Report

SUBSURFACE INVESTIGATION

PROPOSED EAGLE RIVER BRIDGE

MILE 237 - DEMPSTER HIGHWAY

DO NOT REMOVE
FROM OFFICE
OF J. QUONG

DPW 720A
7530-21-029-3807

Report

SUBSURFACE INVESTIGATION

PROPOSED EAGLE RIVER BRIDGE

MILE 237 - DEMPSTER HIGHWAY

DO NOT REMOVE FROM OFFICE OF J. QUONG

DEPARTMENT OF PUBLIC WORKS
WESTERN REGION

REPORT ON SUBSURFACE INVESTIGATION FOR THE PROPOSED EAGLE RIVER BRIDGE MILE 237 - DEMPSTER HIGHWAY

Submitted by: R.D. Cook, P. Eng.
Materials Engineer
August 15, 1974

TABLE OF CONTENTS

I INTRODUCTION

The initial foundation investigation at the Eagle River Crossing was carried out in April 1972, and a report was submitted by the undersigned in June 1972. Due to the complex permafrost conditions at the site, a foundation design for the bridge could not be resolved and it was decided that additional deep borings were required to expand and confirm the original data. These borings were completed during March 1974, and the results of both drilling programs are included herein.

Portions of the 1972 report dealing with the site description and conditions are included in this report with some revisions as a result of the additional borehole data.

All borings and laboratory analysis for this project were undertaken by D.P.W., Whitehorse.

II DESCRIPTION OF SITE AND PROPOSED CONSTRUCTION

The Eagle River drains the western slopes of the southern Richardson Mountains and the south-eastern portion of the Eagle Plain. According to the Geological Survey Memoir 247, the Eagle Plain is 'a low plateau, uplifted some 200 to 400 feet above the Porcupine River where it leaves the Plain.' The mode of deposition of the plain is not

defined -- the area has apparently not been glaciated and the Plain is assumed to be lacustrine in origin.

At the proposed crossing site (roughly Mile 237 on the Dempster Highway - Lat. 66° 26' 30" North, Long. 136° 43' 30" West) the Eagle River is entrenched in the Plain and has formed a relatively broad (3,000'+) flat bottomed valley. The River exhibits a marked meander pattern within the valley with numerous ox-bows and meander scars evident. Permafrost is predominant in the area and test drilling on the valley slopes has revealed much of the subsoil to be exceedingly ice rich, at least in the surface 10 to 20 feet. Helicopter reconaissance of the area and airphoto study reveal several small slump areas or soil flows caused by thermal erosion on the steeper valley walls and on the walls of narrow steep-sided, V-shaped tributory valleys. Inspection of the outside of a meander loop roughly 1,000' downstream from the proposed crossing site in the summer of 1971, following lateral bank erosion by spring runoff waters, revealed numerous ice wedges in the eroded face.

The proposed crossing site is located on a straight stretch of river roughly 1,500' in length, between two meander loops. Ox-bow cutoffs are evident on both sides of the straight section suggesting silts or similar water laid

. 3

sediments at the abutment locations. Data available on the hydraulic aspects of the River is meagre - the high water level was estimated at approximately elevation 1,069 (estimated discharge 11,000 cfs) by J.Y.C. Quong, but recent estimates by others have placed the high-water level as high as elevation 1076. Some driftwood (trees) are carried by the River during flood stages.

At the time of the 1972 investigation, the tentative bridge design included a central pier with two 120' spans. The current design has eliminated the central pier and is a single 300' span with abutments at stations 5091 + 60 and 5094 + 60.

III EVALUATION OF SUBSOIL CONDITIONS

A. Field and Laboratory Investigations

A total of 14 test holes were drilled in the 1972 investigation - 8 relatively deep holes (30' to 60') at the anticipated locations of the bridge pier and abutments, and 6 shallow holes (15') adjacent to the stream channel on centerline, to assess the subsoil in the areas of the approach fills. In 1974 an additional 6 holes were advanced - 3 on each side of the River near the abutment locations. Five of these six holes were drilled to depths in excess of 95', with a maximum of 110'.

In addition a thermistor probe was installed near each proposed abutment location to provide ground

temperature data to assist in foundation design and to assess the effects of bridge construction on the thermal regime adjacent to the stream channel. Installation of the thermistors and continued data gathering and analysis is under the direction of Mr. G. H. Johnston of the National Research Council. To date one set of temperature readings has been obtained and are included herein.

Logs of all boreholes with laboratory test data are included in Appendix II -- the borehole locations are shown on the site plan in Appendix III.

B. Subsoil Profile

The boreholes and the approximate subsoil profile at the crossing site are shown on the site plan in Appendix III. This subsoil profile presents a generalized grouping of the soil types encountered and borehole logs should be consulted for detail. Permafrost is variable across the site and the approximate delineation of frozen and thaw zones is also shown on the site plan.

Four distinctive strata were encountered and are summarized below.

. 5

1) Surficial silty clay -- On either side of the River channel is a surficial stratum of ice rich silty clay extending to a maximum depth of roughly 10', or to elevation 1060'. These materials have probably been deposited by the River during flood stages. The clays contain organic material and are saturated with ice and ice lenses (moisture contents to 88%) and undoubtedly contain ice wedges as reported previously in similar flood plain deposits 1,000' downstream.

2) Silt-sand-gravel -- Extending from elevation 1060' to approximately elevation 1020' is layer of intermixed silts, sands and gravels. These are water-laid deposits and the test drilling indicated some stratification, however, for the most part, precise changes in subsoil could not be identified during drilling. The materials are low plastic and variable in composition. Where permafrost does not exist, penetration tests indicate a loose to medium dense state (blow counts in the 20 to 25 blows per foot range). Where permafrost is present, ice lensing is not excessive and moisture contents are not appreciably higher than in unfrozen zones (approximately 20%).

3) Sand-clay-silt -- Below approximate elevation 1020 are extensive deposits of finer grained soils varying

. 6

from sandy silt to silty clay. At the north abutment these silts and clays extended to the bottom of the drill holes at elevation 960; at the south abutment the deposits terminated at an elevation of approximately 970. Three distinctive strata of the fine grained soil were delineated on the south side of the channel, and are shown on the subsoil profile in Appendix III, however, they are grouped together for discussion here. The deposits are layered throughout and are also water deposited. They are generally of low plasticity with some thin strata of higher plasticity. Moisture contents in both frozen and unfrozen areas are normally in the 25 to 30% range and are near or above the liquid limit of the materials for the most part. Where unfrozen, these deposits are in a stiff state -- penetration resistance varied from roughly 20 to 30 blows per foot, and unconfined compressive strength tests yielded results in the order of 3.0 to 3.5 kips/ft^2. Ice content in the permafrost zone is in the form of small lenses or crystals.

4) Silt-sand-gravel -- Below approximate elevation 970 at the south abutment and extending at least 15' to the bottom of the drill holes, is a very dense clay-silt-sand-gravel mix. The mode of deposition of this deposit is not known -- the granular components cover a wide

. 7

range of rock types which are not common to the area, and this, plus the lack of sorting and the dense nature of the material, suggest a glacial till. Penetration resistance below elevation 970 was extremely high (in excess of 100 blows/foot in many cases) and drill refusal with augers was encountered. Moisture contents were generally low.

C. Permafrost

Permafrost is variable across the River channel and herein lies the main problem in foundation design at this site. The test borings reveal a recession in the permafrost level below the present River channel and the 'thaw lines' shown on the subsoil profile in Appendix III outline at least the partial limits of the thaw zone as of April, 1974. The north bank of the River is completely frozen and hole 74-6 indicates the permafrost-thaw interface extends very sharply below the river bottom -- i.e. there is no 'thaw-bulb' effect (This is consistent with data obtained from borings in the winter of 1973-74 at several Rivers on the Mackenzie Highway north of Ft. Good Hope). On the south bank there is a shallow surface layer of permafrost near the present channel which gradually thickens with the horizontal distance away from the River.

. 8

This thaw configuration is not unrealistic when the meander pattern and profile of the River at the crossing site are considered. From airphotos it is evident the River has, in very recent geologic time, cut off an ox-bow on the south side of the present channel and, at the crossing site, the River is tending to migrate toward the north -- i.e. the profile indicates a near vertical erosion force on the north bank and a deposition area on the south side. The south abutment is in an area which was at one time at mid-channel, hence the underlying subsoil was thawed to an undetermined depth, and following lateral movement of the channel to the north, 'new' permafrost has only been re-established to date in a shallow surface layer. On the north side, however, the thaw zone is migrating with the River channel, and the equilibrium position of the permafrost is possibly lagging slightly behind the River movement.

The following table summarizes the initial temperature data obtained from the thermistor installations at the Eagle River on June 7, 1974.

DEPTH	TEMPERATURE °F	
	SOUTH BANK STA 5091+80	NORTH BANK STA 5094+35
5	30.6	26.0
10	30.7	22.9
20	31.95	24.4
30	32.06	27.0
40	32.2	28.2
50	32.2	28.5
60	32.1	28.6
70	32.1	28.8
80	32.0	28.7
90	32.3	29.0
100	32.1	29.1

These initial readings provide several points for discussion particularly on the south bank. On the north bank the 'old' permafrost is relatively cold near the surface and gradually increases in temperature with depth as would be expected. On the south bank the 'new' permafrost is much warmer near the surface than the 'old' permafrost on the north bank, and the temperature of the 'thawed' subsoil below the shallow permafrost layer is constant near 32.0°F with depth.

At the south bank the temperature at the 5' level is 30.6°F vs. 26.0°F on the north bank -- this temperature

. 10

difference seems rather large in that the temperature of the near surface soil varies with the season (with some time lag), and at such a shallow depth it would seem logical that the temperature on both sides of the river should be approximately the same.

The thickness of the frozen zone at the south abutment as determined by drilling roughly coincides with the 32°F isotherm as determined from the temperature data -- i.e. approximately 20'. Below the 20' level the soil temperature remains at or very near the 32°F mark, with no temperature increase to a depth of at least 100 feet. This lack of a temperature gradient suggests that permafrost still exists at some depth greater than 100' under the south bank and this cold layer 'shields' the subsoil above it from the warming effect of the earth.

The field borehole logs did not report frozen ground in holes 74-1 (thermistor location) or 74-A on the south bank, but the possibility of frozen ground was suggested in hole 74-2 below a depth of approximately 52 feet. Penetration test results in hole 74-2 are higher below the 50' level than in holes 74-1 and 74-A which supports the premise that the subsoil is frozen. In addition, drill holes near mid-span of the proposed bridge in 1972 reported frozen subsoil near the 50'

. 11

level. The thermistor readings show a slight drop below 50' and this, plus the borehole data, suggests that much of the subsoil below approximately 50' under the present channel and the south abutment area is in a semi-thawed state rather than a completely thawed condition. Thus the soil behaves in a semi-plastic manner but a portion of the pore-water is frozen. Semi-disturbed samples taken at depth and examined in the laboratory after complete thawing revealed minute pockets of wet soil in the mass which suggests small ice crystals or lenses, and hence at least partially frozen soil, in situ.

IV FOUNDATION SUPPORT OF BRIDGE STRUCTURE

A. Proposed Bridge Foundations

A considerable amount of discussion and exchange of ideas has taken place within the Department since the 1972 investigation at the Eagle River and a foundation design has been resolved for the proposed bridge. The design will utilize steel H-piles (12BP53) at both abutments. At the south abutment an 18" diameter hole will be drilled through the shallow surface permafrost layer to a depth of approximately 20', the pile installed and driven to refusal on the dense clay-silt-sand-gravel stratum below elevation 970. The void space around the pile in the drill holes will be filled with sand after pile installation in the hole, but prior to driving, to gain the benefit

. 12

of densification during driving.

At the North abutment it is proposed to install the piles in 18" diameter holes drilled to a depth of 65', and backfilled with dry sand for roughly 20'. The piles will be driven into the sand, and possibly into the underlying permafrost soil, until practical refusal is reached. The void space around the pile will then be filled with a sand-slurry which will subsequently freeze and provide load-carrying capacity through tangential adfreezing.

B. South Abutment

The undersigned is in complete agreement with the proposed foundation design at the South Abutment. It is recommended the sand backfill in the pileholes be placed at a moisture content of approximately 8-9% in order that as much densification as possible will occur during drilling. Some artesian pressure was reported during test drilling at the South abutment and it is considered likely that water will rise up through the sand backfill during or following driving and thereby saturated the sand prior to freezing in the permafrost zone.

C. North Abutment

The undersigned is in agreement with the proposed pile installation method at this abutment but is of the opinion that the foundation is overdesigned.

.....13

The abutment will be placed at station 5094+60 or roughly 50' back from the edge of the stream channel and the thaw zone. It is understood armour banks are proposed at the crossing site in order to maintain the channel banks at their present location, and this being the case, it is the author's opinion that the thaw-permafrost interface will migrate very little to the North within the life of the structure. Thus since the permafrost soils will support the bridge loadings on relatively short piles (35') it is unnecessary to use 65'+ piles. The theory of a thaw 'bulb' extending below the North bank has been the basis for using long piles (there is no reason to expect deterioration of the permafrost at the surface) however if such a bulb did develop it would be the lower portion of 65'+ piles that would be in a thaw zone at station 5094+60 hence the additional pile length is of little or no value as a safety factor.

The thermistor data on the North bank indicates an average permafrost temperature of approximately 26°F to a depth of 40'. Test data obtained by the U.S. Army Cold Regions Research and Engineering Laboratory in pile load tests in Alaska, indicate a sustained adfreeze strength for a silt-water slurry backfill and steel of more than 30psi at 28°F. In addition, adfreeze strengths for a saturated, well-graded sand slurry vibrated in place are at least 50% higher. Therefore, if a design adfreeze strength of 10psi is assumed, the average factor of safety will be at least 3 for a sand slurry backfill. At the Eagle River,

the 12"BP53 H-piles will develop a load carrying capacity through adfreezing of 1440 psf x 4 = 5760 lbs per foot of pile, and only 15 feet of effective pile length will be required to support the 40 ton design loads.

It is recommended a well-graded sand with a 100% passing the #4 sieve and less than 15% passing the #200 sieve be utilized for slurry material. Sufficient water should be added to completely saturate the sand but excess water should be avoided. A concrete mixer will serve to mix the slurry and the temperature of the slurry should be as cold as possible. It is estimated the water content of a well-saturated, well-graded sand will be in the order of 20% and the volumetric latent heat will be in the order of 3000 BTU/cu.ft. For an 18" pile hole the latent heat per foot of pile will be approximately 5500 BTU/foot. Based upon CRREL test data, a single pile installed in an 18" hole with a slurry as outlined above, would completely freeze-back within 5 - 6 days at the Eagle River to a depth of 40 feet. Freeze-back time for a group of piles would be greater and would depend upon the pile spacing and configuration, but as the pile spacing is apparently small (3 - 6" c.c.) at the proposed abutment, it is considered worthwhile to gain some immediate load carrying capacity by driving the H piles into sand at the base of the 18" hole as proposed. The sand placed in the hole prior to driving should be well-graded and at

a moisture content of no more than 8%.

To summarize, at the North abutment, the proposed foundation design utilizing 65'+ piles will provide an overdesigned foundation. A safe and economical foundation for the design pile loadings of 40 tons can be obtained by utilizing 35' steel H piles (12 BP 53), driven into 15' of dry sand (8% moisture) at the base of an 18" diameter hole, with the remaining void space backfilled with a completely saturated, well-graded sand slurry, vibrated in place. It is estimated the piles will develop a shaft friction of at least 2 kips/foot when driven into the dry confined sand, which should provide sufficient bearing until complete slurry freeze-back. The design also allows for at least 5' of possible active layer below the abutment.

D. Installation Records

Inasmuch as some aspects of the pile foundation design are unique and innovative, and may provide a basis for further bridge designs on the Mackenzie Highway, it is recommended that detailed records, including a photographic record of all phases of pile installation, be obtained at both abutments (including driving records in the confined sand at the base of the lead holes into permafrost.) The undersigned would appreciate a copy of all such data upon completion.

.....16

E. Approach Fills

The height of approach fills adjacent to the bridge will be in the order of 12 - 14' on both sides of the River. On the North side it is anticipated the permafrost table will rise into the embankment and only minor sloughing at the toe of slope is anticipated.

On the South approach, test holes #9 and #10 indicated only surface frost at the time of drilling with no indication of permafrost to a depth of 15'. These boreholes appear to be in the old cut-off river channel (ox-bow) which floods annually thus inhibiting establishment of permafrost. Some fill settlement will probably occur through this area, however, as the fill height will be relatively shallow, the settlement which occurs will probably be small and can be taken care of during routine maintenance.

R.D. Cook

Materials Engineer

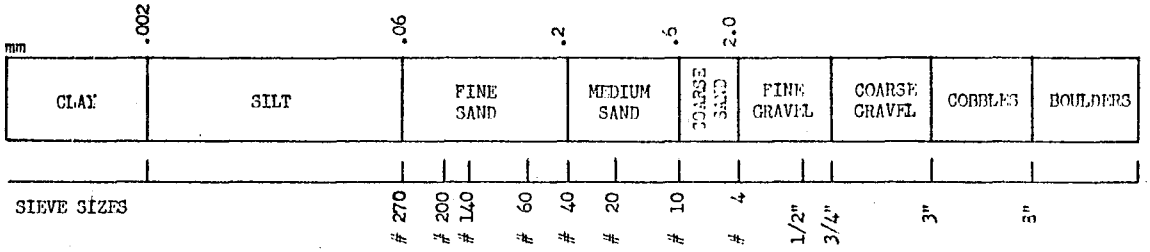
Western Region

APPENDIX I

EXPLANATION OF TERMS & SYMBOLS

TERMS USED IN THE REPORT

CLASSIFICATION BY PARTICLE SIZE



DESCRIPTIVE SOIL TERMS

Glacial Till . . . . . An unstratified Glacial deposit of clay, silt, sand, gravel, cobbles, and boulders in any combination.

Peat . . . . . A fibrous mass of organic matter in various stages of decomposition.

Well-Graded . . . . . Having wide range of grain sizes and substantial amounts of all intermediate sizes.

Poorly Graded . . . . Predominantly of one grain size.

Stratified . . . . . Containing layers of different soil types.

Desiccated . . . . . Dried by moisture evaporation - desiccated clays are sometimes described as fissured or as having nugget structure.

Sensitive . . . . . Exhibiting loss of strength on remolding.

Slickensided . . . . . Refers to a clay that, following shear movements, exhibits planes that are slick and glossy in appearance.

DENSITY OF SANDS & GRAVELS

Descriptive Term	Relative Density	Standard Penetration Test
Very Loose	0 - 20%	0 - 4 blows per foot
Loose	20 - 40%	4 - 10 blows per foot
Medium Dense	40 - 70%	10 - 30 blows per foot
Dense	70 - 90%	30 - 50 blows per foot
Very Dense	90 - 100%	Over 50 blows per foot

CONSISTENCY OF CLAYS AND SILTS

Descriptive Term	Unconfined Compressive Strength - Kips/ft.^{2}	Standard Penetration Test Blows Per Foot	Remarks
Very Soft	Less than 0.5	Less than 2	Can Penetrate with Fist
Soft	0.5 - 1.0	2 - 4	Can Indent with Fist
Firm	1.0 - 2.0	4 - 8	Can Penetrate with Thumb
Stiff	2.0 - 4.0	8 - 15	Can Indent with Thumb
Very Stiff	4.0 - 8.0	15 - 30	Can Indent with Thumb-Nail
Hard	Over 8.0	Over 30	Difficult to Indent with Thumb-Nail

NOTE: Standard Penetration Test employs 140 lb. weight, 30 inch drop, 2" O. D. Sampler. All Shelby Tube Samples are 2" O. D.

CONSISTENCY LIMITS

Descriptive Term	Plasticity Index
Non Plastic	0 - 3
Low Plastic	4 - 9
Medium Plastic	9 - 30
Highly Plastic	Over 30

APPENDIX II

BOREHOLE LOGS

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
NORTH ABUTMENT - EAGLE RIVER BRIDGE	1	DEMPSTER HIGHWAY - YUKON	APRIL 22/72	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA. SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 47' ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
4409	⊠	CI	APPROX 1' OF ORGANIC MTL SILT / CLAY - MEDIUM PLASTIC - ICE RICH (LENSES)	
			10'	10
4411	▨	SM	SAND AND SILTY SAND - - LOW PLASTIC - SOME CLAY AND FINE GRAVEL (-¾") - SOME ICE LENSES AND CRYSTALS EVIDENT	
4412	▨			
4413	▨			20
4414	▨			
			30'	30
4415	▨	ML to SM	CLAY - SILT - SAND MIX - LOW PLASTIC - LAYERED - SOME FINE GRAVEL - ICE LENSES EVIDENT	
4416	▨			
4417	▨			40
			47'	
			BOTTOM OF HOLE - 47'	50
			NOTE - PERMAFROST TO BOTTOM OF HOLE.	60

QU K.S.F
N BLOWS/FT
MOISTURE CONTENT – ω %
15 30 45 60 75

PHYSICAL PROPERTIES										UNCONFINED COMPRESSIVE STRENGTH			
NATURAL MOISTURE CONTENT	BULK DENSITY	CONSISTENCY LIMITS			MECHANICAL ANALYSIS				STRENGTH AS RECEIVED	REMOLDED STRENGTH	SENSITIVITY	SULPHATE
		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	CLAY	SILT	SAND	GRAVEL				
ω	γ	ω_L	ω_P	I_P					q_u	q_u'	S_t	
%	LBS/FT³	%	%	%	%	%	%	%	K.S.F	K.S.F		PPM OR %
87.7		42.9	28.8	14.1	45	45	10	0				
36.7		29.0	20.5	8.5	17	20	60	3				
23.9					12	10	56	22				
22.4		– N. P. –			11	11	46	32				
13.1					15	18	47	20				
28.9		30.0	23.5	6.5	37	41	22	0				
15.5		27.9	19.1	8.8	26	21	32	21				
20.4					0	25	52	23				

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
NORTH ABUTMENT - EAGLE RIVER BRIDGE	2	DEMPSTER HIGHWAY - YUKON	APRIL 24/72	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO
GROUND WATER
BOTTOM OF HOLE 47 ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU K.S.F / N BLOWS/FT / MOISTURE CONTENT – ω % (15 30 45 60 75)	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	CONSISTENCY LIMITS: PLASTIC LIMIT ω_P %	CONSISTENCY LIMITS: PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	MECHANICAL ANALYSIS: SILT %	MECHANICAL ANALYSIS: SAND %	MECHANICAL ANALYSIS: GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	UNCONFINED COMPRESSIVE STRENGTH: REMOLDED STRENGTH q_u' K.S.F.	UNCONFINED COMPRESSIVE STRENGTH: SENSITIVITY S_t	SULPHATE PPM
A418		ML	SANDY CLAY-SILT –			79.1		37.2	31.0	6.2	16	52	32	0				
A419		CL	-LOW TO MEDIUM PLASTIC	10		61.7		34.3	27.2	7.1	18	50	32	0				
			-ICE RICH (LENSES)															
			13'															
A420			SILT-SAND-GRAVEL MIX –			19.6		27.1	19.4	7.7	13	10	53	24				
A421			-VARYING CLAY CONTENT	20		30.7		32.5	20.8	11.7	32	27	27	14				
A422		SC	-SOME FINE GRAVEL ($\frac{1}{2}$")			11.4					8	12	52	28				
A423		SM	-LOW PLASTIC			15.3					11	19	36	34				
A424		ML	-SOME SMALL ICE	30		29.3		26.2	23.7	2.5	16	62	22	0				
A425			LENSES EVIDENT BUT			13.4					13	17	39	31				
A426			GENERALLY LOW	40		20.0					8	5	47	40				
A427			MOISTURE (ICE) CONTENT			15.8					10	10	40	40				
			47'	50														
			BOTTOM OF HOLE – 47'															
			NOTE – "PERMAFROST TO BOTTOM OF HOLE.	60														

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
NORTH ABUTMENT - EAGLE RIVER BRIDGE	3	DEMPSTER HIGHWAY - YUKON	APRIL 25/72	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA. SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 30' ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU K.S.F / N BLOWS/FT	MOISTURE CONTENT – ω % (15 30 45 60 75)	PHYSICAL PROPERTIES: NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F	SENSITIVITY St	SULPHATE PPM OR %
4443		CL	SILTY CLAY – MEDIUM PLASTIC – ICE RICH (LENSES)	9'			102.4		27.8	27.3	10.5	18	67	15	0				
4444			SILTY SAND – LOW PLASTIC – SOME FINE GRAVEL – SOME ICE LENSES EVIDENT BUT GENERALLY LOW MOISTURE (ICE) CONTENT	10			18.0		27.2	23.0	4.2	5	5	51	39				
4445							23.7		– N.P. –			6	10	50	34				
4446				20			32.2		– N.P. –			10	20	61	9				
4447							9.3		– N.P. –			– 25 –		45	30				
				30'															
			BOTTOM OF HOLE - 30'	30															
				40															

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBER

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
PIER AT MIDSPAN - EAGLE RIVER BRIDGE	4	DEMPSTER HIGHWAY - YUKON	APRIL 26/72	

ELEVATION OF GROUND – | DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 59' | ROCK

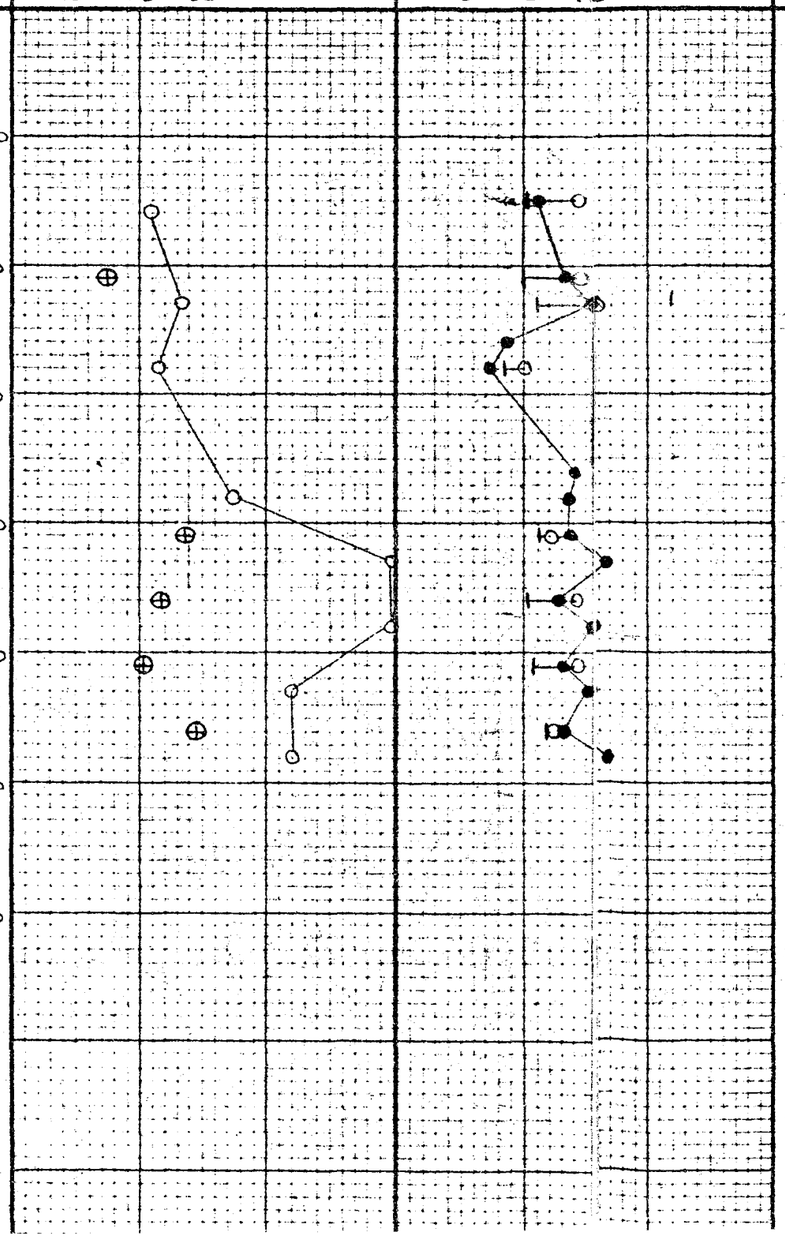
PENETRATION RESISTANCE – N
2" DIA SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) –

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	PHYSICAL PROPERTIES: NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F	SENSITIVITY St
			ICE — 2.5'													
			WATER — 6'													
		S/A GP	SILT - SAND - GRAVEL - LOW PLASTIC - LOOSE TO MEDIUM DENSE													
4451		CL	SANDY CLAY/SILT — 15' - LOW TO MEDIUM PLASTIC		22.0		29.3	20.8	8.5	40	33	20	7			
4449		M/L	- FIRM		26.8	127	29.3	20.1	9.2	20	65	15	0	1.5		
4452					31.0		30.9	22.0	8.9	26	42	26	6			
4452		S/A	SILTY SAND WITH GRAVEL — 24' - MEDIUM DENSE		17.7		– N.P. –			– 18 –		63	19			
4453					14.6		20.4	17.1	3.3	9	11	36	44			
			SILT — 30' - VARYING AMOUNTS OF CLAY AND SAND - LOW PLASTIC MATERIALS - STIFF OR DENSE													
4483					28.2		TRACE			12	84	2	2			
4454					27.9		TRACE			15	70	15	0			
4484					27.4	125	24.5	22.2	2.3	41	57	2	0	2.74		
4455					33.4		TRACE			15	62	23	0			
4485					25.5	122	28.4	20.7	7.7	46	53	1	0	2.35		
4456					31.1		TRACE			18	76	6	0			
4486					26.5	136	28.6	21.6	7.0	52	48	0	0	2.08		
4457					30.2					27	70	3	0			
4487					26.4	125	24.8	24.3	0.5	25	75	0	0	2.90		
4458			– ICE LENSES @ 57'-58' — 58'		33.8					35	65	0	0			
			BOTTOM OF HOLE – 58'													

NOTE - ICE LENSES INDICATED AT A DEPTH OF 58' OTHERWISE NO PERMAFROST INDICATED THROUGHOUT HOLE

- GRAVEL IN STREAM BOTTOM PRIMARILY SHALE AND SANDSTONE DERIVATIVES.



RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
PIER AT MIDSPAN - EAGLE RIVER BRIDGE	5	DEMPSTER HIGHWAY - YUKON	APRIL 25/72	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO
GROUND WATER
BOTTOM OF HOLE 59' ROCK

PENETRATION RESISTANCE – N
2" DIA SPLIT TUBE
2" DIA CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
			ICE — 2.5'	
			WATER — 6'	
		S/M GP	SILT-SAND-GRAVEL – – LOW PLASTIC – LOOSE TO MEDIUM DENSE — 13'	10
4488		CL M/L	CLAY-SAND-SILT – –LOW PLASTIC –FIRM TO STIFF	
4489 4459		S/M		20
			— 24'	
4490 4460		S/M	SILTY SAND WITH GRAVEL – –LOW PLASTIC	
4491 4461		SC	–MEDIUM DENSE	30
			— 34'	
4492 4462		M/L	SILT– –VARYING CLAY CONTENT –VERY LOW PLASTIC	
4493 4463			–STIFF OR MEDIUM DENSE TO 40'	40
4494 4464			–INCREASING IN DENSITY WITH DEPTH	
4495 4465				50
4496 4466			— 59'	
			BOTTOM OF HOLE – 59'	60
			NOTE – NO PERMAFROST INDICATED IN HOLE	
			–GRAVEL IN STREAM BOTTOM PRIMARILY SHALE AND SANDSTONE DERIVATIVES.	70

QU 1.0 2.0 3.0 4.0 K.S.F
N 10 20 30 40 BLOWS/FT

MOISTURE CONTENT – ω %
10 20 30 40 50

PHYSICAL PROPERTIES										UNCONFINED COMPRESSIVE STRENGTH			
NATURAL MOISTURE CONTENT	BULK DENSITY	CONSISTENCY LIMITS: LIQUID LIMIT	CONSISTENCY LIMITS: PLASTIC LIMIT	CONSISTENCY LIMITS: PLASTICITY INDEX	MECHANICAL ANALYSIS: CLAY	MECHANICAL ANALYSIS: SILT	MECHANICAL ANALYSIS: SAND	MECHANICAL ANALYSIS: GRAVEL	STRENGTH AS RECEIVED	REMOLDED STRENGTH	SENSITIVITY	SULPHATE
ω	γ	ω_L	ω_P	I_P					q_u	q_u'	St	
%	LBS/FT	%	%	%	%	%	%	%	K.S.F.	K.S.F.		PPM OR %
18.1	140	28.6	20.2	8.3	40	41	19	0	4.03			
21.5 24.6	126	24.7 21.4	19.8 18.8	4.7 2.6	30 30	39 31	31 38	0 1	1.50			
19.3 20.1		26.9 22.9	20.5 17.5	6.4 5.4	– 28 – – 12 –		36 54	35 34				
13.3 13.9		26.5	18.6	7.9	– 21 – – 13 –		37 40	42 47				
25.2 23.5		– TRACE – – N.P. –			35 13	65 80	0 5	0 2				
26.7 28.9		– TRACE – 20.8	20.4	0.4	27 23	73 77	0 0	0 0				
29.4 32.3		– TRACE –			28 26	72 74	0 0	0 0				
29.6 26.7		– N.P. – – TRACE –			8 14	72 82	20 4	0 0				
25.6 29.1	122	– TRACE –			36 18	62 82	2 0	0 0	3.89			

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
SOUTH ABUTMENT - EAGLE RIVER BRIDGE	6	DEMPSTER HGWY. - YUKON	MAY 5/72	

ELEVATION OF GROUND – | DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE – ▨
2" DIA. SHELBY TUBE – ■
BAG SAMPLE – ⊠

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 50' | ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE ⊖——⊖
2" DIA. CONE ——
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT ●——
LIQUID LIMIT ——⊖
PLASTIC LIMIT ⊢

SAMPLE NO.	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
4467	▨	SC	SILT-SAND-GRAVEL MIX - LOW PLASTIC - MEDIUM DENSE	10
4468	⊠	SW	- COARSE SAND STRATUM FROM APPROX 14'–18'	
4469	▨	SM	- MAXIMUM SIZED MATERIAL APPROX 1½"	20
4497	■		- EASY DRILLING AT SURFACE	
4498	■			30
4470	▨			
4499	■			
4471	▨			40
			40'	
4500	■	CL	SILT-CLAY –	
4472	▨		- LOW TO MEDIUM PLASTIC	
4501	■	ML	- STIFF	50
4473	▨		50'	
			BOTTOM OF HOLE – 50'	
			NOTE - NO PERMAFROST INDICATED IN HOLE.	60
				70

QU. 1.0 2.0 3.0 4.0 K.S.F
N 10 20 30 40 BLOWS/FT
MOISTURE CONTENT – ω % 10 20 30 40 50

NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F.	REMOLDED STRENGTH q_u' K.S.F.	SENSITIVITY St	SULPHATE PPM
17.0		22.8	19.9	2.9	–1–		63	26	12			
27.2		24.6	21.5	3.1	–10–		90	0	17			
12.0					–22–		34	44	22			
15.2		25.2	18.0	7.2	–30–		30	40	27			
12.5		28.2	20.9	7.3	–30–		44	36	32			
16.7		23.5	18.9	4.6	–12–		36	52				
14.0		27.1	19.7	7.4	–24–		44	32				
15.1		26.7	16.8	9.9	16	24	23	37				
25.4	125	36.2	21.5	14.7	66	30	4	0	4.2			
29.0					32	52	16	0				
26.3	126	26.1	19.5	6.6	46	46	3	5	3.6			
25.9					8	86	6	0				

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM — DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
SOUTH ABUTMENT - EAGLE RIVER BRIDGE	7	DEMPSTER HIGHWAY - YUKON	MAY 6/72	

ELEVATION OF GROUND – | DATUM

SAMPLING METHOD: 2" DIA SPLIT TUBE – ▨ ; 2" DIA SHELBY TUBE – ▩ ; BAG SAMPLE – ⊠

DEPTH IN FEET TO: GROUND WATER

BOTTOM OF HOLE 49 | ROCK

PENETRATION RESISTANCE – N: 2" DIA SPLIT TUBE ⊖——⊖ ; 2" DIA. CONE ——

STRENGTH: UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY: NATURAL MOISTURE CONTENT ●—— ; LIQUID LIMIT ——○ ; PLASTIC LIMIT ⊢——

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
		GM	SILT-SAND-GRAVEL MIX –	
			– LOW PLASTIC	
			– STRATIFIED WITH LAYERS OF CLAY-SILT, SILTY SAND AND SILTY GRAVEL	
4474		SC		
4475		CL		
		SM	– SEVERAL GRAVEL SEAMS FROM 21' to 31'	
4476			– MAX SIZE MTL TO 3"	
4477			– MEDIUM DENSE	
4502				
4478				
4480				
4479				40'
4481			SILT –	
			– SANDY CLAY-SILT	
			– LOW PLASTIC	
4503			– FIRM TO STIFF	
4482				49'
			BOTTOM OF HOLE – 49'	
			NOTE. – NO PERMAFROST INDICATED IN HOLE	

QU. K S F: 10 20 30 40 BLOWS/FT

MOISTURE CONTENT – ω %: 10 20 30 40 50

NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_p %	PLASTICITY INDEX I_p %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F.	REMOLDED STRENGTH q_u' K.S.F.	SENSITIVITY St	SULPHATE PPM SO_4
19.1					– 10 –		50	40				
11.9					– 13 –		33	54				
26.1		30.4	21.6	8.8	25	50	21	4				
21.8					– 66 –		22	12				
16.4		26.7	18.6	8.1	– 18 –		60	22				
16.7		21.3	15.9	5.4	– 12 –		46	42				
13.8					– 18 –		34	48				
13.9		23.8	19.3	4.5	– 19 –		39	42				
28.8					9	50	26	15				
		– TRACE –			33	61	5	1				
25.5		– TRACE –			13	83	4	0				

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
SOUTH ABUTMENT - STA 5091+52.3 - EAGLE RIVER BRIDGE	8	DEVELOPMENT - HIGHWAY 43 (W.C.D.)	MAY 3/72	

ELEVATION OF GROUND – | DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 40' | ROCK

PENETRATION RESISTANCE – N
2" DIA SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) –

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO.	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
		CL ML	CLAY - SILT - ICE RICH	5'
4533		SC SM	SILT - SAND - GRAVEL MIX – LOW PLASTIC	
4534		GP	- STRATIFIED SILTS, SILTY SANDS & SILTY, SANDY GRAVELS TO 1"	
4535			- ICE LENSES EVIDENT	20'
		SM	SANDY SILTS OR SILTY SANDS – VARYING AMOUNTS OF GRAVEL	
4536		ML	- LOW PLASTIC	
4537			- MEDIUM DENSE	
			- MTL FLOWED INTO AUGERS AT 22' – NOT FROZEN	
4538				40'

BOTTOM OF HOLE - 40'

NOTE – PERMAFROST INDICATED TO A DEPTH OF 20'.

QU. K.S.F
N 10 20 30 40 BLOWS/FT

MOISTURE CONTENT – ω %
10 20 30 40 50

SAMPLE NO.	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	CONSISTENCY LIMITS: PLASTIC LIMIT ω_p %	CONSISTENCY LIMITS: PLASTICITY INDEX I_p %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F	SENSITIVITY St	SULPHATE PPM OR %
4533	18.4		30.2	20.2	10.0	21		44	35				
4534	29.4		24.0	21.7	3.3	16		70	14				
4535	16.9					11		48	41				
4536	30.0		30.2	25.1	5.1	26	45	27	2				
4537	13.7		26.4	20.0	6.4	32		32	36				
4538	15.8		24.8	18.2	6.2	17		39	44				

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE	LR-11	MILE 237 DEMPSTER HIGHWAY	JULY/1972	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA. SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 54' ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

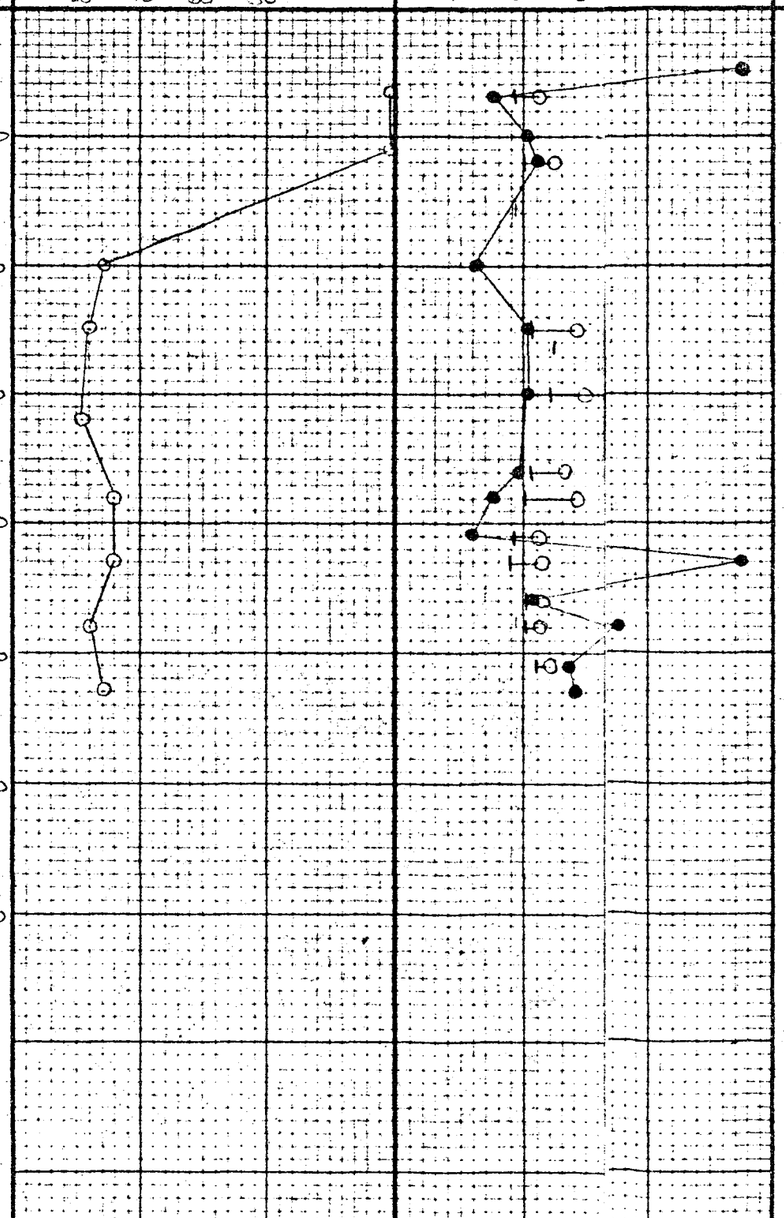
CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
4992			SILT, CLAY & ORGANIC MTL. – WET	
4993			SILTY SAND WITH GRAVEL TO 1½"	5'
4994		SM	– LOW PLASTIC	
4995		SC	– FROZEN TO APPROX 18'	
		GM	– MEDIUM DENSE FROM 18' TO 24'	
4996			– NO ICE LENSES NOTED.	24'
4997			SANDY CLAY-SILT	
		ML	– LOW PLASTIC	
4998		CL	– STIFF	
			– NOT FROZEN	33'
4999		SM	SILTY SAND WITH GRAVEL	
5000			– LOW PLASTIC	
		SC	– MEDIUM DENSE	
5001			– MAX SIZE TO 2"	
5002			– NOT FROZEN	44'
5003			SANDY CLAY-SILT	
5004		ML	– LOW PLASTIC	
			– STIFF	
5005			– NOT FROZEN	
5006				54'

BOTTOM OF HOLE – 54'

NOTE. – FROZEN FROM APPROX 5' TO 18'

BOREHOLE LOCATED STA 5091+40 – 20' RT ℄



NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	CONSISTENCY LIMITS: PLASTIC LIMIT ω_P %	CONSISTENCY LIMITS: PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F	SENSITIVITY St	SULPHATE PPM SO₄
55.2												
15.2		22.5	18.6	3.9	– 14 –		50	36				
20.7		– N. P. –			– 27 –		59	14				
22.0		25.2	20.1	5.1	– 19 –		66	15				
12.7					– 14 –		40	46				
20.3		28.7	21.2	7.5	35	45	18	2				
20.8	119	29.5	24.1	5.4	– 82 –		17	1	2.9			
19.8		26.8	21.0	5.8	– 22 –		32	46				
17.5		28.5	20.2	8.3	– 28 –		48	24				
11.9		22.2	18.6	3.6	– 16 –		70	14				
55.3		23.0	17.8	5.2	– 18 –		54	28				
21.3	121	22.4	20.9	1.5	25	70	5	0	2.8			
35.0		22.4	20.3	2.1	22	54	9	15				
27.5	115	24.1	22.0	2.1	33	67	0	0	2.8			
28.3					22	73	5	0				

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM. | DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE	LR-12	MILE 237 DEMPSTER HIGHWAY	JULY/1972	

ELEVATION OF GROUND – | DATUM

SAMPLING METHOD: 2" DIA. SPLIT TUBE – ▨; 2" DIA. SHELBY TUBE – ▩; BAG SAMPLE – ⊠

DEPTH IN FEET TO: GROUND WATER; BOTTOM OF HOLE 51'; ROCK

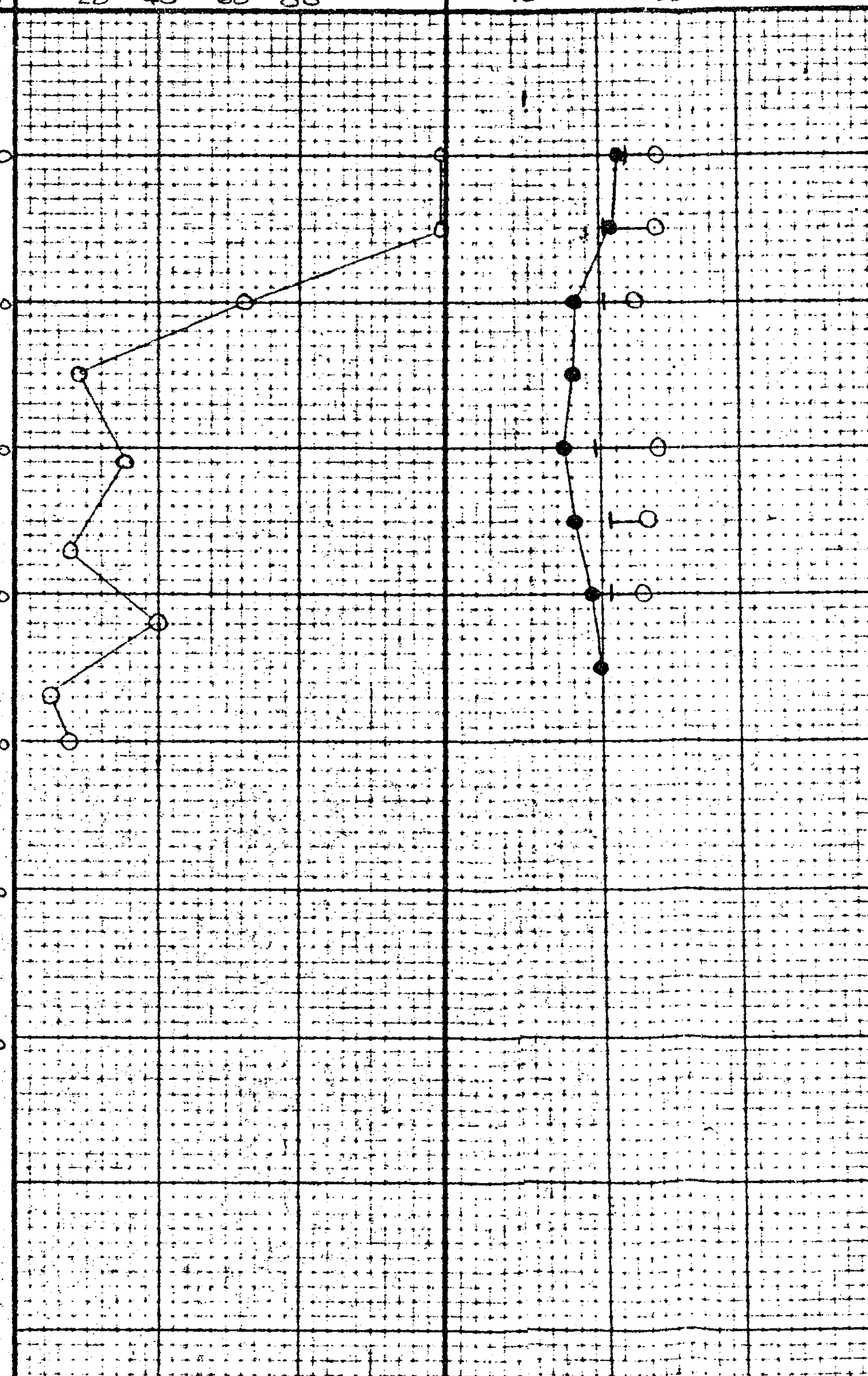
PENETRATION RESISTANCE – N: 2" DIA. SPLIT TUBE; 2" DIA. CONE. STRENGTH: UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕. QU K.S.F; N 20 40 60 80 BLOWS/FT

CONSISTENCY: NATURAL MOISTURE CONTENT; LIQUID LIMIT; PLASTIC LIMIT. MOISTURE CONTENT – ω % 10 20 30 40 50

SAMPLE NO	DEPTH (FT)	SYMBOLS	SOIL DESCRIPTION
			SILT, CLAY & ORGANIC MTL -NOT FROZEN
	5		
			SILTY SAND WITH GRAVEL
5043	10		-LOW PLASTIC
5044		SM	-FROZEN TO APPROX 20' -MEDIUM DENSE BELOW 20'
5045	20	SC	-MAX SIZE TO 1"
5046			-SOME SILT LAYERS -WET BELOW FROST
5057	30		
5058			
5059	40		
	44'		
5060		ML	SANDY CLAY-SILT -LOW PLASTIC -FIRM TO STIFF
	51'		
			BOTTOM OF HOLE – 51'

NOTE – FROZEN FROM APPROX 5' TO 20'

BOREHOLE LOCATED STA 5091+40 ON ℄



PHYSICAL PROPERTIES

SAMPLE NO	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	CLAY %	SILT %	SAND %	GRAVEL %	STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F	SENSITIVITY St	SULPHATE PPM OR %
5043	22.4		28.4	23.7	4.7	–18–		59	23				
5044	21.3		28.2	20.7	7.5	–25–		65	10				
5045	16.7		25.2	20.7	4.5	–16–		60	24				
5046	16.0					–31–		42	27				
5057	15.2		28.2	19.4	8.8	–35–		30	35				
5058	16.1		26.6	21.1	5.5	–20–		56	24				
5059	18.6		25.7	21.4	4.3	–18–		60	22				
5060	19.8		–N.D.–			5	85	10	0				

UNCONFINED COMPRESSIVE STRENGTH

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM. — DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE	LR-13	MILE 237 - DEMASTER HIGHWAY	JULY / 1972	

ELEVATION OF GROUND – | DATUM

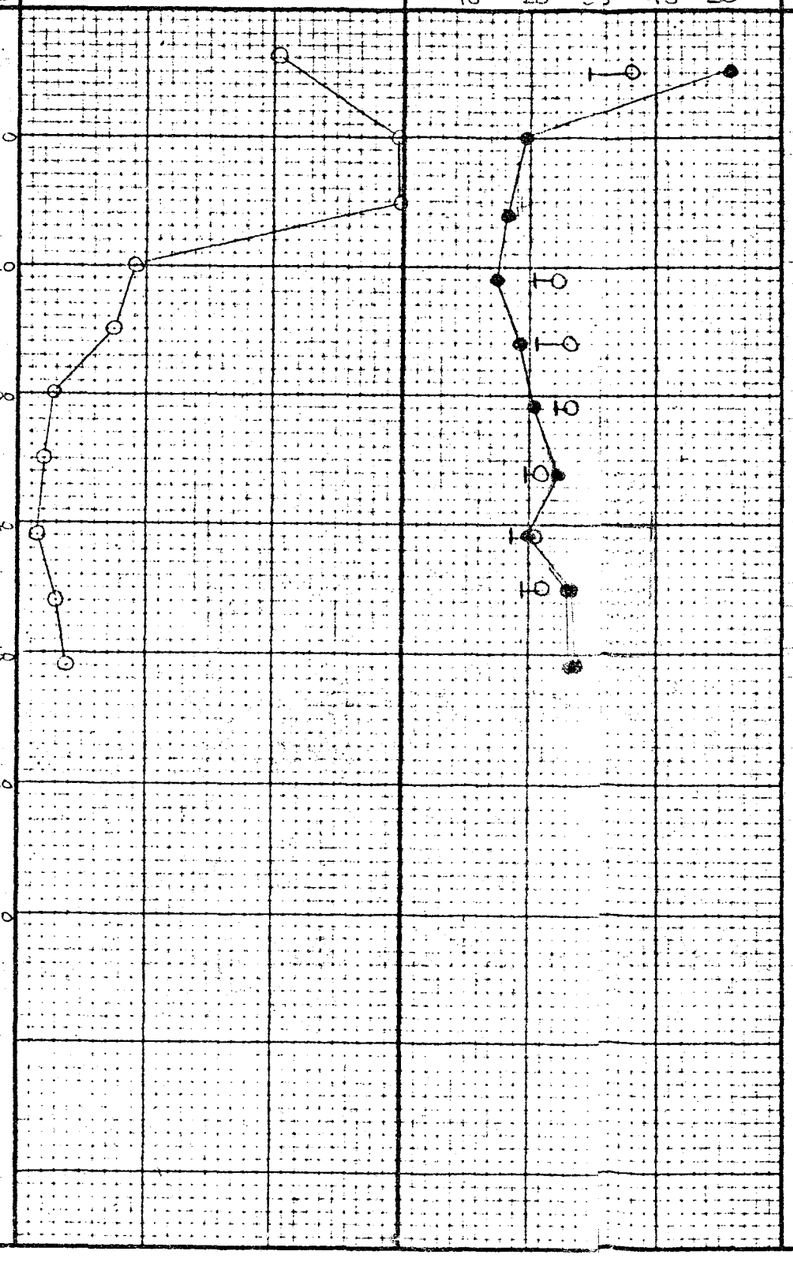
SAMPLING METHOD: 2" DIA. SPLIT TUBE – ▨ ; 2" DIA. SHELBY TUBE – ▩ ; BAG SAMPLE – ⊠

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 52 | ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE ——o——
2" DIA. CONE ————
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT ——●——
LIQUID LIMIT ——o——
PLASTIC LIMIT ——|——

SAMPLE NO.	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
5047	▨		SILT CLAY & ORGANIC MTL - THAWED TO 4'	
			6	
5048	▨	SC	SILTY SAND WITH GRAVEL - LOW PLASTIC - MAX. SIZE TO 1" - FROZEN TO APPROX. 20' - LOOSE TO MEDIUM DENSE BELOW 20' - ICE CRYSTALS BUT FEW ICE LENSES NOTED	10
5049	▨			
5050	▨	SM		20
5051	▨			
5052	▨			30
			33	
5053	▨	SM	SILTY SAND - LOW PLASTIC - NOT FROZEN - LOOSE	
5054	▨			40
			42	
5055	▨	ML	SANDY CLAY - SILT - LOW PLASTIC - FIRM	
5056	▨			50
			52	
			BOTTOM OF HOLE - 52'	
			NOTE - FROZEN FROM APPROX. 4' TO 20'	60
			BOREHOLE LOCATED STA 5091+40 - 20' ℄	70



PHYSICAL PROPERTIES										UNCONFINED COMPRESSIVE STRENGTH			
NATURAL MOISTURE CONTENT	BULK DENSITY	CONSISTENCY LIMITS: LIQUID LIMIT	CONSISTENCY LIMITS: PLASTIC LIMIT	CONSISTENCY LIMITS: PLASTICITY INDEX	MECHANICAL ANALYSIS: CLAY	MECHANICAL ANALYSIS: SILT	MECHANICAL ANALYSIS: SAND	MECHANICAL ANALYSIS: GRAVEL	STRENGTH AS RECEIVED	REMOLDED STRENGTH	SENSITIVITY	SULPHATE
ω	γ	ω_L	ω_P	I_P					q_U	q_U'	St	
%	LBS/FT	%	%	%	%	%	%	%	K S F	K S F		PPM OR %
51.6		35.8	29.4	6.4	30	50	20	0				
19.3					– 24 –		50	26				
16.8					– 23 –		58	19				
15.0		24.5	20.5	4.0	– 20 –		40	40				
18.7		26.4	21.3	5.1	– 20 –		45	35				
20.2		26.9	24.1	2.8	– 23 –		35	42				
24.9		21.5	19.7	1.8	– 20 –		78	2				
19.4		20.5	17.1	3.4	– 17 –		77	6				
26.8		21.7	19.0	2.7	30	50	18	2				
27.6					22	72	5	1				

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
SOUTH ABUTMENT - EAGLE RIVER BRIDGE	LR-14	DEMPSTER HIGHWAY - YUKON	JULY 10/72	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE 52' ROCK

PENETRATION RESISTANCE – N
2" DIA SPLIT TUBE
2" DIA CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	PHYSICAL PROPERTIES: NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_U K.S.F	REMOLDED STRENGTH q_U' K.S.F.	SENSITIVITY S_t	SULPHATE PPM OR %
			ORGANIC SILT — 2														
		CI	CLAY - SILT — 6														
			SILT-SAND-GRAVEL														
			- LOW PLASTIC														
5153		SW	- SOME CLAY	10	18.4		27.2	20.4	6.8	-20-		66	14				
5154			- GRAVEL TO 2"		17.9		24.7	19.6	5.1	-19-		46	35				
5155		SM	- MEDIUM DENSE	20	16.1		— N. P. —			-12-		58	30				
5156			- SAND LENSES		16.6		23.1	18.7	4.4	-19-		43	38				
5157				30	15.6		28.9	19.5	9.4	-51-		35	14				
5158					34.6		26.4	20.2	6.2	-23-		48	29				
5159				40	9.4		26.0	19.4	6.6	-19-		56	25				
5160			SILT - LOW PLASTIC — 45		23.1		28.3	20.9	7.4	-93-		4	3				
5161			- STIFF — 52'	50	22.7		23.6	20.8	2.8	-90-		10	0				
			BOTTOM OF HOLE - 52'														
			NOTE - PERMAFROST FROM APPROX. 2' TO APPROX 22'. ICE CRYSTALS EVIDENT.	60													

QU. K.S.F.
N 10 20 30 40 BLOWS/FT
MOISTURE CONTENT – ω % 10 20 30 40 50

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM. — DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE - STN 5091+80	74-1	MILE 236 - DEMPSTER HGY	MARCH 15/1974.	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :-
GROUND WATER
BOTTOM OF HOLE ROCK

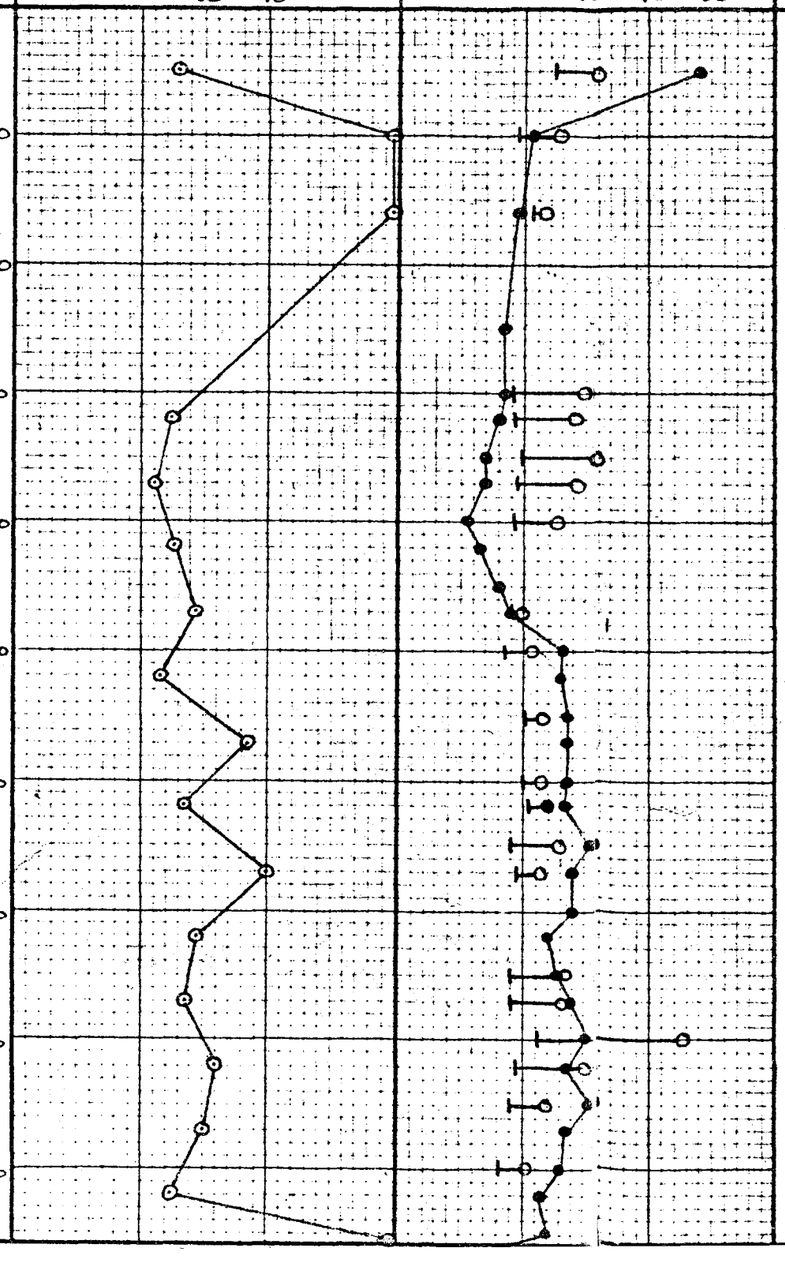
PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO.	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT
			SILTY SAND WITH GRAVEL - LOW PLASTIC WITH SOME COHESIONLESS ZONES - GRAVEL IS PRIMARILY SANDSTONE, SILTSTONE AND/OR ARGILLITE - SOME CLAY ZONES BELOW 25' - LAYERED THROUGHOUT - - FROZEN WITH ICE LENSES TO 18' - FREE WATER @ 18' WITH SOME ARTESIAN PRESSURE. - MEDIUM DENSE IN THAWED STATE.	
		ML SM SC GC		
			48'	
			SANDY CLAY-SILT - LOW PLASTIC - SATURATED THROUGHOUT - CLAY ZONES - MEDIUM DENSE TO DENSE - COHESIVE ZONES ARE IN A STIFF STATE - LAYERED THROUGHOUT - CHANGE TO VERY DENSE ROCK OR GRAVEL FRAGMENTS @ 96' (GLACIAL TILL ?)	
		ML CL		

QU. K.S.F
10 20 30 40 BLOWS/FT

MOISTURE CONTENT – ω %
10 20 30 40 50



DEPTH FT	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F.	SENSITIVITY St	SUB-SOIL TEMP. °F
10	48		31.5	25.2	6.3	– 43 –		57	0				
	21		25.5	19.2	6.3	– 20 –		60	20				
20	19		22.9	21.5	1.4	– 13 –		47	40				
	17		– N. P. –			– 12 –		43	45				
30	17	132	30.1	18.1	12.0	35	31	27	7	3.8			
	16		28.5	18.6	9.9	– 36 –		40	24				
	14		31.6	19.9	11.7	– 44 –		38	18				
40	14												
	11		25.4	18.5	6.9	– 30 –		45	25				
	13												
	16												
	18		19.6	18.1	1.5	– 44 –		30	26				
50	27		21.1	17.4	3.7	23	67	10	0				
	26												
	26	124	22.8	20.4	2.4	32	55	13	0	3.7			
	27												
60	27		23.4	20.2	3.2	21	73	6	0				
	26												38
	31		25.5	18.4	7.1								33
	28		22.7	19.1	3.6	34	66	0	0				
70	28		– TRACE –			17	66	17	0				
	24												33
	26	136	25.7	17.7	8.0	45	52	3	0	3.0			38
	28												40
80	31	125	45.8	22.5	23.3	– 82 –		18	0	3.3			
	27		30.2	18.9	11.3	[illegible]							40
	33		23.5	18.0	5.5	37	63	0	0				42
	27												
90	26		20.4	15.9	4.5	25	55	20	0				44
	23												
	24		– N. P. –			– 28 –		70	2				

AFTER REMOVAL OF

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE - SBN. 5092+24	74-2	MILE 236 - DEMPSTER HWY.	MARCH 19/74.	

ELEVATION OF GROUND – . DATUM

SAMPLING METHOD
2" DIA SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE | ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	PHYSICAL PROPERTIES: NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_U K.S.F	REMOLDED STRENGTH q_U' K.S.F	SENSITIVITY St	SUB-SOIL TEMP °F
			INTERMIXED SILT, SAND & GRAVEL - LAYERED - SOME CLAY CONTENT - LOW PLASTIC - FROZEN TO 8' - MEDIUM DENSE IN THAWED STATE.		15		– TRACE –			– 15 –	50	35		5			
		SM			18		– TRACE –			– 13 –	70	17		10			
		ML			19		25.8	19.2	6.6	– 22 –	60	18		15			
		SP			16												
		GC															
		GM			18					– 40 –	37	23		25			
					12		25.5	16.8	8.7	– 27 –	40	33		30			
					16												
					13		25.0	18.8	6.2	– 24 –	50	26		35			
					16												
					12		25.0	18.5	6.5	– 23 –	50	27					
					19		26.4	17.5	8.9	– 54 –	30	16					
					26.8	126	24.0	20.7	3.3	– 95 –	5	0		3.53			
					30												
					26		– TRACE –			16	84	0	0				
					28												
					29		– N. P. –			23	77	0	0				
					31												
					26		26.8	18.7	8.1								
					35		– TRACE –			17	83	0	0				
					27												
					34		– TRACE –			– 95 –	5	0					32
					25		– TRACE –			24	66	10	0				30
		CL			28		26.5	17.8	8.7	45	50	5	0				32
		CI			29.4	123	37.8	19.6	18.2	75	25	0	0	4.1			32
		ML			26		27.2	17.8	9.4	47	50	3	0				33
					23		– TRACE –			– 75 –	25	0					32
					27		– N. P. –			– 52 –	48	0					
					14		22.7	16.2	6.5	– 25 –	62	13					
					48												
					11		28.7	17.8	10.9	– 47 –	30	23					
			43'														
		ML	SANDY CLAY-SILT - LOW PLASTIC - POSSIBLY FROZEN BELOW 52' - LAYERED														
			68'														
		CL	SANDY SILT-CLAY - LOW TO MEDIUM PLASTIC - LAYERED - STIFF IN THAWED STATE - FROZEN - TEMP. NEAR 32°														
		CI															
		ML															
			88'														
		SM	SAND-SILT MIX - FROZEN - SOME CLAY														
		ML															
			95'														
		SC	CLAY-SILT-SAND-GRAVEL - VERY HARD - FROZEN														
		GC															
			109'														
			BOTTOM OF HOLE - 109'														

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE - STN 5091+48	74-BH-A	MILE 236 - DEMPSTER HGY.	MARCH 21/1974.	

ELEVATION OF GROUND – | DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA. SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE | ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO.	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU K.S.F. / N BLOWS/FT (10 20 30 40)	MOISTURE CONTENT – ω % (10 20 30 40 50)	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_p %	PLASTICITY INDEX I_p %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_u K.S.F	REMOLDED STRENGTH, q_u' K.S.F.	SENSITIVITY St	SUB-SOIL TEMP. °F
		CL / ML	SANDY CLAY-SILT - LOW PLASTIC - ORGANIC MTL - FROZEN - ICE LENSES	7'			61.0		43.9	35.3	8.6	– 68 –	32	0					
		SM / SP / GP / GM	SILT-GRAVEL-SAND - LAYERED - VARIABLE COMPOSITION - LOW PLASTIC - FROZEN TO APPROX 25' WITH ICE LENSES & CRYSTALS EVIDENT. - MEDIUM DENSE IN THAWED STATE.	10			25.0		26.1	20.3	5.8	– 15 –	65	20					
				20			18.0		28.8	20.2	8.6	– 25 –	42	33					
							16.0		27.3	19.8	7.5	– 18 –	40	42					
							17.0		– TRACE –			– 10 –	80	10					
				30			19.0		28.3	18.9	9.4	– 54 –	30	16					33
							13.0		27.9	18.5	9.4	– 37 –	37	26					
							12.0		26.2	19.3	6.9	– 18 –	40	42					32
				40			10.0		24.1	16.5	7.6	– 22 –	44	44					38
							26		23.9	18.0	5.9	– 46 –	30	24					
			45'				13		– TRACE –			– 83 –	15	2					33
			SANDY CLAY-SILT - LOW PLASTIC				28		23.3	20.2	3.1	26	70	4	0				35
		ML	- MEDIUM DENSE - SATURATED	50			25		– TRACE –			22	72	6	0				33
							27					20	75	5	0				
							27					– 95 –	5	0					35
							29		23.3	20.4	2.4	30	62	8	0				38
				60			27												35
							27		22.4	17.4	5.0	32	62	6	0				35
							28												
							25		22.8	16.9	5.9	35	50	15	0				35
			73'	70			30												
		CI / CL	SANDY SILTY CLAY - MEDIUM PLASTIC - STIFF OR DENSE. - LAYERED				31	123	35.0	19.5	15.5	63	30	7	0	2.95			43
							26	127	31.1	17.7	13.4	55	45	0	0	4.3			40
			82	80			29												
		SM / ML	SAND-SILT MIX. - LOW PLASTIC - LAYERED - MEDIUM DENSE				26		21.6	17.4	4.2	27	60	13	0				
							27												
				90			23					– 45 –	55	0					42
			92				18		33.5	21.0	12.5	– 65 –	25	10					
		SC / GC	CLAY-SILT-SAND-GRAVEL MIX - VERY HARD.				20												
							8.4		28.2	18.8	9.4	– 35 –	35	30					
				100			8.1		26.4	18.9	7.5								

BOTTOM OF HOLE - 105'

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE - SIN 5094+35	74-BH-D	MILE 236 - DEMPSTER HGY.	MARCH. 24/1974.	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA. SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE . ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) –

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU. K.S.F / N BLOWS/FT	MOISTURE CONTENT – ω % (10 20 30 40 50)	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_p %	PLASTICITY INDEX I_p %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: AS RECEIVED q_u K.S.F	REMOLDED STRENGTH q_u' K.S.F	SENSITIVITY St	SULPHATE PPM OR %
		CL / ML	SANDY CLAY-SILT - ORGANIC / ATT. - HIGH ICE CONTENT TO 5-6'				104		45.5	33.3	12.2								
			10'	10															
		ML	SANDY CLAY-SILT - LAYERED WITH SAND TO 25' AND VARIABLE GRAVEL CONTENT - SIGNIFICANT GRAVEL CONTENT FROM APPROX. 14'-27' - LOW PLASTIC THROUGHOUT - FROZEN WITH ICE LENSES AND CRYSTALS - SANDY ZONE TO 25' - INCREASED GRAVEL CONTENT BELOW 38' - SANDSTONE FRAGMENTS				51.4		24.1	24.1	6.4	35	17	47	0				
				20			33.9		– N.P. –			– 4 –		86	10				
							20.1		– N.P. –			– 6 –		68	26				
				30			21.0		26.7	19.5	7.2	– 7 –		22	0				
							28.6		27.6	26.3	1.5	26	44	30	0				
				40			18.6		25.4	18.2	7.2	– 24 –		50	16				
			43'																
			BOTTOM OF HOLE - 43'	50															
				60															

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE - STN 5094+35	74-BH-D8	MILE 236 - DEMPSTER HWY.	MARCH 26/1974	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO:
GROUND WATER
BOTTOM OF HOLE ROCK

PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) –

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU. K.S.F / N BLOWS/FT (10 20 30 40)	MOISTURE CONTENT – ω % (10 20 30 40 50)	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH AS RECEIVED q_u K.S.F	UNCONFINED COMPRESSIVE STRENGTH REMOLDED q_u' K.S.F.	SENSITIVITY S_t	SULPHATE PPM OR %
			HOLE NOT SAMPLED TO 65' DRILL LOG INDICATES SILTY GRAVELLY SAND TO 55'	10 20 30 40 50 60 70 80 90 110															
			SANDY CLAY-SILT -LOW PLASTIC -FROZEN WITH ICE LENSES AND CRYSTALS. -CLAY LAYER @ APPROX. 105'	55'															
		AL		60		28.0	24.3	19.5	4.8	43	50	7	0						
				70		27.0	27.0	20.5	6.5	45	50	5	0						
				80		25.0	24.6	18.3	6.3	-95-		5	0						
				90		25.0	24.1	18.3	5.8	-95-		5	0						
		CH		110'		28.2	50.0	25.3	24.7	86	10	4	0						
			BOTTOM OF HOLE - 110'																

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE. - STN. 5094 + 75	74-BH-F.	MILE 236 - DEMPSTER HGY.	MARCH 28/1974.	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE ROCK

PENETRATION RESISTANCE – N
2" DIA SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) – ⊕

CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU K.S.F. / N BLOWS/FT	MOISTURE CONTENT – ω % (10 20 30 40 50)	NATURAL MOISTURE CONTENT ω %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_U K.S.F	REMOLDED STRENGTH q_U' K.S.F	SENSITIVITY St	SUB-SOIL TEMP °F
		CL CI	SILTY CLAY - SOME ORGANIC LAYERS - FROZEN - ICE LENSES																
			7'																
		SM SP	SILTY SAND - VARIABLE GRAVEL CONTENT - GRAVELLY LAYER FROM APPROX 20-28' - LOW PLASTIC - FROZEN WITH ICE COATINGS ON PARTICLES & SOME ICE LENSES.	10 20			47.0		– N.P. –			– 36 –	64	0					25
							28.5		– N.P. –			– 5 –	75	20					25
							28.0		24.9	17.8	17.1	– 23 –	70	7					26
			30'	30															
			SANDY SILT - VARIABLE CLAY CONTENT - VERY LOW PLASTIC - SOME GRAVEL CONTENT FROM APPROX 35'-45' - FROZEN THROUGHOUT WITH ICE LENSES				28.5		26.2	19.7	6.5	– 77 –	23	0					31
				40			18.2		25.2	17.8	7.4								
		ML		50			27.9		– N.P. –			– 75 –	25	0					29
							28.3		– TRACE –			– 90 –	10	0					
				60			27.9		– N.P. –			– 89 –	11	0					
							28.0		– TRACE –			– 95 –	5	0					28
				70			26.0		– TRACE –			20	75	5	0				30
							26.5		– TRACE –			– 96 –	4	0					30
							26.9		23.4	21.4	2.0	– 95 –	5	0					31
				80			27.5		– N.P. –			18	70	12	0				31
							29.6		– TRACE –			– 95 –	5	0					25
				90			28.8		– N.P. –			15	78	7	0				30
			BOTTOM OF HOLE – 94½' GRANULAR MTL. INDICATED BOW																

RECORD OF SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM.

DEPARTMENT OF PUBLIC WORKS, WESTERN REGION, EDMONTON, ALBERTA.

PROPOSED STRUCTURE	HOLE No.	LOCATION	DATE OF BORING	CHECKED
EAGLE RIVER BRIDGE - STN 5094+05	74-6	MILE 236 - DEMPSTER HGY.	MARCH 30/1974.	

ELEVATION OF GROUND – DATUM

SAMPLING METHOD
2" DIA. SPLIT TUBE –
2" DIA. SHELBY TUBE –
BAG SAMPLE –

DEPTH IN FEET TO :
GROUND WATER
BOTTOM OF HOLE – ROCK

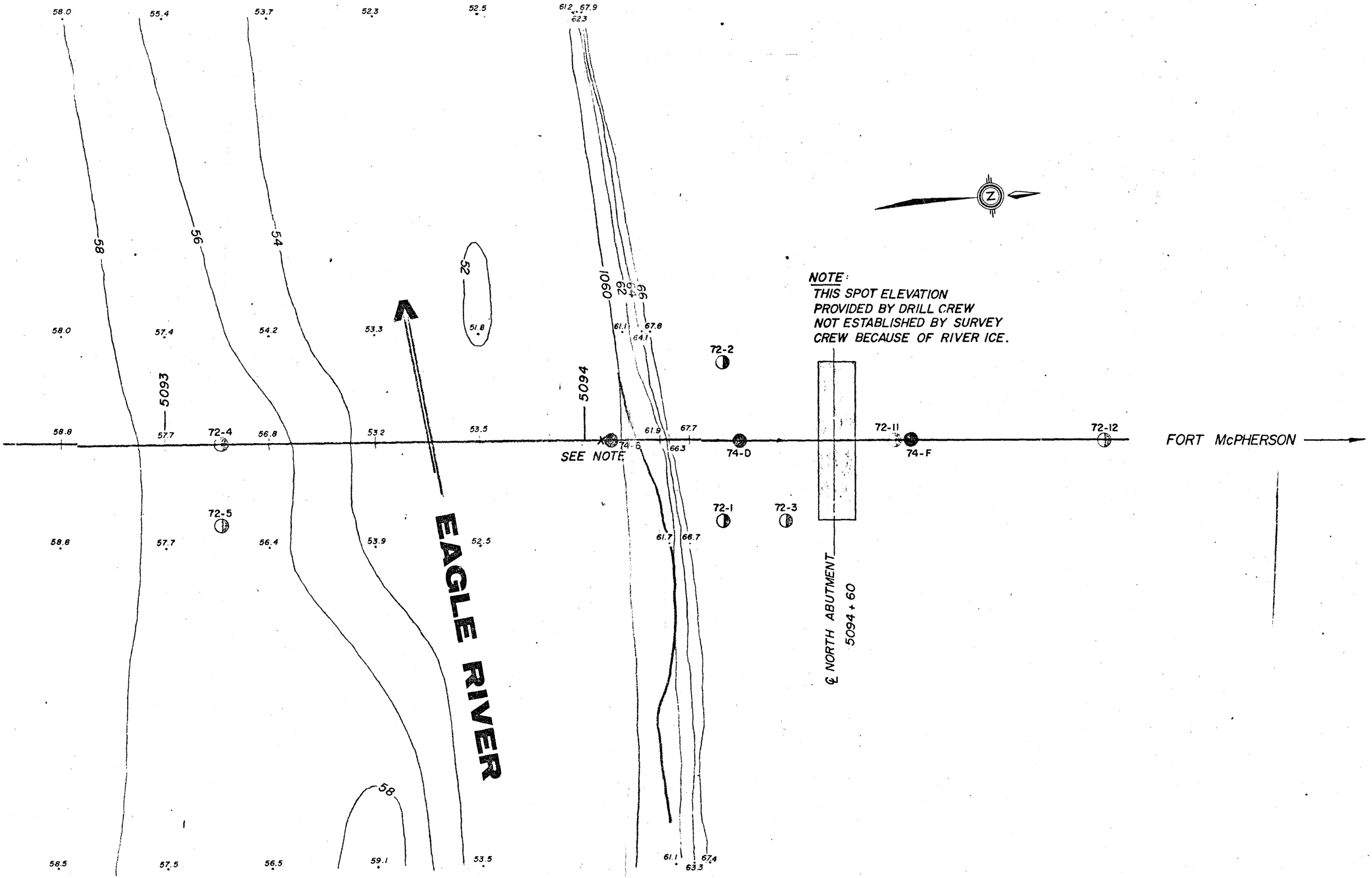
PENETRATION RESISTANCE – N
2" DIA. SPLIT TUBE
2" DIA. CONE
STRENGTH
UNCONFINED COMPRESSIVE STRENGTH (QU) –

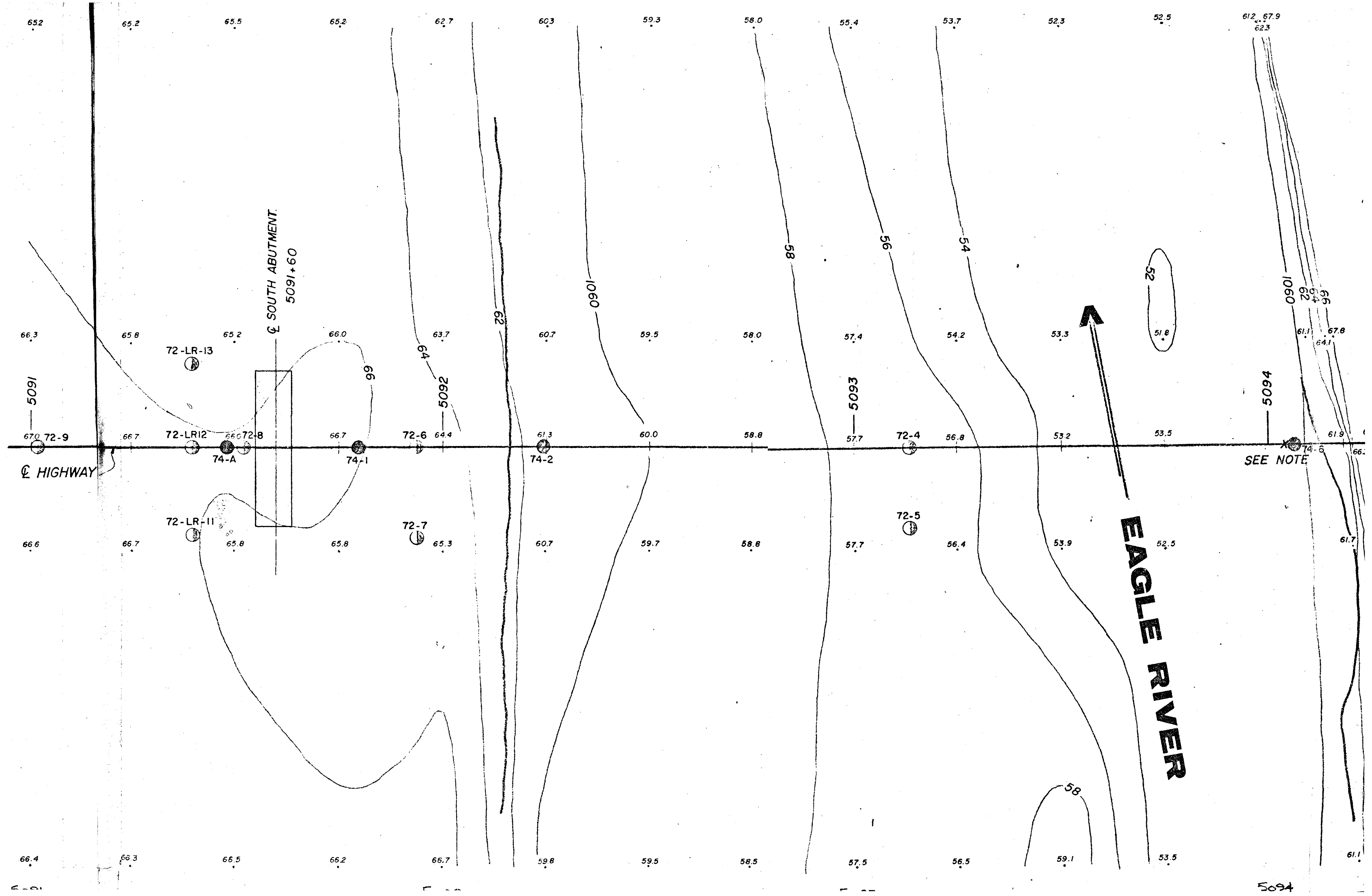
CONSISTENCY
NATURAL MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE NO	SAMPLE TYPE	SYMBOLS	SOIL DESCRIPTION	DEPTH FT	QU K.S.F / N BLOWS/FT	MOISTURE CONTENT – ω % (10 20 30 40 50)	NATURAL MOISTURE CONTENT ε %	BULK DENSITY γ LBS/FT	CONSISTENCY LIMITS: LIQUID LIMIT ω_L %	PLASTIC LIMIT ω_P %	PLASTICITY INDEX I_P %	MECHANICAL ANALYSIS: CLAY %	SILT %	SAND %	GRAVEL %	UNCONFINED COMPRESSIVE STRENGTH: STRENGTH AS RECEIVED q_U K.S.F	REMOLDED STRENGTH q_U' K.S.F.	SENSITIVITY St	SULPHATE PPM OR %
			ICE — 4.5'																
			WATER — 10'	10															
		SM GW	SILTY SAND WITH GRAVEL - MEDIUM TO COARSE SAND - COARSE GRAVEL & COBBLES @ 20' — 23'	20															
		GW CL	SANDY CLAY-SILT - LOW PLASTIC — 26'				24.7		26.2	19.7	6.5	43	42	15	0				
			BOTTOM OF HOLE - 26'	30															
			NOTE. PERMAFROST BELOW 22'. SOME ICE LENSES EVIDENT.	40															

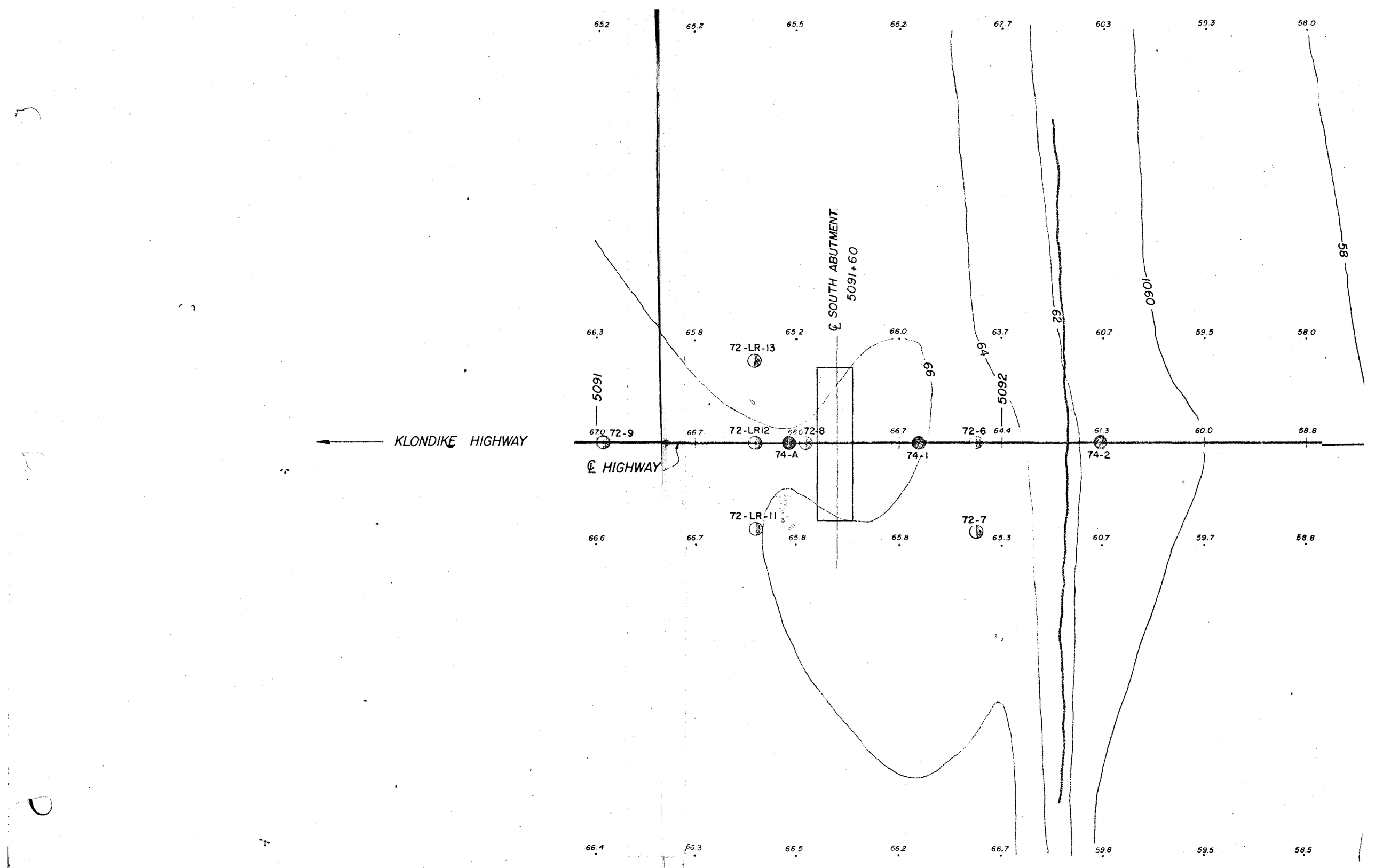
APPENDIX III

SITE PLAN


58.0
55.4
53.7
52.3
52.5
61.2
67.9
62.3
58
56
54
52
1060
29
66
58.0
57.4
54.2
53.3
51.8
61.1
67.8
64.1
5093
5094
72-2
NOTE:
THIS SPOT ELEVATION
PROVIDED BY DRILL CREW
NOT ESTABLISHED BY SURVEY
CREW BECAUSE OF RIVER ICE.
58.8
57.7
72-4
56.8
53.2
53.5
61.9
67.7
74-6
66.3
SEE NOTE
74-D
72-11
74-F
72-12
FORT McPHERSON
72-5
58.8
57.7
56.4
53.9
52.5
72-1
72-3
61.7
66.7
℄ NORTH ABUTMENT
5094 + 60
EAGLE RIVER
58
58.5
57.5
56.5
59.1
53.5
61.1
67.4
63.3



℄ SOUTH ABUTMENT
5091+60
℄ HIGHWAY
5091
5092
5093
5094
72-9
72-LR-13
72-LR12
72-8
74-A
74-1
72-6
74-2
72-4
72-LR-11
72-7
72-5
SEE NOTE
EAGLE RIVER
1060


KLONDIKE HIGHWAY
℄ HIGHWAY
℄ SOUTH ABUTMENT
5091+60
5091
5092
72-LR-13
72-LR12
72-LR-11
72-9
72-8
72-7
72-6
74-A
74-1
74-2
65.2
65.2
65.5
65.2
62.7
60.3
59.3
58.0
66.3
65.8
65.2
66.0
63.7
60.7
59.5
58.0
67.0
66.7
66.0
66.7
64.4
61.3
60.0
58.8
66.6
66.7
65.8
65.8
65.3
60.7
59.7
58.8
66.4
66.3
66.5
66.2
65.7
59.8
59.5
58.5
66
64
60
58
29

APPROXIMATE DECK ELEVATION.

HIGH WATER LEVEL - 1076

72-4;5

74-6

72-12

ICE

WATER

SILTY CLAY
-FROZEN - ICE RICH

LT - AND - GRAVEL MIX
MEDIUM DENSE
TO TIGHT
THAWED

APPROXIMATE
THAW LINE

SANDY - CLAY - SILT
-FROZEN

SILTY CLAY

1080
1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950
940
930

APPROXIMATE DECK ELEVATION

72
LR-11
LR-12
LR-13

74-A

72-B

74-1

72-6&7

74-2

ESTIMATED GROUNDWATER LEVEL -1076'

72-4&5

74-6

74-12

74-5

SILT CLAY
...RGEN ICE RICH

...VEL MIX

ICE

WATER

SILT-AND-GRAVEL MIX
MEDIUM DENSE
STRATIFIED
THAWED

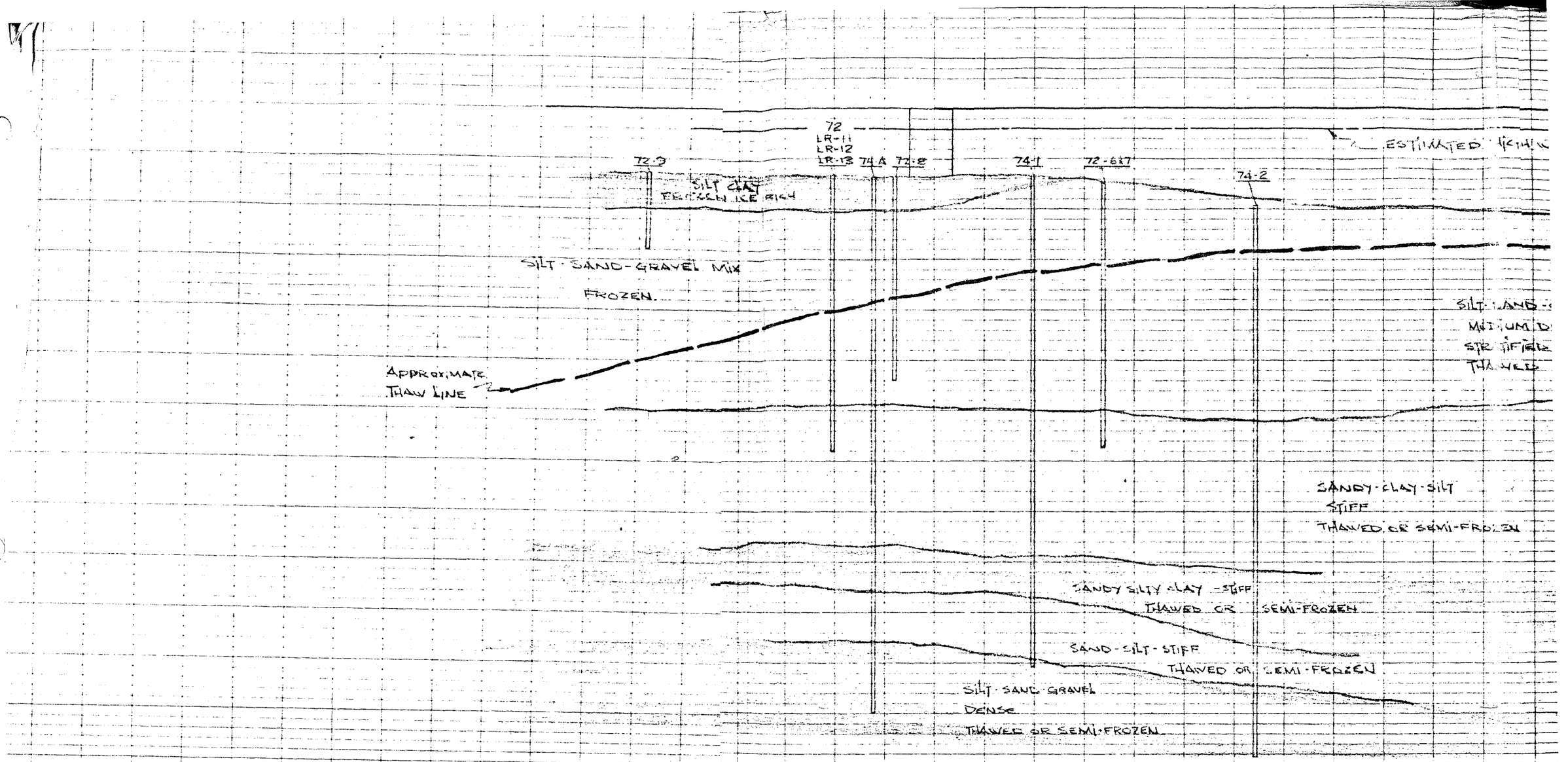
SANDY-CLAY-SILT
STIFF
THAWED OR SEMI-FROZEN

APPROXIMATE
THAW LINE

SANDY SILTY CLAY - STIFF
THAWED OR SEMI-FROZEN

SAND-SILT-STIFF
THAWED OR SEMI-FROZEN

SILT-SAND-GRAVEL
DENSE
THAWED OR SEMI-FROZEN


72
LR-11
LR-12
LR-13
72-3
74-A
72-8
74-1
72-6&7
74-2
ESTIMATED
SILT CLAY
FROZEN ICE RICH
SILT-SAND-GRAVEL MIX
FROZEN.
APPROXIMATE
THAW LINE
SILT-SAND-
MEDIUM D
STIFF
THAWED
SANDY-CLAY-SILT
STIFF
THAWED OR SEMI-FROZEN
SANDY SILTY CLAY - STIFF
THAWED OR SEMI-FROZEN
SAND-SILT-STIFF
THAWED OR SEMI-FROZEN
SILT-SAND-GRAVEL
DENSE
THAWED OR SEMI-FROZEN