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September 12, 1977

Daon Development Corporation
5th Floor - 1050 West Pender Street
Vancouver, British Columbia
V6E 3S8

Attention: Mr. Lawrence Ross

Subject: Groundwater Examination
Riverbend Property
River Road & 222nd Street
Maple Ridge, British Columbia

Dear Sirs:

The writer in company with your Mr. Ross examined the subject property on foot on September 8th, 1977.

The property is the site of an old slide which reportedly moved towards and into the Fraser River sometime in the early 1880's. It was also the source of water for Haney until sometime in the early 1950's. Remnants of the storage tanks and piping were observed at the time of inspection.

The topography of the site exhibits a "text book" example of a typical land slide. Congealed or "frozen waves" of earth can be observed. The low places between these "waves" are filled with water. Springs issue from the base of the steep bank along the north side of the property. Additional water flows from some of the low lying areas.

The site examination was conducted after an extended dry period. We therefore believe that the water observed flowing in the various ditches was from a groundwater source and not from surface runoff.

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September 12, 1977

Daon Development
Corporation

We recommend that weirs be set in the two or three culverts that cross under the railroad tracks as soon as possible before the rains start. These weirs will measure the total amount of groundwater that will be expected to flow through the storm sewer system. This, added to the design storm flow, will allow the storm sewer system to be adequately designed.

The storm sewer system should consist of a collector running along the base of the slope at the north of the property and north-south trending lines along the various proposed roads.

If, after clearing, springs are observed on the floor of the site they can be drained to the storm sewer system. The draining of any individual spring will need to be accomplished on the ground to meet actual field conditions.

Based upon the on-site inspection we anticipate that the groundwater seepages can be readily controlled and that no unusually difficult site conditions will be caused by these seepages.

If any of the above needs amplification or clarification please do not hesitate to call.

Yours truly

BROWN, ERDMAN & ASSOCIATES LTD.



W. L. BROWN, P. Eng.

WLB/sa

AUG 31 1977

Cook Pickering & Doyle Ltd.

CONSULTING ENGINEERS

PHONE 879-0494

835 WEST 7TH AVENUE

VANCOUVER, B.C.

V5Z 1C2

August 29, 1977

Project #4637 - M/R.

Daon Development Corporation
5th floor - 1050 West Pender St.
Vancouver, B. C.
V6E 3S8

Attention: Mr. Lawrence Ross

Dear Sirs:

Re: Riverbend Property
River Road & 222nd St.
Maple Ridge, B. C.

As per your authorization of August 22nd and our letter of August 18, 1977, we have completed a series of hand auger holes on the above mentioned property. The purpose of this work was to check the surficial soils within the "Old Slide Area" to establish the extent of construction problems that should be anticipated.

The results obtained from the nine hand auger holes were not as anticipated. The only hand auger hole which encountered surficial conditions similar to our expectations was H.A. 3. This hole encountered a thin desiccated brownish grey clay layer underlain by soft sensitive marine clay. The other holes all encountered layers of very silty sand with some gravel interbedded with soft organic silt and clay. The holes along the southern side of site all encountered a water table near the ground surface, even though the field work was undertaken on August 18, 1977 (the last day of our recent prolonged dry spell). In fact, the two hand auger holes on the western portion of the site (H.A. 6 and 7) encountered very loose sand as a result of the groundwater flow.

Based on these results, it is obvious that the extent of the water problem on this site has not been adequately appreciated. Development of the site will require a substantial number of subsurface drains to lower the water table and stabilize the loose saturated silty sands. It is basically impossible to complete a detailed design of the drainage installations required since there is no consistent stratigraphy to the site. As a result, the locations of critical "wet spots" will only become evident during construction. The subsurface drainage would be installed in locations as necessary based on field inspection during construction.

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Daon Development Corporation

August 29, 1977

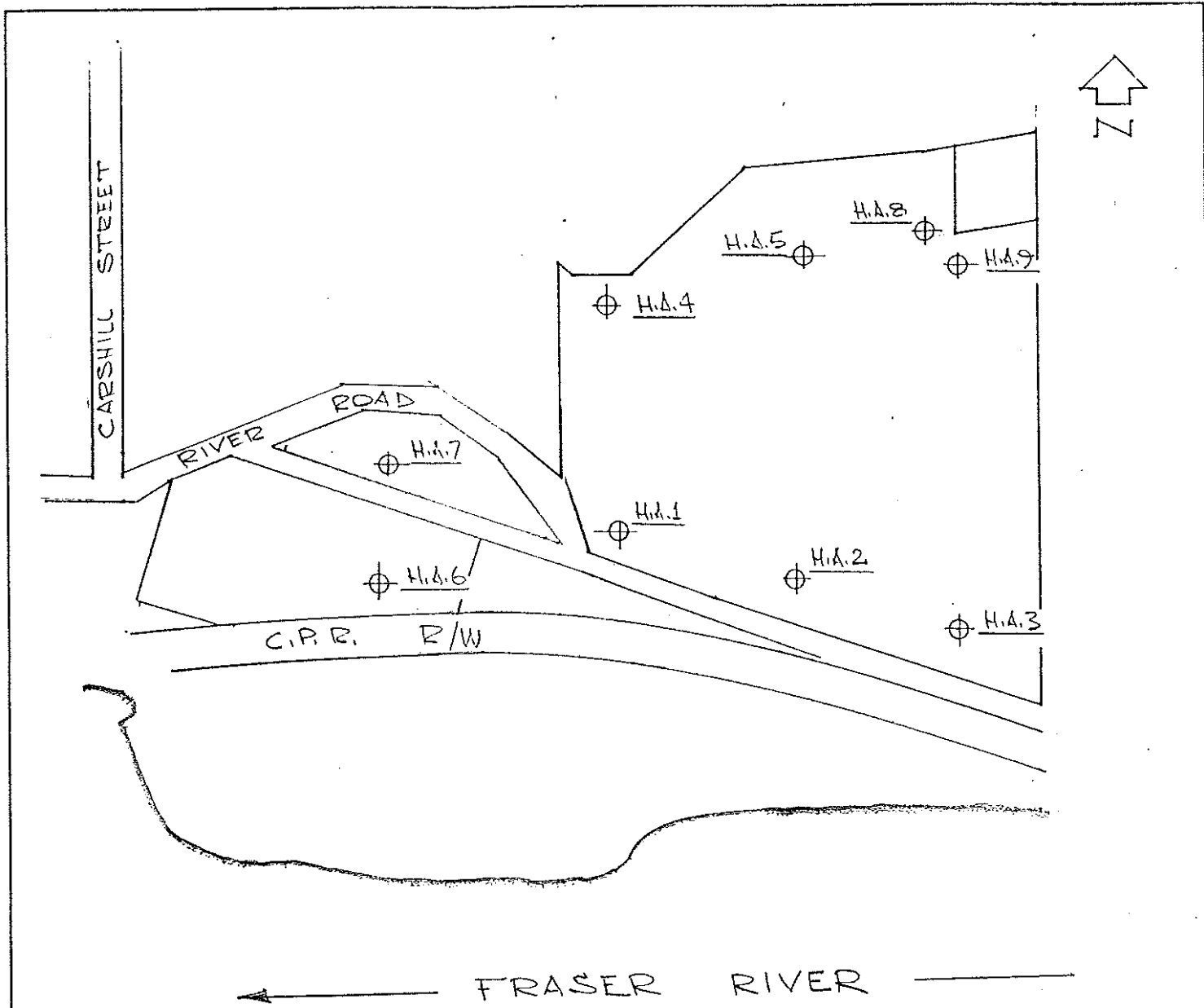
In addition, areas encountered similar to H.A. 3 will definitely cause mobility problems for equipment. The desiccated crust is very thin and as a result, equipment will not be able to run directly on the original ground. Our letter of August 3, 1976 suggested that 24 to 30 in. of granular fill would be required to develop stable pavement sections and the results obtained from the hand auger holes confirm this estimate. The major difficulty estimating site development costs will result from the problems of clearing, stumping and grubbing along with draining the site. Your site development costs should provide for a liberal allowance for this work.

Yours very truly,

A handwritten signature in cursive script, appearing to read "D. E. Snead".

D. E. SNEAD, P. ENG.
COOK, PICKERING & DOYLE LTD.

DES:nk
Attachments



SCALE: 1" = 300'
 ⊕ HANDAUGER HOLE

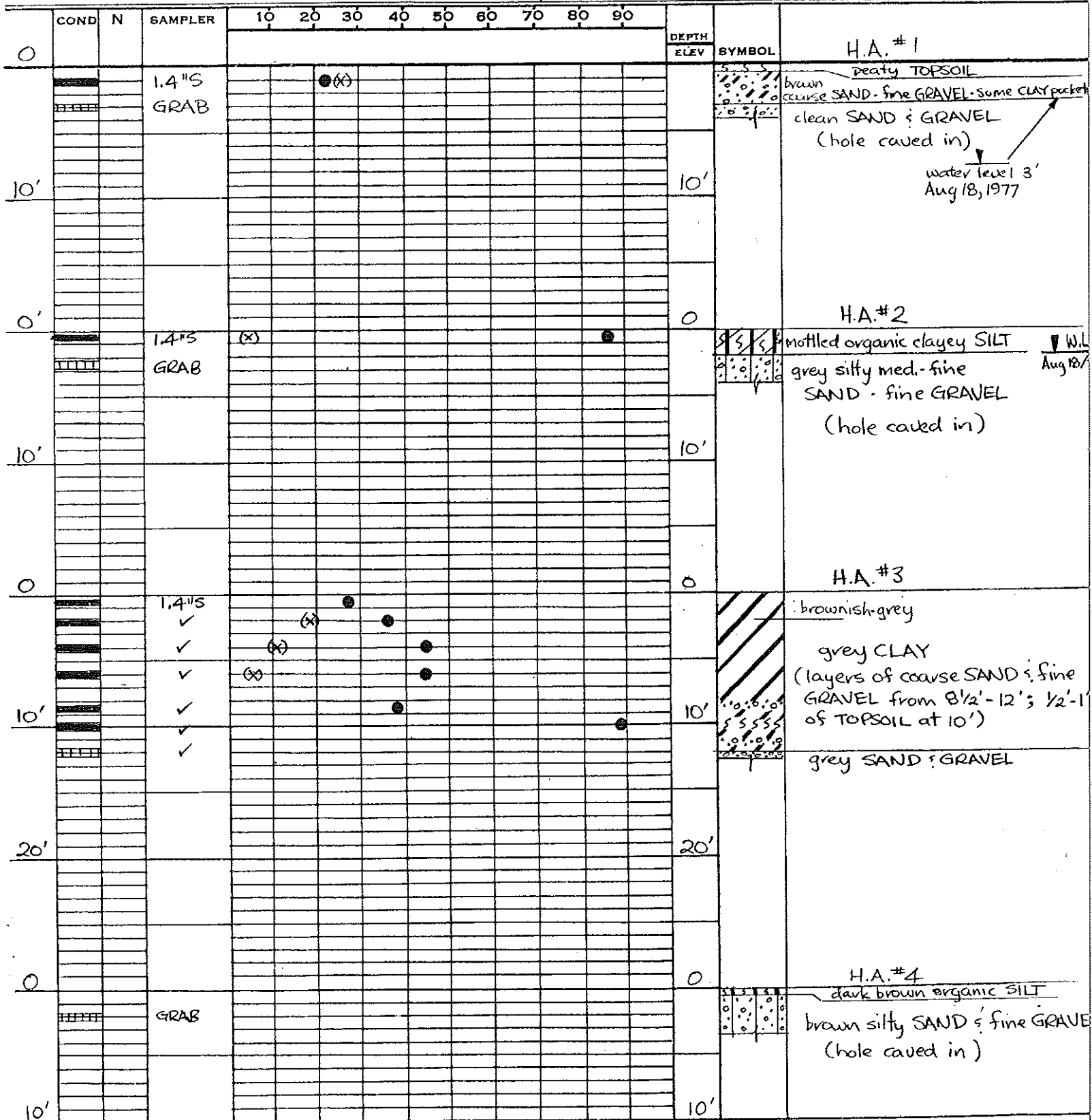
HANDAUGER HOLE LOCATION PLAN RIVER ROAD & 223 rd ST., MAPLE RIDGE, B.C.	
Cook, Pickering & Doyle Ltd. CONSULTING ENGINEERS	Dwg. No. 1 4637 M/R
AUG '77	W.H.

Cook Pickering & Deane Ltd.

835 WEST 7TH AVENUE, VANCOUVER 9, B.C.

PROJECT MAPLE RIDGE - RIVER ROAD & 223 rd ST

JOB NO. 4637 M/R



N — STANDARD PENETRATION TEST — NUMBER OF BLOWS OF 140 LB. HAMMER DROPPED 30" TO PRODUCE 12" OF PENETRATION OR PENETRATION AS NOTED — INCHES
 • — MOISTURE CONTENT IN % BY DRY WT. OF SOIL ▶ — PLASTIC LIMIT ◀ — LIQUID LIMIT ▼ — GROUND WATER LEVEL
 X — UNCONFINED COMPRESSION STRENGTH — PSI. (X) — TORVANE OR PENETROMETER IN EQUIV. UNCONFINED STRENGTH — PSI.
 TYPE OF SAMPLER — 2" STA. — 2" STANDARD S — SHELBY-TUBE FP — FIXED PISTON STL — SPLIT TUBE WITH LINER
 COND — SAMPLE CONDITION [diagonal lines] — GOOD [vertical lines] — DIST'D [horizontal lines] — NIL COPYRIGHT

COND	N	SAMPLER	10	20	30	40	50	60	70	80	90	DEPTH ELEV	SYMBOL	DESCRIPTION
												0		H.A. #5
		1.4" S ✓	(X)	(X)								0		mottled clayey SILT, SAND & GRAVEL
		GRAB										0		brown clayey SILT with some SAND & GRAVEL
		1.4" S		(X)								0		grey silty SAND & GRAVEL
		GRAB										0		brown TOPSOIL (2" layer) W.L. Aug 22/77
		1.4" S										10'		mottled gritty CLAY, some coarse SAND & fine GRAVEL around 6 1/2'
		GRAB										10'		
												0		H.A. #6
		GRAB										0		peaty TOPSOIL W.L. Aug 22/77
		1.4" S										0		brown silty coarse SAND & fine GRAVEL
		✓										10'		grey SAND - some CLAY layers, silty at 10'
		✓										10'		(very loose material - able to push rods through it very easy - QUICKSAND)
												10'		grey coarse SAND & GRAVEL
												0		H.A. #7
		1.4" S ✓										0		brown silty TOPSOIL W.L. Aug 22/77
		GRAB										0		grey coarse SAND, fine GRAVEL, some SILT & patches of CLAY, (very loose)
		1.4" S ✓										10'		denser grey coarse SAND & GRAVEL
												10'		
												0		H.A. #8
		GRAB ✓										0		brown sandy SILT, some GRAVEL (2" approx.)
												10'		(unable to go further due to gravel)

N - STANDARD PENETRATION TEST - NUMBER OF BLOWS OF 140 LB. HAMMER DROPPED 30" TO PRODUCE 12" OF PENETRATION OR PENETRATION AS NOTED - INCHES

• - MOISTURE CONTENT IN % BY DRY WT. OF SOIL ▶ - PLASTIC LIMIT ◀ - LIQUID LIMIT ▼ - GROUND WATER LEVEL
 X - UNCONFINED COMPRESSION STRENGTH - PSI. (X) - TORVANE OR PENETROMETER IN EQUIV. UNCONFINED STRENGTH - PSI.

TYPE OF SAMPLER - 2" STA. - 2" STANDARD S - SHELBY-TUBE FP - FIXED PISTON STL - SPLIT TUBE WITH LINER

COND - SAMPLE CONDITION [diagonal lines] GOOD [vertical lines] DIST'D [horizontal lines] NIL

Cook Pickering & Deane Ltd.

835 WEST 7TH AVENUE, VANCOUVER 9, B.C.

PROJECT MAPLE RIDGE - RIVER ROAD @ 233rd ST.

JOB NO. 4637 M/R

COND	N	SAMPLER	10 20 30 40 50 60 70 80 90																	DEPTH ELEV	SYMBOL	H.A.#9	
		1.4" S ✓																					brown sandy SILT - some fine GRAVEL
		✓																					brown CLAY with some coarse SAND & fine GRAVEL pockets
		✓																					TOPSOIL
		✓																			10'		dark brown organic SILT - CLAY ^{some grey} _{at 10'}
		✓																					soft blue CLAY
																							(hit rock at 14' - could not proceed further with hole)
0'																							
10'																							
20'																							

N — STANDARD PENETRATION TEST — NUMBER OF BLOWS OF 140 LB. HAMMER DROPPED 30" TO PRODUCE 12" OF PENETRATION OR PENETRATION AS NOTED — INCHES
 • — MOISTURE CONTENT IN % BY DRY WT. OF SOIL ► — PLASTIC LIMIT ◀ — LIQUID LIMIT ▼ — GROUND WATER LEVEL
 X — UNCONFINED COMPRESSION STRENGTH — PSI. (X) — TORVANE OR PENETROMETER IN EQUIV. UNCONFINED STRENGTH — PSI.
 TYPE OF SAMPLER — 2" STA. — 2" STANDARD S—SHELBY-TUBE FP—FIXED PISTON STL—SPLIT TUBE WITH LINER
 COND — SAMPLE CONDITION GOOD DIST'D NIL