

APPENDIX A2

Boring Logs

(Pages A2-1 to A2-141)

Project: Klamath River Dam Removal Project
Project Location: Klamath River
Project Number: 60537920

Key to Log of Soil Boring

Sheet 1 of 4

Elevation feet	Depth, feet	SAMPLES					Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight (pcf)	Fines Content (% <200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance blows/6-in.	Recovery (inches)							
1	2	3	4	5	6	7		8	9	10	11	12

COLUMN DESCRIPTIONS

- | | |
|---|--|
| <p>1 Elevation: Elevation in feet referenced to specified datum.</p> <p>2 Depth: Depth in feet below the ground surface.</p> <p>3 Sample Type: Type of soil sample collected at depth interval shown; sampler symbols are explained below.</p> <p>4 Sample Number: Sample identification number.</p> <p>5 Sampling Resistance: Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop; or down-pressure for pushed sampler.</p> <p>6 Recovery: Percentage of driven or pushed sample length recovered; "NA" indicates data not recorded.</p> <p>7 Graphic Log: Graphic depiction of subsurface material encountered; typical symbols are explained below.</p> | <p>8 Material Description: Description of material encountered; may include density/consistency, moisture, color, and grain size.</p> <p>9 Water Content: Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.</p> <p>10 Dry Unit Weight: Density of soil as measured in the laboratory, in pounds per cubic foot</p> <p>11 Fines Content: Percentage passing the #200 sieve as measured in the laboratory</p> <p>12 Remarks and Other Tests: Comments and observations regarding drilling or sampling made by driller or field personnel.</p> |
|---|--|

TYPICAL MATERIAL GRAPHIC SYMBOLS

	FAT CLAY (CH)		FAT CLAY with SAND (CH)		SANDY FAT CLAY with GRAVEL (CH)		SANDY FAT CLAY (CH)
	LEAN CLAY WITH ORGANICS (CL)		SANDY LEAN CLAY (CL)		LEAN CLAY with GRAVEL and SAND (CL)		GRAVELLY LEAN CLAY (CL)
	LEAN CLAY with SAND (CL)		SANDY LEAN CLAY with GRAVEL (CL)		CLAYEY GRAVEL (GC)		CLAYEY GRAVEL with SAND (GC)
	POORLY GRADED GRAVEL (GP)		POORLY GRADED GRAVEL with SAND (GP)		POORLY GRADED GRAVEL with CLAY (GP-GC)		WELL GRADED GRAVEL WITH SAND (GW)

TYPICAL SAMPLER GRAPHIC SYMBOLS

	2.5-inch I.D. Modified California		Standard Penetration Test
	Shelby Tube		2.0-inch I.D. California

GENERAL NOTES

- Check By:** Soil and core samples reviewed in-person by Project Geologist.
- Reviewed By:** Soil and core samples reviewed via run photos or core box photos in office by Project Engineer.

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Key to Log of Soil and Core Boring

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type Number	Blows / 6 in.	Recovery, %				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

COLUMN DESCRIPTIONS

- 1 Elevation:** Elevation (in feet) referenced to North American Vertical Datum of 1988 (NAVD88).
- 2 Depth:** Distance (in feet) below the collar of the borehole.
- 3 Run No.:** Number of the individual coring interval.
- 4 Box No.:** Number of the core box which contains core from the corresponding runs.
- 5 Recovery:** Amount in percent of core recovered from coring interval; calculated as length of core recovered divided by length of run.
- 6 Fractures per Foot:** (Fracture Frequency) The number of naturally occurring fractures in each foot of core; does not include mechanical breaks (induced by drilling) or healed fractures. "NA" indicates not applicable due to lack of core recovery or soil-like nature of rock.
- 7 R Q D:** (Rock Quality Designation) Amount (in percent) of intact core (pieces of sound core greater than 4 inches in length) in each coring interval; calculated as the sum of lengths of intact core divided by length of core run.
- 8 Fracture Drawing:** Sketch of the naturally occurring fractures and mechanical breaks, showing the angle of the fractures relative to the cross-sectional axis of the core. "NR" indicates no recovery.
- 9 Fracture Number:** Location of each naturally occurring fracture (numbered) and mechanical break (labeled "M"). Naturally occurring fractures are described in Column 11 (keyed by number) using descriptive terms defined on Sheet 2 (Items a through g).

- 10 Lithology:** Graphic depiction of subsurface material encountered, typical symbols are explained below
- 11 Description:** Lithologic description in this order: rock type, color, grain size, texture, weathering, strength, and other features; descriptive terms are defined on Sheet 2. Also, abbreviated description of fractures numbered in Column 9 using terms defined on Sheet 2.
- 12 Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.
- 13 Sample Number:** Sample identification number.
- 14 Blows / 6 in.:** Number of blows to advance driven sampler each 6-inch drive interval, or distance noted, using a 140-lb hammer with a 30-inch drop (unless otherwise noted).
- 15 Recovery:** Actual soil recovery in driven sampler as a percentage of the sampler penetration.
- 16 Drill Time [Rate]:** Time (in 24-hour clock) marking start and finish of each run; drill rate (in feet per hour) is reported in brackets.
- 17 Field Notes and Tests Results:** Comments and observations regarding drilling or sampling made by driller or field personnel.

OTHER GRAPHIC SYMBOLS

TYPICAL MATERIAL GRAPHIC SYMBOLS

	SILT with SAND and GRAVEL (ML)		SANDY SILT (ML)		ORGANIC SILT WITH SAND (OL)		GRAVELLY FAT CLAY with SAND (CH)
	CLAYEY SAND to SANDY LEAN CLAY (SC-CL)		CLAYEY SAND with GRAVEL (SC)		SILTY SAND (SM)		SILTY to CLAYEY SAND with GRAVEL (SM-SC)
	SILTY SAND with GRAVEL (SM)		POORLY GRADED SAND (SP)		POORLY GRADED SAND with GRAVEL (SP)		POORLY GRADED SAND with SILT (SP-SM)
	WELL GRADED SAND with GRAVEL (SW)						

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Key to Log of Core Boring

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE							Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
1	2	3	4	5	6	7	8	9	10	11	13	14

COLUMN DESCRIPTIONS

- 1 Elevation:** Elevation (in feet) referenced to mean sea level (MSL).
- 2 Depth:** Distance (in feet) below the collar of the borehole.
- 3 Run No.:** Number of the individual coring interval.
- 4 Box No.:** Number of the core box which contains core from the corresponding run.
- 5 Recovery:** Amount (in percent) of core recovered from the coring interval; calculated as length of core recovered divided by run length.
- 6 Fractures per Foot:** (Fracture Frequency) The number of naturally occurring fractures in each foot of core; does not include mechanical breaks (induced by drilling) or healed fractures. "NA" indicates not applicable due to lack of core recovery.
- 7 R Q D:** (Rock Quality Designation) Amount (in percent) of intact core (pieces of sound core greater than 4 inches in length) in the coring interval; calculated as the sum of lengths of intact core divided by the run length. RQD value with "*" indicates moderately weathered / altered rock that does not meet soundness requirements, but provides an indication of rock quality with respect to degree of fracturing.
- 8 Fracture Drawing:** Sketch of the naturally occurring fractures and mechanical breaks, showing the angle of the fractures relative to the cross-sectional axis of the core. "NR" indicates no recovery.

- 9 Fracture Number:** Location of each naturally occurring fracture (numbered) and mechanical break (labeled "M"). Naturally occurring fractures are described in Column 11 (keyed by number) using descriptive terms defined on Sheet 2 (Items a through g).
- 10 Lithology:** A graphic log of material encountered using symbols to represent differing soil and rock types; symbols are explained below.
- 11 Description:** Lithologic description in this order: rock type, color, texture, grain size, weathering, strength, and other features; descriptive terms are defined on Sheet 2. A detailed description of overburden material is not necessarily provided. Also, abbreviated description of fractures numbered in Column 9 using terms defined on Sheet 2.
- 12 Drill Time [Rate]:** Time (in 24-hour clock) marking start and finish of each run; drill rate (in feet per hour) is reported in brackets.
- 13 Field Notes and Other Tests:** Comments regarding drilling and sampling made by driller or field personnel. Tested rock specimen intervals and a record of tests performed using the abbreviations listed below.

TYPICAL MATERIAL GRAPHIC SYMBOLS

 ASPHALT	 ANDESITE	 BASALT	 BOULDERS and COBBLES
 BOULDER	 DIATOMITE	 DIATOMITE WITH ELASTIC SILT	 VOLCANIC BRECCIA
 VOLCANIC CINDER	 VOLCANIC CLAYSTONE	 VOLCANIC CONGLOMERATE	 VOLCANIC MUDSTONE
 VOLCANIC SANDSTONE	 VOLCANIC SILTSTONE/CLAYSTONE	 VOLCANIC SILTSTONE	 VOLCANIC SILTY SANDSTONE

OTHER GRAPHIC SYMBOLS

-  Static Water Level
-  First water encountered at time of drilling
- Inferred or transitional contact
-  Change in material properties within a stratum

LABORATORY TEST ABBREVIATIONS

- PL:** Point Load Index Test (psi)
- UC:** Unconfined Compressive Strength test (psi)

Material descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced, and are not warranted to be representative of subsurface conditions at other locations or times.

Project: Klamath River Dam Removal Project

Project Location: Copco and Iron Gate Reservoirs

Project Number: 60537920

Key to Log of Boring

Sheet 4 of 4

KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS**DISCONTINUITY DESCRIPTORS****a** Dip of discontinuity, measured relative to a plane normal to the core axis.**b** **Discontinuity Type:**

F - Fault
J - Joint
Sh - Shear
Fo - Foliation
V - Vein
B - Bedding

e **Amount of Infilling:**

Su - Surface Stain
Sp - Spotty
Pa - Partially Filled
Fi - Filled
No - None

g **Roughness of Surface:**

Slk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
S - Smooth [surface appears smooth and feels so to the touch]
SR - Slightly Rough [asperities on discontinuity surfaces are distinguishable and can be felt]
R - Rough [ridges and side-angle steps are evident; asperities are clearly visible; surface feels very abrasive]
VR - Very Rough [near-vertical steps and ridges occur on discontinuity surface]

c **Aperture (inches):**

W - Wide (0.5-2.0)
MW - Moderately Wide (0.1-0.5)
N - Narrow (0.05-0.1)
VN - Very Narrow (<0.05)
T - Tight (0)

f **Surface Shape of Joint:**

Pl - Planar
Wa - Wavy
St - Stepped
Ir - Irregular

d **Type of Infilling:**

Bi - Biotite Mn - Manganese
Cl - Clay No - None
Ca - Calcite Py - Pyrite
Ch - Chlorite Qz - Quartz
Ep - Epidote Sd - Sand
Fe - Iron Oxide Se - Serpentine
H - Healed Si - Silty
My - Mylonite Uk - Unknown
CR - Crushed Rock

ROCK FRACTURING

Description	Recognition
Intensely Fractured	Fractures spaced less than 2 inches apart
Highly Fractured	Fractures spaced 2 inches to 1 foot apart
Moderately Fractured	Fractures spaced 1 foot to 3 feet apart
Slightly Fractured	Fractures spaced 3 feet to 10 feet apart
Massive	Fracture spacing greater than 10 feet

ROCK WEATHERING / ALTERATION

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered/Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand
Highly Weathered/Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric
Moderately Weathered/Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered/Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh/Unweathered	Rock shows no discoloration, loss of strength, or other effect of weathering/alteration

ROCK STRENGTH

Description	Recognition	Approximate Uniaxial Compressive Strength (psi)
Extremely Weak Rock	Can be indented by thumbnail	35 - 150
Very Weak Rock	Can be peeled by pocket knife	150 - 700
Weak Rock	Can be peeled with difficulty by pocket knife	700 - 3,600
Moderately Strong Rock	Can be indented 5 mm with sharp end of pick	3,600 - 7,200
Strong Rock	Requires one hammer blow to fracture	7,200 - 14,500
Very Strong Rock	Requires many hammer blows to fracture	14,500 - 36,000
Extremely Strong Rock	Can only be chipped with hammer blows	>36,000

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-01

Sheet 1 of 2

Date(s) Drilled	9/27/2018	Logged By	S. Janowski	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, HQ-3 wireline diamond bit	Total Depth of Borehole	25.5 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2346 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.5-inch ID ModCal; SPT; HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Camp Creek Bridge	Coordinate Location	N 2602866 E 6443027

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]
	0								2-inches GRAVEL roadway						Start 9:00 9/27/2018; hang auger 0.0-5.0ft.
	1								CLAYEY GRAVEL (GC); very stiff; yellowish brown (10YR 5/6); 60% subangular GRAVEL to 1-inch; 30% low plasticity FINES; 10% fine grained SAND; moist						
									--ROAD FILL--						
2344	2														
	3														
2342	4														
	5								LEAN CLAY with GRAVEL and SAND (CL); very stiff; dark yellowish brown (10YR 4/4); 80% medium plasticity FINES; 10% fine grained SAND; 10% subangular GRAVEL to 1/2-inch; moist		6				pp = 2.75 tsf
2340	6								--ALLUVIUM--	S-01	7	0			Hollow stem auger 5.0ft. to 9.0ft.
	7										8				pp = 2.25 tsf
2338	8									S-02	7	0			
	9								GRAVEL and COBBLES in a SANDY LEAN CLAY matrix; GRAVEL and COBBLES are subrounded Basalt		6				
2336	10	1	1	80	NA	NA				S-03	19			1014	Auger refusal at 9.0ft.; advance 4.5-inch casing to 9.0ft. and switch to rotary wash drilling with 3 7/8-inch tricone bit.
	11				NA						17	11		[13]	
2334	12	2		100	NA						10			1021 1037	
	13				NA									[9]	
														1044 1056	
		3		60	NA									[25]	75% fluid circulation

Report: GEO_CORE-SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-01

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-01

Sheet 2 of 2

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
2332	13		1		NA			GRAVEL and COBBLES in a SANDY LEAN CLAY matrix; GRAVEL and COBBLES are subrounded Basalt --ALLUVIUM--(continued)						75% fluid circulation
	14	4		80	NA	NA							1102 1112	
	15												[9]	
2330	16	5		87	NA	NA		VOLCANIC BRECCIA; dark reddish brown (10R 3/4); highly weathered; very weak; highly fractured; friable --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- Becomes yellowish grey (5Y 7/2), moderately weathered					1119 1124	
	17				0								[23]	
2328	18				>6			Becomes greyish brown (5YR 3/2) Intensely fractured					1128 1136	
2326	19	6		94	88*								[16]	*Rock does not meet soundness criteria for RQD calculation
	20				1			1: 15, V, T-VN, H+Uk, Fi, Pl, ? 2: 60, J, N-W, Sd, Fi, Wa, ?						
2324	21				NA								1155 1244	
	22	7		70	0								[15]	
	23	8		0	0								1248 1254	
2322	24				NA								[12]	
	25	9		50	NA	0							1259 1304	
2320	26				>6								[12]	
	27							TOTAL DEPTH = 25.5 FEET					1314	
2318	28													
	29													

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-01

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring B-02

Sheet 1 of 2

Date(s) Drilled	10/12/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6-inch flight auger	Total Depth of Borehole	31.4 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2340 feet
Groundwater Level(s)	13.5 feet below ground surface 10/12/2018	Sampling Method(s)	SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Camp Creek Bridge	Coordinate Location	N 2602747 E 6443180

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
2340	0					2-inches GRAVEL roadway POORLY GRADED GRAVEL (GP); dense; fine to coarse GRAVEL and COBBLES; fine to coarse grained SAND; little no plasticity FINES; moist --FILL--				Start 9:00 9/27/2018; hollow stem auger 0-31ft.
2335	5					LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; trace fine grained SAND; occasional GRAVEL and COBBLE				Logged from auger cuttings and rig chatter
2330	10									
2325	15									
2320	20					POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse GRAVEL to BOULDERS; fine to coarse grained SAND; some no plasticity FINES --ALLUVIUM-- BOULDER, basalt				Rig chatter indicated rocky layer
2315	25					BOULDER, basalt				
		S-01		14 14 44	100	SILTY SAND with GRAVEL (SM); very dense; GRAVEL up to 1-inch; fine to coarse grained SAND; no plasticity FINES --ALLUVIUM--	14		15	SA: G=32%; S=53%; F=15%
30										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 B-02

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring B-02

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
2310	30	S-02	50/0	0	0	[As Above] --ALLUVIUM--(continued) BASALT; dark grey; slightly weathered to fresh; moderately strong --TERTIARY to QUATERNARY INTRUSIVE BASALT-- TOTAL DEPTH = 31.4 FEET				S-02 attempted at 31.4; logged from flake in shoe
2305	35									
2300	40									
2295	45									
2290	50									
2285	55									
2280	60									
	65									

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-03

Sheet 1 of 2

Date(s) Drilled	10/12/2018-10/16/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, 3 7/8-inch tricone, 3 7/8-inch diamond core bit	Total Depth of Borehole	27.3 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2341 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Camp Creek	Coordinate Location	N 2602664 E 6443265

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, f/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse GRAVEL to BOULDERS; fine to coarse grained SAND; some no plasticity FINES; dry to moist						Start 12:00
-2340	1								--FILL--						10/12/2018; hang
	2														auger 0.0-5.0ft.
-2338	3								BOULDER and COBBLES; 3.0-4.8ft.: BOULDER						
	4								--ALLUVIUM--						
-2336	5														End of day
	6								BOULDER						10/12/2018
-2334	7														Begin day
	8								BOULDERS and COBBLES						10/15/2018
-2332	9														Switch to rotary
	10														wash drilling with 3
-2330	11								BOULDERS and COBBLES						7/8-inch tricone bit
	12														Advance 4.5-inch
-2328	13														casing to 5ft.

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-03

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-03

Sheet 2 of 2

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
13									BOULDER and COBBLES --ALLUVIUM--(continued)						Reddish clay cuttings
14									VOLCANIC SILTSTONE; reddish brown to olive grey; moderately to highly weathered; very weak to weak; very thin laminated; locally clayey --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						
2326												14			S-01 One liner retained (16-16.5ft.)
15											S-01	19			
16												23			
2324															
17															
18															
2322															
19															
20															
2320												27			Rig chatter at 20ft. indicates rocky layer
21											S-02	31			S-02 One liner retained (21-21.5ft.)
22												46			
2318		1		NA			NR		becomes moderately weathered; weak					0810	End of day 10/15/2018 Begin day 10/16/2018
23					1			m							Advance 4.5-inch casing to 22ft. Switch to HQ-3 rock coring at 22.3ft.
24								m							
2316		1		82	1	78*		m	1: J, 30, N, Cl, Fi, Pl, S-SR (dissolution voids along joint) 2: J, 10-15, VN, Cl, Fi, Pl-Wa, S-SR					[7]	
25								m							
26					0		NR	m							
2314					0			m							26.3-27.3ft. driller reports harder drilling condition
27					NA		NR	m						0852	
TOTAL DEPTH = 27.3 FEET															
28															
2312															
29															

Report: GEO_CORE+SOIL_NO_PACK_WITH_LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-03

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-04

Sheet 1 of 3

Date(s) Drilled	9/25/2018	Logged By	S. Janowski	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, HQ-3 wireline diamond bit	Total Depth of Borehole	31.5 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2343 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.5-inch ID Mod Cal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Jenny Creek Bridge	Coordinate Location	N 2603560 E 6452773

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									2-inches ASPHALT roadway						Start 9:30 9/25/2018
-2342	1								POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 40% subangular GRAVEL up to 1-inch; 60% medium grained SAND; moist						Hand Auger 0-5ft.
	2								--ROAD BASE--						pp = 3.25 tsf
	3								SANDY LEAN CLAY with GRAVEL (CL); very stiff to hard; brown (10YR 4/3); 60% low plasticity FINES; 20% subangular gravel up to 2-inches; 20% fine grained SAND; moist						
	4								--ROAD FILL--						
-2340	5								↓ Becomes brown (10YR 5/3 with subangular to subrounded GRAVEL up to 1 1/2-inches, effervescent, with rootlets			15			Hollow Stem Auger 5-9.5 ft.
	6									S-01	13	67			pp = >4.5 tsf
	7											11			
-2338	8								CLAYEY GRAVEL with SAND (GC); very stiff; brown (10YR 4/3); 60% subrounded COBBLES and GRAVELS; 30% low plasticity FINES; 10% medium grained SAND						
	9								--ALLUVIUM--						
-2336	10								↓ Becomes basalt COBBLES up to 5 inches in a clayey matrix			21			Auger refusal at 9.5ft.; advance 4.5-inch casing to 9.5ft.
	11	1	1	100	NA	NA				S-02	13	89			pp = 3.0 tsf
-2334	12	2		64	NA	NA						50			Switch to HQ coring at 11ft. with wireline diamond bit; advance 4.5-inch casing to 9.0ft.
-2332	13													1147	
-2330															

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-04

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-04

Sheet 2 of 3

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
	13		1		NA		NR	CLAYEY GRAVEL with SAND (GC); very stiff; brown (10YR 4/3); 60% subrounded COBBLES and GRAVELS; 30% low plasticity FINES; 10% medium grained SAND --ALLUVIUM--(continued)						Driller indicated good fluid return while pump running but rapid fluid level drop between runs
	14	2		64	NA								[30]	
2328	15				NA			↓ Becomes greyish red (5YR 4/2) to brownish black (5YR 2/1), basalt BOULDERS with minor matrix and subrounded GRAVELS infilling void spaces with some vesicles up to 3/4-inches.						
	16				NA									
2326	17				NA		NR						1157 1206	
	18				NA									
2324	19	3		72	NA								[21]	
	20				NA									
2322	21				NA								1220 1232	
	22				NA									
2320	23				NA			BASALT; olive grey (5Y 3/2); completely weathered; very weakly decomposed and easily friable by hand --TERTIARY to QUATERNARY INTRUSIVE BASALT--						
	24	4		40	NA	0							[13]	
2318	25				NA		NR							
	26	5		70	NA	0	NR	↓ Becomes dusky yellow green (5Y 5/2) and pale reddish brown (10Y 5/4), highly to completely weathered, highly to intensely fractured					1250 1257 [10]	Bit blocked off during run
2316	27	6		0	NA	0	NR						1303 1310 [7]	
	28	7		30	NA	0	NR						1319 1431	
2314	29				NA		NR							

Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-04

[illegible]

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-05

Sheet 1 of 4

Date(s) Drilled	9/26/2018	Logged By	S. Janowski	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, HQ-3 wireline diamond bit	Total Depth of Borehole	50.0 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2342 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.5-inch ID ModCal; SPT; HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Jenny Creek Bridge	Coordinate Location	N 2603527 E 6452997

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2342	0								2-inches ASPHALT roadway						Start 8:30 9/26/2018 hand auger 0-5ft.
	1								POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 60% medium grained SAND; 40% subangular GRAVEL up to 1-inch; moist						
	2								--ROAD BASE-- SANDY LEAN CLAY (CL); very stiff; brown (10YR 1/3); low plasticity FINES; fine to medium grained SAND; subangular GRAVEL up to 2-inches; moist						
2340	3								--ROAD FILL--						Pocket Pen = 3.5 tsf
	4														
2338	5								↓ Becomes dark yellowish brown (10YR 4/4); dry to moist						
	6								LEAN CLAY with GRAVEL (CL); stiff; brown (10YR 4/3); 75% medium plasticity FINES; 15% subangular to subrounded GRAVEL up to 3/4-inch; 10% fine grained SAND; moist; with rootlets	S-01	4	72			Hollow stem auger 5-7.5 ft. SA: G=7%; S=25%; F=68% pp = 1.5 tsf
2336	7								--ALLUVIUM--		9				
	8	1			NA				↓ With pulverized GRAVEL (from drive sampler); increased GRAVEL to 25% up to 1-inch		32			1019	Auger refusal at 7.5ft. pp = 2.75 tsf
2334	9				NA		NR			S-02	12	72			
	10	1		15	NA				↓ With greyish black (N2), aphanitic basalt COBBLES and GRAVELS in a washed-out CLAY matrix		7			[48]	Advance 4.5-inch casing to 7.5 ft.; switch to HQ coring at 7.5ft. with wireline diamond bit
2332	11				NA		NR								
	12				NA						4			1024	pp = 1.5 tsf
2330	13	2		20	NA		NR			S-03	8	39		1104	
					NA						4				

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-05

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-05

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
	13	2	1	20	NA	NA			COBBLES and GRAVELS in a washed-out CLAY matrix; brown (10YR 4/3) --ALLUVIUM--(continued)					[38]	50-75% drill fluid return
	14				NA		NR								
2328	15				NA										
	16				NA		NR							1112 1115	
2326	17	3		40	NA		NR							[24]	
	18				NA									1120 1126	Bit blocked off during run
2324	19				NA		NR								
	20	4		50	NA	NA			Basalt BOULDER; greyish red (5RP 4/2); slightly weathered; strong					[60]	UCS = 14975 psi
2322	21				NA		NR		COBBLES and GRAVELS in a washed-out CLAY matrix; very dark grey (10YR 3/1)					1129 1134	
	22	5		80	NA									[17]	
2320	23				NA				Basalt COBBLES and BOULDERS are non vesiculated to vesiculated with vesicles up to 1/2-inch					1141 1156	
	24				NA										
2318	25	6		73	NA	NA								[30]	
	26				NA		NR							1202 1236	
2316	27	7		43	NA	NA	09.2							[20]	
	28				NA									1242 1331	
2314	29	8		43	NA	NA									

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-05

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-05

Sheet 3 of 4

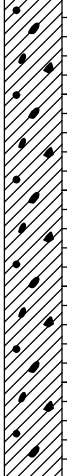
Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
29		8	1	43	NA	NA	NR		COBBLES and GRAVELS in a washed-out CLAY matrix; brown (10YR 4/3)					[30]	0% Fluid return
2312	30				NA				--ALLUVIUM--(continued)						
	31				NA									1337 1344	
2310	32	9		20	NA	NA	NR							[19]	
	33				NA									1352 1401	
2308	34				NA										
	35	10		20	NA	NA	NR							[21]	
	36				NA									1408 1439	
2306	37	11		85	NA	NA	NR			S-04	12	11	0	[20]	
	38		2		NA							11		1445 1528	
2304	39				NA										
	40	12		43	NA	NA	NR							[36]	
2302	41				NA									1533 1600	
	42	13		45	NA	NA	NR							[20]	
2300	43				NA									1606 1611	
	44				NA										
2298	45	14		57	NA	NA	NR							[20]	

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-05

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-05

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
	45	14	2	57	NA	NA			COBBLES and GRAVELS in a washed-out CLAY matrix; brown (10YR 4/3) --ALLUVIUM--(continued)						0% Fluid return
2296	46				NA									1620 1626	
	47	15		65		NA								[15]	
	48				NA									1634 1711	
2294	49	16		0		NA								[20]	
	50				NA									1717	Bit blocked off during run
2292									TOTAL DEPTH = 50.0 FEET						
	51														
	52														
2290															
	53														
	54														
2288															
	55														
	56														
2286															
	57														
	58														
2284															
	59														
	60														
2282															
	61														

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-05

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-06

Sheet 1 of 4

Date(s) Drilled	10/8/2018-10/9/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 3 7/8-inch diamond core bit	Total Depth of Borehole	56.9 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2339 feet
Groundwater Level	13.7 feet below ground surface 10/8/2018	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Jenny Creek	Coordinate Location	N 2603580 E 6453115

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									SANDY LEAN CLAY (CL); stiff; yellowish brown; >50% medium plasticity FINES; fine to coarse grained SAND; GRAVEL up to 2-inches; dry to moist						Start 9:10 10/8/2018; hollow stem auger 0-16.5ft.
2338	1								--FILL--						
	2														
	3														
2336	4														S-01 One liner retained (5-5.5ft.)
	5														
	6									S-01	6				
	7										4				
2334	8														Smoother drilling at 9.0ft.
	9														
	10								SILTY SAND (SM); loose; brownish grey; fine to medium grained SAND; little coarse grained SAND and wood fragments; wet						
	11								--ALLUVIUM--						
2332	12														S-02 One liner retained (10.5-11ft.) SA: S=75%; F=25%
	13														
	14									S-02	1				
	15										3				
2330	16														
	17														
	18														
	19														
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Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-06

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-06

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Type	SOIL SAMPLES			Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				Number	Blows / 6 in.	Recovery, %		
13									SILTY SAND (SM); loose; brownish grey; fine to medium grained SAND; little coarse grained SAND and wood fragments; wet --ALLUVIUM--(continued)						
14															
2324															
15												19			S-03 One liner retained (16-16.5ft.)
16									POORLY GRADED GRAVEL (GP); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet	S-03	29				
2322												18			Switch to rotary wash drilling with 3 7/8-inch tricone bit; advance 4.5-inch casing to 19ft.
17															
18															
2320															
19															
20															
2318															
21															Logged from cuttings
22															
2316															
23															
24															
2314															
25															
26															
2312															
27															
28															
2310															
29															

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-06

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-06

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
29								CLAYEY GRAVEL with SAND (GC); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet						
	30							--ALLUVIUM--						
-2308	31								S-04	16				S-04 One liner retained (31-31.5ft.) SA: G=53%; S=22%; F=25%
	32									14				Advance 4.5-inch casing to 30ft.
-2306	33													
	34													
-2304	35							BOULDER, basalt						On boulder; no drive sample attempted
	36													
-2302	37							BOULDER, basalt						
	38													
-2300	39													
	40													
-2298	41								S-05	27				S-05 One liner retained (41-41.4ft.)
	42									50/5				Advance 4.5-inch casing to 40ft.
-2296	43							BOULDER, basalt						
	44													Total fluid loss at 44ft. (0% fluid return)
-2294	45													

Report: GEO_CORE-SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-06

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-06

Sheet 4 of 4

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-06

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
45								POORLY GRADED GRAVEL (GP); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet --ALLUVIUM--			7			S-06 One liner retained (46-46.5ft.) SA: G=93%; S=7%
46										S-06	10			
2292											36			
47														Advance 4.5-inch casing to 45ft.
48								VOLCANIC SILTSTONE/CLAYSTONE; olive grey; moderately to highly weathered; weak; thinly laminated --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						
2290														Hole caving; End of day 10/8/2018 Begin day 10/9/2018
49														
50														S-07 Two liner retained (50.5-51.0 51.0-51.5ft.) Advance 4.5-inch casing to 50ft.; driller reports consistent olive grey clayey cuttings at 47.5ft.; switch to HQ-3 rock core at 52ft.
2288														
51										S-07	40			
52								VOLCANIC SILTY SANDSTONE; light yellowish brown; highly to moderately weathered; weak to moderately strong; fine to medium grained; becomes bluish grey at 51.8ft.			36			1204
2286		1		>6				VOLCANIC SILTSTONE/CLAYSTONE; reddish brown; moderately weathered; very weak to weak; thinly laminated						
53														[13]
54		1		75	>6	0								
2284														1217
55		2		40		0								
56		3		0		0								[7]
2282		4		100		0		BASALT; slightly weathered; moderately strong --TERTIARY to QUATERNARY INTRUSIVE BASALT--						
57								TOTAL DEPTH = 56.9 FEET						1230 1235 1253 1304 1309 1516
58														Formation pressurized; fluid continued to flow from hole after pump stopped; advanced 4.5-inch casing to 55ft; reddish brown clayey cuttings 55.4-56.6 ft.
2280														
59														
60														
2278														
61														

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-07

Sheet 1 of 3

Date(s) Drilled	10/4/2018-10/5/2018	Logged By	B. Kozlowicz	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, 3 7/8-inch diamond core bit	Total Depth of Borehole	31.8 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2338 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Jenny Creek	Coordinate Location	N 2603568 E 6453234

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0	0								POORLY GRADED SAND with GRAVEL (SP); loose to medium dense; light olive brown (2.5Y 5/3); 60% fine to medium grained SAND; 35% angular GRAVEL up to 2-inches; 5% no plasticity FINES; dry						Start 15:00 10/4/2018 hand auger 0-4.5ft.
	1								--FILL--						
2336	2														
	3														
2334	4														
	5								VOLCANIC SANDSTONE; grey; fine grained; moderately weathered			28			
									--ROCKY FILL?--						
2332	6											20			Hollow stem auger 5-7ft.
	7														
2330	8				NA				CLAYEY GRAVEL with SAND (GC); dark yellowish to olive brown; subangular to subrounded GRAVEL up to 1.5-inches						Hard rocky drilling 6-7ft; auger refusal at 7ft. Advance 4.5-inch casing to 6.8ft. Switch to HQ coring at 7ft. with wireline diamond bit; runs 1 and 2 not retained
					NA				--ROCKY FILL/ALLUVIUM?--						
	9														
2328	10	1		25	NA	NA			VOLCANIC SANDSTONE BOULDER; dark grey; slightly weathered; very strong; fine to medium grained					[30]	
					NA										End of day 10/4/2018 Begin day 10/5/2018
	11														
2326	12				NA										Advance 4.5-inch casing to 9ft.
					NA										0% Fluid Return
	13														

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-07

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-07

Sheet 2 of 3

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-07

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2324	13				NA				CLAYEY GRAVEL with SAND (GC); dark yellowish to olive brown; subangular to subrounded GRAVEL up to 1.5-inches --ROCKY FILL/ALLUVIUM?--						Continued 0% Fluid Return
	14	2		0		NA								[75]	
	15				NA		NR								
2322	16				NA				SILTY SAND (SM); medium dense; very dark grey (10YR 3/1); 80% fine grained SAND; 20% no to low plasticity FINES --ALLUVIUM--		9			0837	SA: G=4%; S=55%; F=41%
	17				NA				VOLCANIC CLAYSTONE; dusky red (10R 3/3); highly weathered; very weak --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--	S-02	37	100			
2320	18				NA						50/5			0859	
	19	3		0	NA	NA	NR							[20]	
	20		1		NA				Broken, likely NR zone					0902	
2318	21								↓ Becomes slightly to moderately weathered, highly fractured, with occasional small, angular GRAVEL					[12]	
	22	4		82	2	36			↓ Becomes mostly moderately weathered, with various amounts of fine to coarse grained SANDSTONE and trace small, subangular GRAVEL, with weak, subhorizontal bedding					0924	
2316	23				3									1048	
	24				5										
2314	25	5		100		10			All Fractures: ?, J, N-VN, No, No, PI, SR					[17]	
	26				4										
2312	27				5										
	28				6									1106	
2310	29				4				VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained					1119	*Rock does not meet soundness criteria for RQD calculation

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-07

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
29		6	1	100	3	16*		VOLCANIC SANDSTONE; dark reddish brown (2.5YR 3/4) to dark red (2.5YR 3/6), grades to fine to medium grained --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)					[16]	
2308	30				4									
	31				NA									
2306	32							Shoe disturbed					1138	
								TOTAL DEPTH = 31.8 FEET						
	33													
2304	34													
	35													
2302	36													
	37													
2300	38													
	39													
2298	40													
	41													
2296	42													
	43													
2294	44													
	45													

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-07

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-08

Sheet 1 of 4

Date(s) Drilled	10/16/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 3 7/8-inch diamond HQ bit	Total Depth of Borehole	52.8 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2194 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.0-inch ID California Sampler, SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Lakeview Bridge	Coordinate Location	N 2587323 E 6441439

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2194	0								POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry						Start 11:30 10/16/2018; hollow stem auger 0-3ft.
	1								--FILL--						
2192	2														
	3														Switch to rotary wash drilling at 3ft.
2190	4														
	5														
2188	6														
	7														
2186	8														
	9														
2184	10														Advance 4.5-inch casing to 10ft.
	11														
2182	12														
	13														

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-08

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-08

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
13								GRAVELLY FAT CLAY with SAND (CH); very stiff; olive brown; medium to high plasticity FINES; trace fine grained SAND; occasional fine to coarse GRAVEL; wet --FILL--(continued)			4			LL= 69; PL=22
2180	14									S01	7			
	15							Rocky layer Becomes greyish green			13			Rig chatter with grayish green cuttings
2178	16							SILT with SAND (ML); very soft; olive brown; low plasticity FINES; trace fine to coarse grained SAND; occasional fine GRAVEL; wet --FILL--			0			S-02 advanced with weight of hammer to 8-inches then pushed to 18-inches with 100 psi without liners SA: G=8%; S=12%; F=80%
	17									S02	0			
2176	18										0			
	19													
2174	20													Advance 4.5-inch casing to 20ft; bluish grey cuttings; S-03 driven without liners
	21									S03	7			
	22							Rocky layer			3			
2172	23							Rocky layer			3			
	24							POORLY GRADED GRAVEL with SAND (GP) to POORLY GRADED SAND with GRAVEL (SP); dense; brown; fine to medium, locally coarse grained SAND; fine to coarse GRAVEL; wet --ALLUVIUM--						Driller notes smooth drilling below 23.5ft.
2170	25									S04	50/5			Advance 4.5-inch casing to 25ft.
2168	26													
	27							VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; highly fractured; fine grained with rounded clasts up to 2 1/2-inches; well cemented with mechanical breaks along fractures --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						Basalt chip in cuttings; steady drilling
2166	28													
	29													

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-08

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-08

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
29									VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; highly fractured; fine grained with rounded clasts up to 2 1/2-inches; well cemented with mechanical breaks along fractures --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
2164	30														
	31														
2162	32														
	33														
2160	34														
	35		1		0			m	1: 70, J, VN, Ch?, Pa, Pl-Wa, SR					1512	Switch to HQ-3 rock coring at 35ft.
	36	1	100		0	89		m						[15]	
2158	37							m							
	38				NA			1						1523	
2156	39							m						1532	
	40	2	100		1	95		m	VOLCANIC SANDSTONE; light to medium grey; slightly weathered to fresh; moderately strong; highly fractured; fine grained with angular, white clasts up to 5 mm						
2154	41							m							
	42				1			2							
2152	43							m							
	44				1			m							
2150	45				0			m	1: 80-90, J, N-MW, Ca, Fi, Wa, SR					1551	1600

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-08

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-08

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
45		3	1	100	1	70	2		VOLCANIC SANDSTONE; light to medium grey; slightly weathered to fresh; moderately strong; highly fractured; fine grained with angular, white clasts up to 5 mm --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)					[21]	UCS = 15268 psi
2148	46				0		m		2: 60, J, Vn, Ch/Cl, Fi, Pl, SR						
47					0		m								
2146	48		2		2		1		VOLCANIC CONGLOMERATE					1614	
49					3		3		1: 5-15, J, VN-N, Cl, Pa, Wa, SR 2: 40, J, VN, Fe, Su, Pl, S 3: 50-60, J, Vn, Qz, Su, Pl, S					1622	[17]
2144	50	4		100	3	42	5,6		VOLCANIC CONGLOMERATE						
51					3		7		4: 30, J, VN, Qz, Pa/Su, Pl-Wa, S-SR 5: 40, J, VN, Qz, Su/Pa, Pl-Wa, S-SR 6: 40, J, VN, Qz, Su/Pa, Pl-Wa, S-SR 7: 10, J, T, H+Uk, Uk, Wa, SR 8: 60, J, VN, Qz, Su, Pa, Pl, S						
2142	52				NA		8,4		VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; highly fractured; fine grained with rounded clasts up to 2 1/2-inches; well cemented with mechanical breaks along fractures						
53									TOTAL DEPTH = 52.8 FEET					1640	
2140	54														
55															
2138	56														
57															
2136	58														
59															
2134	60														
61															

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-08

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-10

Sheet 1 of 4

Date(s) Drilled	10/17/2018-10/18/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 3 7/8-inch diamond HQ bit	Total Depth of Borehole	52.2 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2194 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Lakeview Bridge	Coordinate Location	N 2587076 E 6441583

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry						Start 10:10 10/17/2018; rotary wash drilling 0-29.5
1									--FILL--						
2192															
2															
3															
2190															
4									CLAYEY SAND (SC); medium dense; reddish brown; fine to coarse grained SAND; medium to high plasticity FINES; trace to some GRAVEL; moist	S01		10	6	0	
5												4			
6															
2188									POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry						
7															
2186															
8															
9															
2184															
10															Too cobbly for drive sample at 10ft.
11															
2182															
12															
13															

Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-10

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-10

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Type	SOIL SAMPLES			Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Number	Blows / 6 in.	Recovery, %		
13								POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; greyish brown; fine to coarse grained SAND; fine to coarse, angular to rounded GRAVEL with COBBLES and BOULDERS; dry						
-2180	14							--FILL--(continued)						
	15													
-2178	16													
	17													
-2176	18													
	19													
-2174	20													
	21													
-2172	22													
	23													
-2170	24													Advance 4.5-inch casing to 23.5ft.
	25													
-2168	26									S02	12 20 26			S-02 bagged
	27													
-2166	28							VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; rounded clasts up to 2 1/2-inches in a fine grained matrix; moderately fractured with mechanical breaks around clasts; well cemented						
	29							--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						

Report: GEO_CORE-SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-10

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-10

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
	29								VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; rounded clasts up to 2 1/2-inches in a fine grained matrix; moderately fractured with mechanical breaks around clasts; well cemented --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
2164	30		1		NA		1	2	1: 60, J, VN, No, No, Pl, S 2: 10, J, VN, Qz, Sp, Pl, S 3: 40, J, VN, Fe, St, Pl, S					1305	Switch to HQ-3 rock coring at 29.5ft.
	31	1		100	1	72	3	3						[15]	
					0		m	m							
2162	32							m						1315	
														1335	
	33	2		100	1	86	1	2	1: 35, J, VN, No, No, Pl-Wa, SR 2: 45, J, VN, Fe, St, Wa, S-SR					[14]	
2160	34				NA			m	VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm					1341	Driller reports hard drilling at 33.4ft.
														1355	
	35														
	35	3		94		78	3	3	1: 20, J, VN, No, No, Pl-Wa, SR 2: 40, J, VN, No, No, Pl-Wa, SR 3: 60, J, VN, No, No, Wa, SR 4: 20, J, VN, Qz, Sp, Pl-Wa, SR					[6]	
2158	36				0			m							
	37				1			4							
														1430	
2156	38	4		100	0	100		m						1442	
	39				NA			m						[4]	
														1505	
2154	40	5		91	1	71	1	2	VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm					1525	
	41				0			m	1: 30, J, VN, No, No, Pl-Wa, SR 2: 20, J, VN-N, Fe, St, Pl, SR 3: 60, J, MW, Qz, Pa-Sp, Wa, SR-R 4: 30, J, N-MW, Qz, Sp, Wa-Pl, SR					[8]	
2152	42				1			4	VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm						
														1550	
	43				2			m						0755	End of day 10/17/2018 Begin day 10/18/2018
	44				2			2	1: 10-15, J, N, Fe, St, Pl-Wa, SR 2: 30, J, T-VN, Fe, St, Pl, S 3: 55, J, N-MW, Fe, St, Wa-Pl, S-SR						
2150															
	45	6	2	100	1	69		3						[9]	

Report: GEO_CORE+SOIL_NO_PACK_WITH_LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-10

Report: GEO_CORE-SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-10

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-10

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS			
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %			Fracture Drawing Number	Type	Number	Blows / 6 in.		Recovery, %	Drill Time [Rate, ft/hr]	
	45		2		1		4	VOLCANIC CONGLOMERATE; medium grey; slightly weathered to fresh; moderately strong to strong; rounded clasts up to 2 1/2-inches in a fine grained matrix; moderately fractured with mechanical breaks around clasts; well cemented --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued) 4: 20, J, T, No, No, Pl, S 5: 60, J, N, Fe, St, Wa-St, SR-R 1: 85-90, J, T, H+Uk, Pl-Wa, SR 2: 50, J, N, Fe, St, Wa, SR 3: 60, J, N-MW, Fe, St, Pl-Wa, SR 4: 60, J, VN, Fe, St, Pl-Wa, SR 5: 50, J, VN, Fe, St, Wa, SR 6: 10, J, VN-N, Fe, St, Pl, SR VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm								
-2148	46				1		m									
	47						5							0830		
-2146	48				NA		1							0847		
	49				2		m									
-2144	50	7		82	2	71	3							[9]		
	51				3		4									
-2142	52				NA		m									
	53								TOTAL DEPTH = 52.2 FEET					0920		
-2140	54															
	55															
-2138	56															
	57															
-2136	58															
	59															
-2134	60															
	61															

Report: GEO_CORE+SOIL_NO_PACK_WITH_LITH- File: Klamath_MASTER.GPJ; 6/20/2019 B-10

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-13

Sheet 1 of 2

Date(s) Drilled	10/3/2018	Logged By	B. Kozlowski	Reviewed By	B. Aldridge
Drilling Method	HQ-3 Rock Core	Drill Bit Size/Type	3 3/4-inch diamond core bit	Total Depth of Borehole	21.1 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2494 feet
Groundwater Level	Not encountered before HQ rock coring	Sampling Methods	HQ Core Barrel	Inclination from Horizontal/True North Bearing	Vertical
Borehole Completion	Bentonite cement grout to ground surface	Location	Fall Creek	Coordinate Location	N 2606346 E 6463221

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
0	0								1-inch ASPHALT			
-2494	1								WELL GRADED SAND with GRAVEL (SW); medium dense to dense; dark yellowish brown (10YR 4/4); fine to coarse grained SAND; angular to rounded GRAVEL up to 2-inches			Start 12:00 10/3/2018 hand auger 0-3.5ft.
	2		1						--ROAD BASE--			
-2492	3	1		60	NA	0	NR		BASALT; very dark grey to black; slightly to moderately weathered; strong; highly fractured with iron staining along fracture surfaces; porphyritic; vesicular; with plagioclase phenocrysts up to 1/4-inch and irregular vesicles up to 1/2-inch	1252	[23]	
	4								--TERTIARY to QUATERNARY INTRUSIVE BASALT--	1256		
-2490	5	2		28	NA	0	NR		↓ Becomes dark yellowish brown, locally highly weathered with CLAYEY SAND, with rootlets	1324		Auger refusal at 3.5ft.; switch to HQ rock coring with 3 3/4-inch diamond bit
	6										[29]	0% fluid return
-2488	7				NA				↓ Becomes highly to locally completely weathered to a CLAYEY SAND/SANDY CLAY with trace small gravel and strong, slightly weathered corestones of BASALT	1330		
	8								CLAYEY SAND/SANDY CLAY	1338		
-2486	9	3		66	NA	0					[20]	
	10											
-2484	11				NA		NR					
	12	4		68	NA	19					1353	
-2482	13								highly fractured with SANDY CLAY infilling	1405		

Report: GEO CORE OAK C: File: KLAMATH MASTER.GPJ: 6/20/2019 B-13

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-13

Sheet 2 of 2

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
13			1		5	19			BASALT; very dark grey to black; slightly to locally completely weathered; strong; highly to intensely fractured; porphyritic; vesicular; with plagioclase phenocrysts up to 2/5-inches and irregular vesicles up to 1/2-inch; fractures are wide and infilled with CLAYEY SAND/SANDY CLAY and small GRAVEL --TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)			Continued 0% fluid return
	4			68							[28]	
2480					NA							
	15				NA							
	16											
2478					>6						1415 1424	Bit blocked off during run UCS = 6528 psi
	17				4							
	18											
2476					3	18					[30]	
	19								CLAYEY SAND and GRAVEL with roots			
					NA							
2474					NA							
	21										1434	
									TOTAL DEPTH = 21.1 FEET			
2472												
	23											
	24											
2470												
	25											
	26											
2468												
	27											
	28											
2466												
	29											

Report: GEO_CORE_OAK_C; File: Klamath_MASTER.GPJ; 6/20/2019 B-13

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-14

Sheet 1 of 2

Date(s) Drilled	10/4/2018	Logged By	B. Kozlowicz	Reviewed By	B. Aldridge
Drilling Method	HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, 3 3/4-inch diamond coring bit	Total Depth of Borehole	28.6 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2494 feet
Groundwater Level	Not encountered before HQ rock coring	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Fall Creek	Coordinate Location	N 2606321 E 6463161

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2494	0								WELL GRADED GRAVEL with SAND (GW); loose to medium dense; dark yellowish brown (10YR 4/4); angular to subangular GRAVEL up to 3-inches; fine to coarse grained SAND; trace no plasticity FINES --ROAD FILL--						Start 9:00 10/4/2018 hand auger 0-2ft.
	1														
2492	2		1						SANDY LEAN CLAY (CL); stiff; very dark brown (7.5YR 2.5/3); 60% low plasticity FINES; 40% fine to medium grained SAND; trace angular, coarse grained SAND; trace fine GRAVEL --ALLUVIUM/COLLUVIUM?-- ← At 2.3ft.: Cored 4-inch cobble of dark grey, VOLCANIC SANDSTONE, fine to medium grained, with dark yellowish brown SANDY CLAY and 1-inch root					0920	Auger refusal at 2.3ft.; switch to HQ rock coring with 3 3/4-inch diamond bit
	3														
2490	4	1		12	NA	0	NR							[27]	Run 1 bagged
	5				NA										
2488	6				NA									0929	SA: G=1%; S=29%; F=70% LL=62; PL=22
	7				NA				FAT CLAY with SAND (CH); very stiff; dark brown (7.5YR 3/3); medium plasticity FINES; fine to medium SAND; rare angular GRAVEL	S-01	17	60			Two liners retained
2486	8				NA										
	9	2		40	NA	0	NR		COBBLES and BOUDLERS with CLAYEY SAND and GRAVEL; dark greenish grey and olive to reddish brown; slightly weathered, moderately strong volcanic sandstone COBBLES --CHANNEL ALLUVIUM-- ↓ Becomes grey, volcanic sandstone COBBLE with rounded upper terminus ↓ COBBLES and BOUDLERS become dusky red, fine grained, slightly weathered, very strong intrusive volcanic					1026	
	10				NA									[18]	
2484	11	3		60	NA	25	NR							[13]	
	12				NA									1049	
2482	13	4		7	NA	0								[18]	Coarse grained SAND in cuttings
														1103	

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-14

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-14

Sheet 2 of 2

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
13		5	1	100	1	0		PORPHYRITIC ANDESITE; very dark greyish brown (10YR 3/2); highly weathered; very weak; locally friable; with steeply dipping vein infilled with very pale yellow, fine grained SAND --TERTIARY VOLCANICS, undifferentiated--					1103 [6] 1109 1124	100% fluid return
2480	14				0			↓ Becomes dark reddish brown and very pale yellow, weak to extremely weak, highly to completely altered; with irregular chlorite alteration and vitreous quartz crystals up to 1/4-inch						
	15				0									
2478	16	6		70	0	0							[18]	
	17				NA		NR							
2476	18				NA								1141 1149	Fast drilling 18.6 to 20.5ft likely no recovery zone
	19				NA		NR							
2474	20				NA									
	21	7		62	0	0							[19]	
2472	22				0									
	23				0								1205 1215	
2470	24	8		80	0	0	NR						[12]	
	25				4			↓ Becomes moderately to locally highly weathered, moderately strong, highly fractured					1220 1228	
2468	26				3	0								
	27	9		63	0	0		↓ Becomes highly to completely weathered, extremely weak, friable					[17]	
2466	28				NA		NR							
	29				NA								1242	
TOTAL DEPTH = 28.6 FEET														

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-14

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-15

Sheet 1 of 4

Date(s) Drilled	1/22/2019-1/23/2019	Logged By	S. Janowski	Checked By	P. Respass
Drilling Method	Solid Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	4-inch solid stem auger, 4-inch diamond coring bit	Total Depth of Borehole	51.5 feet
Drill Rig Type	Truck Mounted CME 75	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2344 feet
Groundwater Level	11.7' 1/23/2019	Sampling Methods	2.5-inch ID ModCal, SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	North end of Daggett Road Bridge	Coordinate Location	N 2602349 E 6462482

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2344	0								SANDY LEAN CLAY with GRAVEL (CL); very stiff; moist; dark brown (10yr3/3); 20% subrounded to rounded GRAVEL to 3/4"; 20% fine- to medium-grained SAND; 60% medium plasticity FINES						
	1								--FILL--						
2342	2														
	3														
2340	4														
	5														
	6										1-1 1-2	6 6 8	78		pp=3.0 tsf
	7														
2336	8								CLAYEY GRAVEL with SAND (SC); very dense; moist; yellowish brown to dark brown; interbedded layers of gravel with clay and sand						Fill estimate based on height of slope embankment
	9								--ALLUVIUM--						
2334	10										2	100/1"	100		
	11														
2332	12														
	13														

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-15

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-15

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
13								CLAYEY GRAVEL with SAND (SC); very dense; moist; yellowish brown to dark brown; interbedded layers of gravel with clay and sand --ALLUVIUM-- (continued)						
2330	14													
	15													
2328	16									3	16 20 34	78		SA: G=42%; S=27%; F=31%
	17													
2326	18							BASALT BOULDERS and COBBLES in SAND & GRAVEL matrix; medium dark gray (N4) to dark gray (N3), strong, some boulders are scoriaceous, matrix washed out --ALLUVIUM--						Rig chatter
	19													
2324	20													
	21									4	17 50 50	61		
	22	1	1	100	NA	0							0921 [6] 0926 0933	End of day 1/22/2019 Begin day 1/23/2019; AM water level=11.7' bgs Switch to HQ rock core
2322	23				NA									
	24				NA									
2320	25	2		2	NA	0								
	26				NA									
2318	27				NA									
	28				NA					5	65	100	0936 0956	
2316	29	3		71	NA	27*								*Rock does not meet soundness criteria for RQD calculation
					NA			VOLCANICLASTIC BRECCIA --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						

Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-15

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-15

Sheet 3 of 4

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-15

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
29		3	1	71	5	27*	1,1	△	VOLCANICLASTIC BRECCIA; light olive gray (5Y5/2); moderately weathered; weak; highly to intensely fractured; angular clasts to 1/2"					[68]	*Rock does not meet soundness criteria for RQD calculation
2314	30						1	△	— TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)—						
					6		1	△	1: 20°, J, MW, Sd, Sp, Wa, R						
							1	△	↓ Becomes grayish blue-green (5BG5/2); slightly weathered; moderately strong						
31					0		M	△						1000	
2312	32						1	△	1: 30°, J, MW, Sd+Fe, Sp+Su, Wa, R					1008	
					3		M	△							
33					1		M	△							
2310	34	4		100	82		1	△	↓ Becomes slightly fractured					[60]	
					0			△							
35					0			△							*Rock does not meet soundness criteria for RQD calculation
2308	36				0		M	△						1013	
								△						1017	
37					0		M	△							
2306	38				0		M	△	↓ Becomes light olive gray (5Y5/2); moderately weathered; weak; highly fractured						
					0		M	△							
39		5		100	96*		1	△	1: 15°, J, MW, Fe, Su, Wa, VR					[75]	
2304	40				1		M	△							
			2		1		M	△							
41					2		1	△	2: 60°, J/Sh, MW, Fe+Mn+Sd, Su+Sp, Wa, R					1021	
2302	42				1		1	△	↓ Becomes grayish blue-green (5BG5/2); slightly weathered					1024	
					1		M	△	1: 20°, J, MW, No, No, Wa-St, VR						
								△	↓ Becomes moderately fractured						[43]
43					0			△							
2300	44	6		100	72			△							
					0		M	△							
45								△	↓ Becomes weak to very weak						

Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-15

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-16

Sheet 1 of 2

Date(s) Drilled	1/12/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3-7/8-inch tricone, 3 3/4-inch diamond coring bit	Total Depth of Borehole	24.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2319 feet
Groundwater Level	12 feet above ground surface	Sampling Methods	SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	12' downstream of Daggett Road bridge	Coordinate Location	N 2602237 E 6462573

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
	0							Δ Δ	VOLCANICLASTIC BRECCIA; gray-green; completely weathered; extremely weak; fine-grained matrix; dark gray-black angular clasts up to 1/4"-1/2"; slightly fractured with widely-spaced natural fractures; numerous mechanical breaks --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--			3			12' of water in river at time of drilling
	1							Δ Δ			1	5			
2318								Δ Δ				15			5" HWT casing driven to 14' (refusal) Tricone to 15' and continue with HQ core High Water Circulation Return (WCR)
	2							Δ Δ							
	3							Δ Δ							
2316			1					Δ Δ	↓ Becomes moderately to slightly weathered; moderately strong; slightly fractured; multi-colored clasts up to 2" Broken mechanical					1024	
	4	1		100	0	100		M Δ							[90]
	5				0			M Δ							1025
2314								Δ Δ							1029
	6				0			M Δ							
	7	2		100	100		1	Δ Δ	1: 20°, J, N, No, No, Wa, SR						[150]
2312					1			M Δ							
	8				0			Δ Δ							
	9							Δ Δ							
2310					0			M Δ							1031
	10				0			Δ Δ							1034
	11				0			M Δ							
2308					0			Δ Δ							
	12	3		100	100			M Δ							[100]
	13				0			M Δ							

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-16

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-16

Sheet 2 of 2

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS					
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %							
2306	13	3	1	100	0	100		△ △	VOLCANICLASTIC BRECCIA; gray-green; moderately to slightly weathered; moderately strong; slightly fractured; multi-colored clasts up to 2"; numerous mechanical breaks. Becomes clasts up to 3-4" at 13.8' --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued) 1: 30°, J, N, No, No, Pl-Wa, SR					High WCR						
	14							△ △												
								△ △												
		△ △																		
		△ △																		
		△ △																		
2304	15		2		0			△ △												
								△ △												
								△ △												
	16				0			△ △												
								△ △												
								△ △												
	17	4		100	0	100		△ △												
2302								△ △												
								△ △												
	18				0			△ △												
								△ △												
								△ △												
	19				0			△ △												
2300								△ △												
								△ △												
	20				0			△ △												
								△ △												
								△ △												
	21				0			△ △												
2298								△ △												
								△ △												
	22	5		96	0	96		△ △												
								△ △												
								△ △												
	23				0			△ △												
2296								△ △												
								△ △												
	24			NA			1	△ △												
								△ △												
								△ △												
	25							TOTAL DEPTH = 24.5 FEET 15 gallons of grout: 6 sack mix with 5% bentonite							1049					
2294																				
	26																			
	27																			
2292																				
	28																			
	29																			

Report: GEO_CORE+SOIL_NO_PACK_WITH_LITH; File: KIAMATH_MASTER.GPJ; 6/20/2019 B-16

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-16

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-17

Sheet 1 of 3

Date(s) Drilled	1/22/2019	Logged By	S. Janowski	Checked By	P. Respass
Drilling Method	Solid Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	4-inch solid stem auger, 4-inch diamond coring bit	Total Depth of Borehole	41.5 feet
Drill Rig Type	Truck Mounted CME 75	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2341 feet
Groundwater Level	Not encountered before HQ rock coring	Sampling Methods	2.5-inch ID ModCal, SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	South end of Daggett Road Bridge	Coordinate Location	N 2602195 E 6462721

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									GRAVELLY CLAY with SAND (CL); stiff; moist; dark brown (7.5YR3/3); subangular to subrounded GRAVEL to 1/2"; medium-grained SAND; medium plasticity FINES						
-2340	1								--FILL--						
	2														
-2338	3														
	4														
-2336	5														
	6										1-1	5			pp=1.0 tsf Driller adds water to facilitate advancement
	7										1-2	50/5"	100		
-2334	8														
	9								SANDY GRAVEL (GP); very dense; moist; brown; subangular to subrounded GRAVEL to 2.25"; medium- to coarse-grained SAND						
-2332	10								--ALLUVIUM--						
	11														
-2330	12										2-1	42			
	13										2-2	50/4"	100		
-2328									VOLCANICLASTIC BRECCIA						Driller felt change during advancement
									--TERTIARY VOLCANICS--						

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-17

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-17

Sheet 2 of 3

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
13								△	VOLCANICLASTIC BRECCIA; greenish-gray (5G6/1); slightly weathered; moderately strong; slightly fractured; angular clasts to 1/2" in fine matrix --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)						
								△							
								△							
								△							
								△							
								△							
								△							
								△							
								△							
								△							
2326								△							
15		1	1	100	0	100	M	△		II	3	50/4"	100	1110	Switch to HQ core
16								△						[45]	
2324					0		M	△						1112	
								△						1147	
17					0			△							
18					0			△							UCS = 2130 psi
2322					0		M	△							
19		2		100		100	M	△						[75]	
					0		M	△							
20					0		M	△							
2320					0			△							
21					0			△							
					0			△						1151	
22					0			△						1216	
2318					0			△							
23					1		1	△	} Very weak 1: 20°, J, VN, Cl+Sd, Sp, Pl, S-SR						
24		3		100		84	1	△						[100]	
2316					2		1	△	} Weak						
								△							
25					0		M	△							
26							M	△							
2314					0		M	△						1219	
								△						1223	
27					0			△							
28		4		100		100	M	△						[75]	
2312					0			△							
29								△							

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-17

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-17

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %			Fracture Drawing Number	Type	Number	Blows / 6 in.		Recovery, %
29			2		0			△ △ VOLCANICLASTIC BRECCIA; greenish-gray (5G6/1); slightly weathered; moderately strong; slightly fractured; angular clasts to 1/2" in fine matrix --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)						
30		4		100		100		△ △					[75]	
2310					0			△ △						
31								△ △						
					0		M	△ △					1227	
32								△ △					1231	
2308					0			△ △						
33								△ △						
					0			△ △						
34		5		100		86		△ △					[100]	
2306					1			△ △						
35					3		1	△ △						
36								△ △						
2304					0		M	△ △					1234	
37							M	△ △					1239	
					0		M	△ △						
38								△ △						
2302					0		M	△ △						
39		6		100		100		△ △					[75]	
40					0			△ △						
2300					0		M	△ △						UCS = 2985 psi
41					0			△ △						
								△ △					1243	
42								TOTAL DEPTH = 41.5 FEET Grout mix: 20 gallons of water, five 47# bags of cement, no bentonite						
2298														
43														
44														
2296														
45														

Report: GEO_CORE+SOIL_NO_PACK_WITH_LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-17

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-17

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring B-18

Sheet 1 of 1

Date(s) Drilled	10/11/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6-inch flight auger	Total Depth of Borehole	28.3 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2347 feet
Groundwater Level(s)	15.0 feet below ground surface (10/11/2018)	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Scotch Creek	Coordinate Location	N 2603250 E 6441988

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
	Type	Number	Sampling Resistance	Recovery (feet)						
0						2.5-inches ASPHALT roadway				Start 10/11/2018; hollow stem auger 0-28ft.
2345						GRAVEL				
						SANDY LEAN CLAY (CL); medium stiff to stiff; reddish brown; 80-90% medium plasticity FINES; 10-20% fine to coarse grained SAND; occasional GRAVEL and COBBLE				
						--FILL--				Smooth drilling
5										Rig chatter
2340						GRAVEL				
10										Return to smooth drilling to 13ft.
2335										
15						POORLY GRADED GRAVEL with SAND (GP); medium dense; varied dark grey with purple, red, and yellowish brown; fine to coarse angular GRAVEL, COBBLES, and BOUDLERS; fine to coarse grained SAND				Rig chatter
2330						--FILL--(continued)				
20						BOUDLER				Driller indicates hard rock at 18ft.
2325						ALLUVIUM				
25	S-01 S-02		50/3 100/4	0		BOUDLER, basalt				Driller indicates smooth, consistent drilling 22-25ft.
2320										
	S-03		100/4							
						VOLCANIC SILTSTONE; reddish purple; slightly weathered to fresh; weak to moderately strong; very thinly laminated				
						--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS)?--				
30						TOTAL DEPTH = 28.3 FEET				

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 B-18

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-19

Sheet 1 of 3

Date(s) Drilled	10/11/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 3 7/8-inch #6 HQ bit	Total Depth of Borehole	37.5 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2346 feet
Groundwater Level	15.0 feet below ground surface (10/11/2018)	Sampling Methods	2.5-inch ID ModCal, SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Scotch Creek	Coordinate Location	N 2603261 E 6442042

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									2.5-inches ASPHALT roadway						Start 10/11/2018; hollow stem auger 0-23ft.
2346									GRAVEL						
									--ROAD BASE--						
	1								SANDY LEAN CLAY (CL); medium stiff to stiff; reddish brown; 80-90% medium plasticity FINES; 10-20% fine to coarse grained SAND; occasional GRAVEL and COBBLE						S-01 One liner retained (6-6.5ft.) SA: S=30%; F=70%
									--FILL--						
	2														
2344															
	3														
	4														
2342															
	5								SANDY SILT (ML); stiff; light reddish brown; non to medium plasticity FINES; fine to medium grained SAND			9			
									--FILL--		S01	8			
	6											10			
2340															
	7														S-02 One liner retained (11-11.5ft.) LL=54; PL=22
	8														
2338															
	9														
	10								FAT CLAY with SAND (CH); medium stiff; light reddish brown; high plasticity FINES; fine to medium grained SAND			9			
2336									--FILL--		S02	7			
	11											7			
	12														
2334															
	13														

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-19

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-19

Sheet 2 of 3

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-19

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
13								POORLY GRADED GRAVEL with SAND (GP); medium dense; dark grey with some yellow brown; fine to coarse angular GRAVEL, COBBLES, and BOUDLERS; fine to coarse grained SAND; trace to little low plasticity FINES; moist to wet --FILL--(continued)						Rig chatter
2332	14													
	15													
	16								S03	6	4			S-03 One liner retained (16-16.5ft.) SA: G=6%; S=42%; F=52%
2330	17							SANDY SILT (ML); soft to medium stiff; dark grey; fine grained SAND; low plasticity FINES; trace GRAVEL; wet			4			
	18							CLAYEY GRAVEL with SAND (GC); medium dense; dark grey with some yellow brown; fine to coarse angular GRAVEL, COBBLES, and BOUDLERS; fine to coarse grained SAND; low plasticity FINES; moist to wet						Continued rig chatter
2328	19													
	20													
2326	21								S04	12	21			S-04 One liner retained (21-21.5ft.) SA: G=40%; S=34%; F=26%
	22							ALLUVIUM			12			
2324	23													
	24							BOUDLER, basalt						
2322	25													
	26													Switch to rotary wash drilling with 3 7/8-inch tricone bit; yellowish brown clayey cuttings with rounded gravel 24.5-28ft.
2320	27													
	28							VOLCANIC SILTY CLAYSTONE/SILTSTONE; reddish purple; slightly weathered; weak; very thinly laminated --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						Reddish purple clayey and rock cuttings
2318														
	29													

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-19

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
29									VOLCANIC SILTY CLAYSTONE/SILTSTONE; reddish purple; slightly weathered; weak; very thinly laminated --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
2316	30	1			0			m	↓ Becomes weak to moderately strong	II	S05	50/3		1150	Switch to HQ rock coring with 3 7/8-inch diamond bit; all breaks mechanical
	31	1	100		0	100		m						[8]	
2314	32							m							
	33				0			m						1208 1215	
	34				0			m							
2312	35	2	86		0	86		m						[13]	
	36				0			m							
2310	37				0			m							0.7 ft. of core slipped out of core barrel; left in hole prior to grouting
	37				NA		NR							1238	
									TOTAL DEPTH = 37.5 FEET						
2308	38														
	39														
2306	40														
	41														
2304	42														
	43														
2302	44														
	45														

Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-19

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-20

Sheet 1 of 4

Date(s) Drilled	10/10/2018	Logged By	P. Respass	Reviewed By	B. Aldridge
Drilling Method	Hollow Stem Auger, Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 3 7/8-inch #6 HQ bit	Total Depth of Borehole	47.0 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2340 feet
Groundwater Level	14.5 feet below ground surface 10/10/2018	Sampling Methods	2.5-inch ID ModCal, SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Camp Creek	Coordinate Location	N 2602768 E 6443160

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									2.5-inches Aggregate base						Start 9:00 10/10/2018; hollow stem auger 0-28ft.
-2340									POORLY GRADED GRAVEL (GP); dense; fine to coarse GRAVEL and COBBLES, little no plasticity FINES; moist						
	1								--FILL--						
	2														
-2338															
	3								FAT CLAY (CH); medium stiff, brown; medium plasticity FINES; trace fine grained SAND; occasional GRAVEL and COBBLES; moist						
	4														
-2336															
	5														S-01 One liner retained (5.5-6ft.) LL=87; PL=24
	6										S01	3			
-2334												5			
	7											6			
	8														
-2332															
	9														
	10								SANDY LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; fine to coarse grained SAND; rare GRAVEL; moist						S-02 One liner retained (10.5-11ft.) SA: G=3%; S=33%; F=64%
-2330											S02	4			
	11											4			
	12											6			
-2328															
	13														

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-20

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-20

Sheet 2 of 4

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
13									SANDY LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; fine to coarse grained SAND; rare GRAVEL; moist --FILL--(continued)						
14									SANDY CLAY to CLAYEY SAND (CL-SC); medium stiff; olive brown; ~ 50% medium plasticity FINES; ~50% fine to coarse grained SAND and fine GRAVEL						
2326															
15												7			S-03 One liner retained (16-16.5ft.)
16											S03	8			
2324												7			
17									POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse grained SAND; fine to coarse GRAVEL with COBBLES and BOULDERS, wet --ALLUVIUM--						
18															
2322															
19															
20									CLAYEY SAND (SC); medium dense; fine to coarse grained SAND; fine GRAVEL with COBBLES and BOULDERS, wet --ALLUVIUM--						S-04 One liner retained (21-21.5ft.) SA: G=14%; S=42%; F=44%
2320												4			
21											S04	5			
22												6			
2318															
23															
24															
2316															
25												22			S-05 One liner retained (26-26.5ft.)
26											S05	24			
2314												18			
27															
28									BOULDER: 28-29.5 ft.						Switch to rotary wash drilling with 3 7/8-inch tricone bit at 28ft.
2312															
29															

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-20

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-20

Sheet 3 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
29								BOULDER: 28-29.5 ft.						
								--ALLUVIUM--(continued)						
30								POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse grained SAND; fine to coarse GRAVEL with COBBLES and BOULDERS						Skip sample; rig behavior indicates gravel and cobbles
2310														
31								BASALT; dark grey; slightly weathered; moderately strong; with Fe staining around joints; chlorite and quartz infilling; numerous healed fractures						
								--TERTIARY to QUATERNARY INTRUSIVE BASALT--						
32														
2308														
33														
34														
2306														
35														Skip sample; rig behavior indicates gravel and cobbles
36														
2304														
37														
38														
2302														
39														
40			1							SO60	1.5		1305	Switch to HQ rock coring with 3 7/8-inch diamond bit UCS = 343 psi
2300					3									
41		1		100	2	30							[7]	
42														
2298					2								1328	
43					0								1338	
44														
2296					1									
45		2		100		79							[12]	

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-20

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-20

Sheet 4 of 4

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
	45		1		1		2	BASALT; dark grey; slightly weathered; moderately strong; with Fe staining around joints; chlorite and quartz infilling; numerous healed fractures						UCS = 7517 psi
	46						3	--TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)						
2294					2		4	2: 60, J/V, W (20mm), Ch, Fi, Wa, ? 3: 60, J, N, Ch, Sp, SR, ? 4: 70, J, VN, Ch, Sp, SR						
	47							TOTAL DEPTH = 47.0 FEET					1400	
	48													
2292														
	49													
	50													
2290														
	51													
	52													
2288														
	53													
	54													
2286														
	55													
	56													
2284														
	57													
	58													
2282														
	59													
	60													
2280														
	61													

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 B-20

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-201

Sheet 1 of 4

Date(s) Drilled	8/23/2018 - 8/24/2018	Logged By	T. Vande Voorde	Checked By	B. Kozlowski/K. Zeiger
Drilling Method	Rotary Wash; HQ-3 Rock Core	Drill Bit Size/Type	5-inch tricone; 5-inch rock bit; 4-inch #2 diamond coring bit	Total Depth of Borehole	50.5 feet
Drill Rig Type	Track Mounted Fraste XL	Drilling Contractor	Pitcher Drilling Company	NAVD 88 Ground Surface Elevation	2334 feet
Groundwater Level	Not encountered before rotary wash drilling	Sampling Methods	2.5-inch ID ModCal; SPT; HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir; S of Klamath River	Coordinate Location	N 2601064 E 6460697

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									SANDY FAT CLAY (CH); very stiff; very dark greyish brown (10YR 3/4) with mottled yellow; 52% high plasticity FINES; 42% medium to coarse grained SAND; 6% angular GRAVEL up to 1 1/4-inch; trace organics (roots); dry						Start 10:00 8/23/2018
1									--ALLUVIUM--						Trash barrel drilling to 3.5ft.
2332															Trash barrel sample at 1.5ft bagged.
2															
3									↓ Becomes brown (10YR 4/3); GRAVEL is volcanic tuff and basalt						Trash barrel sample at 3-3.5ft bagged.
2330															Begin rotary wash drilling at 3.5ft with 5-inch tricone bit
4															
5									↓ With streaks of very pale brown (10YR 8/4); GRAVEL up to 1/2-inch						Switch to 5-inch rock bit at 5ft.
2328											S01	7			2 liners retained
6												13	50		LL=52; PL=23
7												17			SA: G=6.1%
2326															S=42.4%; F=51.5%
8															
9									FAT CLAY (CH); medium stiff; brown (10YR 4/3); 85% high plasticity FINES; 15% fine grained SAND; trace angular GRAVEL up to 1/4-inch; moist; cohesive						Rig chatter
2324															
10												2			
11											S02	3	33		
2322												4			
12															
13															

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-201

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES					FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]		
	13								FAT CLAY (CH); medium stiff; brown (10YR 4/3); 85% high plasticity FINES; 15% fine grained SAND; trace angular GRAVEL up to 1/4-inch; moist; cohesive							
2320	14								--ALLUVIUM-- (continued)							
	15															
2318	16								↓ Becomes 100% high plasticity FINES; with trace organic material (rodent bone) and black laminations		S03	3				
	17											7	89			
	18											5				3 liners retained LL=64; PL=26 SA: S=14%; SILT=36.6% CLAY=43.4%
2316	19															
	20															
2314	21								CLAYEY GRAVEL with SAND (GC); medium dense; brown (10YR 4/3); 55% angular basaltic GRAVEL up to 1 1/4-inch; 30% angular coarse grained SAND; 15% low plasticity FINES; wet			7				
	22											S04	10	33		Possible slough
2312	23												16			
	24															
2310	25								BOULDERS and COBBLES; dark bluish grey with white filled vesicles; round to angular COBBLES; some fine to coarse grained SAND; trace FINES; GRAVEL is slightly weathered, strong to very strong basalt							Rig chatter Some water loss Basalt fragments in cuttings 22-23ft.
	26								--RIVER ALLUVIUM--			S05	50	50		Advance 5-inch casing to 23ft.
2308	27	1	1	70	NA	NA	NR								1231	Switch to HQ coring with 4-inch #2 diamond bit at 23.5ft.
	28	2		90	NA	NA	NR								1248	
	29														1258	
2306	30														[4]	
	31														1314	
	32														1323	
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Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-201

Sheet 3 of 4

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-201

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
2304	29	5	1	100	1	80	2	BASALT; moderate bluish grey; slightly weathered; moderately strong to very strong; highly fractured; fine grained; with CaCO ₃ filled vesicles and occasional green phenocrysts --TERTIARY to QUATERNARY INTRUSIVE BASALT--					[4] 1436 1459	Less but continued water take Caving borehole at 26 ft. End of day 8/23/2018 Begin day 8/24/2018
	30	6		100	5	40*	3 4 1 2 3	1: 20, J, VN, Fe, Su, Pl, R 2: 80-90, J, VN, Fe, Su, Wa, SR 3: 50, J, N-MW, Fe+Cl, Su+Fi, Pl, SR 4: 60, J, N, Fe, Su, Pl, SR					[5]	
	31						4	↓ Becomes slightly to moderately weathered with brown staining along joints; intensely fractured					1521	
2302					4		m	↓ Becomes light bluish grey; moderately to highly weathered/alterd; moderately strong; with 1/2-inch wide Calcite vein					0830	
	32	7		60	>6	0	2 2 3 4 5	1: 30, J, ?, Fe+Sd, Su+Pa, Pl, R 2: 65, J, VN, Fe+Sd+Ca, Fi, Pl 3: 80, J, VN, H+Fe, Su, Pl, ? 4: 15, J, MW, Fe+Ca, Pa, Ir, VR 5: 70, J, VN, H+Fe+Sd, Fi, Pl					[2]	
	33							↓ Becomes highly to completely weathered, highly oxidized, yellowish brown					0940	
2300					NA		m						0958	
	34						m	Brown, moderately weathered, moderately strong						
	35	8		57		0	m							
2298					NA		1	↓ Becomes dark yellowish brown to pale tan, completely weathered, very weak, highly fractured, granular, partially decomposed to clay 1: 50, J, ?, No, No, Pl, R (possibly mechanical)					[4]	
	36													
	37				NA		m	↓ Becomes moderately to highly weathered, moderately strong to strong, fine grained matrix					1045	
2296							1						1055	
	38	9	2	100	3	25*	1 1 1 1 2 2 3	1: 10-20, J, VN-N, Fe + some are H, Fi-Pa, Pl 2: 20-30, J, N, H+Fe, Fi, Pl 3: 5, J, MW, Fe+Cl, Su+Pa, Ir, R 4: 50, J, N, Fe+Sd, Su+Sp, Pl, R					[4]	
2294					5			Intensely fractured/broken, abundant oxidation						
	40						2							
	41				4		m	↓ Becomes light bluish grey, slightly to locally moderately weathered, strong to very strong, irregular calcite filled vesicles 1: 20, J, N, Fe, Su, Pl, R 2: 15, J, N-VN, H+Fe, Pl, ? 3: 30, J, VN, No, No, Pl, ? (possibly mechanical) 4: 15, J, N, Fe, Su, Pl, R					1154	
2292		10		100	4	20*	2 3 4						1206	
	42						m	↓ Becomes moderately strong 5: 20, J, ?, Fe, Su, Pl, R						
	43				5		4 5 1	Intensely fractured					1234	
2290							4	1: 30, J, VN, H+Fe, Fi, Pl 2: 10, J, N-VN, H+Fe, Pl 3: 60, J, VN, H+Fe, Su, Pl, SR 4: 60, J, VN, H+Fe, Fi, Pl					1246	
	44	11		100		60*	2 2 3	↓ Becomes bluish grey with brownish orange staining along fractures, strong, fine grained, with irregular Calcite filled vesicles and veins					[8]	
	45				0									

Report: GEO CORE+SOIL NO PACK WITH LITH; File: KLAMATH MASTER.GPJ; 6/20/2019 B-201

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-202

Sheet 1 of 7

Date(s) Drilled	8/18/2018 - 8/22/2018	Logged By	T. Vande Voorde	Checked By	B. Kozlowicz/K. Zeiger
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 4-inch #6 diamond coring bit; 4-inch carbonado coring bit	Total Depth of Borehole	100.5 feet
Drill Rig Type	Track Mounted Fraste XL	Drilling Contractor	Pitcher Drilling Company	NAVD 88 Ground Surface Elevation	2332 feet
Groundwater Level	4.8 feet bgs 8/23/2018	Sampling Methods	HQ Core Barrel	Inclination from Horizontal/True North Bearing	60°/205°
Borehole Completion	Two VWP's with neat cement grout to ground surface	Location	Iron Gate Reservoir; S/SE of Daggett Rd	Coordinate Location	N 2601406 E 6460935

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
2332	0								SANDY FAT CLAY with GRAVEL (CH); stiff; dark brown (10YR 3/3) to very dark greyish brown (10YR 3/2); 70% high plasticity FINES; 15% angular GRAVEL up to 1/4-inch; 15% coarse grained SAND; dry; GRAVEL is volcanic tuff; some organics (grass and roots) --ALLUVIUM--			6-inch trash barrel to 8.5ft.
	1											
	2											
2330	3											
	4											
2328	5								With increasing SAND; becomes brown (10YR 4/3); dry to moist			
	6											
	7											
2326	8											
	9											Advance 4-inch casing to 9ft. Switch to rotary wash drilling with 3 7/8-inch tricone bit.
2324	10											
	11											
2322	12											
	13											

Report: GEO_CORE_OAK_C: File: Klamath_MASTER.GPJ: 6/20/2019 B-202

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-202

Sheet 2 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
	13								With increasing GRAVEL and decreasing SAND; abundant grey to black basaltic COBBLES fragments			Rig chatter; possible boulder at 13-14ft.
	14		1		NA				BOULDERS and COBBLES; bluish grey; 60% angular GRAVEL up to 2-inches; 30% medium to coarse grained SAND; 10% medium plasticity FINES; BOUDLERS (fragments) and COBBLES are fresh to slightly weathered, rounded, very strong porphyritic BASALT up to 10-inches; MATRIX is fine grained with quartz and trace pyrite phenocrysts weathered to a POORLY GRADED SAND with GRAVEL and CLAY; --RIVER ALLUVIUM--		1301	Switch to HQ coring at 14ft with 4-inch #6 diamond coring bit
2320	15	1		53		NA					[8]	
					NA		NR				1312	
	16										1324	
	17				NA							
2318	18											
	19	2		66		NA					[6]	Coarse material from Run 1 - 14 retained in core box
	20				NA		NR					
2316	21										1357	
	22										1413	
	23	3		100		NA			With basaltic BOULDERS (fragments) up to 1-foot; rounded to angular GRAVEL, coarse grained SAND, and medium plasticity FINES		[6]	
	24				NA						1429	
	25										1438	
2314	26											
	27	4		56		NA					[14]	Driller notes softer material at 21.5ft. Minor fluid loss.
	28				NA		NR					
	29										1449	
2312	30										1457	
	31	5		87		NA					[7]	Driller notes material is alternating soft and hard.
	32				NA		NR				1510	
	33										1521	
	34	6		100		NA					[10]	
	35				NA						1527	
2310	36										1535	
	37											Minor fluid loss.
	38	7		100		NA					[11]	
	39				NA							
2308	40										1549	
	41	8		68		NA			with basaltic BOULDERS (fragments) and COBBLES up to 5-inches; abundant rounded GRAVEL		0750	End of day 8/18/2018
	42										[6]	Begin day 8/19/2018
	43											

Report: GEO_CORE_OAK_C: File: Klamath_MASTER.GPJ: 6/20/2019 B-202

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-202

Sheet 3 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS																																			
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number																																								
2306	29	8	1	68	NA	NA			BOULDERS and COBBLES; bluish grey; 60% angular GRAVEL up to 2-inches; 30% medium to coarse grained SAND; 10% medium plasticity FINES; BOUDLERS (fragments) and COBBLES are fresh to slightly weathered, rounded, very strong BASALT up to 10-inches; MATRIX is fine grained with quartz and trace pyrite phenocrysts weathered to a POORLY GRADED SAND with GRAVEL and CLAY; with boulders and cobbles up to 8-inches at 28.2' --RIVER ALLUVIUM--(continued)		[6]	Increasing fluid loss.																																			
	30					NR																																									
	31				NA																																										
2304	32	9		100	NA	NA										[8]	Advance 4-inch casing to 29.5ft.																														
	33				NA																																										
	34				NA																																										
2302	35	10		100	NA	NA															[7]	Swivel breaks at 32.5ft; End of day 8/19/2018 Begin day 8/20/2018																									
	36				NA																																										
	37				NA																																										
2300	38	11		85	NA	NA																				[4]	Drill fluid becomes brownish grey.																				
	39				NA		NR																																								
	40				NA																																										
2298	41	12		12	NA	NA	NR																								[7]	Some fluid loss.															
	42				NA																																										
	43				NA																																										
2296	44	13		0	NA	NA	NR																												[6]	Switch to 4" carbonado bit at 40.5ft; pale brown, tuff-like material in bit											
	45				NA																																										
	46				NA																																										
2294	47	14		8	NA	NA	NR																																	[13]	Drill fluid becomes light grey						
	48				NA																																										
	49				NA																																										
2292	50				NA																																										
	51				NA																																										
	52				NA																																										
2290	53				NA																																										
	54				NA																																										
	55				NA																																										
2288	56				NA																																										
	57				NA																																										
	58				NA																																										
2286	59				NA																																										
	60				NA																																										
	61				NA																																										
2284	62				NA																																										
	63				NA																																										
	64				NA																																										
2282	65				NA																																										
	66				NA																																										
	67				NA																																										
2280	68				NA																																										
	69				NA																																										
	70				NA																																										
2278	71				NA																																										
	72				NA																																										
	73				NA																																										
2276	74				NA																																										
	75				NA																																										
	76				NA																																										
2274	77				NA																																										
	78				NA																																										
	79				NA																																										
2272	80				NA																																										
	81				NA																																										
	82				NA																																										
2270	83				NA																																										
	84				NA																																										
	85				NA																																										
2268	86				NA																																										
	87				NA																																										
	88				NA																																										
2266	89				NA																																										
	90				NA																																										
	91				NA																																										
2264	92				NA																																										
	93				NA																																										
	94				NA																																										
2262	95				NA																																										
	96				NA																																										
	97				NA																																										
2260	98				NA																																										
	99				NA																																										
	100				NA																																										
2258	101				NA																																										
	102				NA																																										
	103				NA																																										
2256	104				NA																																										
	105				NA																																										
	106				NA																																										
2254	107				NA																																										
	108				NA																																										
	109				NA																																										
2252	110				NA																																										
	111				NA																																										
	112				NA																																										
2250	113				NA																																										
	114				NA																																										
	115				NA																																										
2248	116				NA																																										
	117				NA																																										
	118				NA																																										
2246	119				NA																																										
	120				NA																																										
	121				NA																																										
2244	122				NA																																										
	123				NA																																										
	124				NA																																										
2242	125				NA																																										
	126				NA																																										
	127				NA																																										
2240	128				NA																																										
	129				NA																																										
	130				NA																																										
2238	131				NA																																										
	132				NA																																										
	133				NA																																										
2236	134				NA																																										
	135				NA																																										
	136				NA																																										
2234	137				NA																																										
	138				NA																																										
	139				NA																																										
2232	140				NA																																										
	141				NA																																										
	142				NA																																										
2230	143				NA																																										
	144				NA																																										
	145				NA																																										
2228	146				NA																																										
	147				NA																																										
	148				NA																																										
2226	149				NA																																										
	150				NA																																										
	151				NA																																										
2224	152				NA																																										
	153				NA																																										
	154				NA																																										
2222	155				NA																																										
	156				NA																																										
	157				NA																																										
2220	158				NA																																										
	159				NA																																										
	160				NA																																										
2218	161				NA																																										
	162				NA																																										
	163				NA																																										
2216	164				NA																																										
	165				NA																																										
	166				NA																																										
2214	167				NA																																										
	168				NA																																										
	169				NA																																										
2212	170				NA																																										
	171				NA																																										
	172				NA																																										
2210	173				NA																																										
	174				NA																																										
	175				NA																																										
2208	176				NA																																										
	177				NA																																										
	178				NA																																										
2206	179				NA																																										
	180				NA																																										
	181				NA																																										
2204	182				NA																																										
	183				NA																																										
	184				NA																																										
2202	185				NA																																										
	186				NA																																										
	187				NA																																										
2200	188				NA																																										
	189				NA</																																										

Report: GEO_CORE_OAK_C: File: Klamath_MASTER.GPJ: 6/20/2019 B-202

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-202

Sheet 4 of 7

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
45		14		8	NA	NA	NA	△ VOLCANIC BRECCIA; light grey; highly to completely weathered; △ very weak with strong clasts; slightly fractured; locally friable; fine △ grained matrix with angular to subrounded strong, black clasts up to △ 3/4-inch and extremely weak, green clasts up to 1 1/4-inch △ --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, △ undifferentiated)--		1240 1252	
46			2								
2292		15		65	NA	0				[8]	
47							NR				
48					NA			1: 15, J, N, No, No, Pl, R-VR (likely mechanical) Becomes pale greenish grey, weak to locally extremely weak, highly weathered, increased percentage of clasts in a fine grained matrix		1307 1321	Minor fluid loss.
2290		16		100		0				[7]	
49											
50											
51					0		1			1347 1403	
2288											
52					0		2	1: 10, J, N-VN, Ch?, Pa, Pl, R (mechanical) 2: 0, J, N-MW, No, No, Ir, VR (mechanical) 3: 15, J, VN-N, No, No, Pl, R (mechanical)			
53		17		100		0	3			[10]	
2286											
54					0			With green, clayey clasts elongated vertically			
55							1				
2284					1		m	Light bluish grey, completely weathered, extremely weak, with coarse grained SAND and fine GRAVEL		1434 1303	End of day 8/20/2018 Begin day 8/21/2018
56					0						
57							1	Increasingly cohesive, extremely weak, highly to completely weathered, with smaller clasts			
58		18		44	NA	0	NR	1: 55, J, VN-N, No, No, Pl		[14]	
2282					NA						
59					NA						
60											
2280					1		m	60.5-61.4ft: completely weathered to a residual soil, extremely weak, friable, with soil-like texture, clasts up to 1/2-inch		1325 1340	
61							1				

Report: GEO CORE OAK C: File: Klamath MASTER.GPJ: 6/20/2019 B-202

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-202

Sheet 5 of 7

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
61			3	0			m	VOLCANIC BRECCIA; light bluish grey; completely weathered; extremely weak with strong clasts; slightly fractured; locally friable; fine grained matrix with angular to subrounded strong, black clasts up to 3/4-inch and extremely weak, green clasts up to 1 1/4-inch --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)			
62				0							
2278		19		80	0	0		Highly weathered, with strong, black clasts up to 3/4-inch and very soft, green clasts up to 1 1/4-inch, extremely weak/friable 63.6-64.2'		[15]	
63				0							
64				NA			1	1: 0, J, MW, No, No, PI/Ir, R (mechanical)			
2276				NA			m	Weaker zone		1400 1412	
66				0				Becomes highly to completely weathered; increased clast size and percentage, larger subrounded basaltic clasts			
67		20		100	0	0				[9]	
2274				0							
68				0			m	With subangular clasts		1429 1442	
69				0							
2272		21		100	0	0		1 to 2-inch thick, planar green clast		[7]	
70				0			m	Becomes very light bluish grey, with basaltic clasts up to 1.5-inch and filled vesicles		1505 1517	0.1' of Run 20 recovered with Run 21
71				0			1	Planar green clast			
2270			4	0							
72				0							
73		22		100	0	0		1: 50-60, J, VN, No, No, PI, SR (mechanical) 2: 5, J, VN, No, No, PI, SR (mechanical)		[7]	
74				0				Planar green clast			
2268				0							
75				0			2			1600 0722	End of day 8/21/2018 Begin day 8/22/2018 0.2' of Run 20 recovered with Run 21
76		23		100	0	0	m	Becomes light greenish grey; decreasing percentage of clasts		[8]	
2266				0							
77											

Report: GEO_CORE_OAK_C: File: Klamath_MASTER.GPJ: 6/20/2019 B-202

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-202

Sheet 6 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
77			4		0			△ △	VOLCANIC BRECCIA; light greenish grey; highly to completely weathered; extremely weak with strong clasts; slightly fractured; locally friable; fine grained matrix with angular to subrounded strong, black clasts and extremely weak, green clasts up			
78	23			100	0			△ △	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --(continued)		[8]	
79					0			△ △	With increased clast size and percentage; matrix is extremely weak matrix with strong basaltic clasts and decomposed green clasts			
80					0		1	△ △	1: 0-5, J, N, No, No, Pl, SR (mechanical)			
81					0			△ △			0802 0817	UCS 82.0-82.8 = 614 psi
82					0			△ △	With stronger matrix			Top of Run 24 mechanically broke when transferring to core box
83	24			100	0			△ △			[10]	
84			5		0			△ △				
85					0			△ △				
86					0			△ △	With weaker matrix		0847 0900	
87					1		1	△ △	1: 30, J/V, N-MW, Ca, Fi, Pl, SR-R (vuggy with Calcite crystals)			
88	25			100	6			△ △			[30]	
89					0			△ △				
90					0			△ △	2: 10-40, Contact, rough 3: 55, J, N?, Ca?, Pa, Pl, SR-S			
91					1			△ △	VOLCANIC MUDSTONE; dusky to very dusky red (2.5 YR 3/2 TO 2.5/2); slightly weathered; weak to very weak; slightly fractured; fine grained with occasional gravel up to 1/2-inch		0910 0923	
92	26			86	0	86		△ △	Becomes dark reddish brown		[19]	
93					0			△ △				

Report: GEO_CORE_OAK_C; File: Klamath_MASTER.GPJ; 6/20/2019 B-202

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-202

Sheet 7 of 7

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number				
93			5		2		1	VOLCANIC MUDSTONE; dusky to very dusky red (2.5 YR 3/2 TO 2.5/2); slightly weathered; weak to very weak; slightly fractured; fine grained with occasional gravel up to 1/2-inch			
94	26			86	NA	86	2	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --(continued) With trace gravel		[19]	
95							2				
2250	95						m	1: 40, J, N, Cl, Fi, Pl, ? 2: 20-30, J, N-W, Cl + Gravel, Pa-No, Ir-Pl, R		0939	
			6		NA		m	Without gravel; increasing strength		0955	
96	27			100		100	1	1: 10, J/V, N-MW, H+Cl, Fi, Pl, ? 2: 70, J, ?, No, No, Pl. ? (mechanical)		[8]	
					0		2			1003	
97							m	1: 40, J, W, Cl+Sd, Pa, Pl, R		1017	
							1				
2248	97				0						
98											
99	28			93	0	86				[13]	
2246	99				NA						
100					NA		NR				
										1035	
101								TOTAL DEPTH = 100.5 FEET Televiewer and caliper survey by NorCal Geophysics 8/22/2018. Install two VWPs at 28ft and 72ft with neat cement grout to ground surface with 3ft above-ground monument.			
2244	102										
2242	103										
	104										
2240	105										
	106										
	107										
	108										
	109										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 1 of 8

Date(s) Drilled	1/8/2019-1/11/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3-7/8-inch tricone, 3 3/4-inch diamond coring bit #10	Total Depth of Borehole	120.0 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2305 feet
Groundwater Level	25 feet above ground surface	Sampling Methods	SPT, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Completion	Bentonite cement grout to ground surface	Location		Coordinate Location	N 2601762 E 6461124

Elevation, feet	Depth, feet	ROCK CORE						MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]
	0														
2304	1							SILTY SAND with GRAVEL and COBBLES (SM); various lithologies; shell fragments; rounded clasts --ALLUVIUM (Qal)--			1	20 54			Mudline is 24' below reservoir level
2302	3	1		16	NA	NA	NR							0906	End of day 1/8/2019 Begin day 1/9/2019 Mudline is 25' below reservoir level Tricone to 2' switch to HQ-3
	4				NA		NR	BASALT COBBLE						[15]	
2300	5				NA		NR	VOLCANICLASTIC BRECCIA; yellow-brown; highly weathered; very weak; angular clasts up to 1/4"-1" --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						0916 0923	Yello-brown cuttings 0% Water Circulation Return (WCR)
	6	2		0	NA	0	NR								
2298	7				NA							18 38 50/5"		0923	
	8				NA						2		71		
2296	9	3		0	NA	0	NR	Becomes grayish blue-green (5BG5/2)						1239	Advance 5" HWT casing to 8'; good WCR
	10				NA									[10]	Blue-gray cuttings
2294	11				NA									1252	0% WCR to 13' Change HQ drill bit; no advancement; change to tricone advancement
	12				NA										
2292	13				NA										

Report: GEO_CORE+SOIL_17B_PACK; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 2 of 8

Elevation, feet	Depth, feet	ROCK CORE						MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
13			1		NA			VOLCANICLASTIC BRECCIA; grayish blue-green (5BG5/2); highly weathered; very weak; angular clasts up to 1/4"-1" --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)						1410	Good WCR; blue-green clayey cuttings
14					NA										
2290	15	4		0		0	NR							[16]	
16					NA										
2288	17				NA		M							1423 1443	Change HQ drill bit to increase recovery Blue-green clayey cuttings
18					NA										
2286	19	5		20		0	NR							[75]	
20					NA										
2284	21				NA		M M M								Broken Becomes slightly weathered; moderately strong; slightly fractured
22					NA		M							1447 1455	
2282	23	6		100		0								[30]	
24						0	M							1500 1503	
2280	25					0									Moderately weathered; weak
26						0									
2278	27	7		100		0	M M M							1507 1510	
28						0									
2276	29	8		100		0	M							[38]	

Report: GEO_CORE+SOIL_17B_PACK; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 3 of 8

Elevation, feet	Depth, feet	ROCK CORE						MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
29			1		0			VOLCANICLASTIC BRECCIA; grayish blue-green (5BG5/2); slightly weathered; moderately strong; angular clasts up to 1/4"-1"; slightly fractured --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)							Good WCR
30		8		100	0									[38]	
2274							M								
31					0		M	↓ Becomes moderately weathered; weak to very weak						1518	
32			2				M							1526	
33					0		M								
2272							M	Broken							
34		9		100	0									[38]	
35					0			↓ Becomes very to extremely weak							
2270					1		M,1								
36								1: 50°, J, N, Ca, Pa, Ir-Wa, SR Broken						1534	
2268							NR							1539	
37							M	↓ Becomes weak to very weak							
38					0		M								
2266					0										
39		10		92	0		M							[43]	
40							M								
2264					1		1	1: 40°, J, N, Ca, Pa, Ir-Wa, SR							
41							M							1546	
42							NR							1550	
2262					0		M								
43					0										
44		11		92	0			BASALT; grayish red purple (5RP4/2); highly weathered; very to extremely weak						[38]	
2260							M								
45							M								Red-brown cuttings

Report: GEO_CORE+SOIL_17B_PACK; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 4 of 8

Elevation, feet	Depth, feet	ROCK CORE						MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
															Drill Time [Rate, ft/hr]
45			2												
	46	11	92		NA	0									
2258	47		3		NA										End of day 1/9/2019
															Begin day 1/10/2019
	48				NA										
2256	49	12	100		0	73								[40]	
	50				1										
2254	51				NA									1026	50% WCR
														1033	
	52				0										
2252	53	13	96		96									[33]	
					1										
	54				0										
2250															
	55				NA										
	56													1042	
														1051	
2248	57				2										
	58	14	100		86									[43]	0% WCR
2246					0										
	59				1										
	60														
2244	61	15	4	100	100									1058	
														1108	

Report: GEO_CORE+SOIL_17B_PACK; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 5 of 8

Elevation, feet	Depth, feet	ROCK CORE						MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]
61			4					VOLCANICLASTIC BRECCIA; dark greenish gray to greenish gray (5G4/1-6/1); slightly weathered; moderately strong, angular clasts up to 1/4"-2"; hingly to moderately fractured; abundant calcite inclusions and veinlets							Continued 0% WCR
62	15			100	1	100	1	—TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)— (continued) 1: 40°, J, N, Ca, Pa, Ir-St, SR-R							
2242					0		M								1114 1120
63					1		1								
64	16			80	1	80	1	1: 35°, J, VN-N, No, No, Pl-Wa, SR							[38]
2240					1		M								
65					NA		M								1124 1306
66							1, M	1: 60°, J, VN-N, No, No, Wa, SR							
2238					0										
67					1			BASALT; dark gray (N3); slightly weathered; moderately strong; highly to locally intensely fractured; abundant calcite inclusions							
68	17			100		100	2	2: 60°, J, VN, No, No, Wa, SR 3: 70°, J, N-MW, Ca, Pa, Wa, SR							[38]
2236					1		3								
69							M								
70					1										
2234					NA		M	4: 70°, J/Sh, VN, Ca, Pa, Pl-Wa, S-Slk Mechanically broken							1314 1321
71							1, 2								
72					1		3	1: 80°, J, VN-N, Ca+Ch?, Pa, Pl-Wa, S-SR 2: 60°, J, VN-N, Ca+Ch?, Pa, Wa, SR 3: 50°, J, VN, No, No, Pl-Wa, SR-S 4: 50°, J, VN-N, Ca, Pa, Wa, SR 5: 60°, J, VN, Ca, Pa, Pl, S							
2232					2		4								
73	18			100		92	4								[50]
74					0		M								
2230					1		5	↓ Becomes medium dark gray (N4)							
75							M								
76					2		5	↓ Becomes dark gray (N3)							1327 1332
2228							M								
76	19			100		76	1	1: 80°, J, N, Ca, Sp, Pl-Wa, S-SR 2: 50°, J, VN, Ca, Sp, Pl-Wa, S-SR							
77					NA		2	Weak; mechanically broken							

Report: GEO_CORE+SOIL_17B_PACK; File: Klamath_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 6 of 8

Elevation, feet	Depth, feet	ROCK CORE					MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS		
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %			Fracture Drawing Number	Type	Number	Blows / 6 in.		Recovery, %	Drill Time [Rate, ft/hr]
77			5		6		M 3	BASALT; dark gray (N3); slightly weathered; moderately strong; highly to locally intensely fractured; abundant calcite inclusions; with numerous healed fractures (not logged) --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)							Continued 0% WCR
78	19			100		76	M 4	3: 55°, J, VN, Ca, Sp, Wa, S-SR 4: 60°, J, VN-N, Ca, Sp, Wa, S-SR 5: 40°, J, VN, Ca, Sp, Pl-Wa, SR 6: 30°, J, VN, Ca, Sp, Pl-Wa, SR 7: 40°, J, VN-N, Ca, Sp, Pl-Wa, SR 8: 40°, J, VN-N, Ca, Sp, Pl-Wa, SR 9: 50°, J, VN-N, Ca, Sp, Pl-Wa, SR 10: 75°, J, VN-N, Ca, Sp, Pl-Wa, SR						[60]	
2226					3		M 5								
79							M 6								
					3		M 7								
80							M 8								
					5		M 9	Weak; mechanically broken							1337
2224							M 10								1342
81					3		M 1	1: 30°, J, VN, Ca, Sp, Pl-Wa, SR 2: 50°, J, N, Ca, Sp, Pl-Wa, SR 3: 30°, J, N, Ca, Sp, Pl-Wa, SR							
							M 2								
82							M 3								
					0		M 4								
2222							M 5								
83	20			100		90	M 6								[60]
					3		M 7								
84							M 8	4: 25°, J, N, Ca, Sp, Pl-Wa, SR							
					2		M 9								
2220							M 10								
85					NA		M 11	Mechanically broken							1347
							M 12								1454
86					NA		M 13	Weak; intensely fractured with slickensides (shear zone)							
2218							M 14								
87					3		M 15								
							M 16								
88	21			100		50	M 17	1: 60°, J, N, Ca, Sp, Pl-Wa, SR 2: 75°, J, N, Ca, Sp, Pl, S 3: 20°, J, VN-N, Ca, Sp, Wa, SR 4: 50°, J, VN, Ca, Sp, Pl-Wa, SR 5: 40°, J, N, Ca, Sp, Wa, SR						[30]	
					7		M 18								
2216							M 19								
89					6		M 20								
							M 21								
90					2		M 22								1504
2214		6					M 23								1510
91					5		M 24	1: 60°, J, N, Ca, Sp, Pl-Wa, S-SR 2: 35°-45°, J, VN-N, Ca, Sp, Pl-Wa, S-SR							
							M 25								
92	22			100		86	M 26								[38]
					1		M 27								
2212							M 28								
93							M 29								

Report: GEO_CORE+SOIL_17B_PACK; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 7 of 8

Elevation, feet	ROCK CORE						MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]
93		6		2		M.2	VOLCANICLASTIC BRECCIA; grayish blue-green (5BG5/2); slightly weathered; moderately strong; highly to moderately fractured; abundant calcite inclusions and veinlets; with numerous healed fractures (not logged)							Continued 0% WCR
94	22		100	2	86	3.M	—TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)— (continued) 3: 70°, J, VN-N No, No, Wa-Ir, SR						[38]	
2210				0		M							1518 1524	
95														
96				2		1	1: 40°, J, VN-N, No, No, Pl-Wa, S-SR							
2208						1	↓ Becomes mottled very dusky purple (5RP2/2) and grayish blue green (5BG5/2)							
97						M	↓ Mechanically broken							
98	23		100	1	94	1							[33]	
2206				1		M								
99						M								
100				1		M	2: 50°, J, N, No, No, Wa, SR							
2204				1		M	↓ Mechanically broken						1533 1539	
101				2		M.2	1: 30°, J, N, No, No, Pl-Wa, SR 2: 40°, J, VN-N, No, No, Pl-Wa, SR 3: 50°, J, N, No, No, Pl-Wa, SR							
102						3								
2202				NA		M	↓ Mechanically broken							
103	24		62		28	NR							[33]	
104						M								
2200				4		4.4	4: 70°, J, VN-N, Ca, Sp/Pa, Pl, S-SR 5: 70°, V, N, Ca, Fi, Pl, S? 6: 90°, J, N, No, No, Pl-Wa, S-SR							
105				2		4.4	PORPHYRYTIC BASALT; dark gray to grayish black (N3-N2); slightly weathered to fresh; moderately strong to strong; abundant white phenocrysts (feldspar?) and healed calcite fractures and veins; highly fractured							
106		7				M	—TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)— (continued)						1548 1011	End of day 1/10/2019 Begin day 1/11/2019
2198				2		1	1: 30°, J, VN-N, No, No, Wa, S-SR 2: 20°, J, VN-N, Ca?+Ch?, Sp, Pl-Wa, SR 3: 80°, J/V, N, Ca?+Ch?, Fi, Pl, S-SR							
107				1	71	2								
108	25		78			3							[25]	
2196				0		M	↓ Becomes slightly fractured							
109														

Report: GEO_CORE+SOIL_17B_PACK: File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Report: GEO_CORE+SOIL_17B_PACK; File: Klamath_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-203

Sheet 8 of 8

Elevation, feet	Depth, feet	ROCK CORE					MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
109		25	7	78	NA	71	Z	PORPHYRYTIC BASALT; dark gray to grayish black (N3-N2); slightly weathered to fresh; moderately strong to strong; abundant white phenocrysts (feldspar?) and healed calcite fractures and veins; slightly fractured						Faster drilling 109'-110'
110							M	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)					1022 1029	Continued 0% WCR
2194					0									
111					0		M							
112														
2192		26		80	0	100	M						[30]	
113							M	↓ Becomes very dark red (5R2/6)						Faster drilling 113'-117'
					NA			Highly weathered; very to extremely weak; crushed						
114					NA		NR	VOLCANICLASTIC BRECCIA; very dusky purple (5RP2/2) to grayish blue-green (5BG5/2); highly weathered; weak to very weak; moderately fractured; angular to subangular medium- to coarse-grained sand-sized clasts with occasional to 1/2"; with numerous mechanical fractures					1039 1047	
2190					NA		NR	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)						
115							M							
116							M	↓ Becomes moderately strong						
2188					0		M							
117		27		92	1	76	M	↓ Becomes very dusky purple (5RP2/2)					[14]	Slower drilling to TD
118							M	1: 25°, J?, VN, No, No, Pl, S						
2186					0		M							
119							M							
					0		M							
120							M						1109	
TOTAL DEPTH = 120.0 FEET														
2184														
121														
122														
2182														
123														
124														
2180														
125														

Report: GEO_CORE+SOIL_17B_PACK; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-203

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-205

Sheet 1 of 5

Date(s) Drilled	9/12/2018	Logged By	K. Zeiger	Checked By	P. Respass
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch PDC drag bit, 3 3/4-inch carbide tooth bit	Total Depth of Borehole	62.0 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2359 feet
Groundwater Level	21.7 feet bgs 9/13/2018	Sampling Methods	2.5-inch ID ModCal; HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir along Copco Road	Coordinate Location	N 2602659 E 6461881

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0									CLAYEY GRAVEL (GC); dense; dark brown (10YR 3/2); 70% angular GRAVEL up to 1-inch; 25% low plasticity FINES; 5% organics; dry; GRAVEL is volcanic --COLLUVIUM--						Hollow stem auger to 0 to 19ft.
2358	1														
	2								Boulder (fragments)						
	3								Boulder (fragments)						
2356	4														
	5														
2354	6														
	7														
2352	8														
	9								CLAYEY GRAVEL with SAND (GC); medium dense; dark brown (7.5YR 3/2); 35% high plasticity FINES; 40% subangular GRAVEL up to 1-inch; 25% fine grained SAND; dry; cohesive; gravel is chert and rhyolite --COLLUVIUM/RESIDUAL SOIL--						Lithology transition logged from cuttings
2350	10								At 9ft.: becomes moist						
	11								With gravel up to 2.5-inches						
2348	12														
	13								GRAVELLY FAT CLAY (CH); hard; dark brown (7.5 YR 3/2); 65% high plasticity FINES; 35% subangular GRAVEL to 1-inch; moist; cohesive						One liner retained (11-11.5ft.) LL=61; PL=22 SA: G=38.4% S=25.7%; F=34.9%
2346															

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-205

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-205

Sheet 2 of 5

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-205

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
2346	13							GRAVELLY FAT CLAY (CH); hard; dark brown (7.5 YR 3/2); 65% high plasticity FINES; 35% subangular GRAVEL to 1-inch; moist; cohesive --COLLUVIUM/RESIDUAL SOIL--(continued)						
	14													
2344	15							POORLY GRADED GRAVEL with CLAY and SAND (GP-GC); very dense; light olive grey (5Y 5/2); 60% rounded GRAVEL up to 1 1/2-inches; 30% low plasticity FINES; 10% medium grained SAND; dry, cohesive; gravel is weathered in place --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--		S03	23 50/2"	100		Driller reports hard consistent drilling 15.5-19.0ft. Cuttings are dry gravelly
	16													
2342	17													
	18													
2340	19									S04	92/6"	50		Advance 4-inch casing to 19.5ft. Switch to HQ-3 rock coring.
	20	1		NA			m	VOLCANIC CONGLOMERATE; light olive grey (5Y 5/2); highly weathered; very weak; fine grained with rounded to angular clasts up to 1/2-inch					1406	
	21	1	52	NA			m						[17]	
2338	22			NA									1415 1438	
	23			0				↓ Becomes medium bluish grey (5B 5/1); moderately weathered; weak to very weak; massive						
	24			0										
2336	25	2	100	0	34*		m	↓ Becomes highly weathered; very weak					[75]	*Rock does not meet soundness criteria for RQD calculation
2334	26			0				Light olive grey (5Y 5/2)						
	27			0			m						1442 1452	
2332	28	3	100	0										
	29			0										
2330														

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-205

Sheet 3 of 5

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2330	29	3	1	100	0	0			VOLCANIC CONGLOMERATE; medium bluish grey (5B 5/1); highly weathered; very weak; massive; fine grained with rounded to angular clasts up to 1/2-inch; chlorite rich matrix (?) --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)					[100]	
	30				0										
2328	31		2		0										
	32				0									1455 1505	
2326	33				4		1 1 2 3		1: 5, J, MW, No, No, Wa, SR (likely mechanical) 2: 35, J, MW, No, No, Wa, SR (likely mechanical) 3: 20, J, MW, No, No, Wa, SR (likely mechanical)						Run 4 broken during removal from core barrel (all fractures mechanical?)
	34														
2324	35	4		100	2	0	1 2 1							[75]	
	36				2		1 2 1								
	37				4		1 2 1 1							1509 1518	
	38				0										
2320	39	5		100	0	0	m m m		Broken while placing in box					[75]	
	40		3		0										
2318	41				0										
	42				0				With clasts up to 3/4-inch					1522 1528	
2316	43				0										
	44						m								
2314	45	6		100	0	0			Completely weathered to clay; extremely weak					[60]	

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-205

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-205

Sheet 4 of 5

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-205

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS		
		Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]	
2314	45	6	3	100	0	0		m	VOLCANIC CONGLOMERATE; medium bluish grey (5B 5/1); highly weathered; very weak; massive; fine grained with rounded to angular clasts up to 3/4-inch --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)							
	46				0											
2312	47				0									1533 1540	47-49.5ft. wrapped for review	
	48				0											
2310	49	7	4	100	3	0		1 2 3	Fractured zone with iron and manganese staining 1: 85, J, T, Fe+Mn, Su, Wa, SR 2: 10, J, N, No, No, Wa-Ir, R 3: 25, J, MW, Fe+Mn, Su, Wa, SR				[50]			
	50				0											
2308	51				0											
	52				0									1546 1555		
2306	53	8		86	1	0		m	1: 10, J, T, No, No, Wa, SR (contact between weathering zones)					[42]		
	54				NA			1	Becomes completely weathered; extremely weak; clayey						Soft zone plugged bit during Run 8	
2304	55							1	Becomes highly weathered; very weak					1559 1626		
	56	9		100	0	0		m	1: 35, J, N, No, No, Pl, S					[12]		
	57				NA			1	Becomes moderately weathered; weak; intensely fractured with calcite precipitation					1637 1650		
	58				3			2 1								
2300	59	10	5	96	5	20*		3 4 5 6 5 5	VOLCANIC BRECCIA; dusky brown (5YR 2/2); highly weathered; weak; highly fractured; with angular clasts up to 1-inch; 58.4-58.7' crushed 1: 85, J, N, No, No, Wa, SR 2: 70, J, N, Ca, Pa, Pl, Sr 3: 35, J, N, No, No, Pl, S 4: ~10, J, T, No, No, Wa-Ir, SR-R 5: 10-15, J, N, No, No, Wa-Pl, SR 6: 25, J/Bedding, N-T, No, No, Wa, SR				[33]			
2298	61				2			5 5								

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-205

Sheet 5 of 5

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES					FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]		
2298	61	10	5	96	1	20*	7	△ △ △ △ △ △ △ △	VOLCANIC BRECCIA; dusky brown (5YR 2/2); highly weathered; weak; highly fractured; with angular clasts up to 1-inch --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued) 7: 45, J, N, Ca, Sp, Pl, SR TOTAL DEPTH = 62.0 FEET					1659		
2296	63															
	64															
2294	65															
	66															
2292	67															
	68															
2290	69															
	70															
2288	71															
	72															
2286	73															
	74															
2284	75															
	76															
2282	77															

Report: GEO_CORE+SOIL_NO PACK WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-205

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Core Boring B-206

Sheet 1 of 7

Date(s) Drilled	8/14/2018 - 8/16/2018	Logged By	T. Vande Voorde	Checked By	B. Kozlowski/K. Zeiger
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	3 7/8-inch tricone; 4-inch #13 diamond coring bit; 4-inch carbonado coring bit	Total Depth of Borehole	100.0 feet
Drill Rig Type	Track Mounted Fraste XL	Drilling Contractor	Pitcher Drilling Company	NAVD 88 Ground Surface Elevation	2337 feet
Groundwater Level	7.4 feet bgs 8/17/2018	Sampling Methods	HQ Core Barrel	Inclination from Horizontal/True North Bearing	60°/295°
Borehole Completion	Two VWPs with neat cement grout to ground surface	Location	Iron Gate Reservoir; W of Fall Creek boat ramp	Coordinate Location	N 2602022 E 6461272

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
0									SANDY FAT CLAY with GRAVEL (CH); dry; dark brown (10YR 3/3) with trace mottled yellow (10YR 7/6); 75% high plasticity FINES; 15% subangular to rounded GRAVEL up to 1 1/4-inch; 10% fine to coarse grained SAND; little organic material (roots)			Trash barrel to 10ft.
2336	1								--ALLUVIUM--			
	2											
2334	3											
	4											
	5								With angular basaltic and some volcanic tuff GRAVEL up to 1 1/2-inch			
2332	6											
	7											
2330	8											
	9											
2328	10											Begin rotary wash drilling at 10 ft. with 3 7/8-inch tricone bit; Drill fluid is light grey. Rig chatter.
	11											
2326	12											
	13											

Report: GEO_CORE_OAK_C: File: Klamath_MASTER.GPJ: 6/20/2019 B-206

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-206

Sheet 2 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
13									SANDY FAT CLAY with GRAVEL (CH); dry; dark brown (10YR 3/3) with trace mottled yellow (10YR 7/6); 75% high plasticity FINES; 15% subangular to rounded GRAVEL up to 1 1/2-inch; 10% fine to coarse grained SAND; trace organic material (roots) --ALLUVIUM-- (continued)			
2324	14											
15									Weathered light yellow and greenish brown tuff fragments in cuttings			
16												
2322	17											
18												
19												
2320	20		1		NA				Basalt and volcanic tuff fragments in cuttings		1222	Begin HQ rock core at 20ft. with 4-inch carbonado bit.
21												
2318	21	1	40	NA	NA				BOULDER; 2-foot rounded basalt boulder; possible rounded basaltic COBBLES near bottom of run		[4]	Run 1 not retained.
22					NA							
23					NA		NR		BASALT; grey to bluish grey (5B 6/1); slightly to moderately weathered; strong; highly fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch; with 1/2 to 1-inch weathering rind on joints --TERTIARY to QUATERNARY INTRUSIVE BASALT--		1305 1340	Switch to 4-inch #13 diamond coring bit at 23 ft.
2316	24	2	70		0			1 2 3 4 5 6 7	1: 70, J, N, Ca, Fi, Pl, SR 2: 30, J, VN, Fe, Pa+Su, Pl, SR 3: 30, J, VN, H+Fe, Fi, Pl, ? 4: 70, J, VN, Ca+Fe, Pa, Pl, SR 5: 25, J, VN, Fe, Su, Pl, SR 6: 50, J, VN, Fe, Su, Pl, ? 7: 40, J, N, Fe+Ca, Sp, Pl, SR		[3]	
25								1,2 3,4 5 6 7	Without weathering rings		1416 1442	Reviewer note: All healed veins and fractures were mechanically broken by core handling.
2314	26				3			1 2 3 4 5 6 7 8 9 10	1: 50, J, ?, Fe, Sp, Pl, ? 2: 40, J, ?, Fe, Sp, Pl, ? 3: 60, J, VN, H+Ca, Fi, Pl, SR 4: 50, J, VN, H+Ca, Fi, Pl, SR 5: 35, J, VN, H+Fe+Ca, Pa, Pl, SR 6: 80-90, J, VN, H+Ca, Fi, Pl, SR 7: 30, J, VN, H+Ca, Fi, Pl, SR 8: 75, J, VN, Ca, Pa, Pl, SR 9: 75, J, VN-T, Ca, Sp, Pl, SR 10: 50, J, VN, Ca, Sp, Pl, SR			
27		3	100		100							
28					4							
2312	28				5							
29											1541	

Report: GEO CORE OAK C; File: KLAMATH MASTER.GPJ; 6/20/2019 B-206

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-206

Sheet 3 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
29			1		3				BASALT; grey to bluish grey (5B 6/1); slightly weathered; strong; highly fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch --TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)--		1600	
	30				2				1: 40, J, VN, Ca, Sp, Pl, SR 2: 60, J, VN, Ca, Fi, Pl, SR 3: 85, J, VN, H+Ca, Sp, ?, ? (possible mechanical) 4: 40-50, J, VN-T, Ca+Mn, Sp, Pl, SR			
2310	31	4		96	5	90					[11]	
	32				1				5: 65, J, VN, H+No, No, Ir, ? 6: 60, J, N, Uk, Pa, Pl, SR 7: 30, J, VN, Fe, Su, Pl, SR			
2308	33				4							
	34										1627 0750	End of day 8/14/2018 Begin day 8/15/2018
	35				5				1: 50, J, N, Ca, Sp, Pl, SR 2: 45-50, J, VN-MW, Ca+Mn, Fi, Pl, S + with 90° slk 3: 15, J, N, Ca+Mn, Pa, Ir, ?			Drill fluid becomes light grey greenish grey at 35ft.
2306	36				4				4: 55, J, VN, Ca, Sp, Pl, SR (with MN staining) 5: 60, J, N, H+Ca, Fi, Pl, SR (with MN staining) 6: 40, J, VN, Ca, Fi+Sp, Pl, SR (with MN staining)			
	37	5	2	100	3	80					[8]	
2304	38				3				With wider fractures with more infilling 7: 70, J, VN-MW, H+Ca, Fi, Pl, ? 8: 5, J, N, Ca, Fi, Pl, ? 9: 80, J, ?, Ca+Mn, Sp, Pl, ?			
	39				5						0829 0853	
2302	40				>6				1: 25, J, N, Ca, Pa, Pl, SR 2: 70-80, J, Mn, Sp, St/Ir, R			
	41	6		83	4	52			Crushed; likely mechanical		[6]	
	42				3				3: 40, J, T-VN, Ca?, Sp, Pl, SR 4: 60, J, No, No, Pl, S-SR 5: 60, J/Sh, MW, CR+Sd+Ca, Fi, Pl, SR			
2300	43	7		100	>6	0			Becomes intensely fractured		0925 0932	
	44				>6				1: 50, J, Ca?, Sp, Ir, R 2: 80, J, VN, H+Uk, Fi, Wa, ?		[1]	Lost all circulation at 42.5 ft.
	45	8		100	>6	40			1: 45, J, Mn?, Su, Pl, R 2: 50-60, J, VN-MW, H+Ca, Fi, Pl, SR 3: 55, J, Ca, Fi-Pa, Pl, SR 4: 60, V, ?, Ca?, Fi, Pl, ? 5: 70, J, ?, Ca, Pa, Pl, SR		1015 1029	
2298					>6						[5]	
											1053	

Report: GEO CORE OAK C: File: Klamath MASTER.GPJ: 6/20/2019 B-206

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-206

Sheet 4 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
45			2		>6		2		BASALT; grey to bluish grey (5B 6/1); slightly weathered; strong; intensely fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch --TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)--		1107	
46					>6		1		1: 45, J, VN, Ca, Fi, Pl, S-SR 2: 60-90, J, VN, H+Uk, Fi, Pl, ? 3: 30-40, J, VN, H+Ca, Fi, Pl, ? 4: 30, J, VN, H+Fe?, Fi, Ir, ? 5: 80, J, VN-N, Ca+Fe, Fi, Pl, ?			
2296	47	9		100	6	50	5					
	48		3				6		↓ Becomes moderately fractured; with healed fractures			
	49				1		7		6: 60, J, N, Fe+Ca, Pa, Pl, ? 7: 40, J, N, H+Uk, Fi, Pl, ?			
2294	50				1		7					
	51						m				1148	
	52				1		1				1159	
2292	53	10		100	0	100	2		1: 40, J, N, H+Ca+Mn+Fe, Fi+Su, Pl, SR 2: 75, J, N, Fe+Mn+Ca, Su+Pa, Pl, SR 3: 50, J, T, H+No, No, Pl 4: 85, J, VN-N, Ca+Fe, Fi-Pa, Pl-Wa, SR			
	54				1		3					[12]
2290	55						4					
	56				1		m					
	57						m					
	58						m					
2288	59	11		83	50		1		1: 90, J, T, H+Fe?, Fi, Wa, ? 2: 35, J, VN, Ca?, Pa-Sp, Pl, SR 3: 70, J, VN-N, Ca+Fe, Fi, Pl, ?			
	60				3		2		↓ Becomes highly fractured			
	61						3		4: 20, J, VN, Ca?, Pa, Pl, SR 5: 85, J, VN, Ca/Ch?, Pa, Pl, SR			
	62						4					
	63				2		5					
2286	64	12		100	100		m					
	65				2		1					
	66						5					
	67						m					
	68						m					
	69						m					
2284	70	13		98	0	90	2		1: 80, J, N, Ca?, Pl, Pa, SR 2: 75, J, N, H+Ca+Mn, Fi+Sp, Pl, SR 3: 65, J, VN, Ca?, Sp, Pl, SR			
	71						3					
	72						m					
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Report: GEO_CORE_OAK_C; File: Klamath_MASTER.GPJ; 6/20/2019 B-206

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-206

Sheet 5 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
61			4		1		1		BASALT; grey to bluish black (5B 2.5/1); slightly weathered; strong; moderate to highly fractured; abundant healed joints with calcite infilling; aphanitic matrix with feldspar phenocrysts up to 1/4-inch --TERTIARY to QUATERNARY INTRUSIVE BASALT--(continued)--			
62		13		98	2	100	2				[11]	
2282	63				2		4		1: 70, J, VN, H+Ca?, Fi, Pl, ? 2: 55, J, N, Ca, Fi, Pl, ? 3: 80, J, T-N, H+Ca?, Fi, Pl, ? 4: 60, J, N, Ca+Fe, Fi+Sp, Pl, SR 5: 50, J, VN, H+No, No, Pl, ? 6: 80, J, VN, H+Ca, Fi, Pl, ? 7: 85, J, VN, Ca, Pa, Pl, ?			
64					2		5					
65							m				1359	
2280	66	14		100	1	100	2		1: 55, J, N, Ca?, Su, Ir, ? 2: 45, J, VN, Ca, Sp, Pl, SR 3: 45, J, VN, Ca, Pa, Pl, SR		1411	65.2-66.5: Mohs Hardness = 3-4; UCS = 15,739 psi
67							3		With small, calcite infilled vesicles oriented at 30 degrees			
2278	68				4		m				1434	
69		15		100	2	100	2		1: 90, J, VN-T, H+Ca, Fi, Pl, ? 2: 75, J, T, H+Ca?, Fi, Pl, ? 3: 65, J, VN, Fe, Su, Pl, SR		1454	
70					1		3		Becomes slightly fractured			
2276	71				0		2		1: 70, J, T, H+Ca?, Fi, Pl, ? 2: 35, V, T, Ca?, Fi, Pl, ? 3: 40, V, N, Ca/Qz?, Fi, Pl, ? 4: 60, J, T, H+Ca?, Fi, Pl, ?		1510	
72					0		3				1524	
2274	73	16		96	1	96	4		5: 60, J, VN-N, Ca?, Sp, Pl, ? (possibly mechanical) 6: 70, J, N, H+Ca, Fi, Pl, SR (Contact between Basalt and Tuff Breccia) 7: 30, J, N, Ca?, Sp, Pl, ? (possibly mechanical)			[9]
74			5		4		5					
2272	75				0		m		VOLCANIC BRECCIA; greenish grey with grey and black clasts; moderately weathered; moderately strong to strong; slightly to highly fractured; medium grained matrix with angular clasts up to 1-inch; some calcite veins --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--		1556	
76		17		100	3	100	1				0727	End of day 8/15/2018 Begin day 8/16/2018
2270	77				4		2		1: 20-30, J, VN, H+Uk, Fi-Sp, Ir, SR 2: 85, J, MW, Ca, Fi, Pl, SR 3: 75, V, N-MW, Ca, Fi, Pl-Wa, ?			[7] *Rock does not meet soundness criteria for RQD calculation

Report: GEO_CORE_OAK_C: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-206

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-206

Sheet 6 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS						
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number											
2268	77	17	5	100	3	100*		m	△ △ VOLCANIC BRECCIA; greenish grey with grey and black clasts; moderately weathered; moderately strong to strong; highly fractured; medium grained matrix with angular clasts up to 1-inch; some calcite veins		[7]	Packer test #2 from 75.0 to 85.0						
	78							△ △ --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)										
	79							△ △ 4: 50-60, J, VN-T, Ca?, Fi, Pl, ?										
								△ △ 5: 70, V, MW, Uk, Fi, Pl, ?										
								△ △ With planar, 70° fabric										
	80							△ △ 6: 70, J, VN, Ca, Pa, Pl, SR										
								△ △ Becomes highly weathered/alterd; weak to very weak; locally crushed										
	81							△ △ 1: 30, J, VN, No, No, Pl, ? (possibly mechanical)										
								△ △										
								△ △										
2266	82	18	46	NA	16			△ △										
	83							△ △ Becomes slightly weathered; moderately strong to strong; with light bluish grey and dark grey clasts 1/8-inch to 1-inch										
	84							△ △ 2: 60, J, N, No, No, Pl, R										
								△ △ Weak rock in shoe										
								△ △										
	85							△ △ Becomes moderately weathered; moderately strong; medium to coarse grained matrix with strong black and grey clasts and soft clayey green clasts										
	86							△ △ 1: 40, J, VN-T, No, No, Ir, ?										
								△ △ 2: 60, J, N-VN, H+Ca, Fi-Pa, Pl, SR										
								△ △										
	2260	87	19	92	91*	3			△ △									
2260		88							△ △ 1: 30-40, J, VN-N, Ca, Pa, Pl, SR									
		△ △ 2: 10, J, ?, No, No, Pl, R																
		89							△ △ With more abundant soft, green clasts									
									△ △									
									△ △									
		90							△ △ With decreasing clast size									
		91							△ △ Becomes locally moderately strong to strong; moderately to locally highly weathered/alterd; intensely fractured									
									△ △									
									△ △ With fewer breccia clasts									
2258	92	21	100	2	75*			△ △ 1: 0-10, J, VN, No, No, Pl-Ir, ? (possibly mechanical)	[7]		Packer test #1 from 85.0 to 95.0							
	△ △ 2: 25, J, Vn, Mn?, Fi, Pl, ? (surface staining around joint)																	
	△ △ 3: 0, J, VN, Mn?, Su, St-Pl, ? (surface staining around joint)																	
	△ △																	
	△ △																	

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Core Boring B-206

Sheet 7 of 7

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number					
2256	93		6		1			△ △	VOLCANIC BRECCIA; greenish grey with grey and black clasts; moderately to highly weathered; moderately strong; moderately fractured; medium to coarse grained matrix with angular clasts up to 1/2-inch			
	94	21		100		75*	3	△ △	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)			
					0			△ △	At 94.3ft.: becomes brownish grey; weak to moderately strong			
	95							△ △	With 45° fabric		1208	
2254					1			△ △			1215	
	96						1	△ △				
					3		1	△ △	Becomes slightly weathered; strong to moderately strong; with elongated inclusions along fabric			
	97						1	△ △	1: 0, J, VN-MW, Ca?, Sp, Pl, SR 2: 0, J, MW, Cl+Sd, Fi, Pl, ? 3: 50, J, MW, H+Uk, Fi, Pl, ?			
2252		22		100	0	100*		△ △				[7]
	98						m	△ △				
					2		2	△ △	Becomes very light bluish grey; moderately strong; matrix supported			
	99						1	△ △				
					3		m	△ △	Becomes brownish grey; fewer clasts			
2250	100						3	△ △			1300	
									TOTAL DEPTH = 100.0 FEET Televiewer and caliper survey by NorCal Geophysics 8/16/2018. Install two VWP's at 25ft and 92ft with neat cement grout to ground surface with 12" flush mount monument.			
	101											
	102											
2248												
	103											
	104											
2246												
	105											
	106											
2244	107											
	108											
	109											

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-207

Sheet 1 of 6

Date(s) Drilled	9/13/2018-9/18/2018	Logged By	K. Zeiger/B. Kozlowski	Checked By	P. Respass
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	2 7/8-inch ID HQ Bit	Total Depth of Borehole	81.1 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2359 feet
Groundwater Level	23.1 feet bgs 9/14/2018	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir along Copco Road	Coordinate Location	N 2602272 E 6461618

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0	0								CLAYEY GRAVEL (GC); loose; brown (7.5YR 4/3); 70% angular to rounded GRAVEL up to 2 inches; 30% low plasticity FINES; dry; gravel is chert, rhyolite, and other volcanics; abundant roots --ROAD FILL--						Start 12:00 9/13/2018 with Hollow Stem Auger to 15.2ft.; K. Zeiger logging
2358	1														
	2														
	3														
2356	4														
	5														
2354	6								GRAVELLY LEAN CLAY (CL); medium stiff; brown (10YR 4/3); 60% low plasticity FINES; 40% angular GRAVEL up to 1 inch; dry; with roots and rootlets --COLLUVIUM/RESIDUAL SOIL--		9				
	7									S-01	7	100			
2352	8										2				
	9														
2350	10														
	11														
2348	12								SANDY LEAN CLAY with GRAVEL (CL); stiff; brown (10YR 4/3); 55% low plasticity FINES; 25% angular GRAVEL; 25% fine grained SAND; dry; gravel is highly weathered; with rootlets --COMPLETELY WEATHERED VOLCANIC BRECCIA--		8				One liner retained (11.0-11.5ft.)
	13									S-02	10	100			
2346											8				

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-207

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-207

Sheet 2 of 6

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-207

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
13								△ △ VOLCANIC BRECCIA; grey (7.5YR 5/1); slightly weathered; strong; cemented fine grained matrix with angular volcanic clasts up 4 inches; highly fractured --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						
14								△ △						
2344	15							△ △						
		1	1	NA			1	△ △ 1: 10, J, N, No, No, Wa, SR 2: 50, J, N, Fe, Sp, Wa, R 3: 20, J, N?, Ca, Sp, Wa, SR (run break)	■	S-03	50 3.5"	100	1400	Switch to HQ coring with 2 7/8 inch HQ bit at 15.2ft.
16		1		94		61	2	△ △					[20]	
2342	17				2			△ △					1405	
					1			△ △					1411	
18								△ △						
2340	19	2		100	>6	26	3	△ △ Becomes light yellowish brown (10YR 6/4), highly weathered, weak, locally crushed						
								△ △ 1: 60, J, N, No, No, Pl, SR 2: 60, J, MW, rootlet, Sp, Pl, S-SR 3: 20-40, J, N, Fe, Su+Sp, Wa, SR 4: 80, J, MW, Fe, Su, Wa, SR-R					[25]	
2338	20				4		3	△ △ With clasts weathering out of matrix						
					2		3	△ △						
2336	22				0		m	△ △ 1: 20, J, T, No, No, Wa, SR 2: 45, J, N, Ca?, Pa, Pl, S+Slk 3: 10, J, N, No, No, Wa, SR 4: 35, J, N, No, No, Pl, S	▼				1423 1518	0.3ft. of Run 2 recovered with Run 3; HQ inner barrel stuck in rods after Run 2 pull rods to retrieve.
2334	23				2		1	△ △						
		3		96	4	0	2	△ △ With fracturing along clast boundaries					[20]	
2332	25				>6		2	△ △						
					NA		3	△ △						
2330	27						3	△ △ Completely weathered, extremely weak					1533	
		4		100		46*		△ △ Becomes moderately weathered, moderately strong					1541	
					>6		1	△ △ 1: 50, J, N, No, No, Wa, SR 2: 60, J, MW, Fe+Mn, Su, Wa-St, SR-R 3: 10, J, T, Fe, Sp, Wa-Pl, SR						
							2	△ △						
							3	△ △						

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-207

Sheet 3 of 6

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-207

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
29		4	1	100	>6	46*	3	△ △ VOLCANIC BRECCIA; light yellowish brown (10YR 6/4); moderately weathered; moderately strong; locally crushed; highly fractured --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)					[18]	
30				0			4	△ △						
31	2328		2	2			6	△ △ 4: 55, J, N, No, No, Pl, S (clast boundary) 5: 80, J, MW, Fe+Mn, Su, Wa-Ir, SR_R 6: 20, J, N, No, No, Wa, SR						
32							6	△ △					1558	
33	2326				>6		1	△ △ Becomes highly weathered, weak, intensely fractured					1605	
34		5		100	>6	0	1	△ △ 1: 85, JN, No, No, Wa, SR 2: 20, J, T, Fe+Mn, Su, Wa, SR 3: 30, J, N, No, No, Wa, SR 4: 40, J, N, Fe+Mn, Su, Pl, SR 5: 65, J, N, Fe+Mn, Su, Pl, SR 6: 35, J, N, Fe+Mn, Su, Wa, SR					[16]	
35	2324				>6		3	△ △						Lost all circulation at 35.0ft.
36					>6		5	△ △ Highly to completely weathered						
37	2322	6	67	NA	0		5	△ △					1622	
38					>6		6	△ △ Highly to completely weathered, crushed					1637	
39	2320				2		1	△ △ Becomes moderately weathered, moderately strong					[5]	
40		7	56	NA	10		2	△ △					1644	
41	2318				NA		3	△ △ Becomes completely weathered to a CLAYEY SAND, extremely weak					0859	End of day 9/13/2018 Begin day 9/14/2018
42					NA		3	△ △						Driller noted 'harder' drilling conditions
43	2316				NA		4	△ △					0912	
44					NA			△ △					1203	1500 gallons of water used in Run 7
45	2314	8	40	NA	0			△ △						Advance 4-inch casing to 29ft.
								△ △					[19]	

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-207

Sheet 4 of 6

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-207

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
45		8	2	40	>6	0		△ △	VOLCANIC BRECCIA; light yellowish brown (10YR 6/4); completely weathered to a CLAYEY SAND; extremely weak; locally crushed						
46								△ △	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)						
2312	47				>6		1	△ △	At 46ft.: becomes very dark greenish grey (5BG 3/1) and greenish grey (5G 6/1); moderately weathered; moderately strong; intensely fractured					1219	
							2	△ △	1: 20, J, N, Sa, Pa, Pl, S					1241	
							1	△ △	2: 50, J, T, No, No, Pl, S						
					3		m	△ △	At 47ft.: becomes very dark greenish grey (5BG 3/1), highly weathered, very weak, with angular clasts weathering out of soft matrix						
48							1	△ △							
							2	△ △							
2310	49				1		m	△ △							
							3	△ △							
		9	3	100	2	18	4	△ △						[17]	
50							4	△ △	Slightly weathered, strong clast						
							5	△ △							
2308	51				2			△ △	1: 10, J, N, No, No, Wa, SR						
								△ △	2: 45, J, N, No, No, Wa, SR						
								△ △	3: 55, J, T, No, No, Wa, SR						
								△ △	4: 30, J, N?, No, No, Pl, S (clast boundary)						
					0			△ △	5: 20, J, T, No, No, Wa, SR						
52								△ △						1259	
					>6			△ △	Crushed					1309	
2306	53						1	△ △	With calcite veins						
					3		1	△ △							
54							2	△ △							
								△ △	1: 65, J, N, No, No, Wa, SR						
								△ △	2: 30, J, N, No, No, Wa-St, SR						
2304	55	10	66	2	0		3	△ △	3: 10, J, T, No, No, Wa-Pl, SR					[13]	
								△ △							
56					NA			△ △							
								△ △							
2302	57				NA			△ △							
							1	△ △	Becomes slightly to moderately weathered, moderately strong					1333	
					>6		2	△ △	Crushed					1341	
58							3	△ △							
							4	△ △	Becomes slightly fractured						
					2		5	△ △							
2300	59							△ △							
		11	100	0	90		m	△ △	Clast weathering out of matrix					[15]	
60								△ △							
								△ △	1: 85, J, MW, No, No, Wa-St, R						
								△ △	2: 10, J, MN, No, No, Wa-St, R						
								△ △	3: 15, J, N, No, No, Wa, SR						
					0			△ △	4: 50, V, N, H+Ca, Fi, Ir, ?						
2298	61							△ △	5: 30, V, MW, H+Ca, Fi, Wa, ?						

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-207

Sheet 5 of 6

Report: GEO_CORE-SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-207

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
61		11	3	100	0	90		△ △ VOLCANIC BRECCIA; very dark greenish grey (5BG 3/1) and greenish grey (5G 6/1); slightly to locally moderately weathered; moderately strong; slightly fractured; fine grained matrix with angular to subangular clasts of porphyritic basalt up to 1.5 inches						
62			4		1		1	△ △ --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)					1401 0840	End of day 9/14/2018 Begin day 9/18/2018 B. Kozłowicz logging Water level at 28.8 ft. 9/18/2018 50% fluid circulation
2296	63				0		m	△ △ 1: 30-40, J, N, No, No, Ir, R 2: 30, J/Sh, MW, Ca, Sp, Pl, SR 3: 90, J/Sh, MW, Ca, Sp, Pl, SR						
64					0	52		△ △						
2294	65	12		82	0		2	△ △ Becomes moderately weathered, weak to very weak along fracture zones with irregular, subvertical anastomosing calcite veins and small, angular clasts					[10]	
66					4		3	△ △						
2292	67				NA			△ △ Extremely weak, completely weathered/alterd to a CLAYEY SAND					0909 0919	
68					2	47	1	△ △ Becomes highly fractured with clasts up to 2.5 inches					[9]	
2290	69	13		94	NA		1	△ △ 1: 30, J, VN, No, No, Pl, R 2: 80-90, J, N, No, No, Pl, SR with very weak, friable zone along fracture					0932 0955	
70					2		1	△ △ Becomes slightly fractured, strong						
2288	71	14		100	0	74		△ △ 1: 80-90, J, N, No, No, Pl, SR-R					[10]	
72					0			△ △					1013 1032	Very strong, dark gray basalt with calcite
2286	73				2		1	△ △						
74					2		2	△ △ Very strong, dark gray porphyritic basalt						
2284	75	15		100	0	88	m	△ △					[9]	1: 45, J, VN, No, No, Pl, R (possibly mechanical) 2: 10, J, VN, No, No, Ir, SR-R
76					0		m	△ △						
2282	77				0		m	△ △					1107	

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-207

Sheet 6 of 6

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
77			5		0			△ △ VOLCANIC BRECCIA; very dark greenish grey (5BG 3/1) to △ △ greenish grey (5G 6/1) and dark grey; slightly weathered; △ △ strong; slightly fractured; fine grained matrix with angular to △ △ subangular clasts of porphyritic basalt up to 1 inch △ △ --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, △ △ undifferentiated)-- (continued)					1128	
78					0		1	△ △						
2280	79	16		100		85	m	△ △ 1: 75-90. V, MW, H+Ca, Fi, Ir-St, ? △ △ 2: 40, J, VN, No, No, Pl, SR-R (possibly mechanical)					[14]	
80					2		2	△ △ } Very strong, dark grey porphyritic basalt						
2278	81				0		2	△ △					1146	
								TOTAL DEPTH = 81.1 FEET						
82														
2276	83													
84														
2274	85													
86														
2272	87													
88														
2270	89													
90														
2268	91													
92														
2266	93													

Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-207

Date(s) Drilled	9/18/2018-9/21/2018	Logged By	B. Kozlowicz/T. Vande Voorde	Checked By	B. Kozlowicz
Drilling Method	Hollow Stem Auger, HQ-3 Rock Core	Drill Bit Size/Type	6-inch flight auger, 4-inch diamond core bit, 4-inch drag bit	Total Depth of Borehole	80.0 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2338 feet
Groundwater Level	14.1 feet bgs 9/19/2018	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir; Dagget Road	Coordinate Location	N 2601173 E 6460942

[illegible]

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-208

Sheet 2 of 6

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
13									SANDY LEAN CLAY (CL); very stiff; 70% medium plasticity FINES; 30% fine to medium grained SAND; trace small GRAVEL; moist --ALLUVIUM--(continued)						
2324	14														
	15											6			
	16								SANDY LEAN CLAY with GRAVEL (CL); medium still; with rounded to subangular GRAVEL; wet	S-02	6	33			
2322	17											8			Rig chatter
	18								GRAVEL and COBBLES with SANDY LEAN CLAY/CLAYEY SAND; washed, rounded COBBLES and BOULDERS (fragments) up to 6 inches --RIVER ALLUVIUM--						
2320	19														
	20		1				NR								
2318	21	1		100	NA	NA					S-03	50/5"	71		Switch to HQ coring with 4-inch #2 diamond bit at 2.0ft. Advance 4.5-inch casing to 19.0ft; End of Day 9/18/2018
	22				NA									1143	
2316	23				NA		NR								Begin Day 9/19/2018; T. VandeVoorde logging; 0% fluid return
	24	2		32	NA	NA								[18]	
2314	25				NA				With washed, subrounded to rounded GRAVEL; some angular to coarse grained SAND; COBBLES are vesicular up to 6-inches						Advance 4.5-inch casing to 24ft.
	26				NA										
2312	27	3		100	NA	NA								1200 1302	
	28				NA									[26]	
2310	29	4		15	NA	NA	NR							1306 1311	

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-208

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-208

Sheet 3 of 6

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
29		4	1	15	NA	NA	NR	GRAVEL and COBBLES with SANDY LEAN CLAY/CLAYEY SAND; washed, rounded vesicular COBBLES and BOULDERS (fragments) up to 6 inches; washed, subrounded to rounded GRAVEL; some angular to coarse grained SAND --RIVER ALLUVIUM--(continued)					[66]	Advance 4.5-inch casing to 29ft.
2308	30				NA			At 30ft: With vesicular, basaltic GRAVEL and COBBLES up to 3 inches					1314 1316	Angular coarse grained SAND recovered from cuttings possibly from no recovery zones Cuttings bagged for review
2306	31				NA									
	32				NA									Driller notes sandy loose drilling conditions
	33				NA									
2304	34	5		14	NA	NA	NR	COBBLES become angular to rounded					[100]	Initially no recovery for Run 5; run recored and bagged for review
	35				NA									
2302	36				NA			Coarse black and light brown SAND in cuttings					1319 1535	
	37				NA									
2300	38				NA									Cuttings bagged for review
	39	6		0	NA	NA	NR						[33]	
	40				NA									Driller notes change in cuttings with increased brown fine grained SAND or FINES; change in color of drilling fluid from grey to brown
2298	41				NA								1544 1615	
	42				NA		NR							
	43				NA									
2294	44	7		34	NA	NA		With rounded, basaltic COBBLES; angular, vesicular basaltic GRAVEL; some medium to coarse grained SAND					[27]	
	45				NA									

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-208

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-208

Sheet 4 of 6

Report: GEO_CORE-SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-208

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
45		7	1	34	NA	NA			GRAVEL and COBBLES with SAND; rounded, basaltic COBBLES; angular, vesicular basaltic GRAVEL; some medium to coarse grained SAND; 45-46 ft. fine-grained, basaltic BOUDLER with 1-2 mm feldspar phenocrysts --RIVER ALLUVIUM--(continued)						Continued 20-30% fluid return
2292	46				NA									1626 1704	
	47				NA		NR								
2290	48				NA										
	49	8		56	NA	NA			With more rounded COBBLES and BOULDERS; variable volcanic lithologies of basaltic, andesite, and tuff					[13]	Drilling fluid becomes dark brown
2288	50				NA										
	51				NA									1727 1737 [6] 1744 1748	
2286	52	9		0	NA	NA	NR								
	53				NA		NR								
2284	54	10		84	NA	0		mm	VOLCANIC BRECCIA; dark, dusky purple and bluish grey; moderately weathered; extremely weak; fine grained matrix with strong clasts --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--					[12]	Advance 4.5-inch casing to 54ft.
	55				NA			mm						1803 0931	End of day 9/19/2018 Begin day 9/20/2018
2282	56	11		17	NA	0	NR		Strong, volcanic breccia clast in shoe					[7] 0941 0949	
	57		2		NA										
	58	12		0	NA	0	NR								
2280	59				NA				Becomes very dusky red (2.5YR 2.5/2) to dark reddish brown (2.5YR 2.5/4); moderately to highly weathered, very weak breccia clasts in a friable, completely weathered, extremely weak matrix; locally recovered as CLAYEY SAND with GRAVEL					1006 1008 [3] 1021	
	60	13		50	NA	0	NR					31 50/3"	44		Switch to new #2 diamond bit at 59ft.
2278	61	14		73	NA	0	NR	mm				100 1128		[7]	
	61				NA			mm						1141	

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-208

Sheet 5 of 6

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 B-208

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS	
		Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]
	61		2		0			△ △	VOLCANIC BRECCIA; dark brown to dusky purple; moderately to highly weathered; extremely weak; fine grained, sandy matrix with basaltic breccia clasts					1152	Continued 20-30% fluid return; hard drilling (1500psi down pressure)
2276	62				0		m	△ △	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
					0		m	△ △							
	63	15		100	0		m	△ △						[15]	
					0		m	△ △							
2274	64				0		m	△ △							
					0		m	△ △							
	65						m	△ △						1208	
		16		100	0	0	m	△ △	With breccia clasts up to 1/2 inch; locally very weak					1236	Switch to 4-inch drag bit at 65ft.
2272	66						m	△ △						[20]	
							m	△ △						1239	
					0			△ △						1225	
					0			△ △	Be becomes moderately weathered; moderately strong; locally extremely weak; moderately fractured						
					0			△ △							
2270	68	17		90	1	0	1	△ △	Medium to coarse grained VOLCANIC SANDSTONE; brownish purple to greenish grey (10GY 5/1)					[8]	Drilling fluid becomes light grey
								△ △							
	69				0		2 m	△ △							Drilling fluid becomes brown/purple
							m?	△ △							
2268	70				0		3	△ △	1: 60, J, W, Sd, Sp, Pl, SR 2: 80-90, V, N-MW, H+Ca, Fi, Pl 3: 30, V, N, H+Ca, Fi, Pl						
					0		2	△ △	Greenish grey to dark greenish grey						
	71						1	△ △							1302
					0		2	△ △						1311	
2266	72						3 m	△ △	1: 65-90, V, MW-W, Ca, Fi, Pl, S-SR 2: 0, V, MW, Ca, Fi, Pl, SR 3: 70, V, N, Ca, Fi, Pl, ? 4: 80-90, V, N, Ca, Fi, Wa, ? 5: 50, J, VN, H+Ca, Fi, Pl 6: 60-65, V, VN, Ca, Fi, Pl						
		3			0		3	△ △							
	73						4	△ △							
		18		100	2	0	5	△ △						[38]	
2264	74				0		5	△ △	With increasing number of breccia clasts						
					0		6	△ △							
	75							△ △	Greenish grey						
					0		m	△ △							
2262	76						m	△ △	Be becomes highly to intensely fractured; matrix becomes clayey					1319	
		19		86	>6	20	m	△ △						1325	
							1,1	△ △	1: 0-20, J, VN-W, No, No, Pl-Ir, SR 2: 60, V, VN, Ca, Fi, Pl, ?						
	77						2	△ △							

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring B-208

Sheet 6 of 6

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
77		19	3	86	3	20	3	△ △	VOLCANIC BRECCIA; dark reddish grey (10YR 3/1); moderately weathered; extremely weak; highly fractured --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)					[29]	
2260	78				0		4	△ △	3: 65, J, VN, No, No, SR, PI 4: 10, J, W, No, No, Ir, SR						
	79						NR	△ △	↓ Becomes <10% clasts; 90% clayey matrix					1331	
		20	38	NA	0		NR	△ △						1420	
								△ △						[22]	
2258	80							△ △	TOTAL DEPTH = 80.0 FEET					1423	
	81														
2256	82														
	83														
2254	84														
	85														
2252	86														
	87														
2250	88														
	89														
2248	90														
	91														
2246	92														
	93														

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-01

Sheet 1 of 2

Date(s) Drilled	2/5/2018 - 2/6/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	30.4 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2597 feet
Groundwater Level(s)	12.3 feet above ground surface (2/5 at 15:15)	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2608898 E 6476516

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
2595	0	S01	1 1 0	100		SILT with SAND and GRAVEL (ML); very soft; very dark gray to black (2.5Y 3/1 to 2.5/1); fine to coarse grained SAND; subangular to rounded GRAVEL; sand and gravel consist of diatomite clasts --RECENT LAKE SEDIMENT--				Sampler fell 18 inches on last blow Advance 6-inch casing to 6 feet with hammer (hard/stiff at about 3.5 feet)
2590	5	S02	4 3 4	100		Becomes soft; dark olive brown (2.5Y 3/3) to very dark grayish brown (2.5Y 3/2) with trace gravel	43	8		Advance 6-inch casing to 8 feet with hammer LL=33; PL=25
2585	10	S03	7 6 6	80		DIATOMITE; light olive brown (2.5Y 5/4); highly weathered; extremely weak; highly fractured; friable --LACUSTRINE DIATOMACEOUS TERRACE (QI)--	99			End of day 16:45, Begin day 08:30 Advance 6-inch casing to 11 feet with hammer
2580	15									
2575	20	S04	3 2 5	93		Becomes soft with iron staining on irregular subvertical fractures	93	34	99	LL=85; PL=51 SA: G=0%; S=1%; F=99%
2570	25									
30	30	S05	31 50/6"	60		BASALT; black (10Y 2.5/1); highly to completely weathered; friable --TERTIARY to QUATERNARY INTRUSIVE BASALT--				Cuttings become dark greenish gray sandy clay; slower drilling

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-01

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring BC-01

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30		II	S06	50/5"	100	x x x				
		TOTAL DEPTH = 30.4 FEET								
2565										
35										
2560										
40										
2555										
45										
2550										
50										
2545										
55										
2540										
60										
2535										
65										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-02

Sheet 1 of 2

Date(s) Drilled	2/5/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	64.6 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2600 feet
Groundwater Level(s)	9.4 feet above ground surface (2/5 at 9:00)	Sampling Method(s)	2.5-inch ID ModCal, SPT, 3-inch Shelby Tube	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2608331 E 6476958

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)						
0							SANDY LEAN CLAY (CL); very soft; very dark gray (2.5Y 3/1) to black (2.5Y 2.5/1); trace fine rounded gravel --RECENT LAKE SEDIMENT--			28	Drove sampler for extra 6 inches (last three blowcounts reported) SA: G=52%; S=20%; F=28% Advance 6-inch casing to 3.8 feet with hammer
2595	5		S01	2 10 12	85		CLAYEY GRAVEL with SAND (GC); stiff/medium dense; very dark grayish brown (10YR 3/2); subangular to rounded fine to coarse gravel up to 2 inches in diameter; fine to coarse sand --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				
							Black angular basalt cobble				
			S02	5 5 10	13						
			S03	18 10 10	60		DIATOMITE; olive to olive yellow (5Y 4/3 to 2.5Y 6/6); moderately to highly weathered; extremely weak; highly fractured; with sub-horizontal bedding and irregular sub-vertical fractures; friable --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				Drove sampler for extra 6 inches (last three blowcounts reported) Advance 6-inch casing to 8.8 feet with hammer
2590	10		S04	11 9 9	53		Becomes light yellowish brown (2.5Y 6/4); extremely weak/clayey; moderately fractured				
2585	15		S05	4 4 6	80			84	46	99	LL=105; PL=59 SA: S=1%; F=99%
2580	20		S06	200 psi	100		DIATOMITE with ELASTIC SILT; greenish gray (10Y 5/1); soft to extremely weak; highly fractured; friable --LACUSTRINE DIATOMACEOUS TERRACE (QI)--	148			TX-ICU About 50% WCR
2575	25		S07	3 2 3	93						S-07: Two liners retained (25-25.5ft., 25.5-26ft.) About 25% to 50% WCR
2570	30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-02

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring BC-02

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30						DIATOMITE; olive to olive yellow (5Y 4/3 to 2.5Y 6/6); moderately to highly weathered; extremely weak; highly fractured; with sub-horizontal bedding and irregular sub-vertical fractures; friable --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				
2565	35		S08	200 to 500 psi	84		149			TX-ICU
2560	40									Cuttings become very dark gray
2555	45		S09	3 3 4	100	▼ Increase in plasticity; soft; olive (5Y 5/3) and very dark gray to black (2.5Y 2.5/1 to 2.5Y 3/1) in ~2.5-inch beds; sub-horizontal bedding	178	102	100	LL=187; PL=85 SA: S=1%; F=99% S-09: Two liners retained (45-45.5ft., 45.5-46ft)
2550	50									
2545	55		S10	2 3 5	100		171			S-10: Two liners retained (55-55.5ft., 55.-56 ft.)
2540	60									
2535	65		S11	50/3"	100	BASALT; black (10Y 2.5/1); slightly weathered; strong; recovered as angular gravel up to 1-inch in diameter --TERTIARY to QUATERNARY INTRUSIVE BASALT--				Harder drilling, small black basalt chips in cuttings
TOTAL DEPTH = 64.6 FEET										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-02

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-03

Sheet 1 of 3

Date(s) Drilled	2/6/2018 - 2/7/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	96.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2584 feet
Groundwater Level(s)	24.3 feet above ground surface (2/6 at 12:00)	Sampling Method(s)	2.5-inch ID ModCal, SPT, 3-inch Shelby Tube, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2606643 E 6474657

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)						
0							ORGANIC SILT WITH SAND (OL); very soft; very dark grayish brown (2.5Y 3/2) --RECENT LAKE SEDIMENT--	35	NP	67	Sampler settled to 1-foot; drove sampler for extra 6 inches (last three blowcounts reported) LL=48; PL=25 SA: G=3%; S=30%; F=67% Advanced 6-inch casing to 4 feet (stiff from 3 feet)
		S01	1 2 3		2		SANDY LEAN CLAY (CL); soft; black (5Y 2.5/2); fine grained sand; trace rounded gravel; small angular rock fragments; and fine rootlets --COLLUVIUM/RESIDUAL SOIL--				
2580	5	S02	4 3 2		0.6		Without gravel	25			
							POORLY GRADED GRAVEL with CLAY (GP-GC); subrounded gravel up to 2.5-inch in diameter of varied volcanic lithology and clayey infill --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				Hard chattering drilling Switch to rock core bit with SPT sampler
2575	10	R1									
		S03	6 3 2		0.1		DIATOMITE; light olive brown (2.5Y 5/3); very soft; locally clayey with vossicular basalt GRAVEL; bedding/fractures not present --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				Faster drilling from 10.5 to 11.5 feet
2570	15	R2									Return fluid becomes olive Advanced 6-inch casing to 14 feet with hammer
		S04	6 4 5		1.0		Becomes olive brown to dark greyish brown (2.5Y 4/3 to 4/2), extremely weak, massive				Switch back to tricone bit
2565	20										
							DIATOMITE with ELASTIC SILT; dark grayish brown (2.5Y 4/2); massive/soft to very soft --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				
2560	25	S05	3 3 4		1.3			80	NP	100	LL=69; PL=59 SA: F=100%
2555	30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-03

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-03

Sheet 2 of 3

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)						
30							DIATOMITE with ELASTIC SILT; dark grayish brown (2.5Y 4/2); massive/soft to very soft --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				
2550	35										
2545	40	S06		200 to 400 psi	2.5			85 90			TX-ICU TX-ICU
2540	45										Cutting very dark greenish gray
2535	50										
2530	55										
2525	60										
2520	65										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-03

Sheet 3 of 3

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
65			S07	5 5 7	1.5	DIATOMITE with ELASTIC SILT; dark greenish gray (10Y 4/1); massive/soft to very soft; 1 to 2-inch beds/lenses of very dark gray to black clay --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				End of day 2/6/2018 Begin day 2/7/2018 Cuttings greenish black
2515	70									
2510	75									
2505	80		S08	100 psi	0					
2500	85		S09		0.25	With trace rounded GRAVEL (possibly slough)				
2495	90		S10		1.0		120			TX-ICU
2490	95		S11	4 5 5	0.2					Driller out of rods
TOTAL DEPTH = 96.5 FEET										
2485	100									

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-03

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-04

Sheet 1 of 3

Date(s) Drilled	2/1/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	73.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2597 feet
Groundwater Level(s)	11.8 feet above ground surface (2/1)	Sampling Method(s)	2.5-inch ID ModCal, SPT, 3-inch Shelby Tube	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2604812 E 6472949

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0										
2595		S01	101		57	SILTY SAND (SM); very loose; very dark brown (10YR 2/2); trace subangular diatomite GRAVEL up to 0.75 inches in diameter --RECENT LAKE SEDIMENT-- Becomes organic rich and softer/looser with increased nonplastic fines			44	6-inch casing settles to 1.5 feet SA: G=5%; S=51%; F=44% Sampler advanced 1 foot on first blow and 2.5 feet on second blow
2590		S02	233		100	CLAYEY SAND (SC); very loose; very dark brown (10YR 2/2); trace fine GRAVEL and coarse organics --RECENT LAKE SEDIMENT--			58	Advance 6-inch casing to 5.5 feet with hammer SA: G=3%; S=39%; F=58% Drove sampler for extra 6 inches (last three blowcounts reported)
2585		S03	41118		87	WEAKLY CEMENTED DIATOMITE GRAVEL; medium dense; light olive brown (2.5Y 5/4); angular diatomite GRAVEL; weakly cemented and friable with sub-horizontal bedding and sub-vertical fractures --LACUSTRINE DIATOMACEOUS TERRACE (QI)--	61		41	Advance 6-inch casing to 11 feet (resistance at 11 feet) Advance 6-inch casing to 12.5 feet with hammer SA: G=9%; S=50%; F=41% TX-ICU
		S04		400 psi	100		54			
2580		S05		400 psi	100			105		100 percent WCR TX-ICU
2575		S06		200 to 400 psi	100	DIATOMITE with ELASTIC SILT; soft to completely weathered; light greenish gray (5GY 7/1) --LACUSTRINE DIATOMACEOUS TERRACE (QI)--		155		TX-ICU
2570		S07	235		90	Becomes mottled with very pale brown (10YR 8/3) and light greenish gray (5GY 7/1) with 10 degree bedding				Lost circulation to 27.5 feet Drove sampler for extra 6 inches (last three blowcounts reported) About 50% WCR
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-04

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-04

Sheet 2 of 3

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30										
2565						DIATOMITE with ELASTIC SILT; soft to completely weathered; light greenish gray (10YR 8/3) mottled with very pale brown (10YR 8/3) and light greenish gray (5GY 7/1) with 10 degree bedding --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				
		S08		200 to 500 psi	60		117	35	99	LL=120; PL=85 SA: S=1%; F=99% Consol TX-ICU
35										LL = 60 PL = 24 PI = 36
2560										1% Sand 99% Fines About 75% WCR
						↓ Becomes completely weathered to a FAT CLAY; with 0.25-inch very dark gray (5Y 3/1) 10-degree beds (varves?)				
40										
2555										
		S09		1 1 1	100	↓ With vertical dark grey stained (Mn?) fractures				About 50% to 75% WCR
45										
2550										
50										
2545										
		S10		200 to 400 psi	100		154			TX-UU
55										TX-ICU
2540										
60										
2535						DIATOMITE; highly to completely weathered; pale yellow to olive yellow (2.5Y 6/6 to 2.5Y 8/4) with orange oxidation stain/mottling; fine grained vitreous gypsum crystals along very dark gray (5Y 3/1) sub-vertical fractures --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				
		S11		2 2 2						Final hammer blow advanced sampler 2-inches
65										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-04

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring BC-04

Sheet 3 of 3

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
65										
2530						DIATOMITE; highly to completely weathered; pale yellow to olive yellow (2.5Y 6/6 to 2.5Y 8/4) with orange oxidation stain/mottling; fine grained vitreous gypsum crystals along very dark gray (5Y 3/1) sub-vertical fractures --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				
70										
2525						ANDESITE(?); dark grey and reddish brown; moderately to highly weathered; medium strong; fine to medium grained --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				Hard drilling, very dark gray to black volcanic fragments in cuttings
		S12		30 50/5"						
						TOTAL DEPTH = 73.5 FEET				
75										
2520										
80										
2515										
85										
2510										
90										
2505										
95										
2500										
100										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-05

Sheet 1 of 1

Date(s) Drilled	2/2/2018, 2/8/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	20.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2601 feet
Groundwater Level(s)	8.2 feet (2/2 at 11:00) and 6.6 (2/8 at 12:15) feet above ground surface	Sampling Method(s)	2.5-inch ID ModCal, SPT, 3-inch Shelby Tube	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2604139 E 6474515

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)						
2600	0	S01		0 0 0	35		SILTY SAND with GRAVEL (SM); very loose; very dark grayish brown (2.5Y 3/2); greenish gray clayey diatomite GRAVEL up to 1-inch in diameter; nonplastic FINES --RECENT LAKE SEDIMENT--				Sampler advanced 2 feet under hammer weight Advance 6-inch casing to 5 feet with hammer
2595	5	S02		4 10 20			Clayey gravel made up of mostly DIATOMITE clasts up to 0.75 inches in diameter LEAN CLAY (CL); very stiff; very dark gray to very dark greenish gray (10Y 3/1 to 2.5Y 3/1); low to medium plasticity FINES; trace highly to completely weathered GRAVEL of diatomite and organics --FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtg)--				Drove sampler for extra 6 inches (last three blowcounts reported) Advance 6-inch casing to 8.5 feet (refusal) End of day 2/2/18 at 9.0 ft. Begin day 2/8/18
2590	10	S03		2 1 1	100		DIATOMITE with ELASTIC SILT; extremely weak/very soft; greenish gray (5GY 6/1); 20-degree bedding and 90-degree fractures; with fine roots at 11ft. --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				
2585	15	S04		200 to 400 psi	100		Becomes medium stiff to stiff with olive yellow (2.5Y 6/6) with angular clasts; friable VOLCANIC SANDSTONE; yellowish brown (10YR 5/6); highly to completely weathered; very weak; locally clayey --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--	135 30			TX-ICU TX-ICU Harder drilling with yellowish to reddish brown rock chips in cuttings
2580	20	S05		32 50/5"			TOTAL DEPTH = 20.5 FEET				
2575	25										
	30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-05

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-06

Sheet 1 of 1

Date(s) Drilled	2/2/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	15.4 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2578 feet
Groundwater Level(s)	29.2 feet above ground surface (2/2 at 13:00)	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2605112 E 6476050

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						--RECENT LAKE SEDIMENT--				Advance 6-inch casing to 5ft. with hammer from 2 to 5ft.
2575						LEAN CLAY with SAND (CL); stiff; olive gray to dark olive gray (5Y 4/2 to 5Y 3/2); 20% fine grained SAND; 80% low to medium plasticity FINES; trace fine angular volcanic GRAVEL and wood debris/roots up to 1-inch --COLLUVIUM--				
2570						VOLCANIC SANDSTONE; dark greenish gray to black (5GY 4/1 to GLEY1 2.5/N); moderately to slightly weathered --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				Harder drilling with gravelly cuttings
10		S01		59 14	100					
10		S02		50/4"	100					Hard, slow drilling at 15ft.
2565										
15		S03		50/4"						
TOTAL DEPTH = 15.4 FEET										
2560										
20										
2555										
25										
2550										
30										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-06

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-07

Sheet 1 of 1

Date(s) Drilled	2/2/2018 - 2/3/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	15.9 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2581 feet
Groundwater Level(s)	26.2 feet above ground surface (2/2 at 15:30)	Sampling Method(s)	2.5-inch ID ModCal	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2605439 E 6477039

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
0						--RECENT LAKE SEDIMENTS--				
2580		S01	000	100		FAT CLAY with SAND (CH); medium stiff; very dark gray (10YR 3/1); fine to medium grained SAND; medium to high plasticity FINES; trace rootlets				Sampler advanced 2ft. with weight of hammer
		S02	578	67		--COLLUVIUM/RESIDUAL SOIL-- ← Wood/roots up to 1-inch in size	34	NP	65	Advance 6-inch casing to 2 ft. LL=60; PL=24 SA: G=15%; S=20%; F=65% End of day 2/2/2018 Begin day 2/3/2018 Advance 6-inch casing to 5 ft. with hammer
2575		S03	254	40		CLAYEY SAND (SC); loose; very dark grayish brown (10YR 3/2); medium to coarse grained SAND; medium plasticity FINES; trace fine GRAVEL with some diatomite clasts				Angular diatomite gravel and wood fibers in cutting to about 13 ft.
						--COLLUVIUM/RESIDUAL SOIL--				Advance 6-inch casing to 10 ft. with hammer
2570		S04	997	100		POORLY GRADED SAND with SILT and GRAVEL (SP-SM); loose to medium dense; coarse grained SAND; dark greenish gray (10Y 4/1) subrounded to rounded diatomite GRAVEL up to 1-inch in diameter in shoe			8	SA: G=27%; S=65%; F=8%
		S05	20	50/4"		With shell hash				Hole caving; advanced 6-inch casing to 14ft. with hammer
2565						VOLCANIC SANDSTONE; very weak; light olive brown to strong brown (2.5Y 5/4 to 7.5YR 5/8); highly to completely weathered; with irregular 5 to 10-degree bedding --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				
						TOTAL DEPTH = 15.9 FEET				
20										
2560										
25										
2555										
30										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-07

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-08

Sheet 1 of 1

Date(s) Drilled	2/3/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone, 2 7/8-inch drag bit	Total Depth of Borehole	11.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2586 feet
Groundwater Level(s)	22.2 feet above ground surface (2/3 at 14:00)	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2605190 E 6480346

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
2585	0									
						ORGANIC SILT to ORGANIC CLAY (OL/OH); very soft; dark olive gray (5Y 3/2) with coarse organic debris				Advance 6-inch casing to 3 feet with hammer
						FAT CLAY with SAND (CH); stiff; black (5Y 2.5/2); fine grained SAND; medium plasticity FINES; trace angular to subrounded GRAVEL up to 1.5 inches in diameter				
						--COLLUVIUM/RESIDUAL SOIL--				
		S01		4 8 11	87		31	NP		LL=56; PL=24
2580	5									
						WELL GRADED GRAVEL with SAND (GW); very dense; very dark grayish brown to black (10YR 3/2 to 10YR 2/1); broken rounded GRAVEL up to 1.5 inches in diameter; medium to coarse grained SAND; trace low plasticity FINES				Very hard drilling with volcanic rock chips in cuttings; switched to 2 7/8-inch drag bit
						--FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtz)--				Blow counts affected by large particles
		S02		22 29 37	47					
2575	10									
						TOTAL DEPTH = 11.5 FEET				
2570	15									
2565	20									
2560	25									
	30									

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-08a

Sheet 1 of 3

Date(s) Drilled	2/14/18	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	85.2 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2583 feet
Groundwater Level(s)	25.3 feet above ground surface (2/14 at 10:00)	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2605249 E 6480346

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% <#200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						ORGANIC SILT (OL); very soft; very dark brown (10YR 2/2) --RECENT LAKE SEDIMENT--				
2580										
5		S01		9 20 50/4"	67	CLAYEY SAND to SANDY LEAN CLAY (SC-CL); loose/medium dense; black (10YR 2/1); fine to medium grained SAND; medium plasticity FINES; trace fine rounded GRAVEL --COLLUVIUM/RESIDUAL SOIL--				Sampler sank to 4ft.; drove sampler for extra 18 inches (last three blowcounts reported, previous blows were 2-2-7)
2575		S02		50/8"	80	CLAYEY GRAVEL with SAND (GC); very dense; dark yellowish brown to very dark gray (10YR 4/6 to 10YR 3/1); subangular to rounded GRAVEL and COBBLES up to 3 inches in diameter in a SANDY LEAN CLAY to CLAYEY SAND matrix --FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtg)--				Hard chattering drilling from 7 to 11ft. Advance 6-inch casing to 8ft. with hammer
10										
2570						DIATOMITE; light yellowish brown (2.5Y 6/4); extremely weak; with irregular 45 to 90-degree fractures with some iron staining and 0 to 15-degree fractures --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				Fast smooth drilling with olive brown diatomite cuttings
15										
2565		S03		3 4 5	80					Advance 6-inch casing to 14ft. with hammer
20										
2560										
25										
2555										
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-08a

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-08a

Sheet 2 of 3

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30										
2550										
35		S04		2 4 4	0	DIATOMITE WITH ELASTIC SILT; olive gray (5Y 4/2) and greenish black (10Y 2.5/1); very soft/extremely weak; 0.25 to 0.5-inch alternating beds --LACUSTRINE DIATOMACEOUS TERRACE (QI)--				Cuttings become greenish gray
2545										
40										
2540										
45										
2535										Cuttings become olive gray and greenish gray
50										
2530		S05		2 2 3	100		179	112	99	LL=200; PL=88 SA: S=1%; F=99%
55										
2525										
60										
2520										
65										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-08a

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-08a

Sheet 3 of 3

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
65						DIATOMITE WITH ELASTIC SILT; olive gray (5Y 4/2) and greenish black (10Y 2.5/1); very soft/extremely weak; 0.25 to 0.5-inch alternating beds --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				
2515										
70										
2510										
75		S06		1 2 4		With 0.1-0.2-inch irregular subhorizontal bedding With 0.5-inch dark reddish brown (5YR 2.5/2) CLAY bed at 20°				
2505										
80										
2500										Harder drilling
85		S07		50/3"	50	BASALT; black (10Y 2.5/1); slightly weathered; strong; recovered as angular gravel up to 1-inch in diameter --TERTIARY to QUATERNARY INTRUSIVE BASALT-- TOTAL DEPTH = 85.2 FEET				Tricone refusal
2495										
90										
2490										
95										
2485										
100										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-08a

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-09

Sheet 1 of 3

Date(s) Drilled	2/13/2018	Logged By	B. Kozlowski	Checked By	D. Simpson
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	4-inch Tricone, 4-inch diamond #2 bit	Total Depth of Borehole	70.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2602 feet
Groundwater Level(s)	5.8 feet above ground surface (2/13 at 9:00)	Sampling Method(s)	2.5-inch ID ModCal, SPT, 3-inch Shelby Tube, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2602526 E 6483561

Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)						
0							--RECENT LAKE SEDIMENT--				Sampler advanced 2 feet under weight of hammer
2600			S01	0 0 0	50		FAT CLAY with SAND (CH); medium stiff; brown (10YR 4/3) --ALLUVIUM/RESIDUAL SOIL--				
			R01		70		CLAYEY GRAVEL (GC); dark gray (10YR 4/1) and yellowish brown (10YR 5/6); cored and wash subrounded to rounded basalt GRAVEL and COBBLES; some CLAYEY SAND matrix observed --FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtg)--				
			R02		0						Set casing to 2 feet; hard driving at 2 feet (casing bouncing); switched to core bit
5			S02	4 2 7	67		DIATOMITE with ELASTIC SILT; medium stiff/weak; dark yellowish brown (10YR 4/4); trace fine grained SAND --LACUSTRINE DIATOMACEOUS DEPOSIT (Ql)--				
2595			S03	9 9 7	67						
10											Advance 6-inch casing to 4.5 feet
2590							↓ Becomes greenish gray (10Y 5/1); extremely weak/soft				
			S04	3 3 4	80						
15											TX-UU LL=74; PL=53 SA: F=100% TX-ICU
2585											
20											
2580											
			S05	200 psi	74			80	21	100	
25											
2575											
30											

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-09

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-09

Sheet 2 of 3

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30						DIATOMITE with ELASTIC SILT; extremely weak/soft; greenish gray (10Y 5/1); trace fine grained SAND --LACUSTRINE DIATOMACEOUS DEPOSIT (QI)--(continued)				
2570										
			S06	3 3 4	0					
35										
2565										
			S07	3 3 5	90					
40										Sampler advanced an additional 6 inches by pushing
2560										
45										
2555										
50										
2550										
55			S08	200 psi	0					
2545										
60										
2540										
65										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-09

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-09

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-10

Sheet 1 of 2

Date(s) Drilled	2/7/2018 - 2/8/2018	Logged By	B. Kozlowicz	Checked By	D. Simpson
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	43.0 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2579 feet
Groundwater Level(s)	29.3 feet above ground surface (2/7 at 14:40)	Sampling Method(s)	2.5-inch ID ModCal, SPT, 3-inch Shelby Tube	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to 10 feet bgs	Borehole Location	Copco Reservoir	Coordinate Location	N 2604959 E 6472871

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						--RECENT LAKE SEDIMENT--				Set 6-inch casing to 4 feet (very soft to 2.5 feet)
2575						--COLLUVIUM/RESIDUAL SOIL/SLOPE WASH--				
5										
2570						WELL GRADED GRAVEL with SAND (GW); dense; dark brown (10YR 3/3); subangular to rounded GRAVEL up to 3 inches in diameter consisting of various volcanic lithologies --FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtg)--				Hard, chattering drilling
10		S01		25 26 19	100				1	SA: G=85%; S=15%; F=<1% Advance 6-inch casing to 9 feet with hammer Tricone bit refusal; rock core barrel used to advance
2565										
15		S02		10 5 5	27	DIATOMITE with ELASTIC SILT; olive (5Y 5/3); medium stiff/extremely weak; with trace oxidation --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--				Clayey diatomite curring; switched back to tricone bit Advance 6-inch casing to 14 feet with hammer
2560										
20										
2555										
25		S03		5 4 6	80	Becomes light olive brown (2.5Y 5/4) and olive brown (5Y 5/3) with 0.1 to 0.5 inch 10-degree bedding and some oxidation stains				
2550										
30										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-10

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-10

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
30										
						DIATOMITE with ELASTIC SILT; medium stiff/extremely weak; light olive brown (2.5Y 5/4) and olive brown (5Y 5/3); with 0.1 to 0.5 inch 10-degree bedding and some oxidation stains --LACUSTRINE DIATOMACEOUS TERRACE (QI)--(continued)				
2545										
	35									
2540										
	40	S05		200 to 400 psi	75	VOLCANIC CINDER; very dark brown (10YR 2/2); very weak/dense to very dense; medium to coarse grained weakly welded sand; friable with corestones and weakly expressed 10 to 15-degree bedding --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				Harder drilling
		S04		6 20 37	60	ANDESITE; reddish brown (5YR 5/3); strong brown (7.5YR 5/6); and dusky purple; highly to completely weathered; very weak; coarse grained --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				
2535										
	45					TOTAL DEPTH = 43.0 FEET				
2530										
	50									
2525										
	55									
2520										
	60									
2515										
	65									

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-10

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-11

Sheet 1 of 1

Date(s) Drilled	10/18/2018	Logged By	B. Kozlowski	Checked By	B. Aldridge
Drilling Method	Hollow Stem Auger/Direct Push	Drill Bit Size/Type	6-inch flight auger	Total Depth of Borehole	10.5 feet
Drill Rig Type	Truck Mounted Marl M2.5 DP	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2617 feet
Groundwater Level(s)	Not encountered	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Geoprobe Hydraulic Hammer
Borehole Backfill	Cement grout to ground surface	Borehole Location	Copco Road/Reservoir Rim	Coordinate Location	N 2606419 E 6479490

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						ROAD BASE				Start 10/18/2018 with hollow stem auger
2615						DIATOMITE; pale yellow (2.5Y 7/3); moderately weathered; with occasional subvertical fractures and trace small rootlets --QUATERNARY DIATOMITE (Qd)--				Rig chatter at 2ft.
		S01			57	POORLY GRADED GRAVEL? (GP); very dark grey; with slightly weathered basalt fragments --RESIDUAL SOIL/COLLUVIUM--				Auger refusal at 3.5ft; move 30ft. west of initial boring location and redrill
5		S02			100	VOLCANIC BEDROCK?; olive grey and reddish to yellowish brown; completely weathered; extremely weak; friable --COMPLETELY WEATHERED VOLCANIC BEDROCK--				
2610										
10		S03				Becomes yellowish red				
						TOTAL DEPTH = 10.5 FEET				
2605										
15										
2600										
20										
2595										
25										
2590										
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-11

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-12

Sheet 1 of 1

Date(s) Drilled	10/17/2018	Logged By	B. Kozlowski	Checked By	B. Aldridge
Drilling Method	Hollow Stem Auger/Direct Push	Drill Bit Size/Type	6-inch flight auger	Total Depth of Borehole	16.5 feet
Drill Rig Type	Truck Mounted Marl M2.5 DP	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2642 feet
Groundwater Level(s)	Not encountered	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Geoprobe Hydraulic Hammer
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Road/Reservoir Rim	Coordinate Location	N 2605101 E 6481855

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						SILTY to CLAYEY SAND with GRAVEL (SM-SC); medium dense; brown (10YR 5/5); with angular GRAVEL up to 3-inches --ROAD BASE--				Start 14:00 10/18/2018 with hollow stem auger
2640						SILTY SAND (SM); loose to medium dense; dark brown (10YR 3/3); with occasional small GRAVEL; dry --COLLUVIUM--				
5		X	S-01			CLAYEY SAND to SANDY LEAN CLAY (SC-CL); loose to medium dense; dark brown (10YR 3/3); with angular GRAVEL up to 2-inches; low plasticity FINES; moist				S-01 bagged Smooth drilling 0-4.7ft. Rig chatter 4.7-5.5ft. Smooth drilling 5.5-9ft.
2635										
10		■	S-02		100	POORLY GRADED SAND (SP); loose to medium dense; yellowish brown (10YR 5/4); with small, subangular diatomite GRAVEL; fine to medium grained SAND; dry --Fluvio-Lacustrine Terrace Deposit (Qt)--				S-03 Three liners retained (8.5-9, 9-9.5, 9.5-10ft.)
2630										
15		■	S-03		100	VOLCANIC BEDROCK; very dense; greyish brown (10YR 5/2) to olive brown (2.5Y 4/4); highly to completely weathered; very weak; friable; medium to coarse grained; possibly PORPHYRITIC ANDESITE --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				
2625						TOTAL DEPTH = 16.5 FEET				
20										
2620										
25										
2615										
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-12

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-13

Sheet 1 of 2

Date(s) Drilled	10/2/2018	Logged By	B. Kozlowski	Checked By	B. Aldridge
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6-inch flight auger	Total Depth of Borehole	42.0 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2673 feet
Groundwater Level(s)	Not encountered	Sampling Method(s)	3.0-inch Shelby Tube, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Road/Reservoir Rim	Coordinate Location	N 2604508 E 6475654

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
0						2-inches ASPHALT POORLY GRADED GRAVEL with SAND (GP); dense; brown (10YR 4/4); angular GRAVEL up to 3-inches; dry --ROAD BASE-- LEAN CLAY with SAND (CL); stiff; dark brown (10YR 3/3); low to medium plasticity FINES; fine to coarse grained SAND; trace small GRAVEL; with rootlets --RESIDUAL SOIL/ALLUVIUM--				Start 13:50 10/2/2018 with hand auger
2670						DIATOMACEOUS SAND (SP); loose to medium dense; yellowish brown (10YR 5/4); fine grained --QUATERNARY DIATOMITE--				Hollow stem auger 5 to 42ft.
		S-01		1600 psi	100	↓ Becomes medium dense to dense with some small, angular gravel				TX-UU
2665										
		S-02		1560 psi	95	DIATOMITE; pale yellow (2.5Y 7/3); moderately weathered; with occasional subvertical fractures and trace small rootlets	23			TX-ICU
2660						↓ Becomes pale yellow (2.5Y 7/3), slightly weathered, extremely weak, without fractures or roots				
		S-03		1500 psi	90		30			
2655										
		S-04		1400 psi	100	↓ With Fe + Mn stained vertical fracture surfaces	59			TX-UU
2650										
2645										Cuttings become moist
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-13

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring BC-13

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30			S-05	500 to 1100	100	DIATOMITE; pale yellow (2.5Y 7/3); dry; slightly weathered; extremely weak; massive; with trace orange mottling --QUATERNARY DIATOMITE--(continued)	72			TX-UU
2640										
35						LEAN CLAY with SAND (CL); stiff; dark yellowish brown (10YR 3/4); with trace rootlets --COLLUVIUM/RESIDUAL SOIL--				Logged from cuttings
2635										
40			S-06	500 to 1600	67		21			
2630			S-07	50/6"	100	CLAYEY SAND (SC); very dense/extremely weak; olive and dark yellowish brown to reddish brown; with weakly expressed 20° foliation/bedding --COMPLETELY WEATHERED VOLCANICLASTIC BEDROCK-- TOTAL DEPTH = 42.0 FEET				
45										
2625										
50										
2620										
55										
2615										
60										
2610										
65										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-14

Sheet 1 of 1

Date(s) Drilled	10/2/2018	Logged By	B. Kozlowski	Checked By	B. Aldridge
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6-inch flight auger	Total Depth of Borehole	15.4 feet
Drill Rig Type	Truck Mounted Mobile B-53	Drilling Contractor	Gregg Drilling	NAVD 88 Ground Surface Elevation	2663 feet
Groundwater Level(s)	Not encountered	Sampling Method(s)	3.0-inch Shelby Tube, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Road/Reservoir Rim	Coordinate Location	N 2603695 E 6474756

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						3-inches ASPHALT				Start 10:00 10/2/2018 with hand auger 0-5ft.
						POORLY GRADED GRAVEL with SAND (GP); medium dense; dark yellowish brown; with angular GRAVEL up to 3-inches; dry				
						--ROAD BASE--				
2660						DIATOMITE; very pale brown (10YR 7/4); moderately weathered; medium stiff/dense/very weak; dry; with irregular subvertical, Fe stained fractures				
						--QUATERNARY DIATOMITE--				
	5	X	S-01	1200 psi	80		23			Hollow stem auger 5 to 15.4ft. TX-ICU
		X	S-02	1500 psi	100					TX-UU
2655		X	S-03	1600 psi	100		45			TX-UU
	10	X	S-04		100		24			TX-ICU
2650										
	15	I	S-05	50/5	100	VOLCANIC BEDROCK; yellowish to reddish brown; highly to completely weathered; very dense/very weak				Drilling becomes hard
						--BEDROCK--				
						TOTAL DEPTH = 15.4 FEET				
2645	20									
2640	25									
2635										
30										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-14

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-16

Sheet 1 of 2

Date(s) Drilled	1/14/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	64.8 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2592 feet
Groundwater Level(s)	14 feet above ground surface (1/14/2019)	Sampling Method(s)	2.5-inch ID ModCal	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Lake	Coordinate Location	N 2604576 E 6472913

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	Type	Number	Sampling Resistance	Recovery (feet)						
0						SILTY CLAY (CL-ML); soft; wet; grayish brown; apparent mix of diatomite and topsoil/colluvium --SLUMPED BANK MATERIAL--				Boring logged from cuttings
2590										
5										
2585						DIATOMITE; greenish gray; soft				
10										
2580										
15										
2575										
20										
2570										
25										
2565										
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-16

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-16

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
30										
2560										
35										
2555										
40										
2550										
45										
2545										
50										
2540										
55										
2535										
60										
2530										
65		1		50/3"	100					
TOTAL DEPTH = 64.8 FEET										

VOLCANICLASTIC SANDSTONE; medium gray; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts

--continued--

Harder drilling
 Rig repair 1315-1335
 Bottom liner retained

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-17

Sheet 1 of 2

Date(s) Drilled	1/14/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	37.4 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2593 feet
Groundwater Level(s)	12.5 feet above ground surface (1/14/2019)	Sampling Method(s)	2.5-inch ID ModCal	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Lake	Coordinate Location	N 2603825 E 6474508

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	Type	Number	Sampling Resistance	Recovery (feet)						
0						SILTY CLAY (CL-ML); soft; wet; brown to grayish brown; apparent mix of diatomite and topsoil/colluvium --SLUMPED BANK MATERIAL--				Boring logged from cuttings
2590										
5						DIATOMITE; greenish gray; soft				
2585										
10										
2580										
15										
2575										
20										
2570										
25										
2565										
30										

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring BC-17

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
30						DIATOMITE; greenish gray; soft --continued--				
2560						VOLCANICLASTIC SANDSTONE; grayish brown; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts				
35										
		1	23 27	50/5"						
2555						TOTAL DEPTH = 37.4 FEET				Bottom liner retained
40										
2550										
45										
2545										
50										
2540										
55										
2535										
60										
2530										
65										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-18

Sheet 1 of 2

Date(s) Drilled	1/14/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	34.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2598 feet
Groundwater Level(s)	8 feet above ground surface (1/14/2019)	Sampling Method(s)	2.5-inch ID ModCal	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Lake	Coordinate Location	N 2604477 E 6475056

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	Type	Number	Sampling Resistance	Recovery (feet)						
0						SILTY CLAY (CL-ML); soft; wet; brown to grayish brown; apparent mix of diatomite and topsoil/colluvium; tree root fragments --SLUMPED BANK MATERIAL--				Boring logged from cuttings
2595										
5						DIATOMITE; greenish gray to yellowish brown; soft				
2590										
10										
2585										
15										
2580										
20										
2575										
25										
2570										
30										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-18

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
30						DIATOMITE; greenish gray to yellowish brown; soft --continued--				
2565		1		27 23 24		VOLCANICLASTIC SANDSTONE; grayish brown; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts				Bottom liner retained
35						TOTAL DEPTH = 34.5 FEET				
2560										
40										
2555										
45										
2550										
50										
2545										
55										
2540										
60										
2535										
65										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-18

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-19

Sheet 1 of 2

Date(s) Drilled	1/13/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	37.5 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2599 feet
Groundwater Level(s)	7 feet above ground surface (1/13/2019)	Sampling Method(s)	2.5-inch ID ModCal	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Lake	Coordinate Location	N 2604654 E 6475303

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
	Type	Number	Sampling Resistance	Recovery (feet)						
0						SILTY CLAY (CL-ML); soft; wet; brown to grayish brown; apparent mix of diatomite and topsoil/colluvium --SLUMPED BANK MATERIAL--				Boring logged from cuttings
2595										
5										
2590										
10						DIATOMITE; light gray; soft; occasional fine- to coarse-grained SAND				
2585										
15										
2580										
20										
2575										
25										
2570										
30										

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BC-19

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil Boring BC-19

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log				
30						DIATOMITE; light gray; soft; occasional fine- to coarse-grained SAND --continued--				
2565										
35										
		1	12 24 29			VOLCANICLASTIC SANDSTONE; light to medium gray; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts				Two bottom liners retained
						TOTAL DEPTH = 37.5 FEET				
2560										
40										
2555										
45										
2550										
50										
2545										
55										
2540										
60										
2535										
65										

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BC-20

Sheet 1 of 1

Date(s) Drilled	1/14/2019	Logged By	P. Respass	Checked By	S. Janowski
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	19.0 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2597 feet
Groundwater Level(s)	9 feet above ground surface (1/14/2019)	Sampling Method(s)	2.5-inch ID ModCal	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Bentonite cement grout to ground surface	Borehole Location	Copco Lake	Coordinate Location	N 2606433 E 6479381

Elevation feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
	Type	Number	Sampling Resistance	Recovery (feet)						
0						DIATOMITE; greenish gray to light yellowish brown; soft				Boring logged from cuttings
2595										
5										
2590										
10										
2585										
15										
2580										
20	1		50/0.5"	100		BASALT?; dark gray to black; hard; aphanitic				
2575						TOTAL DEPTH = 19.0 FEET				
25										Hard drilling
2570										
30										

Report: GEO_10B1_OAK; File: KLAMATH_MASTER.GPJ; 6/20/2019 BC-20

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring BI-01

Sheet 1 of 1

Date(s) Drilled	2/20/2018	Logged By	K. Zeiger	Checked By	B. Kozlowski
Drilling Method	Rotary Wash	Drill Bit Size/Type	4-inch Tricone	Total Depth of Borehole	22.2 feet
Drill Rig Type	Barge Mounted CME-45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2318 feet
Groundwater Level(s)	11.8 feet above ground surface (2/20/2018)	Sampling Method(s)	2.5-inch ID ModCal, SPT	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir	Coordinate Location	N 2600814 E 6450535

Elevation feet	Depth, feet	SAMPLES				MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (% < #200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)					
0						LEAN CLAY with ORGANICS (CL); very soft; wet; dark red brown (5YR 3/4); twigs and roots --RECENT LAKE SEDIMENT--				S-1 Sampler sank under weight of rods 12.5-14.5ft. and pushed 14.-17.5ft.
2315		S-1		0 0 0	40	LEAN CLAY (CL); stiff; dry; dark red brown (5YR 3/4); trace rootlets; CaCO3 ribbons; developed soil texture --COLLUVIUM/RESIDUAL SOIL--				
5										Advance 5-inch casing 7.5ft.
2310		S-2		4 7 8	100					
10		S-3		6 8 13	67					Begin rotary wash drilling
2305		S-4		50/4"	100	BASALT; dark red brown (5YR 2.5/2); fresh; strong --TERTIARY to QUATERNARY INTRUSIVE BASALT--				
15										Driller notes change at 11.5ft., Volcanics in cuttings Driller notes bedrock drilling conditions from 12ft.-17ft.
2300		S-5		50/3"	50	VOLCANIC BRECCIA; mottled dark gray (2.5Y 4/1) and light yellow brown (2.5Y 6/4); slightly weathered; moderately strong; coarse grained with quartz phenocrysts --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				
20										
2295		S-6		50/3"	100					
2290										
30										
						TOTAL DEPTH = 22.2 FEET				

Report: GEO_10B1_OAK; File: Klamath_MASTER.GPJ; 6/20/2019 BI-01

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring BI-02

Sheet 1 of 5

Date(s) Drilled	2/22/2018 - 2/23/2018	Logged By	K. Zeiger	Checked By	B. Kozlowski
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	4-inch solid stem auger, 3-7/8 inch tricone, 4-inch #2 diamond coring bit	Total Depth of Borehole	67.0 feet
Drill Rig Type	Truck Mounted CME 75	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2334 feet
Groundwater Level	4.8 feet below ground surface (2/22/2018)	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir; near Fall Creek Boat Ramp	Coordinate Location	N 2602024 E 6461383

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2334	0								SANDY FAT CLAY (CH); stiff; very dark brown (7.5YR 2.5/3); moist; high plasticity fines; 10 percent rounded gravel up to 1-inch in diameter --OLD ALLUVIUM- FLOOD PLAIN DEPOSIT--						4-inch solid stem auger
	1														
	2														
2332	3														
	4														
2330	5														
	6									S-1	8	87		14:30	LL=78; PL=28 SA: G=11%; S=21%; F=68%
2328	7								← 2-inch rounded clasts with trace decomposed rootlets		13				
	8														
2326	9														
	10								SANDY FAT CLAY (CH); stiff; dry; brown (7.5YR 4/3); high plasticity fines; fine grained sand; trace rounded gravel up to 0.25 inches in diameter; CaCO ₃ ribbons --OLDER ALLUVIUM/RESIDUAL SOIL--		5			14:40	LL=58; PL=28 SA: G=5%; S=33%; F=62%
2324	11									S-2	7	100			
	12										12				
2322	13														

Report: GEO_CORE+SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 BI-02

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring BI-02

Sheet 2 of 5

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
13									SANDY FAT CLAY (CH); stiff; dry; brown (7.5YR 4/3); low plasticity fines; fine grained sand; trace rounded gravel up to 0.25 inches in diameter; CaCO ₃ ribbons --OLDER ALLUVIUM/RESIDUAL SOIL-- (continued)						
2320	14														First water at 14.0 feet; after 20 minutes at 4.8 feet
	15								SANDY FAT CLAY (CH); medium stiff to stiff; brown (7.5YR 5/4); fine grain sand; high plasticity fines; trace rounded gravel up to 1-inch --OLDER ALLUVIUM/RESIDUAL SOIL--		6			15:00	LL=51; PL=27 SA: G=8%; S=40%; F=52% Advance 4-inch casing to 14 feet
2318	16										6	100			
	17	1										7			Switch to rotary wash
	18				NA			1	VOLCANIC BRECCIA; green gray (10Y 6/1); highly to completely weathered; extremely weak; intensely fractured with angular breccia clasts up to 1-inch; fine to medium grained matrix --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- 1: 60, J, N, No, No, Pl, SR 2: 10, J, MW, No, No, Wa, SR					1549	Refusal with tricone bit; switch to HQ rock core
2316	19				NA			2							
	20	1		17	NA	0	NR							[21]	Clayey volcanics cuttings
2314	21				NA										100% fluid return
	22				NA			1	↓ Becomes moderately to slightly weathered; weak to moderately strong; moderately fractured; rough; irregular fractures likely mechanical along weathered contacts of breccia clasts					1601 1610	
2312	23	2		100		48*		2	1: 10, J, T, No, No, Wa, SR 2: 20-80, J, N, No, No, Ir-St, R 3: 10, J, MW, No, No, Wa, SR 4: 20, J, N, No, No, Wa, SR					[22]	*Rock does not meet soundness criteria for RQD calculation
	24							3							
2310	25							4							
	26	3		100		100		1	1: 30, J, N, No, No, Wa, SR 2: 5, J, T, H+Uk, Pa, Wa, ?					[21]	
2308	27							m	← Run break					1618 1622	
	28	4		100		100		1							
2306	29							m						1629 1634	27.0-27.9ft.: Mohs Hardness = 3 UCS = 841 psi Bulk Density = 141.42pcf

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: Klamath_MASTER.GPJ: 6/20/2019 BI-02

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				FIELD NOTES AND TEST RESULTS		
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		Drill Time [Rate, ft/hr]	
29			1					Δ Δ	VOLCANIC BRECCIA; green gray (10Y 6/1); moderately to						Mechanically broken from placement in box	
		4		100	1	100		2	slightly weathered; weak to moderately strong; moderately							100% fluid return
									fractured with angular breccia clasts up to 1-inch; medium							
-2304	30				1			2	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)							
									2: 10-15, J, N, No, No, Wa-St, R							
	31				0											
	32				1			m 1						1644		
-2302														1647		
	33				2			1								
	34		2					2								
-2300									1: 10, J, N, No, No, Wa,SR							
		5		100	1	96		3	2: 40, J, N, No, No, St, SR							
									3: 30, J, T, H+Uk, No, No, Wa, ?							
									4: 10, J, N, No, No, Wa-St, SR							
	35				1			4								
	36				0											
-2298																
	37				1			1						1657		
														1701		
	38				1			1								
-2296																
	39				1	100		2								
		6							1: 10, J, N, No, No, Wa-St, R							
									2: 15, J, T, No, No, Wa, SR							
									3: 30, J, N, No, No, Wa-Pl, SR							
-2294	40				1			3								
	41				0											
	42				1			1						1712		
-2292														1206	End of day 2/22/2018 Begin day 2/23/2018	
	43				4			2	1: 10, J, N, No, No, Wa, SR							
									2: 10-30, J, T, No, No, Wa, SR							
	44							1								
-2290		7		100	1	96										
	45															

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring BI-02

Sheet 4 of 5

Report: GEO_CORE+SOIL_NO PACK_WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 BI-02

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
45							3	△ △ VOLCANIC BRECCIA; green gray (10Y 6/1); moderately to slightly weathered; weak to moderately strong; moderately fractured; angular breccia clasts up to 1-inch; fine to medium grained matrix						100% fluid return
46					1			△ △ --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- (continued)						
2288					1			△ △ 3: 10-30, J, MW, No, No, Wa-Ir, SR-R						
47			3				4	△ △ 4: 30, J, N, No, No, Wa-Pl, SR					1213	
					0			△ △ Becomes strong; slightly fractured					1216	Brazilian Tensile Strength Test
48					0			△ △						
2286					0			△ △						
49							1	△ △ 1: 20, J, MW, H+Ca, Fi, Wa, ?						
		8		100	1	100	2	△ △ 2: 15, J, N, No, No, Wa-St, R					[25]	48.9-50.3ft.: Mohs Hardness = 3 UCS = 1 736 psi Bulk Density=149.67pcf
50					0			△ △						Punch Penetration Index Test
2284					1			△ △						
51					1			△ △						Cerchar Abrasiveness Test
52					0		2	△ △					1228	
2282					0			△ △					1232	Brazilian Tensile Strength Test
53					0			△ △						
54					1	98		△ △						Mechanically broken from placement in box
2280		9		100			1	△ △ 1: 30, J, N, No, No, St, R					[23]	
55					0		m	△ △ 2: 20, J, N, No, No, Wa-St, SR						
56					1		m	△ △						55.4-56.3ft.: Mohs Hardness = 3 UCS = 2 288 psi Bulk Density=148.46pcf
2278					1		2	△ △						
57					1		1	△ △					1245	
					0			△ △					1250	Packer test #1 from 47.0 to 67.0
58					0			△ △						
2276					0			△ △						
59					1	96	2	△ △						
60		10		100				△ △ 1: 20, J, N, No, No, Wa, SR					[20]	
2274					0			△ △ 2: 10, J, N, No, No, Wa-St, R						100% fluid return
61								△ △						

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring BI-02

Sheet 5 of 5

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
61			4		1		3	△ △ VOLCANIC BRECCIA; green gray (10Y 6/1); moderately to slightly weathered; weak to strong; slightly fractured; angular breccia clasts up to 1-inch; fine to medium grained matrix -- TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
2272	62				0			3: 5, J, N, No, No, Wa, SR					1305 1311	Mechanically broken from placement in box
63					1		1							
64					1		2	1: 30, V, N-T, H+Ca, Fi, Wa, ? 2: 10, J, N, No, No, Wa-St, SR-R 3: 60, J/V, MW, Ca, Pa, Wa-Pl, SR 4: 60-70, J/V, N, H+Ca, Fi, Wa, ?					[19]	
2270	65	11	100	0	72									
66					1		3							
2268	66				3		4							
67							4						1327	
								TOTAL DEPTH = 67.0 FEET						
2266	68													
69														
2264	70													
71														
2262	72													
73														
2260	74													
75														
2258	76													
77														

Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 BI-02

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring BI-03

Sheet 1 of 3

Date(s) Drilled	2/21/2018	Logged By	K. Zeiger	Checked By	B. Kozlowski
Drilling Method	Rotary Wash, HQ-3 Rock Core	Drill Bit Size/Type	4-inch solid stem auger, 3-7/8 inch tricone, 4-inch #2 diamond coring bit	Total Depth of Borehole	35.1 feet
Drill Rig Type	Barge Mounted CME 45	Drilling Contractor	Taber Drilling	NAVD 88 Ground Surface Elevation	2306 feet
Groundwater Level	25.3 feet above ground surface (2/21)	Sampling Methods	2.5-inch ID ModCal, HQ Core Barrel	Hammer Data	Automatic hammer; 140 lbs, 30-inch drop
Borehole Backfill	Cement grout to ground surface	Borehole Location	Iron Gate Reservoir	Coordinate Location	N 2601812 E 6461399

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
0	0								POORLY GRADED GRAVEL with SILT and SAND (GP-GM); dark green gray (N 4/1); wet; loose; subangular to subrounded gravel up to 0.25-inch --RIVER ALLUVIUM--						Advance 5-inch casing to 3ft.
2304	1														
2302	2														
	3														
	4														
	5														
2300	6	1			>6		1		VOLCANIC BRECCIA; green gray (5G 6/1). highly weathered; weak to very weak; fine to medium grained matrix with angular to subrounded clasts up to 0.75 inches --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- Becomes moderately weathered; weak; intensely fractured to locally crushed; most rough; irregular fractures likely mechanical due to weathering on clasts/matrix boundaries	S-1	50/2.5"	12	47	10:10	LL=41; PL=26 SA: G=61%; S=30%; F=9% Advance 5-inch casing to 4ft.
	7				>6		2								
	8	1	89		>6	0	3								
2298	9				>6		4								
	10				NA		5								
2296	11				NA		6								
	12						7								
2294	13	2	100	5	14*		8								
							9								
							10								
							11								
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Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring BI-03

Sheet 2 of 3

Report: GEO_CORE-SOIL_NO PACK WITH LITH: File: KLAMATH_MASTER.GPJ: 6/20/2019 BI-03

Elevation, feet	Depth, feet	ROCK CORE					Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
2292	13	1			5		5	VOLCANIC BRECCIA; green gray (5G 6/1); moderately weathered; weak; intensely fractured to locally crushed; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches						
	14	2		100	5	14*	2	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
	15						1	5: 30, J, N, No, No, Wa-Pl, SR						
2290	16				3		1	↓ Becomes slightly fractured; moderately strong					1159 1215	LL=51; PL=27 SA: G=8%; S=40%; F=52% Packer test #1 from 15.1 to 35.1ft.
	17				0									
2288	18	3		100	1	100*	2	1: 35, J, N, No, No, St, R 2: 30, J, N, No, No, Wa, SR 3: 20, J, T, No, No, Wa, SR					[23]	17.4-18.4ft.: UCS = 221 psi *Rock does not meet soundness criteria for RQD calculation 17.4-18.4ft.: Mohs Hardness = 3 UCS = 221 psi Bulk Density=138.44pcf Brazilian Tensile Strength Test
	19				1		3							
2286	20				0									
	21	2			3		1	↓ Becomes highly fractured					1228 1239	
	22				2		2	1: 10, J, MW, No, No, Wa, SR 2: 25, J, T, No, No, Wa-St, SR-R 3: 10, J, MW, No, No, Wa, SR-R						
2284	23				1	86*	3	↓ Becomes moderately fractured						
	24	4		100	0									
2282	25				1		3							
	26				0									
2280	27				5		1	Moderately to highly weathered; weak to very weak; fractures 1; 2; 3 are likely mechanical						
	28	5		100	5	48*	2	1: 15, J, T, No, No, Wa, SR 2: 40, J, T, No, No, Wa-St, SR 3: 5-10, J, MW, No, No, Wa, SR 4: 80, J, N, No, No, Wa-Ir, SR 5: 30, J/V, T, Ca, Pa, Pl-Wa, SR					[15]	Clayey coating 26.5-27.2ft. is from when return hose got disconnected during run
	29				>6		6	Crushed zone 6: 65, J, MW, Sd, Pa, Wa, SR						

Project: Klamath River Renewal Project
 Project Location: Copco and Iron Gate Reservoirs
 Project Number: 60537920

Log of Soil and Core Boring BI-03

Sheet 3 of 3

Elevation, feet	Depth, feet	ROCK CORE						Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number			Type	Number	Blows / 6 in.	Recovery, %		
2276	29	5	2	100	0	48*		△ △	VOLCANIC BRECCIA; green gray (5G 6/1); moderately to highly weathered; weak to moderately strong; moderately fractured; fine to medium grained matrix with angular to subrounded clasts up to 0.75-inches						
	30							△ △	--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)					1321	
					2		1	△ △	At 30.1ft: Becomes intensely fractured, weak to moderately strong, locally very weak to weak					1327	
	31						1	△ △							
							2	△ △	1: 5, J, N, No, No, Pl-Wa, SR						
							2	△ △	2: 20, J, N-MW, No, No, Wa, SR						
2274					4		3	△ △	3: 35, J, N, Ca+Sd, Pa, Pl, S						
							3	△ △	4: 30, J, N, No, No, Pl, SR						
	32						1	△ △							
		6		100	0	54*		△ △						[15]	
	33							△ △							
								△ △							
2272					3		4	△ △							*Rock does not meet soundness criteria for RQD calculation
							4	△ △							
	34				4		5	△ △	Becomes highly weathered; weak; crushed along a fracture?						
							5	△ △	5: 65, J, MW-W, Fe+Sd, Su+Pa, Pl, SR-R with ~0.75-inch Fe stained highly weathered rind						
							6	△ △	6: 10-20, J, T, No, No, Wa-Pl, SR						
	35							△ △						1347	
									TOTAL DEPTH = 35.1 FEET						
2270															
	36														
	37														
2268															
	38														
	39														
2266															
	40														
	41														
2264															
	42														
	43														
2262															
	44														
	45														