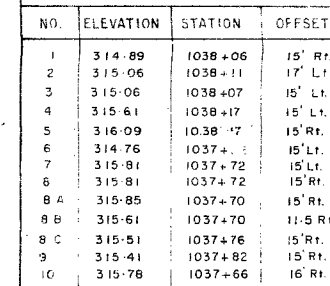
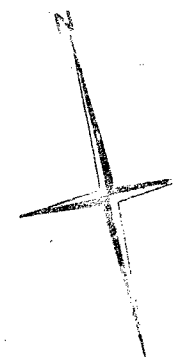


#65-F-253

W.P. #18-65

HWY. #639

♀ WEST LITTLE
WHITE RIVER



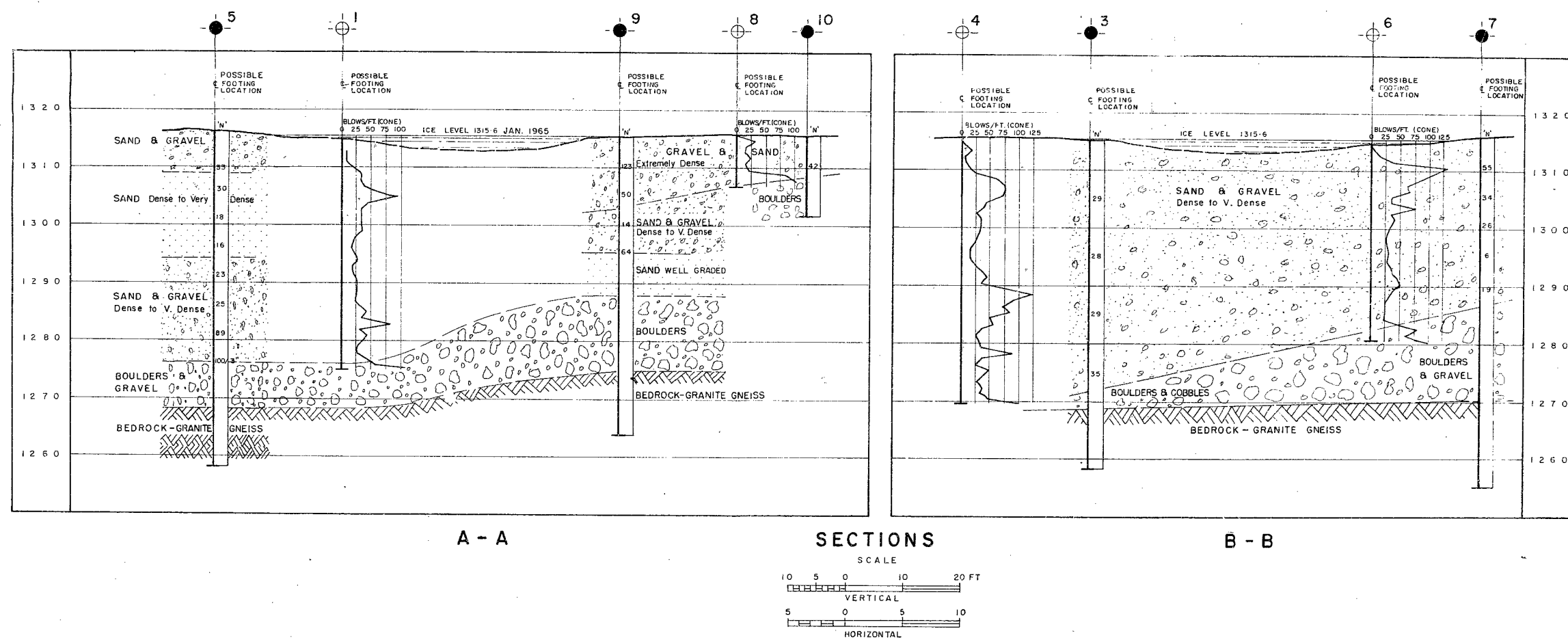
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

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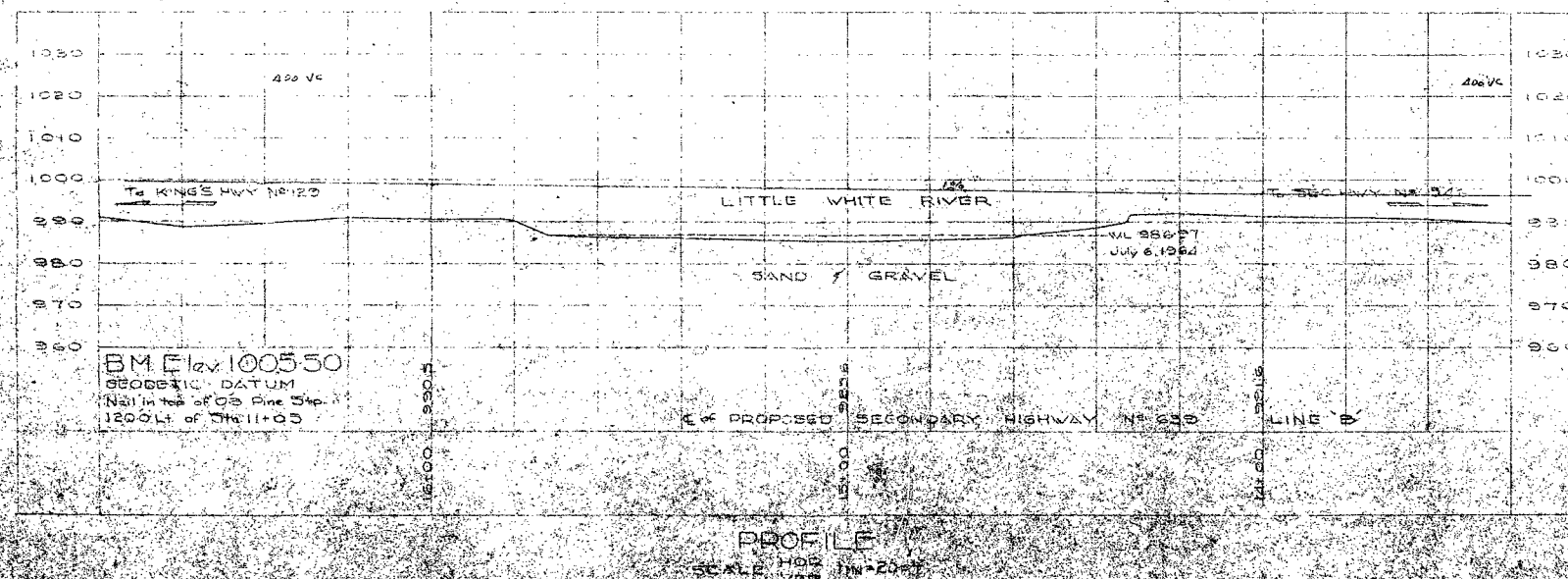
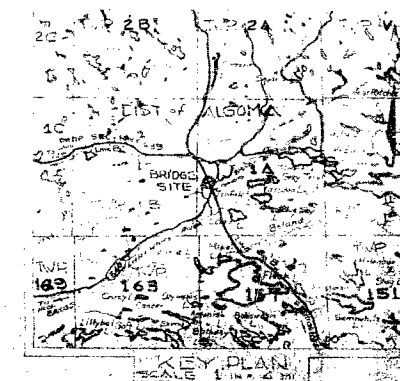
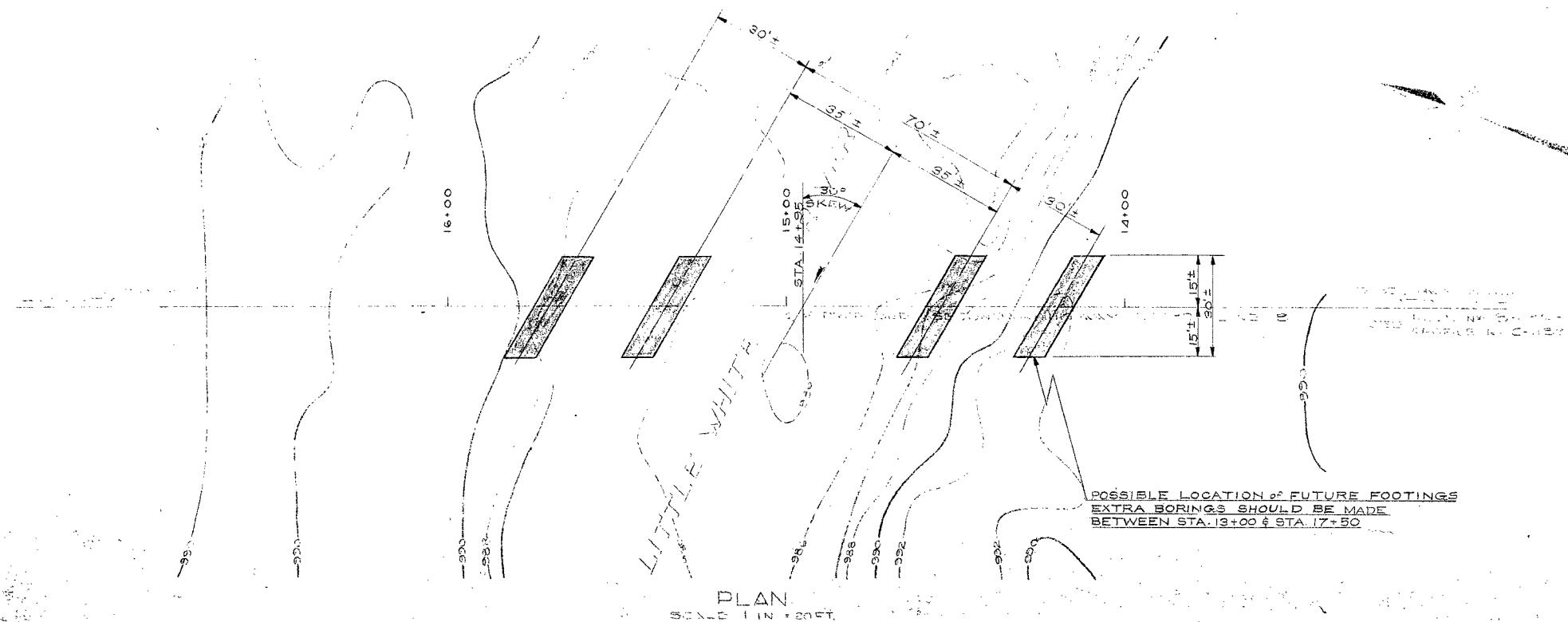
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

KING'S HIGHWAY NO. PROP. SEC. HWY. NO. 639 DIST NO. 18
CO. DIST. OF ALGOMA
TWP. NO. ID LOT CON.

SUBM'D	CHECKED	W.P. NO. 18 - 65	DRAWING NO.
DRAWN	CHECKED	JOB NO.	J 1753
DATE FEB. 1965		SITE NO.	BRIDGE DRAWING NO.
APPROVED:		CONT. NO.	
PROF. EDUCATION ENGINEER			



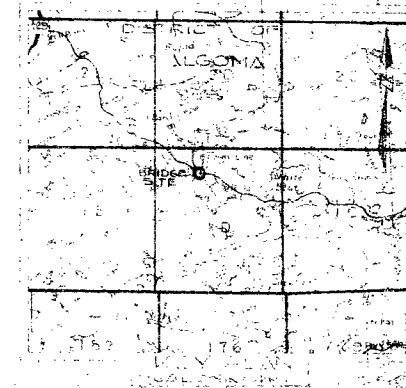
DISTRICT OF ALGOMA
TOWNSHIP No. 13



WD/8-65

DATE	REVISIONS & ADDITIONS	BY	CHKD
DEPARTMENT OF HIGHWAYS ONTARIO DESIGN BRANCH ENGINEERING SURVEYS DIVISION			
BRIDGE SITE			
PROPOSED CROSSING			
AT			
LITTLE WHITE RIVER			
AND			
PROP SEC. HWY NO. 233 LINE B			
TOWNSHIP OF No. 13 DISTRICT OF ALGOMA			
SCALE	DISTRICT	REGION	
AS SHOWN	No. 13	NORTH	
WON. 3010-64-1	DATE	SITE	
PREPARED BY	DESIGNED BY	CHECKED BY	
Chief of Party	Supervisor	Inspector	
Drawn by	Checked by	Approved by	

SOME DEFECTS IN NEGATIVE DUE
TO CONDITION OF ORIGINAL DOCUMENTS



WP 18-65

DATE	REVISIONS	ADDITIONS	BY	CHKD

DEPARTMENT OF HIGHWAYS, ONTARIO
REGIONAL BRANCH
ENGINEERING SURVEYS DIVISION

BRIDGE SITE
PROPOSED CROSSING
AT
WEST LITTLE WHITE RIVER
AND
PROP. SEC. HWY NO 639 - LINE 'C'

TOWN OF NO 10 DISTRICT OF ALGOMA

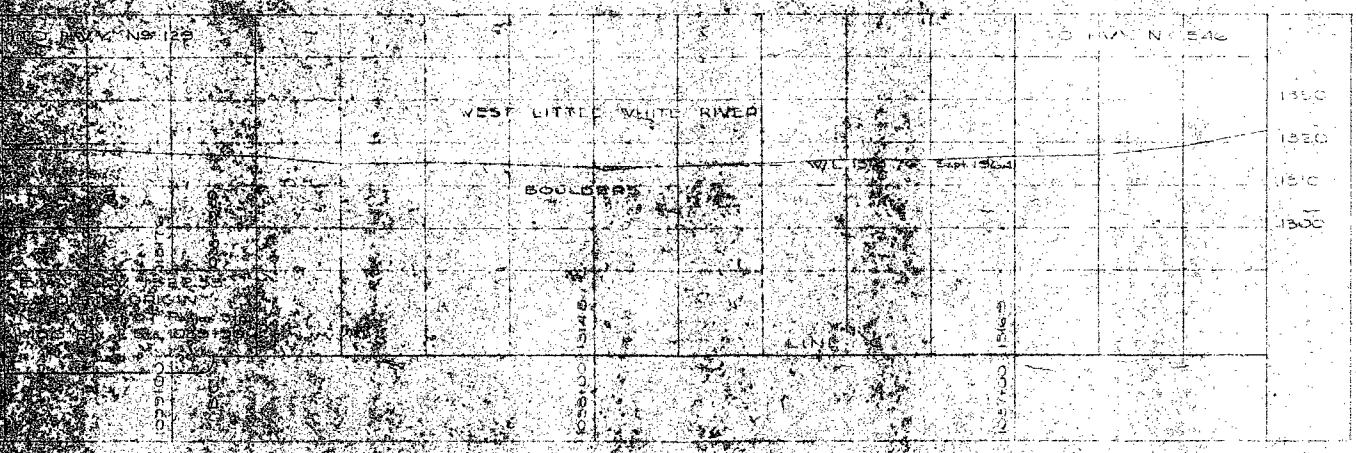
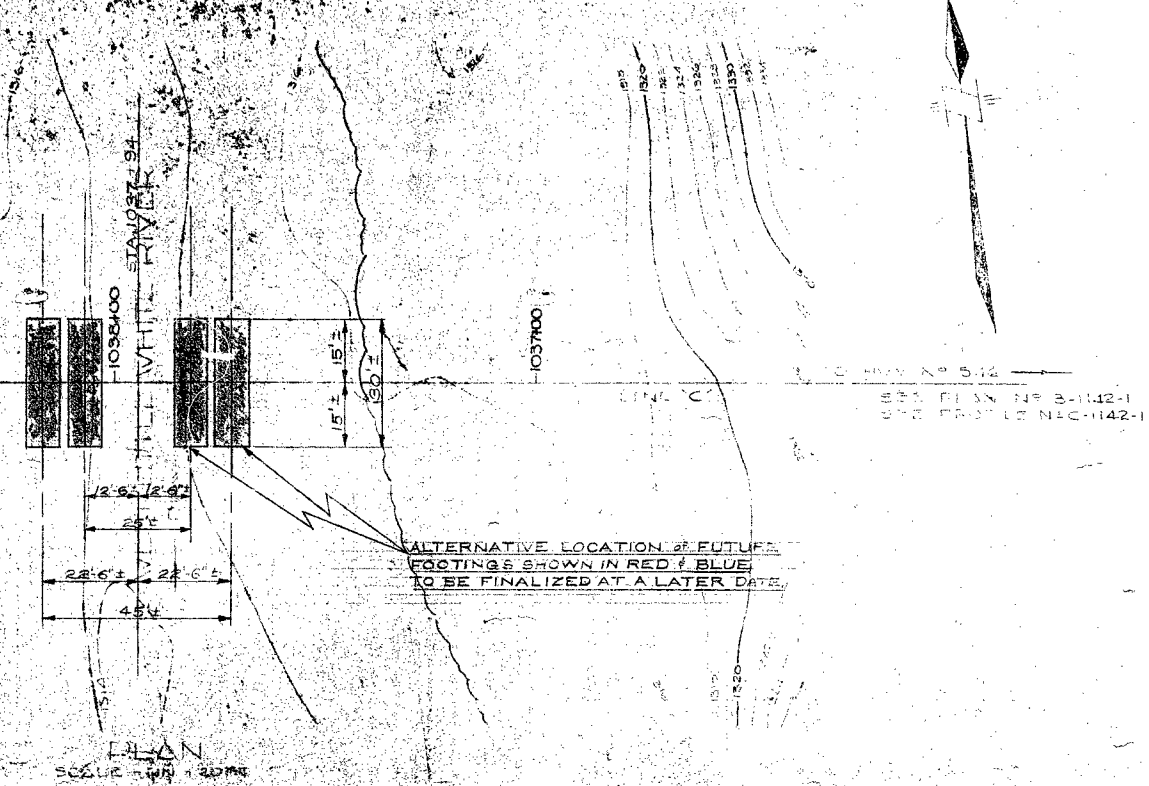
SCALE	DATE	REGION
AS SHOWN	NOV 1964	NORTHWESTERN
1" = 100' (HORIZ.)		
1" = 20' (VERT.)		

SURV. BY	CHKD. BY
Chief of Party: L. RICHARDS	Engineer: T. D. LIND
Supervisor: J. BOYKO	Supervisor: A. GRAY

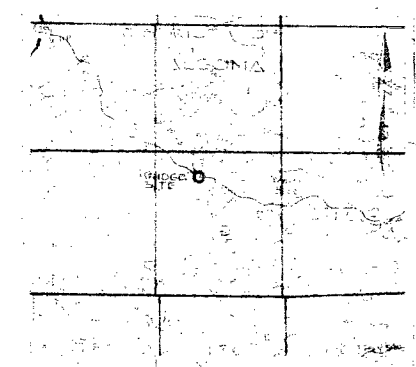
NO E-4528-1

SOME DEFECTS IN NEGATIVE DUE
TO CONDITION OF ORIGINAL DOCUMENTS

DISTRICT 3
TOWN OF ALBION



PROFILE
SCALE 1" = 10'



10-18-65

LATE REVISIONS

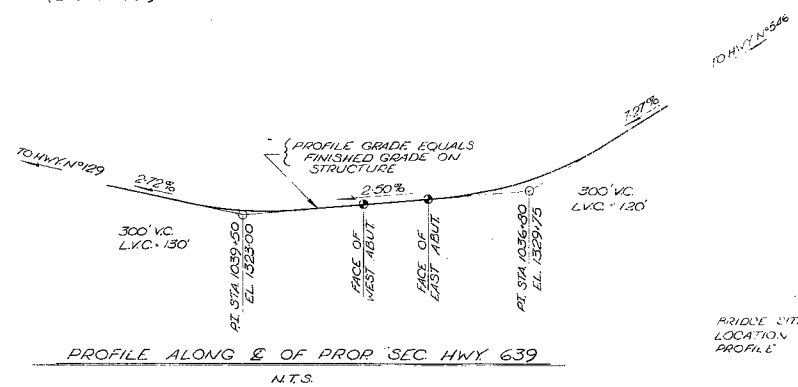
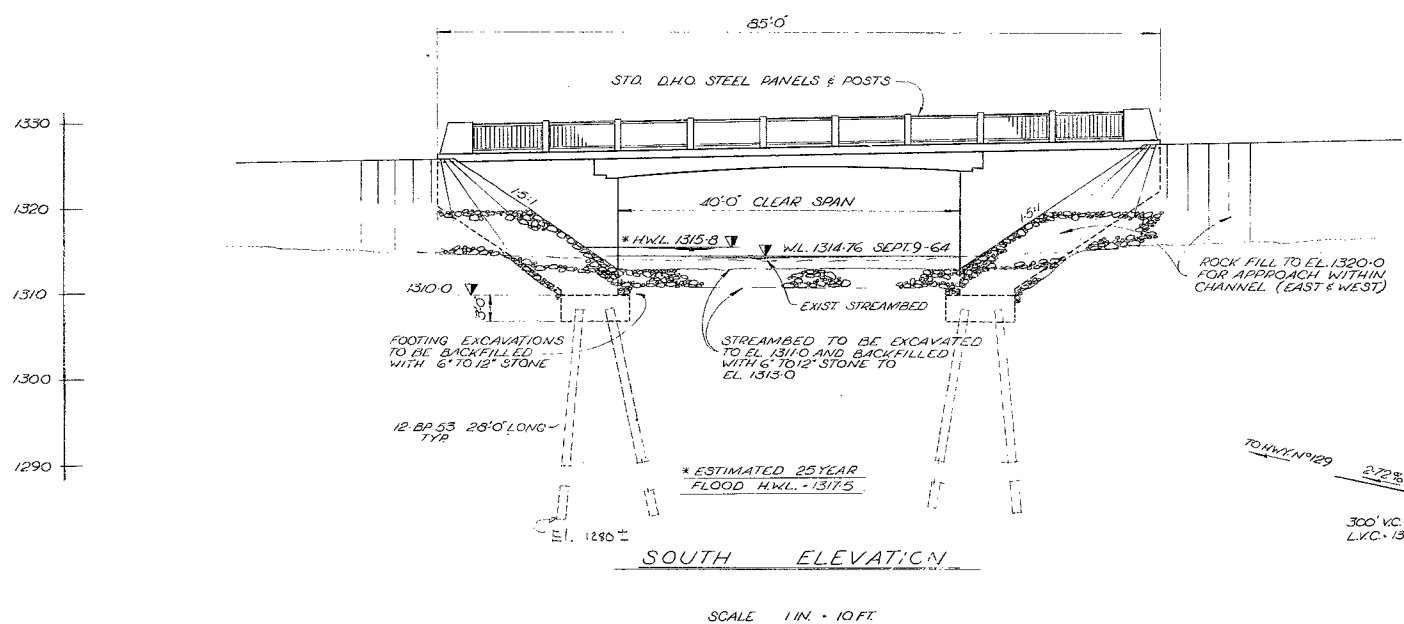
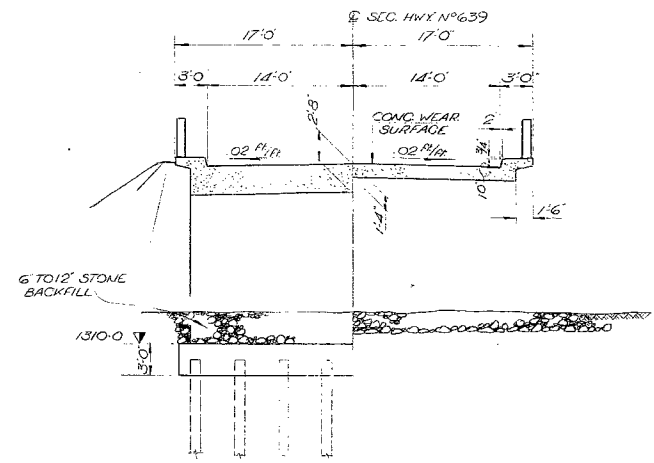
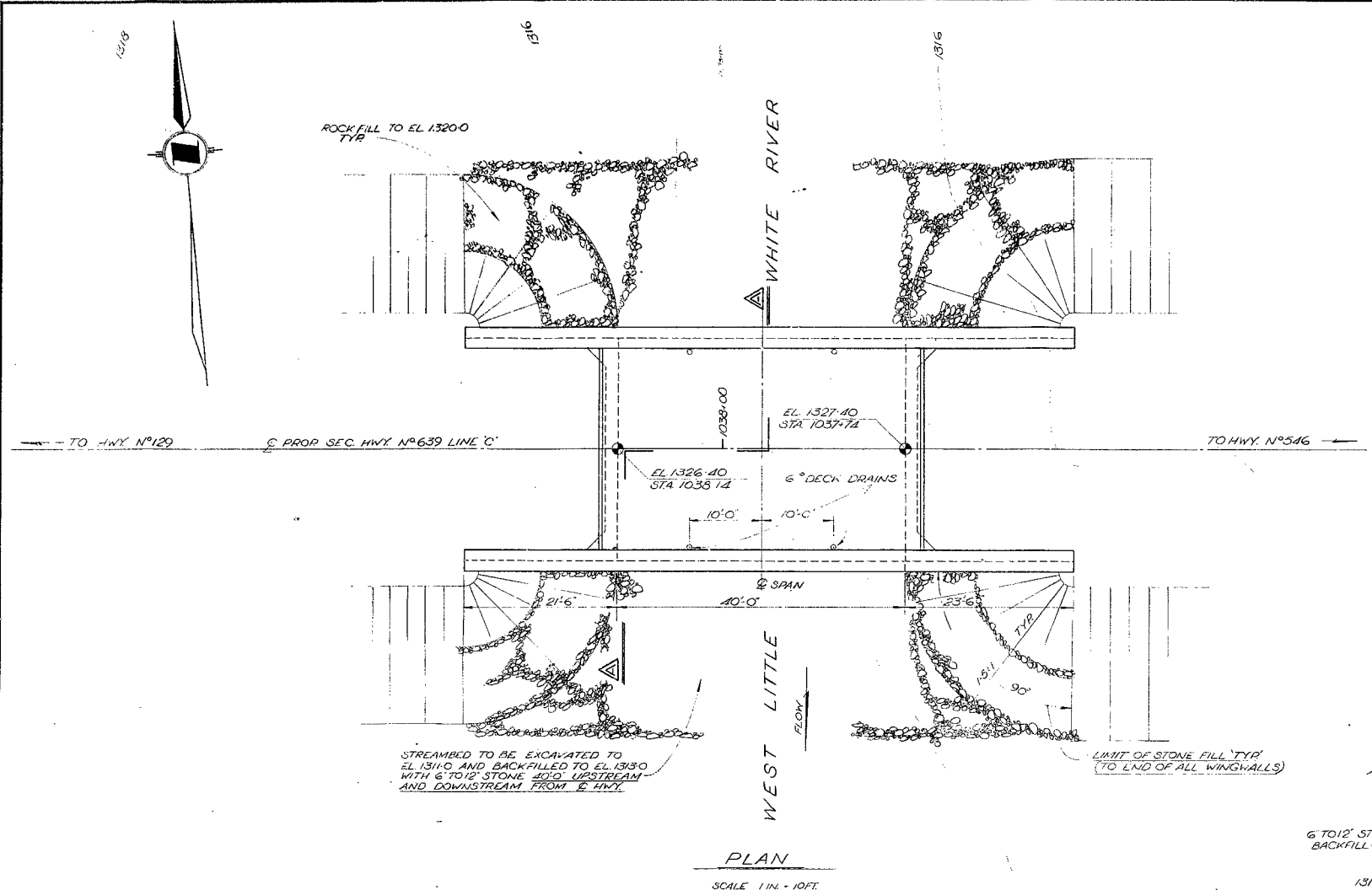
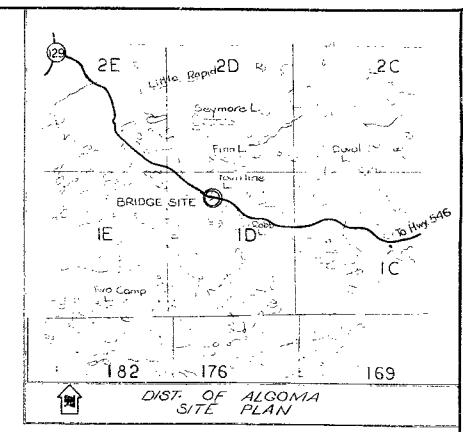
DEPARTMENT OF HIGHWAY CONSTRUCTION
ENGINEERING DIVISION
BRIDGE SITE
PROPOSED CROSSING
WEST LITTLE WHITE RIVER
AND
PROP. SEC. HWY. NO. 639 - LINE 'C'

TOWN OF ALBION

NO. E-4528-1

DESIGNED BY: J. R. GRAY
CHECKED BY: J. R. GRAY
SUPERVISOR: J. R. GRAY

SOME DEFECTS IN NEGATIVE DUE
TO CONDITION OF ORIGINAL DOCUMENTS



PRINT RECORD			
No.	FOR	DATE	

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

WEST LITTLE WHITE RIVER
9.0 MILES EAST OF HIGHWAY 129

KING'S HIGHWAY No. 639 DIST. No. 18
DIST. OF ALGOMA
TWP. LOT CON.

PRELIMINARY PLAN

SITE No. 365-277 W.P. No. 18-65

APPROVED		BRIDGE ENGINEER		CONTRACT	
DESIGN	M.W.	CHECK	J.L.K.	No.	
DRAWING	M.J.O.	CHECK	J.L.K.	No.	
DATE	OCT 65	LOADING	1480 5/16	No.	

C-5679-P1

1850 Jane Street
Weston, Ontario
241-4644

William A. Trow

LJP-18-65

Project: J1753

Soil Mechanics
Consultants
W. A. Trow
MSc. MEIC. P. Eng.
K. Peaker
PhD. MEIC. P. Eng.
D. H. Shields
PhD. MEIC. P. Eng.



Associates Ltd.

Mr. A. Rutka, P. Eng.,
Chief Materials & Research Engineer,
Materials and Research Section,
Department of Highways of Ontario,
Parliament Buildings,
Toronto, Ontario.

March 1, 1965

Attention: Mr. A. G. Stermac, P. Eng.

Re: Foundation Investigation
Proposed Crossing
West Little White River
Highway No. 639
W. P. 18 - 65

Dear Sirs:

In conformance with your authorization of December 17, 1964, a foundation investigation has been completed at the above mentioned site. The field work was carried out during the period of January 31 to February 11 inclusive. Our findings and recommendations on this subject are outlined in the following paragraphs.

1) The site of the proposed crossing is covered with boulders to a depth of about 2 feet. The boulders are underlain by a deposit of dense sand and gravel to a depth of from 30 to 40 feet. A stratum of boulders varying in thickness from 3 to 15 feet underlies the dense sand and gravel. Bedrock was found underlying the boulders at a depth of about 45 feet. The only variation from the above description was noticed in the area of STA. 1037 + 72, 15' R. In this area boulders were found at a depth of 7 feet and continued to a depth of at least 14 feet.

No artesian conditions were evident at this site.

2) At the time of the investigation the depth of the river was about 1 foot and it flowed at a rate of 2 feet per second.

3) It is recommended that the bridge be founded on spread footings placed about 5 feet below the present river bed level or approximate Elevation 1310 feet. On the basis of penetration resistance measurements it is considered that present river scour does not extend to this level. The dense granular soil which exists at this site has a safe net bearing value of 4 tsf.

If it is proposed to perch the abutments on the approach embankment fill, piles should be driven to refusal in the underlying natural soil. Refusal for cylindrical piles may be encountered in a dense layer near Elevation 1305 feet. In any event there is adequate bearing capacity at this level provided there is a reasonable embankment surcharge load applied.

4) As the sand and gravel is free-draining and well-graded, excavation to footing depth below the water table should not be difficult provided that the excavations are large and perimeter drainage ditches are installed.

5) All organic soil, which will be encountered in the heavily wooded areas east and west of the bridge site, should be removed to expose the underlying granular soil. No embankment stability problem exists in the approaches to the bridge.

The above recommendations and conclusions have resulted from the consideration of the following information.

PROJECT

The proposed bridge over the West Little White River in Northern Ontario is on the proposed section of Highway No. 639 - Line 'C'. The subject of this report is the foundation investigation of two alternate footing locations which have been proposed by the Department of Highways for Ontario.

SITE DESCRIPTION

The proposed bridge will provide a crossing over the West Little White River. The river flows in a southerly direction from Townline Lake to Robb Lake at a measured rate of approximately 2 feet per second at the time of the field work. At the bridge site the river was found to be about 25 feet wide and 1 foot deep. The river bottom and banks are boulder strewn (see photograph).

The river valley or flood plain extends approximately 150 feet to the east and 300 feet to the west of the proposed site. The valley is about 20 feet deep in the area of the bridge site.

A massive rock outcrop, probably bedrock, was noticed about 300 feet north of the site (see photograph) on the east side of the river.

An ancient logging dam was observed at the outlet of Townline Lake. At the time of the investigation the head was observed to be about 2 feet. During the investigation the water level in the river rose about 7 inches after a heavy snow storm.

The river returned to its normal level when milder weather melted the ice and snow which was obstructing the flow.

FIELD WORK AND SUBSOIL STRATIGRAPHY

The field work consisted of 6 sampled boreholes and 7 cone penetration tests. Four of the boreholes were advanced at least 10 feet into bedrock. The locations of the boreholes and cone penetration holes are shown on Dwg. 1. The boreholes were advanced using a standard diamond drill and conventional sampling equipment. Samples of the subsoil were obtained with split spoon type samplers which were driven into the soil with an energy conforming with the requirements of the standard penetration test. Bedrock and boulder samples were obtained with an AXT core.

The subsoil encountered at the site is shown in detail on the borehole logs (Dwgs. 2 to 14, inclusive). The subsoil stratigraphy as interpreted from the logs is shown on Dwg. 1.

All borehole elevations are referenced to a benchmark having geodetic origin. The benchmark is described on the Department of Highways Plan No. E - 4528 - 1 as a nail in the top of a poplar stump located at STA. 1039 + 90, 145' 12., having an elevation of 1322.33.

The subsoil at the proposed bridge site consists generally of boulders to a depth of 1 to 2 feet, which are underlain by a deposit of sand and gravel to a depth of from 30 to 40 feet. The sand and gravel, which is in a dense state, is underlain by a stratum

of boulders which varies in thickness from 3 to 15 feet, depending on the location. In the area of cone penetration hole No. 8 (1037 + 72, 15'12) boulders were found to exist at a depth of 7 feet. Data from borehole 10 showed the boulders to be present to a depth of at least 14 feet.

Bedrock was found at a depth of about 15 feet. The bedrock was identified as a granite gneiss which is common in this area.

Water levels in the boreholes were observed to correspond with the river elevation, namely, 1315.6. No artesian conditions were evident.

FOUNDATIONS

a) Spread Footings - It is recommended that the proposed structure be founded below scour level or at approximate Elevation 1310 feet. From the blows on the split spoon sampler and from the cone penetration test a safe net bearing pressure* of 4 tsf is indicated at this level.

Under this loading the settlement will be well within the tolerable limit of the structure (less than 1 inch). As the soil is granular and free-draining, almost all the settlement will take place as the structure is being built.

* Terzaghi, K., Peck, R. B. - Soil Mechanics in Engineering Practice, - John Wiley & Sons, 1948.



Positive measures against possible scour and erosion must be provided. The numerous stones and boulders in the area should provide adequate rip rap material for this purpose. The rip rap should be placed on the soil in front of the abutment and wing walls and also on the adjacent sections of road fill up to the highest anticipated floor level.

b) Pile Foundations - An alternative to spread footings is to perch the abutments on the embankment approaches. With this method piles would be driven through the embankment fill and into the natural soil. It is expected that cylindrical piles will encounter refusal in the very dense sand noted at approximate Elevation 1305 feet. Provided there is a reasonable cover of embankment fill above this level there should be adequate pile capacity even if refusal is not encountered. This opinion is based upon the following computation of the ultimate bearing capacity, Q , of a pile.

$$Q = A \gamma D N + \frac{pk \gamma D^2}{2}$$

where:

- A is the area of the pile tip = 0.78 sq. ft. for a 1 ft. diameter pile
- γ is the unit weight of the sand estimated to be at least 127 pcf above the water table and 65 pcf below
- D is the depth from the base of the pile cap in the compacted fill to the tip of the pile. Considering that the fill will be compacted and the underlying soil will adjust immediately to its weight this length of D is believed to be reasonable.
- N is a bearing capacity factor estimated to be equal at least to 300* for the bearing depth and soil density applicable.
- k is the resultant friction coefficient on the shaft estimated to be equal to 1.0
- p is the perimeter of the pile = π for 12 inch diameter pile

Solving Q ultimate = 265 Tons approximately for a depth of penetration $D=20$ ft. below the base of the pile cap.

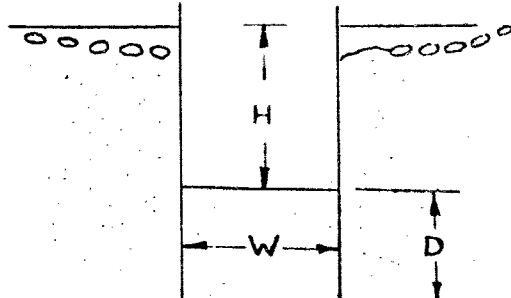
If H piles are used they may well penetrate to bedrock or well into the overlying boulders before refusal is encountered.

* G. G. Meyerhof - Some Research on the Bearing Capacity of Foundations - Canadian Geotechnical Journal, 1963.

FOUNDATION EXCAVATIONS

If the footing proposal is used, foundation excavations below the water table in porous sand and gravel will be necessary. To permit the removal of water, the base of the excavation should be crowned with the footing area in the highest part of the cut and with the ground sloped down beyond the edge of the footing at 3 horizontal to 1 vertical. Seepage will tend to drain to the low edges of the excavation from which it can be removed by pumping.

An alternative procedure would be to excavate inside watertight sheeting. To prevent piping of the sand and gravel, the sheeting must be driven well below footing elevation. The depth to which sheeting should be driven to obtain a factor of safety of 2 against piping can be obtained from the following table.**

	W/H	D	F.S. = 2.0
	0.5	1.75 H	
	1.0	1.4 H	
	2.0	1.0 H	
	3.0	0.8 H	
	4.0	0.75 H	
	5.0	0.7 H	
	10.0	0.6 H	
	20.0	0.52 H	

** McNamee, J., - "Seepage Into a Sheeted Excavation," - Geotechnique, Volume III, 1952 - 53.

The sheeting, if left in place, will provide excellent protection against scour.

APPROACH EMBANKMENTS

Very little organic material was encountered at the site of the proposed bridge. Approach embankments, however, will extend into heavily wooded areas. In these areas it will be necessary to remove the organic soil to expose the alluvial deposit of sand and gravel.

Once the organic soil is removed, the embankments will rest on the underlying granular soil and stability as well as long term settlement will not be a problem.

The natural soil at this site is quite satisfactory for use as embankment fill.

EARTH PRESSURES

If abutments and wing walls are used on this project, i.e. the approach fill does not spill through the abutments, they must be designed to withstand the lateral earth pressure exerted by the retained soils. The earth pressure that will act on the walls can be estimated using a value of earth pressure coefficient equal to 0.35. The earth pressure, p , on the walls at any depth, h , can be found from the expression:

$$p = K \{ \gamma (h - h_1) + \gamma_s h_1 + q \}$$

where

$K = 0.35$, the recommended earth pressure coefficient assuming the walls to be rigid

$\gamma = 125$ pcf, the estimated unit weight of the retained soil

$\gamma_s = 60$ pcf, the estimated submerged weight of the retained soil

$h_1 =$ height of water table above the point being considered

$q =$ surcharge, if any, acting at the top of the wall.

The stability of the abutment and wing walls should be checked for horizontal sliding along the footing base. The resistance against the sliding is the frictional force acting along the footing base. The frictional force developed along the footing base can be calculated using a friction coefficient of 0.7 (concrete sliding on granular soils).

If the resisting force is less than $1\frac{1}{2}$ times the estimated sliding force, the footing base can be extended under the fill to increase the weight of backfill carried by it. In this manner, the resistance to sliding can be increased.

Should any queries arise concerning the contents of this report we will be pleased to discuss them with you.

Yours very truly,

H. Trow
for H. Krzywicki, M. Eng.

H. Trow
W. A. Trow, P. Eng.

HK/amb

(1)
J1753



Air photo
showing bridge
site with Townline
Lake to North



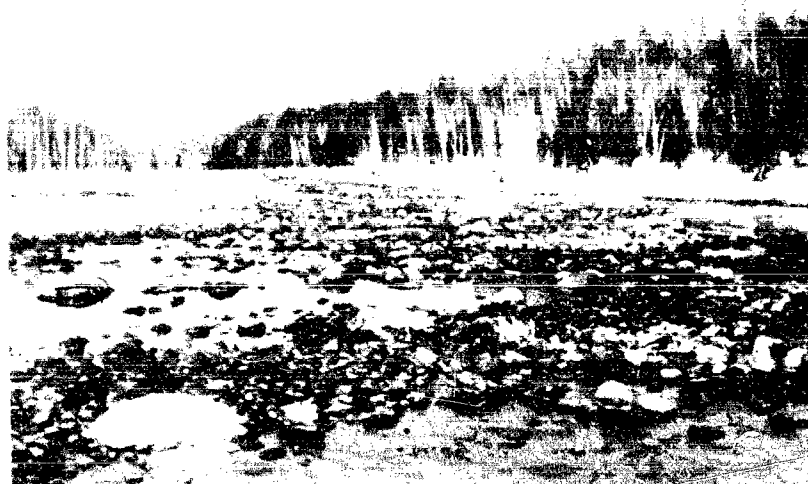
View showing
boulders in river
bed at point 300 ft.
North of the
proposed site.

(looking North)

(i)



Air photo
showing bridge
site with Townline
Lake to North



View showing
boulders in river
bed at point 3 1/2 ft.
North of the
proposed site.

(Looking North)

(11)



J1753



View of rock
outcrop on East
side of river
about 300 ft.
North of site.



View from bridge
site looking
North.

Rock outcrop is
shown on right.

(ii)



31753



View of rock
outcrop on East
side of river
about 300 ft.
North of site.



View from bridge
site looking
North.

Rock outcrop is
shown on right.

(iii)
J1753



View from
bridge site
looking West



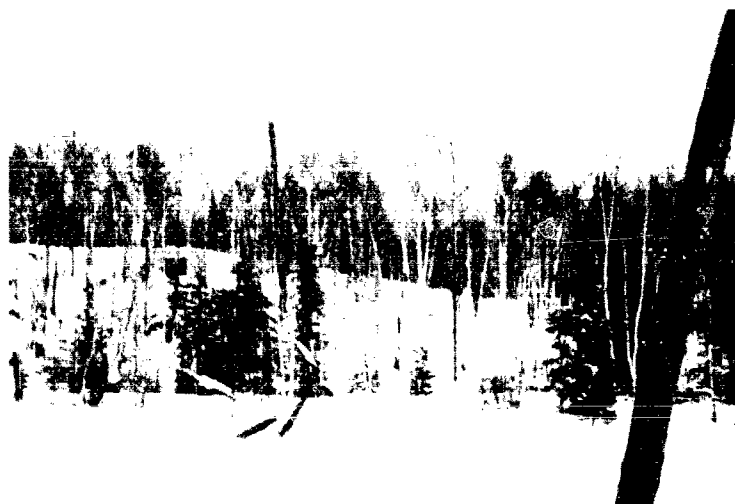
View from
bridge site
looking East

(iii)

J1743



View from
bridge site
looking West



View from
bridge site
looking East

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING NO. 2
PROJECT NO. J1753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE —○—○—○—
2" I.D. SHELBY TUBE * * * * *
2" DIA. CONE ————

SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE ⊕
UNCONFINED COMPRESSION ⊗
VANE TEST AND SENSITIVITY (S) †

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

X^{LI}

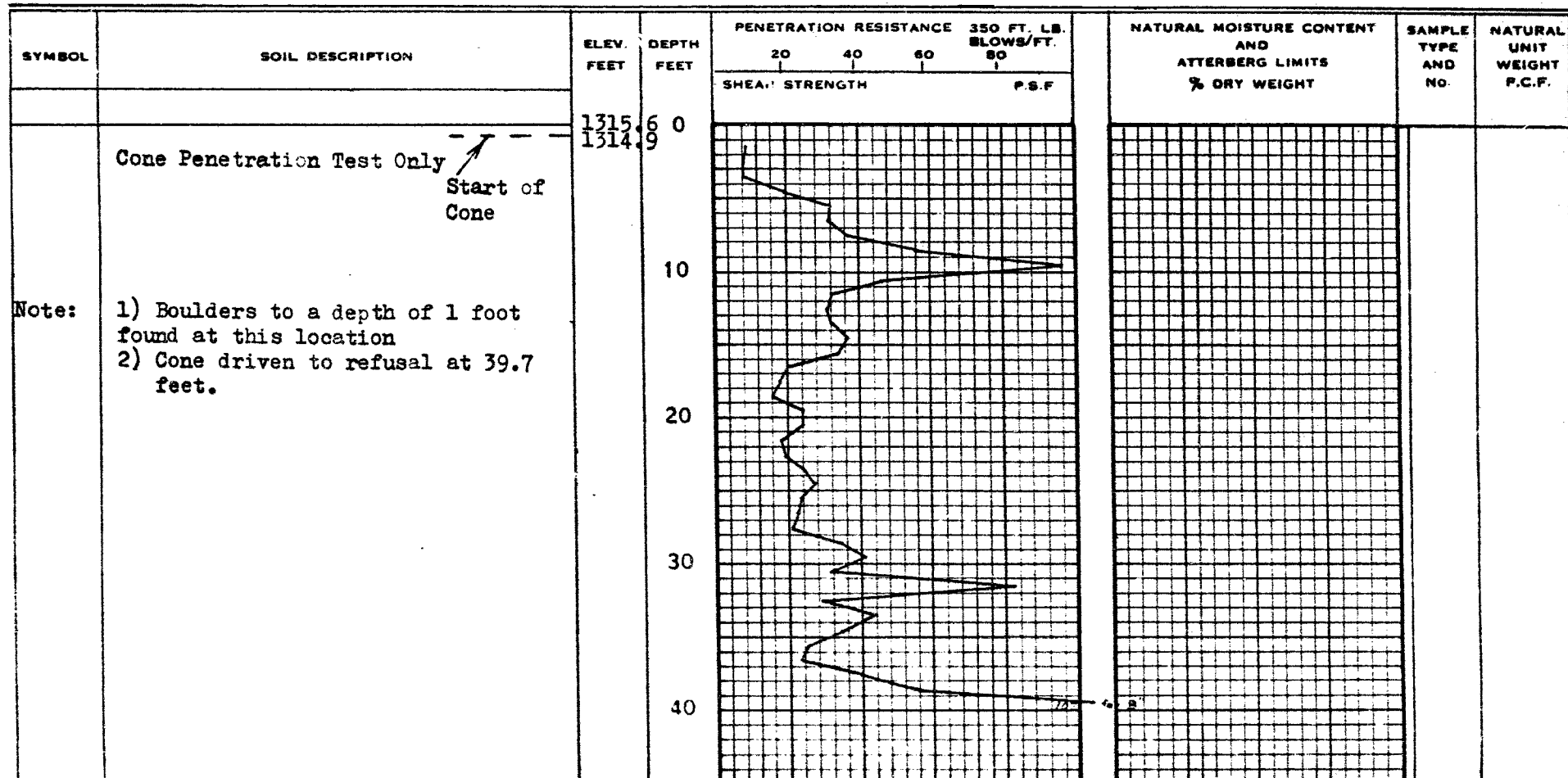
ATTERBERG LIMITS

LIQUID LIMIT —○—
PLASTIC LIMIT ———

SAMPLE TYPE

2" O.D. SPLIT TUBE —■—
2" I.D. SHELBY TUBE —■—
3" O.D. SHELBY TUBE —■—

BOREHOLE NO. 1
PROJECT Proposed Bridge Site
LOCATION West Little White River - WP 18-65
HOLE LOCATION 1038 + 06, 15'R
HOLE ELEVATION 1315.6
DATUM See Dwg. 1.




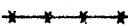
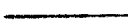
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SITE INVESTIGATIONS - SOIL MECHANICS CONSULTATION




DRAWING No. 3
PROJECT No. 11753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

BOREHOLE No. 2
PROJECT Proposed Bridge Site
LOCATION West Little White River, CT 10-15
HOLE LOCATION 1043 - 111, 111
HOLE ELEVATION 1315.1 ft.
DATUM Sea Level, 1.

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
				20	40			
		1315.6	0					
		1315.1						
		1313.1						
	SAND AND GRAVEL—generally dense to extremely dense, sand is well graded, gravel is less than 1/2 inch.		10					
			20					
			30					
			40					
	—End of Bore—	127.1						
	Notes: 1) Hole advanced using wash boring techniques and diamond drilling. 2) Hole discontinued because of metal obstruction, (concrete).		50					
			60					
			70					
			80					
			90					
			100					
			110					


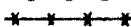

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SITE INVESTIGATIONS - SOIL MECHANICS CONSULTATION




DRAWING No. 4
PROJECT No. J1753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

BOREHOLE No. 1
PROJECT Proposed Bridge Site
LOCATION West Little White River - 10-15-65
HOLE LOCATION 10.8 + 07, 15L
HOLE ELEVATION 1315.1 ft.
DATUM

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
				20	40			
		1315.1	0	SHEAR STRENGTH				
	BOULDERS	1315.1	0					
	SAND AND GRAVEL-generally dense to very dense, sand is well graded and gravel is less than 1/2 inch.	1315.1	0					
			10					
			20					
			30					
		1280.1						
	GRAVEL-dense	1276.6	40					
	SAND AND GRAVEL - run casing	1271.9						
	BOULDERS AND COBBLES -run casing	1268.8						
	BEDROCK-about 100% recovery (granite gneiss)		50					
	End of Bore	1258.3	60					
Notes: 1) Hole advanced using wash boring techniques and diamond drilling. 2) Water level at 1315.6 upon completion (river elevation).								
			70					
			80					
			90					
			100					
			110					


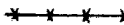

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SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION




DRAWING NO. 5
PROJECT NO. J1753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL
AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX 

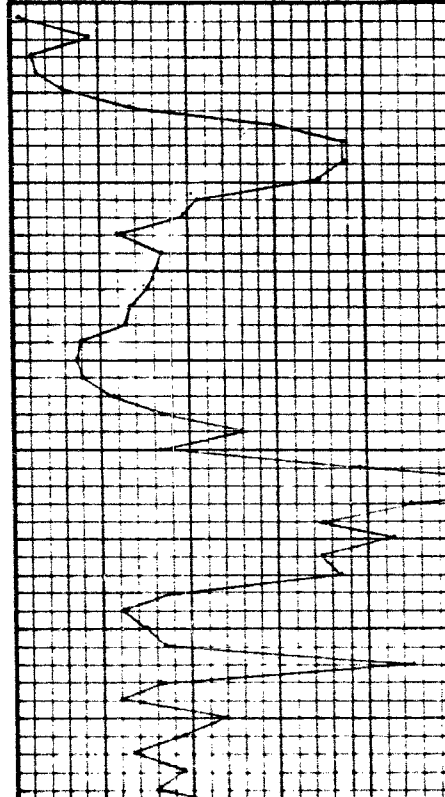
ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

BOREHOLE NO. 4
PROJECT Proposed Bridge Site
LOCATION West Little White River- WP 18-65
HOLE LOCATION 1038 + 17, 15'L
HOLE ELEVATION 1315.6 ft.
DATUM _____

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE				350 FT. LB. BLOWS/FT.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.				
				20	40	60	80								
				SHEAR STRENGTH				P.S.F.							
		1315.6	0												
Notes: 1) Boulders found to a depth of 2 ft. 2) Cone driven to refusal at 45.7 ft.															

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SITE INVESTIGATIONS • SOIL MECHANICS CONSULTATION

DRAWING NO. 5
PROJECT NO. J1753

LEGEND

BOREHOLE NO. 4

PROJECT Proposed Bridge Site

LOCATION West Little White River- WP 18-65

HOLE LOCATION 1038 + 17, 15'L

HOLE ELEVATION 1315.6 ft.

DATUM _____

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 

2" I.D. SHELBY TUBE 

2" DIA. CONE 

SHEAR STRENGTH

UNDRAINED TRIAXIAL
AT OVERBURDEN PRESSURE 

UNCONFINED COMPRESSION 

VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 

PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 

2" I.D. SHELBY TUBE 

3" O.D. SHELBY TUBE 

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE	350 FT. LB. BLOWS/FT.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40			
				SHEAR STRENGTH				
				P S F				
		1315.6	0					
	CONE PENETRATION TEST ONLY							
Notes:	1) Boulders found to a depth of 2 ft. 2) Cone driven to refusal at 45.7 ft.							
			10					
			20					
			30					
			40					

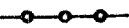
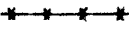
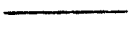
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SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION




DRAWING No. 6
PROJECT No. J1753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX 

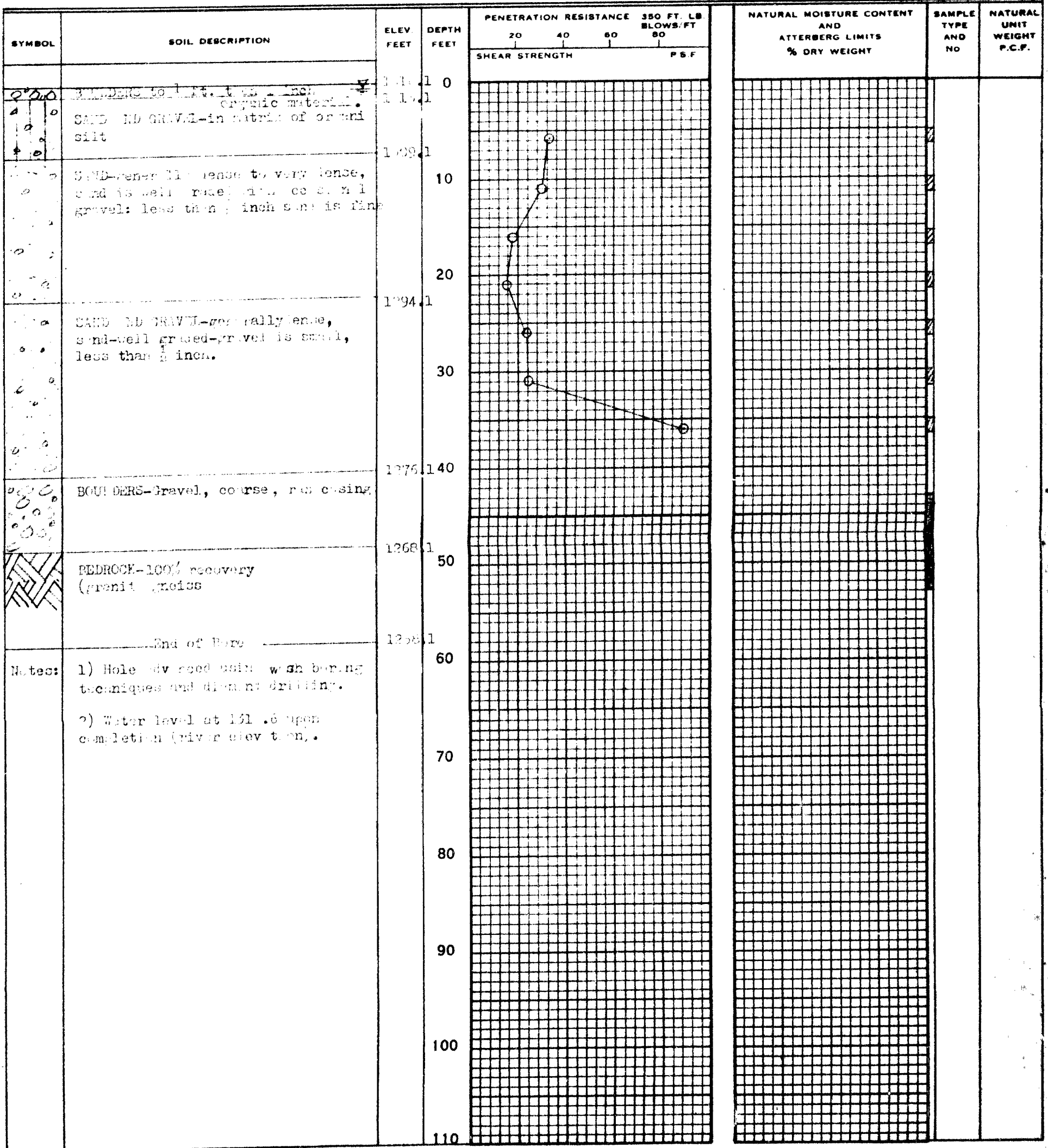
ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

BOREHOLE No. 5
PROJECT Proposed Bridge 21-4
LOCATION West Little White River - 11-65
HOLE LOCATION 1038 + 17, 15K
HOLE ELEVATION 115.1
DATUM



WILLIAM A. TROW & ASSOCIATES LTD.




SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING NO 7
PROJECT NO J1753




LEGEND

BOREHOLE NO 6
PROJECT Proposed Bridge Site
LOCATION West Little White River - WP 18-65
HOLE LOCATION 1037 + 82, 15' L
HOLE ELEVATION 1314.8 ft.
DATUM _____

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL
AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE		350 FT. LB BLOWS/FT 60	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT PCF
				20	40	60			
		1315.6	0	SHEAR STRENGTH					
		1314.8	0						
Notes:	CONE PENETRATION TEST ONLY								
	1) Boulders to 1 foot depth 2) Cone driven to refusal at 34.1 feet.								
			10						
			20						
			30						
			40						

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SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

LEGEND

DRAWING No. 8
PROJECT No. 11753

BOREHOLE NO. 7
PROJECT Provincial Hwy. 104-10
LOCATION 1001 Little White River - 100 - 5
HOLE LOCATION 1001 + 72, 100
HOLE ELEVATION 1315.3
DATUM

PENETRATION RESISTANCE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S_t)

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX
ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT
SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
				20 40 60 80 350 FT. LB. BLOWS FT. 80 SHEAR STRENGTH P.S.F.			
		1315.3	0				
		1310.0					
	SAND AND GRAVEL - sand is well graded, med. dense, gravel is less than 1/2 inch.		10				
		1296.0	20				
	SAND - sandy, fine, loose. SAND AND GRAVEL - sand is well graded med. dense, gravel is less than 1/2 inch.	1293.0					
		1286.5	30				
	ROUNDS AND GRAVEL - sand is med. dense, gravel is less than 1/2 inch.		40				
		1270.2	50				
	REDUCED - almost 100% recovery, (gravel, med. dense).		60				
		1255.2	70				
			80				
			90				
			100				
			110				

Note: 1) This record was made during the initial drilling of the hole.
2) Water level at 1255.6 upon completion, (in 1255.6).




SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

PROJECT NO J1753

LEGEND

BOREHOLE NO. 8
PROJECT Proposed Bridge Site
LOCATION West Little White River - WP 18-65
HOLE LOCATION 1037 + 72, 15'R
HOLE ELEVATION 1315.8 ft.
DATUM _____

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH

UNDRAINED TRIAXIAL ⊕
AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION ⊗
VANE TEST AND SENSITIVITY (S) ⊕

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT

PLASTIC LIMIT

SAMPLE TYPE

2" O.D. SPLIT TUBE _____

2" I.D. SHELBY TUBE_____

3" O.D. SHELBY TUBE_____

SY. BOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE				350 FT. LB. BLOWS/FT	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40	60	80				
				SHEAR STRENGTH				PSF			
		1315.8	0								
	CONE PENETRATION TEST ONLY										
Notes:	1) Boulders to depth of 1 foot.										
	2) Cone driven to refusal at 8.6 feet.		10								
			20								
			30								
			40								

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SITE INVESTIGATIONS - SOIL MECHANICS CONSULTATION

DRAWING No 10




PROJECT No J1753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
 2" I.D. SHELBY TUBE 
 2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL
 AT OVERBURDEN PRESSURE 
 UNCONFINED COMPRESSION 
 VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT
 AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
 PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
 2" I.D. SHELBY TUBE 
 3" O.D. SHELBY TUBE 

BOREHOLE NO 8A
 PROJECT Proposed Bridge Site
 LOCATION West Little White River - WP 18-65
 HOLE LOCATION 1037 + 70, 15'R
 HOLE ELEVATION 1315.9 ft.
 DATUM _____

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40			
				350 FT. LB BLOWS/FT				
				80				
				PSF				
		1315.9	0					
Note:	CONE PENETRATION TEST ONLY							
	1) Cone driven to refusal at 7.7 ft.							
			10					
			20					
			30					
			40					

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SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No 11
PROJECT No J1753

LEGEND

BOREHOLE No 8B
PROJECT Proposed Bridge Site
LOCATION West Little White River - WP 18-65
HOLE LOCATION 1037 + 70, 11.5 R
HOLE ELEVATION 1315.6 ft.
DATUM _____

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE —○—○—○—
2" I.D. SHELBY TUBE —*—*—*—*—
2" DIA. CONE —————

SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE ⊕
UNCONFINED COMPRESSION ⊗
VANE TEST AND SENSITIVITY (S) +^s

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

X^{LI}

ATTERBERG LIMITS

LIQUID LIMIT —○—
PLASTIC LIMIT ———

SAMPLE TYPE

2" O.D. SPLIT TUBE —■—
2" I.D. SHELBY TUBE —■—
3" O.D. SHELBY TUBE —■—

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE 350 FT. LB BLOWS/FT		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40			
				SHEAR STRENGTH P S F				
		1315.6	0					
			10					
			20					
			30					
			40					
Note:	1) Cone driven to refusal at 7.8 ft.							

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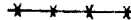

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No 12
PROJECT No J1753




LEGEND

BOREHOLE NO 8C
PROJECT Proposed Bridge Site
LOCATION West Little White River - WP 18-65
HOLE LOCATION 1037 + 76, 15R
HOLE ELEVATION 1315.5 ft.
DATUM _____

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL
AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40 60 80 350 FT. LB BLOWS/FT			
				SHEAR STRENGTH				
		1315.5	0					
Note:	CONE PENETRATION TEST ONLY							
	Cone driven to refusal at 32 ft.							
			10					
			20					
			30					
			40					

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SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING No. 13




PROJECT No. J1753

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX 

ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

BOREHOLE NO. 9
PROJECT Project: Bridge Site
LOCATION West Little River - 1-1-69
HOLE LOCATION 100' + 50' N 100' W
HOLE ELEVATION 1015.4
DATUM

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40	60	350 FT LB BLOWS FT			
	Gravel - to 1 foot	1015.4	0							
	GRAVEL AND SAND - Gravel (1/2 inch or less) in matrix of fine sand, -extremely clean	1015.4	0							
	SAND - well sorted, gravel is less than 1/2 inch, generally smooth to very smooth. - gravel size range 1/2 to 1 inch, to 1 foot.	1015.4	10							
	SAND - well sorted	1015.4	20							
	BOULDERS	1015.4	30							
	BEDROCK - 100% recovery, (granite gneiss)	1015.4	40							
	End of core	1015.4	50							
Notes:	1) Hole advanced using wire line drilling techniques and diamond drilling.		60							
	2) Water level at 1015.4 ft on completion, (river level).		70							
			80							
			90							
			100							
			110							

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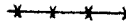

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING No. 14
PROJECT No. J1753




LEGEND

BOREHOLE NO. 10
PROJECT Proposed Bridge Site
LOCATION West Little White River - WP 18-65
HOLE LOCATION 1037 + 66, 16R
HOLE ELEVATION 1315.8 ft.
DATUM _____

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH

UNDRAINED TRIAXIAL
AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 




NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

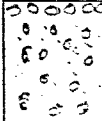
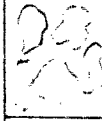
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ATTERBERG LIMITS

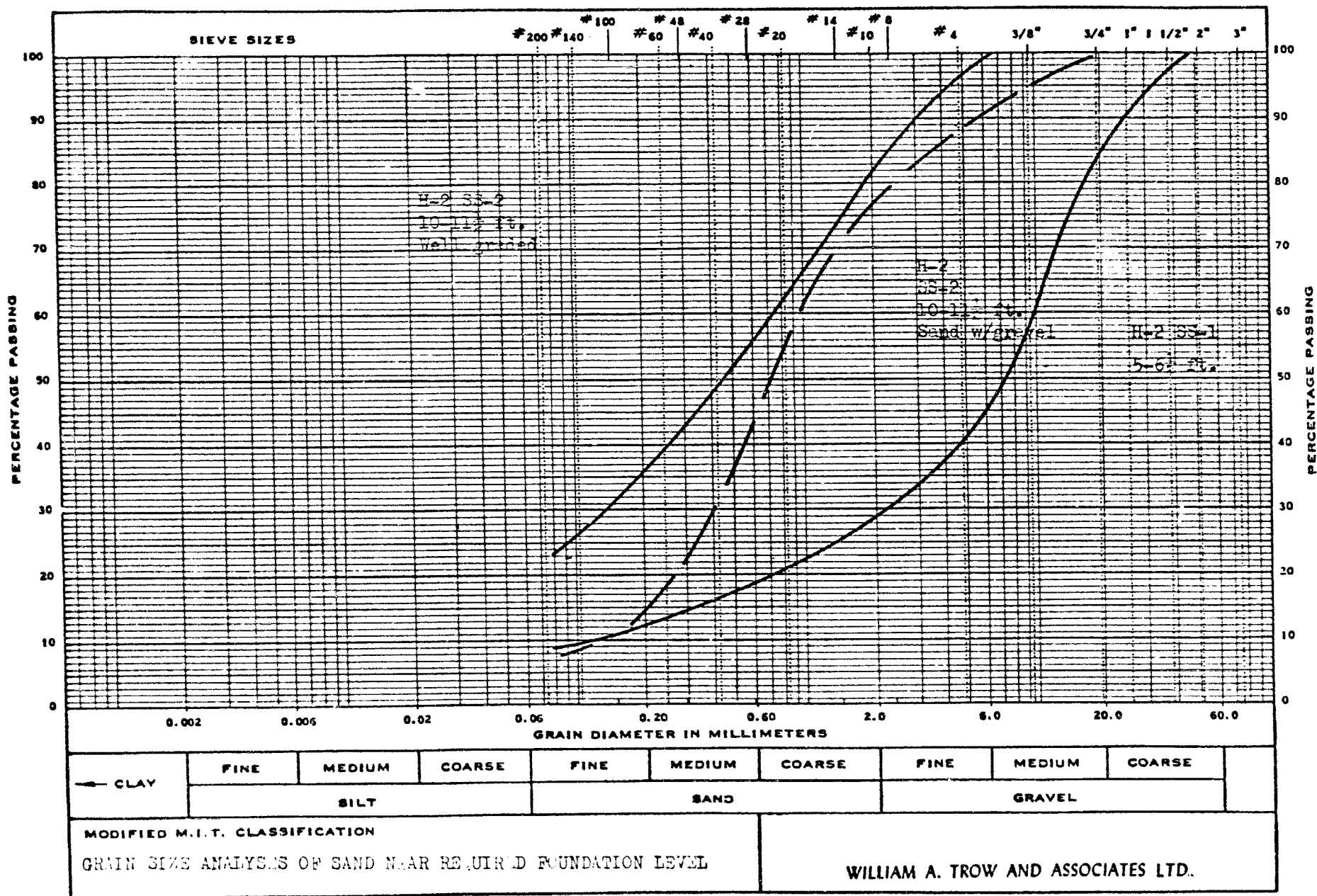
LIQUID LIMIT 
PLASTIC LIMIT 

SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40	60	350 FT. LB. BLOWS/FT 80			
	BOULDERS TO 1 ft. depth.	1315.8	0	SHEAR STRENGTH						
	GRAVEL AND SAND-gravel is large (1 1/2 inches) sand is silty									
	BOULDERS-Ran casing - no sampling possible. Had to terminate on boulders	1308.5	10							
	End of Bore	1301.8								
Notes:	1) Hole advanced using wash boring technique and diamond drilling. 2) Water level at 1315.6 upon completion (river level).		20							
			30							
			40							

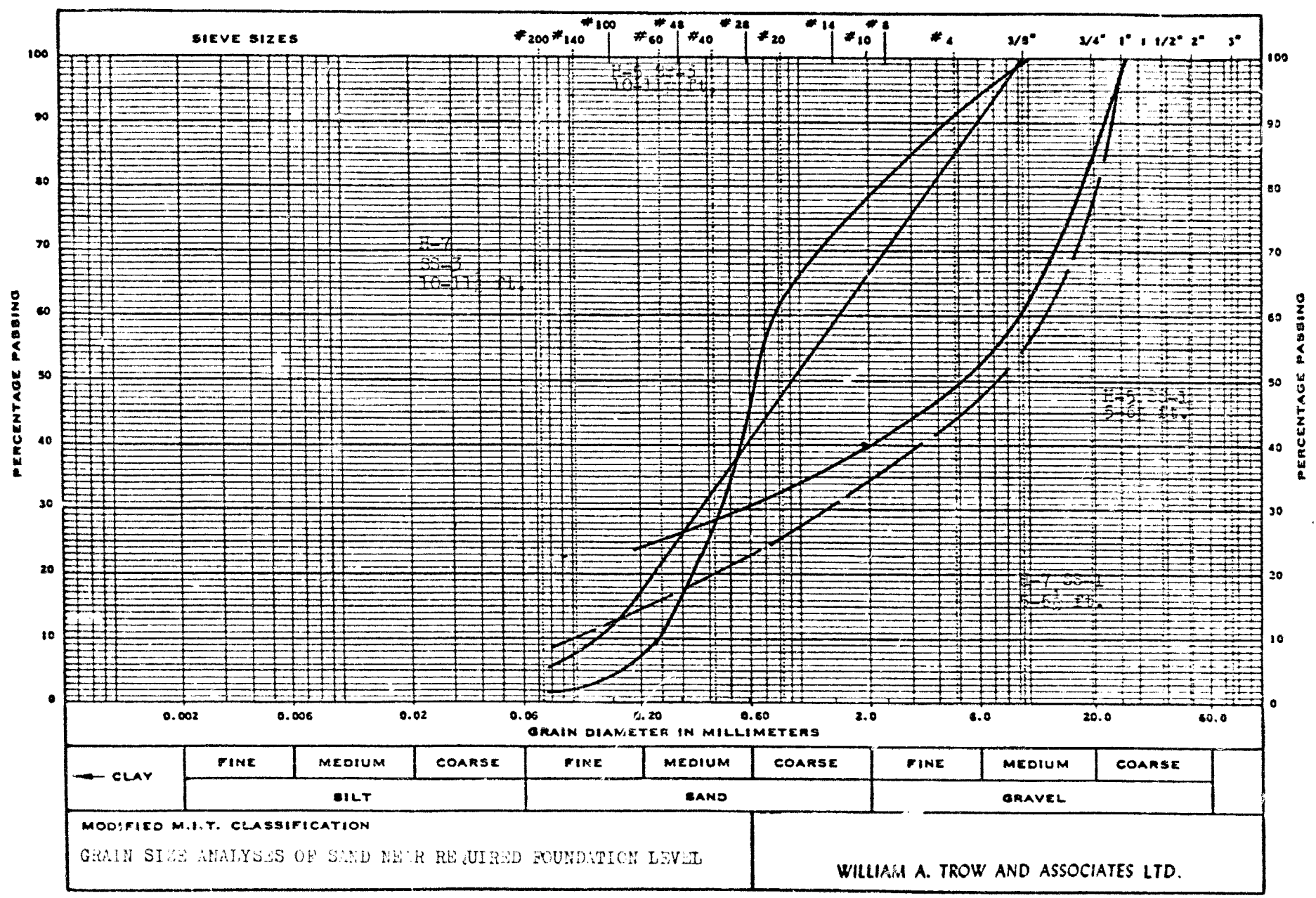
MECHANICAL ANALYSIS



DRAWING NO: 16.

PROJECT: J1753

MECHANICAL ANALYSIS



DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

From: Bridge Division,
Downsview, Ontario.

Date: December 11, 1964.

Our File Ref.

In Reply To

Subject: Foundation Investigation
District 22

Please make the necessary arrangements to have foundation investigations carried out at the following sites:

- | | |
|-----------------|---------------------------------|
| 1) W.P. | Kindigati River (East Crossing) |
| 2) W.P. 16-65 | Kindigati River (West Crossing) |
| 3) W.P. 17-65 | Dunal Ck. |
| ✓ 4) W.P. 18-65 | West Little White River |
| 5) W.P. 19-65 | Rapid River |
| 6) W. | Sharpsand River |

Plans for the above crossings will be available to you by the end of this month.

Checked
by: F. DeVissser

S. McCaule
S. McCaule,
Bridge Planning Engineer.

Hwy. 401 & Keele St.,
Downsview, Ontario.

Materials and Testing Division

December 17, 1964

William A. Trow & Associates, Ltd.,
1850 Jane Street,
Weston, Ontario.

Attention: Mr. Wm. A. Trow

Re: W.P. - , Hwy. 639, Kindiogami River (East Crossing).
W.P. 16-65, Hwy. 639, Kindiogami River (West Crossing).
W.P. 17-65, Hwy. 639, Duval Creek.
W.P. 18-65, Hwy. 639, West Little White River.
W.P. 19-65, Hwy. 639, Rapid River.
W.P. - , Hwy. 639, Sharpsand River.
--- District 18, Sault Ste. Marie ---

Dear Sir:

Please consider this your authority to carry out foundation investigations at the above sites. Plans and profiles were provided to your representative on December 11, 1964.

It is understood that a qualified Soils Engineer will be in charge of the field work at all times.

Ten copies of each completed foundation report, with one additional copy of each subsoil profile, should be submitted to the Foundation Section prior to March 19, 1965. Previous requirements as to preliminary borehole information and laboratory testing program, should be followed.

Because the drawings accompanying the foundation reports, showing the location of borings, the inferred subsoil conditions, etc., are to become contract drawings, you are requested to prepare them in accordance with the D.H.C. standards. To enable you to do this, we are supplying you with sample drawings with all the necessary explanations, together with linen sheets for your drawings. You are also requested to provide the D.H.C. with Cronaflex copies of the drawings.

cont'd. /2 ...

December 17, 1964

Charges for the work performed will be in accordance with your Schedule of Rates, dated November 19, 1962, and invoices to be addressed to the attention of the undersigned.

Yours very truly,



NDS/MdeF

A. Rutka,
MATERIALS & TESTING ENGINEER

cc: Messrs. S. McCombie
H. McArthur
A. A. Ward
E. R. Saint
Mrs. T. Tate
N. D. Smith (2)
Foundations Office ✓
Gen. Files (2)

Mr. A. E. Teye,
Bridge Engineer,
Bridge Division.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attention: Mr. J. J. McCubbin

March 5, 1965

FOUNDATION INVESTIGATION REPORT BY:

Wm. A. Trow & Associates, Limited.

Proposed Crossing - West Little White River,
Highway No. 639, District 18 -- W.P. 18-65.

Attached, please find the above-mentioned report submitted by the Consultant, Wm. A. Trow and Associates Ltd. We have reviewed the report and found the factual information well presented and adequate. The recommendations contained in the report cover all aspects of design and construction work. Our only comment would be that boulders be removed from under the portion of the approach embankment where abutment piles would have to be driven.

Should there be any additional questions or problems that you would like to discuss, please feel free to call on our office.

WAT/ndef
Attach.

Afternoon,
A. G. Leterae,
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. A. E. Teye (2)
H. A. Tregaskes
H. B. McMillan
H. McArthur
A. A. Ward
A. E. Saint
P. De Visser
A. Hall

Foundations Office ✓
Gen. Files

MEMORANDUM

St. A. Haw

DATE: October 27, 1965.

IN REPLY TO

Site 38S-277, W. P. 18-65,
West Little White River,
9.0 Miles East of Hwy. 129,
Hwy. 639, District 18.

F. Lee Kinner

F. DeVISSER,
Regional Bridge Location Engineer.

2000

12/5/65

Mr. C. Grebski,
Bridge Design Engineer,
Bridge Division.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

November 10, 1965

W.P. 17-65 - Duval Creek Bridge - Plan #D-5717-P1
W.P. 18-65 - West Little White River Bridge - Plan #D-5679-P1
W.P. 16-65 - Kintogami River Bridge - Plan #D-5754-P1
- District No. 18 -
(Sault Ste. Marie)

We have reviewed the Preliminary Plans for the
above-mentioned proposed structures with regard to the
subsoil conditions, as outlined in the Foundation Reports
by Wm. A. Trew & Associates. We have no further comments.

KOS/MdeF

H. L. Selby
K. G. Selby,
SENIOR FOUNDATION ENGINEER
For:
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office ✓
Gen. Files

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Laboratory Bldg.,
DOWNSVIEW, Ontario.

FROM: Bridge Division,
208 Simpson Street,
PORT WILLIAM, Ontario.

DATE: October 27, 1965.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Preliminary Plans

When preliminary plans are sent to you for your comments, it would probably be more satisfactory for you to make your comments directly to Mr. C. Grebski, Bridge Design Engineer. However, to keep me informed of any changes or additions would it be possible for you to send me a note if any changes or additions are recommended to the Bridge Design Office.

FDV/mcr



F. DeVISSER,
Regional Bridge Location Engineer.