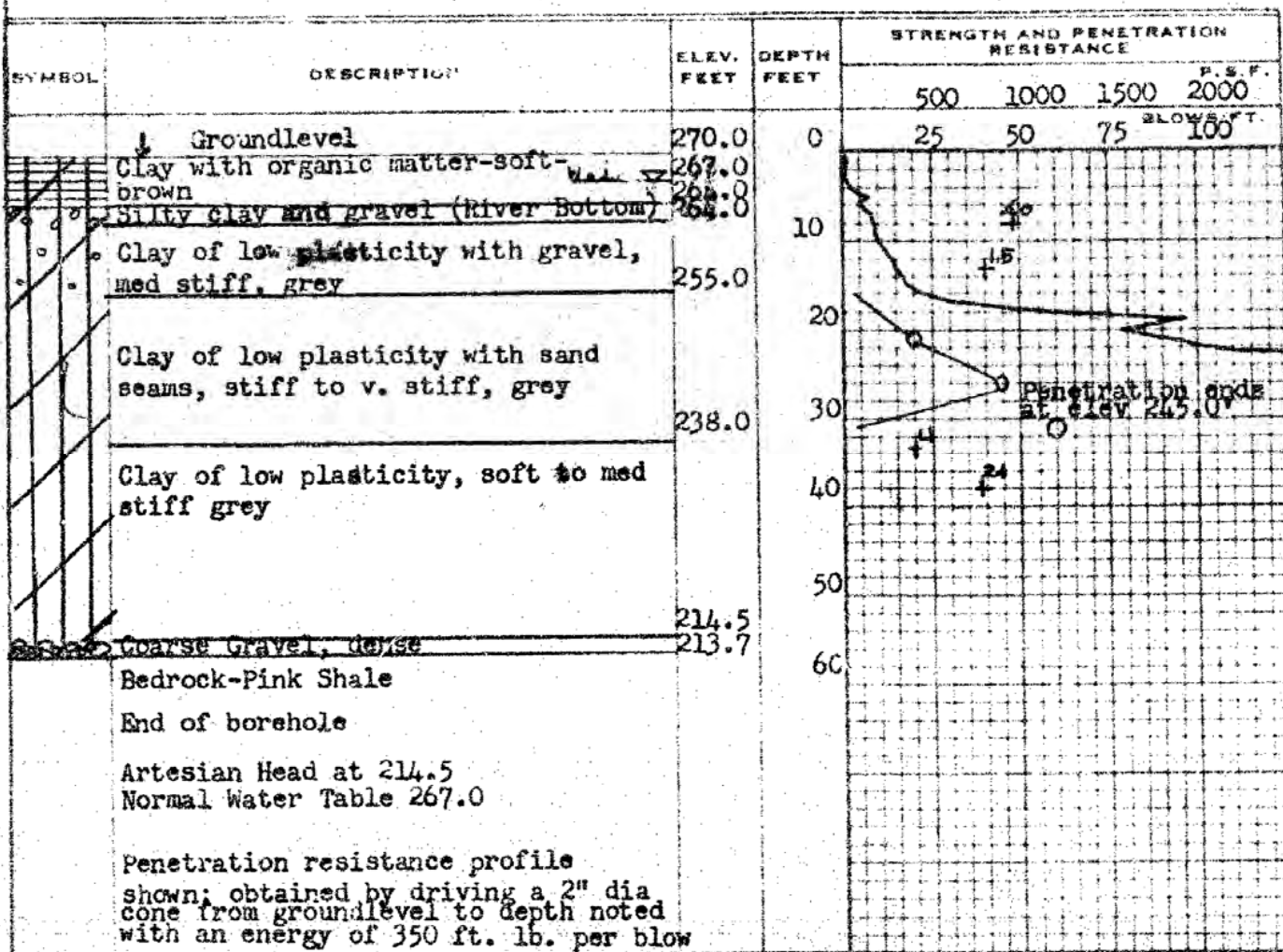
2" DIA. CONE

2" SHELBY

CASING

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1

231-58-2

W.P. 231-58-3

BORE HOLE NO. 65

JOB 60-F-14

STATION 474+30 E.B.L. 60' LT

DATUM G.S.C.

COMPILED BY B.K.

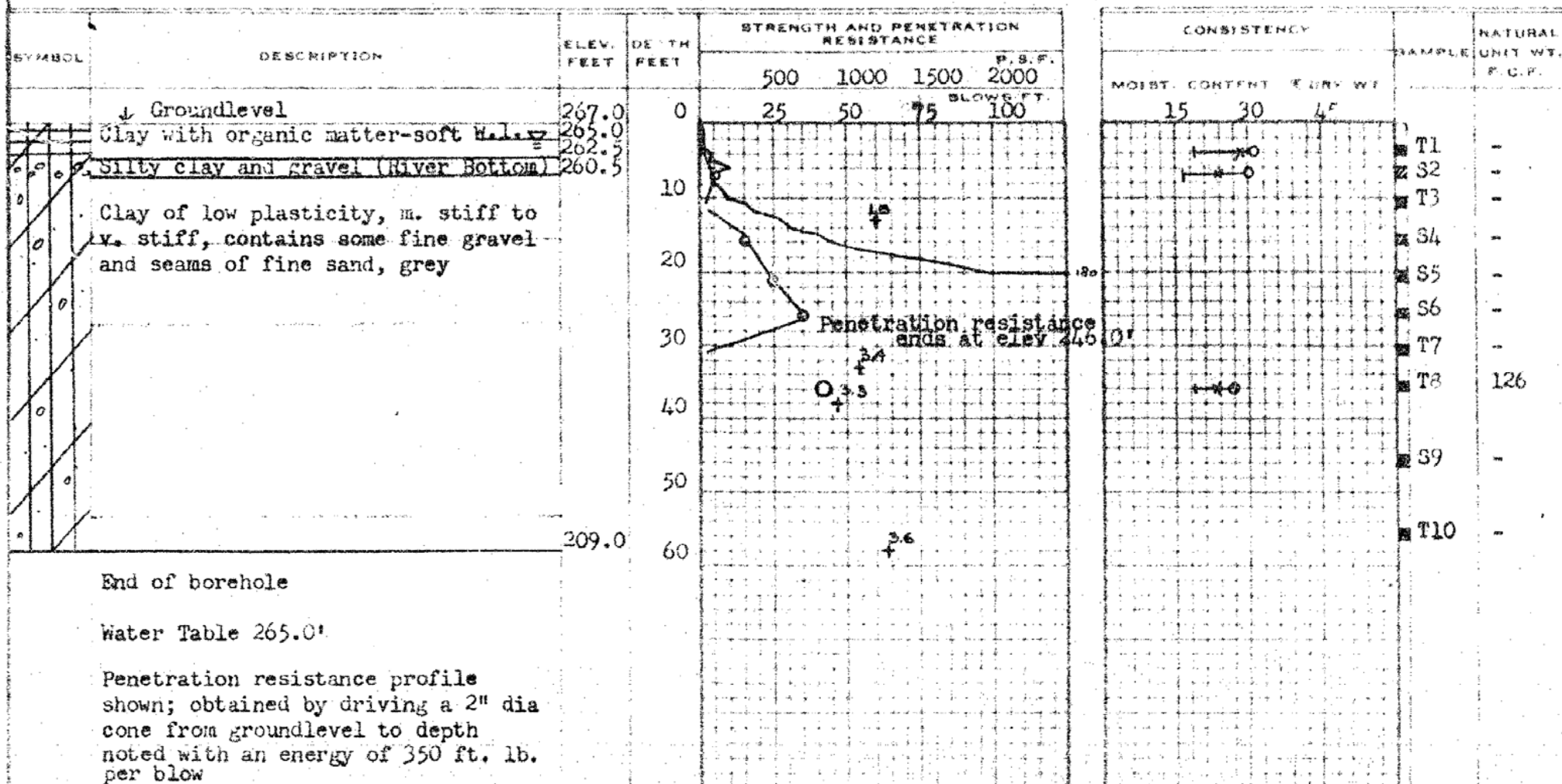
BORING DATE Apr. 20/60

CHECKED BY M.D. & K.S.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1

231-58-2

W.P. 231-58-3

BORE HOLE NO. 66

JOB 60-F-14

STATION 469+80 B.L. 60' Lt

DATUM Q.S.C.

IMPILED BY B.K.

BORING DATE Apr. 22/60

CHECKED BY M.D. & K.S.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

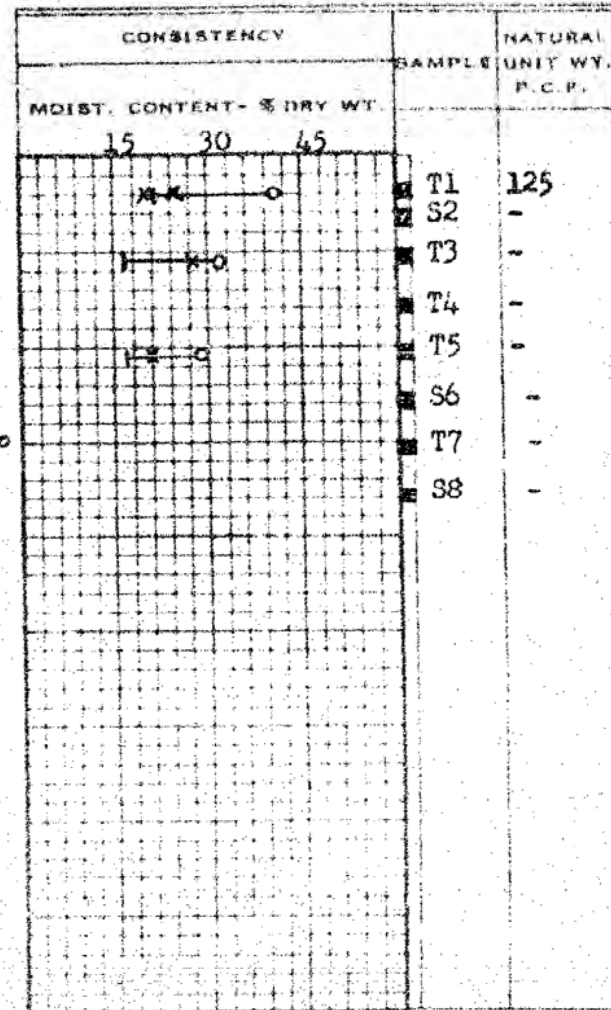
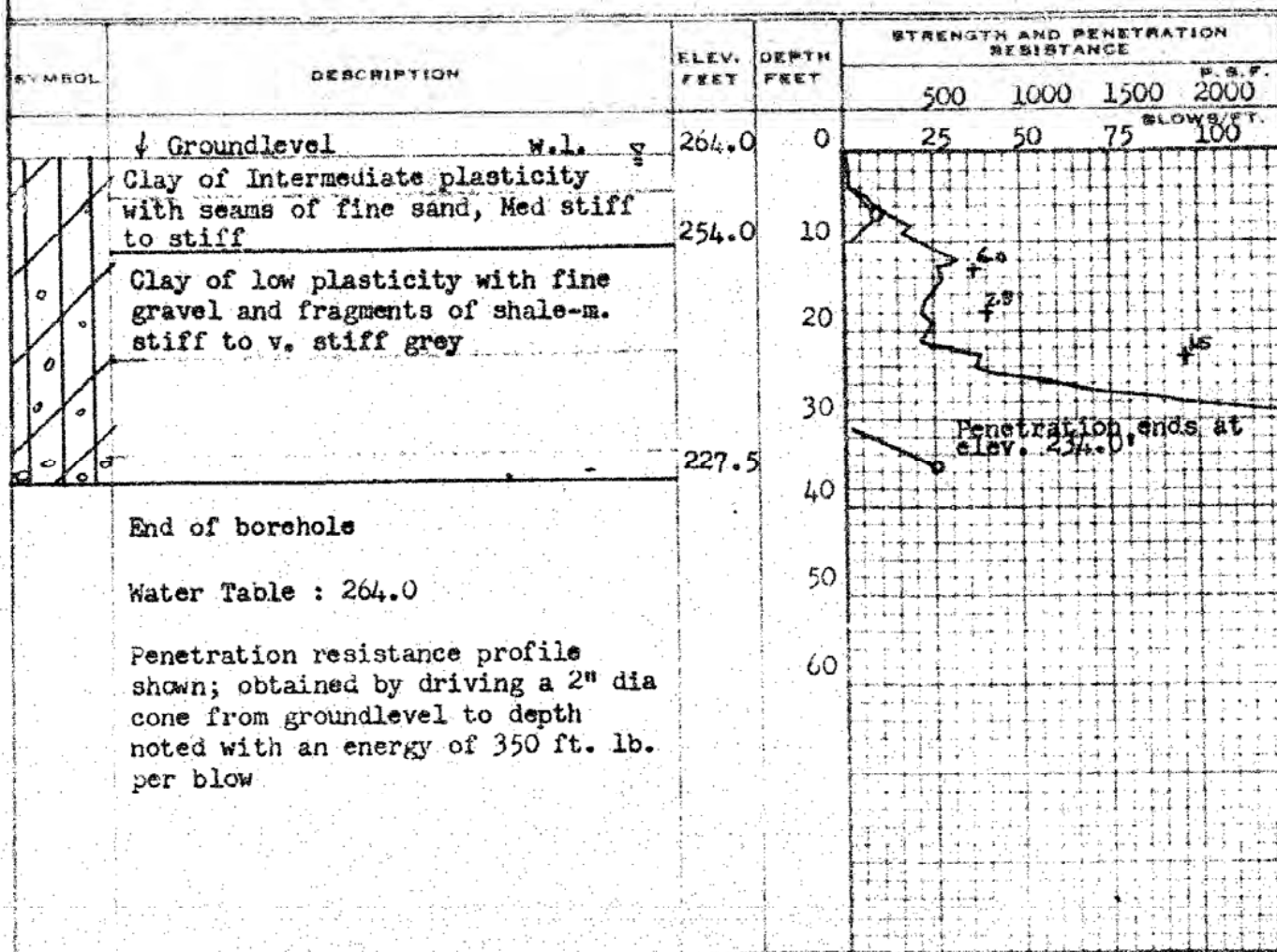
2" DIA. CONE

2" SHELBY

CASING

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

BORE HOLE NO. 67

JOB 60-F-14 STATION 468+70 E.B.L. 60' Rt

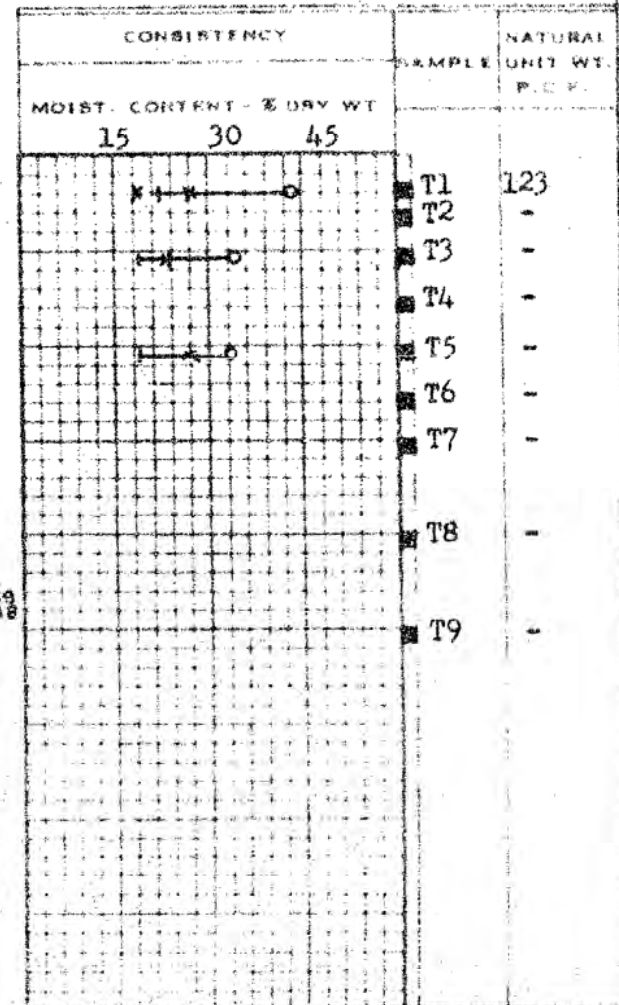
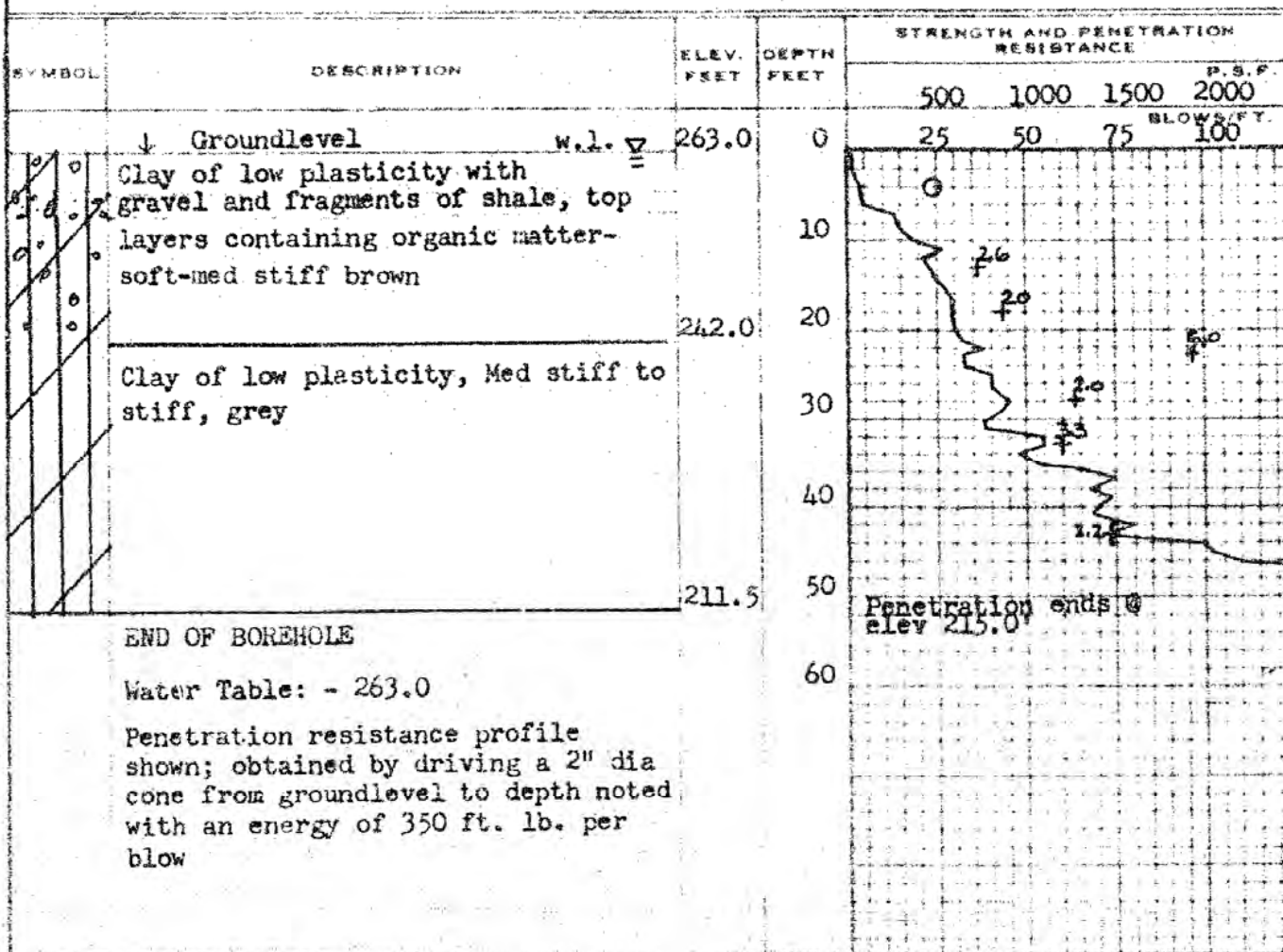
DATUM G.S.C. COMPILED BY B.K.

BORING DATE Apr. 25/60 CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

140-57-1

231-58-2

W.P. 231-58-3

BORE HOLE NO. 68

JOB 60-F-14

STATION 449+90 E.B.L. E

DATUM G.S.C.

COMPILED BY B.K.

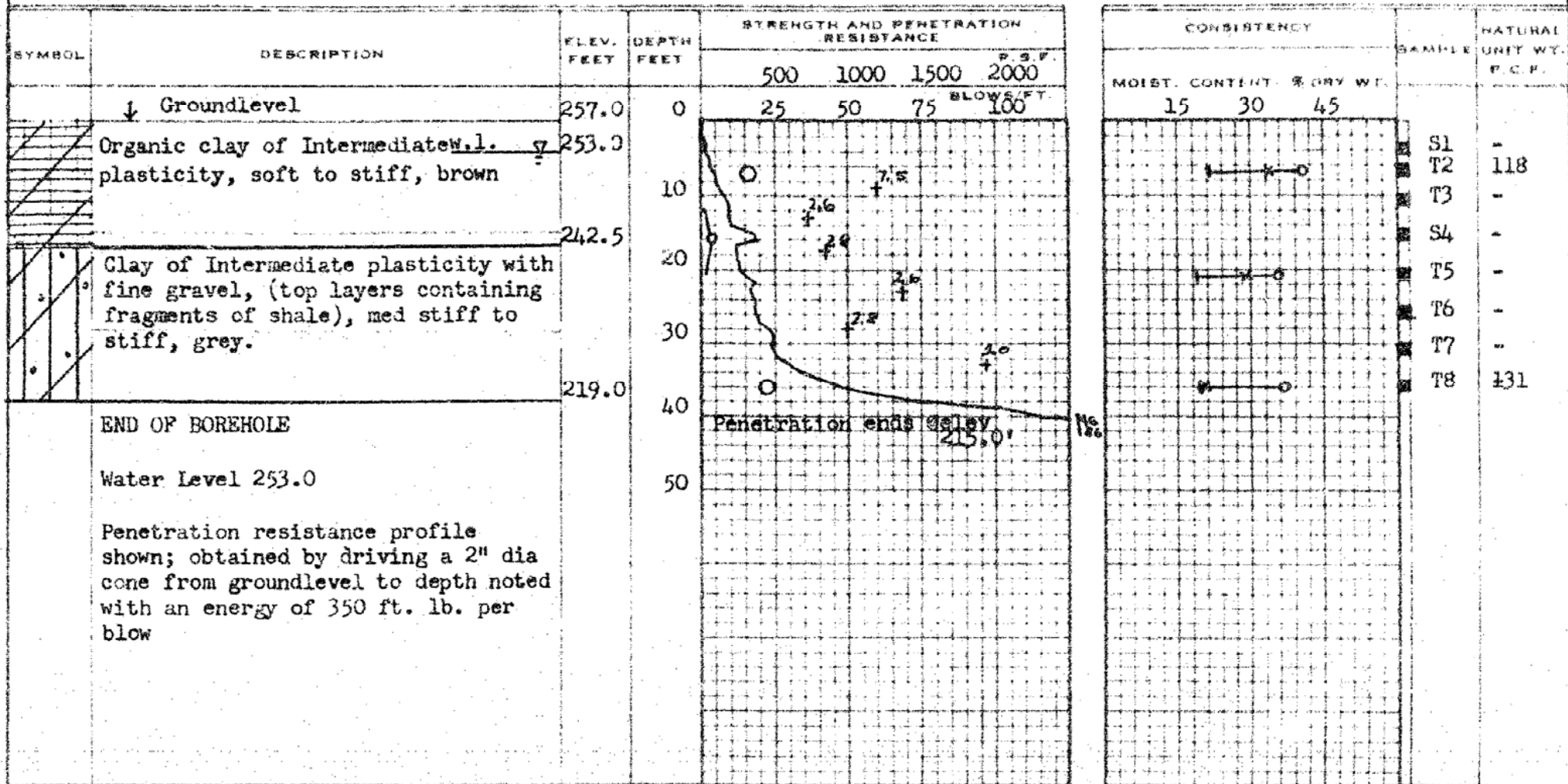
BORING DATE May 4/60

CHECKED BY K.D. & K.S.

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

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) — O
VANE TEST (C) AND SENSITIVITY (S) — +
NATURAL MOISTURE AND LIQUIDITY INDEX — LI
LIQUID LIMIT — L
PLASTIC LIMIT — P



140-57-1

231-58-2

W. P. 231-58-3

BORE HOLE NO. 69

JOB 60-F-14

STATION 449+50 E. B. L. 75' Rt

DATUM G.S.C.

COMPILED BY B.K.

BORING DATE May 5/60

CHECKED BY M.D.&K.S.

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

LEGEND

1/2 UNCONFINED COMPRESSION (QU)	0
VANE TEST (C) AND SENSITIVITY (S)	+2
NATURAL MOISTURE AND LIQUIDITY INDEX	11
LIQUID LIMIT	X
PLASTIC LIMIT	

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

BORE HOLE NO. 701

JOB 60-F-14

STATION 19+00 (160ft Rt of E)
Ramp B

DATUM 294.5'

COMPILED BY B.K.

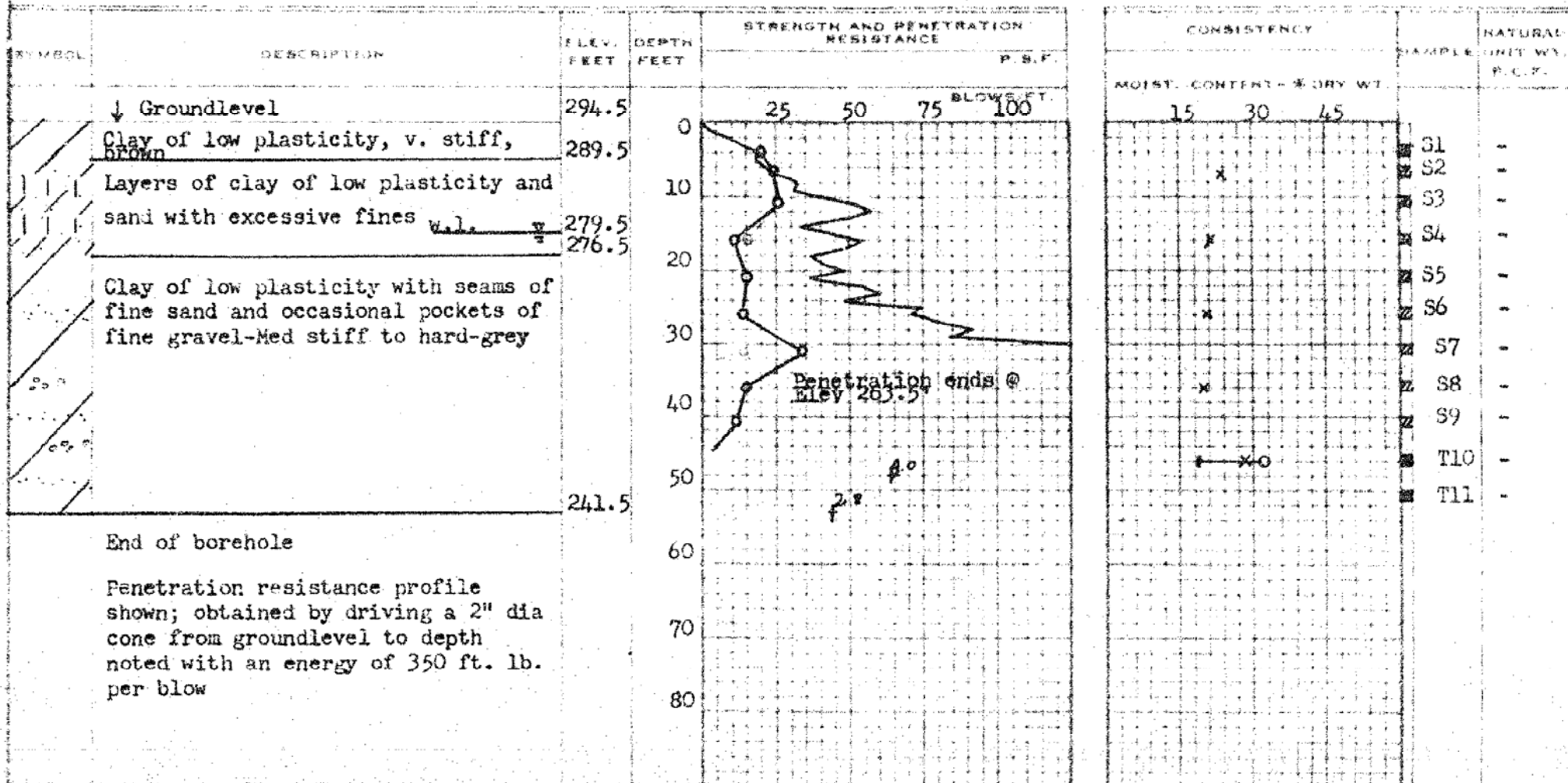
BORING DATE May 25/60

CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

BORE HOLE NO. 702

JOB 60-F-14

STATION 20+45 (80' Rt of E Ramp B)

DATUM 276.0'

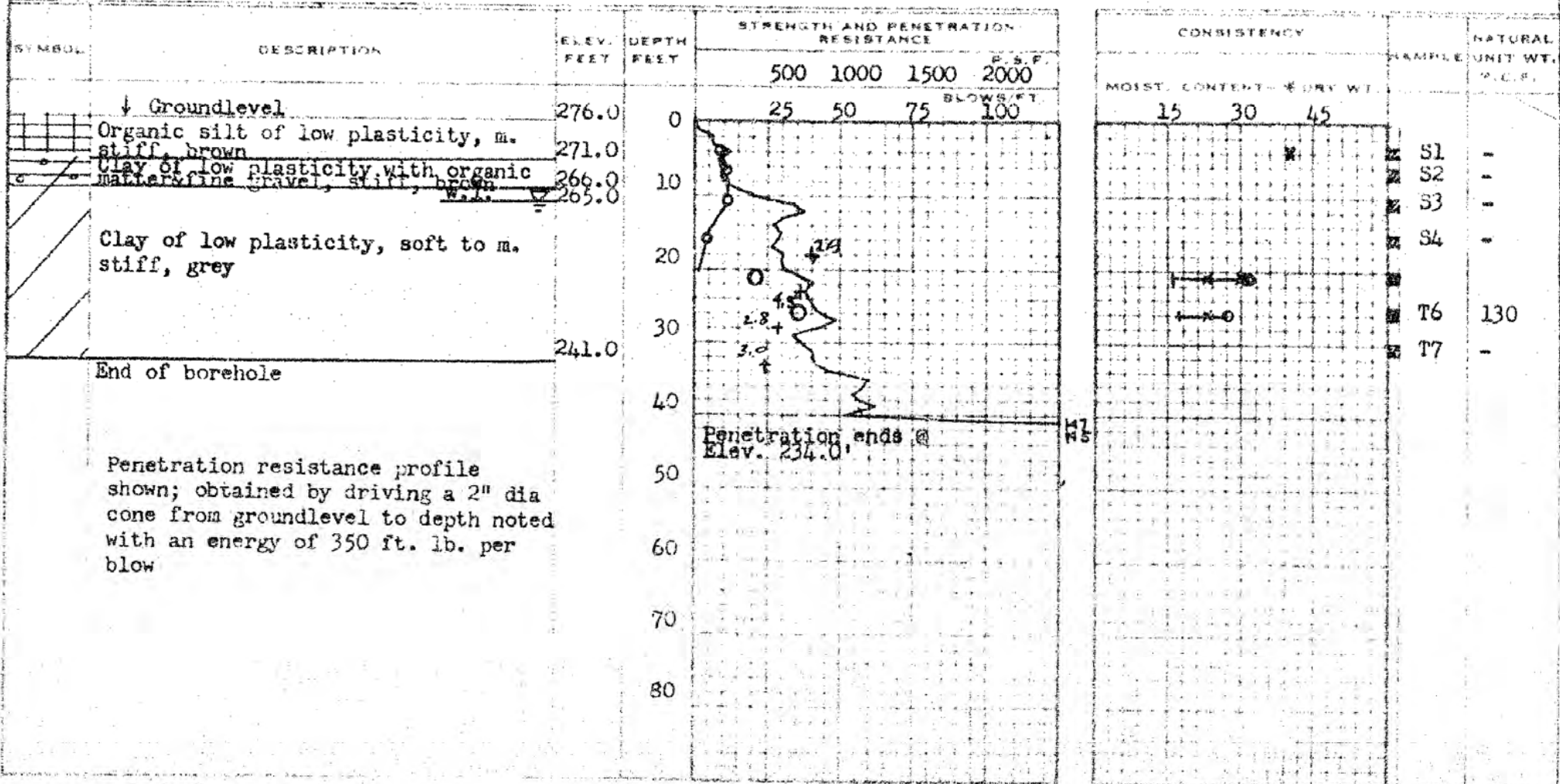
COMPILED BY B.K.

BORING DATE May 26/60

CHECKED BY M.D.

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

JOB 60-F-14

DATUM 288.0'

BORING DATE May 28/60

BORE HOLE NO. 703

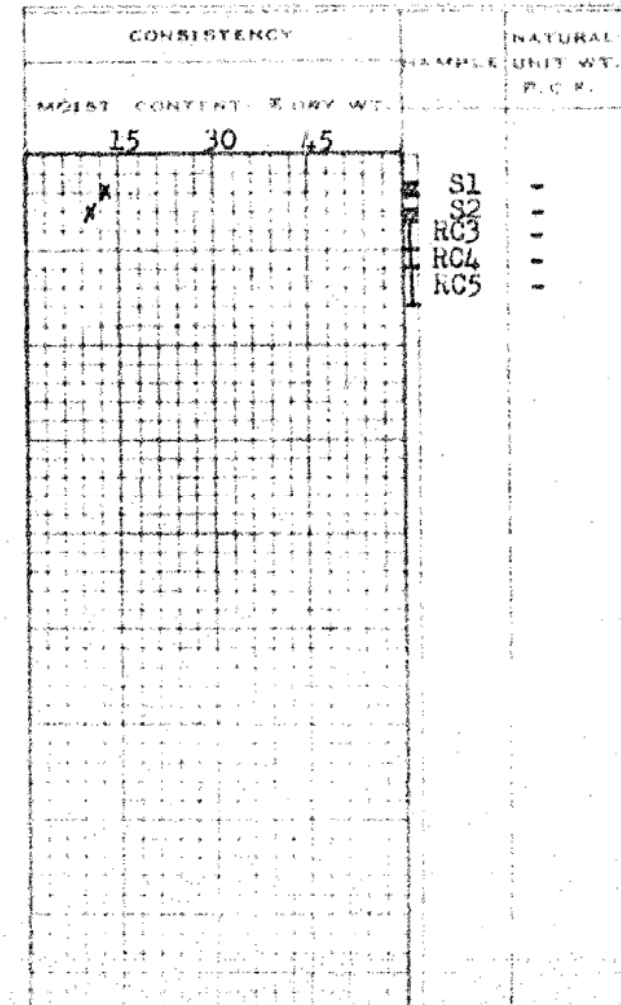
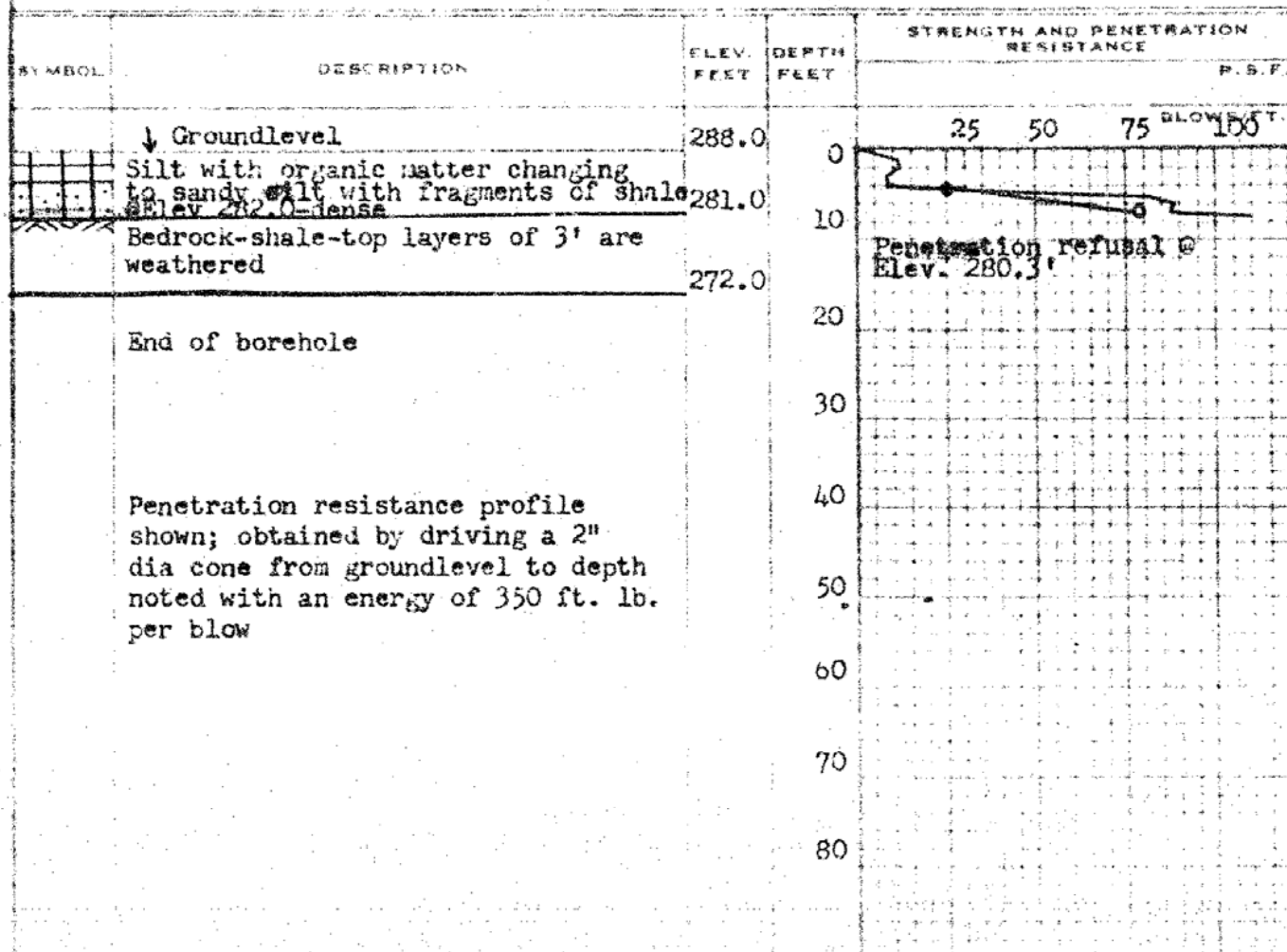
STATION 492+30 (30 ft. of E.E.B. 14)

COMPILED BY B.K.

CHECKED BY M.D.

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) — O
VANE TEST (C) AND SENSITIVITY (S) — +
NATURAL MOISTURE AND LIQUIDITY INDEX — N
LIQUID LIMIT — L
PLASTIC LIMIT — P



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1

231-58-2

W.P. 231-58-3

JOB 60-F-14

DATUM 289.0'

BORING DATE May 30/60

BORE HOLE NO. 704

STATION 25+70 (Port of E
Ramp 'B')

COMPILED BY B.K.

CHECKED BY H.D.

2" DIA SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

2" DIA CONE

2" SHELBY

CASING

LEGEND

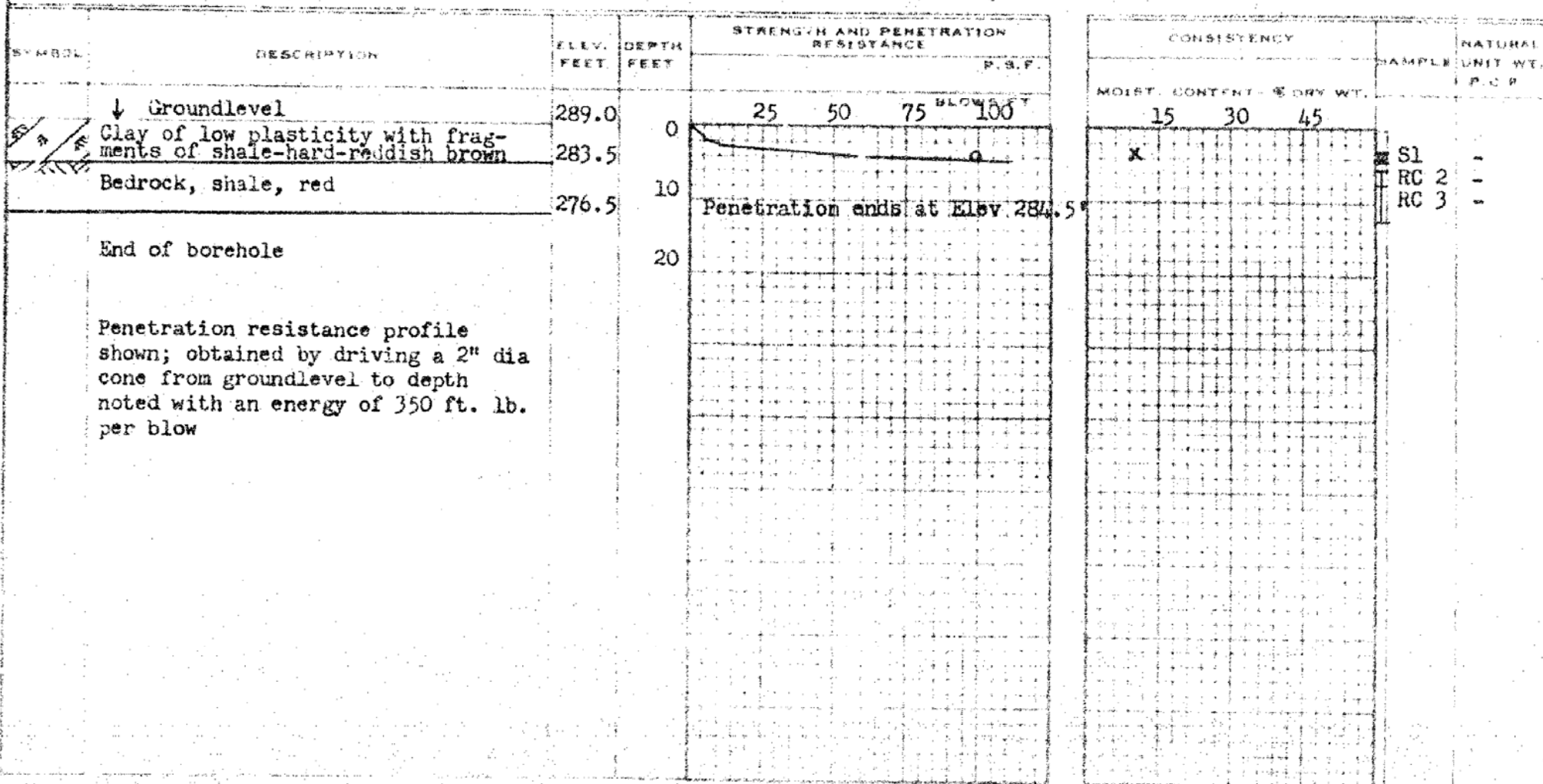
1/2 UNCONFINED COMPRESSION (Qu) O

VANE TEST (C) AND SENSITIVITY (S) +c

NATURAL MOISTURE AND LIQUIDITY INDEX II

LIQUID LIMIT X

PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

140-57-1
231-58-2
W.P. 231-58-3

JOB 60-F-14

DATUM 291.0'

BORING DATE May 31/60

BORE HOLE NO. 705

STATION 497+20 (170' Rt. of C.E.B.L.)

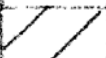
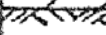
COMPILED BY B.K.

CHECKED BY H.D.

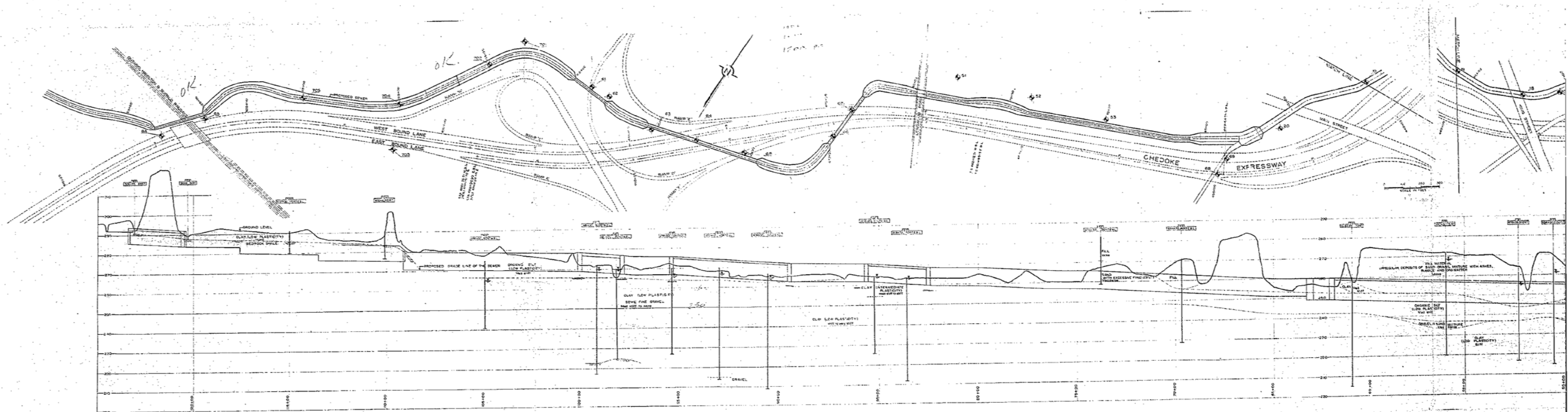
1" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
				BLOW'S/FT.	
	↓ Groundlevel	291.0	0	25	50 75 100
	Clay of low plasticity-hard-red brown	286.0			
	Bedrock-red shale	279.5	10		
	Penetration resistance profile shown; obtained by driving a 2" dia cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow		20		

CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT - % DRY WT		
	S1	-
	RC2	-



Geocres No. 30M5-35

Chedoke Expressway – between Sta. 453+00 and 472+00

DEPARTMENT OF HIGHWAYS - ONTARIO

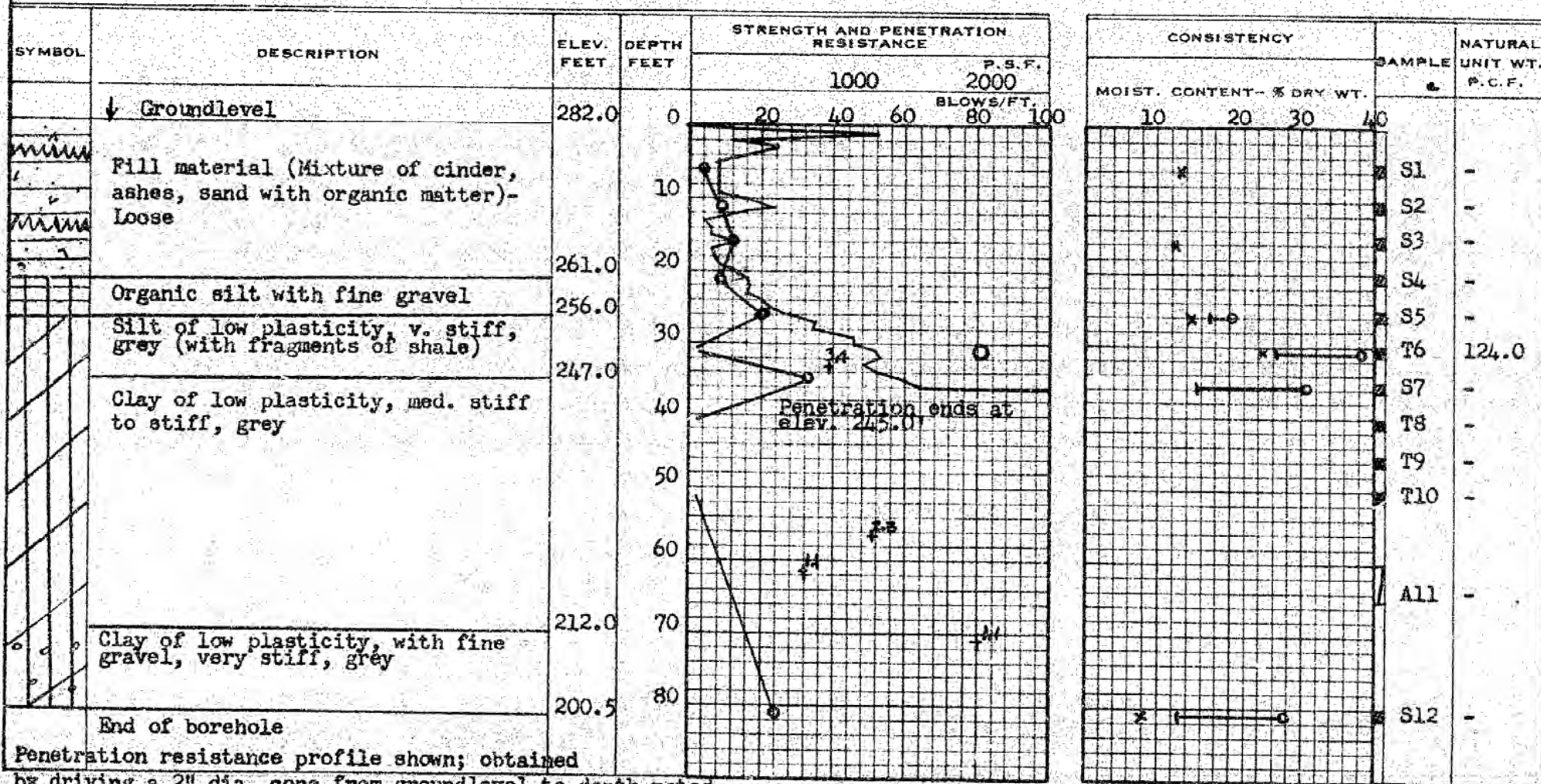
MATERIALS AND RESEARCH SECTION

231-58-3
 W.P. 140-57-1 BORE HOLE NO. 1A
 JOB 60-P-8 STATION 456+00 @ E.B.L.
 DATUM 282.0' COMPILED BY B.K.
 BORING DATE Jan. 28/60 CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

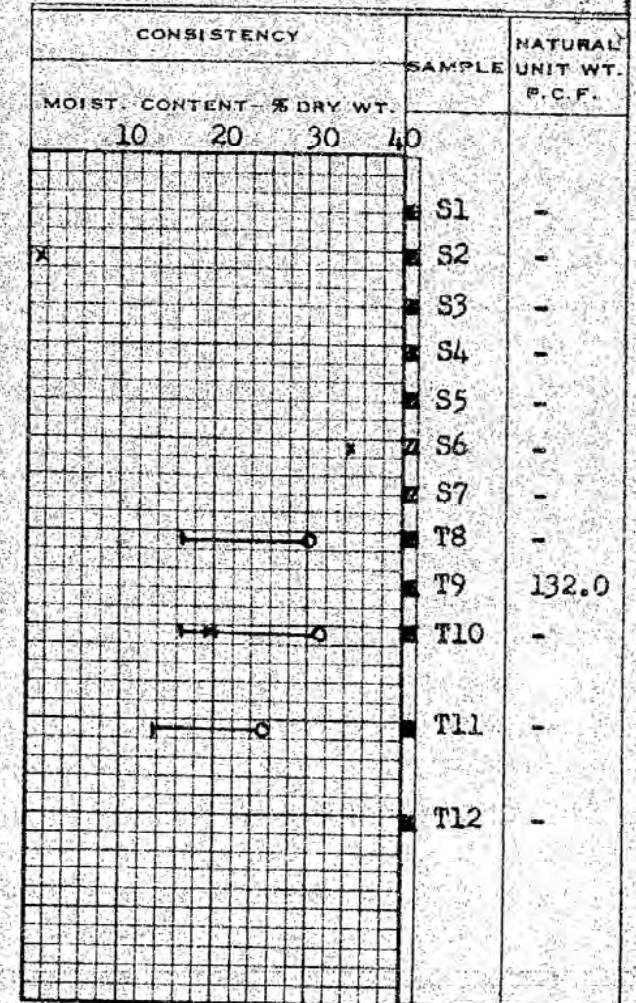
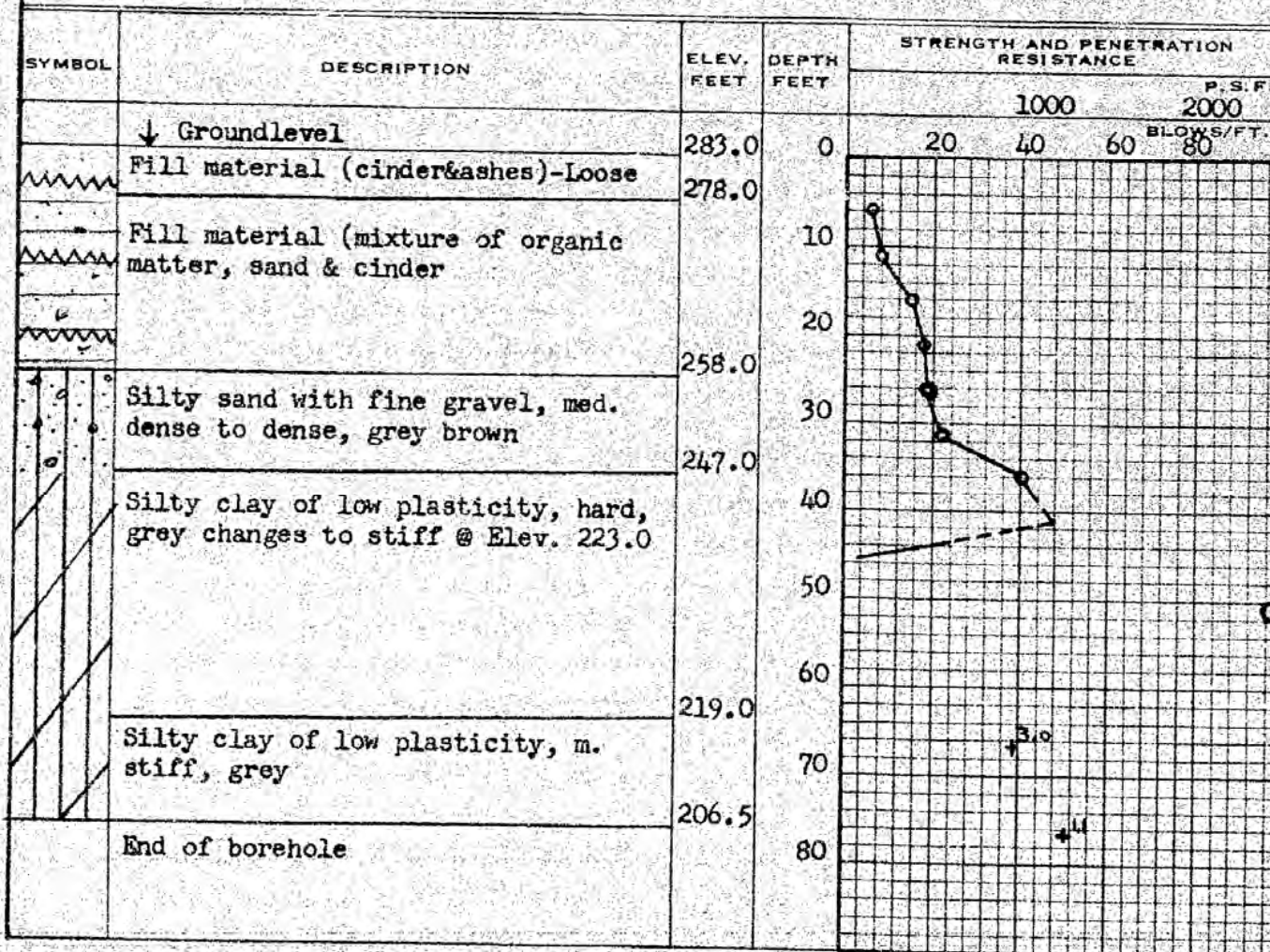
140-57-1
W.P. 231-58-3
JOB 60-F-8
DATUM 283.0'
BORING DATE Feb. 1/60

BORE HOLE NO. 2 A
STATION 458+00 E.E.B.L.
COMPILED BY B.K.
CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

140-57-1
W.P. 231-58-3
JOB 60-F-8
DATUM 283.51
BORING DATE Feb. 3/60

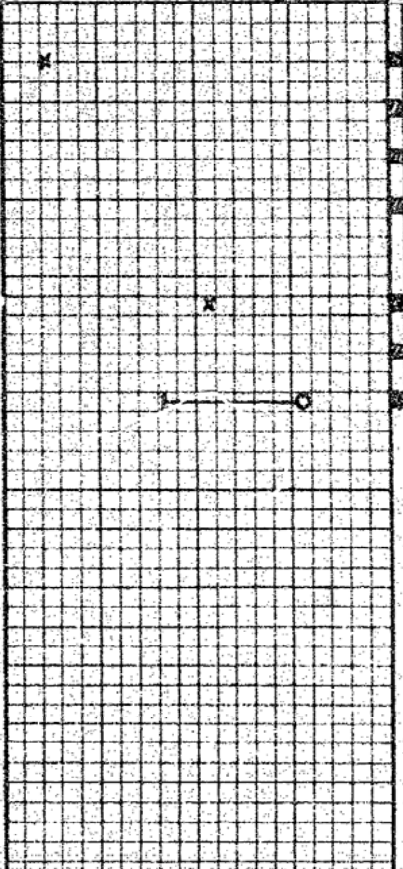
BORE HOLE NO. 3A
STATION 454+00 @ E.B.L.
COMPILED BY B.K.
CHECKED BY M.D.

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

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	BLOWS/FT.
	↓ Groundlevel	283.5	0		
	Fill material (mixture of cinder, ashes sand & gravel)		10		
		258.5	20		
	Clayey silt with fine sand w.l. =	254.5	30		
	changing to silty sand with clay - med. dense	248.5	40		
	Silty clay of low plasticity with gravel & fragments of decayed wood - v. stiff - gray	242.0	50		
	End of borehole		60		
			70		
			80		

CONSISTENCY				SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.					
10	20	30	40		
				S1	-
				S2	-
				S3	-
				S4	-
				S5	-
				S6	-
				S7	-

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

140-57-1

W.P. 231-58-3

BORE HOLE NO. 4A

JOB 60-F-8

STATION 461+00 E.E.B.L.

DATUM 260.5'

COMPILED BY B.K.

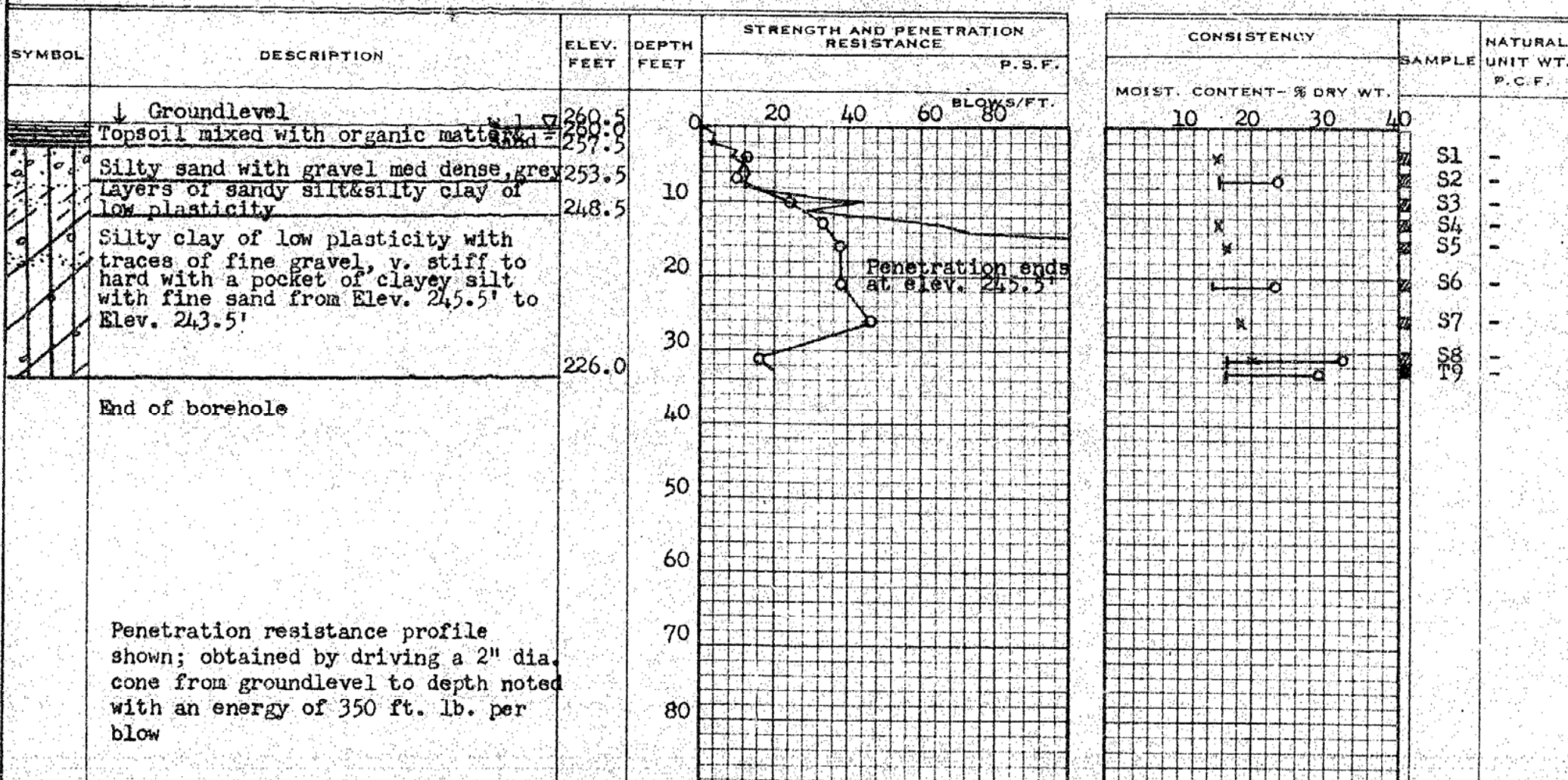
BORING DATE Mar. 24/60

CHECKED BY M.D.

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

LEGEND

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



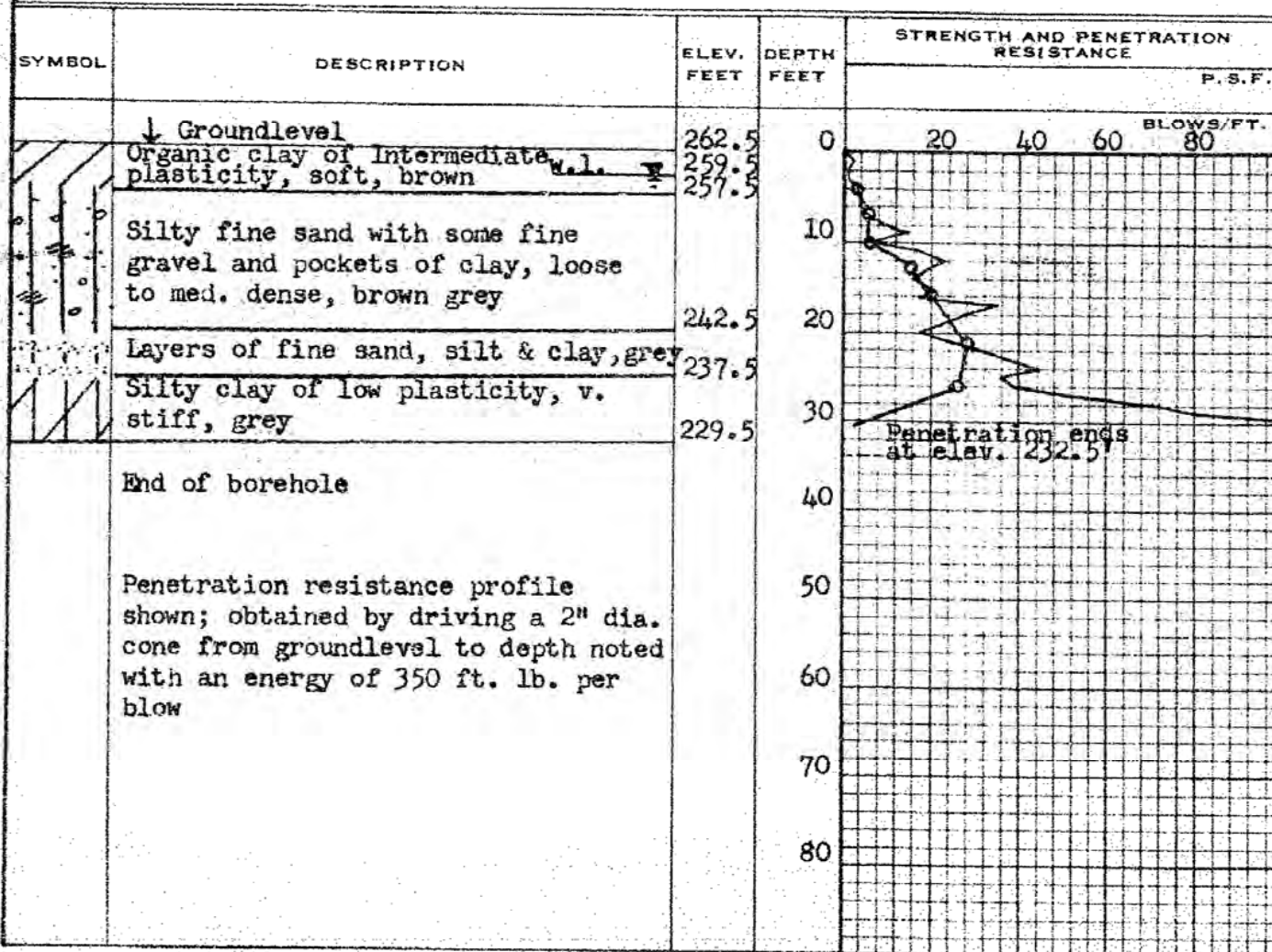
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

140-57-1
W.P. 231-58-3 BORE HOLE NO. 5
JOB 60-F-8 STATION 463+00 E.E.B.L.
DATUM 262.5' COMPILED BY B.K.
BORING DATE Mar. 26/60 CHECKED BY M.D.

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

LEGEND

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



CONSISTENCY				SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.					
10	20	30	40		
				S1	-
				S2	-
				S3	-
				S4	-
				S5	-
				S6	-
				S7	-
				T8	-

OFFICE REPORT ON SOIL EXPLORATION

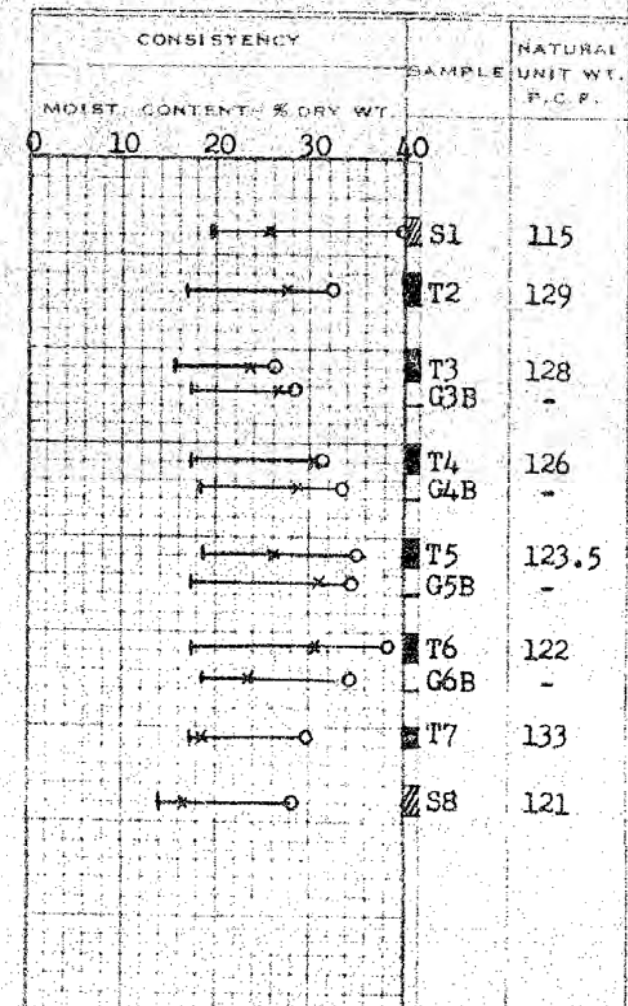
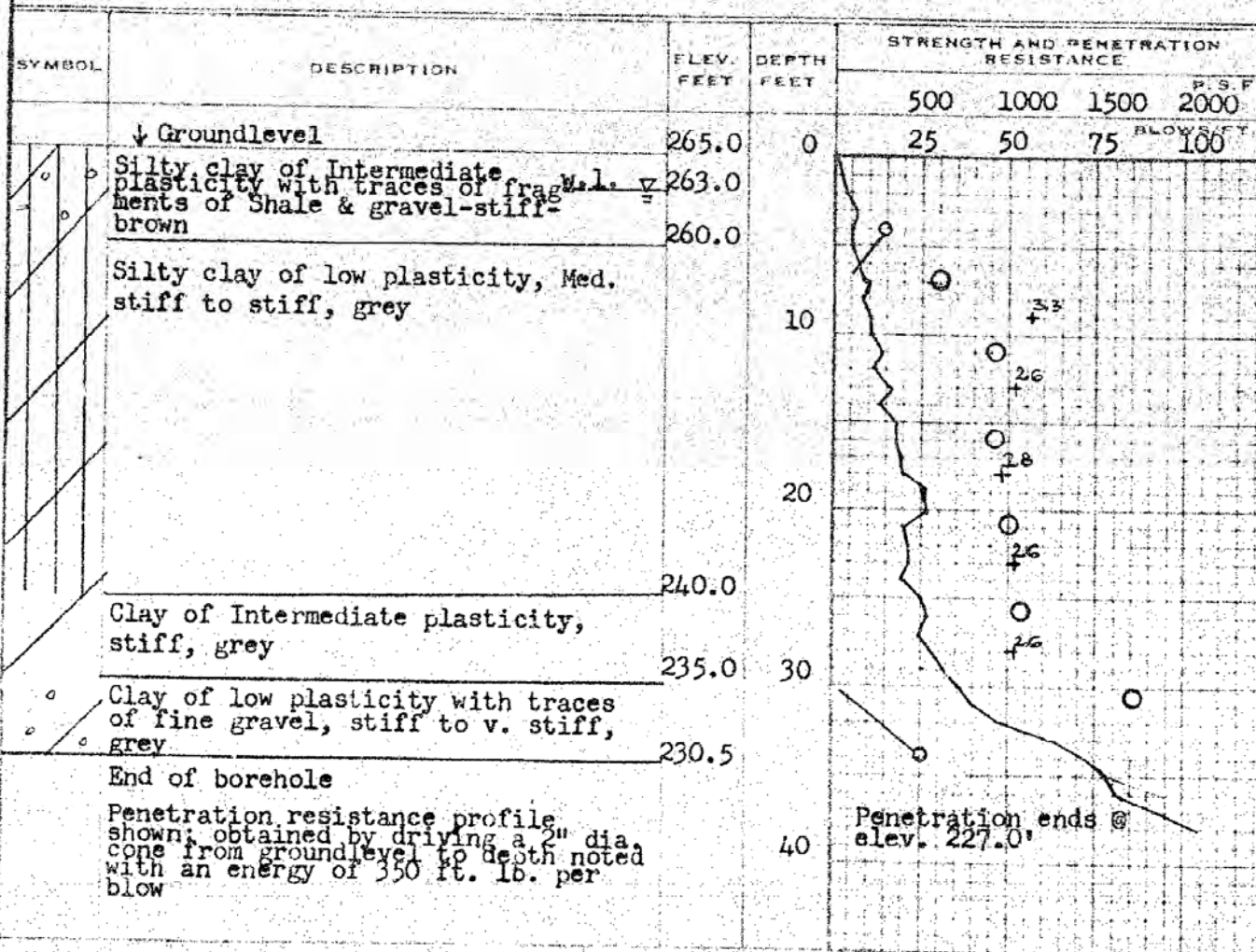
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

140-57-1
W.P. 231-58-3 BORE HOLE NO. 1
JOB 60-F-88 STATION 471+00 & EBL
DATUM 265.0' COMPILED BY B.K.
BORING DATE Oct. 24/60 CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

 140-57-1
 W.P. 231-58-3

BORE HOLE NO. 2

JOB 60-F-88

STATION 468+00 E RBL

DATUM 263.0'

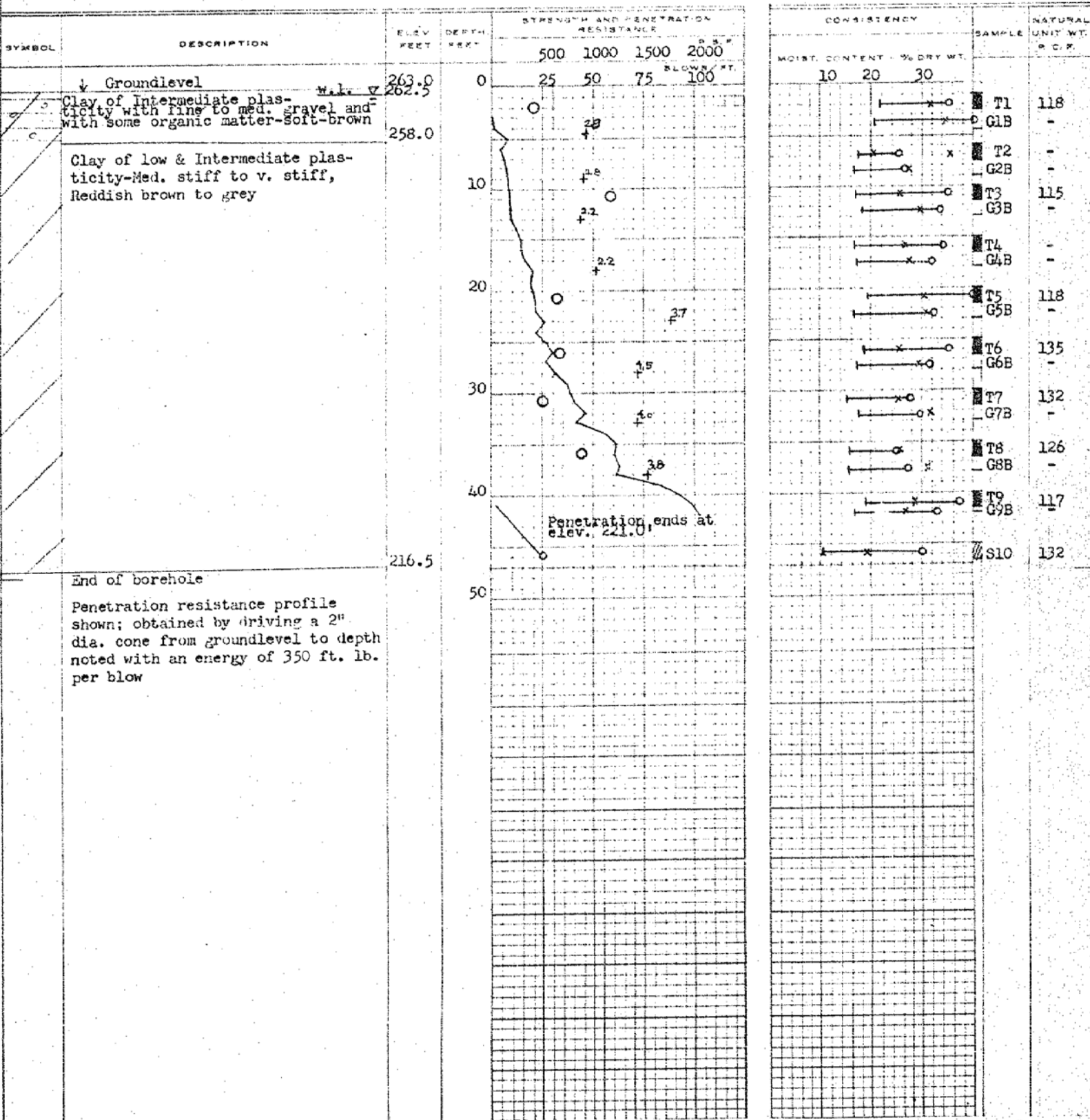
COMPILED BY B.K.

BORING DATE Oct. 27/60

CHECKED BY M.D.

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

 140-57-1
 W.P. 231-58-3

 BORE HOLE NO. 3
 STATION 466+60 (50' Rt) EBL

JOB 60-F-88

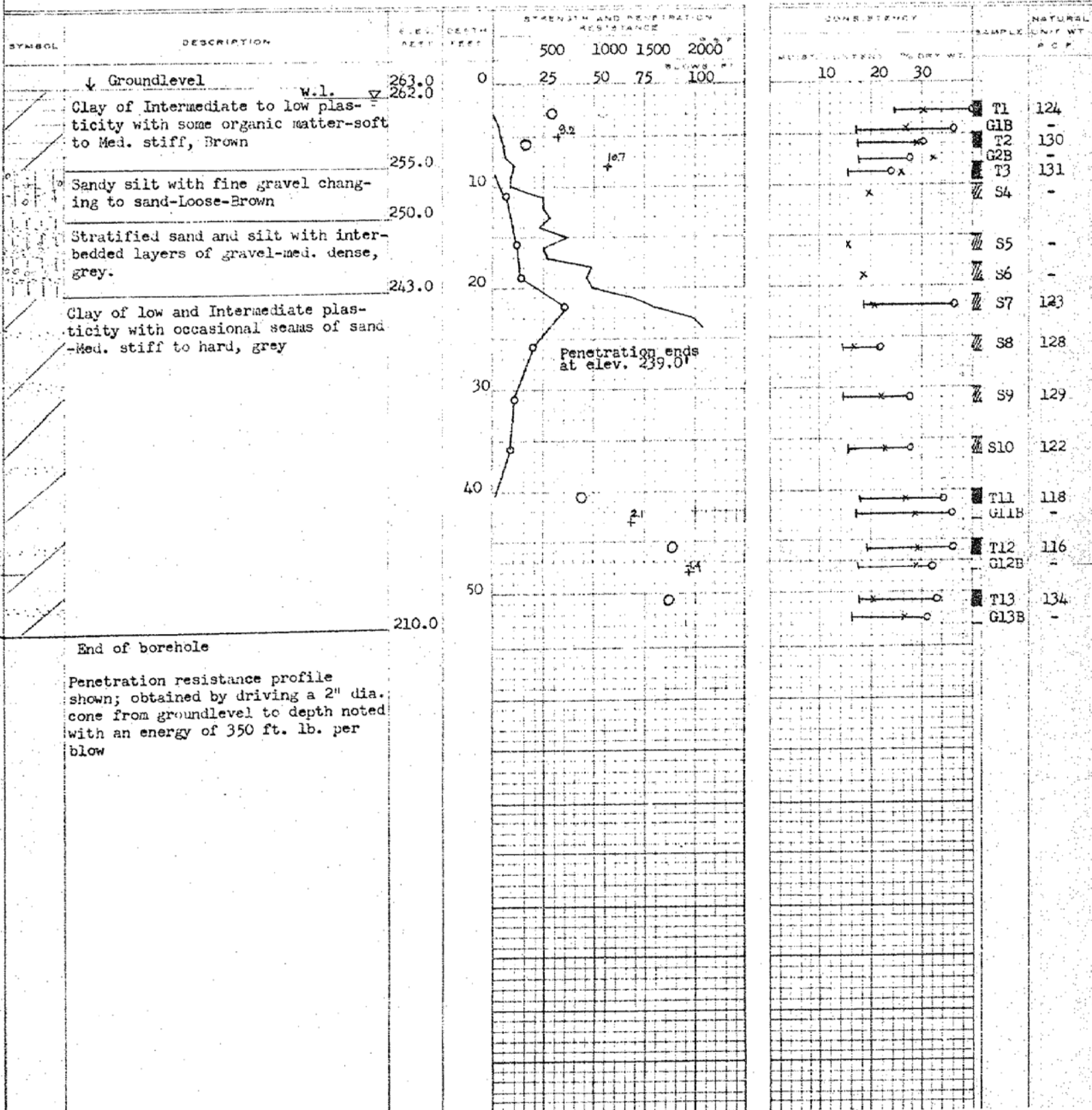
COMPILED BY B.K.

DATUM 263.0'

CHECKED BY M.D.

BORING DATE Oct. 28/60

LEGEND

 UNCONTINUED COMPRESSION (QU) 0
 VANE TEST (C) AND SENSITIVITY (S) +S
 NATURAL MOISTURE AND LIQUIDITY INDEX LI
 LIQUID LIMIT L
 PLASTIC LIMIT P


DEPARTMENT OF HIGHWAYS - ONTARIO

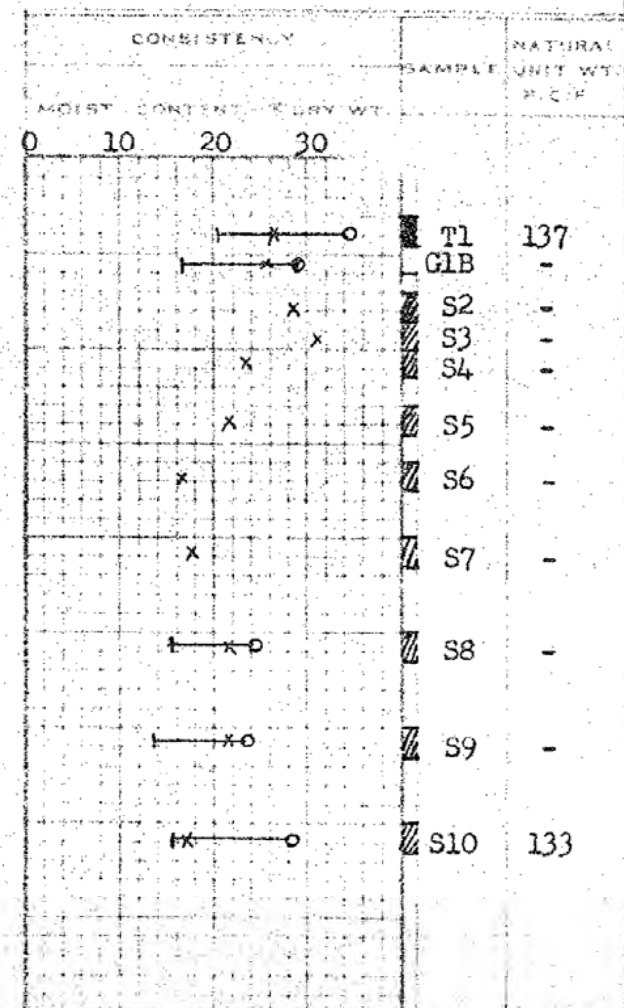
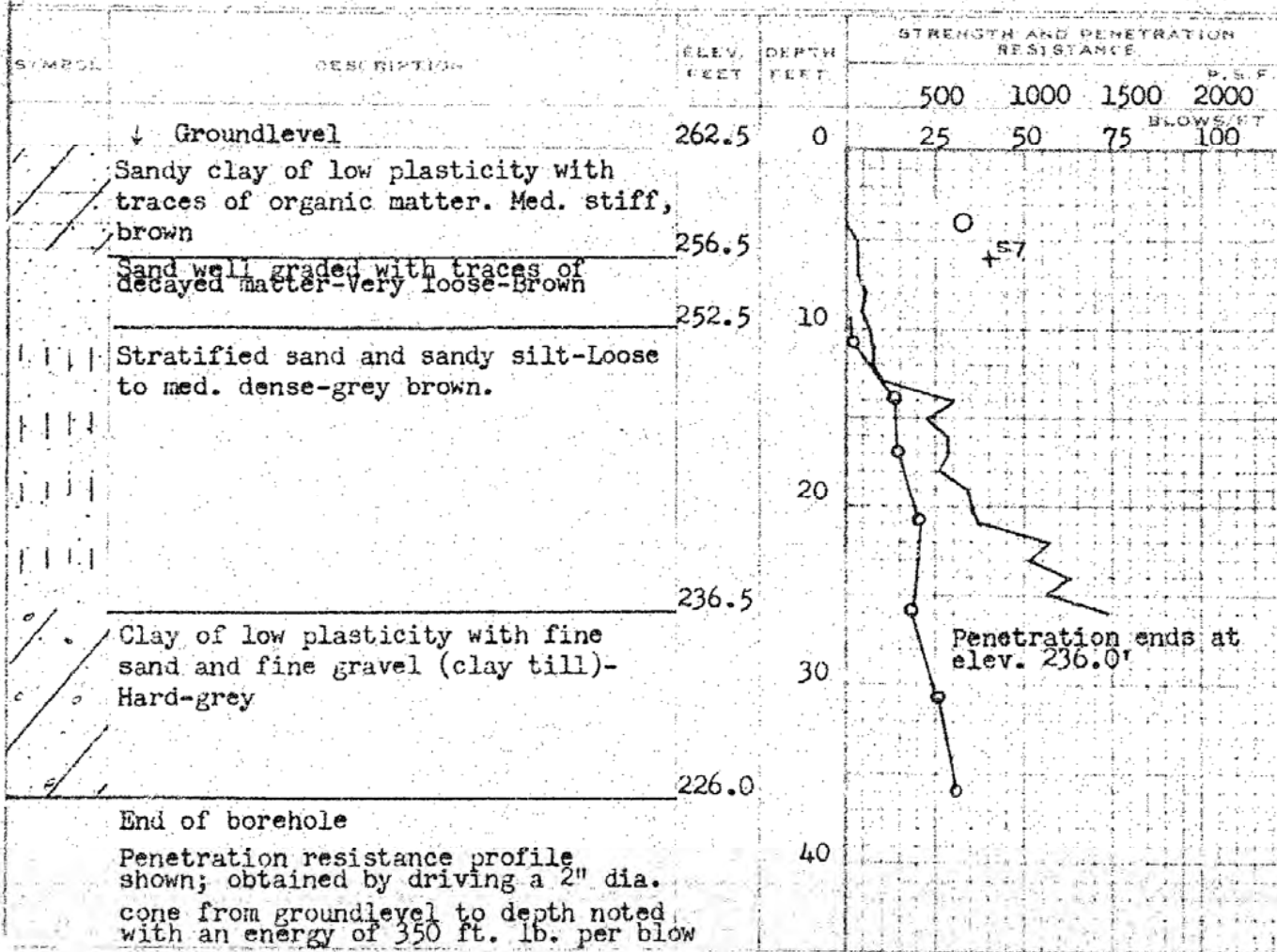
MATERIALS AND RESEARCH SECTION

140-57-1
 W.P. 231-58-3 BORE HOLE NO. 4
 JOB 60-F-88 STATIC 464/50 @ WBL
 DATUM 262.5' COMPILED BY B.K.
 BORING DATE Nov. 1/60 CHECKED BY M.D.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

140-57-1

W.P. 231-58-3

JOB 60-F-88

DATUM 261.0'

BORING DAT. Nov. 3/60

BORE HOLE NO. 5

STATION 462+50 E WBL

COMPILED BY B.K.

CHECKED BY M.D.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPLIT TUBE

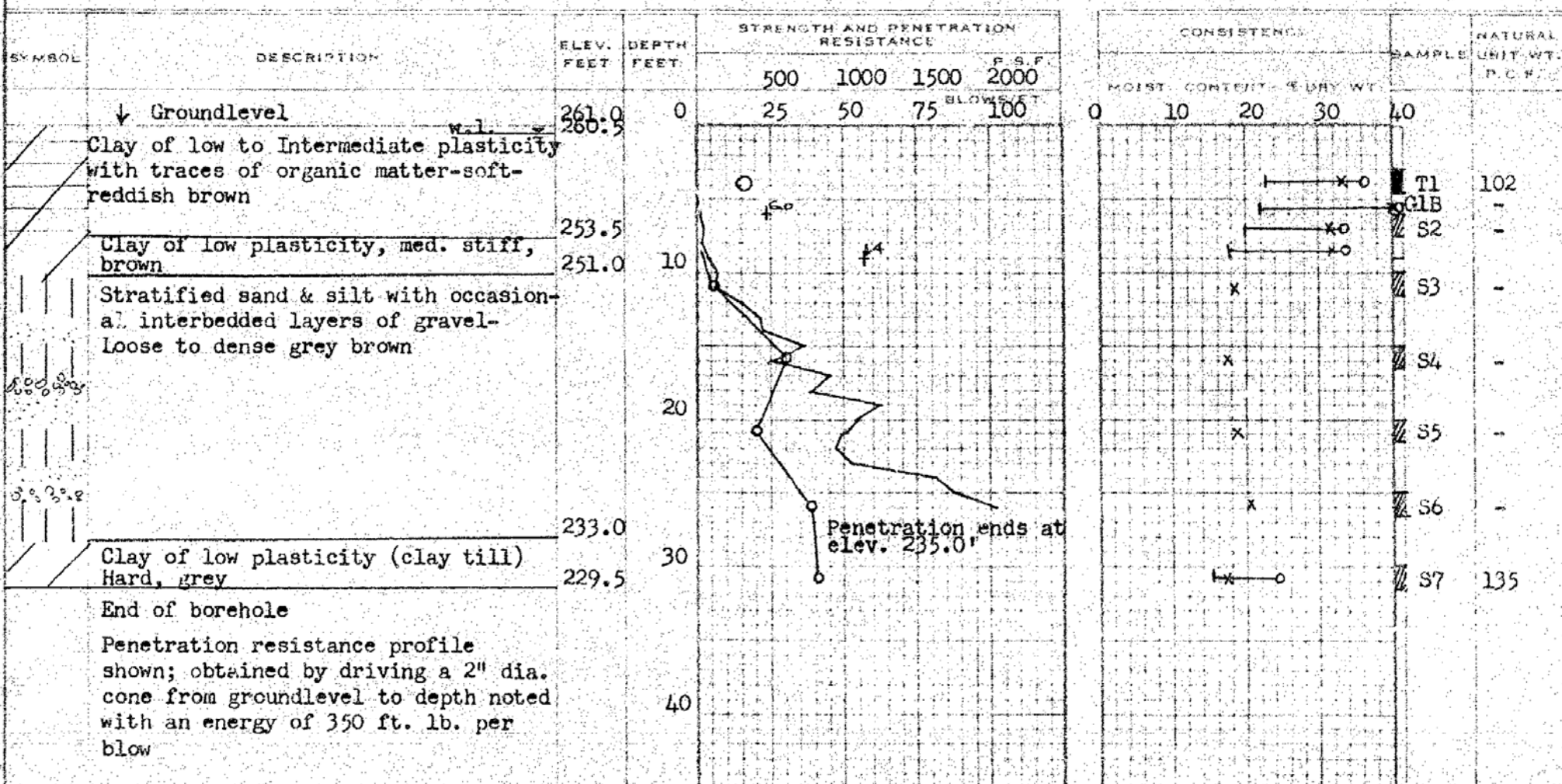
2" DIA. CONE

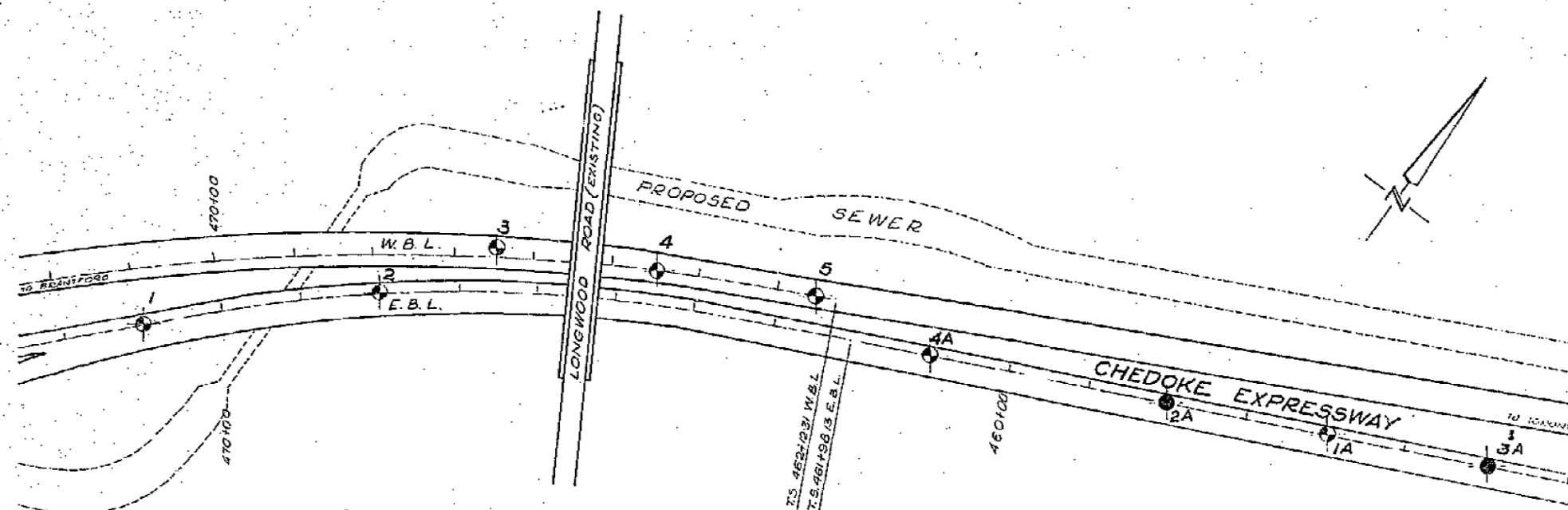
2" SHELBY

CASING

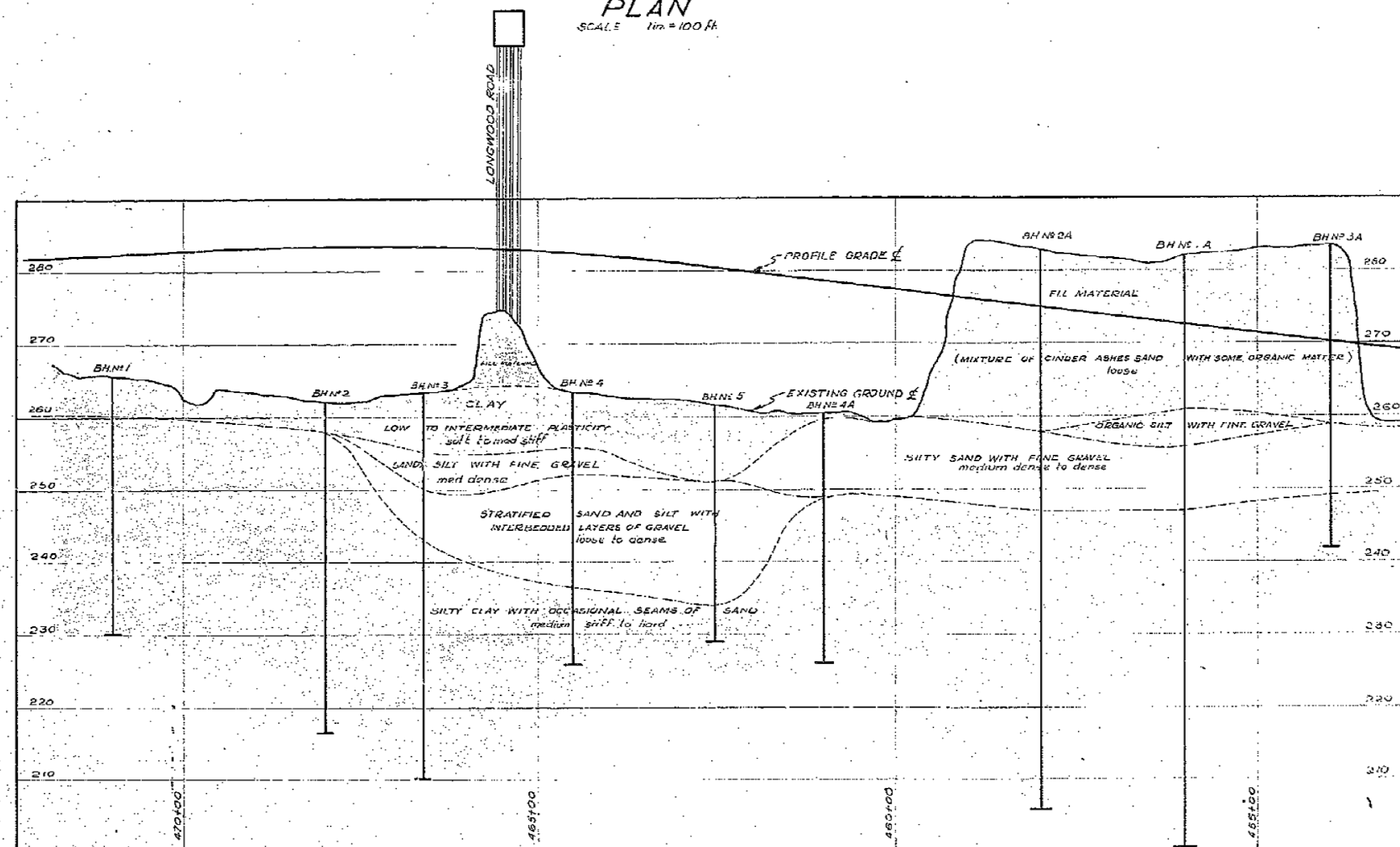
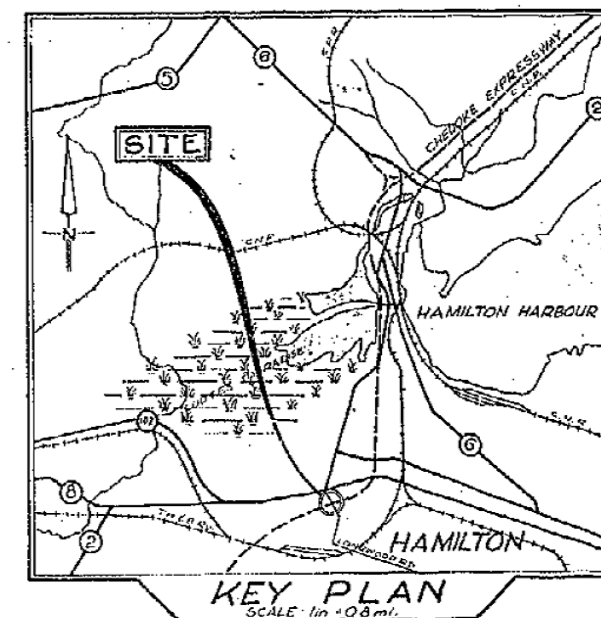
LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) \bigcirc
 VANE TEST (C) AND SENSITIVITY (S) \times
 NATURAL MOISTURE AND LIQUIDITY INDEX \square
 LIQUID LIMIT \sim
 PLASTIC LIMIT \sim





PLAN
SCALE 1 in. = 100 ft.



PROFILE
SCALE HORIZONTAL 1"=100' VERTICAL 1"=10'

LEGEND			
	BOREHOLE		
	BORE AND PENETRATION HOLE		
HOLE	ELEVATION	STATION	OFFSET
1	2650	471+00	E.E.B.L.
2	2630	468+00	E.E.B.L.
3	2630	466+00	50' RT E.B.L.
4	2625	464+50	W.B.L.
5	2610	462+50	E.W.B.L.
1A	2620	456+00	E.E.B.L.
2A	2630	458+00	E.E.B.L.
3A	2635	457+00	E.E.B.L.
4A	2605	461+00	E.E.B.L.

DEPARTMENT OF HIGHWAYS - ONTARIO		
MATERIALS & RESEARCH SECTION		
CHEDOKE EXPRESSWAY		
STATION 453+00 TO 472+00		
ENGINEERED BY M. DEWATA	DISTRICT NO. 7	DATE 10 JULY 1961
DRAWN BY J. A. 1003	W.P. NO./40-51-14231-50-3	JUD. NO. 60-F-88-89
CHECKED BY J. A. 1003	SCALE AS SHOWN	DRAWING NO. 60-F-88A
APPROVED		

Geocres No. 30M5-36

Proposed Aberdeen Avenue Interchange

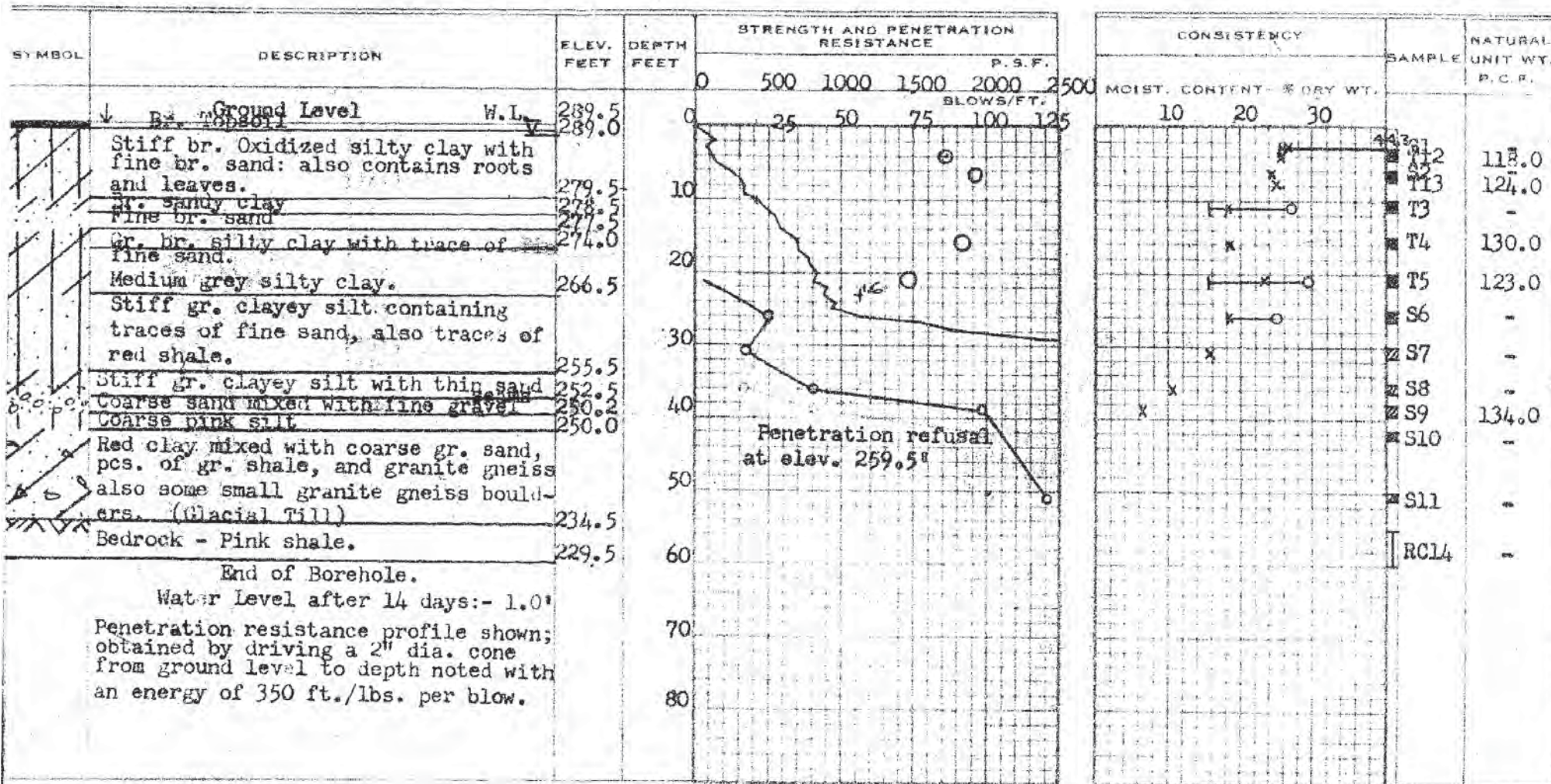
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 182-60 BORE HOLE NO. 1
JOB 60-F-6 STATION 12+80 19.0' Left
DATUM G.S.C. COMPILED BY B.K.
BORING DATE 17/2/60 CHECKED BY K.G.C.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 182-60 BORE HOLE NO. 2

JOB 60-F-6 STATION 13+41 Ramp 'C' 9' It

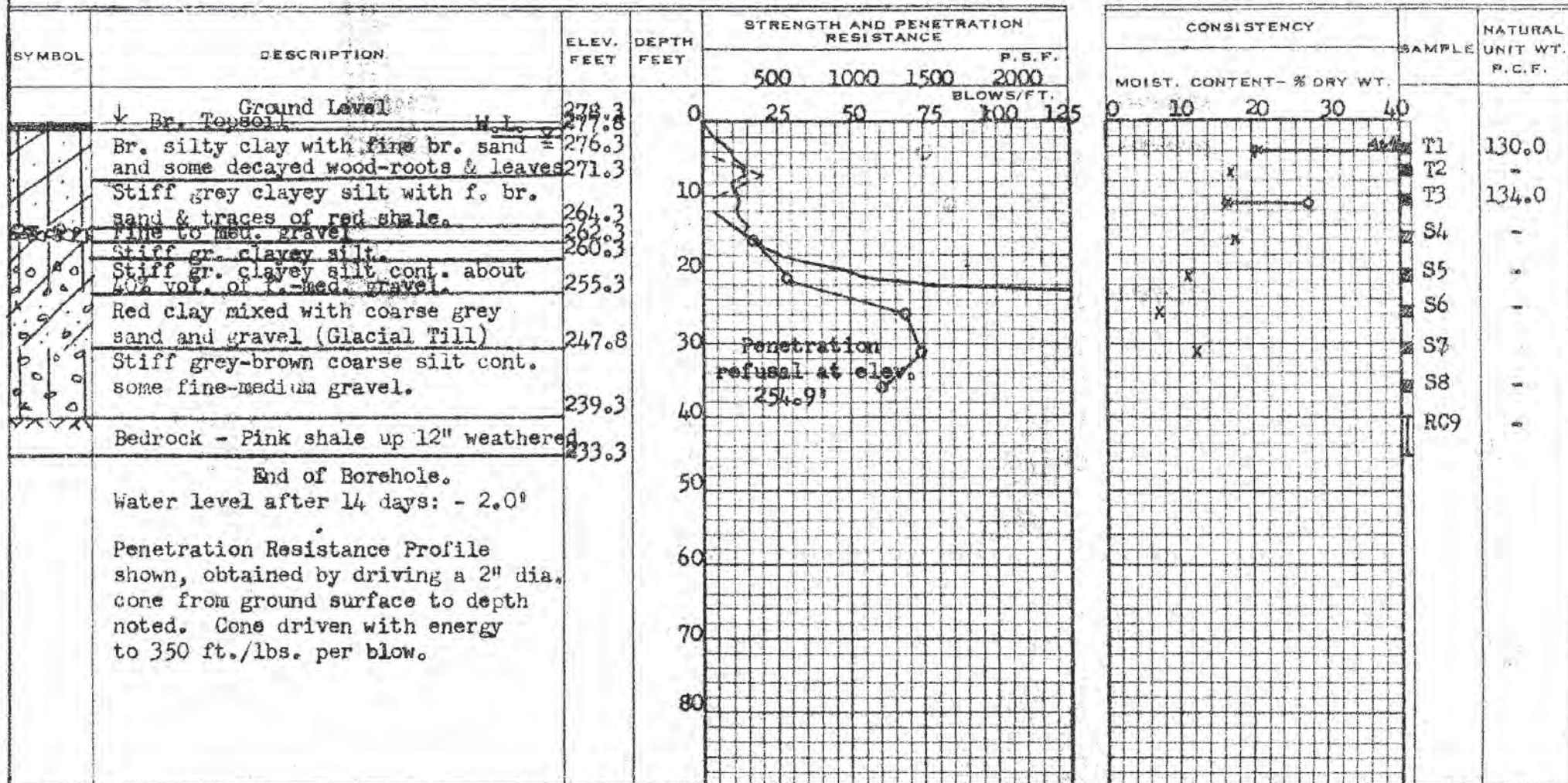
DATUM G. S. C. COMPILED BY B. K.

BORING DATE 24/2/60 CHECKED BY K. G. S.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 182-60 BORE HOLE NO. 3
 JOB 60-F-6 STATION 14/41 Ramp 'C' 19.0'
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE 1/3/60 CHECKED BY K. G. S.

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

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				500	1000	1500	2000
	Ground Level	273.0	0				
	Soft br. organic silt.	269.5					
	Stiff gr. silty clay with high % of med. gr.	268.0					
	Medium gr. silty clay cont. small amount of fine to medium gravel.	258.0					
	Stiff grey silty clay.	253.5					
	Red clay cont. coarse sand & gravel and silt. (Glacial Till)	247.5					
	Gr.-br. stiff silt cont. fine to med. to coarse gr. & small boulders	242.5					
	Bedrock - Pink shale.	237.5					
	End of Borehole.						
	Water level after 14 days: - G. L.						
	Penetration Resistance Profile shown, obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 350 ft./lbs. per blow.						

CONSISTENCY					SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.						
0	10	20	30	40		
					S1	-
					T2	-
					T3	131.0
					T4	133.0
					S5	-
					RC6	-

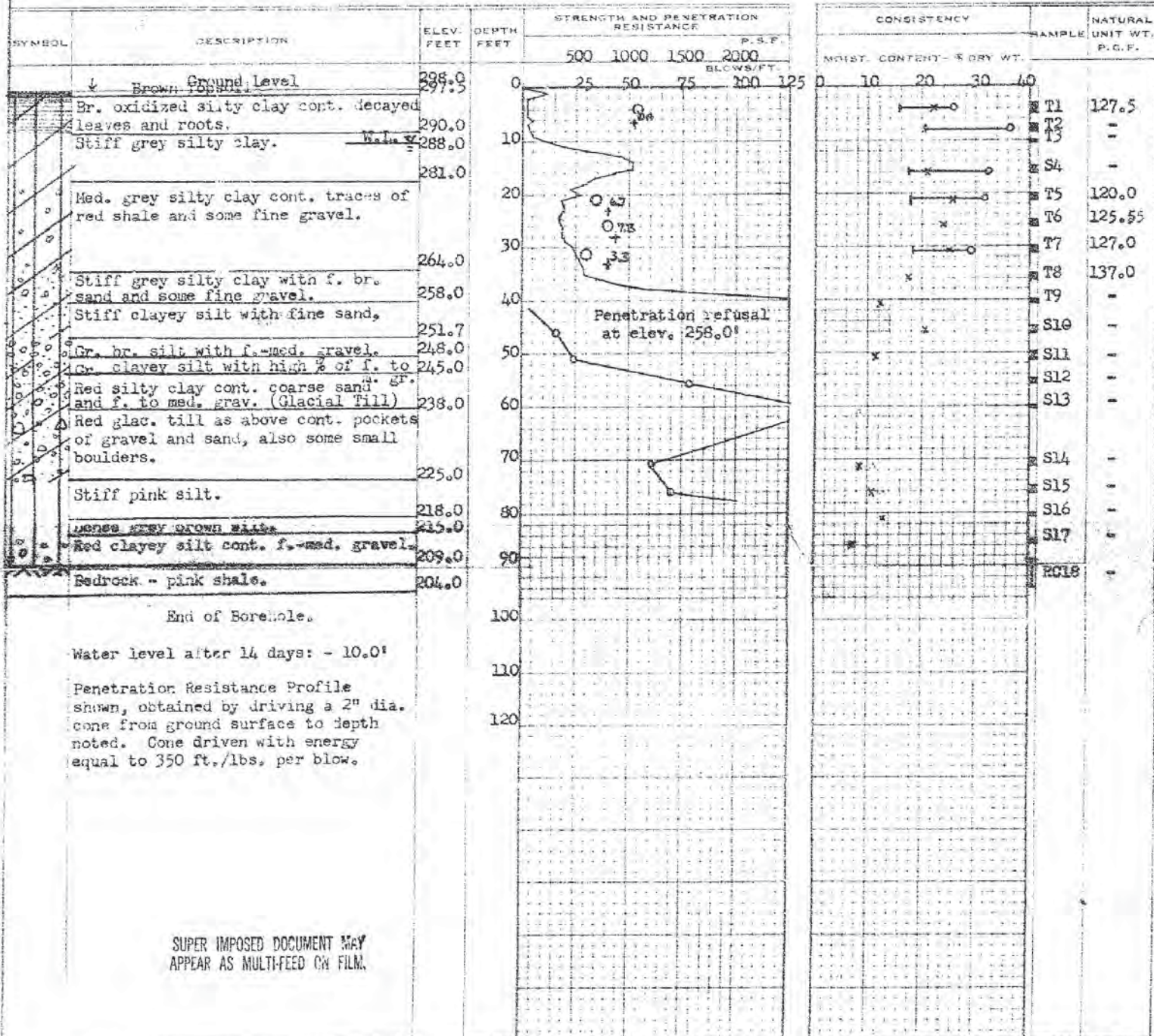
OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 266-60 BORE HOLE NO. 4
 JOB 60-F-6 STATION 13/16 Ramp D 15' Lt
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE 2/3/60 CHECKED BY K. G. S.

LEGEND

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



SUPER IMPOSED DOCUMENT MAY
 APPEAR AS MULTI-FEED ON FILM.

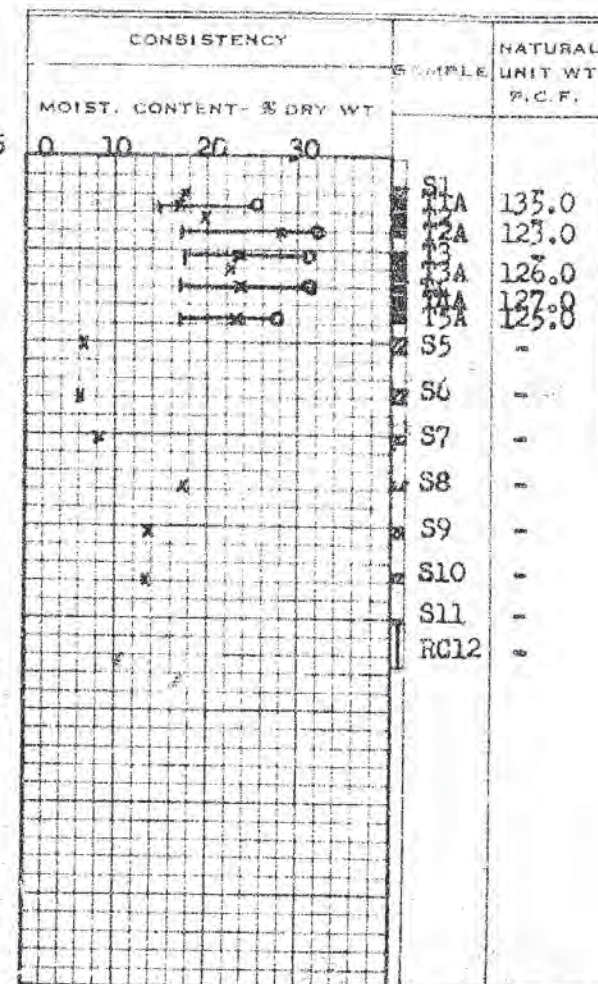
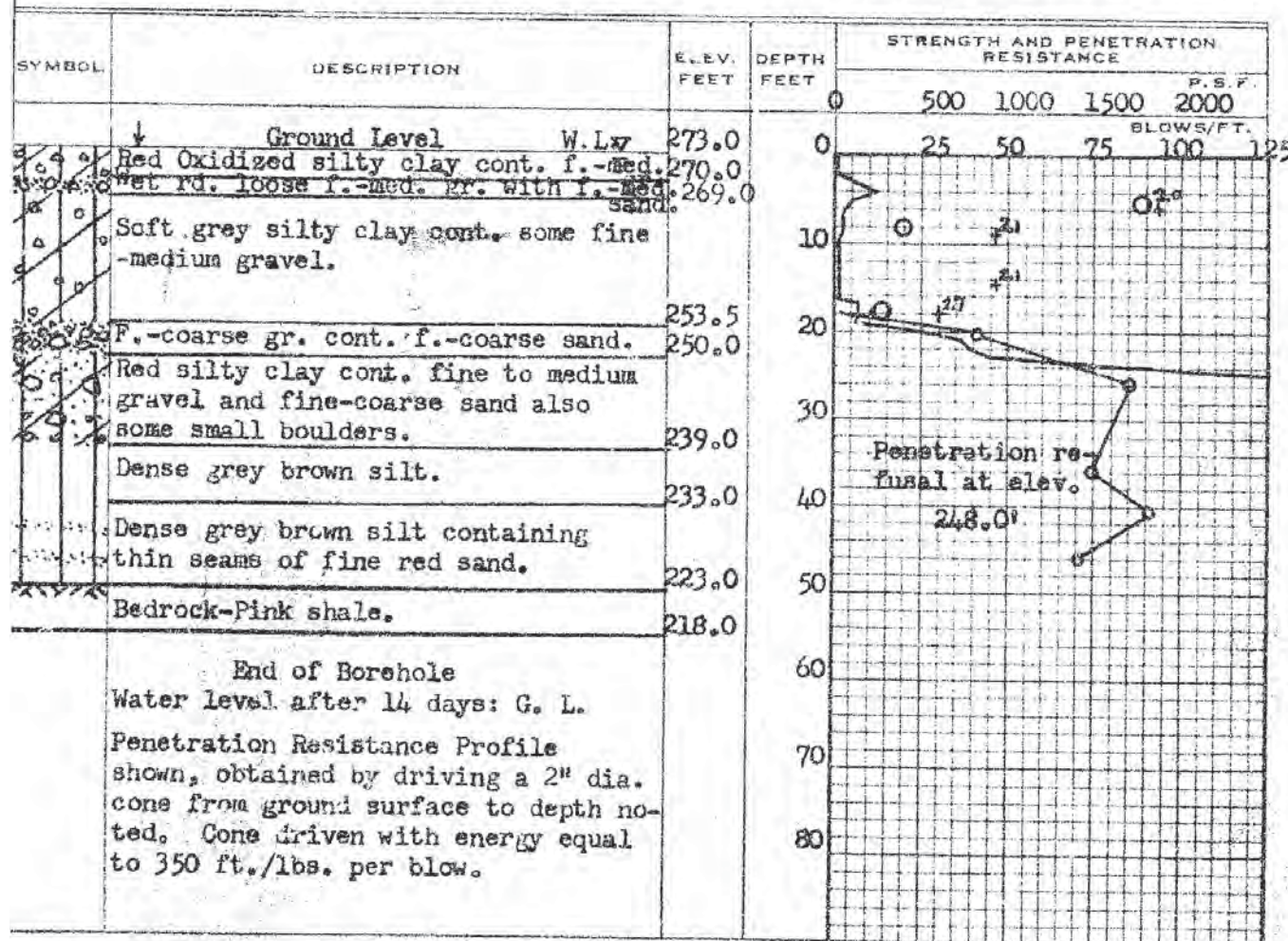
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 266-60 BORE HOLE NO. 5
JOB 60-P-6 STATION 12/19 Ramp 'D' 7' Lt
DATUM G. S. C. COMPILED BY B. K.
BORING DATE 10/3/60 CHECKED BY K. G. S.

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

LEGEND

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

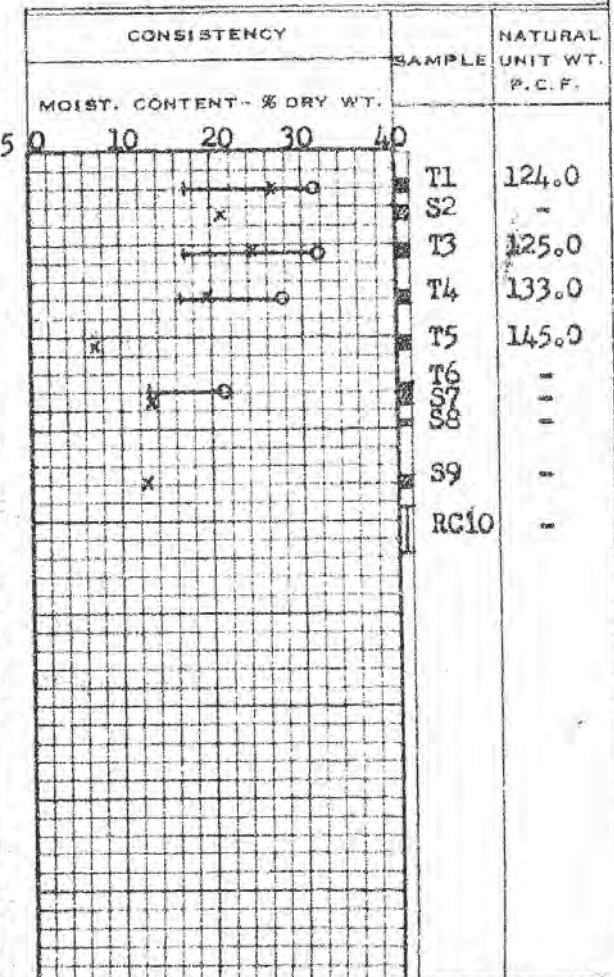
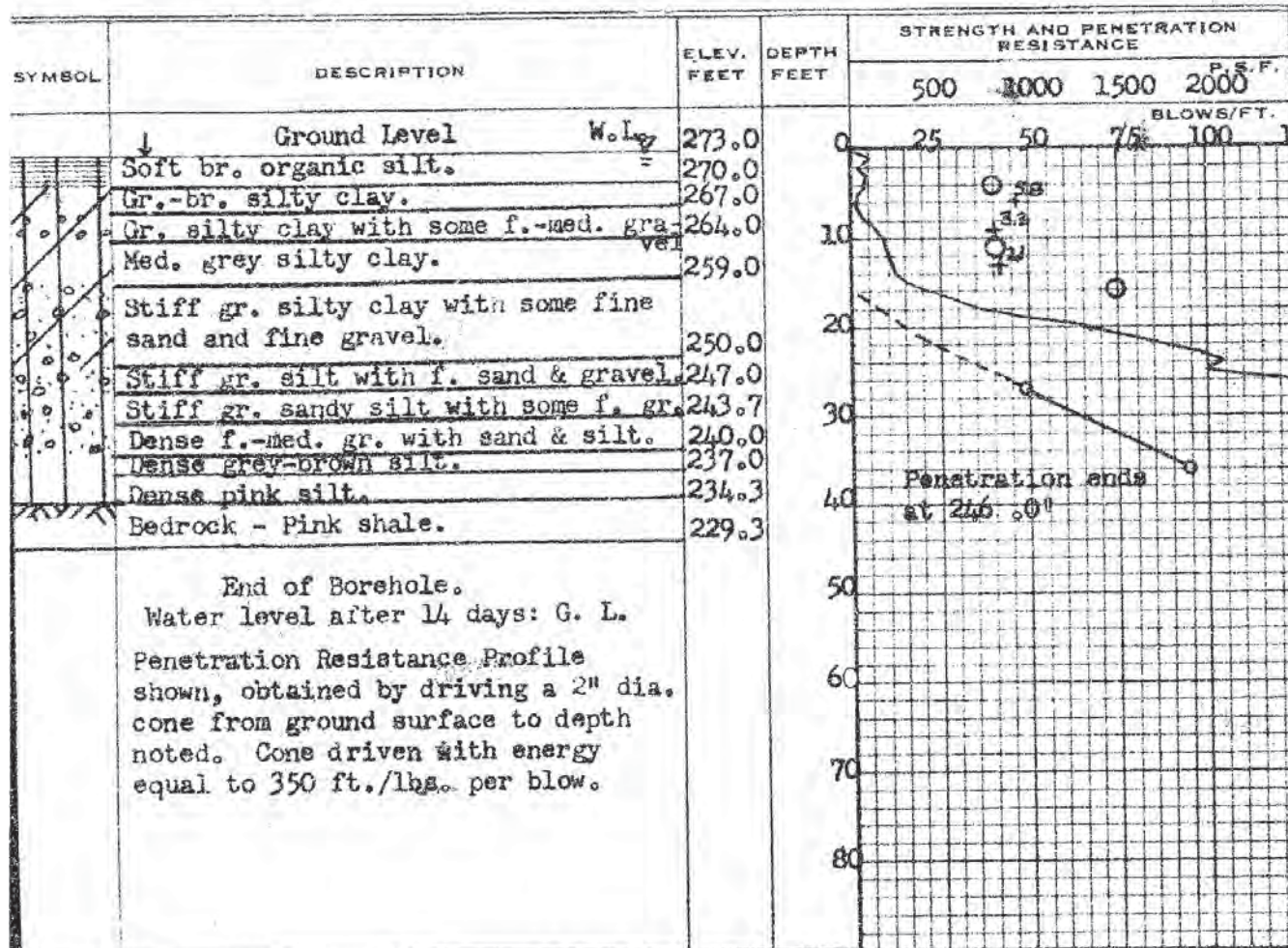


DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 266-60 BORE HOLE NO. 6
JOB 60-F-6 STATION STA. 11/28 Ramp 'D' 15' Ls.
DATUM G. S. C. COMPILED BY B. K.
BORING DATE 8/3/60 CHECKED BY K. G. S.

LEGEND

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

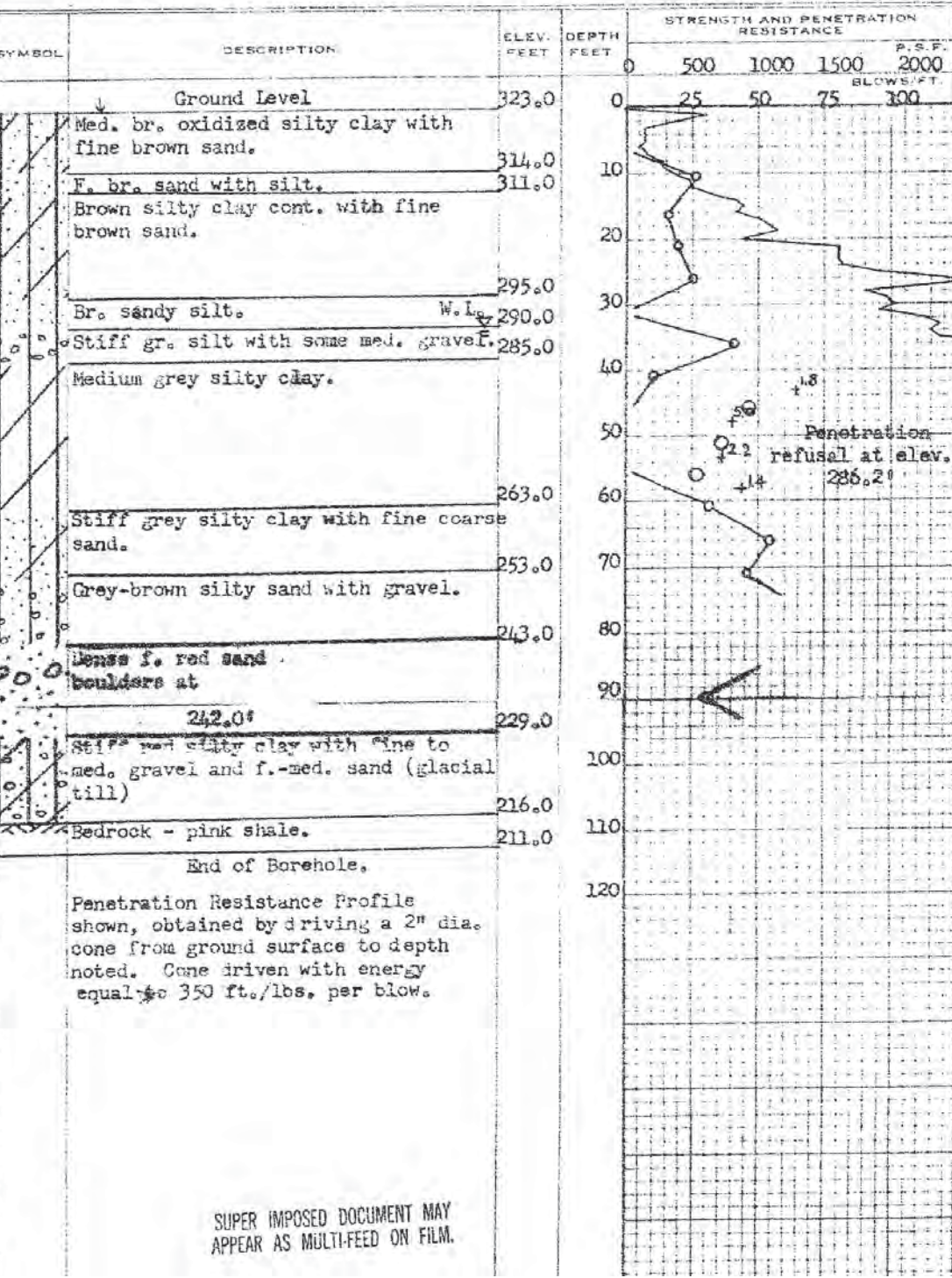


DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 182 -60 BORE HOLE NO. 7
JOB 60-F-6 STATION 11+80 @ Ramps B & C
DATUM G. S. C. COMPILED BY B. K.
BORING DATE 11/3/60 CHECKED BY K. G. S.

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

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



MOIST. CONTENT - % DRY WT.	CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
		T1	-
		T2	125.0
		S3	-
		S4	-
		S5	-
		S6	-
		T7	134.0
		S8	-
		S9	-
		T10	127.0
		T11	125.0
		T12	130.0
		S13	136.0
		S14	-
		S15	-
		S16	-
		S17	-
		S18	-
		S19	-
		RC20	-

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 182-6 BORE HOLE NO. 8

JOB 60-F-6 STATION 14+75.2 B& C 20' Rt.

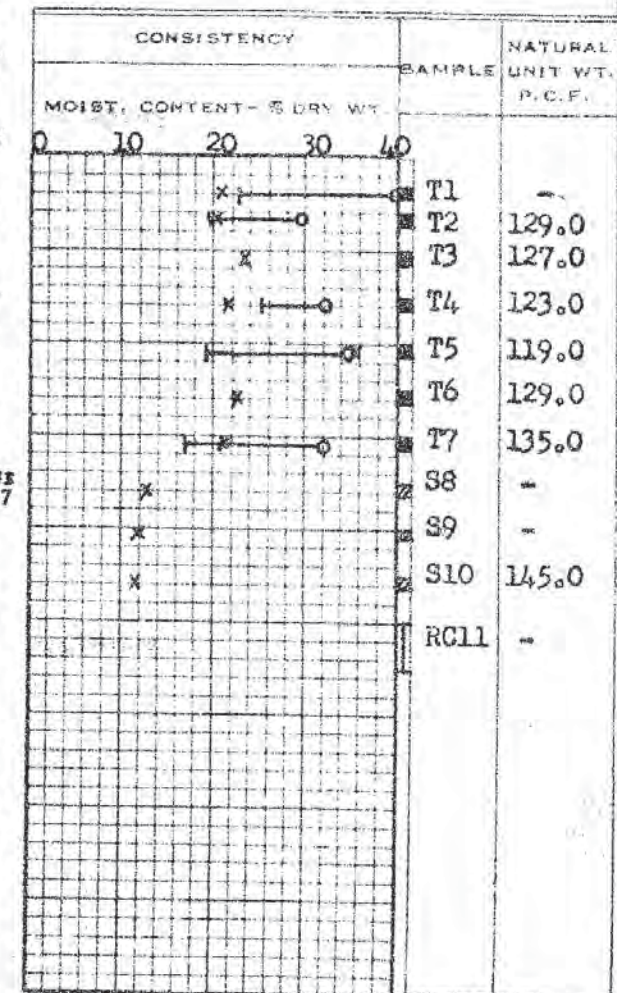
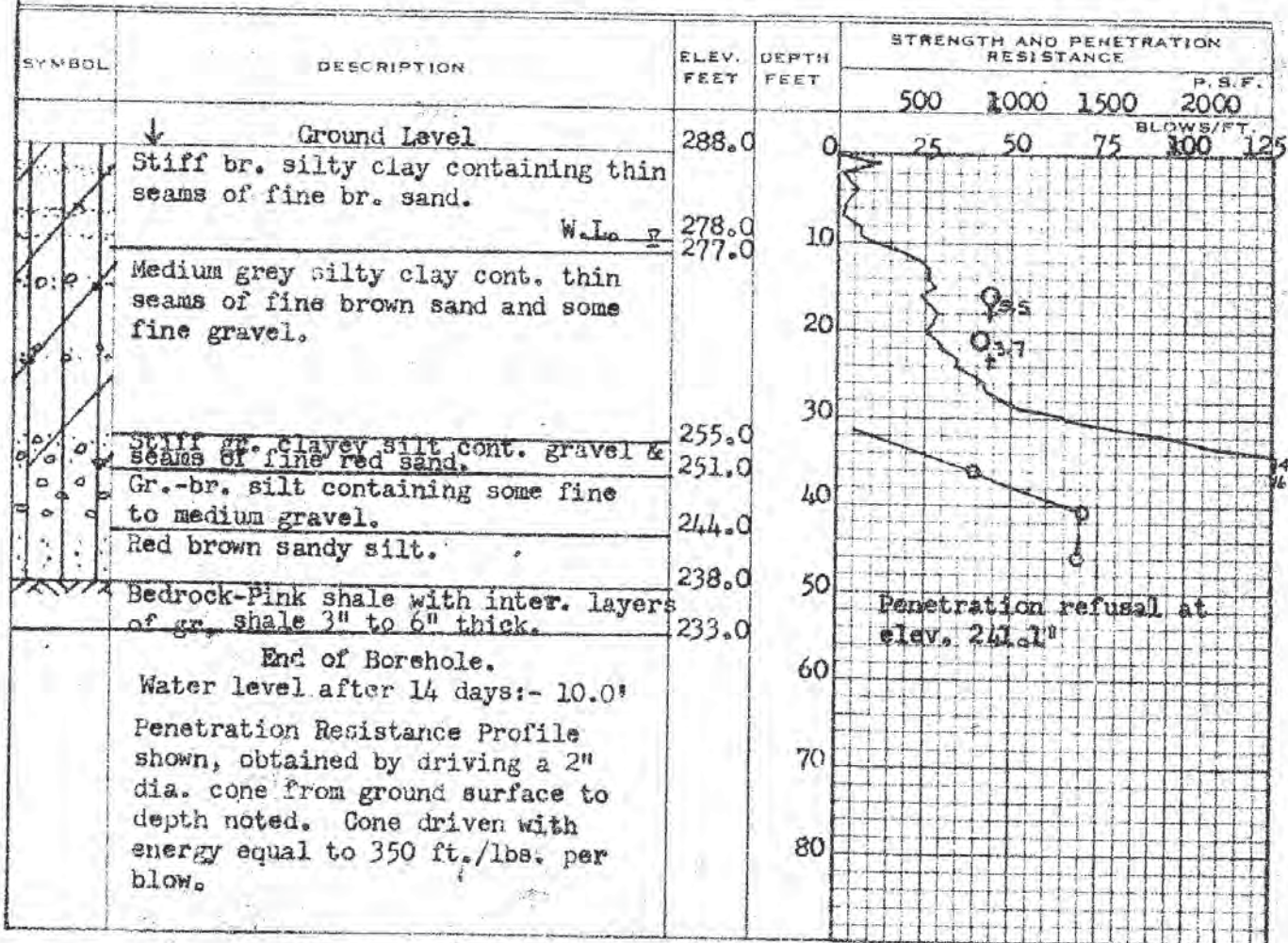
DATUM G. S. C. COMPILED BY B. K.

BORING DATE 15/3/60 CHECKED BY K. G. S.

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

LEGEND

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



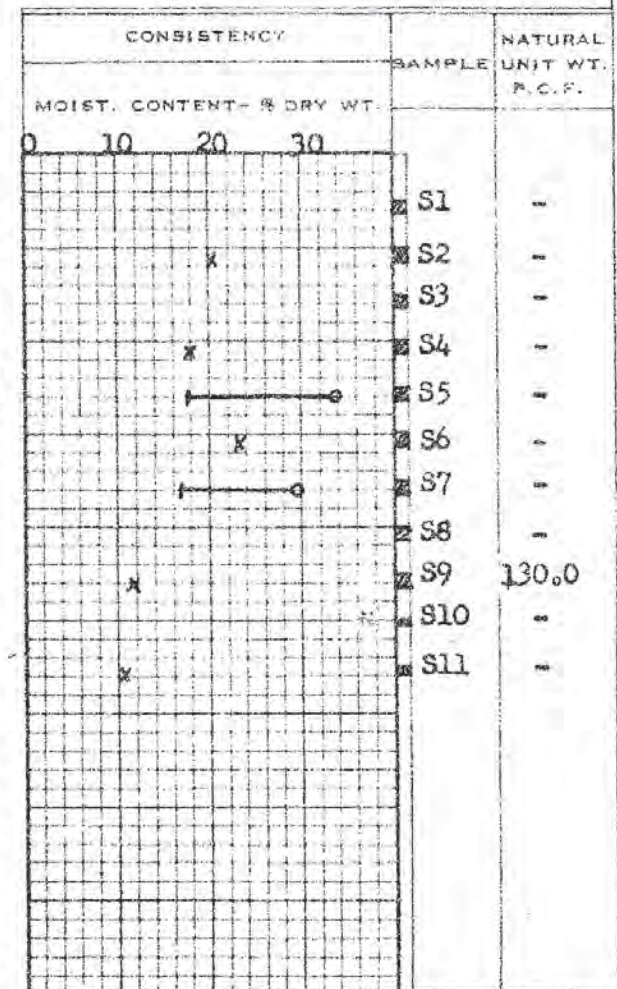
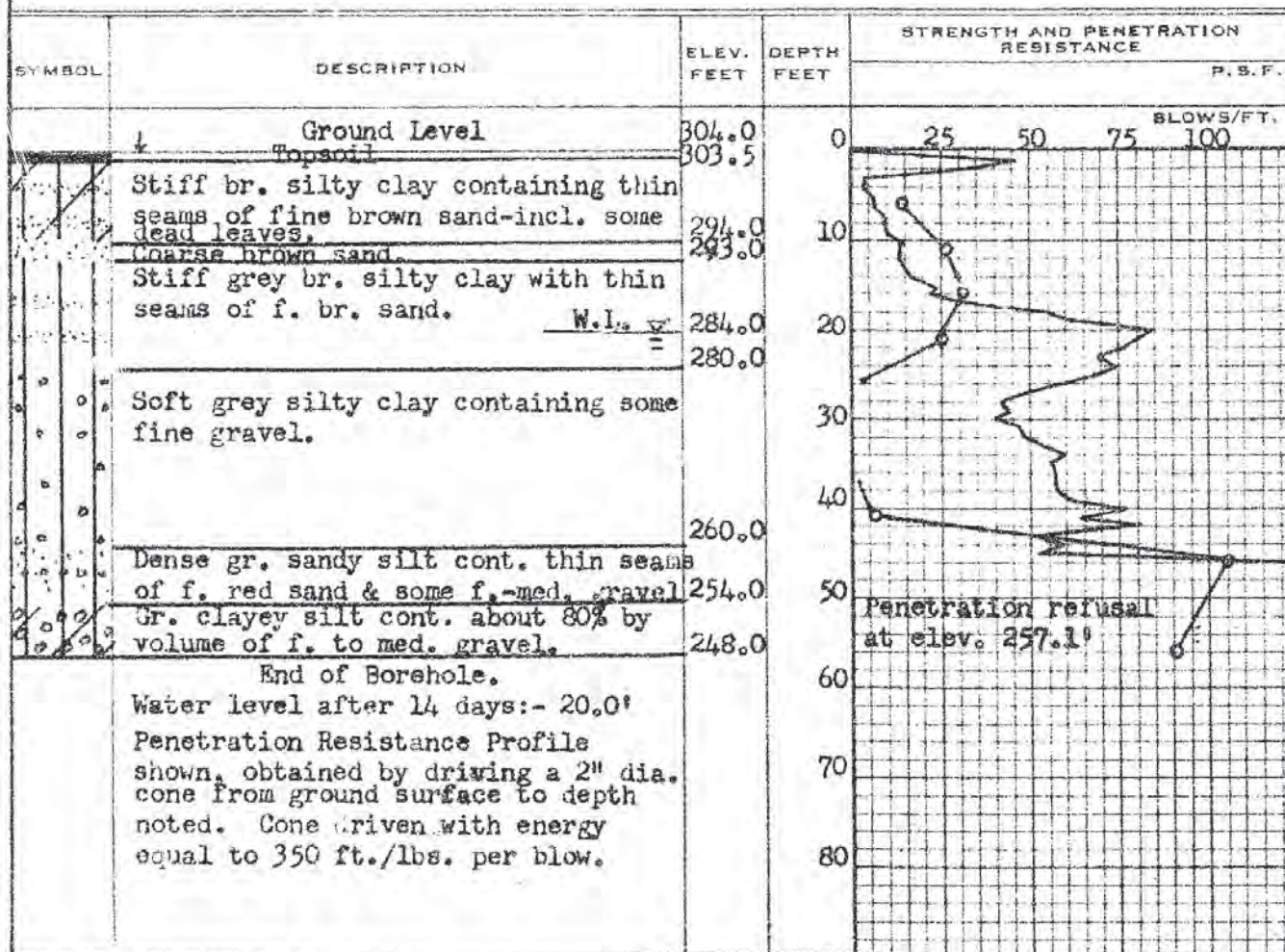
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 266-60 BORE HOLE NO. 9
 JOB 60-F-6 STATION 10+70 & Ramp 'D'
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE 28/3/60 CHECKED BY K. G. S.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 266-60

BORE HOLE NO. 10

JOB 60-F-6

STATION 13+60 & Ramp 'D'

DATUM G. S. C.

COMPILED BY B. K.

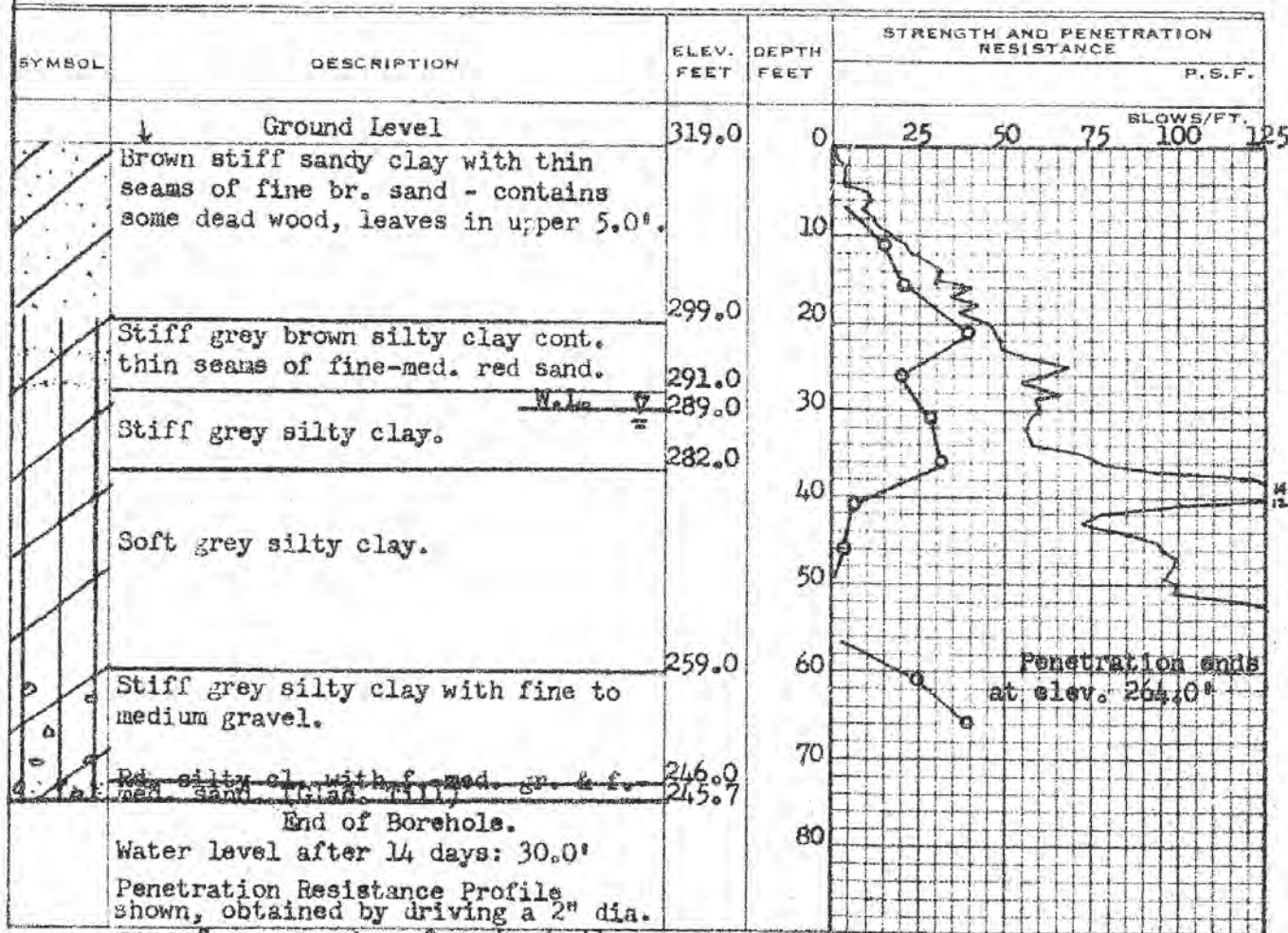
BORING DATE 8/4/60

CHECKED BY K. G. S.

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

LEGEND

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



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
	S1	-
	S2	-
	S3	-
	S4	-
	S5	-
	S6	-
	S7	-
	S8	-
	S9	-
	S10	-
	S11	-
	S12	-
	S13	-
	S14	-

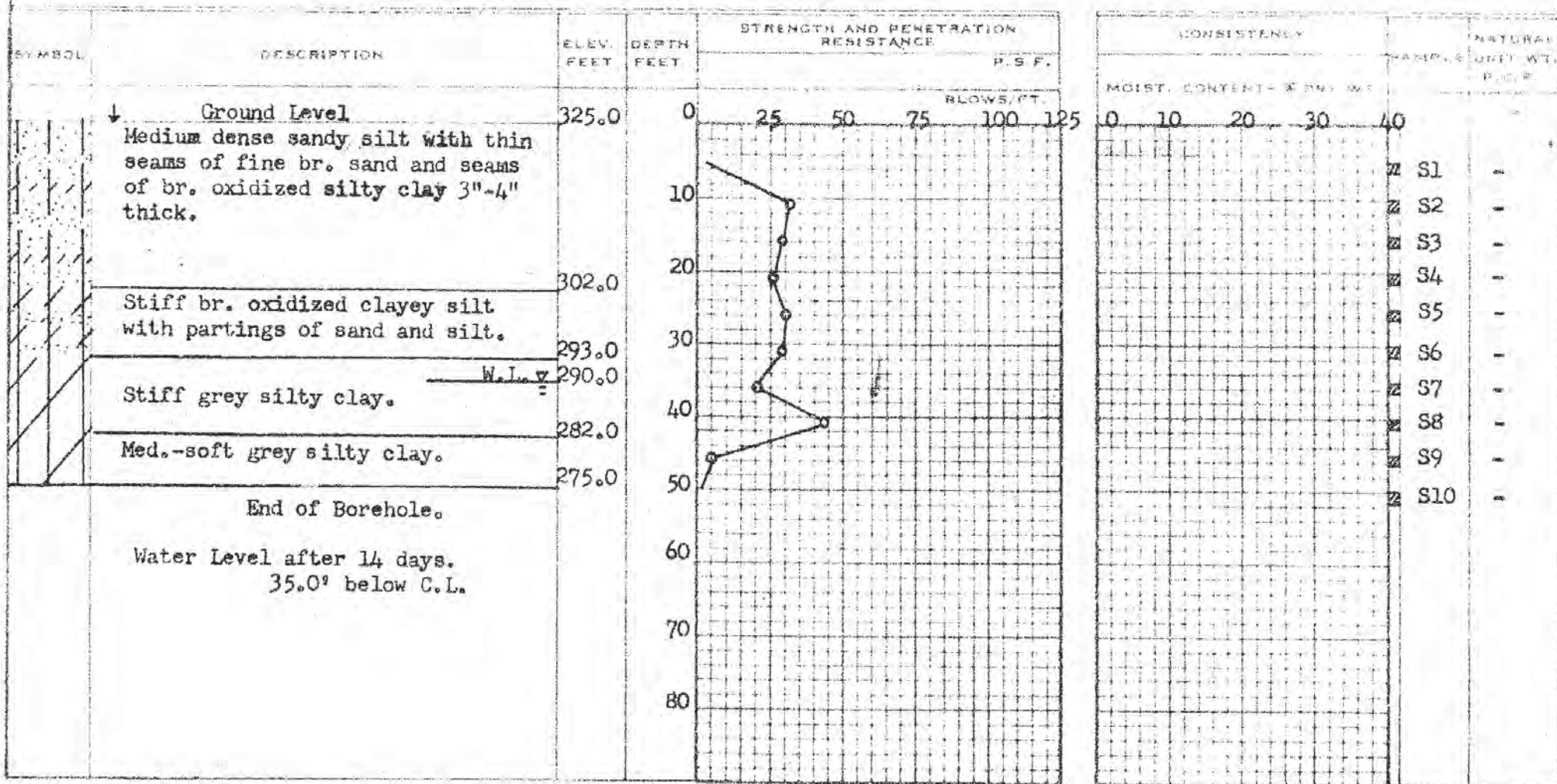
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 140-57-1 BORE HOLE NO. 11
JOB 60-F-6 STATION 225/50 R Ramp 'C'
DATUM G. S. C. COMPILED BY B. K.
BORING DATE Mar. 31/60 CHECKED BY K. G. S.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 140-57-1 BORE HOLE NO. 12

JOB 60-F-6 STATION 473+10 ± W.B.L. 110' Rt

DATUM G. S. C. COMPILED BY B. K.

BORING DATE May 17/60 CHECKED BY K. G. S.

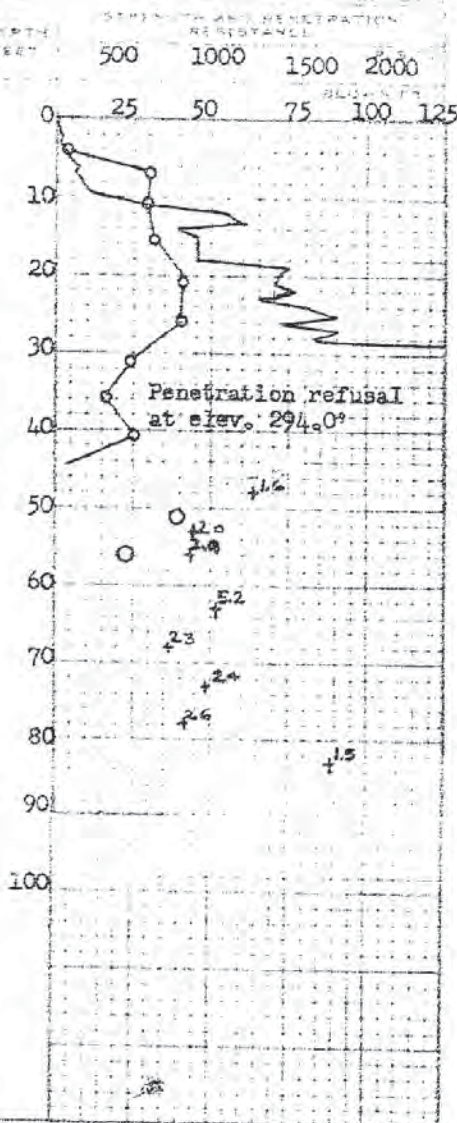
2" DIA. SPLIT TUBE
2" CHLORIDE TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SPLIT TUBE
2" DIA. CONE
2" SPLIT TUBE
2" DIA. CONE

LOGS

1.5% WATER, 60% COMPRESSION (1001)
VOLUME TESTED AND DRY WEIGHT (1001)
NATURAL MOISTURE AND
WATER CONTENT (1001)
1.5% WATER, 60% COMPRESSION (1001)
VOLUME TESTED AND DRY WEIGHT (1001)
NATURAL MOISTURE AND
WATER CONTENT (1001)

DEPTH FEET	DESCRIPTION	ELEV. FEET
0	Ground Level	323.0
0	Topsoil	322.0
0	Loose fill- ashes, sand & gravel.	319.0
10	Very stiff br. Oxidized silty clay cont. thin seams of sand and silt.	
29.5		295.0
30	Stiff gr.-br. clayey silt cont. thin seams of sand and silt.	
38.1		281.0
40	Medium-soft grey silty clay and traces of fine sand and fine gravel.	
78		238.0
80	Stiff grey silty clay.	
100		223.0

End of Borehole.
Penetration Resistance Profile
shown obtained by driving a 2" dia.
cone from ground surface to depth
noted. Cone driven with energy equal
to 350 ft./lbs. per blow.



DEPTH FEET	RESISTANCE LB./SQ. FT.	NATURE
0		S1 -
10		S2 -
20		S3 -
30		S4 -
40		S5 -
50		S6 -
60		S7 -
70		S8 -
80		S9 -
90		T10 -
100		T11 121
110		T12 125
120		T13 -
130		T14 -
140		T15 -
150		T16 -
160		T17 -
170		T18 -
180		S19 -
190		S20 -

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 140-57-1 BORE HOLE NO. 13

JOB 60-F-6 STATION 473+25 W.B.L. 55' Rt

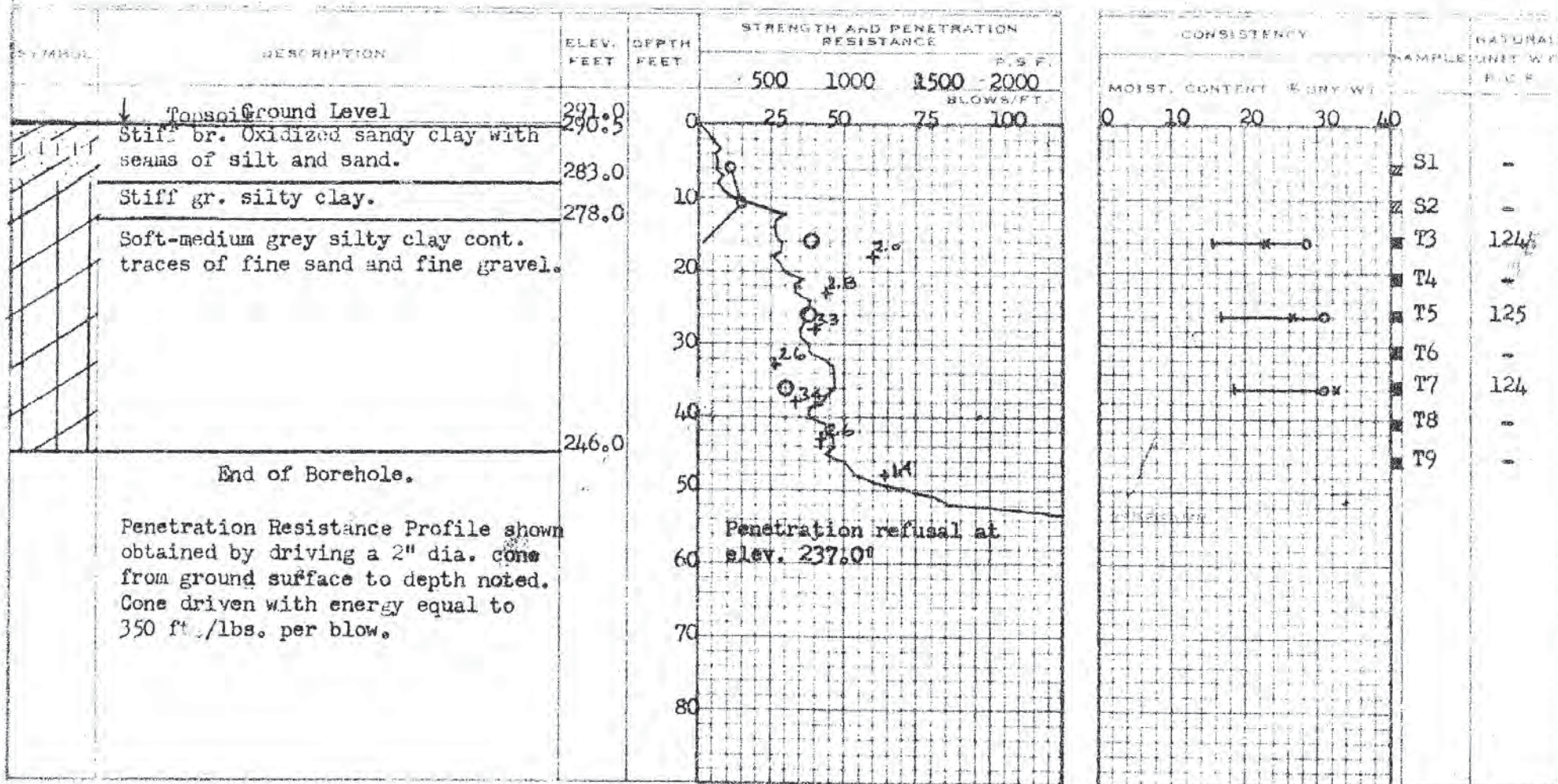
DATUM G. S. C. COMPILED BY B. K.

BORING DATE May 25/60 CHECKED BY K. G. S.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.F. 140-57-1

BORE HOLE NO. 14

JOB 60-F-6

STATION 476+45 W.B.L. 95' Rt 2" DIA. SPLIT TUBE

DATUM G. S. C.

COMPILED BY B.K.

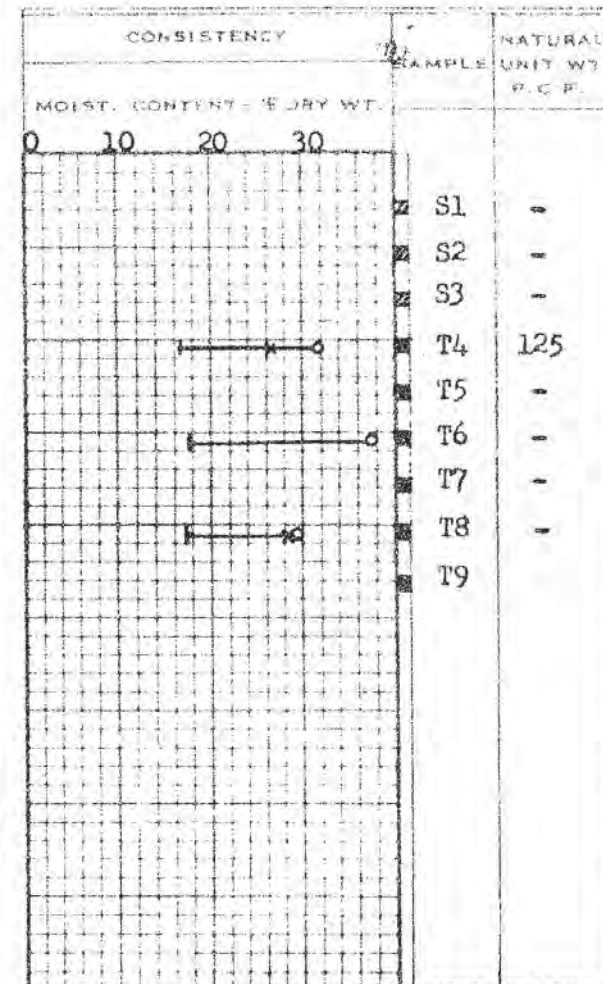
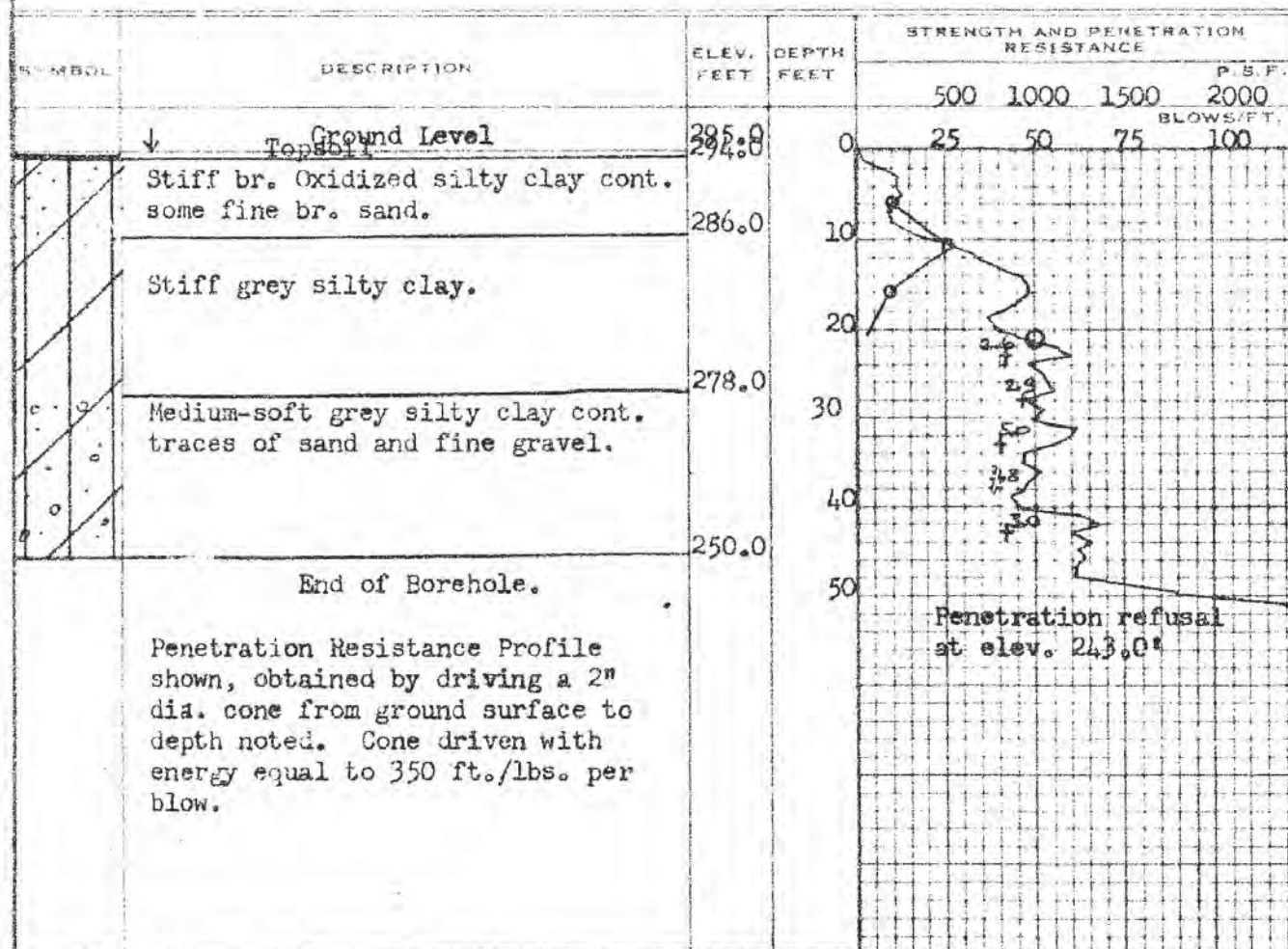
BORING DATE May 26/60

CHECKED BY K. G. S.

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

LEGEND

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



DEPARTMENT OF HIGHWAYS - ONTARIO

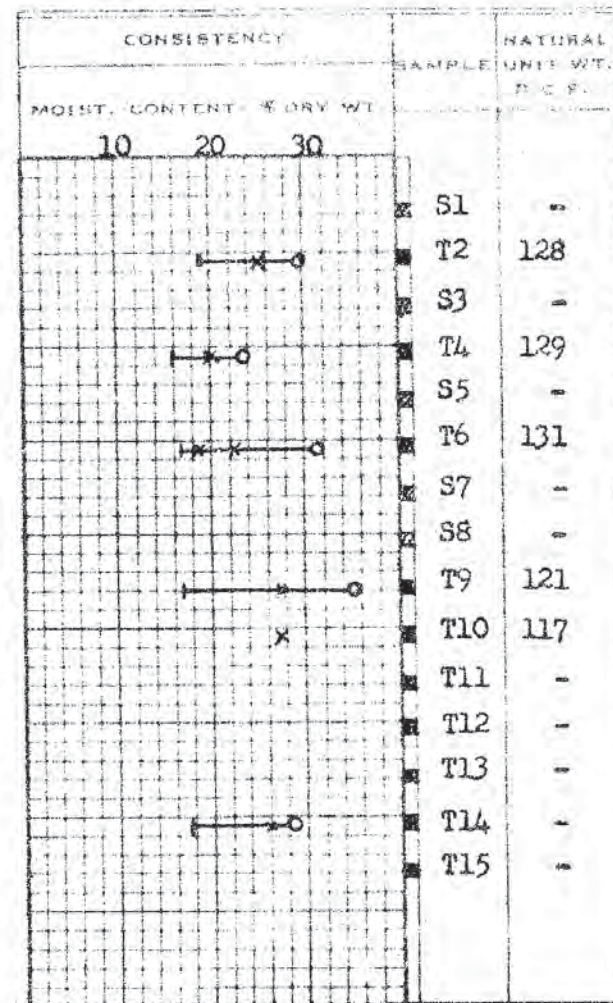
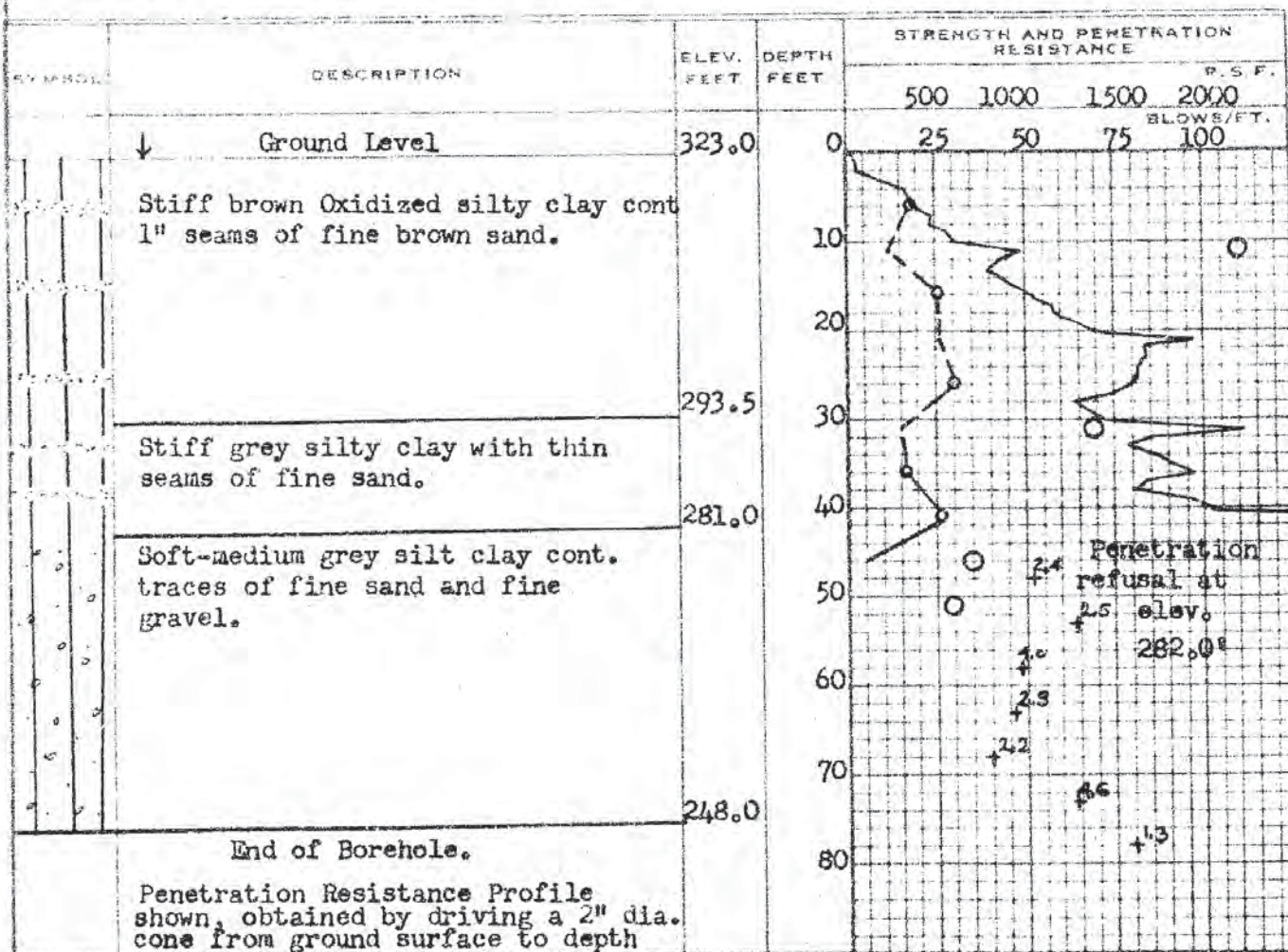
MATERIALS AND RESEARCH SECTION

W.P. 140-57-1 BORE HOLE NO. 15
 JOB 60-F-6 STATION 476+20 & W.B.L. 155' Rt.
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE May 30/60 CHECKED BY K. G. S.

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

LEGEND

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



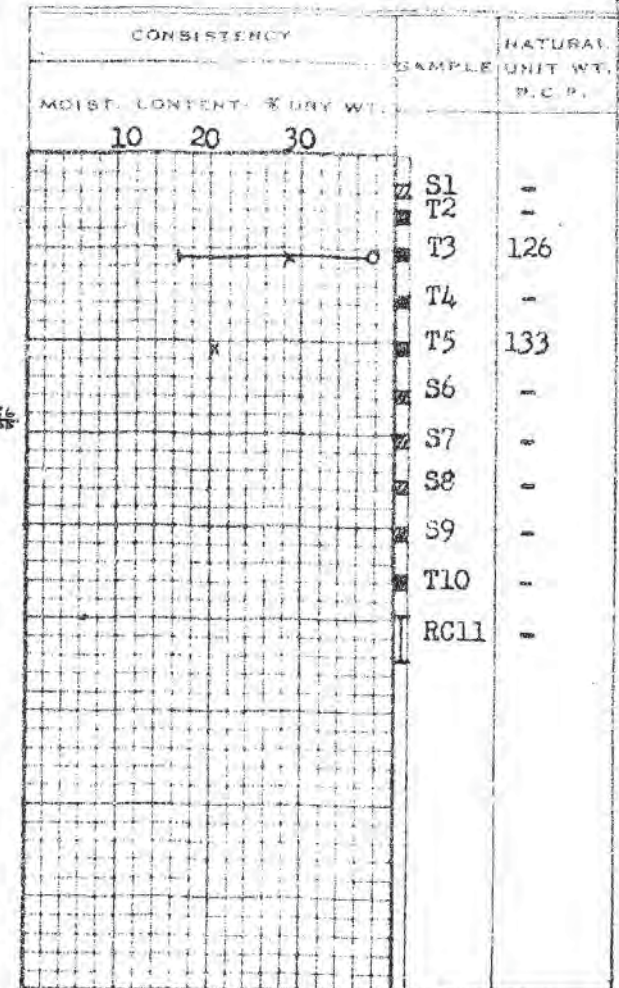
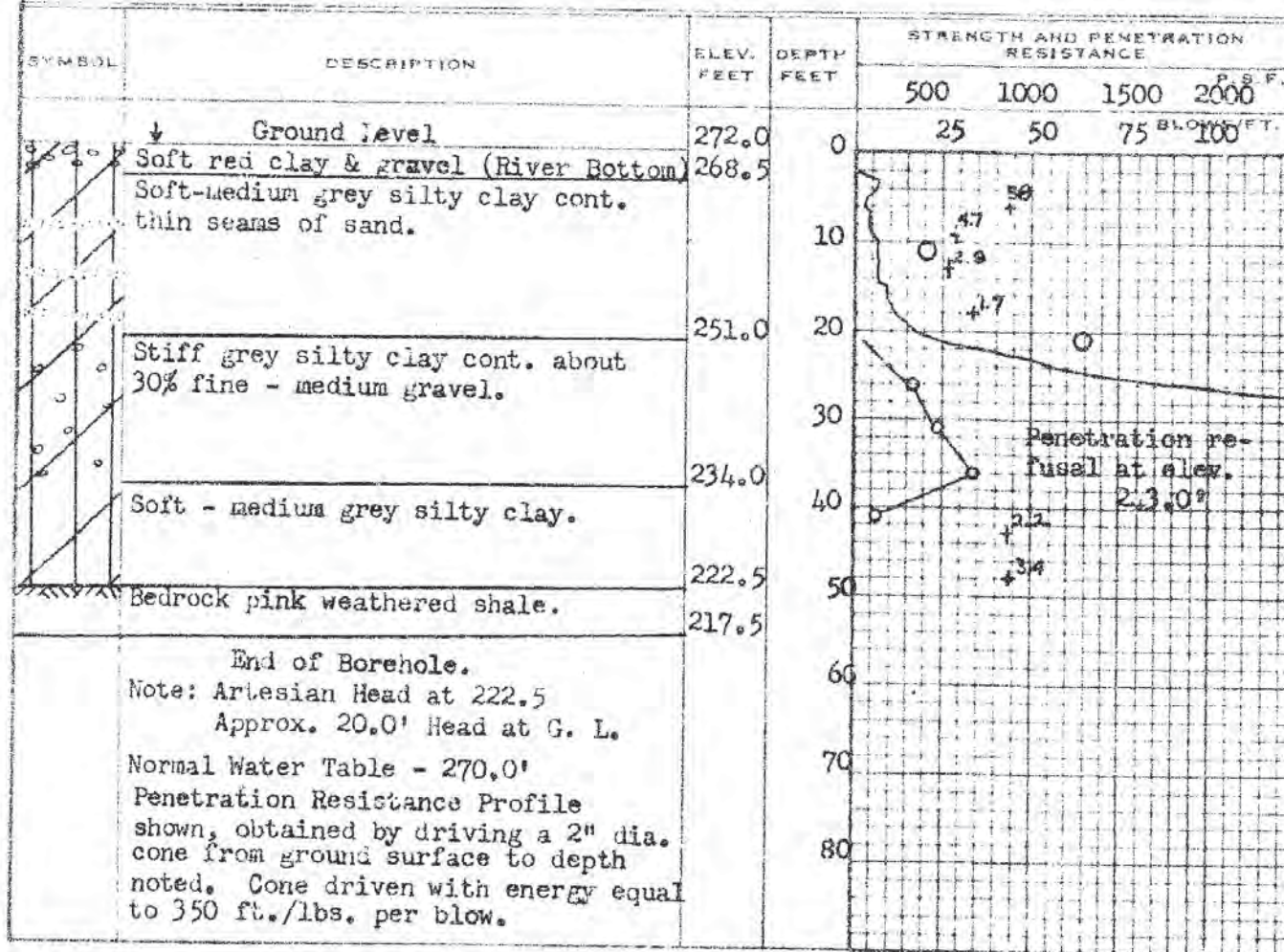
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

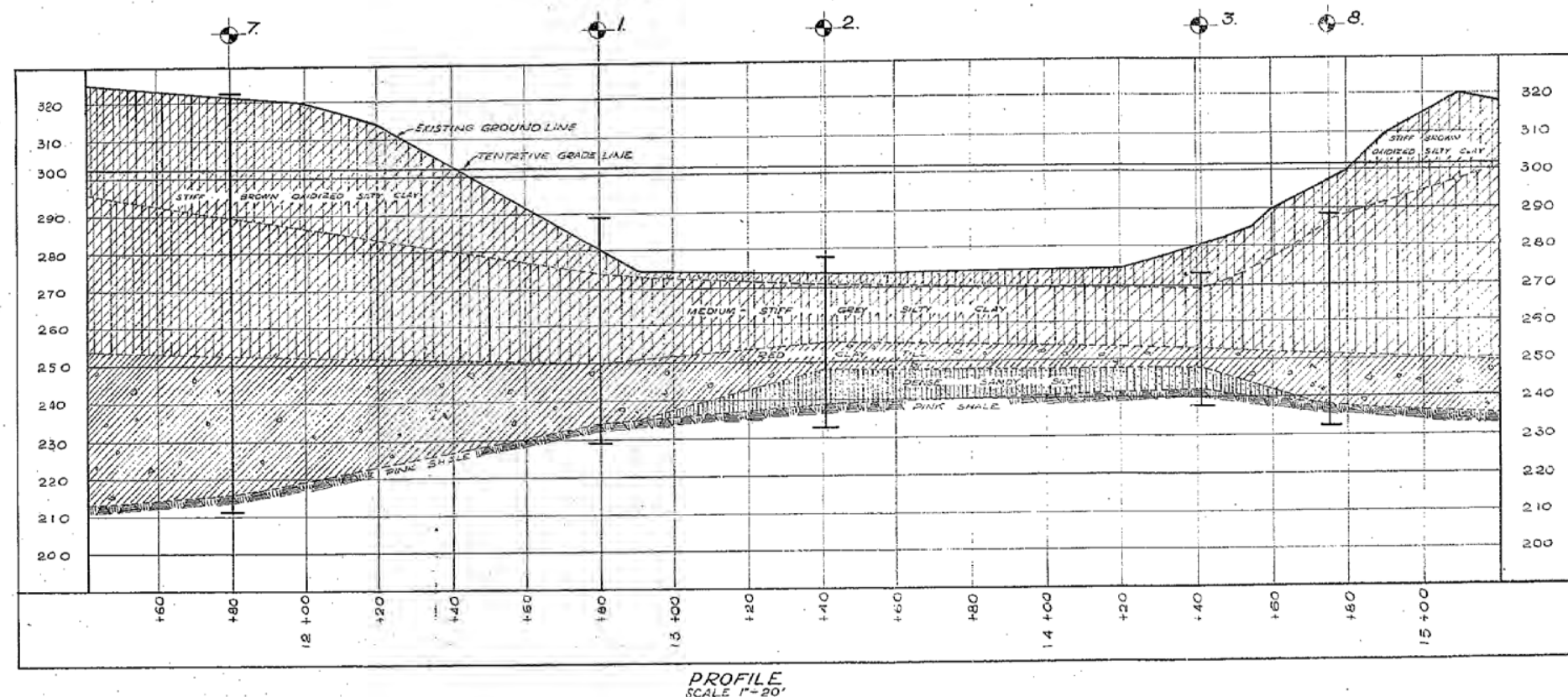
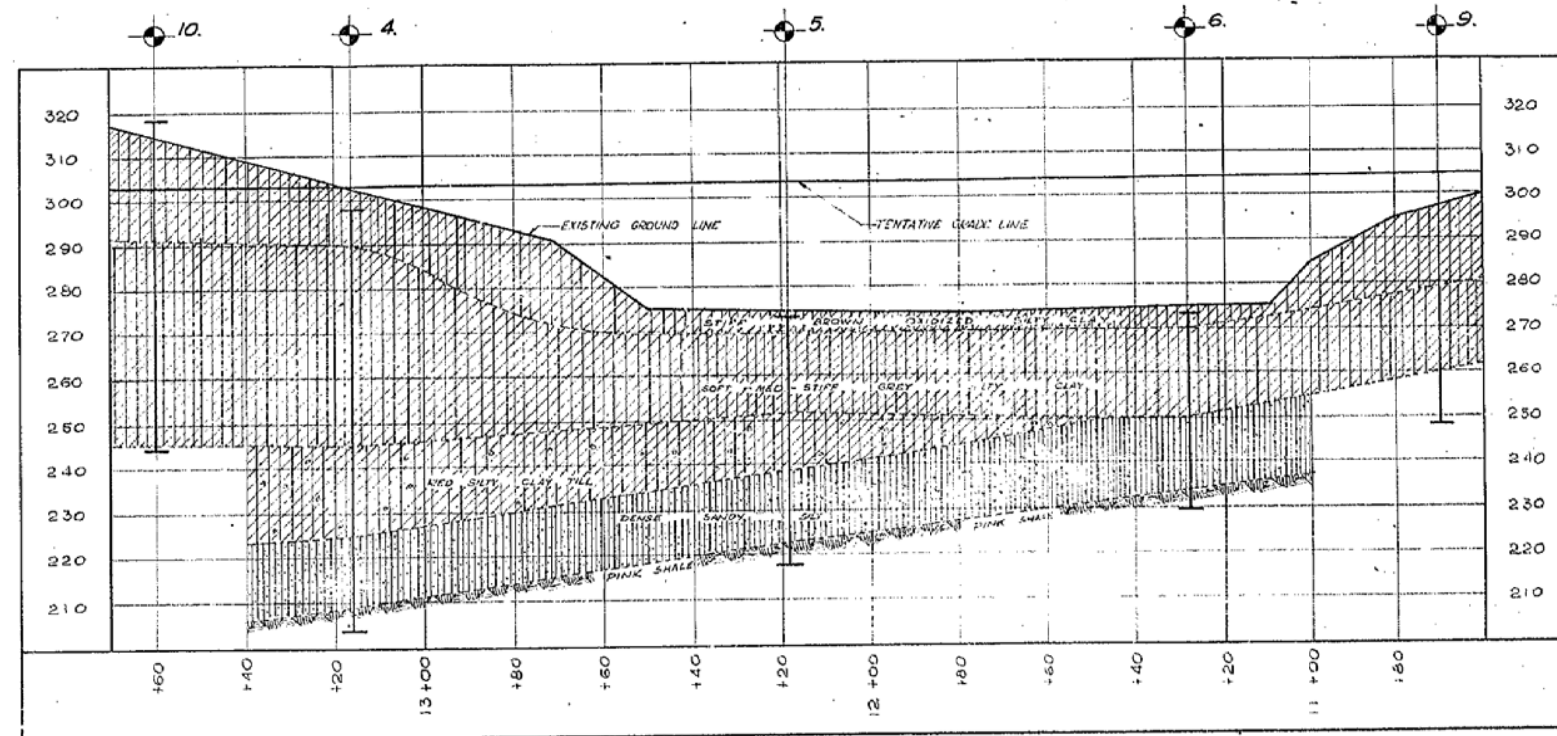
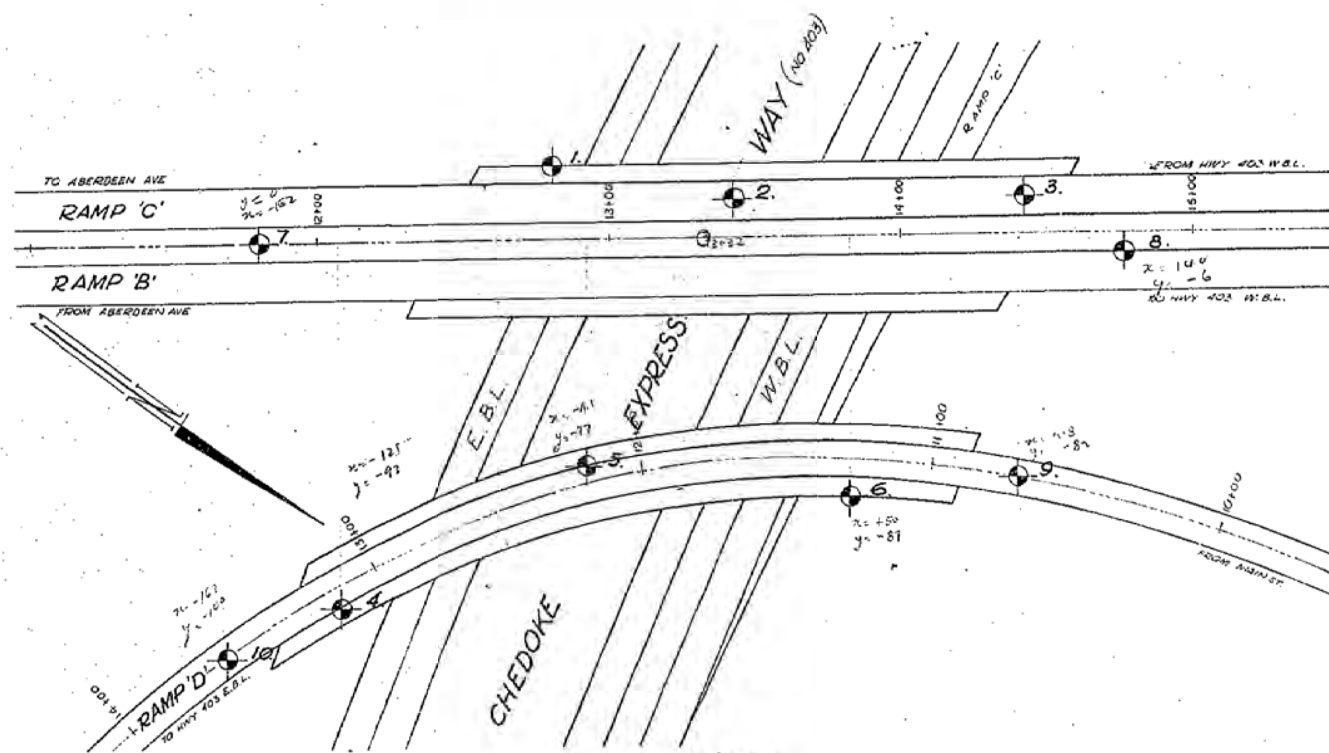
W.P. 140-57-1 BORE HOLE NO. 16
 JOB 60-P-6 STATION 8+35 Ramp 'D' 20' Rt.
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE Apr. 14/60 CHECKED BY K. G. S.

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

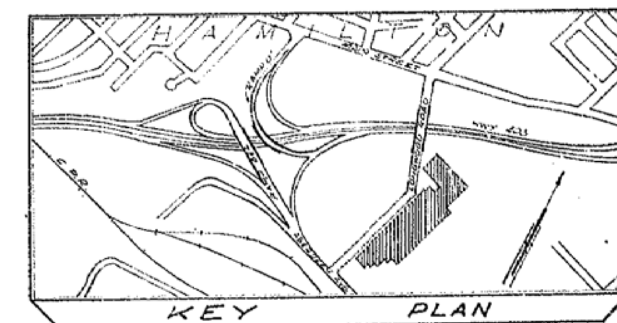
LEGEND

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





LEGEND			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E
1	289.5	12+80	RAMP C & B 25' LT.
2	278.3	13+41	RAMP C & B 12' LT.
3	273.0	14+41	RAMP C & B 12' LT.
4	298.0	13+16	RAMP D 6' LT.
5	273.0	12+19	RAMP D 6' LT.
6	273.0	11+28	RAMP D 16' LT.
7	323.0	11+80	RAMP C & B E.
8	266.0	14+75	RAMP C & B 16' LT.
9	304.0	10+70	RAMP D E.
10	319.0	13+60	RAMP D E.



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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

**ABERDEEN UNDERPASS
RAMPS B, C & D**

SHOWING POSITIONS & ELEVATIONS OF HOLES

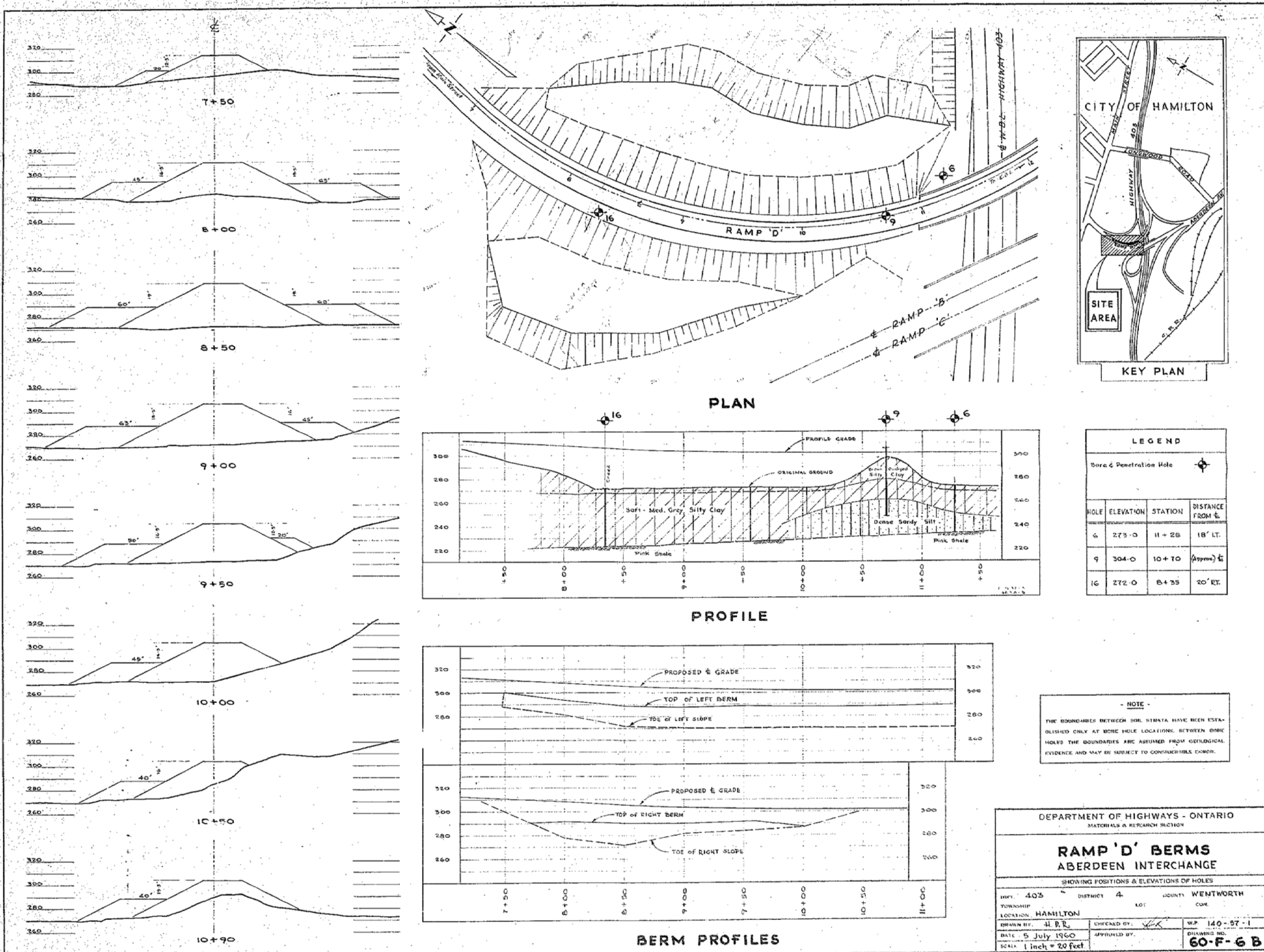
TOWNSHIP: 403 DISTRICT: 4 COUNTY: WENTWORTH

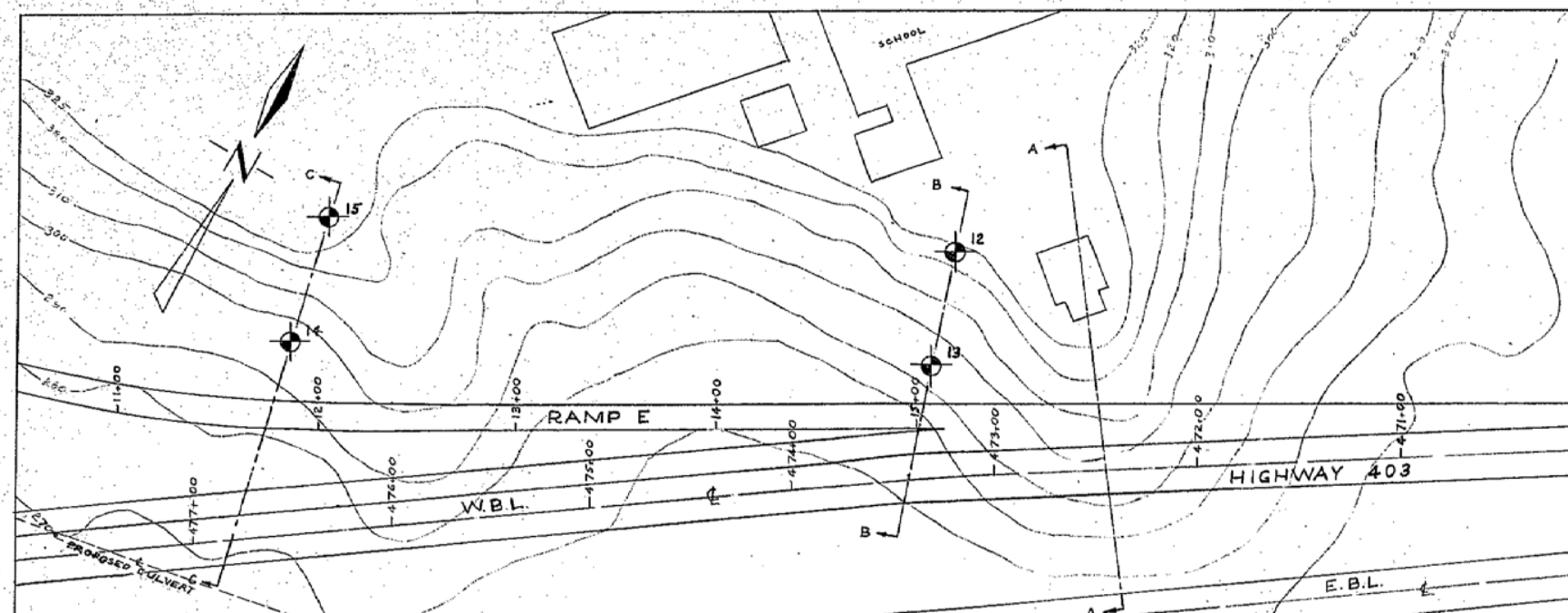
LOCATION: HAMILTON

DRAWN BY: J. G. GORDON CHECKED BY: [Signature] W.P. 266-60 & 192-60

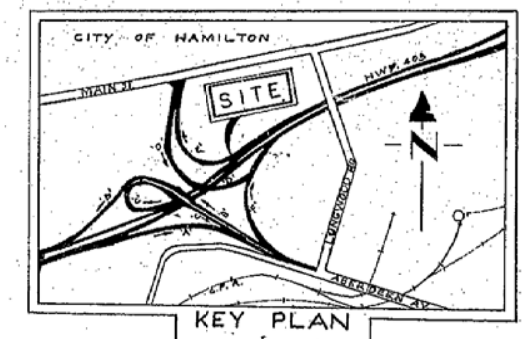
DATE: 20. MAY. 1960 APPROVED BY: [Signature] DRAWING NO. 60-F-6A

SCALE: AS SHOWN



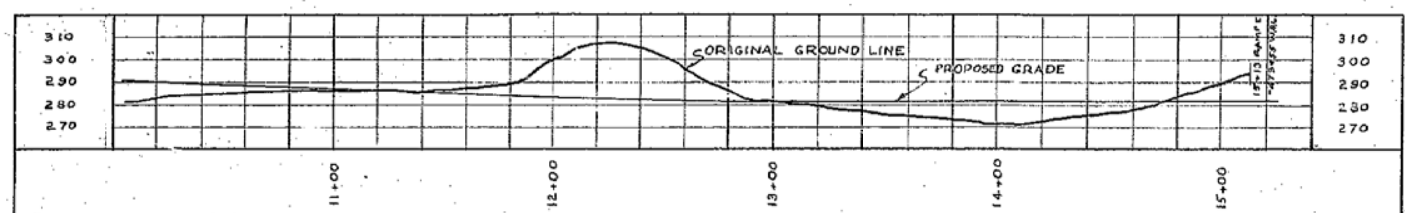


PLAN

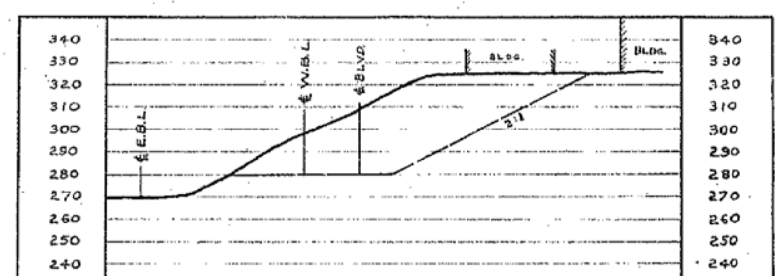


LEGEND

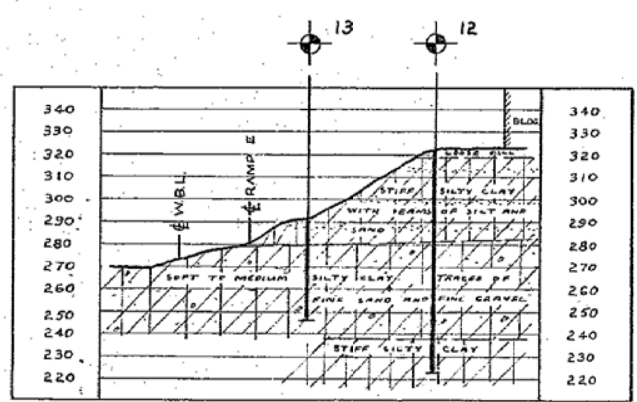
BORE & PENETRATION HOLES			
HOLE	ELEVATION	STATION	DISTANCE FROM E
12	323.0	473+10	110' RT.
13	291.0	473+25	55' RT.
14	285.0	476+20	155' RT.
15	323.0	476+45	35' RT.



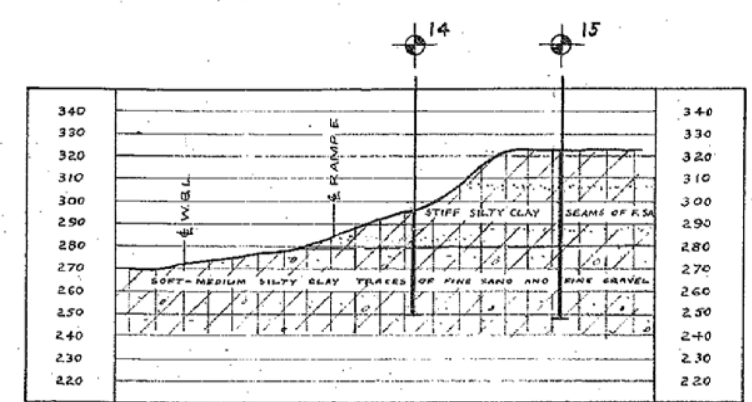
RAMP E PROFILE



A-A



B-B



C-C

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

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

ABERDEEN INTERCHANGE
EARTH CUT AT RAMP 'E' & W.B.L.

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 403 DISTRICT 4 COUNTY WENTWORTH

TOWNSHIP HAMILTON LOT CON.

DRAWN BY: D.A.M. CHECKED BY: [Signature] W.P. 140-57-1

DATE: 5 JULY 1960 APPROVED BY: [Signature] DRAWING NO. 60-F-6C

SCALE: 1" = 40'

Geocres No. 30M5-37

Slope Failure – Hwy. 403, Culvert Sta.'s 105+10 – 106+70

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 64-F-39 LOCATION Hwy. 403 Sta. 105+93 10' Rt. ORIGINATED BY G.C.
W.P. 231-58-3 BORING DATE May 12-13, 1964. COMPILED BY G.C.
DATUM Geodetic 274.55 BOREHOLE TYPE Washboring & Vane Hole CHECKED BY K.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					WATER CONTENT			REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	SOIL / NO.	250	500	750	1000	1250	20	40	60	
274.55 0.0	<u>Clayey silt, firm to very soft.</u> Gray, with layers of brown silty clay between El. 269.5 and El. 264.3		1	TW	PM									123 118 116 125 121 118
			2	TW	PM	3.7	3.7	3.4						
			3	TW	PM	4.4	8.3	4.4						
			4	TW	PM	4.4	5.6							
			5	TW	PM	4.0	5.0	9.3	8.5					
			6	TW	PM			5.5	6.0					
			7	TW	PM			1.6	1.5					
261.05 13.5	<u>Silt, dense</u>		8	SS	5									
258.05 16.5	Gray End of borehole.		9	SS	36									

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

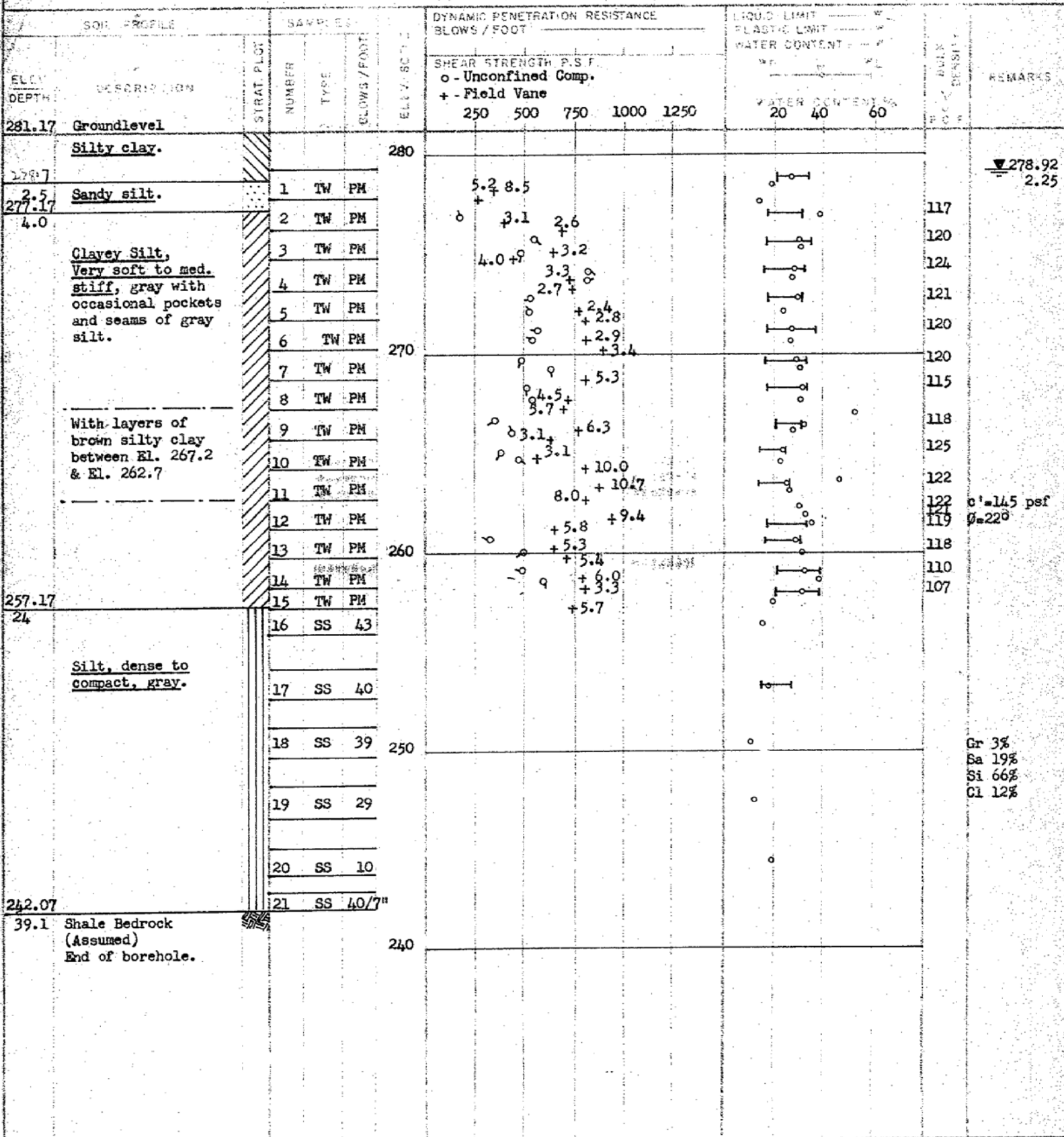
RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 64-F-39
W.P. 231-58-3
DATUM Geodetic 281.17

LOCATION Hwy. 403 Sta. 105+93 32' Rt.
BORING DATE May 14 - 21, 1964.
BOREHOLE TYPE Washboring & Vane Hole

ORIGINATED BY G.C.
COMPILED BY G.C.
CHECKED BY K.S.



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 64-F-39

LOCATION Hwy. 403 Sta. 105+93 61' Rt.

ORIGINATED BY G.C.

W.P. 231-58-3

BORING DATE May 21-26, 1964.

COMPILED BY G.C.

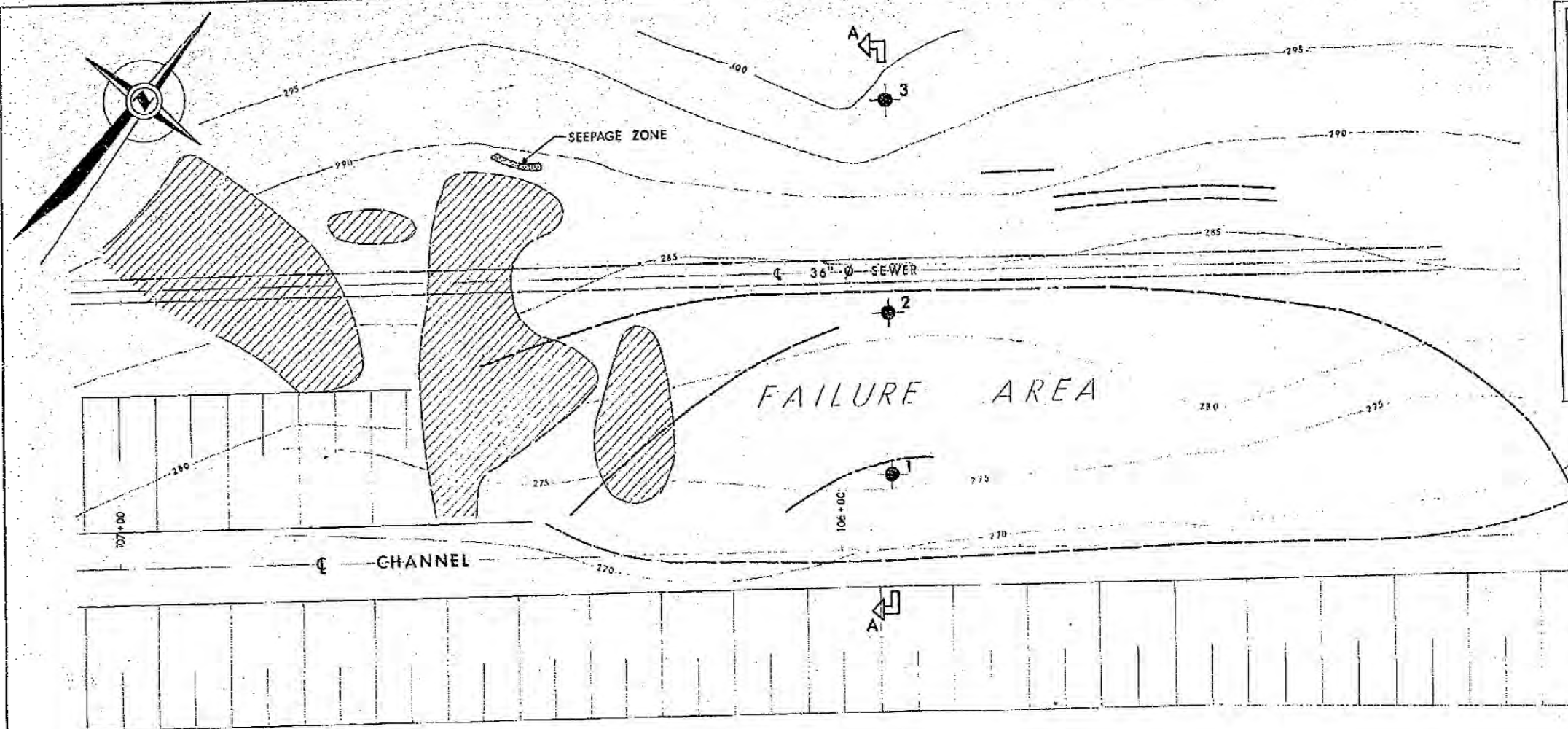
DATUM Geodetic 295.94

BOREHOLE TYPE Washboring & Vane Hole

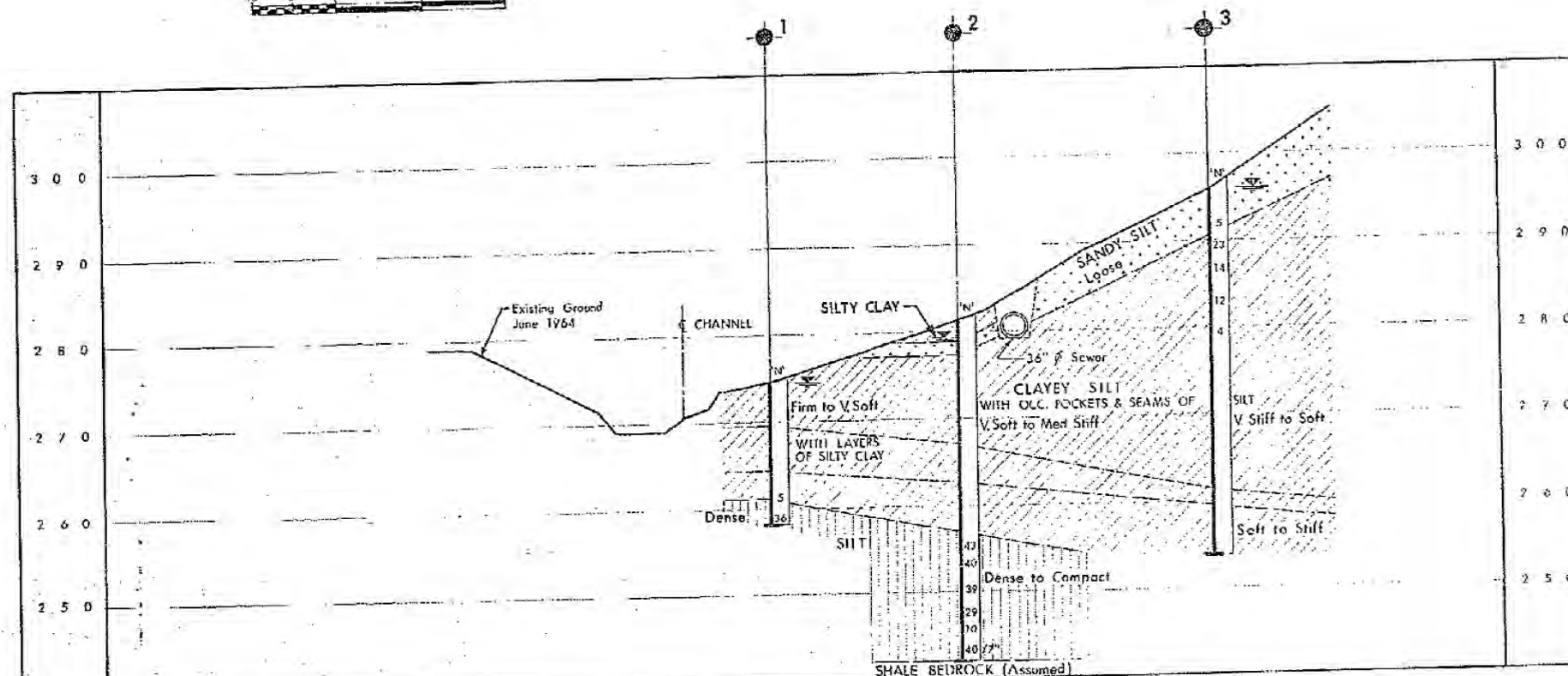
CHECKED BY K.S.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— W PLASTIC LIMIT ——— PL WATER CONTENT ——— W		WATER CONTENT % 20 40 60	WATER CONTENT % 20 40 60	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLAT.	NUMBER TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. o - Unconfined Comp. + - Field Vane					
295.94	Groundlevel				250 500 750 1000 1250					▽295.94 0.0
0.0	Sandy silt, loose, brown.		1 SS 5							
290.94			2 SS 23							
5.0	Clayey silt very stiff to soft, gray, with occasional pockets and seams of gray silt.		3 SS 14							
			4 SS 12							
			5 SS 4							
			6 TW PM							126
			7 TW PM							120
			8 TW PM							121
			9 TW PM							121.5
			10 TW PM							123.5
			11 TW PM							121.5
			12 TW PM							121.5
			13 TW PM							122
			14 TW PM							123
			15 TW PM							124
			16 TW PM							128.5
261.44			17 TW PM							123
34.5	With layers of brown silty clay.		18 TW PM							119
259.94			19 TW PM							120
36.0	Clayey silt, soft to stiff, gray.		20 TW PM							120
			21 TW PM							118
			22 TW PM							130
253.69										
42.25	End of borehole.									

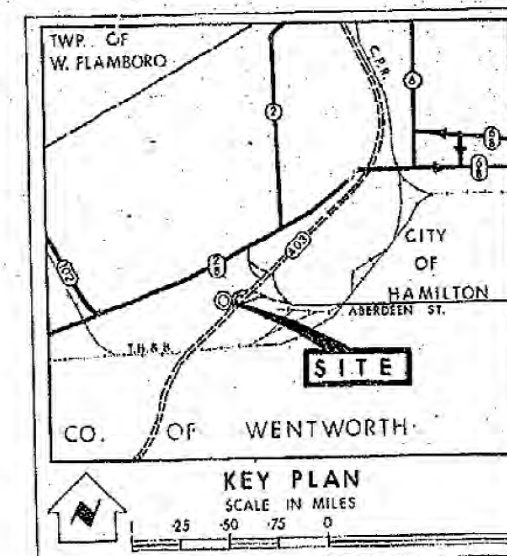
0
15 5 % Strain at Failure
10



PLAN
SCALE
10 5 0 10 20 FT.



SECTION A-A
SCALE
10 5 0 10 20 FT.



E 5 8850
N 49 8755
Z 17

LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation, (May 27, 1964)		
	Wet Area		
	Tension Cracks		
NO.	ELEVATION	STATION	OFFSET
1	274.55	105+93	10' RT.
2	281.17	105+93	32' RT.
3	295.94	105+93	61' RT.

NOTE
THE BOUNDARIES BETWEEN THE STATIONS HAVE BEEN ESTABLISHED ONLY AS MORE OR LESS APPROXIMATE, BEING BASED ON THE FIELD INVESTIGATION AND ASSUMED FROM AERIAL PHOTOGRAPHS AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO			
CHANNEL BANK FAILURE			
CHEROKEE EXPRESSWAY			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
NO. 403	STATION 4	CITY OF HAMILTON	COUNTY WENTWORTH
DATE 15 JULY 1964	APPROVED BY	CHECKED BY	W.P. 238-58-3
SCALE AS SHOWN	DRAWN BY	DATE 15 JULY 1964	W.P. 238-58-3

W.P. 238-58-3
W.P. 238-58-3

Geocres No. 30M5-38

Proposed Railway Underpass on the Ancaster Bypass

Hole Begun _____

Foundation Engineering Division

Hole Ended _____

Engineering Data Sheet for Borehole: 1

Helper _____

Job Name: Foundation Investigation For Railway Underpass

Job Located: Ancaster By-Pass Ontario

Checked by _____

Hole Located: See Enclosure No.1

Hole Elevation: 324.5 Datum: M.S.L.

Day _____ Month _____ Year _____

DEPTH	EL.	THICK- NESS	SYMBOL	DESCRIPTION	Penetration Resistance	SAMPLING METHOD
0	324.5			Ground Surface	20 40 60 80 100	
				Brown medium sand with gravel	SS1	
6	318.5				SS2	
11	313.5			Weathered shale and limestone	10	
15	309.5			Red shale and limestone		

Hole Begun _____

Foundation Engineering Division

Hole Ended _____ Engineering Data Sheet for Borehole: 2

Helper _____

Job Name: Foundation Investigation For Railway Underpass

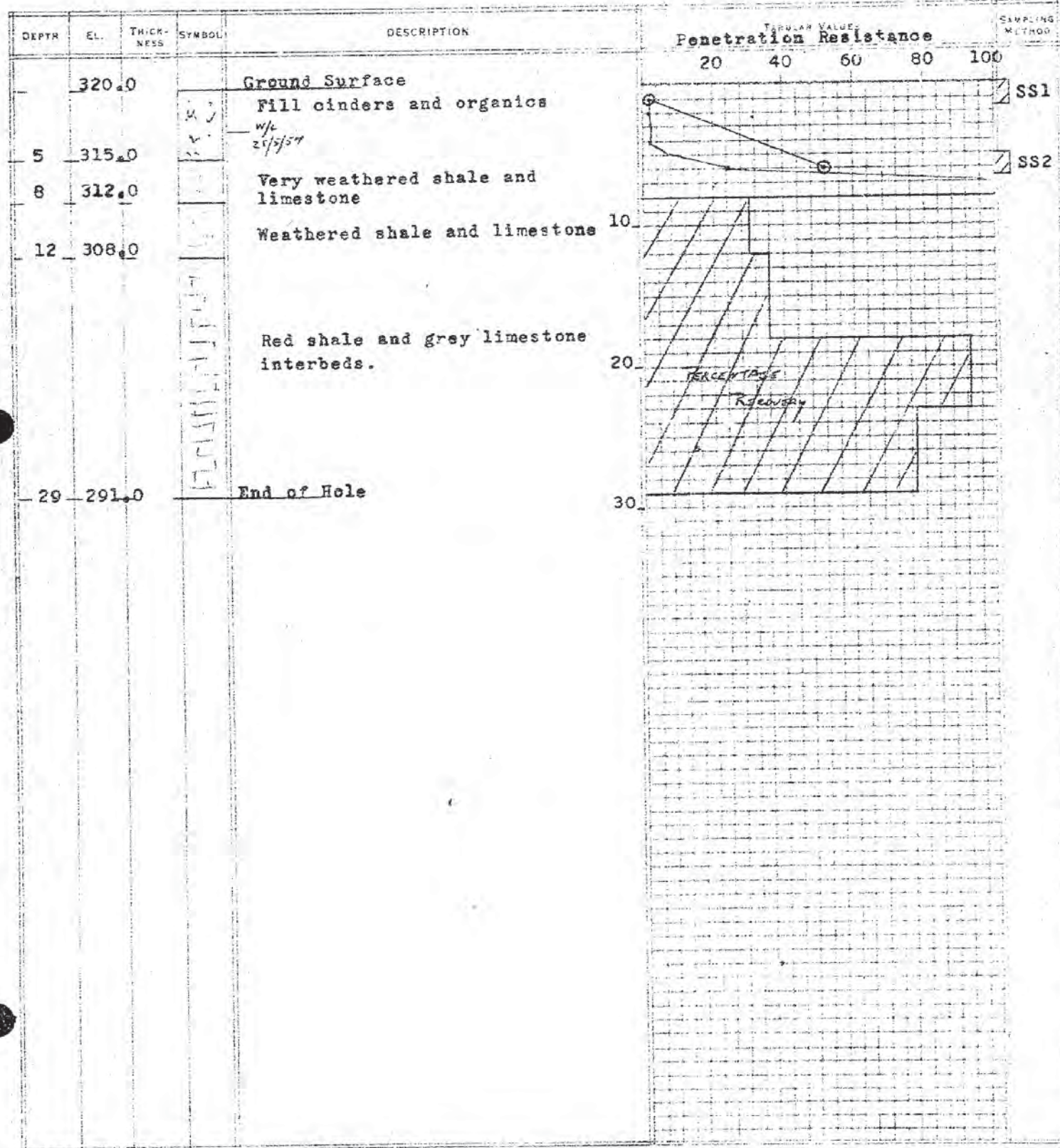
Checked by _____

Job Located: Ancaster By-Pass Ontario

Hole Located: See Enclosure No. 1

Hole Elevation: 320.0 Datum: M.S.L.

Day _____ Month _____ Year _____



Hole Begun _____

Foundation Engineering Division

Hole Ended _____ Engineering Data Sheet for Borehole: 3

Helper

Job Name: Foundation Investigation For Railway Underpass

Job Located: Ancaster By-Pass Ontario

Checked by

Hole Located: See Enclosure No. 1

Hole Elevation: 327.0 Datum: M.S.L.

Day Month Year

DEPTH	EL.	THICK- NESS	SYMBOL	DESCRIPTION	Penetration Resistance	SAMPLING METHOD
0	327.0			Ground Surface	20 40 60 80 100	
3	324.0			Soft brown clayey organic topsoil		SS1
5	322.0			Loose brown sand		SS2
11	216.0			Very stiff greyish brown clay with silt and sand partings		TW3
				Weathered shale		SS4
				Slightly weathered shale and limestone		
30				End of Hole		

Order No.: S/500/T-745 RACEY, MACCALLUM AND ASSOCIATES

LIMITED

Printer

Hole Begun _____

Foundation Engineering Division

Hole Ended _____

Engineering Data Sheet for Borehole: 4

Helper

Job Name: Foundation Investigation For Railway Underpass

P.M.

Job Located: Ancaster By-pass Ontario

Checked by

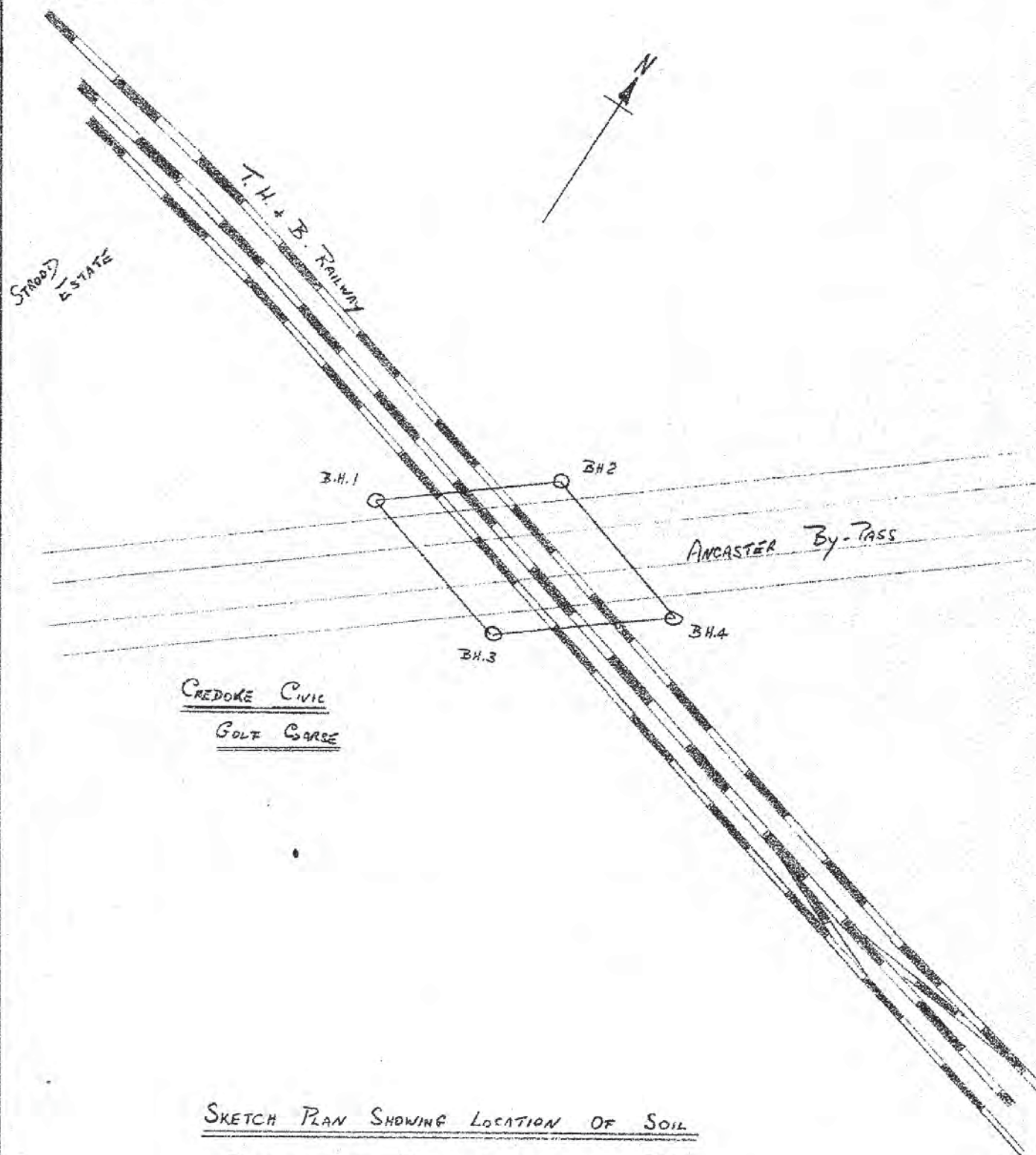
Hole Located: See Enclosure No. 1

Hole Elevation: 325.4 Datum: M.S.L.

Day Month Year

DEPTH	EL.	THICK- NESS	SYMBOL	DESCRIPTION	TABULAR VALUES Penetration Resistance					SAMPLING METHOD
					20	40	60	80	100	
0	325.4			Ground Surface						
				Black dirt fill cinders and organics						SS1
4	321.4			Medium dense brown sandy clay with some gravel & weathered shale						SS2
8	317.4			Slightly weathered red shale and limestone interbeds						SS3
16	309.4			End of Hole						

Prep. By P.M.



SKETCH PLAN SHOWING LOCATION OF SOIL

INVESTIGATION BOREHOLES FOR THE PROPOSED

T.H. & B RAILWAY UNDERPASS ON THE ANCASTER

By-Pass, ANCASTER ONTARIO

Geocres No. 30M5-39

Proposed Subway at Chedoke Expressway and T.H.&B. Railway Crossing

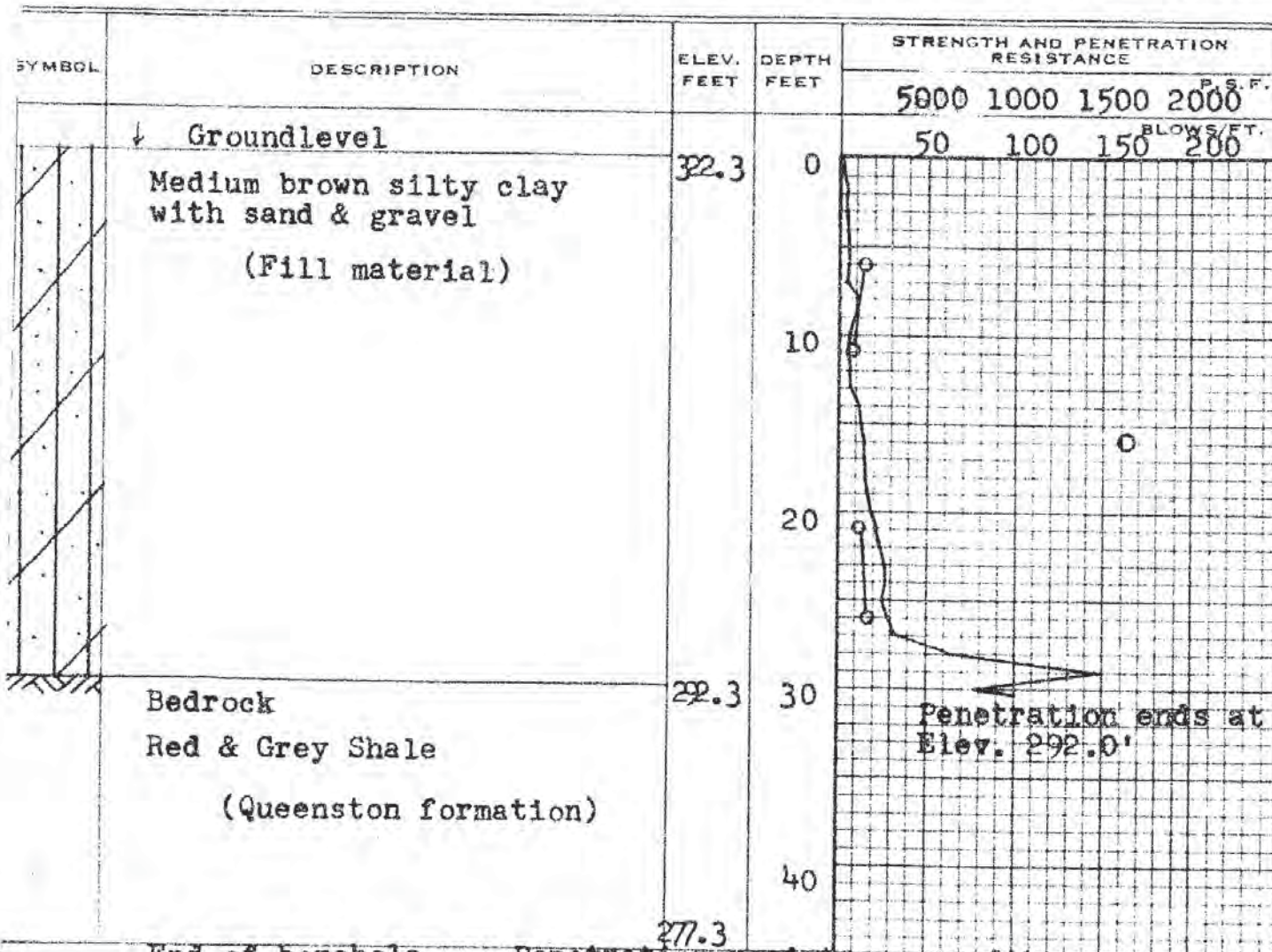
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

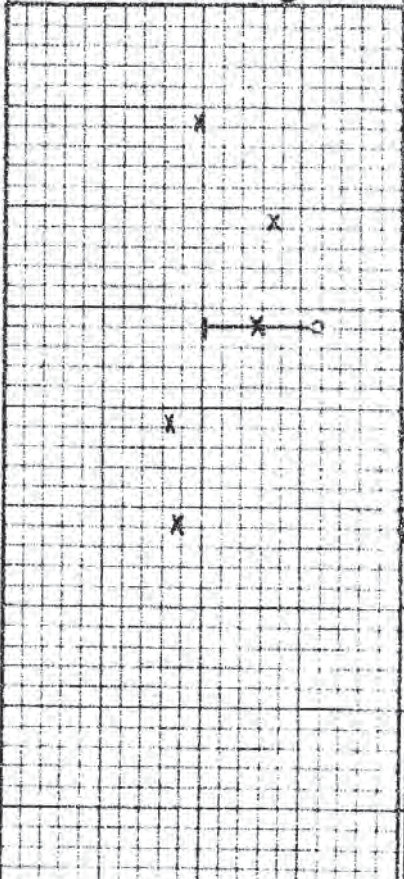
N.P. 144-60 BORE HOLE NO. 1
JOB F 59-109 STATION 503+40 (55' RT)
DATUM 322.3' COMPILED BY B.K.
BORING DATE Nov. 2/59. CHECKED BY V.K. & A.L.

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

LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.				
10	20	30		
			S1	-
			S2	-
			T3	125.0
			S4	-
			S5	-
			Rc6	-
			Rc7	0
			Rc8	--

Penetration resistance profile shown, obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350' lb. per blow.

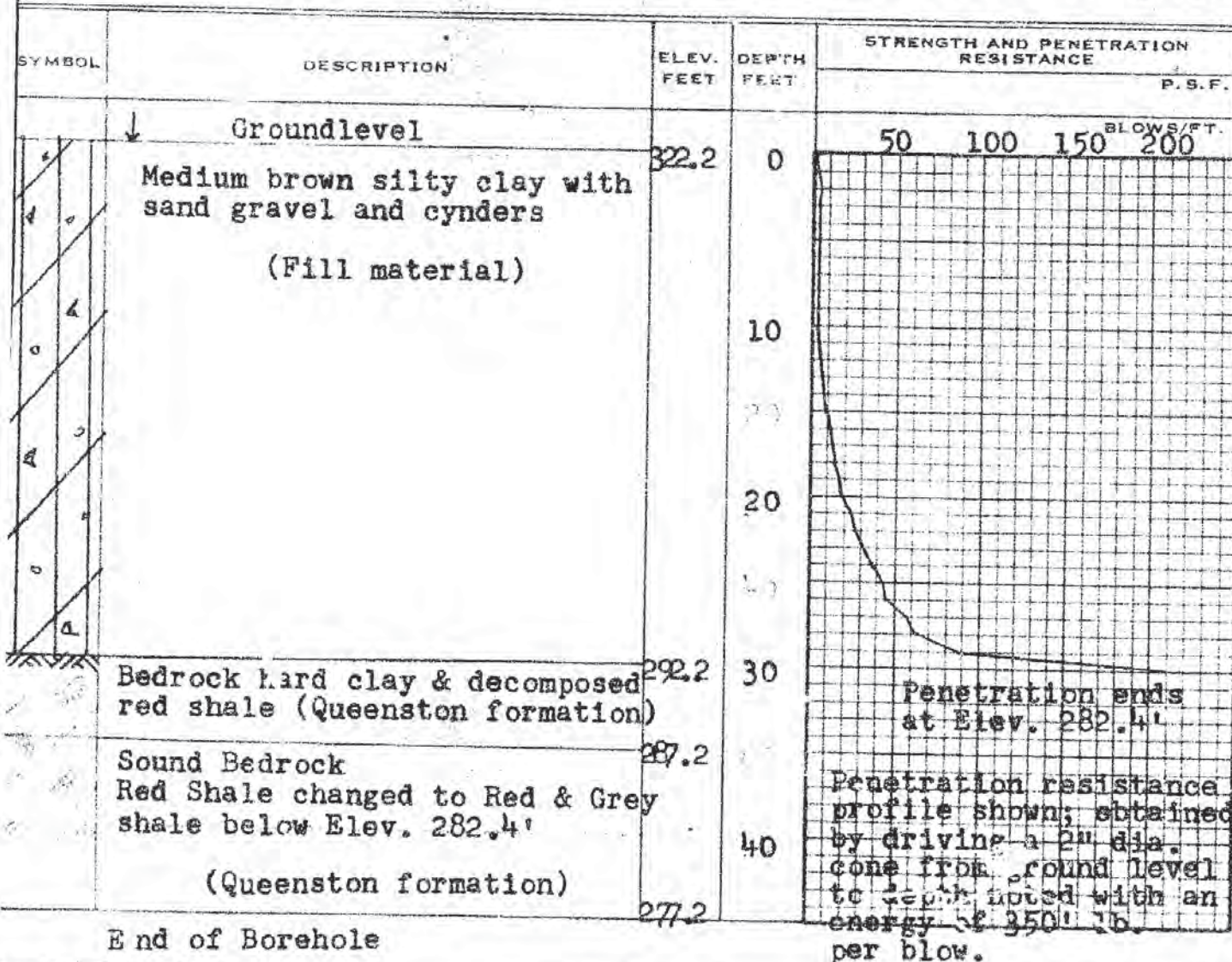
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 144-60 BORE HOLE NO. 2
 JOB F 59-109 STATION 503+07 (1' LT)
 DATUM 322.4' COMPILED BY B.K.
 BORING DATE Nov. 5/59. CHECKED BY V.K. & A.L.

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

LEGEND

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



CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT - % DRY WT.		
	Rc1	-
	Rc2	-
	Rc3	-

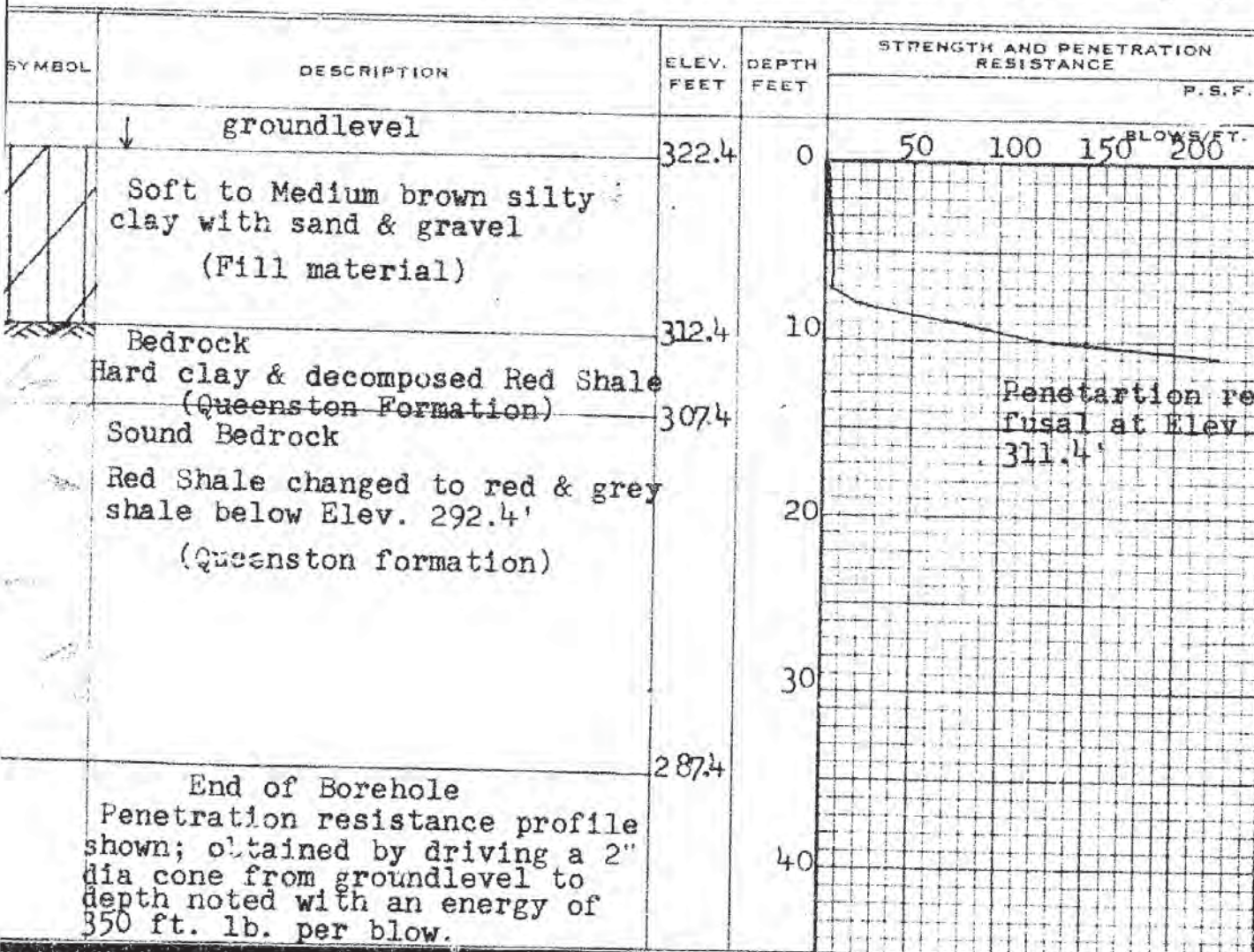
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

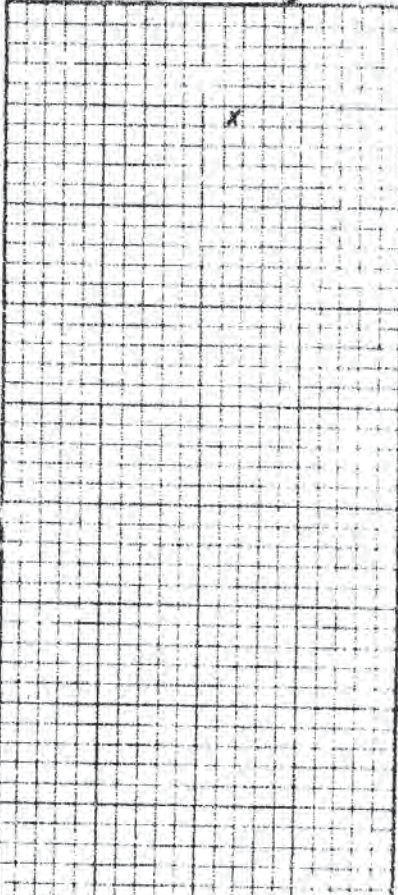
W.P. 144-60 BORE HOLE NO. 3
JOB F 59-109 STATION 502+78 (51' LT)
DATUM 322.4' COMPILED BY B.K.
BORING DATE Nov. 6/59 CHECKED BY V.K. & A.L.

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

LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			S 1	-
			RC 2	-
			RC 3	-
			RC 4	-
			RC 5	-
			RC 6	-

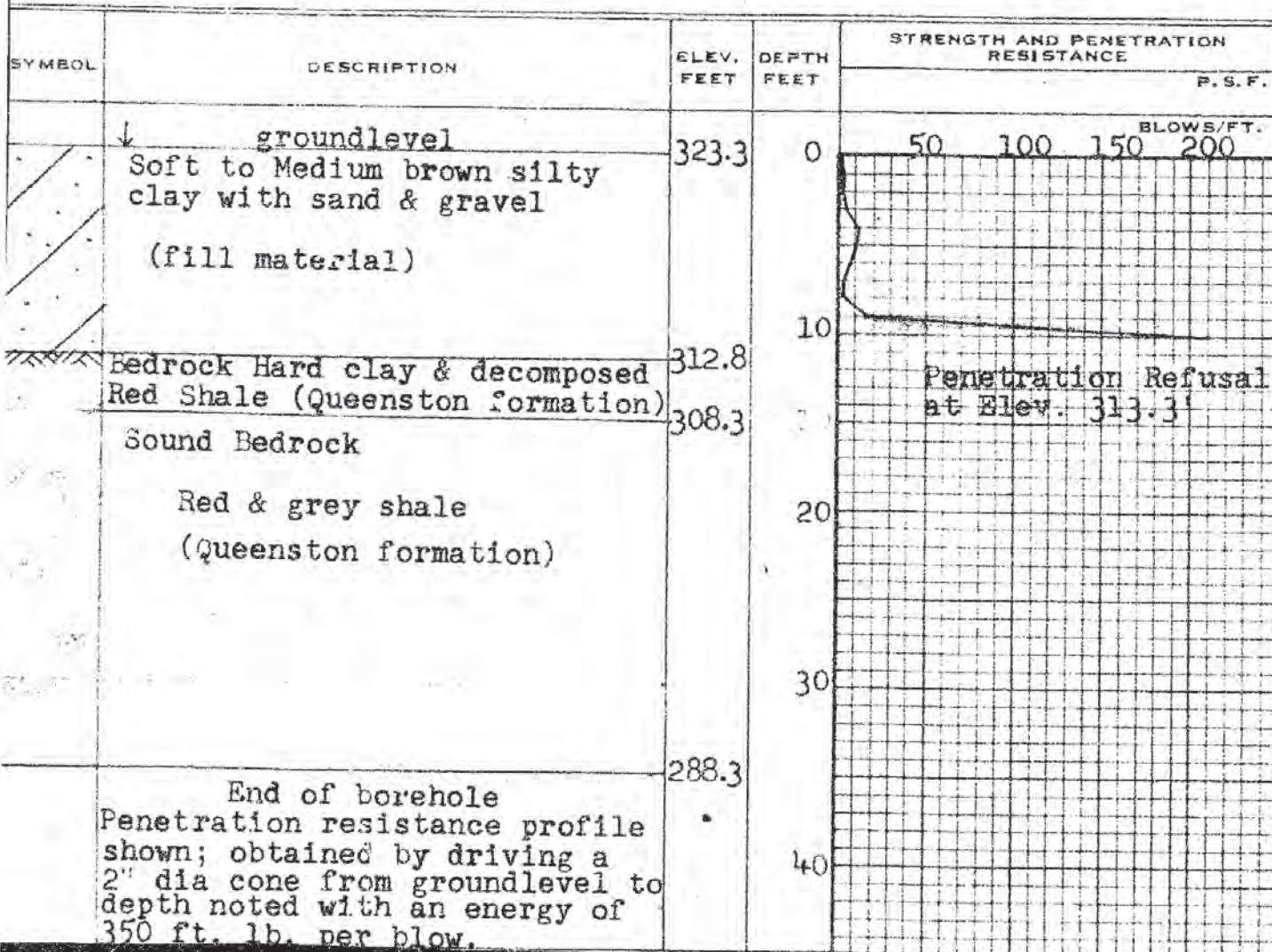
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 144-60 BORE HOLE NO. 4
JOB F 59-109 STATION 501+90(66' LT)
DATUM 323.3' COMPILED BY B.K.
BORING DATE Nov. 10/59 CHECKED BY V.K. & A.L.

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

LEGEND

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



CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT - % DRY WT.		
10 20 30		
	S 1	-
	S 2	-
	RC 3	-
	RC 4	-
	RC 5	-
	RC 6	-
	RC 7	-

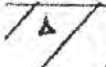
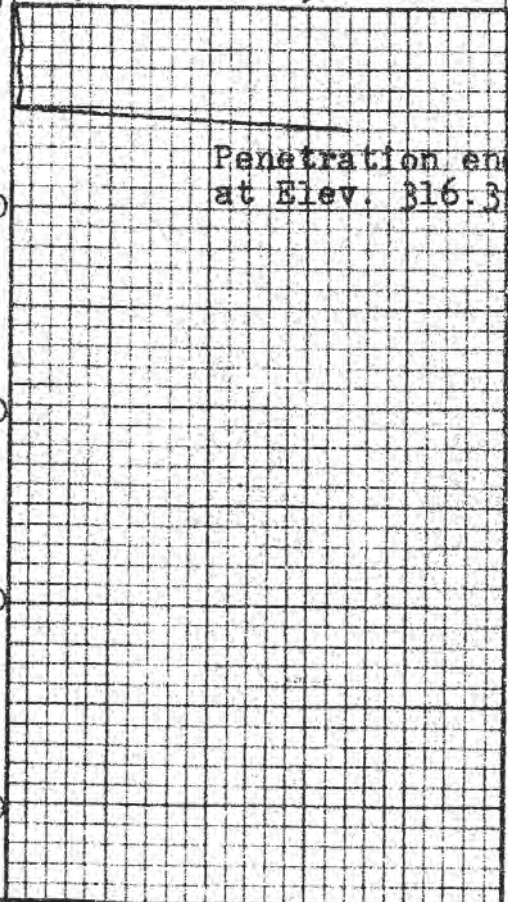
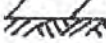
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 144-60 BORE HOLE NO. 5
 JOB F 59-109 STATION 501+77 (2' RT)
 DATUM 322.3' COMPILED BY B.K.
 BORING DATE Nov. 12/59 CHECKED BY V.K. & A.L.

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

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
				P.S.F.				
	groundlevel			50	100 150 200	MOIST. CONTENT- % DRY WT.		
	Soft brown silty clay with cynders (fill material)	294.8	0				RC	-
	Bedrock	289.8						
	Red to grey shales (Queenston Formation)	284.8	10	Penetration ends at Elev. 316.3'				
	End of borehole							
	Penetration resistance profile shown; obtained by driving a 2" dia cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		20					
			30					
			40					

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 144-60 BORE HOLE NO. 6
JOB F 59-109 STATION 502+11 (54' RT)
DATUM 295.0' COMPILED BY B.K.
BORING DATE Nov. 12/59 CHECKED BY V.K. & A.L.

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

LEGEND

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	↓ groundlevel	295.0	0	50 100 150 200	BLOWS/FT.
	Soft brown silty clay with sand (fill material)	291.0			
	Bedrock Red & grey shale (Queenston formation)	285.0	10	Penetration ends at Elev. 290.7'	
	End of borehole				
	Penetration resistance profile shown; obtained by driving a 2" dia cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.				

CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT - % DRY WT.		
	RC1	-

MATERIALS AND RESEARCH SECTION

BORE HOLE NO. 7

STATION 503+92 (51' LT)

COMPILED BY B.K.

CHECKED BY V.K. & A.L.

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

LEGEND

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




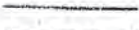


SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	↓ groundlevel				
	Medium brown silty clay with some sand	324.2	0	50	100 150 200
	Bedrock Red & grey Shale (Queenston formation)	315.0	10	Penetration Refusal at Elev. 315.0'	
	End of borehole	295.0	30		
	Penetration resistance profile shown; obtained by driving a 2" dia cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		40		






CONSISTENCY		SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT- % DRY WT.			
10	20	30	
			S 1 -
			RC 2 -
			RC 3 -
			RC 4 -
			RC 5 -

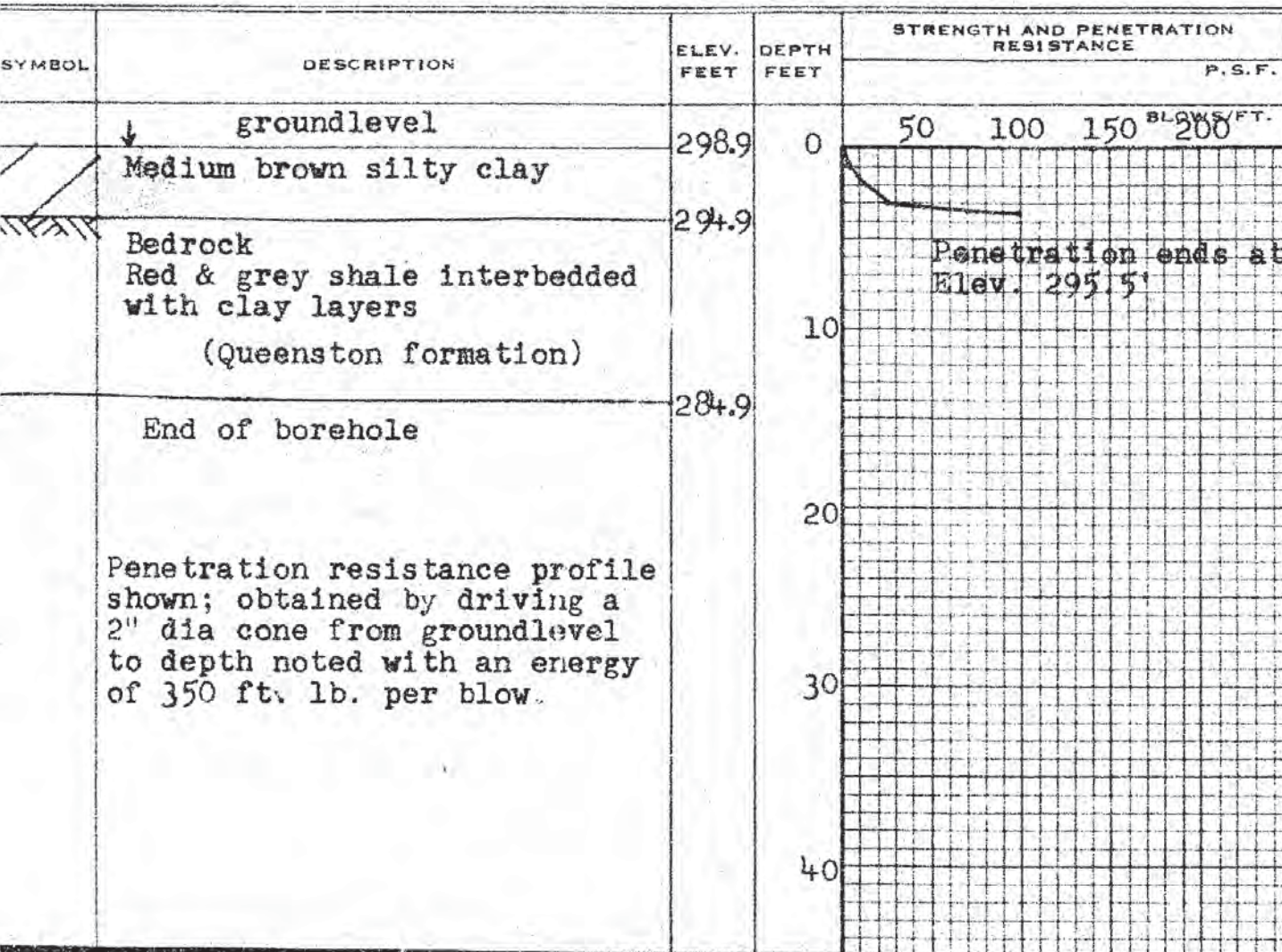
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 144-60 BORE HOLE NO. 8
 JOB F 59-109 STATION 504+58 (44' RT)
 DATUM 298.9' COMPILED BY B.K.
 BORING DATE Nov. 17/59 CHECKED BY V.K. & A.L.

LEGEND

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

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



CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
MOIST. CONTENT-- % DRY WT.		
	H 1	-
	RC 2	-
	RC 3	-

Appendix F

List of OPS Specifications

List of OPS Documents Referenced in this Report

- OPSS.PROV 501
- OPSS.PROV 804
- OPSS 902
- OPSS.PROV 1010
- OPSS.PROV 1205
- OPSD 802 and 803 Series
- OPSD 810.010
- OPSD 3121.150