

57-F-231C

Hwy. #17

WHITE RIVER WEST

BA 648

57-F-231C

TROW, SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS
AND
SOIL MECHANICS CONSULTATION

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Project: C 108/ J 108

September 9, 1957.

Mr. A. M. Toye,
Bridge Engineer,
Dept. of Highways of Ontario,
280 Davenport Rd.,
Toronto, Ont.

Attention: Mr. S. McCombie

Foundation Investigation
Proposed White River West Crossing
T.C.H. No. 17, Thunder Bay District

Dear Sirs:

Enclosed herewith is our report on the subsoil conditions existing at the above noted river crossing. The field work performed in connection with this investigation was carried out during the period July 2nd to July 10th, 1957.

For your convenience a summary of our conclusions and recommendations resulting from this investigation is as follows:

- (1) The upper stratum of subsoil encountered in the borings carried out at this site is described as a fine to medium sand containing a random distribution of fine gravel sizes. The relative density of this material as determined from Standard Penetration Test Results varies from very loose to medium dense. Spread footings bearing directly on this subsoil can not be used at this site.
- (2) A dense competent layer of sand and angular gravel with numerous boulders was found to underlie the above stratum of loose to medium dense material. This layer averaged 10 feet in thickness. It is recommended that footings for abutments and piles be supported on piles founded in the dense layer of sand gravel and boulders. As a guide to piling lengths required a tabulation is included giving pile lengths between cut off elevation and refusal elevation at each pair of borehole locations.
- (3) Horizontal thrusts of the order of 39 kips per abutment will result from the earth fill on back of each abutment. If vertical piles are used a total of 26 piles will be required at each abutment. This number can of course be reduced by using batter piles.

-2-

(4) Observations made on the condition of the river banks and river bottom indicate that appreciable bank erosion and stream bed scour can be expected. It is recommended that rip rap be provided at the abutment breast wall face and that sheet piling be driven around the perimeter of the piers proposed in the stream channel. High water level is noted as elev. 1125.0 and rip rap should be provided on the embankment slopes to an elevation 2 feet above high water level.

(5) The condition of the presently constructed west embankment and the nature of the granular subsoil qualitatively preclude embankment instability.

We are pleased to have been of service to you on this occasion and should any queries arise in connection with information contained in this report do not hesitate to call upon us.

Yours very truly,

L. G. Soderman

Lawrence G. Soderman (P.Eng.)

LGS/lt
Encl.

DEPARTMENT OF HIGHWAYS OF ONTARIO
280 DAVENPORT ROAD
TORONTO, ONTARIO

FOUNDATION INVESTIGATION
PROPOSED WHITE RIVER WEST CROSSING
T.C.H. NO. 17 THUNDER BAY DISTRICT

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FOUNDATION INVESTIGATION
FOR THE
WHITE RIVER WEST CROSSING
HIGHWAY #17, THUNDER BAY DISTRICT

Reported herein are the results of a foundation investigation recently completed at the above noted river crossing. In addition to a detailed description of the soil types encountered in the borings, this report includes an evaluation of the competency of these materials with respect to abutment and pier footing support.

Location and Description of Site

The proposed structure is to span the White River which is crossed by Highway No.17 approximately 9 miles east of Regan, Ontario. This has been designated as the White River West Crossing and occurs at road centre line chainage 5206 + 00. A sketch plan of the bridge site showing the location of the boreholes is included as drawing No.1.

The reaches of the White River in the vicinity of the bridge site are currently used for logging operations by the Abitibi Pulp and Paper Company, and shallow draft boats are used extensively in connection with these operations. The stream velocity has been described as slow on D.H.O. drawing No. E-3119-1. During spring run off however, it seems reasonable to anticipate higher flow velocities. At the time of this investigation, with water levels 5 feet below spring flood level, the stream velocity was such that a power winch had to be used to move the drilling raft into position in the river channel. The direction of flow is very nearly at right angles to the road centre line.

High water elevation has been noted as approximately 1125.0. This elevation is evidenced by marks on trees close to the shoreline and also by information from local inhabitants and contractors who were in the area during the spring of 1957. Flood levels at this time are reported to be the highest ever witnessed in this area. The condition of the river banks at the crossing site and immediately downstream of road centre line indicate that erosion is taking place along the east shoreline and that deposition is in process along the west shoreline. The depth of water is greatest near the east side of the channel and this could very well be the result of scouring. Pieces of wood were also encountered in river borings Nos. 3 and 6 at depths of 5 to 10 feet below present river bottom, indicating that this depth of material has been placed in recent times.

The above evidence indicates that adequate provision will have to be made to protect piers and abutments against the possibility of river bed scour and river bank erosion. The placing of supporting piers in the stream channel will also give rise to an increase in the scour and fill activity.

Description of Field Work

The drilling and soil sampling equipment was moved onto the site on July 2nd and work commenced the following day on borehole No.7. The holes were advanced by alternately driving and washing out 3 inch diameter casing. Where boulders were encountered or where bedrock sampling was considered necessary, rotary drilling, using diamond cutting bits, was used.

Sampling in the granular non-cohesive soil types existing at this site was carried out at depth intervals of five feet using a 2 inch diameter split spoon sampler. In addition to carrying out Standard Penetration Tests in the open boreholes at the above noted depth intervals, dynamic cone penetration profiles were established adjacent to each borehole. These profiles were obtained by fixing a 2 inch diameter cone to the end of a Standard A drilling rod and then driving the cone and rods from ground surface to refusal depth. A driving energy equivalent to that of the Standard Penetration Test was used (i.e. 350 ft.lb.per blow) and the resistance to penetration was recorded as number of blows required per foot of cone advance. When water bearing sand strata are encountered in an open borehole the results of the Standard Penetration Test are somewhat conservative; the dynamic cone results provide a more realistic relative density determination under these conditions. The possibility of disturbance during boring operations is also eliminated in dynamic cone penetration results.

Samples recovered were carefully examined, described, and then placed in moisture proof containers. On completion of the boring program in the White River area, the samples were transported by rail to the Toronto Laboratory where they will be kept in storage for future reference if required.

At the time of this investigation the road contractor had completed the embankment to grade elevation on the west side of the river. Construction of the east embankment was not yet started. The initial lifts of embankment fill consisted of large boulders and sand; to avoid the high cost of drilling through the boulder-laden fill, holes Nos. 1 and 2 were moved to correspond to the toe of slope of the present embankment. The offset distances for these two holes are 40 feet instead of the initially proposed 16 foot offsets. Chainage locations of the boreholes and offsets from road centre line are shown on drawing No.1. The surveying required in accurately locating the boreholes and obtaining respective elevations was carried out by the D.H.O. Engineering party supervising construction in the area.

Field work was completed on July 10, 1957.

Discussion of Soil Types

The results of the borings and cone penetration profiles carried out at this site show that the subsoil type is a non-cohesive granular material consisting of **fine** to medium sand with gravel sizes present. Two strata were encountered in each of the borings. The upper stratum extending from ground surface to an average elevation of 1100, appears to be a post glacial deposit of sand with fine gravel sizes varying in percentage with depth and borehole location. The relative density of this deposit varied from loose to medium dense. The stratum underlying the above deposit appears to be of glacial origin and is described as a dense composite of sand and angular gravel with

-3-

numerous boulders. The underlying bedrock was intersected at an average elevation of 1090 ft., indicating that the above described dense stratum is of the order of 10 feet in thickness over the site. Refusal for piling would be obtained at very small penetration depths in this dense layer.

Samples of AXT core size obtained from boreholes numbered 2 and 7 show that the bedrock is of igneous origin and is described as sound massive grey granite. The depths at which bedrock was intersected in these two holes indicates that the surface of this formation is horizontal at the crossing area.

The depth of oxidation in the upper loose to medium dense stratum is approximately 8 feet, based on results of borings 1, 2, 7 and 8. No zone of oxidized material was noted in the holes located in the river channel.

A profile showing the stratigraphy from west to east across the bridge site has been included as drawing number 1. Separate profiles for each of the boreholes are included as drawings numbered 2 to 9 inclusive.

Consideration of Footing Support

In determining the type of footing support for abutments and piers at this crossing site the strength and deformation characteristics of the following three strata need be considered:

- 1) A loose to medium dense stratum of fine to medium grained sand containing varying percentages of fine gravel which occurred in pockets and thin lenses. The zone of oxidation evidenced at both the east and west abutment locations averaged 8 feet in depth.
- 2) A stratum of dense grey fine sand containing angular gravel and numerous boulders. This layer extends across the site and averages 10 feet in thickness. Refusal to pile penetration would be obtained in this stratum.
- 3) A light coloured medium grained bedrock formation described as grey granite. The surface of this formation appears to be non-fragmented and free of weathering. Based on the elevations at which bedrock was contacted in holes 2 and 7, the surface appears to be horizontal underlying the bridge site.

The safe allowable bearing pressures that can be transmitted to fine grained granular soil types such as underlie this site are dependent upon the strength and deformation characteristics of these materials. These properties are primarily a function of the relative density of granular soils and current accepted practice in America and the United Kingdom is to determine the relative density by means of the Standard Penetration Test. These test results have been correlated with density measurements and plate loading tests from which an empirical relationship giving safe bearing capacities for a limiting value of 1 inch settlement has been published.⁽¹⁾

(1) Terzaghi & Peck - "Soil Mechanics in Engineering Practice",
John Wiley & Sons, New York 1948. P.423

The allowable bearing pressures corresponding to the Standard Penetration (N) values obtained in the loose to medium dense upper stratum underlying the abutment and pier locations at this site are such that adequate support for spread footings can not be obtained in this stratum. The variation in relative density evidenced in adjacent holes under the abutment locations would not only give rise to excessive vertical movements but also result in tilting of the abutments. Adequate spread footing support could only be obtained at the dense sand and gravel horizon contacted at an average elevation of 1100.0.

Footings supported on piles founded in or bearing on the dense stratum of sand, gravel and boulders appears to be the most economic means of support at this site. Large displacement timber piles or steel monotube type piling would reach refusal in this stratum. Penetration of ~~H~~ piles into this stratum could not exceed an average length of 10 feet which is the depth to the underlying bedrock. The choice of type and arrangement of piling under the footings will depend upon the abutment and pier loads which are not available to the author at this time.

As a guide to the length of piling required at each of the abutment and pier locations the following tabulation is included. Cut-off elevation has been assumed at 6 feet below ground elevation at the abutment locations and 4 feet below river bed locations at the proposed pier locations. Timber piles are assumed driven to refusal.

<u>Location</u>	<u>Length of Piling below cut off elevation</u>
Holes 1 & 2	20 feet
Holes 3 & 4	12 "
Holes 5 & 6	10 "
Holes 7 & 8	22 "

Length as given above is maximum for location noted.

Lateral thrusts on Piles

The proposed grade elevation at the abutment locations has been taken from D.H.O. drawing No. E-3119-1 as 1132.0 ft., assuming footing elevation at 1117.0 ft. This gives an active embankment height of 15 feet. The provision of rip rap to protect the water side of the abutment footings from erosion will also result in some passive earth pressures to resist the horizontal thrusts from the embankment fill. Because of the improbability that the rip rap and underlying toe material will be removed by river erosion the active fill height is taken at 10 feet rather than the maximum of 15 feet noted above.

Horizontal thrusts due to embankment fill of 10 feet in height can be estimated from the following expression:

$$P_H = \frac{1}{2} \gamma H^2 K_A$$

where P_H = total thrust per foot width of breastwall

γ = density of back fill material in p.c.f. = 110 p.c.f.

H = active height of Fill = 10 feet

K_A = 0.23 = active horizontal earth pressure coefficient assuming granular backfill for which $\phi = 35^\circ$ and wall friction $\phi_c = 20^\circ$

Substitution gives

$$P_H = 0.5 \times 110 \times 10^2 \times 0.23 \approx 1300 \text{ p.l.f.}$$

Assuming a breastwall width of 30 feet, a total thrust of the order of $30 \times 1300 = 39$ Kips is indicated. If vertical piles are used, a total of 26 piles would be required to accommodate this thrust, assuming an allowable horizontal resistance of 1.5 Kips per vertical pile. If this number of vertical piles cannot be accommodated under a practicable footing size a combination of batter and vertical piles will be required. The type of piling, number required, and resultant efficient pile pattern will depend upon the abutment loadings which are not known at the time of writing this report.

Embankment Stability

The subsoil underlying the embankments in the vicinity of the river is essentially a free draining granular material. The permeability of the embankment foundation materials is considered to be such that immediate pore pressure dissipation would result upon embankment loading. This would give rise to a shearing resistance increase in proportion to the effective pressure increment and for the relatively low embankments being considered, a major slip is considered impossible. The competency of the granular subsoil to support the embankments is perhaps best evidenced by the fact that the west embankment has been completed to grade for over 3 months to date, and no signs of distress are evident.

Comments and Recommendations

(1) The subsoil existing at this bridge site is essentially a fine grained granular free draining material. The relative density of the upper stratum of fine to medium sand encountered in each of the borings has been determined as loose to medium and is considered unsuitable for spread footing support.

(2) Spread footings can not be used at economic excavation depths and as a consequence bearing piles founded in the dense sand gravel and boulder layer overlying bedrock are recommended. If timber piles are used, cut-off elevation must be below low water level. Footings for the centre piers should be carried a minimum depth of 4 feet below stream bed elevation.

A tabulation of length of piling required at each of the abutment and pier locations has been included in the body of this report. Lengths noted are from cut-off elevation to pile tip, at estimated refusal elevation.

(3) An estimate of the horizontal thrusts due to earth pressures acting on back of the abutments has been made. A total of 26 vertical piles is required to accommodate the thrusts estimated at each abutment. This number can of course be reduced by using batter piles.

(4) Observations of the condition of the river banks and river bottom indicate that the abutments and piles will have to be protected against erosion and scouring. Rip rap should be provided at the abutments and sheet piling should be driven around the pier perimeters. High water level has been noted as elevation 1125.0 ft.

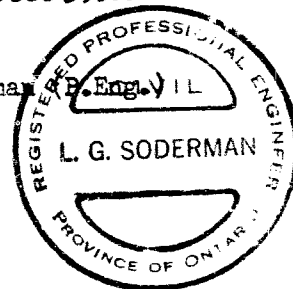
(5) The subsoil is considered competent to support the embankment heights necessary in the vicinity of the bridge site. The west embankment has been constructed to grade elevation and shows no evidence of local general failure.

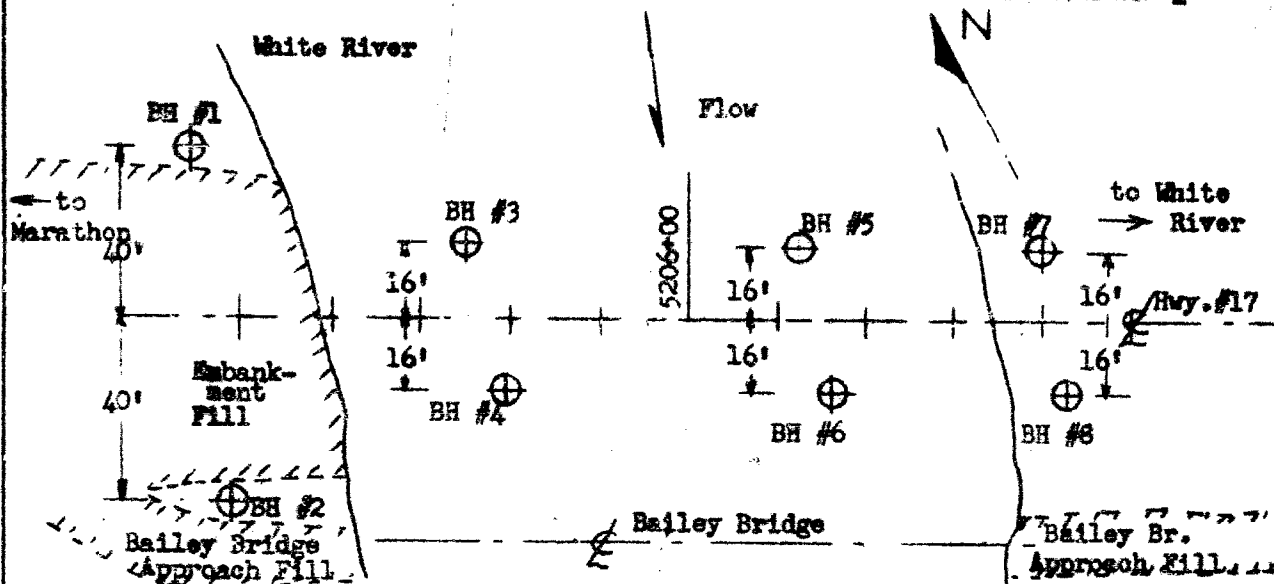
L. G. Soderman

LGS/lt

Lawrence G. Soderman P. Eng. VIL

September 9, 1957.
C 108 J 108

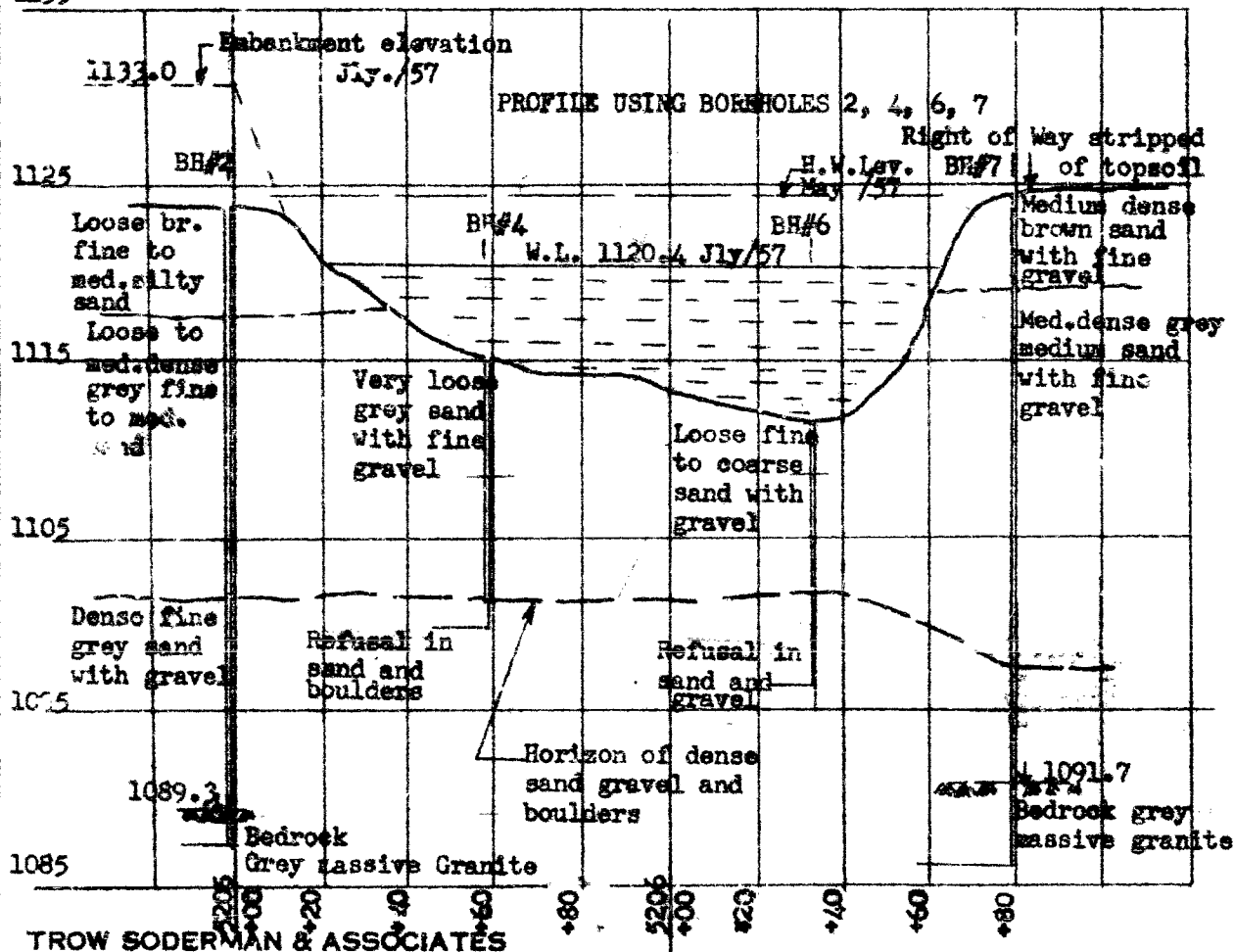




PLAN OF BOREHOLE LOCATIONS
White River West Crossing

Scale 1" = 40' Horizontal
1" = 10' Vertical

1135



PROJECT NO. J 108/C 108

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

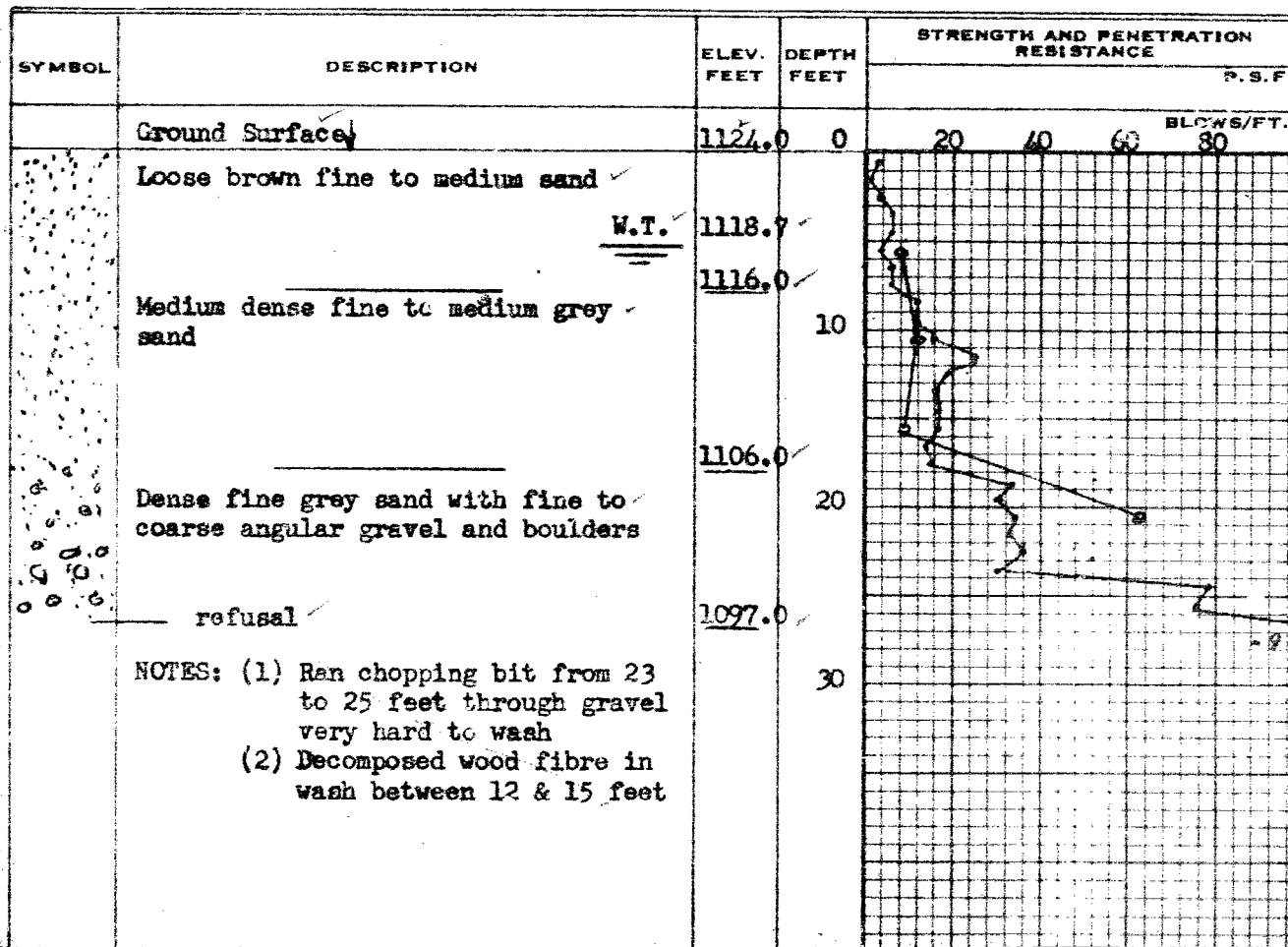
PROJECT White River West Crossing
 LOCATION Highway 17, East of Regan, Ont.
 HOLE LOCATION Chainage 5204+90, 40' left
 HOLE ELEVATION AND DATUM 1124.0

BOREHOLE NO. 1
 FIELD SUPERVISOR L.S.
 DRILLER M.C.
 PREP. L.S.

DRAWING NO. 2

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CORE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (Qu)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.		
	1	
	2	
	3 lost	
	4	

PROJECT NO. C 108 J 108

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT White River West Crossing

LOCATION Highway 17, east of Regan, Ont.

HOLE LOCATION Chainage 5204 + 95 - 40 ft. right

HOLE ELEVATION AND DATUM 1124.3

BOREHOLE NO. 2

FIELD SUPERVISOR L.S.

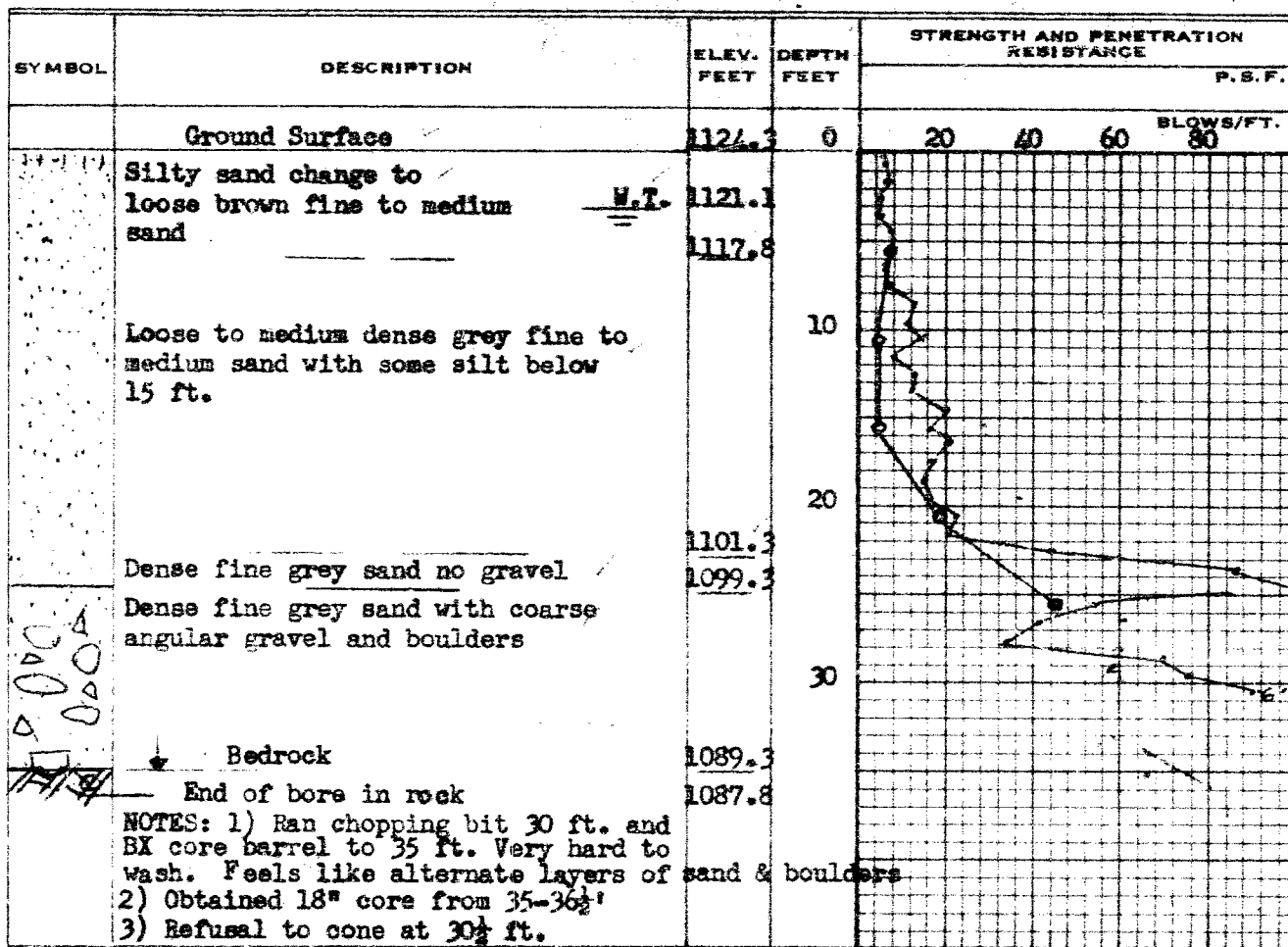
DRILLER M.G.

PREP. L.S.

DRAWING NO. 3

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
CASING
2" SHELBY
1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.		
	1	
	2	
	3 lost	
	4 lost	
	5	

PROJECT NO. 0108/1108DRAWING NO. 4

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT White River West Crossing
 LOCATION Highway 17, East of Regan, Ont.
 HOLE LOCATION Chainage 5205 + 51
 HOLE ELEVATION AND DATUM 1120.4

BOREHOLE NO. 3
 FIELD SUPERVISOR L.S.
 DRILLER M.C.
 PREP. L.S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (Qu)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	River surface ↓ ✓	1120.4	0	20 40 60 80	BLOWS/FT.
	Bed of River	1115.0			
	Loose grey medium to coarse sand with fine to medium gravel below 10 ft.		10		
	Refusal - pipe bouncing on boulder or bedrock	1101.9	20		
	NOTES: (1) Piece of decomposed wood in wash between 10 & 15 ft.		30		

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

PROJECT NO. C 108/J108

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

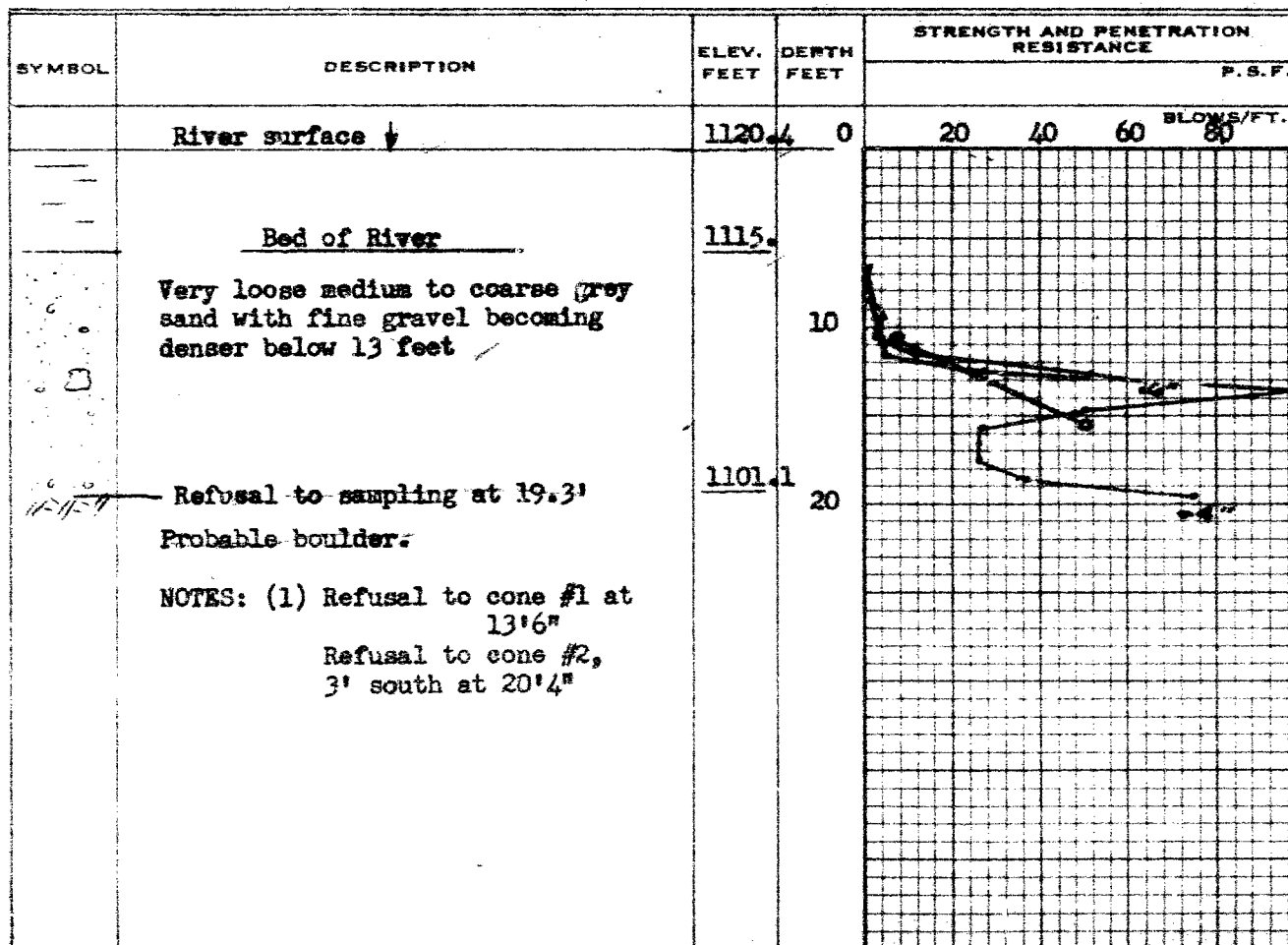
DRAWING NO. 5

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (Qu)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

PROJECT White River, West Crossing
 LOCATION Highway 17, East of Regan, Ont.
 HOLE LOCATION Chainage 5205 +59, 16' right
 HOLE ELEVATION AND DATUM 1120.4

BOREHOLE NO. 4
 FIELD SUPERVISOR L.S.
 DRILLER M.C.
 PREP. L.S.



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

PROJECT NO. **C 108 J 108**

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

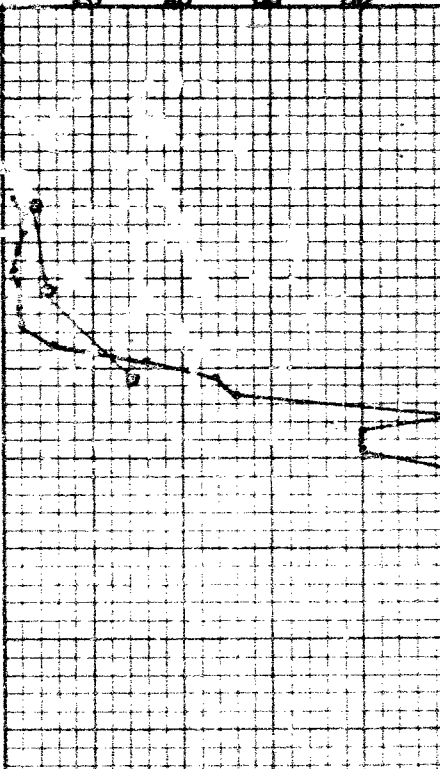
PROJECT **White River West Crossing**
 LOCATION **Highway 17, East of Regan, Ont.**
 HOLE LOCATION **Chainage 5206 +25 16' left**
 HOLE ELEVATION AND DATUM **1120.4**

BOREHOLE NO. **5**
 FIELD SUPERVISOR **L.S.**
 DRILLER **M.C.**
 PREP. **L.S.**

DRAWING NO. **6**

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (QU)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P. S. F.	
	+ River surface July 7/57	1120.4	0	BLOWS/FT. 20 40 60 80	
	<u>River bed</u>	1110.8	10		
	loose gray med. to coarse sand with fine to medium gravel.				
	Occasional boulders below 17 ft. Dense below 19 ft.		20		
	Refusal	1096.1			
NOTES: 1) Refusal to cone at 25'10"					
2) Hit boulder in borehole at 17½'. Moved hole 3 ft. south.					
3) Refusal in boring 24'3"					

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

PROJECT NO. C 108 J 108

DRAWING NO. 7

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT White River West Crossing
 LOCATION Highway 17, East of Ragan, Ont.
 HOLE LOCATION Chainage 5206 + 33, 16' right
 HOLE ELEVATION AND DATUM 1120.4

BOREHOLE NO. 6
 FIELD SUPERVISOR L.S.
 DRILLER M.C.
 PREP. L.S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (Qu)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT

①
 +
 X
 -

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	Surface of River	1120.4	0	20	40 60 80
	River bed	1111.4	10		
	Loose fine to coarse grey sand with some fine gravel.				
	Dense below 18 ft.				
	Refusal in gravel and boulders	1095.4	30		

- NOTES: 1) Refusal to cone 24 ft.
 2) Hard to turn chopping bit below 19 ft.
 3) Piece of timber in wash 15 - 20 ft.

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

PROJECT NO. C 108 J 108

DRAWING NO. 8

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT White River West Crossing
 LOCATION Highway 17, East of Regan, Ont.
 HOLE LOCATION Chainage 5206 + 80 - 16' left
 HOLE ELEVATION AND DATUM 1125.2

BOREHOLE NO. 7
 FIELD SUPERVISOR L.S.
 DRILLER M.C.
 PREP. L.S.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (QU)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
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 PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P.S.F.	
	Ground surface	1125.2	0	20 40 60 80	
	Medium dense brown medium sand with fine gravel changing to grey in colour below 7 and 10 ft.	1120.2		BLOWS/FT.	
			10		
			20		
		1100.2			
	Dense fine grey sand with fine to medium gravel	1097.2			
	Ran BX from 28'10" to 34 ft. through boulders, stones and fine to coarse gravel. Boulders approx. 6 inches in diameter.	1091.7	30		
	Assumed bedrock. Granite.				
	Drilled 34 to 38 ft. 34 inch recovery	1087.7			
	End of bore		40		
	NOTES: (1) Hard to wash 18 to 20'				
	(2) Approx. 1' topsoil stripped from area				
	(3) Refusal for cone 28 ft.				

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P. C. F.
MOIST. CONTENT- % DRY WT.			
		1	
		2	
		3	
		4	
		5	

PROJECT NO. C 108 & 108

TROW SODERMAN AND ASSOCIATES

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT White River West Crossing
LOCATION Highway 17, East of Regan, Ont.
HOLE LOCATION Chainage 5206 + 85 16' left
HOLE ELEVATION AND DATUM 1124.4

BOREHOLE NO. 8
FIELD SUPERVISOR L.S.
DRILLER M.C.
PREP. L.S.

DRAWING NO. 9

LEGEND

- 2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
CASING
2" SHELBY
1/2 UNCONFINED COMPRESSION [Qu]
VANE TEST [C] AND SENSITIVITY [S]
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT



SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
				P.S.F.	BLOWS/FT.			
	Ground surface	1124.4	0					
	Medium dense brown fine to medium sand with fine gravel change to grey in colour at approx. 8 ft.	1118.4						
		1112.4	10					
	Drilled with chopping bit through dense gravel and sand - too hard to wash.							
		1102.	20					
	Ran AIT core barrel 2 1/2 ft. recovered to ins. of light grey granite core, probably large boulder							
	End of Bore							
	NOTES: 1) Refusal Cone No.1.at 18 1/2' in boulders Refusal Cone No.2 at 22'							

AUG 57

Enclosure #10
C 108 J 108



Drilling Rig in Position over BH #6
West Embankment in Background



Drilling Rig on set-up over BH #2
at toe of slope of West Embankment

AUG 57

Enclosure #10
C 108 J 108



Drilling Rig in Position over BH #6
West Embankment in Background



Drilling Rig on set-up over BH #2
at toe of slope of West Embankment