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GEOCRES No. _____

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W.P. No. _____

CONT. No. _____

W. O. No. 93-11030

STR. SITE No. 47-204

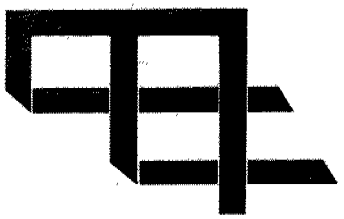
HWY. No. Mun.

LOCATION Wabi River — Twp of Kerns
(Hillcoat Bridge)

No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____



HILLCREST BRIDGE

SPANNED

STRUCTURE SITE No. 47-204

MERLEX ENGINEERING LTD.,

Consulting Geotechnical Engineers

MERLEX ENGINEERING LTD.

CONSULTING GEOTECHNICAL ENGINEERS

Reference No. 91/06/1061

December 23, 1991

H. Sutcliffe Ltd.
9 Wellington Street
P.O. Box 1208
New Liskeard, Ontario
P0J 1P0

Attention: Mr. I. M. ElAmin, P. Eng.

Re: Geotechnical Investigation
Replacement of Hillcoat Bridge
Township of Kerns
MTO Site No.47-204

We have carried out a geotechnical investigation for the above project and we submit the results along with our comments and recommendations in this letter report.

1.0 FIELD WORK

The field work consisted of three boreholes and two dilatometer tests (DMT) at the locations shown on the enclosed Borehole Location Plan (Enclosure No. 2). This work was carried out in the period of June 17, 18 and 19, 1991, using a CME muskeg mounted drill rig with hollow stem augers.

Split spoon and thin walled tube samples were taken from the borehole using the standard penetration test method and, where cohesive material was encountered, in-situ vane shear strengths were carried out between samples. All boreholes were drilled and sampled to a depth of 16 m. The dilatometer tests were discontinued at depths of 20 m and 27.6 m.

The soil samples were brought to our laboratory where they will be stored for a period of three months following the date of this report and then discarded unless instructed otherwise.

The elevations of the ground level at the borehole locations were determined using a local geodetic benchmark (elevation 192.122 m) consisting of a nail and washer at the south side of a hydro pole located on the south side of the road, about 95 m east of the east end of the existing bridge.

2.0 SOIL CONDITIONS

The soil conditions at the borehole locations are shown on the enclosed Borehole Logs.

2.1 Fill

Boreholes 1 and 3 encountered about 2.1 m and 2.9 m of fill or probable fill at the west and east banks, respectively. The upper 0.6 m to 1 m of the fill consists of coarse granular material. The remainder consists mainly of sandy silt with a trace to some clay. The fill appears to be in a compact state in Borehole 1 and loose to compact in Borehole 3.

2.2 Fine Sand and Silt

The fill in Borehole 3 is underlain by what appears to be original topsoil, about 400 mm in thickness, consisting of black organic sand. This material and the fill in Borehole 1 are underlain by sandy silt

with a trace to some clay. In Borehole 2 this material occurs below about 1.4 m of silty fine sand. The sand and silt have a variable organic content. As sampled, the sand and sandy silt at Borehole 2 and 3 are generally in a loose to occasionally very loose state while the sandy silt in Borehole 1 is generally compact.

2.3 Varved Clay

The sandy silt extends to about elevation 184 in Borehole 1 and to about elevation 181 in Boreholes 2 and 3. A deposit of varved clay occurs below these elevations. As indicated by the boreholes and dilatometer tests these deposits extend to at least elevation 161 and probably considerably deeper based on local well records. ? ≥ 35'

The clay in Borehole 1 has a crust extending to about elevation 181. In Borehole 2 and 3, the crust is absent and may have been removed by erosion in the past. The varved nature of the clay is only apparent below about elevation 177 where clay layers are typically between 25 mm and 50 mm in thickness and silt layers are typically of the order of 5 mm to 25 mm in thickness.

The natural moisture content was determined for each sample and the results are shown on the borehole logs which also show the result of atterberg limit tests on selected samples. The natural moisture content of the clay crust in Borehole 1 was of the order of 30%. Within the softer clay the natural moisture content of the clay layers is of the order of 50% to 70% while the natural moisture content of

the silt layers is typically of the order of 25%. The liquid limit of the lower clay is between 50% and 60% and the plasticity index is of the order of 35% to 40%.

The in-situ undrained shear strength of the clay was measured by vane tests in all boreholes and by dilatometer tests adjacent to Boreholes 1 and 2. The results of the field vane tests of all tests are plotted against elevation on Enclosure No. 1. The vane strengths shown on Enclosure No. 1 and on the borehole logs have been reduced by 20% on the basis of plasticity. The graph shows the desiccated crust in Borehole 1 with a shear strength up to about 46 kPa. Below the crust, the shear strength increases for a low value of about 14.5 kPa to a maximum of the order of 55 kPa at about elevation 161, which is the maximum depth reached by the dilatometer tests.

3.0 GROUNDWATER

At the time of the investigation the water level of the Wabi River at the bridge location was at elevation 182.0. In Borehole 1, groundwater reached elevation 185.2 as measured 43 hours after completion of the borehole. In Borehole 2 and 3, the groundwater level appeared to be considerably lower. In Borehole 2 it reached elevation 176.6 measured 66 hours after completion and in Borehole 3 it reached elevation 178.3 as measured 36 hours after completion of the borehole.

4.0 DISCUSSION

The existing bridge is a three-span structure with timber piers and abutments supported on timber piles. The proposed new bridge will be of similar design with longer spans and with concrete piers and abutments on piled foundations. Current planning calls for raising the approach grade by about 1 m but it is possible that higher profile grades may be required.

4.1 Piled Foundations

The soil conditions as determined at the borehole locations, confirm the choice of a piled foundation. Considering the extent of the soft clay stratum and experience with similar structures or similar soils, a system of timber friction piles is recommended.

The preliminary design drawings show the abutment and pier pile caps to be at about elevation 185 to 181, respectively. For design purposes, the piles are therefore considered to be bearing wholly in clay.

Using an average undrained shear strength of 24 kPa for the clay along the full length of the pile, the factored pile capacity (Q_p) at ULS can be determined from the expression:

$$Q_f = 180\ A_t + 12 A_s L \text{ (kN)}$$

where, A_t = area of pile tip (m^2)

A_s = average circumference of pile (m)

L = length of pile (m)

For a size 36 timber pile with a butt diameter of 360 mm, a tip diameter 240 mm, an average shaft diameter of 300 mm and length of 14 m, the above expression produces a U_f equal to 164 kN.

Q_f

For the same pile, neglecting all transient loadings, the pile capacity at SLS Type II (Q_s) is considered to be of the order of 102 kN.

$\frac{102}{14} = 7.29$ kN/m

4.2 Embankment GIVE DETAILED GEOMETRY!

At the present time, it is proposed to raise the approach embankments by about 1 m. The proposed side and forward slopes are to be 3:1 and 3.3:1, respectively. It is understood that consideration is being given to raising more than 1 m, however, this has not yet been determined.

Numerous sections of the proposed construction have been reviewed and the critical section A-A, as shown on the enclosed plan, was chosen for detailed analysis using the STABL5 computer program.

Considering that the DMT data, which indicates the clay deposit is marginally overconsolidated, along with other published data on glacio-lacustrine deposits from this area (glacial lake Barlow-Ojibway) a total stress analysis (TSA) has been used in analyzing the slopes.

The computer printouts for the existing embankment and proposed, with 1 m of fill and a 3.3:1 side/forward slope are shown on Enclosure No. 3 in Appendix A. As can be seen the existing factor of safety is in the order of 1.25 and reduces to some 1.1 with the addition of 1 m of fill. As such, we recommend that at this time the depth of fill be limited to the 1 m depth and the fill slopes be maintained as shown on the preliminary Plan No. 90-587.

4.3 Settlement

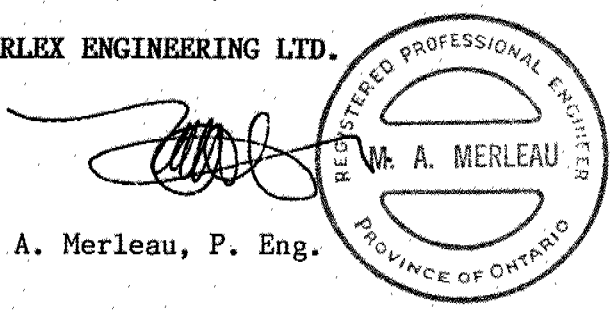
Using the result of the dilatometer tests and assuming a profile grade rise of 1.0 m, it is estimated that settlement resulting from the additional embankment fill will be of the order of 75 mm to 100 mm.

The comments in this report are intended for the guidance of the design engineer. The number of boreholes required to determine the localized conditions between boreholes directly affecting construction costs, equipment, scheduling, hydraulic elevator shafts, etc. would in fact be greater than what has been carried out for design purposes. Therefore, contractors bidding on this project or undertaking this work should make their own interpretations of the factual borehole results and carry out further work as they deem necessary to assess the scope of the project.

We trust that the comments contained in this report are sufficient for your present requirements. However should you have any queries or if we could be of further assistance to you please do not hesitate to contact the undersigned.

Yours very truly,

MERLEX ENGINEERING LTD.

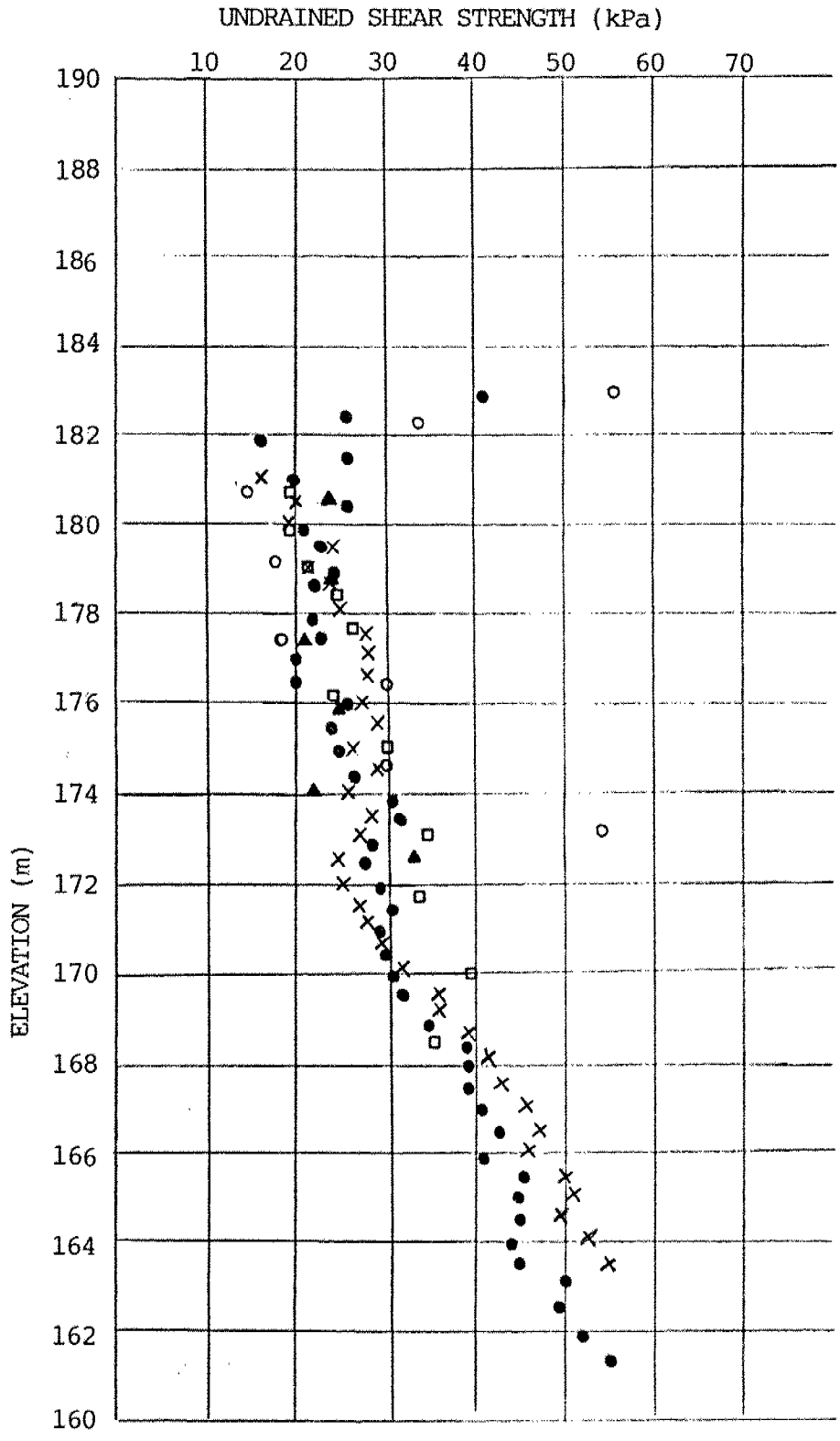


M. A. Merleau, P. Eng.

APPENDIX "A"

REFERENCE Nº 91/06/1061

ENCLOSURE Nº 1



LEGEND

- ● DMT at BH1
- × DMT at BH2
- o VANE at BH1
- □ VANE at BH2
- ▲ VANE at BH3

NOTE: All field vanes reduced by 20% for Plasticity.

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SHEAR STRENGTH RESULTS
Hillcoat Bridge, Township of Kerns

ENCLOSURE Nº 2

WABI RIVER

DMT B
BH 1
BH 3
BH 2
DMT A

BM
Nail and Washer on the south face of Hydro Pole (Elev. 192.122 m)

LEGEND

- Borehole
- Dilatometer

MERLEX ENGINEERING LTD.
CONSULTING GEOTECHNICAL ENGINEERS

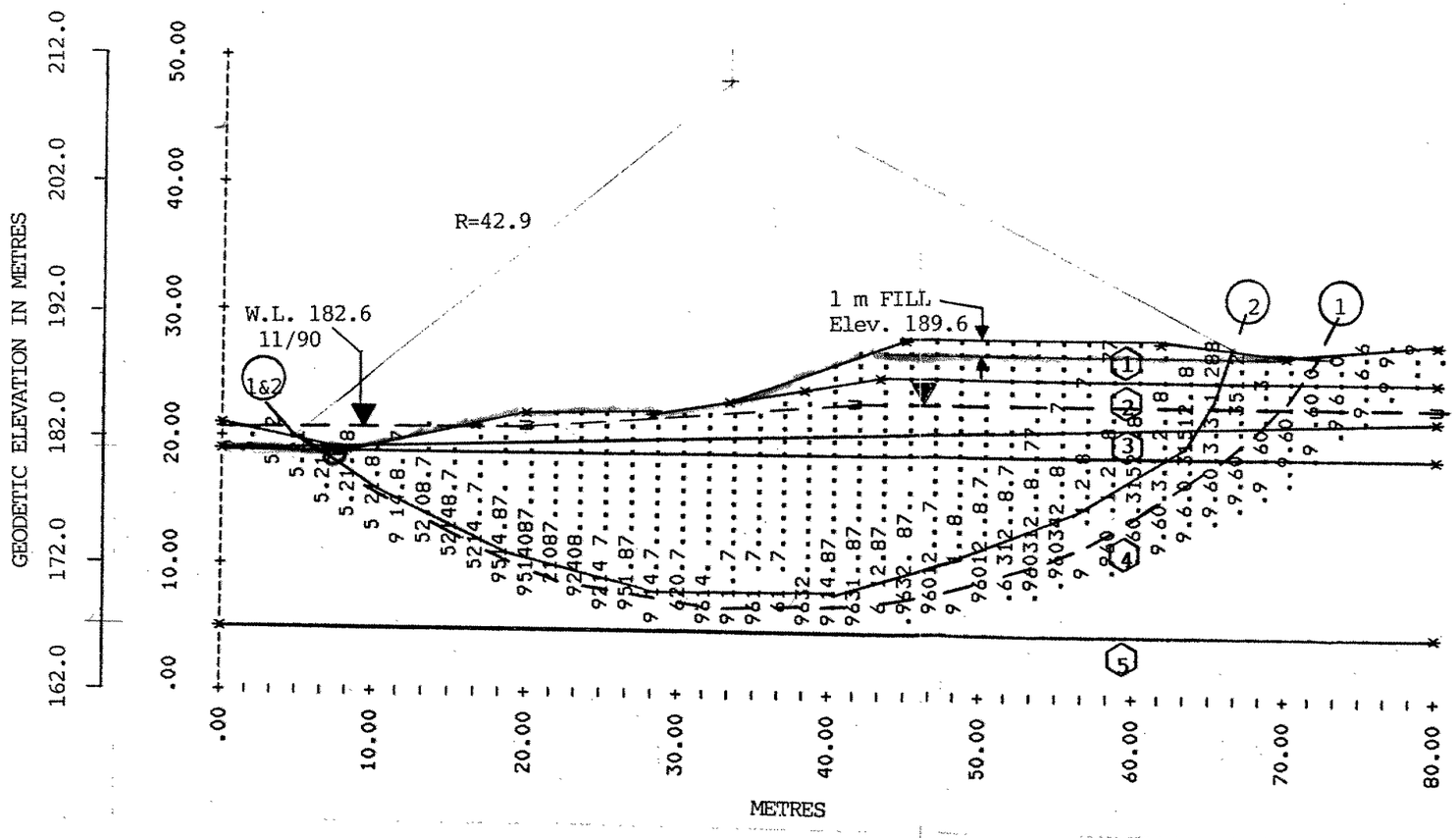
BOREHOLE LOCATION PLAN
Hillcoat Bridge
MTO Site 47-204
Township of Kerns
New Liskeard, Ontario

SCALE: N.T.S.

REFERENCE Nº 91/06/1061

ENCLOSURE Nº 3

SOIL PARAMETERS						SUMMARY OF SAFETY FACTORS		
SOIL DESCRIPTION	MARK	UNIT WEIGHT NAT. MC.	UNIT WEIGHT SAT	SHEAR STRENGTH COHESION	SHEAR STRENGTH PHI	FAILURE SURFACE	CONDITION	Fs
Granular Fill	⟨1⟩	1850	1920	0	40	CIRCLE (1)	Existing Embankment	1.25
Sandy Silt	⟨2⟩	1745	1790	0	30	CIRCLE (2)	1 m Fill	1.06
Firm Clay (Crust)	⟨3⟩	1800	1800	4600	0			
Soft Clay	⟨4⟩	1760	1760	2250	0			
Firm Clay	⟨5⟩	1820	1880	3375	0			
		kg/cu.m.		kg/sq.m.				



SECTION A-A

MERLEX ENGINEERING LTD.
CONSULTING GEOTECHNICAL ENGINEERS

HILLCOAT BRIDGE
MTO SITE 47-204
Township of Kerns
SW Abutment

LOG OF BOREHOLE No. 1 - Page 1 of 2

JOB No.: 91/06/1061 **LOCATION:** Kern's Twp, Lot 2, Cons 3 & 4
JOB DESCRIPTION: Soils Investigation, Hillcoat Bridge
METHOD OF BORING: CME 45 **DATE:** June 17, 1991

ELEV. / DEPTH m	SOIL DESCRIPTION	SAMPLES No.	TYPE	"N"	DEPTH SCALE SYMBOL m
188.86	Existing Grade				
	FILL - 150 mm of organic sand over gravelly sand some silt with occasional cobbles, compact, brown	1	DO	10	
187.86		2	DO	12	1
~1.00	PROBABLE FILL - sandy silt some clay, trace of fine gravel				
186.76		3	DO	13	2
~2.10	SANDY SILT - trace to some clay, compact, grey-brown to grey	4	DO	12	
		5	DO	15	3
184.16					4
~4.70	VARVED CLAY - some sand seams, stiff to firm, grey-brown to brown and grey	6	DO	3	5
		6B	DO	6	6
		7	DO	5	7
180.96		8	DO	3	8
7.90 180.79	VARVED CLAY - soft to firm, grey.				
8.07	Continued on page 2				

PENETRATION RESISTANCE (blows/0.3m) 0 20 40 60 80

SHEAR STRENGTH kPa + 20 40 60 80

DYNAMIC CONE PENETRATION TEST

St=6.4

St=4.2

WATER CONTENT (%) • Wp 20 40 60 80 W_L

WATER LEVEL

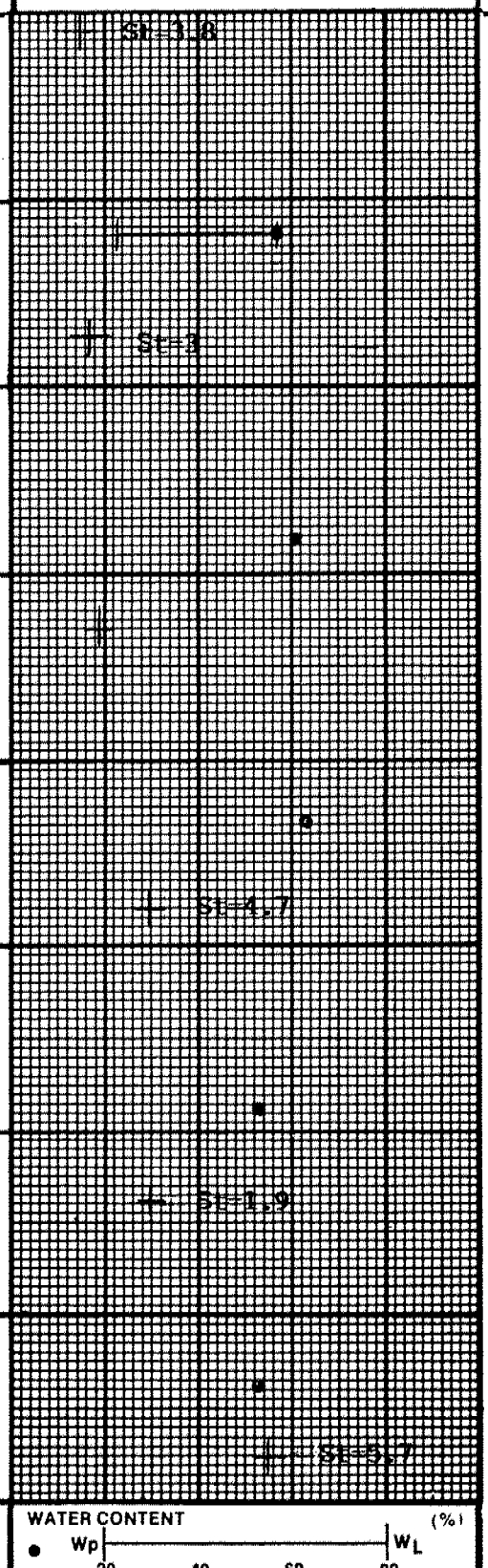
Water level at 3.65 m on June 19, after 43 hours.

LOG OF BOREHOLE No. 1 - Page 2 of 2

JOB No.: 91/06/1061 **LOCATION:** Kern's Twp., Lot 2, Cons 3 & 4
JOB DESCRIPTION: Soils Investigation, Hillcoat Bridge
METHOD OF BORING: CME 45 **DATE:** June 17, 1991

ELEV. DEPTH m	SOIL DESCRIPTION	SAMPLES No.	SAMPLES TYPE	SAMPLES "N"	DEPTH SCALE SYMBOL m
180.79	Con't from page 1				
	VARVED CLAY - soft to firm, grey				
		9	DO	PM	
		10	DO	PM	
		11	DO	WR	
		12	DO	WR	
		13	DO	PH	
172.86 16.00	END OF BOREHOLE				

PENETRATION RESISTANCE (blows/0.3m) 0 20 40 60 80
SHEAR STRENGTH kPa + 20 40 60 80
WATER LEVEL



MERLEX ENGINEERING LTD.

LOG OF BOREHOLE No. 2 - Page 1 of 2

JOB No.: 91/06/1061 **LOCATION:** Kern's Twp, Lot 2, Cons 3 & 4
JOB DESCRIPTION: Soils Investigation, Hillcoat Bridge
METHOD OF BORING: CME 45 **DATE:** June 18, 1991

ELEV. / DEPTH m	SOIL DESCRIPTION	SAMPLES No.	TYPE	"N"	DEPTH SCALE SYMBOL m
184.27	Existing Ground				
	SILTY FINE SAND - trace to some organics, trace to some clay, loose, brown	1	DO	4	
		2	DO	6	1
182.87					
~1.40	SANDY SILT - trace of organics, trace to some clay, loose, brown becoming grey at ±2m	3	DO	7	2
		4	DO	5	
180.97					3
~3.30	VARVED CLAY - soft to firm, grey	5	DO	3	
		6	DO	2	4
		7	DO	PM	5
		8	DO	PM	6
		9	DO	PM	7
		10	DO	PM	8
176.20					
8.07	Continued on Page 2				

PENETRATION RESISTANCE (blows/0.3m) O 20 40 60 80
SHEAR STRENGTH kPa + 20 40 60 80

St=4.3
St=3
St=6.8
St=4.4
St=6.4

WATER CONTENT (%) Wp ● W_L 20 40 60 80

WATER LEVEL

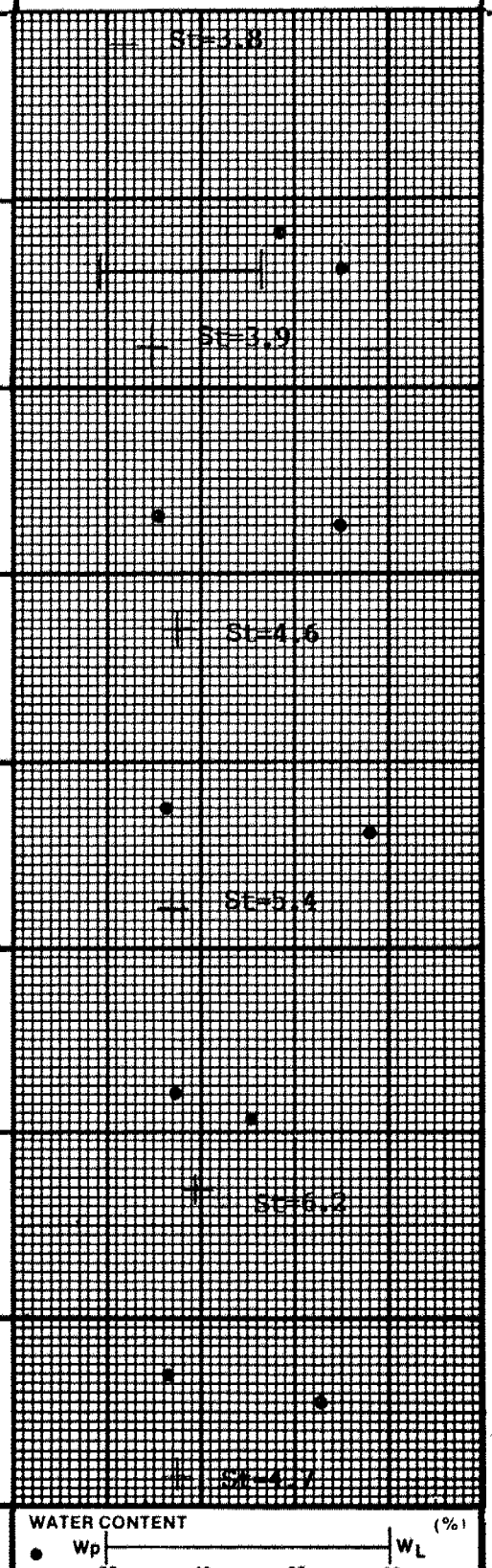
Water level at 7.6 m on June 21, after 66 hours.

LOG OF BOREHOLE No. 2 - Page 2 of 2

JOB No.: 91/06/1061 **LOCATION:** Kern's Twp., Lot 2, Cons 3 & 4
JOB DESCRIPTION: Soils Investigation, Hillcoat Bridge
METHOD OF BORING: CME 45 **DATE:** June 18, 1991

ELEV. / DEPTH m	SOIL DESCRIPTION	SAMPLES No.	SAMPLES TYPE	SAMPLES "N"	DEPTH SCALE SYMBOL m
176.20	Con't from page 1				
	VARVED CLAY - soft to firm, grey				
		11	DO	WR	
		12	DO	PM	
		13	DO	PM	
		14	DO	WR	
		15	DO	WR	
168.27					
16.00	END OF BOREHOLE				

PENETRATION RESISTANCE (blows/0.3m) O 20 40 60 80
SHEAR STRENGTH kPa + 20 40 60 80
WATER LEVEL



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LOG OF BOREHOLE No. 3 - Page 1 of 2

JOB No.: 91/06/1061 **LOCATION:** Kern's Twp., Lot 2, Cons 3 & 4
JOB DESCRIPTION: Soils Investigation, Hillcoat Bridge
METHOD OF BORING: CME 45 **DATE:** June 19, 1991

ELEV. / DEPTH m	SOIL DESCRIPTION	SAMPLES No.	TYPE	"N"	DEPTH SCALE SYMBOL m
188.53	Existing Grade				
	PROBABLE FILL - gravelly sand, brown changing at 0.6m± to silt with fine sand and some clay, brown, loose to compact.	1	DO	14	
		2	DO	10	1
		3	DO	7	2
		4	DO	8	
185.63					3
~2.90	BLACK ORGANIC SAND - possible original topsoil				
185.23		5	DO	7	
~3.30	SANDY SILT - trace to some clay, very loose to loose, brown	6	DO	3	4
183.83					
~4.70	SANDY SILT - with clay organic pockets throughout very loose to loose, grey	7	DO	4	5
		8	DO	7	
		9	DO	4	6
181.53					7
~7.00	VARVED CLAY - firm, grey	10	DO	PM	
180.46					8
8.07	Continued on Page 2				

PENETRATION RESISTANCE (blows/0.3m) 0 20 40 60 80
SHEAR STRENGTH kPa + 20 40 60 80
WATER LEVEL
WATER CONTENT (%) • Wp W_L 20 40 60 80

MERLEX ENGINEERING LTD.

LOG OF BOREHOLE No. 3 - Page 2 of 2

JOB No.: 91/06/1061 **LOCATION:** Kern's Twp., Lot 2, Cons 3 & 4
JOB DESCRIPTION: Soils Investigation, Hillcoat Bridge
METHOD OF BORING: CME 45 **DATE:** June 19, 1991

ELEV. / DEPTH m	SOIL DESCRIPTION	SAMPLES No.	SAMPLES TYPE	SAMPLES "N"	DEPTH SCALE SYMBOL m
180.46	Con't from Page 1				
	VARVED CLAY - firm, grey				
					9
		11	TW	PM	
					10
		12	TW	WR	11
					12
		13	DO	WR	
					13
		14	TW	WR	14
					15
		15	DO	PM	
172.53					16
16.00	END OF BOREHOLE				

PENETRATION RESISTANCE (blows/0.3m) 0 20 40 60 80

SHEAR STRENGTH kPa + 20 40 60 80

St=4.3

St=3

St=3.8

St=5

St=5

St=5.3

WATER CONTENT (%) Wp W_L 20 40 60 80

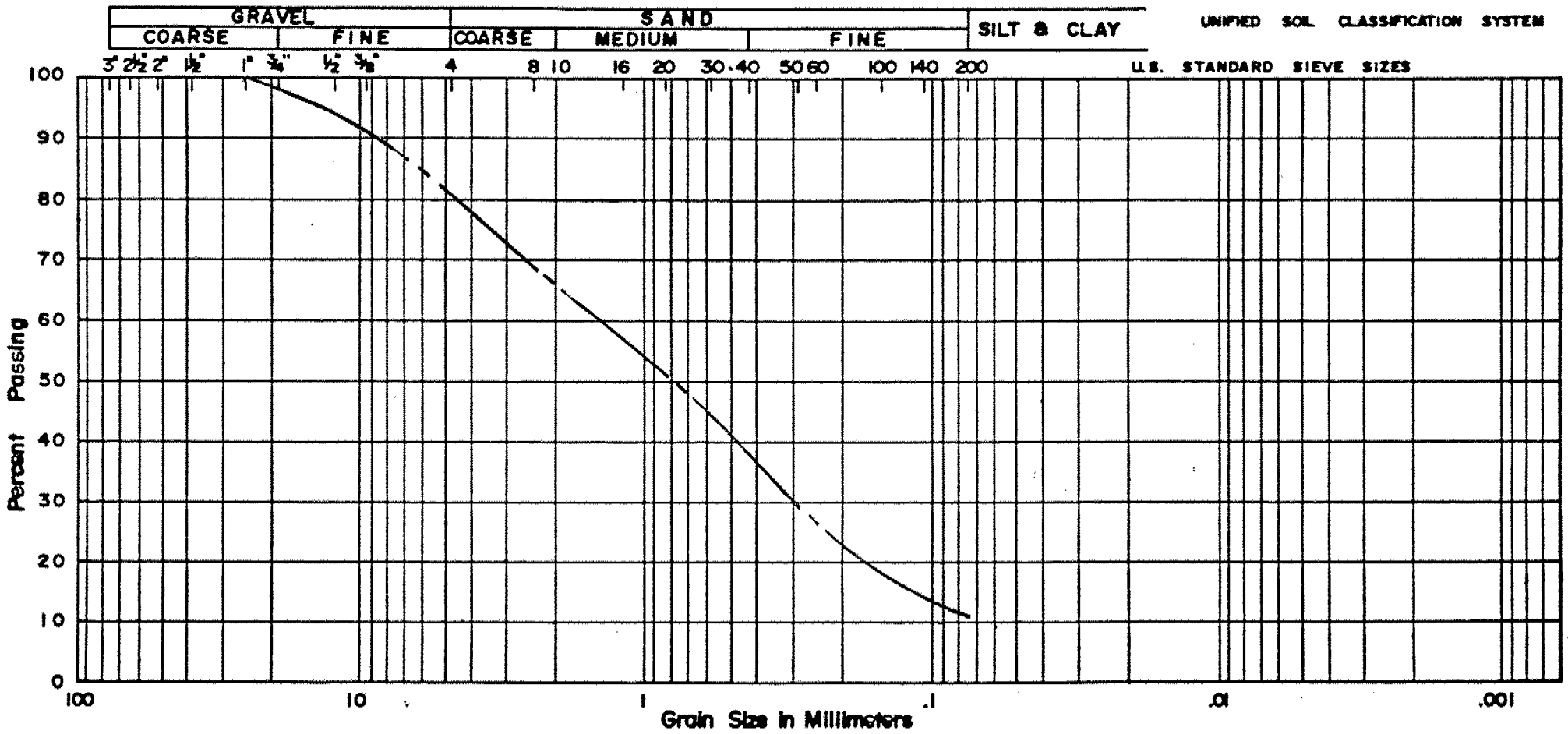
WATER LEVEL

Water level at 10.2 m on June 21, after 36 hours.

91/06

OUR REFERENCE № 1061

GRAIN SIZE DISTRIBUTION



PROJECT: Hillcoat Bridge
LOCATION: Kerns Twp.
BOREHOLE № : 1
SAMPLE № : 1
DEPTH: 0 - 0.6m
ELEVATION: 188.87 - 188.27

COEFFICIENT OF UNIFORMITY : D60/D10 =
COEFFICIENT OF CURVATURE : $(D30)^2/D10xD60$ =

Classification of Sample and Group Symbol:

SAND WITH FINE GRAVEL, SOME SILT

PLASTIC PROPERTIES

LIQUID LIMIT	%	=
PLASTIC LIMIT	%	=
PLASTICITY INDEX	%	=
MOISTURE CONTENT	%	=

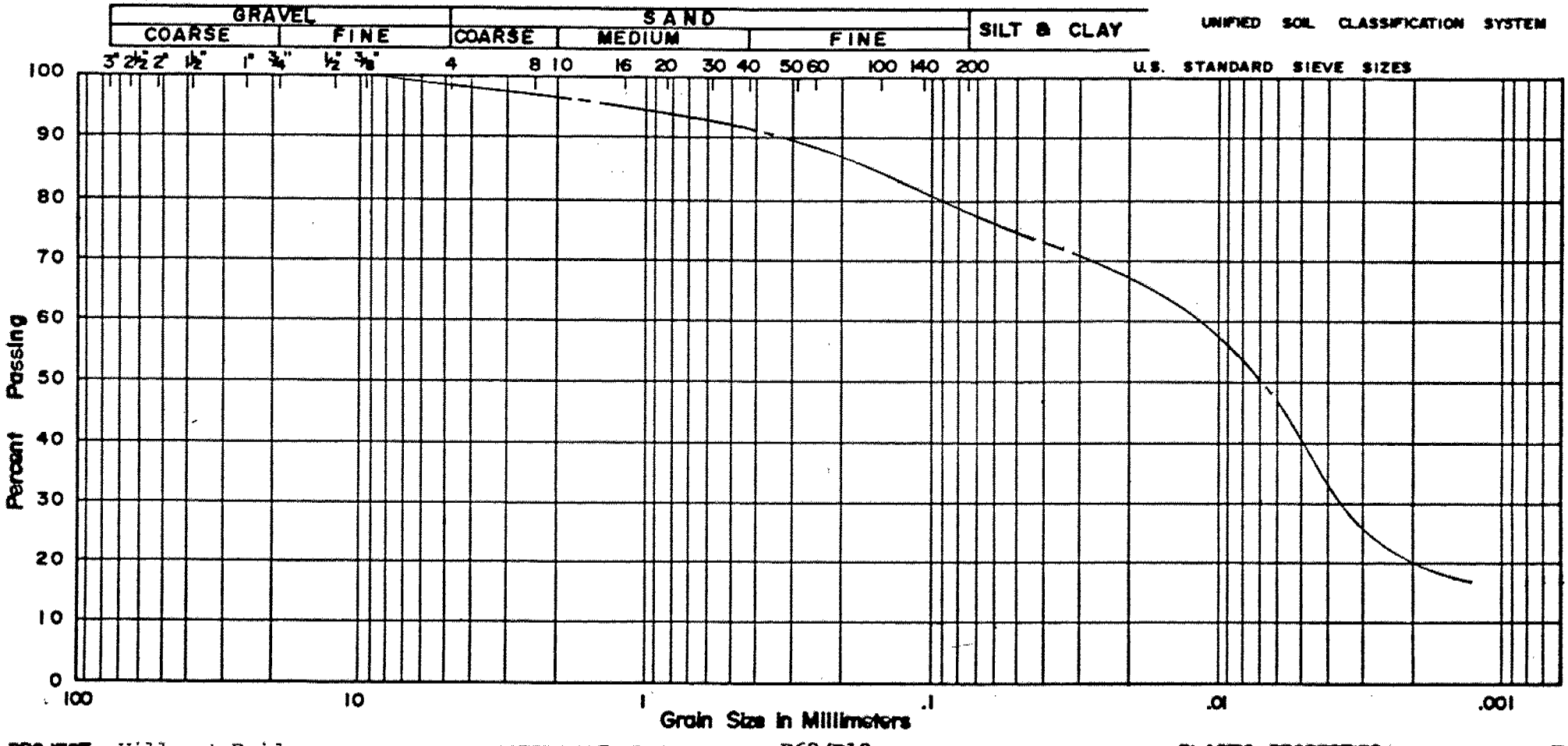
ENCLOSURE №

MERLEX ENGINEERING LTD.

91/06/

OUR REFERENCE № 1061

GRAIN SIZE DISTRIBUTION



PROJECT: Hillcoat Bridge
LOCATION: Kerns Twp.
BOREHOLE №: 1
SAMPLE №: 3
DEPTH: 1.5 - 2m
ELEVATION: 187.37 - 186.87m

COEFFICIENT OF UNIFORMITY: D60/D10 =
COEFFICIENT OF CURVATURE: $(D30)^2/D10xD60$ =

Classification of Sample and Group Symbol:

SANDY SILT, SOME CLAY, TRACE OF FINE GRAVEL

PLASTIC PROPERTIES

LIQUID LIMIT % =
PLASTIC LIMIT % =
PLASTICITY INDEX % =
MOISTURE CONTENT % =

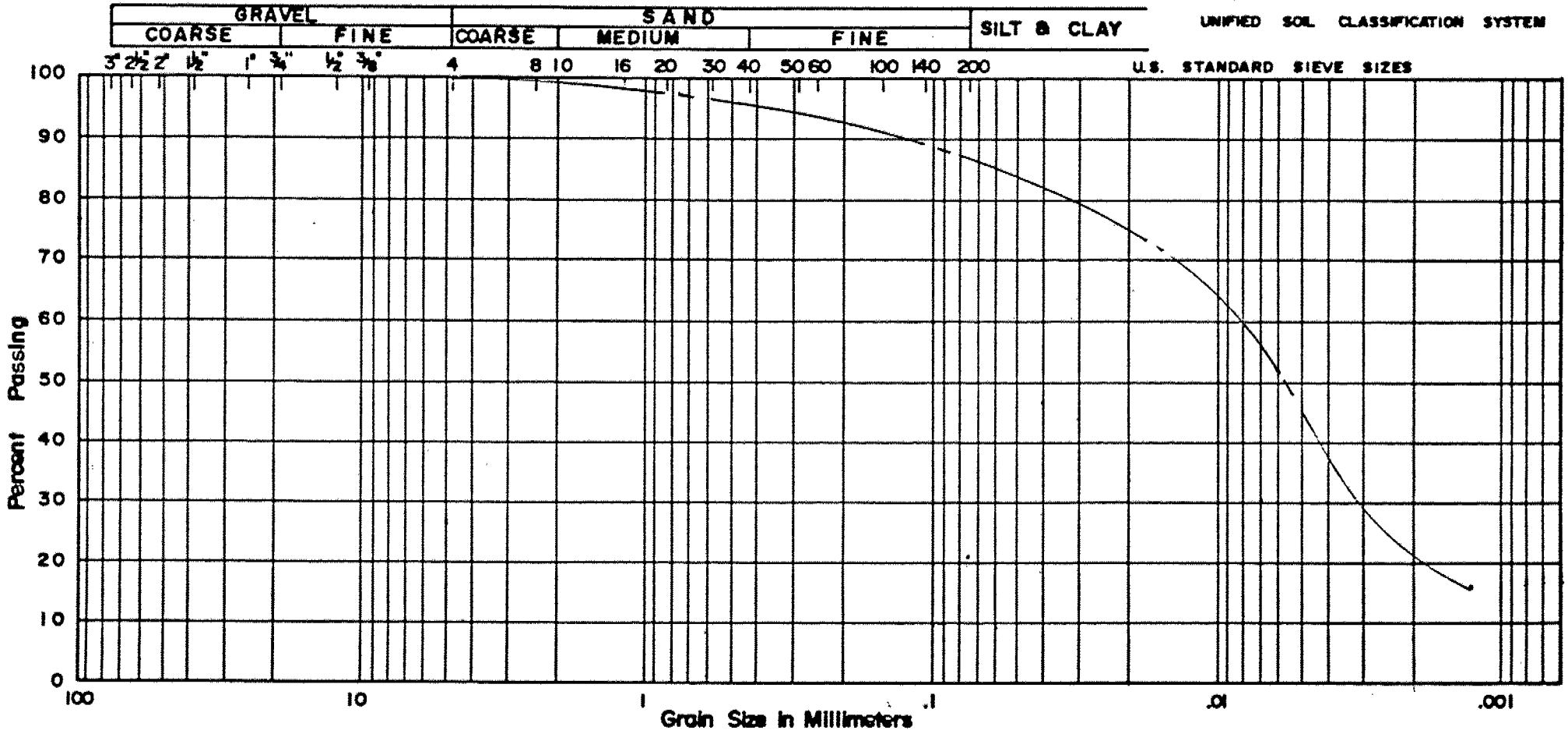
ENCLOSURE №

MERLEX ENGINEERING LTD.

91/06/

OUR REFERENCE Nº 1061

GRAIN SIZE DISTRIBUTION



PROJECT: Hillcoat Bridge
LOCATION: Kerns Twp.
BOREHOLE Nº: 1
SAMPLE Nº: 5
DEPTH: 3 - 3.5m
ELEVATION: 185.87 - 185.37m

COEFFICIENT OF UNIFORMITY: D60/D10 =
COEFFICIENT OF CURVATURE: $(D30)^2/D10xD60$ =

Classification of Sample and Group Symbol:

SILT WITH CLAY, SOME SAND

PLASTIC PROPERTIES

LIQUID LIMIT	% =
PLASTIC LIMIT	% =
PLASTICITY INDEX	% =
MOISTURE CONTENT	% =

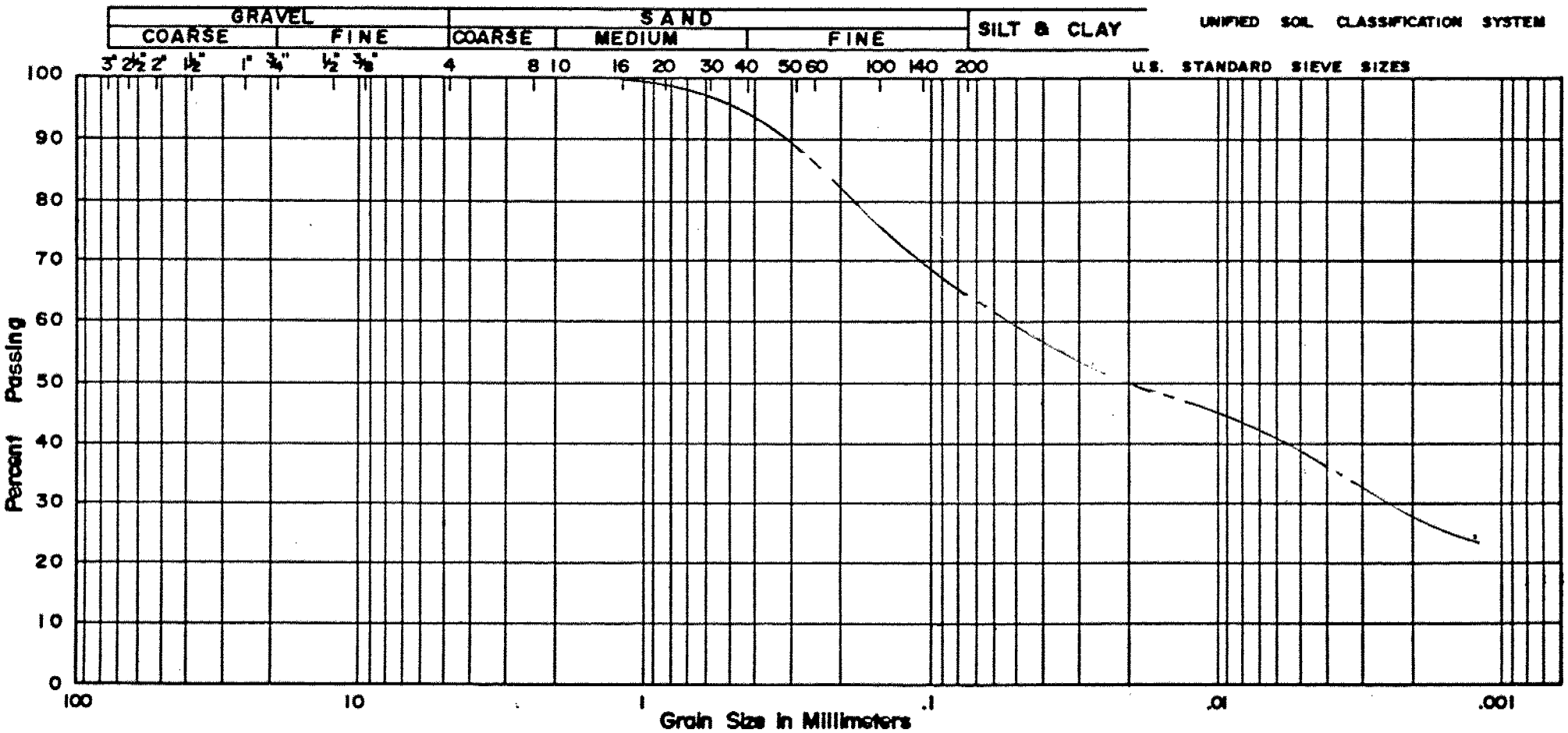
ENCLOSURE Nº

MERLEX ENGINEERING LTD.

91/06

OUR REFERENCE Nº 1061

GRAIN SIZE DISTRIBUTION



PROJECT: Hillcoat Bridge

LOCATION: Kerns Twp.

BOREHOLE Nº: 2

SAMPLE Nº: 3

DEPTH: 1.5 - 2m

ELEVATION: 182.77 - 182.27m

COEFFICIENT OF UNIFORMITY: D60/D10 =

COEFFICIENT OF CURVATURE: $(D30)^2/D10xD60$ =

Classification of Sample and Group Symbol:

SANDY SILT WITH CLAY

PLASTIC PROPERTIES

LIQUID LIMIT % =

PLASTIC LIMIT % =

PLASTICITY INDEX % =

MOISTURE CONTENT % =

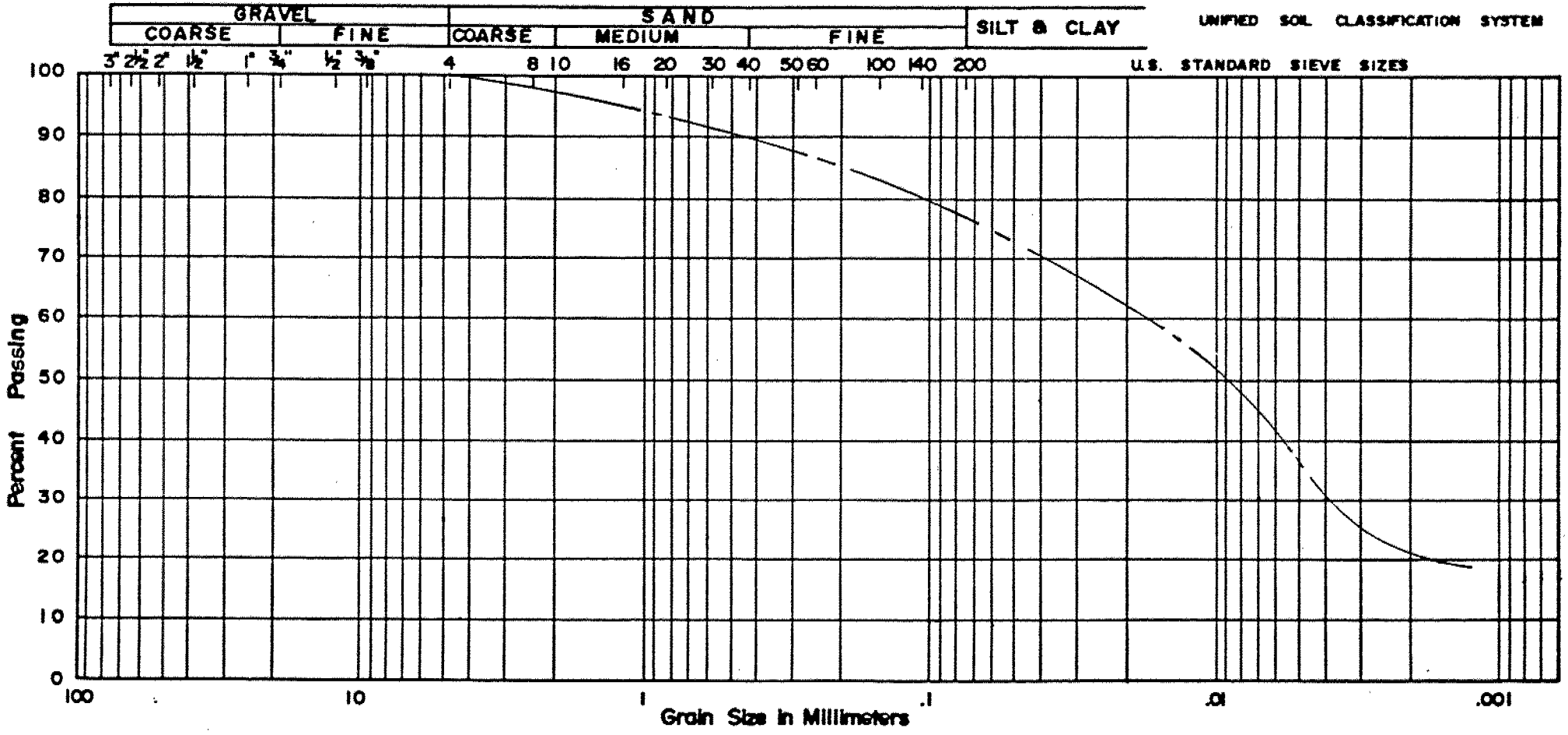
ENCLOSURE Nº

MERLEX ENGINEERING LTD.

91/06/

OUR REFERENCE № 1061

GRAIN SIZE DISTRIBUTION



PROJECT: Hillcoat Bridge
LOCATION: Kerns Twp.
BOREHOLE № : 3
SAMPLE № : 3
DEPTH: 1.5 - 2m
ELEVATION: 187.03 - 186.53m

COEFFICIENT OF UNIFORMITY : D60/D10 =
COEFFICIENT OF CURVATURE : $(D30)^2/D10xD60$ =

Classification of Sample and Group Symbol:

SILT WITH FINE SAND, SOME CLAY

PLASTIC PROPERTIES

LIQUID LIMIT % =
PLASTIC LIMIT % =
PLASTICITY INDEX % =
MOISTURE CONTENT % =

ENCLOSURE №

MERLEX ENGINEERING LTD.

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CONSULTING GEOTECHNICAL ENGINEERS

Reference No. 91/06/1061

November 16, 1992

H. Sutcliffe Ltd.
9 Wellington Street
P.O. Box 1208
New Liskeard, Ontario
P0J 1P0

Attention: Mr. I. M. Elamin, P. Eng.

Re: Geotechnical Investigation
Replacement of Hillcoat Bridge
MTO Site No. 47-204

Dear Sir:

In the initial concept, the proposed new bridge was to be a 50 m long, three span concrete structure and the approach embankment grades were to be raised by 1.0 m or more.

Our geotechnical report on the subject (Reference no. 91/06/1061, dated December 23, 1991) concluded that the factor of safety of the existing west approach embankment was 1.25 and that this would decrease to 1.06 following the addition of 1.0 m of fill. Potential total settlement under the latter condition was estimated to be of the order of 75 mm to 100 mm.

These values were deemed to be unacceptable and you have since considered various alternatives with a view of increasing slope stability and either decreasing settlement or ameliorating its effect. The current proposal which you asked us to analyze is a 54.86 m long, two span Acrow Panel 700 Series Bridge with increase in embankments grades to be limited to 600 mm and 500 mm at the east and west approach, respectively.

120 PROGRESS COURT • P.O. BOX 885 • NORTH BAY, ONTARIO. P1B 8K1 • TEL: (705) 476-2550 • FAX: (705) 476-8882

The revised layout, prepared by you, has been reproduced on the enclosed plan which also shows the boring locations and the cross sections which were selected for final stability analyses.

Increasing the bridge span and limiting the addition of fill have improved the factors of safety as follows:

CROSS SECTION	CASE	FACTOR OF SAFETY
SW Embankment (A-A)	3:1 slopes w/500 mm FILL	1.28
	2:1 slopes w/500 mm FILL	1.35
NE Embankment (B-B)	3:1 slopes w/600 mm FILL	1.16
	2:1 slopes w/600 mm FILL	1.23
	2:1 slopes w/300 mm FILL and 300 mm HI	1.28
E Embankment (C-C)	600 mm FILL	1.26
	300 mm FILL and 300 mm HI	1.30

Note: FILL - indicates granular fill unit wt. 19.2 kN/m^3
HI - indicated insulation unit wt. 0.5 kN/m^3

As can be seen, changing the embankment slopes from 3:1 to 2:1 improves the factor of safety against deep-seated failure. The 2:1 slope was analyzed for shallow failure and the factor of safety was of the order of 1.8.

It can further be seen that in order to significantly raise the factor of safety above 1.25, it is necessary to reduce the weight of the fill. In the above analyses this has been achieved by the use of expanded polystyrene (EPS) rigid plastic foam.

In using EPS under pavement structures, the design must be checked for potential floatation during floods and the insulation must be covered by polyethylene sheeting to protect it against solvent (hydrocarbon) spills. The longitudinal section of the insulation should be tapered at the ends as per OPSD 514.01 and 514.02 to minimize differential movement due to frost penetration.

Settlement of the approach will vary depending upon the amount of new fill added. If new granular fill is limited to 300 mm it is estimated, based on DMT data, that settlement will be less than 25 mm. If 500 mm of new fill (west side) is added the estimated settlement increases to 35 to 50 mm.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known, in our analysis certain assumptions had to be made. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis.

The comments in this report are intended for the guidance of the design engineer. The number of boreholes required to determine the localized conditions between boreholes directly affecting construction costs, equipment, scheduling, etc. would in fact be greater than what has been carried out for design purposes. Therefore, contractors bidding on this project or undertaking this work should make their own interpretations of the factual borehole results and carry out further work as they deem necessary to assess the scope of the project.

We trust that the comments contained in this report are sufficient for your present requirements. However should you have any queries or if we could be of further assistance to you please do not hesitate to contact the undersigned.

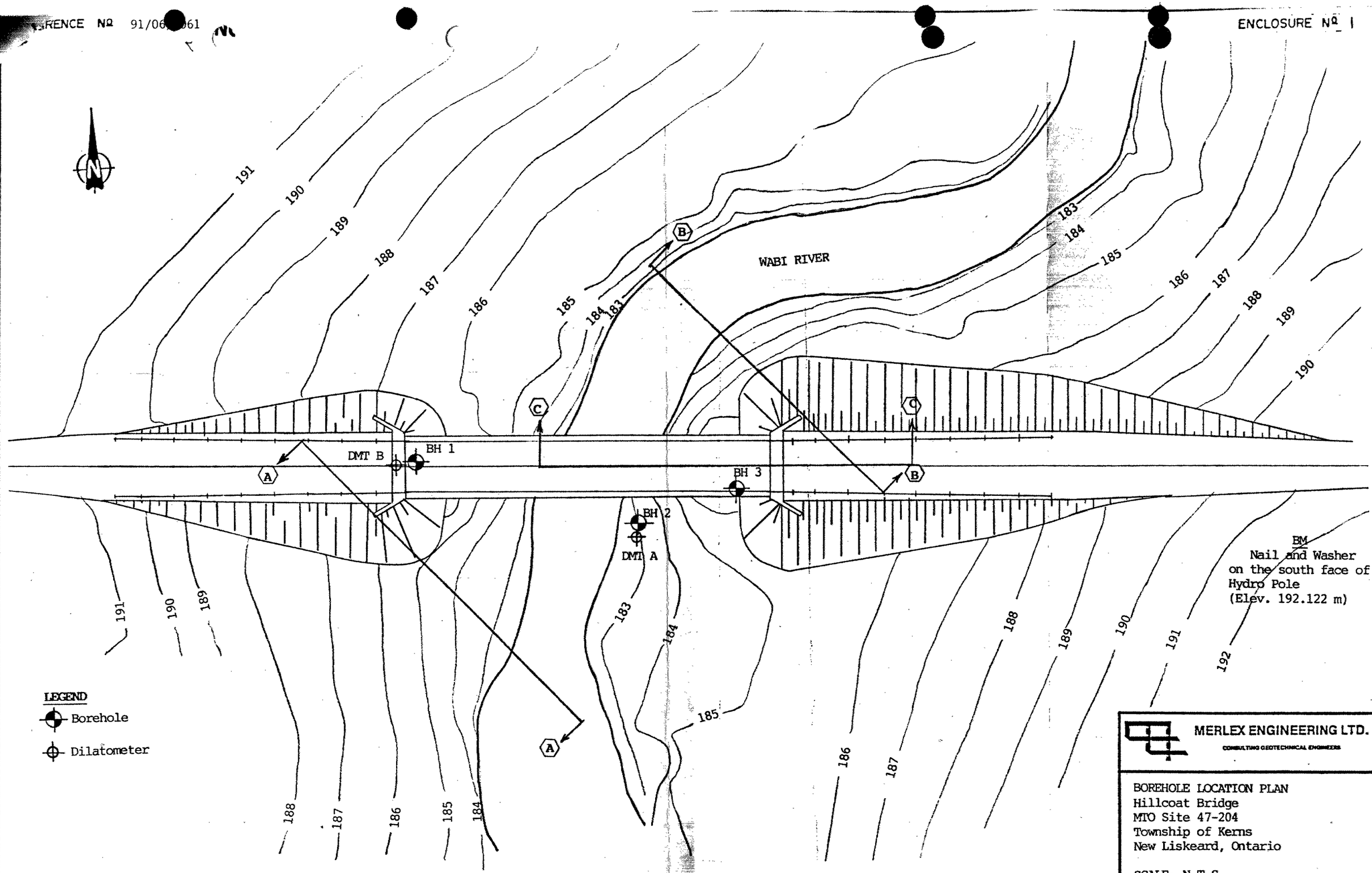
Yours very truly,

MERLEX ENGINEERING LTD.

M. A. Merleau, P. Eng.

MAM/cl

ENCLOSURE NO 1



MERLEX ENGINEERING LTD.
CONSULTING GEOTECHNICAL ENGINEERS

BOREHOLE LOCATION PLAN
Hillcoat Bridge
MTO Site 47-204
Township of Kerns
New Liskeard, Ontario

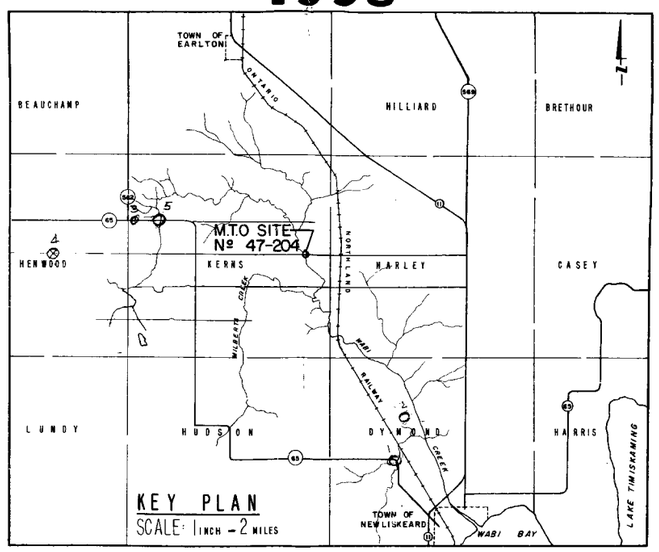
SCALE: N.T.S.

CORPORATION OF THE TOWNSHIP OF KERNS

HILLCOAT BRIDGE

LOT 2 CONCESSION 3&4
TOWNSHIP OF KERNS DISTRICT OF TIMISKAMING

1993



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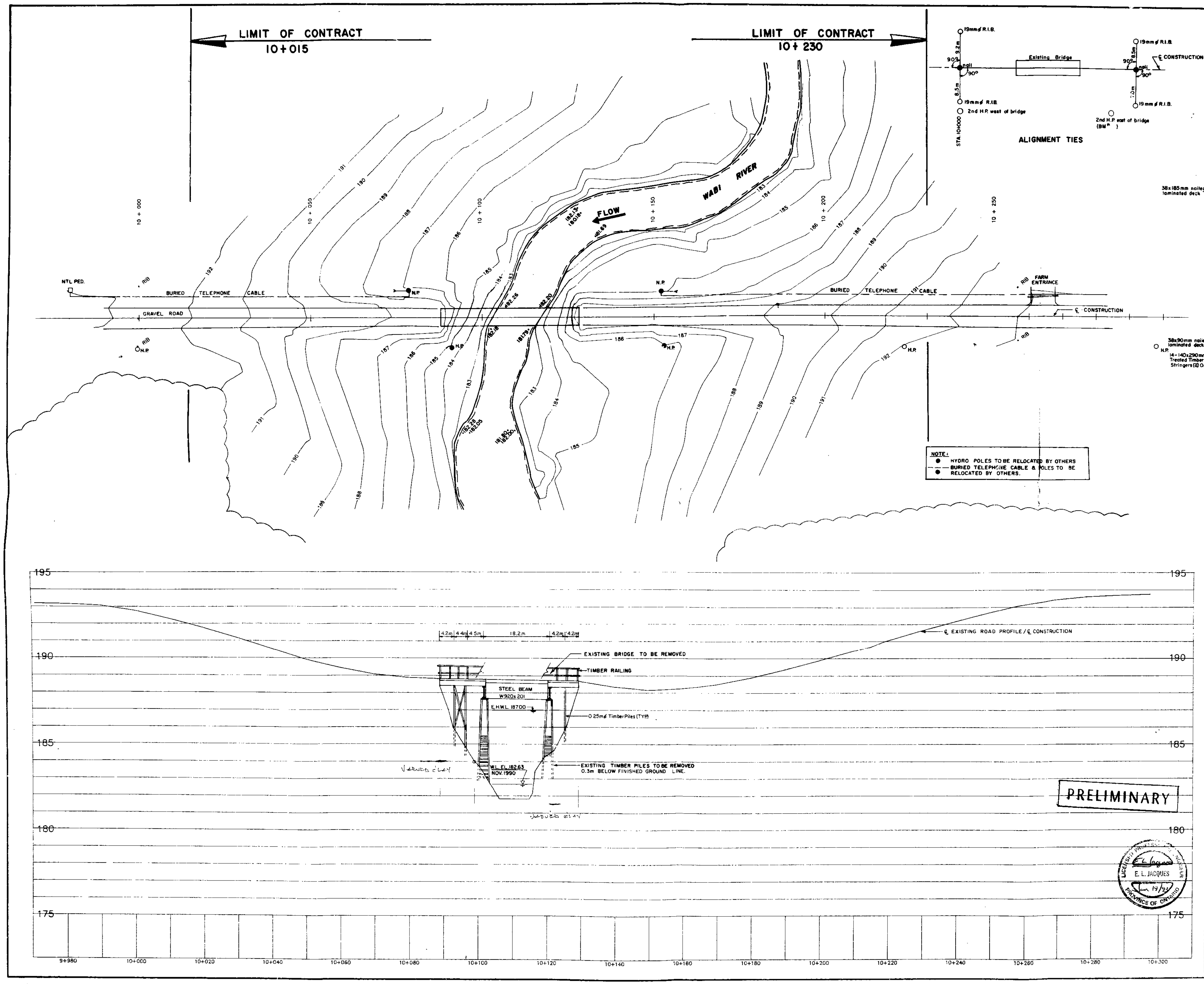
PRELIMINARY

CORPORATION OF THE
TOWNSHIP OF KERNS
R R Nº 1
NEW LISKEARD ONT.

PROJECT NO. E-90036

H S UTCLIFFE LIMITED
CONSULTING ENGINEERS
NEW LISKEARD ONTARIO



DRAWING TITLE	SHEET Nº
REMOVALS	1

ORIENTATION

Nº	DATE	REVISION	BY

CORPORATION OF THE
TOWNSHIP OF KERNS

HILLCOAT BRIDGE
LOT 2, CON III & IV, TWP. OF KERNS
M.T.O. STRUCTURE 47-204

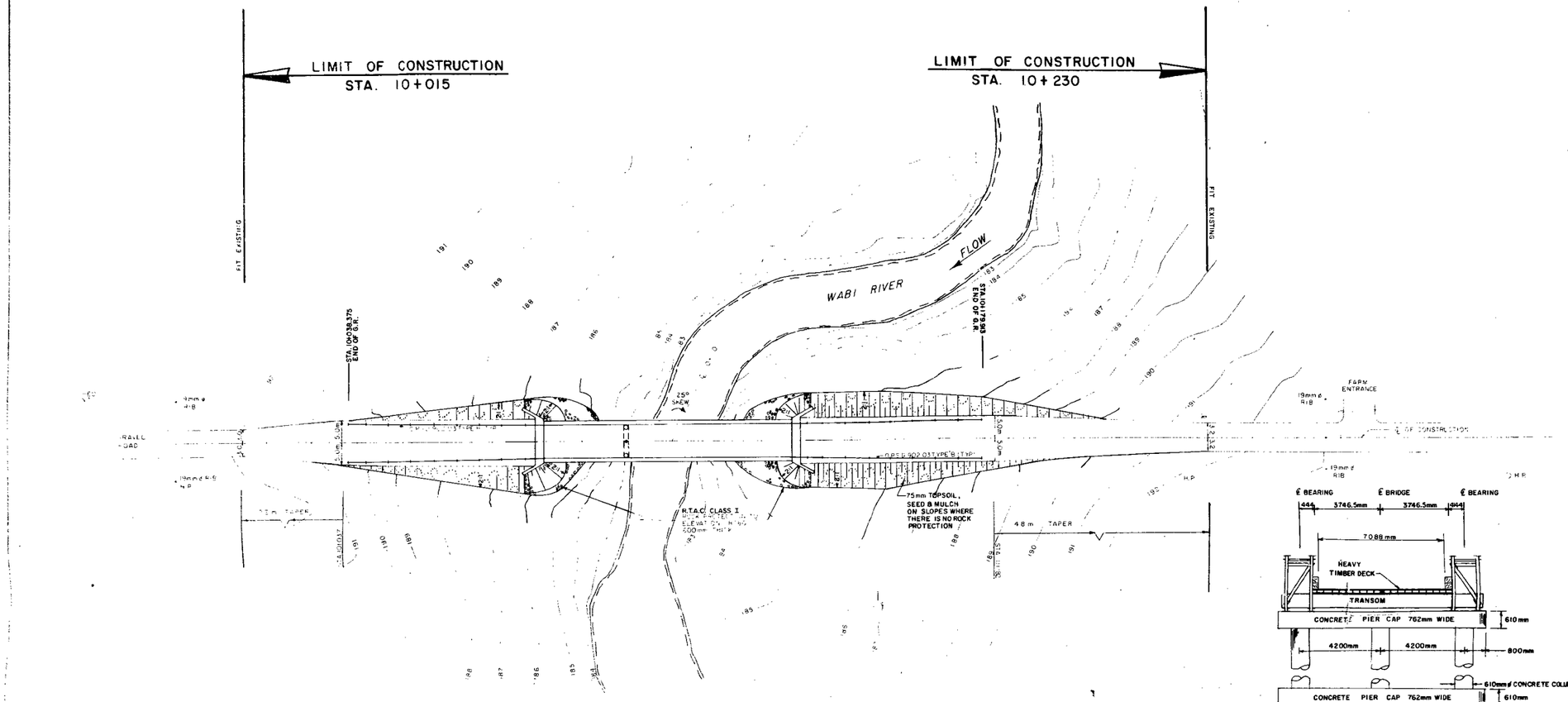
PROJECT Nº E90036

DRAWING TITLE

REMOVALS

DRAWN J.W.S. B.R.P./CAD	SCALES HORIZ. 1:500 VERT. 1:100
CHECKED I.M.E.	PLAN Nº. 90-587
NOTES E-45 E90036+.CRE	SHEET Nº. 1
DATE MAR. 1991	REVISION

H SUTCLIFFE LIMITED
CONSULTING ENGINEERS
NEW LISKEARD, ONTARIO P.O. BOX 1208
TELEPHONE (705) 647-4311, FAX (705) 647-3111



DRAWING TITLE: NEW CONSTRUCTION — SHEET No. 2

ORIENTATION

SPECIFICATIONS

1. ONTARIO HIGHWAY BRIDGE DESIGN CODE, 1983.
2. LIVE LOAD O.H.B.D.C. – 83.
3. RAILING LOADS AND DEFLECTION LIMITS DO NOT CONFORM TO O.H.B.D.C.

GENERAL NOTES

1. ACROW PANEL BRIDGE MANUFACTURED BY ACROW LIMITED.
2. DOUBLE WIDE HEAVY TIMBER DECK, WEST SPAN- DOUBLE-SINGLE CONSTRUCTION, EAST SPAN- DOUBLE-SINGLE REINFORCED 2H CONSTRUCTION.
3. ALL BRIDGE STEEL COMPONENTS TO BE GALVANIZED.
4. ACROW MANUFACTURE SHOP DRAWINGS TO BE SUBMITTED FOR APPROVAL PRIOR TO FABRICATION.
5. CONTRACTOR TO SUPPLY SITE SUPERVISION BY AN ACROW ENGINEER OR HIS REPRESENTATIVE DURING LAUNCHING OF THE ACROW PANEL BRIDGE.
6. DOUBLE WIDE HEAVY TIMBER DECK CONSISTS OF 18 BAYS AT 3.048m = 54.86m NOMINAL SPAN. TOTAL WEIGHT OF BRIDGE STEEL COMPONENTS = 88 TONNES.

BENCH MARKS

BM No.1 nail and washer at the south side of an [illegible] pole located on the south of the road, about 95m east of the east end of the existing bridge.

No.	DATE	REVISION	BY
3	JAN 93	ADDED EXTRUDED EXPANDED POLYSTRENE BOARDS	J.W.S.
2	JAN 93	CHANGED ROAD SLOPES FROM 3:1 TO 2:1	J.W.S.
1	APR 92	CHANGED BRIDGE TO ACROW PANEL (700)	J.W.S.
No.	DATE	REVISION	BY

CORPORATION OF THE TOWNSHIP OF KERNS

HILLCOAT BRIDGE
LOT 2, CON III & IV, TWP. OF KERNS
M.T.C. STRUCTURE 47-204

PROJECT No. E90036

DRAWING

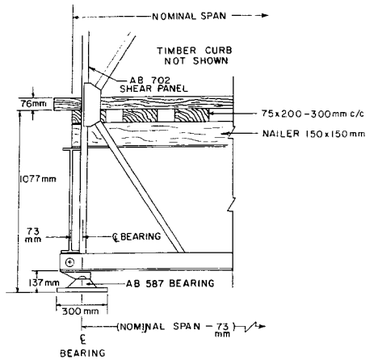
NEW CONSTRUCTION

I. M. Ali ELAMIN — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

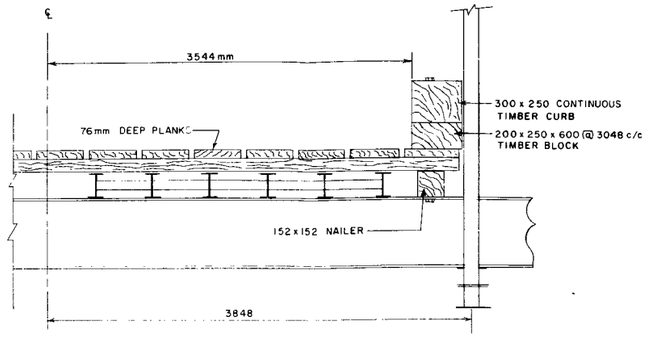
E. L. JACQUES — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — Jan 19/93

DRAWING No. 90-54
SHEET No. 2
DATE: FEB 1991
REVISION No.

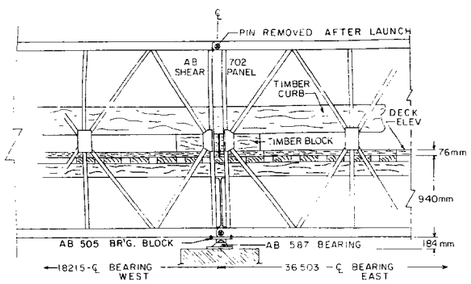
H. SUTCLIFFE
CONSULTING ENGINEERS
NEW LISKEARD, ONT. PO BOX 1208 TEL (705) 647-43[illegible]



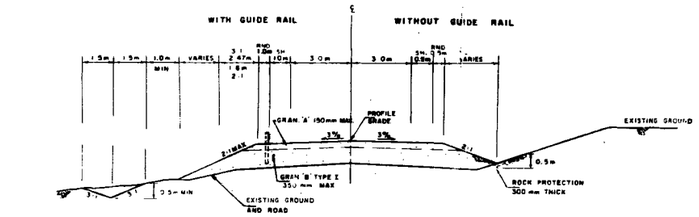
END ELEVATION ACROW PANEL (700) BRIDGE
TWO LANE TIMBER DECK



TYPICAL SECTION ACROW PANEL
BRIDGE - DOUBLE WIDE HEAVY TIMBER



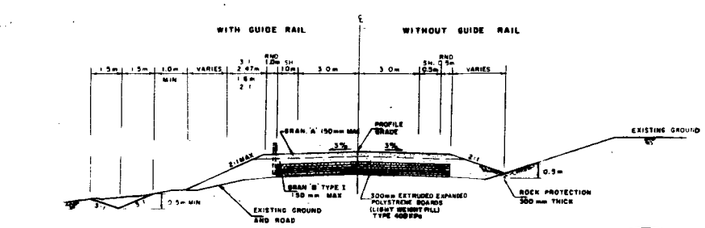
ELEVATION AT PIER - BROKEN SPAN
TWO LANE TIMBER DECK



NOTES

MINIMUM WIDTH OF SHOULDER 0.5m EXCEPT WHEN GUIDE RAIL IS REQUIRED, WIDTH TO BE 1.0m PLUS 1.0m RND.
CUT SLOPES: DEPTH OF CUT 0.5m OR LESS - 3:1, OVER 0.5m 2:1.

TYPICAL CUT AND FILL
SECTION
NOT TO SCALE
STA. 10+015 to 10+080.8 &
STA. 10+182.5 to 10+230.0



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TYPICAL CUT AND FILL
SECTION
NOT TO SCALE
STA. 10+137.5 to 10+182.5

LICENSED PROFESSIONAL ENGINEER
E. L. JACQUES
PROVINCE OF ONTARIO

DRAWING TITLE: TYPICAL SECTIONS — SHEET Nº 3
ORIENTATION

PRELIMINARY

Nº	DATE	REVISION	BY

CORPORATION OF THE TOWNSHIP OF KERNS

HILLCOAT BRIDGE
LOT 2, CON III & IV, TWP OF KERNS
M.T.O. STRUCTURE 47-204

PROJECT Nº E90036

DRAWING TITLE
TYPICAL SECTIONS

DRAWN	SCALES
J.W.S	AS SHOWN
CHECKED	PLAN Nº
I.M.E	90-587
NOTES	SHEET Nº 3
DATE	REVISION Nº
JAN 1993	A

REGISTERED PROFESSIONAL ENGINEER
I. M. Al ELAMIN
PROVINCE OF ONTARIO
91/1/93

H. SUTCLIFFE LIMITED
CONSULTING ENGINEERS
NEW LISKEARD ONT. P.O. BOX 1208 TEL. (705) 647-4311