

G.I.-30 SEPT. 1976

GEOCRES No. 31E-121DIST. 11 REGION W.P. No. 529/530-89-00CONT. No. W. O. No. STR. SITE No. HWY. No. 69LOCATION Route Planning Study
Hwy 69, Hwy 141 to Hwy 559No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

FILE

WP 529-89-00
WP 530-89-00
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DRAFT REPORT ON

**PREFEASIBILITY STUDY - GEOTECHNICAL INVESTIGATION
EXPANSION AND REALIGNMENT OF HIGHWAY 69
MACTIER TO NOBEL
PARRY SOUND DISTRICT, ONTARIO**

Submitted to:

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May 1992

921-1310

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May 19, 1992

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Cole, Sherman & Associates Ltd.
75 Commerce Valley Drive East
Thornhill, Ontario
L3T 7N9

ATTENTION: Mr. C. Ricketts, P.Eng.

**RE: PREFEASIBILITY STUDY - GEOTECHNICAL INVESTIGATION
EXPANSION AND REALIGNMENT OF HIGHWAY 69
MACTIER TO NOBEL
PARRY SOUND DISTRICT, ONTARIO**

Dear Sirs:

This report presents the results of a subsurface investigation carried out for the above project. The purpose of the investigation is to provide an indication of the depth and lateral extent of the organic terrain within eighteen swamp locations along the proposed highway alignment by means of a limited number of hand auger probeholes. The terms of reference for this project are contained in our proposal letter dated January 24, 1992.

BACKGROUND INFORMATION

It is understood that the Ministry of Transportation (MTO) is carrying out a prefeasibility study for the proposed route alternatives for the expansion and realignment of Highway 69 from MacTier to Nobel, in the District of Parry Sound, Ontario. The general site area and swamp crossing locations are shown on Figure 1. We understand that Cole, Sherman and Associates Ltd. is the consultant for the section between MacTier and Highway 141, and McCormick Rankin & Associates is the consultant for the section between Highway 141 and Nobel.

INVESTIGATION PROCEDURES

The field work for this investigation was carried out between March 2, 1992 and March 11, 1992 and on March 30, 1992 when a total of 228 hand auger probeholes were put down by members of our engineering staff within the eighteen swamp crossing locations. Light-weight field

equipment which could be carried by hand was used throughout the fieldwork. Snowmobiles were used by one of the field crews for transportation into and within the snow covered swamp locations.

At the time of the investigation, there were no survey benchmarks or reference points for the determination of the locations of the centreline of the proposed route. The general area of the proposed route was therefore established to the best of the field engineers' ability using the aerial photographs and topographic plans provided by the Engineers.

Soundings (probeholes) were taken at 25 m intervals along highway centreline as established if the swamp length was less than 100 m along centreline and at 50 m intervals if the swamp length was more than 100 m along centreline. Offset soundings were taken at the deepest point at 25 m or 50 m intervals up to the limit of the swamp or to a maximum of 200 m left and right of centreline. Additional offset soundings were also carried out to provide the maximum coverage of swamp. The swamp and probehole locations were referenced to prominent on-site surface features, such as fences, hydro poles and the like and the assumed highway centreline was marked with orange survey tape for subsequent surveying by the Engineers.

The probeholes were generally advanced by a peat sampler followed by hand augering. Most of the holes were advanced until hard augering or auger refusal was encountered. The probeholes were generally less than 6 m deep due to the practical difficulty of using the hand auger but some of the holes were advanced to depths of about 7 m to 8 m. Each probehole was logged and visual inspection of the samples obtained from the peat sampler or from the auger was carried out at regular intervals of depth. Selected samples of the soils encountered in the probeholes were returned to our office for further classification and testing. The groundwater conditions were recorded for each probehole. Hand field vane tests were carried out in the soft silty clay encountered in Swamp No. 6, 30 and 45 to measure the undrained shear strength of the deposit.

SUBSURFACE CONDITIONS

The probehole layout and details of the subsurface conditions encountered in each of the probeholes are given on the attached Figures 2 to 16. The results of laboratory tests carried out

on selected soil samples are shown in Table 1. It should be noted that the stratigraphic boundary depths indicated in the tabulated summaries of the probeholes are inferred from non-continuous sampling and represent transitions between soil types rather than exact planes of geological change. Conditions will vary between and beyond the probehole locations.

Swamp No. 10, 15, 16 and 19 are located between MacTier and Highway 141 within the section of highway to be designed by Cole, Sherman and Associates Ltd. The rest of the swamps are located between Highway 141 and Nobel within the section to be designed by McCormick Rankin & Associates. A summary of the probehole results with respect to the thickness of the organics and the depth to "firm" bottom (base of the soft clay and/or organics) is given in Table 2.

The following discussion provides a general description of the subsoil conditions encountered in each swamp.

Highway 69 Realignment Between MacTier and Highway 141

Swamp 10: A total of nine probeholes were put down within this swamp at the locations shown on Figure 2. Five of the probeholes are located along the centreline of the proposed highway; two offset probes were put down on each side of the centreline within the right-of-way. Typically, the subsoils consist of up to 5.1 m of peat underlain by soft silty clay which in turn overlies dense sand. Bedrock was inferred by auger refusal in two of the probeholes at depths ranging from 5.6 m to 6.9 m. Seven probeholes were terminated in dense sand which was encountered at depths ranging from 0.4 m to 6 m.

The probes indicate that the depth of the organics and soft silty clay decreases to the north along the highway centreline and decreases slightly to the east of the proposed highway.

The water levels in the probeholes was found to vary between 0 m to 0.4 m above ground surface. The natural water content of one sample of the peat was found to be 884% with organic

content of 88%. An Atterberg Limits test carried out on one sample of the soft silty clay gave a liquid limit of 48% and plasticity index of 21 with a natural water content of 69%.

Swamp 15: A total of 13 probeholes were put down in this swamp at the locations shown on Figure 3. The five probeholes located along the centreline and within the right-of-way of the proposed highway encountered auger refusal at variable depths. Typically, the subsoils consisted of 0.5 m to 4 m of peat underlain by sand or soft silty clay. Bedrock was inferred by auger refusal in two of the probeholes at depths ranging from 0.6 m to 5.3 m. Three of the five probes were terminated at depths between 1.7 m to 3.8 m due to hard augering within dense sand. ✓

Eight offset probes were put down within the swamp area, with four probes on each side of the proposed highway. The peat was thickest in probe 15-3A on the east side where 4.2 m of organics was encountered. The depth of peat in the offset probes varied between 0.3 m and 4.2 m; the depth of the organics decreases to the west of the proposed highway. The variability of the peat thickness along the east side is consistent with that found along the centreline of proposed highway. Bedrock was inferred in two of the probeholes by auger refusal at depths ranging from 2.3 m and 3.8 m. Six of the eight offset probes were terminated at 0.3 m to 4.2 m due to hard augering within sands. The water level was found to vary between 0.1 m and 0.5 m above ground surface.

Swamp 16: A total of fourteen probeholes were put down in this swamp at the locations shown on Figure 4. The two probeholes located within the right-of-way of the proposed highway both encountered hard augering and were terminated at a depth of 1.35 m. The subsoils penetrated consist of about 0.5 m of peat underlain by soft to stiff silty clay.

The 12 offset probes encountered about 0.1 m to 0.5 m of peat and hard augering was encountered in most of the probes at less than 1.4 m depth. Firm bottom is inferred at depths between 0.1 m and 0.5 m. The water level was found to vary between 0 m and 0.5 m below ground surface across the swamp.

Swamp 19: A total of twenty-one probeholes were put down in this swamp at the locations shown on Figure 5. The twelve probeholes located along the centreline and within or close to the right-of-way of the proposed highway encountered hard augering at variable depths. Typically, the subsoils consist of up to 5 m of peat underlain by dense sand or silt. Firm bottom is typically inferred at 1.1 m to 4.4 m depth at the base of the peat. The peat was found to be 5 m thick in probe 19-3B on the east edge of the proposed highway.

Nine offset probes were put down within the swamp area, with six probes to the east and three probes to the west of the proposed highway. The probes indicate that the peat thickness increases in the south-east quadrant of the swamp (adjacent to the existing highway where up to 7.3 m of organics was encountered. The thickness of the peat decreases to the west of the proposed highway to less than 2.3 m. Firm bottom was encountered at depths ranging from 2.1 m to 7.9 m on the east and from 0.7 m to 2.3 m on the west.

The water/ice depth was found to vary from 0.1 m to 1 m above ground surface. The natural water content of one sample of the peat was found to be 566% with organic content of 84%.

Highway 69 Realignment Between Highway 141 and Nobel

Swamp 3: A total of five probeholes were put down in this swamp as shown on Figure 6. Only one probehole was located within the right-of-way of the proposed highway. The subsoil encountered in this probe consisted of loose sand at ground surface underlain by loose silt which in turn overlies soft silty clay. The hole was terminated at 4.2 m depth without encountering refusal.

Four offset probes were put down within the swamp area on the east side of the proposed highway. The probes indicate that the depth of the peat or organics varies between about 0.4 m and 1.9 m. The peat is generally underlain by soft silty clay with some sandy interlayers. Probe 3-E4 encountered auger refusal at 2.1 m depth which could be inferred as bedrock. Three probes were terminated at 2.1 m to 4 m depth without encountering refusal. The water/ice depth was found to vary from 0.70 m to 1.8 m above ground surface across the swamp.

Swamps 4 and 5: A total of sixteen probeholes were put down in these two swamps as shown on Figure 6. The ten probeholes located within the right-of-way of the proposed highway encountered auger refusal at variable depths. Typically, the subsoils consisted of up to 5.8 m of peat underlain by soft silty clay with some sandy interlayers. Bedrock was inferred by auger refusal at depths ranging from 0.6 m to 8 m. Two of the probes were terminated at 5.2 m and 6.2 m depth without encountering refusal.

Six offset probes were put down within the swamp area to the west of the proposed highway. These probes typically indicate that the depth of the organics and soft silty clay increases to the west. The thickest layer of peat of 6.8 m was encountered in probe W-5. Five of the six probes were terminated at 5.9 m to 7.9 m depth without encountering auger refusal.

The water level was generally at ground surface across the swamp. Measured natural water contents of four samples of the peat varied between 389% to 1,072%; the organic content measured on one of the samples was 54%. An Atterberg-Limits test carried out on one sample of the soft silty clay gave a liquid limit of 64% and plasticity index of 29% with a natural water content of 114%.

Swamp 6: A total of ten probeholes were put down in this swamp at the locations shown on Figure 7. The seven probeholes located close to the centreline encountered auger refusal at variable depths. Typically, the subsoils consisted of up to 2.8 m of peat underlain by soft silty clay and/or silty sand. Bedrock was inferred by auger refusal at 1 m to 3.6 m depth in four of the probeholes. Probe 6-C2 was terminated at 3.5 depth without encountering auger refusal. Otherwise, firm bottom is inferred at about 0.1 m to 4.5 m depth.

The greatest thickness of peat (2.8 m) underlain soft silty clay to 4.5 m depth was encountered at the location of probe 6-E1 in the central area of the swamp.

Hand field vane tests were carried out in the soft clay layer at the location of probes 6-C3 and 6-E5 and gave an average undrained shear strength value of 17.4 kPa. The water level was observed at ground surface across the swamp.

Swamp 7: A total of fourteen probeholes were put down in this swamp at the locations shown on Figure 8. The four probeholes located within the right-of-way of the proposed highway encountered up to 3.5 m of peat underlain by compact silty sand. Firm bottom is inferred at 0.7 m to 3.5 m depth. Bedrock was inferred by auger refusal at depths ranging from 1 m to 3.5 m.

Ten offset probes were put down within the swamp area on the west side of the proposed right-of-way. The depth of peat in the offset probes varies between 2.1 m and 5.5 m with the greatest thickness of peat encountered at the location of probe 7-W1. The peat is generally underlain by soft silty clay or loose silty sand. Bedrock was inferred by auger refusal at depths between 2.4 m and 5.3 m in some locations. Four of the ten probes were terminated at 6.0 m to 7.2 m depth without encountering refusal. The water level was generally at ground surface across the swamp.

Swamp 8: A total of thirteen probeholes were put down in this swamp as shown on Figure 8. The subsoils encountered in three of the four probeholes located within the right-of-way of the proposed highway consist of 2 m to 2.5 m of peat underlain by soft silty clay. Bedrock and/or firm bottom was inferred at depths ranging from 3 m to 4.6 m. At the location of probe 8-C4, only about 0.3 m of peat was encountered underlain by hard clayey silt and dense sand.

Nine offset probes were put down within the swamp on the east side of the proposed right-of-way. The depth of the peat in the offset probes varied between 0.9 m and 3 m with the thickest peat layer encountered at the location of probe 8-E7. The peat is generally underlain by loose silt or soft silty clay with sand layers. Bedrock was inferred by auger refusal at depths ranging from 2.4 m and 6.4 m at some probehole locations close to the edges of the swamp. Probes 8-E5, -E6 and -E7 were terminated at depths greater than 7.0 m without encountering auger refusal indicating a local depression of rock surface in this area. The thickness of the soft clay is greater than 5.1 m at the location of these three probes.

The water level was generally at ground surface across the swamp. The natural water content measured on three samples of the peat varied between 439% and 572%. The natural water contents measured on four samples of silty clay ranged between 27% and 48%. An Atterberg

Limits test carried out on one sample of silty clay gave a liquid limit of 39% and plasticity index of 19.8.

Swamp 21: A total of thirteen probeholes were put down in this swamp which is generally located to the west of the proposed highway right-of-way as shown on Figure 9. Bedrock was encountered at shallow (less than 0.7 m depth) at six probe locations in the west portion of the swamp. The remaining seven probeholes encountered auger refusal at variable depths. The subsoils in the above 7 probes typically consist of up to 2.7 m of peat underlain by compact sand which in turn overlies soft silty clay. The one probehole within the highway right-of-way encountered about 0.3 m of peat underlain by dense sand. Firm bottom is inferred at all other locations at depths ranging from 1.1 m to 7 m. The water/ice depth was found to vary between 0 m to 1.65 m above ground surface across the swamp.

Swamp 27: A total of fifteen probeholes were put down in this swamp as shown on Figure 10. The fourteen probeholes located along the centreline and within the right-of-way of the proposed highway encountered firm bottom at depths ranging from 0.2 m to 2.4 m. Typically the subsoils consisted of up to 2.4 m of peat underlain by compact to dense sand. Bedrock was inferred by auger refusal in four of the probeholes at depths ranging from 0.4 m to 2.3 m.

The offset probe 27-2J on the west side of the proposed right-of-way encountered a 2.2 m thick layer of peat underlain by dense silty sand and the hole was terminated at 2.8 m in the silty sand. The water/ice depth generally varied from 0.3 m to 1.1 m above ground surface across the swamp.

Swamp 28: A total of ten probeholes were put down in this swamp as shown on Figure 11. The eight probeholes located within the right-of-way of the proposed highway typically encountered about 0.5 m to 2.8 m of peat underlain by dense sand. There was no organics noted at two of the probe locations (28-2F and 2G) at the extreme west limit of the swamp.

The two offset probes on the east side of the proposed right-of-way encountered about 0.25 and 1.25 m of peat; firm bottom is inferred at these depths. The water/ice depth was found to be vary from 0.3 m to 1.8 m above ground surface across the swamp.

Swamp 30: A total of fifteen probeholes were put down in the swamp as shown on Figure 12. The three probeholes located at the north-east corner of the swamp within the proposed highway right-of-way encountered about 1.8 m to 3 m of peat underlain by silty clay. No peat layer was found at the location of probes 30-C1, -C2, -C3, -C4 and -E2 near the centreline. The subsoils in these probes typically consist of loose silty sand or silt underlain by soft silty clay. The depth of soft silty clay was found to be greater than 6 m at the location of probe 30-C2. Three of the four probes along the east edge of the right-of-way were terminated at 1.9 to 4.9 m depths without encountering auger refusal. One probe was terminated on probable bedrock at a depth of 5.5 m.

The depth of peat/organics encountered in the seven offset probes east of the proposed right-of-way varied between 0.5 m and 2.5 m. The peat layer is generally underlain by soft silty clay. Four of the seven probes were terminated at 2.4 m to 5.1 m without encountering auger refusal. Bedrock was inferred by auger refusal at depths ranging from 2.3 m to 4.3 m for the remaining three probes (30-E6, -E7 and -E11) in the east part of the swamp.

Three hand vane tests carried out in the soft clay deposit at the location of probe 30-E10 indicated an average undrained shear strength of 23 kPa. The water/ice depth was observed to vary from 0 m to 0.6 m above ground surface. The natural water contents of three organic sandy silt samples were found to vary between 66% to 97%. An Atterberg Limits test carried out on one sample of the silty clay gave a liquid limit of 42% and plasticity index of 15 with natural water content of 62%.

Swamp 45: A total of sixteen probeholes were put down at this swamp as shown on Figure 13. The ten probeholes located within or close to the right-of-way of the proposed highway encountered 0.7 m or less of peat or organics. Typically, the subsoils consist of peat/organics underlain by compact sandy silty which in turn overlies soft silty clay. Probable bedrock and/or

hard augering was met in three of the probes at depths ranging from 4.1 m to 7.3 m. The remainder of the probes were terminated at 1.5 m to 5.8 m without encountering auger refusal.

Six offset probes were put down within the swamp area, with five probes on the east side outside the right-of-way and one probe on the west side. The peat thickness encountered was found to be less than 0.5 m where noted in these offset probes and was generally underlain by loose to compact sandy silt which in turn overlies soft to stiff silty clay. Firm bottom is inferred at depths greater than 3.4 m.

The water/ice depth was found to vary from 0 m to 0.2 m above ground surface across the swamp. Six hand vane tests carried out in the soft clay deposit in probe 45-C5 and 45-C6 gave an average undrained shear strength of 28 kPa. The natural water content of one peat sample was measured to be 97% while the water contents of two sandy silt samples were found to be 28% and 44%.

Swamp 49: A total of seventeen probeholes were put down in this swamp as shown on Figure 14. The ten probeholes located within the right-of-way of the proposed highway typically encountered about 0.1 m to 0.9 m of peat and/or topsoil underlain by dense sand or stiff clayey silt. The holes were terminated at 0.4 m to 1.8 m depth due to auger refusal and/or hard augering. Firm bottom is inferred at depths ranging from 0.1 m to 0.9 m.

The seven offset probeholes to the east of the proposed right-of-way encountered a peat/organic layer of thickness up to 5 m. The greatest thickness was found at the location of probe 49-3D in the south-east area of the swamp. The organics are generally underlain by compact to dense sand. Firm bottom is inferred at depths ranging from 0.6 m to 5 m. The water/ice depth was observed to vary from 0 m to 0.6 m above ground surface across the swamp.

Swamp 50: A total of twenty-three probeholes were put down in this swamp as shown on Figure 15. The fifteen probeholes located within the right-of-way of the proposed highway encountered auger refusal at variable depths. Typically, the subsoils consisted of up to 3.8 m of peat underlain by dense sand or soft silty clay. The probes were terminated at depths ranging from

0.1 m to 7.4 m due to auger refusal and/or hard augering. In some of the holes, the surficial sands were difficult to penetrate. Based on the results of other probes within this swamp, it is possible that there are soft clays present underlying the sands in the probes which were terminated at shallow depth.

Eight offset probes were put down within the swamp area, with three on the east side and five on the west side of the proposed right-of-way. The three probes on the east side encountered up to 3.3 m of peat and firm bottom is inferred at depths between 1 m and 6.4 m. The five probes on the west side of the proposed right-of-way encountered up to 4.2 m of peat and firm bottom is inferred at depths of 0.8 m to 5.7 m. The water/ice depth was found to vary from 0.2 m to 1.2 m above ground surface across the swamp.

Swamp 51: A total of six probeholes were put down in this swamp as shown on Figure 16 within the right-of-way of the proposed highway. Typically, the subsoils consist of up to 1.8 m of peat underlain by loose to compact sand or sandy silt. All holes were terminated at 0.8 m to 4.5 m due to hard augering. Firm bottom is inferred at depths 0.8 m to 2.2 m. The water/ice depth was found to vary from 0.18 m to 1.5 m above ground surface across the swamp.

DISCUSSION

Generally, highway construction over swamp areas can be carried out with subexcavation of the organics and soft deposits where not more than about 4 m of subexcavation is required. Where there is more than 4 m of organics and soft deposits, subexcavation is excessive and consideration is given to controlled displacement and/or surcharging of the soft compressible deposits.

As indicated in Table 2, there are three swamps where the probeholes put down indicate that there is greater than 4 m of organics (5 m to 5.8 m) within the proposed highway right-of-way:

Swamp No. 10	5.1 m organics over soft clay to 6 m depth
Swamp No. 19	5.0 m organics
Swamp No. 4 & 5	5.8 m organics over soft clay to 8 m depth ✓

In addition, soft clay deposits were encountered underlying the organics and extending to greater than 4 m depth in:

Swamp No. 15	to 5.3 m depth
Swamp No. 6	greater than 4.5 m depth
Swamp No. 30	greater than 6 m depth
Swamp No. 45	to 7.3 m depth ✓
Swamp No. 50	to 6.9m depth

Although no detailed testing has been carried out on samples of the clay deposit, this material is typically almost as compressible as the organic deposits and similar consideration to highway construction treatment should be given in these areas. Based on the offset probes completed, there does not appear to be any advantage to shifting the highway alignment to another area of the swamp; bypassing, if possible, could be considered.

At the remaining swamp locations, variable depths of subexcavation would be required for highway construction generally ranging from 0.9 m to 3.5 m depth.

We trust that this report is sufficient for your immediate requirements. Please contact us if further clarification of any of the information provided is required. We would be pleased to discuss the project and the report with you prior to finalizing the report.

Yours truly,

GOLDER ASSOCIATES LTD.

S.Y. Chan

A.S. Poschmann, P.Eng.
SC/ASP/pds

Att.: List of Abbreviations
Figures 1 to 16

TABLE 1

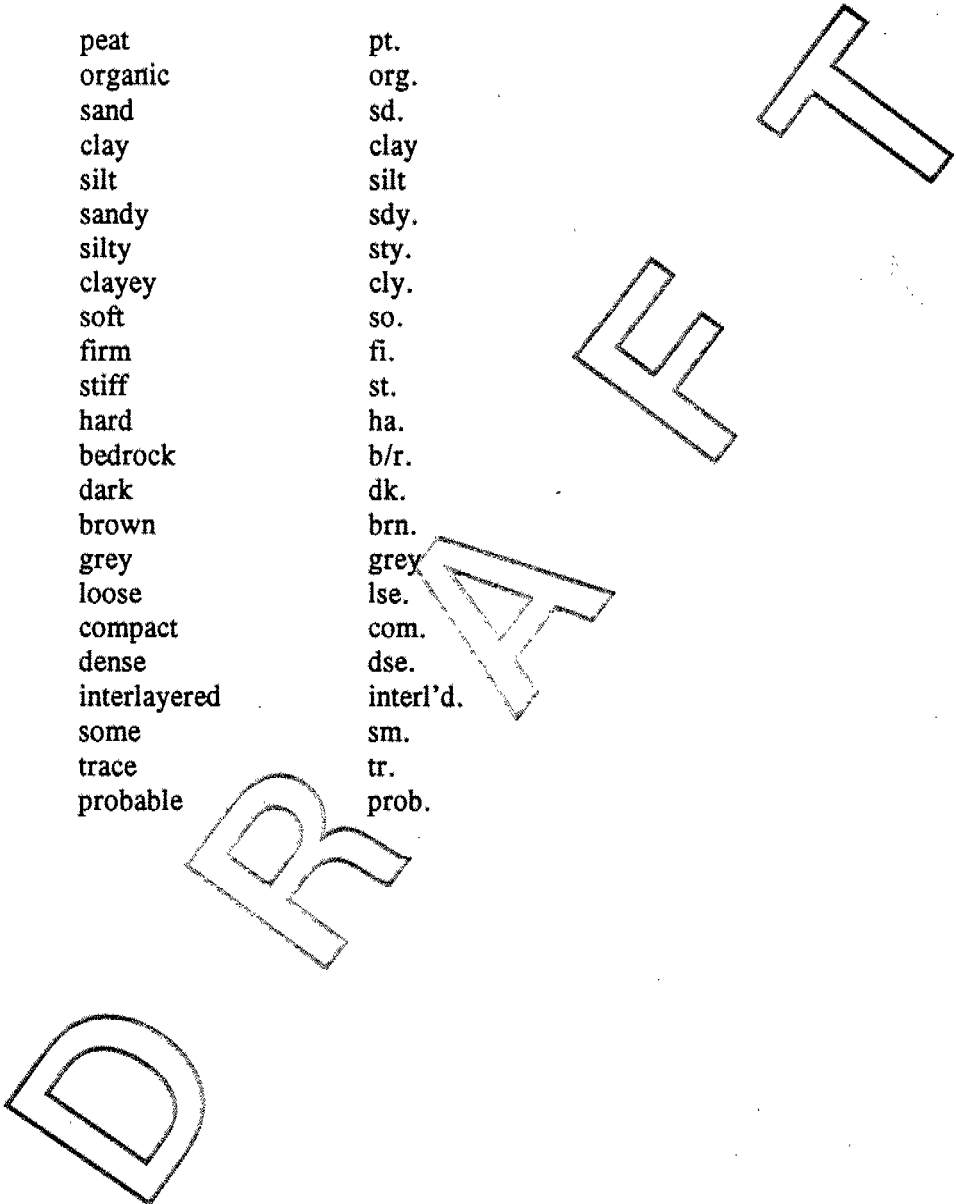
**HIGHWAY 69 EXPANSION AND REALIGNMENT
SUMMARY OF LABORATORY TEST RESULTS**

SWAMP NO.	PROBE NO.	SAMPLE DEPTH (m)	SOIL TYPE	WATER CONTENT (%)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX	ORGANIC CONTENT (%)
4&5	W2	2.85 - 3.0	Peat	1022	-	-	-	-
	W2	3.85 - 4.0	Peat	1072	-	-	-	-
	W2	4.85 - 5.0	Peat	900	-	-	-	54
	W2	5.85 - 6.0	Peat	389	-	-	-	-
	W2	6.85 - 7.0	Silty Clay	114	64	35	29	-
8	E5	0.85 - 1.0	Peat	439	-	-	-	-
	E5	1.95 - 2.10	Peat	572	-	-	-	-
	E5	2.55 - 2.70	Peat	556	-	-	-	-
	E5	3.35 - 3.50	Silty Clay	44	-	-	-	-
	E5	4.55 - 4.70	Silty Clay	46	-	-	-	-
	E5	5.85 - 6.0	Silty Clay	48	39	19	20	-
	E5	7.65 - 7.80	Silty Clay	27	-	-	-	-
10	3	0.37 - 1.66	Peat	884	-	-	-	88
	3	5.10 - 5.20	Silty Clay	69	48	27	21	-
19	2	0.0 - 2.65	Peat	566	-	-	-	84
30	E4	1.05 - 1.20	Organic Sandy Silt	97	-	-	-	-
	E4	1.55 - 1.70	Organic Sandy Silt	73	-	-	-	-
	E4	1.95 - 2.10	Organic Sandy Silt	66	-	-	-	-
	E4	2.55 - 2.70	Silt	46	-	-	-	-
	E4	3.85 - 4.0	Silty Clay	62	42	26	15	-
45	E2	0.25 - 0.40	Peat	97	-	-	-	-
	E2	0.55 - 0.70	Sandy Silt	44	-	-	-	-
	E2	0.75 - 0.90	Sandy Silt	29	-	-	-	-

TABLE 2
HIGHWAY 69 EXPANSION AND REALIGNMENT
SUMMARY OF SWAMP PROBE RESULTS

SWAMP NUMBER	THICKNESS OF ORGANICS / DEPTH TO "FIRM" BOTTOM (m)		GENERAL DESCRIPTION OF SOIL STRATA UNDERLYING ORGANICS
	Within Proposed Highway Alignment	Offset Probes	
10	0.3 - 5.1 / 0.3 - 6.0	—	Silty Sand, Silty Clay, Bedrock
15	0.5 - 4.0 / 0.6 - 5.3	0.3 - 4.2 / 0.3 - 4.2	Sand, Clayey Silt, Bedrock
16	0.1 - 0.5 / 1.25 - 1.35	0.1 - 0.5 / 0.1 - 1.35	Clayey Silt, Silty Sand
19	0.15 - 5.0 / 0.5 - 5.0	0.7 - 7.3 / 0.7 - 7.3	Clayey Silt, Sand, Silt
3	0.0 / > 4.2	0.4 - 1.9 / > 4.0	Silty Clay
4 & 5	0.6 - 5.8 / 0.6 - 8.0	1.8 - 6.8 / 3.2 - > 7.9	Silty Clay, Sand, Bedrock
6	0.1 - 2.8 / 0.1 - > 4.5		Silty Sand, Silty Clay, Bedrock
7	0.4 - 3.5 / 0.7 - 3.5	2.0 - 5.5 / 2.2 - > 7.2	Silt, Silty Sand, Silty Clay, Bedrock
8	0.3 - 2.5 / 0.6 - 4.6	0.6 - 3.0 / 2.6 - > 7.8	Silt, Silty Clay with Sand layers, Bedrock
21	0.3 / 0.3	0.1 - 2.7 / 0.1 - 7.0	Sand, Silty Clay, Bedrock
27	0.2 - 2.3 / 0.4 - 2.3	2.2 / 2.2	Sand, Clayey Silt, Bedrock
28	0.0 - 2.8 / 0.1 - 2.8	0.3 - 1.3 / 0.3 - 1.3	Sand, Bedrock
30	0.0 - 3.0 / 0.3 - > 6	0.0 - 2.5 / 2.3 - > 5.1	Silty Sand, Silty Clay, Bedrock
45	0.1 - 0.7 / 4.1 - 7.3	0.3 - 0.5 / > 3.4	Silt, Sandy Silt, Silty Clay, Bedrock
49	0.1 - 0.9 / 0.1 - 0.9	0.6 - 5.0 / 0.6 - 5.0	Sand, Clayey Silt, Silty Clay
50	0.1 - 3.8 / 0.1 - 6.9	0.8 - 4.2 / 0.8 - 6.4	Sand, Silty Sand, Silty Clay
51	0.3 - 1.8 / 0.8 - 2.2	0.7 / 0.9	Silt, Sandy Silt, Silty Clay

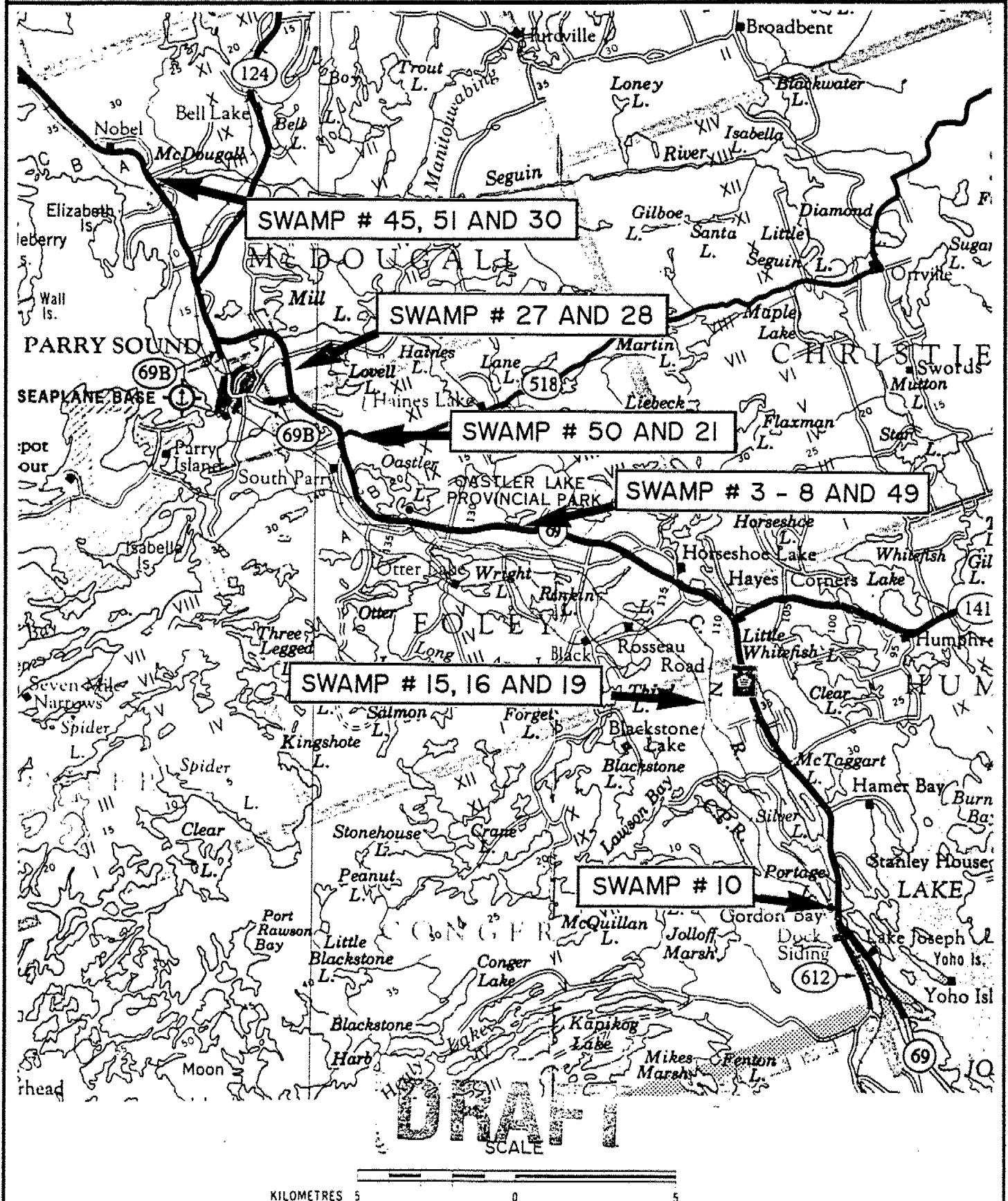
LIST OF ABBREVIATIONS



peat	pt.
organic	org.
sand	sd.
clay	clay
silt	silt
sandy	sd.
silty	sty.
clayey	cly.
soft	so.
firm	fi.
stiff	st.
hard	ha.
bedrock	b/r.
dark	dk.
brown	brn.
grey	grey
loose	lse.
compact	com.
dense	dse.
interlayered	interl'd.
some	sm.
trace	tr.
probable	prob.

SITE LOCATION PLAN

FIGURE 1



Date MAR / 1992
Project 921-1310

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Chkd.

PROBEHOLE LOCATION PLAN
SWAMP No. 10

FIGURE 2

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 10

10-1: 0.0 m - 0.35 m So. dk. brn. pt. 0.35 m - 1.54 m Dse. grey sand to sty. sand, tr. roots. 1.54 m; Hard augering; End of hole	10-3A: 0.0 m - 4.20 m So. dk. brn. pt. 4.20 m - 5.60 m So. grey sty. clay, tr. org. 5.60 m; Auger refusal, prob. B/R; End of hole
10-2: 0.0 m - 1.30 m So. dk. brn. pt. 1.30 m - 3.05 m Dse. grey sty. sand, sm. clay. 3.05 m; Hard augering; End of hole	10-3B: 0.0 m - 2.60 m So. dk. brn. pt. 2.60 m - 3.70 m So. grey sty. clay, tr. sand. 3.70 m - 3.85 m Dse. grey sand. 3.85 m; Hard augering; End of hole
10-3: 0.0 m - 5.10 m So. dk. brn. pt. 5.10 m - 5.25 m So. gry sty. clay. 5.25 m - 5.40 m Dse. grey sty. sand. 5.40 m; Hard augering; End of hole	10-3C: 0.0 m - 4.50 m So. dk. brn. pt. 4.50 m - 5.40 m So. grey sty. clay. 5.40 m; Hard augering; End of hole
10-4: 0.0 m - 4.95 m So. dk. brn. pt. 4.95 m - 6.0 m So. grey cly. silt, tr. sand. 6.0 m - 6.85 m Dse. grey sty. sand 6.85 m; Auger refusal; prob. B/R; End of hole	10-3D: 0.0 m - 4.10 m So. dk. brn. pt. 4.10 m - 5.0 m So. grey org. cly. silt 5.0 m - 5.20 m V. dse. grey sand. 5.20 m; Hard augering; End of hole
10-5: 0.0 m - 4.10 m So. dk. brn. pt. 4.10 m - 4.60 m Dse. grey sand, tr. silt. 4.60 m; Hard augering; End of hole	

Notes: (1) All soil depths measured from ground surface.
(2) Water level varies from 0.0 m to 0.37 m above ground surface.

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SCALE 1:2,000 (APPROX.)

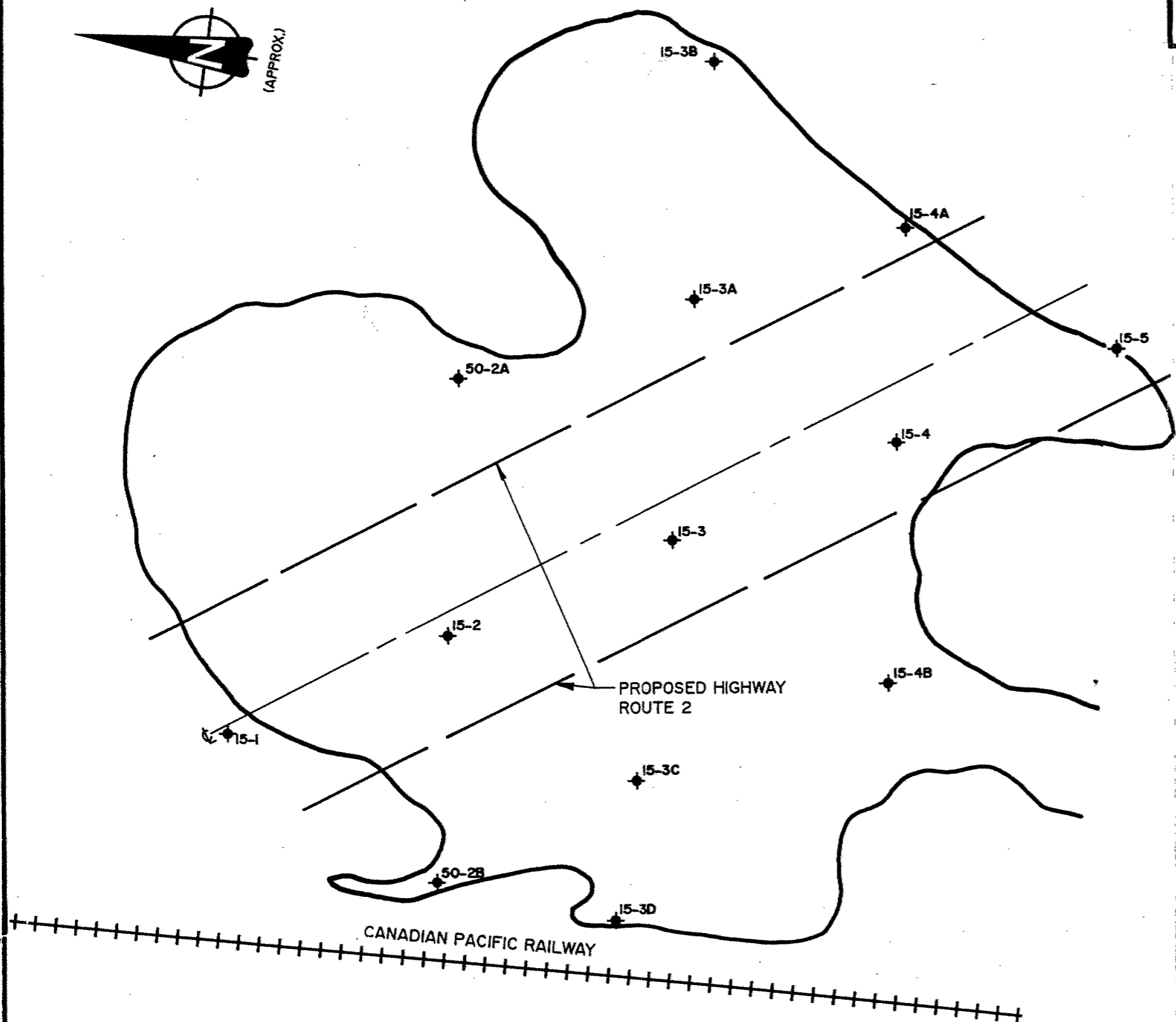
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Project...921-1310.....

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Chkd

PROBEHOLE LOCATION PLAN
SWAMP No. 15

FIGURE 3



LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 15

15-1: 0.0 m - 0.63 m So. dk. brn. pt. 0.63 m; Auger refusal; prob. B/R; End of hole	15-3C: 0.0 m - 3.0 m So. dk. brn. pt. 3.0 m - 3.2 m So. grey cly. silt, tr. sand. 3.2 m; Hard augering in dsc. sand; End of hole
15-2: 0.0 m - 3.50 m So. dk. brn. pt. 3.50 m - 3.77 m Dsc. grey sand. 3.77 m; Hard augering; End of hole	15-3D: 0.0 m - 0.30 m So. dk. brn. pt. 0.30 m; Hard augering in dsc. sand; End of hole
15-3: 0.0 m - 4.0 m So. dk. brn. pt. 4.0 m - 4.3 m Loose, grey sand. 4.3 m - 5.3 m So. grey cly. silt. 5.3 m; Auger refusal; prob. B/R; End of hole	15-2A: 0.0 m - 1.1 m Matted vegetation. 1.1 m - 1.20 m Dsc. brn. sand, tr. org. 1.20 m; Auger refusal; End of hole
15-4: 0.0 m - 2.1 m So. dk. brn. pt. 2.1 m; Hard augering; End of hole	15-2B: 0.0 m - 0.50 m So. dk. brn. pt. 0.50 m - 1.2 m St. brn. grey cly. silt, tr. sand. 1.2 m; Auger refusal in sand; End of hole
15-5: 0.0 m - 0.5 m Matted vegetation. 0.5 m - 1.7 m So. to fi. grey brn. sty. clay. 1.7 m; Hard augering; End of hole	15-4A: 0.0 m - 2.30 m So. dk. brn. pt. 2.30 m - 2.50 m Com. to dsc brn. sand. 2.30 m; Auger refusal; prob. B/R; End of hole
15-3A: 0.0 m - 4.20 m So. dk. brn. pt. 4.20 m; Sampler refusal in sand; End of hole	15-4B: 0.0 m - 2.40 m So. dk. brn. pt. 2.40 m - 3.80 m So. grey cly. silt, sm. sand. 3.80 m; Auger refusal; prob. B/R; End of hole
15-3B: 0.0 m - 0.40 m Matted vegetation 0.40 m - 1.70 m So. dk. brn. pt. 1.70 m - 2.30 m Dsc. grey sand, tr. org. 2.30 m; Hard augering; End of hole	

- Notes: (1) All soil depths measured from ground surface.
(2) Water level varies from 0.1 m to 0.5 m above ground surface.

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SCALE 1:1,000 (APPROX.)

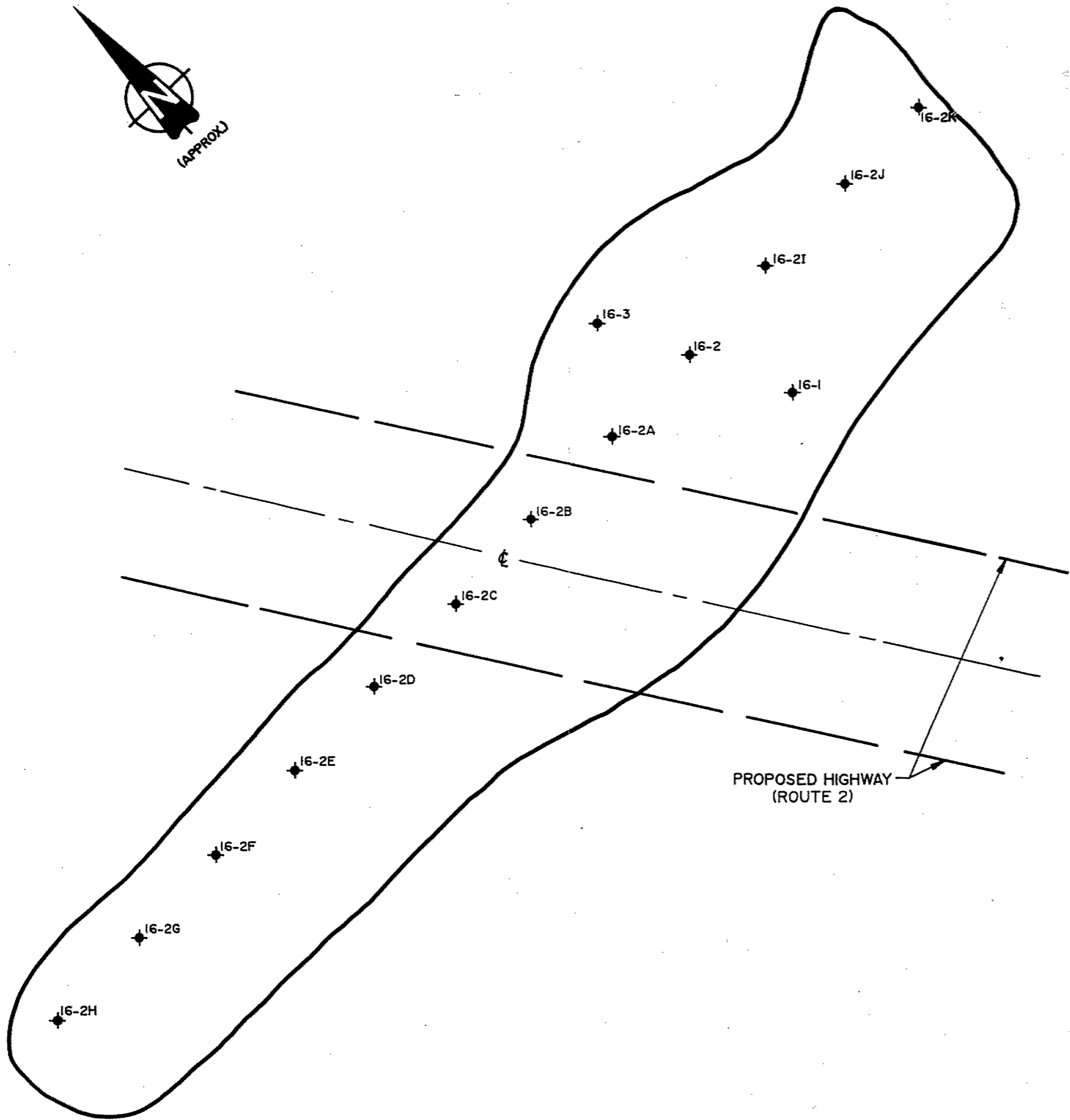
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Project... 921-1310

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Chkd

PROBEHOLE LOCATION PLAN
SWAMP No. 16

FIGURE 4



LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- — — PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- — — PROPOSED HIGHWAY 69 CENTRELINE

Swamp 16

16-1: 0.0 m - 0.25 m So. dk. brn. pt. 0.25 m - 0.85 m St. grey cly. silt, sm. sand. 0.85 m; Hard augering; End of hole	16-2E: 0.0 m - 0.15 m So. dk. brn. pt. 0.15 m - 1.35 m So. to st. brn. grey cly. silt, sm. sand layers, tr. org. 1.35 m; Hard augering; End of hole
16-2: 0.0 m - 0.45 m So. dk. brn. pt., sm. org. silt. 0.45 m - 1.35 m St. grey cly. silt, sm. sand. 1.35 m; Hard augering; End of hole Water level at 0.3 m below ground surface	16-2F: 0.0 m - 0.15 m Lse. brn. org. sand, tr. silt. 0.15 m - 0.55 m St. grey cly. silt. 0.55 m - 1.15 m Dse. grey sand, sm. silt. 1.15 m; Hard augering; End of hole
16-3: 0.0 m - 0.20 m So. dk. brn. pt. 0.20 m - 0.45 m St. brn. cly. silt. 0.45 m - 0.80 m Dse. grey sdy. silt, tr. clay. 0.80 m; Hard augering; End of hole Water level at 0.50 m below ground surface	16-2G: 0.0 m - 0.25 m So. dk. brn. pt. 0.25 m - 0.60 m St. brn. grey cly. silt. 0.60 m - 1.35 m Dse. grey sdy. silt. 1.35 m; Hard augering; End of hole
16-2A: 0.0 m - 0.10 m So. dk. brn. pt. 0.10 - 0.45 m So. brn. grey cly. silt, sm. org. 0.45 m - 1.25 m V. st. grey cly. silt. 1.25 m - 1.40 m Dse. grey sdy. silt. 1.40 m; Hard augering; End of hole	16-2H: 0.0 m - 0.10 m So. dk. brn. pt. 0.10 m - 0.60 m St. brn. grey cly. silt. 0.60 m - 1.25 m Dse. grey sty. sand. 1.25 m; Hard augering; End of hole
16-2B: 0.0 m - 0.10 m So. dk. brn. pt. 0.10 m - 1.35 m So. to st. grey cly. silt. 1.35 m; Hard augering; End of hole	16-2I: 0.0 m - 0.25 m So. dk. brn. pt. 0.25 m - 0.85 m Fi brn. cly. silt, sm. org. 0.85 m - 1.20 m Dse. grey sdy. silt. 1.20 m; Hard augering; End of hole
16-2C: 0.0 m - 0.50 m So. dk. brn. pt. 0.50 m - 1.35 m So. to st. brn. grey cly silt, tr. sand. 1.35 m; Hard augering; End of hole	16-2J: 0.0 m - 0.30 m So. dk. brn. pt. 0.30 m - 0.90 m Fi. brn. cly. silt, sm. org. 0.90 m - 1.25 m Dse. grey sdy. silt. 1.25 m; Hard augering; End of hole
16-2D: 0.0 m - 0.35 m So. dk. brn. pt. 0.35 m - 1.10 m Dse. grey sand, tr. silt. 1.10 m; Hard augering; End of hole	16-2K: 0.0 m - 0.10 m So. dk. brn. pt. 0.10 m - 1.10 m Fi. brn. cly. silt, sm. org. tr. sand. 1.10 m - 1.40 m Dse. grey sdy. silt. 1.40 m; Hard augering; End of hole.

- Notes: (1) All soil depths measured from ground surface.
(2) Water levels at ground surface unless otherwise stated.

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Project...221-1319.....

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Drawn...DV.....
Chkd.....

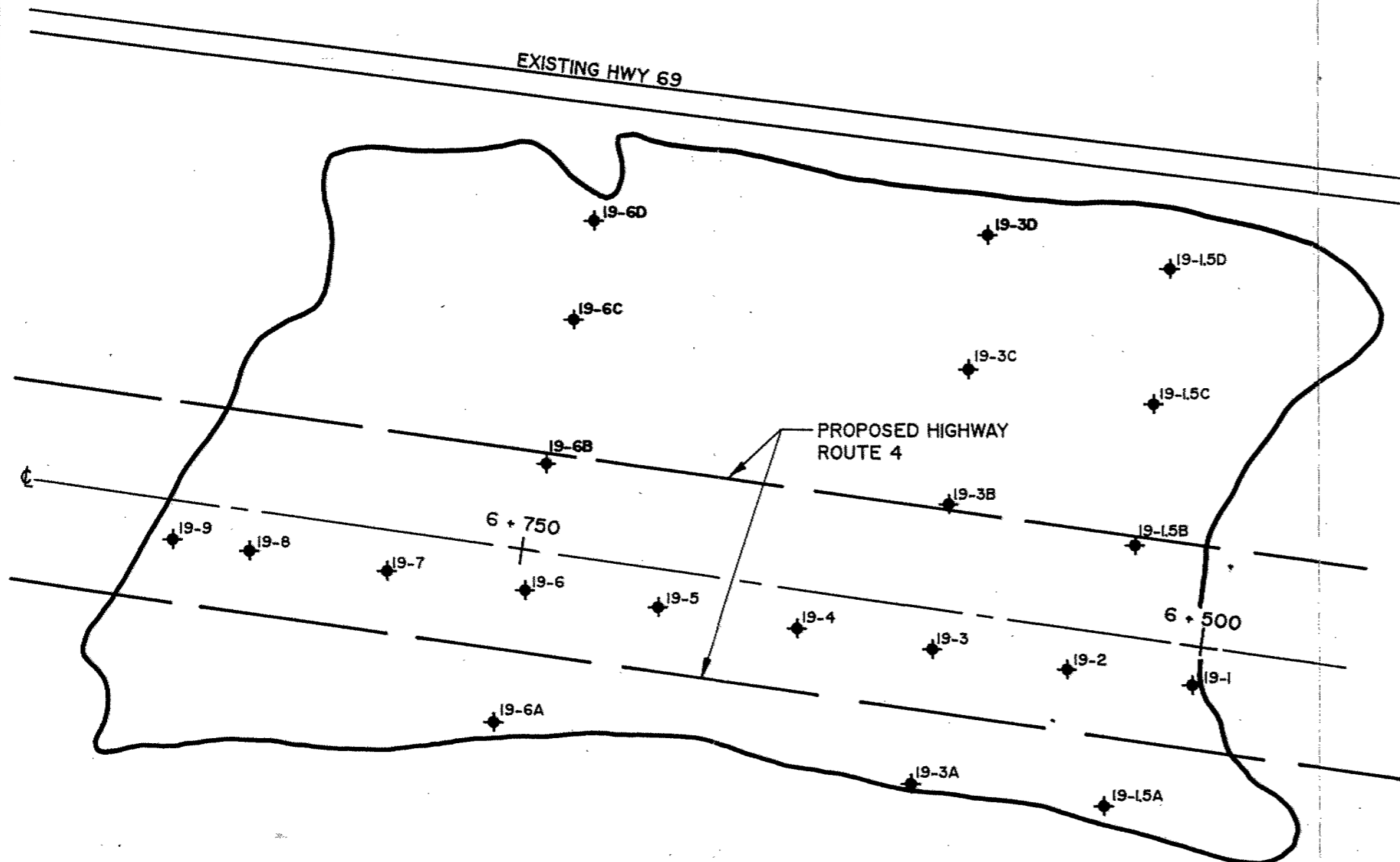
PROBEHOLE LOCATION PLAN SWAMP No. 19

FIGURE 5

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 19



19-1: 0.0 m - 0.35 m So. dk. brn. pt. 0.35 m - 1.0 m V. st. grey brn. cly. silt, sm. sand, tr. org. 1.0 m; Hard augering; End of hole	19-1.5C 0.0 m - 1.65 m So. dk. brn. pt. 1.65 m - 3.55 m Dsc. grey sdy. silt. 3.55 m; Hard augering; End of hole
19-2: 0.0 m - 2.65 m So. dk. brn. pt. 2.65 m - 4.45 m Com. to dsc. grey silt. 4.45 m; Hard augering; End of hole	19-1.5D 0.0 m - 7.3 m So. dk. brn. pt. 7.3 m - 7.6 m Dsc. grey sand. 7.6 m - 7.9 m Lsc. grey silt. 7.9 m; Hard augering; End of hole
19-3: 0.0 m - 4.35 m So. dk. brn. pt. 4.35 m - 4.50 m Dsc. grey sty. sand. 4.5 m; Hard augering; End of hole	19-3A 0.0 m - 0.70 m So. dk. brn. pt. 0.70 m - 1.15 m Dsc. grey sand, tr. silt. 1.15 m; Hard augering; End of hole
19-4: 0.0 m - 3.75 m So. dk. brn. pt. 3.75 m - 3.85 m Dsc. grey sty. sand. 3.85 m; Hard augering; End of hole	19-3B 0.0 m - 5.0 m So. dk. brn. pt. 5.0 m - 5.3 m Com. to dsc. grey sdy. silt. 5.30 m; Hard augering; End of hole
19-5: 0.0 m - 3.2 m So. dk. brn. pt. 3.20 m - 3.45 m Dsc. grey sand, tr. silt. 3.45 m; Hard augering; End of hole	19-3C 0.0 m - 4.60 m So. dk. brn. pt. 4.60 m - 4.70 m Dsc. grey sand, tr. silt. 4.70 m; Hard augering; End of hole
19-6: 0.0 m - 3.80 m So. dk. brn. pt. 3.80 m - 4.05 m Dsc. grey sty. sand. 4.05 m; Hard augering; End of hole	19-3D 0.0 m - 5.45 m So. dk. brn. pt. 5.45 m - 5.75 m Com. grey sand, tr. silt. 5.75 m - 7.25 m Lsc. grey silt. 7.25 m - 7.70 m Com. to dsc. grey sdy. silt. 7.70 m; Hard augering; End of hole
19-7: 0.0 m - 1.5 m So. dk. brn. pt. 1.5 m - 1.70 m Dsc. grey sand, sm. silt. 1.70 m; Hard augering; End of hole	19-4A 0.0 m - 2.3 m So. dk. brn. pt. 2.30 m - 2.50 m Com. to dsc. grey. silt, sm. clay. 2.50 m; End of hole
19-8: 0.0 m - 1.05 m So. dk. brn. pt. 1.05 m - 1.15 m Dsc. grey sand, sm. silt. 1.15 m; Hard augering; End of hole	19-4B 0.0 m - 3.4 m So. dk. brn. pt. 3.40 m - 3.50 m Com. to dsc. grey silt. 3.50 m; End of hole
19-9: 0.0 m - 0.15 m So. to fi. brn. pt. 0.15 m - 0.60 m Dsc. brn. sand, tr. silt. 0.60 m; Hard augering; End of hole	19-4C 0.0 m - 2.65 m So. dk. brn. pt. 2.65 m - 3.20 m St. brn. grey cly. silt, sm. sand seams. 3.20 m; End of hole
19-1.5A 0.0 m - 1.40 m So. dk. brn. pt. 1.40 m - 2.25 m Dsc. grey sand, tr. silt. 2.25 m; Hard augering; End of hole	19-4D 0.0 m - 2.10 m So. dk. brn. pt. 2.10 m - 2.20 m Dsc. grey sand, tr. silt. 2.20 m; End of hole
19-1.5B 0.0 m - 1.35 m So. dk. brn. pt. 1.35 m - 1.85 m Dsc. grey sand, tr. silt. 1.85 m; Hard augering; End of hole	

Notes: (1) All soil depths measured from ground surface.
(2) Water/ice depth varies from 0.10 m to 1.0 m above ground surface.

SCALE 1:1,000 (APPROX.)

Golder Associates

Date: MAR / 1992
Project: 92-1310

Drawn: DV
Chkd:

PROBEHOLE LOCATION PLAN SWAMP No. 3, 4 AND 5

FIGURE 6

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp No. 3:

E1: 0.0 m - 1.40 m 1.4 m - 2.30 m 2.30 m - 4.20 m 4.20 m; End of hole	Lae. dk. brn. sand to sdy. silt, sm. org. Lae. grey silt, sm. sand. So. grey sty. clay.
E2: 0.0 m - 0.50 m 0.50 m - 2.50 m 2.50 m; End of hole	So. dk. brn. pt. So. brn. grey sty. clay.
E3: 0.0 m - 0.50 m 0.50 m - 0.90 m 0.90 m - 2.40 m 2.40 m; End of hole	So. dk. brn. pt. Lae. grey sty. sand. So. grey sty. clay.
E4: 0.0 m - 0.4 m 0.40 m - 2.10 m 2.10 m; Auger refusal; prob. B/R; End of hole	Com. to dsc. grey org. sand. Fi. to st. grey brn. cly. silt.
E5: 0.0 m - 1.90 m 1.90 m - 4.0 m 4.0 m; End of hole	So. dk. brn. pt. So. grey sty. clay.

Notes: (1) All soil depths measured from ground surface.
(2) Water/ice depth varies from 0.70 m to 1.8 m above ground surface.

Swamp 4 & 5:

C1: 0.0 m - 1.5 m 1.5 m - 2.30 m 2.3 m - 2.8 m 2.8 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay. Lae. sand and gravel.	W2: 0.0 m - 6.5 m 6.5 m - 7.0 m 7.0 m; End of hole	So. dk. brn. pt. So. grey sty. clay.
C2: 0.0 m - 1.1 m 1.1 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt.	W3: 0.0 m - 3.60 m 3.60 m - 4.5 m 4.5 m - 5.6 m 5.6 m - 5.9 m 5.9 m; End of hole	So. dk. brn. pt. Lae. grey silt, sm. clay. So. grey sty. clay. Lae. grey sty. sand.
C3: 0.0 m - 2.0 m 2.0 m - 4.90 m 4.90 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay.	W4: 0.0 m - 4.90 m 4.90 m - 6.5 m 6.5 m - 7.0 m 7.0 m; End of hole	So. dk. brn. pt. So. grey org. silt. So. grey sty. clay.
C4: 0.0 m - 1.40 m 1.40 m - 3.80 m 3.80 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay.	W5: 0.0 m - 6.80 m 6.80 m - 7.90 m 7.90 m; End of hole	So. dk. brn. pt. So. to fi. brn. grey sty. clay
C5: 0.0 m - 2.80 m 2.80 m - 3.40 m 3.40 m - 5.50 m 5.50 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Fi. dk. grey org. cly. silt. So. grey sty. clay.	W6: 0.0 m - 4.50 m 4.50 m - 6.20 m 6.20 m; End of hole	So. to fi. dk. brn. pt. So. grey sty. clay.
C6: 0.0 m - 2.20 m 2.20 m - 2.50 m 2.50 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lae. grey silt, sm. clay.	W7: 0.0 m - 1.8 m 1.8 m - 3.0 m 3.0 m - 3.2 m 3.2 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay. Lae. grey sty. sand.
C7: 0.0 m - 0.60 m 0.60 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt.	W8: 0.0 m - 3.50 m 3.50 m - 5.20 m 5.20 m; End of hole	So. to fi. dk. brn. pt. So. grey sty. clay.
W1: 0.0 m - 5.8 m 5.8 m - 7.2 m 7.2 m - 8.0 m 8.0 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay. Lae. grey sty. sand, sm. gravel.	W9: 0.0 m - 4.4 m 4.4 m - 5.8 m 5.8 m - 6.3 m 6.3 m; End of hole	So. dk. brn. pt. Lae. dk. grey org. silt. So. grey sty. clay.

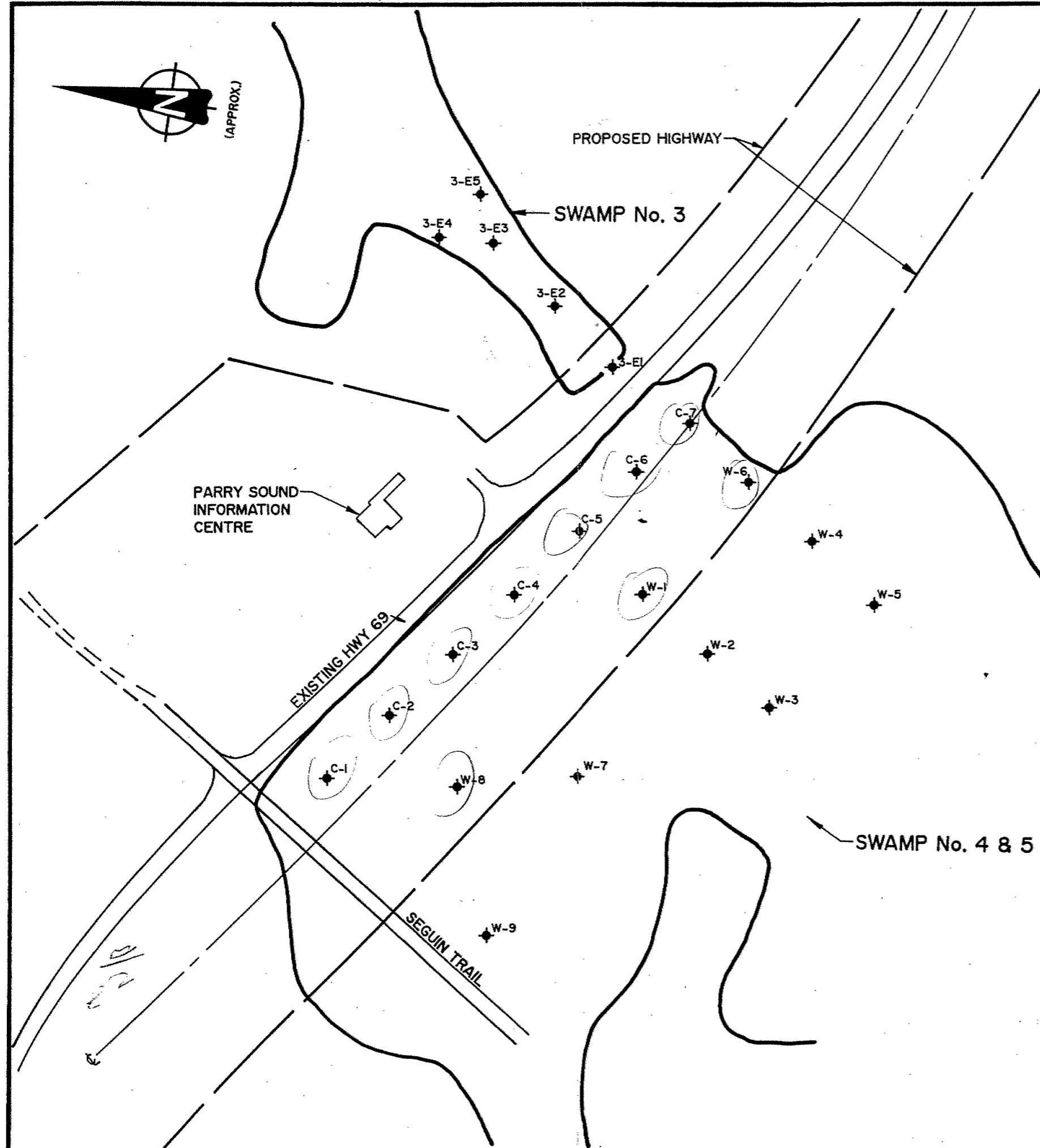
Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

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Date: MAR / 1992
Project: 921-1310

Drawn: DV
Chkd:



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PROBEHOLE LOCATION PLAN SWAMP No. 6

FIGURE 7

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 6

C1: 0.0 m - 0.1 m 0.10 m - 1.20 m 1.2 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. V. st. to ha. brn. cly. silt.	E5: 0.0 m - 0.70 m 0.70 m - 1.90 m 1.90 m - 2.50 m 2.50 m; End of hole	So. dk. brn. pt. Interi'd com. to dsc. grey sty. sand and cly. silt. so. brn. grey sty. clay.																									
C2: 0.0 m - 2.60 m 2.60 m - 3.50 m 3.50 m; End of hole	So. dk. brn. pt. So. grey sty. clay.	E6: 0.0 m - 0.90 m 0.90 m - 2.0 m 2.0 m - 3.20 m 3.20 m - 3.40 m 3.40 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Interi'd com. to dsc. grey sty. sand and cly. silt. So. brn. grey sty. clay. Dsc. grey sand and gravel																									
C3: 0.0 m - 2.10 m 2.10 m - 3.60 m 3.60 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey. sty. clay	E7: 0.0 m - 0.70 m 0.70 m - 1.20 m 1.20 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Dsc. grey sty. sand, tr. clay.																									
E1: 0.0 m - 2.80 m 2.80 m - 4.50 m 4.50 m - 4.80 m 4.80 m; End of hole	So. dk. brn. pt. So. grey st. clay, sm. sand seams. Lsc. gry silt, tr. clay.	<table><thead><tr><th>Hole No.</th><th>Depth (m)</th><th>Shear Strength (kPa)</th></tr></thead><tbody><tr><td rowspan="5">6-C3</td><td>2.2</td><td>19.1</td></tr><tr><td>2.3</td><td>14.3</td></tr><tr><td>2.4</td><td>12.9</td></tr><tr><td>2.5</td><td>13.8</td></tr><tr><td>2.6</td><td>16.7</td></tr><tr><td rowspan="5">6-E5</td><td>2.7</td><td>15.3</td></tr><tr><td>2.2</td><td>20.6</td></tr><tr><td>2.3</td><td>20.6</td></tr><tr><td>2.4</td><td>23.9</td></tr><tr><td>2.5</td><td>17.2</td></tr></tbody></table>	Hole No.	Depth (m)	Shear Strength (kPa)	6-C3	2.2	19.1	2.3	14.3	2.4	12.9	2.5	13.8	2.6	16.7	6-E5	2.7	15.3	2.2	20.6	2.3	20.6	2.4	23.9	2.5	17.2	
Hole No.	Depth (m)		Shear Strength (kPa)																									
6-C3	2.2		19.1																									
	2.3		14.3																									
	2.4		12.9																									
	2.5		13.8																									
	2.6		16.7																									
6-E5	2.7		15.3																									
	2.2		20.6																									
	2.3		20.6																									
	2.4	23.9																										
	2.5	17.2																										
E2: 0.0 m - 1.30 m 1.30 m - 1.95 m 1.95 m - 2.25 m 2.25 m - 3.20 m 3.20 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lsc. grey sty. sand. So. brn. grey sty. clay Dsc. brn. sdy. silt, sm. clay.																											
E3: 0.0 m - 1.20 m 1.20 m; Hard augering; End of hole	V. st. to ha. grey brn. cly. silt, sm. sand.																											
E4: 0.0 m - 0.50 m 0.50 m - 1.0 m 1.0 m; Auger refusal; prob. B/R; End of hole	Lsc. grey sty. sand, sm. org. Lsc. grey sty. sand.																											

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

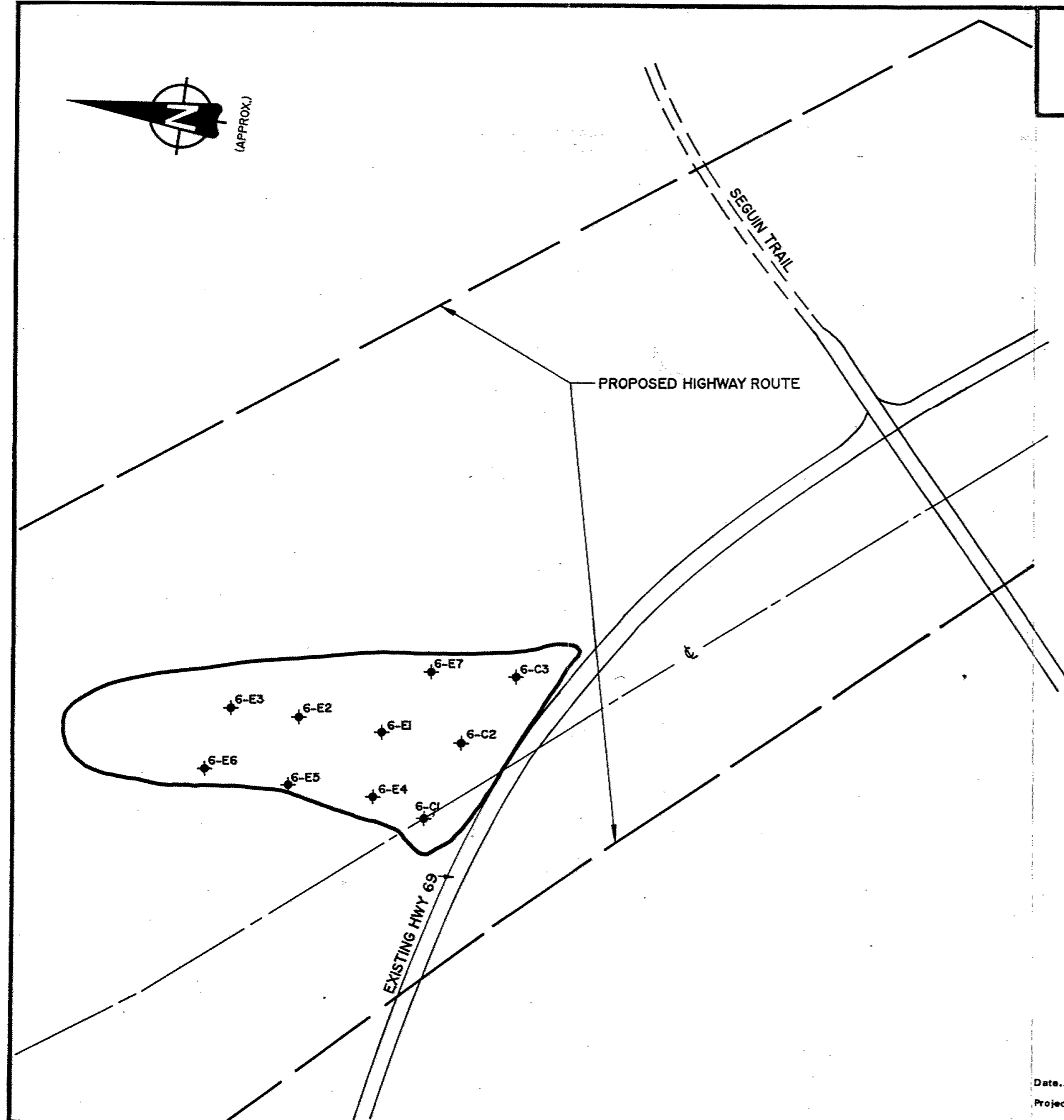
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Date... MAR / 1992
Project... 221-1310

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Drawn... DV
Chkd



PROBEHOLE LOCATION PLAN SWAMP No. 7 AND 8

FIGURE 8

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 7

C1: 0.0 m - 0.40 m 0.40 m - 0.70 m 0.70 m - 1.0 m 1.0 m; Auger refusal; prob. B/R; End of hole	Lac. dk., brn. org. sand. So. brn. cly. silt, sm. sand. Doe. brn. sty. sand.	W5: 0.0 m - 2.60 m 2.60 m - 2.80 m 2.80 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lac. grey sty. sand, sm. org.
C2: 0.0 m - 1.50 m 1.50 m - 3.50 m 3.50 m; Auger refusal; prob. B/R; End of hole	So. dk. grey org. silt. So. dk. grey sty. clay.	W6: 0.0 m - 2.80 m 2.80 m - 3.10 m 3.10 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay.
C3: 0.0 m - 1.30 m 1.30 m - 1.70 m 1.70 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Coen. to doe. grey sty. sand.	W7: 0.0 m - 3.0 m 3.0 m - 6.0 m 6.0 m; End of hole	So. grey org. cly. silt, sm. pt. Lac. grey silt to sdy. silt, tr. clay.
W1: 0.0 m - 5.50 m 5.50 m - 6.30 m 6.30 m; End of hole	So. dk. grey org. silt. So. grey sty. clay.	W8: 0.0 m - 4.3 m 4.3 m - 7.2 m 7.2 m; End of hole	So. dk. brn. pt., sm. org. cly. silt. Lac. grey silt to sdy. silt, tr. clay.
W2: 0.0 m - 2.0 m 2.0 m - 4.0 m 4.0 m - 6.20 m 6.20 m; End of hole	Lac. brn. sand, tr. roots. So. dk. grey org. silt to org. sty. sand. So. grey sty. clay.	W9: 0.0 m - 3.9 m 3.9 m - 4.9 m 4.9 m - 5.30 m 5.30 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt., sm. org. silt. So. grey sty. clay. Lac. grey sdy. silt., tr. clay.
W3: 0.0 m - 2.20 m 2.20 m - 2.40 m 2.40 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Coen. dk. grey sdy. silt.	W10: 0.0 m - 2.7 m 2.7 m - 3.30 m 3.30 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt., sm. org. cly. silt. So. brn. grey sty. clay.
W4: 0.0 m - 2.10 m 2.10 m - 2.40 m 2.40 m - 2.90 m 2.90 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay. Lac. grey sty. sand, tr. org.	W11: 0.0 m - 0.70 m 0.70 m - 1.80 m 1.80 m - 2.0 m 2.0 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lac. to coen. grey sty. sand. v. st. brn. cly. silt, sm. sand.

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

DRAFT

SCALE 1:2,500 (APPROX.)

Date...MAR. 7, 1992.....
Project...92I-1310.....

Golder Associates

Drawn...DV.....
Chkd.....

PICNIC AREA

SWAMP No. 8

SWAMP No. 7

BADGER ROAD

HOUSE

PROPOSED HIGHWAY

EXISTING HWY 69

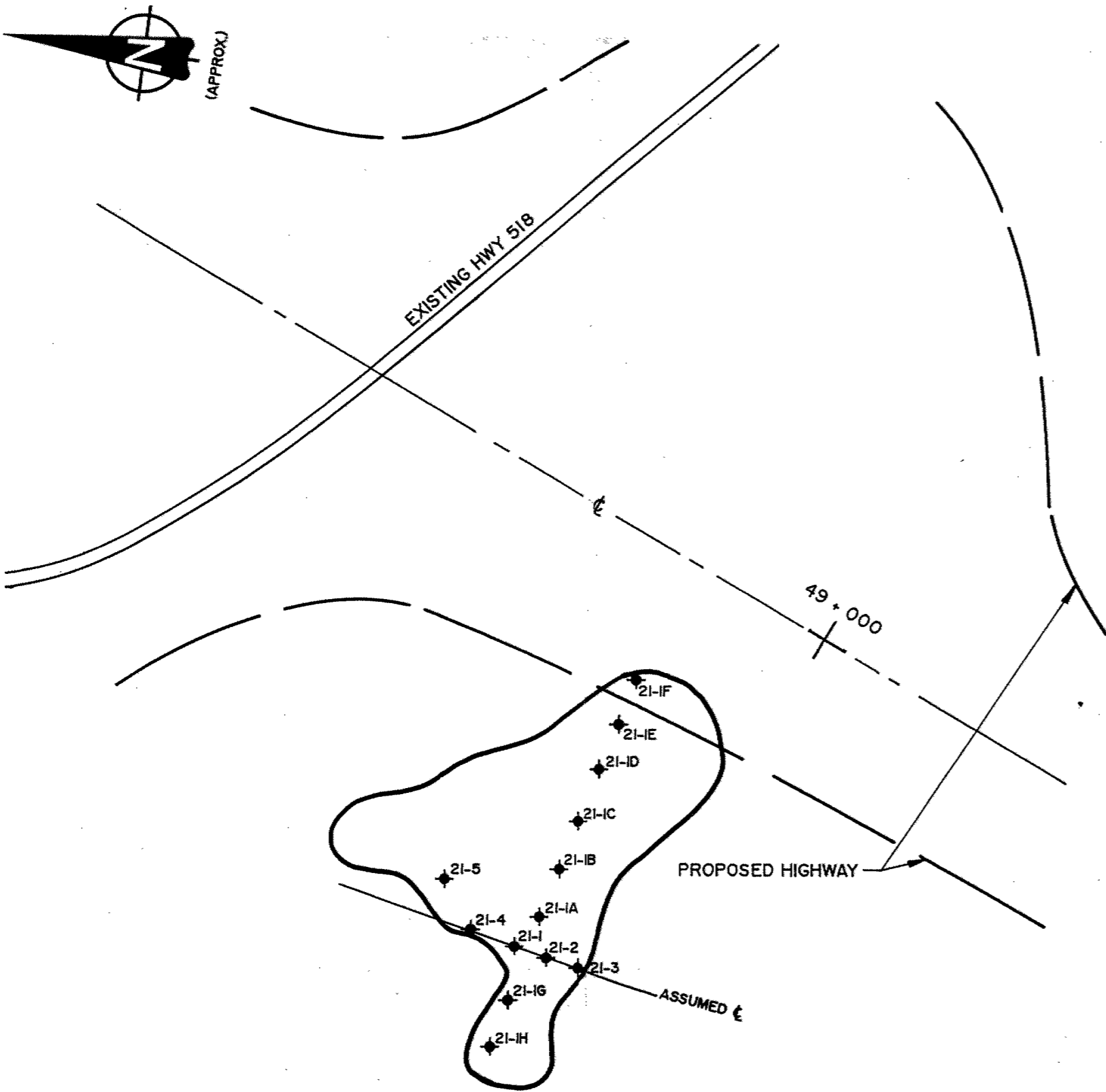
Swamp 8

C1: 0.0 m - 2.10 m 2.10 m - 4.60 m 4.6 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. to fi. grey sty. clay	E4: 0.0 m - 1.80 m 1.80 m - 5.0 m 5.0 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay, sand seams between 2.30 m to 2.40 m
C2: 0.0 m - 2.50 m 2.50 m - 3.0 m 3.0 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay.	E5: 0.0 m - 2.9 m 2.90 m - 7.80 m 7.80 m; End of hole	So. dk. brn. pt. So. grey sty. clay.
C3: 0.0 m - 2.0 m 2.0 m - 4.0 m 4.0 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. sm. org. sand. So. grey sty. clay.	E6: 0.0 m - 2.70 m 2.70 m - 7.80 m 7.80 m; End of hole	So. dk. brn. pt. So. grey sty. clay.
C4: 0.0 m - 0.30 m 0.30 m - 0.60 m 0.60 m - 1.50 m 1.50 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. V. st. to ha. grey cly. silt. Doe. grey sand to sty. sand	E7: 0.0 m - 3.0 m 3.0 m - 7.0 m 7.0 m; End of hole	So. dk. brn. pt. So. grey sty. clay.
E1: 0.0 m - 0.65 m 0.65 m - 1.6 m 1.6 m - 2.40 m 2.40 m; Auger refusal; prob. B/R; End of hole	So. to fi. dk. brn. pt. V. st. to ha. grey cly. silt. So. grey sty. clay.	E8: 0.0 m - 1.20 m 1.20 m - 1.80 m 1.80 m - 2.60 m 2.60 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lac. grey sand tr. org. Lac. grey silt, tr. clay.
E2: 0.0 m - 2.0 m 2.0 m - 2.80 m 2.80 m - 4.60 m 4.60 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lac. grey silt, tr. clay. So. grey sty. clay.	E9: 0.0 m - 2.30 m 2.30 m - 3.30 m 3.30 m - 6.40 m 6.40 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Lac. grey silt, sm. org. So. grey sty. clay.
E3: 0.0 m - 2.40 m 2.40 m - 4.30 m 4.30 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay.		

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

PROBEHOLE LOCATION PLAN
SWAMP No. 21

FIGURE 9



LEGEND

- ★ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 21

21-1; 21-2; 21-3; and 21-4: Auger refusal below ice; prob. B/R; End of hole		21-1D: 0.0 m - 1.95 m So. dk. brn. pt. 1.95 m - 2.45 m Dse. grey sand. 2.45 m; Auger refusal in sand; End of hole
21-5: 0.0 m - 2.55 m So. dk. brn. pt. 2.55 m - 6.75 m Dse. grey sand, sm. so. sty. clay layers	21-1E: 0.0 m - 1.10 m So. dk. brn. pt. 1.10 m - 2.35 m Dse. grey sand. 2.35 m; Auger refusal in sand; End of hole	
21-1A: 0.0 m - 2.45 m V. so. dk. brn. pt. 2.45 m - 3.75 m Com. to dse. grey sand, sm. silt, tr. clay.	21-1F: 0.0 m - 0.27 m So. dk. brn. pt. 0.27 m - 0.47 m Dse. grey sand. 0.47 m; Sampler refusal in sand; End of hole	
21-1B: 0.0 m - 2.70 m So. dk. brn. pt. 2.70 m - 3.10 m Dse. grey sand. 3.10 m - 3.50 m So. grey sty. clay. 3.50 m - 7.0 m So. grey sty. clay, with sm. sand layers.	21-1G: 0.0 m - 0.70 m Com.brn. org. sand, sm.pt. 0.70 m; Auger refusal; prob. B/R; End of hole	
21-1C: 0.0 m - 1.85 m So. dk.brn. pt. 1.85 m - 2.55 m Dse. grey sand, tr. silt. 2.55 m - 6.0 m So grey sty. clay, with sm. sand layers.	21-1H: 0.0 m - 0.05 m So. dk. brn. pt. 0.05 m; Auger refusal; prob. B/R; End of hole	
6.75 m; Hard augering; End of hole		
3.75 m; Auger refusal; prob. B/R; End of hole		
7.0 m; Auger refusal in sand; End of hole		
6.0 m; Auger refusal; prob. B/R; End of hole		

- Notes: (1) All soil depths measured from ground surface.
(2) Water/Ice depth varies from 0.0 m to 1.65 m above ground surface.

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Date...MAR 7, 1992.....
Project...92L1310.....

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PROBEHOLE LOCATION PLAN
SWAMP No. 27

FIGURE 10

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 27

27-1: 0.0 m - 0.47 m So. dk. brn. pt. 0.47 m; Auger refusal; prob. B/R; End of hole	27-2D: 0.0 m - 0.20 m So. dk. brn. pt., sm. org. clay. 0.20 m - 0.30 m Dse. grey sand. 0.30 m; Hard augering; End of hole
27-2: 0.0 m - 2.0 m So. dk. brn. pt. 2.0 m - 2.3 m Com. to dse. grey sand. 2.30 m; Auger refusal; prob. B/R; End of hole	27-2E: 0.0 m - 0.75 m Dse. brn. grey sand. 0.75 m; Hard augering; End of hole
27-3: 0.0 m - 0.40 m So. dk. brn. pt. 0.40 m; Auger refusal; prob. B/R; End of hole	27-2F: 0.0 m - 2.40 m So. dk. brn. pt. 2.40 m - 3.0 m Dse. grey brn. sand. 3.0 m; Auger refusal in sand; End of hole
27-4: 0.0 m - 0.80 m So. dk. brn. pt. 0.80 m - 1.25 m Dse. grey sand. 1.25 m; Auger refusal in sand; End of hole	27-2G: 0.0 m - 2.30 m So. dk. brn. pt. 2.30 m - 2.70 m Dse. grey sand. 2.70 m; Hard augering; End of hole
27-5: 0.0 m - 0.65 m So. dk. brn. pt. 0.65 m - 2.2 m St. grey brn. cly. silt. 2.2 m - 2.35 m Dse. grey brn. sand. 2.35 m; Auger refusal in sand; End of hole	27-2H: 0.0 m - 2.10 m So. dk. brn. pt. 2.10 m - 2.40 m Dse. grey sand. 2.40 m; Auger refusal in sand; End of hole
27-2A: 0.0 m - 1.85 m So. dk. brn. pt. 1.85 m - 2.10 m Dse. grey sand. 2.10 m; Auger refusal; prob. B/R; End of hole	27-2I: 0.0 m - 1.30 m So. dk. brn. pt. 1.30 m - 1.85 m Dse. grey sand. 1.85 m; Hard augering; End of hole
27-B: 0.0 m - 0.80 m So. dk. brn. pt. 0.80 m - 0.95 m Dse. grey sand. 0.95 m; Hard augering; End of hole	27-2J: 0.0 m - 2.15 m So. dk. brn. pt. 2.15 m - 2.80 m Dse. grey sty. sand. 2.80 m; Hard augering; End of hole
27-2C: 0.0 m - 0.80 m So. dk. brn. pt. 0.80 m - 0.95 m Dse. grey sand. 0.95 m; Auger refusal in sand; End of hole	

Notes: (1) All soil depths measured from ground surface.
(2) Water/Ice depth varies from 0.30 m to 1.1 m above ground surface.

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SCALE 1 : 2,500 (APPROX.)

Date...MAR. 7, 1992.....
Project...921-1310.....

Golder Associates

Drawn...DV.....
Chkd.....

PROBEHOLE LOCATION PLAN
SWAMP No. 28

FIGURE II



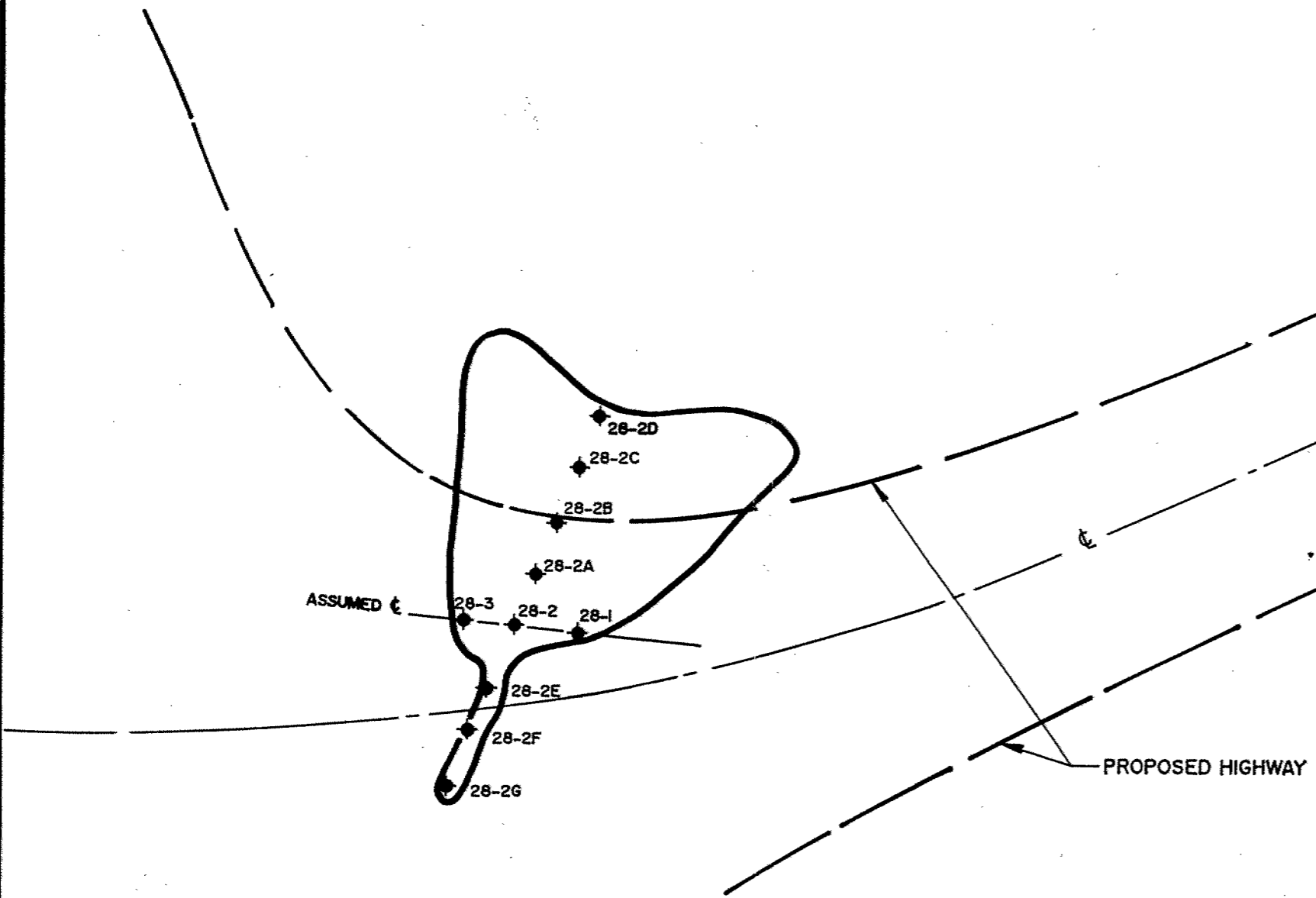
LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 28

28-1: 0.0 m - 0.55 m So. dk. brn. pt. 0.55 m; Auger refusal; prob. B/R; End of hole	28-2C: 0.0 m - 1.25 m So. dk. brn. pt. 1.25 m - 1.70 m Dsc. grey sand. 1.70 m; Auger refusal in sand; End of hole
28-2: 0.0 m - 2.45 m So. dk. brn. pt. 2.45 m - 2.85 Dsc. grey sand. 2.85 m; Hard Augering; End of hole	28-2D: 0.0 m - 0.25 m So. dk. brn. pt. 0.25 m - 0.40 m Dsc. brn. grey sand. 0.40 m; Auger refusal; prob. B/R; End of hole
28-3: 0.0 m - 0.50 m So. dk. brn. pt. 0.50 m - 0.80 m Dsc. brn. sand, sm. gravel 0.80 m; Auger refusal; prob. B/R; End of hole	28-2E: 0.0 m - 1.70 m So. dk. brn. pt. 1.70 m - 1.75 m Dsc. grey sand. 1.75 m; Auger refusal; prob. B/R; End of hole
28-2A: 0.0 m - 2.80 m So. dk. brn. pt. 2.80 m - 3.35 m Dsc. grey sand 3.35m; Hard Augering; End of hole	28-2F: 0.0 m - 0.05 m Lsc. brn. sand and gravel. 0.05 m; Auger refusal; prob. B/R; End of hole
28-2B: 0.0 m - 2.30 m So. dk. brn. pt. 2.30 m - 2.50 m Dsc. grey sand 2.50 m; Auger refusal in sand; End of hole	28-2G: 0.0 m - 0.20 m Lsc. brn. sand, sm. gravel 0.20 m; Auger refusal in sand; End of hole

- Notes: (1) All soil depths measured from ground surface.
(2) Water/Ice depth varies from 0.30 m to 1.80 m above ground surface.



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SCALE 1: 2,500 (APPROX.)

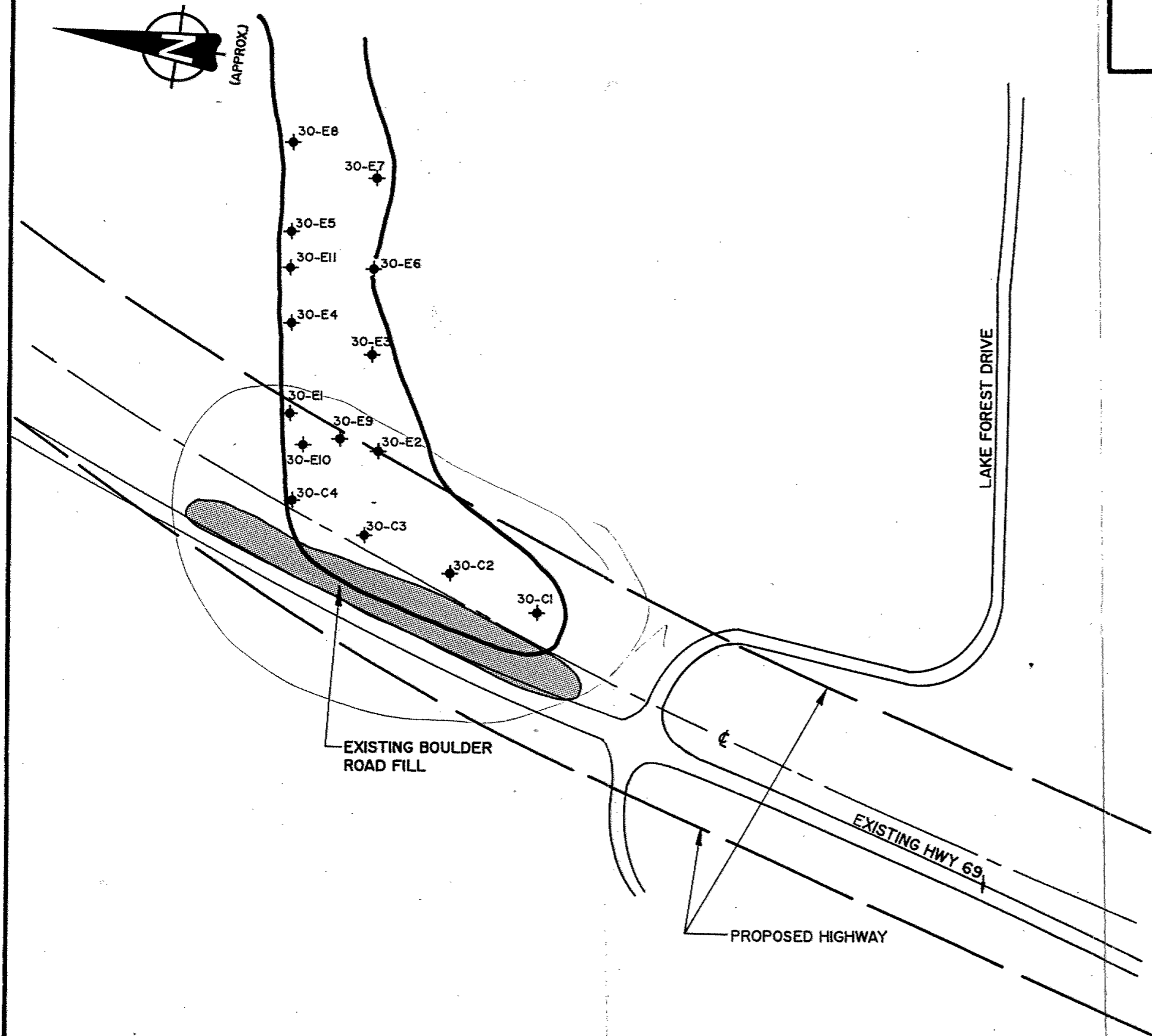
Date... MAR / 1992
Project... 921-1310

Golder Associates

Drawn... DV
Chkd

PROBEHOLE LOCATION PLAN
SWAMP No. 30

FIGURE 12



LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 30															
C1: 0.0 m - 0.30 m 0.30 m - 2.0 m 2.0 m; End of hole	Lsc. brn. sty. sand. St. to ha. brn. cly. silt.	E5: 0.0 m - 0.70 m 0.70 m - 1.20 m 1.20 m - 2.50 m 2.50 m; End of hole	So. dk. brn. pt. Fi. to so. grey cly. silt. sm. org. So. grey sty. clay.												
C2: 0.0 m - 2.60 m 2.60 m - 3.0 m 3.0 m - 3.5 m 3.5 m - 6.0 m 6.0 m; End of hole	Fi. brn. grey silt (FILL) Fi. grey sty. clay. Lsc. brn. sdy. silt. So. to fi. grey sty. clay.	E6: 0.0 m - 0.90 m 0.90 m - 3.0 m 3.0 m; Auger refusal, prob. B/R; End of hole	So. dk. grey. org. cly. silt. Fi. grey brn. sty. clay.												
C3: 0.0 m - 0.60 m 0.60 m - 2.60 m 2.60 m - 3.50 m 3.50 m - 4.90 m 4.90 m; End of hole	Lsc. dk. brn. sty. sand, sm. org. Lsc. grey sty. sand. St. to v. st. grey sty. clay. So. grey sty. clay.	E7: 0.0 m - 0.60 m 0.60 m - 1.10 m 1.10 m - 2.30 m 2.30 m; Auger refusal, prob. B/R; End of hole	So. dk. brn. pt. Fi. to st. brn. grey sty. clay So. brn. grey sty. clay.												
C4: 0.0 m - 1.0 m 1.0 m - 2.0 m 2.0 m - 4.70 m 4.70 m; End of hole	Lsc. dk. grey. org. sand Lsc. grey sdy. silt to silt. So. grey sty. clay.	E8: 0.0 m - 0.60 m 0.60 m - 2.0 m 2.0 m - 3.20 m 3.20 m; End of hole	Fi. grey org. cly. silt. Fi. to st. brn. cly. silt, sm. sdy. silt layers. So. brn. sty. clay.												
E1: 0.0 m - 3.0 m 3.0 m - 4.90 m 4.90 m; End of hole	So. dk. brn. pt. So. grey sty. clay.	E9: 0.0 m - 1.80 m 1.80 m - 2.50 m 2.50 m - 4.0 m 4.0 m; End of hole	So. dk. brn. pt. So. grey org. cly. silt So. grey sty. clay.												
E2: 0.0 m - 0.6 m 0.6 m - 1.9 m 1.90 m; End of hole	Fi. brn. grey sty. clay, tr. org. So. grey sty. clay.	E10: 0.0 m - 3.0 m 3.0 m - 5.0 m 5.0 m - 5.5 m 5.5 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay. Com. grey sand.												
E3: 0.0 m - 0.5 m 0.5 m - 0.9 m 0.9 m - 2.4 m 2.40 m; End of hole	Fi. brn. grey sty. clay, sm. org. Fi. brn. cly. silt. So. grey sty. clay.	E11: 0.0 m - 1.30 m 1.30 m - 2.10 m 2.10 m - 3.70 m 3.70 m - 4.30 m 4.30 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Com. grey sand to sty. sand. So. grey sty. clay. Comp. grey sand.												
E4: 0.0 m - 2.50 m 2.50 m - 2.80 m 2.80 m - 5.10 m 5.10 m; End of hole	Lsc. dk. brn. org. sdy. silt. Lsc. grey silt, sm. clay. So. grey sty. clay.	Vane Test Results <table border="1"> <thead> <tr> <th>Hole No.</th> <th>Depth (m)</th> <th>Shear Strength (kPa)</th> </tr> </thead> <tbody> <tr> <td>E10</td> <td>3.70</td> <td>20.6</td> </tr> <tr> <td></td> <td>3.80</td> <td>23.5</td> </tr> <tr> <td></td> <td>3.90</td> <td>24.9</td> </tr> </tbody> </table>		Hole No.	Depth (m)	Shear Strength (kPa)	E10	3.70	20.6		3.80	23.5		3.90	24.9
Hole No.	Depth (m)	Shear Strength (kPa)													
E10	3.70	20.6													
	3.80	23.5													
	3.90	24.9													

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Notes: (1) All soil depths measured from ground surface.
(2) Water/ice depth varies from 0.0 m to 0.6 m above ground surface.

Date... MAR / 1992
Project... 921-1310

SCALE 1 : 2,500 (APPROX.)
Golder Associates

Drawn... DV
Chkd

New Cont N/R + S JOLAND

PROBEHOLE LOCATION PLAN SWAMP No. 45

FIGURE 13



LEGEND

- ★ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 45

C1: 0.0 m - 0.45 m 0.45 m - 1.40 m 1.40 m - 2.80 m 2.80 m - 5.70 m 5.70 m - 5.85 m 5.85 m: Auger refusal; prob. B/R; End of hole	Loc. dk. grey org. sdy. silt. So. to f. brn. sdy. clay to silt. St. grey clay. silt. So. grey sdy. clay. Dec. grey sand.	E3: 0.0 m - 0.40 m 0.40 m - 1.15 m 1.15 m - 1.70 m 1.70 m: End of hole	So. dk. brn. pt. Com. brn. sdy. silt. St. brn. to grey sdy. clay
C2: 0.0 m - 0.30 m 0.30 m - 1.15 m 1.15 m - 2.60 m 2.60 m: End of hole	Loc. to com. dk. grey org. sdy. silt. Loc. to com. brn. sdy. silt. to silt. So. grey sdy. clay to clay. silt.	E4: 0.0 m - 0.45 m 0.45 m - 0.80 m 0.80 m - 1.60 m 1.60 m - 2.30 m 2.30 m: End of hole	So. dk. brn. pt. So. brn. sdy. clay. Com. brn. sdy. silt. St. to so. grey sdy. clay.
C3: 0.0 m - 0.30 m 0.30 m - 1.80 m 1.80 m - 2.50 m 2.50 m: End of hole	Loc. dk. brn. org. sdy. silt. Com. brn. sdy. silt. So. grey sdy. clay.	E5: 0.0 m - 0.60 m 0.60 m - 1.20 m 1.20 m - 2.50 m 2.50 m: End of hole	So. dk. brn. pt. Com. brn. sdy. silt. St. to f. brn. sdy. clay.
C4: 0.0 m - 0.70 m 0.70 m - 1.20 m 1.20 m - 1.70 m 1.70 m: End of hole	Loc. dk. brn. org. sdy. silt. Comp. brn. sdy. silt. to silt. So. to st. grey clay. silt. to sdy. clay.	E6: 0.0 m - 0.45 m 0.45 m - 1.10 m 1.10 m - 1.90 m 1.90 m - 3.40 m 3.40 m: End of hole	So. dk. brn. pt. Com. brn. sdy. silt. Ha. grey brn. sdy. clay. Fi. grey sdy. clay.
C5: 0.0 m - 0.15 m 0.15 m - 1.80 m 1.80 m - 7.10 m 7.10 m - 7.30 m 7.30 m: Hard augering; End of hole	So. dk. brn. pt. Com. to dec. grey brn. sdy. silt. So. grey sdy. clay. St. grey sdy. clay, sen. sand.	E7: 0.0 m - 0.50 m 0.50 m - 1.45 m 1.45 m - 2.0 m 2.0 m: End of hole	Loc. grey silt. am. roots. V. st. brn. sdy. clay. St. grey sdy. clay
C6: 0.0 m - 0.10 m 0.10 m - 1.25 m 1.25 m - 1.80 m 1.80 m - 4.10 m 4.10 m: Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Com. brn. sdy. silt. St. yellow brn. clay. silt. So. grey sdy. clay.	W1: 0.0 m - 0.45 m 0.45 m - 2.10 m 2.10 m - 5.80 m 5.80 m: End of hole	Loc. dk. brn. org. sdy. silt. Com. to loc. brn. sdy. silt. so. grey sdy. clay.
E1: 0.0 m - 0.25 m 0.25 m - 1.80 m 1.80 m - 2.30 m 2.30 m: End of hole	So. dk. brn. pt. Loc. to com. grey sdy. silt. to silt. So. grey sdy. clay.	W2: 0.0 m - 0.30 m 0.30 m - 1.10 m 1.10 m - 1.50 m 1.50 m: End of hole	Loc. dk. brn. org. sdy. silt. Com. brn. sdy. silt. St. brn. sdy. clay.
E2: 0.0 m - 0.50 m 0.50 m - 1.10 m 1.10 m - 1.90 m 1.90 m - 3.10 m 3.10 m: End of hole	So. dk. brn. pt. Loc. to com. grey sdy. silt. to silt. St. brn. sdy. clay. So. grey sdy. clay.	W3: 0.0 m - 0.30 m 0.30 m - 1.25 m 1.25 m - 2.60 m 2.60 m: End of hole	Fi. dk. brn. org. clay. silt. Com. brn. sdy. silt. V. st. to f. brn. then grey sdy. clay.

Swamp 45

Vane Test Results		
Hole No.	Depth (m)	Shear Strength (kPa)
C5	2.10	22.3
	2.20	29.2
	2.30	30.2
	2.80	25.9
	2.90	28.7
	3.0	31.1
C6	2.4	26.3
	2.55	28.7
	2.70	30.2
	3.0	27.3
	3.1	30.2
	3.2	31.1

Notes: (1) All soil depths measured from ground surface.
(2) Waterline depth varies from 0.8 m to 0.20 m above ground surface.

SCALE 1:2,500 (APPROX.)

Date: MAR / 1992
Project: 921-1310

Golder Associates

Drawn: DV
Chkd:

DRAFT

PROPOSED HIGHWAY

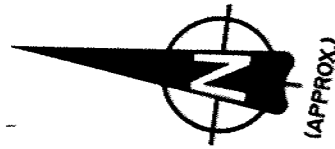
HOUSE No. 26

34 + 500

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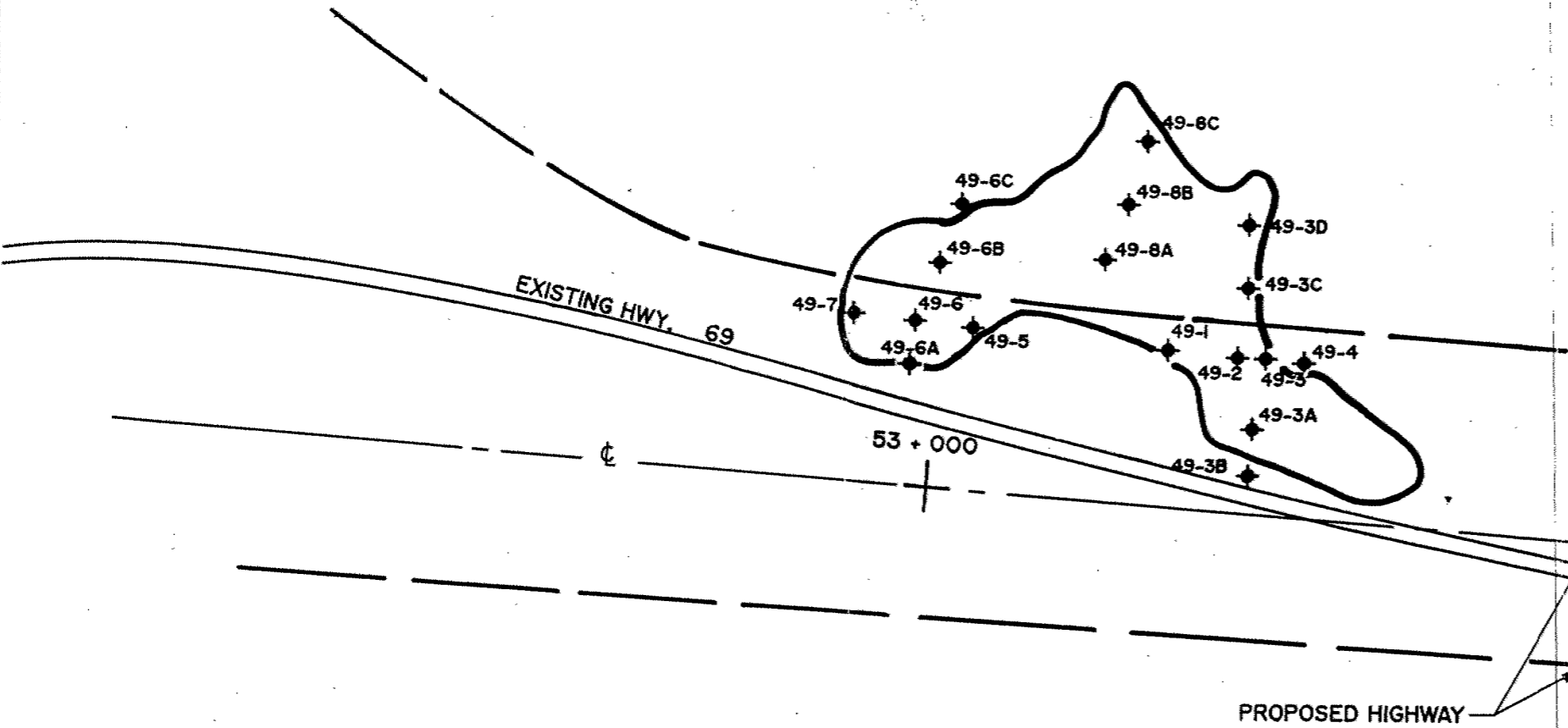
PROBEHOLE LOCATION PLAN
SWAMP No. 49

FIGURE 14



LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE



Swamp 49

49-1: 0.0 m - 0.30 m So. dk. brn. pt. 0.30 m - 0.35 m Dse. brn. sand, sm. gravel. 0.35 m; Auger refusal; prob. B/R; End of hole	49-3C: 0.0 m - 1.90 m So. dk. brn. pt. 1.90 m - 3.7 m So. brn. grey org. sty clay. 3.70 m - 3.80 m Dse. sand. 3.80 m; Auger refusal; End of hole
49-2: 0.0 m - 0.20 m So. dk. brn. pt. 0.20 m - 0.40 m St. brn. cly. silt. 0.40 m - 0.75 m Dse. brn. grey sand. 0.75 m - 1.05 m V. st. grey cly. silt, sm. sand. 1.05 m; Auger refusal in sand; End of hole	49-3D: 0.0 m - 2.50 m So. dk. brn. pt. 2.50 m - 2.90 m Com. grey sand. 2.90 m - 4.95 m So. grey brn. org. sty. clay. 4.95 m; Sampler refusal in silt; End of hole
49-3: 0.0 m - 0.35 m So. dk. brn. pt. 0.35 m - 1.05 m V. st. brn. sty. clay. 1.05 m; Auger refusal in v. st. clay; End of hole	49-6A: 0.0 m - 0.50 m So. dk. brn. pt. 0.50 m - 1.20 m V. st. grey cly. silt. 1.20 m; End of hole
49-4: 0.0 m - 0.1 m Dse. brn. sdy. topsoil. 0.1 m - 0.85 m Dse. brn. sdy. silt. 0.85 m; Auger refusal; End of hole	49-6B: 0.0 m - 1.40 m So. dk. brn. pt. 1.40 m - 1.80 m So. dk. brn. org. silt 1.80 m - 2.0 m Dse. grey sand. 2.0 m; End of hole
49-5: 0.0 m - 0.55 m So. dk. brn. pt. 0.55 m - 1.75 m Fi. to st. brn. cly. silt. 1.75 m; End of hole	49-6C: 0.0 m - 0.60 m So. dk. brn. pt. 0.60 m - 1.0 m V. st. to ha. brn. cly. silt. 1.0 m; End of hole
49-6: 0.0 m - 0.90 m So. dk. brn. pt. 0.90 m - 1.75 m V. st. to ha. brn. cly. silt. 1.75 m; End of hole	49-8A: 0.0 m - 1.15 m So. dk. brn. pt. 1.15 m - 4.75 m Lse. to com. brn. org. sand, sm. pt. org. sand, sm. pt. 4.75 m; Sampler Refusal in sand; End of hole
49-7: 0.0 m - 0.35 m So. dk. brn. pt. 0.35 m - 0.90 m St. to v. st. grey brn. cly. silt. 0.90 m; End of hole	49-8B: 0.0 m - 3.85 m So. dk. brn. pt. 3.85 m - 4.05 m Dse. brn. sand and gravel. 4.05 m; End of hole
49-3A: 0.0 m - 0.40 m So. dk. brn. pt. 0.40 m - 0.65 m V. st. to ha. brn. grey cly. silt, sm. sand. 0.65 m; Auger refusal; End of hole	49-8C: 0.0 m - 1.10 m So. dk. brn. pt. 1.10 m - 1.50 m V. st. grey cly. silt, sm. sand layers. 1.50 m - 1.90 m Dse. brn. sand and gravel. 1.90 m; End of hole
49-3E: 0.0 m - 0.25 m St. brn. cly. topsoil. 0.25 m - 0.60 m Ha. brn. cly. silt. 0.60 m; Auger refusal; End of hole	

Notes: (1) All soil depths measured from ground surface.
(2) Water/ice depth varies from 0.0 m to 0.60 m above ground surface.

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SCALE 1 : 2,500 (APPROX.)

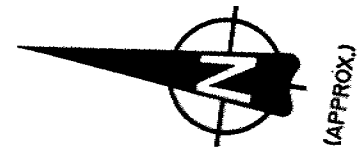
Date... MAR / 1992
Project... 221-1310

Golder Associates

Drawn... DV
Chkd

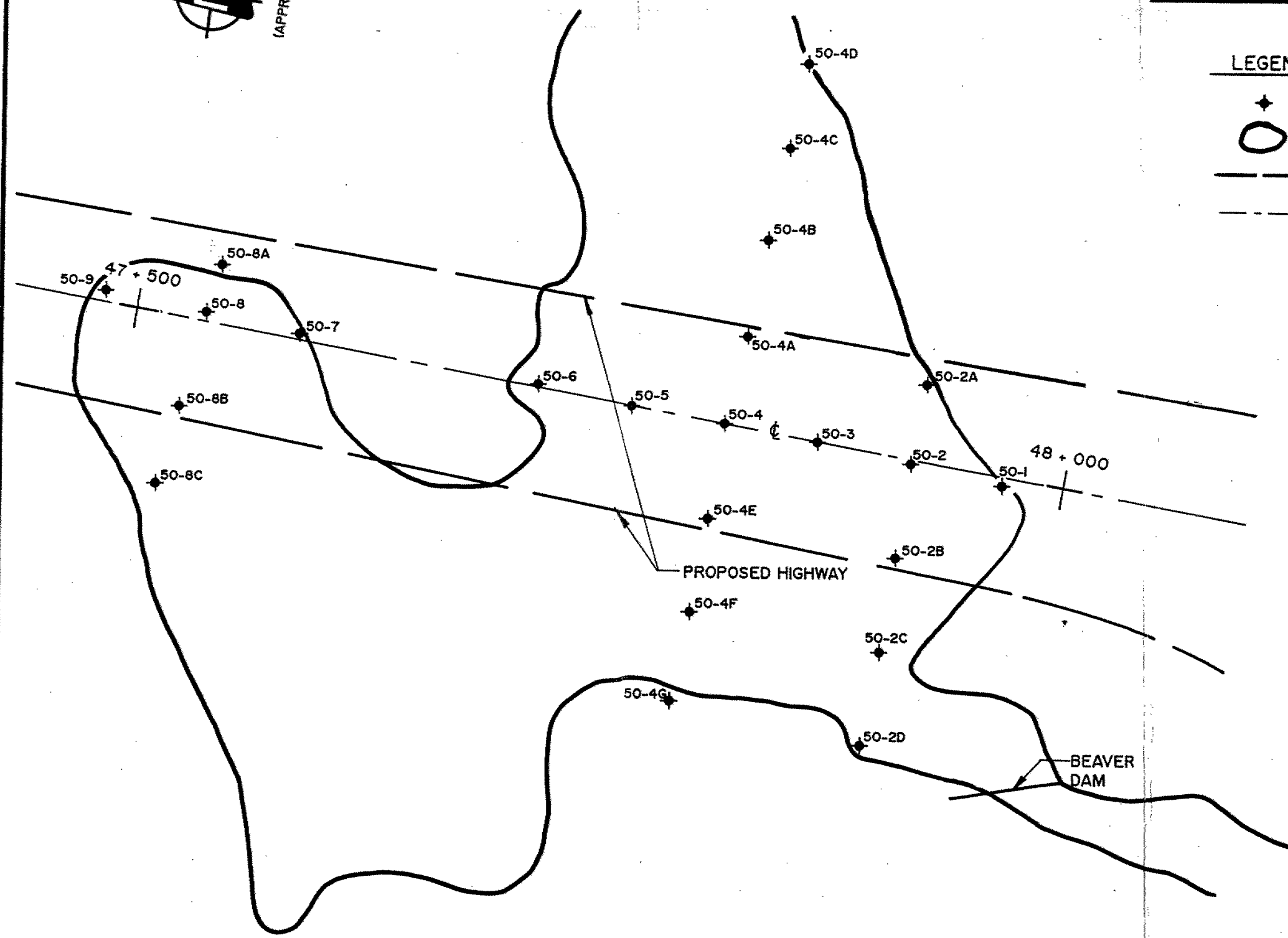
PROBEHOLE LOCATION PLAN
SWAMP No. 50

FIGURE 15



LEGEND

- ★ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE



Swamp 50			
50-1: 0.0 m - 0.10 m So. dk. brn. pt. 0.10 m; Auger refusal; prob. B/R; End of hole	50-2D: 0.0 m - 2.70 m So. dk. brn. pt. 2.70 m - 3.40 m Com. grey sand, sm. clay. 3.40 m; End of hole		
50-2: 0.0 m - 3.45 m So. dk. brn. pt. 3.45 m - 7.40 m Dec. grey sty. sand with sm. so. grey sty. clay layers 7.40 m; Auger refusal; End of hole	50-4A: 0.0 m - 3.05 m So. dk. brn. pt. 3.05 m - 6.15 m So. grey sty. clay, sm. sand. 6.15 m; Sampler refusal in sand; End of hole		
50-3: 0.0 m - 3.35 m So. dk. brn. pt. 3.35 m - 6.60 m So. grey sty. clay, sm. sand layers. 6.60 m - 7.15 m Dec. grey sty. silt. 7.15m; Auger refusal; End of hole	50-4B: 0.0 m - 3.25 m So. dk. brn. pt. 3.25 m - 3.55 m Dec. grey sty. sand 3.55 m - 6.40 m So. grey sty. clay, sm. sand layers. 6.40 m - 6.45 m Dec. grey sand. 6.45 m; Auger refusal; End of hole		
50-4: 0.0 m - 3.70 m So. dk. brn. pt. 3.70 m - 6.90 m So. grey sty. clay, sm. sand layers. 6.90 m - 7.00 m Dec. grey sty. sand. 7.00 m; Auger refusal; End of hole	50-4C: 0.0 m - 1.95 m So. dk. brn. pt. 1.95 m - 3.60 m Com. to dec. grey sand. 3.60 m - 4.95 m So. grey sty. clay. 4.95 m - 5.25 m Dec. grey sty. sand. 5.25 m; Auger refusal; End of hole		
50-5: 0.0 m - 3.40 m So. dk. brn. pt. 3.40 m - 4.70 m So. grey sty. clay, sm. sand seams. 4.70 m - 4.80 m Dec. grey sand. 4.80 m; End of hole	50-4D: 0.0 m - 1.0 m So. dk. brn. pt. 1.0 m - 1.20 m Lac. grey brn. sand. 1.20 m; Auger refusal in dec. sand; End of hole		
50-6: 0.0 m - 0.25 m So. dk. brn. pt. 0.25 m - 0.50 m Dec. grey brn. sand 0.50 m - 0.80 m St. grey brn. cly. silt. 0.80 m - 0.95 m Dec. grey sand and gravel. 0.95 m; Auger refusal; End of hole	50-4E: 0.0 m - 3.75 m So. dk. brn. pt. 3.75 m - 4.30 m Com. to dec. grey sty. sand 4.30 m - 6.6 m So. grey sty. clay. 6.6 m - 6.65 m Dec. grey sty. sand. 6.65 m; End of hole		
50-7: 0.0 m - 0.40 m So. dk. brn. pt. 0.40 m - 0.80 m Dec. grey sand. 0.80 m; Auger refusal; End of hole	50-4F: 0.0 m - 3.75 m So. dk. brn. pt. 3.75 m - 4.05 m Dec. grey sand. 4.05 m; End of hole		
50-8: 0.0 m - 2.40 m So. dk. brn. pt. 2.40 m - 3.90 m Com. to dec. grey sty. sand. 3.90 m - 6.05 m So. to fi. grey sty. clay. 6.05 m - 6.95 m Dec. grey sty. sand. 6.95 m; Auger refusal; End of hole	50-4G: 0.0 m - 3.15 m So. dk. brn. pt. 3.15 m - 3.70 m lac. to com. grey silt. 3.70 m - 4.15 m So. grey sty. clay. 4.15 m - 4.45 m Dec. grey sty. sand. 4.45 m; End of hole		
50-9: 0.0 m - 0.95 m So. dk. brn. pt. 0.95 m - 1.55 m Dec. grey sand. 1.55 m; Auger refusal; End of hole	50-8A: 0.0 m - 0.30 m So. dk. brn. pt. 0.30 m - 0.80 m Dec. grey sand. 0.80 m; Auger refusal; End of hole		
50-2A: 0.0 m - 0.55 m So. dk. brn. pt. 0.55 m - 0.75 m St. grey brn. org. cly. silt. 0.75 m - 0.80 m Dec. grey sand. 0.80 m; End of hole	50-8B: 0.0 m - 3.70 m So. dk. brn. pt. 3.70 m - 4.0 m So. grey sty. clay. 4.00 m - 5.10 m Dec. grey sand. 5.10 m - 6.70 m So. grey sty. clay, sm. sand seams. 6.70 m; Auger refusal in sand; End of hole		
50-2B: 0.0 m - 3.75 m So. dk. brn. pt. 3.75 m - 4.05 m Dec. grey sand. 4.05 m - 6.45 m Com. grey sand, sm. so. grey sty. clay. 6.45 m; Auger refusal in sand; End of hole	50-8C: 0.0 m - 0.80 m So. dk. brn. pt. 0.80 m - 0.85 m Dec. grey sand, sm. org. 0.85 m; Auger refusal; prob. B/R; End of hole		
50-2C: 0.0 m - 4.20 m So. dk. brn. pt. 4.20 m - 5.70 m So. grey sty. clay. 5.70 m - 7.0 m Com. to dec. grey sand, sm. clay. 7.0 m; End of hole			

Notes: (1) All soil depths measured from ground surface.

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Date...MAR./1992.....
Project...221-1310.....

SCALE 1 : 2,500 (APPROX.)
Golder Associates

Drawn...DV.....
Chkd.....

PROBEHOLE LOCATION PLAN SWAMP No. 51

FIGURE 16

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp No. 51

C1: 0.0 m - 0.60 m	So. dk. brn. pt.
0.60 m - 1.76 m	Lsc. brn. grey to grey silt to sdy. silt.
1.76 m; Hard augering; End of hole.	
C2: 0.0 m - 0.55 m	So. dk. brn. pt.
0.55 m - 1.12 m	Lsc. brn. sdy. silt.
1.12 m; Hard augering; End of hole;	
C3: 0.0 m - 0.56 m	So. dk. brn. pt.
0.56 m - 0.82 m	Lsc. grey sdy. silt.
0.82 m; Hard augering; End of hole.	
E1: 0.0 m - 1.80 m	So. dk. brn. pt.
1.80 m - 2.20 m	Lsc. to com. grey sand.
2.20 m - 4.50 m	Com. to dsc. grey sdy. silt.
4.50 m; Hard augering; End of hole.	
W1: 0.0 m - 0.31 m	So. dk. brn. pt.
0.31 m - 0.79 m	Lsc. grey silt.
0.79 m; Hard augering; End of hole.	
W2: 0.0 m - 0.80 m	So. dk. brn. pt.
0.80 m - 1.10 m	St. brn./grey sty. clay.
1.10 m; Hard augering; End of hole.	
W3: 0.0 m - 0.70 m	So. dk. brn. pt. to org. sdy. silt.
0.70 m - 0.90 m	Lsc. to com. grey sdy. silt.
0.90 m; Hard augering; End of hole.	

- Notes:
- (1) All soil depths measured from ground surface.
 - (2) Water/Ice depth varies from 0.18 m to 1.50 m above ground surface.

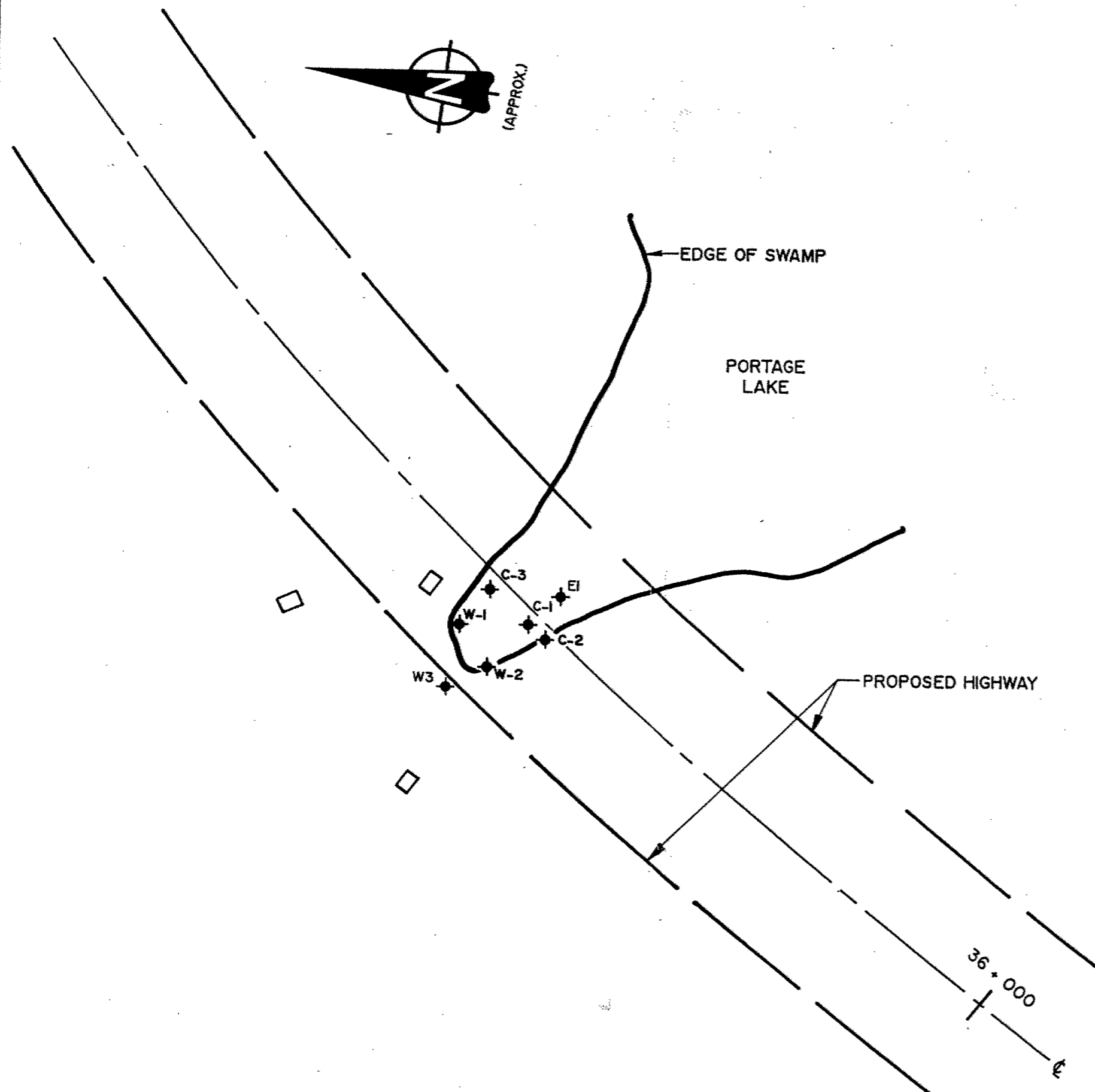
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Date...MAR / 1992...
Project...92L1310...

Golder Associates

Drawn...DV...
Chkd



memorandum



To: J. McDougall
Geotechnical Section
Northern Region

Date: 1992 11 25

Attn: R. Purdy
Soils Supervisor, West

From: Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Hwy. 69 From Tower Drive to Hayes Corner
From Hayes Corner to Hwy. 559
W.P. 529-89-00/W.P. 530-89-00
District 11, Huntsville

This letter is being written in response to your letter of August 27, 1992 and the additional information which has been provided in response to our review of the above-captioned project.

After reviewing the data, we have the following comments:

- 1) Swamps 7 and 50 - You have indicated swamps 7 and 50 are no longer of concern.
- 2) Swamps 4 and 5 - Assuming that the shear strength of the silty clay is only 10 kPa as suggested (ie. no vane shear tests were conducted at this site), our analyses of 6 m high embankments over similar soft clays, indicates that an acceptable factor of safety cannot be obtained even if the embankment is constructed with very large berms and not only the peat but also the underlying silty clay is subexcavated and replaced down to the maximum practical depth.

An embankment over such clays would have to be constructed of lightweight fill and reduced in height (to about 4 m) even with midheight berms and subexcavation.

In order to avoid large settlements, the peat would have to be subexcavated. Moving the proposed roadway closer to the existing embankment, as suggested, would further increase the need for excavation support.

A foundation investigation would be required for us to provide recommendations for this site.

3) Swamp 30 -

The shear strength data, which has been provided, indicates that serious consideration should be given to reducing the height of this embankment to 4 or 5 m.

Similar comments, given for swamps 4 and 5, also apply here.

Once again, a foundation investigation would be required for us to provide recommendations.

4) Swamp 8 -

No shear strength data has been given for this site.

It also appears that additional subsurface information may be required in the area bounded by C1, C2 and E5.

In view of the height of the proposed embankment (6 m), a foundation investigation would be required for us to provide recommendations.

It appears that, in most areas, the highway can be constructed to the suggested grades along the proposed alignment, provided that the peat, as well as some of the soft clay can be safely excavated and replaced. It appears that at swamps 4/5, 30 and possibly 8, the embankments will have to be reduced in height. Excavation support will be required in any areas where the subexcavation encroaches upon the existing embankments.

Should you require additional details (ie. berm widths, excavation depths etc.) please provide us with separate requests for foundation investigations for each swamp.

John A. Blair

J.A. Blair, P. Eng.
Project Foundation Engineer

for

D. Dundas, P. eng.
Sr. Foundation Engineer

DD/JAB/jb

memorandum



To: Mr. J. McDougall
Head, Geotechnical Section
Northern Region
North Bay, Ontario

Date: 1992 07 12

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Hwy 69 From Tower Drive to Hayes Corner
And From Hayes Corner to Hwy 559
W.P. 529-89-00 / W.P. 530-89-00
Golder Associates Ltd. Draft Report
on the Feasibility Study -
Geotechnical Investigation Expansion
and Realignment of Hwy 69 from Mactier to Nobel

In response to your letter of request, dated June 19, 1992, we have reviewed the Draft Report, which was prepared by Golder Associates Limited, on the "Prefeasibility Study - Geotechnical Investigation Expansion and Realignment of Hwy 69 From Mactier to Nobel". This letter summarizes our comments on some of the swamps which were investigated and summarized in that report.

The five (5) swamp locations, which you indicated appeared to be most critical, will be dealt with first.

Swamp 3

At Swamp 3, it appears that the only borehole, which was drilled within the right-of-way (3-E1), was terminated within a layer of soft, grey silty clay (ie. a firm base was not established). All of the other four boreholes, located to the north of the right-of-way, were also terminated early within the same clay layer. Since neither the thickness of the clay nor its shear strength are known, there is insufficient data in which to properly evaluate the suitability of the subsoils to support the proposed alignment, to predict settlements, or to determine if removal of the clay is a possible alternative.

Swamps 4 and 5

Several boreholes were drilled within the proposed right-of-way. Seven (7) boreholes were drilled between the existing Highway 69 embankment and the centreline of the proposed highway (C-1 to C-7). Three others (W-1, W-6 and W-8) were drilled between the centreline of the proposed highway and the southern limit of the right-of-way.

It appears that all of the first seven boreholes mentioned were augered to refusal. However, at Boreholes C-3, C-4 and C-5, a soft, grey, silty clay, from 1.1 to 2.9 m thick, was encountered at depths of 1.4 to 3.4 m. Such material was found to extend to a depth of 5.5 m at Borehole C-3. Once again, without adequate shear strength results, there is insufficient data in which to properly evaluate the suitability of the subsoils to support the proposed alignment over this swamp, nor is there enough information to predict settlements.

The remaining three boreholes (ie. those to the south of the centreline), encountered peat from 3.5 to 5.8 m thick, which is underlain by soft clay. The thickness of the clay is only known at one of the boreholes (W1), since this was the only one that was augered to refusal.

Removal of the clay is possible, at the areas represented by Boreholes C-1 to C-7, since the clay extends to a maximum depth of about 5.5 m. However, without shear strength results, it is not known what effect excavation of the clay may have on the existing embankment. In any case, in the areas further south, the thickness of the soft clay, in most areas, is not known and the possibility of its removal cannot be evaluated.

Swamp 30

At Swamp 30, of the eight boreholes drilled within the right-of-way, six of them (C-2, C-3, C-4, E-1, E-2, E-9 and E-10) were terminated within soft, grey, silty clay.

Three vane shear strength tests within the soft, clay were conducted, at one borehole location (E-10). It should be noted, however, that the results of vane tests, at only one location, cannot be used to represent the shear strength of the clay underlying the entire swamp. In any case, it is not clear to us how standard field vane tests using an MTO vane can be conducted at 0.1 m intervals, unless each were carried out in separate boreholes.

Once again, since the thickness of the clay and its shear strength is not adequately known, supporting an embankment on the subsoils, prediction of settlements, the possibility of the removal of the weak clay or the effect of the removal of the clay on the existing embankment cannot be properly evaluated at this swamp.

Swamp 45

Based on the available borehole information, it appears that, in general, the extent of the soft silty clay is fairly well-defined at Swamp 45. However, two of the boreholes (C-2 and C-3) were terminated in soft silty clay and one borehole (C-4) in soft to stiff, silty clay. The thickness of the soft clay was found to be 5.3 m, at Borehole C-5.

Some shear strength data has been provided at two locations (including C-5). However, as mentioned earlier for Swamp 30, it is not clear to us how standard field vane tests using an MTO vane can be conducted at 0.1 m intervals.

The thickness of the clay at C-2 to C-4 and additional shear strength data, using an MTO vane, at this site would be required, for a more accurate evaluation of the consistency of the clay subsoils, prediction of settlements and the possibility of removal of the weak caly.

Additional Swamps

It is recommended that the thickness of the clay should be more precisely determined at the north boundary of the right-of-way at Swamp 7 (eg. Borehole W-1) and the south boundary of the right-of-way (eg. Borehole E-5) at Swamp 8. Reliable shear strength data is also required at Swamps 6, 7, 8 and 50, wherever deposits of soft, silty clay to clayey silt, are encountered.

Concluding Remarks

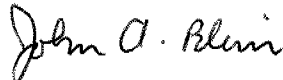
Generally, the thickness and shear strength of the soft clays has not been adequately investigated, at the various swamps mentioned above.

Without more reliable information, it is difficult to assess the following:

- 1) Can an embankment can be built on the soft clays which are found at these sites?
- 2) What settlements can be expected?
- 3) Can the clay can be removed and replaced?
- 4) What effect will the removal of the clay have on the existing embankments?

In order to answer these questions more fully, it may be desirable to request that the Geotechnical Consultant provide additional information to the Region, in the areas which are lacking.

Should you have any questions regarding this letter, please do not hesitate to contact this office.



J. A. Blair, P.Eng.
Project Foundation Engineer

for

D. Dundas, P.Eng.
Senior Foundation Engineer

JB/jb

cc: R. Purdy (1)
G. Todd (H. Herbrand) (1)
Files

Golder Associates Ltd.

2180 Meadowvale Boulevard
Mississauga, Ontario, Canada L5N 5S3
Telephone (416) 567-4444
Fax (416) 567-6561



August 26, 1992

921-1310

Cole, Sherman & Associates Ltd.
75 Commerce Valley Drive East
Thornhill, Ontario
L3T 7N9

Attention: Mr. C. Ricketts, P.Eng.

**RE: EXPANSION AND REALIGNMENT OF HIGHWAY 69
MACTIER TO NOBEL
PARRY SOUND DISTRICT, ONTARIO**

Dear Sirs:

As requested, this letter summarizes and provides clarification of specific aspects of the proposed embankment construction outlined in our letter dated July 29, 1992. Consideration has also been given to the revised embankment heights as provided in the facsimile from McCormick Rankin dated August 4, 1992. This letter should be read in conjunction with the above noted letter which summarizes the results of stability and settlement assessments of the proposed embankments at three swamp crossings.

Swamp 45 (Nobel Marsh)

The proposed embankment, with maximum height of 3 m, is considered to have an adequate factor of safety against failure. The organic deposits, maximum depth measured of 0.7 m, should be removed prior to embankment construction.

Swamp 4 & 5 (Tourist Information Center Wetland)

The currently proposed highway embankment has a maximum height of 4 m. It is considered that this height of embankment can be constructed with removal of the organic deposits which were found to extend to depths of up to 4.5 m. Settlement of the embankment due to consolidation of the underlying soft silty clay could range from 0.5 m to 1 m depending on the consolidation characteristics of the deposit. Where the new embankment is in close proximity to the existing Highway 69, the excavation will have to be supported to prevent failure of the existing embankment.

A detailed geotechnical investigation should be carried out along the proposed road alignment at this swamp crossing to obtain more detailed strength and compressibility parameters of the deposits.

Cole, Sherman & Associates Ltd.
Mr. C. Ricketts, P. Eng.

-2-

August 26, 1992
921-1310

Swamp 30 (Portage Lake Swamp)

The currently proposed highway embankment has a maximum height of 11 m. It is estimated that the maximum height of embankment which can be constructed (with removal of the organic deposits and without the use of stabilizing berms) is 5 m. The organic deposits which were found to extend to depths of up to 3 m at this site should be removed from beneath the embankment. Temporary support to the excavation during removal of the organics may be required where excavations are in close proximity to the existing Highway 69.

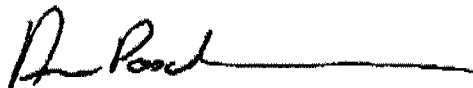
Stabilizing measures, such as the use of berms, will be required to construct the road embankment to heights greater than 5 m. A significant width of berm may be required and there would be benefits to keeping the northbound and southbound embankments relatively close such that the central berm can act as a common stabilizer. There would also be benefit to shifting the road alignment such that the existing road embankment is utilized either as base support (depending on the extent of the subexcavation carried out) or as part of the berm. Settlement of the proposed 11 m high embankment due to consolidation of the underlying silty clay deposit could range from 0.5 m to 1 m depending on the consolidation characteristics of the deposit.

A detailed geotechnical investigation should be carried out along the proposed road alignment at this swamp crossing to obtain more detailed strength and compressibility parameters of the deposits and to delineate the extent of the existing road embankment fill.

We trust that this letter is sufficient for your immediate requirements. Please contact us if further clarification of the information provided is required.

Yours truly,

GOLDER ASSOCIATES LTD.



A. S. Poschmann, P.Eng.
ASP/pds

cc: McCormick Rankin - Attention: Mr. N.F. Ahmed, P.Eng.

Golder Associates

2180 Meadowvale Boulevard
Mississauga, Ontario, Canada L5N 5S3
Telephone (416) 567-4444
Fax (416) 567-6861



July 29, 1992

921-1310

Cole, Sherman & Associates Ltd.
75 Commerce Valley Drive East
Thornhill, Ontario
L3T 7N9

Attention: Mr. C. Ricketts, P.Eng.

**RE: EXPANSION AND REALIGNMENT OF HIGHWAY 69
MACTIER TO NOBEL
PARRY SOUND DISTRICT, ONTARIO**

Dear Sirs:

Further to recent correspondence, this letter provides the information as requested by the Ontario Ministry of Transportation in their review of our draft report number 921-1310 dated May 1992.

We have addressed the three swamps (numbered 3/4 & 5, 30 and 45) as the critical areas and for each swamp have summarized the subsurface information obtained, the assumptions made for our analysis and the conclusions from the analysis. The main concerns were the question of whether the organic deposits and soft clay can safely be excavated, whether the proposed embankment could be built without failure and what settlement of the embankment could be expected.

Where field vane testing was carried out during the investigation to determine undrained shear strength of the soft deposits, a standard field vane sized for use in hand auger holes was used. The vane has been calibrated by the accepted method based on the dimensions of the vane.

Swamp 45 (Nobel Marsh)

Typically, the subsoils encountered within or near the proposed highway right-of-way consist of up to about 0.7 m of peat/organics underlain by about 0.5 m to 1.6 m of silt to clayey silt which is in turn underlain by soft silty clay. The silty clay deposit was found to extend to depths of up to about 7.3 m below ground surface. Field vane tests carried out in the silty clay deposit indicate undrained shear strengths ranging from 22 kPa to 31 kPa with an average of 28 kPa.

The proposed road embankment is about 3-m in height based on the plans and profiles provided. Subexcavation to the required maximum depth of 7.3 m is not considered feasible for road construction at this site. Preliminary estimates of settlement and stability of the proposed embankment were carried out using the following assumptions:

- a) subsurface conditions as encountered in Probehole 45-C5 with 1.7 m of sandy silt overlying 5.4 m of silty clay
- b) a range in compression index of 0.3 to 0.5 based on measured water contents of samples of the silty clay
- c) an undrained shear strength for the silty clay deposit of 22 kPa (the minimum value measured)

Assuming that the organic deposits will be removed from within the road embankment width, it is estimated that about 0.5 m of settlement of the proposed embankment could occur due to compression of the silty clay deposit. The stability of the proposed embankment is considered adequate with a Factor of Safety against base failure greater than 1.5.

Swamp 4 & 5 (Tourist Information Centre Wetland)

Typically, the subsoils encountered close to the proposed highway centreline (close to the existing Highway 69) consist of about 0.6 m to 2.8 m of peat/organics underlain by soft silty clay. Refusal to auger penetration along the proposed centreline was encountered at depths of 0.6 m to 5.5 m. To the southwest of the centreline within the right of way, about 3.5 m to 5.8 m of peat was encountered underlain by soft silty clay deposit which was found to extend to up to 7.2 m depth.

The proposed road embankment is about 6 m in height based on the plans and profiles provided. The proposed roadway extends in close proximity to the existing Highway 69 road embankment which is about 4 m high above the general ground surface in the swamp. Subexcavation of the soft deposits to the required maximum depth of 7.2 m is not considered feasible for road construction at this site. Consideration could be given to subexcavation of the peat deposit. Preliminary estimates of settlement and stability of the proposed embankment were carried out using the following assumptions:

- a) subsurface conditions as encountered in Probehole W-6 with 4.5 m of peat overlying 4.0 m of silty clay
- b) for the peat:
compression index equal to 12, initial void ratio equal to 16 and undrained shear strength equal to 10 kPa based on the measured organic content of 55 % and water contents of 1000 to 1100 %
- c) for the silty clay:
compression index equal to 1.4, initial void ratio equal to 1.7 and undrained shear strength equal to 10 kPa based on the measured water contents of 100 to 150 %, liquid limit of 64 % and plasticity index of 29.

Without prior base preparation and support, the proposed 6 m high embankment would not be stable with respect to base failure and the settlements would be significant (greater than 3 m) without removal of the peat deposit. The maximum height of embankment which could be constructed without any subgrade preparation is estimated to be 3 m to 4 m. Assuming that the organic deposits were removed from within the road embankment width, it is estimated that about 1.5 m of settlement of the proposed embankment could occur due to consolidation of the underlying silty clay. The stability of the existing Highway 69 embankment is of concern, however, where subexcavation is carried out in close proximity. The subexcavation would have to be carried out within a supported excavation with temporary support (such as steel sheetpiling) installed between the existing and proposed embankments.

Consideration could be given to moving the proposed roadway closer to the existing such that the greater depths of soft clay are avoided. Consideration could be given to a combination of subexcavation of the organic deposit and overbuilding the embankment to minimize post construction settlements. The stability of the proposed surcharged embankment would have to be checked and berms would likely be required to stabilize the embankment.

It is recommended that further subsurface investigation be carried out in this swamp area to obtain shear strength data within the swamp and to establish the subsoil conditions under the edge of the existing highway embankment. A drill rig would be required to advance through the existing embankment fills and to confirm the nature of the subsoils at depth.

Swamp 30 (Portage Lake Marsh)

Typically, the subsoils encountered close to the proposed highway centreline (close to the existing Highway 69) consist of about 2 m to 3.5 m of silt, sand and/or stiff silty clay underlain by soft silty clay. The deposits overlying the clay are probably road embankment fill materials. Outside of this fill area and within the proposed road right-of-way, about 1.8 m to 3 m of peat was encountered overlying soft silty clay. The silty clay deposit within the road right-of-way was found to be greater than 6 m in depth. Field vane tests carried out in the silty clay deposit indicate undrained shear strengths ranging from 21 kPa to 25 kPa.

The proposed road embankment varies from about 9 m to 11 m in height based on the plans and profiles provided. The proposed roadway extends in close proximity to the existing Highway 69 road embankment which is about 4 m high above the general ground surface in the swamp. Since the organic/silty clay deposits extend to depths in excess of 6 m, subexcavation of the soft deposits is not considered feasible for road construction at this site. It appears that the organic deposits have been removed during construction of the existing road. Consideration could be given to further subexcavation of the peat deposit for the new road construction. Preliminary estimates of settlement and stability of the proposed embankment were carried out using the following assumptions:

- a) subsurface conditions consisting of
 - i) 3 m of peat overlying 4 m of silty clay, and
 - ii) 2.5 m of sand/silt fill overlying 4.5 m of silty clay

Cole, Sherman & Associates Ltd.
Mr. C. Ricketts, P. Eng.

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July 29, 1992
921-1310

- b) for the peat:
compression index equal to 12 and initial void ratio equal to 16 based on the organic content and water content measurements from samples in other swamp areas
- c) for the silty clay:
compression index equal to 0.5 and initial void ratio equal to 0.9 based on the measured water contents and Atterberg Limits test results; undrained shear strength equal to 21 kPa (based on the measured values)

Without prior base preparation and support, the proposed 11 m high embankment would not be stable with respect to base failure and the settlements would be significant (about 3 m) without removal of the peat. The peat deposit should be removed in order to minimize differential settlements across the embankment width. Due to the proximity of the existing Highway 69 embankment, temporary support to the excavation may be required during removal of the organic deposits.

The maximum height of embankment which could be constructed under these conditions is estimated to be 5 m and it is estimated that about 0.7 m of settlement of the proposed embankment could occur due to consolidation of the underlying silty clay. For an embankment with height greater than 5 m, the stability can be increased by constructing berms. The existing road embankment could serve this purpose on one side of the proposed road. There is insufficient data available at this time to investigate the required configuration of the berms.

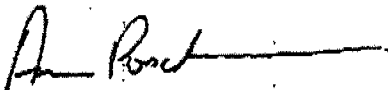
It is recommended that sampled boreholes (advanced using a drill rig) be put down in this swamp area to obtain further shear strength data and to establish the subsoil conditions under the edge of the existing highway embankment.

It should be noted that the estimates of embankment settlement given in this letter are based on published correlations with routine laboratory test results (water content and plasticity). More detailed borehole sampling and laboratory consolidation tests would be required to obtain better predictions of anticipated settlement.

We trust that this letter is sufficient for your immediate requirements. Should you require further clarification regarding the recommendations given above, please do not hesitate to contact us.

Yours truly,

GOLDER ASSOCIATES LTD.



A. S. Poschmann, P. Eng.
ASP/pds

cc: McCormick Rankin - Attention: Mr. N. Ahmad

PROBEHOLE LOCATION PLAN SWAMP No. 7 AND 8

FIGURE 8

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- PROPOSED HIGHWAY 69 CENTRELINE

Swamp 7

C1: 0.0 m - 0.40 m 0.40 m - 0.70 m 0.70 m - 1.0 m 1.0 m: Auger refusal (prob. B/R) End of hole	Lac. dk. brn. org. sand. So. brn. clay silt. sm. sand. Dus. clay. sty. sand. 2.80 m: Auger refusal (prob. B/R) End of hole	W5: 0.0 m - 1.60 m 1.60 m - 2.80 m 2.80 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Lac. grey sty. sand. sm. sty. 2.80 m: Auger refusal (prob. B/R) End of hole
C2: 0.0 m - 3.50 m 3.50 m: Auger refusal (prob. B/R) End of hole	So. dk. grey org. silt. So. dk. grey org. silt. sm. sand. 2.80 m - 3.10 m: So. grey sty. clay. 3.10 m: Auger refusal (prob. B/R) End of hole	W6: 0.0 m - 2.80 m 2.80 m - 3.10 m: So. grey sty. clay. 3.10 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. So. grey sty. clay. 3.10 m: Auger refusal (prob. B/R) End of hole
C3: 0.0 m - 1.30 m 1.30 m - 1.70 m 1.70 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Com. to lac. grey sty. sand. 1.70 m: Auger refusal (prob. B/R) End of hole	W7: 0.0 m - 3.0 m 3.0 m - 6.0 m 6.0 m: End of hole	So. grey org. clay. silt. sm. pt. Lac. grey silt to sty. silt. tr. clay. 6.0 m: End of hole
W1: 0.0 m - 5.50 m 5.50 m - 6.30 m 6.30 m: End of hole	So. dk. grey org. silt. So. grey sty. clay. 6.30 m: End of hole	W8: 0.0 m - 4.3 m 4.3 m - 7.2 m 7.2 m: End of hole	So. dk. brn. pt., sm. org. clay. silt. Lac. grey silt to sty. silt. tr. clay. 7.2 m: End of hole
W2: 0.0 m - 2.0 m 2.0 m - 4.0 m 4.0 m - 6.20 m 6.20 m: End of hole	Lac. brn. sand. tr. roots. So. dk. grey org. silt to org. sty. sand. So. grey sty. clay. 6.20 m: End of hole	W9: 0.0 m - 3.9 m 3.9 m - 4.9 m 4.9 m - 5.30 m 5.30 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt., sm. org. silt. So. grey sty. clay. Lac. grey sty. silt. tr. clay. 5.30 m: Auger refusal (prob. B/R) End of hole
W3: 0.0 m - 1.20 m 1.20 m - 2.40 m 2.40 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Com. dk. grey sty. silt. 2.40 m: Auger refusal (prob. B/R) End of hole	W10: 0.0 m - 2.7 m 2.7 m - 3.30 m 3.30 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt., sm. org. clay. silt. So. brn. grey sty. clay. 3.30 m: Auger refusal (prob. B/R) End of hole
W4: 0.0 m - 2.10 m 2.10 m - 2.40 m 2.40 m - 2.90 m 2.90 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. So. grey sty. clay. Lac. grey sty. sand. tr. org. 2.90 m: Auger refusal (prob. B/R) End of hole	W11: 0.0 m - 0.70 m 0.70 m - 1.80 m 1.80 m - 2.0 m 2.0 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Lac. to com. grey sty. sand. v. st. brn. clay. silt. sm. sand. 2.0 m: Auger refusal (prob. B/R) End of hole

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

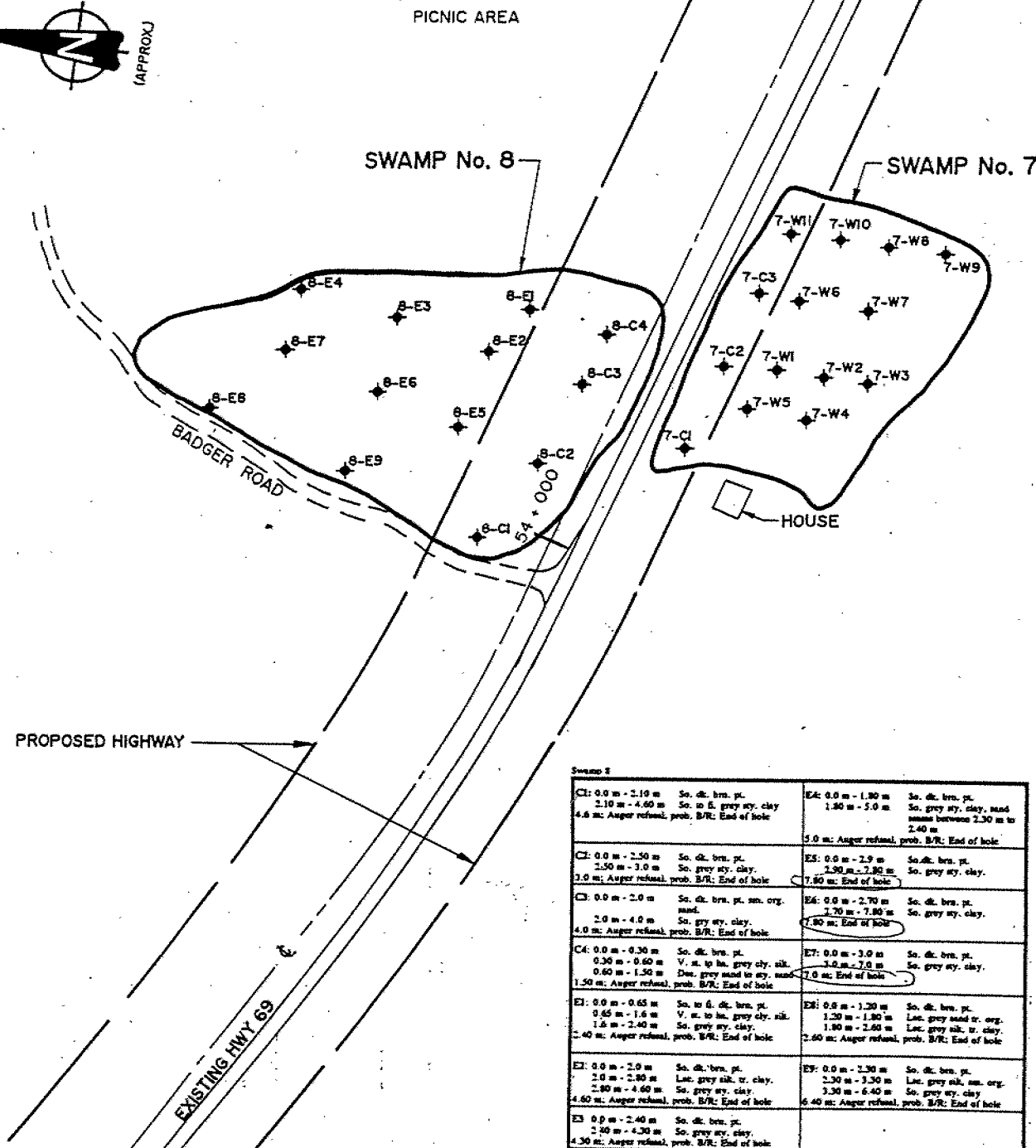
DRAFT

SCALE 1: 2,500 (APPROX.)

Golder Associates

Date: MAR 7, 1992
Project: 921-1310

Drawn: DV
Chkd: _____



Swamp 8

C1: 0.0 m - 2.10 m 2.10 m - 4.60 m 4.6 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. So. dk. grey sty. clay 4.6 m: Auger refusal (prob. B/R) End of hole	E4: 0.0 m - 1.80 m 1.80 m - 5.0 m 5.0 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. So. grey sty. clay, sand same between 2.30 m to 2.40 m 5.0 m: Auger refusal (prob. B/R) End of hole
C2: 0.0 m - 2.50 m 2.50 m - 3.0 m 3.0 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. So. grey sty. clay. 3.0 m: Auger refusal (prob. B/R) End of hole	E5: 0.0 m - 2.9 m 2.90 m - 2.80 m 2.80 m: End of hole	So. dk. brn. pt. So. grey sty. clay. 2.80 m: End of hole
C3: 0.0 m - 2.0 m 2.0 m - 4.0 m 4.0 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. sm. org. sand. So. grey sty. clay. 4.0 m: Auger refusal (prob. B/R) End of hole	E6: 0.0 m - 2.70 m 2.70 m - 7.80 m 7.80 m: End of hole	So. dk. brn. pt. So. grey sty. clay. 7.80 m: End of hole
C4: 0.0 m - 0.30 m 0.30 m - 0.60 m 0.60 m - 1.50 m 1.50 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. V. st. to br. grey clay. silt. Dus. grey sand to sty. sand. 1.50 m: Auger refusal (prob. B/R) End of hole	E7: 0.0 m - 3.0 m 3.0 m - 7.0 m 7.0 m: End of hole	So. dk. brn. pt. So. grey sty. clay. 7.0 m: End of hole
E1: 0.0 m - 0.65 m 0.65 m - 1.6 m 1.6 m - 2.40 m 2.40 m: Auger refusal (prob. B/R) End of hole	So. to dk. brn. pt. V. st. to br. grey clay. silt. So. grey sty. clay. 2.40 m: Auger refusal (prob. B/R) End of hole	E8: 0.0 m - 1.20 m 1.20 m - 1.80 m 1.80 m - 2.40 m 2.40 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Lac. grey sand tr. org. Lac. grey silt. tr. clay. 2.40 m: Auger refusal (prob. B/R) End of hole
E2: 0.0 m - 2.0 m 2.0 m - 2.80 m 2.80 m - 4.60 m 4.60 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Lac. grey silt. tr. clay. So. grey sty. clay. 4.60 m: Auger refusal (prob. B/R) End of hole	E9: 0.0 m - 2.30 m 2.30 m - 3.30 m 3.30 m - 6.40 m 6.40 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. Lac. grey silt. sm. org. So. grey sty. clay. 6.40 m: Auger refusal (prob. B/R) End of hole
E3: 0.0 m - 2.40 m 2.40 m - 4.30 m 4.30 m: Auger refusal (prob. B/R) End of hole	So. dk. brn. pt. So. grey sty. clay. 4.30 m: Auger refusal (prob. B/R) End of hole		

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

CREEK

BADGER ROAD
(CLOSED)

CREEK

260

250

240

220

210

200

K=120

-0.6%

+1.2%

6m

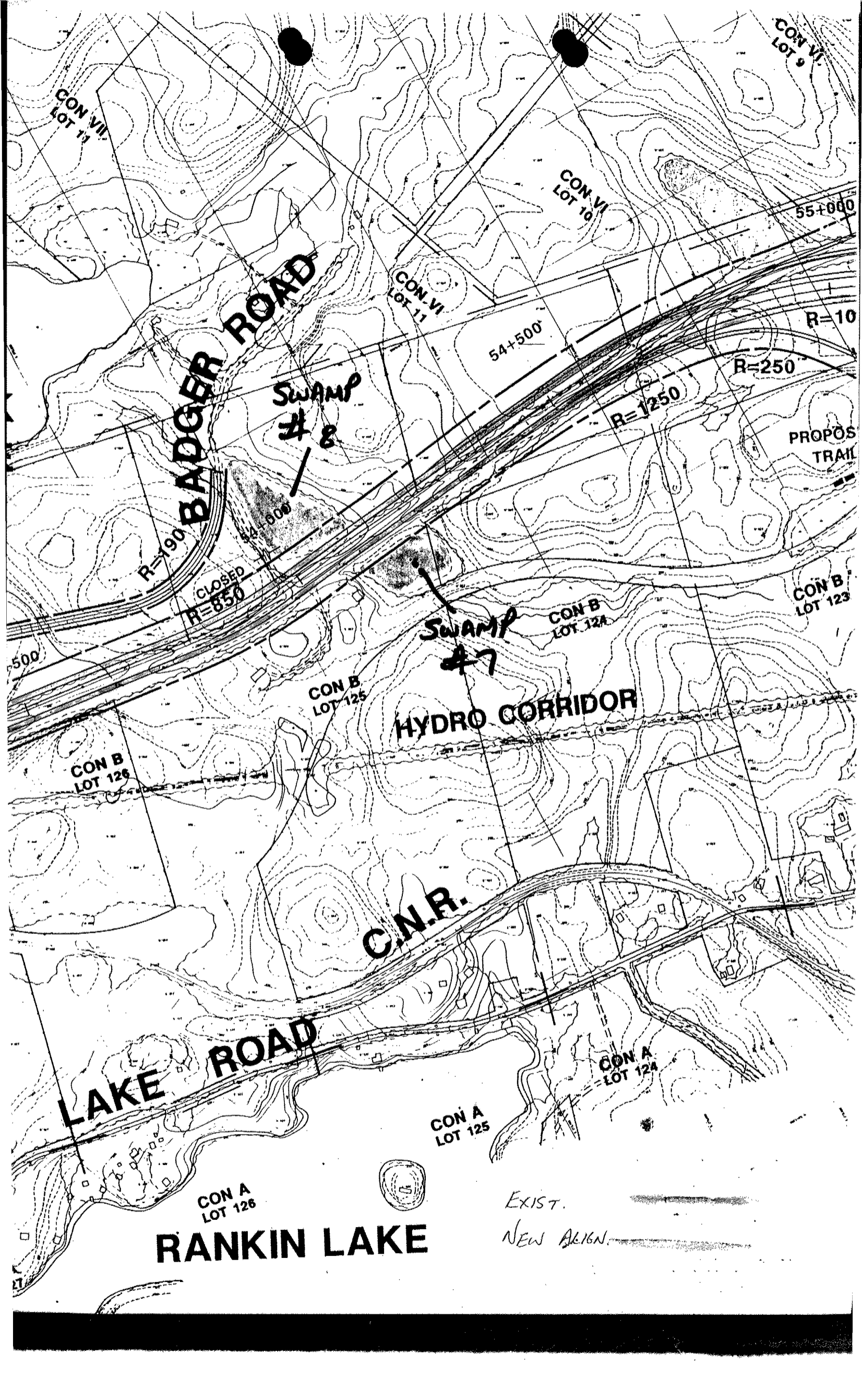
GRADE
EXISTING
HIGHWAY 69

K=120

FILE HEIGHT @ NBL
SWAMP #8

POINT A1/A3a 53+000

54+000



CON VI LOT 9

CON VII LOT 11

CON VI LOT 10

CON VI LOT 11

55+000

54+500

BADGER ROAD

SWAMP #8

R=10

R=250

R=1250

PROPOS TRAIL

CON B LOT 123

CON B LOT 124

CON B LOT 125

SWAMP #7

HYDRO CORRIDOR

CON B LOT 126

C.N.R.

LAKE ROAD

CON A LOT 124

CON A LOT 125

CON A LOT 126

RANKIN LAKE

EXIST.

NEW ALIGN.

PROBEHOLE LOCATION PLAN

SWAMP No. 6

FIGURE 7

LEGEND



APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER

APPROXIMATE EXTENT OF SWAMP

PROPOSED HIGHWAY 69 RIGHT-OF-WAY

PROPOSED HIGHWAY 69 CENTRELINE

Swamp 6

C1: 0.0 m - 0.1 m 0.10 m - 1.20 m 1.2 m; Auger refusal	So. dk. brn. pt. V. st. to ha. brn. cly. silt. prob. B/R; End of hole	E5: 0.0 m - 0.70 m 0.70 m - 1.90 m 1.90 m - 2.50 m 2.50 m; End of hole	So. dk. brn. pt. Inter'd com. to dsc. grey sty. sand and cly. silt. so. brn. grey sty. clay.
C2: 0.0 m - 2.60 m 2.60 m - 3.50 m 3.50 m; End of hole	So. dk. brn. pt. So. grey sty. clay.	E6: 0.0 m - 0.90 m 0.90 m - 2.0 m 2.0 m - 3.20 m 3.20 m - 3.40 m 3.40 m; Auger refusal	So. dk. brn. pt. Inter'd com. to dsc. grey sty. sand and cly. silt. So. brn. grey sty. clay. Dsc. grey sand and gravel. prob. B/R; End of hole
C3: 0.0 m - 2.10 m 2.10 m - 3.60 m 3.60 m; Auger refusal	So. dk. brn. pt. So. grey sty. clay prob. B/R; End of hole	E7: 0.0 m - 0.70 m 0.70 m - 1.20 m 1.20 m; Auger refusal	So. dk. brn. pt. Dsc. grey sty. sand, tr. clay prob. B/R; End of hole
E1: 0.0 m - 2.80 m 2.80 m - 4.50 m 4.50 m - 4.80 m 4.80 m; End of hole	So. dk. brn. pt. So. grey st. clay, sm. sand scams. Lsc. gry silt, tr. clay.	Hole No. Depth (m) Shear Strength (kPa)	
E2: 0.0 m - 1.30 m 1.30 m - 1.95 m 1.95 m - 2.25 m 2.25 m - 3.20 m 3.20 m; Auger refusal	So. dk. brn. pt. Lsc. grey sty. sand. So. brn. grey sty. clay Dsc. brn. ady. silt, sm. clay prob. B/R; End of hole	6-C3	2.2 19.1 2.3 14.3 2.4 12.9 2.5 13.8 2.6 16.7 2.7 15.3
E3: 0.0 m - 1.20 m 1.20 m; Hard augering; End of hole	V. st. to ha. grey brn. cly. silt, sm. sand.	6-E5	2.2 20.6 2.3 20.6 2.4 23.9 2.5 17.2
E4: 0.0 m - 0.50 m 0.50 m - 1.0 m 1.0 m; Auger refusal	Lsc. grey sty. sand, sm. org. Lsc. grey sty. sand. prob. B/R; End of hole		

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

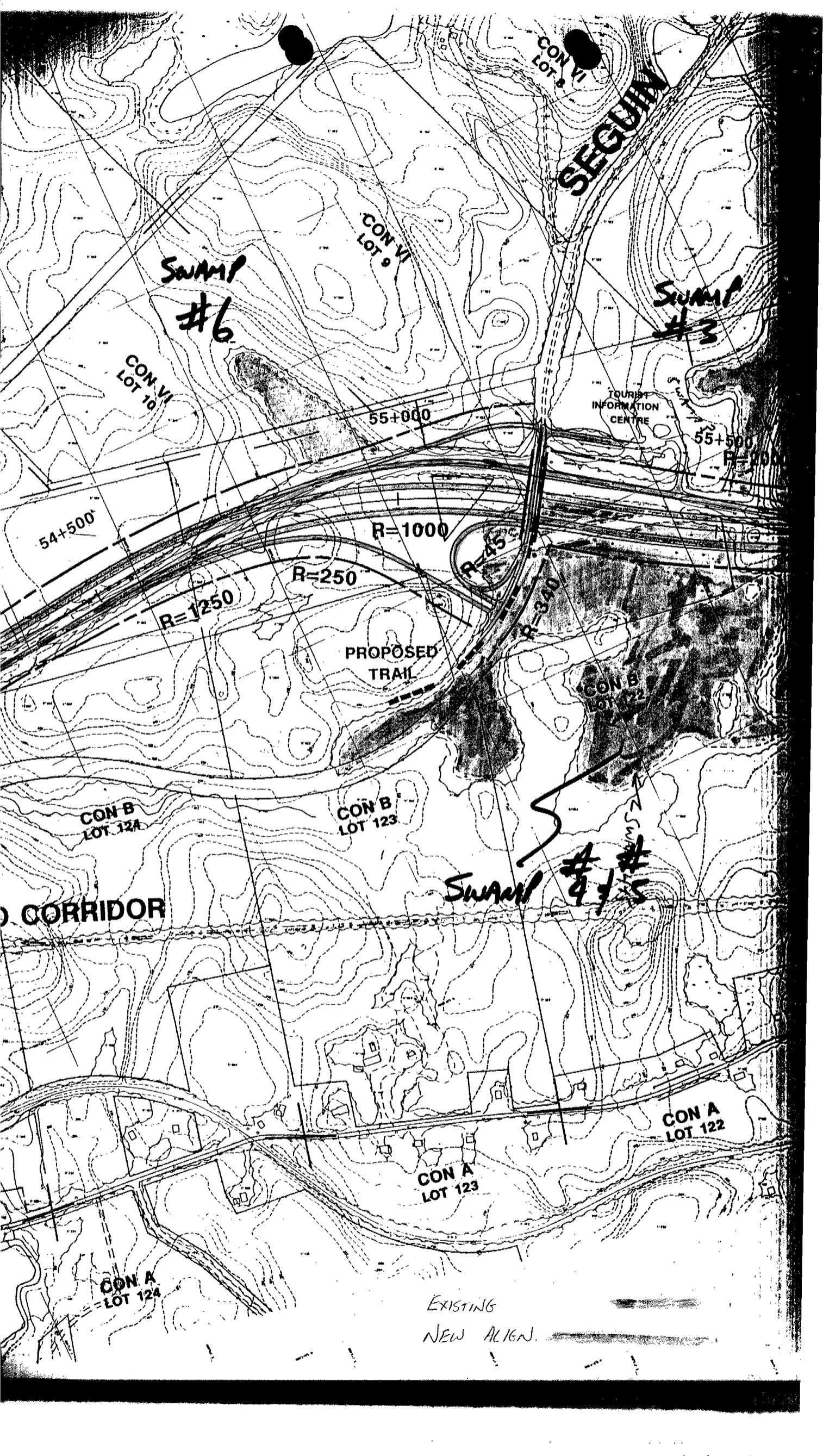
DRAFT

SCALE 1: 2,500 (APPROX.)

Date: MAR / 1992
Project: 921-1310

Golder Associates

Drawn: DV
Chkd: _____



SWAMP #6

SWAMP #3

SWAMP #4 & #5

CORRIDOR

PROPOSED TRAIL

TOURIST INFORMATION CENTRE

SEGUIN

CON VI LOT 9

CON VI LOT 10

CON VI LOT 11

CON B LOT 124

CON B LOT 123

CON B LOT 122

CON A LOT 123

CON A LOT 122

CON A LOT 124

EXISTING
NEW ALIGN.

GER ROAD
CLOSED)

INFORMATION CENTRE
ENTRANCE (CLOSED)

Φ
CREEK

Φ
CREEK

260

250

240

+1.2%

230

K=120

-0.7%

K=80

+3.0%

FILL HEIGHT = 3m ±

VICINITY
OF
SWAMP #6

SWAMP #3 4 5

220

210

200

547000

551000

FAX 416-235-5240

FAXGRAM

REPORTATION
CASE TYPE

DATE

92 06 16

PAGE

1 OF 5

TO: Dave Dunbar
Foundations Section Newfoundland

FROM: Ron Purdy
Geotechnical Engineering Section
Northern Region

SUBJECT: SWAMP PROBLEM LOCATIONS HWY. 69 ROUTE PLANNING STUDY
FROM FORT Mc TIGR TO HWY. 559

ATTACHES ARE COPIES OF 3 SITES (SWAMP 3, 475, SWAMP 30
AND SWAMP 45) WHICH WE WOULD LIKE TO DISCUSS WHEN
YOU ARE IN THE REGION ON JUNE 19/92

PLEASE INFORM ME IN THE FAX ON THE PROGRESS
RESULTS IS NOT CLEAR AS I CAN FAX AN ENLARGEMENT
OF THESE RESULTS

PROBEHOLE LOCATION PLAN SWAMP No. 3, 4 AND 5

FIGURE 6

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp No. 3.

E1: 0.0 m - 1.40 m 1.4 m - 3.30 m 3.30 m - 4.30 m 4.30 m: End of hole	Loc. dk. brn. sand to silty, silty, med. clay. Loc. grey silty, med. sand. So. grey silty clay.
E2: 0.0 m - 0.50 m 0.50 m - 2.50 m 2.50 m: End of hole	So. dk. brn. pt. So. brn. grey silty clay.
E3: 0.0 m - 0.50 m 0.50 m - 0.80 m 0.80 m - 2.40 m 2.40 m: End of hole	So. dk. brn. pt. Loc. grey silty, sand. So. grey silty clay.
E4: 0.0 m - 6.4 m 6.40 m - 3.10 m 3.10 m: Auger refusal, prob. B/C; End of hole	Core to dec. grey org. mud. Fg. to silty grey brn. silty dk.
E5: 0.0 m - 1.00 m 1.00 m - 4.0 m 4.0 m: End of hole	So. dk. brn. pt. So. grey silty clay.

Notes: (1) All soil depths measured from ground surface.
(2) Water level depth varies from 0.70 m to 3.5 m above ground surface.

Swamp No. 4 & 5

C1: 0.0 m - 1.5 m 1.5 m - 3.30 m 3.3 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. So. grey silty clay. Loc. sand and gravel.	W2: 0.0 m - 0.5 m 0.5 m - 7.0 m 7.0 m: End of hole	So. dk. brn. pt. So. grey silty clay.
C2: 0.0 m - 1.1 m 1.1 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. So. grey silty clay.	W3: 0.0 m - 5.00 m 5.00 m - 4.5 m 4.5 m - 5.6 m 5.6 m - 5.9 m 5.9 m: End of hole	So. dk. brn. pt. Loc. grey silty, med. clay. So. grey silty clay. Loc. grey silty, sand.
C3: 0.0 m - 3.8 m 3.8 m - 4.90 m 4.90 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. So. grey silty clay.	W4: 0.0 m - 4.90 m 4.90 m - 6.5 m 6.5 m - 7.0 m 7.0 m: End of hole	So. dk. brn. pt. So. grey silty clay.
C4: 0.0 m - 1.40 m 1.40 m - 2.80 m 2.80 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. So. grey silty clay.	W5: 0.0 m - 6.00 m 6.00 m - 7.90 m 7.90 m: End of hole	So. dk. brn. pt. So. med. brn. grey silty clay.
C5: 0.0 m - 2.80 m 2.80 m - 3.40 m 3.40 m - 3.50 m 3.50 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. Fg. dk. grey org. silty, silty. So. grey silty clay.	W6: 0.0 m - 4.30 m 4.30 m - 6.20 m 6.20 m: End of hole	So. dk. brn. pt. So. grey silty clay.
C6: 0.0 m - 2.30 m 2.30 m - 2.50 m 2.50 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. Loc. grey silty, med. clay.	W7: 0.0 m - 3.1 m 3.1 m - 3.0 m 3.0 m - 5.2 m 5.2 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. So. grey silty clay. Loc. grey silty, sand.
C7: 0.0 m - 0.80 m 0.80 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt.	W8: 0.0 m - 3.50 m 3.50 m: End of hole	So. dk. brn. pt. So. grey silty clay.
W9: 0.0 m - 5.5 m 5.5 m - 7.2 m 7.2 m - 8.0 m 8.0 m: Auger refusal, prob. B/C; End of hole	So. dk. brn. pt. So. grey silty clay. Loc. grey silty, med. sand, gravel.	W10: 0.0 m - 4.4 m 4.4 m - 5.1 m 5.1 m - 6.3 m 6.3 m: End of hole	So. dk. brn. pt. Loc. dk. grey silty, silty. So. grey silty clay.

Notes: (1) All soil depths measured from ground surface.
(2) All water levels at ground surface.

SCALE 1 : 2,500 (APPROX.)

Golder Associates

DRAFT

Drawn: DV
Checked: CHM

Date: MAR / 1992
Project: 92-1310

NOTES:
1/ EXISTING HWY. 69 TO REMAIN OPEN TO N/B + S/B TRAFFIC DURING CONSTRUCTION.
2/ NEW CONCR. OR PETH N/B + S/B LANES
3/ 30M MEDIAN
4/ HT. OF FILL APPROX. 4M



PROPOSED HIGHWAY

SWAMP No. 3

PARRY SOUND
INFORMATION
CENTRE

EXISTING HWY 69

SWAMP No. 4 & 5

SEGUN TRAIL

PROBEHOLE LOCATION PLAN SWAMP No. 30

FIGURE 12

LEGEND



APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER



APPROXIMATE EXTENT OF SWAMP

— — — PROPOSED HIGHWAY 69 RIGHT-OF-WAY

- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 30

C1: 0.0 m - 0.30 m 0.30 m - 2.0 m 2.0 m; End of hole	Lac. brn. sty. sand. St. to br. brn. clay. silt.	E5: 0.0 m - 0.70 m 0.70 m - 1.20 m 1.20 m - 2.50 m 2.50 m; End of hole	So. dk. brn. pt. Fi. to so. grey clay. silt. sm. org. So. grey sty. clay.	
C2: 0.0 m - 2.60 m 2.60 m - 3.0 m 3.0 m - 3.5 m 3.5 m - 6.0 m 6.0 m; End of hole	Fi. brn. grey silt (FILL) Fi. grey sty. clay. Lac. brn. sdy. silt. So. to fi. grey sty. clay.	E6: 0.0 m - 0.90 m 0.90 m - 3.0 m 3.0 m; Auger refusal, prob. B/R; End of hole	So. dk. grey. org. clay. silt. Fi. grey brn. sty. clay. So. brn. sty. clay.	
C3: 0.0 m - 0.60 m 0.60 m - 2.60 m 2.60 m - 3.50 m 3.50 m - 4.90 m 4.90 m; End of hole	Lac. dk. brn. sty. sand, sm. org. Lac. grey sty. sand. St. to v. st. grey sty. clay. So. grey sty. clay.	E7: 0.0 m - 0.60 m 0.60 m - 1.10 m 1.10 m - 2.30 m 2.30 m; Auger refusal, prob. B/R; End of hole	So. dk. brn. pt. Fi. to st. brn. grey sty. clay So. brn. grey sty. clay. prob. B/R; End of hole	
C4: 0.0 m - 1.0 m 1.0 m - 2.0 m 2.0 m - 4.70 m 4.70 m; End of hole	Lac. dk. grey. org. sand Lac. grey sdy. silt to silt. So. grey sty. clay.	E8: 0.0 m - 0.60 m 0.60 m - 2.0 m 2.0 m - 3.20 m 3.20 m; End of hole	Fi. grey org. clay. silt. Fi. to st. brn. clay. silt, sm. sdy. silt layers. So. brn. sty. clay.	
E1: 0.0 m - 3.0 m 3.0 m - 4.90 m 4.90 m; End of hole	So. dk. brn. pt. So. grey sty. clay.	E9: 0.0 m - 1.80 m 1.80 m - 2.50 m 2.50 m - 4.0 m 4.0 m; End of hole	So. dk. brn. pt. So. grey org. clay. silt So. grey sty. clay.	
E2: 0.0 m - 0.6 m 0.6 m - 1.9 m 1.90 m; End of hole	Fi. brn. grey sty. clay, tr. org. So. grey sty. clay.	E10: 0.0 m - 3.0 m 3.0 m - 5.0 m 5.0 m - 5.5 m 5.5 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. So. grey sty. clay. Comp. grey sand.	
E3: 0.0 m - 0.5 m 0.5 m - 0.9 m 0.9 m - 2.4 m 2.40 m; End of hole	Fi. brn. grey sty. clay, sm. org. Fi. brn. clay. silt. So. grey sty. clay.	E11: 0.0 m - 1.30 m 1.30 m - 2.10 m 2.10 m - 3.70 m 3.70 m - 4.30 m 4.30 m; Auger refusal; prob. B/R; End of hole	So. dk. brn. pt. Comp. grey sand to sty. sand. So. grey sty. clay. Comp. grey sand.	
E4: 0.0 m - 2.50 m 2.50 m - 2.80 m 2.80 m - 5.10 m 5.10 m; End of hole	Lac. dk. brn. org. sdy. silt. Lac. grey silt, sm. clay. So. grey sty. clay.	Year Test Results		
		Hole No.	Depth (m)	Shear Strength (kPa)
		E10	1.70	20.6
			3.10	23.5
			3.90	24.9

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Notes: (1) All soil depths measured from ground surface.
(2) Waterline depth varies from 8.0 m to 0.6 m above ground surface.

Date: MAR / 1992
Project: 921-1310

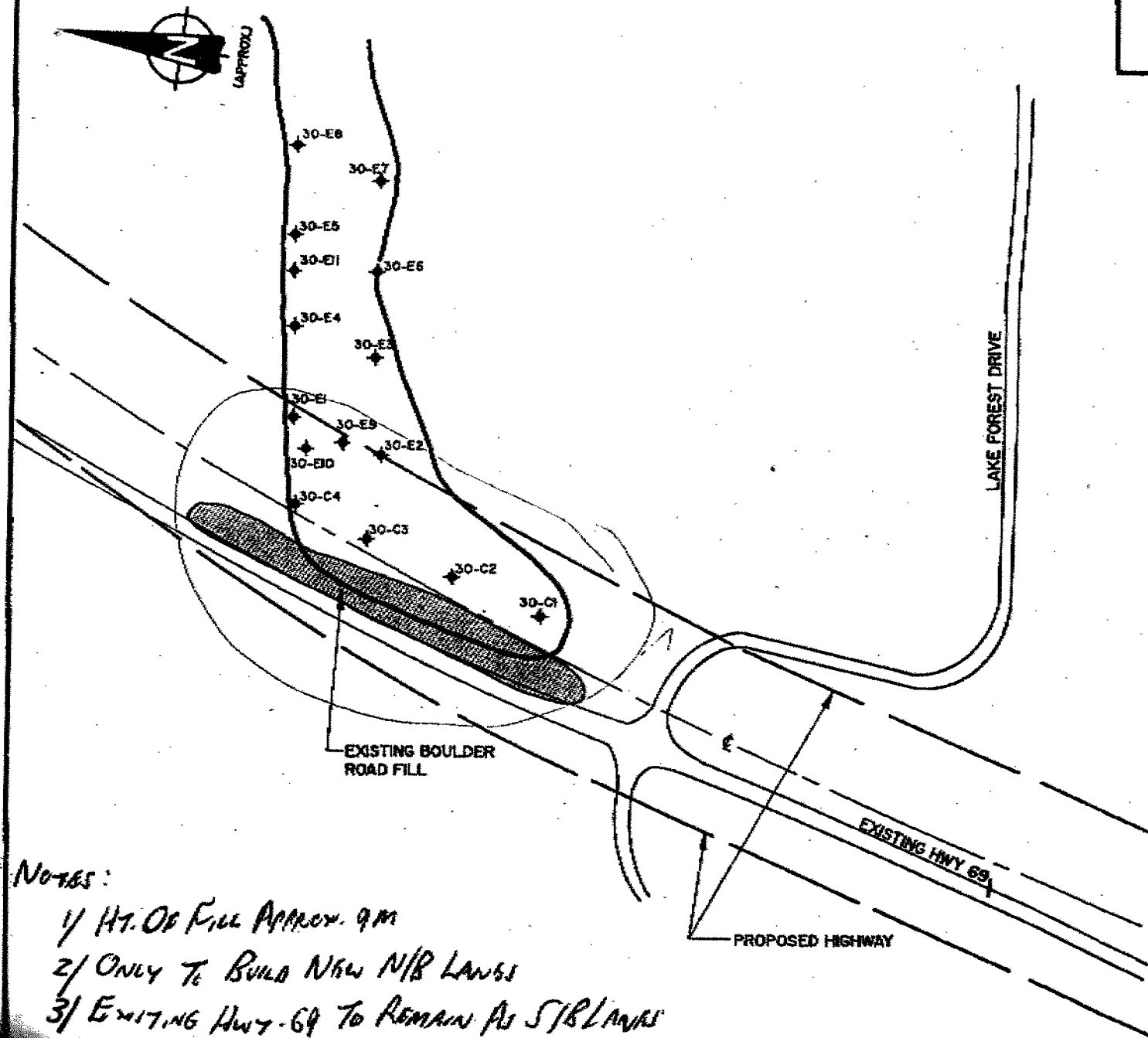
SCALE 1:2,500 (APPROX)
Golder Associates

Drawn: DV
Chkd: _____

NOTES:

- 1/ Ht. Of Fill APPROX. 9m
- 2/ ONLY TO BUILD NEW N/R LANES
- 3/ EXISTING HWY. 69 TO REMAIN AS S/R LANES
- 4/ 30 m MEDIAN

EXISTING HWY. 69 FILL HAS BEAMS (SEE ATTACHED SHEET 20 FOR
CONST. OF EXISTING FILL ON HWY. 69 (STA 17+100))



PROBEHOLE LOCATION PLAN SWAMP No. 45

FIGURE 13

LEGEND

- ◆ APPROXIMATE PROBEHOLE LOCATION AND IDENTIFICATION NUMBER
- APPROXIMATE EXTENT OF SWAMP
- PROPOSED HIGHWAY 69 RIGHT-OF-WAY
- - - PROPOSED HIGHWAY 69 CENTRELINE

Swamp 45

C1: 0.0 m - 0.5 m 0.45 m - 1.45 m 1.40 m - 1.80 m 2.30 m - 1.70 m 1.70 m - 1.55 m 5.85 m: Auger refusal; push. 50% End of hole	Loc. dk. gray org. silt. sh. So. to E. med. silt. clay to sh. St. gray silt. sh. St. gray silt. clay. Dk. gray sand	E3: 0.0 m - 0.40 m 0.40 m - 1.15 m 1.15 m - 1.70 m 1.70 m: End of hole	So. dk. brn. pt. Cm. brn. silt. sh. St. dk. to gray silt. clay
C2: 0.0 m - 0.30 m 0.30 m - 1.15 m 1.15 m - 2.40 m 2.40 m: End of hole	Loc. to west. dk. gray org. silt. sh. Loc. to east. brn. silt. sh. to sh. Dk. gray silt. clay to silt. sh.	E4: 0.0 m - 0.45 m 0.45 m - 0.90 m 0.90 m - 1.60 m 1.60 m - 2.30 m 2.30 m: End of hole	So. dk. brn. pt. So. brn. silt. clay Cm. brn. silt. sh. St. to dk. gray silt. clay
C3: 0.0 m - 0.20 m 0.20 m - 1.80 m 1.80 m - 2.50 m 2.50 m: End of hole	Loc. dk. brn. org. silt. sh. Cm. brn. silt. sh. Dk. gray silt. clay.	E5: 0.0 m - 0.60 m 0.60 m - 1.30 m 1.30 m - 1.90 m 1.90 m: End of hole	So. dk. brn. pt. Cm. brn. silt. sh. St. to dk. gray silt. clay
C4: 0.0 m - 0.70 m 0.70 m - 1.30 m 1.30 m - 1.70 m 1.70 m: End of hole	Loc. dk. brn. org. silt. sh. Cm. brn. silt. sh. to sh. St. to dk. gray silt. clay to silt. sh.	E6: 0.0 m - 0.45 m 0.45 m - 1.50 m 1.50 m - 1.90 m 1.90 m - 2.40 m 2.40 m: End of hole	So. dk. brn. pt. Cm. brn. silt. sh. St. gray silt. clay. St. gray silt. clay.
C5: 0.0 m - 0.15 m 0.15 m - 1.50 m 1.50 m - 1.80 m 1.80 m: End of hole	So. dk. brn. pt. Cm. to dk. gray brn. silt. sh. St. gray silt. clay. St. gray silt. clay, med. sand	E7: 0.0 m - 0.30 m 0.30 m - 1.45 m 1.45 m - 2.0 m 2.0 m: End of hole	Loc. dk. brn. org. silt. sh. V. to brn. silt. clay St. gray silt. clay
C6: 0.0 m - 0.10 m 0.10 m - 1.10 m 1.10 m - 1.80 m 1.80 m: End of hole	So. dk. brn. pt. Cm. brn. silt. sh. St. yellow brn. silt. sh. St. gray silt. clay.	E8: 0.0 m - 0.45 m 0.45 m - 2.10 m 2.10 m - 2.80 m 2.80 m: End of hole	Loc. dk. brn. org. silt. sh. Cm. to brn. silt. sh. St. gray silt. clay.
E1: 0.0 m - 0.25 m 0.25 m - 1.30 m 1.30 m - 2.30 m 2.30 m: End of hole	So. dk. brn. pt. Loc. to east. gray silt. sh. to sh. St. gray silt. clay.	E9: 0.0 m - 0.30 m 0.30 m - 1.10 m 1.10 m - 1.50 m 1.50 m: End of hole	Loc. dk. brn. org. silt. sh. Cm. brn. silt. sh. St. brn. silt. clay.
E2: 0.0 m - 0.20 m 0.20 m - 1.10 m 1.10 m - 1.80 m 1.80 m: End of hole	So. dk. brn. pt. Loc. to west. gray silt. sh. to sh. St. brn. silt. clay. St. gray silt. clay.	E10: 0.0 m - 0.30 m 0.30 m - 0.75 m 0.75 m - 1.50 m 1.50 m: End of hole	St. dk. brn. silt. sh. Cm. brn. silt. sh. V. to E. brn. med. gray silt. clay

Swamp 45

Swamp 45

Probe No.	Depth (m)	Soil Strength (kPa)
C1	2.50	25.0
C2	2.50	25.0
C3	2.50	25.0
C4	2.50	25.0
C5	2.50	25.0
C6	2.50	25.0
E1	2.50	25.0
E2	2.50	25.0
E3	2.50	25.0
E4	2.50	25.0
E5	2.50	25.0
E6	2.50	25.0
E7	2.50	25.0
E8	2.50	25.0
E9	2.50	25.0
E10	2.50	25.0

DRAFT

SCALE 1:2,500 (APPROX.)

Date: MAR / 1992
Project: 921-1310

Golder Associates

Drawn: DV
Chd: _____

NOTES
1/ USE APPROX NEW & OF MEDIAN
2/ HT. OF FILL APPROX. 9 m
3/ NEW CENTER FOR BOTH N/R & S/R LANES
4/ 30 m MEDIAN

HOUSE No. 26

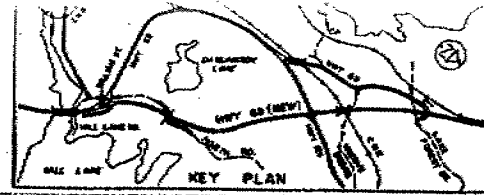
PROPOSED HIGHWAY

36' 000

34' 500



APPROX NEW &



METRIC

NOTE-DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.

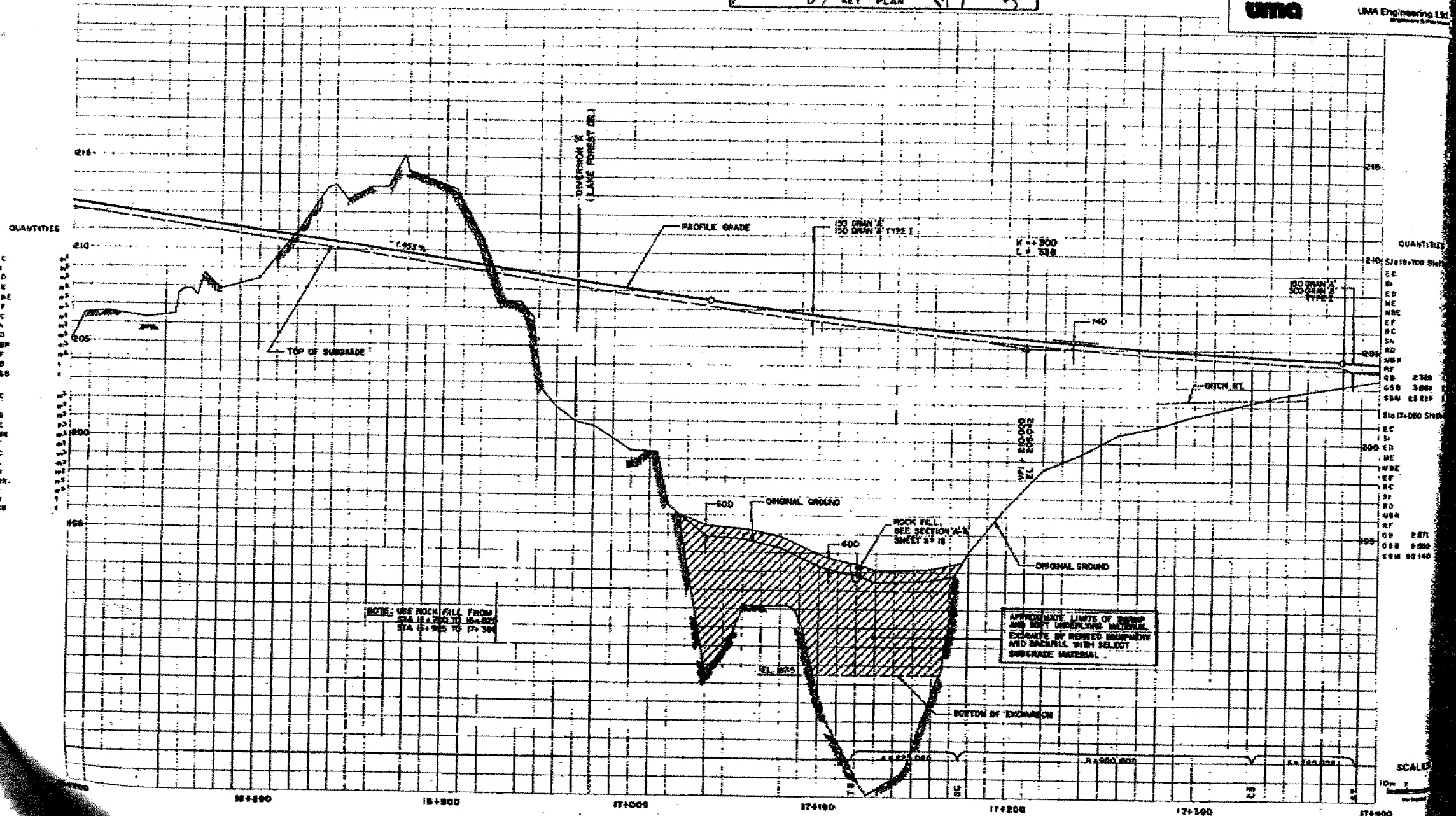
CONT No 89-228
WP No 74-77-01

NEW CONSTRUCTION
STA 16+700 TO STA 17+400
Survey June 79, Revised

SHEET
20

UMA

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SCALE



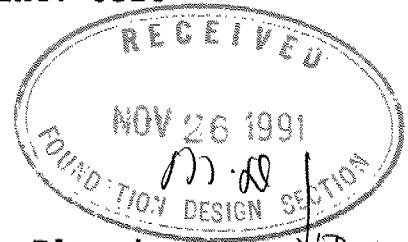
memorandum



To: M. Devata, Head
Foundation Design Section
Engineering Materials Office
Downsview, Ontario

Date: 25 November 1991
Phone: 1-705-497-5478
Ext. 6328

From: Geotechnical Section
Northern Region



Subject: Re: W.P. 530-89-00, Hwy 69 Route Planning
Study, Hwy 141 to Hwy 559, Dist #11
=====

The Geotechnical Section is presently providing comments on the swamps located on the proposed routes for the above Route Planning Study. During the course of our analysis we identified a potential problem area on the Parry Sound By-Pass from Station 17+097 to Station 17+172. As you are aware there has been some settlement at this location.

Could you please provide comments on twinning of this section and any potential fill stability problems that may be encountered by January 17, 1992. The two additional lanes will be located on the east side. The median width will be 30 m.

Attached are copies of the relevant plans.

Sincerely,

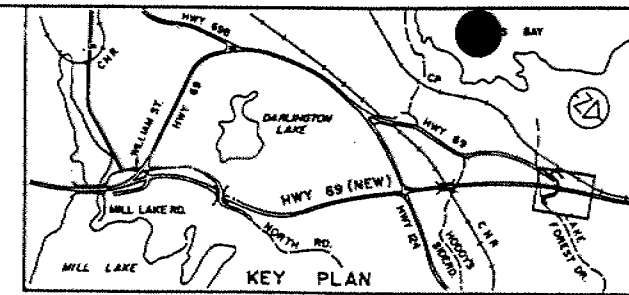
Michele Bailey
Pavement Design
and Evaluation
Officer

for: J. I. McDougall, P. Eng.
Head, Geotechnical Section

MB/JIMCD/wa
attach.

cc: File

To file Nov. 26/91 from D. Dundas.
I called Michele and asked her to clarify her request. Apparently she may not want us to do field work. I told her that it would be difficult to give design specs based on the info. she had provided since there was no shear strength value or consolidation data. Also I explained that her due date was not feasible if field work required and that 2x42 would be more practical. She said she would consider and get back to us. I assume she returned.



METRIC

NOTE - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.

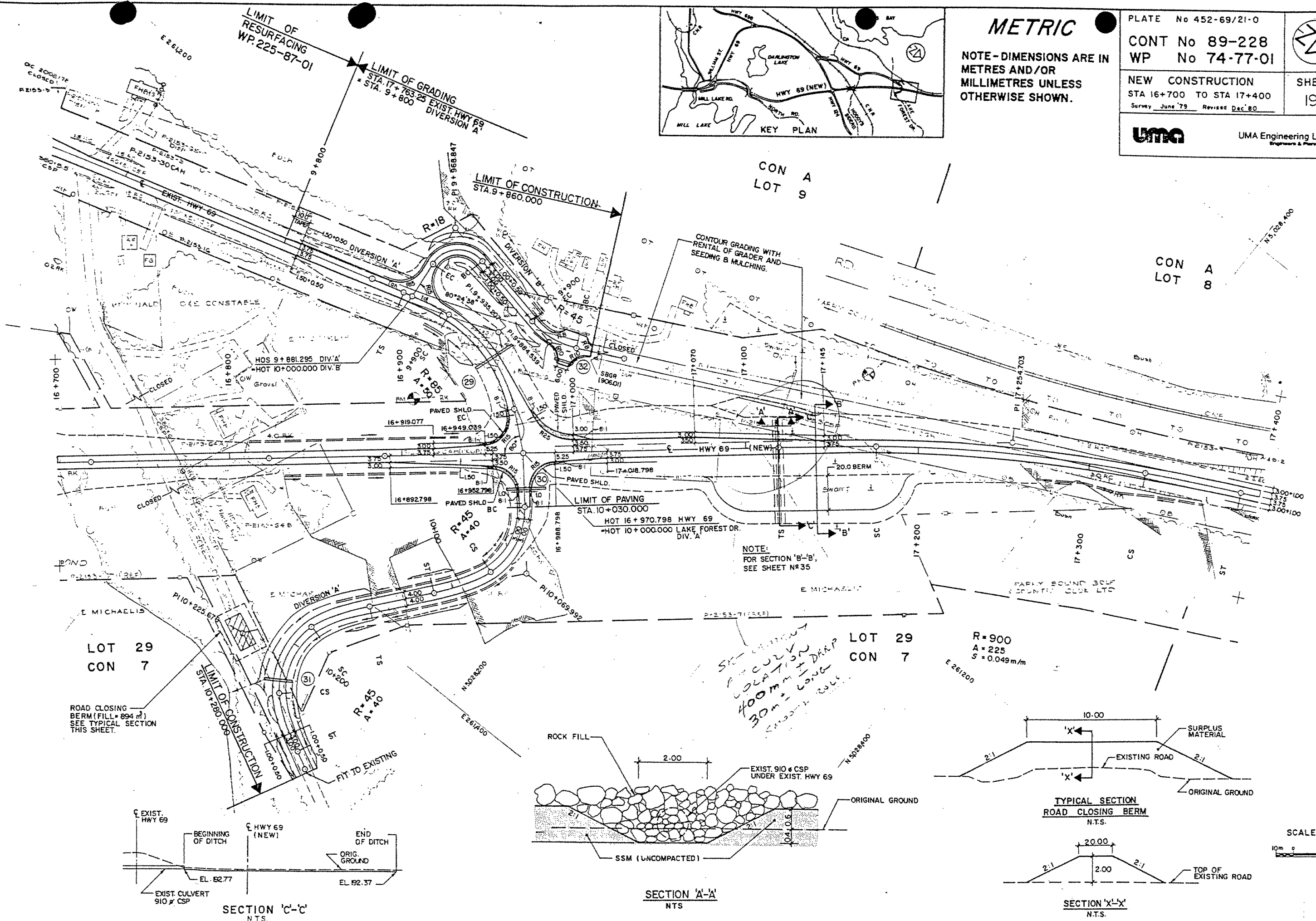
PLATE No 452-69/21-0

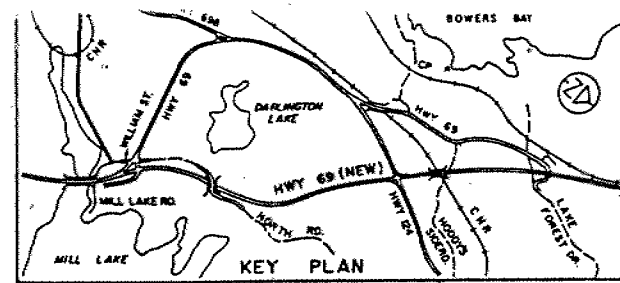
CONT No 89-228
WP No 74-77-01

NEW CONSTRUCTION
STA 16+700 TO STA 17+400
Survey June '79 Revised Dec '80



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METRIC

NOTE - DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.

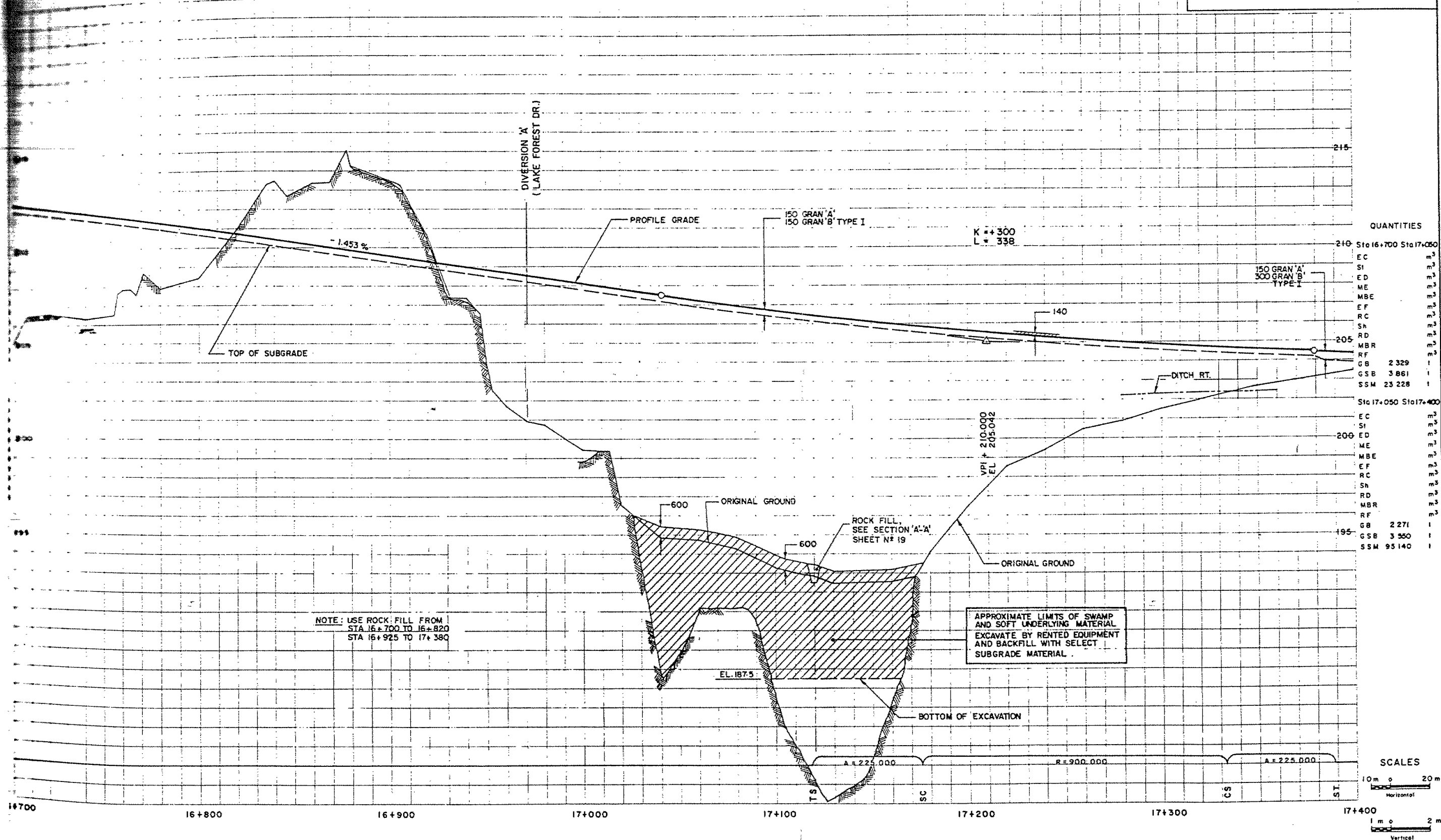
CONT No 89-22
WP No 74-77-01

NEW CONSTRUCTION
STA 16+700 TO STA 17+400
Survey June '79 Revised

SHEET
20



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QUANTITIES

	Sta 16+700	Sta 17+050
EC	3.3	3.3
SI	3.3	3.3
ED	3.3	3.3
ME	3.3	3.3
MBE	3.3	3.3
EF	3.3	3.3
RC	3.3	3.3
Sh	3.3	3.3
RD	3.3	3.3
MBR	3.3	3.3
RF	3.3	3.3
GB	2 329	1
GSS	3 861	1
SSM	23 228	1
	Sta 17+050	Sta 17+400
EC	3.3	3.3
SI	3.3	3.3
ED	3.3	3.3
ME	3.3	3.3
MBE	3.3	3.3
EF	3.3	3.3
RC	3.3	3.3
Sh	3.3	3.3
RD	3.3	3.3
MBR	3.3	3.3
RF	3.3	3.3
GB	2 271	1
GSS	3 550	1
SSM	95 140	1

SCALES

