

SUBSURFACE INVESTIGATION
OF
DISTURBED GLACIAL DEPOSITS
ON
LAKE CAVANAUGH ROAD

SKAGIT NUCLEAR POWER PROJECT

RETURN TO REACTOR DOCKET
FILES

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BECHTEL, INC.
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TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Location of Study Area

1.2 Purpose of Present Study

1.3 Previous Investigation

1.4 Scope of Present Study

1.5 Conclusions

2.0 DISCUSSION

2.1 Description of Local Surface Geology

2.2 Auger Drilling Program

2.3 Results of Drilling

FIGURES

Figure 1 Location Map - Lake Cavanaugh Road Investigation

Figure 2 Lake Cavanaugh Road Auger Drilling-Plan and Section

1.0 INTRODUCTION

1.1 Location of Study Area

The auger-drilling program described herein was conducted along Lake Cavanaugh Road in Skagit County, Washington. The drill site, located about 13-1/2 miles southeast of the Skagit Site, is in the southeast one-quarter of Section 17, T33N, R6E, about 2 miles west of Lake Cavanaugh, as shown on Figure 1.

1.2 Purpose of the Present Study

Field mapping by the US Geological Survey noted deformation within glacial deposits in the area described above. This deformation is near the southeast projection of a lineation, visible on 1:62500 side-looking airborne radar imagery, in a portion of Gilligan Creek. Because Dr. John Whetten has postulated a fault in Gilligan Creek, the U.S. Geological Survey drilled six auger holes adjacent to these disturbed glacial deposits. As a result of this drilling, the USGS interpreted a 20-ft vertical offset of a till horizon below the exposure in question (Maynard, oral communication, 1978). The USGS reported these deformations to the geology staff of the Nuclear Regulatory Commission, together with several possible origins for them, one of which is tectonic faulting; other possible causes suggested by the USGS to the NRC included ice contact, sediment loading or gravity slumping (Pessl, oral communication, 1978). No question was directed to the Applicant by the NRC as a result of the USGS information; however a series of newspaper articles and television news reports, based on press releases at about the same

time the NRC was notified, implied that active faulting could be considered the most likely cause of the deformation in the glacial deposits. Therefore, this possibility was further investigated by Bechtel.

The purpose of the auger drilling program conducted by Bechtel was to obtain direct evidence regarding the configuration of marker horizons at depth across the observed deformation, specifically, the continuity or lack thereof, of the till surface reported by the USGS. The drilling was done with a large, heavy auger rig, and holes spaced closer than those drilled by the USGS.

1.3 Previous Investigations

The deformation in the exposures of glacial deposits noted by the USGS had been previously mapped during Bechtel field studies. At and near the locality studied, deformation features occur in both lacustrine clays and silts, and in silts, sands and gravels of deltaic and outwash deposits which overlie the lacustrine strata. These features include variously oriented but predominantly northeast striking fractures with and without offset in all the units, and synform and antiform warping in the lacustrine beds. Previous examination had concluded that the deformation observed in the glacial deposits had probably resulted from a combination of gravity slumping and response of saturated sediments to loading. (If the lacustrine sediments were deposited on stagnating ice, subsequent melting of the ice would also cause slumping in the overlying materials.) Similar deformation in glacial deposits are not unusual and are due solely to glacial processes, or to later slumping or sliding.

1.4 Scope of Present Study

The current program consisted of: 1) an examination of available exposures of glacial deposits in the immediate area, and 2) twenty-six 8-in. hollow-stem auger holes. Split spoon samples were taken periodically during drilling. Remote sensing imagery for this project was also reviewed for the study area. The auger drilling required seven days.

1.5 Conclusions

The principal conclusions of the Lake Cavanaugh Road study are that: 1) within the interval investigated, a hard till occurs at a depth of approximately 40 ft below local road surface; and 2) there is no evidence from the auger holes that the till surface is offset; on the contrary, the surface of the till is remarkably uniform over the interval examined.

2.0 DISCUSSION

2.1 Description of local surface geology

Bedrock is exposed in the immediate area of this study. The closest bedrock outcrops are exposures of greenstone metavolcanics about three-quarters of a mile north and south of Lake Cavanaugh Road.

Several glacial stratigraphic units are exposed along Lake Cavanaugh Road and in nearby Pilchuck Creek. The lowermost unit topographically, and stratigraphically, is a gray, very hard, pebble-cobble till which is exposed locally in Pilchuck Creek and nearby drainages. This till is interpreted to correlate with the lowermost unit encountered in the auger holes. Easterbrook (personal communication, 1978) observes that this lowermost till "appears to represent Vashon till." Another till is exposed along Lake Cavanaugh Road, and forms a low, roughly north-south aligned ridge. The apparent configuration of this deposit suggests that it is a remnant of a moraine.

Road cuts, several hundred feet in length along Lake Cavanaugh Road, expose an interval of blue-gray, thinly-bedded (though locally massively bedded) very fine sands, silts and clays. These materials are lake-bed deposits of probable Vashon recessional age. The strata vary from clean sand and silt to highly plastic clay. Irregularly shaped pods of very fine-grained sand occasionally occur within the unit. The lacustrine deposits apparently occur only to the east of the till-ridge described above. This suggests that the ridge represents, at least in part, the dam which caused the lake wherein the fine sediments

were deposited. Because the lake deposits occur to slightly higher elevations than the crest of the ridge along Lake Cavanaugh Road, the ice mass apparently constituted the bulk of the dam; the till ridge is probably on ice-marginal feature.

Overlying the lacustrine strata along Lake Cavanaugh Road are outwash sediments. They include silt, very fine to medium-grained sand and minor pea-gravel. Locally, graded bedding is discernable.

The uppermost unit in the section at this locality is not exposed in the Lake Cavanaugh Road cut but it is exposed in a pit on a side-road several hundred feet to the north-northeast. This uppermost unit consists of sand and gravel exposed in topset and foreset deltaic beds.

No deformation structures, such as simple fracturing, were observed in any of the till exposures around the drill site. Several features do occur in the overlying stratigraphic units, and are especially well-exposed in a relatively high roadcut on Lake Cavanaugh Road. In this roadcut, the blue-gray lacustrine deposits comprise the most distinctive stratigraphic member. The most notable structural feature here occurs within this unit and consists of a relatively abrupt, synformal warping of the strata within an otherwise horizontal interval. The axis of this downwarp is aligned approximately north-south. Fluting and flame-structures (plumes of sediments squeezed into the overlying layer) occur within bedding, particularly well exposed in the east limb of the warp,

but these features are interpreted as soft-sediment deformation due to flowage and sediment loading and are not related to subsequent deformation of the section. Five prominent fractures occur on the west limb of the downwarp. These fractures average in strike about $N70^{\circ}E$; most dip steeply to the south. Normal offset on these fractures ranges from 1/2 ft. to 4 ft.; cumulative displacement on these five fractures is about 9 ft. The strike of the lineation coincident with portions of Gilligan Creek is approximately $N25^{\circ}W$; thus the prominent fractures are essentially perpendicular in strike to the projection of this lineation. Less prominent fractures of various orientation occur elsewhere in the lake beds along the road cut. Weakly developed anticlines are evident in the lake sediments at two localities on either side of Lake Cavanaugh Road adjacent to the drill site.

The sand and silt beds overlying the lacustrine sequence contain random fractures with up to about 18 in. maximum normal offset. This fracturing appears to be concentrated over the downslumping in the underlying silt and clay beds but does not extend into them.

Minor fracturing also occurs in the foreset beds of the deltaic deposits at the top of the local section. Normal offsets along $N50^{\circ}E$ fractures dip generally southward, similar to but not parallel to the dip of the foreset beds.

2.2 Auger Drilling Program

The auger drilling program along Lake Cavanaugh Road consisted of 26 auger holes. The holes were located along the north side of the road immediately adjacent to the large roadcut wherein the deformation

described previously is exposed. Twenty holes were drilled at 10-foot spacing. They span the disturbed interval, and all but the easternmost one of the six USGS drill holes. An additional five-holes were augered at 40-foot intervals east of the first group. One hole was drilled 120 ft west of the close-spaced series. The distance between the easternmost and westernmost auger holes is 510 ft. The layout for all twenty six auger holes relative to the roadcut is shown on Figure 2.

Drilling was performed using a mobile (B-75) hydraulic drill rig and 3-3/8 in. ID hollow-stem auger rods which cut an 8 in. diameter hole. All holes were drilled to the till surface. Interception of the till surface was determined during drilling by extreme rig noise (chatter) and substantial jumping of the rig on its stabilizer stands. The till is very dense and is therefore difficult to drill. Maximum penetration into the till was 6-1/2 ft. A geologist observed the drilling operation full time to observe cuttings and drill action as well as log the samples.

2.3 Results of Drilling

Drilling generally defined an irregular wedge-shaped lens of coarse sediments 1 ft. to 9 ft. thick at a depth of about 20 ft. in the close-spaced holes, LCAG 7 through LCAG 20. Materials in this wedge included silty sand with significant amounts of gravel, cobbles and occasional small boulders; minor amounts of clay, occurring as interstitial matrix and as blebs in the unsorted material, are also present. The coarse sediment wedge thickens notably in an easterly direction reaching maximum thickness around LCAG 19.

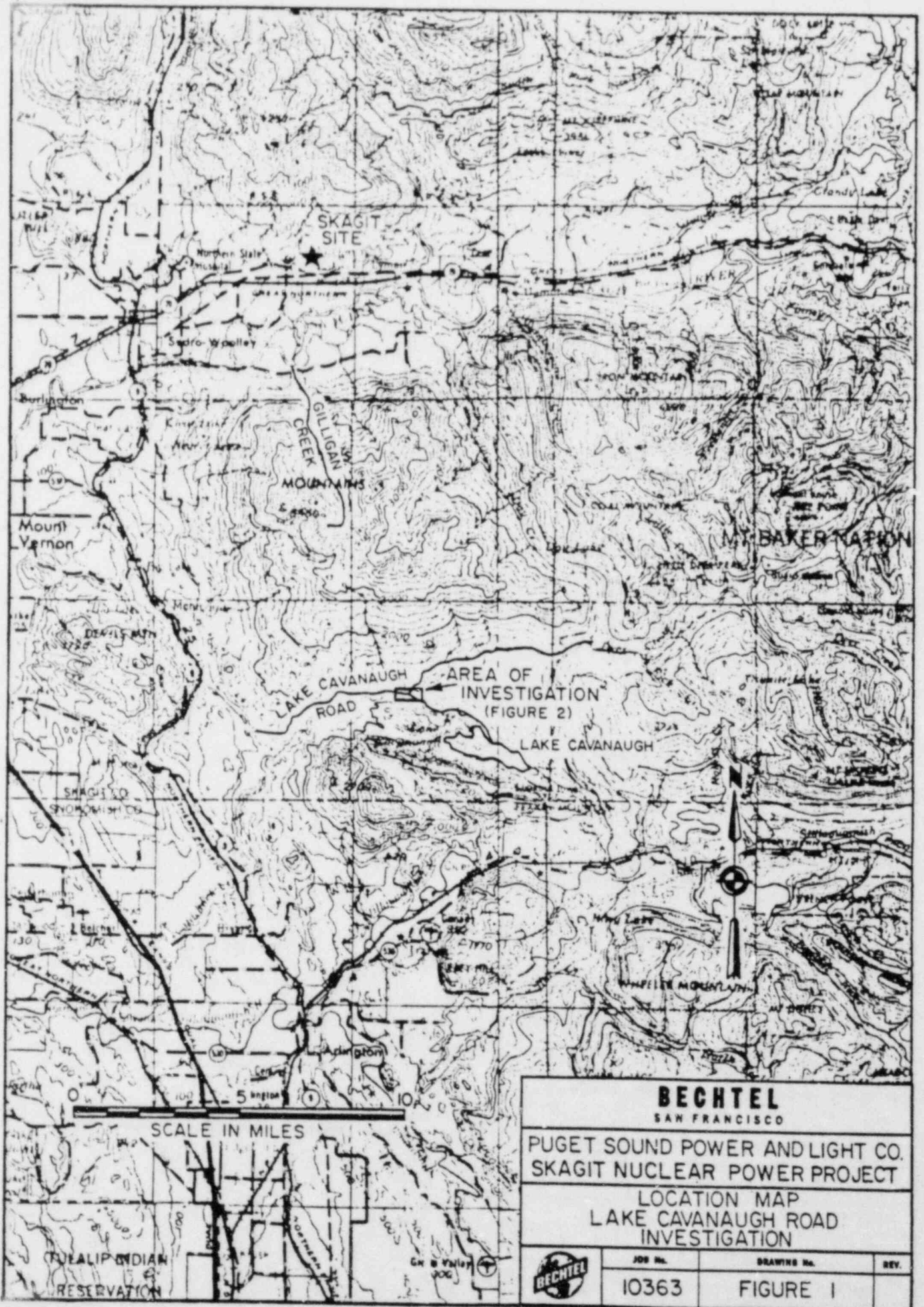
See Figure 2. Drilling through these coarse materials was characterized by rig noise and jumping similar to that encountered while penetrating the till horizon at 40 ft., but drilling through the upper zone was often more difficult due to the presence of greenstone and argillite boulders. The composition, generally unsorted condition and presence of interstitial clays suggest this zone might well be a till horizon. However, the variable cohesiveness, variable amount of matrix clay, locally saturated nature of the material, and lack of lateral extent also suggest the zone could be a reworked till or local ablation product such as an ice float deposit. Dr. Easterbrook considers this zone to be a second or upper till, possibly correlative to the till in the moraine ridge west of the drill site. He notes that the upper surface of this layer is parallel to the lower till surface, is not offset vertically beneath the Lake Cavanaugh Road cut and is not involved in the synclinal deformation (personal communication, 1978).


Minor gravels occur throughout the column above the till but are more prevalent in the western half of the section. Silty clays encountered were generally restricted to the upper column above the coarse wedge with silty sands and sands predominant in the lower column. A clean sand was found to overlie the till in most holes, with small gravel at the contact.

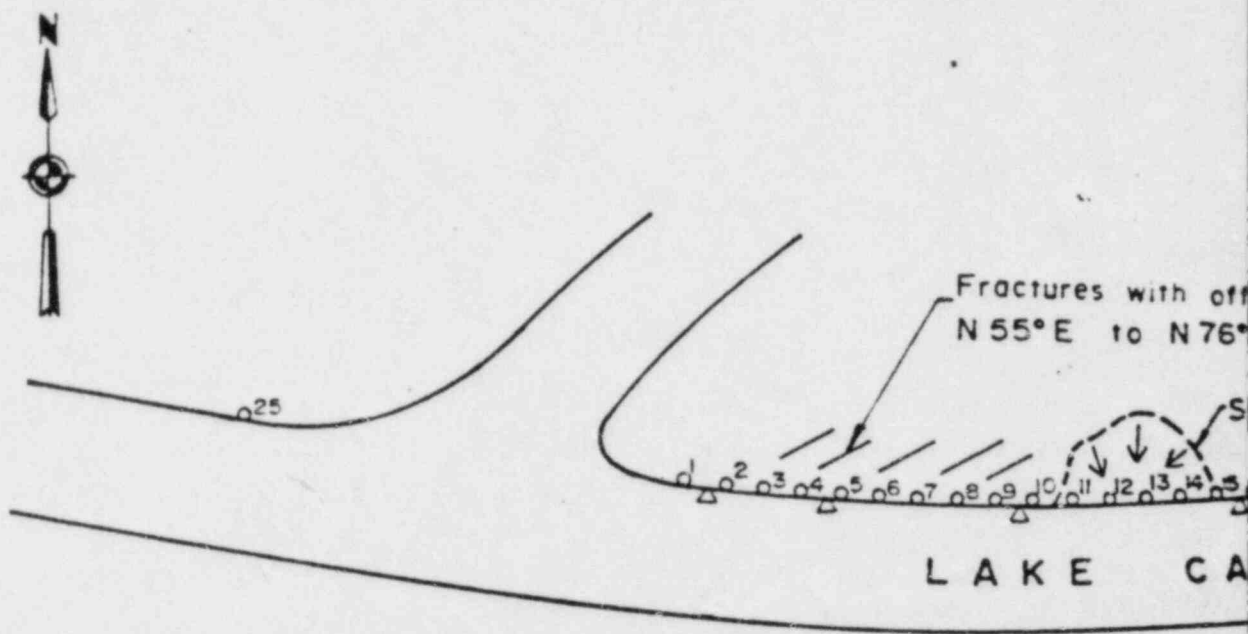
The lowest stratigraphic unit throughout the explored interval along Lake Cavanaugh Road is a hard till which was encountered

in all of the auger holes at depths of 37 to 45 feet (the variation is due mostly to differences in elevation of ground surface at the auger holes).

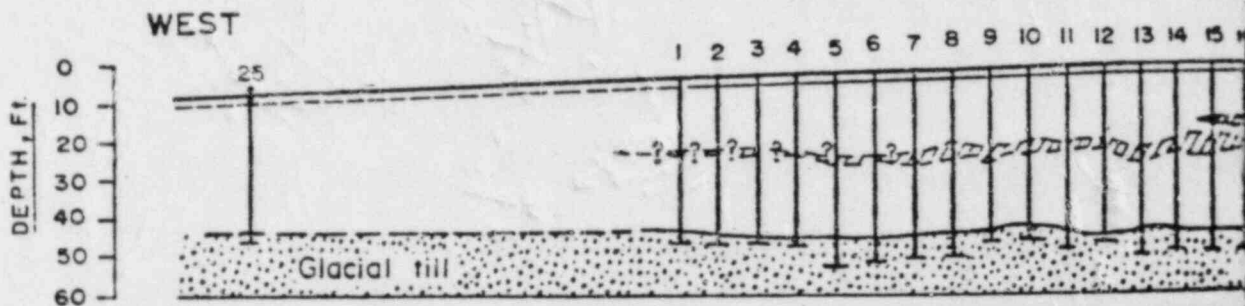
Sampling indicated the till is a blue-grey, dense diamicton (poorly sorted or non-sorted terrigenous sediment with a wide range of particle sizes) composed of coarse sands, gravels and cobbles in a clayey matrix. Coarse fraction constituents include sandstone, greenstone, argillite, coal, phyllite and greenschist. The closely-spaced auger holes demonstrated that the till surface under the deformed sediments in the road cut is unusually uniform considering that the surfaces of till layers are often quite irregular. It was concluded that there is no evidence from the auger holes that the till layer is offset.



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LOCATION MAP LAKE CAVANAUGH ROAD INVESTIGATION		
	JOB No. 10363	DRAWING No. FIGURE I
		REV.



PLAN VIEW



SECTION

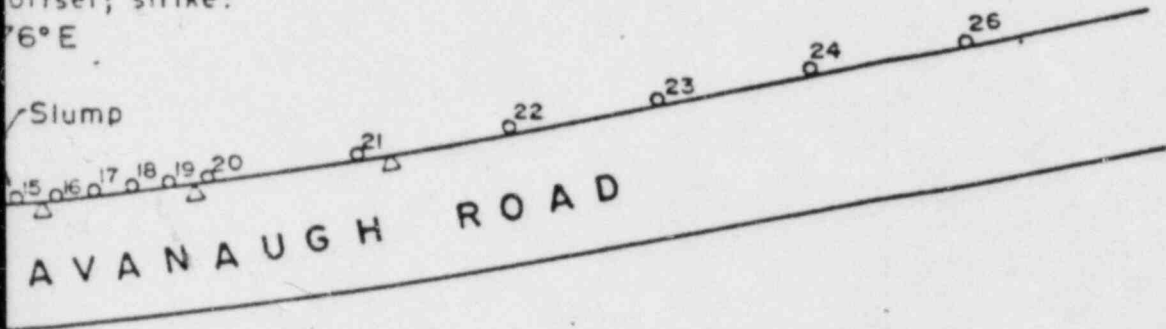
NO VERTICAL EXAGGERATION

NOTES:

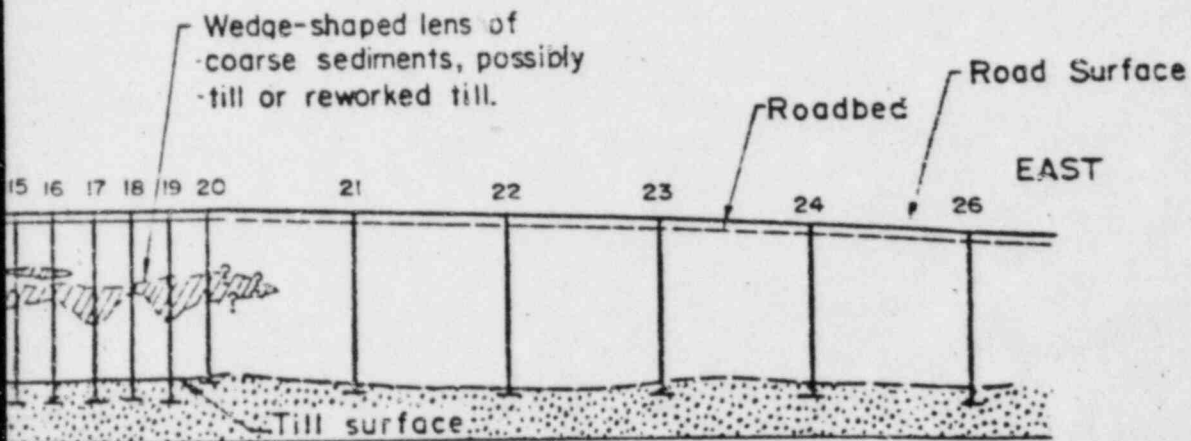
1. Section reflects relative elevations of drill holes.
2. USGS auger hole locations are estimated from spoils on ground surface.

O²
△

offset; strike:
76° E



VIEW



ION

100

FEET

EXAGGERATION

EXPLANATION

- ² Auger hole by Bechtel.
- △ Estimated location of USGS auger hole (See NOTE 3).

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SKAGIT NUCLEAR POWER PROJECT

LAKE CAVANAUGH ROAD
AUGER DRILLING



JOB NO.	DRAWING NO.	REV.
10363	FIGURE 2	

RIGHT

GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC. 17 S.E. 1/4		10363	1 of 1	LACG 1					
DATE		COMPLETED		DRILLER		DRILL MAKE AND MODEL		ANGLE FROM HORIZ.	BEARING				
10/25/76		10/25/78		Pacific Testing Labs		3-3/8" Auger		90°					
CORE RECOVERY (PT.%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. ABOVE WATER		DEPTH/EL. TOP OF ROCK					
			9		893'			44.5'					
SAMPLE HAMMER WEIGHT/PALL		CASING LEFT IN HOLE DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY	CORE RECOVERY	SAMPLE FLOW	PERCENT CORE RECOVERY	WATER PRESSURE TESTS		ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
						LOSS IN P.P.M.	TIME IN MINUTE						
H												0-2.5' Roadbed: brown, sand, gravel & cobbles.	"H"=3-3/8" hole - low stem auger drilling an 8" dry hole.
SS	18	18	2-2-3						5	A		2.5-11' Silty Sand: blue-gray, moderate to well-sorted, loose, contains thin lenses of silty clay and fine sand.	
H									10	B		11-14' Silty Clay: blue-gray, loose.	Gravel horizon @ 10', 1 foot thick - rig chatter short duration but loud
SS	18	18	2-3-3						15	C		14-16.5' Silty Sand: blue-gray, well-sorted, loose density.	
H									20	D		16.5-19' Sand: gray, well-sorted, loose.	Scattered gravel @ 20' rig chatter and minor rig jumping
SS	18	18	3-3-6						25	E		19-24' Silty Sand: blue-gray, moderate to well-sorted, loose to medium density.	
H									30	F		24-29' Sand: gray, well-sorted, medium density.	Coarse gravel @ 33', less than 1' thick - rig chatter loud
SS	18	18	4-6-14						35	G		29-37' Silty Sand: blue-gray, moderate to well-sorted, loose to medium density, contains a coarse gravel horizon and fine gravel lenses.	with some jumping on stands
H									40	H		37-39.5' Sand: gray, well-sorted, loose.	Till @ 39.5' - hard surface w/ cobbles at contact of fine sand and till - rig chatter loud with substantial rig jumping on stands.
SS	18	18	3-6-10						45			39.5-44.5' Till: blue-gray diamicton, dense to very dense.	
H												Bottom of hole @ 44.5'	
SS	10	10	25-40/4"										

SS = SPLIT SPOON; ST = SHELBY TUBE;
 B = BENNISON; P = PITCHER; C = OTHER

LAKE CAVANAUGH ROAD

HOLE NO.
LACG 1



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.						
				Skagit Nuclear Power Project	10363	1 of 1	LCAG 2						
SITE		COORDINATES			ANGLE FROM HORIZ.		BEARING						
LAKE CAVANAUGH ROAD		T33N R6E SEC. 17 S.E. 1/4			90°								
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVLR BURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH						
10/25/78	10/25/78	Pacific Testing Labs	3-3/8" Auger	8"			44.5'						
CORE RECOVERY (%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK						
			2		893'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	SPAGNIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVEL, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H												0-3' Roadbed: brown, sand gravel & cobbles.	"H"=3-3/8" hollow stem auger drilling 8" dry hole
												3-39' Silty Sand: blue-gray moderate to well sorted, loose.	3-39' variable drilling rate indicates thin silty clay and sand lenses but not defined in cuttings
												Small gravel @ 19'—zone = 1' thick—loud rig chatter with minimal jumping on stands.	
SS	18	18	2-4-9									39-41.5' Sand: gray, fine, well sorted, loose.	Thin gravel horizon at 34' minor rig chatter and slight jumping on stand
H												41.5-44.5' Till: blue-gray diamicton, dense.	
SS	18	18	7-35-43									- Bottom of Hole @ 44.5' -	Coarse gravel @ 40-41'—loud chatter with rig jumping on stands
													Till @ 41.5'—hard, compact, rig jumped with very loud chatter.
SS = SPLIT SPOON; ST = SHELBY TUBE; S = SHERIDAN; P = PITCHER; O = OTHER								LAKE CAVANAUGH ROAD				HOLE NO. LCAG 2	



GEOLOGIC DRILL LOG		PROJECT	JOB NO.	SHEET NO.	HOLE NO.								
		Skagit Nuclear Power Project	10363	1 OF 1	LCAG 3								
SITE		COORDINATES		ANGLE FROM HORIZ.	BEARING								
LAKE CAVANAUGH ROAD		T33N R6E SEC. 17 S.E. 1/4		90°									
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH						
10/26/78	10/26/78	Pacific Testing Labs	3-3/8" Auger	8"			44.5'						
CORE RECOVERY (PT.%)		CORE SECS	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK						
			1		893'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY CORE RECOVERY	SAMPLER BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN C.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H													
SS 18 18 7-8-38													
0-3' Roadbed: brown; sand, gravel & cobbles.													H"-3-3/8" hollow stem auger drilling
3-42.5' Silty Sand: blue-gray, moderate to well sorted, loose.													8" dry hole.
42.5-44.5' Till: blue-gray, diamicton, dense.													3-42.5' - Variable drilling rate indicates probable silty clay and sand lenses but not defined in cuttings.
- Bottom of Hole @ 44.5' -													Small gravel horizon @ 20' less than 1' thick rig chatter loud w/ minor jumping on stand.
													Thin small gravel horizon @ 35' - minor rig chatter w/ slight jumping
													Till @ 42.4' - hard compact, rig jumped w/ loud chatter.

SS - SPLIT SPOON; ST - SHELBY TUBE;
D - DENNISON; P - FITCHER; O - OTHER

LAKE CAVANAUGH ROAD

HOLE NO.
LCAG 3



GEOLOGIC DRILL LOG			PROJECT	JOB NO.	SHEET NO.	HOLE NO.							
LAKE CAVANAUGH ROAD			T33N R6E SEC.17 S.E. 1/4	Skagit Nuclear Power Project 10363	1 OF 1	LCAG 4							
BEGIN	COMPLETED	DRILLED	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH						
10/26/78	10/26/78		Pacific Testing Labs 3-3/8" Auger	8"			44.5'						
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK						
			1		894'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLE TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
									5			0-2.5' Roadbed: brown sand, gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling
									10			2.5-43' Silty Sand: blue-gray, moderately sorted, loose, contains few thin gravel lenses.	8" dry hole
									15				Variable drilling rate probably thin silty clay units at 5-10' but auger cuttings inconclusive.
									20				Gravel horizon @ 20' - approx. 1' thick, rig chatter loud w/minor jumping on stand.
									25				
									30				
									35				
									40				
									43			43-44.5' Till: blue-gray, diamicton, dense.	Gravel horizon @ 35' - thin, less than 1', rig chatter minor w/very slight jumping on stand.
									44.5			- Bottom of Hole @ 44.5' -	Till @ 43' - hard compact unit, rig jumped substantially w/loud chatter.
SS 18	18	7-6-28											
SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER												HOLE NO.	
LAKE CAVANAUGH ROAD												LCAG 4	



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.							
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4	Skagit Nuclear Power Project 10363	1 of 1	LACG 5							
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH							
10/19/78	10/19/78	Pacific Testing Labs	3-3/8" Auger	8"			49.5'							
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK							
		9			894'									
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE DIA./LENGTH		LOGGED BY:										
140 LBS/SPT		0		Jorge Martinez										
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE AND DIAMETER	SAMPLER LENGTH	CORE RECOVERY	SAMPLE BLOWS	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
						LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H										5			0-2.5' Roadbed: brown, sand, gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole.
SS	18	18	3-5-7							10	A		2.5-11.5' Silty Clay: blue-gray, loose to medium density, interbedded with thin silty sand lenses.	Gravelly zone @ 23 - 25', slight rig chatter and minor jumping on stands.
H										15	B		11.5-31.5' Silty Sand: blue-gray, moderate to well sorted, loose to medium density, interbedded with thin silty clay lenses.	Gravelly zone @ 38' - slight rig chatter and minor jumping on stands.
SS	18	18	5-7-11							20	C			
H										25	D		31.5-43.0' Sand: gray, well sorted, medium density.	Till @ 43' - hard, compact, very loud rig chatter and substantial jumping on stands.
SS	18	18	6-12-15							30	E			
H										35	F			
SS	18	18	5-9-3							40	G			
H										45	H		43.0-49.5' Till: blue-gray diamicton, medium to dense.	
SS	18	18	3-14-15							50	I		- Bottom of Hole @ 49.5' -	
H														
SS	18	18	22-33-55											

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

SITE

LAKE CAVANAUGH ROAD

HOLE NO.

LACG 5



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.							
LAKE CAVANAUGH ROAD				Skagit Nuclear Power Project	10363	1 OF 1	LCAG 6							
SITE		COORDINATES			ANGLE FROM HORIZ.		BEARING							
T33N R6E SEC.17 S.E. 1/4		90												
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH							
10/19/78	10/19/78	Pacific Testing Labs	3-3/8" Auger	8"			49.5'							
CORE RECOVERY (PT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK							
		10			894'									
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:										
140 LBS/SPT		0		Jorge Martinez										
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE	LENGTH CORE RUN	SAMPLES RECOVERED	SAMPLE BLOWS	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
						LOSS IN O.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H	SS	18	18	6-6	14					5	A	0-2.5' Roadbed: brown, sand, gravel & small cobbles.	"H"-3-3/8" hollow stem auger drilling an 8" dry hole. Small gravel zones below 23' - slight chatter w/ minor jumping on stands. Till @ 44' - hard compact unit - rig chatter loud with jumping on stands considerable.	
H	SS	18	18	4-6	18				10	B	2.5-4' Silty Clay: blue-gray, medium density, with thin interbedded silty sand lenses.			
H	SS	18	18	4-5	8				15	C	4-6.5' Silty Sand: blue-gray, medium density, with thin lenses of silty clay.			
H	SS	18	18	8-10	13				20	D	6.5-11.5' Silty Clay: blue-gray, medium density, with thin silty sand lenses.			
H	SS	18	18	11-11	15				25	E	11.5-31.5' Silty Sand: blue-gray, well to moderately sorted, loose to medium density, contains thinly interbedded lenses of silty clay.			
H	SS	18	18	6-12	15				30	F	31.5-36' Sand: gray, well-sorted, medium density.			
H	SS	18	18	8-12	15				35	G	36-38.5' Silty Sand: blue-gray, moderately sorted, medium density.			
H	SS	18	18	8-12	14				40	H	38.5-44' Sand: gray, well-sorted, medium density.			
H	SS	18	18	5-40	54				45	I	44-49.5' Till: blue-gray diamicton, dense.			
H	SS	18	18	10-33	40				50	J	- Bottom of Hole @ 49.5' -			

SC = SPLIT SPOON; ST = SHELBY TUBE;
 O = DENNISON; P = PITCHER; Q = OTHER

LAKE CAVANAUGH ROAD

HOLE NO. LCAG 6



GEOLOGIC DRILL LOG		PROJECT Skagit Nuclear Power Project	JOB NO. 10363	SHEET NO. 1 OF 1	HOLE NO. LCAG 7
SITE LAKE CAVANAUGH ROAD		COORDINATES T33N R6E SEC.17 S.E. 1/4		ANGLE FROM NORIL. 90°	BEARING
BEGIN 0/20/78	COMPLETED 10/20/78	DRILLER Pacifi. Testing Labs	DRILL MAKE AND MODEL 3-3/8" Auger	HOLE SIZE 8"	OVERBURDEN (FT.) ROCK (FT.) TOTAL DEPTH 49.5'
CORE RECOVERY (FY,%)	CORE BOXES 10	SAMPLES EL TOP OF CASING	GROUND EL. 894'	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
SAMPLE HAMMER WEIGHT/FALL 140 LBS/SPT		CASING LEFT IN HOLE: DIA./LENGTH 0		LOGGED BY: Jorge Martinez	

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOSS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H	SS 18 18 7-9-11								5	A	0-2' Roadbed: brown, sand, gravels & cobbles.	"H"=3-3/8" hollow stem auger drilling	
H	SS 18 18 3-4-8								10	B	2-3.5' Silty Sand: blue-gray, well-sorted, medium density.	8" dry hole.	
H	SS 18 18 5-7-11								15	C	3.5-19' Silty Clay: blue-gray, loose - medium density, interbedded with very thin silty sand lenses.	Small boulder @ 25' - rig jumped on stand w/very loud chatter.	
H	SS 18 18 3-4-13								20	D			
H	SS 18 18 6-15-7								25	E	19'-23' Silty Sand: blue-gray, very fine, well-sorted, slightly plastic, medium density.	Gravel @ 38.5' , rig made loud chatter, some jumping on stand.	
H	SS 18 18 2-6-9								30	F			
H	SS 18 18 6-9-10								35	G	23'-25.5' Silty Sand: blue-gray, poorly sorted with scattered gravel and cobble horizons in a silty clayey matrix.	Till @ 43' - compact, rig jumped substantially, very loud chatter.	
H	SS 18 18 6-10-11								40	H	25.5'-31.5' Sand: gray, very well-sorted, loose to medium, with thin lenses of silty sand.		
H	SS 18 18 40-50/5"								45	I			
H	SS 18 18 30-35-35								50	J	31.5'-36.5' Silty Sand: blue-gray, moderately sorted, medium density, contains thin lenses of sand and small gravel.		
											36.5-43' Sand: gray, moderately sorted, medium density.		
											43-49.5' Till: blue-gray diamicton, very dense.		
											- Bottom of Hole @ 49.5' -		

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER	SITE LAKE CAVANAUGH ROAD	HOLE NO. LCAG 7
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GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.								
LAKE CAVANAUGH ROAD				Skagit Nuclear Power Project	10363	1 OF 1	LCAG 8								
SITE				COORDINATES		ANGLE FROM HORIZ. BEARING									
T33N R6E SEC.17 S.E. 1/4				90°											
BEGUN	COMPLETED	DRILLER	DRILL MARK AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH								
0/20/78	10/20/78	Pacific Testing Labs	3-3/8" Auger	8"			49.5'								
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK								
		10			895'										
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:											
140 LBS/SPT		0		Jorge Martinez											
SAMPLE TYPE AND DIAMETER	SAMPLER ADVANCE	SAMPLER CORE LENGTH	SAMPLE RECOVERY	SAMPLE RECOVERY	SAMPLE LOSS	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H	SS 18 18	3-14	18								5	A	0-2.5' Roadbed: brown, sand & gravel with cobbles.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole.	
H	SS 18 18	9-12	14								10	B	2.5'-5.5' Silty Sand: blue-gray, well sorted, medium density.		
H	SS 18 18	4-9-5									15	C	5.5'-16.5' Silty Clay: blue-gray, medium to loose density with interbedded silty sands (very thin) and sandy silts.	Large cobbles & small boulder @ 19' - rig lifted off Stands, extreme jumping and chatter.	
H	SS 18 18	3-18	22								20	D	16.5'-19.0' Silty Sand: blue-gray, well-sorted, medium density.	Gravel @ 30' - rig jumped w/loud chatter - not extreme.	
H	SS 18 18	8-17	37								25	E	19.0'-24' Silty Sand: blue-gray, moderately sorted with scattered gravels and cobbles, coarse sandy gravel base, minor clay.	Fine sand over till @ 43' with gravel at contact.	
H	SS 18 18	5-20	27								30	F	24'-29.5' Sand: gray, moderately sorted, medium to dense, thin, silty, clay @ base.	Till @ 43' - rig jumped substantially w/loud chatter.	
H	SS 18 18	5-11	14								35	G	29.5'-32.5' Silty Sand: blue-gray, well-sorted with gravel and coarse sand lenses, medium to dense.		
H	SS 18 18	5-14	10								40	H	32.5-43' Sand: gray, moderately sorted, medium density, gravel horizon @ 40'-41'.		
H	SS 18 18	24-25	26								45	I	43-49.5' Till: blue-gray, diamicton, medium dense.		
H	SS 18 18	18-38	42								50	J	- Bottom of Hole @ 49.5' -		

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENISON; P = PITCHER; O = OTHER

SITE

LAKE CAVANAUGH ROAD

HOLE NO.

LCAG 8



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				Skagit Nuclear Power Project	10363	1 OF 1	LCAG 9					
SITE				COORDINATES	ANGLE FROM HORIZ.		BEARING					
LAKE CAVANAUGH ROAD				T33N R6E SEC. 17	90°							
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)					
10/20/78	10/20/78	Pacific Testing Labs	3-3/8" Auger		8"							
CORE RECOVERY (PT.%)		CORE BOXES	SAMPLES	TOP OF CASING	GROUND SL.	DEPTH/SL. GROUND WATER						
			10		895'							
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:								
140 LBS/SPT		0		Jorge Martinez								
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE IN	SAMPLER RECOVERY CORE RECOVERY	SAMPLER SLOWS PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H	SS 18 18	12-14	18					5	A	0-2.5' Roadbed: brown, sand, gravel & cobbles.	"H" 3-3/8" hollow stem auger drilling 8" dry hole.	
H	SS 18 18	3-4-6					10	B	2.5-4' Silty Clay: blue-gray, rounded, medium density.			
H	SS 18 18	2-4-7					15	C	4-6.5' Silty Sand: blue-gray, very fine, well-sorted, loose to medium, thin lenses of silty clay.	Gravel @ 20' & 24' rig jumped with loud chatter, some cobbles encountered.		
H	SS 18 18	5-9-12					20	D	6.5-9' Sand: gray, well-sorted, loose.			
H	SS 18 18	4-19-21					25	E	9-11.5' Silty Clay: blue-gray, loose, interbedded, with fine silty sand lenses.	Till @ 42.5' - rig jumped substantially with very loud chatter.		
H	SS 18 18	5-9-10					30	F	16.5-20' Silty Clay: blue-gray, loose, interbedded, with fine silty sand lenses.			
H	SS 18 18	3-6-8					35	G	11.5-16.5' Silty Sand: blue-gray, well-sorted, medium density, with thin lenses of silty clay.			
H	SS 18 18	1-5-6					40	H	20-24.5' Silty Sand: blue-gray, poorly sorted, medium density, medium gravels with cobbles and silty clayey lenses.			
H	SS 18 18	4-8-10					45	I	24.5-26.5' Silty Sand: blue-gray, well-sorted, loose, with thin lenses of silty clay.			
H	SS 18 18	3-12-23						J	26.5-42.5' Sand: gray, well-sorted, loose with thin silty clay lenses.			
										42.5-44.5' Till: blue-gray diamicton, medium density.		
										-Bottom of Hole @ 44.5'-		

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DENNISON; P = FITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 9



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.							
LAKE CAVANAUGH ROAD				T33N R6E SEC. 17 S.E. 1/4	10363	1 of 1	LCAG 10							
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH							
10/20/78	10/20/78	Pacific Testing Labs	3-3/8" Auger	8"			44.5'							
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK							
		4			895'									
SAMPLE HAMMER WEIGHT/FALL			CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:									
140 LBS/SPT			0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY CORE RECOVERY	SAMPLER BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS				ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.N.	PRESSURE P.S.I.	TIME IN MINUTES							
H													0-2.5' Roadbed: brown, sand, gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling
													2.5-20' Silty Clay: blue-gray, loose with fine lenses of silty sand.	8" dry hole.
													20-22.5' Silty Sand: blue-gray, poorly sorted, medium density, cobbles and scattered coarse gravel throughout, minor clays in matrix.	Gravel & cobbles @ 20' - rig jumped substantially w/loud chatter.
	SS 18 18 5-18-20												22.5-30' Sand: gray, moderately sorted, loose with scattered small gravel & silty clay lenses.	Till @ 41' - compact, rig jumping extreme on stands w/ very loud chatter.
H														
	SS 18 18 5-5-8													
H														
	SS 18 18 3-7-8												30-31.5' Silty Clay: blue-gray, well-sorted, with thin coarse sand lenses.	
H													31.5-41' Sand: gray, well sorted, with thin coarse sand lenses.	
	SS 18 18 5-25-23												41-44.5' Till: blue-gray diamicton, medium density.	
														- Bottom of Hole @ 44.5' -

SS = SPLIT SPDRN; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

SITE

LAKE CAVANAUGH ROAD

HOLE NO.

LCAG 10

RECORDED

GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4		10363	1 of 1	LCAG 11					
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH					
10/21/78	10/21/78	Pacific Testing Labs	3-3/8" Auger		8"			44.5'					
CORE RECOVERY (PT.%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
			4		896'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE IN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOW "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H									0-2.5'		Roadbed: brown, sand, gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole	
								5	2.5-8'		Silty Clay: brown, loose density.		
								10	8-15.5'		Silty Clay: blue-gray, loose, with thin lenses of silty sand.		
	SS 18 18 6-8-8							15	15.5-23'	A	Silty Sand: blue-gray, well to poorly sorted, minor silty clay lenses, loose to medium density.	Gravel horizon @ 16', thin-rig made only minimal chatter.	
H								20	23	B	42' Silty Sand: blue-gray, loose to medium density, with thin lenses of silty clay.		
	SS 18 18 6-10-15							25				Cobbles and gravels from 20'-23'; rig made considerable chatter.	
H								30					
	SS 18 18 4-6-8							35		C			
								40	42-44'		Sand: gr y, well sorted, loose - medium.		
H								45	44-49.5'		Till: blue-gray, diamicton, medium density.	Till @ 44'-compact; rig jumped extremely on stands w/ very loud chatter.	
	SS 18 18 12-18-30							50		D			
												- Bottom of hole @ 49.5' -	

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DENNISON; P = PITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 11



GEOLOGIC DRILL LOG				PROJECT Skagit Nuclear Power Project		JOB NO. 10363	SHEET NO. 1 of 1	HOLE NO. LCAG 12				
SITE LAKE CAVANAUGH ROAD			COORDINATES T33N R6E SEC. 17 S.E. 1/4			ANGLE FROM HORIZ. 90°		BEARING				
BEGUN 10/21/78	COMPLETED 10/21/78	DRILLER Pacific Testing Labs	DRILL MAKE AND MODEL 3-3/8" Auger		HOLE SIZE 8"	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH 45.5'				
CORE RECOVERY (FT./%)		CORE BOXES 5	SAMPLES EL. TOP OF CASING 896'		DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
SAMPLE HAMMER WEIGHT/P.F.A.L. 140 LBS/SPT			CASING LEFT IN HOLE: DIA./LENGTH 0		LOGGED BY: Jorge Martinez							
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE PLUG	SAMPLE RECOVERY CORE RECOVERY	SAMPLE SLOGS "N" PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H								0-2.5'			Roadbed: brown, sand gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole. Gravel @ 20', coarse - rig chatter very loud with substantial jumping on stands. Till @ 44 - hard, compact, rig chatter loud with substantial jumping on stands.
							5	2.5-8'			Silty Clay: brown, loose to medium density, with thin blue silty clay lenses.	
							10	8-20'			Silty Clay: blue-gray, loose to medium density.	
							15	20-22'			Silty Sand: blue-gray, poorly sorted, scattered cobbles and gravel throughout, with silty clayey matrix near base.	
SS	18	18	9-21-76				20	22-27.5'			Silty Clay: blue-gray, with thin interbed lenses of fine silty sand.	
H							25	27.5-34.5'			Silty Sand: blue-grey, well sorted, loose.	
SS	18	18	2-8-9				35	34.5-39.5'			Sand: grey, well-sorted, loose.	
H							40	39.5-41'			Silty Clay: blue-grey, medium density.	
SS	18	18	4-12-16				40	41-44'			Sand: gray, well-sorted, medium density.	
SS	18	18	3-17-78				40	44-45.5'			Till: blue-gray diamicton, dense.	
SS	18	18	24-24-38				45			- Bottom of Hole @ 45.5' -		

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 12

REVISED

GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.						
LAKE CAVANAUGH ROAD				T33N R6E SEC. 17 S.E. 1/4	10363	1 OF 1	LCAG 13						
SITE		COORDINATES			ANGLE FROM HORIZ.		BEARING						
LAKE CAVANAUGH ROAD		T33N R6E SEC. 17 S.E. 1/4			90°								
BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH						
10/21/78	10/21/78	Pacific Testing Labs	3-3/8" Auger	8"			49.5'						
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK						
			8		896'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOBS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H									5			0-2.5' Roadbed: brown, sand, gravel & small cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole. Gravels @ 23' - very coarse & rig chatter very loud with substantial jumping on stands, SPT on small boulder 100/3" Till @ 43' - rig chatter very loud with substantial jumping on stands.
SS	18	18	4-10-11						10	A		2.5-7' Silty Clay: brown, loose.	
H									15	B		7-12' Silty Sand: brown, well sorted, medium density.	
SS	18	18	2-5-6						20	C		12-23' Silty Clay: blue-gray, loose, with brown silty clay and fine sand lenses.	
H									25	D		23-26' Silty Sand: blue-gray, poorly sorted, with cobbles, gravel, and small boulders scattered throughout, minor clay in matrix.	
SS	18	18	4-16-15						30	E		26-32' Silty Clay: blue-gray, loose, with thin brown silty clay lenses.	
H									35	F			
SS	18	18	2-4-5						40	G		32-37' Silty Sand: blue-gray, loose, with thin coarse sand lenses.	
H									45	H		37-43' Sand: gray, well-sorted, medium density.	
SS	18	18	2-3-18						50			43-49.5' Till: blue-gray diamicton, medium density.	
H												- Bottom of Hole @ 49.5' -	

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; F = FITCHER; O = OTHER

SITE

LAKE CAVANAUGH ROAD

HOLE NO.

LCAG 13

BECHTEL

GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4	10363	1 OF 1	LCAG 14					
DATE	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH					
10/23/78	10/23/78	Pacific Testing Labs	3-3/8" Auger	8"			49.5'					
CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK						
		3		896'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:								
140 LBS/SPT		0		Jorge Martinez								
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE (S)	SAMPLER RECOVERY CORE RECOVERY	SAMPLER BLOWS PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H											0-2.5' Roadbed: brown, sand, gravel and cobbles.	"H" = 3 3/8" hollow stem auger drilling 8" dry hole.
											2.5-13' Silty Clay: brown, loose-medium density, with thin lenses of brown silty clay.	
	SS 18 18	18	24-15	13							13-20' Silty Clay: blue-gray loose-medium density, with thin lenses of brown silty clay.	Gravel @ 20'-coarse, rig chatter very loud with substantial jumping on stands.
H											20-23' Silty Sand: blue-gray, poorly sorted, medium density, with silty clay to coarse gravel and small cobbles scattered throughout.	
	SS 18 18	18	2-5	10							23-42.5' Silty Sand: blue-gray, medium density, contains thin lenses of silty clay.	Till @ 45'-rig chatter very loud with substantial jumping on stands.
H											42.5-45' Sand: gray, fine, well-sorted, loose.	
	SS 18 18	18	12-40	50							45-49.5' Till: blue-gray, diamicton, very dense.	- Bottom of Hole @ 49.5' -

SS = SPLIT SPOON; ST = SHELBY TUBE;
 B = BENNISON; P = FITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 14

BECHTEL

GEOLOGIC DRILL LOG			PROJECT			JOB NO.	SHEET NO.	HOLE NO.	
LAKE CAVANAUGH ROAD			T33N R6E SEC. 17 S.E. 1/4			10363	1 OF 1	LCAG 15	
SITE			COORDINATES			ANGLE FROM HORIZ. BEARING			
LAKE CAVANAUGH ROAD			T33N R6E SEC. 17 S.E. 1/4			90°			
BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH	
10/23/78	10/23/78	Pacific Testing Labs	3-3/8" Auger		8"			49.5'	
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK	
		4			896'				
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY:				
140 LBS/SPT		0			Jorge Martinez				
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY CORE RECOVERY	SAMPLER RECOVERY PERCENT CORE RECOVERY	WATER PRESSURE TESTS	ELEVATION	DEPTH	GRAPHIC LOG SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
H						5		0-2.5' Roadbed: brown, sand, gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole.
						10		2.5-15' Silty Clay: brown, loose, contains thin lenses of fine silty sand.	Gravelly zones @ 15' and 19'-
						15		15-16' Silty Sand: blue-gray moderately sorted, medium density.	very coarse gravel and small cobbles, rig chatter
	SS 18	18	7-24-19			20	A	16-19.5' Sand: gray, well-sorted, medium density, interbedded with very thin fine silty sand.	very loud with substantial jumping on stands.
						25			
H						30		19.5-23.5' Silty Sand: blue-gray, poorly sorted, medium density, silty clay to coarse gravels.	Gravel @ 36'- rig chatter loud with some jumping on stands.
	SS 18	18	5-10-12			35			
H						40	B	23.5-36' Silty Sand: blue-gray, well-sorted, medium density.	Till @ 44' very hard, rig chatter very loud with substantial jumping on stands.
	SS 18	18	2-4-10			45	C	36-39' Silty Sand: blue-gray, well-sorted, with poorly sorted silty sand and gravelly sand lenses.	
H						50	D		
	SS 18	18	10-24-49					39-41.5' Sand: gray, well-sorted, loose to medium density.	
								41.5-43' Silty Sand: blue-gray, well-sorted, loose.	
								43-44' Sand: gray, moderately sorted, medium density.	
								44-49.5' Till: blue-gray diamicton, dense to very dense.	
- Bottom of Hole @ 49.5' -									

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DENNISON; P = PITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 15



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.						
LAKE CAVANAUGH ROAD				T33N R6E SEC17 S.E. 1/4	10363	1 OF 1	LCAG 16						
DATE	COORDINATES			ANGLE FROM HORIZ.		BEARING							
10/23/78	T33N R6E SEC17 S.E. 1/4			90°									
BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH					
10/23/78	10/23/78	Pacific Testing Labs	3-3/8" Auger		8"			49.5'					
CORE RECOVERY (TV%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
		2			896'								
SAMPLE HAMMER WEIGHT/FALL			CASING LEFT IN HOLE DIA./LENGTH		LOGGED BY:								
140 LBS/SPT			0		Jorge Martinez								
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE (IN)	SAMPLER RECOVERY CORE RECOVERY	SAMPLER BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H									5			0-2.5' Roadbed: brown, sand, gravel & cobbles.	*H" = 3 3/8" hollow stem auger drilling an 8" dry hole. Gravelly zones @ 15' & 20' - very coarse, rig chatter was very loud with heavy jumping on stands.
									10			2.5-15' Silty Clay: brown, moderately plastic, loose to medium density, thin lenses of blue silty clay.	
									15			15-23.5' Silty Sand blue-gray, poorly sorted, with scattered cobbles and coarse gravels, and blue silty clay lens 18'-20'.	
SS	18	18	5-1-8						20				
H									25			23.5-44' Silty Sand: blue-gray, loose to medium density with fine sand lens 32'-33.5'.	
									30				
									35				
									40				
									45			44-49.5' Till: blue-gray diamicton, very dense.	
SS	18	18	9-24-49						49.5			- Bottom of Hole @ 49.5' -	

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DENNISON; P = PITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 16



GEOLOGIC DRILL LOG				PROJECT			JOB NO.	SHEET NO.	HOLE NO.				
LAKE CAVANAUGH ROAD				Skagit Nuclear Power Project			10363	1 OF 1	LCAG 17				
SITE				COORDINATES				ANGLE FROM HORIZ. BEARING					
LAKE CAVANAUGH ROAD				T33N	R6E	SEC.17	S.E. 1/4	90°					
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL			HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH				
10/23/78	10/23/78	Pacific Testing Labs	3-3/8" Auger			8"			49.5'				
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
		2			896'								
SAMPLE HAMMER WEIGHT/FALL			CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY:							
140 LBS/SPT			0			Jorge Martinez							
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE (S)	SAMPLER RECOVERY CORE RECOVERY	SAMPLER LOSS PERCENT CORE RECOVERY	WATER PRESSURE TESTS				ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
				LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES							
H									5		0-3' Roadbed: brown, sand & small cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole. Gravels & cobbles @ 20'-30'-rig chatter moderate to extreme with substantial jumping on stands.	
									10		3-13' Silty Clay: brown, with blue-gray lenses, loose to medium density.		
									15		13-20' Silty Clay: blue-gray, loose.		
									20		20-30' Silty Sand: blue-gray medium to poor sorting, scattered gravels and small cobbles with fine silty clay lenses.		
									25				
	SS 18 18		2-7-14						30	A	30-41.5' Silty Sand: blue-gray, loose to medium density.	Till @ 44'-hard, compact, chatter very loud with substantial jumping on stands.	
H									35		41.5-44' Sand: gray, moderately sorted, loose.		
									40		44-49.5' Till: blue-gray diamicton, medium density.		
									45				
	SS 18 18		10-23-33						50	B			
- Bottom of Hole @ 49.5' -													



GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.				
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4		10363	1 OF 1	LCAG 18				
SITE		COORDINATES		ANGLE FROM HORIZ.		BEARING						
LAKE CAVANAUGH ROAD		T33N R6E SEC.17 S.E. 1/4		90°								
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH				
10/24/78	10/24/78	Pacific Testing Labs	3-3/8" Auger		8"			49.5				
CORE RECOVERY (PT.%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK				
			10		896'							
SAMPLE HAMMER WEIGHT/PALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:								
140 LBS/SPT		0		Jorge Martinez								
SAMPLE TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE (IN)	SAMPLER RECOVERY CORE RECOVERY (%)	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES					
H	SS 18	18	4-4-7						0-2.5'	A	Roadbed: brown, sand, gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole Gravel horizons at 14' & 20-22', medium to coarse, rig chatter with some minor jumping on stands. Till @ 45', hard, compact, very loud chatter with substantial jumping on stands.
H	SS 18	18	1-4-8					2.5-4'	B	Sand: gray, loose, moderately sorted.		
H	SS 18	18	3-5-7					4-14.5'	C	Silty Clay: blue-gray, loose, with very thin silty sand and fine sand lenses.		
H	SS 18	18	1-4-10					4.5-45'	D	Silty Sand: blue-gray, well-sorted, with interbedded fine sand lenses 1.5'-2' thick, thin lenses of silty clay, and a gravel horizon at 20'-21.5'.		
H	SS 18	18	3-50-2						E			
H	SS 18	18	1-4-7						F			
H	SS 18	18	5-13-14						G			
H	SS 18	18	2-5-7						H			
H	SS 18	18	2-4-4						I			
H	SS 18	18	7-29-33						J	45-49.5' Till: blue-gray, diamicton, medium density.		
											- Bottom of Hole @ 49.5' -	

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DEBNISON; P = PITCHER; O = OTHER

LAKE CAVANAUGH ROAD

HOLE NO. LCAG 18



GEOLOGIC DRILL LOG

PROJECT: Skagit Nuclear Power Project
 JOB NO.: 10363
 SHEET NO.: 1 OF 1
 HOLE NO.: LCAG 19

SITE: LAKE CAVANAUGH ROAD
 COORDINATES: T33N R6E SEC17 S.E. 1/4
 ANGLE FROM HORIZ.: 90°
 BEARING:

BEGIN: 0/24/78
 COMPLETED: 10/24/78
 DRILLER: Pacific Testing Labs
 DRILL MAKE AND MODEL: 3-3/8" Auger
 HOLE SIZE: 8"
 OVERBURDEN (FT.):
 ROCK (FT.):
 TOTAL DEPTH: 49.5'

CORE RECOVERY (FT./%)
 CORE BOXES: 2
 SAMPLES: EL. TOP OF CASING: 896'
 GROUND EL.:
 DEPTH/EL. GROUND WATER:
 DEPTH/EL. TOP OF ROCK:

SAMPLE HAMMER WEIGHT/FALL: 140 LBS/SPT
 CASING LEFT IN HOLE: DIA./LENGTH: 0
 LOGGED BY: Jorge Martinez

SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RIG	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOW "M"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H									5			0-2.5' Roadbed; brown, sand, gravels & cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole.
									10			2.5-17' <u>Silty Clay</u> : blue-gray, loose, with silty sand lenses.	
									15			17-28' <u>Silty Sand</u> : blue-gray, well-sorted, with silty clay	Gravel zone @ 17'-rig noise moderately loud with occasional jumping on stands.
									20			22.5'-24.5' and scattered medium gravels in silty sands, minor clay.	
									25			28-45' <u>Silty Sand</u> : blue-gray, well-sorted, loose to medium density.	Till @ 45'-rig chatter very loud with substantial jumping on stands.
									30				
									35				
									40				
									45			45-49.5' <u>Till</u> : blue-gray diamicton, medium density.	
									50			- Bottom of Hole @ 49.5' -	

SS = SPLIT SPOON; ST = SHELBY TUBE; SITE: LAKE CAVANAUGH ROAD; HOLE NO.: LCAG 19
 D = DENNISON; P = PITCHER; O = OTHER



GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4		10363	1 of 1	LCAG 20					
SITE		COORDINATES			ANGLE FROM HORIZ.		BEARING						
LAKE CAVANAUGH ROAD		T33N R6E SEC.17 S.E. 1/4			90°								
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH					
10/24/78	10/24/78	Pacific Testing Labs	3-3/8" Auger		8"			44.5'					
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
			4		896'								
SAMPLE HAMMER WEIGHT/FALL			CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:								
140 LBS/SPT			0		Jorge Martinez								
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLER BLOW "M"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H									0-2.5'			Roadbed: brown, sand, gravel and small cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole.
									2.5-15'			Silty Clay: blue-gray, loose, with very thin lenses of silty sand.	Gravels 15'-23' - rig chatter
									15-24'			Silty Sand: blue-gray, well-sorted, with small to medium gravel lenses, interbedded fine sand and silty clay.	loud with some minor jumping on stands.
SS	18	18	2-4	8					20		A		Thin gravel horizon @ 34.5'
H									24-34.5'			Sand: gray, well-sorted, medium density, with thin lenses of silty clay.	- minor rig chatter.
SS	18	18	3-7	11					25		B		Till @ 43.5' - rig chatter
H									34.5-43.5'			Silty Clay: blue-gray, loose, with thin lenses of very fine silty sand.	extreme w/ substantial jumping on stands.
SS	18	18	2-12	24					35		C		
H									43.5-44.5'			Till: blue-gray diamicton, medium density.	
SS	18	18	8-10	17					45		D		
									50				
												- Bottom of Hole @ 45.5' -	

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DENNISON; P = FITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 20



GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.						
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4	10363	1 of 1	LCAG 21						
DATE	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH						
10/24/78	10/24/78	Pacific Testing Labs	3-3/8" Auger	8"			45.5'						
CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK							
		9		896'									
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE (IN)	SAMPLER RECOVERY CORE RECOVERY (%)	SAMPLER BLOW COUNT	PERCENT CORE RECOVERY (%)	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN S.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H												0-2.5' Roadbed: brown, sand, gravel & small cobbles.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole. Thin gravel horizons @ 13'-minor rig chatter. Thin gravel horizon @ 28'-minor rig chatter. Till @ 44'-rig chatter very loud with substantial jumping on stands.
SS	18	18	8-6-8					5	A		2.5-6.5' Silty Sand: blue-gray, well-sorted, loose, with interbedding lenses of silty clay.		
H								10	B		6.5-21.5' Silty Clay: blue-gray with thin lenses of very fine silty sand.		
SS	18	18	2-2-5					15	C		21.5-31.5' Silty Sand: blue-gray, well-sorted, loose, with interbedded, fine-medium sand and silty clay.		
H								20	D		31.5-38.5' Sand: gray, well-sorted, medium density.		
SS	18	18	4-2-3					25	E		38.5-44' Silty Sand: blue-gray, well-sorted, loose, with very thin lenses of fine sand.		
H								30	F		44-45.5' Till: blue-gray diamicton, dense.		
SS	18	18	1-2-2					35	G				
H								40	H				
SS	18	18	2-3-5					45	I				
H								50					
SS	18	18	2-4-5										
H													
SS	18	18	2-4-9										
H													
SS	18	18	2-7-11										
H													
SS	18	18	2-4-9										
H													
SS	18	18	6-21-30										
H													
- Bottom of Hole @ 45.5' -													

SS = SPLIT SPOON; ST = SHELBY TUBE;
 B = BENNISON; P = PITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 21



GEOLOGIC DRILL LOG		PROJECT Skagit Nuclear Power Project	JOB NO. 10363	SHEET NO. 1 of 1	HOLE NO. LCAG 22
SITE LAKE CAVANAUGH ROAD		COORDINATES T33N R6E SEC. 17 S.E. 1/4		ANGLE FROM HORIZ. 90°	BEARING
BEGIN 10/25/78	COMPLETED 10/25/78	DRILLER Pacific Testing Labs	DRILL MAKE AND MODEL 3 3/8" Auger	HOLE SIZE 8"	OVERBURDEN (FT.) ROCK (FT.) TOTAL DEPTH 44.5'
CORE RECOVERY (PT.%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL. 895'
SAMPLE HAMMER WEIGHT/FALL 140 LBS/SPT		CASING LEFT IN HOLE: DIA./LENGTH 0		LOGGED BY: Jorge Martinez	

SAMPLE TYPE AND DIAMETER	SAMPLER ADVANCE	LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "M"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
						LOSS IN S.P.M.	PRESSURE P.S.F.	TIME IN MINUTES					
H											0-2.5 Roadbed brown, sand, gravel & small cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" hole. Thin, small gravel zone @ 3' - minor rig chatter. Thin gravel horizons @ 28' & 34' - minor rig chatter. Till @ 43.5' - very loud rig chatter w/ substantial jumping on stands.	
SS	18	18	3-5-5						5	A	2.5-24 Silty Clay: blue-gray, loose, interbedded with fine silty sand and thin fine to medium sand lenses.		
H									10	B			
SS	18	18	1-2-3						15	C	24-36.5 Silty Sand: Well sorted, loose, with thin lenses of fine sand.		
H									20	D			
SS	18	18	2-4-7						25	E	36.5-39 Sand: gray, well sorted, loose.		
H									30	F			
SS	18	18	2-5-7						35	G	39-41.5 Silty Sand: blue-gray, well sorted, loose.		
H									40	H	41.5-43.5 Sand: gray, moderately sorted, medium density.		
SS	18	18	2-6-7						45	I	43.5-44.5' Till: blue-gray, diamicton, dense.		
H													
SS	18	18	3-6-8										
H													
SS	18	18	16-35-34										

- Bottom of Hole @ 44.5' -

SS = SPLIT SPOON; ST = SHELBY TUBE; S = SENNISON; P = PITCHER; O = OTHER	SPTS LAKE CAVANAUGH ROAD	HOLE NO. LCAG 22
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GEOLOGIC DRILL LOG				PROJECT	JOB NO.	SHEET NO.	HOLE NO.							
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E. 1/4	10363	1 of 1	LCAG 23							
DATE	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH							
0/25/78	10/25/78	Pacific Testing Labs	3-3/8" Auger	8"			44.5'							
CORE RECOVERY (PT./%)	CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK								
		9		895'										
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:										
140 LBS/SPT		0		Jorge Martinez										
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE FT.	SAMPLE RECOVERY CORE RECOVERY	SAMPLER BLOWS PER FEET	PERCENT CORE RECOVERY	WATER PRESSURE TESTS				ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES							
H													0-2.5' Roadbed: brown, sand, gravel & small cobbles.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole.
SS	18	18	2-3-5						5	A			2.5-17.5' Silty Clay: blue-gray, loose, with thin lenses of fine silty sand and very fine sand.	Gravel lens @ 39', minor rig chatter.
H									10	B			17.5-31.5' Silty Sand: blue-gray, well-sorted, loose, with thin lenses of silty clay and fine sands.	Till @ 43'-rig chatter very loud with substantial jumping on stands.
SS	18	18	1-2-3						15	C			31.5-41.5' Silty Clay: blue-gray, loose, silty sand lenses near base of unit.	
H									20	D				
SS	18	18	2-2-3						25	E				
H									30	F				
SS	18	18	1-5-4						35	G				
H									40	H			41.5-43' Sand: gray, moderately sorted, loose.	
SS	18	18	3-5-2						45	I			43-44.5' Till: blue-gray diamicton, dense.	- Bottom of Hole @ 44.5' -
H														
SS	18	18	1-3-3											
H														
SS	18	18	1-3-7											
H														
SS	18	18	2-25-40											

SS = SPLIT SPOON; ST = SHELBY TUBE;
 B = BENNISON; P = PITCHER; O = OTHER

LAKE CAVANAUGH ROAD

HOLE NO.
 LCAG 23



GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC.17 S.E.1/4		10363	1 of 1	LCAG 24					
SITE		COORDINATES			ANGLE FROM HORIZ.		BEARING						
LAKE CAVANAUGH ROAD		T33N R6E SEC.17 S.E.1/4			90°								
BEGIN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH						
10/25/78	10/25/78	Pacific Testing Labs	3-3/8" Auger	8"			44.5'						
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
			9		892'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY:								
140 LBS/SPT		0			Jorge Martinez								
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLER RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H	SS 18 18	2-2-5							5	A	0-2.5' Roadbed: brown, sand gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling an 8" dry hole. Gravelly zones 27'-36', minor rig chatter with little or no jumping. Till @ 42' chatter very loud with substantial jumping on stands.	
H	SS 18 18	7-2-3						10	B	2.5-24' Silty Clay: blue-gray loose, with thin lenses of fine silty sand, also contains gravelly sand @ 18.5' and fine sand @ 21.5".			
H	SS 18 18	7-1-3						15	C	24-29.5' Silty Sand: blue-gray, well sorted, loose.			
H	SS 18 18	7-2-2						20	D	29.5-36.3' Sand: gray, well-sorted, loose.			
H	SS 18 18	4-4-8						25	E	36.3-39' Silty Clay: blue-gray, loose.			
H	SS 18 18	1-3-6						30	F	39-42' Silty Sand: blue-gray loose, well-sorted, with lenses of fine sand.			
H	SS 18 18	2-7-9						35	G	42-44.5' Till: blue-gray diamicton, very dense.			
H	SS 18 18	1-1-5						40	H				
H	SS 18 18	7-100							I				
											- Bottom of Hole @ 44.5' -		

SS = SPLIT SPOON; ST = SHELBY TUBE;
 D = DENNISON; P = PITCHER; O = OTHER

SITE LAKE CAVANAUGH ROAD

HOLE NO. LCAG 24

RECORDED

GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC. 17 S.E. 1/4		10363	1 OF 1	LCAG 25					
SITE		COORDINATES				ANGLE FROM HORIZ.		BEARING					
10/26/78		10/26/78		Pacific Testing Labs		3-3/8" Auger		8"					
CORE RECOVERY (FT./%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		TOTAL DEPTH					
		8			888'			39.5'					
SAMPLE HAMMER WEIGHT/FALL			CASING LEFT IN HOLE: DIA./LENGTH			LOGGED BY:							
L40 LBS/SPT			0			Jorge Martinez							
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RUN	SAMPLE RECOVERY CORE RECOVERY	SAMPLE BLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H												0-2.5' Roadbed: brown, sand gravel & cobbles.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole.
SS	18	18	4-8-12						5	A		2.5-4' Silty Sand: brown, moderately sorted, medium density.	Small gravel horizon @ 15' - minor chatter in rig w/little jumping.
H									10	B		4-12' Silty Clay: blue-gray, loose, with thin lenses of fine sand and very fine silty sand scattered throughout.	Small gravel at 32' - rig chatter, little rig jumping.
SS	18	18	2-2-3						15	C		12-16.5' Sand: gray, well-sorted, loose, overlying thin silty clay and silty sand.	Till @ 37' - hard surface, rig jumped substantially, very loud chatter.
H									20	D		16.5-21.5' Silty Clay: blue gray, loose, with very thin lenses of 'clayey silt'.	
SS	18	18	3-4-5						25	E		21.5-26.5' Sand: gray, well-sorted, medium density, with thin lenses of silty sand and silty clay.	
H									30	F		26.5-34.5' Silty Sand: blue-gray, well sorted, loose.	
SS	18	18	2-5-6						35	G		34.5-37' Sand: gray, well sorted, loose.	
H									40	H		37-39.5' Till: blue-gray, diamicton, medium density.	
SS	18	18	3-7-12									- Bottom of Hole @ 39.5' -	
H													
SS	18	18	2-4-6										
H													
SS	18	18	2-4-7										
H													
SS	18	18	8-10-30										

SS = SPLIT SPOON; ST = SHELBY TUBE; SITE
 O = DENNISON; P = FITCHER; D = OTHER

LAKE CAVANAUGH ROAD

HOLE NO. LCAG 25



GEOLOGIC DRILL LOG				PROJECT		JOB NO.	SHEET NO.	HOLE NO.					
LAKE CAVANAUGH ROAD				T33N R6E SEC. 17 S.E. 1/4		10363	1 of 1	LCAg 26					
SITE		COORDINATES				ANGLE FROM HORIZ.		BEARING					
LAKE CAVANAUGH ROAD		T33N R6E SEC. 17 S.E. 1/4				90°							
BEGUN	COMP. BY	DRILLER	DRILL MAKE AND MODEL		HOLE SIZE	OVERBURDEN (FT.)	ROCK (FT.)	TOTAL DEPTH					
10/26/78	10/26/78	Pacific Testing Labs	3-3/8" Auger		8"			44.5'					
CORE RECOVERY (PT.%)		CORE BOXES	SAMPLES	EL. TOP OF CASING	GROUND EL.	DEPTH/EL. GROUND WATER		DEPTH/EL. TOP OF ROCK					
			9		891'								
SAMPLE HAMMER WEIGHT/FALL		CASING LEFT IN HOLE: DIA./LENGTH		LOGGED BY:									
140 LBS/SPT		0		Jorge Martinez									
SAMPLER TYPE AND DIAMETER	SAMPLER ADVANCE LENGTH CORE RIG	SAMPLER RECOVERY	SAMPLE FLOWS "N"	PERCENT CORE RECOVERY	WATER PRESSURE TESTS			ELEVATION	DEPTH	GRAPHIC LOG	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
					LOSS IN G.P.M.	PRESSURE P.S.I.	TIME IN MINUTES						
H									0-2.5'	A	Roadbed: brown, sand, gravel & cobble.	"H" = 3-3/8" hollow stem auger drilling 8" dry hole.	
SS	18	18	1-2-3						2.5-3.5'	B	Silty Sand: blue-gray, well-sorted, loose.	Small gravels 16.5'-36.5' - rig made slight chatter with little jumping on stand.	
H									3.5-16.5'	C	Silty Clay: blue-gray, loose, contains thin layers of fine to very fine sand and silty sand.		
SS	18	18	1-2-2						16.5-36.5'	D	Silty Sand: blue-gray, well-sorted, loose, contains thin lenses of silty clay.	Till @ 40' - rig jumped on stands substantially w/loud chatter	
H									36.5-40'	E	Sand: gray, well-sorted, loose density, contains lens of silty clay 38.5'-39.5'.		
SS	18	18	1-3-4						40-44.5'	F	Till: blue-gray, diamicton, medium density.		
H										G			
SS	18	18	2-4-5							H			
H										I			
SS	18	18	3-6-4										
H													
SS	18	18	2-6-8										
H													
SS	18	18	3-5-8										
H													
SS	18	18	3-5-9										
H													
SS	18	18	9-24-26										
- Bottom of Hole @ 44.5' -													

SS = SPLIT SPOON; ST = SHELBY TUBE;
 O = DENNISON; P = PITCHER; G = OTHER

SITE

LAKE CAVANAUGH ROAD

HOLE NO.

LCAg 26