

GEOCRES No. 30M15-97

DIST. 6 REGION

W.P. No. EGG-000-35

CONT. No. 601

W. O. No.

STR. SITE No.

HWY. No.

LOCATION WPCP ACCESS ROAD BRIDGE

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FOUNDATION INVESTIGATION
W.P.C.P. ACCESS STRUCTURE
W.P. EGG-000-35
DISTRICT 6
WHITBY, ONTARIO

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FINAL

B.P. WALKER ASSOCIATES LTD.

B.P.Walker Associates Ltd.

Consulting Geotechnical, Inspection and Testing Engineers

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(416)491-4075

January 9th, 1984

Project No. 1744-9/3

Ministry of Transportation
and Communications
1201 Wilson Avenue
DOWNSVIEW, Ontario
M3M 1J8

ATTENTION: Mr. M. Devata, P. Eng.

Foundation Investigation
W. P. C. P. Access Structure
W. P. EGG-000-35
District 6
WHITBY, Ontario

Dear Sir:

INTRODUCTION

This report contains the results and recommendations of a foundation investigation carried out at the site of the above mentioned project during the period of August 30th to September 6th, 1983 *and during the period December 15 and 16, 1983.*

The fieldwork consisted of eighteen (18) sampled boreholes advanced by means of continuous flight auger machines, bombardier mounted CME 55 and CME 45, equipped with 10 cm O.D. solid stem auger. The boreholes ranged from 5.8 m to 12 m below the existing ground surface.

SITE DESCRIPTION AND GEOLOGY

The site is located south of Hwy 401, between Hwy 401 and Victoria Street, and west of Dunlop Drive, in the Town of Whitby in Regional Municipality of Durham.

The area is located in the physiographical region known as the Iroquois Plain. In this area the subsoil is a mosaic of till plains, drumlins and areas of silty lacustrine deposits. The topography is flat to gently rolling.

SUBSURFACE CONDITIONS

Subsurface conditions at the site were found to be fairly uniform. With the exception of 1 borehole, borehole 11, fill was encountered at all boreholes varying in depth from 1.2m to 3.8m. The original ground is predominately a glacial till composed of a mixture of sand and gravel with silt and traces of clay. The lower boundry of this deposit is on shale bedrock, proven by coring on borehole 102.

A detailed description of the soil encountered in each borehole is given in the Record of Borehole sheets. The estimated stratigraphical profile and the sections shown on Drawing EGG-000-35 A&B are based upon this information. The location of the boreholes is shown on drawing EGG-000-35A. From the ground level downwards, the subsurface conditions are as follows.

FILL MATERIAL

With the exception of borehole 11 fill was encountered at all borehole locations varying in depth from 1.2m to 3.8m. The composition of the fill varies considerably over the site from a silty clay with sand and trace of gravel, organics, paper and odd debris and clean silty sand with trace of gravel and sand.

Standard Penetration tests gave 'N' values in the range of 2 - 94 blows per 30 cm. The fill, in general, has a soft to firm consistency. The high 'N' values are due mainly to obstructions, thick layers of paper etc., in the fill and are not indicative of the consistency of the fill.

NATURAL SOILS

Varved Clay

A thin deposit of varved clay was encountered at boreholes ~~5~~, 6 & 14. The thickness of this deposit varies from 0.7m to 1.0m. The varved clay is comprised of a silty clay with sand and trace of gravel and is grey in colour. Standard Penetration test gave 'N' value in the range 7 - 9 indicating that the deposit has a firm consistency.

The results of Atterberg Limit tests are shown on the Plasticity chart on Fig. 4. These results indicate that the matrix is inorganic and of low plasticity - CL zone.

The results of grain size distribution testing performed on representative samples from this deposit are shown on Fig. 1.

ALLUVIUM

A thin alluvial deposit comprising of sandy gravel with silt and trace of clay, varying in depth from 0.8m to 1.0m, was encountered at boreholes 10 and 12. This deposit is non-plastic and grey in colour.

The Standard Penetration tests gave 'N' value in the range 13 - 21 indicating that the deposit has a compact consistency.

GLACIAL TILL

The predominant material on this site is a mixture of sand and gravel with silt and traces of clay. The relative proportions of the sand and gravel in the deposit vary considerably, ranging from silty sand with gravel traces of clay to gravelly sand with trace of silt and clay.

Standard Penetration test gave 'N' values in the range of 7 to over 100 blows per 30 cm. Based on these 'N' values the consistency of the deposit is loose to very dense, and generally in the very dense range.

This deposit is non-cohesive.

The results of grain size testing performed on representative samples from the silty sand with gravel trace of clay and gravelly sand with trace of silt and clay are shown in an envelope form, on Fig. 2 & 3 respectively.

SHALE

Shale was encountered at most of the boreholes. The shale represents the bedrock and is black with a slight odour. The depth of weathering of the shale bedrock varies.

Shale bedrock was proved at borehole 102 by taking a BXL core for a depth of 1.5m into the rock. The core recovery and the RQD of the core was 93% and 43% respectively indicating a poor quality shale bedrock.

GROUNDWATER

The groundwater level conditions were observed by measuring in the open boreholes during and after completion of the foundation investigation. The groundwater level was found to vary between elevation of 76.6m to ~~75.8m~~ ^{75.2 m} with the exception of borehole 101, where the water level was at an elevation of 78.9m.

High water level reading at borehole 101 could be due to perched water in the fill.

The fill may contain some perched water and the level of this perched water will vary with the seasons of the years.

DISCUSSIONS AND RECOMMENDATIONS

A total of fifteen (15) boreholes were carried out, during our initial subsoil investigation, between August 30th to September 6th, 1983 inclusive. These boreholes were located so as to provide subsoil data to assist in the design and construction of

A. (i) either an 11m single span bridge, \varnothing at STN 14+474 with 83m and 17m retaining walls on East & West of the bridge respectively, as per drawing no. TP49 - (BHS. 1, 2, 3, 5, 6, & 8).

(ii) Or a two span bridge with pier at STN 14+462 and two equal spans of 26.0m with a 75m retaining wall on the East side of the bridge as per drawing no. TP49 - (BHS. 1, 2, 3, 4, 7, & 10).

B. Retaining wall south of the existing hydro transformer - BH. 13.

C. Retaining wall south of the existing reservoir - BHS. 14 & 15.

D. Possible realignment of the Pringle Creek - BHS. 9, 11, & 12.

Due to a change in the GO-A.L.R.T. alignment the information obtained during our initial investigation could not be used for the proposed structure at the site. Boreholes 101 to 103 inclusive were carried out on December 15th & December 16th, 1983 for the new structure.

The new structure, proposed at this site, will consist of a 2 span bridge separating the proposed GO-A.L.R.T. alignment from the proposed access road to the Water Pollution Control Plant and the realignment of the Pringle Creek. The top of GO-A.L.R.T. track elevation will be at about 87.0m at the ∇ of the bridge and 86.5m & 87.5m at the West and East Abutments respectively.

In view of the presence of fill at this site there are a number of alternatives for the foundation of the proposed structures. These are given below. No footings shall be placed on the existing fill material.

DRIVEN PILES

Driven piles may be safely used to found the proposed structures. These piles may be supported in the very dense glacial till at approximately the following elevations.

<u>BOREHOLE NO.</u>	<u>ELEVATION (m)</u>	<u>DEPTH BELOW EXISTING GROUND (m)</u>
101	74.0	5.8
102	71.4	7.6
103	73.0	6.0

The soils at the above elevations are considered to be unyielding soils. ~~HP~~ ¹¹⁰ 310 X 100 steel H piles, driven to the above elevation may be designed for a factored bearing capacity at Ultimate Limit States (Qf) of 1600 kN and a factored bearing capacity at Serviceability Limit States Type II (Qs) of 1150 kN.

The piles should be driven using a hammer with a minimum energy of 52, 500 joules and according to M.T.C. Standards SS103-11 or SS103-10, the piles should be equipped with reinforced tips.

SPREAD FOOTINGS

A. ON NATURAL SOILS

Footings for the bridge should be carried to competent natural undisturbed glacial till consisting of gravelly sand with silt trace of clay at the following depths and elevations.

<u>BOREHOLE NO.</u>	<u>ELEVATION (m)</u>	<u>DEPTH BELOW EXISTING GROUND (m)</u>
101	77.5	2.3
102	75.0	4.0
103	75.0	4.0

Footings founded at the above elevation should be designed using a factored bearing capacity at Ultimate Limit State (Q_f) of 750 kPa.

Settlements of less than 25mm were estimated for a loading of 200 kPa. We would, therefore, recommend the bearing capacity at Serviceability Limit States Type II (Q_s) of 200 kPa.

B. ENGINEERED FILL

For spread footings on natural undisturbed soil the footings will have to be carried well below the existing ground level. It might be economical to place footings on compacted fill, especially the abutment footings. Compacted fill should be placed on a surface which has been stripped of all fill and soft material. Fig. 5 gives details for this design.

For a granular 'A' fill, compacted to M.T.C. specifications, the footings should be designed for a factored bearing capacity at Ultimate Limit States (Q_f) of 850 kPa and a bearing capacity at Serviceability Limit States Type II (Q_s) of 325 kPa.

Where footings are placed on natural material we recommend a co-efficient of sliding resistance between concrete of the footings and granular material of 0.65. This value is based on a angle of shearing resistance of 33° .

For footings placed on compacted granular 'A' backfill we recommend a co-efficient of sliding resistance between concrete of the footings and granular fill of 0.70. This value is based on an angle of shearing resistance of 35° for the well compacted granular fill.

Any one of the above alternatives will be a suitable foundation type. The resulting total and differential settlement will be less than 25mm.

In assessing the earth pressure of the backfill against the abutments, the following equivalent fluid pressure may be assumed.

(a) At Ultimate Limit States:

- | | |
|--------------------|----------|
| (i) Active State | 8 kPa/m |
| (ii) At Rest State | 10 kPa/m |

(b) At Serviceability Limit States:

- | | |
|--------------------|-----------|
| (i) Active State | 6.5 kPa/m |
| (ii) At Rest State | 8.5 kPa/m |

In order to use the above values it is essential that approved free-draining backfill be used.

Adequate permanent drainage should be provided for the backfill to ensure that water pressure does not build-up.

All footings should be placed below a depth of 1.2m to avoid frost penetration. All footings for the bridge should be placed at a sufficient depth and with adequate protection to prevent scouring.

The existing hydro transformer and the reservoir are more than 33m away from the Q of the ~~purpose~~^{Proposed} centreline of the GO-A.L.R.T. and will not be affected by the fill of the proposed embankment. Retaining walls to protect them from the fill will, therefore, not be required.

REALIGNMENT OF PRINGLE CREEK CHANNEL

Subsoil conditions at the proposed Pringle Creek Channel realignment, at the existing creek level, is a glacial till consisting of sand, gravel with silt and trace of clay.

Rigid frame open footing concrete culvert should be used with design bearing pressures recommended for the bridge foundations on natural undisturbed soil.

Footings should be placed at a sufficient depth and with adequate protection to prevent scouring.

As an alternative to the rigid frame concrete culvert a galvanized corrugated iron pipe culvert may be used. The culvert should be placed on a bed of well graded granular 'A'.

The backfill around the culvert should be granular 'C'.

CONSTRUCTION CONSIDERATIONS

Although the natural glacial till, silty sand with gravel and trace of clay, at this site is reasonably impermeable and will not allow free flow of water, it may contain permeable sand seams, which could be connected to the water in the Pringle Creek.

If excavation is to be carried out below the creek bed, i.e. below stabilized water level, it will be difficult to maintain the non-cohesive material in an undisturbed state. It will be necessary to control seepage of water into the excavation during the construction of the footings.

The water table may be lowered by installing drainage ditches around the perimeter of the construction area. The water from these drainage ditches can be led to sumps dug in the glacial till from where it can be pumped out.

Dewatering the area using well points is another alternative.

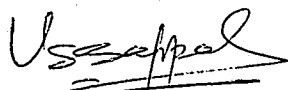
MISCELLANEOUS

The field work for the investigation was performed under the supervision of Mr. Mark McKinnon, Technician. The drilling equipment was operated by Master Soils Investigation Ltd., Weston, Ontario during the initial investigation and by Eastern Soils Investigation Ltd., Scarborough, Ontario during the additional work due to unavailability of drilling equipment from other sources.

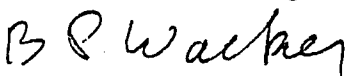
If you have any questions concerning the contents of this report, please contact this office.

Yours very truly,

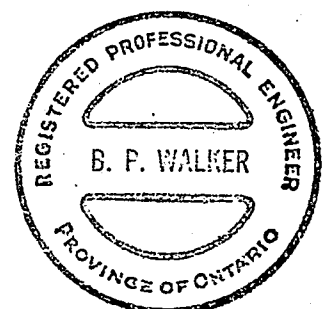
B. P. WALKER ASSOCIATES LTD



U. S. Sappal, P. Eng



B.P. Walker, Ph. D., P. Eng.





RECORD OF BOREHOLE No 1

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4858 253.5 E 350 811.0 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 06 CHECKED BY BPW

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 (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										WATER CONTENT (%) 20 40 60		
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
80.2	GROUND LEVEL																			
0.0	Silty Clay with Sand, Trace of Gravel, Organics, Paper, Odd Debris, Slight Odour, Black (Fill)						80													
			1	SS	15		79													
			2	SS	15															
			3	SS	14		78													
			4	SS	21		77													
76.4	Gravelly Sand with Silt, Trace of Clay (Glacial Till), Non-Plastic, Compact to Very Dense, Grey																			
3.8			5	SS	56		76													
			6	SS	63		75													
			7	SS	24	74														

RECORD OF BOREHOLE No 2

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 242.0 E 350 788.0 ORIGINATED BY MM
 DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
 DATUM Geodetic DATE 83 09 01 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
80.8	GROUND LEVEL																
0.0	Silty Clay with Sand, Trace of Gravel, Cinders, Organics, Paper, Glass, Black (Fill), Firm to Very Stiff		1	SS	15		80										
			2	SS	10		79										
			3	SS	94		78										
			4	SS	10		77										
76.6			5	SS	24												
4.2	Gravelly Sand with Silt, Trace of Clay, (Glacial Till), Non-Plastic, Very Dense, Grey		6	SS	58		76										
			7	SS	151		75										
							74										
			8	SS	75		73										
							72										
71.4			9	SS	190/25cm		71										
9.4	Shale, Weathered, Black, Slight Odour																
70.2	Refusal to Auger End of Borehole Water level on completion of borehole		10	SS	100/1cm												
10.6																	

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 3

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 227.8 E 350 754.5 ORIGINATED BY MM
 DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
 DATUM Geodetic DATE 83 09 01 CHECKED BY BPW

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			20 40 60 80 100								WATER CONTENT (%) 20 40 60		
								SHEAR STRENGTH										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										
80.9	GROUND LEVEL														GR SA SI CL			
0.0	Sandy Silt with Clay, Trace of Gravel, Compact, Brown (Fill)		1	SS	8		80								13 55 22 10			
			2	SS	8		79											
			3	SS	16		78											
77.5			4	SS	18		77											
3.4	Silty Sand with Gravel, Trace of Clay, (Glacial Till), Non-Plastic, Compact to Very Dense, Grey		5	SS	26		76											
			6	SS	18		75											
			7	SS	48		74											
			8	SS	164		73											
							72											
71.4			9	SS	104/15cm		71											
9.5	Shale, Weathered, Black, Slight Odour																	
70.1			10	SS	140/12cm													
10.8	Refusal to Auger End of Borehole Water level on completion of borehole																	

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 227.2 E 350 745.0 ORIGINATED BY MM
 DIST 6 HWYGO -A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
 DATUM Geodetic DATE 83 08 31 & 09 01 CHECKED BY BPW

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 (%) GR SA Si CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
							WATER CONTENT (%) 20 40 60										
81.1	GROUND LEVEL																
0.0	Silty Clay with Sand, Trace of Gravel, Organics, Stiff to Very Stiff Brown (Fill)						81										
			1	SS	23		80						○				
			2	SS	23								○				
			3	SS	36		79						○				
78.0																	
3.1	Silty Sand with Gravel, Trace of Clay, (Glacial Till), Non-Plastic, Compact, Grey		4	SS	16		78						○				
							77										
			5	SS	18							○					
75.9																	
5.2	Gravelly Sand, Trace of Silt and Clay (Glacial Till), Non-Plastic, Very Dense, Grey						76										
			6	SS	170/25cm		75						○				
							74										
			7	SS	91/15cm		73						○				
							72						○				
			8	SS	133												
70.9							71										
10.2	Shale, Weathered, Black, Slight Odour		9	SS	200/12cm												
70.1																	
11.0	Refusal to Auger End of Borehole Water level on completion of borehole																

+³, x⁵: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 223.5 E 350 736.6 ORIGINATED BY MM
DIST 6 HWY GO - A.I.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 08 30 CHECKED BY BPW

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 (%) GR SA Si CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					
								SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
							WATER CONTENT (%) 20 40 60						
79.0	GROUND LEVEL												
0.0	Silty Clay with Sand, Trace of Gravel, Stiff to Very Stiff, Brown (Fill)		1	SS	27		78		○				
77.5													
1.5	Silty Clay with Sand, Trace of Gravel, Low Plasticity, (Varved Clay), Firm, Grey		2	SS	8		77		○				6 24 27 43
76.7													
2.3	Silty Sand with Gravel, Trace of Clay (Glacial Till), Non-Plastic, Dense to Very Dense Grey		3	SS	33		76		○				
			4	SS	64				○				
							75						
			5	SS	158	22cm	74		○				20 50 22 8
			6	SS	100	12cm	73		○				
							72						
	Sandy Gravel with Silty and Clay (Glacial Till), Non-Plastic, Very Dense, Grey		7	SS	193		71		○				52 37 (11)
69.9	Chale												
9.1	End of Borehole Water level on completion of borehole		8	SS	200	3cm	70		○				

Silt

out!

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 6

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 219.0 E 350 724.4 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 08 30 CHECKED BY BPW

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			20 40 60 80 100									WATER CONTENT (%)		
								SHEAR STRENGTH									20 40 60		
78.7	GROUND LEVEL																		
0.0	Silty Sand, Trace of Gravel and Clay, Organics, Loose, Brown (Fill)						78												
77.7																			
1.0	Silty Clay with Sand and Trace of Gravel, (Varved Clay), Low Plasticity,		1	SS	6														
76.7	Firm, Grey		2	SS	9		77									8 29 26 37			
2.0	Sandy Gravel with Silt, Trace of Clay, (Glacial Till), Non-Plastic, Compact to Very Dense, Grey		3	SS	10		76									43 35 16 6			
			4	SS	23														
							75												
			5	SS	230		74												
							73												
			6	SS	127														
							72												
							71												
			7	SS	118														
							70												
69.5																			
9.2	End of Borehole Water level on completion of borehole																		



RECORD OF BOREHOLE No 7

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N 4 858 216.5 E 350 717.3 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 08 31 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
78.6	GROUND LEVEL																
0.0	Silty Sand, Trace of Gravel, Cinders, Brick Fragments, Compact, Brown/Black (Fill)		1	SS	12		78										
	Topsoil		2	SS	7		77										
76.2			3	SS	9		76									13 48 24 15	
2.4	Silty Sand with Gravel and Clay, (Glacial Till), Non-Plastic, Compact to Very Dense		4	SS	24		75										
							74										
74.1			5	SS	61		73										
4.5	Gravelly Sand with Silt, Trace of Clay, (Glacial Till), Non-Plastic, Very Dense, Grey		6	SS	128		72									31 49 14 6	
			7	SS	69		71										
							70										
69.5			8	SS	100/3cm												
9.1	Refusal to Auger End of Borehole on Probable Bedrock Water level on completion of borehole																



RECORD OF BOREHOLE No 8

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 217.0 E 350 708.2 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 08 31 CHECKED BY BPW

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 (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										WATER CONTENT (%)		
								SHEAR STRENGTH												
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE														
78.3	GROUND LEVEL																			
0.0	Silty Clay, Trace of Gravel, Organics (Fill), Firm to Stiff, Brown						78													
			1	SS	19			77												
			2	SS	13			76												
75.6	Silty Sand, Trace of Gravel and Clay (Glacial Till), Non-Plastic, Compact to Very Dense, Grey		3	SS	9															
2.7								75												
			4	SS	10															
								74												
			5	SS	65			73												
								72												
			6	SS	64			71												
						70														
69.2	Weathered Shale, Black, Slight Odour																			
9.1	End of Borehole																			
	Water level on completion of borehole																			



RECORD OF BOREHOLE No 9

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 186.8 E 350 699.6 ORIGINATED BY MM
DIST 6 HWYGO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 01 CHECKED BY BPW

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 (%) GR SA S1 CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
79.1	GROUND LEVEL																
0.0	Silty Clay with Sand, Trace of Gravel, Organics, Pieces of Wood, (Fill), Firm, Brown/Grey		1	SS	10												
			2	SS	5												
			3	SS	8												
			4	SS	7												
75.3																	
3.8	Silty Sand with Gravel, Trace of Clay (Glacial Till), Non-Plastic, Very Dense, Grey		5	SS	61												
72.6			6	SS	101												
6.5	End of Borehole																
	Water Level on completion of borehole																



RECORD OF BOREHOLE No 10

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS N. 4 858 212.5 E 350 692.2 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 02 CHECKED BY BPW

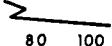



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
77.4	GROUND LEVEL																
0.0	Silty Sand, Trace of Gravel and Clay, Organics (Fill), Loose, Brown		1	SS	5		77						○				
76.0							76						○				
1.4	Sandy Gravel with Silt, Trace of Clay, Compact, Grey (Alluvium)		2	SS	21		75						○				
74.7			3	SS	13		74						○				
2.7	Gravelly Sand, Trace of Silt and Clay (Glacial Till), Non-Plastic, Very Dense, Grey		4	SS	120		73						○				
			5	SS	144		72						○				
			6	SS	125		71						○				
							70						○				
69.7			7	SS	100/1cm								○				
7.7	Shale, Weathered																
69.3	Black, Slight Odour																
8.1	Refusal to Auger End of Borehole Water level on completion of borehole																



RECORD OF BOREHOLE No 11

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 212.3 E 350 695.6 ORIGINATED BY MM
DIST 6 HWY GO-A.I.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 06 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
76.0	GROUND LEVEL																
0.0	Silty Sand, Trace of Gravel and Clay, (Glacial Till), Non-Plastic, Compact to Very Dense, Grey						75									8 75 11 6	
			1	SS	19												
			2	SS	47												
			3	SS	55												
			4	SS	170			27cm									
70.9			5	SS	165	25cm	71										
5.1	Shale, Weathered, Black, Slight Odour																
70.2																	
5.8	Refusal to Auger																
	End of Borehole																
	Water level on completion of borehole																



RECORD OF BOREHOLE No 12

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 240.5 E 350 700.5 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 06 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
77.4	GROUND LEVEL																
0.0	Silty Sand, Trace of Gravel and Clay (Fill), Loose, Brown						77										
76.2			1	SS	6		76										
1.2	Sandy Gravel with Silt, Trace of Clay, Compact, Grey, (Alluvium)																
75.5			2	SS	16												
1.9	Silty Sand, Trace of Clay and Gravel (Glacial Till), Non-Plastic, Dense to Very Dense, Grey						75										
			3	SS	38												
							74										
			4	SS	58												
							73										
			5	SS	53												
							72										
71.3																	
6.1	Shale, Weathered, Black, Slight Odour		6	SS	125												
71.0																	
6.4	Refusal to Auger																
	End of Borehole																
	Water level on completion of borehole																



RECORD OF BOREHOLE No 13

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 221.0 E 350 674.2 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 02 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
78.0	GROUND LEVEL																
0.0	Silty Sand, Trace of Gravel, Organics (Fill), Compact, Brown		1	SS	13												
			2	SS	12												
75.3	Organics		3	SS	22												
2.7	Sandy Gravel, Trace of Silt and Clay (Glacial Till), Non-Plastic, Compact to Dense, Grey		4	SS	20												
			5	SS	45												
72.7																	
5.3	Gravelly Sand with Silt, Trace of Clay (Glacial Till), Non-Plastic, Very Dense, Grey		6	SS	125												
70.4																	
7.6	Shale, Weathered, Black, Slight Odour		7	SS	205	12cm											
7.9	Refusal to Auger																
	End of Borehole																
	Water level on completion of borehole																



RECORD OF BOREHOLE No 14

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N 4 858 201.2 E 350 593.6 ORIGINATED BY MM
DIST 6 HWY GO-A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 02 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
78.5	GROUND LEVEL															
0.0	Silty Clay with Trace of Gravel and Sand, Organics (Fill), Soft to Firm, Grey/Black		1	SS	6		78									
			2	SS	17		77									
			3	SS	9		76									
			4	SS	8		75									
74.8			5	SS	7		74									
3.7	Silty Clay with Sand, Trace of Gravel (Varved Clay), Medium Plasticity, Firm, Grey		6	SS	38		73									
73.9			7	SS	150		72									
4.6	Silty Sand with Gravel, Trace of Clay (Glacial Till), Non-Plastic, Dense to Very Dense, Grey		8	SS	200/3cm		71									
							70									
69.9	Shale, weathered, black															
8.7	Refusal to Auger End of Borehole Water level on completion of borehole															



RECORD OF BOREHOLE No 15

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 197.7 E 350 561.8 ORIGINATED BY MM
DIST 6 HWYGO - A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 09 02 CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100									
								SHEAR STRENGTH									
78.4	GROUND LEVEL																
0.0	Silty Clay, Trace of Gravel and Sand (Fill), Soft to Firm, Brown/Grey						78										
			1	SS	12												
			2	SS	3		77										
			3	SS	2		76										
			4	SS	6		75										
74.5																	
3.9	Silty Sand with Gravel, Trace of Clay (Glacial Till), Non-Plastic, Compact to Very Dense, Grey		5	SS	21		74									18 54 23 5	
			6	SS	39		73										
							72										
			7	SS	153/27cm		71										
70.7																	
7.7	End of Borehole Water level on completion of borehole																



RECORD OF BOREHOLE No 101

METRIC

W P EGG - 000 - 35 LOCATION CO-ORDS. N. 4 858 220.5; E. 350 747.2 ORIGINATED BY MM
DIST 6 HWY GO - A.L.R.T. BOREHOLE TYPE Solid Auger COMPILED BY USS
DATUM Geodetic DATE 83 12 15 CHECKED BY BPW

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			20	40	60	80	100					
79.8	GROUND LEVEL																
0.0	Silty Sand with Gravel, Trace of Clay, Asphalt, Some Organics, Brown/Black, (Fill)		1	SS	83		79						o				
77.8			2	SS	32		78						o				
2.0	Silty Sand with Gravel and Clay, (Glacial Till)																
77.1	Brown/Grey, Dense		3	SS	41		77						o				
2.7	Gravelly Sand with Trace of Silt and Clay (Glacial Till) Non-Plastic, Dense to Very Dense Grey		4	SS	22								o				
			5	SS	60/	8cm	76						o				
			6	SS	103	15cm	75						o				
			7	SS	73/	15cm	74						o				
			8	SS	100	8cm	72						o				
70.7							71										
9.1	Shale Weathered, Black		9	SS	100	10cm							o				
69.6							70										
10.2	Refusal to Auger End of Borehole Water level on completion of borehole																

23 57 12 8



RECORD OF BOREHOLE No 102

METRIC

W P EGG - 000 - 35 LOCATION CO - ORDS. N. 4 858 209.3; E. 350 724.5 ORIGINATED BY MM
DIST 6 HWY G0 - A.L.R.T. BOREHOLE TYPE Solid Auger to 10.5m; Wash boring 10.5m to 12.02m COMPILED BY USS
DATUM Geodetic DATE 83 12 16 CHECKED BY BPW

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			20	40	60	80	100					
79.0	GROUND LEVEL																
0.0	Silty Clay with Sand and Gravel, Organics Black (Fill) Firm to Stiff		1	SS	15		78										
			2	SS	13		77										
			3	SS	8		76										
75.8			4	SS	7		75										
3.2	Gravelly Sand with Trace of Silt and Clay (Glacial Till) Non-Plastic Loose to Very Dense Grey		5	SS	73/	15cm	74										46 34 11 9
			6	SS	53		73										
			7	SS	69/	15cm	71										45 49 (6)
70.8			8	SS	75/	13cm	70										
8.2	Shale, Weathered, black						69										
68.5							68										
10.5	Shale, Sound, Black		9	RC BXL	Rec 93%												R.Q.D. 43%
67.0																	
12.0	End of Borehole																
	Water level on completion of solid stem augering																



RECORD OF BOREHOLE No 103

METRIC

W P EGG - 000 - 35

LOCATION CO - ORDS. N. 4 858 197.3; E. 350 701.2

ORIGINATED BY MM

DIST 6 HWY GO - A.L.R.T.

BOREHOLE TYPE Solid Auger

COMPILED BY USS

DATUM Geodetic

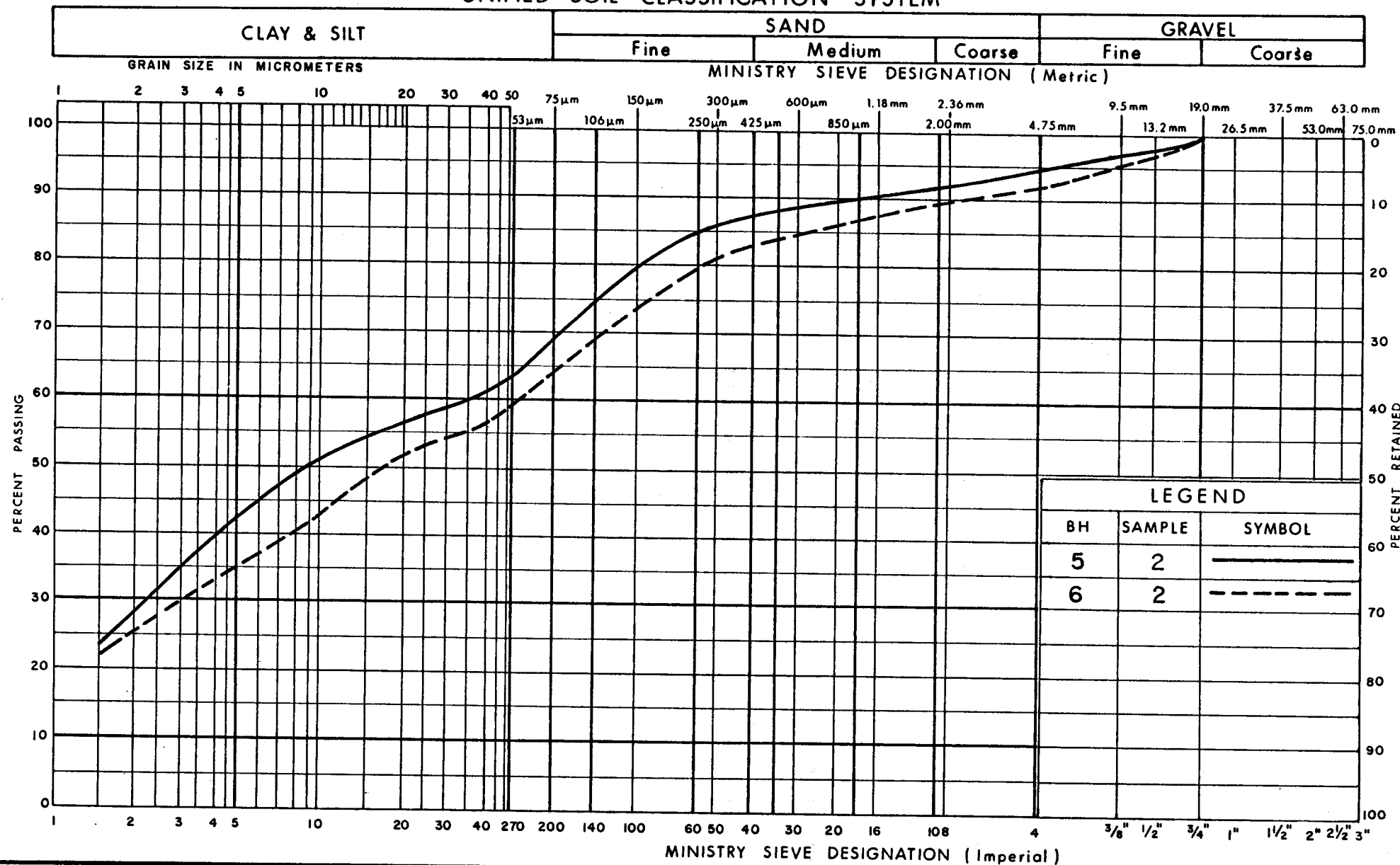
DATE 83 12 15

CHECKED BY BPW

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								
79.0	GROUND LEVEL															
0.0	Silty Clay, Sand and Gravel, Organics, Pieces of Wood, Occasional Sand Layers (Fill) Brown/Grey Stiff		1	SS	7											
			2	SS	7											
			3	SS	10											
			4	SS	13											
75.5	Gravelly Sand with Silt, Trace of Clay, (Glacial Till) Non-Plastic Very Dense		5	SS	72/	15cm										
3.5			6	SS	83/	15cm										
71.4	Shale, Weathered, Black		7	SS	107/	15cm										
7.6																
70.8	Refusal to Auger															
8.2	End of Borehole															
	Water level on completion of borehole															

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



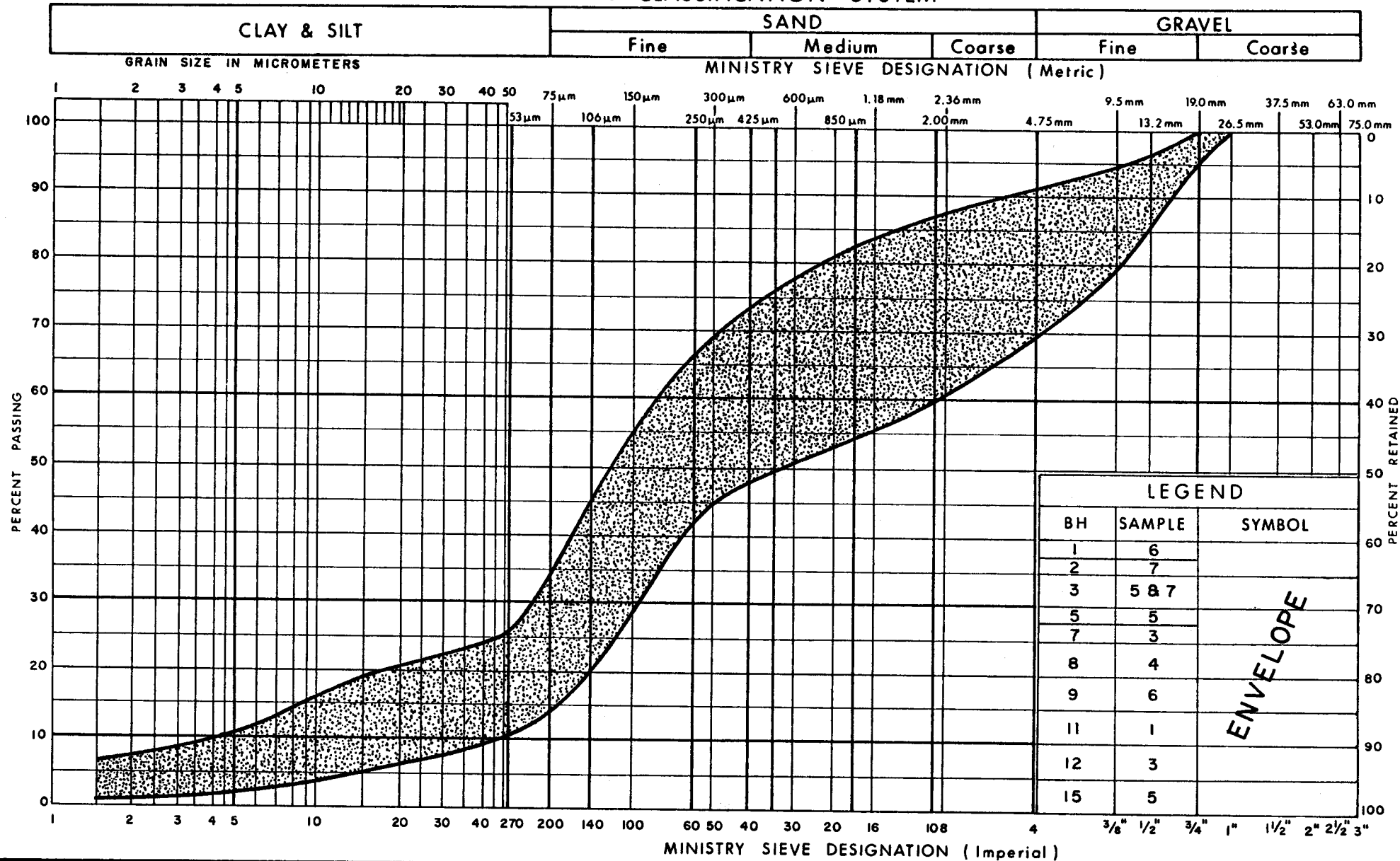
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY CLAY WITH SAND TRACE OF GRAVEL
(VARVED CLAY)

FIG No 1

WP EGG-000-35

UNIFIED SOIL CLASSIFICATION SYSTEM



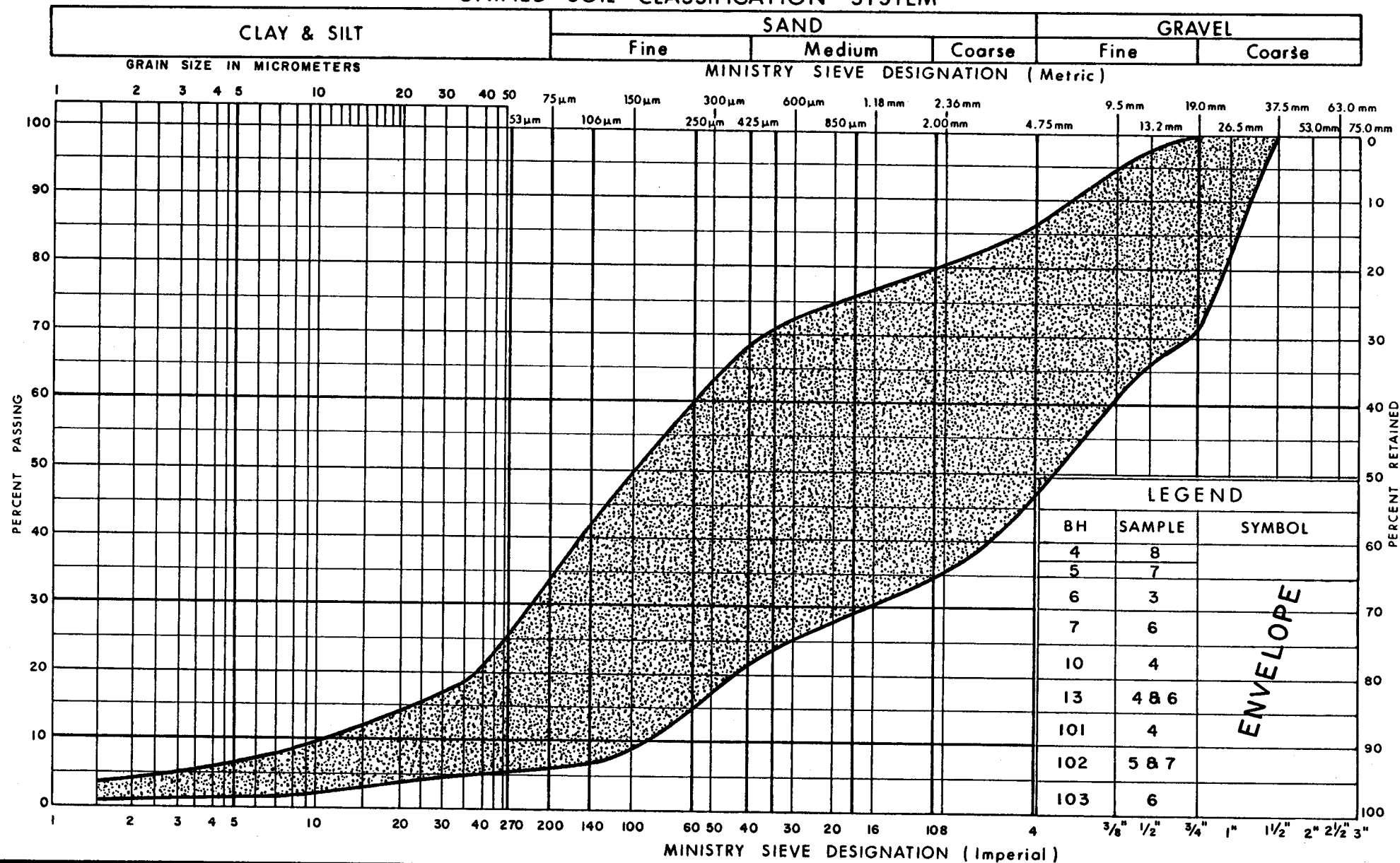
Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
SILTY SAND WITH GRAVEL TRACE OF CLAY
(Glacial Till)

FIG No 2

W P EGG-000-35

UNIFIED SOIL CLASSIFICATION SYSTEM

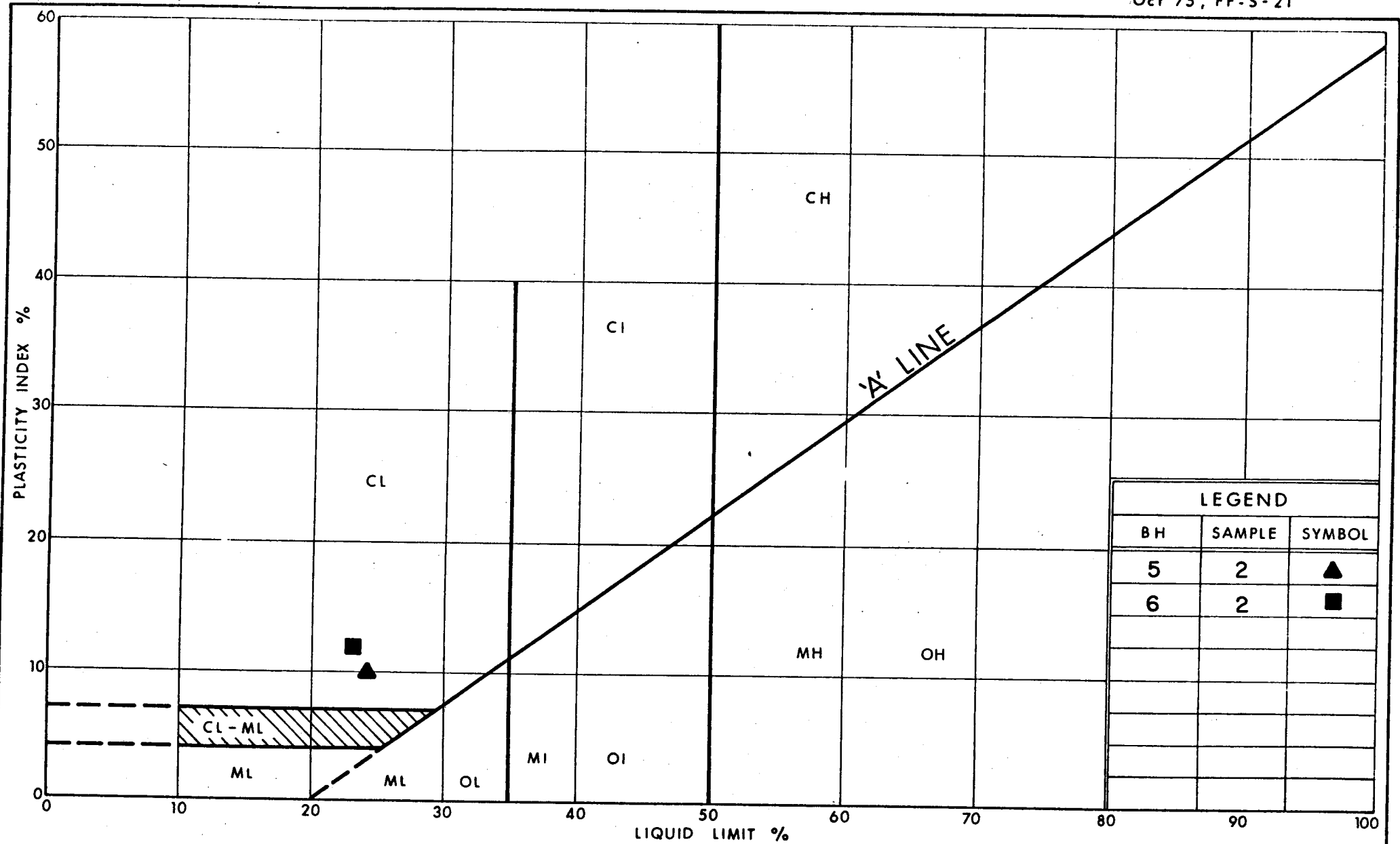


Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
GRAVELLY SAND TRACE OF SILT AND CLAY
(Glacial Till)

FIG No 3

W P EGG-000-35



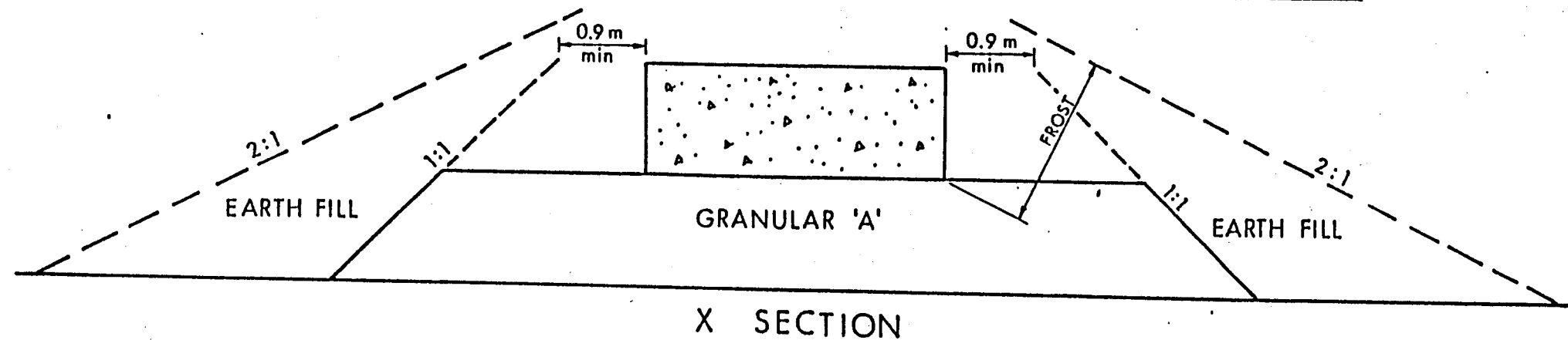
Ministry of
Transportation and
Communications

PLASTICITY CHART SILTY CLAY WITH SAND TRACE OF GRAVEL (VARVED CLAY)

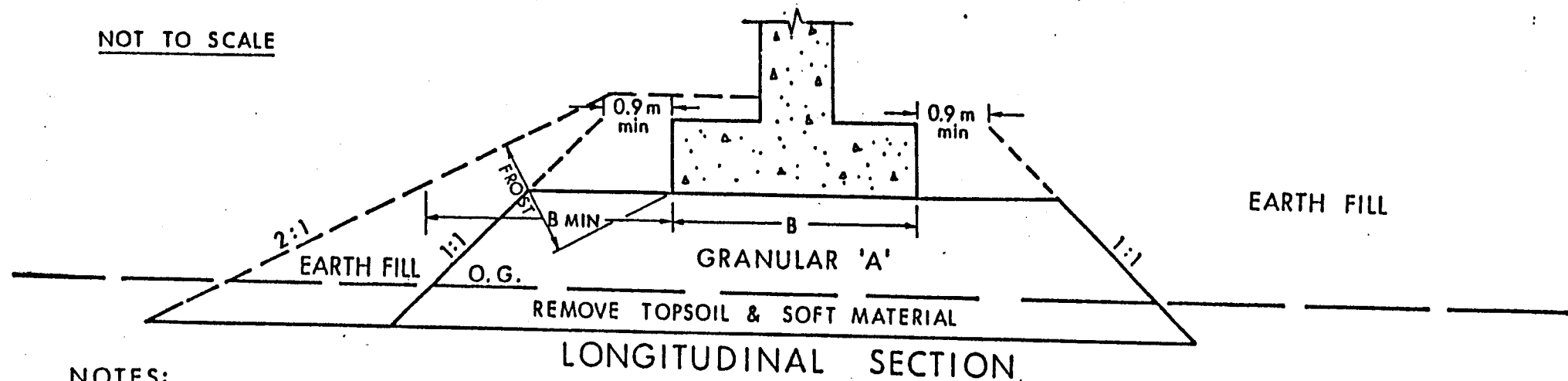
FIG No 4

W P EGG-000-35

FOOTINGS ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



NOT TO SCALE



NOTES:

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.
- 2 - PLACE GRANULAR 'A' & EARTH FILL TO BASE OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.
- 3 - CONSTRUCT FOOTINGS.
- 4 - PLACE REMAINDER OF FILL.

FIGURE 5

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

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

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

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

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

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

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

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

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	kN/m^3	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

METRIC

ALL DIMENSIONS SHOWN ARE
IN METRES AND/OR MILLI-
METRES UNLESS OTHERWISE
NOTED.

B.P. Walker Associates Ltd.

SEE DWG No. EGG00035-A

KEY PLAN
SCALE

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation
- 1983 08, 1983 09 and 1983 12

No	ELEVATION	CO-ORDINATES NORTH	EAST
1	80.2	4 858 233.5	350 811.0
2	80.8	4 858 242.0	350 788.0
3	80.9	4 858 227.8	350 754.5
4	81.1	4 858 227.5	350 745.0
5	79.0	4 858 223.5	350 736.6
6	78.7	4 858 219.0	350 724.4
7	78.6	4 858 216.5	350 717.3
8	78.3	4 858 217.0	350 708.2
9	78.1	4 858 186.8	350 699.4
10	77.4	4 858 212.5	350 692.2
11	76.0	4 858 212.3	350 695.6
12	77.4	4 858 240.5	350 700.5
13	78.0	4 858 221.0	350 674.2
14	78.5	4 858 201.2	350 593.6
15	78.4	4 858 197.7	350 561.8

Geocres No

NOTE

The boundaries between soil strata have been established
only at Bore Hole locations. Between Bore Holes the
boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for
this project and other related documents may be examined at the
Engineering Materials Office, Downsview. Information contained in
this report and related documents is specifically excluded in
accordance with the conditions of Section 102-2 of Form 100.

60-ALHT REF PDI-601

WATER POLLUTION CONTROL PLANT
ACCESS ROAD

SECTIONS AND SOIL STRATA







CONTRACT NO. 601 DWG NO. EGG00035-B REV. SHEET

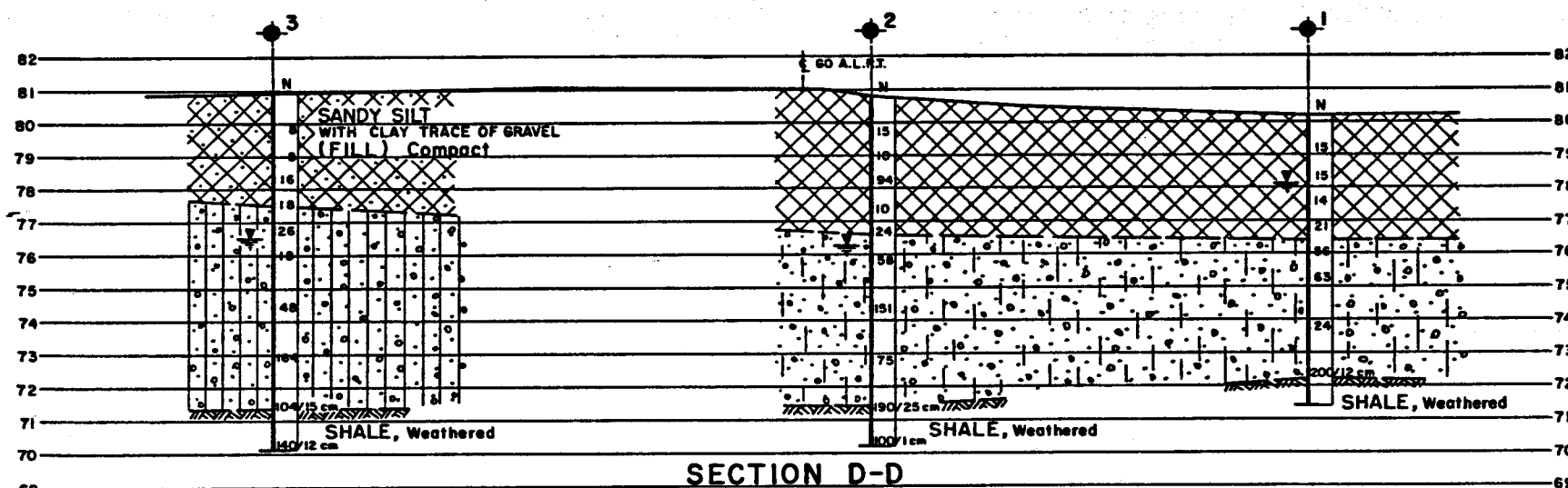
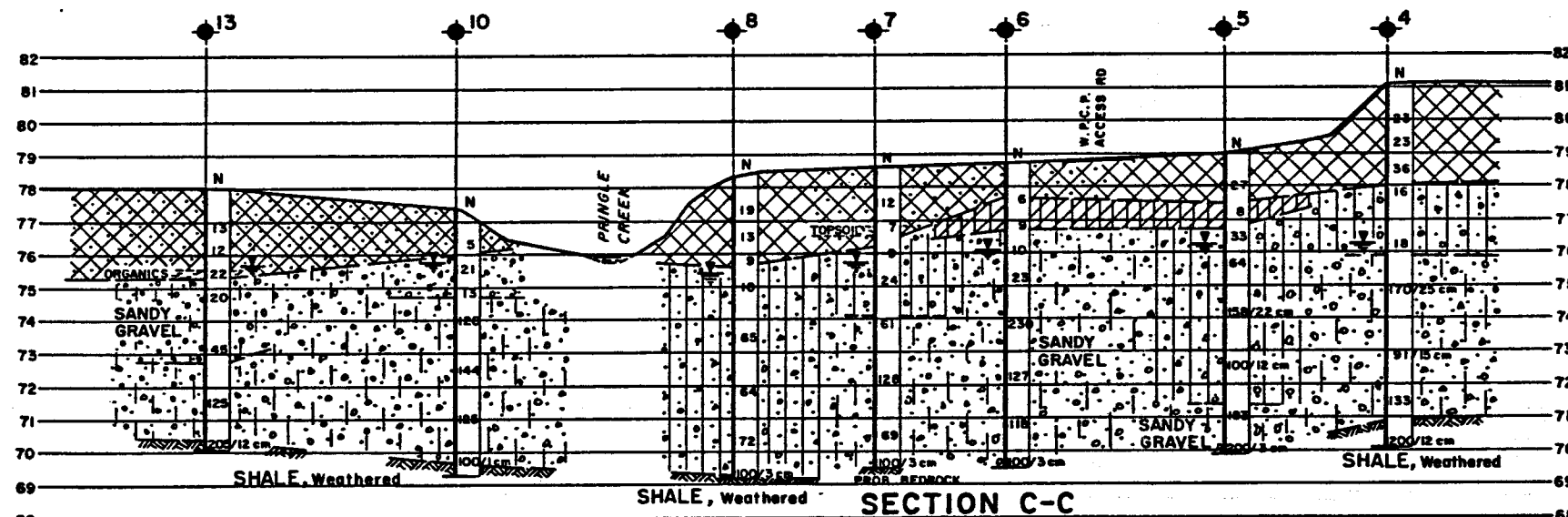
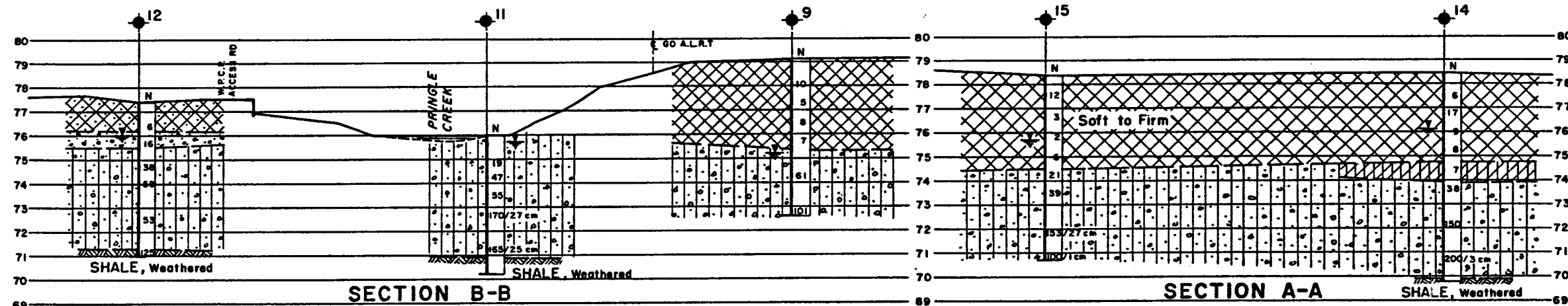
GO-ALHT
Ministry of Transportation and Communications

PROJECT MANAGER

SCALE FOR SECTIONS
4m 2 0 4m Hor.
2m 1 0 2m Vert.

SOIL STRATIGRAPHY LEGEND

-  SILTY CLAY
WITH SAND, TRACE OF GRAVEL,
ORGANICS, CINDERS, PAPER & GLASS
(FILL) Firm to Very Stiff
-  SILTY SAND
TRACE OF GRAVEL, CLAY & ORGANICS
(FILL) Loose to Compact
-  SILTY CLAY
WITH SAND, TRACE OF GRAVEL
(VARVED CLAY) Firm
-  SANDY GRAVEL
WITH SILT, TRACE OF CLAY
(ALLUVIUM) Compact
-  SILTY SAND
WITH GRAVEL, TRACE OF CLAY
(Glacial Till)
Compact to Very Dense
-  GRAVELLY SAND
WITH SILT, TRACE OF CLAY
(Glacial Till)
Compact to Very Dense



REFERENCE DRAWINGS		REVISIONS			DRAWN BY: D.T.	DESIGNED BY: ?
					CHK'D BY: U.S.S. <th>APPROVED BY: ?</th>	APPROVED BY: ?
					SCALE: FULL SIZE ONLY	
					AS NOTED	

ALL DIMENSIONS SHOWN ARE
IN METRES AND/OR MILLI-
METRES UNLESS OTHERWISE
NOTED.

FOR APPROVAL ONLY

CLASS OF CONCRETE

DECK, ABUTMENTS, PIER, PARAPET WALLS
& WING WALLS ----- 30 MPa
FOOTINGS & REMAINDER ----- 20 MPa

FOOTINGS	100 ± 25mm
ABUTMENTS & WINGWALLS	80 ± 20mm
	70 ± 20mm
PIER	50 ± 20mm
DECK: TOP	70 ± 20mm
BOTTOM	40 ± 10mm
PARAPET WALLS	70 ± 20mm

REINFORCING STEEL SHALL BE GRADE 400
UNLESS OTHERWISE SPECIFIED.
BARS MARKED WITH SUFFIX 'C' SHALL BE
COATED BARS.

THE CONTRACTOR SHALL FINISH THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS TO A TOLERANCE OF ± 3 mm.

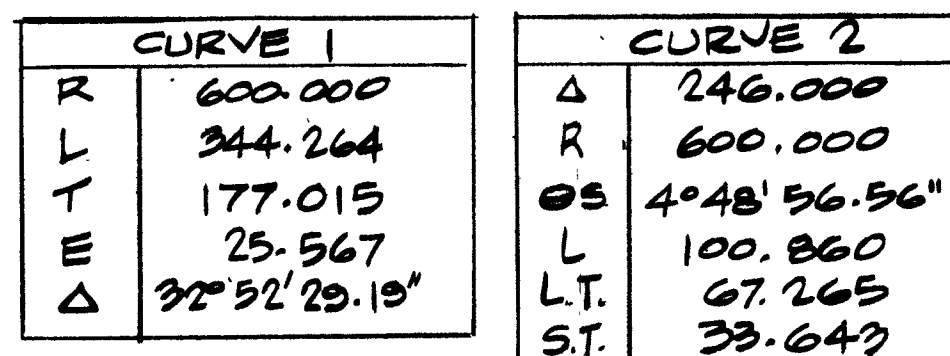
- 1 GENERAL ARRANGEMENT
- 2 BORE HOLE LOCATIONS & SOIL STRATA
- 3 FOOTING LAYOUT & DETAILS
- 4 WEST ABUTMENT
- 5 EAST ABUTMENT
- 6 PIER DETAILS
- 7 GIRDER LAYOUT & DETAILS
- 8 STRUCTURAL STEEL DETAILS
- 9 DECK LAYOUT & DETAILS
- 10 DECK ELEVATIONS
- 11 PARAPET WALL & DETAILS
- 12 RAILING FOR PARAPET WALL
- 13 STANDARD DETAILS SHEET 1
- 14 STANDARD DETAILS SHEET 2
- 15 BRIDGE DATE & SITE NUMBER DATA

GO-ALRT REF PD 1-601

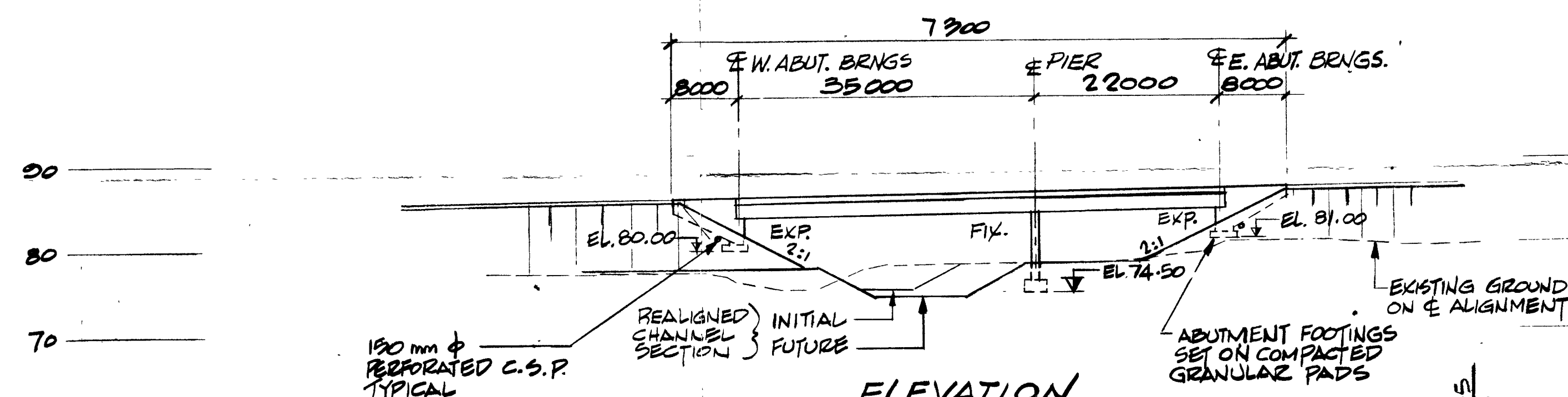
WPCP ACCESS ROAD BRIDGE

GENERAL ARRANGEMENT

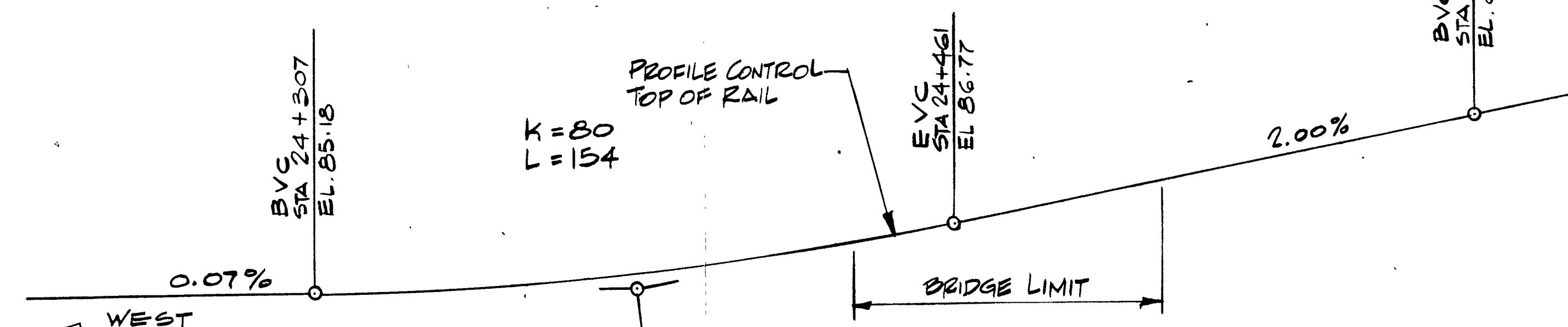
CONTRACT NO 601	DWG NO	REV	SHEET 1
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PLAN
1:500



ELEVATION
1:500



- BENCH MARK

B.M. 180-A ELEV. 88.057
ST. JOHN'S ANGLICAN CHURCH, 160 m
SOUTH OF C.N., 100 m EAST OF BROCK
ST., FRONT OR SOUTH WALL, 0.7 m
FROM S.W. CORNER & 0.2 m ABOVE
GROUND. BOLT SET HORIZONTALLY

GO ALRT PROFILE

REVISIONS

DRAWN BY:
B. E. WRIGHT

DESIGNED BY:
S M.

CHK'D BY:
S. P. S.

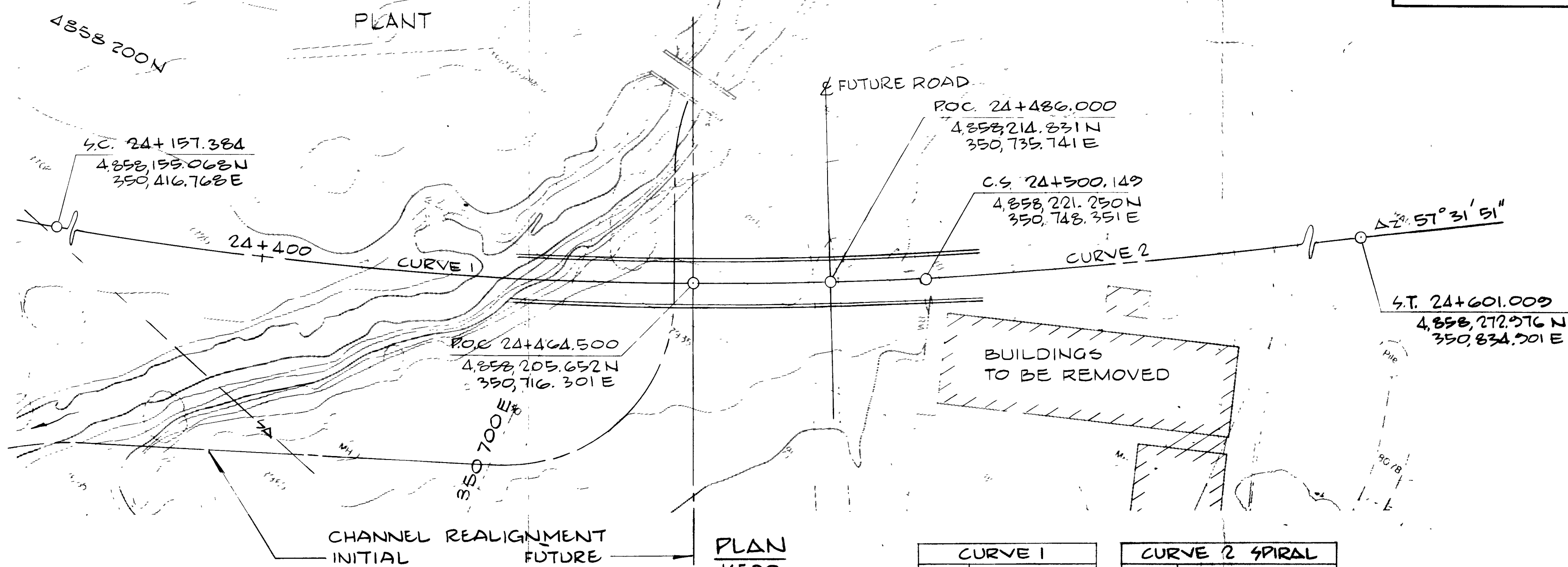
APPROVED BY:
S.P.S.

SCALE: FULL SIZE ONLY
AS NOTED



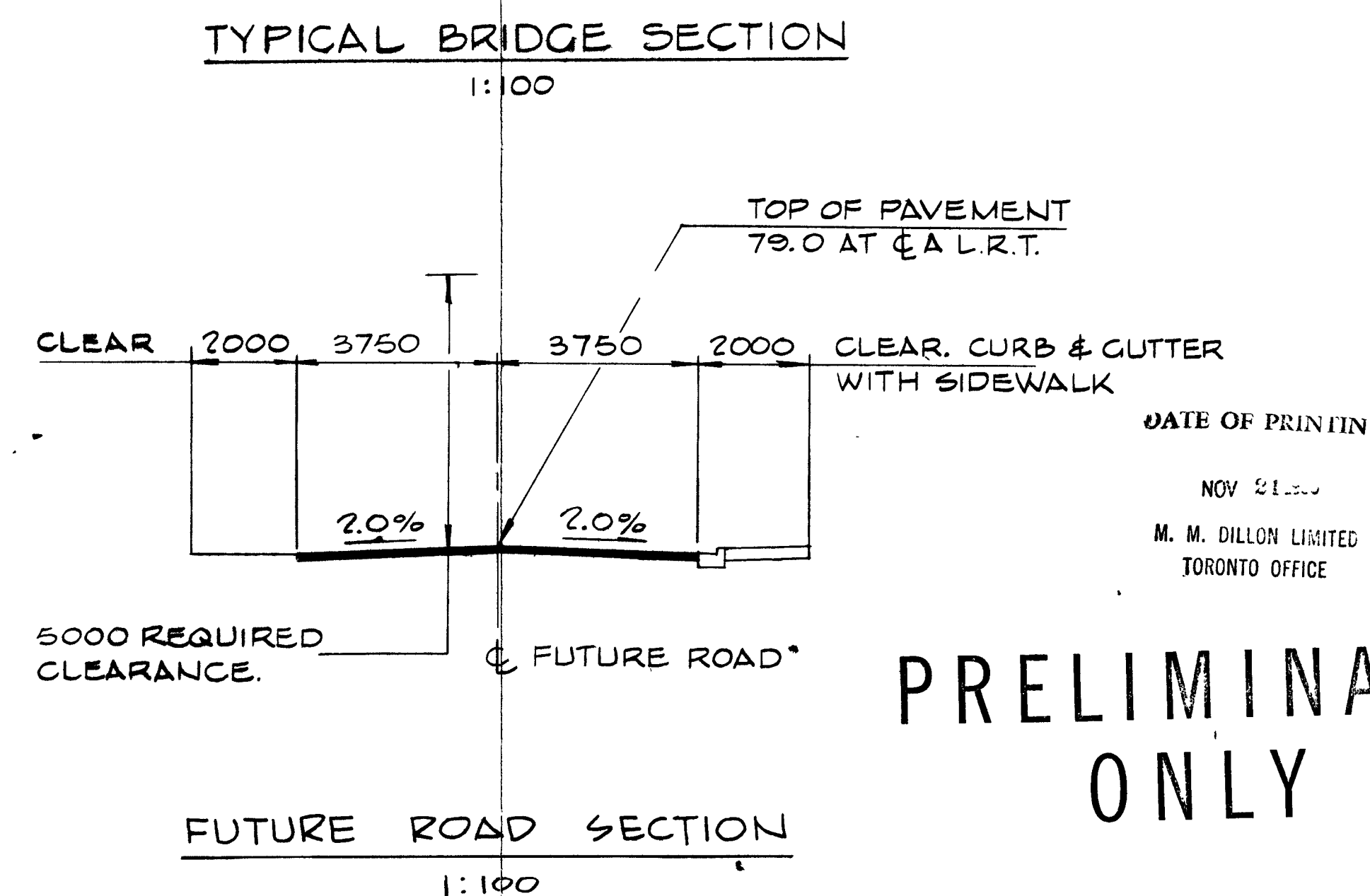
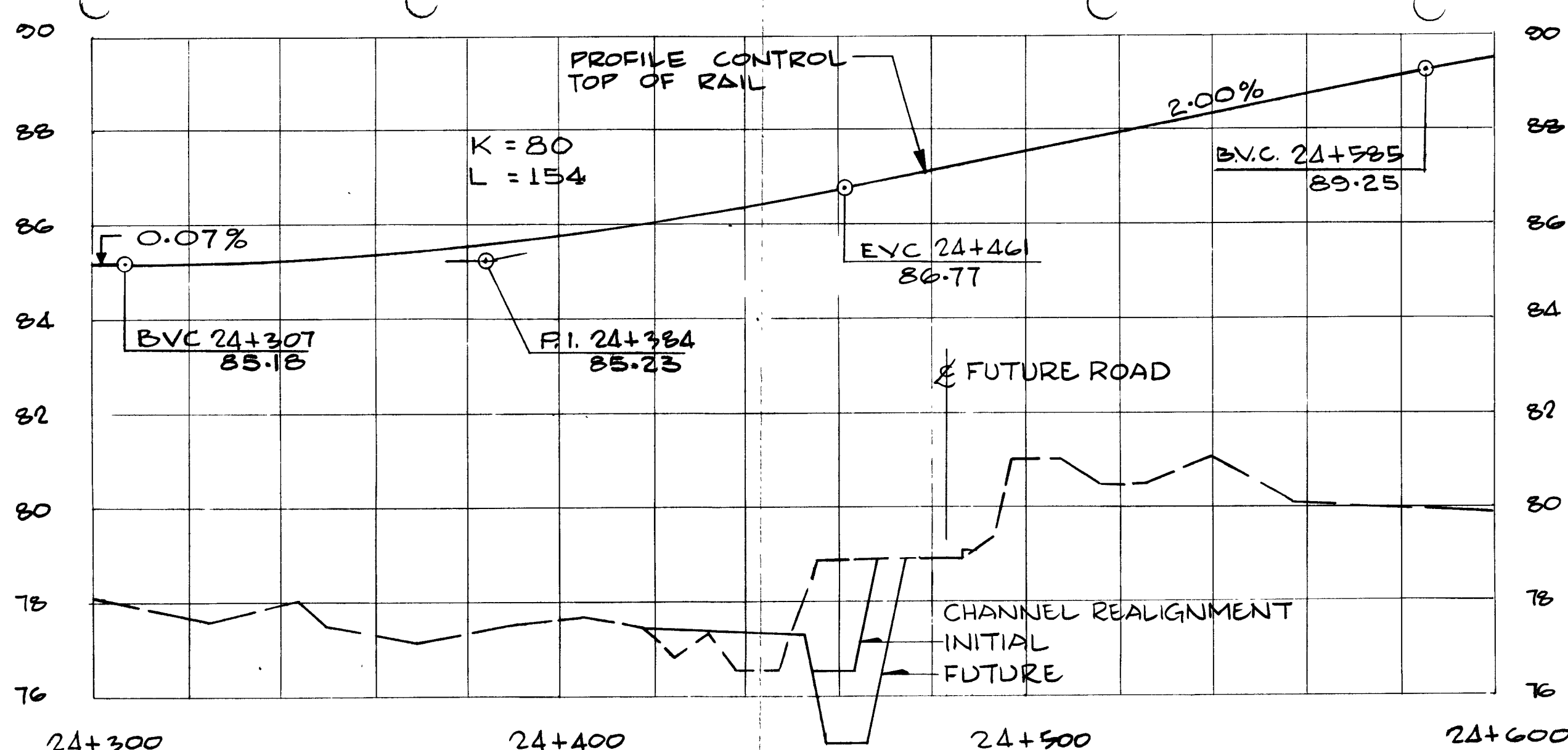
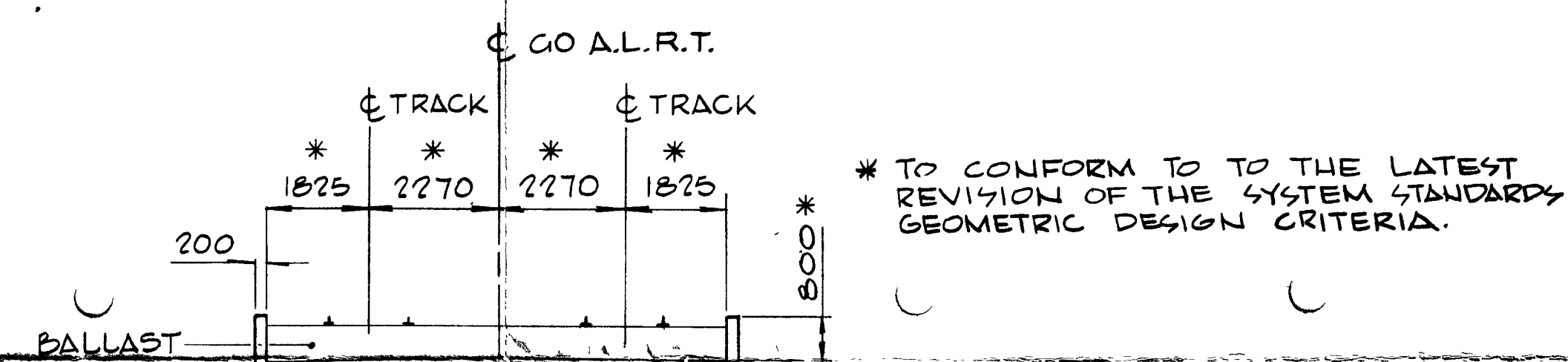
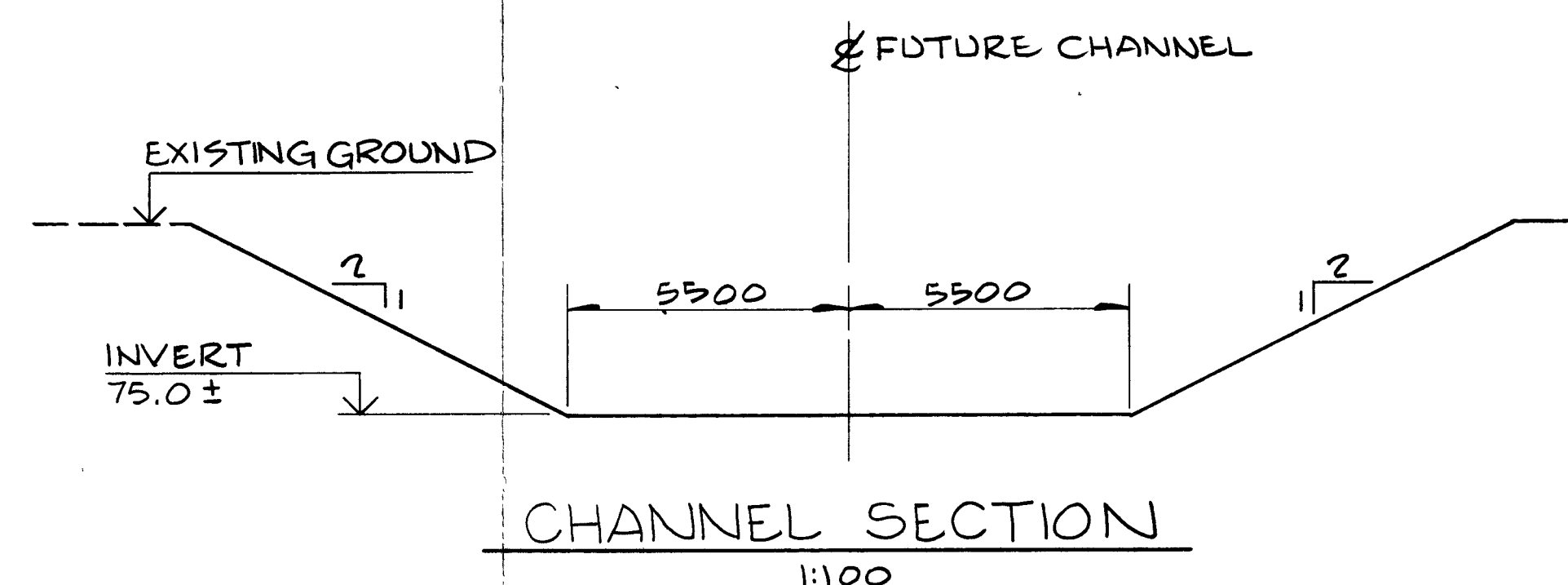
GOALRT
Ministry of Transportation and Communications

PROJECT MANAGER




CURVE 1	
R	600,000
L	342.765
T	176.201
E	25,337
Δ	3' 43" 53.85"

CURVE 2 SPIRAL	
A	246.000
R	600.000
CS	4°48'56.56"
L	100.860
L.T.	67.265
S.T.	35.643



PRELIMINARY
ONLY

GO-ALRT REF **PD 1-601**

REFERENCE DRAWINGS		REVISIONS			DRAWN BY:	DESIGNED BY:	 Ministry of Transportation and Communications	WATER POLLUTION CONTROL PLANT ACCESS ROAD			
					CHK'D BY:	APPROVED BY:		SITE PLAN			
					SCALE: FULL SIZE ONLY			E-			
							PROJECT MANAGER	CONTRACT NO 601	DWG NO	REV	SHEET