UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Klamath River Renewal Corporation	**Project Nos. 14803-001;**
PacifiCorp	**2082-063**

AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

EXHIBIT R

100% Design Report

(Part 10 of 12)

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Klamath River Renewal Corporation **PacifiCorp**	**Project Nos. 14803-001; 2082-063**

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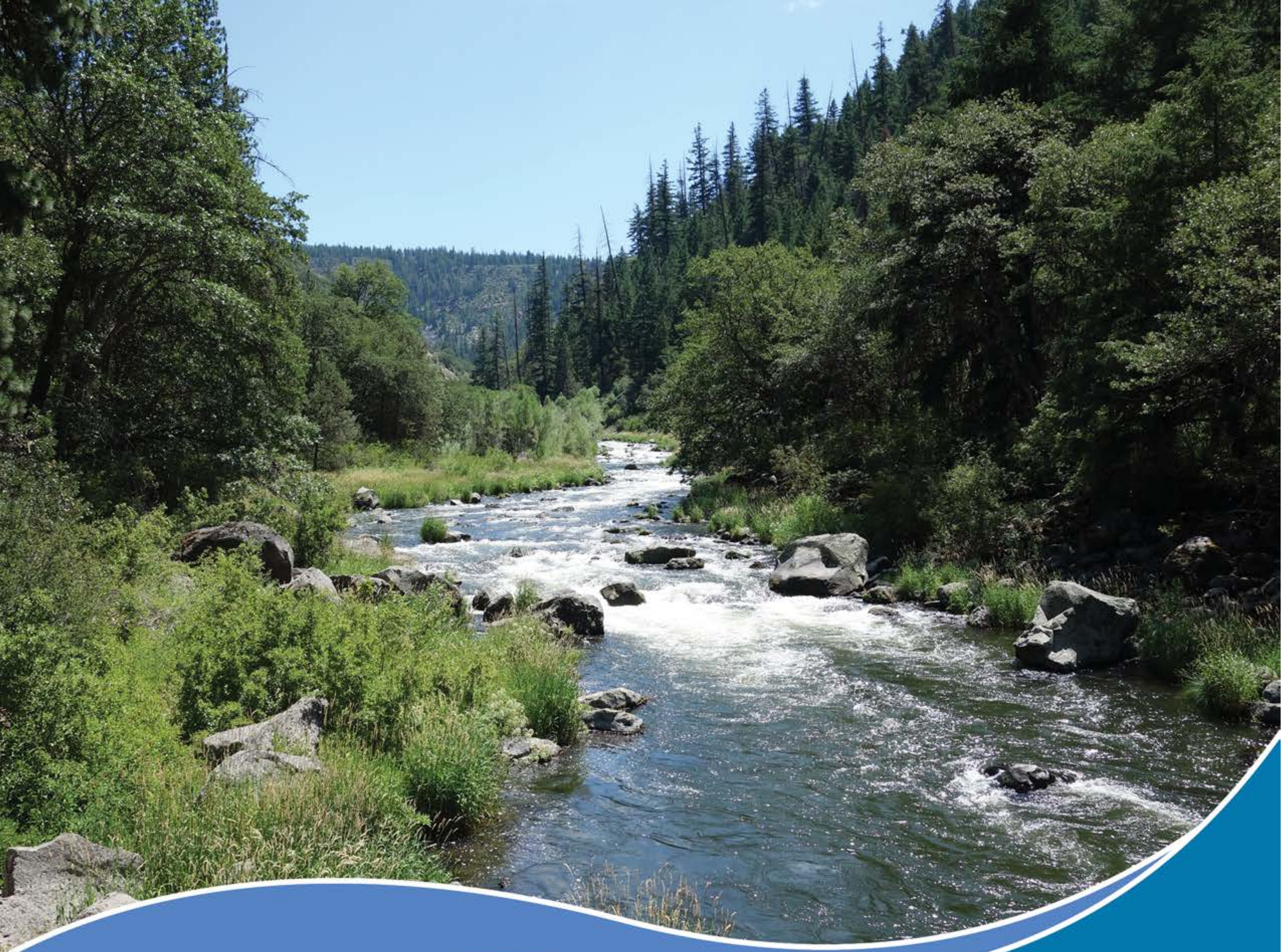
EXHIBIT R-5
Fall Creek Hatchery
(continued)

Fall Creek Hatchery 100% Design Specifications
(continued)

Attachment A
Klamath River Renewal Project – Geotechnical Data Report



Klamath River Renewal Project

Geotechnical Data Report

KLAMATH
RIVER RENEWAL
CORPORATION

June 2019

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Acronyms and Abbreviations

GDR	Geotechnical Data Report
psi	pound(s) per square inch
SPT	Standard Penetration Test
bgs	below ground surface
KRRP	Klamath River Renewal Project
ModCal	Modified California
HDD	horizontal directional drilling

Chapter 1: Introduction

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1. INTRODUCTION

1.1 Purpose and Scope

This Geotechnical Data Report (GDR) includes the results of the field investigation conducted from February 2018 through January 2019, and associated laboratory and geophysical testing.

1.2 Report Organization

After this introductory section, the GDR is organized as follows:

- Section 2: Describes the investigations at Copco and Iron Gate Reservoirs, at Jenny Creek, Camp Creek, Lakeview, Dry Creek, Fall Creek, and Scotch Creek Bridges, and along the proposed City of Yreka replacement water line. The investigations included soil and rock borings, piezometer construction, downhole geophysical testing, and field hydraulic conductivity testing.
- Section 3: Describes the laboratory testing.
- Section 4: Discusses the limitations of the work.

The data collected during the investigations is presented in Appendices A through E.

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Chapter 2: Field Investigations

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2. FIELD INVESTIGATIONS

2.1 Subsurface Investigations

AECOM performed geotechnical investigations for the Klamath River Renewal Project between February 2018 and January 2019. The geotechnical investigations are described below. The field investigations were conducted in general conformance with the following ASTM standards:

1. Rock core drilling, ASTM D2113
2. Soil logging, ASTM D2488
3. Standard penetration test (SPT) sampling, ASTM D1586
4. Thin-walled (Shelby) tube sampling, ASTM D1587
5. Preserving and transporting of soil samples, ASTM D4220

2.1.1 Soil and Rock Borings

Forty-eight soil and/or rock core borings were drilled between February 1, 2018 and January 23, 2019. Boring locations are shown on Figure 1 Sheets 1 through 8 and summarized in Table 1 – Borings Summary Table.

The borings were drilled by Taber Drilling of West Sacramento, California, Gregg Drilling of Martinez, California, and/or Pitcher Drilling of East Palo Alto, CA. The locations of the borings were surveyed with a hand-held GPS unit with an approximate accuracy of ±15 feet. The coordinate locations for the borings are shown on the boring logs in State Plane Zone 1 coordinates.

Drilling footage totaled 2163.4 linear feet at the Copco Reservoir, Iron Gate Reservoir, City of Yreka Water line, and bridge abutment borings. The borings ranged in depth from 10.5 to 120 feet below ground surface (bgs). All but two borings were drilled vertically; two borings (B-202 and B-206) were drilled at an angle of 60° below horizontal.

The 2.5-inch HQ-3 core, 1.375-inch I.D. Standard Penetration Test (SPT), 2.5-inch I.D. Modified California (ModCal), and 2.0-inch I.D. California drive samples were photographed, labeled, bagged, or boxed (for rock cores), and stored onsite prior to transport of the samples to Tonon USA in Austin, TX, Cooper Testing Laboratory in Palo Alto, CA, or Inspection Services Inc. of Berkeley, CA. Pitcher barrel, Osterberg, and Shelby Tube samples were sealed with paraffin and carefully transported to the laboratory for testing.

City of Yreka Water Line Borings

Nine borings (B-201 to B-203, B-205 through B-208, BI-02 and BI-03) totaling 696.2 linear feet were drilled along a proposed tunnel alignment to determine subsurface geologic conditions for the replacement of the existing City of Yreka waterline by Horizontal Directional Drilling (HDD) or micro tunnel drilling. These boring locations are shown on Figure 1, Sheet 4, and the boring logs are presented in Appendix A.

The borings were drilled from February 21st to 23rd, August 14th to September 21st, 2018, and January 8th to January 11th, 2019. The boring logs and core box photographs are presented in Appendix A and Appendix E, respectively. Borings were advanced using hollow stem auger, rotary wash, and/or rock core drilling methods, and sampling methods included HQ-3 core, SPT, and a ModCal drive sampler. Blows per each 6-inches of driven sample were recorded.

Three of the borings (B-201, B-202, and B-206) were drilled by Pitcher Drilling Company of East Palo Alto, CA with a track-mounted Fraste XL drill rig. Three additional borings (B-205, B-207, and B-208) were drilled by Gregg Drilling of Martinez, CA with a truck-mounted B-53 drill rig. Three borings (BI-02, BI-03, and B-203) were drilled by Taber Drilling of West Sacramento, CA with BI-02 being drilled using a truck-mounted CME-55 and BI-03 and B-203 being drilled using a barge-mounted CME-45 drill rig.

Copco No. 1 Rim Stability

A subsurface investigation with laboratory testing was performed at Copco No. 1 reservoir to characterize and analyze the stability of the fluvio-lacustrine terrace deposits (diatomite) present around the reservoir rim and within the reservoir bed. Twenty-one hollow stem auger and rotary wash borings, described below, were completed as part of the rim stability investigation. The boring locations are shown on Figure 1, Sheets 6 through 8, and boring logs are presented in Appendix A.

Eleven rotary wash borings, BC-01 through BC-10 and BC-8a, were performed by Taber Drilling using a barge-mounted CME 45 between February 1st and 14th, 2018. The boring depths ranged from 11.5 to 96.5 feet below ground surface.

On land, along the Copco Reservoir Rim, five borings (BC-11 through BC-15) were drilled by Gregg Drilling, between October 2nd and 18th, 2018,using a truck-mounted Mobile B-53 (BC-13 through BC-15) and a track-mounted Geoprobe (BC-11 and BC-12). The borings were advanced to bedrock (10.5 to 42 feet bgs). BC-15 encountered bedrock within 1 foot of the surface; where the boring was terminated, and no boring log or laboratory test data is included as part of this GDR.

Soil samples were obtained in BC-01 to BC-15 using SPT, ModCal, and 3-inch diameter thin-walled Shelby tubes. The tubes were advanced by direct push or with a hydraulically activated piston sampler (Osterberg). Blows per each 6-inches of driven sample and hydraulic gage down pressure for undisturbed samples were recorded.

Five additional over-water borings (BC-16 through BC-20) were completed between January 13th and 14th, 2019. BC-16 through BC-20 were drilled without sampling to bedrock, with the goal of identifying the top of bedrock. Bedrock was inferred when the driller noted significantly harder drilling conditions. Bedrock was sampled with an SPT sampler at the bottom of each exploration to confirm that bedrock was encountered.

Iron Gate Rim Stability

One boring, BI-01 shown on Figure 1, Sheet 3, was completed to characterize landslide history of a feature identified in aerial photograph at Iron Gate reservoir. Two other borings, BI-02 and BI-03 shown on Figure 1, Sheet 4, provided data for the rim stability analysis of Iron Gate, and are described in the City of Yreka Water Line section above.

The one rotary wash boring was drilled on February 20th, 2018 to 22.2 feet below ground surface with a barge-mounted CME-45 by Taber Drilling. The material was sampled with a ModCal or SPT; blows per 6-inches were recorded.

Bridge Abutment Borings

Seventeen borings were planned at the abutments of bridges requiring replacement or improvement during the Klamath River Renewal Project:

- Camp Creek Bridge (four borings, BC-01, BC-02, BC-03, and BC-20), See Figure 1, Sheet 2
- Jenny Creek Bridge (four borings, BC-04, BC-05, BC-06, and BC-07), See Figure 1, Sheet 3
- Lakeview Bridge (two borings, B-08 and B-10), See Figure 1, Sheet 1
- Fall Creek Bridge (two borings, B-13 and B-14), See Figure 1, Sheet 5
- Daggett Bridge (three borings, B-15, B-16, and B-17), See Figure 1, Sheet 4
- Scotch Creek Bridge (two borings, B-18 and B-19), See Figure 1, Sheet 2

The boring locations are shown on Figure 1, Sheets 1 through 5, and boring logs are presented in Appendix A.

Fourteen of the borings were drilled by Gregg Drilling between September 25 and October 18, 2018 with a truck-mounted Mobile B-53 drill rig to depths between 21.2 and 56.9 feet below ground surface. The borings were advanced with hollow stem auger, rotary wash, and/or HQ-3 rock coring. Soil was sampled with a ModCal or SPT; blows per 6 inches of driven sample were recorded.

Three additional borings, B-15 through B-17, were drilled by Taber Drilling with a barge-mounted CME-45 drill rig and a truck-mounted CME-75 between January 12th and 23rd, 2019. The depths of these borings ranged from 24.5 to 51.5 feet below grade. The borings were advanced using solid stem auger, rotary wash, and HQ-3 rock coring. Soil was sampled with a ModCal or SPT; blows per six inches of driven sample were recorded.

2.1.2 Piezometers

Two vibrating wire piezometers (VWP) were installed in each of the inclined borings B-202 and B-206, as shown in Table 1. In B-202, the VWPs were installed at 24.2 feet and at 62.4 bgs (28 and 72 lineal feet on boring trajectory). The VWPs were installed at 21.7 feet and another at 79.7 feet (at 25 and 92 lineal feet on boring trajectory) in B-206. All four VWPs were installed with recording dataloggers. Groundwater level data from the VWPs will be reported as an addendum to this report.

Borings were tremie-backfilled with neat cement grout to the ground surface without installation of a screen or sand sock.

2.1.3 Field Hydraulic Conductivity (Packer) Testing

Nine hydraulic conductivity (packer) tests were performed as part of the geotechnical investigation: seven by Taber Drilling with one in each of borings BI-02 and BI-03, and five in boring B-203 and two by Pitcher Drilling in boring B-206.The tests were performed to characterize hydraulic conductivities of the rock along the new HDD or micro-tunnel alignment for the City of Yreka water line. Results of the packer tests are presented in Appendix B.

Single Pneumatic Packer Tests

For borings BI-02, BI-03, and B-203, testing with a single pneumatic packer was used in a down-stage method, meaning that each successive packer test was performed as the hole was drilled deeper. An In-situ Level Troll 300 water pressure data logger installed in the packer assembly with a surface readout was used to monitor water pressures within the test intervals of the boreholes. Test interval lengths were 20.0 feet.

Prior to conducting the hydraulic conductivity testing, each borehole was conditioned by circulating clear water to remove cuttings and traces of polymer-based drilling fluid. Drill rods were then lifted off the bottom of the hole approximately 20 feet to expose the test section of the borehole.

For each interval a maximum test pressure (P_{max}) of 1 psi/foot of depth to the center of the test section was used to reduce the potential for hydrofracturing of the formation. When the packer assembly was in place and inflated, the testing commenced. Testing generally consisted of a five-step test at varying pressures approximately equal to ½ P_{max}, ¾ P_{max}, P_{max}, ¾ P_{max}, and ½ P_{max}. At each step, the pressure was held constant until a steady rate of flow could be maintained, which was then monitored for approximately five minutes. At the completion of the fifth step, the packer was deflated, removed from the borehole and drilling resumed.

Double Pneumatic Packer Tests

For boring B-206, an upstage technique was used after completion of drilling, with two pneumatic packers sealing off 10-foot intervals of the borehole for testing. A vibrating wire pressure transducer installed in the packer assembly with a surface readout was used to monitor water pressure during the test. Clean water was circulated in the boring after drilling to remove cuttings and traces of drilling fluid.

As for the single pneumatic packer tests discussed above, the maximum test pressure (P_{max}) of 1 psi/foot of depth to the center of the test section was used to prevent hydrofracturing of the formation. Due to poor performance of the flow metering equipment and hydraulic response of the formation at the test intervals, testing consisted of a one-step test at P_{max}. The pressure was held constant until a steady rate of flow could be maintained, which was then monitored for approximately five minutes. After the two consecutive tests (85 to 95 feet, and then 75 to 85 feet), the packer was deflated and removed from the borehole. Additional tests were not performed in this borehole due to failure of the pressure monitoring equipment. The boring was subsequently backfilled by tremie-grouting.

2.1.4 Borehole Geophyiscal Surveys

Televiewer Logging

To identify the orientation and width of planar geologic structural features encountered by the borings, borehole acoustic televiewer logging was performed in two borings drilled along the proposed water tunnel alignment (B-202 and B-206). Televiewer logging was performed by NORCAL Geophysical Consultants, Inc. and the results of which are presented in Appendix C.

Chapter 3: Laboratory Testing

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3. LABORATORY TESTING

Representative soil samples obtained from the exploratory borings were tested by Cooper Testing Labs in Palo Alto, California and Inspection Services Inc. in Berkeley, California. Representative rock samples were also obtained from the borings and tested by Tonon Laboratory in Austin, Texas and Cooper Testing Labs in Palo Alto, California. Laboratory test reports are presented in Appendix D.

The following geotechnical tests were performed on soils samples from borings:

1. Moisture Content, ASTM D2216
2. Atterberg Limits, ASTM D4318
3. Consolidated Undrained triaxial Compression Strength Tests, ASTM D4767
4. Unconsolidated Undrained triaxial Compression Strength Tests, ASTM D2850
5. Consolidation, ASTM D2435
6. Grain-Size Distribution Analysis, ASTM D422
7. Percent Passing No. 200, ASTM D1140
8. Moisture-Density tests, ASTM D7263b
9. X-rays of Samples
10. Corrosion Testing (pH and Minimum Resistivity (CT 643), Sulfate (CT 147), and Chloride (CT 422))

The following geotechnical tests were performed on rock core samples from borings:

1. Brazilian Tensile Strength Test, ASTM D3967
2. Moisture Content, ASTM D2216
3. Cerchar Abrasiveness tests, ASTM D7625
4. Point Load tests, ASTM D5731
5. Mohs Hardness
6. Unconfined Compressive Strength tests, ASTM D7012

7. Punch Penetration testing, Colorado Schools of Mines – 13
8. Bulk Density tests, ISRM 1977
9. Petrographic Analyses

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Chapter 4: Limitations

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4. LIMITATIONS

This GDR references geotechnical data obtained from various phases of geotechnical investigation programs and serves as a source of geotechnical information for the Klamath River Renewal Project.

Groundwater levels presented reflect conditions observed at the time of measurement and are expected to vary over time. The conditions indicated in boring logs and geophysical surveys represent only the subsurface conditions at the locations of the borings. The actual subsurface conditions are expected to vary between those locations.

This report does not interpret the available data. It is the Contractor’s responsibility to become familiar with the data in this GDR. The Contractor shall make its own interpretation of this data and shall assume full responsibility for its interpretation.

AECOM represents that the work described in this GDR were conducted in a manner consistent with the standard of care ordinarily applied as the state of practice in the profession within the limits prescribed by our client. No other warranties, either expressed or implied, are included or intended in this GDR.

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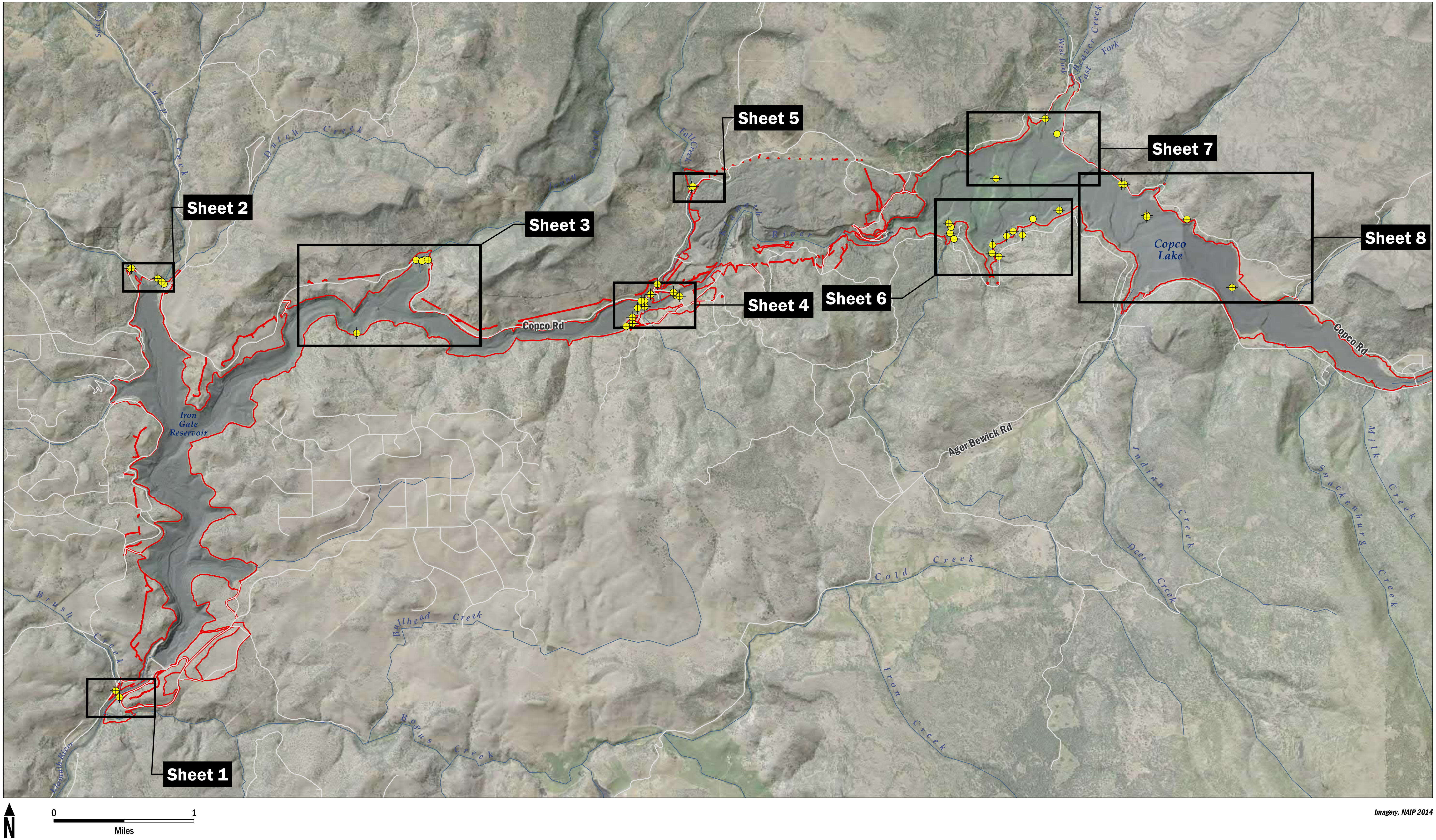
TABLE 1

BORING NUMBER	LOCATION	BORING TYPE	DEPTH (feet)	BEARING/ PLUNGE	PIEZO INSTALLED	IN-SITU TESTING	GOAL
B-01	Camp Creek	soil/core	25.5	Vertical	NA	NA	Bridge Foundation
B-02	Camp Creek	soil	31.4	Vertical	NA	NA	Bridge Foundation
B-03	Camp Creek	soil/core	27.3	Vertical	NA	NA	Bridge Foundation
B-04	Jenny Creek	soil/core	31.5	Vertical	NA	NA	Bridge Foundation
B-05	Jenny Creek	soil/core	50.0	Vertical	NA	NA	Bridge Foundation
B-06	Jenny Creek	soil/core	56.9	Vertical	NA	NA	Bridge Foundation
B-07	Jenny Creek	soil/core	31.8	Vertical	NA	NA	Bridge Foundation
B-08	Lakeview Bridge	soil/core	52.8	Vertical	NA	NA	Bridge Foundation
B-10	Lakeview Bridge	soil/core	52.2	Vertical	NA	NA	Bridge Foundation
B-13	Fall Creek	core	21.1	Vertical	NA	NA	Bridge Foundation
B-14	Fall Creek	core	28.6	Vertical	NA	NA	Bridge Foundation
B-15	Daggett Bridge	soil/core	51.5	Vertical	NA	NA	Bridge Foundation
B-16	Daggett Bridge Over Water	soil/core	24.5	Vertical	NA	NA	Bridge Foundation
B-17	Daggett Bridge	soil/core	41.5	Vertical	NA	NA	Bridge Foundation
B-18	Scotch Creek	soil	28.3	Vertical	NA	NA	Bridge Foundation
B-19	Scotch Creek	soil/core	37.5	Vertical	NA	NA	Bridge Foundation
B-20	Camp Creek	soil/core	47.0	Vertical	NA	NA	Bridge Foundation
B-201	Upper Irongate	soil/core	50.5	Vertical	NA	NA	Water Line
B-202	Upper Irongate	soil/core	100.5	30/205	VWP	T	Water Line
B-203	Upper Irongate	soil/core	120.0	Vertical	NA	HC	Water Line
B-205	Upper Irongate - Copco Road	soil/core	62.0	Vertical	NA	NA	Water Line
B-206	Upper Irongate - Copco Road	soil/core	100.0	30/295	VWP	T, HC	Water Line
B-207	Upper Irongate - Copco Road	soil/core	81.1	Vertical	NA	NA	Water Line
B-208	Upper Irongate	soil/core	80.0	Vertical	NA	NA	Water Line
BC-01	Copco - Over Water	soil	30.4	Vertical	NA	NA	Rim Stability
BC-02	Copco - Over Water	soil	64.6	Vertical	NA	NA	Rim Stability
BC-03	Copco - Over Water	soil	96.5	Vertical	NA	NA	Rim Stability
BC-04	Copco - Over Water	soil	73.5	Vertical	NA	NA	Rim Stability
BC-05	Copco - Over Water	soil	20.5	Vertical	NA	NA	Rim Stability
BC-06	Copco - Over Water	soil	15.4	Vertical	NA	NA	Rim Stability
BC-07	Copco - Over Water	soil	15.9	Vertical	NA	NA	Rim Stability
BC-08	Copco - Over Water	soil	11.5	Vertical	NA	NA	Rim Stability
BC-08a	Copco - Over Water	soil	85.2	Vertical	NA	NA	Rim Stability
BC-09	Copco - Over Water	soil	70.5	Vertical	NA	NA	Rim Stability
BC-10	Copco - Over Water	soil	43.0	Vertical	NA	NA	Rim Stability
BC-11	Copco Road	soil	10.5	Vertical	NA	NA	Rim Stability
BC-12	Copco Road	soil	16.5	Vertical	NA	NA	Rim Stability
BC-13	Copco Road	soil	42.0	Vertical	NA	NA	Rim Stability
BC-14	Copco Road	soil	15.4	Vertical	NA	NA	Rim Stability
BC-15	Copco Road	soil	1.0	Vertical	NA	NA	Rim Stability
BC-16	Copco Rim	soil	64.8	Vertical	NA	NA	Rim Stability
BC-17	Copco Rim	soil	37.4	Vertical	NA	NA	Rim Stability
BC-18	Copco Rim	soil	34.5	Vertical	NA	NA	Rim Stability
BC-19	Copco Rim	soil	37.5	Vertical	NA	NA	Rim Stability
BC-20	Copco Rim	soil	19.0	Vertical	NA	NA	Rim Stability
BI-01	Irongate Rim - Over Water	soil	22.2	Vertical	NA	NA	Rim Stability
BI-02	Irongate - Fall Creek	soil/core	67.0	Vertical	NA	HC	Water Line
BI-03	Irongate - Over Water	soil/core	35.1	Vertical	NA	HC	Water Line
NOTES:	1) HC = hydraulic conductivity, T = televiewer, VWP = vibrating wire piezometer, NA = not applicable						

AECOM Oakland CA 6/5/2019 USER alexander.remar PATH \\Oakland\Oakland\Projects\Secure\Water\Klamath Dam\400-Technical\440 GIS\02_Maps\02_Map_Production_and_Reports\Geotechnical_WorkPlan\Figure 1 Planned and Completed Geotechnical Borings Overview.mxd



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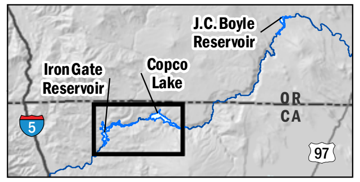

- ⊕ As-Drilled Boring
- — Road
- ▭ Detail Sheet Extent
- ▭ Limits of Work

FIGURE 1

Planned and Completed Geotechnical Borings Overview

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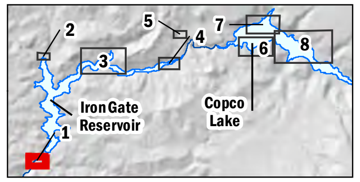

⊕ As-Drilled Boring
▭ Project Boundary

FIGURE 1

Planned and Completed Geotechnical Borings
Sheet 1 of 8

Imagery, NAIP 2014

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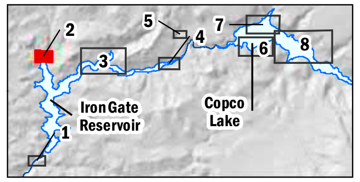

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▭	Project Boundary

FIGURE 1

Planned and Completed Geotechnical Borings

Sheet 2 of 8

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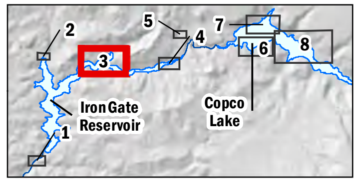
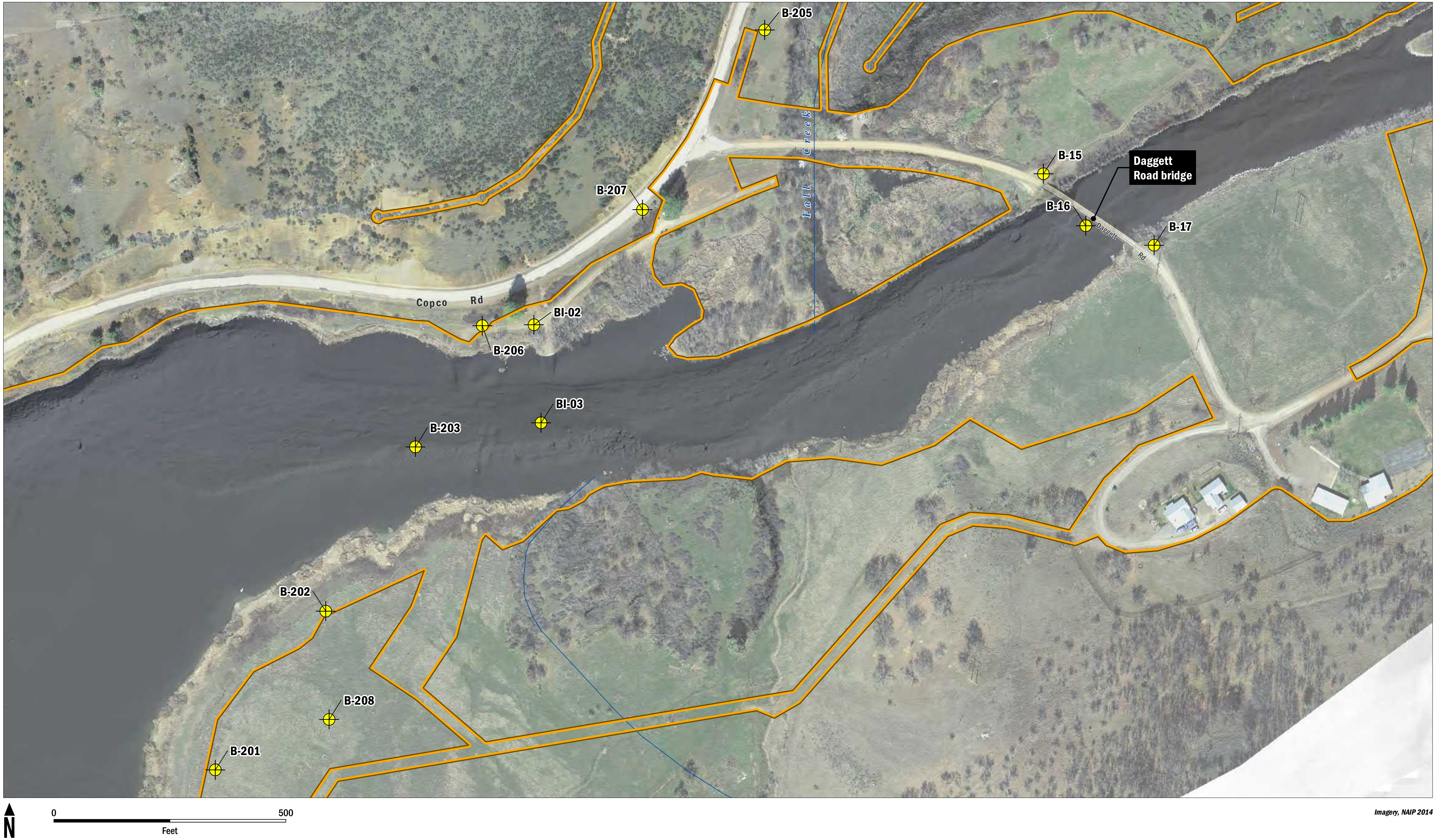


● As-Drilled Boring

▭ Project Boundary

FIGURE 1

Planned and Completed
Geotechnical Borings
Sheet 3 of 8



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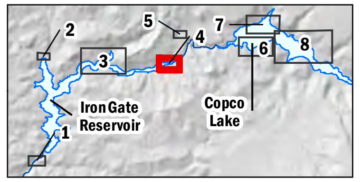

⊕	As-Drilled Boring
▭	Project Boundary

FIGURE 1

Planned and Completed Geotechnical Borings

Sheet 4 of 8

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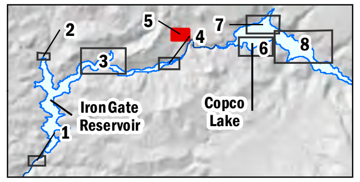

⊕ As-Drilled Boring
▭ Project Boundary

FIGURE 1

Planned and Completed
Geotechnical Borings
Sheet 5 of 8

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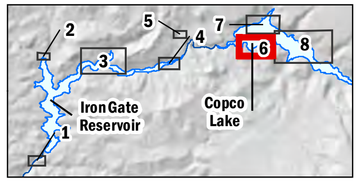

- ⊕ As-Drilled Boring
- ▭ Project Boundary

FIGURE 1

Planned and Completed Geotechnical Borings

Sheet 6 of 8

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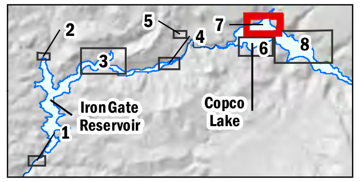

- ⊕ As-Drilled Boring
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FIGURE 1

Planned and Completed Geotechnical Borings

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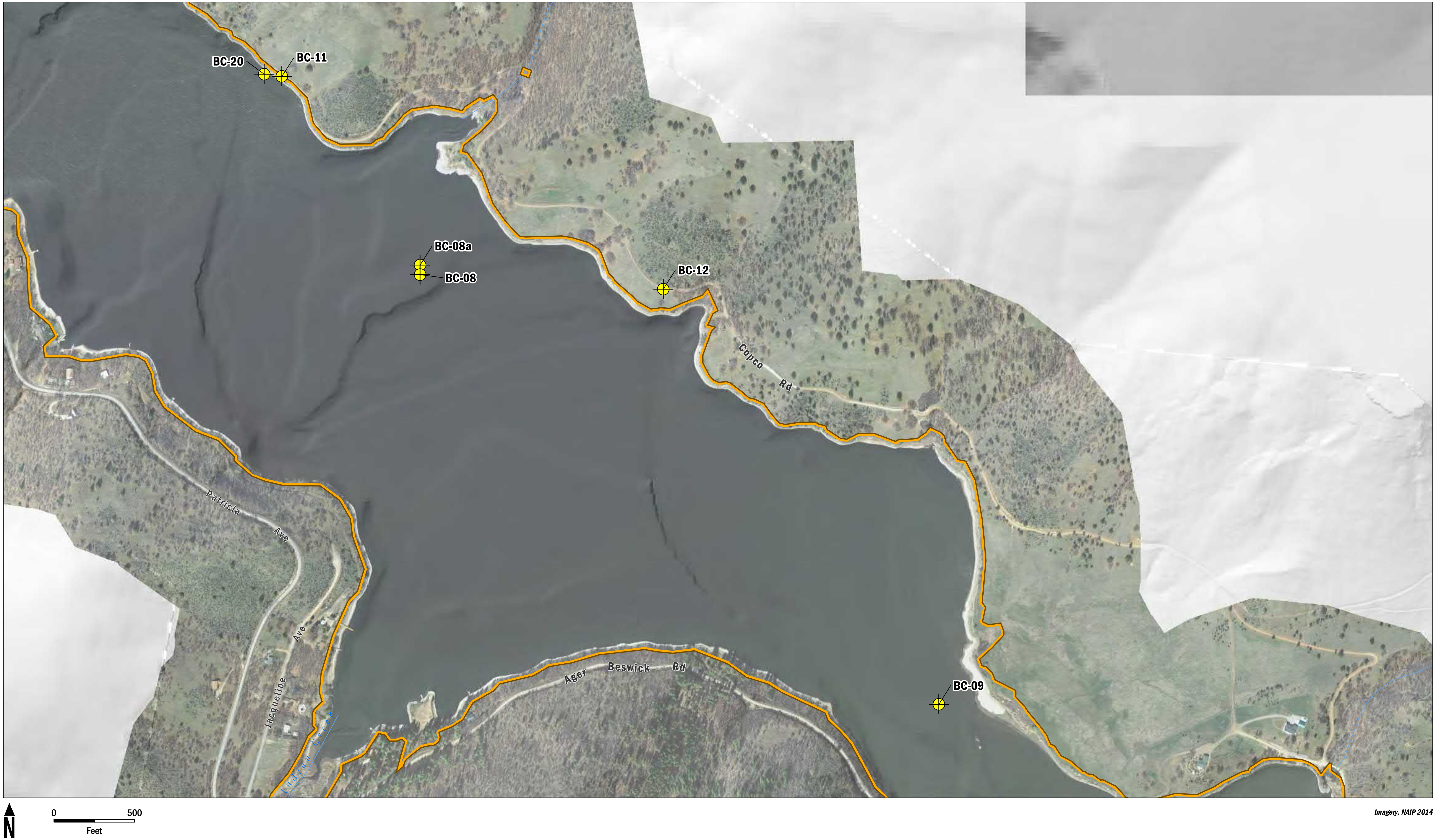

Imagery, NAIP 2014

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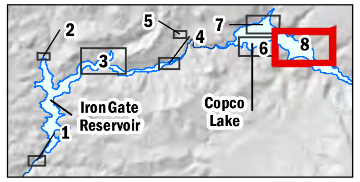
Klamath River Renewal Corporation

Klamath River Renewal Project



⊕ As-Drilled Boring

▭ Project Boundary

FIGURE 1

Planned and Completed Geotechnical Borings

Sheet 8 of 8

APPENDIX A BORING LOGS

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

Key to Log of Soil Boring

Sheet 1 of 4

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

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to specified datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

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.

6 **Recovery:** Percentage of driven or pushed sample length recovered; "NA" indicates data not recorded.

7 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

8 **Material Description:** Description of material encountered; may include density/consistency, moisture, color, and grain size.

9 **Water Content:** Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

10 **Dry Unit Weight:** Density of soil as measured in the laboratory, in pounds per cubic foot

11 **Fines Content** Percentage passing the #200 sieve as measured in the laboratory

12 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel.

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

		ROCK CORE									SOIL SAMPLES					
Elevation, feet	Depth, feet	Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
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

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)

d **Type of Infilling:**

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

e **Amount of Infilling:**

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

f **Surface Shape of Joint:**

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

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]

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	SOIL SAMPLES Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	0							2-inches GRAVEL roadway					Start 9:00 9/27/2018; hang auger 0.0-5.0ft.
2344 2342	1 2 3 4							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--					pp = 2.75 tsf
2340	5 6							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 --ALLUVIUM--	S-01	6 7 8	0		Hollow stem auger 5.0ft. to 9.0ft. pp = 2.25 tsf
2338	7 8								S-02	6 7 8	0		
								GRAVEL and COBBLES in a SANDY LEAN CLAY matrix; GRAVEL and COBBLES are subrounded Basalt					
2336	9 10	1	1	80	NA NA	NA			S-03	19 17 10	11	1014 [13] 1021	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	2		100	NA	NA	m					1037 [9] 1044	
2334	12 13	3		60	NA NA	NA						1056 [25]	75% fluid circulation

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	13		1		NA			●	GRAVEL and COBBLES in a SANDY LEAN CLAY matrix; GRAVEL and COBBLES are subrounded Basalt --ALLUVIUM--*(continued)*						75% fluid circulation
2332															
	14	4		80	NA	NA		●						1102 1112 [9] 1119	
	15	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)--					1124 [23]	
2330	16				NA		m	△ △	Becomes yellowish grey (5Y 7/2), moderately weathered					1128	
	17	6		94	0	88*		△ △						1136	
2328	18				>6		m m	△ △	Becomes greyish brown (5YR 3/2) Intensely fractured						
	19				0			△ △						[16]	*Rock does not meet soundness criteria for RQD calculation
2326	20				1		1 2	△ △	1: 15, V, T-VN, H+Uk, Fi, Pl, ? 2: 60, J, N-W, Sd, Fi, Wa, ?						
	21				NA		m m	△ △						1155	
2324	22	7		70		0	m m	△ △						1244 [15] 1248	
	23	8		0	NA	0		△ △						1254 [12] 1259	
2322	24	9		50	NA	0		△ △						1304 [12]	
	25				>6			△ △						1314	
2320	26								**TOTAL DEPTH = 25.5 FEET**						
	27														
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. Respess**	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 Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
2340	0					●	2-inches GRAVEL roadway POORLY GRADED GRAVEL (GP); dense; fine to coarse GRAVEL and COBBLES; fine to corase grained SAND; little no plasticity FINES; moist --FILL--				Start 9:00 9/27/2018; hollow stem auger 0-31ft.
						▨	LEAN CLAY (CL); medium stiff; brown; medium plasticity FINES; trace fine grained SAND; occasional GRAVEL and COBBLE				
2335	5					▨					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										

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

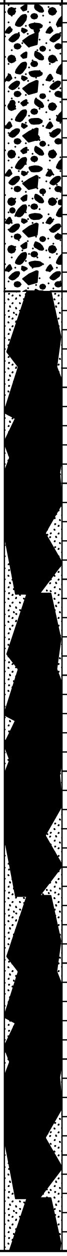
Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
2310	30		S-02	50/0	0		[As Above] --ALLUVIUM--*(continued)*				S-02 attempted at 31.4; logged from flake in shoe
							BASALT; dark grey; slightly weathered to fresh; moderately strong --TERTIARY to QUATERNARY INTRUSIVE BASALT-- **TOTAL DEPTH = 31.4 FEET**				
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. Respess**	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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	0								POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse GRAVEL to BOULDERS; fine to corase grained SAND; some no plasticity FINES; dry to moist --FILL--						Start 12:00 10/12/2018; hang auger 0.0-5.0ft.
2340	1														
	2														
2338	3								BOULDER and COBBLES; 3.0-4.8ft.: BOULDER --ALLUVIUM--						
	4														End of day 10/12/2018 Begin day 10/15/2018
2336	5								BOULDER						Switch to rotary wash drilling with 3 7/8-inch tricone bit
	6														
2334	7								BOULDERS and COBBLES						Advance 4.5-inch casing to 5ft.
	8														
2332	9														
	10								BOULDERS and COBBLES						
2330	11														
	12														
2328	13														

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

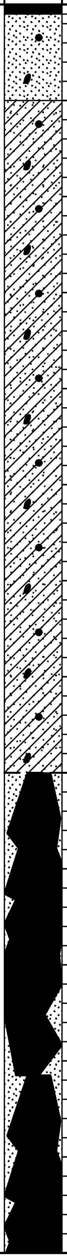
Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	13							BOULDER and COBBLES --ALLUVIUM--*(continued)*	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

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	0								2-inches ASPHALT roadway						Start 9:30 9/25/2018 Hand Auger 0-5ft.
2342									POORLY GRADED SAND with GRAVEL (SP); greenish grey (10G 5/1); 40% subangular GRAVEL up to 1-inch; 60% medium grained SAND; moist --ROAD BASE--						
	1								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 --ROAD FILL--						pp = 3.25 tsf
	2														
2340	3														
2338	4														pp = 4.25 tsf
	5								Becomes brown (10YR 5/3 with subangular to subrounded GRAVEL up to 1 1/2-inches, effervescent, with rootlets		S-01	15 13 11	67		Hollow Stem Auger 5-9.5 ft. pp = >4.5 tsf
2336	6														
	7														
	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 --ALLUVIUM--						
2334	9								Becomes basalt COBBLES up to 5 inches in a clayey matrix		S-02	21 13 50	89		Auger refusal at 9.5ft.; advance 4.5-inch casing to 9.5ft. pp = 3.0 tsf
2332	10														
	11	1	1	100	NA	NA	m							1147	Switch to HQ coring at 11ft. with wireline diamond bit; advance 4.5-inch casing to 9.0ft.
2330	12	2		64	NA	NA	NR								
	13														

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

Log of Soil and Core Boring B-04

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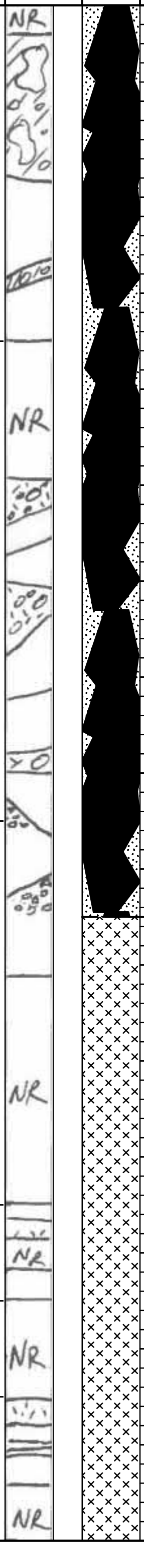

		ROCK CORE						SOIL SAMPLES					
Elevation, feet	Depth, feet	Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	13		1		NA		CLAYEY GRAVEL with SAND (GC); very stiff; brown (10YR 4/3); 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	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							1157 1206	
2326	17				NA								
	18				NA								
2324	19	3		72	NA	NA						[21]	
	20				NA								
2322	21				NA							1220 1232	
	22				NA		BASALT; olive grey (5Y 3/2); completely weathered; very weakly decomposed and easily friable by hand --TERTIARY to QUATERNARY INTRUSIVE BASALT--						
2320	23	4		40	NA	0						[13]	
	24				NA								
2318	25				NA		Becomes dusky yellow green (5Y 5/2) and pale reddish brown (10Y 5/4), highly to completely weathered, highly to intensely fractured					1250 1257	Bit blocked off during run
	26	5		70	NA	0						[10] 1303 1310	
2316	27	6		0	NA	0						[7] 1319 1431	Bit blocked off during run
	28	7		30	NA	0							
2314	29												

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

Log of Soil and Core Boring B-04

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Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	29	7	1	30	NA NA	0	NR		BASALT; dusky yellow green (5Y 5/2) and pale reddish brown (10Y 5/4); highly to completely weathered; highly to intensely fractured; very weak; No Recovery likely in completely weathered zones --TERTIARY to QUATERNARY INTRUSIVE BASALT--*(continued)*					[13] 1445	
	30														
2312	31	8		0	NA	0	NR							1455 [7] 1504	Bit blocked off during run
									TOTAL DEPTH = 31.5 FEET						
	32														
2310	33														
	34														
2308	35														
	36														
2306	37														
	38														
2304	39														
	40														
2302	41														
	42														
2300	43														
	44														
2298	45														

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

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

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

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

Log of Soil and Core Boring B-05

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

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. Respess**	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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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 --FILL--						Start 9:10 10/8/2018; hollow stem auger 0-16.5ft.
2338															
	1														
	2														
2336															
	3														
	4														
2334															
	5											3			S-01 One liner retained (5-5.5ft.)
	6										S-01	6			
												4			
2332															
	7														
	8														
2330															
	9								SILTY SAND (SM); loose; brownish grey; fine to medium grained SAND; little coarse grained SAND and wood fragments; wet --ALLUVIUM--						Smoother drilling at 9.0ft.
	10											2			S-02 One liner retained (10.5-11ft.) SA: S=75%; F=25%
2328															
	11										S-02	1			
												3			
	12														
2326															
	13														

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

Log of Soil and Core Boring B-06

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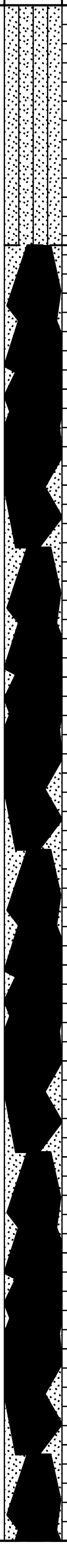


Elevation, feet	Depth, feet	ROCK CORE						MATERIAL DESCRIPTION	SOIL SAMPLES				Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number		Type	Number	Blows / 6 in.	Recovery, %		
	13							SILTY SAND (SM); loose; brownish grey; 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.)
								POORLY GRADED GRAVEL (GP); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet		S-03	29			
	16										18			
2322														Switch to rotary wash drilling with 3 7/8-inch tricone bit; advance 4.5-inch casing to 19ft.
	17													
	18							BOULDER						
2320														
	19													
	20													
2318								CLAY, yellowish brown						
	21													Logged from cuttings
	22							CLAY, yellowish brown						
2316														
	23													30-60% Fluid return (higher in boulders)
	24													
2314														
	25							BOULDER						
	26													
2312														
	27							CLAY, reddish brown						
	28													
2310														
	29													

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 --ALLUVIUM--						
	30											22			S-04 One liner retained (31-31.5ft.) SA: G=53%; S=22%; F=25%
2308											S-04	16			
	31											14			
															Advance 4.5-inch casing to 30ft.
	32														
2306															
	33														
	34														
2304									BOULDER, basalt						
	35														On boulder; no drive sample attempted
	36														
2302															
	37								BOULDER, basalt						
	38														
2300															
	39														
	40											13			S-05 One liner retained (41-41.4ft.)
2298											S-05	27			
	41											50/5			
															Advance 4.5-inch casing to 40ft.
	42														
2296									BOULDER, basalt						
	43														
	44														Total fluid loss at 44ft. (0% fluid return)
2294															
	45														

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
2292	45–47.5								POORLY GRADED GRAVEL (GP); medium dense; brownish grey; rounded GRAVEL, COBBLES, and BOULDERS; SAND and CLAY infilling; wet --ALLUVIUM--		S-06	7 10 36			S-06 One liner retained (46-46.5ft.) SA: G=93%; S=7% Advance 4.5-inch casing to 45ft.
2290 2288	47.5–51.3								VOLCANIC SILTSTONE/CLAYSTONE; olive grey; moderately to highly weathered; weak; thinnly laminated --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--		S-07	31 40 36			Hole caving; End of day 10/8/2018 Begin day 10/9/2018 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.
	51.3–52.2								VOLCANIC SILTY SANDSTONE; light yellowish brown; highly to moderately weathered; weak to moderately strong; fine to medium grained; becomes bluish grey at 51.8ft.						
2286 2284	52–55	1	1	75	>6 >6 NA	0			VOLCANIC SILTSTONE/CLAYSTONE; reddish brown; moderately weathered; very weak to weak; thinnly laminated					1204 [13] 1217	
	55–55.3	2		40		0	NR							1230 [6] 1235	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.
	55.3–56.5	3		0	NA	0	NR							1253 [7] 1304	
2282	56.5–56.9	4		100	NA	0			BASALT; slightly weathered; moderately strong --TERTIARY to QUATERNARY INTRUSIVE BASALT--					1309 [3] 1316	
2280 2278	57–61								**TOTAL DEPTH = 56.9 FEET**						

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								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 --FILL--						Start 15:00 10/4/2018 hand auger 0-4.5ft.
	1														
2336	2														
	3														
2334	4														
	4.5								VOLCANIC SANDSTONE; grey; fine grained; moderately weathered --ROCKY FILL?--			28			
	5										S-01	27	20		Hollow stem auger 5-7ft.
2332	6											20			
	7								CLAYEY GRAVEL with SAND (GC); dark yellowish to olive brown; subangular to subrounded GRAVEL up to 1.5-inches --ROCKY FILL/ALLUIVUM?--						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									0818	
2330	8				NA		NR								
	9														
		1		25	NA	NA			VOLCANIC SANDSTONE BOULDER; dark grey; slightly weathered; very strong; fine to medium grained					[30]	
2328	10				NA		NR								End of day 10/4/2018 Begin day 10/5/2018
	11													0826	
					NA									0833	Advance 4.5-inch casing to 9ft.
2326	12				NA										0% Fluid Return
	13														

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

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				NA				CLAYEY GRAVEL with SAND (GC); dark yellowish to olive brown; subangular to subrounded GRAVEL up to 1.5-inches --ROCKY FILL/ALLUIVUM?--						Continuted 0% Fluid Return
2324	14	2		0	NA	NA	NR							[75]	
	15				NA										
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--					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	9 37 50/5	100		
2320	18	3		0	NA	NA	NR							0859 [20] 0902	
	19	4	1	82	NA	36			Broken, likely NR zone					0910	
2318	20				2				Becomes slightly to moderately weathered, highly fractured, with occasional small, angular GRAVEL					[12]	
	21				3									0924	
2316	22	5		100	5	10			Becomes mostly moderately weathered, with various amounts of fine to coarse grained SANDSTONE and trace small, subangular GRAVEL, with weak, subhorizontal bedding					1048	
	23				3										
2314	24				4				All Fractures: ?, J, N-VN, No, No, Pl, SR					[17]	
	25				5										
2312	26				6									1106	
	27				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
2310	28				3										
	29														

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

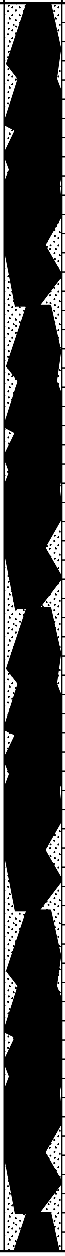
		ROCK CORE									SOIL SAMPLES				
Elevation, feet	Depth, feet	Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	29	6	1	100	3	16*				VOLCANIC SANDSTONE; 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					Shoe disturbed					1138	
2306	32									**TOTAL DEPTH = 31.8 FEET**						
	33															
2304	34															
	35															
2302	36															
	37															
2300	38															
	39															
2298	40															
	41															
2296	42															
	43															
2294	44															
	45															

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. Respess**	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**

		ROCK CORE								SOIL SAMPLES					
Elevation, feet	Depth, feet	Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
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 --FILL--						Start 11:30 10/16/2018; hollow stem auger 0-3ft.
	1														
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														

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

Log of Soil and Core Boring B-08

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)*		S01	4 7 13			LL= 69; PL=22
2180	14														
	15								Rocky layer Becomes greyish green						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--		S02	0 0 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														
2176	18														
	19														
2174	20										S03	7 3 3			Advance 4.5-inch casing to 20ft; bluish grey cuttings; S-03 driven without liners
	21								Rocky layer						
2172	22														
	23								Rocky layer 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	24														
	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														

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

Log of Soil and Core Boring B-08

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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	1	100	0	89	m m m m						1512	Switch to HQ-3 rock coring at 35ft.
2158	36				0		m m,m m m m m						[15]	
	37				NA		1	1: 70, J, VN, Ch?, Pa, Pl-Wa, SR					1523	
2156	38	2		100	1	95	m m						1532	
	39				1		1 1 m 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	40				1		m,m m 2 m 2						[16]	
	41				1			1: 40, J, VN-N, No, No, Wa, SR 2: 20, J, N, Cl, Pa, Wa, SR 3: 80, J, N-MW, Ca, Fi, Wa, SR						
2152	42				1		m 3						1551	
	43				1		m m 1 m,m m	1: 80-90, J, N-MW, Ca, Fi, Wa, SR					1600	
2150	44				0		m							
	45													

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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]	
2148	46				0		m		2: 60, J, Vn, Ch/Cl, Fi, Pl, SR						UCS = 15268 psi
	47				0		m m							1614	
2146	48		2		2		1 2		VOLCANIC CONGLOMERATE 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	
	49				3		1 3 4		VOLCANIC CONGLOMERATE						
2144	50	4		100	3	42	4 5,6 6		VOLCANIC CONGLOMERATE 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					[17]	
	51				3		7 1,6		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						
2142	52				NA		8, 4							1640	
	53								**TOTAL DEPTH = 52.8 FEET**						
2140	54														
	55														
2138	56														
	57														
2136	58														
	59														
2134	60														
	61														

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. Respess**	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**

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

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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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 --FILL--*(continued)*						
2180															
	14														
	15														
2178															
	16														
	17														
2176															
	18														
	19														
2174															
	20														
	21														
2172															
	22														
	23														
2170															Advance 4.5-inch casing to 23.5ft.
	24														
	25														
2168												12			
	26										S02	20			S-02 bagged
												26			
	27														
2166									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)--						
	28														
	29														

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

Log of Soil and Core Boring B-10

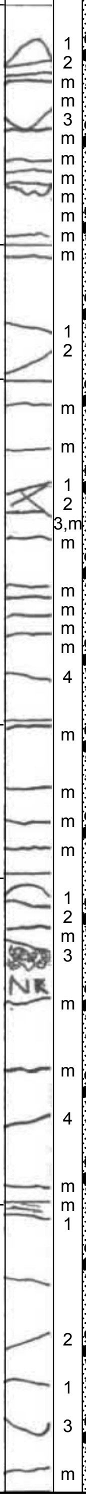
Sheet 3 of 4

ROCK CORE

Depth, feet	Run No.	Box No.	Recovery, %	R Q D, %	Drill Time [Rate, ft/hr]
29.5–32	1	1	100	72	1305 [15] 1315
32–33.4	2		100	86	1335 [14] 1341
33.4–37	3		94	78	1355 [6] 1430
37–38.6	4		100	100	1442 [4] 1505
38.6–42	5		91	71	1525 [8] 1550
42–45	6	2	100	69	0755 [9]

Depth, feet	Fractures per Foot
29.5–30	NA
30–31	1
31–32	0
32–33	1
33–34	NA
34–35	3
35–36	0
36–37	1
37–38	0
38–39	NA
39–40	1
40–41	0
41–42	1
42–43	2
43–44	2
44–45	1

Elevation, feet	Depth, feet
	29
2164	30
	31
2162	32
	33
2160	34
	35
2158	36
	37
2156	38
	39
2154	40
	41
2152	42
	43
2150	44
	45



MATERIAL DESCRIPTION

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)*

1: 60, J, VN, No, No, Pl, S
2: 10, J, VN, Qz, Sp, Pl, S
3: 40, J, VN, Fe, St, Pl, S

1: 35, J, VN, No, No, Pl-Wa, SR
2: 45, J, VN, Fe, St, Wa, S-SR

VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm

VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm

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

VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm

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

VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm

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

SOIL SAMPLES: Type | Number | Blows / 6 in. | Recovery, %

FIELD NOTES AND TEST RESULTS

Switch to HQ-3 rock coring at 29.5ft.

Driller reports hard drilling at 33.4ft.

End of day 10/17/2018
Begin day 10/18/2018

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				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, %		
2148	45		2		1			4 m	●∴	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)*						
	46				1			m m 5	●∴	4: 20, J, T, No, No, Pl, S 5: 60, J, N, Fe, St, Wa-St, SR-R					0830	
2146	47				NA			1 2 3	●∴						0847	
	48				2			5 m 4	●∴	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						
2144	49	7		82	2	71		3 6	●∴						[9]	
	50				3			6 4 4	●∴	VOLCANIC SANDSTONE; light to medium grey; slightly weathered; strong; fine grained with white clasts up to 6 mm						
2142	51				NA			m m	●∴						0920	
	52									**TOTAL DEPTH = 52.2 FEET**						
2140	53															
	54															
2138	55															
	56															
2136	57															
	58															
2134	59															
	60															
	61															

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. Kozlowicz**	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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
2494	0						1-inch ASPHALT 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 --ROAD BASE--			Start 12:00 10/3/2018 hand auger 0-3.5ft.
	1									
2492	2	1	1	60	NA	0	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 --TERTIARY to QUATERNARY INTRUSIVE BASALT--		1252 [23]	
	3				>6				1256 1324	Auger refusal at 3.5ft.; switch to HQ rock coring with 3 3/4-inch diamond bit
2490	4				NA		Becomes dark yellowish brown, locally highly weathered with CLAYEY SAND, with rootlets			0% fluid return
	5	2		28	NA	0			[29]	
2488	6				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 1338	
	7				>6		CLAYEY SAND/SANDY CLAY			
2486	8				>6					
	9	3		66	NA	0			[20]	
2484	10				NA					
	11				NA				1353 1405	
2482	12	4		68	>6	19	highly fractured with SANDY CLAY infilling			
	13									

Fracture Drawing Number

Lithology

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	13	4	1	68	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)*		[28]	Continued 0% fluid return
2480	14				NA				⊠				
	15				NA				⊠			1415	
2478	16	5		70	>6	18			⊠			1424	Bit blocked off during run
	17				4				⊠				UCS = 6528 psi
2476	18				3				⊠			[30]	
	19				NA				⊠	CLAYEY SAND and GRAVEL with roots			
2474	20				NA				⊠			1434	
	21									**TOTAL DEPTH = 21.1 FEET**			
2472	22												
	23												
2470	24												
	25												
2468	26												
	27												
2466	28												
	29												

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
2494	0 1								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.
2492 2490 2488	2 3 4 5 6	1	1	12	NA NA NA	0	NR		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 [27] 0929	Auger refusal at 2.3ft.; switch to HQ rock coring with 3 3/4-inch diamond bit Run 1 bagged
	7				NA 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	8 17 17	60		SA: G=1%; S=29%; F=70% LL=62; PL=22 Two liners retained
2486	8 9	2		40	NA 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					1026 [18] 1031	
2484	10 11	3		60	NA NA NA	25	NR		COBBLES and BOUDLERS become dusky red, fine grained, slightly weathered, very strong intrusive volcanic					1040 [13] 1049	80-100% fluid return
2482	12 13	4		7	NA NA	0								1058 [18] 1103	Coarse grained SAND in cuttings

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	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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	NA	0	NR						[12] 1220 1228	
	25				4			Becomes moderately to locally highly weathered, moderately strong, highly fractured						
2468	26	9		63	3	0		Becomes highly to completely weathered, extremely weak, friable					[17]	
	27				NA									
2466	28				NA		NR						1242	
	29							TOTAL DEPTH = 28.6 FEET						

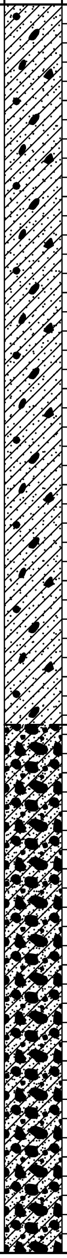
Report: GEO_CORE+SOIL_NO PACK_WITH LITH; File: KLAMATH_MASTER.GPJ; 6/20/2019 B-14

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	**1/22/2019-1/23/209**	Logged By	**S. Janowski**	Checked By	**P. Respess**
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 --FILL--						
	1														
2342	2														
	3														
2340	4														
	5										1-1 1-2	6 6 8	78		pp=3.0 tsf
2338	6														
	7														
									CLAYEY GRAVEL with SAND (SC); very dense; moist; yellowish brown to dark brown; interbedded layers of gravel with clay and sand --ALLUVIUM--						Fill estimate based on height of slope embankment
2336	8														
	9														
2334	10										2	100/1"	100		
	11								▼						
2332	12														
	13														

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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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												16			SA: G=42%; S=27%; F=31%
												3	20	78		
2328	16												34			
	17									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
2326	18															
	19															
2324	20												17			
												4	50	61		
	21	1	1	100	NA	0							50		0921 [6] 0926	End of day 1/22/2019
															0933	Begin day 1/23/2019; AM water level=11.7' bgs Switch to HQ rock core
2322	22				NA											
	23				NA		NR									
2320	24	2		2		0									[100]	
					NA											
	25				NA											
2318	26														0936	
					NA							5	65	100		
	27														0956	
					NA		NR									
2316	28	3		71		27*										*Rock does not meet soundness criteria for RQD calculation
					NA					VOLCANICLASTIC BRECCIA --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--						
	29															

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

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

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

Log of Soil and Core Boring B-15

Sheet 4 of 4

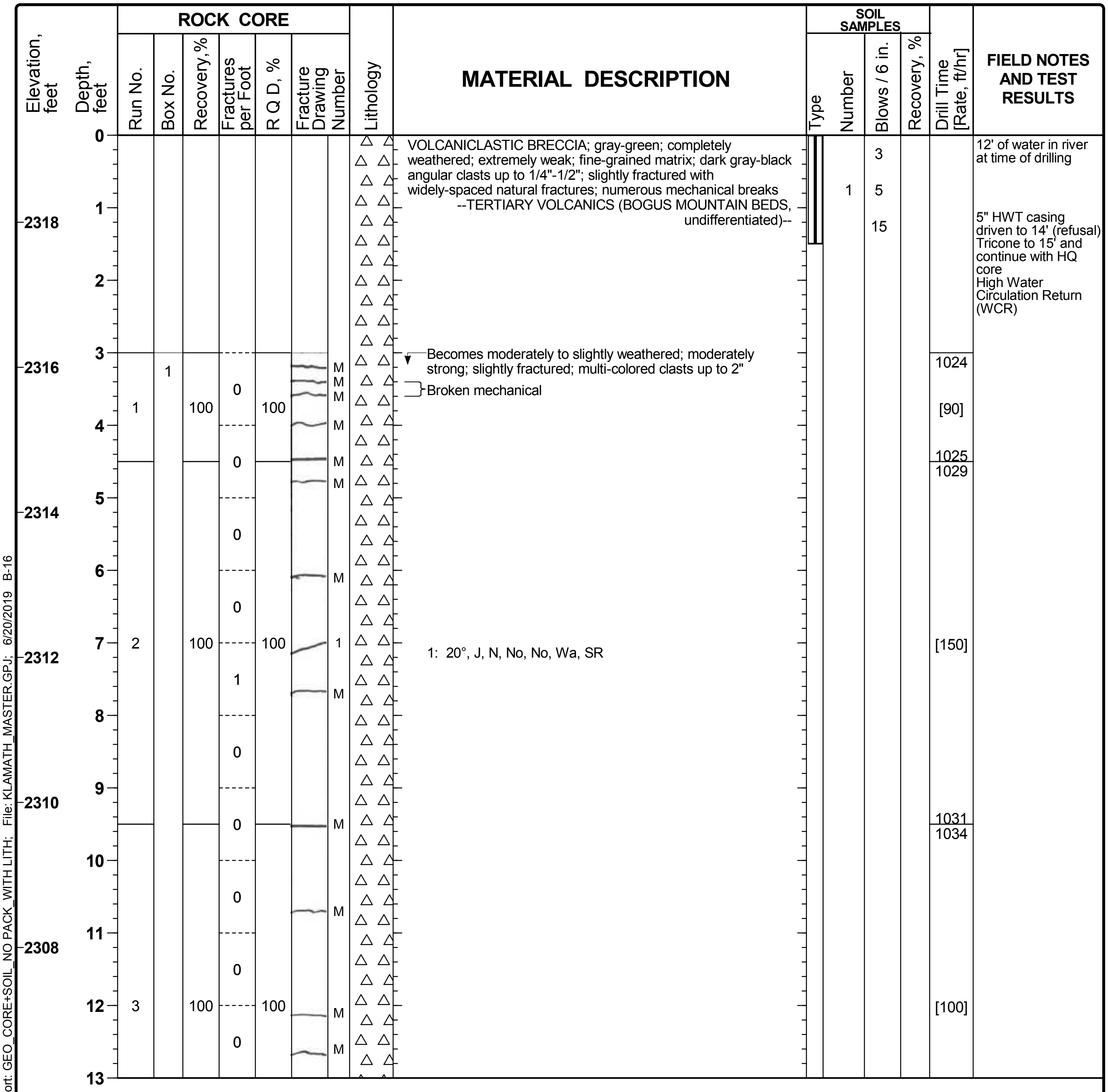
Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	45	6	2	100	4	72	1 1	△ △	VOLCANICLASTIC BRECCIA; grayish blue-green (5BG5/2); slightly weathered; weak to very weak; highly fractured; angular clasts to mostly to 1/2", occasionally to 1.5" --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*						
2298	46				0		M M M	△ △						1031 1035	UCS = 1546 psi
	47				0		M	△ △							
2296	48				1		1	△ △	1: 20°, J, MW, No, No, Wa, R 2: 15°, J, N-VN, Sd+Si, So-Pa, Pl, R-SR						
	49	7		100	2	94	2,2	△ △						[43]	
2294	50				2		2 2	△ △							
	51				0		M	△ △						1042	
	51.5								**TOTAL DEPTH = 51.5 FEET** **Grout mix: 30 gallons of water, six 47# bags of cement, no bentonite**						
2292	52														
	53														
2290	54														
	55														
2288	56														
	57														
2286	58														
	59														
2284	60														
	61														

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. Respess**	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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	0							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	5			
2318	1										15			5" HWT casing driven to 14' (refusal) Tricone to 15' and continue with HQ core High Water Circulation Return (WCR)
	2													
2316	3		1				M M M	Becomes moderately to slightly weathered; moderately strong; slightly fractured; multi-colored clasts up to 2" Broken mechanical					1024	
		1		100	0	100							[90]	
	4						M							
					0		M M						1025 1029	
2314	5				0									
	6						M							
					0									
2312	7	2		100		100	1	1: 20°, J, N, No, No, Wa, SR					[150]	
					1		M							
	8				0									
2310	9				0		M						1031 1034	
	10				0		M							
2308	11				0									
	12	3		100		100	M						[100]	
					0		M							
	13													

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

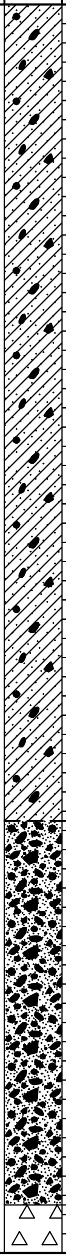
Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
2306	13	3	1	100	0	100		△ △	VOLCANICLASTIC BRECCIA; 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)*						High WCR
	14				0		M M	△ △						1037 1040	
2304	15	4	2		0		M M	△ △							
	16				1		1	△ △	1: 30°, J, N, No, No, Pl-Wa, SR						
2302	17			100	0	100	M	△ △						[150]	
	18				0		M M	△ △							
2300	19				0		M M	△ △						1042 1045	
	20	5			0			△ △							
2298	21				0		M	△ △							
	22			96	0	96	M M	△ △						[75]	
2296	23				0		1	△ △							
	24				NA		NR	△ △						1049	
	24.5								**TOTAL DEPTH = 24.5 FEET** **15 gallons of grout: 6 sack mix with 5% bentonite**						
2294	25														
	26														
2292	27														
	28														
	29														

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. Respess**
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**

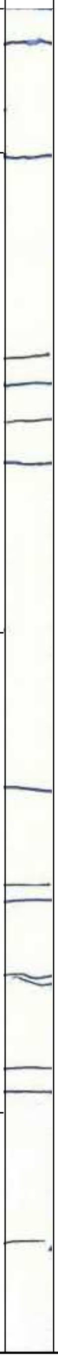


Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	0								GRAVELLY CLAY with SAND (CL); stiff; moist;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

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



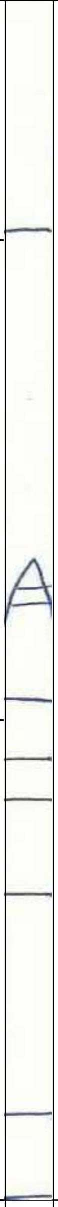
Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	13							△ △	VOLCANICLASTIC BRECCIA; greenish-gray (5G6/1); slightly weathered; moderately strong; slightly fractured; angular clasts to 1/2" in fine matrix --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*						
	14							△ △							
2326								△ △							
	15		1					△ △		▯	3	50/4"	100	1110	Switch to HQ core
					0		M	△ △							
		1		100		100		△ △						[45]	
	16							△ △							
					0		M	△ △						1112 1147	
2324								△ △							
	17							△ △							
					0			△ △							
	18							△ △							UCS = 2130 psi
2322					0		M	△ △							
	19	2		100		100	M	△ △						[75]	
							M	△ △							
					0		M	△ △							
	20							△ △							
2320					0			△ △							
	21							△ △							
					0			△ △						1151 1216	
	22							△ △							
2318					0			△ △							
	23						1	△ △	}Very weak 1: 20°, J, VN, Cl+Sd, Sp, Pl, S-SR						
					1			△ △							
	24	3		100		84	1 1	△ △	}Weak					[100]	
2316					2			△ △							
	25						M	△ △							
					0			△ △							
	26						M M	△ △							
2314					0			△ △						1219 1223	
	27							△ △							
					0			△ △							
		4		100		100	M	△ △						[75]	
	28							△ △							
2312					0			△ △							
	29														

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	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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)*						
2310	30	4		100	0	100		△ △						[75]	
	31				0		M	△ △	Coarser clasts to 2"					1227 1231	
2308	32				0			△ △							
	33				0			△ △							
2306	34	5		100	1	86		△ △						[100]	
	35				3		1	△ △	Light brownish gray (5YR6/1); moderately weathered; weak; highly fractured 1: 60°, J/Sh, W, Ca+Mn+Fe, Pa+Su IR, VR-Slk (rough grooves)						
2304	36				0		M	△ △	Abundant mechanical fractures					1234 1239	
	37				0		M M	△ △							
2302	38				0		M	△ △							
	39	6		100	0	100		△ △						[75]	
2300	40				0		M	△ △	1.5" Clast						UCS = 2985 psi
	41				0			△ △						1243	
2298	42								**TOTAL DEPTH = 41.5 FEET** **Grout mix: 20 gallons of water, five 47# bags of cement, no bentonite**						
	43														
2296	44														
	45														

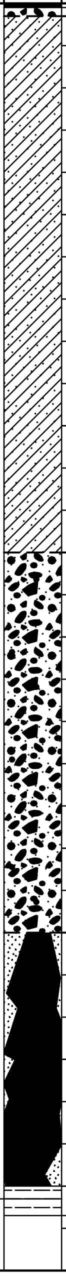


Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil Boring B-18

Sheet 1 of 1

Date(s) Drilled	**10/11/2018**	Logged By	**P. Respess**	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	Depth, feet	SAMPLES Type	 Number	 Sampling Resistance	 Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						2.5-inches ASPHALT roadway 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--				Start 10/11/2018; hollow stem auger 0-28ft.
2345											Smooth drilling
	5						GRAVEL				Rig chatter
2340											Return to smooth drilling to 13ft.
	10										
2335							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 --FILL--*(continued)* ▽				Rig chatter
	15										
2330							BOUDLER				Driller indicates hard rock at 18ft.
	20										
2325							ALLUVIUM				Driller indicates smooth, consistent drilling 22-25ft.
	25	■ ▯	S-01 S-02	50/3 100/4	0		BOUDLER, basalt				
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)?-- **TOTAL DEPTH = 28.3 FEET**				
	30										

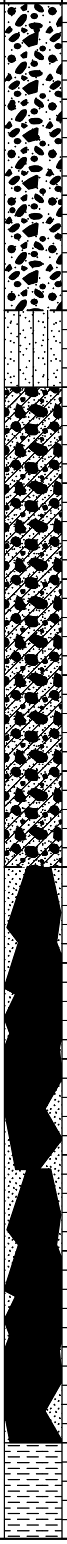
Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
Project Number: 60537920

Log of Soil and Core Boring B-19

Sheet 1 of 3

Date(s) Drilled	**10/11/2018**	Logged By	**P. Respess**	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**

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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								∇			6			S-03 One liner retained (16-16.5ft.) SA: G=6%; S=42%; F=52%
											S03	4			
2330	16								SANDY SILT (ML); soft to medium stiff; dark grey; fine grained SAND; low plasticity FINES; trace GRAVEL; wet			4			
	17								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	18														
	19														
2326	20											12			S-04 One liner retained (21-21.5ft.) SA: G=40%; S=34%; F=26%
											S04	21			
	21											12			
2324	22								ALLUVIUM						
	23														
2322	24								BOUDLER, basalt						Switch to rotary wash drilling with 3 7/8-inch tricone bit; yellowish brown clayey cuttings with rounded gravel 24.5-28ft.
	25														
2320	26														
	27														
2318	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
	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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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	◫	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 m m m							[8]	
2314	32				0		m m m m							1208 1215	
	33				0		m m m								
2312	34				0										
	35	2		86	0	86	m							[13]	
2310	36				0		m								0.7 ft. of core slipped out of core barrel; left in hole prior to grouting
	37				NA									1238	
	37.5								**TOTAL DEPTH = 37.5 FEET**						
2308	38														
	39														
2306	40														
	41														
2304	42														
	43														
2302	44														
	45														

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. Respess**	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**

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

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	29									BOULDER: 28-29.5 ft. --ALLUVIUM--*(continued)*						
										POORLY GRADED GRAVEL with SAND (GP); medium dense to dense; fine to coarse grained SAND; fine to coarse GRAVEL with COBBLES and BOULDERS						
	30															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		3			1 2 3				S06	50/1.5		1305	Switch to HQ rock coring with 3 7/8-inch diamond bit UCS = 343 psi
2300																
	41	1		100	2	30		m 4 5							[7]	
	42				2			1 6		1: 60, J, N, Fe+Ch, Pa, Wa-Pl, SR 2: 70-90, J, VN, Fe, Pa, Wa, SR 3: 70, J/V, Vn, Qz, Pa, Wa, SR 4: 60, V, VN, Qz, Pa-Sp, Wa-Pl, SR 5: 40, J/V, N, Qz+Ch, Fi, Wa, ? 6: 40, J, VN, Ch, Pa-Su, Pl-Wa, SR						
2298															1328 1338	
	43				0											
	44				1											
2296																
	45	2		100		79		1		1: 40, J, VN, Ch, Fi, Pl, ?					[12]	

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

Log of Soil and Core Boring B-20

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 --TERTIARY to QUATERNARY INTRUSIVE BASALT--*(continued)*						UCS = 7517 psi
2294	46				2			3 4		2: 60, J/V, W (20mm), Ch, Fi, Wa, ? 3: 60, J, N, Ch, Sp, SR, ? 4: 70, J, VN, Ch, Sp, SR					1400	
	47									**TOTAL DEPTH = 47.0 FEET**						
	48															
2292	49															
	50															
2290	51															
	52															
2288	53															
	54															
2286	55															
	56															
2284	57															
	58															
2282	59															
	60															
2280	61															

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. Kozlowicz/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 --ALLUVIUM--						Start 10:00 8/23/2018 Trash barrel drilling to 3.5ft.
	1														
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			7			Switch to 5-inch rock bit at 5ft.
2328											S01	13	50		2 liners retained
	6											17			LL=52; PL=23 SA: G=6.1% S=42.4%; F=51.5%
	7														
2326															
	8								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
	9														
2324															
	10											2			
											S02	3	33		
	11											4			
2322															
	12														
	13														

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

Log of Soil and Core Boring B-201

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing	Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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 --ALLUVIUM-- *(continued)*						
2320	13.5														
	14														
	15								Becomes 100% high plasticity FINES; with trace organic material (rodent bone) and black laminations			3			
2318	15.5										S03	7	89		3 liners retained
	16											5			LL=64; PL=26 SA: S=14%; SILT=36.6% CLAY=43.4%
	17														
2316	17.5														
	18														
	19								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						
2314	19.5														
	20											7			
	20.5										S04	10	33		Possible slough
	21											16			
2312	21.5														
	22								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 --RIVER ALLUVIUM--						Rig chatter Some water loss Basalt fragments in cuttings 22-23ft.
	23				NA						S05	50	50		Advance 5-inch casing to 23ft.
2310	23.5	1	1	70		NA	NR							1231 [4] 1248	Switch to HQ coring with 4-inch #2 diamond bit at 23.5ft.
	24				NA										
2308	24.5	2		90		NA	NR							1258 [4] 1314	
	25				NA										
	25.5	3		85	NA	NA	NR							1323 [7] 1341	High water take 25.5ft to 29.5 ft.
	26								Round to angular basaltic GRAVEL and COBBLES up to 5-inches; occasional brecciated tuff						
	27				NA										
2306	27.5	4		100	NA	NA								1349 [5] 1402	
	28				1										
	28.5	5		100		80		m 1	BASALT (see next page) 1: 25, J, VN, Fe, Su, Pl, SR 2: 25, J, W, Fe+Sd, Fi, Pl, R					1422 [4]	
	29														

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

Log of Soil and Core Boring B-201

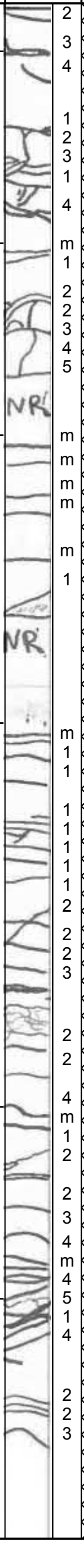
Sheet 3 of 4

ROCK CORE

Run No.	Box No.	Recovery, %	R Q D, %	Drill Time [Rate, ft/hr]
5	1	100	80	[4] 1436
6		100	40*	1459 [5] 1521
7		60	0	0830 [2] 0940
8		57	0	0958 [4] 1045
9	2	100	25*	1055 [4] 1154
10		100	20*	1206 [4] 1234
11		100	60*	1246 [8]

Depth, feet	Fractures per Foot
29	1
30	5
31	4
32	>6
33	NA
34	0
35	NA
36	NA
37	4
38	3
39	5
40	4
41	4
42	5
43	5
44	0
45	

Elevation, feet
2304
2302
2300
2298
2296
2294
2292
2290



MATERIAL DESCRIPTION

BASALT; moderate bluish grey; slightly weathered; moderately strong to very strong; highly fractured; fine grained; with CaCO3 filled vesicles and occasional green phenocrysts
--TERTIARY to QUATERNARY INTRUSIVE BASALT--

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

Becomes slightly to moderately weathered with brown staining along joints; intensely fractured

Becomes light bluish grey; moderately to highly weathered/altered; moderately strong; with 1/2-inch wide Calcite vein
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

Becomes highly to completely weathered, highly oxidized, yellowish brown

Brown, moderately weathered, moderately strong

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)

Becomes moderately to highly weathered, moderately strong to strong, fine grained matrix

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

Intensely fractured/broken, abundant oxidation

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

Becomes moderately strong
5: 20, J, ?, Fe, Su, Pl, R
Intensely fractured

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

Becomes bluish grey with brownish orange staining along fractures, strong, fine grained, with irregular Calcite filled vesicles and veins

FIELD NOTES AND TEST RESULTS

Less but continued water take

Caving borehole at 26 ft.

End of day 8/23/2018
Begin day 8/24/2018

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

Log of Soil and Core Boring B-201

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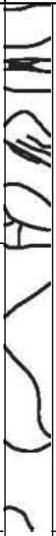

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
2288	45	11	2	100	4	60*	5 6 6 6		BASALT; bluish grey; slightly to locally moderately weathered; strong; highly fractured; fine grained with calcite filled vesicles; brownish orange oxidation along fractures --TERTIARY to QUATERNARY INTRUSIVE BASALT-- *(continued)*						
	46				4		7 8		5: 10-15, J, N, Fe, Su, Pl 6: 10, J, N-W, Fe, Su, Ir, VR 7: 80, J, N-MW, Fe+Ca, Su+Pa, Pl, SR 8: 55, J, N, Fe, Su, Pl, SR with 1-inch weathered rind					[8]	
	47				3		9 10 m		9: 20, V, N, Ca, Fi, Pl 10: 40, J, ?, Fe, Su, Pl-Ir, VR					1323	
2286	47.5	12		100		100			Becomes dark bluish grey, slightly weathered, very strong, with white, round to angular infilling, possible flow direction of ~60°					1332	
	48				1		1								
2284	49				1		2 m		1: 40, J, MW, Ca+Fe, Fi+Su, Pl, SR 2: 80-90, J, VN, Fe+Ca, Su+Pa, Pl-Ir, R 3: 60, J, N-MW, Fe+Ca, Su+Fi, Pl, R					[11]	
	50				NA		3							1349	
	50.5								**TOTAL DEPTH = 50.5 FEET**						
2282	51														
	52														
2280	53														
	54														
2278	55														
	56														
2276	57														
	58														
2274	59														
	60														
	61														

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 VWPs 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: Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	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--			
2332													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												Advance 4-inch casing to 9ft. Switch to rotary wash drilling with 3 7/8-inch tricone bit.
	9												
2324	10												
	11												
2322	12												
	13												

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

Log of Core Boring B-202

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	29	8	1	68	NA	NA					[6]	Increasing fluid loss.
	30						NR					
2306					NA						0814 1102	Advance 4-inch casing to 29.5ft.
	31											
		9		100	NA	NA					[8]	
	32											
					NA						1117 0934	Swivel breaks at 32.5ft; End of day 8/19/2018 Begin day 8/20/2018
2304	33											
		10		100	NA	NA					[7]	
	34											
					NA						0951 1002	
2302	35											Drill fluid becomes brownish grey.
		11		85	NA	NA					[4]	
	36											
					NA		NR				1031 1046	Some fluid loss.
	37											
2300					NA							
		12		12		NA					[7]	
	38						NR					
					NA							
	39										1108 1126	
					NA		NR					
2298		13		0		NA					[6]	
	40											
					NA						1142 1216	Switch to 4" carbonado bit at 40.5ft; pale brown, tuff-like material in bit
	41											
					NA							
2296	42											
					NA							
	43	14		8		NA	NR				[13]	Drill fluid becomes light grey
					NA							
2294	44											
					NA							
	45											

MATERIAL DESCRIPTION

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)*

Becomes round to angular COBBLES up to 4-inches, abundant fine GRAVEL, coarse grained SAND, with some brown, no plasticity FINES

With basalt and very strong brecciated tuff COBBLES

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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Number	Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	45	14		8	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	
			2				m					
2292	46	15		65	NA	0					[8]	
	47				NA		m				1307 1321	
	48						1		1: 15, J, N, No, No, Pl, R-VR (likely mechanical)			
					0		m		Becomes pale greenish grey, weak to locally extremely weak, highly weathered, increased percentage of clasts in a fine grained matrix			Minor fluid loss.
2290	49	16		100	0	0	m				[7]	
	50				0		m 1				1347 1403	
2288	51				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)			
	52				0		3					
2286	53	17		100	0	0					[10]	
	54				0				With green, clayey clasts elongated vertically			
	55						1					
					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
2284	56				0							
	57				NA		1 m		Increasingly cohesive, extremely weak, highly to completely weathered, with smaller clasts			
2282	58	18		44	NA	0			1: 55, J, VN-N, No, No, Pl		[14]	
	59				NA							
2280	60				1		m m 1		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											

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

Log of Core Boring B-202

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	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	63	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]	
	64				NA		1 m m m	1: 0, J, MW, No, No, Pl/Ir, R (mechanical)			
2276	65				NA		NR m m	Weaker zone		1400 1412	
	66	20		100	0	0		Becomes highly to completely weathered; increased clast size and percentage, larger subrounded basaltic clasts		[9]	
2274	67				0						
	68	21		100	0	0	m	With subangular clasts		1429 1442	
2272	69				0			1 to 2-inch thick, planar green clast		[7]	
	70	22		100	0	0	m	Becomes very light bluish grey, with basaltic clasts up to 1.5-inch and filled vesicles Planar green clast		1505 1517	0.1' of Run 20 recovered with Run 21
	71				0		1				
2270	72		4		0						
	73				0			1: 50-60, J, VN, No, No, Pl, SR (mechanical) 2: 5, J, VN, No, No, Pl, SR (mechanical)		[7]	
2268	74				0			Planar green clast			
	75				0		2 m m m			1600 0722	End of day 8/21/2018 Begin day 8/22/2018
2266	76	23		100	0	0		Becomes light greenish grey; decreasing percentage of clasts		[8]	0.2' of Run 20 recovered with Run 21
	77										

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

Log of Core Boring B-202

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Elevation, feet	Depth, feet	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --*(continued)*			
	78	23		100		0				[8]	
					0		m				
2264	79							With increased clast size and percentage; matrix is extremely weak matrix with strong basaltic clasts and decomposed green clasts			
					0		1	1: 0-5, J, N, No, No, Pl, SR (mechanical)			
	80										
					0		m m			0802 0817	
	81						m				
2262					0		m				UCS 82.0-82.8 = 614 psi
	82						m	With stronger matrix			Top of Run 24 mechanically broke when transferring to core box
					0						
	83	24		100		0				[10]	
2260					0						
	84		5								
					0		m				
	85										
					0		m			0847 0900	
2258	86							With weaker matrix			
					0						
	87										
					1		1	1: 30, J/V, N-MW, Ca, Fi, Pl, SR-R (vuggy with Calcite crystals)			
2256	88	25		100		6				[30]	
					0		m				
	89										
					0			2: 10-40, Contact, rough 3: 55, J, N?, Ca?, Pa, Pl, SR-S			
	90						2 3	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			
2254					1		m			0910 0923	
	91						m	Becomes dark reddish brown			
					0						
	92	26		86		86				[19]	
					0		m				
2252	93										

Log of Core Boring B-202

Elevation, feet	Depth, feet	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	93		5		2		1			
	94	26		86	NA	86	2 2 m		[19]	
2250	95				NA		m		0939	
			6						0955	
	96	27		100	NA	100	1 m 2 m 1		[8] 1003 1017	
	97				0					
2248	98	28		93	0	86			[13]	
	99				0					
2246	100				NA					
					NA				1035	
	101									
2244	102									
	103									
2242	104									
	105									
	106									
2240	107									
	108									
	109									

MATERIAL DESCRIPTION

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
--TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated) --*(continued)*

With trace gravel

1: 40, J, N, Cl, Fi, Pl, ?
2: 20-30, J, N-W, Cl + Gravel, Pa-No, Ir-Pl, R

Without gravel; increasing strength

1: 10, J/V, N-MW, H+Cl, Fi, Pl, ?
2: 70, J, ?, No, No, Pl. ? (mechanical)

1: 40, J, W, Cl+Sd, Pa, Pl, R

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.

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

Log of Soil and Core Boring B-203

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Date(s) Drilled	**1/8/2019-1/11/2019**	Logged By	**P. Respess**	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**

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

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

Log of Soil and Core Boring B-203

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Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES: Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	13		1					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
					NA										
	14														
					NA										
2290		4		0		0								[16]	
	15														
					NA										
	16														
					NA		M							1423 1443	Change HQ drill bit to increase recovery
2288	17														
					NA										
	18														Blue-green clayey cuttings
					NA										
2286	19	5		20		0								[75]	
					NA										
	20														
					NA		M M								
2284	21						M	Broken							
					NA		M	Becomes slightly weathered; moderately strong; slightly fractured						1447 1455	
	22														
					0										
2282	23	6		100		0	M							[30]	
					0		M								
	24						M							1500 1503	
					0										
2280	25	7		100	0	0								[38]	
	26								PT#1 26.5'-46.5'						
					0		M M	Moderately weathered; weak	▨					1507 1510	
2278	27						M,M		▨						
		8		100	0	0			▨					[38]	
	28								▨						
					0				▨						
2276	29						M		▨						

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

Log of Soil and Core Boring B-203

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	45		2		NA		M	BASALT; grayish red purple (5RP4/2); highly weathered; very to extremely weak; slightly fractured; mechanically broken to 47.8' --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*	PT #2 45'-65.5'						
	46	11		92		0									
					NA		M							1558 1020	End of day 1/9/2019 Begin day 1/10/2019
2258	47		3												
					NA		M								
	48							VOLCANICLASTIC BRECCIA; dark greenish gray to greenish gray (5G4/1-6/1); slightly weathered; weak; slightly fractured; angular clasts up to 1/4"-1"; abundant calcite inclusions and veinlets							
		12		100	0	73	M							[40]	
2256	49						M								
					1		1	Becomes moderately fractured 1: 30°, J/V, VN-N, Ca, Pa, Ir-Wa, SR							
	50							Mechanically broken							50% WCR
					NA		M	BASALT; medium bluish gray (5B5/1) to dark gray (N3); slightly weathered; moderately strong; abundant calcite inclusions						1026 1033	
2254	51														
					0		M								
	52														
					0										
2252	53	13		96		96								[33]	
					1		1	1: 70°, J, N, Cl, Fi, Pl-Wa							
							M								
	54														
					0		M								
2250	55														
					NA		1 2 3	Becomes dark gray (N3); highly to moderately fractured 1: 70°, J, VN, No, No, Pl-Wa, SR 2: 35°, J, VN, No, No, Pl-Wa, SR 3: 60°, J, N, Ca, Pa, Pl-Wa, SR 4: 50°, J, VN, No, No, Pl-Wa, SR 5: 20°, J, VN, No, No, Pl-Wa, SR						1042 1051	
	56														
					2		4								
2248	57														
					1		5								
	58	14		100		86								[43]	0% WCR
					0										
2246	59														
					1										
							6 M M	6: 30°, J, VN-N, Ca (Ch?), Pa, Pl-Wa, SR							
	60						M,M	Overdrilled							
					NA		M							1058 1108	
2244		15	4	100		100	M,M								
	61														

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	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	61–62	15	4	100	1	100	1	VOLCANICLASTIC BRECCIA; dark greenish gray to greenish gray (5G4/1-6/1); slightly weathered; moderately strong, angular clasts up to 1/4"-2"; hihgly to moderately fractured; abundant calcite inclusions and veinlets --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*						[25]	Continued 0% WCR
2242	62–63				0		M M	1: 40°, J, N, Ca, Pa, Ir-St, SR-R						1114	
	63–64	16		80	1	80	1							1120	
2240	64–65				1		1 M	1: 35°, J, VN-N, No, No, Pl-Wa, SR						[38]	
	65–65.5				NA		NR		PT#3 65.5'-85.5'					1124	
	65.5–66	17		100	NA	100	M 1,M							1306	
2238	66–67				0			1: 60°, J, VN-N, No, No, Wa, SR							
	67–68				1		2	BASALT; dark gray (N3); slightly weathered; moderately strong; highly to locally intensely fractured; abundant calcite inclusions						[38]	
2236	68–69				1		3 M	2: 60°, J, VN, No, No, Wa, SR 3: 70°, J, N-MW, Ca, Pa, Wa, SR							
	69–70				1		4								
	70–70.5				NA		M	4: 70°, J/Sh, VN, Ca, Pa, Pl-Wa, S-Slk Mechanically broken						1314	
2234	70.5–71	18		100	NA	92	1,2							1321	
	71–72				1		M 3 M	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	72–73				2		4 4							[50]	
	73–74				0		M								
2230	74–75				1		5 M	Becomes medium dark gray (N4)							
	75–75.5				2		M 5 M	Becomes dark gray (N3)						1327	
	75.5–76	19	5	100	2	76	1	1: 80°, J, N, Ca, Sp, Pl-Wa, S-SR						1332	
2228	76–77				NA		2 M	2: 50°, J, VN, Ca, Sp, Pl-Wa, S-SR 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	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
		ROCK CORE								SOIL SAMPLES					
	77	19	5	100	6	76	M 3 4	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				3		5 M 6	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						[60]	
2226	79				3		7 8	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							
	80				5		M 9 10 M	Weak; mechanically broken						1337 1342	
2224	81	20		100	3	90	1 2 M 3	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							
	82				0										
2222	83				3		3 4 3	4: 25°, J, N, Ca, Sp, Pl-Wa, SR						[60]	
	84				2		M		PT#4 85.5'-105.5'						
2220	85				NA		M	Mechanically broken						1347 1454	
	86	21		100	NA	50		Weak; intensely fractured with slickensides (shear zone)							
2218	87				3		1								
	88				7		2 M 3 4 3	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]	
2216	89				6		5 2 3								
	90				2		M 1							1504 1510	
2214	91	22	6	100	5	86	2 2 2 2 2 2	1: 60°, J, N, Ca, Sp, Pl-Wa, S-SR 2: 35°-45°, J, VN-N, Ca, Sp, Pl-Wa, S-SR						[38]	
	92				1										
2212	93														

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	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	93		6				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) --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*							Continued 0% WCR
					2		M								
	94	22		100	2	86	3,M	3: 70°, J, VN-N No, No, Wa-Ir, SR						[38]	
2210	95														
					0		M							1518 1524	
	96						1	1: 40°, J, VN-N, No, No, Pl-Wa, S-SR							
					2		1	Becomes mottled very dusky purple (5RP2/2) and grayish blue green (5BG5/2)							
2208	97						M M	Mechanically broken							
					1		1								
	98	23		100		94	1 M							[33]	
					1		M								
2206	99						M M								
					1		2	2: 50°, J, N, No, No, Wa, SR							
	100						M M	Mechanically broken							
					1		1							1533 1539	
2204	101						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							
					2		3								
	102						M	Mechanically broken							
					NA										
2202	103	24		62		28								[33]	
					NA										
	104						M 4,4 5	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	PT#5 105'-120'						
					4		4,4	PORPHORYTIC 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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*							
2200	105						6								
					2		M							1548 1011	End of day 1/10/2019 Begin day 1/11/2019
			7												
	106						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							
					2		2								
2198	107														
					1		3								
		25		78		71								[25]	
	108							Becomes slightly fractured							
					0		M								
2196	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 8 of 8

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	Packer Test Intervals	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	109	25	7	78	NA	71		PORPHORYTIC 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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*	▨						Faster drilling 109'-110' Continued 0% WCR
	110						M		▨					1022 1029	
					0				▨						
2194	111				0		M		▨						
	112	26		80	0	100	M		▨					[30]	
2192							M M	Becomes very dark red (5R2/6)	▨						
	113				NA			Highly weathered; very to extremely weak; crushed	▨						Faster drilling 113'-117'
	114				NA			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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*	▨						
2190	115				NA		M M		▨					1039 1047	
	116				0		M M,M M	Becomes moderately strong	▨						
2188	117	27		92	1	76	M,M M M,M 1,M	Becomes very dusky purple (5RP2/2) 1: 25°, J?, VN, No, No, Pl, S	▨					[14]	Slower drilling to TD
	118				0		M,M M M M,M		▨						
2186	119				0		M,M M		▨						
	120							**TOTAL DEPTH = 120.0 FEET**						1109	
2184	121														
	122														
2182	123														
	124														
2180	125														

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. Respess**
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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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								Boulder (fragments)						
	2								Boulder (fragments)						
2356	3														
	4														
2354	5											9			One liner retained (5.8-6.3ft.)
	6										S01	22 29	87		
2352	7														
	8								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	9								At 9ft.: becomes moist						
	10								With gravel up to 2.5-inches			19			One liner retained (11-11.5ft.) LL=61; PL=22 SA: G=38.4% S=25.7%; F=34.9%
2348	11								GRAVELLY FAT CLAY (CH); hard; dark brown (7.5 YR 3/2); 65% high plasticity FINES; 35% subangular GRAVEL to 1-inch; moist; cohesive		S02	14 21	100		
	12														
2346	13														

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

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
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.
			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	
	20							m m							
		1		52	NA	NA								[17]	
2338	21														
					NA		NR		▼						
	22													1415 1438	
					0										
2336	23								Becomes medium bluish grey (5B 5/1); moderately weathered; weak to very weak; massive						
					0										
	24	2		100	0	34*		m	Becomes highly weathered; very weak					[75]	*Rock does not meet soundness criteria for RQD calculation
2334	25				0				Light olive grey (5Y 5/2)						
	26				0			m							
2332	27				0									1442 1452	
	28	3		100	0	0									
					0										
2330	29														

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 3 of 5

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
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		2		0										
2328	31				0									1455	
	32				0									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	4		100	2	0	1 2 1							[75]	
2324	35				2		1								
	36				4		1 2 1 1							1509	
2322	37				0									1518	
	38				0		m								
2320	39	5	3	100	0	0	m m		Broken while placing in box					[75]	
	40				0										
2318	41				0									1522	
	42				0				With clasts up to 3/4-inch					1528	
2316	43				0										
	44	6		100	0	0	m		Completely weathered to clay; extremely weak					[60]	
2314	45														

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

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
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				5		1 2 3	Fractured zone with iron and manganese staining						
2310	49	7	4	100	3	0		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	1: 10, J, T, No, No, Wa, SR (contact between weathering zones) Becomes completely weathered; extremely weak; clayey					[42]	
	54				NA		NR							Soft zone plugged bit during Run 8
2304	55				0		1 m	Becomes highly weathered; very weak					1559 1626	
	56	9		100	0	0		1: 35, J, N, No, No, Pl, S					[12]	
2302	57				NA		m NR 1 2 1	Becomes moderately weathered; weak; intenselt fractured with calcite precipitation					1637 1650	
	58				3		3 4 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						
2300	59	10	5	96	5	20*	5 6	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]	
	60				2		5 5							
2298	61													

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

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Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
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)*					1659	
	62									7: 45, J, N, Ca, Sp, Pl, SR **TOTAL DEPTH = 62.0 FEET**						
2296	63															
	64															
2294	65															
	66															
2292	67															
	68															
2290	69															
	70															
2288	71															
	72															
2286	73															
	74															
2284	75															
	76															
2282	77															

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. Kozlowicz/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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	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) --ALLUVIUM--			Trash barrel to 10ft.
2336												
	1											
	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											
	12											
2326												
	13											

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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	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)*			
	14												
2324													
	15									Weathered light yellow and greenish brown tuff fragments in cuttings			
	16												
2322	17												
	18												
2320	19												
	20		1		NA					Basalt and volcanic tuff fragments in cuttings		1222	Begin HQ rock core at 20ft. with 4-inch carbonado bit.
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					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--			
	23				NA		NR					1305 1340	Switch to 4-inch #13 diamond coring bit at 23 ft.
2316	24	2		70	5	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				3			1,2 3,4 5 3		Without weathering rings		1416 1442	Reviewer note: All healed veins and fractures were mechanically broken by core handling.
2314	26				3			7 3 3		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	4	100		6 4 m 7				[4]	
2312	28				5			8 9 10					
	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

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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		1 2 3 4 4 4		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	
2310	30				2		4		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			
	31	4		96	5	90	4 5 4 6				[11]	
	32				1		4 4		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		4 7					
	34				5		1 2 3 2 2		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, ?		1627 0750	End of day 8/14/2018 Begin day 8/15/2018
2306	35				4		4 5 6		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)			Drill fluid becomes light grey greenish grey at 35ft.
	36	5	2	100	3	80	6 2				[8]	
2304	37				3		2 7		With wider fractures with more infilling 7: 70, J, VN-MW, H+Ca, Fi, Pl, ?			
	38				5		2,8 2 9 m		8: 5, J, N, Ca, Fi, Pl, ? 9: 80, J, ?, Ca+Mn, Sp, Pl, ?			
	39				>6		1 2 m		1: 25, J, N, Ca, Pa, Pl, SR 2: 70-80, J, Mn, Sp, St/Ir, R Crushed; likely mechanical		0829 0853	
2302	40	6		83	4	52	3		3: 40, J, T-VN, Ca?, Sp, Pl, SR		[6]	
	41				3		3 4		4: 60, J, No, No, Pl, S-SR 5: 60, J/Sh, MW, CR+Sd+Ca, Fi, Pl, SR			
2300	42	7		100	>6	0	m 1 2 m		Becomes intensely fractured 1: 50, J, Ca?, Sp, Ir, R 2: 80, J, VN, H+Uk, Fi, Wa, ?		0925 0932 [1]	Lost all circulation at 42.5 ft.
	43				>6		m 1 4,2 2 3		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	44	8		100	>6	40	2 2 3 2 2				[5]	
	45										1053	

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
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Elevation, feet	Depth, feet	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	45	9	2	100	>6	50	2 5 1 1 2		1107	
2296	46				>6		3 3 3 1 4			
	47		3		6		5 5 1 6		[7]	47.4-48.7ft.: Mohs Hardness = 3-4; UCS = 20,886 psi
	48				1		7			
2294	49				1		7		1148	
	50	10		100	1	100	m 1		1159	
2292	51				1		2 2			
	52				0				[12]	
2290	53				1		3			
	54				1		4 m m m		1224	
	55	11		83	1	50	m 1		1239	
2288	56				3		2 3 3		[10]	
	57				4		4 5 m		1254	
	57.5	12		100		100	1 5 m		1306	
2286	58				2		2		[14]	
	59				2		3 m		1317	
2284	60	13	4	98	0	90			1332 [11]	
	61									

MATERIAL DESCRIPTION

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)*--

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, ?

Becomes moderately fractured; with healed fractures

6: 60, J, N, Fe+Ca, Pa, Pl, ?
7: 40, J, N, H+Uk, Fi, Pl, ?

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

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, ?

Becomes highly fractured

4: 20, J, VN, Ca?, Pa, Pl, SR
5: 85, J, VN, Ca/Ch?, Pa, Pl, SR

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

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

Log of Core Boring B-206

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Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Lithology	MATERIAL DESCRIPTION	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	61–65	13	4	98	1 2 2 2	100	BASALT	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)*-- 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, ?	[11] 1359	
2282	63									
2280	65–67.5	14		100	2 1 4	100	BASALT	1: 55, J, N, Ca?, Su, Ir, ? 2: 45, J, VN, Ca, Sp, Pl, SR 3: 45, J, VN, Ca, Pa, Pl, SR (67) With small, calcite infilled vesicles oriented at 30 degrees	1411 [7] 1434	65.2-66.5: Mohs Hardness = 3-4; UCS = 15,739 psi
2278	67.5–70	15		100	2 1	100	BASALT	(68) 1-inch diameter calcite nodule 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 (69) Becomes slightly fractured	1454 [9] 1510	
2276	70									
2274	70–75	16	5 (from ~73.6)	96	0 0 1 4 0	96	BASALT to 73.9; VOLCANIC BRECCIA below	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, ? 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) 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)--	1524 [9] 1556	
2272	74.6									
	75–77	17		100	3 4	100*	VOLCANIC BRECCIA	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, ?	0727 [7]	End of day 8/15/2018 Begin day 8/16/2018 *Rock does not meet soundness criteria for RQD calculation
2270	77									

Packer Test Intervals: none

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

Project: Klamath River Renewal Project
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Elevation, feet	Depth, feet	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Number	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
	77	17	5	100	3	100*	m 4 4	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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*		[7]	
	78				3		5 6	4: 50-60, J, VN-T, Ca?, Fi, Pl, ? 5: 70, V, MW, Uk, Fi, Pl, ? With planar, 70° fabric			
2268	79				2		m m m m	6: 70, J, VN, Ca, Pa, Pl, SR Becomes highly weathered/altered; weak to very weak; locally crushed			
	80	18			4		1 1	1: 30, J, VN, No, No, Pl, ? (possibly mechanical)		0810 0825	Packer test #2 from 75.0 to 85.0
2266	81				NA						
	82			46	NA	16				[9]	
2264	83				2		2 m	Becomes slightly weathered; moderately strong to strong; with light bluish grey and dark grey clasts 1/8-inch to 1-inch 2: 60, J, N, No, No, Pl, R			
	84				NA			Weak rock in shoe			
	85	19			0		m 1	Becomes moderately weathered; moderately strong; medium to coarse grained matrix with strong black and grey clasts and soft clayey green clasts		0858 0923	
2262	86			92	3	91*	2 m 2	1: 40, J, VN-T, No, No, Ir, ? 2: 60, J, N-VN, H+Ca, Fi-Pa, Pl, SR		[5]	
	87	20			1		m 1	1: 30-40, J, VN-N, Ca, Pa, Pl, SR 2: 10, J, ?, No, No, Pl, R		0951 1050	Switch to 4-inch carbonado bit
2260	88		6	88	3	75*	1 1 2	With more abundant soft, green clasts		[8]	
	89				NA		m	With decreasing clast size			
2258	90	21			0		m m	Becomes locally moderately strong to strong; moderately to locally highly weathered/altered; intensely fractured		1110 1123	Packer test #1 from 85.0 to 95.0
	91				2		1 1 1 1 1	With fewer breccia clasts			
	92			100	2	75*	2 1 1 3	1: 0-10, J, VN, No, No, Pl-Ir, ? (possibly mechanical) 2: 25, J, Vn, Mn?, Fi, Pl, ? (surface staining around joint) 3: 0, J, VN, Mn?, Su, St-Pl, ? (surface staining around joint)		[7]	
	93										

Project: Klamath River Renewal Project
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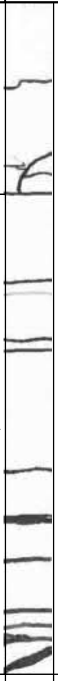

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	Packer Test Intervals	Drill Time, 24-hr [Drill Rate, ft/hr]	FIELD NOTES AND OTHER TESTS
2256	93		6		1			△ △	VOLCANIC BRECCIA; greenish grey with grey and black clasts; moderately to highly weathered; moderately strong; moderately fractured; medium to coarse grained matrix with angular clasts up to 1/2-inch --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--*(continued)*			
	94	21		100		75*	3	△ △			[7]	
					0		m m m	△ △	At 94.3ft.: becomes browish grey; weak to moderately strong			
	95							△ △	With 45° fabric		1208 1215	
2254					1			△ △				
	96						1	△ △				
					3		1 1	△ △	Becomes slightly weathered; strong to moderately strong; with enlongated inclusions along fabric			
	97							△ △	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*	m	△ △			[7]	
	98							△ △				
					2		2 1	△ △	Becomes very light bluish grey; moderately strong; matrix supported			
	99							△ △				
					3		1 m m 3	△ △	Becomes brownish grey; fewer clasts			
2250	100								**TOTAL DEPTH = 100.0 FEET** **Televiewer and caliper survey by NorCal Geophysics 8/16/2018.** **Install two VWPs at 25ft and 92ft with neat cement grout to ground surface with 12" flush mount monument.**		1300	
	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. Kozlowicz**	Checked By	**P. Respess**
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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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														
2356	3														
	4														
2354	5								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--		S-01	9 7 2	100		
	6														
2352	7														
	8														
2350	9														
	10								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--		S-02	8 10 8	100		One liner retained (11.0-11.5ft.)
2348	11														
	12														
2346	13														

Project: Klamath River Renewal Project
Project Location: Copco and Iron Gate Reservoirs
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Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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		NA		1 2	△ △	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	2	61		△ △						[20]	
2342	17				1		3	△ △						1405 1411	
	18				>6		1 2 3	△ △	Becomes light yellowish brown (10YR 6/4), highly waethered, weak, locally crushed						
2340	19	2		100	>6	26	3 3	△ △	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]	
	20				4		4 3	△ △	With clasts weathering out of matrix						
2338	21				2		3	△ △							0.3ft. of Run 2 recovered with Run 3; HQ inner barrel stuck in rods after Run 2 pull rods to retrieve.
	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	
2336	23				2		1	△ △	▼						
	24	3		96	4	0	2	△ △	With fracturing along clast boundaries					[20]	
2334	25				>6		2 3	△ △							
	26				NA		3 3 4 3	△ △	Completely weathered, extremely weak						
2332	27				0			△ △	Becomes moderately weathered, moderately strong					1533 1541	
	28	4		100	>6	46*	1 2 3	△ △	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						
2330	29														

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

Log of Soil and Core Boring B-207

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Elevation, feet	Depth, feet	Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	29		1				3	△ △	VOLCANIC BRECCIA; light yellowish brown (10YR 6/4); moderately weathered; moderately strong; locally crushed; highly fractured --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*						
		4		100	>6	46*	4 3 5	△ △						[18]	
	30				0			△ △							
2328	31		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						
					2		6	△ △							
	32				>6		1 2 1	△ △	Becomes highly weathered, weak, intensely fractured					1558 1605	
2326	33				>6		3 4 3	△ △	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						
	34	5		100	>6	0	3	△ △						[16]	
2324	35				>6		5 5 6	△ △	Highly to completely weathered						Lost all circulation at 35.0ft.
	36							△ △						1622	
		6		67	NA	0		△ △						1637 [5] 1644	
2322	37				>6		1 2 3	△ △	Highly to completely weathered, crushed Becomes moderately weathered, moderately strong					0859	End of day 9/13/2018 Begin day 9/14/2018
	38				2		1	△ △							Driller noted 'harder' drilling conditions
2320	39	7		56	NA	10	3 3 4	△ △	Becomes completely weathered to a CLAYEY SAND, extremely weak					[23]	
	40				NA			△ △							
2318	41				NA			△ △							
	42				NA			△ △						0912 1203	1500 gallons of water used in Run 7
2316	43				NA			△ △							Advance 4-inch casing to 29ft.
	44	8		40	NA	0		△ △						[19]	
2314	45														

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

Log of Soil and Core Boring B-207

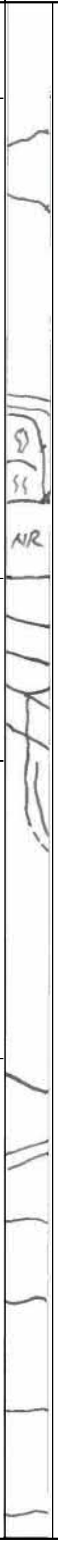
Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	45	8	2	40	>6	0		△ △	VOLCANIC BRECCIA; light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

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*					1401	
	62	12	4	82	1	52	1						0840	End of day 9/14/2018 Begin day 9/18/2018 B. Kozlowicz logging Water level at 28.8 ft. 9/18/2018
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								[10]	50% fluid circulation
2294	65				4		2 2 3	Becomes moderately weathered, weak to very weak along fracture zones with irregular, subvertical anastomosing calcite veins and small, angular clasts						
	66				NA			Extremely weak, completely weathered/altered to a CLAYEY SAND					0909	
2292	67	13		94	2	47	1 1	Becomes highly fractured with clasts up to 2.5 inches					0919	
	68				NA		1 2	1: 30, J, VN, No, No, Pl, R 2: 80-90, J, N, No, No, Pl, SR with very weak, friable zone along fracture					[9] 0932	
2290	69	14		100	2	74	1	Becomes slightly fractured, strong					0955	
	70				0			1: 80-90, J, N, No, No, Pl, SR-R					[10]	
2288	71				0								1013	
	72	15		100	2	88	1	Very strong, dark gray basalt with calcite					1032	
2286	73				2		1 2	Very strong, dark gray porphyritic basalt						
	74				0		m						[9]	
2284	75				0		m	1: 45, J, VN, No, No, Pl, R (possibly mechanical) 2: 10, J, VN, No, No, Ir, SR-R						
	76				0		m							
2282	77												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 m	△ △	1: 75-90. V, MW, H+Ca, Fi, Ir-St, ? 2: 40, J, VN, No, No, Pl, SR-R (possibly mechanical)						
2280	79	16		100	2	85		2	△ △						[14]	
	80				0			2	△ △	Very strong, dark grey porphyritic basalt						
2278	81								△ △	**TOTAL DEPTH = 81.1 FEET**					1146	
	82															
2276	83															
	84															
2274	85															
	86															
2272	87															
	88															
2270	89															
	90															
2268	91															
	92															
2266	93															

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

Log of Soil and Core Boring B-208

Sheet 1 of 6

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**

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
2338	0								CLAYEY SAND with GRAVEL (SC); loose to medium dense; dark brown (10YR 3/3); 40% low plasticity FINES; 40% fine to coarse grained SAND; 20% angular to subrounded GRAVEL and COBBLES up to 3 inches; dry --ALLUVIUM--						Start 15:50 9/18/2018 with Hollow Stem Auger; B. Kozlowicz logging
	1														
2336	2														
	3														
2334	4														
	5														
2332	6														
	7								SANDY LEAN CLAY (CL); very stiff; 70% medium plasticity FINES; 30% fine to medium grained SAND; trace small GRAVEL; moist --ALLUVIUM--						
2330	8														
	9														
2328	10										S-01	16 11 16	20		
	11														
2326	12								∇						
	13														

Log of Soil and Core Boring B-208

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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										S-02	6 6 8	33		
2322	16								SANDY LEAN CLAY with GRAVEL (CL); medium still; with rounded to subangular GRAVEL; wet						
	17														Rig chatter
									GRAVEL and COBBLES with SANDY LEAN CLAY/CLAYEY SAND; washed, rounded COBBLES and BOULDERS (fragments) up to 6 inches --RIVER ALLUVIUM--						
2320	18														
	19														
2318	20	1	1	100	NA	NA	NR				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
	21	2		32	NA	NA								1143	
2316	22				NA		NR								Begin Day 9/19/2018; T. VandeVoorde logging; 0% fluid return
	23				NA									[18]	
2314	24				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.
	25				NA									1200	
2312	26	3		100	NA	NA								1302 [26]	
	27				NA									1306	
2310	28	4		15	NA	NA	NR							1311	
	29														

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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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						Angular coarse grained SAND recovered from cuttings possibly from no recovery zones
	31				NA									1314 1316	Cuttings bagged for review
2306	32				NA										Driller notes sandy loose drilling conditions
	33	5		14	NA	NA	NR							[100]	
2304	34				NA				COBBLES become angular to rounded						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	6		0	NA	NA	NR							[33]	Cuttings bagged for review
	39				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	40				NA										
	41				NA									1544 1615	
2296	42				NA		NR								
	43	7		34	NA	NA								[27]	
2294	44				NA				With rounded, basaltic COBBLES; angular, vesicular basaltic GRAVEL; some medium to coarse grained SAND						
	45														

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

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing	Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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	8		56	NA	NA			With more rounded COBBLES and BOULDERS; variable volcanic lithologies of basaltic, andesite, and tuff					[13]	
	49				NA										Drilling fluid becomes dark brown
2288	50				NA										
	51	9		0	NA	NA	NR							1727 1737 [6] 1744 1748	
2286	52				NA		NR								
	53	10		84	NA	0		m m m m	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]	
2284	54				NA									1803 0931	Advance 4.5-inch casing to 54ft.
	55	11		17	NA	0	NR		Strong, volcanic breccia clast in shoe					[7] 0941	End of day 9/19/2018 Begin day 9/20/2018
2282	56		2		NA									0949	
	57	12		0	NA	0	NR							[7]	
2280	58	13		50	NA	0	NR		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	
	59				NA		NR				S-04 S-05	31 50/3" 70/2"	44 100	1128	Switch to new #2 diamond bit at 59ft.
2278	60	14		73	NA	0		m m m						[7] 1141	
	61														

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 5 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, %		
	61	15	2	100	0	0		m	△ △	VOLCANIC BRECCIA; dark brown to dusky purple; moderately to highly weathered; extremely weak; fine grained, sandy matrix with basaltic breccia clasts --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--*(continued)*					1152	Continued 20-30% fluid return; hard drilling (1500psi down pressure)
-2276	62				0			m	△ △							
	63				0			m	△ △						[15]	
-2274	64				0			m	△ △						1208	
	65	16		100	0	0		m m m m m	△ △	With breccia clasts up to 1/2 inch; locally very weak					1236 [20] 1239	Switch to 4-inch drag bit at 65ft.
-2272	66	17		90	0	0			△ △	Becomes moderately weathered; moderately strong; locally extremely weak; moderately fractured					1225	
	67				0				△ △							
-2270	68				1			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 m?	△ △	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						Drilling fluid becomes brown/purple
-2268	70				0			3 2	△ △	Greenish grey to dark greenish grey					1302	
	71	18		100	0	0		1 2 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					1311	
-2266	72		3		0			3	△ △							
	73				2			4 5 5	△ △	With increasing number of breccia clasts					[38]	
-2264	74				0			6	△ △	Greenish grey						
	75				0			m m	△ △						1319	
-2262	76	19		86	>6	20		m m 1,1 1,1 2	△ △	Becomes highly to intensely fractured; matrix becomes clayey 1: 0-20, J, VN-W, No, No, Pl-Ir, SR 2: 60, V, VN, Ca, Fi, Pl, ?					1325	
	77															

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

		ROCK CORE									SOIL SAMPLES					
Elevation, feet	Depth, feet	Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing	Number	Lithology	MATERIAL DESCRIPTION	Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	77	19	3	86	3	20		1 3 4 4 m	△ △	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		NR		△ △	3: 65, J, VN, No, No, SR, Pl 4: 10, J, W, No, No, Ir, SR					1331	
	79	20		38	NA	0	NR		△ △	Becomes <10% clasts; 90% clayey matrix					1420 [22] 1423	
2258	80									**TOTAL DEPTH = 80.0 FEET**						
	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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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
2595											Advance 6-inch casing to 6 feet with hammer (hard/stiff at about 3.5 feet)
	5										
2590			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
	10						DIATOMITE; light olive brown (2.5Y 5/4); highly weathered; extremely weak; highly fractured; friable --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--				
2585			S03	7 6 6	80			99			
											End of day 16:45,Begin day 08:30 Advance 6-inch casing to 11 feet with hammer
	15										
2580											
	20										
2575			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%
	25										
2570											
							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
			S05	31 50/6"	60						
	30										

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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30	▮	S06	50/5"	100	⊠					
							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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0		S01	2 10 12	85	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%
						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 (Ql)--				Advance 6-inch casing to 3.8 feet with hammer
2595	5		S02	5 5 10	13	Black angular basalt cobble				
			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 (Ql)--				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%
						DIATOMITE with ELASTIC SILT; greenish gray (10Y 5/1); soft to extremely weak; highly fractured; friable --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--				
2580	20		S06	200 psi	100		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									

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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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 (Ql)--*(continued)*				
2565	35	☒	S08	200 to 500 psi	84			149			TX-ICU
2560	40										Cuttings become very dark gray
							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				
2555	45	◣	S09	3 3 4	100			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										
							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
		◫	S11	50/3"	100						
2535	65										

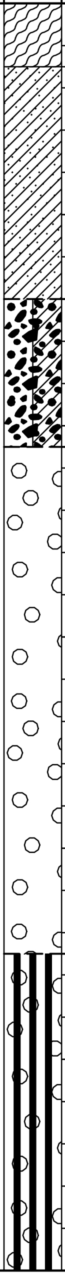
TOTAL DEPTH = 64.6 FEET

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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0					ORGANIC SILT WITH SAND (OL); very soft; very dark grayish brown (2.5Y 3/2) --RECENT LAKE SEDIMENT--				
			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--	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)
2580						Without gravel				
	5		S02	4 3 2	0.6		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 (Ql)--				Hard chattering drilling Switch to rock core bit with SPT sampler
2575			R1							
	10									
						DIATOMITE; light olive brown (2.5Y 5/3); very soft; locally clayey with vessicular basalt GRAVEL; bedding/fractures not present --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--				Faster drilling from 10.5 to 11.5 feet
			S03	6 3 2	0.1					
										Return fluid becomes olive
2570	15		R2							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 (Ql)--				
2560	25		S05	3 3 4	1.3		80	NP	100	LL=69; PL=59 SA: F=100%
2555	30									

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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30						DIATOMITE with ELASTIC SILT; dark grayish brown (2.5Y 4/2); massive/soft to very soft --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--*(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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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 (Ql)--*(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										

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. Kozlowicz**	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 Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						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--				6-inch casing settles to 1.5 feet
2595										44	SA: G=5%; S=51%; F=44%
		◣	S01	1 0 1	57		Becomes organic rich and softer/looser with increased nonplastic fines				Sampler advanced 1 foot on first blow and 2.5 feet on second blow
	5										Advance 6-inch casing to 5.5 feet with hammer
							CLAYEY SAND (SC); very loose; very dark brown (10YR 2/2); trace fine GRAVEL and coarse organics --RECENT LAKE SEDIMENT--				
2590										58	SA: G=3%; S=39%; F=58%
		◣	S02	2 3 3	100						Drove sampler for extra 6 inches (last three blowcounts reported)
	10										Advance 6-inch casing to 11 feet (resistance at 11 feet)
2585		◣	S03	4 11 18	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 (Ql)--			41	Advance 6-inch casing to 12.5 feet with hammer SA: G=9%; S=50%; F=41%
		☒	S04	400 psi	100			61 54			TX-ICU TX-ICU
	15										
2580											100 percent WCR
		☒	S05	400 psi	100			105			TX-ICU
	20										
2575							DIATOMITE with ELASTIC SILT; soft to completely weathered; light greenish gray (5GY 7/1) --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--				
		☒	S06	200 to 400 psi	100			155			TX-ICU
	25										Lost circulation to 27.5 feet
2570											
		◣	S07	2 3 5	90		Becomes mottled with very pale brown (10YR 8/3) and light greenish gray (5GY 7/1) with 10 degree bedding				Drove sampler for extra 6 inches (last three blowcounts reported) About 50% WCR
	30										

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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30						DIATOMITE with ELASTIC SILT; soft to completely weathered; light greenish grey (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 (Ql)--*(continued)*				
2565											
		☒	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											About 50% to 75% WCR
			S09	1 1 1	100		With vertical dark grey stained (Mn?) fractures				
	45										
2550											
	50										
2545											
		☒	S10	200 to 400 psi	100			154			TX-UU TX-ICU
	55										
2540											
	60						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 (Ql)--				
2535											
			S11	2 2 2							Final hammer blow advanced sampler 2-inches
	65										

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

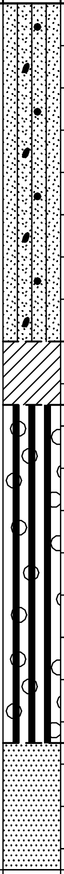
Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	65						DIATOMITE; highly to completely weathered; pale yellow to olive yellow (2.5Y 6/6 to 2.5Y 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 (Ql)--*(continued)*				
2530											
	70						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
2525											
			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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0					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
2600			S01	0 0 0	35					Advance 6-inch casing to 5 feet with hammer
	5									
2595										
			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
	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 (Ql)--				
2590										
	15		S04	200 to 400 psi	100	Becomes medium stiff to stiff with olive yellow (2.5Y 6/6) with angular clasts; friable	135 30			TX-ICU
2585										TX-ICU
						VOLCANIC SANDSTONE; yellowish brown(10YR 5/6); highly to completely weathered; very weak; locally clayey --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--				Harder drilling with yellowish to reddish brown rock chips in cuttings
	20		S05	32 50/5"						
						TOTAL DEPTH = 20.5 FEET				
2580										
	25									
2575										
	30									

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. Kozlowicz**	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 Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0					≋	--RECENT LAKE SEDIMENT--				Advance 6-inch casing to 5ft. with hammer from 2 to 5ft.
						▨	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--				
2575											
	5	◪	S01	5 9 14	100	▨					
						░	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
2570											
	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										

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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						--RECENT LAKE SEDIMENTS--				
2580			S01	0 0 0	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 --COLLUVIUM/RESIDUAL SOIL--				Sampler advanced 2ft. with weight of hammer Advance 6-inch casing to 2 ft.
			S02	5 7 8	67		← Wood/roots up to 1-inch in size	34	NP	65	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
	5										
2575											
			S03	2 5 4	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 --COLLUVIUM/RESIDUAL SOIL--				Angular diatomite gravel and wood fibers in cutting to about 13 ft. Advance 6-inch casing to 10 ft. with hammer
	10										
2570											
			S04	9 9 7	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 --COLLUVIUM/RESIDUAL SOIL--			8	SA: G=27%; S=65%; F=8%
	15		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										

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. Kozlowicz**	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**

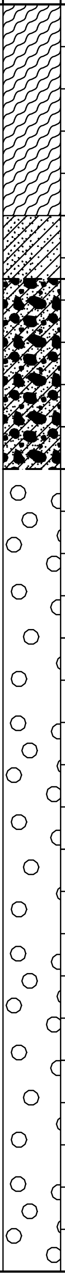
Elevation feet	Depth, feet	SAMPLES				Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
		Type	Number	Sampling Resistance	Recovery (feet)						
	0						ORGANIC SILT to ORGANIC CLAY (OL/OH); very soft; dark olive gray (5Y 3/2) with coarse organic debris				Advance 6-inch casing to 3 feet with hammer
2585							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
	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 --FLUVIO-LACUSTRINE TERRACE DEPOSIT WITH GRAVEL (Qtg)--				Very hard drilling with volcanic rock chips in cuttings; switched to 2 7/8-inch drag but Blow counts affected by large particles
2580											
			S02	22 29 37	47						
	10										
2575											
							TOTAL DEPTH = 11.5 FEET				
	15										
2570											
	20										
2565											
	25										
2560											
	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. Kozlowicz**	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**

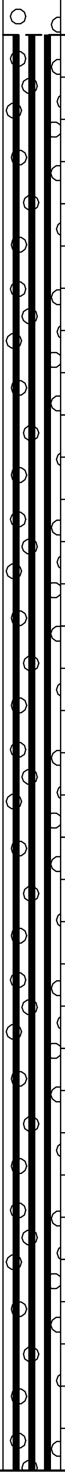


Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						ORGANIC SILT (OL); very soft; very dark brown (10YR 2/2) --RECENT LAKE SEDIMENT--				
2580											Sampler sank to 4ft.; drove sampler for extra 18 inches (last three blowcounts reported, previous blows were 2-2-7)
	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--				
			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
2575											
	10										
							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 (Ql)--				Fast smooth drilling with olive brown diatomite cuttings
2570											
	15										Advance 6-inch casing to 14ft. with hammer
2565											
			S03	3 4 5	80						
	20										
2560											
	25										
2555											
	30										

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 Type	Number	Sampling Resistance	Recovery (feet)	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30									
						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 (Ql)--				Cuttings become greenish gray
2550										
		◩	S04	2 4 4	0					
	35									
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									

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

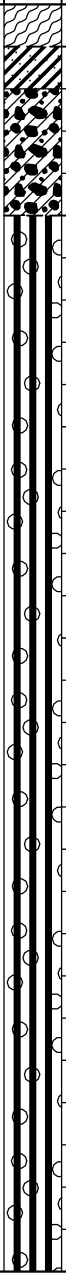
Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	65						DIATOMITE WITH ELASTIC SILT; olive gray (5Y 4/2) and greenish black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

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. Kozlowicz**	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**

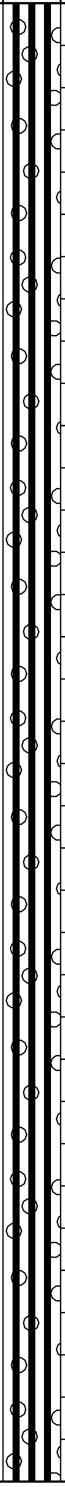


Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0		S01	0 0 0	50		--RECENT LAKE SEDIMENT--				Sampler advanced 2 feet under weight of hammer
2600							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)--				Set casing to 2 feet; hard driving at 2 feet (casing bouncing); switched to core bit
			R02		0						
	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											Advance 6-inch casing to 4.5 feet
			S03	9 9 7	67						
	10										
2590							Becomes greenish gray (10Y 5/1); extremely weak/soft				
			S04	3 3 4	80						
	15										
2585											
	20										
2580											
			S05	200 psi	74			80	21	100	TX-UU LL=74; PL=53 SA: F=100% TX-ICU
	25										
2575											
	30										

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

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

Log of Soil Boring BC-09

Sheet 3 of 3

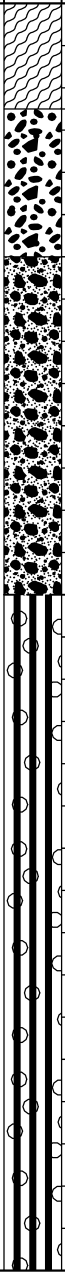
Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
2535	65						DIATOMITE with ELASTIC SILT; extremely weak/soft; greenish gray (10Y 5/1); trace fine grained SAND --LACUSTRINE DIATOMACEOUS DEPOSIT (Ql)--*(continued)*				
		☒	S09	200 to 400 psi	100			92 96			Consol TX-ICU TX-ICU
2530	70						**TOTAL DEPTH = 70.5 FEET**				
2525	75										
2520	80										
2515	85										
2510	90										
2505	95										
	100										

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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						--RECENT LAKE SEDIMENT--				Set 6-inch casing to 4 feet (very soft to 2.5 feet)
							--COLLUVIUM/RESIDUAL SOIL/SLOPE WASH--				
2575											
	5										
							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
2570											
	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											
							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
	15		S02	10 5 5	27						
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										

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

Log of Soil Boring BC-10

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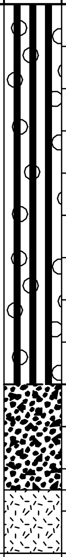


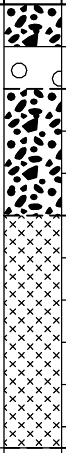
Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30					DIATOMITE with ELASTIC SILT; medium stiff/extremely weak; light olive brown (2.5Y 5/4) and olive brown (5Y 5/3); with 0.1 to 0.5 inch 10-degree bedding and some oxidation stains --LACUSTRINE DIATOMACEOUS TERRACE (Ql)--*(continued)*				
2545										
	35									
2540						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
	40		S05	200 to 400 psi	75					
			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						**TOTAL DEPTH = 43.0 FEET**				
	45									
2530										
	50									
2525										
	55									
2520										
	60									
2515										
	65									

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. Kozlowicz**	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 Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						ROAD BASE				Start 10/18/2018 with hollow stem auger
							DIATOMITE; pale yellow (2.5Y 7/3); moderately weathered; with occasional subvertical fractures and trace small rootlets --QUATERNARY DIATOMITE (Qd)--				
2615							POORLY GRADED GRAVEL? (GP); very dark grey; with slightly weathered basalt fragments --RESIDUAL SOIL/COLLUVIUM--				Rig chatter at2ft.
			S01		57						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										

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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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	☒	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-cines; low plasticity FINES; moist				S-01 bagged Smooth drilling 0-4.7ft. Rig chatter 4.7-5.5ft. Smooth drilling 5.5-9ft.
2635											
		◣	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.)
	10										
2630											
						▒	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)--				
	15	▯	S-03		100						
2625							**TOTAL DEPTH = 16.5 FEET**				
	20										
2620											
	25										
2615											
	30										

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. Kozlowicz**	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 Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						2-inches ASPHALT POORLY GRADED GRAVEL with SAND (GP); dense; brown (10YR 4/4); angular GRAVEL up to 3-inches; dry --ROAD BASE--				Start 13:50 10/2/2018 with hand auger
							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--				
2670											
							DIATOMACEOUS SAND (SP); loose to medium dense; yellowish brown (10YR 5/4); fine grained --QUATERNARY DIATOMITE--				
	5										Hollow stem auger 5 to 42ft.
		☒	S-01	1600 psi	100		Becomes medium dense to dense with some small, angular gravel				TX-UU
2665											
	10						DIATOMITE; pale yellow (2.5Y 7/3); moderately weathered; with occasional subvertical fractures and trace small rootlets				
		☒	S-02	1560 psi	95			23			TX-ICU
2660											
	15						Becomes pale yellow (2.5Y 7/3), slightly weathered, extremely weak, without fractures or roots				
		☒	S-03	1500 psi	90			30			
2655											
	20										
							With Fe + Mn stained vertical fracture surfaces	59			TX-UU
		☒	S-04	1400 psi	100						
2650											
	25										
2645											Cuttings become moist
	30										

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

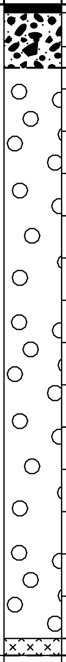
Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30	☒	S-05	500 to 1100	100		DIATOMITE; pale yellow (2.5Y 7/3); dry; slightly weathered; extremely 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			
			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				
2630											
	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. Kozlowicz**	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 Type	Number	Sampling Resistance	Recovery (feet)	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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 subvertival, Fe stained fractures --QUATERNARY DIATOMITE--				
	5	☒	S-01	1200 psi	80		23			Hollow stem auger 5 to 15.4ft. TX-ICU
2655		☒	S-02	1500 psi	100					TX-UU
	10	☒	S-03	1600 psi	100		45			TX-UU
2650		☒	S-04		100		24			TX-ICU
	15	▯	S-05	50/5	100	VOLCANIC BEDROCK; yellowish to reddish brown; highly to completely weathered; very dense/very weak --BEDROCK--				Drilling becomes hard
						TOTAL DEPTH = 15.4 FEET				
2645										
	20									
2640										
	25									
2635										
	30									

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. Respess**	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	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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										
							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-16

Sheet 2 of 2

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30					○	DIATOMITE; greenish gray; soft *--continued--*				
2560											
	35										
2555											
	40										
2550											
	45										
2545											
	50										
2540											
	55										
2535											
	60										
2530											
						▨	VOLCANICLASTIC SANDSTONE; medium gray; completely to highly weathered; weak; angular to subangular, fine- to medium-grained clasts				Harder drilling Rig repair 1315-1335
		◣	1	50/3"	100						Bottom liner retained
	65										

TOTAL DEPTH = 64.8 FEET

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. Respess**	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	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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						▨					
						○	DIATOMITE; greenish gray; soft				
	5					○					
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

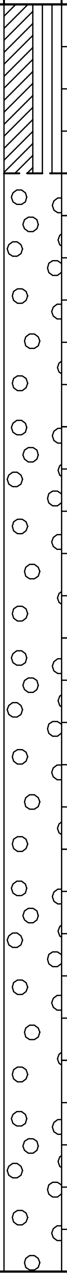
Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30						DIATOMITE; greenish gray; soft *--continued--*				
							VOLCANICLASTIC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

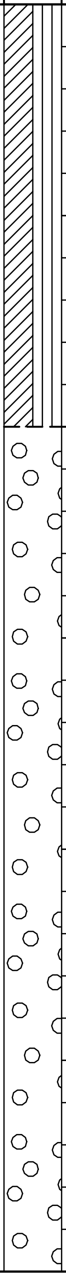
Elevation feet	Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resistance	SAMPLES Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	30					○	DIATOMITE; greenish gray to yellowish brown; soft *--continued--*				
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
							TOTAL DEPTH = 34.5 FEET				
	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-19

Sheet 1 of 2

Date(s) Drilled	**1/13/2019**	Logged By	**P. Respess**	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	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	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										

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

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. Kozlowicz**
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 Type	Number	Sampling Resistance	Recovery (feet)	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Plasticity Index	Fines Content (%<#200 Sieve)	REMARKS AND OTHER TESTS
	0						LEAN CLAY with ORGANICS (CL); very soft; wet; dark red brown (5YR 3/4); twigs and roots --RECENT LAKE SEDIMENT--				
			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--				S-1 Sampler sank under weight of rods 12.5-14.5ft. and pushed 14.-17.5ft.
2315											
	5										
			S-2	4 7 8	100						Advance 5-inch casing 7.5ft.
2310											
	10		S-3	6 8 13	67						Begin rotary wash drilling
			S-4	50/4"	100		BASALT; dark red brown (5YR 2.5/2); fresh; strong --TERTIARY to QUATERNARY INTRUSIVE BASALT--				Driller notes change at 11.5ft., Volcanics in cuttings Driller notes bedrock drilling conditions from 12ft.-17ft.
2305											
	15										
			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)--				
2300											
	20										
			S-6	50/3"	100		**TOTAL DEPTH = 22.2 FEET**				
2295											
	25										
2290											
	30										

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. Kozlowicz**
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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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
2334															
	1														
	2														
2332															
	3														
	4														
2330															
									▼						
	5											6		14:30	LL=78; PL=28 SA: G=11%; S=21%; F=68%
	6										S-1	8	87		
2328									←2-inch rounded clasts with trace decomposed rootlets			13			
	7														
	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; CaCO3 ribbons --OLDER ALLUVIUM/RESIDUAL SOIL--			5		14:40	LL=58; PL=28 SA: G=5%; S=33%; F=62%
2324											S-2	7	100		
	11											12			
	12														
2322															
	13														

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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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; CaCO3 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
								▨			S-3	6	100		
2318	16							▨				7			Switch to rotary wash
	17		1					▨							
		1			NA		1 2	△	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	18				NA			△							
	19			17	NA	0	NR	△						[21]	Clayey volcanics cuttings
2314	20				NA			△							100% fluid return
	21				NA			△						1601	
		2					1	△	Becomes moderately to slightly weathered; weak to moderately strong; moderately fractured; rough; irregular fractures likely mechanical along weathered contacts of breccia clasts					1610	
2312	22				2		2	△							
	23			100	3	48*	3 3 1 4	△	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
2310	24				1		m	△	Run break					1618	
		3					1	△						1622	
	25			100	2	100	2 1	△	1: 30. J, N, No, No, Wa, SR 2: 5, J, T, H+Uk, Pa, Wa, ?					[21]	
2308	26				1		1	△							
	27						m	△	Run break					1629	
		4			1			△						1634	27.0-27.9ft.: Mohs Hardness = 3 UCS = 841 psi Bulk Density= 141.42pcf
2306	28			100	0	100	1 m	△	1: 5, J, N, No, No, Wa, SR					[30]	
	29														

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

Log of Soil and Core Boring BI-02

Sheet 3 of 5

Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	29	4	1	100	1	100	2		VOLCANIC BRECCIA; green gray (10Y 6/1); moderately to slightly weathered; weak to moderately strong; moderately fractured with angular breccia clasts up to 1-inch; medium grained matrix --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--*(continued)*					[30]	Mechanically broken from placement in box
2304	30				1		2		2: 10-15, J, N, No, No, Wa-St, R						100% fluid return
	31				0										
2302	32	5		100	1	96	m 1							1644 1647	
	33				2		1								
2300	34		2		1		2 3		1: 10, J, N, No, No, Wa,SR 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					[31]	
	35				1		4								
2298	36				0										
	37	6		100	1	100	1							1657 1701	
2296	38				1		1								
	39				1		2		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					[26]	
2294	40				1										
	41				0		3								
2292	42	7		100	1	96	1							1712 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						
2290	44				1		1							[43]	
	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

Elevation, feet	Depth, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES: Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	45				1		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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)-- *(continued)*						100% fluid return
2288	46		3		1		4		3: 10-30, J, MW, No, No, Wa-Ir, SR-R 4: 30, J, N, No, No, Wa-Pl, SR						
	47				0				Becomes strong; slightly fractured					1213 1216	Brazilian Tensile Strength Test
2286	48				0										
	49	8		100	1	100	1 2		1: 20, J, MW, H+Ca, Fi, Wa, ? 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
2284	50				0										Punch Penetration Index Test
	51				1		2								Cerchar Abrasiveness Test
2282	52				0									1228 1232	Brazilian Tensile Strength Test
	53				0										
2280	54	9		100	1	98	1		1: 30, J, N, No, No, St, R 2: 20, J, N, No, No, Wa-St, SR					[23]	Mechanically broken from placement in box
	55				0		m								55.4-56.3ft.: Mohs Hardness = 3 UCS = 2 288 psi Bulk Density=148.46pcf
2278	56				1		m 2								
	57				1		1							1245 1250	Packer test #1 from 47.0 to 67.0
2276	58				0										
	59	10		100	1	96	2		1: 20, J, N, No, No, Wa, SR 2: 10, J, N, No, No, Wa-St, R					[20]	
2274	60				0										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 Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	61		4		1		m m 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)*					1305	
2272	62				0			△ △	3: 5, J, N, No, No, Wa, SR					1311	Mechanically broken from placement in box
	63				1		1 2	△ △							
2270	64	11		100	0	72		△ △	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]	
	65				1		3	△ △							
2268	66				3		4 4 m	△ △						1327	
	67								**TOTAL DEPTH = 67.0 FEET**						
2266	68														
	69														
2264	70														
	71														
2262	72														
	73														
2260	74														
	75														
2258	76														
	77														

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

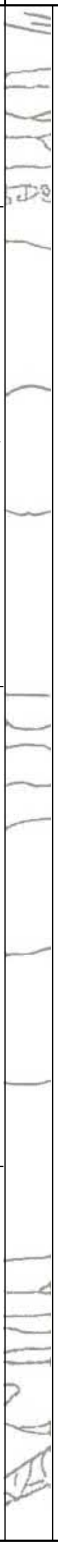
Date(s) Drilled	**2/21/2018**	Logged By	**K. Zeiger**	Checked By	**B. Kozlowicz**
Drilling Method	**Rotary Wash, HQ-3 Rock Core**	Drill Bit Size/Type	**4-inch solid stem auger, 3-7/8 inch tricone, 4-inch #2 diamond coring bit**	Total Depth of Borehole	**35.1 feet**
Drill Rig Type	**Barge Mounted CME 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 Run No.	Box No.	Recovery, %	Fractures per Foot	R Q D, %	Fracture Drawing Number	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
	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.
	1													
2304	2													
2302	3													
	4							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)--	◣	S-1	12 50/2.5'	47	10:10	LL=41; PL=26 SA: G=61%; S=30%; F=9% Advance 5-inch casing to 4ft.
	5													
2300	6	1	1	89	>6	0	1 2	Becomes moderately weathered; weak; intensely fractured to locally crushed; most rough; irregular fractures likely mechanical due to weathering on clasts/matrix boundaries					1059	Refusal with tricone bit; switched to HQ rock core
	7				>6		3 4 2 5 4 4							
2298	8				>6		6 4 7	1: 60, J, N, No, No, St, R 2: 40, J, T, No, No, St, R 3: 50-60, J, T, No, No, St, R 4: 30, J, MW, No, No, St, R 5: 10, J, N, No, No, St, R 6: 40, J, N, No, No, Wa, SR 7: 70, J, T, No, No, Wa, SR,					[13]	
	9				>6									
2296	10				NA		5							
	11	2		100	NA	14*	1						1120 1143	LL=58; PL=28 SA: G=5%; S=33%; F=62%
2294	12				4		2 3 3	1: ~10, J, N, No, No, Wa, SR 2: 30, J, N-T, No, No, Wa-St, SR 3: 40-50, J, N, No, No, Wa-St, SR-R 4: 20, J, MW, No, Wa, St, SR-R						
	13				5		4 3 4 2						[19]	*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 BI-03

Sheet 2 of 3



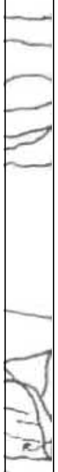
Elevation, feet	Depth, feet	ROCK CORE Run No.	Box No.	Recovery,%	Fractures per Foot	R Q D, %	Fracture Drawing Number	Lithology	MATERIAL DESCRIPTION	SOIL SAMPLES Type	Number	Blows / 6 in.	Recovery, %	Drill Time [Rate, ft/hr]	FIELD NOTES AND TEST RESULTS
2292	13	2	1	100	5	14*	5 2 2		VOLCANIC BRECCIA; green 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 --TERTIARY VOLCANICS (BOGUS MOUNTAIN BEDS, undifferentiated)--(continued)						
	14				5		1 2 2		5: 30, J, N, No, No, Wa-Pl, SR						
2290	15	3		100	3	100*	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.
	16				0										
2288	17				1		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
	18				1		3								
2286	19				0										
	20	4	2	100	3	86*	1 2 3		Becomes highly fractured 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					1228 1239	
2284	21				2		3 2		Becomes moderately fractured						21.5-22.9ft.: Mohs Hardness = 3 UCS = 352 psi Bulk Density=134.96pcf
	22				1		3							[18]	Brazilian Tensile Strength Test
2282	23				0										
	24				1		3								Punch Penetration Index Test
2280	25	5		100	0	48*								1256 1301	Cerchar Abrasiveness Test
	26				5		1 2 3 3		Moderately to highly weathered; weak to very weak; fractures 1; 2; 3 are likely mechanical						Clayey coating 26.5-27.2ft. is from when return hose got disconnected during run
2278	27				5		3 3 4 5		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]	
	28				>6		6		Crushed zone 6: 65, J, MW, Sd, Pa, Wa, SR						
	29														

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

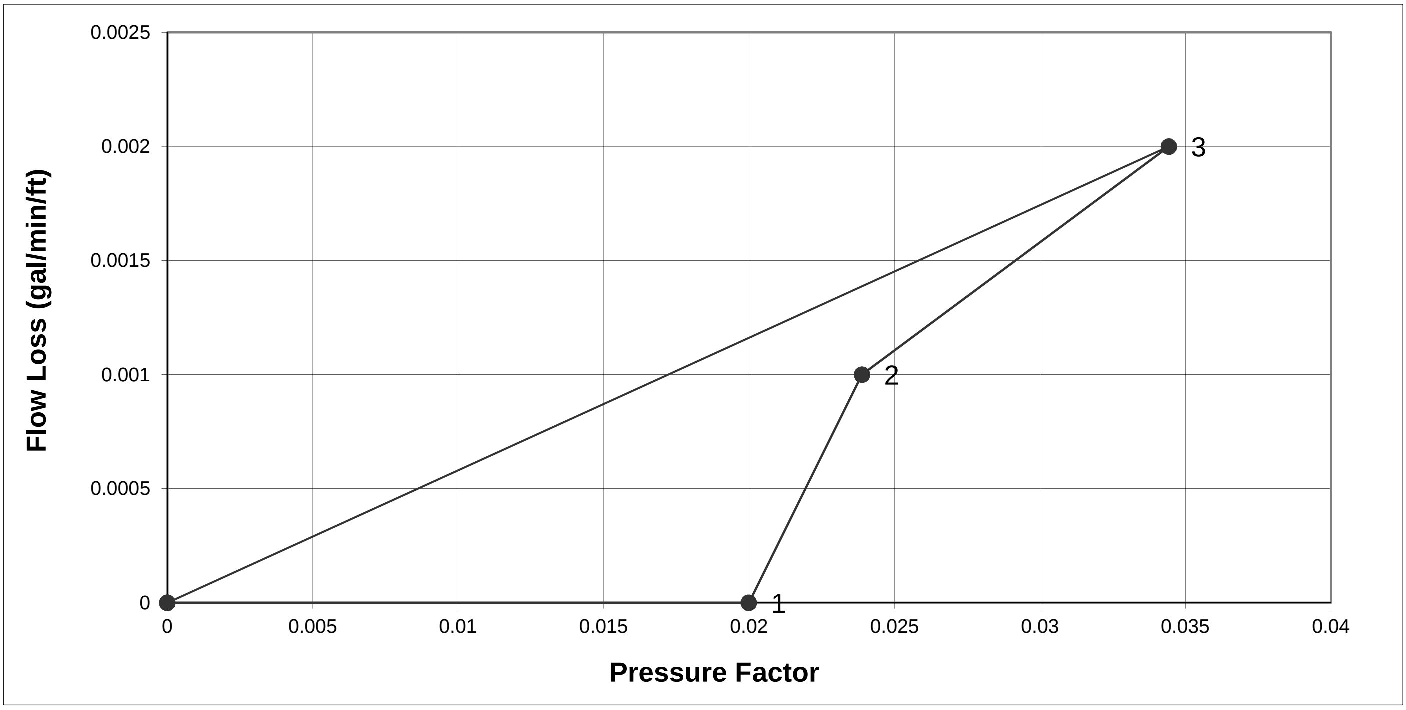


APPENDIX B PACKER TEST DATA

Boring	B-203
Surface El. (ft)	2305
Groundwater El. (ft)	2330
Test No.	1
Test Interval Center Elevation (ft)	2268.5
Test Interval Length, L (ft)	20.0
Max. Measured Pressure, P_{MAX} (psi)	62.0
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	0

Top of Test Elevation (ft)	2278.5
Bottom of Test Elevation (ft)	2258.5
Top of Test Depth (ft)	26.5
Bottom of Test Depth (ft)	46.5
Angle from Vertical (deg)	0

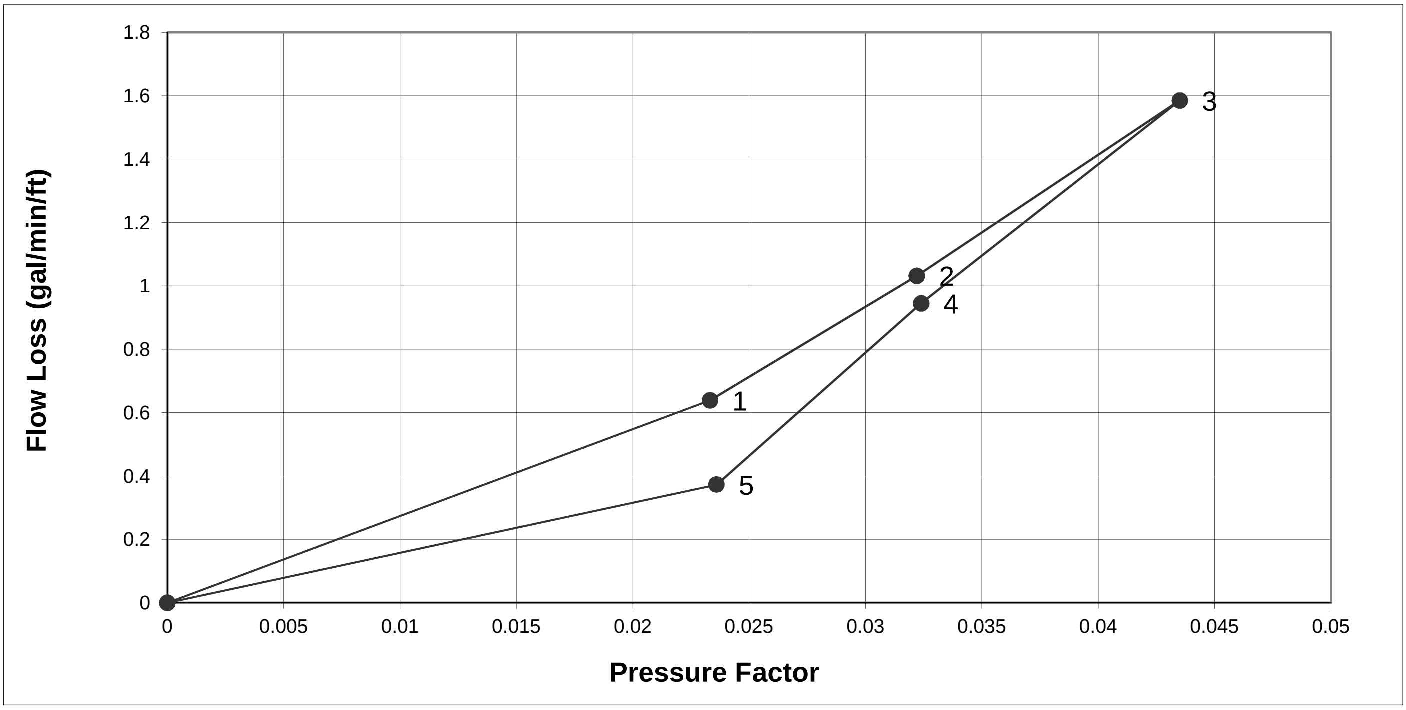
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	36.00	0.019990005	0.00	0.0000	0
2	75%	43.00	0.02387695	0.02	0.0010	0
3	100%	62.00	0.034427231	0.04	0.0020	0
4	75%		#N/A			
5	50%		#N/A			
0	0		0	0	0	



Boring	B-203
Surface El. (ft)	2305
Groundwater El. (ft)	2330
Test No.	2
Test Interval Center Elevation (ft)	2249.5
Test Interval Length, L (ft)	20.0
Max. Measured Pressure, P_{MAX} (psi)	78.3
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	36

Top of Test Elevation (ft)	2259.5
Bottom of Test Elevation (ft)	2239.5
Top of Test Depth (ft)	45.5
Bottom of Test Depth (ft)	65.5
Angle from Vertical (deg)	0

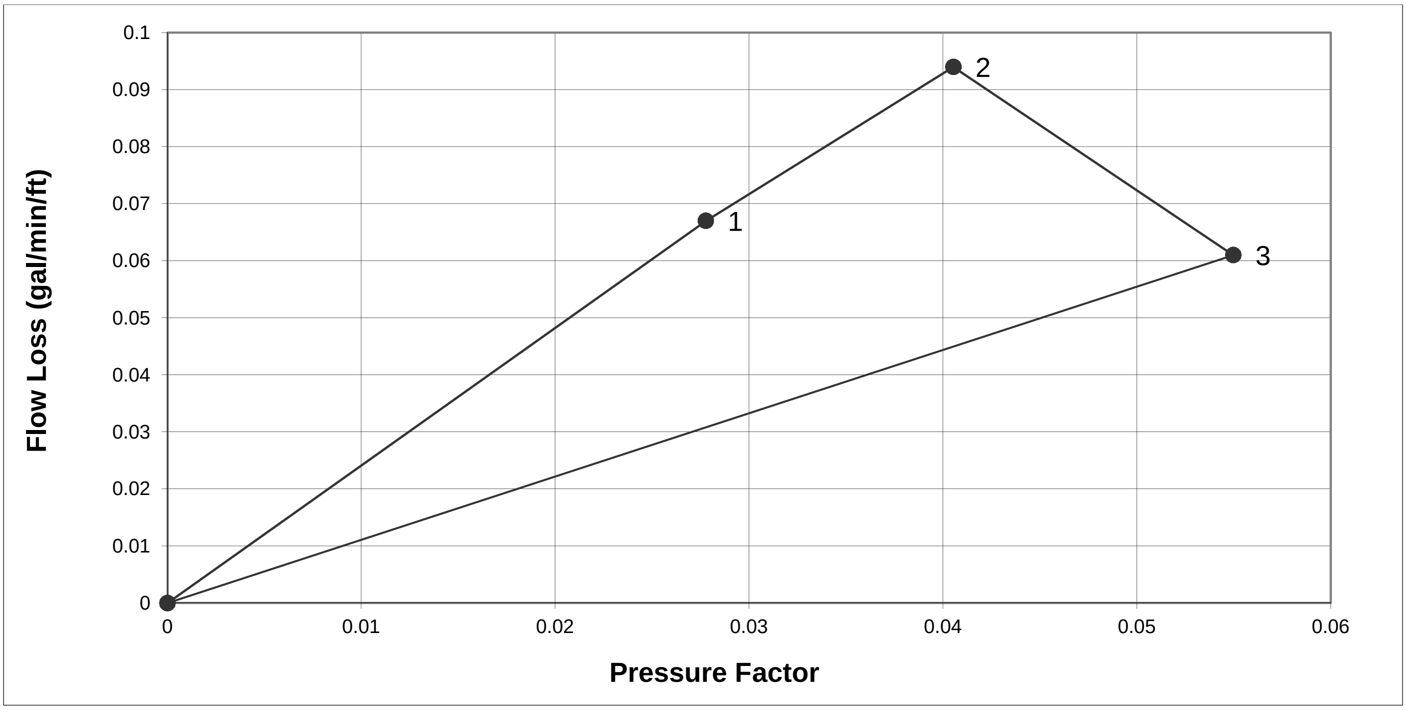
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	42.00	0.023321672	12.78	0.6390	27
2	75%	58.00	0.032206119	20.64	1.0320	32
3	100%	78.33	0.04349677	31.70	1.5850	36
4	75%	58.33	0.032391212	18.90	0.9450	29
5	50%	42.50	0.023599311	7.46	0.3730	16
0	0		0	0	0	



Boring	B-203
Surface El. (ft)	2305
Groundwater El. (ft)	2330
Test No.	3
Test Interval Center Elevation (ft)	2229.5
Test Interval Length, L (ft)	20.0
Max. Measured Pressure, P_{MAX} (psi)	99.0
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	1

Top of Test Elevation (ft)	2239.5
Bottom of Test Elevation (ft)	2219.5
Top of Test Depth (ft)	65.5
Bottom of Test Depth (ft)	85.5
Angle from Vertical (deg)	0

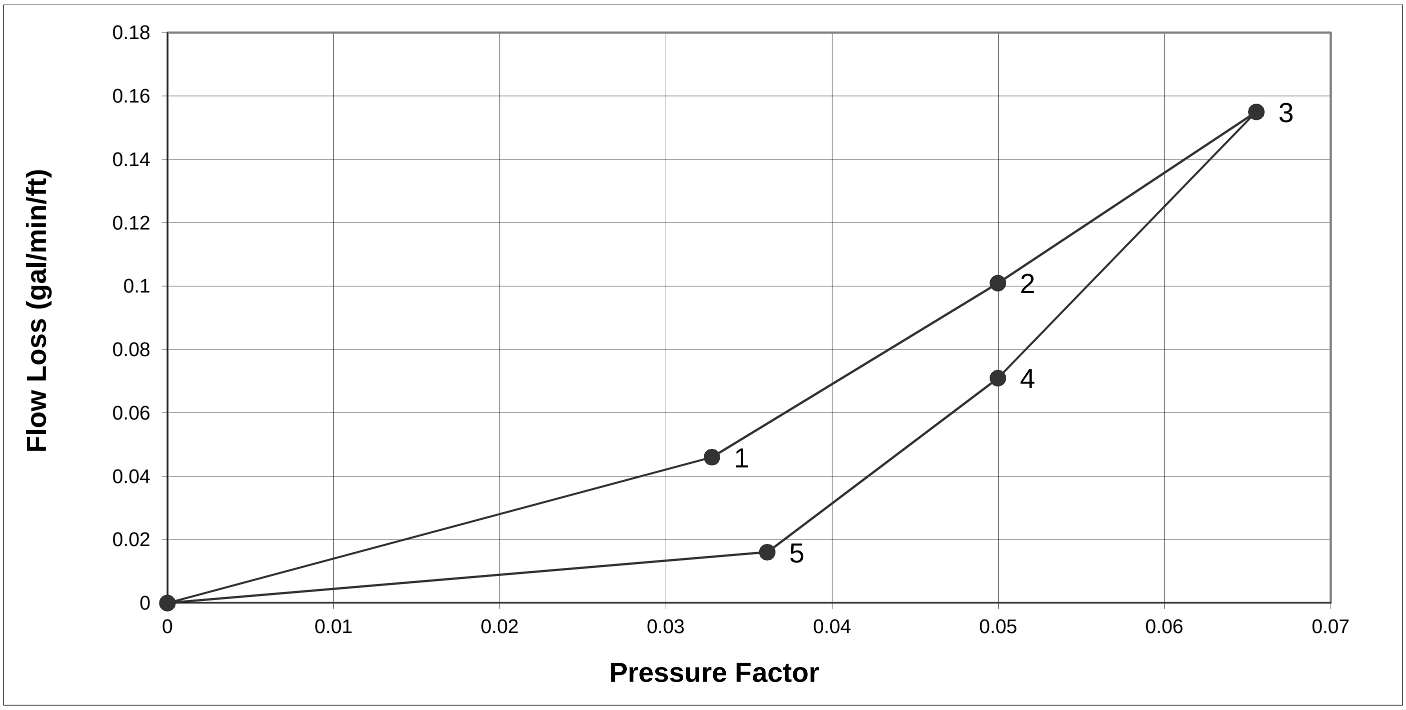
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	50.00	0.027763896	1.34	0.0670	2
2	75%	73.00	0.040535288	1.88	0.0940	2
3	100%	99.00	0.054972514	1.22	0.0610	1
4	75%		#N/A			
5	50%		#N/A			
0	0		0	0	0	



Boring	B-203
Surface El. (ft)	2305
Groundwater El. (ft)	2330
Test No.	4
Test Interval Center Elevation (ft)	2209.5
Test Interval Length, L (ft)	20.0
Max. Measured Pressure, P_{MAX} (psi)	118.0
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	2

Top of Test Elevation (ft)	2219.5
Bottom of Test Elevation (ft)	2199.5
Top of Test Depth (ft)	85.5
Bottom of Test Depth (ft)	105.5
Angle from Vertical (deg)	0

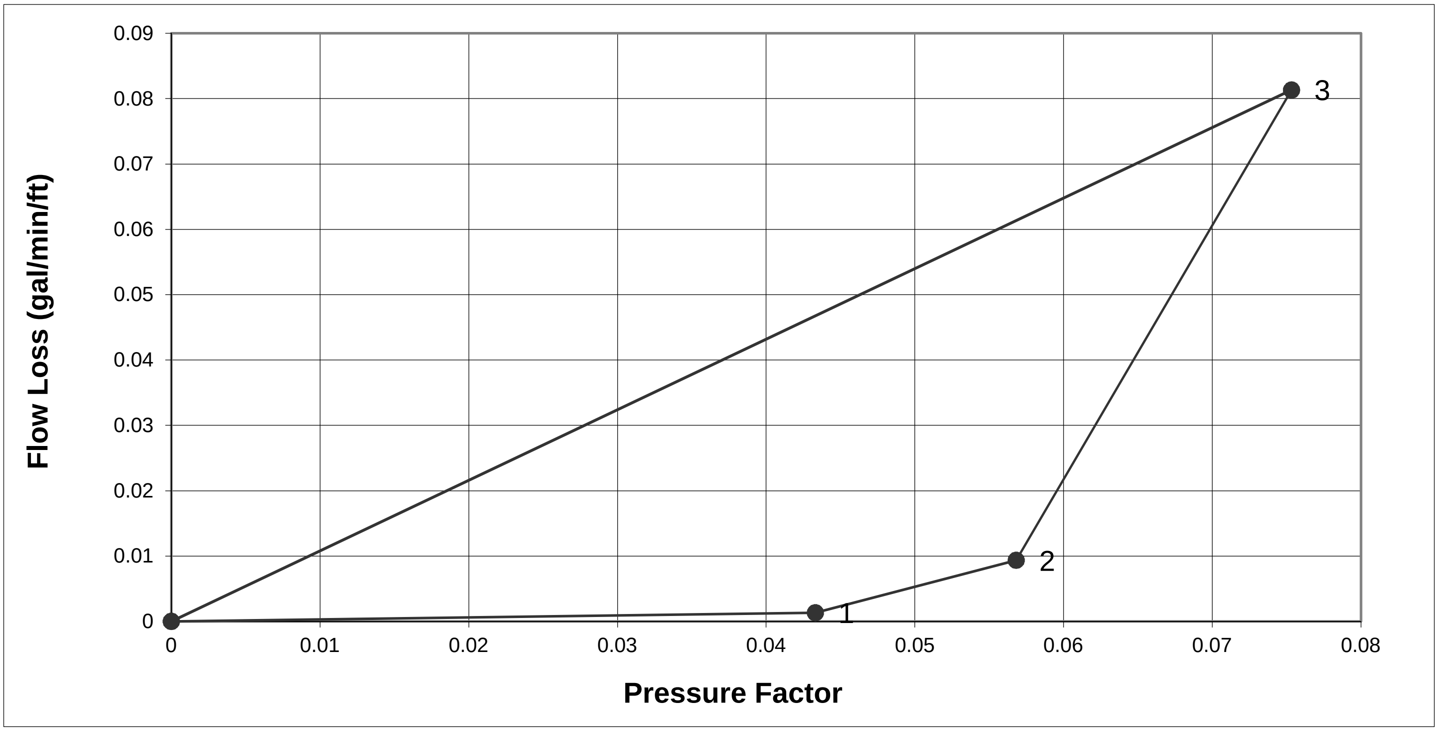
Step No.	%P_{MAX}	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	59.00	0.032761397	0.92	0.0460	1
2	75%	90.00	0.049975012	2.02	0.1010	2
3	100%	118.00	0.065522794	3.10	0.1550	2
4	75%	90.00	0.049975012	1.42	0.0710	1
5	50%	65.00	0.036093065	0.32	0.0160	0
0	0		0	0	0	



Boring	B-203
Surface El. (ft)	2305
Groundwater El. (ft)	2330
Test No.	5
Test Interval Center Elevation (ft)	2192.5
Test Interval Length, L (ft)	15.0
Max. Measured Pressure, P_{MAX} (psi)	135.7
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	1

Top of Test Elevation (ft)	2200.0
Bottom of Test Elevation (ft)	2185.0
Top of Test Depth (ft)	105
Bottom of Test Depth (ft)	120
Angle from Vertical (deg)	0

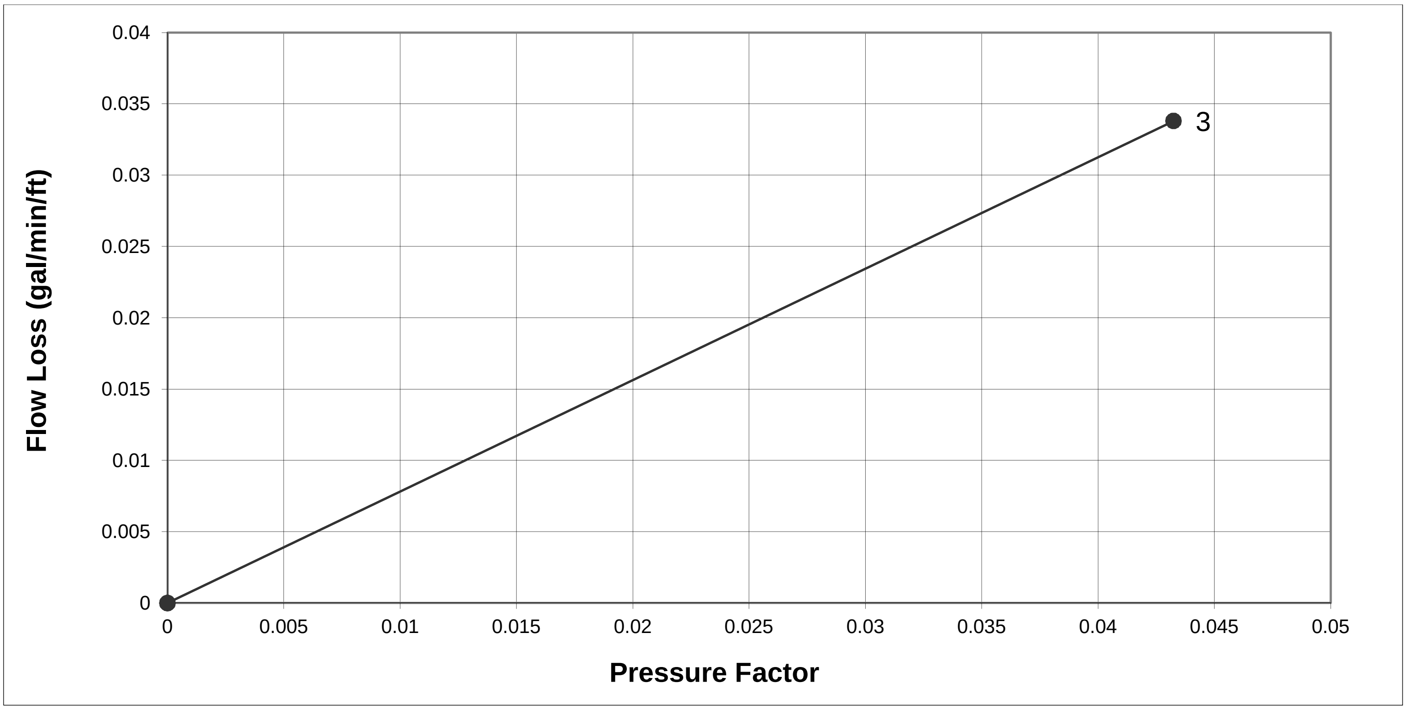
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	78.00	0.043311677	0.02	0.0013	0
2	75%	102.33	0.05682344	0.14	0.0093	0
3	100%	135.67	0.075332704	1.22	0.0813	1
4	75%		#N/A			
5	50%		#N/A			
0	0		0	0	0	



Boring	B-206
Surface El. (ft)	2336.62231
Groundwater El. (ft)	2328.02231
Test No.	1
Test Interval Center Elevation (ft)	2258.7
Test Interval Length, L (ft)	10.0
Max. Measured Pressure, P_{MAX} (psi)	77.9
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	1

Top of Test Elevation (ft)	2263.0
Bottom of Test Elevation (ft)	2254.3
Top of Test Depth (ft)	85
Bottom of Test Depth (ft)	95
Angle from Vertical (deg)	30

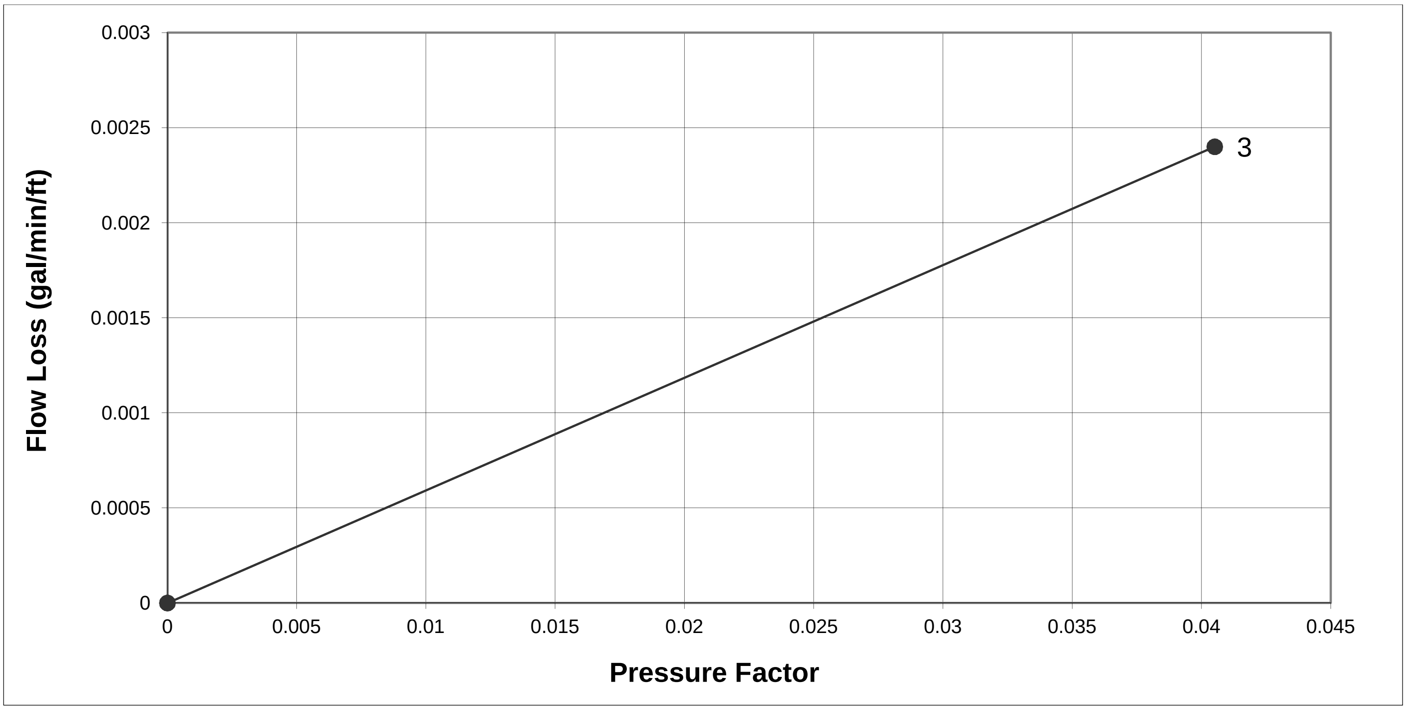
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%		#N/A			
2	75%		#N/A			
3	100%	77.88	0.043245044	0.34	0.0338	1
4	75%		#N/A			
5	50%		#N/A			
0	0		0	0	0	



Boring	B-206
Surface El. (ft)	2336.62231
Groundwater El. (ft)	2328.02231
Test No.	2
Test Interval Center Elevation (ft)	2267.3
Test Interval Length, L (ft)	10.0
Max. Measured Pressure, P_{MAX} (psi)	73.0
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	0

Top of Test Elevation (ft)	2271.7
Bottom of Test Elevation (ft)	2263.0
Top of Test Depth (ft)	75
Bottom of Test Depth (ft)	85
Angle from Vertical (deg)	30

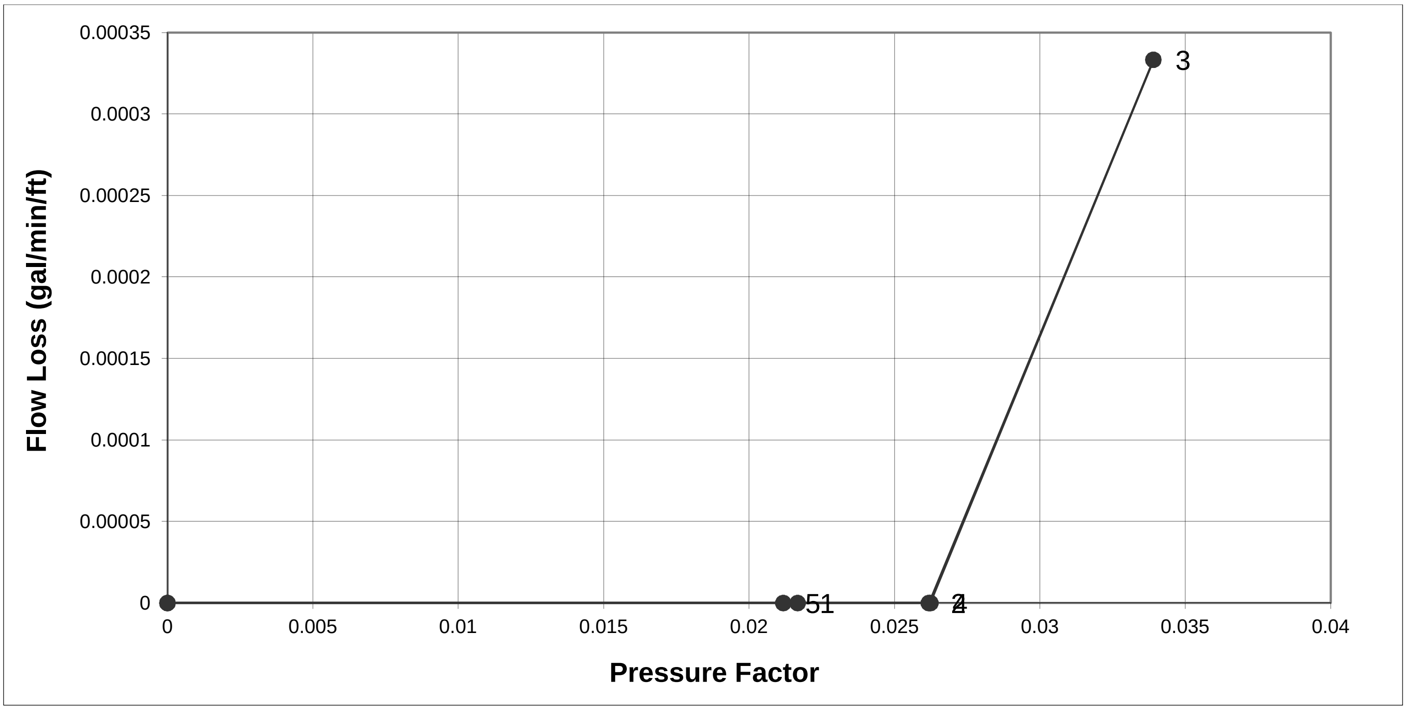
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%		#N/A			
2	75%		#N/A			
3	100%	72.96	0.040513077	0.02	0.0024	0
4	75%		#N/A			
5	50%		#N/A			
0	0		0	0	0	



Boring	BI-02
Surface El. (ft)	2334.3
Groundwater El. (ft)	2329.5
Test No.	1
Test Interval Center Elevation (ft)	2277.3
Test Interval Length, L (ft)	20.0
Max. Measured Pressure, P_{MAX} (psi)	61.1
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	0

Top of Test Elevation (ft)	2287.3
Bottom of Test Elevation (ft)	2267.3
Top of Test Depth (ft)	47
Bottom of Test Depth (ft)	67
Angle from Vertical (deg)	0

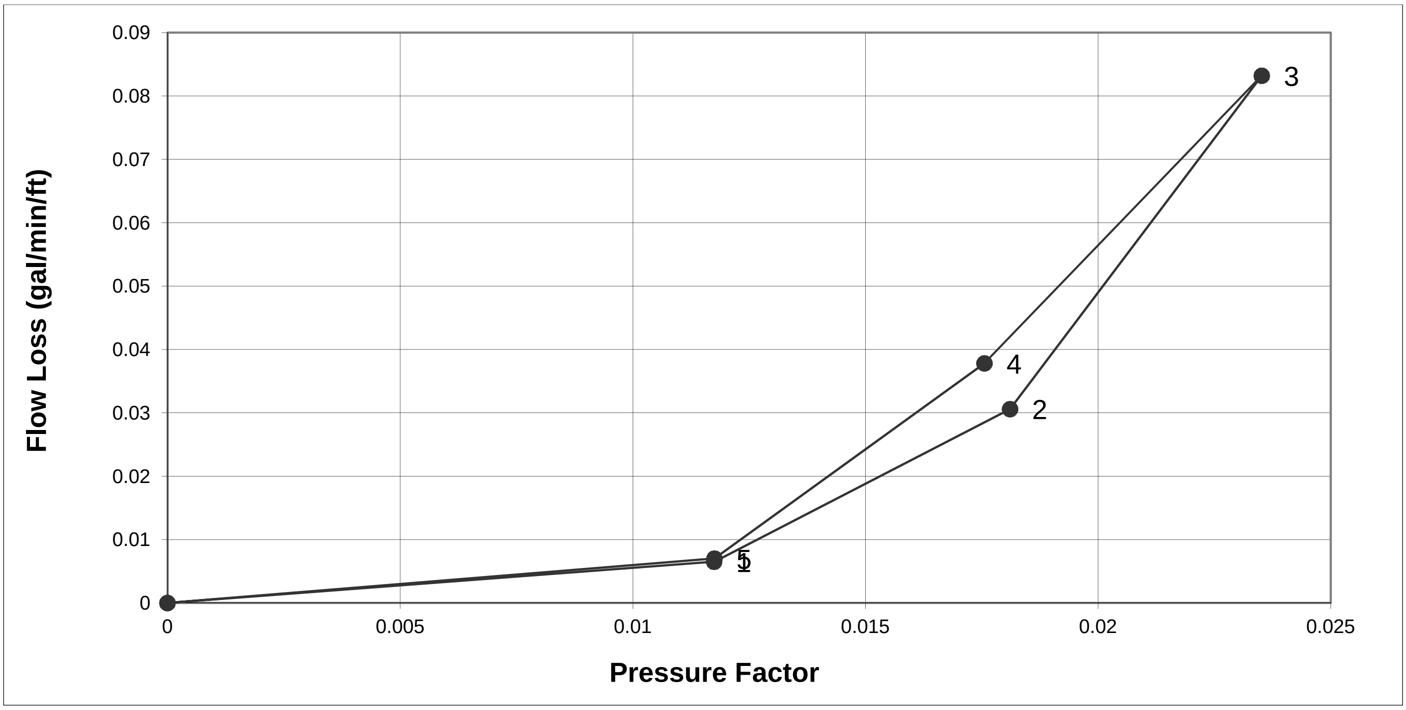
Step No.	$\%P_{MAX}$	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	39.02	0.021669027	0.00	0.0000	0
2	75%	47.15	0.026180984	0.00	0.0000	0
3	100%	61.06	0.033903789	0.01	0.0003	0
4	75%	47.24	0.026232069	0.00	0.0000	0
5	50%	38.13	0.021173117	0.00	0.0000	0
0	0		0	0	0	



Boring	BI-03
Surface El. (ft)	2302.2
Groundwater El. (ft)	2327.5
Test No.	1
Test Interval Center Elevation (ft)	2277.1
Test Interval Length, L (ft)	20.0
Max. Measured Pressure, P_{MAX} (psi)	42.4
Reference Pressure, P_0 (psi)	145
Representative Lugeon Value	4

Top of Test Elevation (ft)	2287.1
Bottom of Test Elevation (ft)	2267.1
Top of Test Depth (ft)	15.1
Bottom of Test Depth (ft)	35.1
Angle from Vertical (deg)	0

Step No.	%P_{MAX}	Measured Pressure (psi)	Pressure Factor, ψ	Flow, q (gal/min)	Flow loss (gal/min/ft)	Lugeon
0	0		0	0	0	-
1	50%	21.16	0.011748459	0.13	0.0065	1
2	75%	32.61	0.018106835	0.61	0.0306	2
3	100%	42.36	0.023519129	1.66	0.0832	4
4	75%	31.62	0.017556	0.76	0.0378	2
5	50%	21.16	0.01175168	0.14	0.0070	1
0	0		0	0	0	



APPENDIX C TELEVIEWER DATA

NORCAL
GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

October 11, 2018

AECOM
300 Lakeside Drive, Suite 400
Oakland, CA 94612, USA

Subject: Borehole Televiewer Logging Survey
Klamath River Project
Iron Gate Reservoir
Siskiyou County, California

NORCAL Job No: NS185074

Attention: Ben Kozlowicz

This report presents the findings of a borehole geophysical investigation performed by NORCAL Geophysical Consultants, Inc. at the Klamath River Project at the northeast end of Iron Gate Reservoir. This investigation was part of a geotechnical study to assess subsurface conditions along a propose water tunnel alignment. The survey was performed on two separate mobilizations during the period of August 16 through 23, 2018 by NORCAL Professional Geophysicist William J. Henrich PGp 893. Logistical support and safety information were provided onsite by Mr. Tim VandeVoorde, Engineering Geologist of AECOM.

1.0 SITE DESCRIPTION

Our work concerned 2 boreholes situated near the north and south shore at the very northeastern end of Iron Gate Reservoir (see Plate 1, Borehole Location Map). The purpose of this investigation was to help determine rock mass characteristics that included orientations and depth distribution of bedrock discontinuities. The site was underlain by unconsolidated river deposits, basalt flows and tuff breccia.

2.0 SCOPE

Geophysical borehole logging was conducted in two drilled boreholes labeled as B-202 and B-206. The geophysical logging methods consisted of acoustic televiewer and caliper. The scope of work included a report detailing analysis, methods, and presentation of results.

3.0 BOREHOLE CONDITIONS

Both boreholes were inclined 60 degrees from horizontal. They contained shallow Hwt. 4.5- inch diameter steel conductor casings from depths of 9 to 29.5-ft bgs. The casing was installed to prevent caving from unconsolidated river deposits. Below the conductor casing the boreholes were advanced with a HQ- diamond coring method. The HQ open bore diameter was approximately 3.82-inches. The principle rock types consisted of relatively hard, well consolidated basalt and highly weathered, weak tuff breccia. The latter geologic unit tended to cave and create washouts of the borehole wall. This impeded the advancement of the acoustic televiewer in Borehole B-202.

4.0 GEOPHYSICAL LOGGING EQUIPMENT AND METHODOLOGY

NORCAL conducted geophysical borehole logging using a digital ***MICROLOGGER2*** System manufactured by **Robertson Geologging, Ltd.** This system consisted of the following components:

- control console,
- computer,
- motorized cable winch,
- Televiewer (acoustic)
- caliper

4.1 TELEVIEWER

Complete descriptions of the methodology, data acquisition and data analysis procedures are presented in Appendix A.

4.2 CALIPER

Caliper logs are a measure of the borehole diameter versus depth. The tool was used both as a survey technique to assess the relative consolidation of bedrock and provide parameter input to a computer program that calculates discontinuity dip. The caliper tool consists of three interconnected mechanical arms that are spring loaded against the borehole wall. The horizontal deflections of the arms gauge the borehole diameter in units of inches with depth. The logging measurement was made in the up hole direction at a speed of approximately 12-ft per minute. The data sampling rate for this instrumentation was every 0.2-ft.

5.0 RESULTS AND INTERPRETATION

Caliper and televiewer field logs are presented in Appendix B. Specific interpreted log plots (Televiewer Analysis of Dips) from the televiewer logging are presented in Appendix C. Supporting numerical tables (Discontinuity Tables) that tabulated depth, dip angles, dip azimuths, aperture thickness where applicable and fracture classification are presented in Appendix D.

Over 95 percent of all discontinuities subjected to orientation analysis were classified as fractures. The remaining percentage were attributed to lithologic contacts between basalt and tuff breccia. Fracture classifications are discussed in Appendix A. The discontinuities classified as fractures were present only in the basalt unit in Borehole B-206. No discontinuities in the tuff breccia in the lower portion of this borehole and the entire logged open borehole section of B-202 were observed. This is because this unit, based on very low BHTV amplitude returns and variable borehole diameters (washouts), is highly weathered and poorly consolidated. As a result, this geologic unit was not capable of supporting brittle fractures. Note that not all visible fractures-joints on the televiewer images were chosen for orientation analysis. This was because these non-selected features were either too fragmented or feint to be considered representative. We did subdivide or classify the fractures-joints based on the appearance of the televiewer image and related caliper responses.

6.0 STANDARD OF CARE

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

Thank you for the opportunity to participate on this project.

Sincerely,

NORCAL Geophysical Consultants, Inc.

William J. Henrich
Professional Geophysicist PGp 893

WILLIAM J. HENRICH
10/11/2018
No. 893

Donald J. Kirker

Donald J. Kirker
Professional Geophysicist PGp 997

DONALD KIRKER
No. 997
10-11-18

WJH/DJK/tlt
Enclosures:

Appendix A: Borehole Imaging Televiewer Surveying and Data Processing
Appendix B: Field Logs Televiewer and Caliper Survey, Boreholes B-202 and B-206
Appendix C: Interpreted Televiewer Plot, Borehole B-206
Appendix D: Discontinuity Table Borehole B-206

Appendix A:

Televiewer Analysis Boreholes B-202 and B-206

APPENDIX A

BOREHOLE TELEVIEWER SURVEY

1.0 METHODOLOGY

Televiewers are downhole tools that are used to produce radial images of the interior of a borehole. The images are composited sequentially using computer software to produce continuous color images. These images are like unfolded, or unwrapped, cylinders displayed on a two-dimensional surface. The "unwrapped" radial images are referenced to magnetic north by an on-board magnetic compass. In addition, an on-board three-axis magnetic inclinometer determines the inclination and azimuth of the borehole.

Televiewer images can be used to detect bedrock discontinuities (joints, fractures, bedding planes, geologic contacts, etc.) in boreholes and determine their frequency, depths and orientations. Interpretable discontinuities appear as thin sinusoidal forms that stretch across the image. Interactively fitting lines to these sinusoids provides data that computer software uses to determine the orientation and dip of the discontinuities. The midpoint or half amplitude of the sinusoid is taken as the depth of the discontinuity.

There are two types of televiewers; optical and acoustic. Optical televiewers (OPTV) use a digital optical sensor to produce radial images to a vertical resolution as fine as 0.004 feet and a radial resolution to 720 pixels. However, they can only be used in dry holes or in water filled holes with sufficient clarity to create an interpretable high resolution image. Acoustic televiewers (BHTV) require a water column to act as a medium for the transmission and reception of acoustic signals. The water does not have to be optically clear. In operation the BHTV transmits an ultrasonic signal into the borehole fluid and detects ultrasonic energy that is reflected from the borehole wall. Sidewall borehole images are created by measuring variations in the two-way travel time of the ultrasonic pulses as well as variations in the amplitude of the reflected signals.

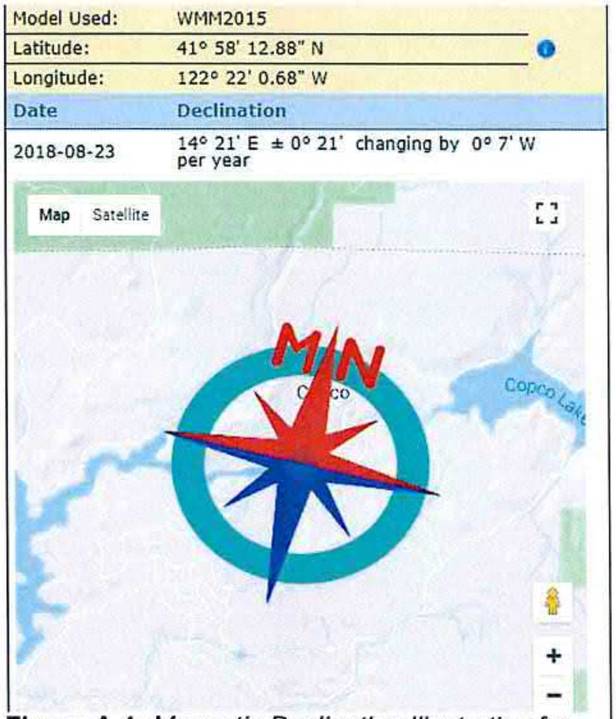
2.0 DATA ACQUISITION

Prior to Televiewer logging we checked the correct operation of the onboard tool compass of bearing direction against the readings provided by a Brunton Compass. This procedure involves setting the probe vertically in a jig with a bar situated in the south (magnetic) direction and recording a time-drive record so that the bar forms a straight line down the center of the waterfall image. Alternately, we incline the probe (greater than 45 degrees from vertical) in an arbitrary direction and compare the bearing displayed in test mode to the bearing indicated on the Brunton compass face. Variations of 1 to 2 degrees in azimuth between the tool display and Brunton Compass bearing confirms the tools compass is operating satisfactory.

Given that all boreholes maintained a shallow fluid level, image logging was accomplished with the acoustic method. We acquired acoustic BHTV data at a rate of approximately 1000 two-way pulses times per second. The tool was raised/lowered at a rate of 4.5-ft per minute. This resulted in a BHTV depth sample interval of 0.006 ft. Two logs were acquired in each borehole; one in the up direction and one in the down direction. This allowed us to demonstrate the tools compass stability by comparing the orientations of common features between the two logs.

3.0 DATA ANALYSIS

We used the computer program ***WELLCAD*** (Version 5.1, ALT, and Luxemburg) to display BHTV images and to calculate the orientations of interpreted discontinuities (e.g. fractures, joints, bedding). Corrections for the magnetic declination in the survey area required adding 14.3 degrees to the magnetic compass bearings in order to orient the borehole images to true north (see Figure A-1 below). Since borehole diameter is a major reduction parameter in determining dip magnitude, we input caliper log measurements. In each borehole, discontinuity analyses were performed interactively on sections of the unwrapped optical or acoustic amplitude images as viewed on a computer monitor. An interpretable discontinuity on a two-dimensional unwrapped borehole televiewer log appears as a recognizable sinusoidal trace that usually extends across the full width of the borehole image. The sinusoidal shape is a manifestation of planar discontinuities intercepting a three-dimensional cylindrical borehole. Planar discontinuities can be geologic features that include discrete fractures or joints, bedding planes and planar intrusions such as veins and geologic contacts. The traces of discontinuities identified on the image logs were



Model Used:	WMM2015
Latitude:	41° 58' 12.88" N
Longitude:	122° 22' 0.68" W
Date	Declination
2018-08-23	14° 21' E ± 0° 21' changing by 0° 7' W per year

Figure A-1: *Magnetic Declination Illustration for Eastern Iron Gate Reservoir.*

fitted with a bendable sinusoid overlying the trace, as shown in Figure A-2. This provided data that were used by ***WELLCAD*** to calculate a plane representing the orientation of the discontinuity in terms of dip direction and dip magnitude. This process was repeated for every significant discontinuity until the entire borehole was interpreted. At this stage, the apparent dip direction and dip magnitude of the identified discontinuities were converted to true geographic dip azimuth and dip magnitude by factoring the borehole tilt (inclination) and azimuth at the depth of the discontinuity.

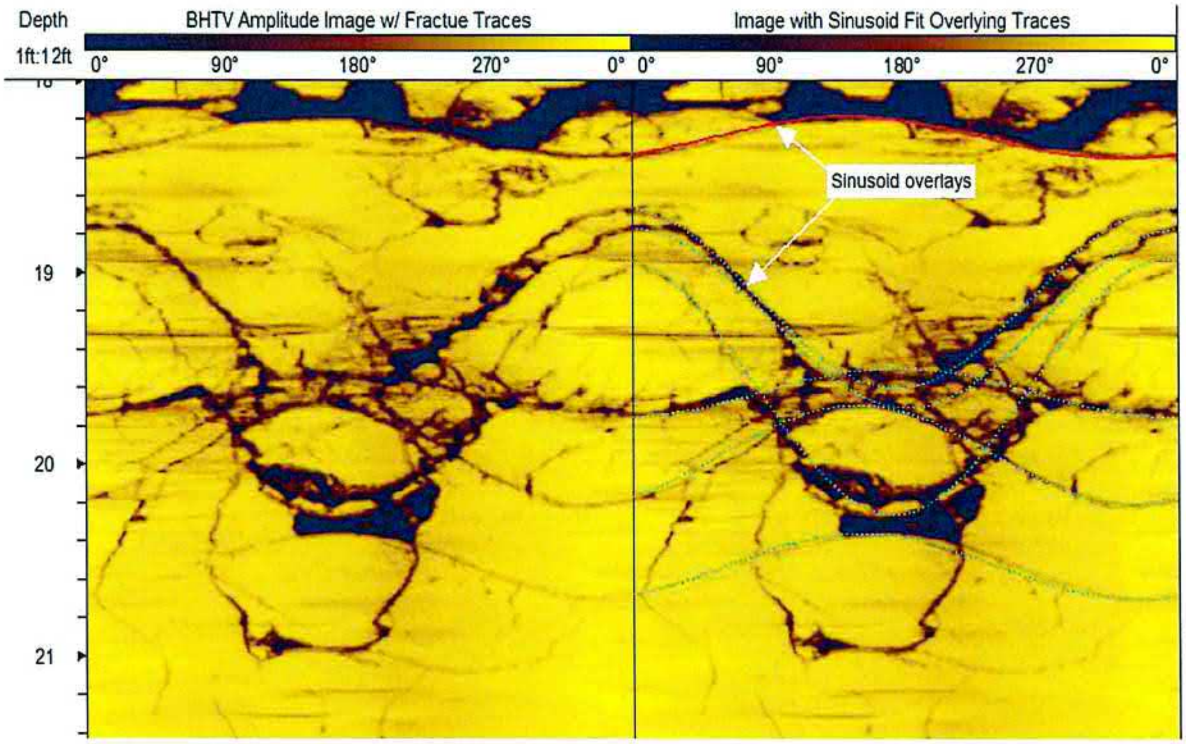


Figure A-2: *A sample BHTV section showing observable discontinuity traces (left) versus the same image (right) with the addition of interpreted sinusoidal overlays (solid red and green colored traces).*

Based on observations of the core and discussions with the on-site geologist, as well as our own experience identifying planar features in acoustic televiewer images, we classified discontinuity features into three fracture/joints categories as follows:

1) “Open continuous fractures”. These have characteristics that are relatively wide (measureable >> 1mm) apparent apertures, continuous sinusoidal traces across the circumference of the borehole wall and show relief/breakage along the borehole wall. This relief is usually shown as diameter enlargements on the caliper log.

2) “Thin partial to continuous fracture”. These features are “thin” (indicative of very small apertures 1 mm or less) partial or discontinuous across the full 360 degrees span of the image to continuous. Feature traces can be irregular (non-sinusoidal) especially if the dip angles are greater than 60 degrees.

3) “Lithologic Contacts”. Boundaries between basalt and tuff breccia.

We did not tabulate (interpret) cemented or highly discontinuous or fragmented fractures.

4.0 PRESENTATIONS

Field Logs showing the two completed BHTV logging runs referenced to magnetic North are presented in Appendix B. Two televiewer images are presented to show the stability of the compass orientation of common fracture features between separate logging runs. The Televiewer Analysis for B-206 referenced to true geographic North, is presented in Appendix C. This plot is several pages long, with header information presented at the top of the first page only. The plot contains several columns of information described, from left to right, as follows:

COLUMN 1 – DEPTH AXIS

The depth axis indicates the relative vertical distance below the ground surface. Ground surface was set equal to zero feet. Depth values are positive and increase in the downward direction.

COLUMN 2 - TELEVIEWER IMAGE

This is an unwrapped false color (BHTV) image representing the interior of the borehole wall. On the BHTV images the relationship between color and signal amplitude is indicated by the color bar at the top of the header. Dark shades (blue) indicate relatively low amplitude and the brighter shades (yellow) indicate relatively high amplitudes. BHTV images are oriented relative to true North as indicated by the azimuth information presented in the header where North, East, South and West correspond to 0°, 90°, 180° and 270°, respectively. The diameter of the borehole is indicated by the white dashed line superimposed on the image. Solid and dashed color lines superimposed on sinusoidal fracture/joint traces depict interpreted discontinuities. The colors of the lines relate to the fracture/joint classification as follows, red = open continuous fractures, teal = “thin”, partial to complete fractures and blue = lithologic contacts. Note, that due to the wide apparent thickness of some fractures, we expanded the line trace into a broader hachured sinusoidal section.

COLUMN 3 - DIPS PLOT

The Dips Plot indicates the dip of discontinuities and their direction of maximum dip. These parameters are indicated by small symbols called “tadpoles” which consist of colored circles or squares with a straight line (tail) extending from them. The position of the tadpole indicates the degree of dip, from 0° on the left to 90° on the right, according to the scale shown at the top of the column. The direction that the tail is pointing indicates the direction of dip where straight up is true north and 90° to the right indicates due east. The tadpole symbol colors relate to the three classifications of fractures and joints. A Discontinuity Legend in the sub-header related the colors to the classification. The numerical values of dip azimuth and dip angle are also presented in discontinuity tables presented at the end of this appendix.

COLUMN 4 - CORE PLOT

This plot is a graphic rendering of the BHTV image into a 3-D core based on amplitude variations. This is basically what the image shown in Column 2 would look like if it was re-wrapped to form a cylinder where the vertical center line of the cylinder represents true north (0°), the right edge represents west (270°) and the left edge represents east (90°). South (180°) is out of view behind the core. Although the color spectrum of the core is the same as that used for the BHTV image, the core reconstruction tends to compress the amplitude spectrum into a darker range. This has the effect of making the core appear to be reddish rather than yellow. Planes drawn through the interpreted discontinuities illustrate the relative dip and dip direction of the discontinuities.

COLUMN 5 - BOREHOLE DEVIATION

This plot indicates the azimuth and tilt of the borehole. The solid blue line represents the dip direction, from 0° to 360°, according to the header scale labeled “Azimuth”. The dotted green line represents the angle of the borehole from true vertical according to the header scale labeled “Tilt”. This scale ranges from 0° to 4°.

5.0 DISCONTINUITY TABLES

The dip azimuth and dip angle of all interpreted discontinuities from the televiewer analysis plot are tabulated Appendix D. The tables present 5 column headers listed left to right as follows: Depth, Dip Azimuth, Dip Angle, Corrected Aperture and Discontinuity Classification. A brief description of the meaning of these terms is presented below.

Depth – relates to the center of discontinuity's sinusoid in feet below ground surface.

Dip Azimuth – dip direction of the discontinuity in degrees from true North.

Dip Angle – inclination of the plane of the discontinuity in degrees from horizontal.

Corrected Aperture – true thickness of fracture/joint corrected for dip measured in tenths of inches. In this survey, we used this processing facility to indicate the true thickness of weathered/altered fractures.

Discontinuity Classification – number designating classification type of fracture/joint (see Legend for explanation).

Appendix B:

Field Logs Televiewer and Caliper Survey
Boreholes B-202 and B-206

NORCAL

NORCAL GEOPHYSICAL CONSULTANTS, INC.

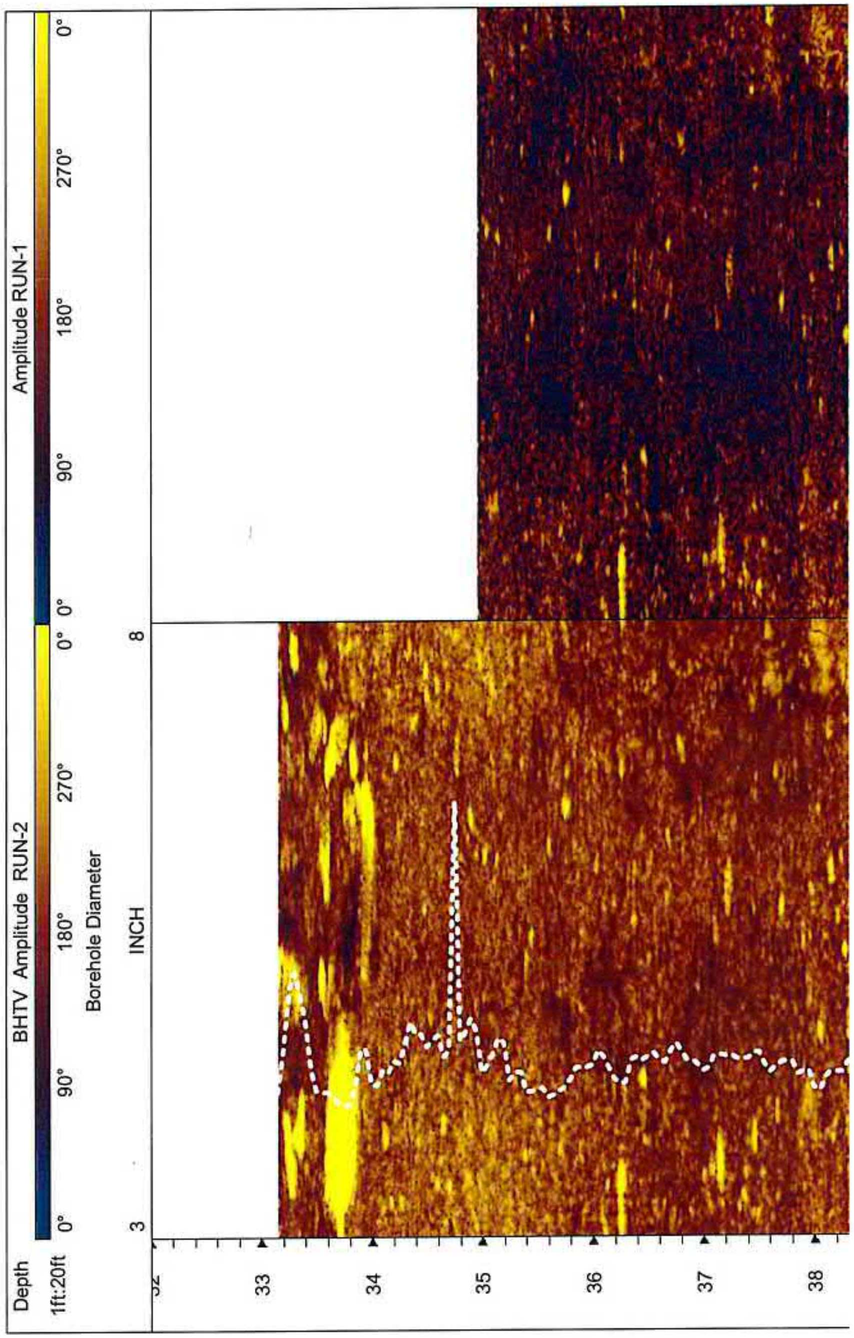
ACOUSTIC TELEVIEWER, CALIPER LOGS

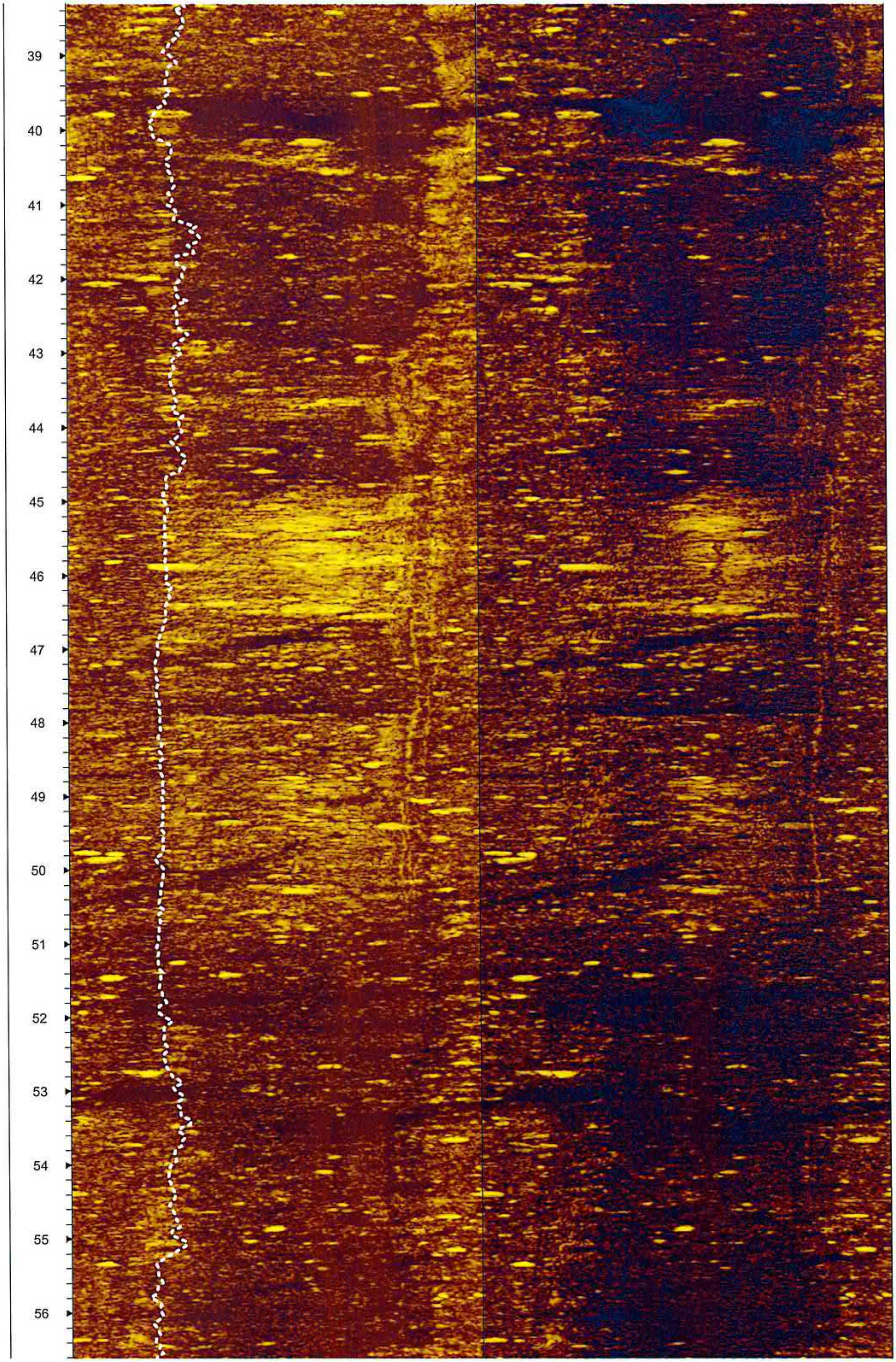
CO AECOM
WELL B-202
FLD IRON GATE RESERVOIR
CTY SISKIYOU CO.
STE CA
FILING No NS185074

COMPANY	AECOM			
WELL ID	B-202			
FIELD	IRON GATE RESERVOIR			
COUNTRY	USA	STATE	CA	
LOCATION LAT 41.97048 LONG -122.37038				OTHER SERVICES
SEC	TWP	RGE		
PERMANENT DATUM	GROUND SURFACE	ELEVATION	~2300' msl	K.B.
LOG MEAS. FROM	GROUND SURFACE	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND SURFACE			G.L.

DATE	AUGUST 23, 2018	TYPE FLUID IN HOLE	water w/ polymer
RUN No	RUNS 1 through 3	SALINITY	na
TYPE LOG	CALIPER AND BHTV (3)	DENSITY	
DEPTH-DRILLER	100	LEVEL	11
DEPTH-LOGGER	97.8' bgs	MAX. REC. TEMP.	na
BTM LOGGED INTERVAL	BHTV 82' BGS		
TOP LOGGED INTERVAL	BHTV 18.06' BGS		
OPERATING RIG TIME	3		
RECORDED BY	W HENRICH		
WITNESSED BY	Tim VerdeVoorde		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	4.25"	0	29.5 ft	4.25"	Hwt	0	29.5
2	HQ 3.825"	29.5	100 ft				

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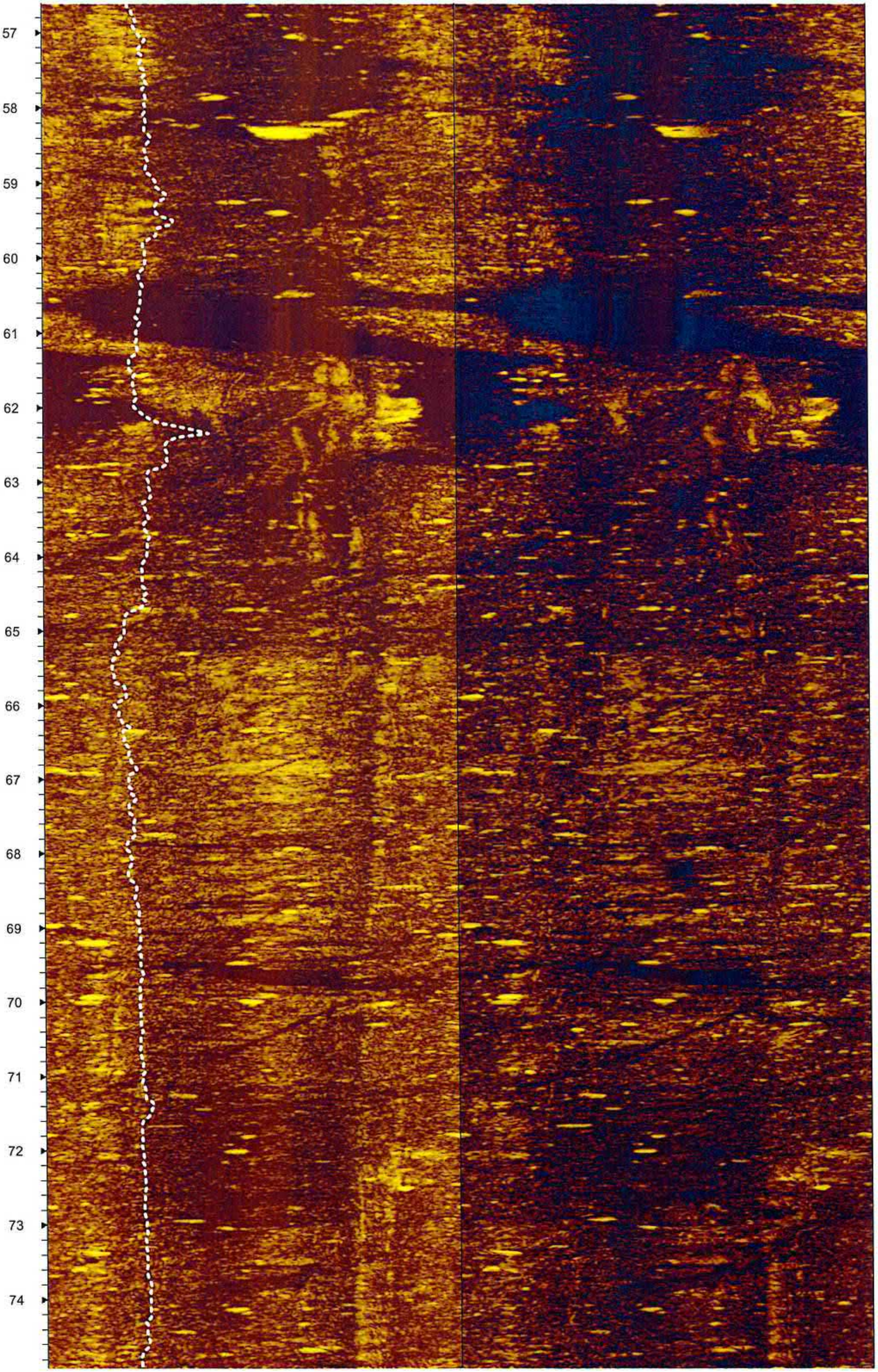

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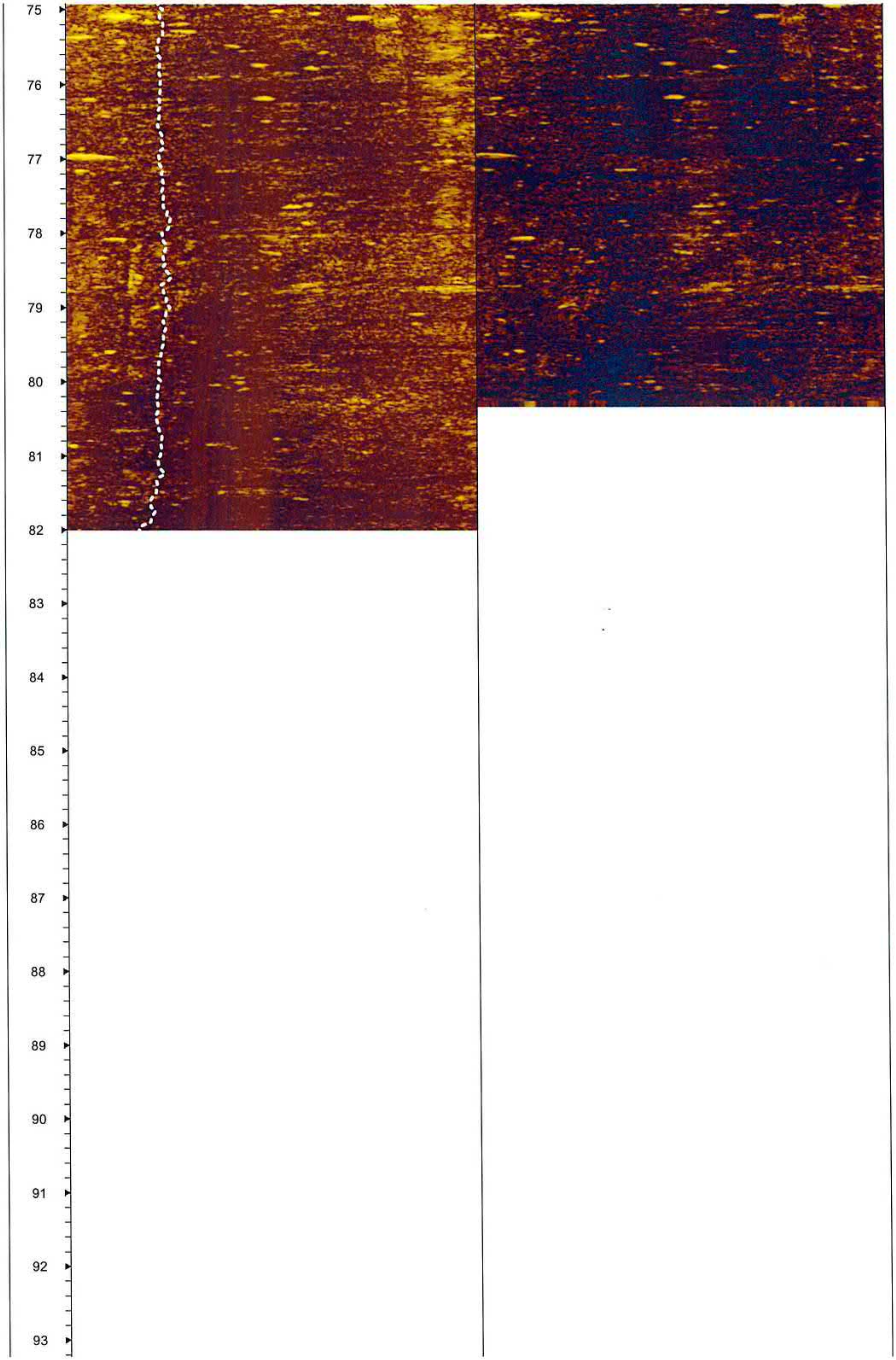
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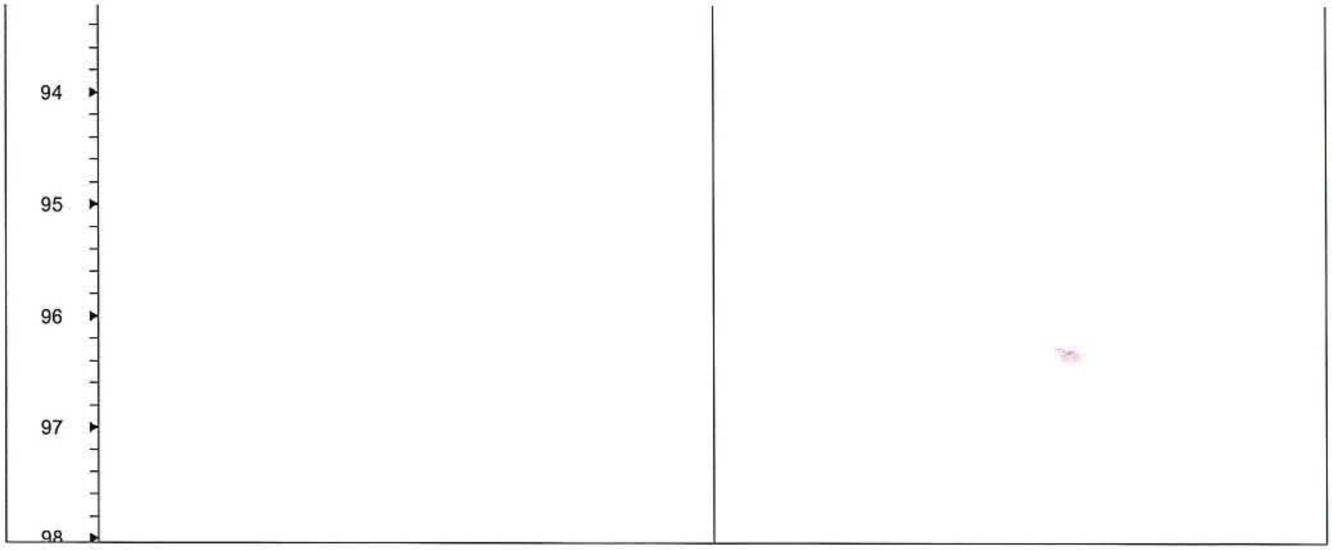
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NORCAL

NORCAL GEOPHYSICAL CONSULTANTS, INC.

ACOUSTIC TELEVIEWER, CALIPER LOGS

CO AECOM
WELL B-206
FLD IRON GATE RESERVOIR
CTY SISKIYOU CO.
STE CA
FILING No NS185074

COMPANY AECOM
WELL ID B-206
FIELD IRON GATE RESERVOIR
COUNTRY USA STATE CA

LOCATION
LAT 41.972184
LONG -122.36915

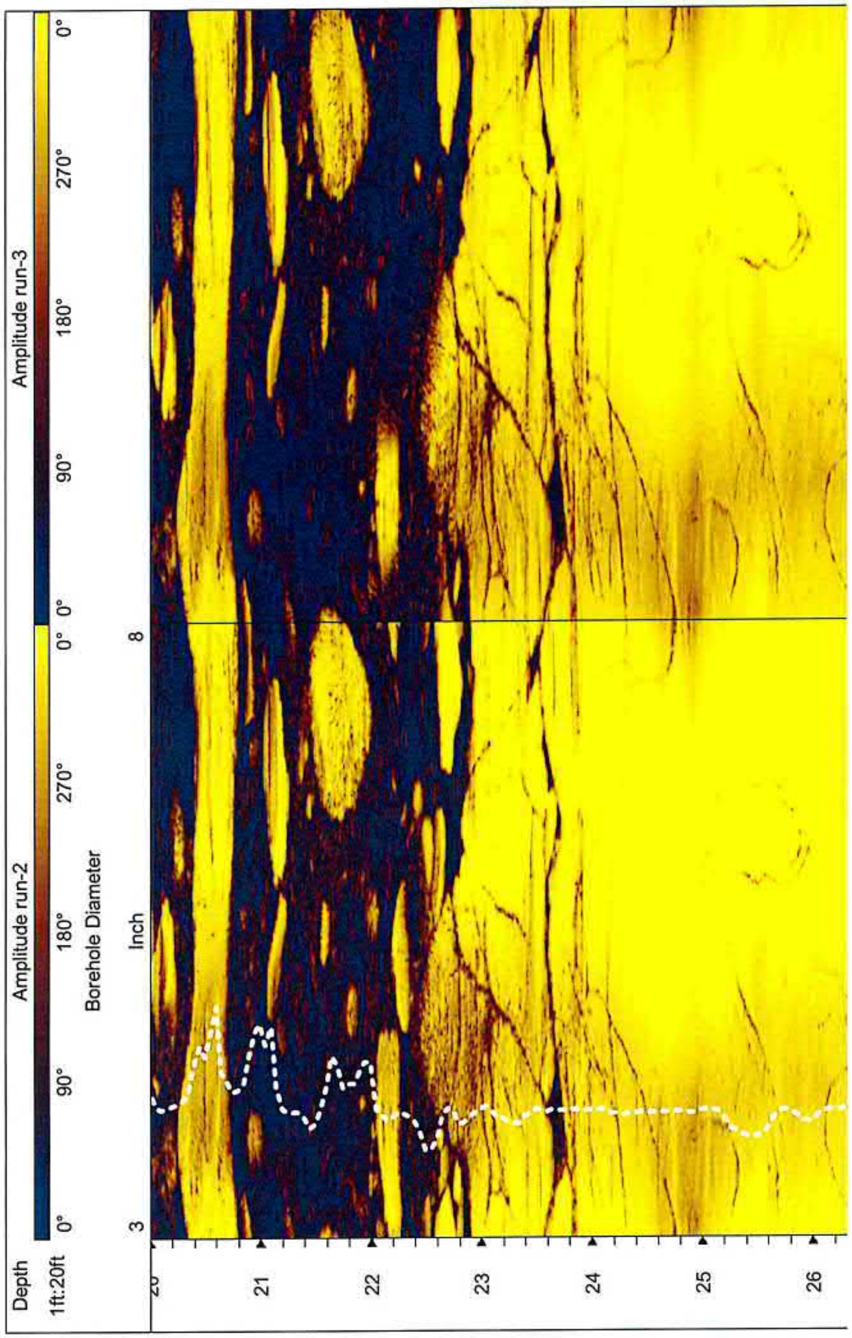
OTHER SERVICES

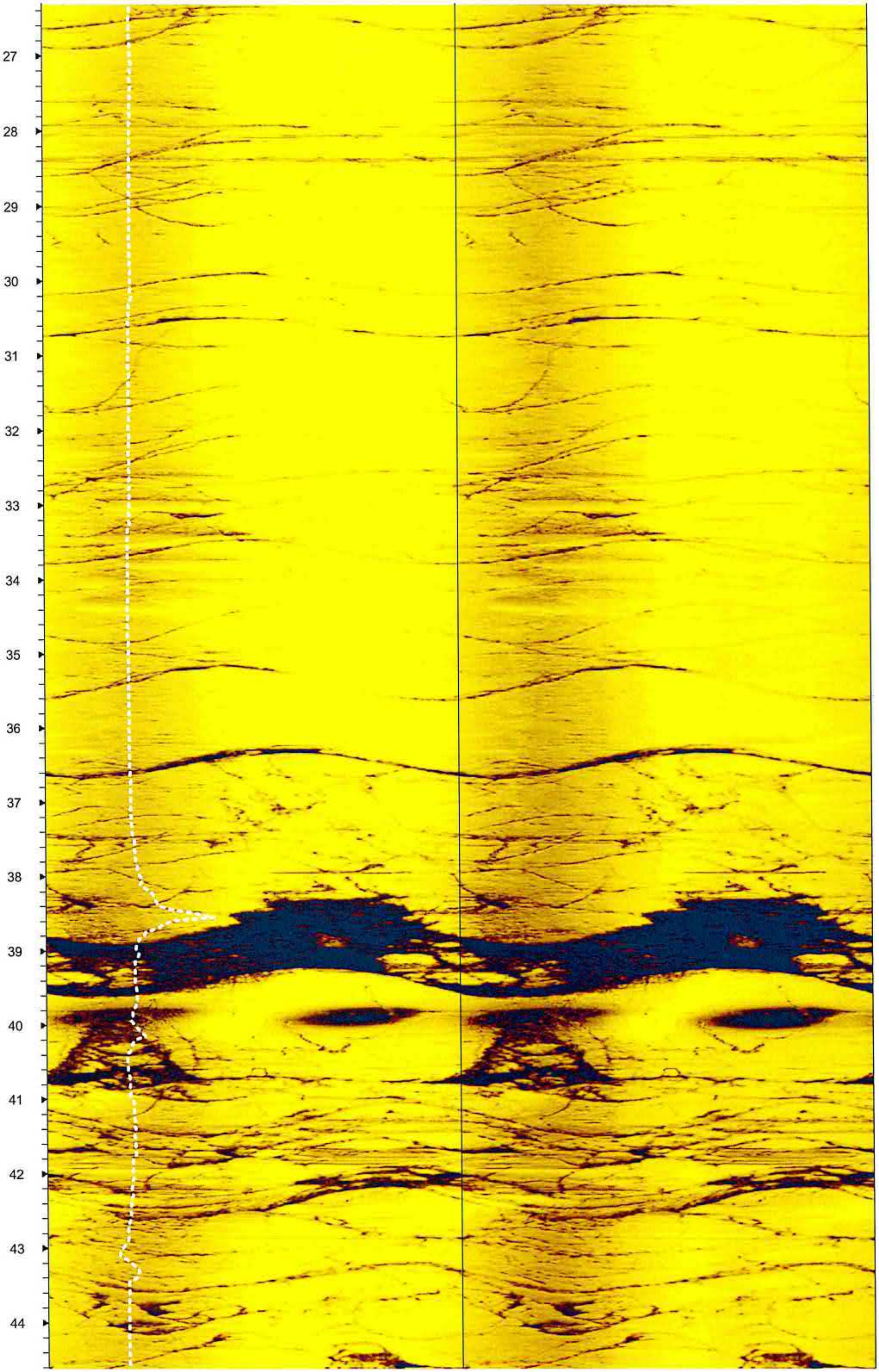
SEC TWP RGE

PERMANENT DATUM	GROUND SURFACE	ELEVATION	~2300' msl	K.B.
LOG MEAS. FROM	GROUND SURFACE	ABOVE PERM. DATUM		D.F.
DRILLING MEAS. FROM	GROUND SURFACE			G.L.

DATE	AUGUST 18, 2018	TYPE FLUID IN HOLE	
RUN No	RUNS 1 through 4	SALINITY	na
TYPE LOG	CALIPER AND BHTV (3)	DENSITY	
DEPTH-DRILLER	100	LEVEL	10
DEPTH-LOGGER	98.45	MAX. REC. TEMP.	na
BTM LOGGED INTERVAL	98.5		
TOP LOGGED INTERVAL	BHTV 18.06' BGS		
OPERATING RIG TIME	3		
RECORDED BY	W HENRICH		
WITNESSED BY	Tim VerdeVoorde		

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	4.25"	0	9 ft	4.25	Hwt	0	9
2	HQ 3.825"	9	100 ft				

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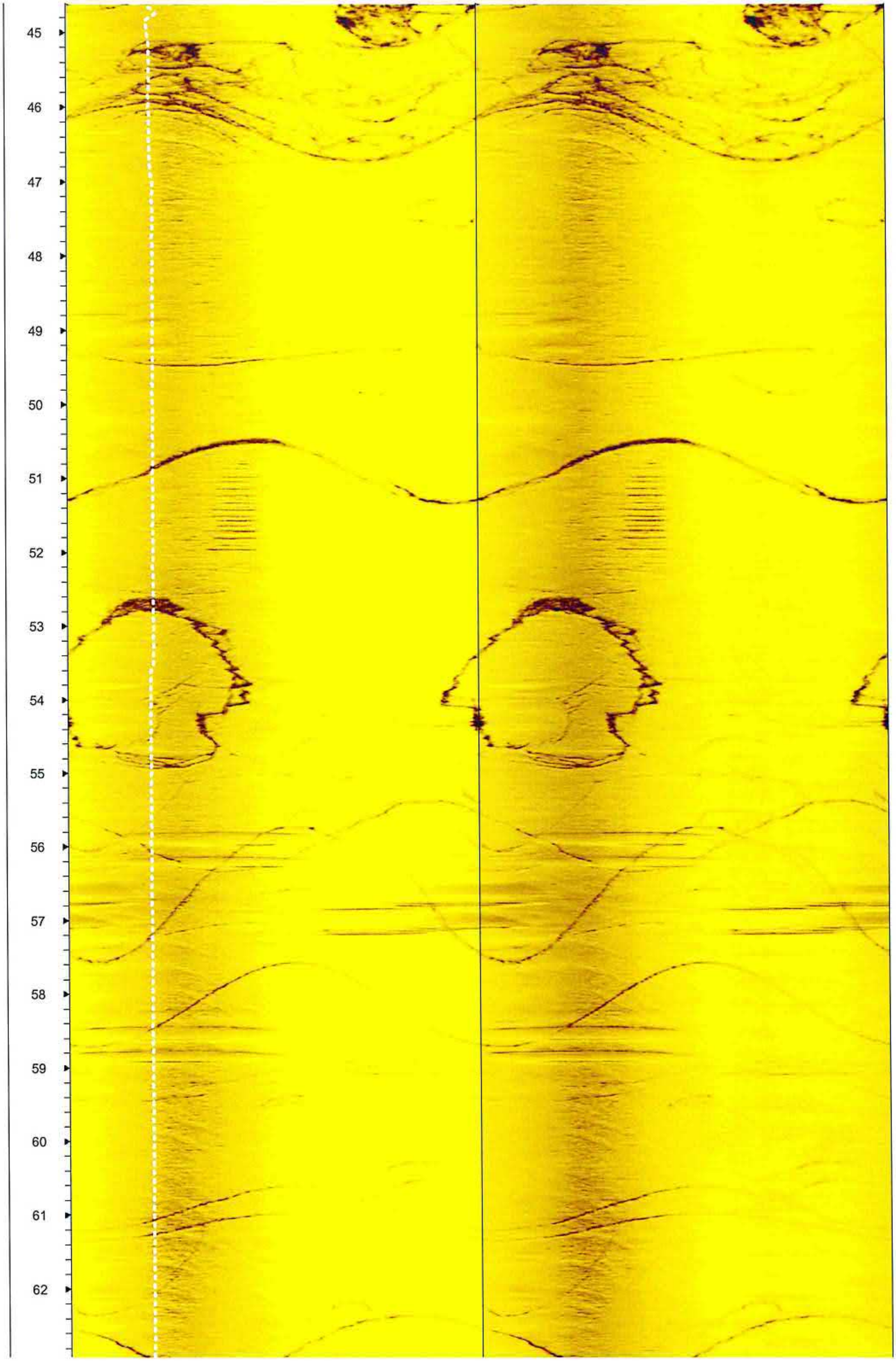
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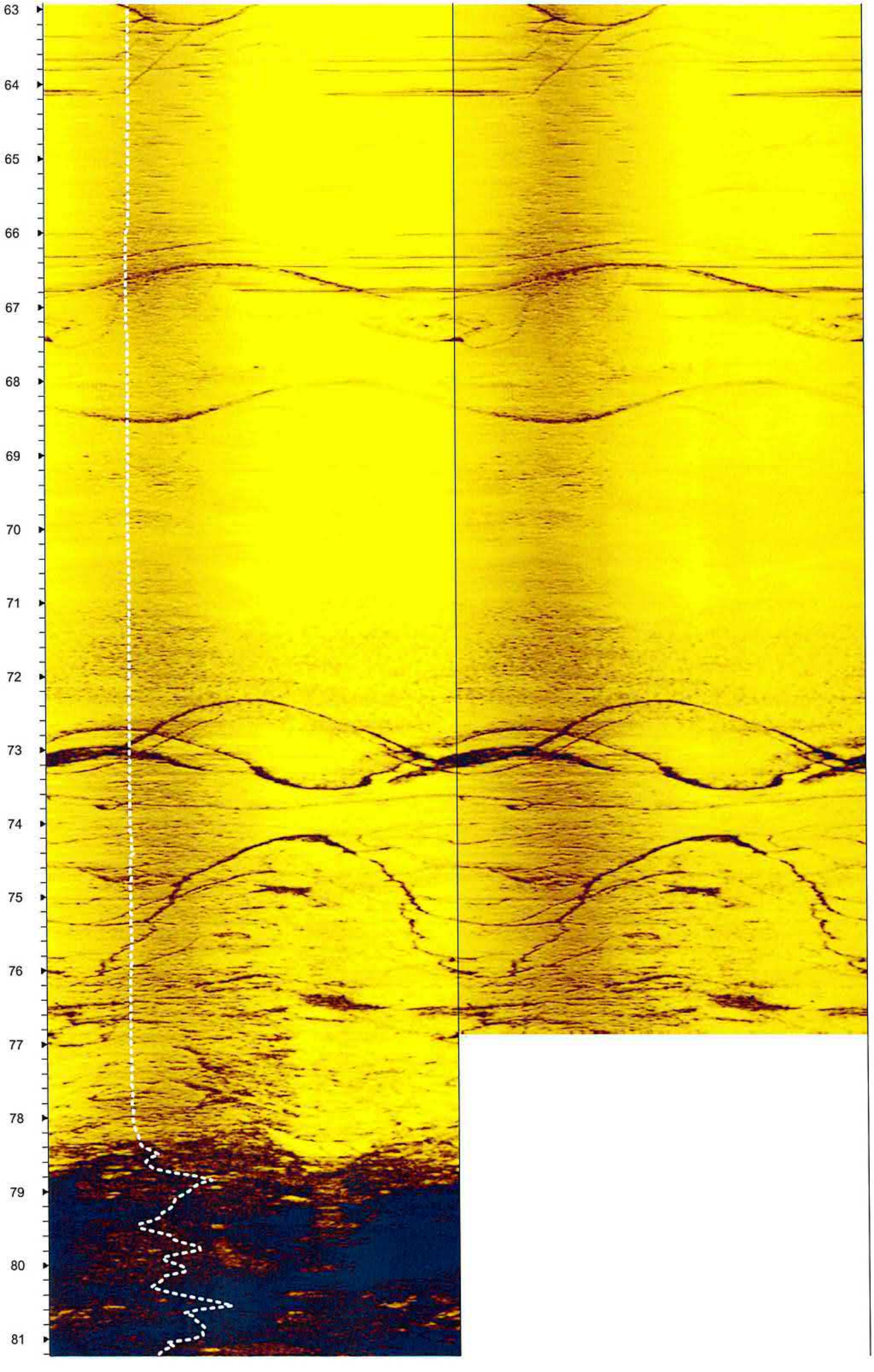
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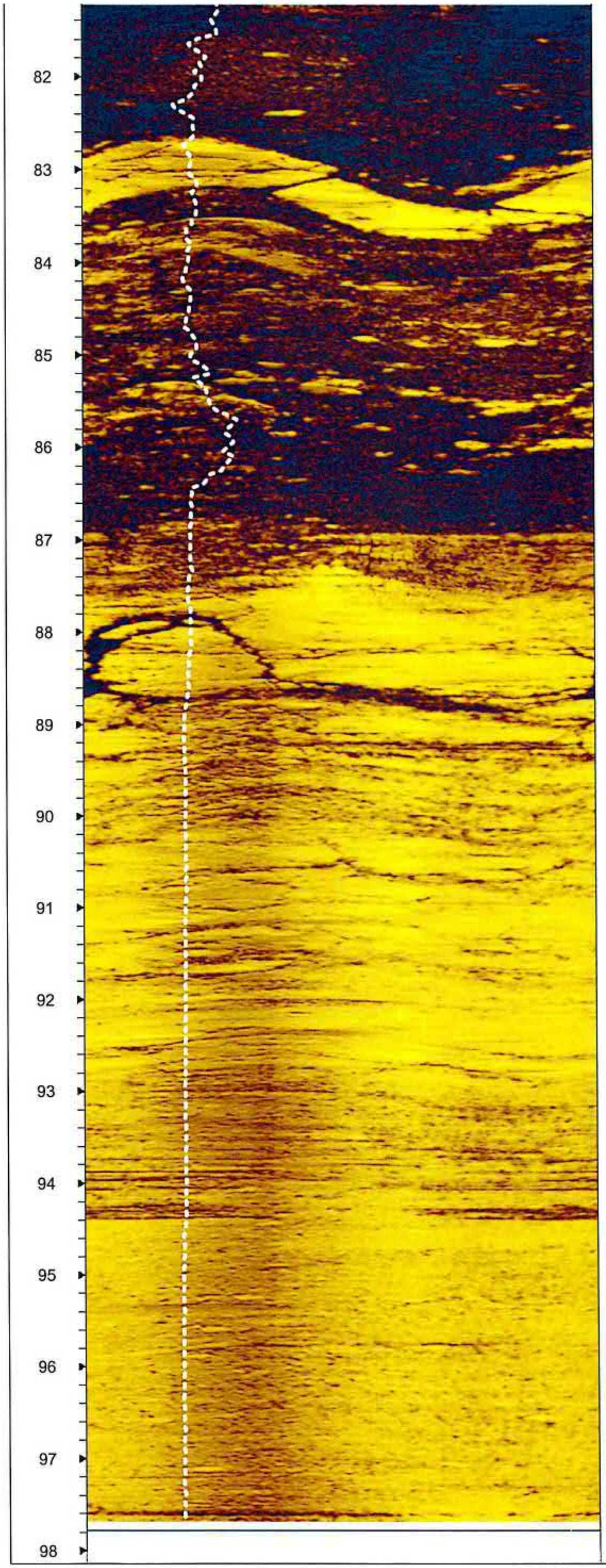
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Appendix C:

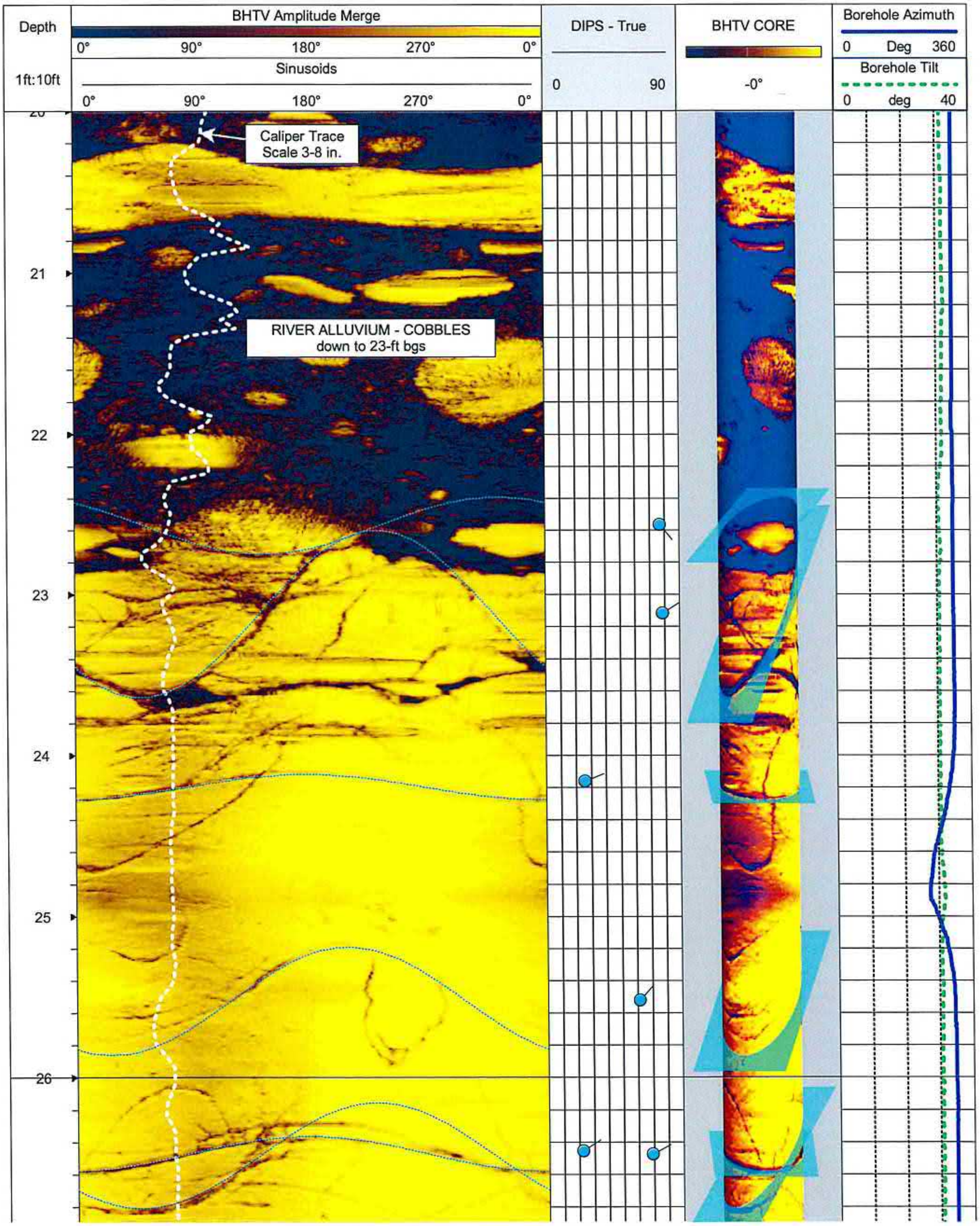
Televiewer Analysis Plot
Borehole B-206

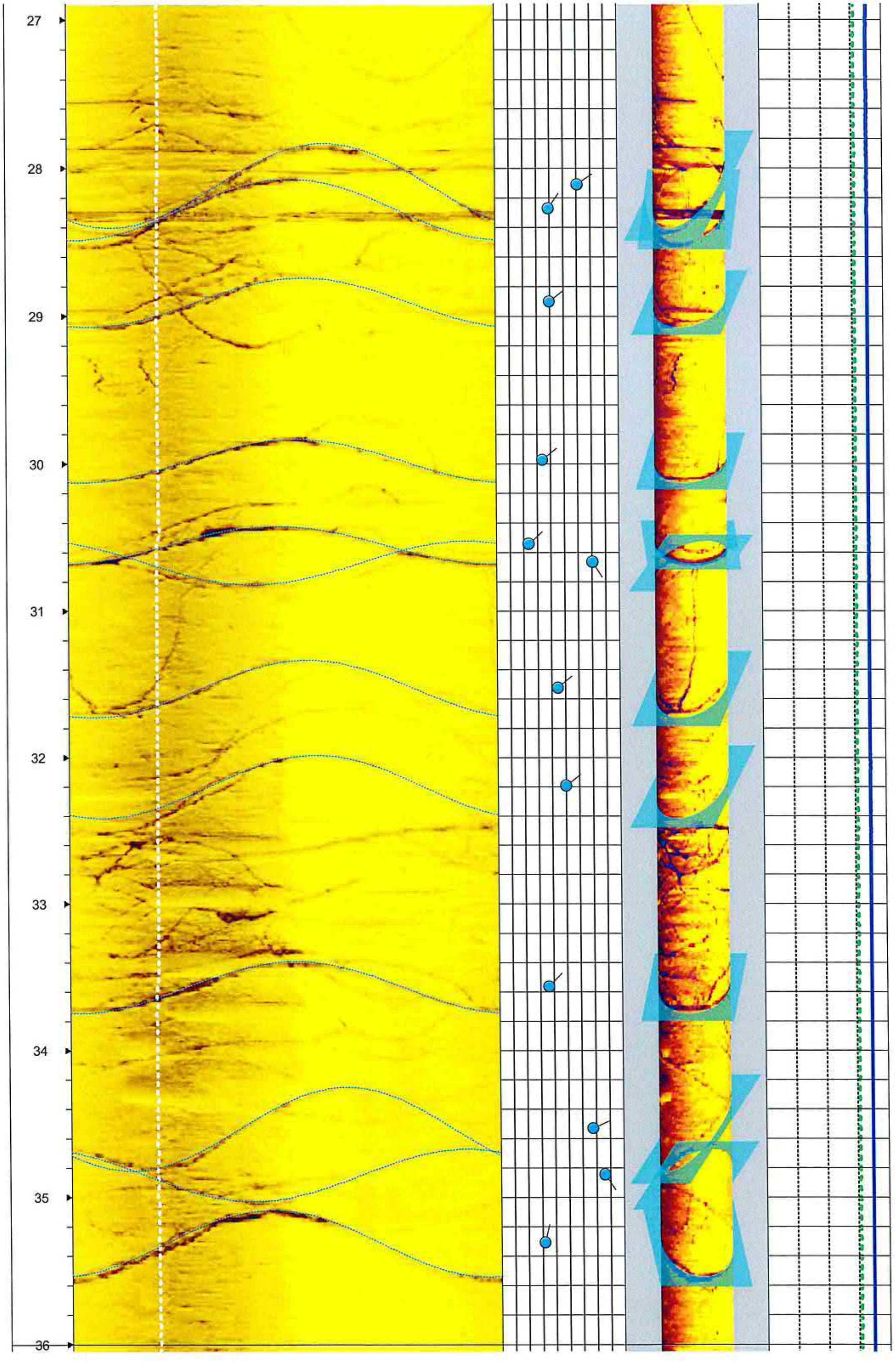
NORCAL GEOPHYSICAL CONSULTANTS INC. A Terracon COMPANY	**TELEVIEWER ANALYSIS**	COMPANY: AECOM WELL ID: B-206 FIELD: Iron Gate Reservoir COUNTY: Siskiyou	DATE: 8-16-2018 CASING: Steel to 9 ft-bgs JOB NO. NS185074 STATE: CA

NOTES:

DISCONTINUITY LEGEND

Code	Tadpole	Sine Wave	Name
1	●	——	Open, continuous fracture
2	●	- - - -	Thin, partial to continuous fracture
3	●	——	Lithologic contact

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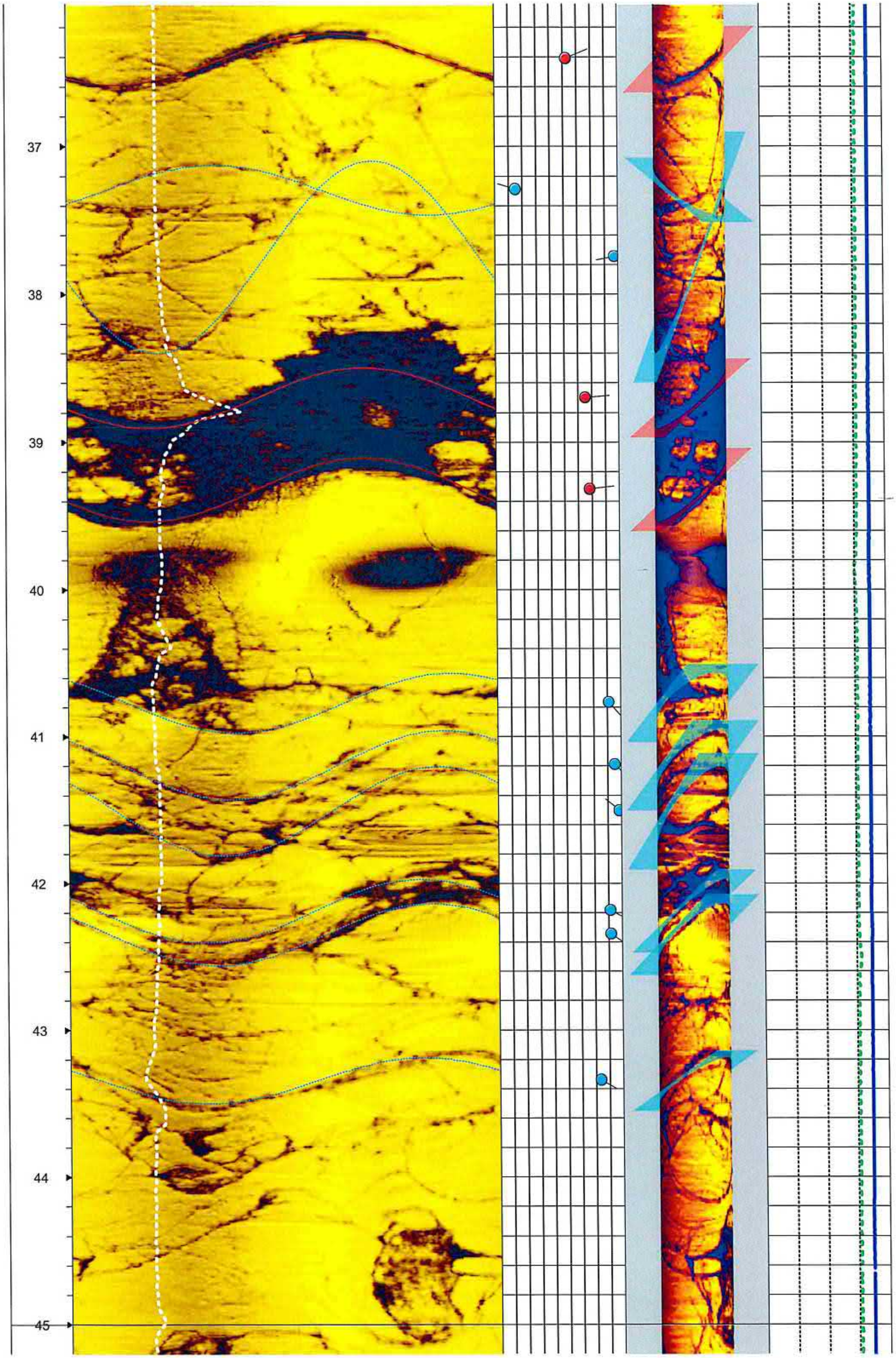
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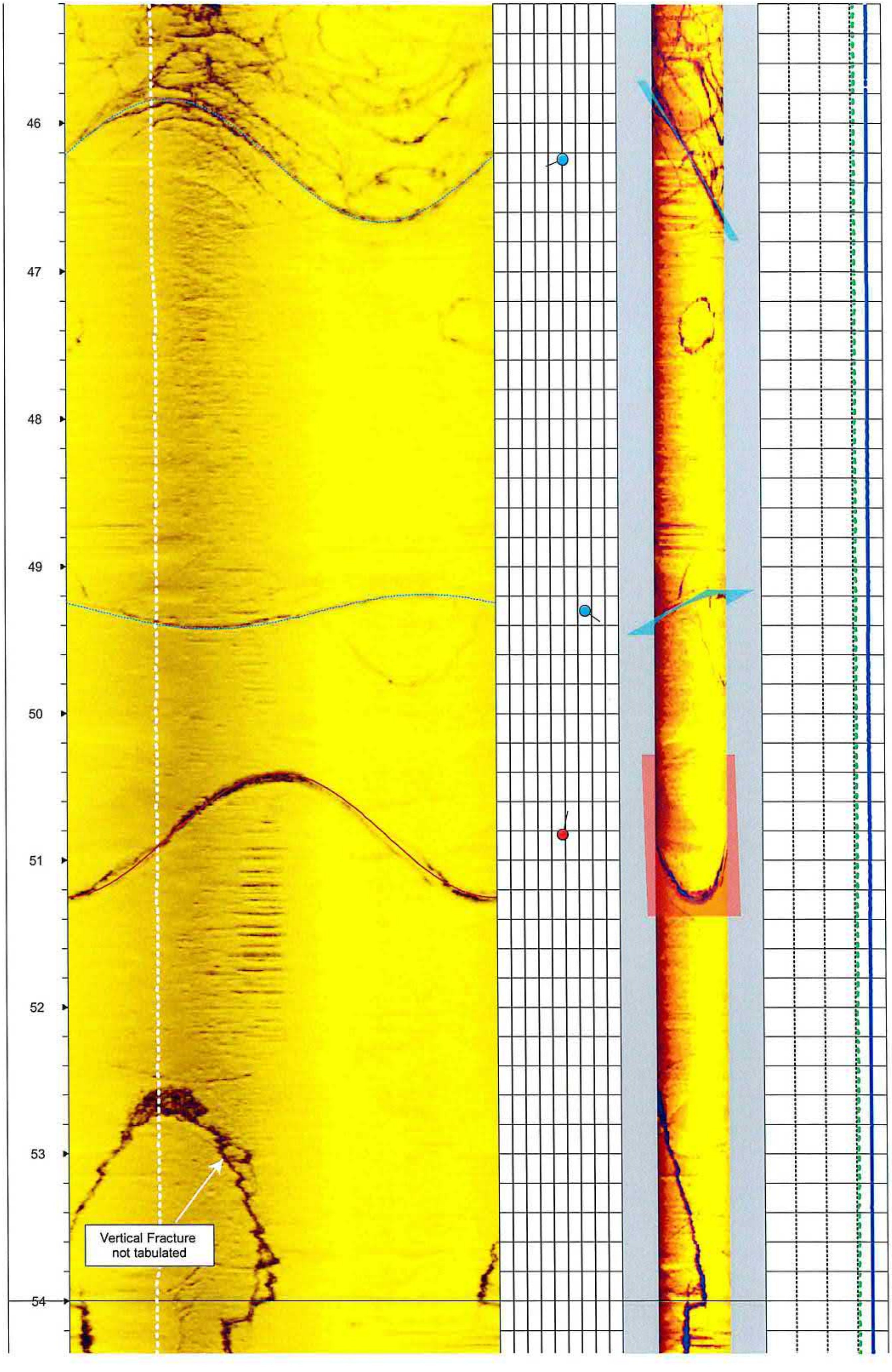
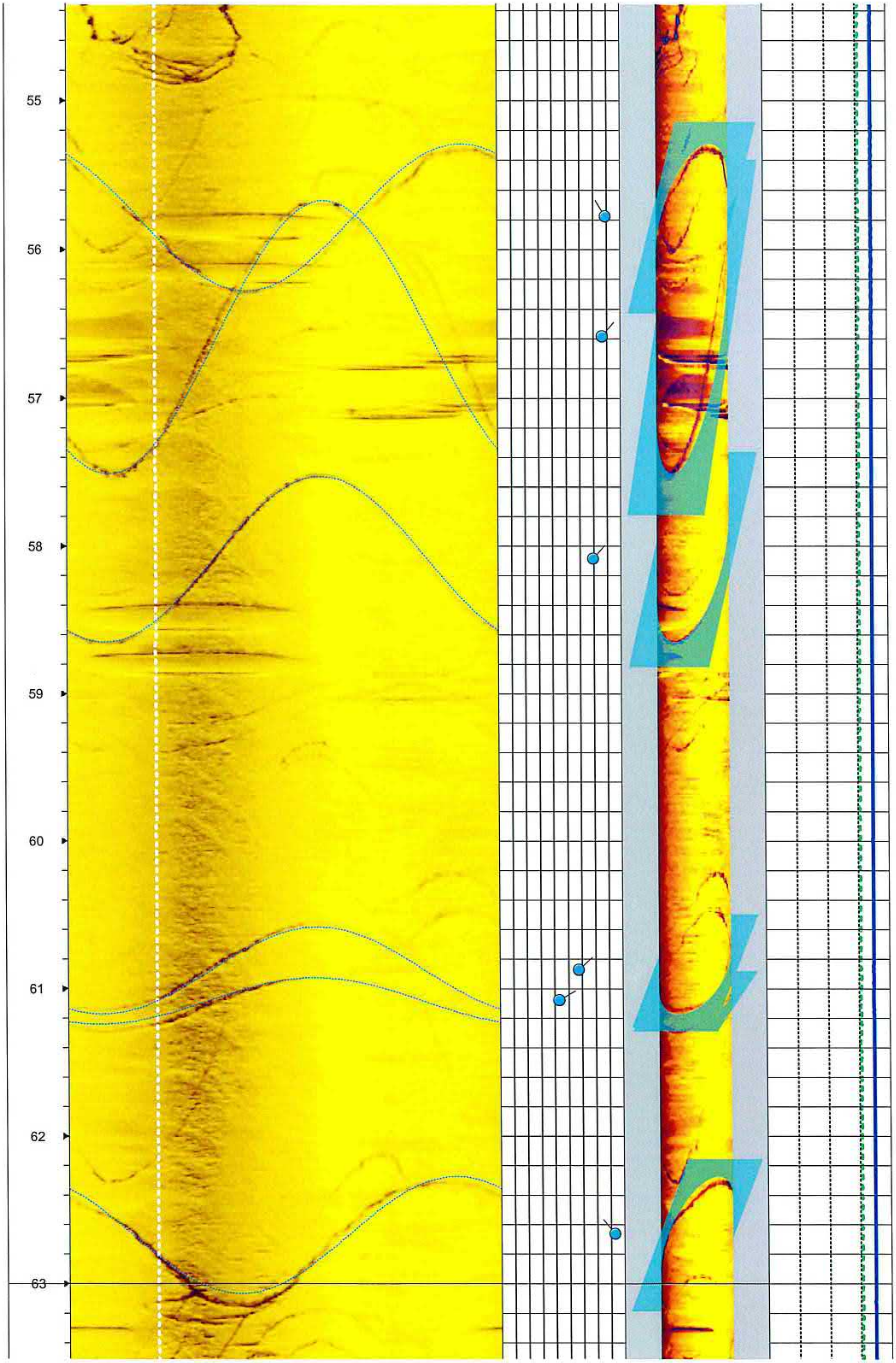


Vertical Fracture not tabulated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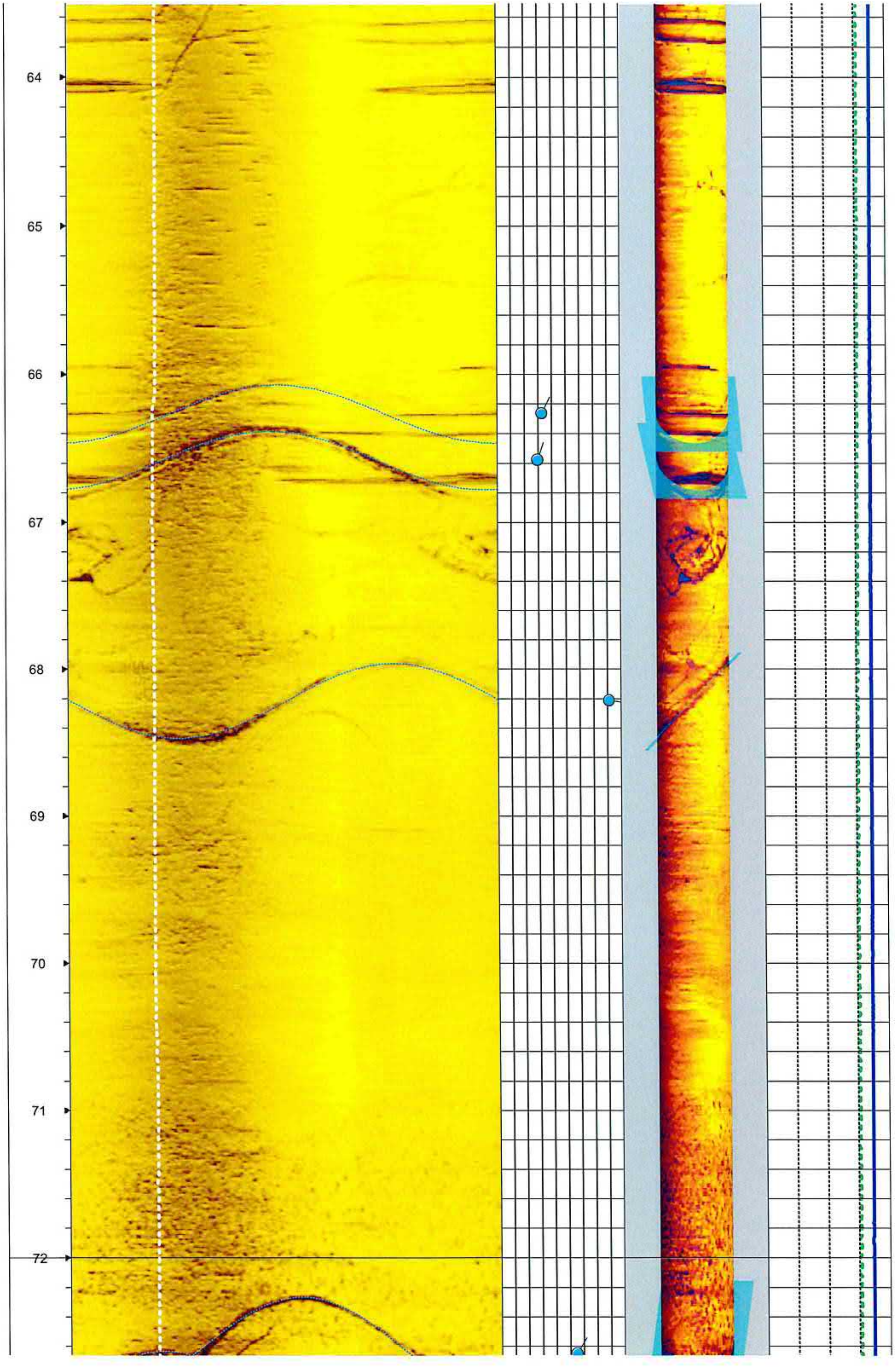
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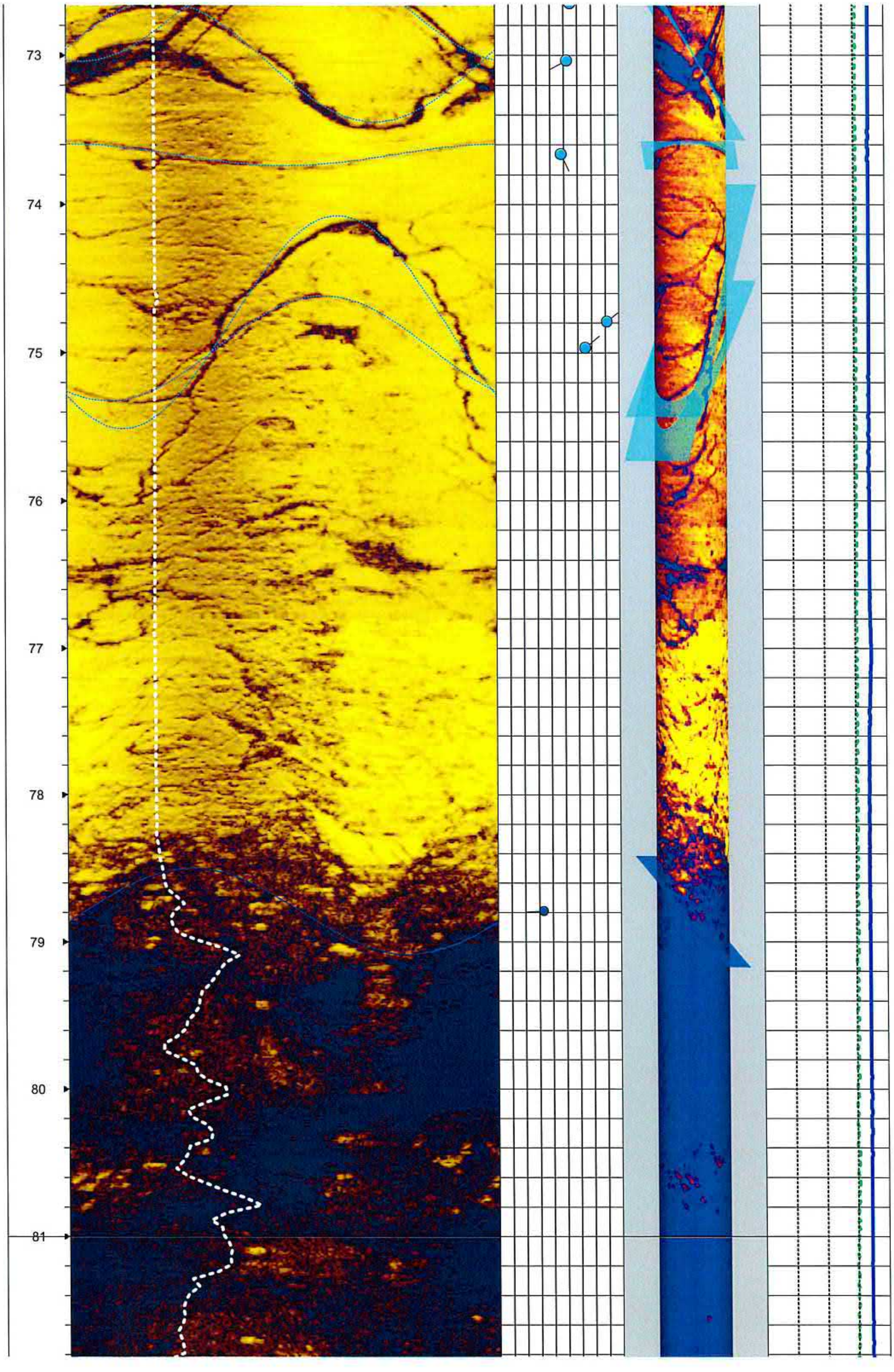
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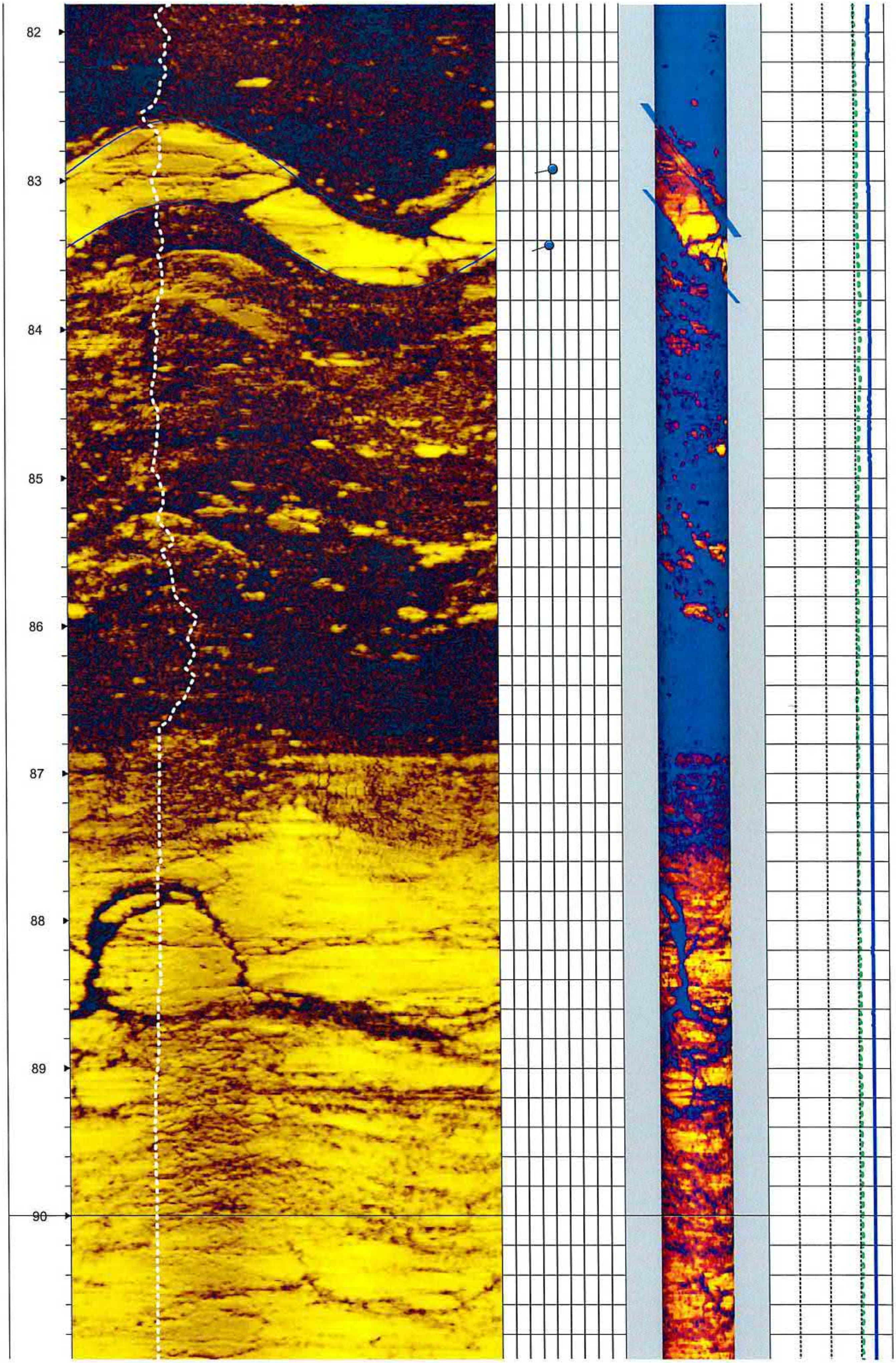
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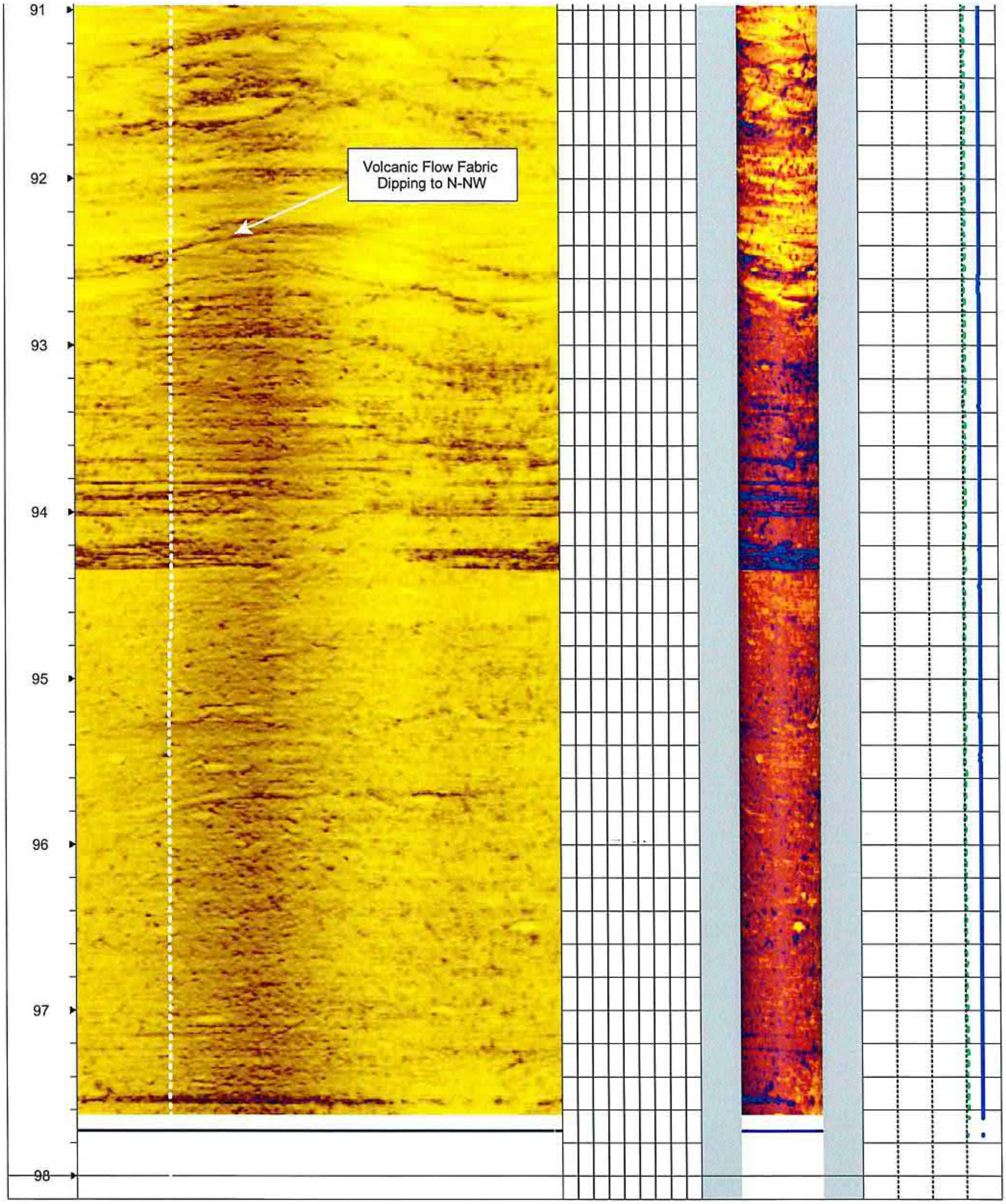
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Volcanic Flow Fabric Dipping to N-NW
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Appendix D:

Discontinuity Table
Boreholes B-206

Borehole-B-206 Borehole Discontinuity Orientations from Televiewer Analysis
Klamath River Project, Siskiyou Co., CA
NORCAL JOB NO. NS185074

DISCONTINUITY LEGEND

Code	Tadpole	Sine Wave	Name
1	●	———	Open, continuous fracture
2	●	- - - - -	Thin, partial to continuous fracture
3	●	———	Lithologic contact

Field work conducted in July, 2018

Depth ft	Dip Azimuth deg	Dip Angle deg	Vein Thickness 1/10 inches	Discontinuity Classification (see Explanation)
22.57	140.32	76.75	na	2
23.12	58.29	78.68	na	2
24.16	67.97	25.98	na	2
25.52	42.73	61.45	na	2
26.46	57.25	22.54	na	2
26.48	62.09	69.06	na	2
28.11	53.72	60.46	na	2
28.27	35.86	39.18	na	2
28.9	52	39.62	na	2
29.97	51.76	33.87	na	2
30.54	46.92	23.86	na	2
30.67	148.32	70.68	na	2
31.53	49.6	44.6	na	2
32.19	52.06	49.96	na	2
33.56	43.07	36.46	na	2
34.53	65.47	67.69	na	2
34.85	146.65	76.34	na	2
35.31	13.66	32.06	na	2
36.41	68.13	52.28	na	1
37.29	286.06	15.36	na	2
37.74	258.54	87.17	na	2
38.7	85.98	65.14	0.47	1
39.32	82.73	68.45	0.34	1
40.77	138.04	81.09	na	2
41.19	134.45	85.46	na	2
41.51	309.75	88.64	na	2
42.19	118.19	81.57	na	2
42.35	126.15	81.88	na	2
43.34	120.37	73.78	na	2
46.25	249.1	50.56	na	2
49.3	124.62	65.04	na	2
50.83	11.82	48.04	na	1
55.78	328.96	79.19	na	2
56.58	41.25	76.59	na	2
58.08	41.73	69.34	na	2

60.87	46.4	57.42	na	2
61.08	59.22	43.18	na	2
62.66	321.44	82.92	na	2
66.26	26.68	32.79	na	2
66.58	18.98	29.74	na	2
68.21	99.31	81.31	na	2
72.65	29.26	54.98	na	2
73.03	242.35	52.54	na	2
73.66	155.6	48.28	na	2
74.79	53.08	81.3	na	2
74.97	50.2	65.09	na	2
78.79	266.85	33.13	na	3
82.92	257.8	41.65	na	3
83.43	251.52	38.95	na	3

Note: "na" = true thickness of discontinuty aperture not determined

APPENDIX D LABORATORY TEST DATA

Log of Shelby Tube

CTL No.: 020-272

Company Name: AECOM

Project Name: Klamath River Dam

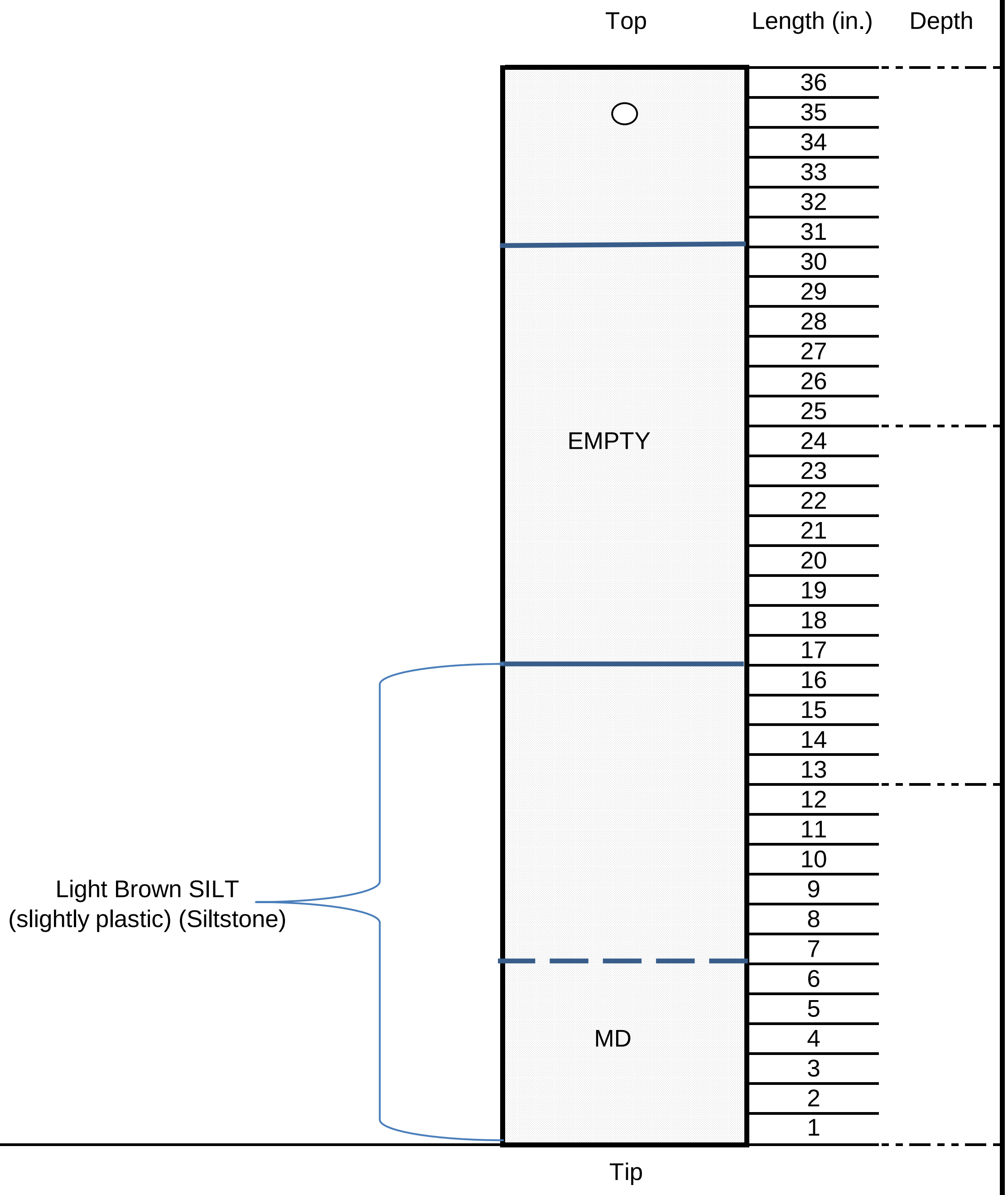
Project No.: 60537920

Boring: **BC-13** Sample: **S03** Depth (ft.): **17'**

Date: 1/15/2019

Run By: MD

Reduced By: RU

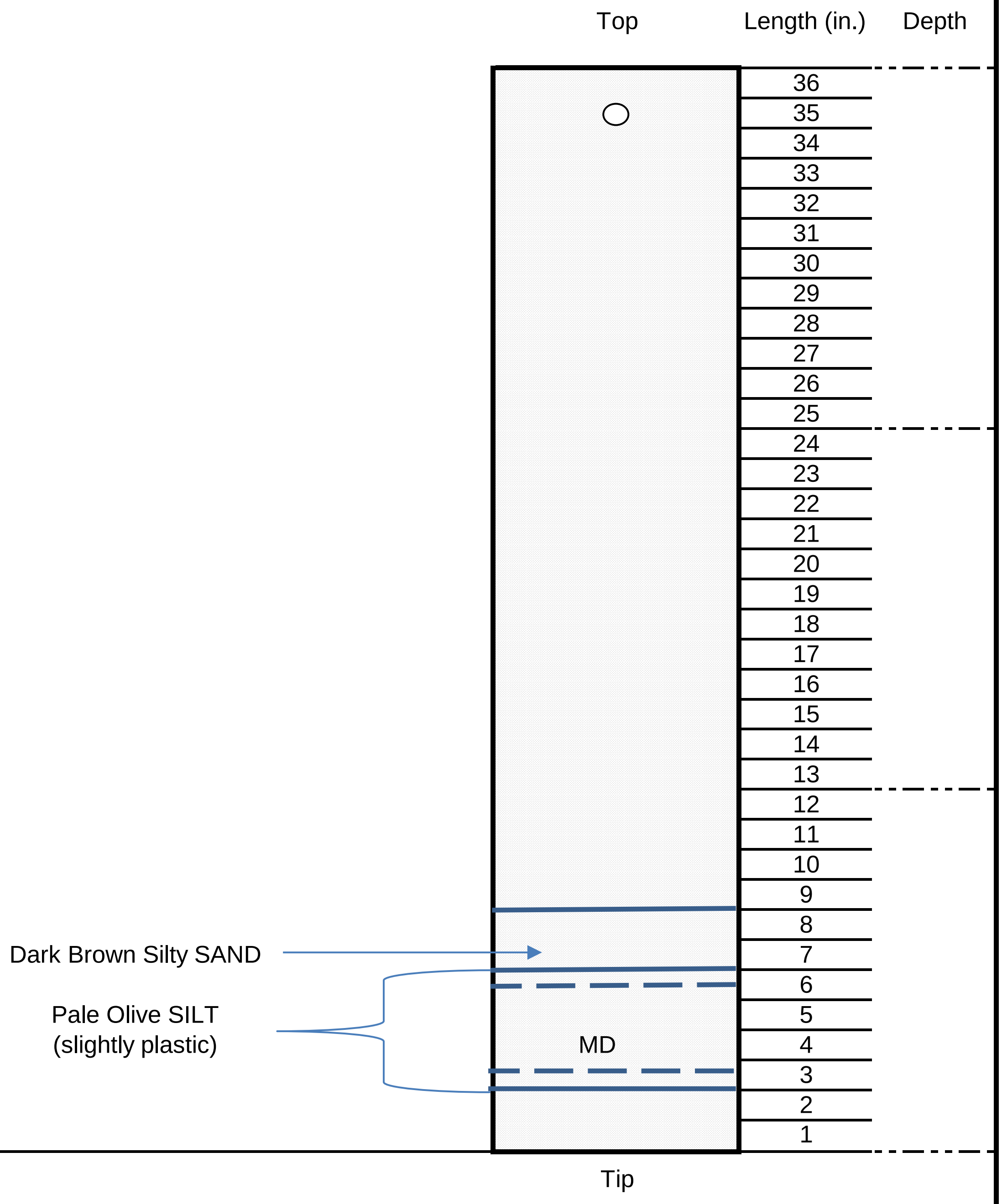


NOTE: All descriptions are visual descriptions unless classification tests were performed on that portion of the tube. Dashed lines indicate zones where listed tests were performed.

COOPER
TESTING LABORATORY

Log of Shelby Tube

CTL No.: 020-272
Company Name: AECOM
Project Name: Klamath River Dam
Project No.: 60537920
Boring: **BC-13**
Sample: **S04**
Depth (ft.): **22'**
Date: 1/15/2019
Run By: MD
Reduced By: RU

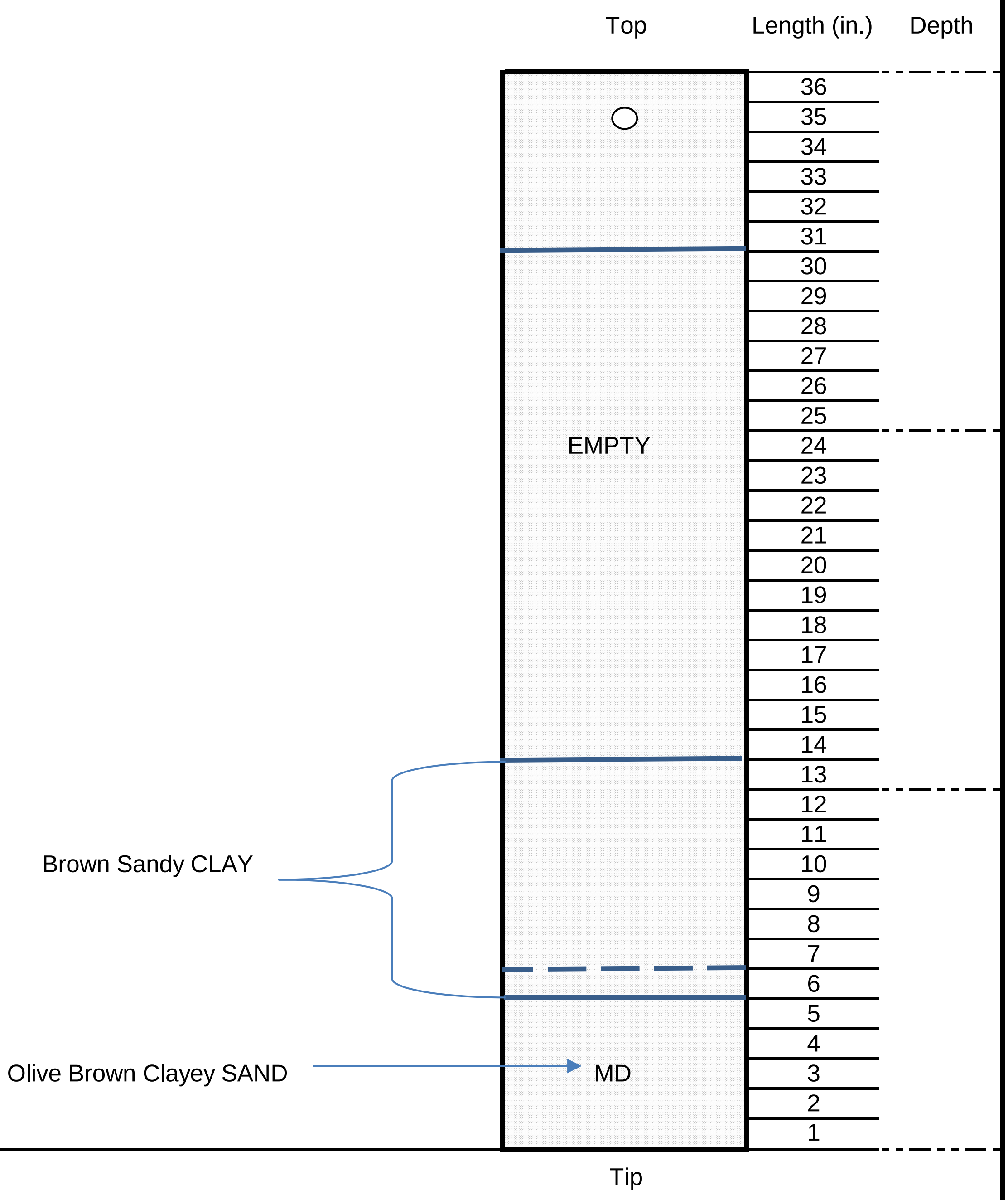


NOTE: All descriptions are visual descriptions unless classification tests were performed on that portion of the tube. Dashed lines indicate zones where listed tests were performed.

Log of Shelby Tube

CTL No.: 020-272
Company Name: AECOM
Project Name: Klamath River Dam
Project No.: 60537920
Boring: **BC-13**
Sample: **S06**
Depth (ft.): **40'**

Date: 1/15/2019
Run By: MD
Reduced By: RU



NOTE: All descriptions are visual descriptions unless classification tests were performed on that portion of the tube. Dashed lines indicate zones where listed tests were performed.

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

22 February, 2019

Job No. 1902023
Cust. No. 12259

Mr. John Hunt
Inspection Services Inc.
1798 University Avenue
Berkeley, CA 94703-1514

Subject: Project No.: 60537920
Project Name: Klamath River Dam Removal Project
Corrosivity Analysis – CalTrans Test Methods

Dear Mr. Hunt:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on February 05, 2019. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, Sample No.003 is classified as "severely corrosive" and the remaining samples are classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations reflect none detected with a reporting limit of 15 mg/kg.

The sulfate ion concentrations reflect none detected & 26 mg/kg and are determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH of the soils ranged from 7.84 to 8.97, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

Client: Inspection Services, Inc.
Client's Project No.: 60537920
Client's Project Name: Klamath River Dam Removal Project
Date Sampled: 1-Feb-19
Date Received: 5-Feb-19
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 22-Feb-2019

Job/Sample No.	Sample I.D.	Moisture (%)	pH	Min.Resistivity (ohms-cm)**	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1902023-001	B-6, S-01 @ 5-6.5'	-	8.97	840	-	N.D.	N.D.
1902023-002	B-19, S-01 & S-02 @ 5-11.5'	-	7.97	980	-	N.D.	26
1902023-003	B-20, S-01 & S-02 @ 5-11.5'	-	7.84	470	-	N.D.	N.D.

Method:	CT 226 (a)	CT 643 (b)	CT 643 (b)	-	CT 422 (c)	CT 417 (c)
Reporting Limit:	-	-	-	50	15	15
Date Analyzed:	-	8-Feb-2019	14-Feb-2019 & 19-Feb-2019	-	8-Feb-2019	8-Feb-2019

* Results Reported on an "As Received" Basis

N.D. - None Detected

(a) Rev. July 2010 (b) Rev. June 2007 (c) Rev. November 2006

Cheryl McMillen
Laboratory Director

Quality Control Summary - **All laboratory quality control parameters were found to be within established limits**

Chain of Custody

Page of

1100 Willow Pass Court
Concord, CA 94520-1006
925 462 2771
Fax: 925 462 2775

CERCO analytica

Job No. 1902093 CU# 12359 Client Project I.D. 60537920

Schedule

Analyte CalTrans w/Brief Evalation

Date Sampled

Date Due

Full Name John Hunt

Fax

Phone

Company IST Berkeley

Cell 510-809-5130 ☒

Sample Source Klamath River Dam Removal Project

ANALYSIS

Lab No.	Sample I.D.	Date	Time	Matrix	Contain.	Size	Preserv.	Qty.	pH	Sulfate	Chloride	Resistivity-Minimum	Brief Evaluation
001	B-6 S-01 5-6.5'	2-1				Baggie			x	x	x	x	X
002	B-19 S-01 5-11.5' S-02	2-1				Baggie			X	X	X	X	X
003	B-20 S-01 5-11.5' S-02	2-1				Baggie			X	X	X	X	X

MATRIX

DW - Drinking Water
GW - Ground Water
SW - Surface Water
WW - Waste Water
Water
SL - Sludge
S - Soil
Product

ABBREVIATIONS

HB - Hosebib
PV - Petcock Valve
PT - Pressure Tank
PH - Pump House
RR - Restroom
GL - Glass
PL - Plastic
ST - Sterile

SAMPLE RECEIPT

Total No. of Containers
Rec'd Good Cond/Cold
Conforms to Record
Temp. a t Lab -°C
Sampler

Relinquished By: Date 2/5/19 Time 1213
Received By: Date 2/5/19 Time 1213
Relinquished By: Date Time
Received By: Date Time
Relinquished By: Date Time
Received By: Date Time

Comments:

THERE IS AN ADDITIONAL CHARGE FOR METAL/POLY TUBES

jhunt@inspectionservices.net

Moisture-Density-Porosity Report

Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No: 020-251a **Project No.** 60537920 **By:** RU

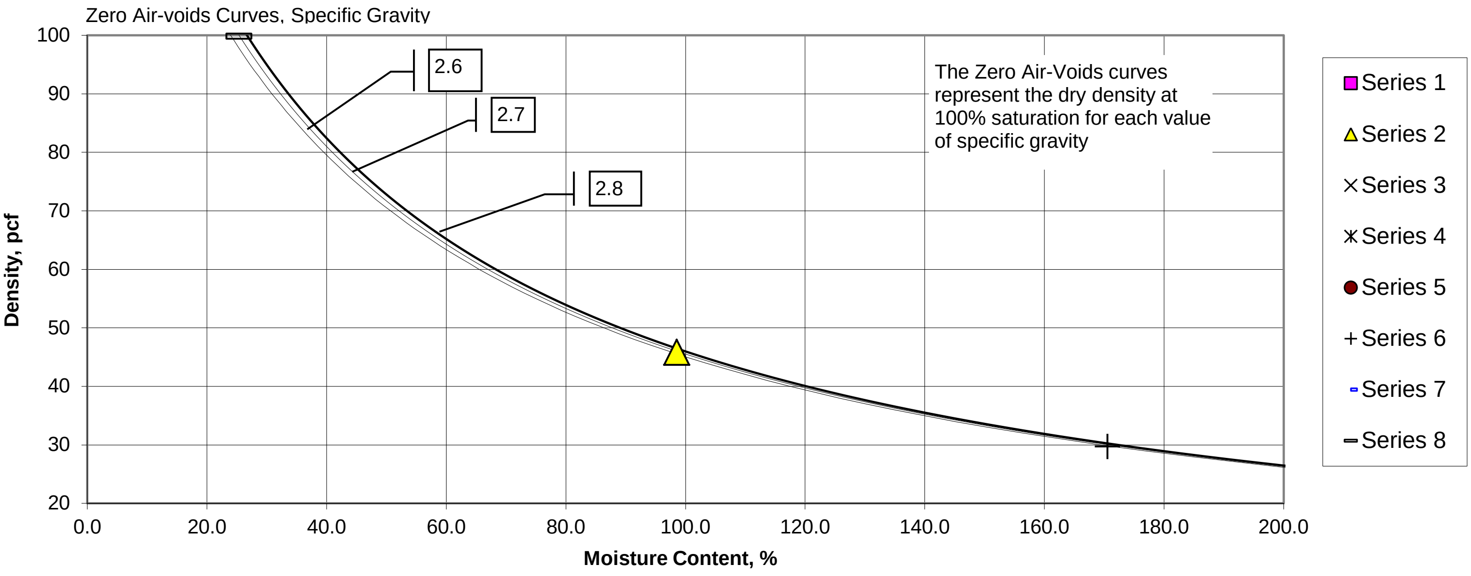
Client: AECOM **Date:** 06/13/18

Project Name: Klamath River Dam Removal Project **Remarks:**

Boring:	BC-01	BC-01	BC-01	BC-02	BC-02	BC-02	BC-03	BC-03
Sample:	S-02	S-03	S04	S05	S09	S10	S-01	S-02
Depth, ft:	6.5	12.5-13	21.5	14.5	44.5	54.8-55.3	1	5.5-6.0
Visual Description:	Dark Olive Gray Sandy SILT	Light Yellowish Brown Sandy CLAY	Gray Elastic SILT	Gray Elastic SILT	Gray Elastic SILT	Black CLAY	Dark Olive Brown Sandy Lean CLAY	Dark Olive Brown Sandy CLAY w/ Gravel
Actual G_s								
Assumed G_s		2.70				2.70		2.70
Moisture, %	43.1	98.6	92.9	83.7	177.8	170.6	34.7	25.4
Wet Unit wt, pcf		91.0				80.3		125.2
Dry Unit wt, pcf		45.8				29.7		99.9
Dry Bulk Dens.pb, (g/cc)		0.73				0.48		1.60
Saturation, %		99.3				98.3		99.4
Total Porosity, %		72.8				82.4		40.8
Volumetric Water Cont,Ɵw,%		72.3				81.0		40.6
Volumetric Air Cont., Ɵa,%		0.5				1.4		0.2
Void Ratio		2.68				4.68		0.69
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

Moisture-Density



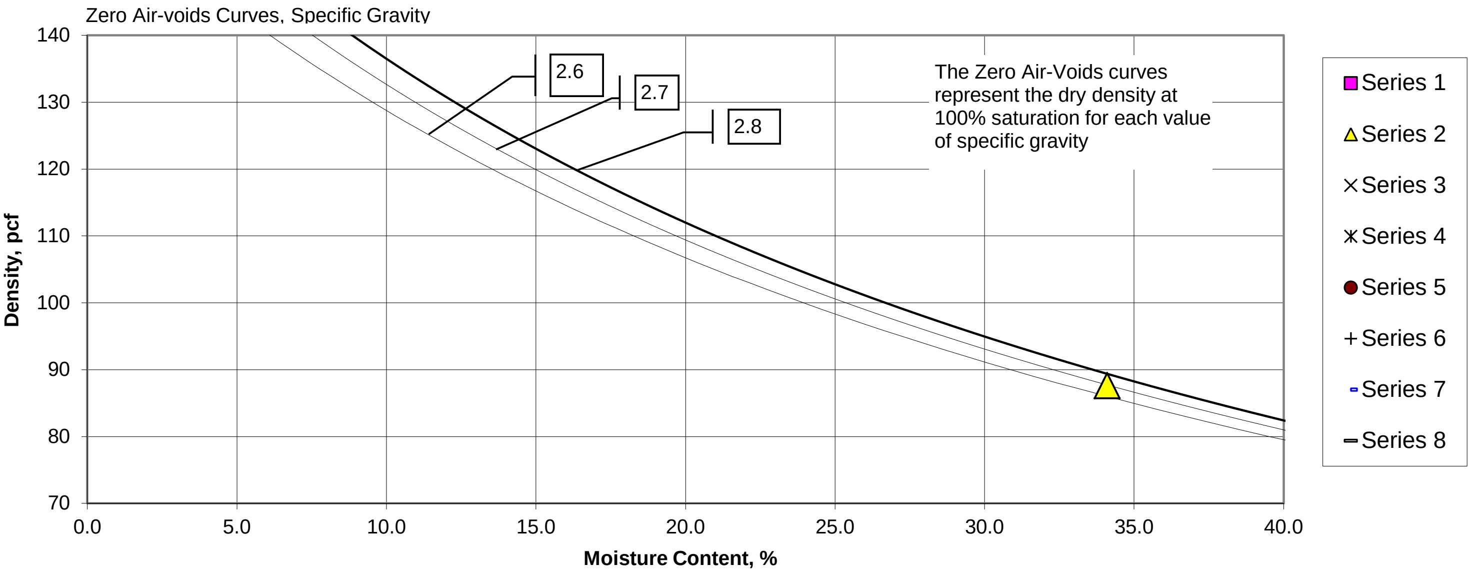
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No: 020-251b **Project No.** 60537920 **By:** RU
Client: AECOM **Date:** 06/13/18
Project Name: Klamath River Dam Removal Project **Remarks:**

Boring:	BC-03	BC-07	BC-08	BC-08A	BI-02	BI-02	BI-02	BI-03
Sample:	S05	S-02	S-01	S05	S1	S2	S3	S-1
Depth, ft:	24.5	4-4.5	3	54	5	10	15	3.5
Visual Description:	Light Olive Brown Elastic SILT	Very Dark Olive Brown Sandy Fat CLAY w/ Gravel	Dark Reddish Brown Sandy Fat CLAY	Light Olive Brown Elastic SILT	Dark Reddish Brown Sandy Fat CLAY	Yellowish Brown Sandy Fat CLAY	Yellowish Brown Sandy Fat CLAY	Olive Gray Poorly Graded GRAVEL w/ Silt & Sand
Actual G_s								
Assumed G_s		2.70						
Moisture, %	80.3	34.1	31.4	178.6	27.8	28.7	38.4	12.0
Wet Unit wt, pcf		117.5						
Dry Unit wt, pcf		87.6						
Dry Bulk Dens.pb, (g/cc)		1.40						
Saturation, %		99.5						
Total Porosity, %		48.1						
Volumetric Water Cont,Θw,%		47.8						
Volumetric Air Cont., Θa,%		0.2						
Void Ratio		0.93						
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

Moisture-Density

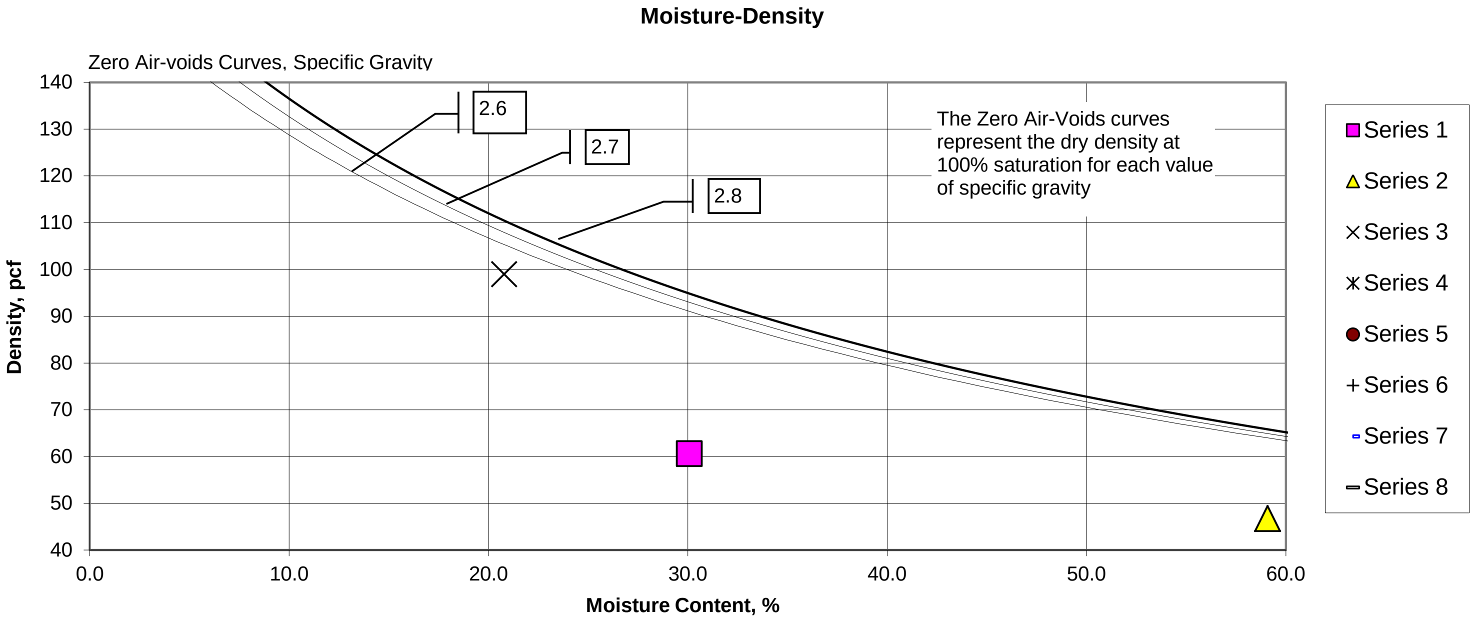


Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No:	020-272	**Project No.**	60537920	**By:** RU
Client:	AECOM	**Date:**	01/18/19	
Project Name:	Klamath	**Remarks:**		

Boring: **Sample:** **Depth, ft:**	BC-13 S03 17	BC-13 S04 22	BC-13 S06 40					
Visual Description:	Light Brown SILT (Siltstone) (slightly plastic)	Pale Olive SILT (slightly plastic)	Olive Brown Clayey SAND					
Actual G_s								
Assumed G_s	2.70	2.70	2.70					
Moisture, %	30.1	59.1	20.8					
Wet Unit wt, pcf	78.8	74.4	119.6					
Dry Unit wt, pcf	60.6	46.8	99.0					
Dry Bulk Dens.pb, (g/cc)	0.97	0.75	1.59					
Saturation, %	45.5	61.2	79.7					
Total Porosity, %	64.1	72.3	41.3					
Volumetric Water Cont,Өw,%	29.2	44.2	32.9					
Volumetric Air Cont., Өa,%	34.9	28.0	8.4					
Void Ratio	1.79	2.61	0.70					
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

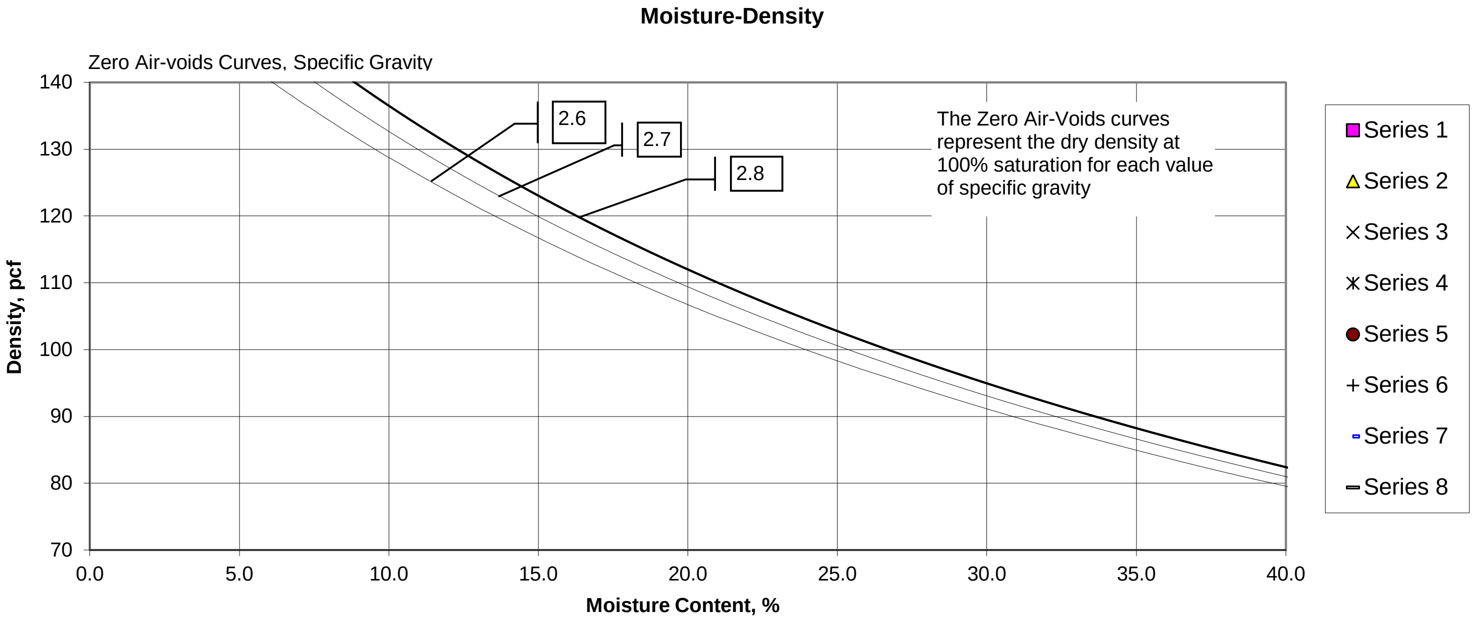


Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No: 020-251b
Client: AECOM
Project Name: Klamath River Dam Removal Project
Project No. 60537920
Date: 06/13/18
Remarks:
By: RU

Boring: **Sample:** **Depth, ft:**					BI-02 S1 5	BI-02 S2 10	BI-02 S3 15	BI-03 S-1 3.5
Visual Description:					Dark Reddish Brown Sandy Fat CLAY	Yellowish Brown Sandy Fat CLAY	Yellowish Brown Sandy Fat CLAY	Olive Gray Poorly Graded GRAVEL w/ Silt & Sand
Actual G_s								
Assumed G_s								
Moisture, %					27.8	28.7	38.4	12.0
Wet Unit wt, pcf								
Dry Unit wt, pcf								
Dry Bulk Dens.pb, (g/cc)								
Saturation, %								
Total Porosity, %								
Volumetric Water Cont,Θw,%								
Volumetric Air Cont., Θa,%								
Void Ratio								
Series					1	2	3	4

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



MOISTURE & DENSITY TEST

Client : AECOM
Project : Klamath River Dam Removal Project
ISI Lab No.: G-63174
Job no : 60537920

Boring #	B-2	B-4	B-5	B-6	B-6	B-6	B-6	B-6
Sample #	S-01	S-01	S-02	S-02	S-03	S-04	S-05	S-06
Depth (ft.)	27-27.5	5-6.5	7.5-9	10-11.5	15-16.5	30-31.5	40-41.5	45-46.5
Soil type: (visual)	Gray silty sand with gravel	Grayish brown sandy clay with gravel	Grayish brown clayey gravel with sand	Grayish brown silty sand with organics	Dark gray clayey sand	Reddish brown clayey gravel with sand	Grayish brown gravel with sand	Gray gravel
1. Date tested:	01/23/19	01/26/19	01/26/19	01/23/19	01/26/19	01/26/19	01/26/19	01/26/19
2. Tested by:	JH	JH	JH	JH	JH	JH	JH	JH
3. Specimen height (in.)		5.17		5.37		5.98		
4. Wt. of specimen + tare (gm)		805.91		824.75		1173.34		
5. Tare wt. (gm)		0.00		206.10		203.70		
6. Diameter (in.)		2.42		2.42		2.42		
7. Wet wt. of soil + dish wt. (gm)	1157.51	1002.84	453.90	446.32	384.60	1323.52	974.35	825.39
8. Dry wt. of soil + dish wt. (gm)	1032.81	912.52	437.81	359.22	317.89	1209.09	945.10	788.49
9. Wt. of dish (gm)	166.03	200.96	83.11	187.89	84.88	361.35	187.94	188.28
10. Dish ID								

Wet Density (pcf)		129.0		95.3		134.2		
Dry Density (pcf)		114.5		63.2		118.2		
Moisture Content (%)	14.4	12.7	4.5	50.8	28.6	13.5	3.9	6.1

Gs (Assumed)	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Void Ratio		0.472		1.666		0.425		
Saturation (%)		72.6		82.4		85.7		

Additional data:

Wt. of dry soil + dish before washing (gm)								
Wt. of dry soil + dish after washing (gm)								
% Passing # 200 sieve								
USCS symbol								

MOISTURE & DENSITY TEST

Client : AECOM

Project : Klamath River Dam Removal Project

ISI Lab No.: G-63174

Job no : 60537920

	Boring #	B-7	B-8	B-8	B-8	B-8	B-10	B-19	B-19
	Sample #	S-02	S-01	S-02	S-03	S-04	S-02	S-01	S-03
	Depth (ft.)	16.5-18	13-14.5	16-17.5	20-21.5	25-25.5	25.5-27	5-6.5	15-16.5
	Soil type: (visual)	Gray clayey sand with organics			Grayish brown clay with sand	Dark grayish brown clayey sand	Grayish brown clayey sand		Mottled grayish brown sandy clay
1.	Date tested:	01/26/19	01/26/19	01/26/19	01/26/19	01/26/19	01/26/19	01/26/19	01/26/19
2.	Tested by:	JH	JH	JH	JH	JH	JH	JH	JH
3.	Specimen height (in.)							5.67	
4.	Wt. of specimen + tare (gm)							788.65	
5.	Tare wt. (gm)							0.00	
6.	Diameter (in.)							2.42	
7.	Wet wt. of soil + dish wt. (gm)	359.80	113.16	124.99	133.28	499.55	457.34	237.77	1074.57
8.	Dry wt. of soil + dish wt. (gm)	269.65	100.69	95.27	113.85	469.95	428.90	204.03	939.01
9.	Wt. of dish (gm)	85.87	50.55	50.56	51.16	188.28	85.30	50.63	356.12
10.	Dish ID								

Wet Density (pcf)							115.1	
Dry Density (pcf)							94.4	
Moisture Content (%)	49.1	24.9	66.5	31.0	10.5	8.3	22.0	23.3

Gs (Assumed)	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Void Ratio							0.786	
Saturation (%)							75.6	

Additional data:

Wt. of dry soil + dish before washing (gm)								
Wt. of dry soil + dish after washing (gm)								
% Passing # 200 sieve								
USCS symbol								

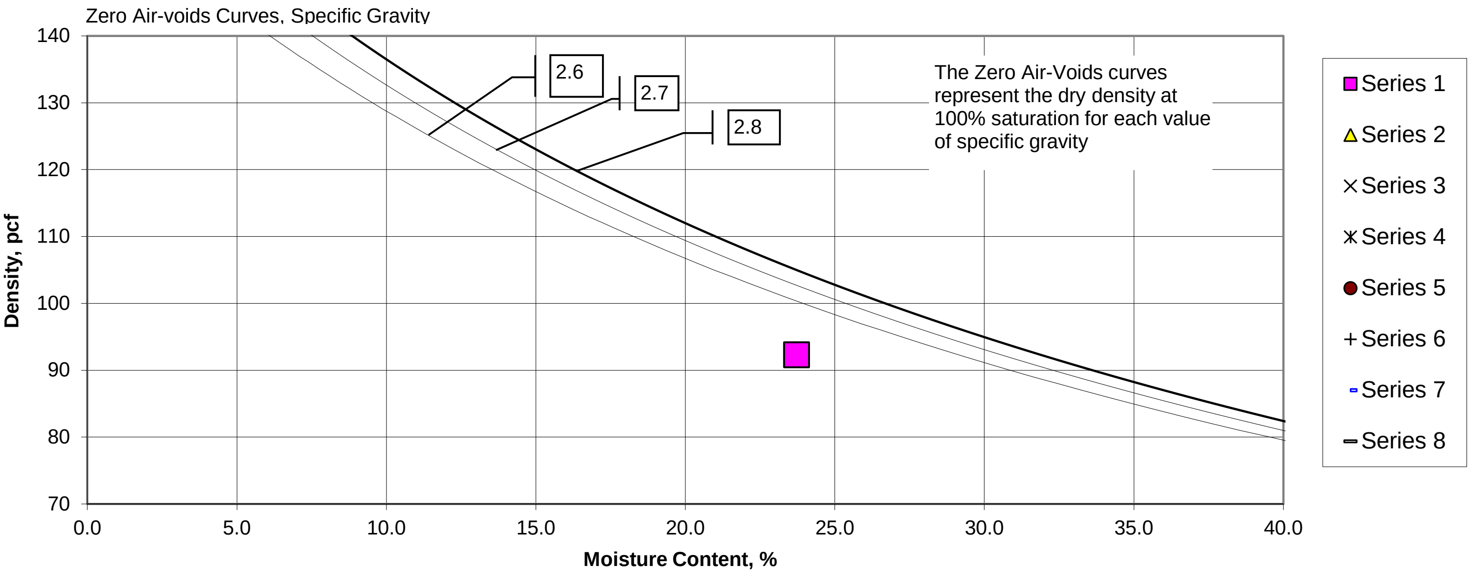
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No: 020-277 **Project No.** 60537920 **By:** RU
Client: AECOM **Date:** 03/21/19
Project Name: Klamath River Renewal Project **Remarks:**

Boring: **Sample:** **Depth, ft:**	B-15 S1 5-5.5							
Visual Description:	Brown Sandy Fat CLAY							
Actual G_s								
Assumed G_s	2.70							
Moisture, %	23.7							
Wet Unit wt, pcf	114.1							
Dry Unit wt, pcf	92.3							
Dry Bulk Dens.pb, (g/cc)	1.48							
Saturation, %	77.3							
Total Porosity, %	45.3							
Volumetric Water Cont,Θw,%	35.0							
Volumetric Air Cont., Θa,%	10.3							
Void Ratio	0.83							
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

Moisture-Density



MOISTURE & DENSITY TEST

ISI Lab No.: G-63174

Client : AECOM

Project : Klamath River Dam Removal Project

Job no : 60537920

Boring #	B-19	B-20	B-20	B-20				
Sample #	S-04	S-03	S-04	S-05				
Depth (ft.)	20-21.5	15-16.5	20-21.5	25-26.5				
Soil type: (visual)	Grayish brown clayey gravel with sand	Grayish brown sandy clay	Grayish brown clayey sand	Grayish brown clayey sand with gravel				
1. Date tested:	01/26/19	01/26/19	01/26/19	01/26/19				
2. Tested by:	JH	JH	JH	JH				
3. Specimen height (in.)								
4. Wt. of specimen + tare (gm)								
5. Tare wt. (gm)								
6. Diameter (in.)								
7. Wet wt. of soil + dish wt. (gm)	1187.41	680.92	765.13	630.86				
8. Dry wt. of soil + dish wt. (gm)	1024.76	550.85	657.31	563.27				
9. Wt. of dish (gm)	311.57	186.22	188.13	187.57				
10. Dish ID								

Wet Density (pcf)								
Dry Density (pcf)								
Moisture Content (%)	22.8	35.7	23.0	18.0				

Gs (Assumed)	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
Void Ratio								
Saturation (%)								

Additional data:

Wt. of dry soil + dish before washing (gm)								
Wt. of dry soil + dish after washing (gm)								
% Passing # 200 sieve								
USCS symbol								

COOPER
TESTING LABORATORY

#200 Sieve Wash Analysis
ASTM D 1140

Job No.: 020-251
Project No.: 60537920
Run By: MD
Client: AECOM
Date: 6/14/2018
Checked By: DC
Project: Klamath River Dam Removal Project

Boring:	BC-02	BC-03	BC-04	BC-04				
Sample:	S-01	S-01	S-01	S02				
Depth, ft.:	1-2	1	1.5	7				
Soil Type:	Dark Olive Brown Clayey GRAVEL w/ Sand	Dark Olive Brown Sandy Lean CLAY	Dark Olive Brown Clayey SAND	Dark Olive Brown Sandy CLAY				
Wt of Dish & Dry Soil, gm	1247.4	707.6	696.3	656.3				
Weight of Dish, gm	175.6	175.8	172.4	173.0				
Weight of Dry Soil, gm	1071.8	531.8	523.9	483.3				
Wt. Ret. on #4 Sieve, gm	556.7	16.7	22.3	15.6				
Wt. Ret. on #200 Sieve, gm	774.5	177.4	291.7	205.6				
% Gravel	**51.9**	**3.1**	**4.3**	**3.2**				
% Sand	**20.3**	**30.2**	**51.4**	**39.3**				
% Silt & Clay	**27.7**	**66.6**	**44.3**	**57.5**				

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).

COOPER
TESTING LABORATORY

#200 Bulk Sieve Wash Analysis
ASTM D 1140m

Job No.: 020-251
Client: AECOM
Project: Klamath River Dam Removal Project
Project No.: 60537920
Date: 6/14/2018
Run By: MD
Checked By: DC

Boring:	BC-07							
Sample:	S-02							
Depth, ft.:	4-4.5							
Soil Type:	Very Dark Olive Brown Sandy Fat CLAY w/ Gravel							
Bulk Sample wt. lb.	218.0							
Wt of Dish & Dry Soil <#4,gm	389.5							
Weight of Dish, gm	171.0							
Weight of Dry Soil <#4, gm	218.5							
Wt. Ret. on #4 Sieve, lb	33.1							
Wt. Ret. on #200 Sieve, gm	52.3							
% Gravel	**15.2**							
% Sand	**20.3**							
% Silt & Clay	**64.5**							

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).

ASTM D-1140
PERCENT PASSING NO. 200 SIEVE REPORT

Method A
Specimens Soaked Overnight without Deflocculating Agent
Dry Mass Determined Directly

Client Name AECOM
Project Name Klamath River Dam Removal Project
Project Number 60537920

Boring Number	B-6	B-6	B-8	B-10	B-20
Sample Number	S-03	S-05	S-04	S-02	S-03
Depth (ft)	15-16.5	40-41.5	25-25.5	25.5-27	15-16.5
Percent of Soil Finer than No. 200 Sieve	36.2	2.4	27.6	15.7	67.8
Visual Classification	Dark gray clayey sand	Grayish brown gravel with sand	Dark grayish brown clayey sand	Grayish brown clayey sand	Grayish brown sandy clay

Date	01/26/19	01/26/19	01/26/19	01/26/19	01/26/19
Weight of Dry Soil + Pan (before wash)	317.9	945.1	470.0	428.9	550.9
Weight of Dry Soil + Pan (after wash)	233.5	927.2	392.2	375.1	303.7
Weight of Pan	84.9	187.9	188.3	85.3	186.2

COOPER
TESTING LABORATORY

#200 Sieve Wash Analysis
ASTM D 1140

Job No.: 020-277 **Project No.:** 60537920 **Run By:** MD

Client: AECOM **Date:** 3/26/2019 **Checked By:** DC

Project: Klamath River Renewal Project

Boring:	B-15							
Sample:	S3							
Depth, ft.:	15-16.5							
Soil Type:	Brown Clayey GRAVEL w/ Sand							
Wt of Dish & Dry Soil, gm	687.3							
Weight of Dish, gm	172.2							
Weight of Dry Soil, gm	515.1							
Wt. Ret. on #4 Sieve, gm	218.3							
Wt. Ret. on #200 Sieve, gm	357.6							
% Gravel	**42.4**							
% Sand	**27.0**							
% Silt & Clay	**30.6**							

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).

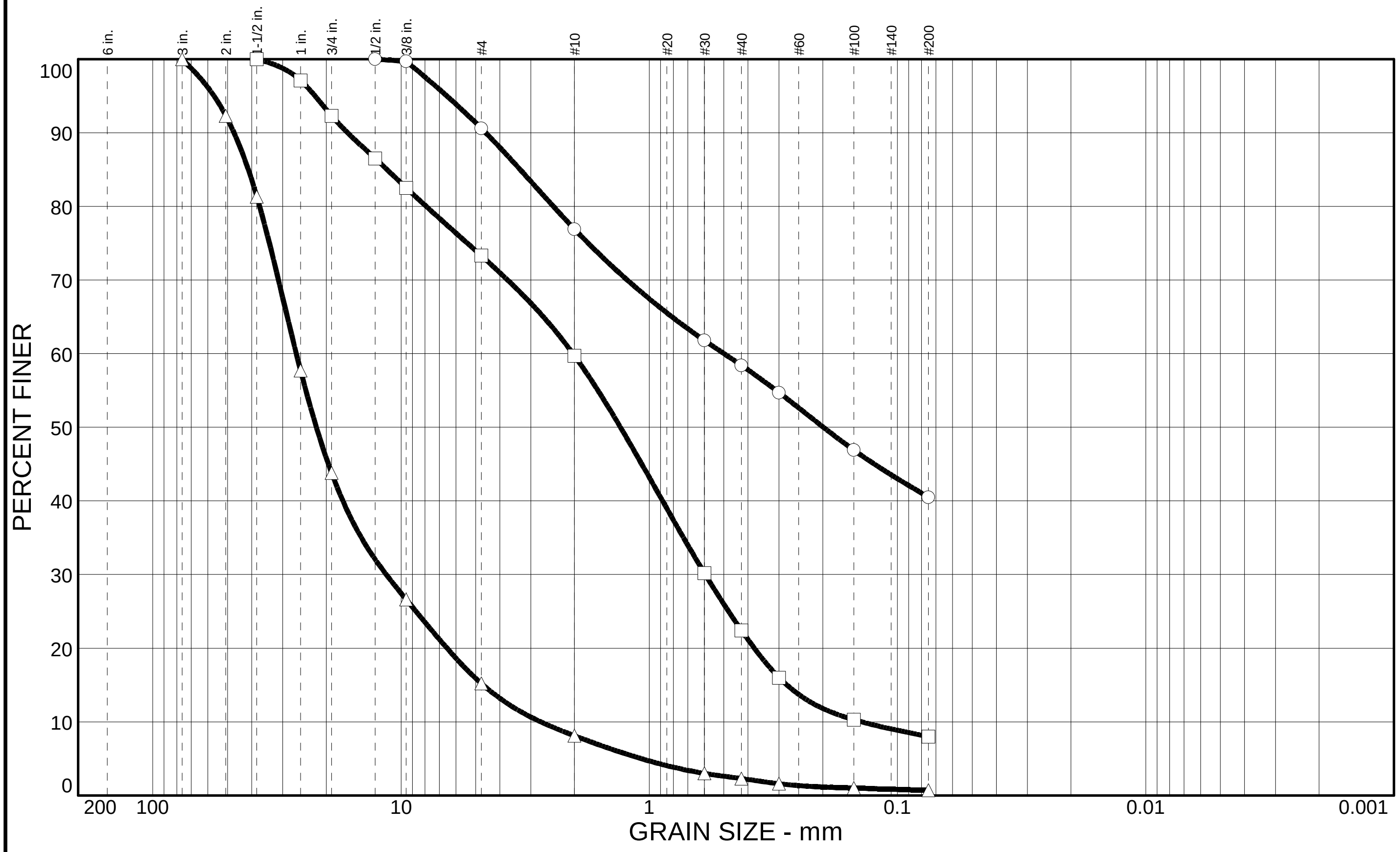
ASTM D-1140
PERCENT PASSING NO. 200 SIEVE REPORT
Method A
Specimens Soaked Overnight without Deflocculating Agent
Dry Mass Determined Directly

Client Name AECOM
Project Name Klamath River Dam Removal Project
Project Number 60537920

Boring Number	B-20				
Sample Number	S-05				
Depth (ft)	25-26.5				
Percent of Soil Finer than No. 200 Sieve	23.1				
Visual Classification	Grayish brown clayey sand with gravel				

Date	01/26/19				
Weight of Dry Soil + Pan (before wash)	563.3				
Weight of Dry Soil + Pan (after wash)	476.3				
Weight of Pan	187.6				

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		9.4	50.1	40.5					
□		26.7	65.3	8.0					
△		84.8	14.5	0.7					

SIEVE inches size	PERCENT FINER ○	□	△
3			100.0
2			92.3
1.5"		100.0	81.3
1"		97.1	57.7
3/4"		92.3	43.8
1/2"	100.0	86.5	
3/8"	99.7	82.5	26.6
	GRAIN SIZE		
D_{60}	0.500	2.03	26.4
D_{30}		0.595	11.5
D_{10}		0.139	2.74
	COEFFICIENTS		
C_c		1.25	1.82
C_u		14.56	9.65

SIEVE number size	PERCENT FINER ○	□	△
#4	90.6	73.3	15.2
#10	76.9	59.7	8.1
#30	61.8	30.2	3.0
#40	58.4	22.4	2.3
#50	54.7	16.0	1.6
#100	46.9	10.3	1.0
#200	40.5	8.0	0.7

SOIL DESCRIPTION

○ Reddish Brown Clayey SAND

□ Dark Olive Brown Well-Graded SAND w/ Silt & Gravel

△ Dark Olive Brown Well-Graded GRAVEL

REMARKS:

○

□ Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

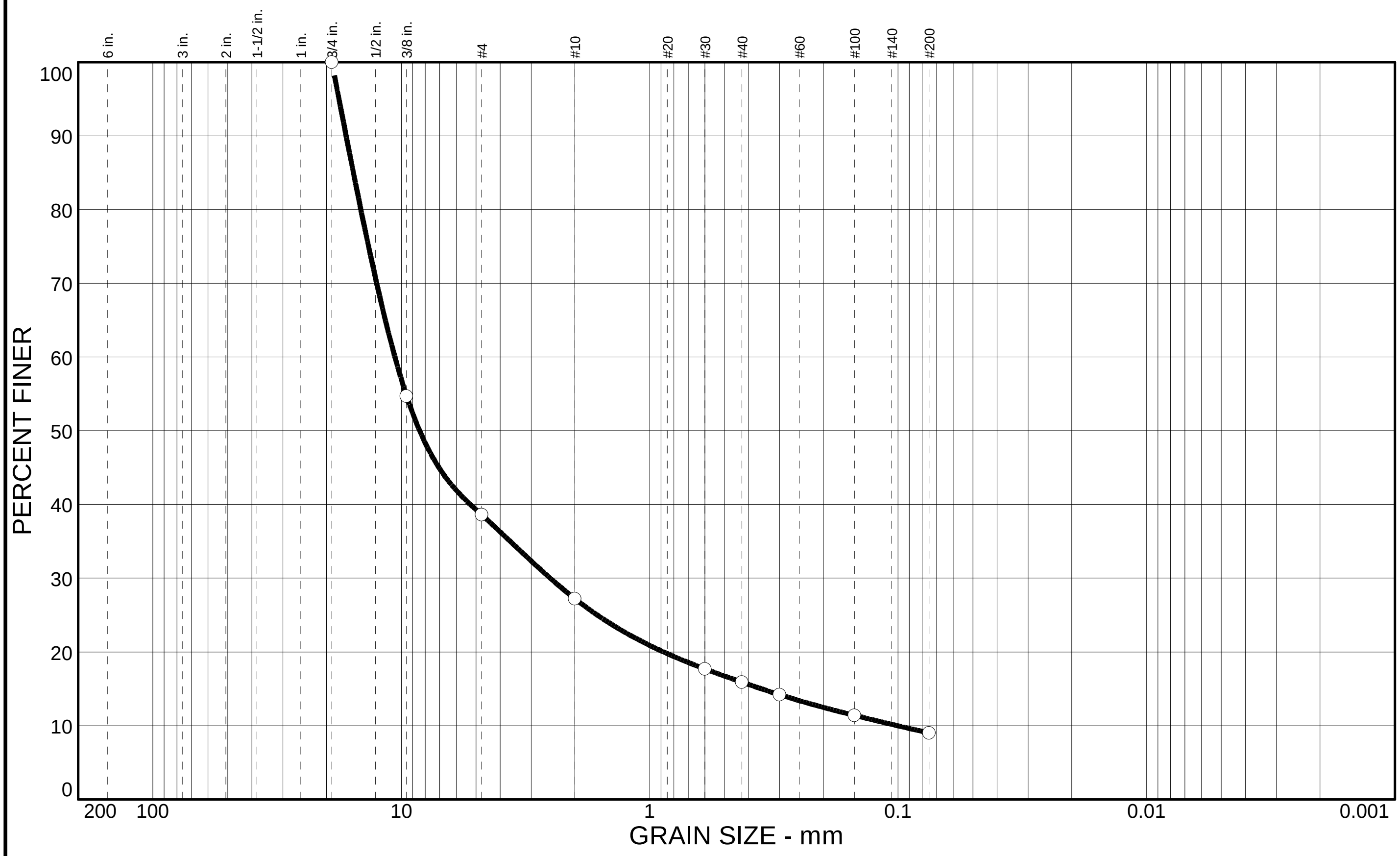
△

○ Source: BC-04 Sample No.: S-03 Elev./Depth: 11-12.5'
□ Source: BC-07 Sample No.: S-04 Elev./Depth: 13'
△ Source: BC-10 Sample No.: S-01 Elev./Depth: 9.5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No.: 020-251 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		61.4	29.6	9.0		GP-GM		26	41

SIEVE inches size	PERCENT FINER ○		
3/4"	100.0		
3/8"	54.7		
	GRAIN SIZE		
D_{60}	10.6		
D_{30}	2.52		
D_{10}	0.101		
	COEFFICIENTS		
C_c	5.92		
C_u	105.44		

SIEVE number size	PERCENT FINER ○		
#4	38.6		
#10	27.2		
#30	17.7		
#40	15.9		
#50	14.2		
#100	11.4		
#200	9.0		

SOIL DESCRIPTION

○ Olive Gray Poorly Graded GRAVEL w/ Silt & Sand

REMARKS:

○

○ Source: BI-03 Sample No.: S-01 Elev./Depth: 3.5'

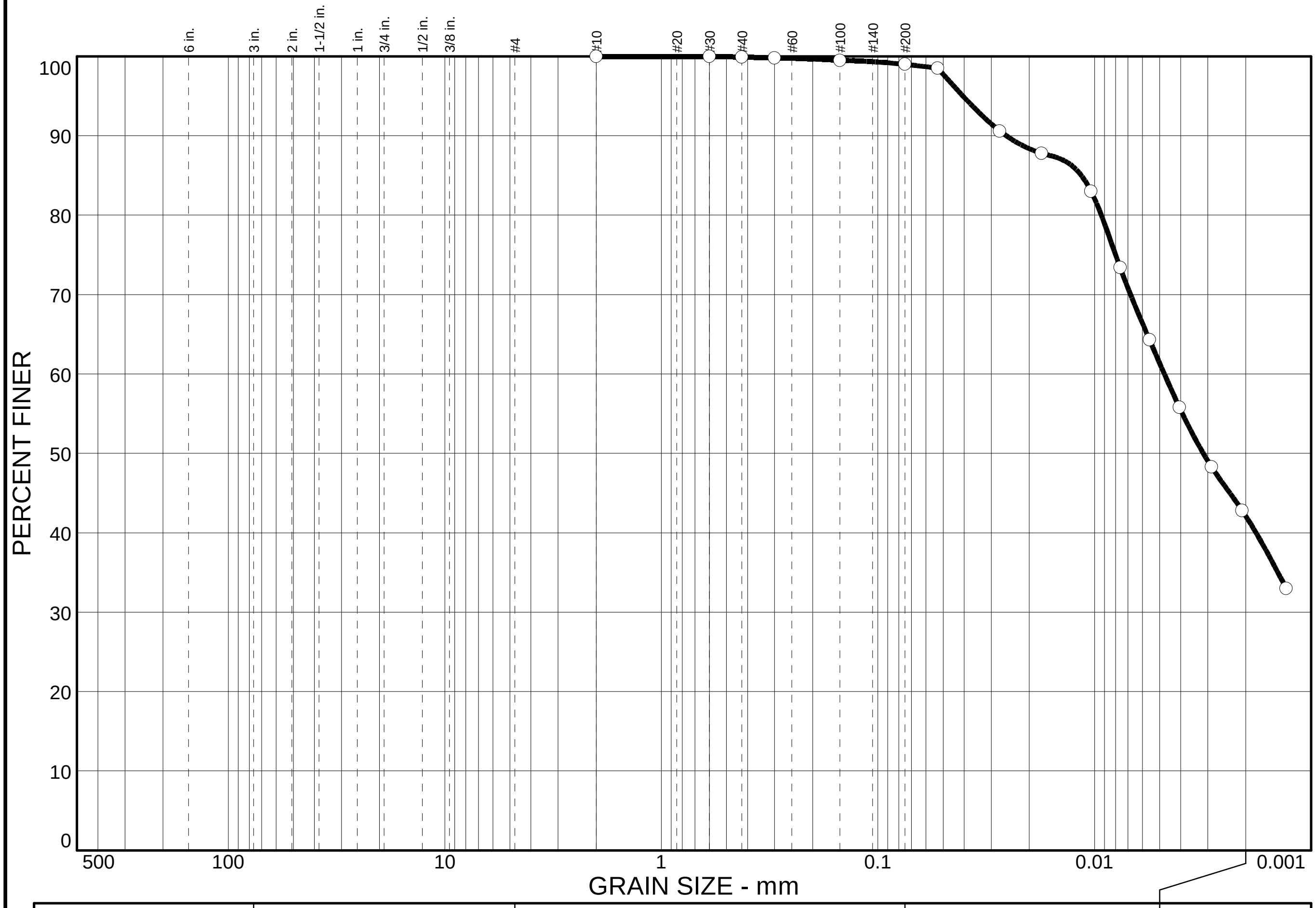
COOPER TESTING LABORATORY

Client: AECOM

Project: Klamath River Dam Removal Project - 60537920

Project No.: 020-251 Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	1.0	56.9	42.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	100.0		
#40	99.9		
#50	99.8		
#100	99.5		
#200	99.0		
#270	98.5		
0.0274 mm.	90.6		
0.0176 mm.	87.8		
0.0104 mm.	83.0		
0.0076 mm.	73.4		
0.0056 mm.	64.3		
0.0041 mm.	55.8		
0.0029 mm.	48.3		
0.0021 mm.	42.8		
0.0013 mm.	33.0		

* (no specification provided)

Soil Description

Olive Gray Elastic SILT

Atterberg Limits

PL= 51 LL= 85 PI= 34

Coefficients

D_{85}= 0.0115 D_{60}= 0.0048 D_{50}= 0.0031
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

Remarks

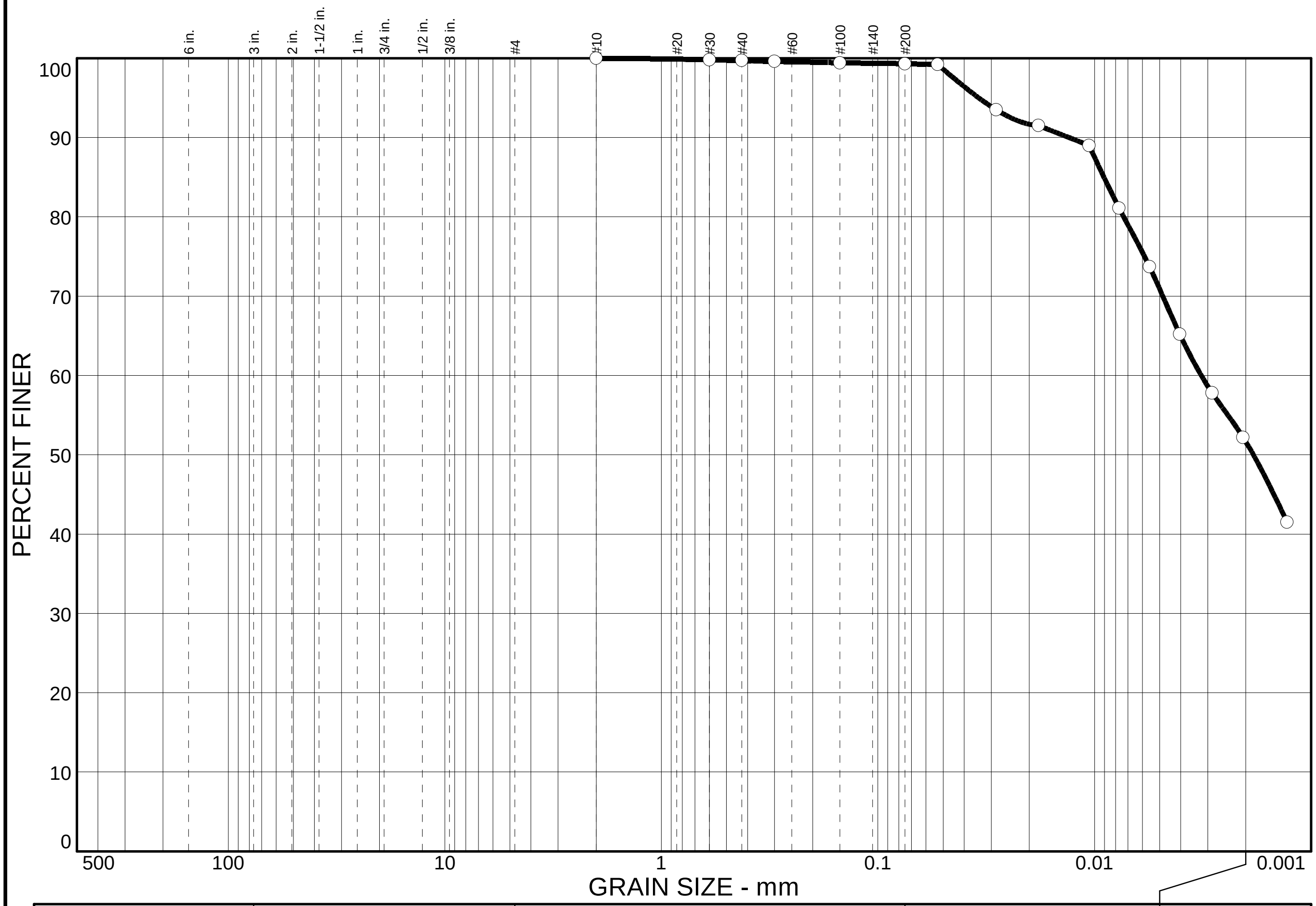
Sample No.: S-04 **Source of Sample:** BC-01 **Date:** 6/5/18
Location: **Elev./Depth:** 21.5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.7	47.7	51.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.8		
#40	99.7		
#50	99.6		
#100	99.4		
#200	99.3		
#270	99.2		
0.0285 mm.	93.5		
0.0182 mm.	91.5		
0.0106 mm.	89.0		
0.0077 mm.	81.1		
0.0056 mm.	73.7		
0.0040 mm.	65.2		
0.0029 mm.	57.8		
0.0021 mm.	52.2		
0.0013 mm.	41.5		

* (no specification provided)

Soil Description

Gray Elastic SILT

Atterberg Limits

PL= 59 LL= 105 PI= 46

Coefficients

D_{85}= 0.0090 D_{60}= 0.0032 D_{50}= 0.0018
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

Remarks

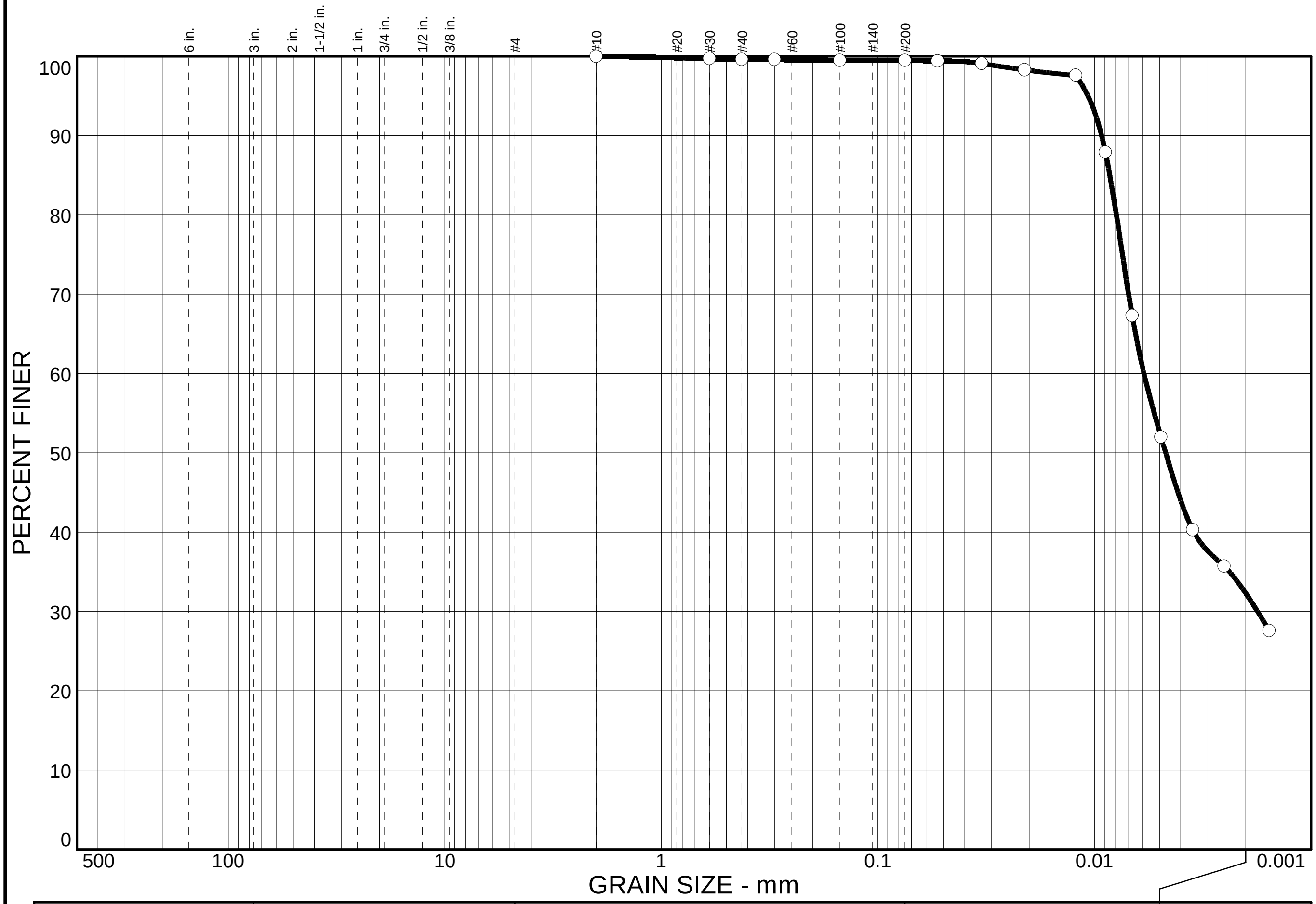
Sample No.: S-05 **Source of Sample:** BC-02 **Date:** 6/5/18
Location: **Elev./Depth:** 14.5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.5	67.2	32.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.7		
#40	99.6		
#50	99.6		
#100	99.5		
#200	99.5		
#270	99.4		
0.0331 mm.	99.1		
0.0210 mm.	98.3		
0.0122 mm.	97.6		
0.0089 mm.	87.9		
0.0067 mm.	67.3		
0.0049 mm.	52.0		
0.0035 mm.	40.3		
0.0025 mm.	35.7		
0.0016 mm.	27.6		

* (no specification provided)

Soil Description

Gray Elastic SILT

Atterberg Limits

PL= 85 LL= 187 PI= 102

Coefficients

D_{85}= 0.0085 D_{60}= 0.0059 D_{50}= 0.0047
D_{30}= 0.0018 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

Remarks

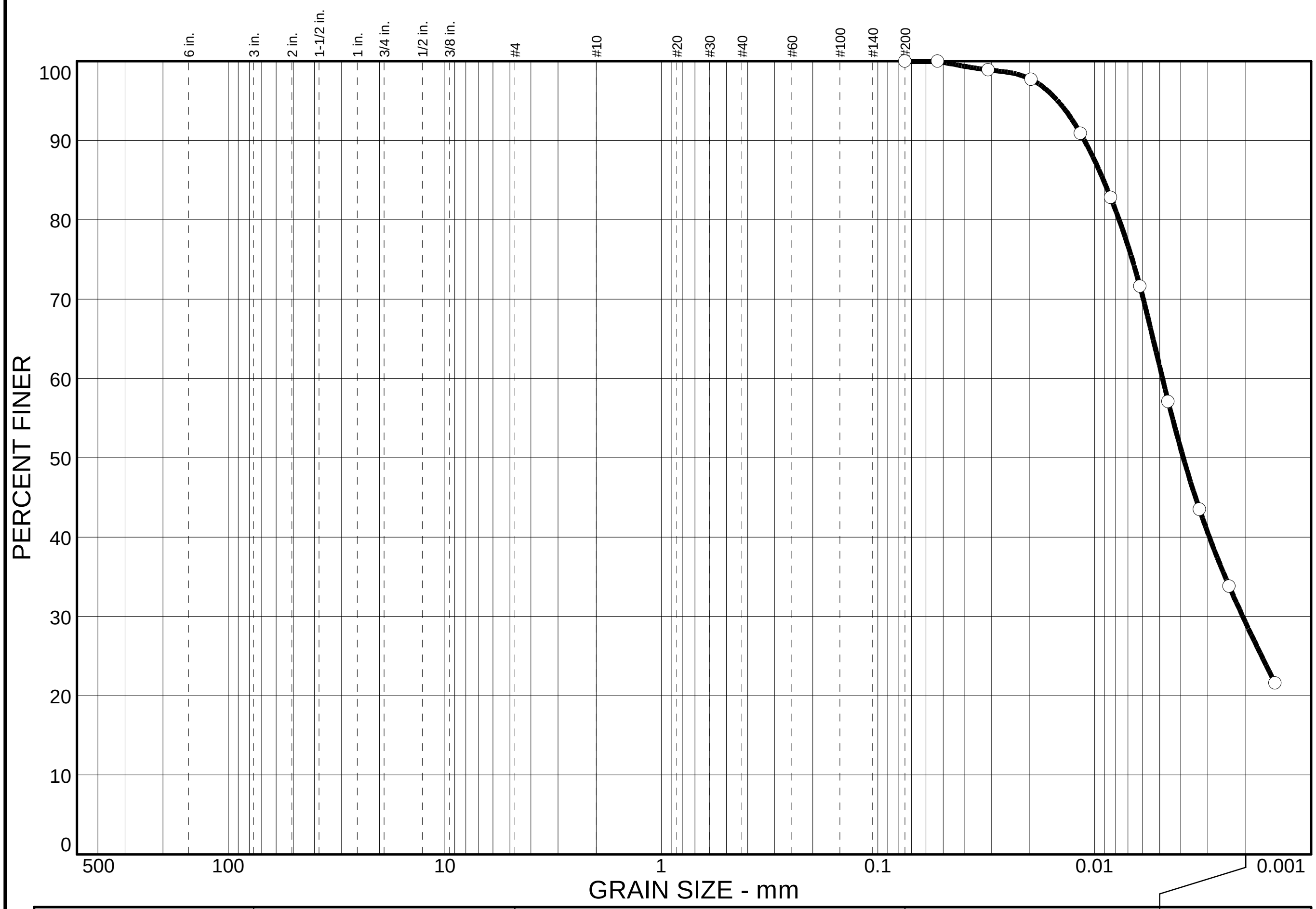
Sample No.: S-09 **Source of Sample:** BC-02 **Date:** 6/5/18
Location: **Elev./Depth:** 44.5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.0	70.9	29.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	100.0		
#270	100.0		
0.0309 mm.	98.9		
0.0196 mm.	97.7		
0.0116 mm.	90.9		
0.0084 mm.	82.8		
0.0062 mm.	71.6		
0.0046 mm.	57.1		
0.0033 mm.	43.5		
0.0024 mm.	33.8		
0.0015 mm.	21.6		

* (no specification provided)

Soil Description

Light Olive Brown Elastic SILT

Atterberg Limits

PL= 59 LL= 69 PI= 10

Coefficients

D_{85}= 0.0091 D_{60}= 0.0049 D_{50}= 0.0039
D_{30}= 0.0021 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

Remarks

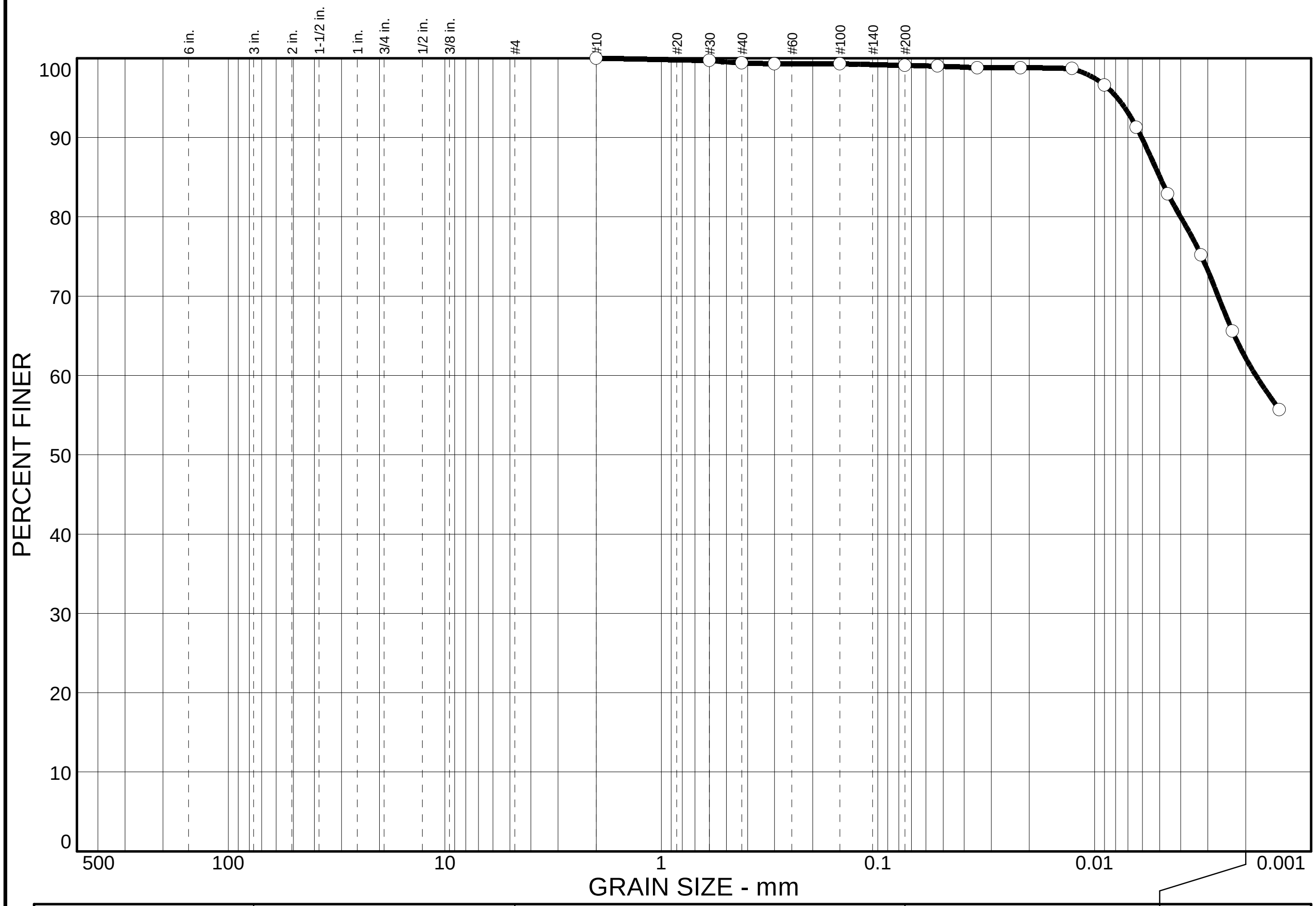
Sample No.: S-05 **Source of Sample:** BC-03 **Date:** 6/5/18
Location: **Elev./Depth:** 24.5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.9	37.0	62.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.7		
#40	99.4		
#50	99.3		
#100	99.3		
#200	99.1		
#270	99.0		
0.0347 mm.	98.8		
0.0219 mm.	98.8		
0.0127 mm.	98.7		
0.0090 mm.	96.6		
0.0064 mm.	91.3		
0.0046 mm.	82.9		
0.0032 mm.	75.2		
0.0023 mm.	65.6		
0.0014 mm.	55.7		

* (no specification provided)

Soil Description

Pale Brown Mottled Gray Elastic SILT

Atterberg Limits

PL= 85 LL= 120 PI= 35

Coefficients

D_{85}= 0.0050 D_{60}= 0.0018 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

Remarks

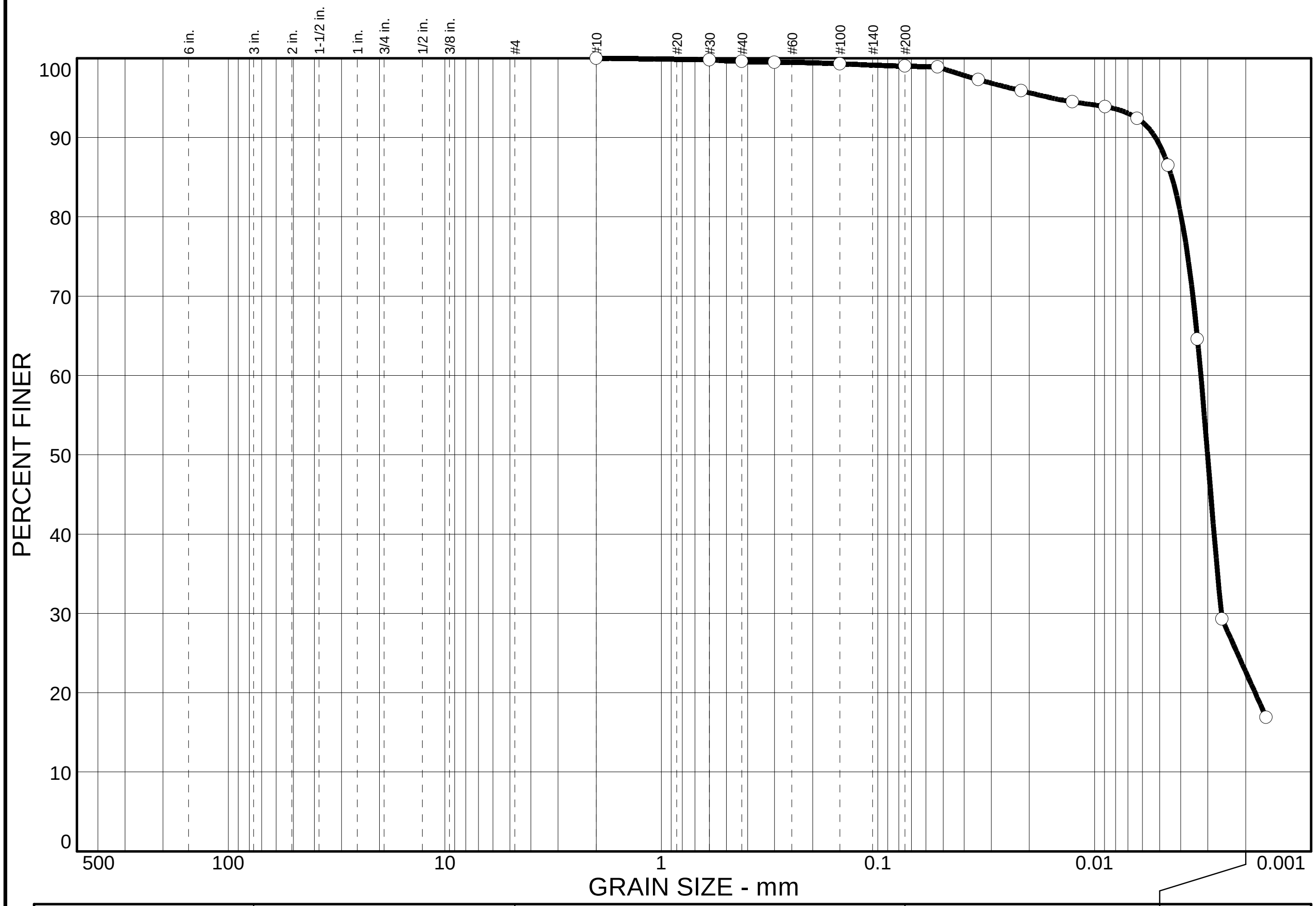
Sample No.: S-08 **Source of Sample:** BC-04 **Date:** 5/16/18
Location: **Elev./Depth:** 32.5(Tip-16")

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	1.0	76.4	22.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.8		
#40	99.6		
#50	99.5		
#100	99.3		
#200	99.0		
#270	98.9		
0.0343 mm.	97.3		
0.0218 mm.	95.9		
0.0126 mm.	94.5		
0.0089 mm.	93.9		
0.0063 mm.	92.4		
0.0046 mm.	86.5		
0.0034 mm.	64.6		
0.0026 mm.	29.3		
0.0016 mm.	16.9		

* (no specification provided)

Soil Description

Light Olive Brown Elastic SILT

Atterberg Limits

PL= 88 LL= 200 PI= 112

Coefficients

D_{85}= 0.0044 D_{60}= 0.0032 D_{50}= 0.0030
D_{30}= 0.0026 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

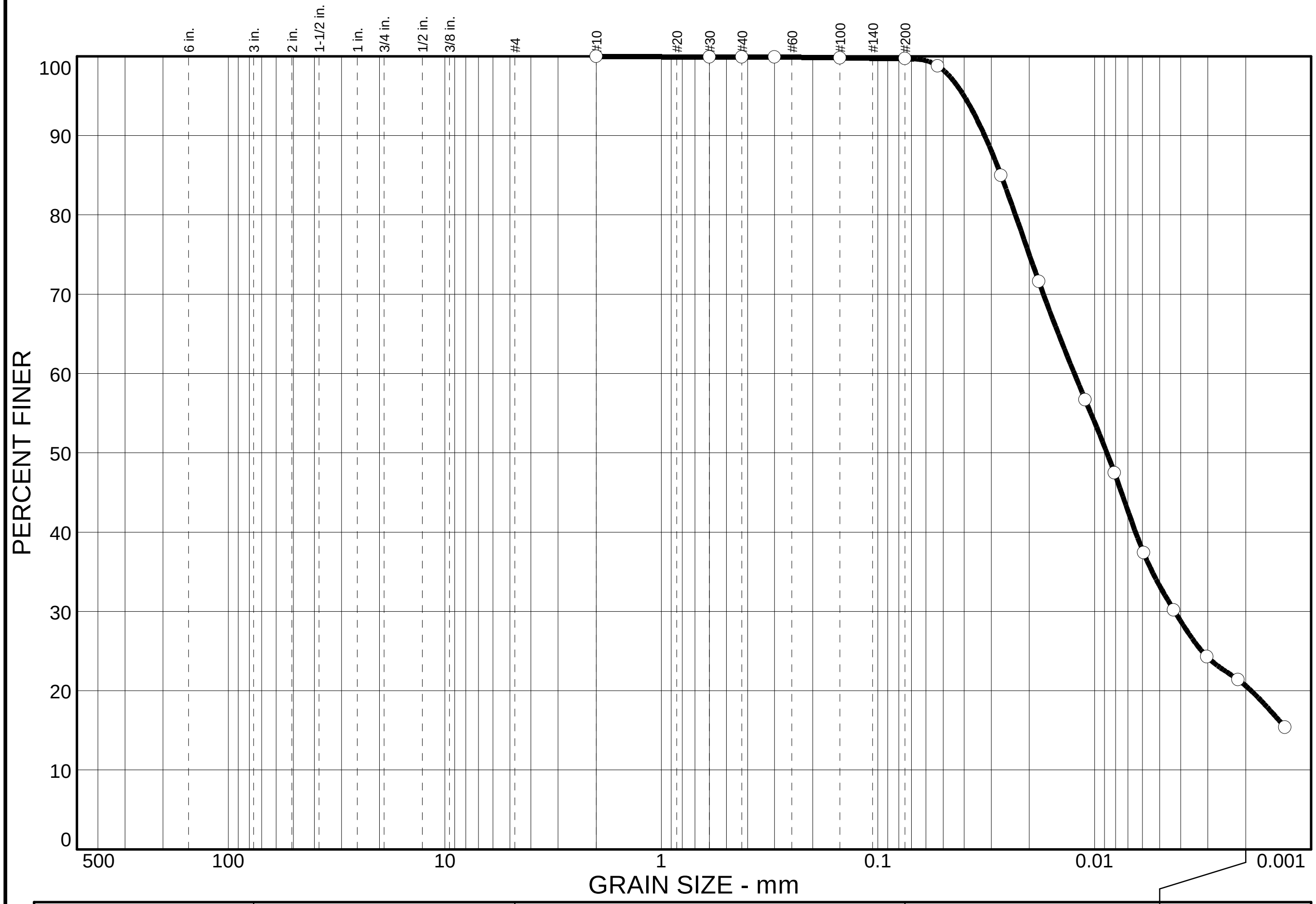
Remarks

Sample No.: S-05 **Source of Sample:** BC-08A **Date:** 6/5/18
Location: **Elev./Depth:** 54'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	0.3	79.1	20.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	99.9		
#40	99.9		
#50	99.9		
#100	99.8		
#200	99.7		
#270	98.8		
0.0270 mm.	85.0		
0.0181 mm.	71.6		
0.0110 mm.	56.7		
0.0081 mm.	47.5		
0.0059 mm.	37.4		
0.0043 mm.	30.2		
0.0030 mm.	24.3		
0.0022 mm.	21.4		
0.0013 mm.	15.4		

* (no specification provided)

Soil Description

Dark Gray Elastic SILT

Atterberg Limits

PL= 53 LL= 74 PI= 21

Coefficients

D_{85}= 0.0270 D_{60}= 0.0124 D_{50}= 0.0088
D_{30}= 0.0043 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO=

Remarks

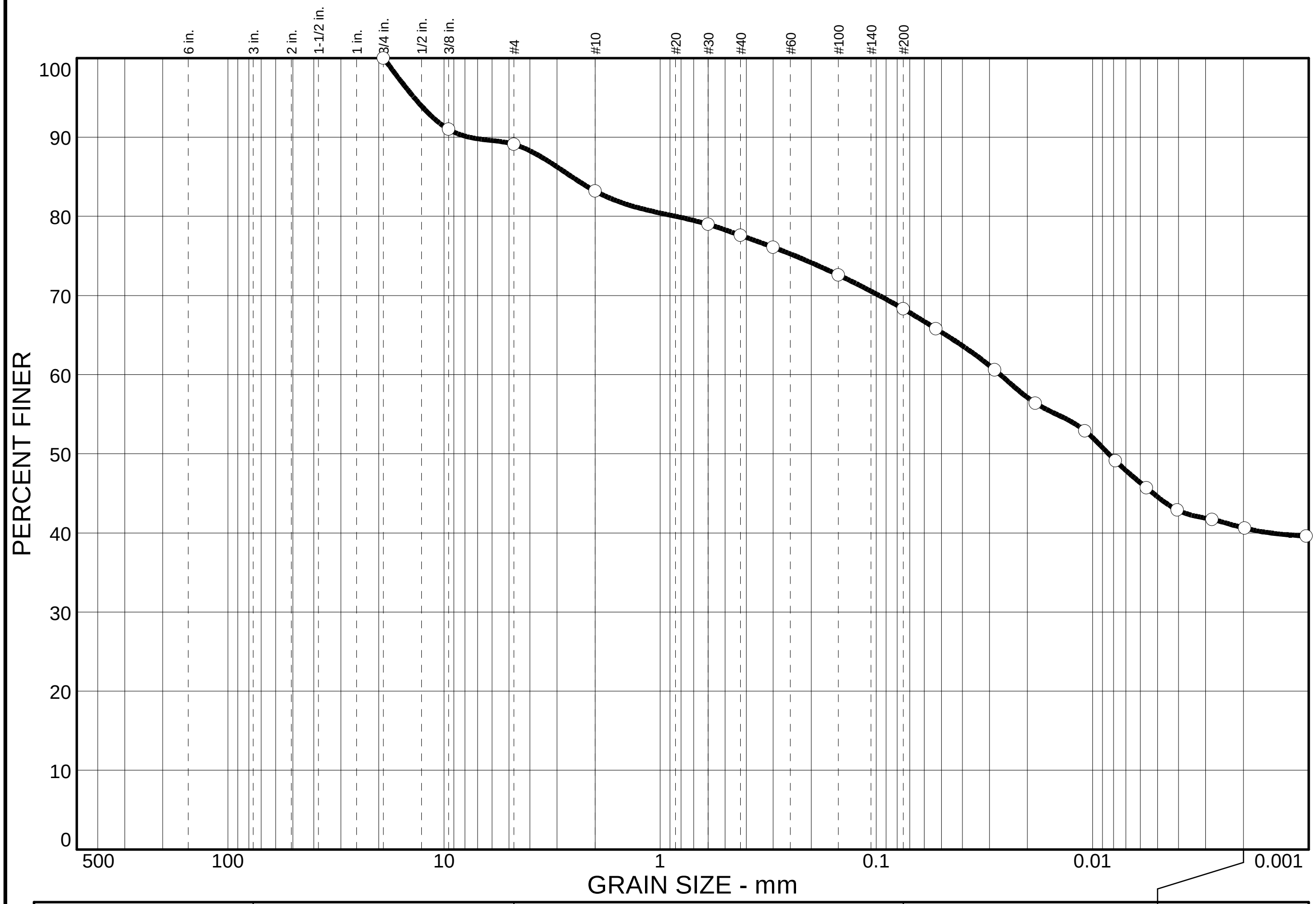
Sample No.: S-05 **Source of Sample:** BC-09 **Date:** 6/5/18
Location: **Elev./Depth:** 23(Tip-5")

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	10.9	20.8	27.7	40.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	91.0		
#4	89.1		
#10	83.2		
#30	79.0		
#40	77.6		
#50	76.1		
#100	72.6		
#200	68.3		
#270	65.8		
0.0284 mm.	60.6		
0.0184 mm.	56.4		
0.0108 mm.	52.9		
0.0078 mm.	49.1		
0.0056 mm.	45.7		
0.0041 mm.	42.9		
0.0028 mm.	41.7		
0.0020 mm.	40.6		
0.0010 mm.	39.6		

* (no specification provided)

Soil Description

Dark Reddish Brown Sandy Fat CLAY

Atterberg Limits

PL= 28 LL= 78 PI= 50

Coefficients

D_{85}= 2.56 D_{60}= 0.0267 D_{50}= 0.0084
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

Remarks

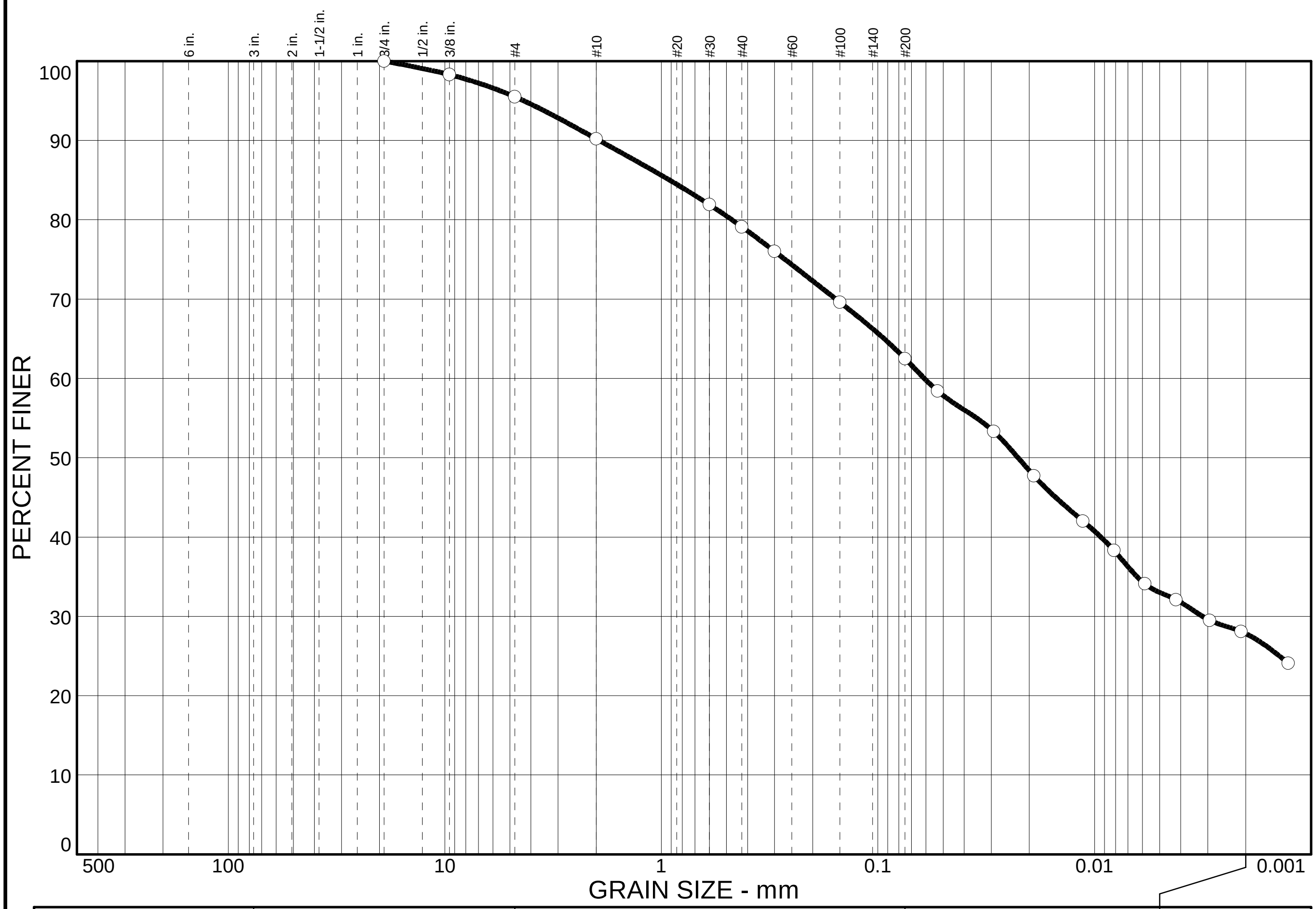
Sample No.: S-01 **Source of Sample:** BI-02 **Date:** 6/6/18
Location: **Elev./Depth:** 5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	4.5	33.0	34.7	27.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	98.3		
#4	95.5		
#10	90.2		
#30	81.9		
#40	79.1		
#50	76.0		
#100	69.6		
#200	62.5		
#270	58.4		
0.0292 mm.	53.3		
0.0190 mm.	47.7		
0.0113 mm.	42.0		
0.0081 mm.	38.3		
0.0059 mm.	34.1		
0.0042 mm.	32.1		
0.0029 mm.	29.5		
0.0021 mm.	28.1		
0.0013 mm.	24.1		

* (no specification provided)

Soil Description

Yellowish Brown Sandy Fat CLAY

Atterberg Limits

PL= 28   LL= 58   PI= 30

Coefficients

D_{85}= 0.917 D_{60}= 0.0612 D_{50}= 0.0226
D_{30}= 0.0032 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH   AASHTO=

Remarks

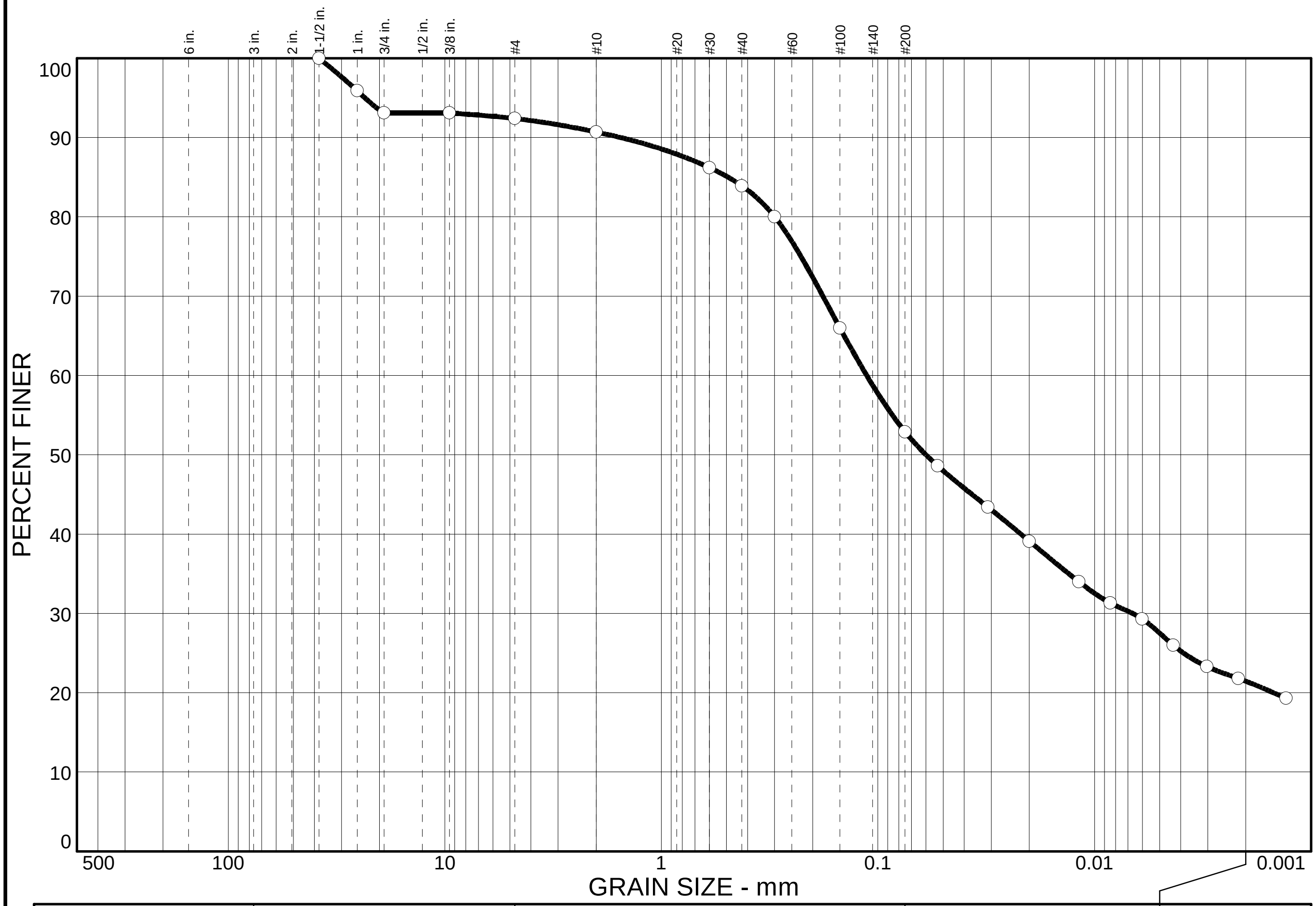
Sample No.: S-02   **Source of Sample:** BI-02   **Date:** 6/6/18
Location: **Elev./Depth:** 10'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251   **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	7.6	39.5	31.5	21.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	95.9		
3/4 in.	93.1		
3/8 in.	93.1		
#4	92.4		
#10	90.7		
#30	86.2		
#40	83.9		
#50	80.0		
#100	66.0		
#200	52.9		
#270	48.6		
0.0311 mm.	43.4		
0.0200 mm.	39.1		
0.0118 mm.	34.0		
0.0084 mm.	31.3		
0.0060 mm.	29.3		
0.0043 mm.	26.0		
0.0030 mm.	23.3		
0.0022 mm.	21.8		
0.0013 mm.	19.3		

* (no specification provided)

Soil Description

Yellowish Brown Sandy Fat CLAY

Atterberg Limits

PL= 27 LL= 51 PI= 24

Coefficients

D_{85}= 0.492 D_{60}= 0.113 D_{50}= 0.0601
D_{30}= 0.0067 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

Remarks

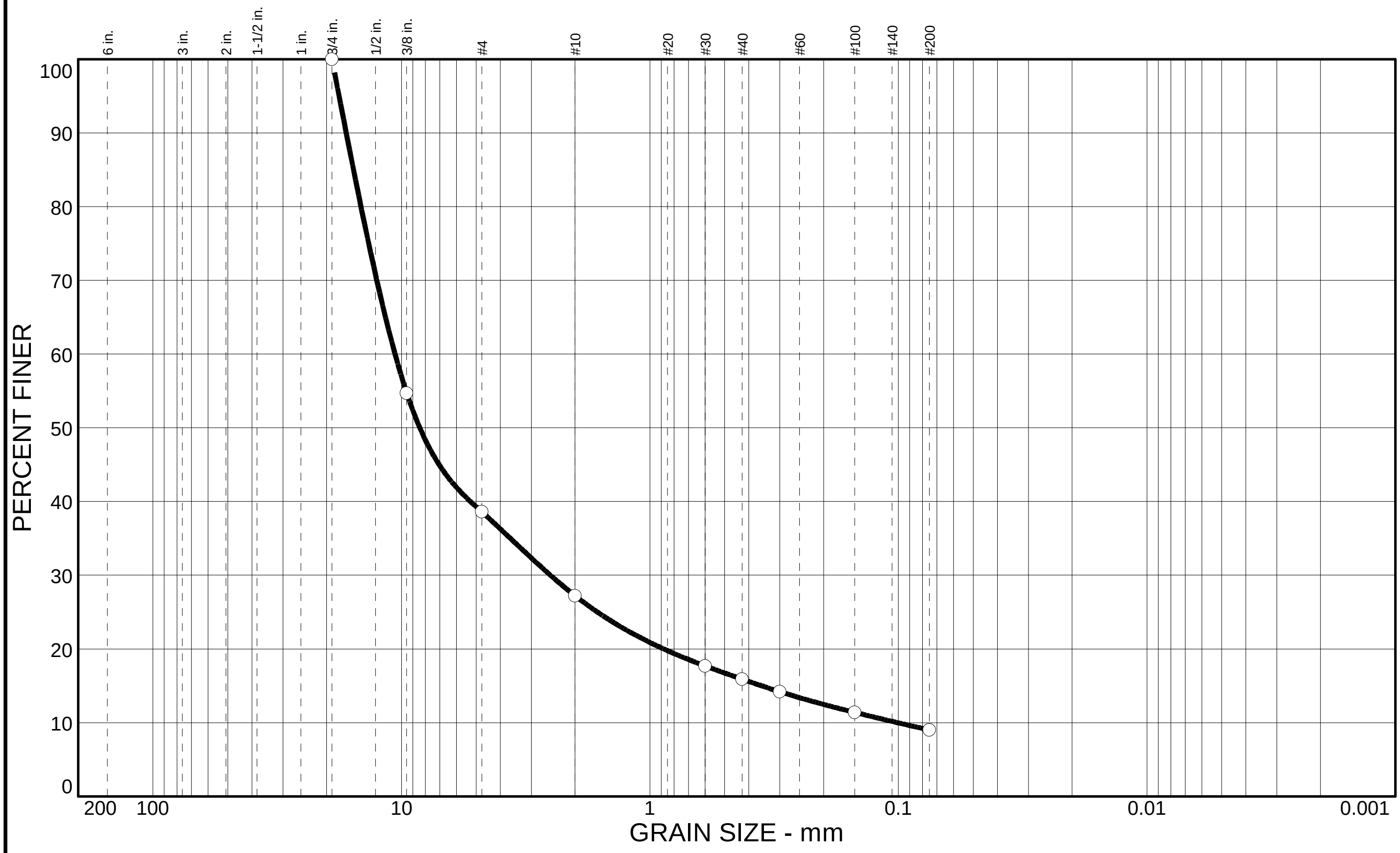
Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

Sample No.: S-03 **Source of Sample:** BI-02 **Date:** 6/6/18
Location: **Elev./Depth:** 15'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920
Project No: 020-251 **Figure**

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		61.4	29.6	9.0		GP-GM		26	41

SIEVE inches size	PERCENT FINER ○		
3/4"	100.0		
3/8"	54.7		
	GRAIN SIZE		
D_{60}	10.6		
D_{30}	2.52		
D_{10}	0.101		
	COEFFICIENTS		
C_c	5.92		
C_u	105.44		

SIEVE number size	PERCENT FINER ○		
#4	38.6		
#10	27.2		
#30	17.7		
#40	15.9		
#50	14.2		
#100	11.4		
#200	9.0		

SOIL DESCRIPTION

○ Olive Gray Poorly Graded GRAVEL w/ Silt & Sand

REMARKS:

○

○ Source: BI-03

Sample No.: S-01

Elev./Depth: 3.5'

COOPER TESTING LABORATORY

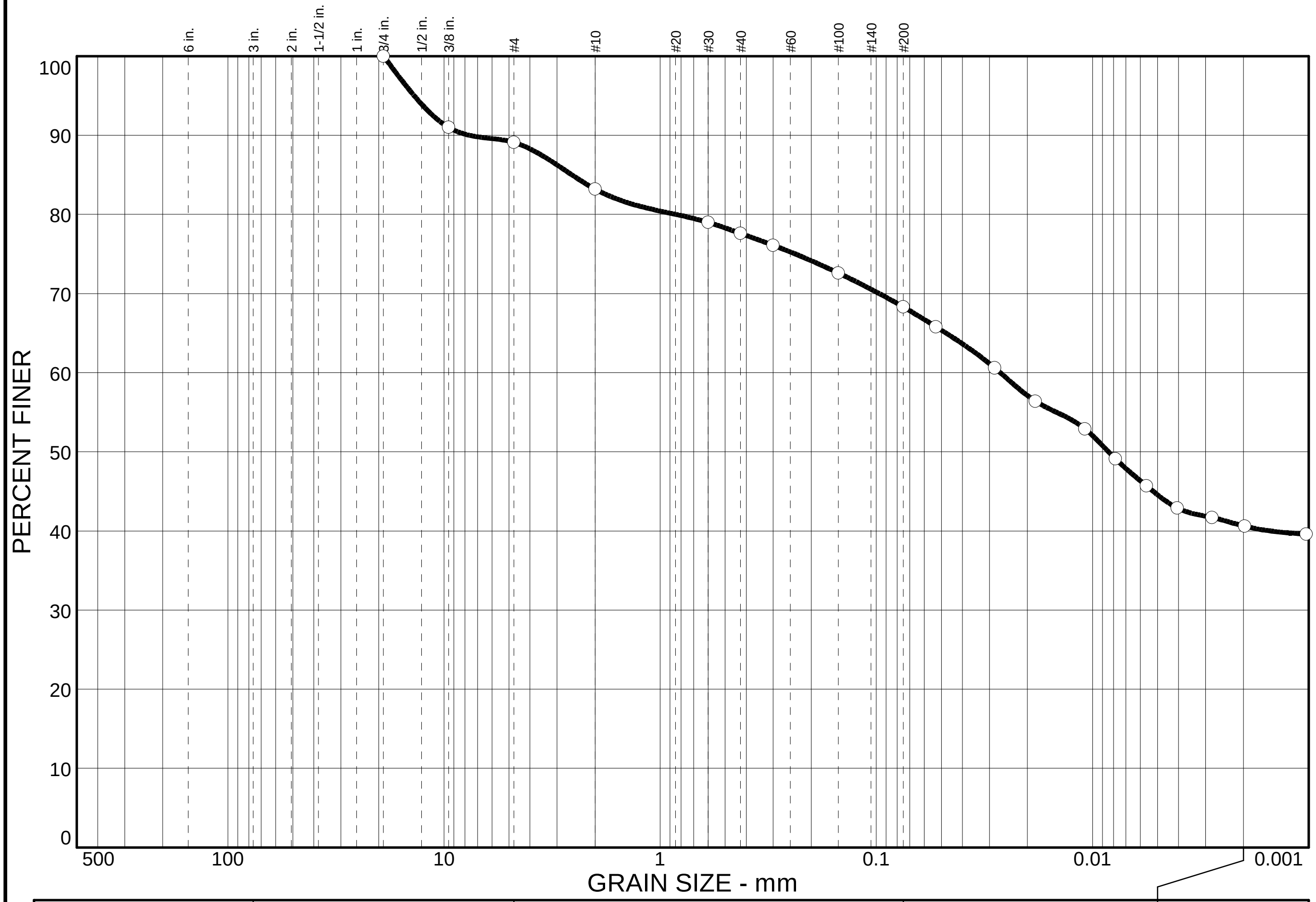
Client: AECOM

Project: Klamath River Dam Removal Project - 60537920

Project No.: 020-251

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	10.9	20.8	27.7	40.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	91.0		
#4	89.1		
#10	83.2		
#30	79.0		
#40	77.6		
#50	76.1		
#100	72.6		
#200	68.3		
#270	65.8		
0.0284 mm.	60.6		
0.0184 mm.	56.4		
0.0108 mm.	52.9		
0.0078 mm.	49.1		
0.0056 mm.	45.7		
0.0041 mm.	42.9		
0.0028 mm.	41.7		
0.0020 mm.	40.6		
0.0010 mm.	39.6		

* (no specification provided)

Soil Description

Dark Reddish Brown Sandy Fat CLAY

Atterberg Limits

PL= 28 LL= 78 PI= 50

Coefficients

D_{85}= 2.56 D_{60}= 0.0267 D_{50}= 0.0084
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

Remarks

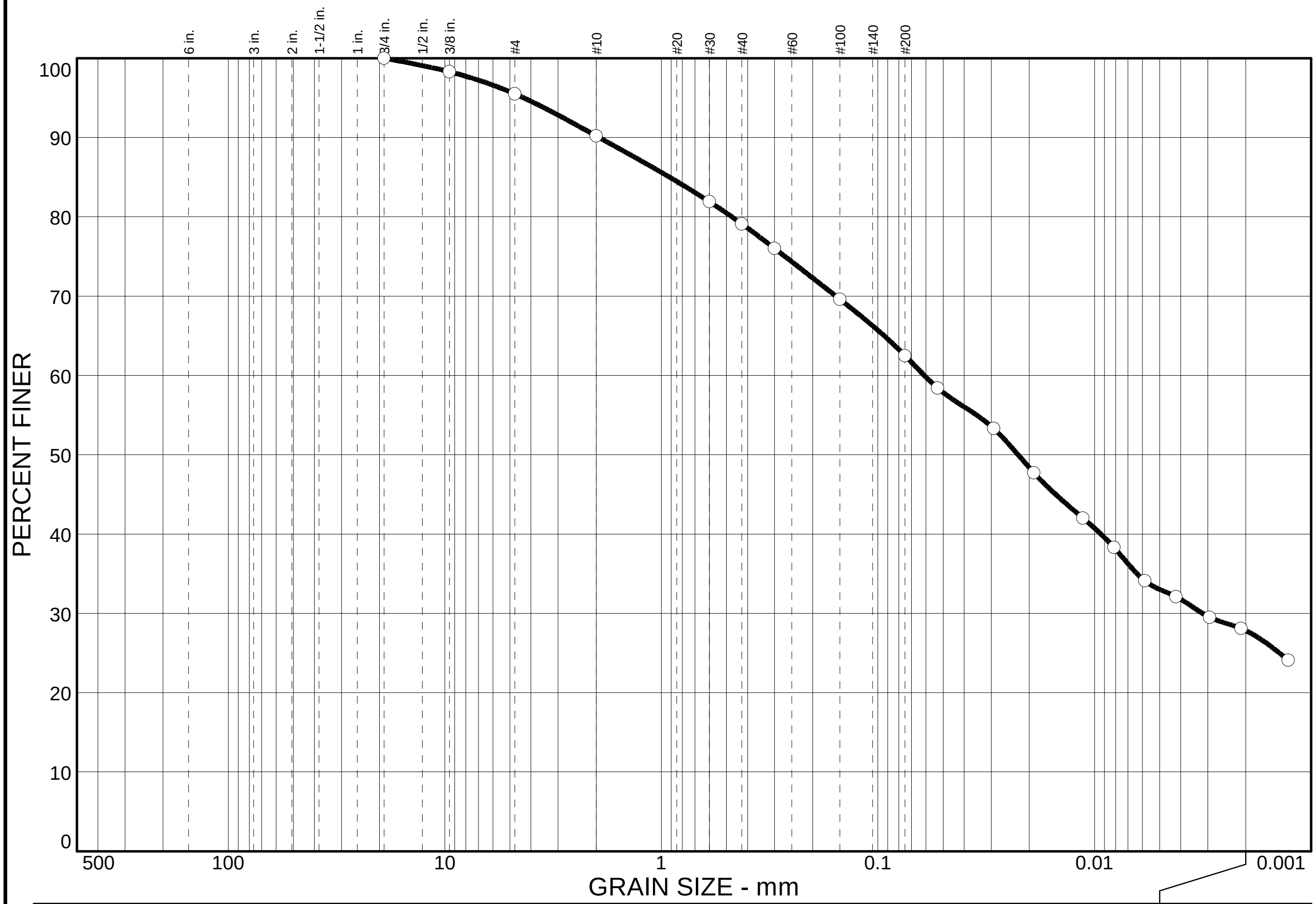
Sample No.: S-01 **Source of Sample:** BI-02 **Date:** 6/6/18
Location: **Elev./Depth:** 5'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	4.5	33.0	34.7	27.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	98.3		
#4	95.5		
#10	90.2		
#30	81.9		
#40	79.1		
#50	76.0		
#100	69.6		
#200	62.5		
#270	58.4		
0.0292 mm.	53.3		
0.0190 mm.	47.7		
0.0113 mm.	42.0		
0.0081 mm.	38.3		
0.0059 mm.	34.1		
0.0042 mm.	32.1		
0.0029 mm.	29.5		
0.0021 mm.	28.1		
0.0013 mm.	24.1		

* (no specification provided)

Soil Description

Yellowish Brown Sandy Fat CLAY

Atterberg Limits

PL= 28 LL= 58 PI= 30

Coefficients

D_{85}= 0.917 D_{60}= 0.0612 D_{50}= 0.0226
D_{30}= 0.0032 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

Remarks

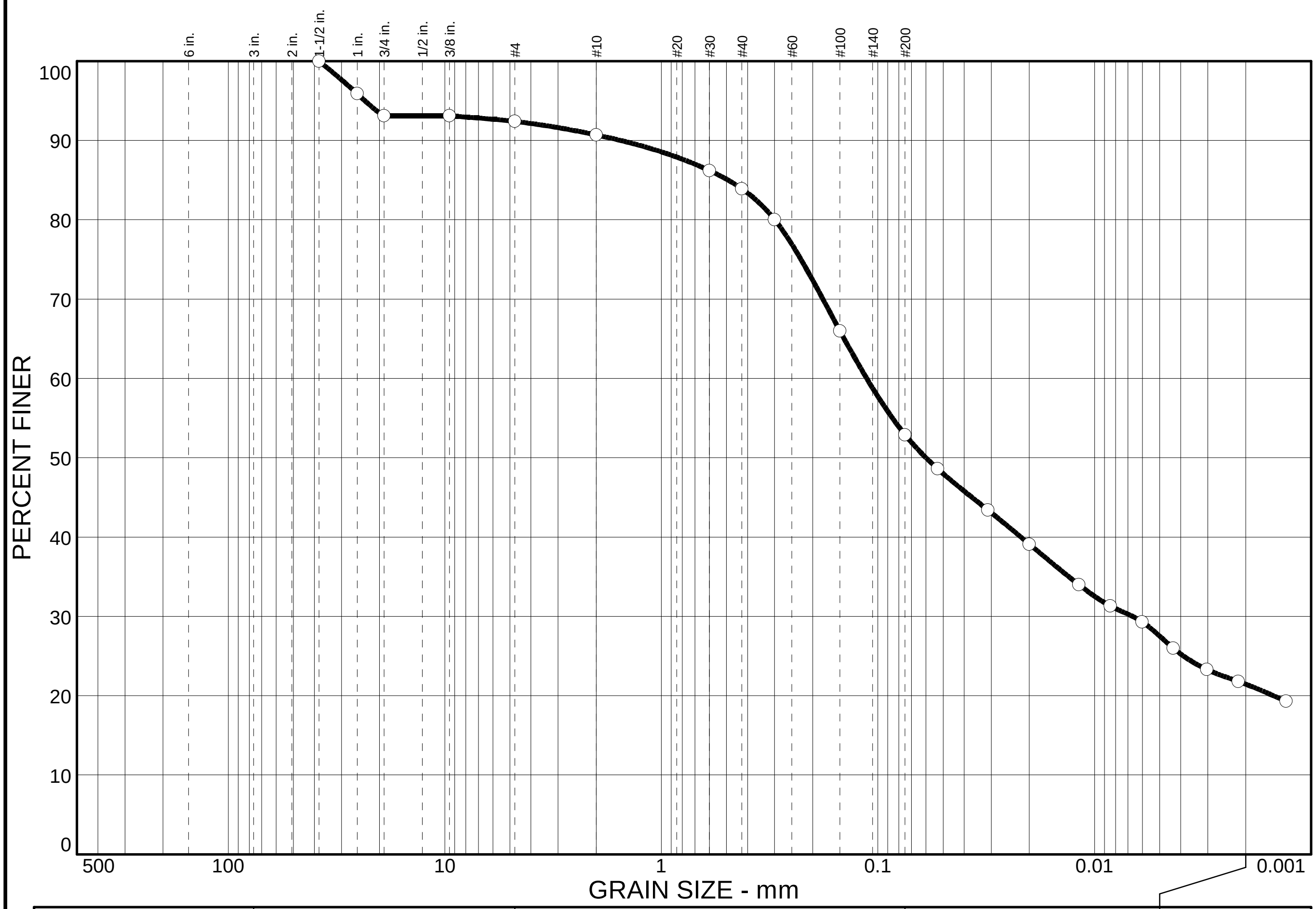
Sample No.: S-02 **Source of Sample:** BI-02 **Date:** 6/6/18
Location: **Elev./Depth:** 10'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	7.6	39.5	31.5	21.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5 in.	100.0		
1 in.	95.9		
3/4 in.	93.1		
3/8 in.	93.1		
#4	92.4		
#10	90.7		
#30	86.2		
#40	83.9		
#50	80.0		
#100	66.0		
#200	52.9		
#270	48.6		
0.0311 mm.	43.4		
0.0200 mm.	39.1		
0.0118 mm.	34.0		
0.0084 mm.	31.3		
0.0060 mm.	29.3		
0.0043 mm.	26.0		
0.0030 mm.	23.3		
0.0022 mm.	21.8		
0.0013 mm.	19.3		

* (no specification provided)

Soil Description

Yellowish Brown Sandy Fat CLAY

Atterberg Limits

PL= 27 LL= 51 PI= 24

Coefficients

D_{85}= 0.492 D_{60}= 0.113 D_{50}= 0.0601
D_{30}= 0.0067 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO=

Remarks

Due to the small sample size, relative to the largest particle size, this data should be considered to be approximate.

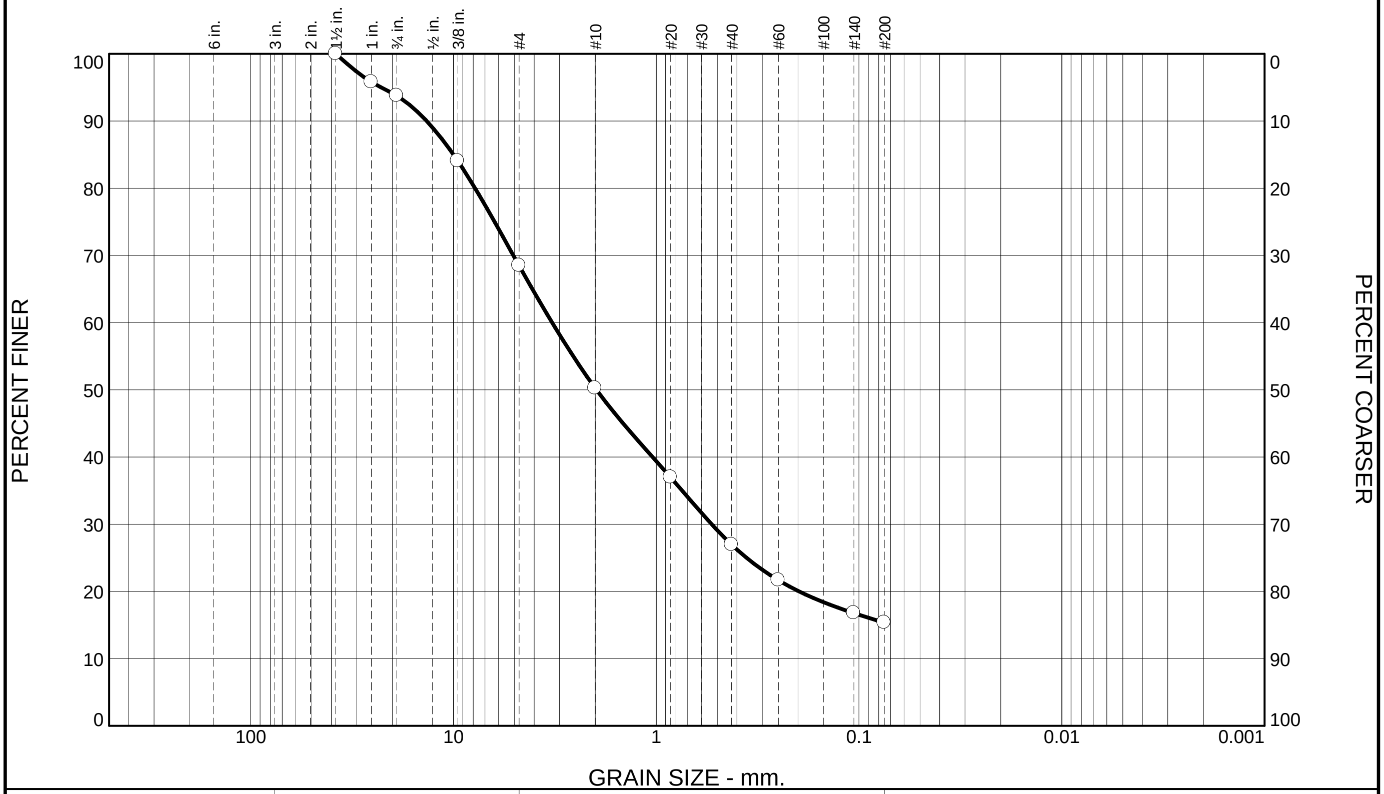
Sample No.: S-03 **Source of Sample:** BI-02 **Date:** 6/6/18
Location: **Elev./Depth:** 15'

COOPER TESTING LABORATORY

Client: AECOM
Project: Klamath River Dam Removal Project - 60537920

Project No: 020-251 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	6	26	18	23	12	15	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	96		
3/4	94		
3/8	84		
#4	68		
#10	50		
#20	37		
#40	27		
#60	22		
#140	17		
#200	15		

* (no specification provided)

Soil Description

Gray silty sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 13.5779 D_{85}= 10.0161 D_{60}= 3.2642
D_{50}= 1.9723 D_{30}= 0.5334 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

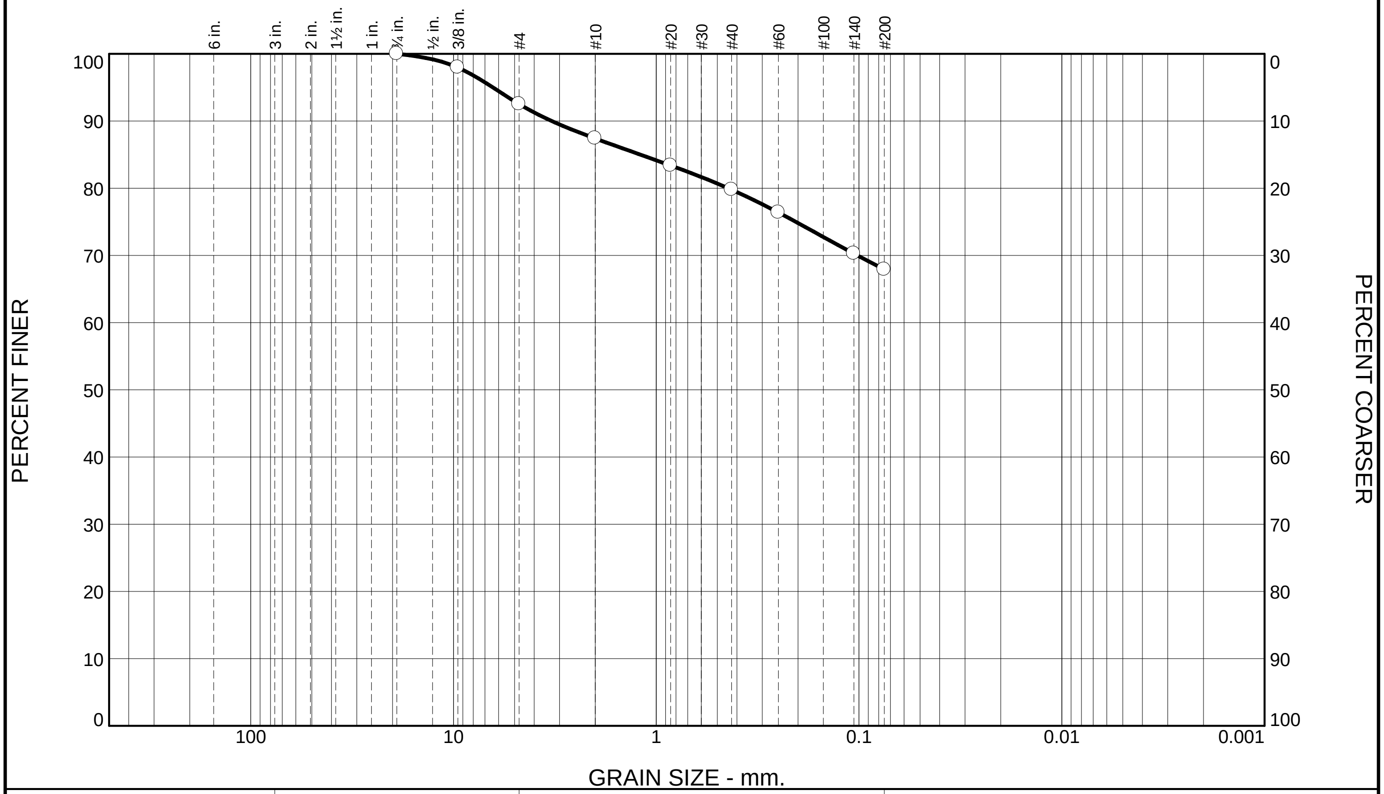
Source of Sample: B-2 **Depth:** 27-27.5
Sample Number: S-01

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	7	6	7	12	68	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
3/8	98		
#4	93		
#10	87		
#20	83		
#40	80		
#60	76		
#140	70		
#200	68		

* (no specification provided)

Soil Description

Brown clay with sand

Atterberg Limits

PL= LL= PI=

Coefficients

$D_{90}=$ 3.2821 $D_{85}=$ 1.2011 $D_{60}=$

$D_{50}=$ $D_{30}=$ $D_{15}=$

$D_{10}=$ $C_u=$ $C_c=$

Classification

USCS= CL AASHTO=

Remarks

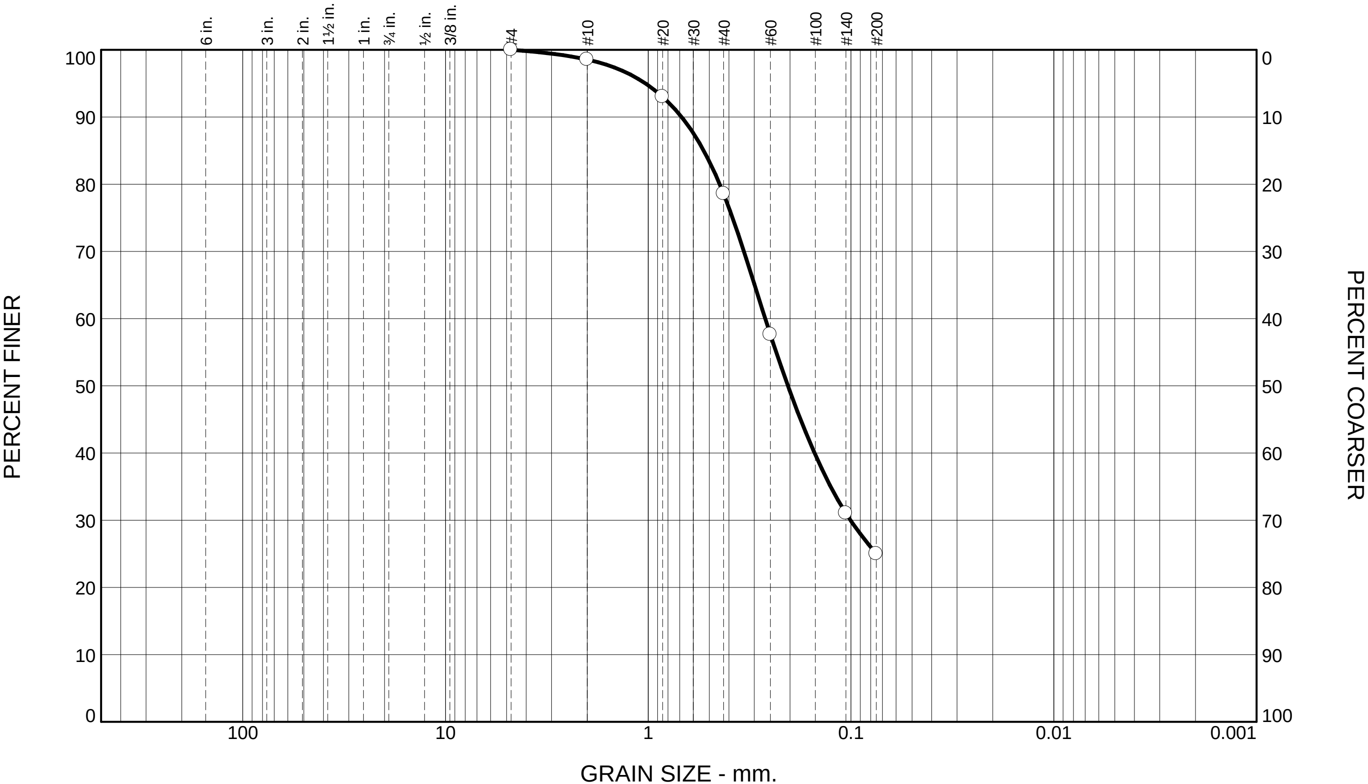
Source of Sample: B-5 **Depth:** 5-6.5
Sample Number: S-01

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	20	54	25	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100		
#10	99		
#20	93		
#40	79		
#60	58		
#140	31		
#200	25		

* (no specification provided)

Soil Description

Grayish brown silty sand with organics

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6851	D_{85}= 0.5329	D_{60}= 0.2650
D_{50}= 0.2048	D_{30}= 0.1007	D_{15}=
D_{10}=	C_u=	C_c=

Classification

USCS= SM AASHTO=

Remarks

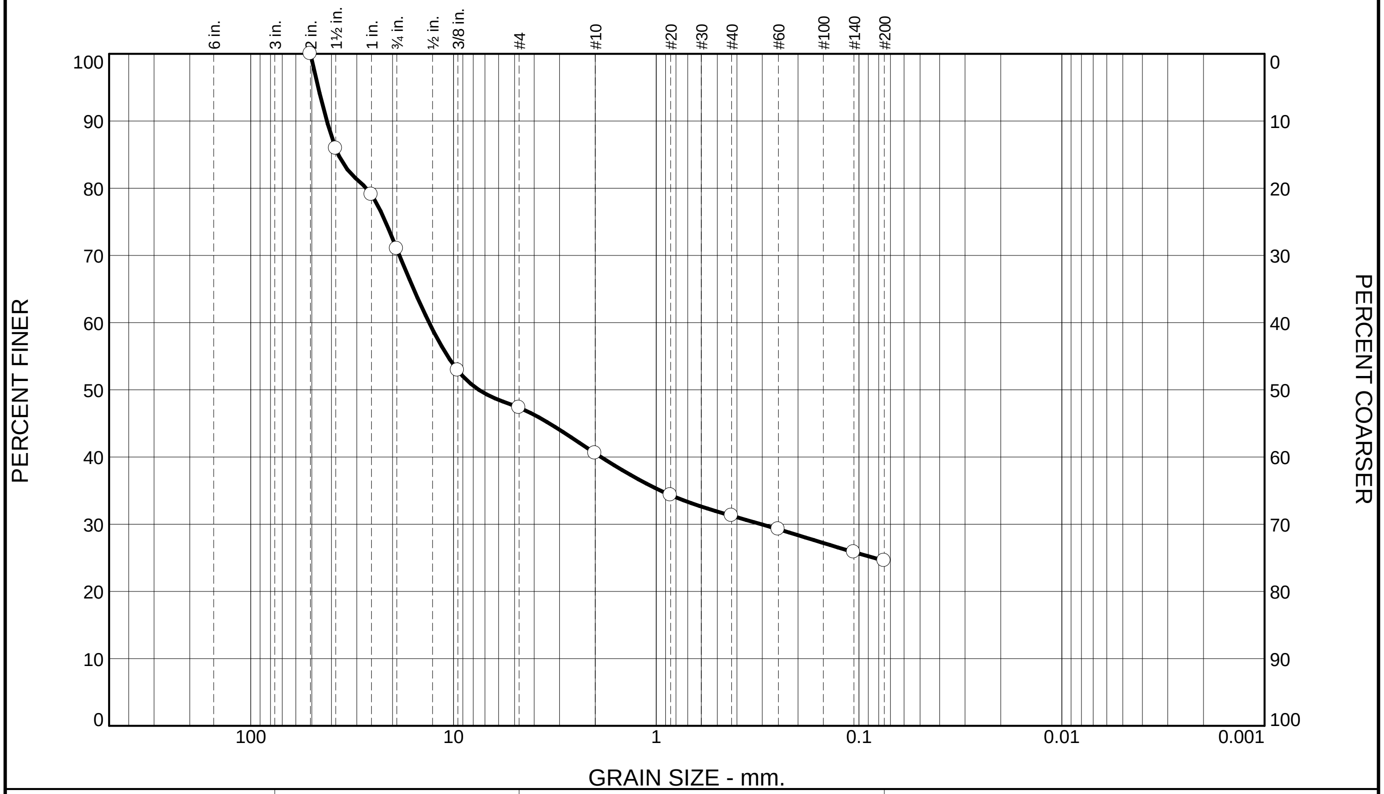
Source of Sample: B-6 **Depth:** 10-11.5
Sample Number: S-02

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	29	24	6	10	6	25	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100		
1.5	86		
1	79		
3/4	71		
3/8	53		
#4	47		
#10	41		
#20	34		
#40	31		
#60	29		
#140	26		
#200	25		

* (no specification provided)

Soil Description

Reddish brown clayey gravel with sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 42.1617 D_{85}= 36.9884 D_{60}= 13.2018
D_{50}= 7.5052 D_{30}= 0.3044 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

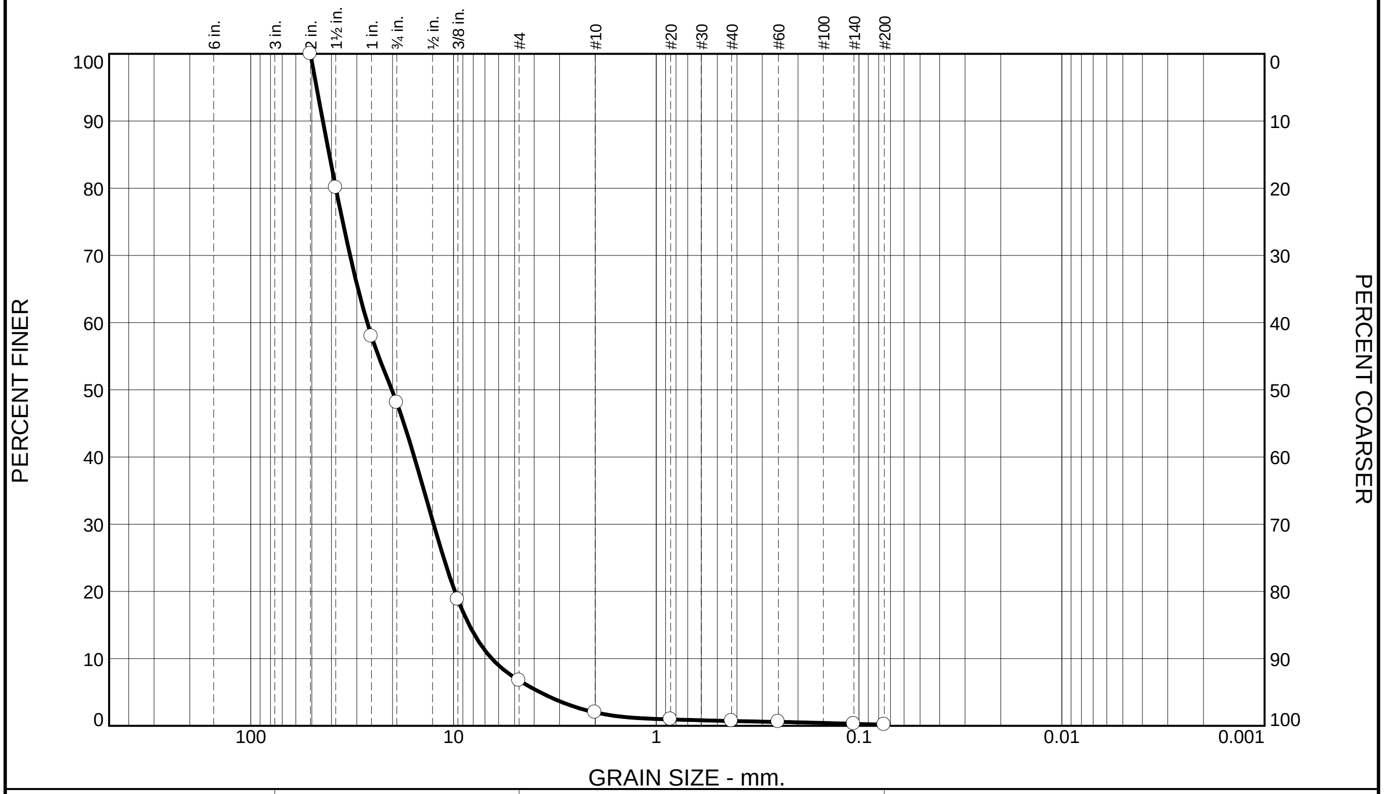
Source of Sample: B-6 **Depth:** 30-31.5
Sample Number: S-04

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	52	41	5	1	1	0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100		
1.5	80		
1	58		
3/4	48		
3/8	19		
#4	7		
#10	2		
#20	1		
#40	1		
#60	1		
#140	0		
#200	0.2		

* (no specification provided)

Soil Description

Gray gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 44.0963 D_{85}= 41.0141 D_{60}= 26.6693
D_{50}= 20.1288 D_{30}= 12.5388 D_{15}= 8.3745
D_{10}= 6.4815 C_u= 4.11 C_c= 0.91

Classification

USCS= GP AASHTO=

Remarks

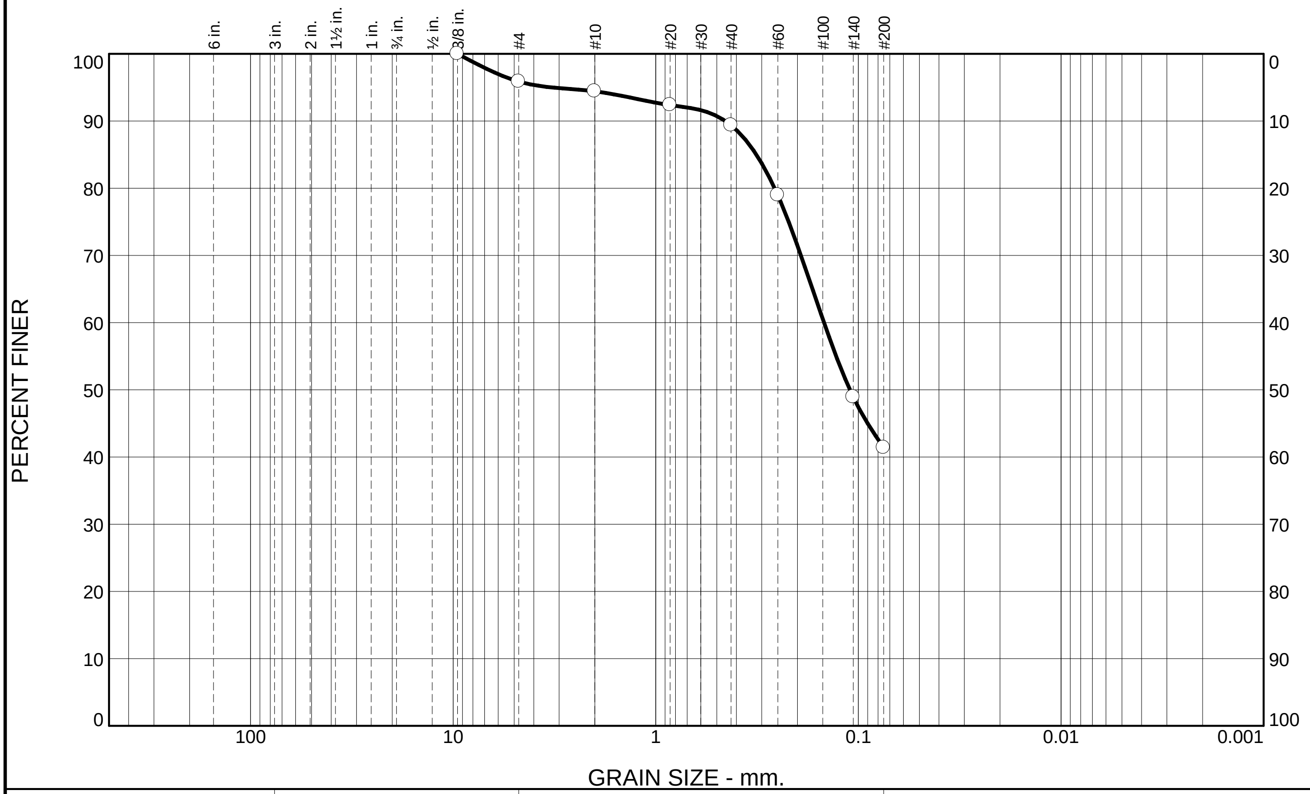
Source of Sample: B-6 **Depth:** 45-46.5
Sample Number: S-06

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	4	2	5	48	41	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100		
#4	96		
#10	94		
#20	92		
#40	89		
#60	79		
#140	49		
#200	41		

* (no specification provided)

Soil Description

Gray clayey sand with organics

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4544 D_{85}= 0.3191 D_{60}= 0.1478
D_{50}= 0.1102 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

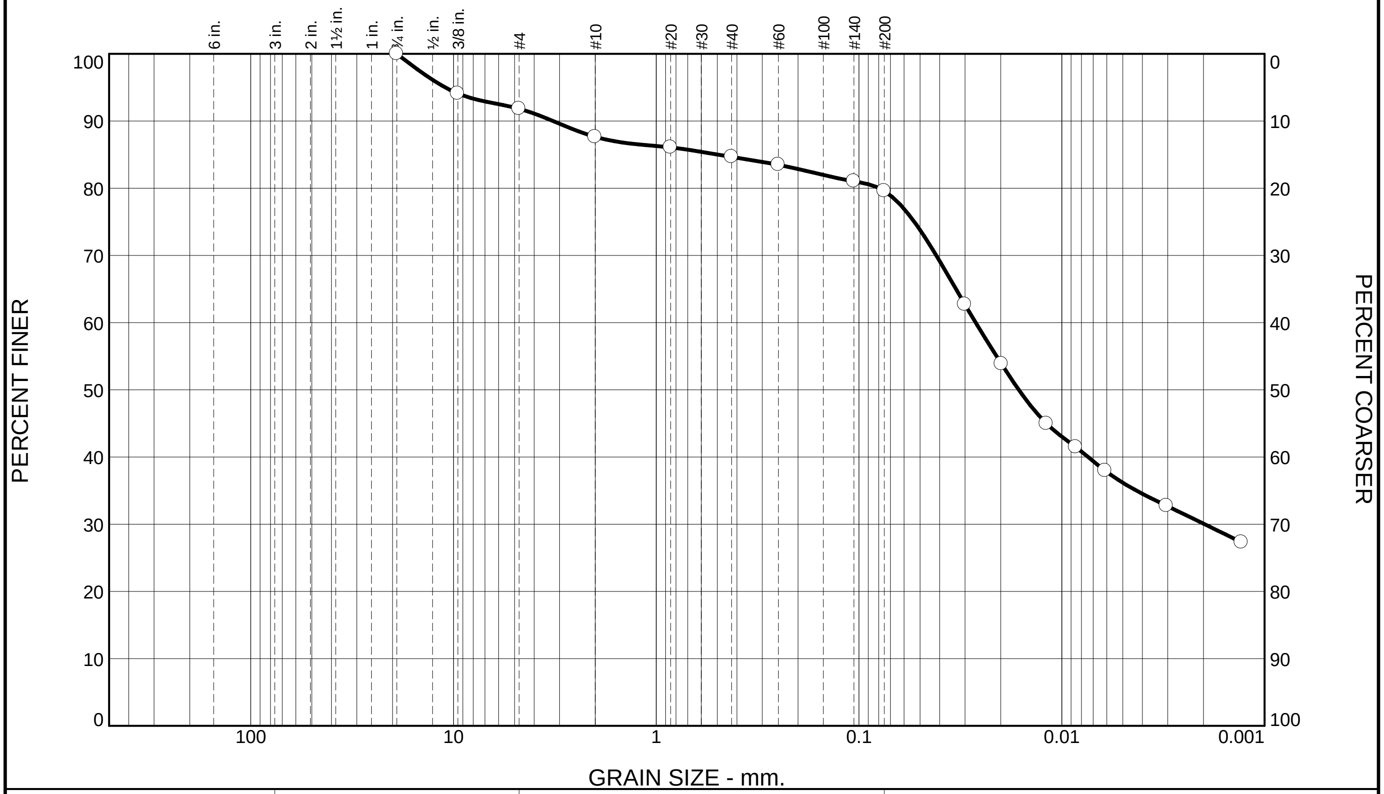
Source of Sample: B-7 **Depth:** 16.5-18
Sample Number: S-02

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



<table>
<tr><th rowspan="2">% +3"</th><th colspan="2">% Gravel</th><th colspan="3">% Sand</th><th colspan="2">% Fines</th></tr>
<tr><th>Coarse</th><th>Fine</th><th>Coarse</th><th>Medium</th><th>Fine</th><th>Silt</th><th>Clay</th></tr>
<tr><td>0</td><td>0</td><td>8</td><td>4</td><td>3</td><td>5</td><td>44</td><td>36</td></tr>
</table>

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
3/8	94		
#4	92		
#10	88		
#20	86		
#40	85		
#60	83		
#140	81		
#200	80		
0.0301 mm.	63		
0.0198 mm.	54		
0.0119 mm.	45		
0.0085 mm.	41		
0.0061 mm.	38		
0.0030 mm.	33		
0.0013 mm.	27		

* (no specification provided)

Soil Description

Black silt with sand and organics

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.2357 D_{85}= 0.4971 D_{60}= 0.0266
D_{50}= 0.0163 D_{30}= 0.0020 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

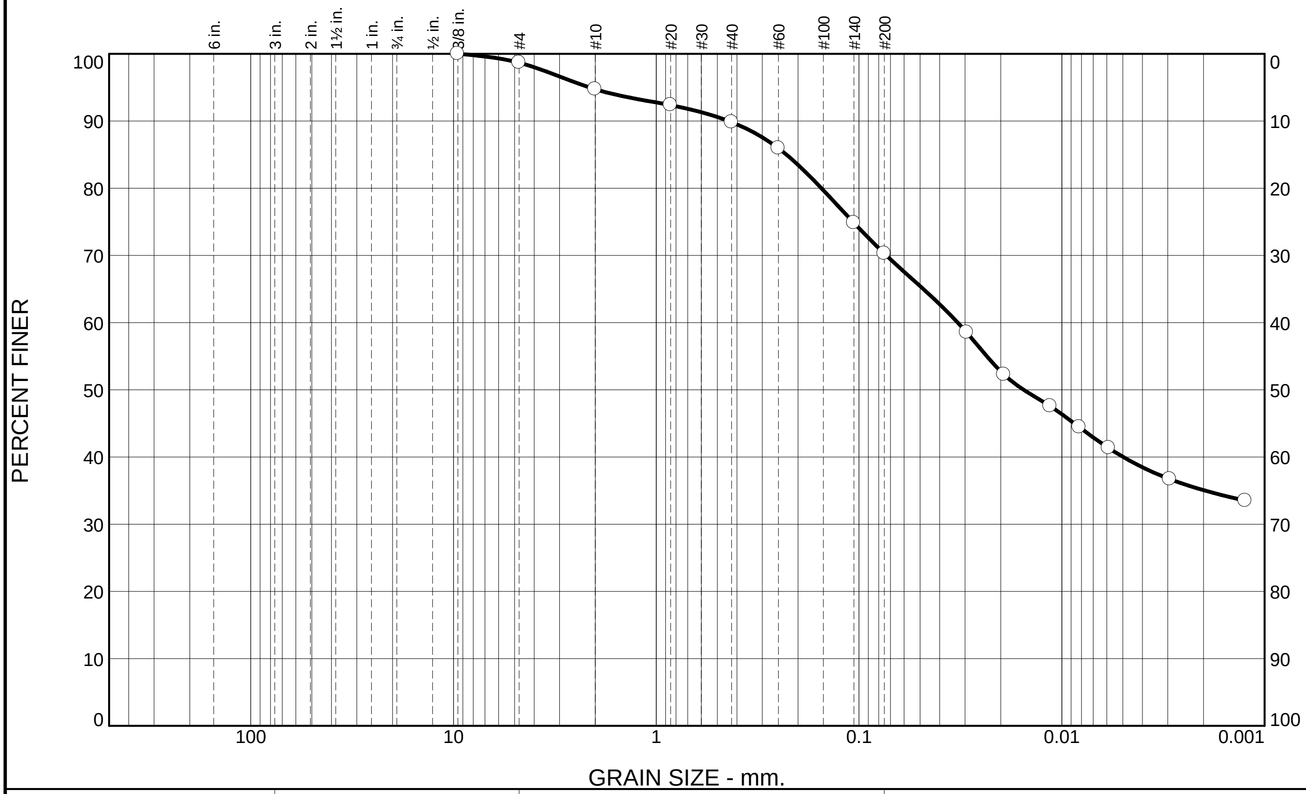
Remarks

Source of Sample: B-8 **Depth:** 16-17.5
Sample Number: S-02 **Date:** 2-11-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	4	5	20	30	40

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8	100		
#4	99		
#10	95		
#20	92		
#40	90		
#60	86		
#140	75		
#200	70		
0.0294 mm.	59		
0.0193 mm.	52		
0.0114 mm.	48		
0.0082 mm.	44		
0.0059 mm.	41		
0.0029 mm.	37		
0.0012 mm.	33		

* (no specification provided)

Soil Description

Brown sandy clay

Atterberg Limits

PL= 22 LL= 62 PI= 40

Coefficients

D_{90}= 0.4406	D_{85}= 0.2283	D_{60}= 0.0326
D_{50}= 0.0154	D_{30}=	D_{15}=
D_{10}=	C_u=	C_c=

Classification

USCS= CH AASHTO= A-7-6(27)

Remarks

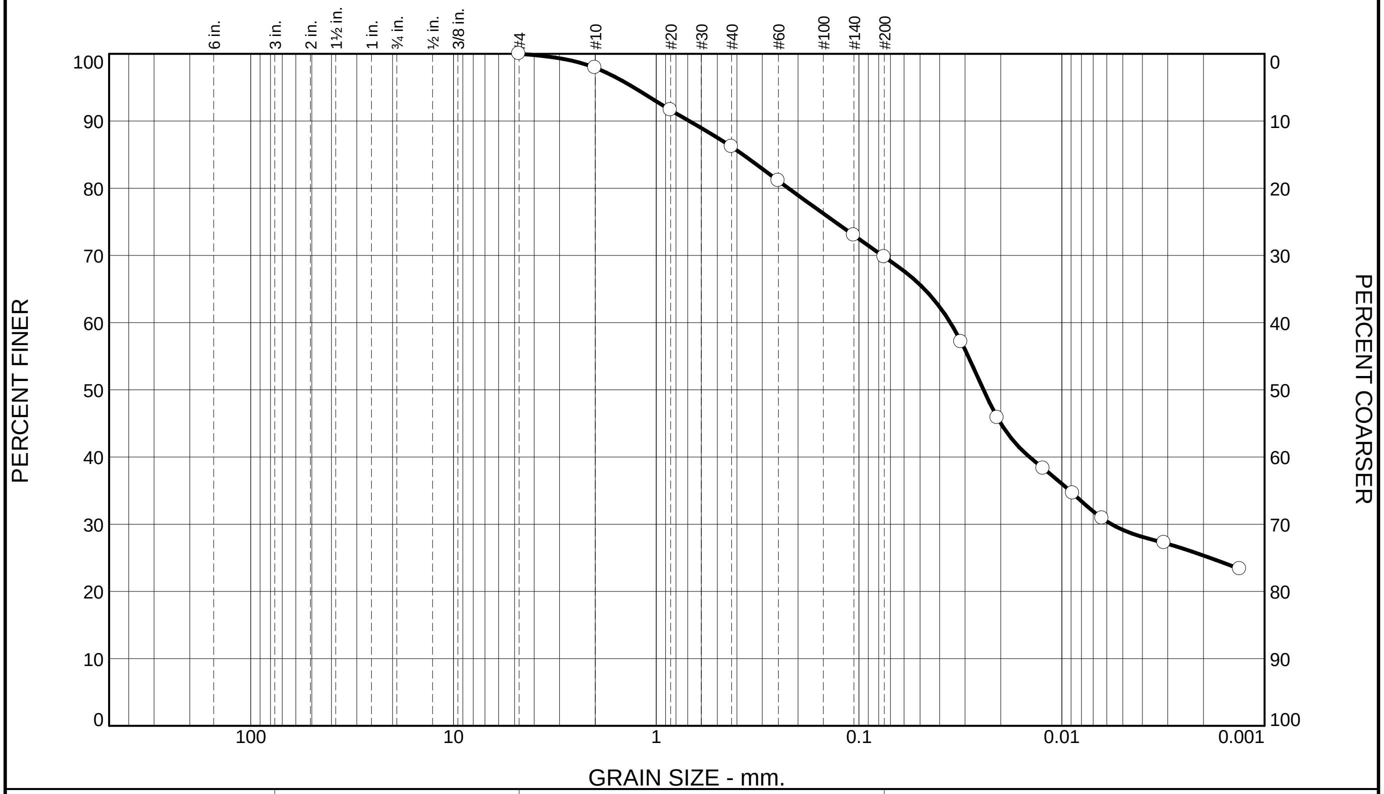
Source of Sample: B-14 **Depth:** 6.4-7.9
Sample Number: S-01

Date: 2-11-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	2	12	16	41	29

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100		
#10	98		
#20	92		
#40	86		
#60	81		
#140	73		
#200	70		
0.0313 mm.	57		
0.0207 mm.	46		
0.0123 mm.	38		
0.0088 mm.	35		
0.0063 mm.	31		
0.0031 mm.	27		
0.0013 mm.	23		

* (no specification provided)

Soil Description

Brown sandy silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.6889 D_{85}= 0.3736 D_{60}= 0.0355
D_{50}= 0.0243 D_{30}= 0.0057 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

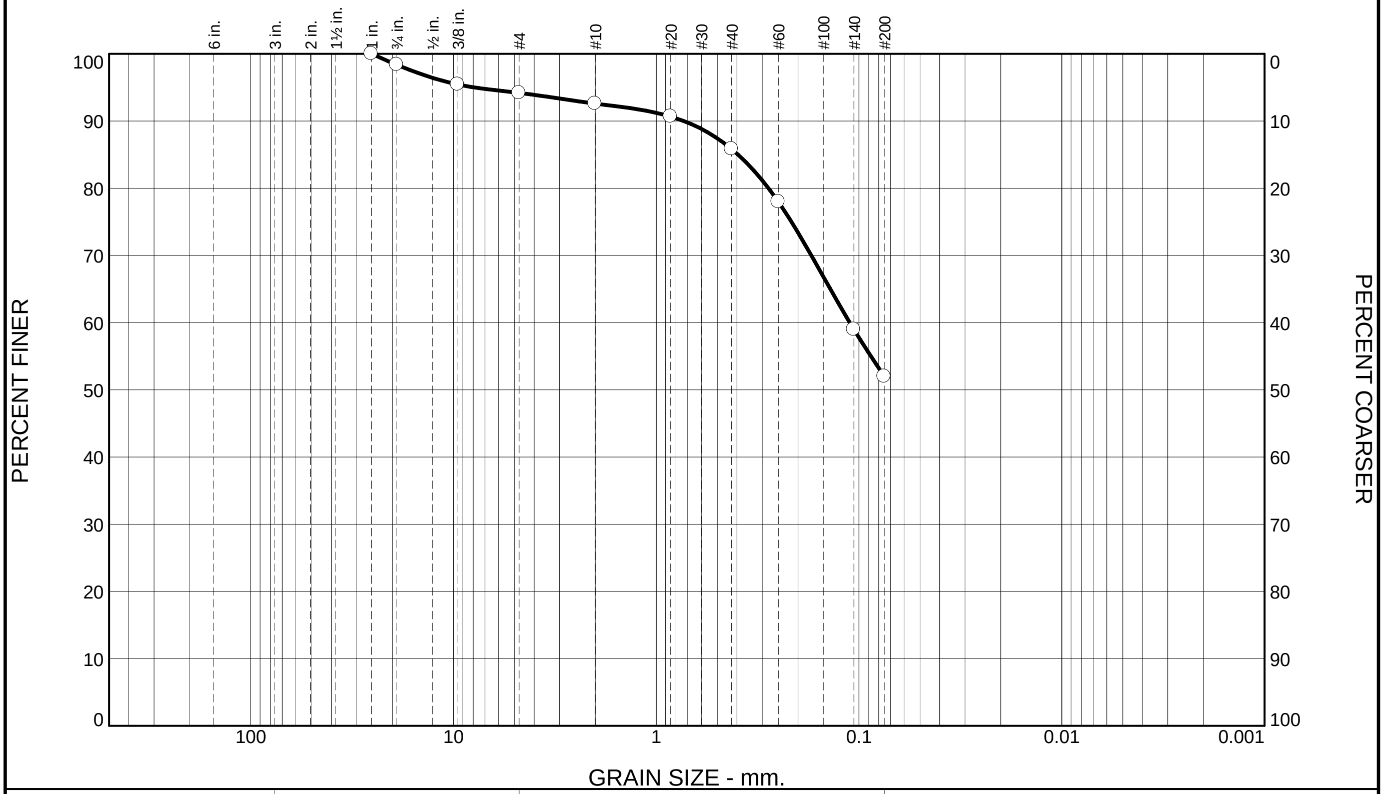
Remarks

Source of Sample: B-19 **Depth:** 5-6.5
Sample Number: S-01
Date: 2-11-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	2	4	1	7	34	52	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100		
3/4	98		
3/8	95		
#4	94		
#10	93		
#20	91		
#40	86		
#60	78		
#140	59		
#200	52		

* (no specification provided)

Soil Description

Mottled grayish brown sandy clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7332 D_{85}= 0.3954 D_{60}= 0.1112
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

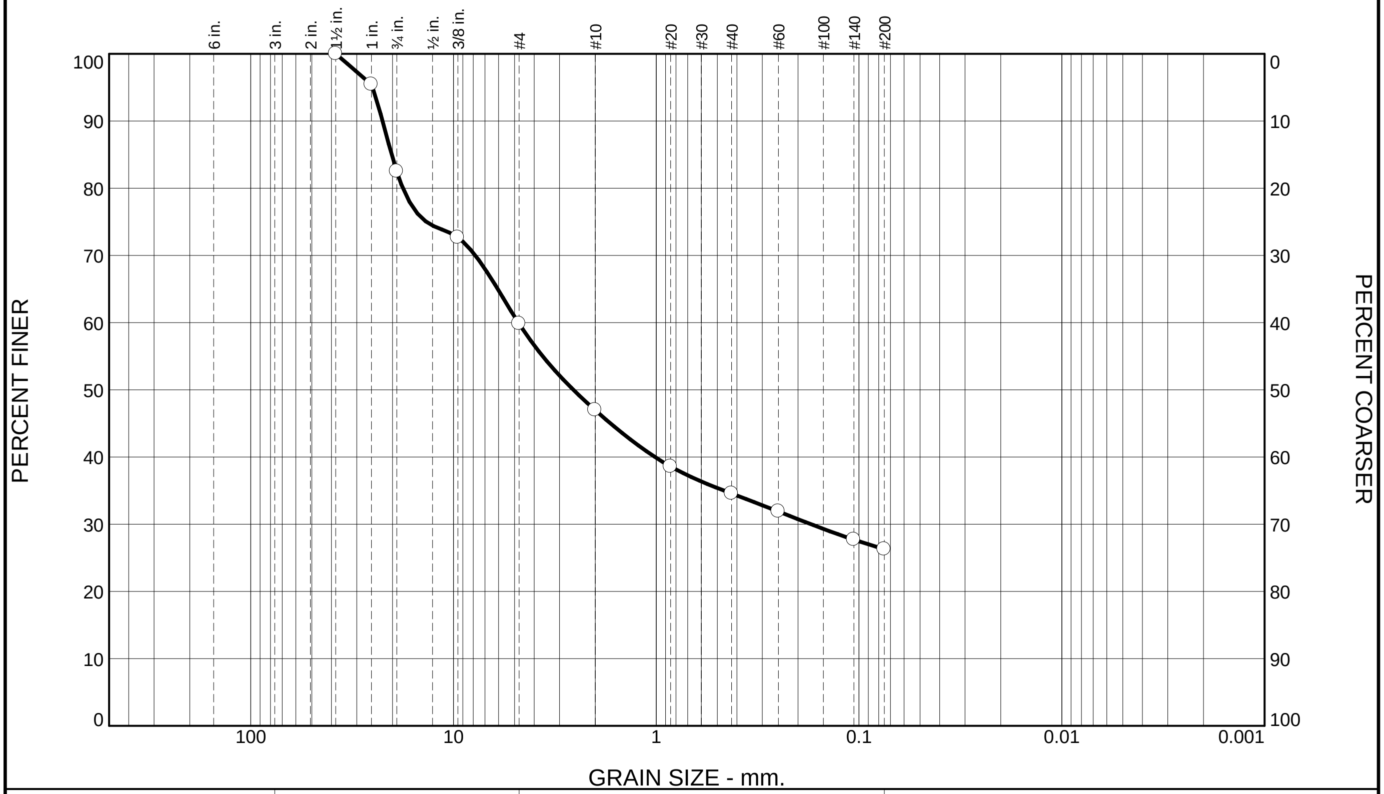
Remarks

Source of Sample: B-19 **Depth:** 15-16.5
Sample Number: S-03 **Date:** 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	18	22	13	12	9	26	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100		
1	95		
3/4	82		
3/8	73		
#4	60		
#10	47		
#20	39		
#40	35		
#60	32		
#140	28		
#200	26		

* (no specification provided)

Soil Description

Grayish brown clayey gravel with sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.3903 D_{85}= 20.1845 D_{60}= 4.7896

D_{50}= 2.5659 D_{30}= 0.1726 D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= GC AASHTO=

Remarks

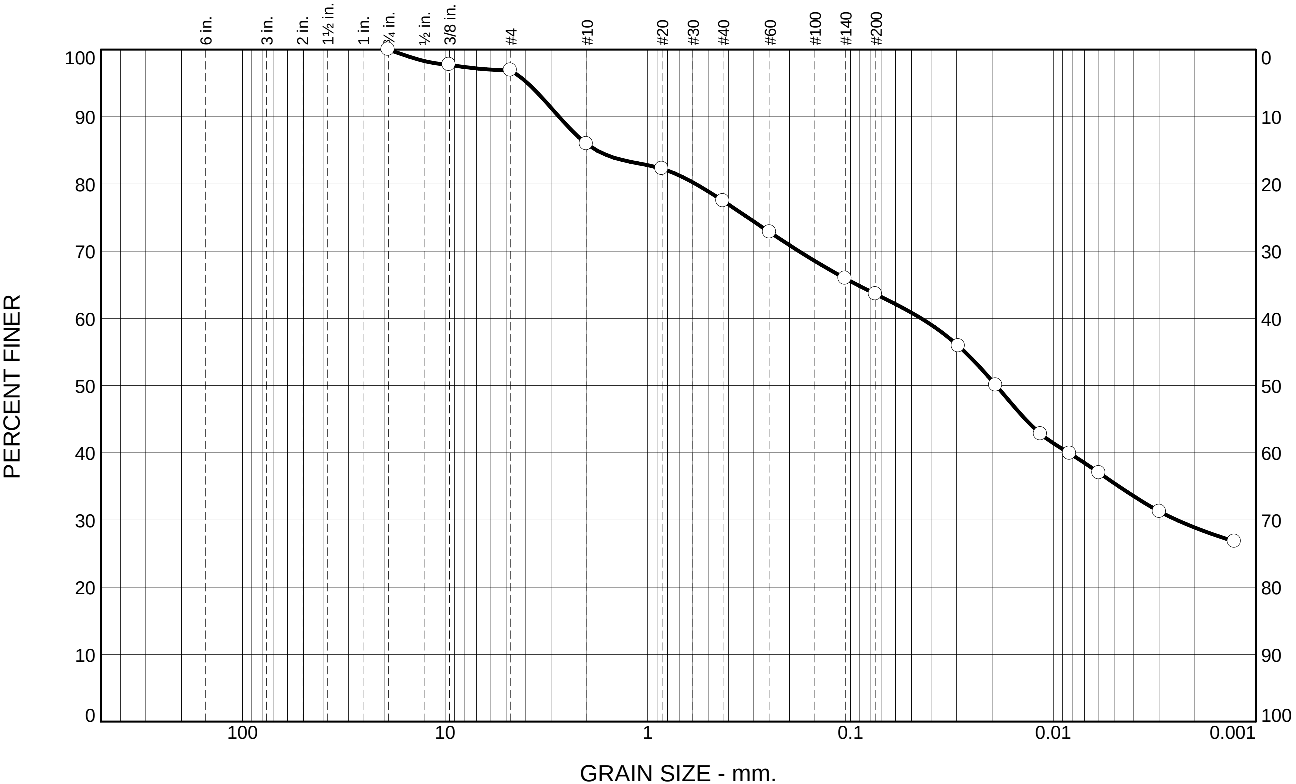
Source of Sample: B-19 **Depth:** 20-21.5
Sample Number: S-04

Date: 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	3	11	9	13	29	35

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
3/8	98		
#4	97		
#10	86		
#20	82		
#40	77		
#60	73		
#140	66		
#200	64		
0.0292 mm.	56		
0.0191 mm.	50		
0.0115 mm.	43		
0.0083 mm.	40		
0.0059 mm.	37		
0.0030 mm.	31		
0.0013 mm.	27		

* (no specification provided)

Soil Description

Brown sandy clay

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 2.7420 D_{85}= 1.7874 D_{60}= 0.0448
D_{50}= 0.0191 D_{30}= 0.0025 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Remarks

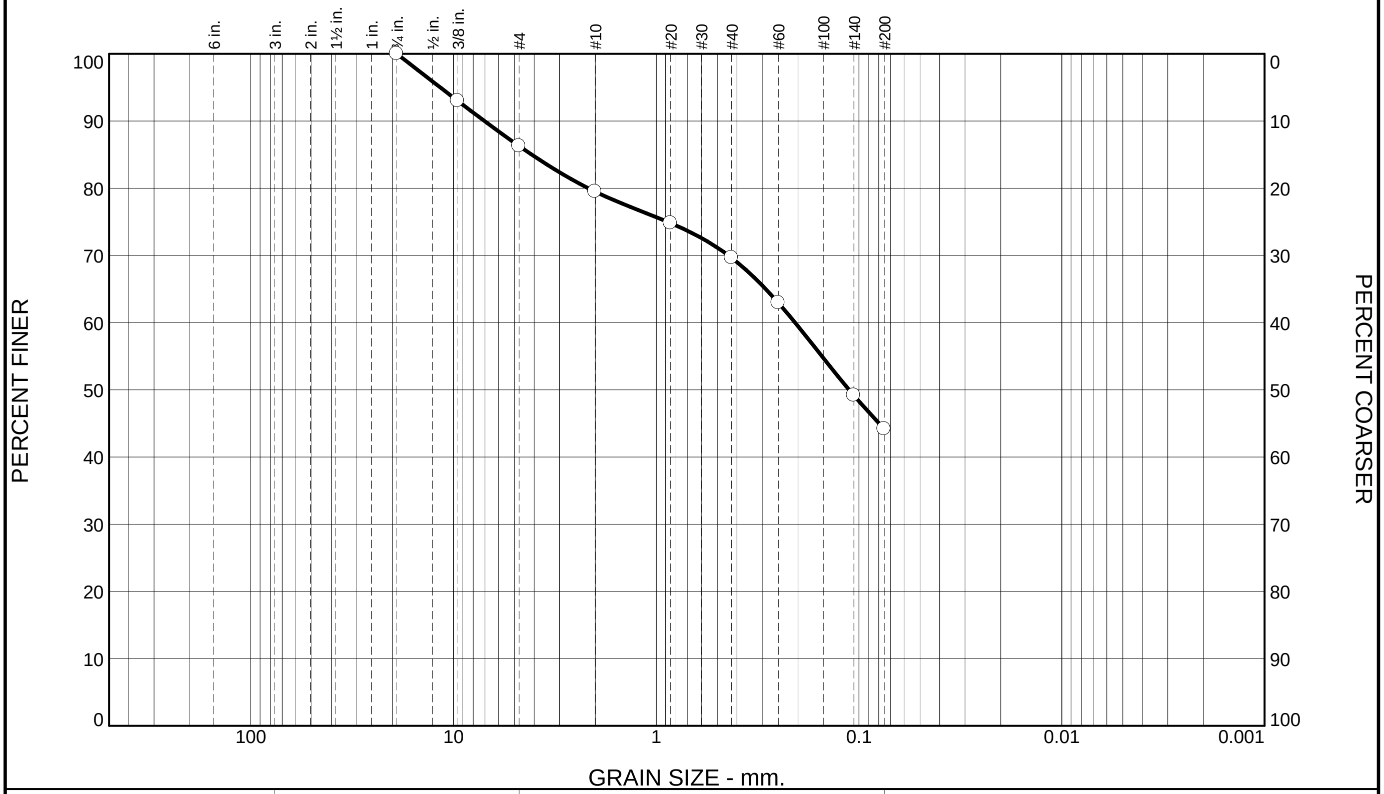
Source of Sample: B-20 **Depth:** 10-11.5
Sample Number: S-02

Date: 2-11-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	14	7	9	26	44	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100		
3/8	93		
#4	86		
#10	79		
#20	75		
#40	70		
#60	63		
#140	49		
#200	44		

* (no specification provided)

Soil Description

Grayish brown clayey sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.0418 D_{85}= 4.1173 D_{60}= 0.2068
D_{50}= 0.1119 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO=

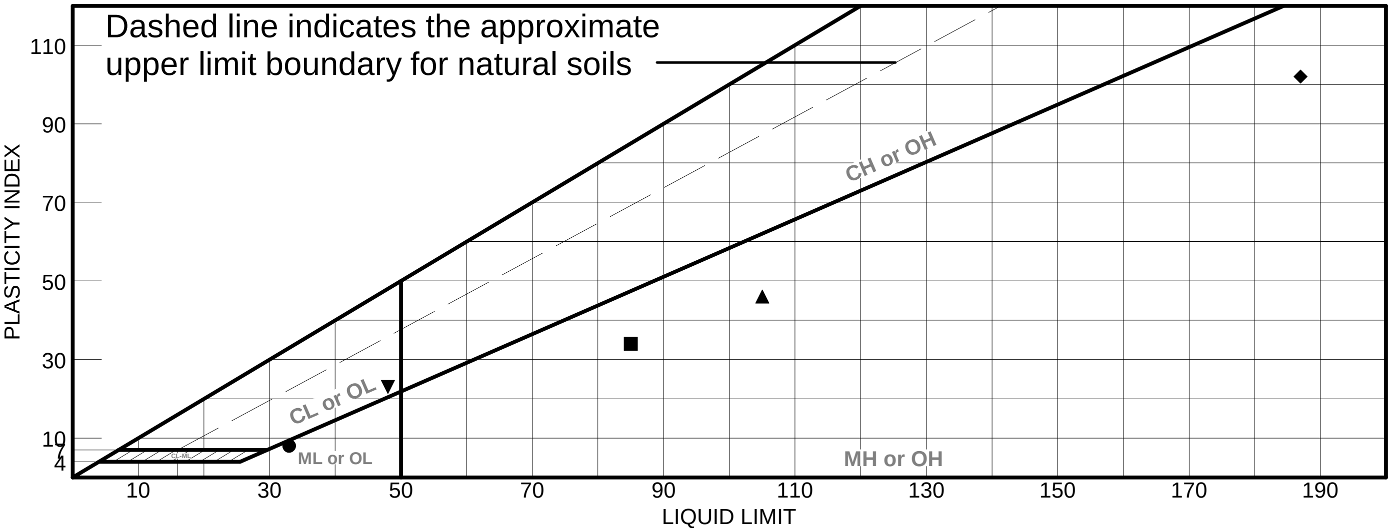
Remarks

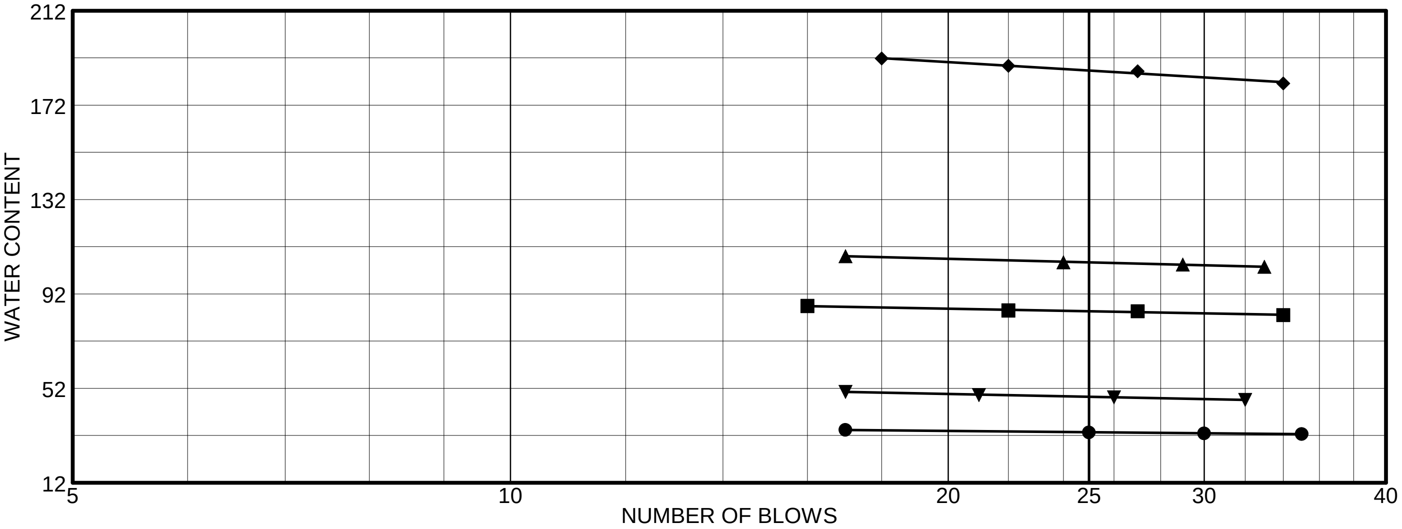
Source of Sample: B-20 **Depth:** 20-21.5
Sample Number: S-04 **Date:** 2-1-19

Client: AECOM
Project: Klamath River Dam Removal Project
60537920
Project No: 2301-069.0 **Figure**

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Olive Gray Sandy SILT	33	25	8			
■	Olive Gray Elastic SILT	85	51	34	99.9	99.0	MH
▲	Gray Elastic SILT	105	59	46	99.7	99.3	MH
◆	Gray Elastic SILT	187	85	102	99.6	99.5	MH
▼	Dark Olive Brown Sandy Lean CLAY	48	25	23			

Project No. 020-251 **Client:** AECOM

Project: Klamath River Dam Removal Project - 60537920

● **Source:** BC-01 **Sample No.:** S-02 **Elev./Depth:** 6.5'
■ **Source:** BC-01 **Sample No.:** S-04 **Elev./Depth:** 21.5'
▲ **Source:** BC-02 **Sample No.:** S-05 **Elev./Depth:** 14.5'
◆ **Source:** BC-02 **Sample No.:** S-09 **Elev./Depth:** 44.5'
▼ **Source:** BC-03 **Sample No.:** S-01 **Elev./Depth:** 1'

Remarks:
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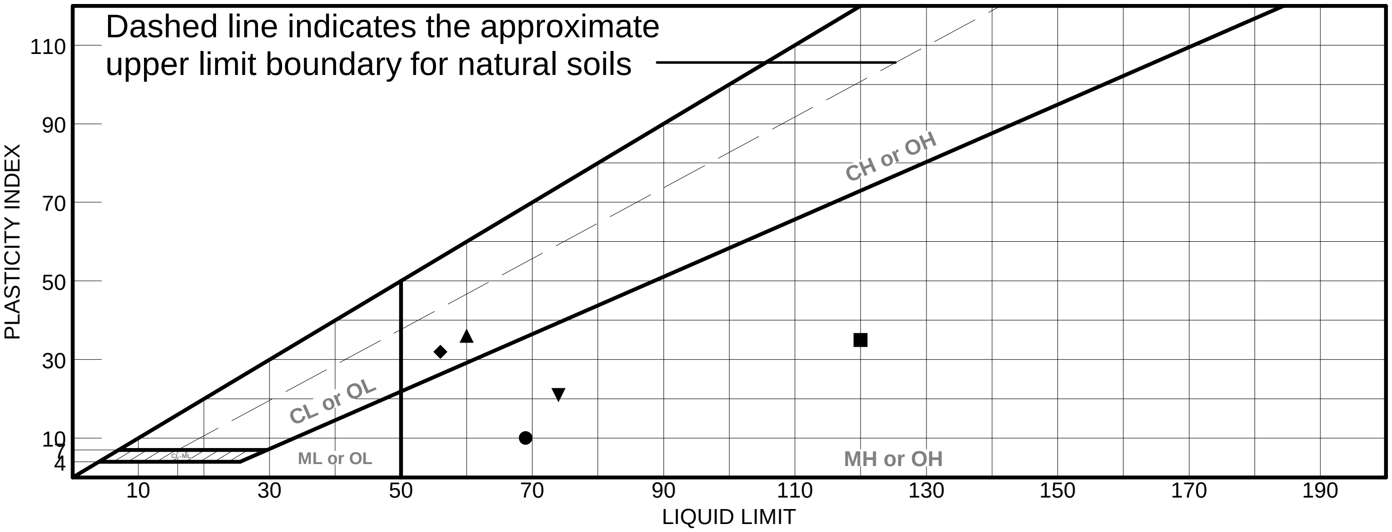
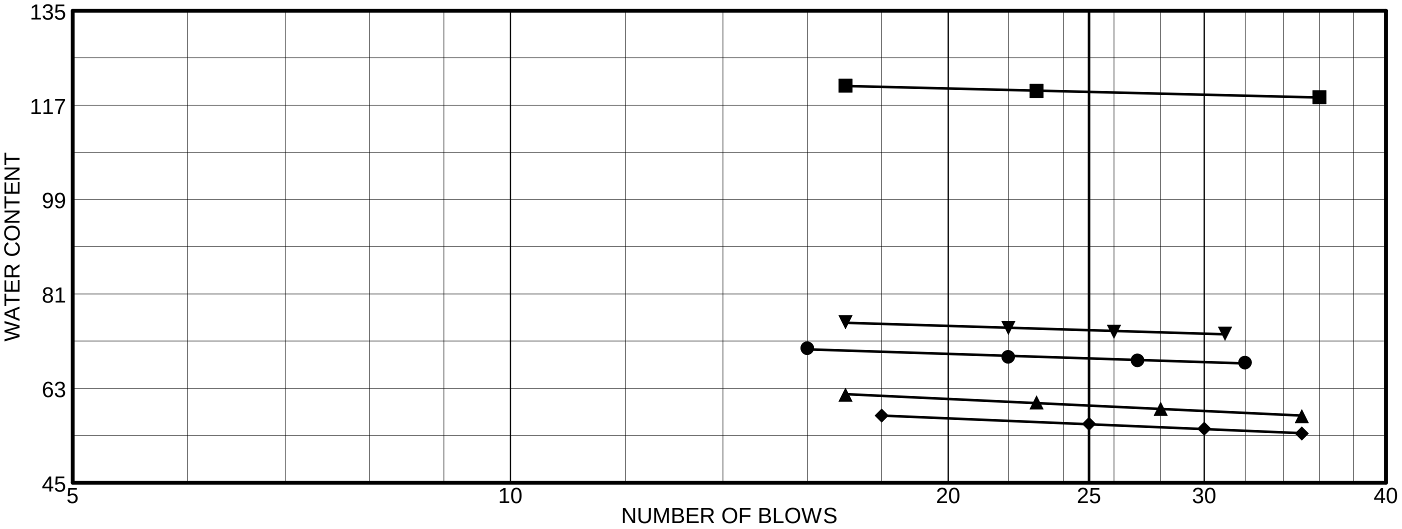
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Olive Brown Elastic SILT	69	59	10	100.0	100.0	MH
■	Pale Brown Mottled Gray Elastic SILT	120	85	35	99.4	99.1	MH
▲	Very Dark Olive Brown Sandy Fat CLAY w/ Gravel	60	24	36			
◆	Dark Reddish Brown Sandy Fat CLAY	56	24	32			
▼	Dark Gray Elastic SILT	74	53	21	99.9	99.7	MH

Project No. 020-251 **Client:** AECOM

Project: Klamath River Dam Removal Project - 60537920

● **Source:** BC-03 **Sample No.:** S-05 **Elev./Depth:** 24.5'
■ **Source:** BC-04 **Sample No.:** S-08 **Elev./Depth:** 32.5(Tip-16")
▲ **Source:** BC-07 **Sample No.:** S02 **Elev./Depth:** 4-4.5'
◆ **Source:** BC-08 **Sample No.:** S-01 **Elev./Depth:** 3.0'
▼ **Source:** BC-09 **Sample No.:** S-05 **Elev./Depth:** 23(Tip-5")

Remarks:
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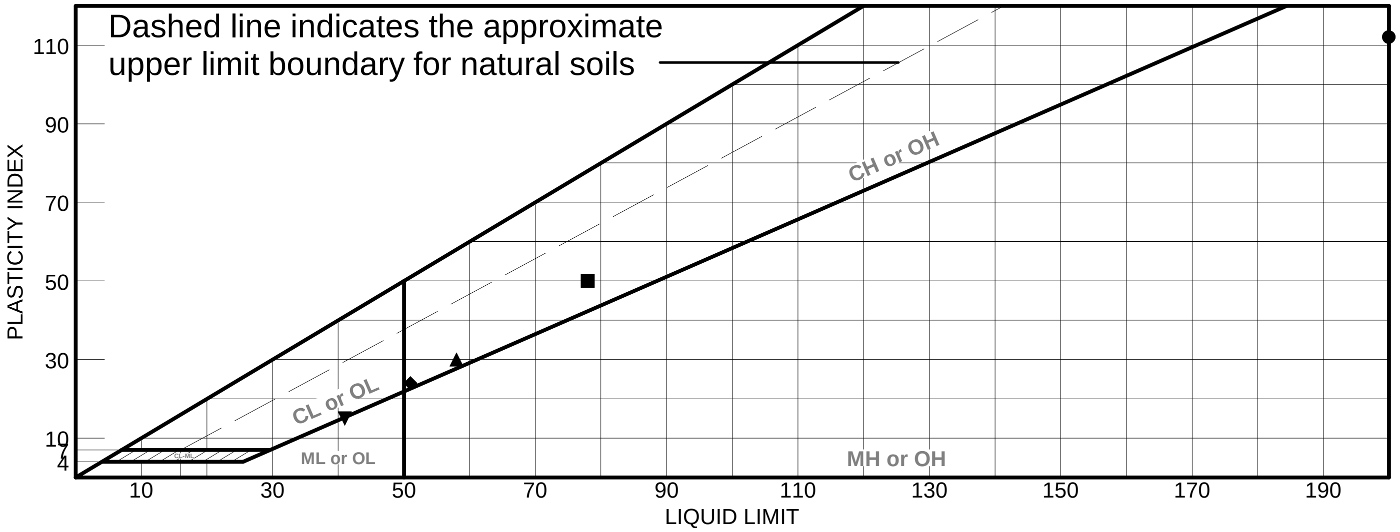
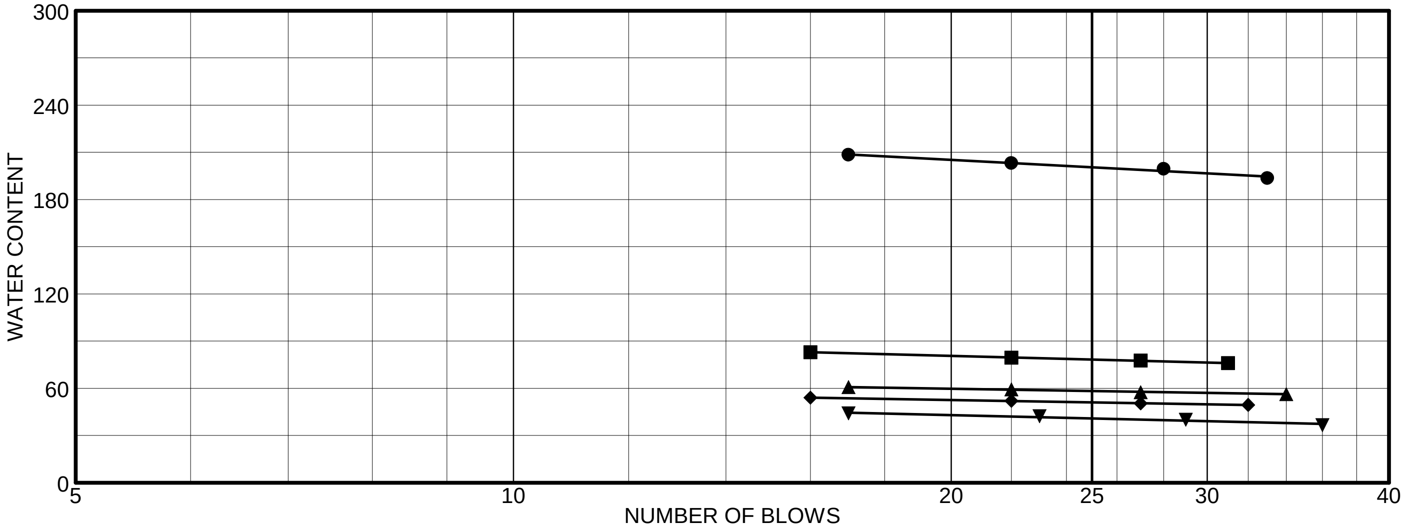
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Olive Brown Elastic SILT	200	88	112	99.6	99.0	MH
■	Dark Reddish Brown Sandy Fat CLAY	78	28	50	77.6	68.3	CH
▲	Yellowish Brown Sandy Fat CLAY	58	28	30	79.1	62.5	CH
◆	Yellowish Brown Sandy Fat CLAY	51	27	24	83.9	52.9	CH
▼	Olive Gray Poorly Graded GRAVEL w/ Silt & Sand	41	26	15	15.9	9.0	GP-GM

Project No. 020-251 **Client:** AECOM

Project: Klamath River Dam Removal Project - 60537920

● **Source:** BC-08A	**Sample No.:** S-05	**Elev./Depth:** 54'
■ **Source:** BI-02	**Sample No.:** S-01	**Elev./Depth:** 5'
▲ **Source:** BI-02	**Sample No.:** S-02	**Elev./Depth:** 10'
◆ **Source:** BI-02	**Sample No.:** S-03	**Elev./Depth:** 15'
▼ **Source:** BI-03	**Sample No.:** S-01	**Elev./Depth:** 3.5'

Remarks:
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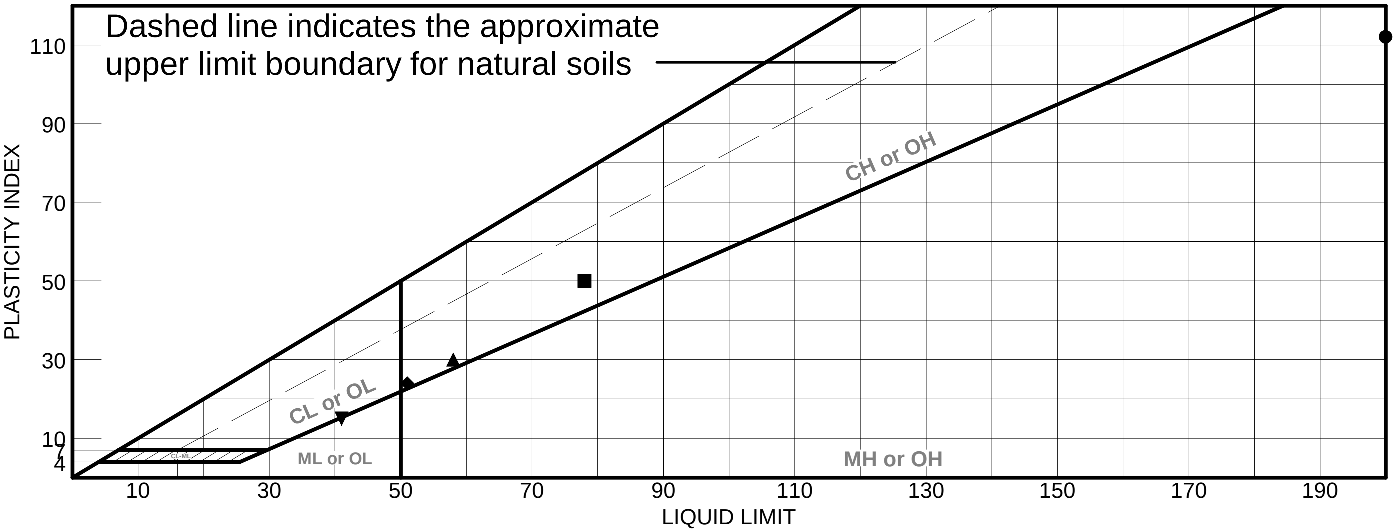
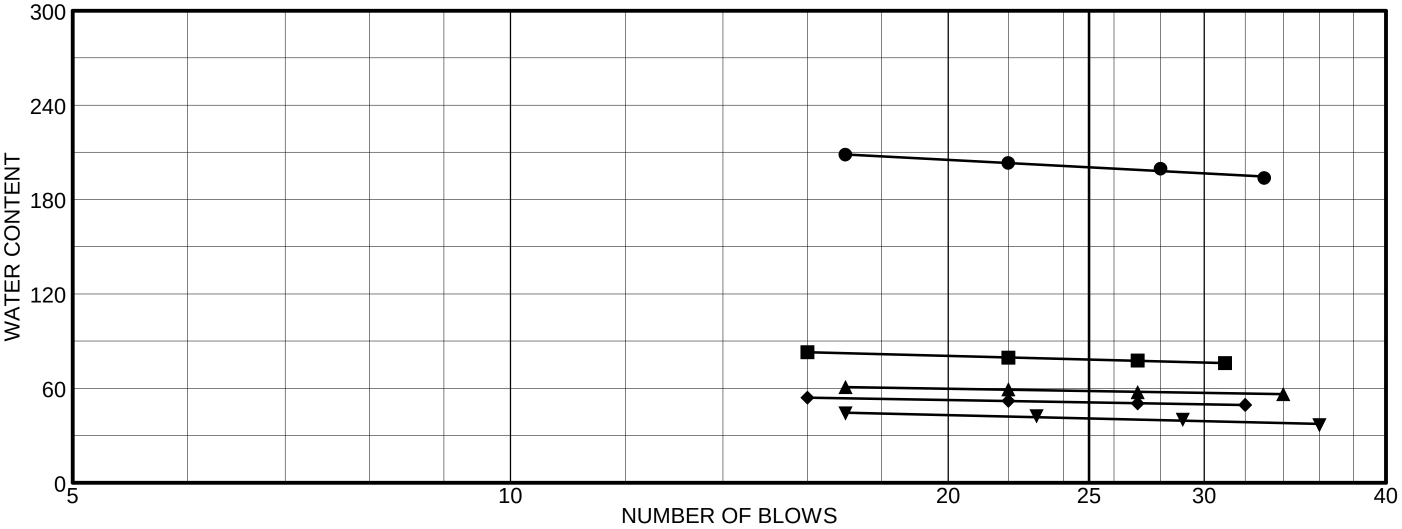
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Olive Brown Elastic SILT	200	88	112	99.6	99.0	MH
■	Dark Reddish Brown Sandy Fat CLAY	78	28	50	77.6	68.3	CH
▲	Yellowish Brown Sandy Fat CLAY	58	28	30	79.1	62.5	CH
◆	Yellowish Brown Sandy Fat CLAY	51	27	24	83.9	52.9	CH
▼	Olive Gray Poorly Graded GRAVEL w/ Silt & Sand	41	26	15	15.9	9.0	GP-GM

Project No. 020-251 **Client:** AECOM

Project: Klamath River Dam Removal Project - 60537920

● **Source:** BC-08A **Sample No.:** S-05 **Elev./Depth:** 54'
■ **Source:** BI-02 **Sample No.:** S-01 **Elev./Depth:** 5'
▲ **Source:** BI-02 **Sample No.:** S-02 **Elev./Depth:** 10'
◆ **Source:** BI-02 **Sample No.:** S-03 **Elev./Depth:** 15'
▼ **Source:** BI-03 **Sample No.:** S-01 **Elev./Depth:** 3.5'

Remarks:
●
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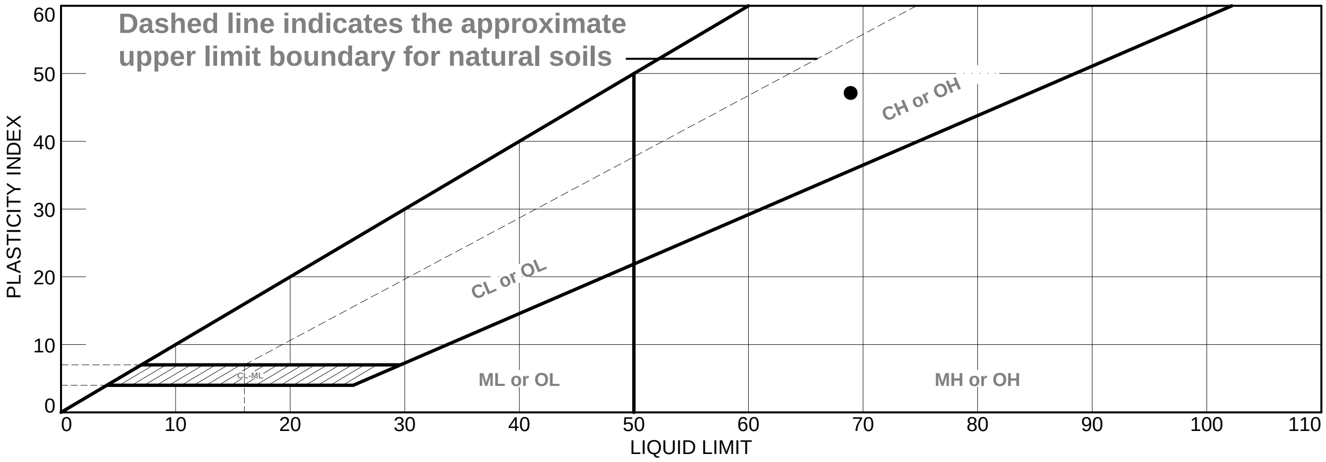
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT


Dashed line indicates the approximate upper limit boundary for natural soils

	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown clay with sand	69	22	47			CH

Project No. 2301-069.0 **Client:** AECOM

Project: Klamath River Dam Removal Project
60537920

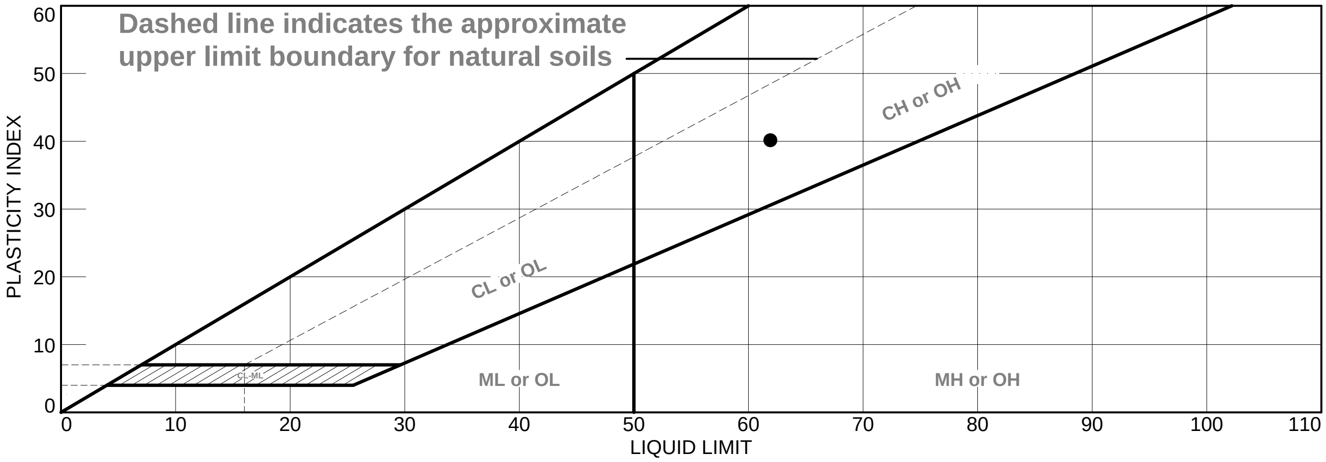
● **Source of Sample:** B-8 **Depth:** 13-14.5 **Sample Number:** S-01

Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown sandy clay	62	22	40	90	70	CH

Project No. 2301-069.0 **Client:** AECOM

Project: Klamath River Dam Removal Project
60537920

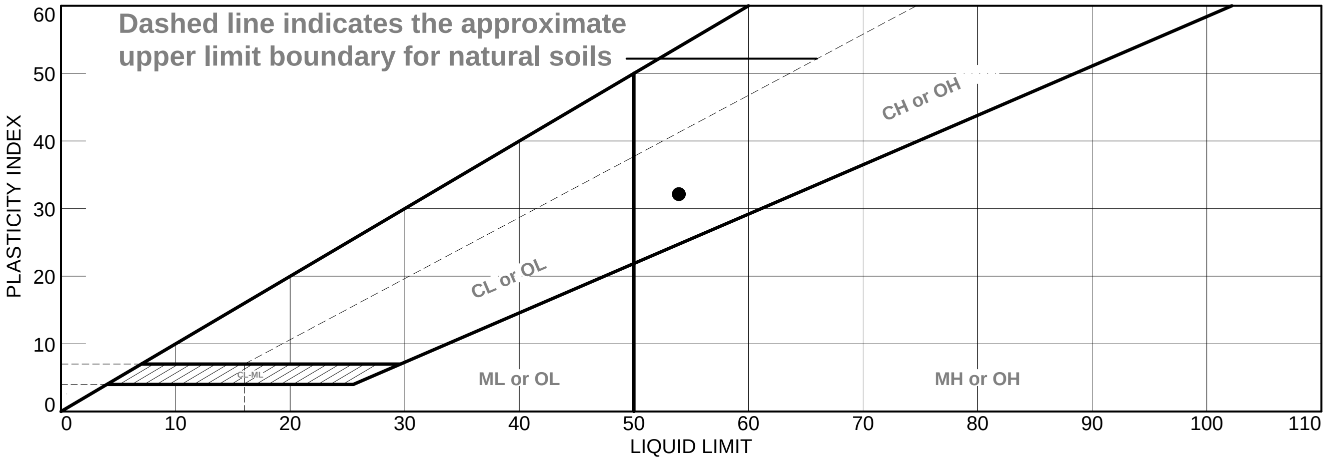
●**Source of Sample:** B-14 **Depth:** 6.4-7.9 **Sample Number:** S-01

Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown clay	54	22	32			CH

Project No. 2301-069.0 **Client:** AECOM

Project: Klamath River Dam Removal Project
60537920

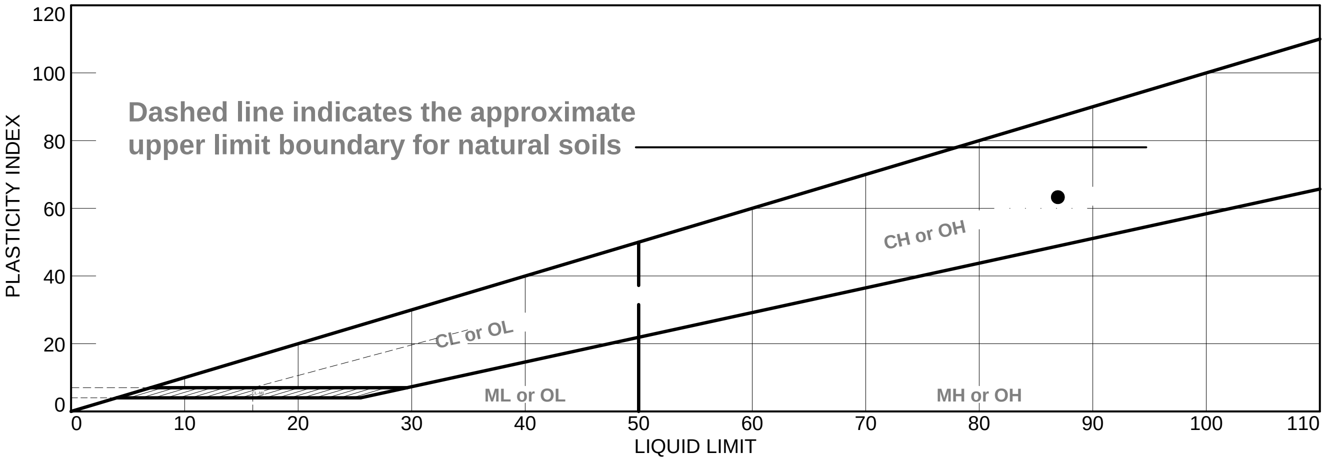
● **Source of Sample:** B-19 **Depth:** 10-11.5 **Sample Number:** S-02

Remarks:

Figure

Tested By: JH **Checked By:** JH

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown clay	87	24	63			CH

Project No. 2301-069.0 **Client:** AECOM

Project: Klamath River Dam Removal Project
60537920

●**Source of Sample:** B-20 **Depth:** 5-6.5 **Sample Number:** S-01

Remarks:

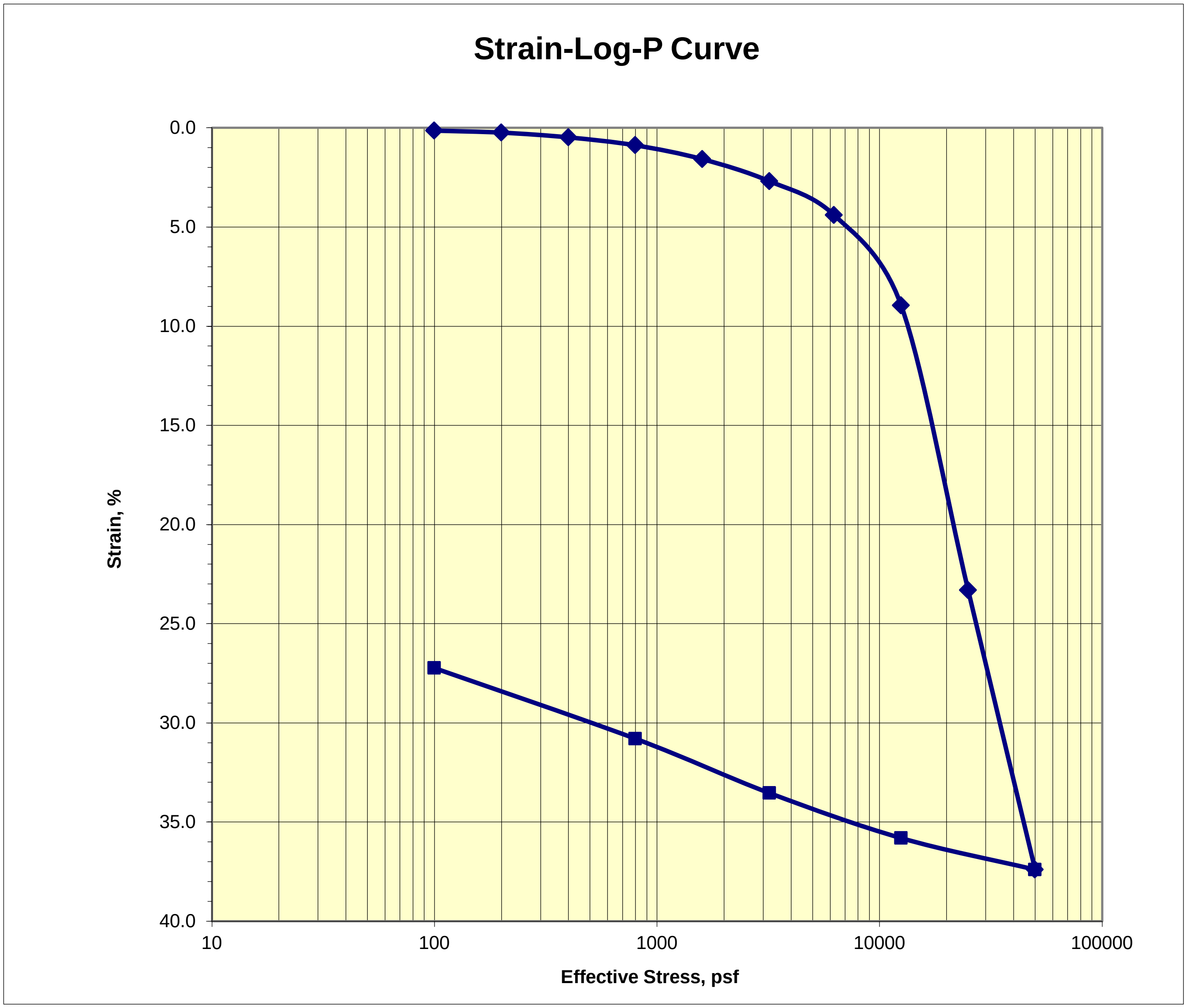
Figure

Tested By: JH **Checked By:** JH

COOPER TESTING LABORATORY

Consolidation Test
ASTM D2435

Job No.:	020-251	**Boring:**	BC-04	**Run By:**	MD
Client:	AECOM	**Sample:**	S-08	**Reduced:**	PJ
Project:	60537920	**Depth, ft.:**	32.5(Tip-2")	**Checked:**	PJ/DC
Soil Type:	Pale Brown Mottled Gray Elastic SILT			**Date:**	6/1/2018



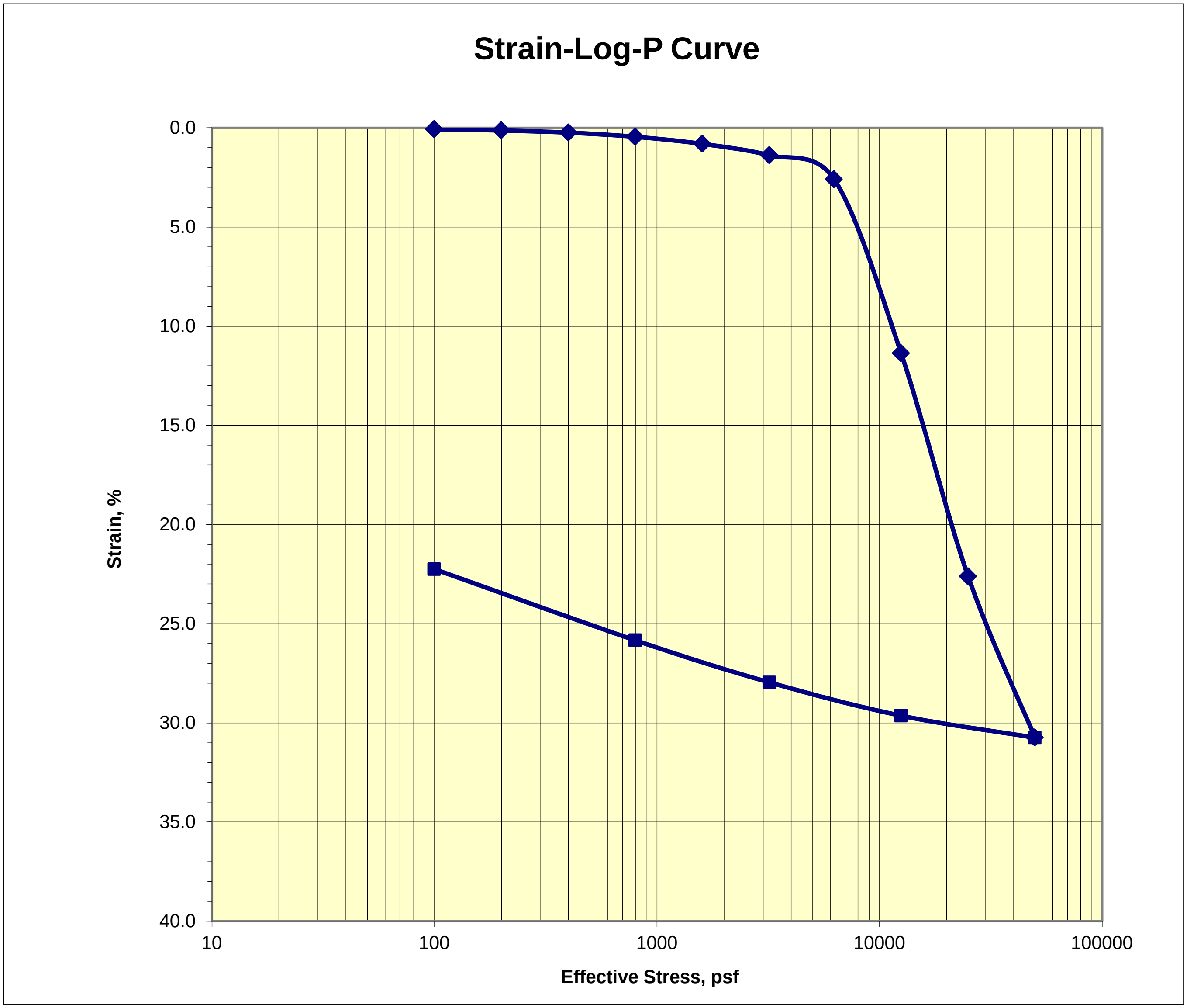
Assumed Gs 2.6	**Initial**	**Final**
Moisture %:	149.5	104.4
Dry Density, pcf:	32.1	43.7
Void Ratio:	4.058	2.715
% Saturation:	95.8	100.0

Remarks:

Consolidation Test

ASTM D2435

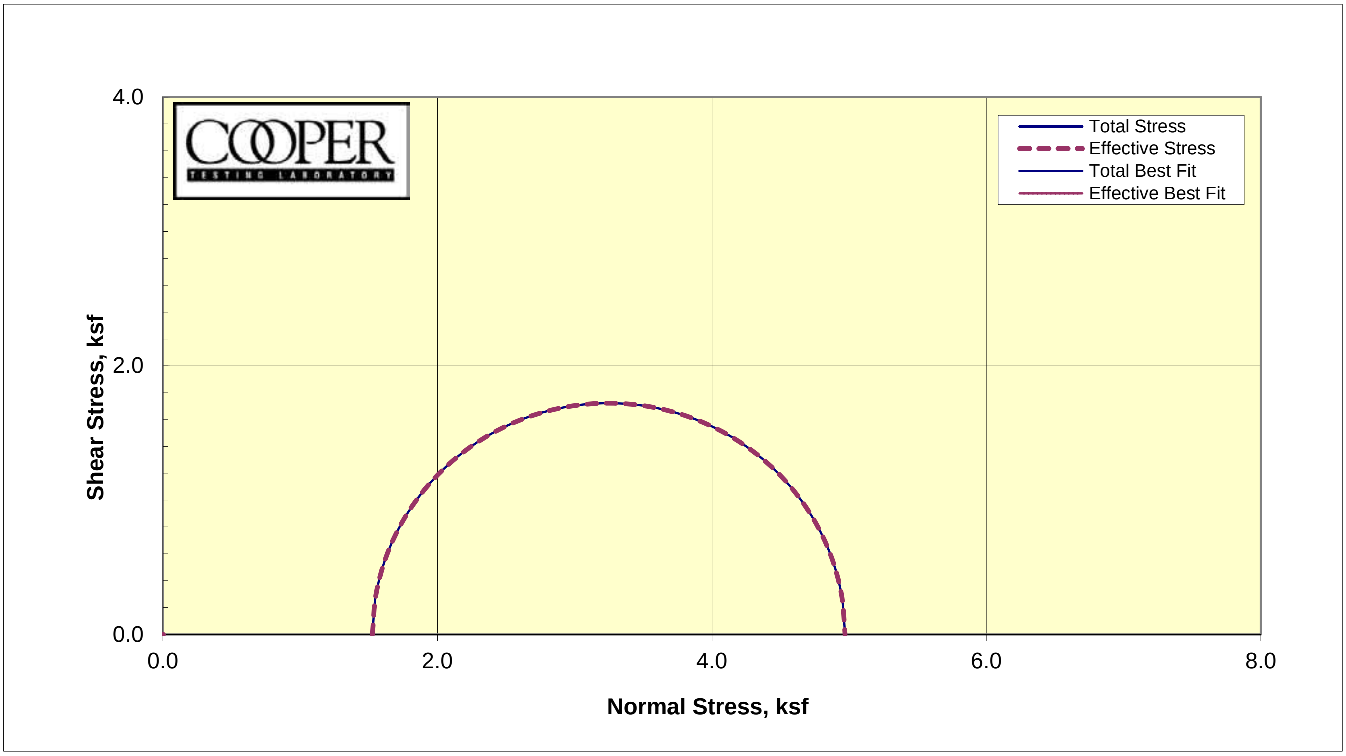
Job No.:	020-251	**Boring:**	BC-09	**Run By:**	MD
Client:	AECOM	**Sample:**	S-09	**Reduced:**	PJ
Project:	60537920	**Depth, ft.:**	68-70.5(Tip-20")	**Checked:**	PJ/DC
Soil Type:	Dark Greenish Gray CLAY (Silty)			**Date:**	6/1/2018

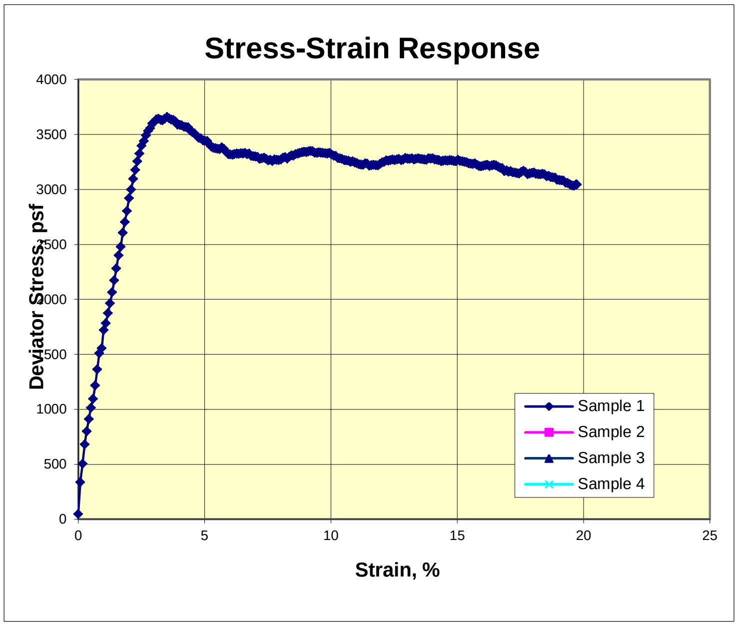


Assumed Gs 2.6	**Initial**	**Final**
Moisture %:	88.4	60.3
Dry Density, pcf:	48.6	63.2
Void Ratio:	2.340	1.568
% Saturation:	98.2	100.0

Remarks:

Triaxial Unconsolidated-Undrained
(ASTM D2850m)





Sample:	1	2	3	4
MC, %	160.5			
Dry Dens, pcf	30.5			
Sat. %	95.9			
Void Ratio	4.519			
Diameter in	2.87			
Height, in	6.08			
	Final			
MC, %	163.5			
Dry Dens, pcf	31.1			
Sat. %	100.0			
Void Ratio	4.414			
Diameter, in	2.84			
Height, in	6.08			
Cell, psi	49.1			
BP, psi	38.5			
	Effective Stresses At:			
Strain, %	5.0			
Deviator ksf	3.444			
Excess PP	0.000			
Sigma 1	4.970			
Sigma 3	1.526			
P, ksf	3.248			
Q, ksf	1.722			
Stress Ratio	3.256			
Rate in/min	0.0588			
Total C	N/A	ksf		
Total Phi	N/A	Degrees		
Eff. C	N/A	ksf		
Eff. Phi	N/A	Degrees		

Job No.: 020-251 **Date:** 5/24/2018

Client: AECOM BY:MD/DC

Project: 60537920

Sample 1) BC-04_S-10 @ 52.5(Tip-18") Bluish Gray CLAY (Silty)

Sample 2)

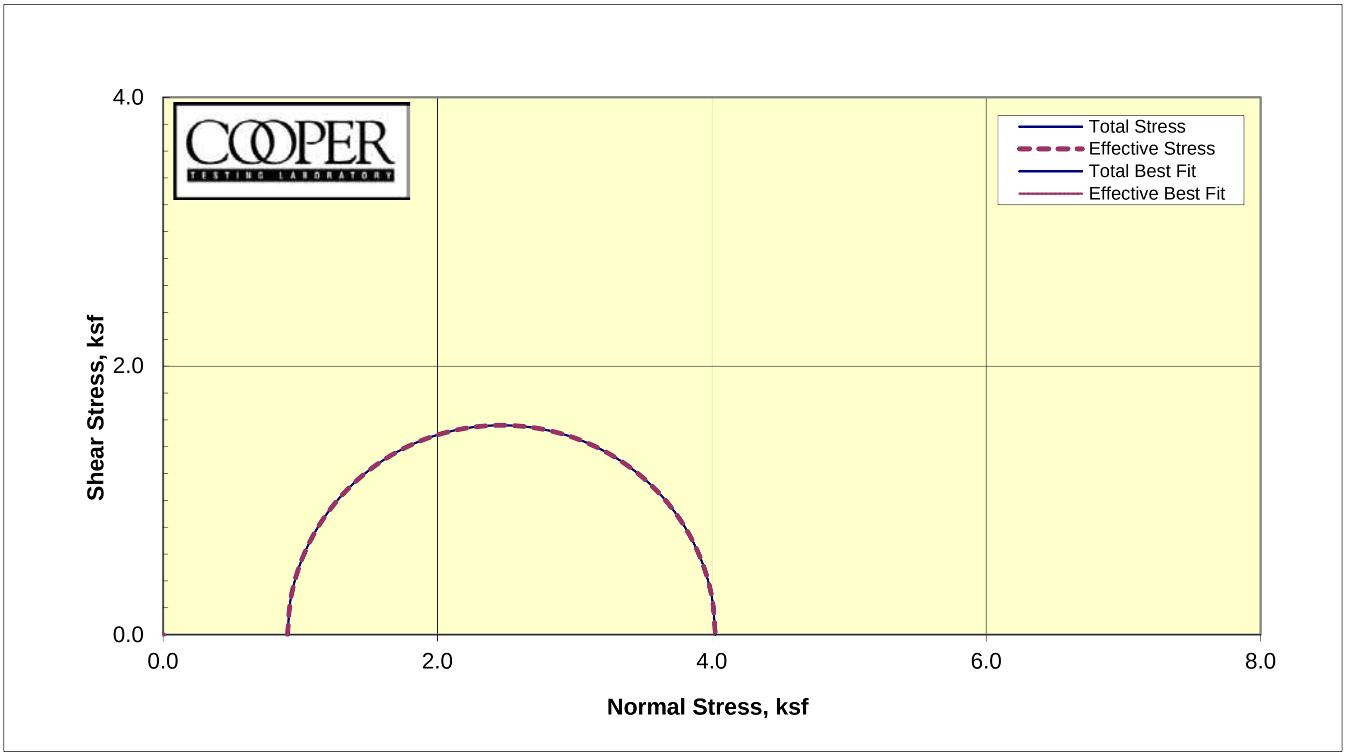
Sample 3)

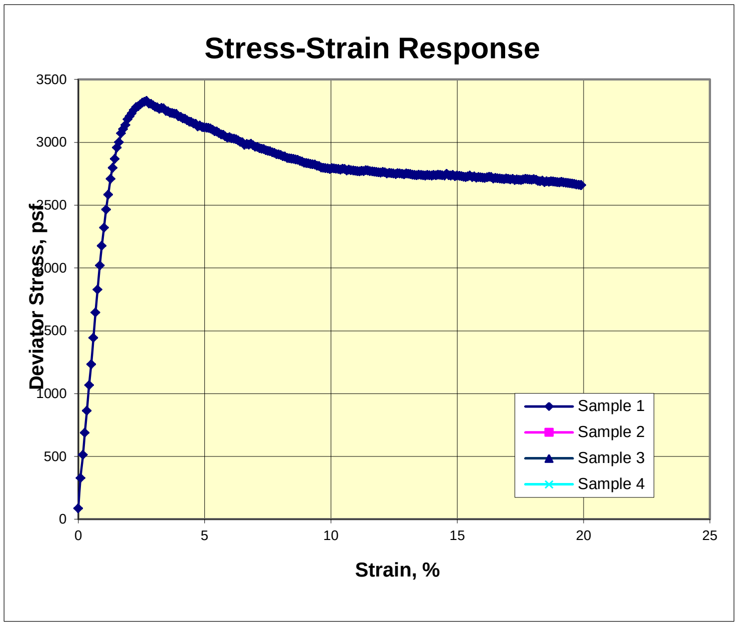
Sample 4)

REMARKS: Strengths picked at 5% strain.
*Sample was back-pressure saturated prior to shear.

Triaxial Unconsolidated-Undrained

(ASTM D2850m)





Job No.: 020-251 **Date:** 5/25/2018

Client: AECOM BY:MD/DC

Project: 60537920

Sample 1) BC-09_S-05 @ 23(Tip-13") Dark Gray Elastic SILT

Sample 2)

Sample 3)

Sample 4)

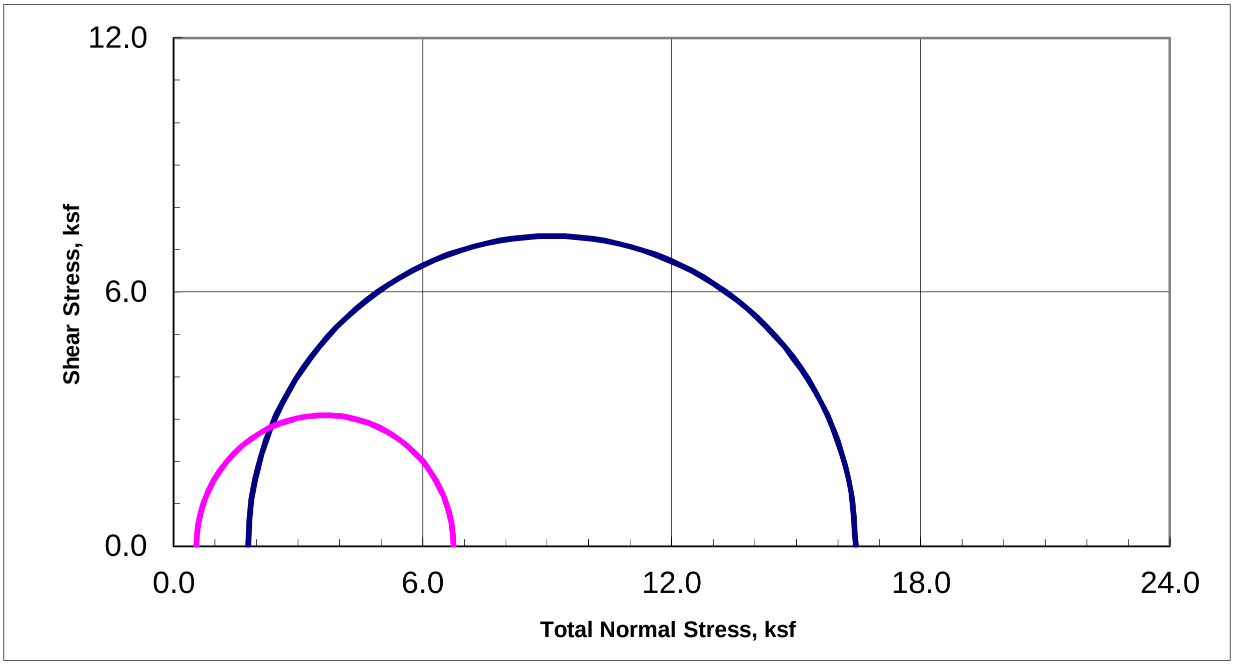
REMARKS: Strengths picked at 5% strain.
*Sample was back-pressure saturated prior to shear.

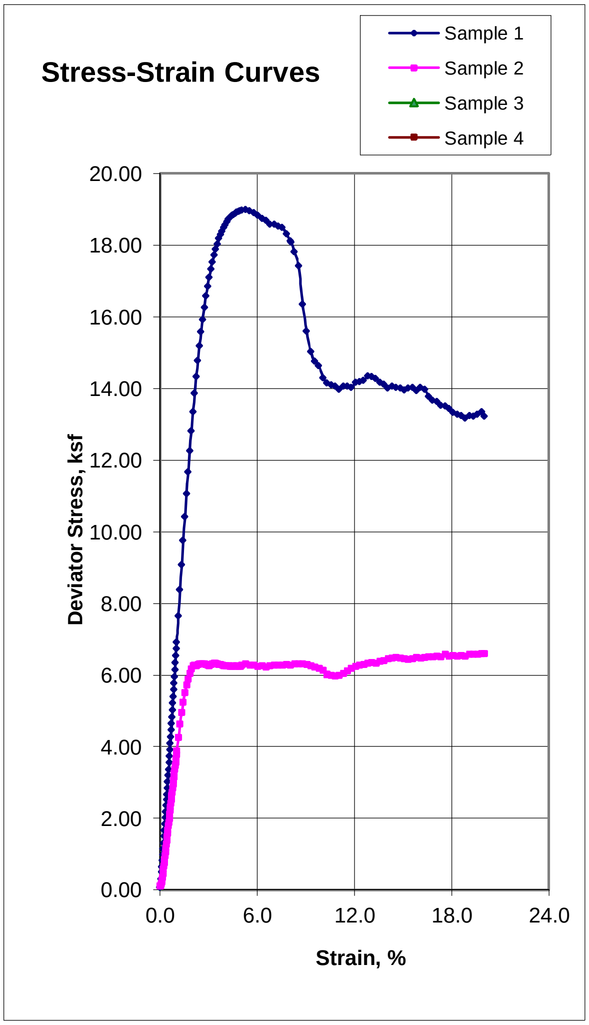
Sample:	1	2	3	4
MC, %	76.3			
Dry Dens, pcf	54.0			
Sat. %	97.1			
Void Ratio	2.121			
Diameter in	2.87			
Height, in	6.05			
	Final			
MC, %	76.6			
Dry Dens, pcf	54.9			
Sat. %	100.0			
Void Ratio	2.068			
Diameter, in	2.85			
Height, in	6.03			
Cell, psi	54.8			
BP, psi	48.5			
	Effective Stresses At:			
Strain, %	5.0			
Deviator ksf	3.118			
Excess PP	0.000			
Sigma 1	4.025			
Sigma 3	0.907			
P, ksf	2.466			
Q, ksf	1.559			
Stress Ratio	4.437			
Rate in/min	0.0588			
Total C	N/A	ksf		
Total Phi	N/A	Degrees		
Eff. C	N/A	ksf		
Eff. Phi	N/A	Degrees		

Cooper Testing Labs, Inc.
937 Commercial Street
Palo Alto, CA 94303

COOPER
TESTING LABORATORY

Unconsolidated-Undrained Triaxial Test
ASTM D2850





Sample Data

	1	2	3	4
Moisture %	76.6	34.4		
Dry Den,pcf	48.3	70.8		
Void Ratio	2.363	1.293		
Saturation %	84.3	69.3		
Height in	6.06	6.04		
Diameter in	2.86	2.85		
Cell psi	12.4	3.8		
Strain %	10.00	10.00	10.00	10.00
Deviator, ksf	14.642	6.188		
Rate %/min	1.00	1.00		
in/min	0.061	0.060		
Job No.:	**020-272**			
Client:	**AECOM**			
Project:	**60537920**			
Boring:	BC-13	BC-14		
Sample:	S04	S02		
Depth ft:	22(Tip-12')	7(Tip-1")		

Visual Soil Description

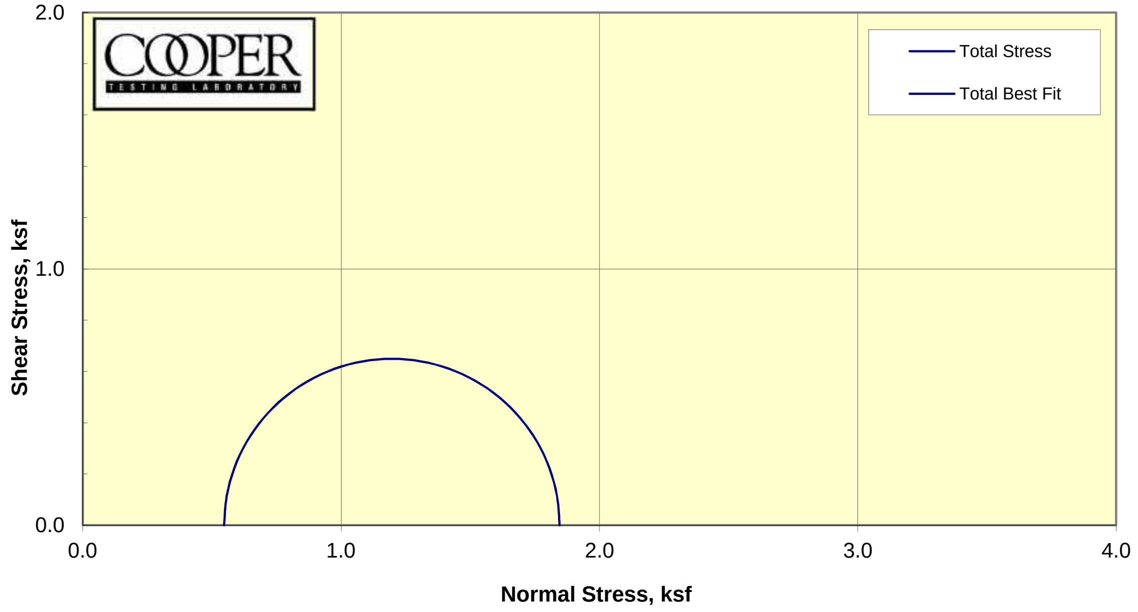
Sample #	
1	Olive Brown CLAY w/ Sand
2	Light Yellowish Brown Sandy CLAY w/ Claystone
3	
4	

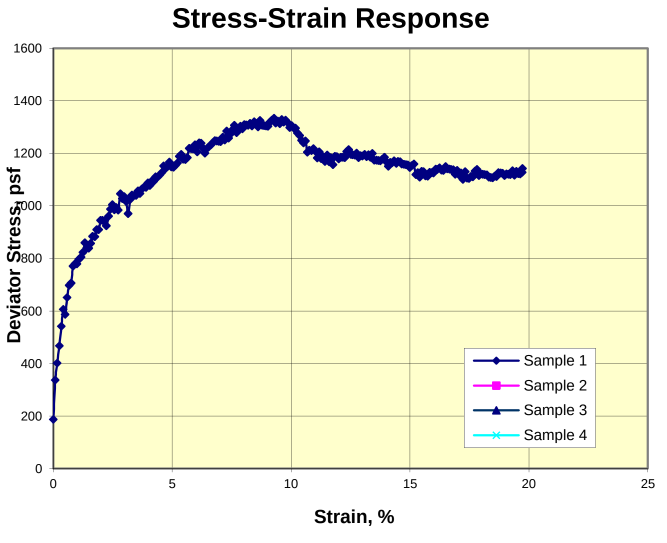
Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

Triaxial Unconsolidated-Undrained

(ASTM D2850m)





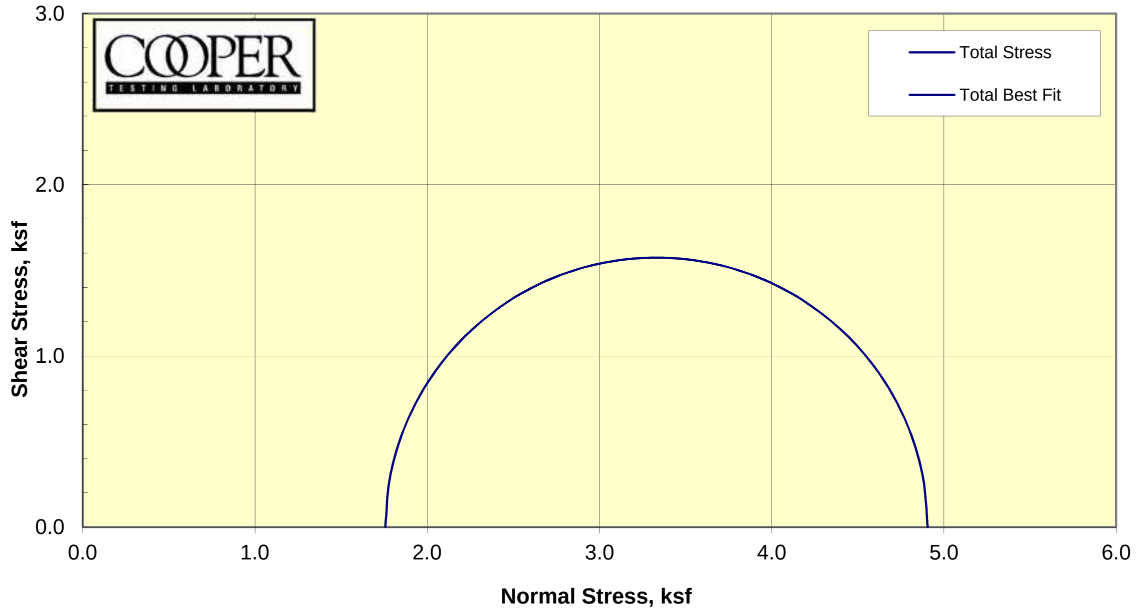
Job No.:	020-272	**Date:**	12/19/2018
Client:	AECOM		BY:MD/DC
Project:	60537950		
Sample 1)	BC-13_S01 @ 7(Tip-4") Olive Brown Silty SAND (Weathered Rock)		
Sample 2)			
Sample 3)			
Sample 4)			

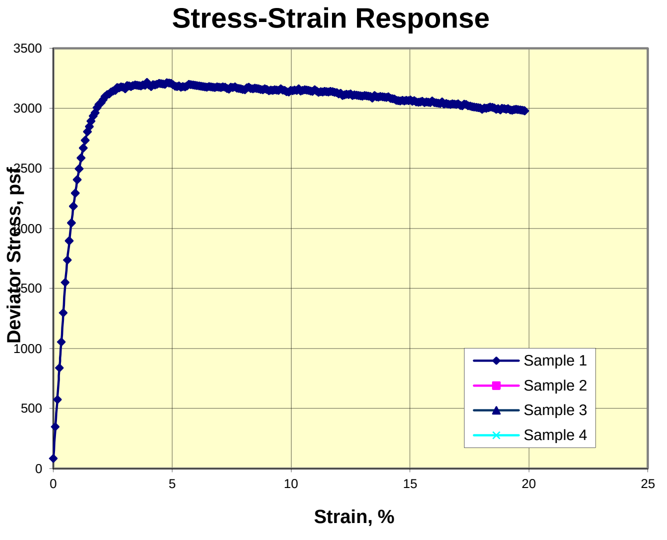
REMARKS: Strengths picked at 10% strain.
*Sample was back-pressure saturated prior to shear.

Sample:	**1**	**2**	**3**	**4**
MC, %	21.9			
Dry Dens, pcf	77.6			
Sat. %	52.3			
Void Ratio	1.090			
Diameter in	2.87			
Height, in	6.09			
	Final			
MC, %	39.9			
Dry Dens, pcf	79.6			
Sat. %	100.0			
Void Ratio	1.038			
Diameter, in	2.84			
Height, in	6.09			
Cell, psi	92.8			
BP, psi	89.0			
	Effective Stresses At:			
Strain, %	10.0			
Deviator ksf	1.299			
Excess PP	0.000			
Sigma 1	1.846			
Sigma 3	0.547			
P, ksf	1.196			
Q, ksf	0.649			
Stress Ratio	3.373			
Rate in/min	0.0600			
Total C	N/A	ksf		
Total Phi	N/A	Degrees		
Eff. C	N/A	ksf		
Eff. Phi	N/A	Degrees		

Triaxial Unconsolidated-Undrained

(ASTM D2850m)





Job No.: 020-272 **Date:** 12/19/2018

Client: AECOM BY:MD/DC

Project: 60537920

Sample 1) BC-13_S04 @ 22(Tip-18.5") Olive Brown Silty SAND/ Clayey SAND (Weathered Rock)

Sample 2)

Sample 3)

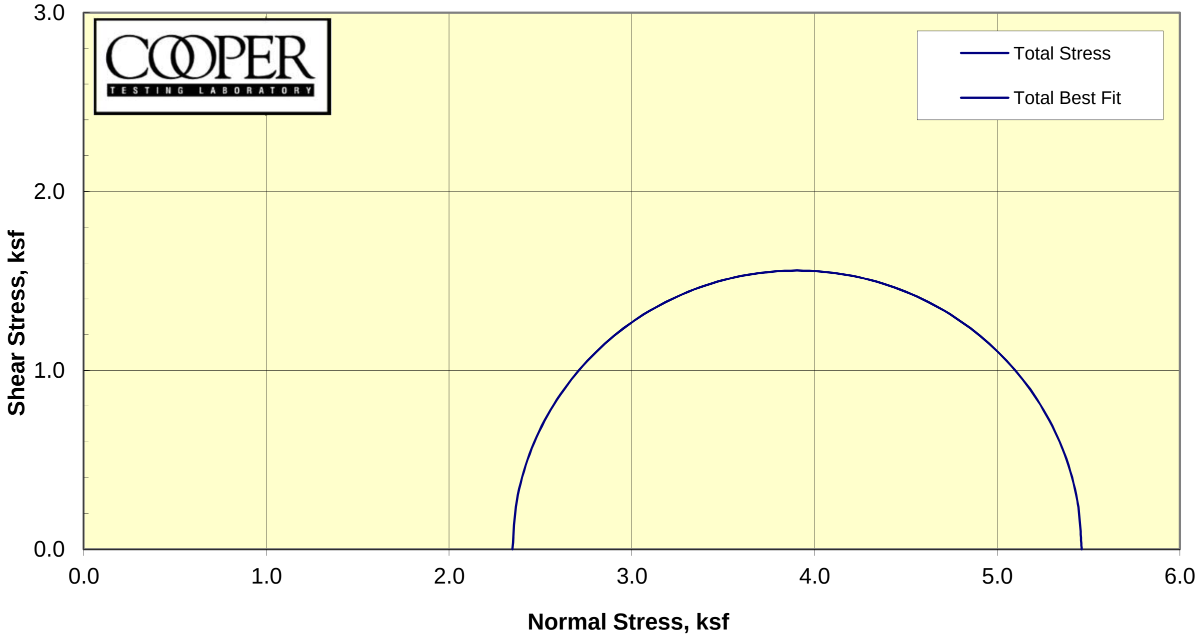
Sample 4)

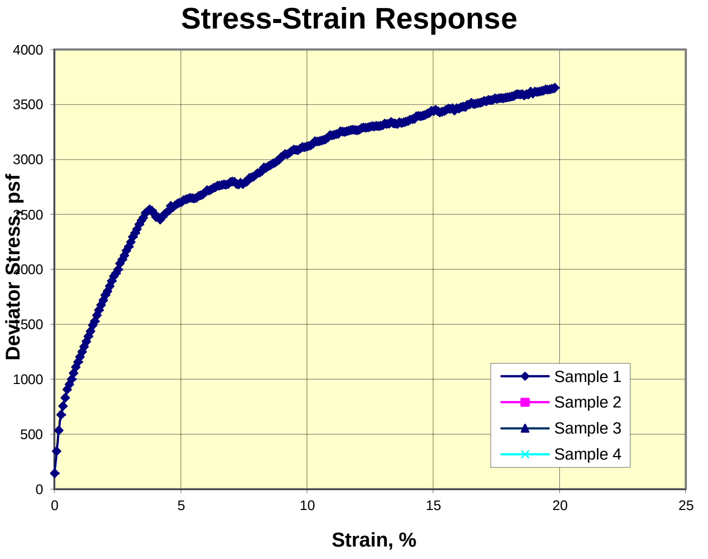
REMARKS: Strengths picked at 10% strain.
*Sample was back-pressure saturated prior to shear.

Sample:	1	2	3	4
MC, %	28.4			
Dry Dens, pcf	74.3			
Sat. %	62.4			
Void Ratio	1.184			
Diameter in	2.87			
Height, in	6.08			
	Final			
MC, %	42.6			
Dry Dens, pcf	77.0			
Sat. %	100.0			
Void Ratio	1.108			
Diameter, in	2.83			
Height, in	6.06			
Cell, psi	91.2			
BP, psi	79.0			
	Effective Stresses At:			
Strain, %	10.0			
Deviator ksf	3.148			
Excess PP	0.000			
Sigma 1	4.905			
Sigma 3	1.757			
P, ksf	3.331			
Q, ksf	1.574			
Stress Ratio	2.792			
Rate in/min	0.0592			
Total C	N/A	ksf		
Total Phi	N/A	Degrees		
Eff. C	N/A	ksf		
Eff. Phi	N/A	Degrees		

Triaxial Unconsolidated-Undrained

(ASTM D2850m)





Sample:	1	2	3	4
MC, %	72.2			
Dry Dens, pcf	39.4			
Sat. %	60.3			
Void Ratio	3.116			
Diameter in	2.87			
Height, in	6.08			
	Final			
MC, %	112.3			
Dry Dens, pcf	41.4			
Sat. %	100.0			
Void Ratio	2.919			
Diameter, in	2.81			
Height, in	6.06			
Cell, psi	95.3			
BP, psi	79.0			
	Effective Stresses At:			
Strain, %	10.0			
Deviator ksf	3.116			
Excess PP	0.000			
Sigma 1	5.463			
Sigma 3	2.347			
P, ksf	3.905			
Q, ksf	1.558			
Stress Ratio	2.327			
Rate in/min	0.0588			
Total C	N/A	ksf		
Total Phi	N/A	Degrees		
Eff. C	N/A	ksf		
Eff. Phi	N/A	Degrees		

Job No.: 020-272 **Date:** 12/19/2018

Client: AECOM BY:MD/DC

Project: 60537920

Sample 1) BC-13_S05 @ 30.5(Tip-11") Pale Brown SILT (slightly plastic) w/ CaCO3 deposits (Weathered Rock)

Sample 2)

Sample 3)

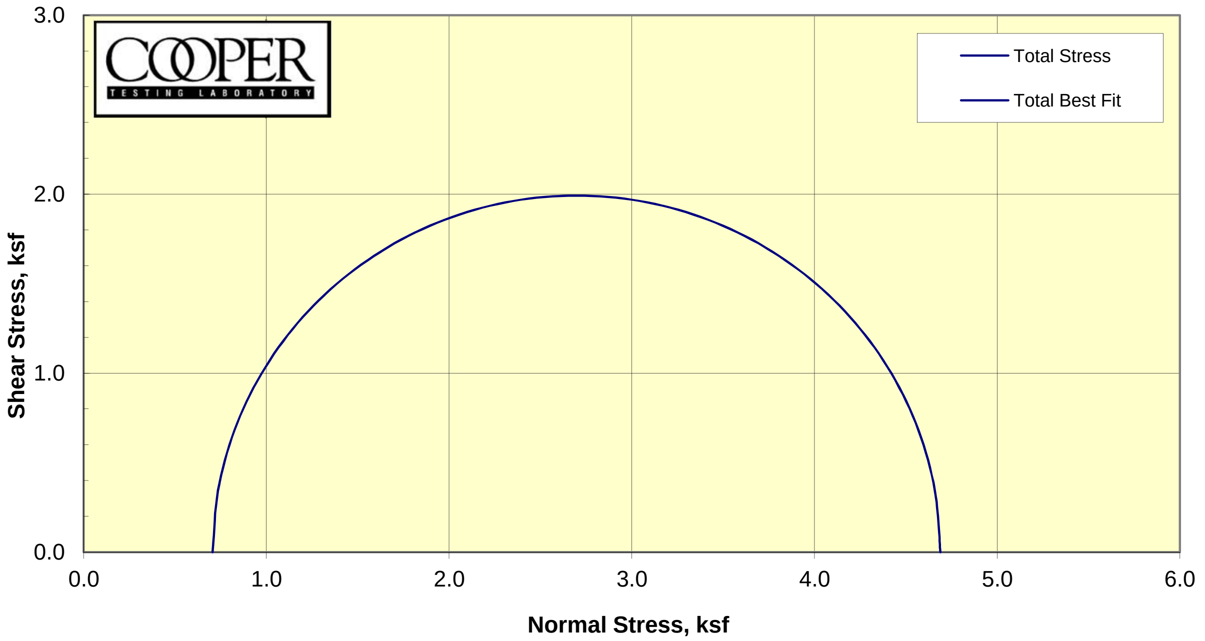
Sample 4)

REMARKS: Strengths picked at 5% strain.

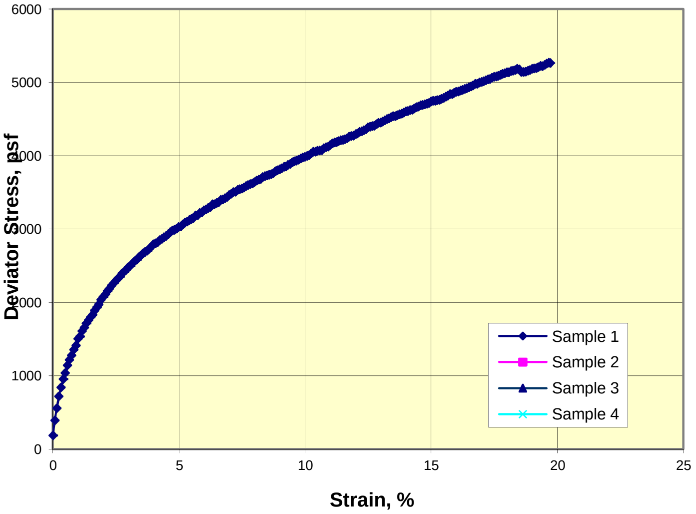
*Sample was back-pressure saturated prior to shear.

Triaxial Unconsolidated-Undrained

(ASTM D2850m)



Stress-Strain Response



Sample:	1	2	3	4
MC, %	45.1			
Dry Dens, pcf	54.7			
Sat. %	59.6			
Void Ratio	1.968			
Diameter in	2.87			
Height, in	6.09			
	Final			
MC, %	72.9			
Dry Dens, pcf	56.0			
Sat. %	100.0			
Void Ratio	1.895			
Diameter, in	2.84			
Height, in	6.09			
Cell, psi	73.9			
BP, psi	69.0			
	Effective Stresses At:			
Strain, %	10.0			
Deviator ksf	3.984			
Excess PP	0.000			
Sigma 1	4.690			
Sigma 3	0.706			
P, ksf	2.698			
Q, ksf	1.992			
Stress Ratio	6.646			
Rate in/min	0.0587			
Total C	N/A	ksf		
Total Phi	N/A	Degrees		
Eff. C	N/A	ksf		
Eff. Phi	N/A	Degrees		

Job No.: 020-272 **Date:** 12/19/2018

Client: AECOM BY:MD/DC

Project: 60537920

Sample 1) BC-14_S03 @ 9(Tip-1") Olive Brown Clayey GRAVEL w/ Sand (Weathered Rock)

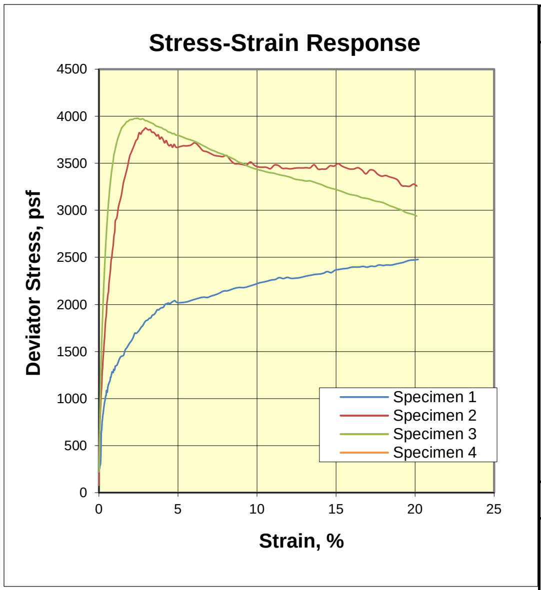
Sample 2)

Sample 3)

Sample 4)

REMARKS: Strengths picked at 10% strain.
*Sample was back-pressure saturated prior to shear.

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

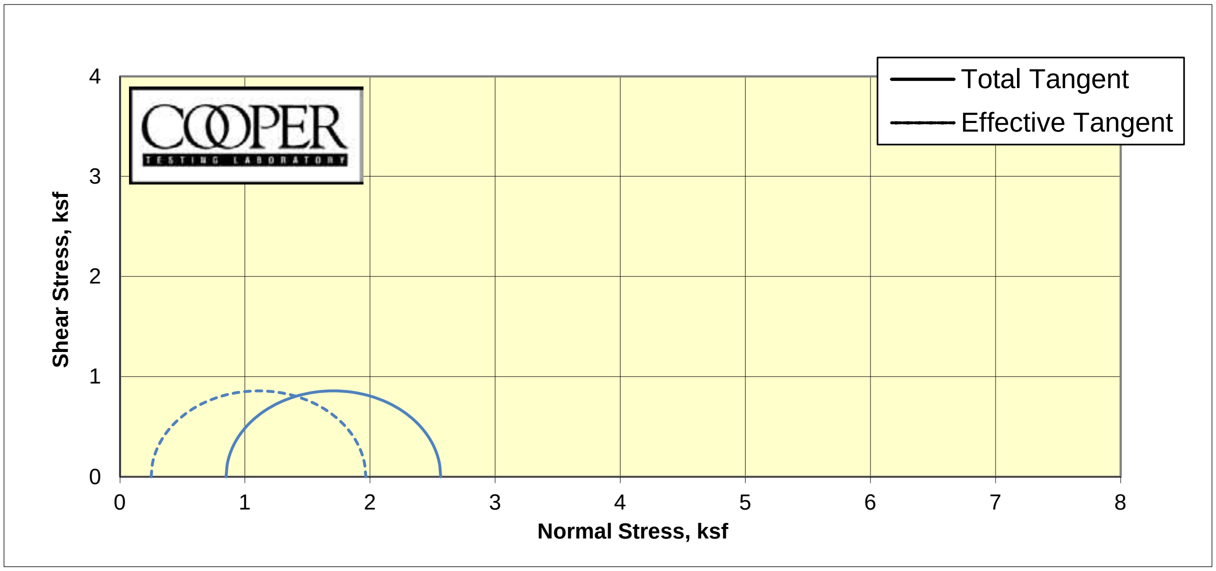


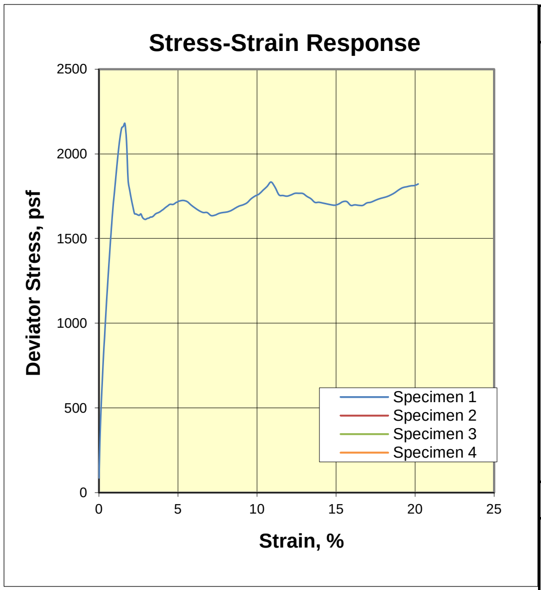
Specimen	**1**	**2**	**3**	**4**
Boring	Outcrop #1	Outcrop #1	Outcrop #1	
Sample				
Depth				
Visual Description	Pale Brown Siltstone (Diatomite)	Pale Brown Siltstone (Diatomite)	Pale Brown Siltstone (Diatomite)	
MC (%)	8.2	7.1	5.9	
Dry Density (pcf)	53.1	56.9	58.0	
Saturation (%)	10.2	9.7	8.4	
Void Ratio	2.176	1.961	1.907	
Diameter (in)	1.86	1.86	1.85	
Height (in)	4.00	4.00	4.00	
	Final			
MC (%)	78.4	73.5	71.9	
Dry Density (pcf)	54.1	56.5	57.3	
Saturation (%)	100.0	100.0	100.0	
Void Ratio	2.116	1.984	1.942	
Diameter (in)	1.85	1.87	1.87	
Height (in)	3.96	3.98	3.98	
Cell Pressure (psi)	124.0	135.0	144.9	
Back Pressure (psi)	119.7	119.8	120.4	
	Effective Stresses At:			
Strain (%)	2.0	2.0	2.0	
Deviator (ksf)	1.596	3.571	3.959	
Excess PP (psi)	3.5	10.2	14.0	
Sigma 1 (ksf)	1.708	4.282	5.488	
Sigma 3 (ksf)	0.111	0.712	1.529	
P (ksf)	0.909	2.497	3.509	
Q (ksf)	0.798	1.785	1.980	
Stress Ratio	15.338	6.018	3.589	
Rate (in/min)	0.0003	0.0003	0.0003	

CTL Number:	020-232		
Client Name:	AECOM		
Project Name:	Klamath		
Project Number:	60537920		
Date:	9/25/2017	By:	MD/DC
Total C	**0.470**	**ksf**	
Total phi	**17.2**	**degrees**	
Eff. C	**0.470**	**ksf**	
Eff. Phi	**28.4**	**degrees**	©

Remarks: The sample was delivered as singular 13" x 16" block. The specimens were trimmed into a brass tube 2" x 4". The orientation of the outcrop block was unknown. All samples were trimmed in the same approximate orientation. The material is highly structured and cemented. It disperses when exposed to water. All three specimens behaved differently during shear.

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767



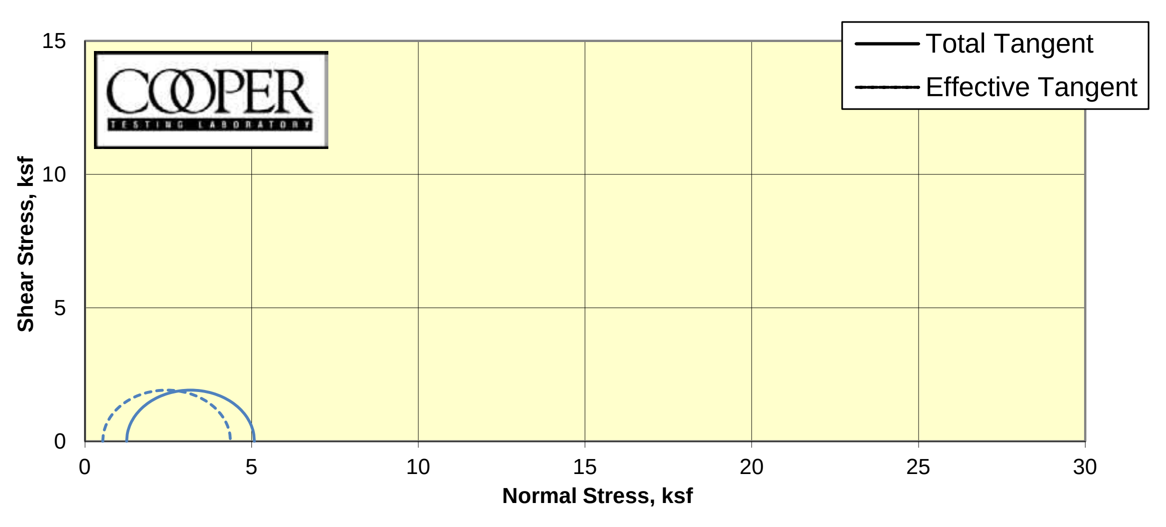


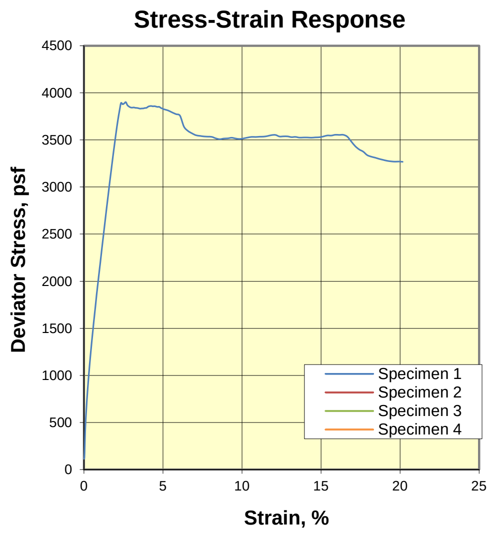
CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/30/2018	By:	MD/DC

Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-02			
Sample	S-06			
Depth	19.5(Tip-2")			
Visual Description	Gray CLAY (Silty)			
MC (%)	147.5			
Dry Density (pcf)	31.6			
Saturation (%)	92.6			
Void Ratio	4.139			
Diameter (in)	2.86			
Height (in)	6.07			
	Final			
MC (%)	147.6			
Dry Density (pcf)	33.6			
Saturation (%)	100.0			
Void Ratio	3.838			
Diameter (in)	2.79			
Height (in)	6.02			
Cell Pressure (psi)	86.4			
Back Pressure (psi)	80.5			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	1.716			
Excess PP (psi)	4.2			
Sigma 1 (ksf)	1.966			
Sigma 3 (ksf)	0.250			
P (ksf)	1.108			
Q (ksf)	0.858			
Stress Ratio	7.869			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767





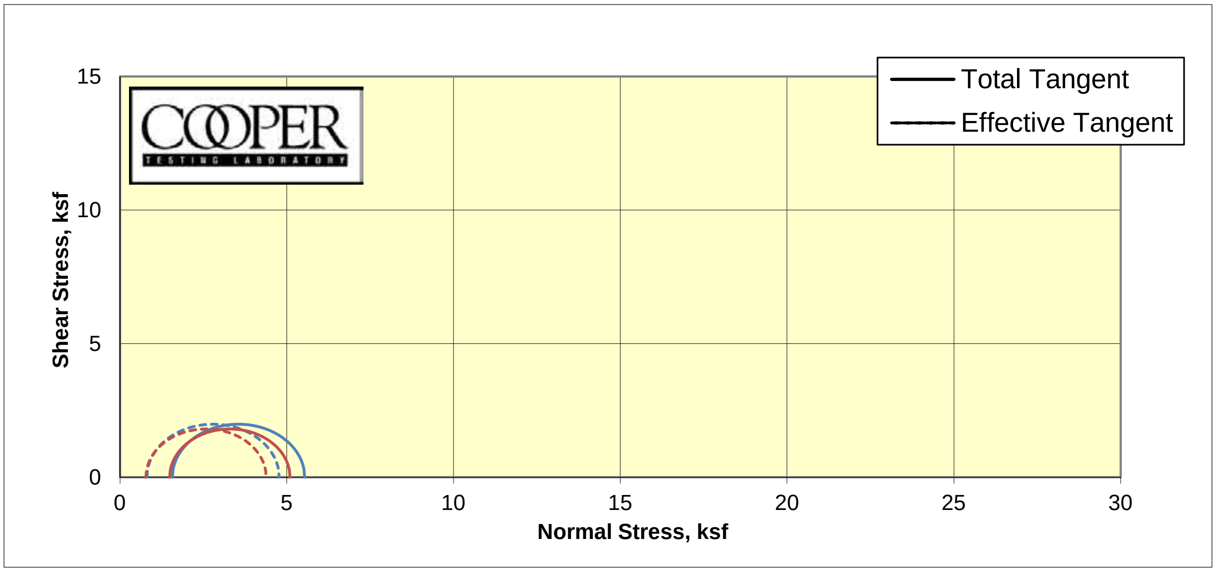
CTL Number:	020-251
Client Name:	AECOM
Project Name:	Klamath River Dam Removal Project
Project Number:	60537920
Date:	5/14/2018 By: MD/DC

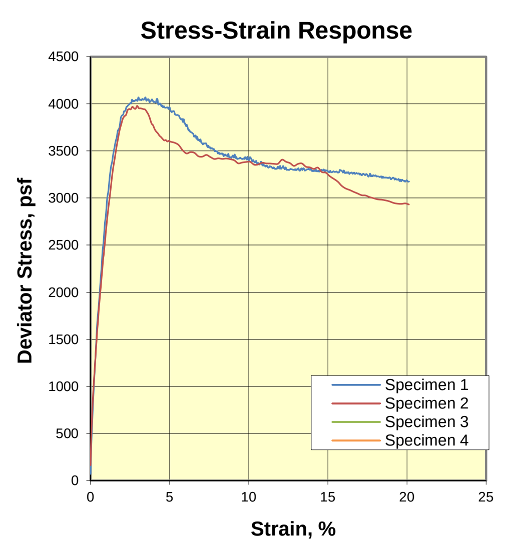
Total C	#DIV/0!	**ksf**
Total phi	#DIV/0!	**degrees**
Eff. C	#DIV/0!	**ksf**
Eff. Phi	#DIV/0!	**degrees**

©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-02			
Sample	S-08			
Depth	34.5(Tip-6")			
Visual Description	Pale Brown CLAY (Silty)			
MC (%)	148.8			
Dry Density (pcf)	32.7			
Saturation (%)	96.6			
Void Ratio	4.158			
Diameter (in)	2.87			
Height (in)	6.07			
	Final			
MC (%)	148.5			
Dry Density (pcf)	33.6			
Saturation (%)	100.0			
Void Ratio	4.010			
Diameter (in)	2.84			
Height (in)	6.02			
Cell Pressure (psi)	88.8			
Back Pressure (psi)	80.1			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	3.832			
Excess PP (psi)	5.0			
Sigma 1 (ksf)	4.368			
Sigma 3 (ksf)	0.536			
P (ksf)	2.452			
Q (ksf)	1.916			
Stress Ratio	8.153			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

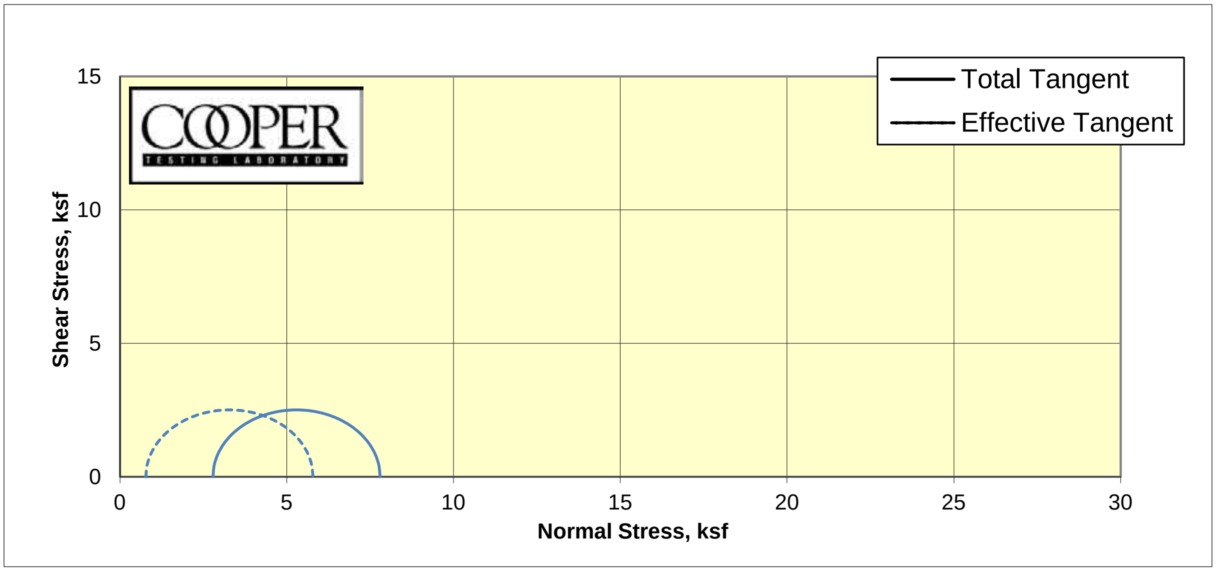


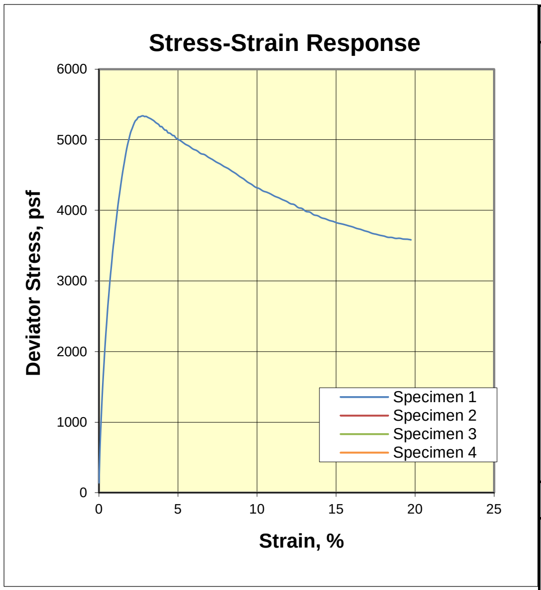


CTL Number:	020-251			
Client Name:	Klamath River Dam Removal Project			
Project Name:	60537920			
Project Number:	43237			
Date:	5/17/2018	By:	MD/DC	
Total C	#DIV/0!	**ksf**		
Total phi	#DIV/0!	**degrees**		
Eff. C	#DIV/0!	**ksf**		
Eff. Phi	#DIV/0!	**degrees**	©	

Specimen	**1**	**2**	**3**	**4**
Boring	BC-03	BC-03		
Sample	S-06	S-06		
Depth	39.5-42(Tip-11")	39.5-42(Tip-4")		
Visual Description	Dark Gray CLAY (Silty)	Dark Gray CLAY		
MC (%)	84.9	90.1		
Dry Density (pcf)	50.2	47.7		
Saturation (%)	99.0	97.6		
Void Ratio	2.230	2.402		
Diameter (in)	2.87	2.87		
Height (in)	6.06	6.08		
	Final			
MC (%)	83.0	87.9		
Dry Density (pcf)	51.4	49.4		
Saturation (%)	100.0	100.0		
Void Ratio	2.158	2.285		
Diameter (in)	2.85	2.83		
Height (in)	6.02	6.04		
Cell Pressure (psi)	90.5	91.6		
Back Pressure (psi)	79.5	81.2		
	Effective Stresses At:			
Strain (%)	5.0	5.0		
Deviator (ksf)	3.966	3.607		
Excess PP (psi)	5.3	5.0		
Sigma 1 (ksf)	4.775	4.386		
Sigma 3 (ksf)	0.809	0.779		
P (ksf)	2.792	2.582		
Q (ksf)	1.983	1.804		
Stress Ratio	5.901	5.632		
Rate (in/min)	0.0005	0.0005		

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767





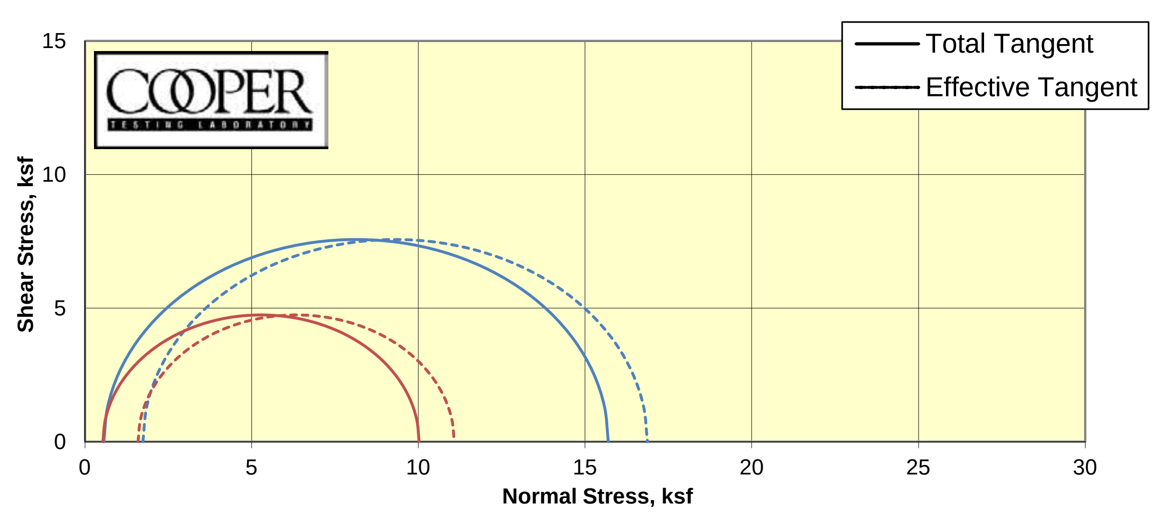
CTL Number:	020-251
Client Name:	AECOM
Project Name:	Klamath River Dam Removal Project
Project Number:	60537920
Date:	5/21/2018 By: MD/DC

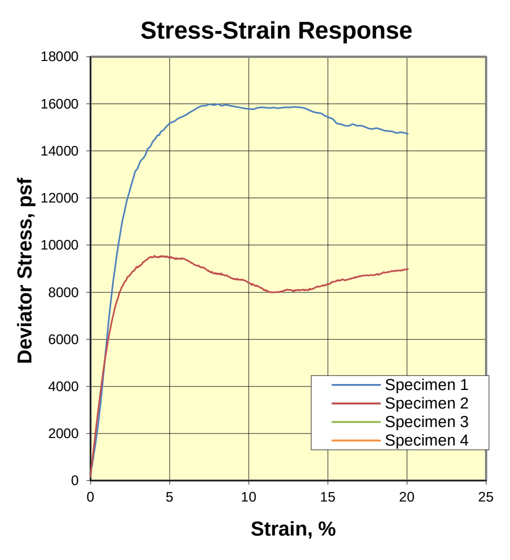
Total C	#DIV/0!	ksf
Total phi	#DIV/0!	degrees
Eff. C	#DIV/0!	ksf
Eff. Phi	#DIV/0!	degrees

©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-03			
Sample	S-10			
Depth	90(Tip-13")			
Visual Description	Dark Gray CLAY			
MC (%)	119.8			
Dry Density (pcf)	35.8			
Saturation (%)	88.1			
Void Ratio	3.533			
Diameter (in)	2.87			
Height (in)	6.08			
	Final			
MC (%)	116.3			
Dry Density (pcf)	40.3			
Saturation (%)	100.0			
Void Ratio	3.023			
Diameter (in)	2.69			
Height (in)	6.16			
Cell Pressure (psi)	99.9			
Back Pressure (psi)	80.5			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	5.012			
Excess PP (psi)	14.0			
Sigma 1 (ksf)	5.788			
Sigma 3 (ksf)	0.777			
P (ksf)	3.283			
Q (ksf)	2.506			
Stress Ratio	7.452			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

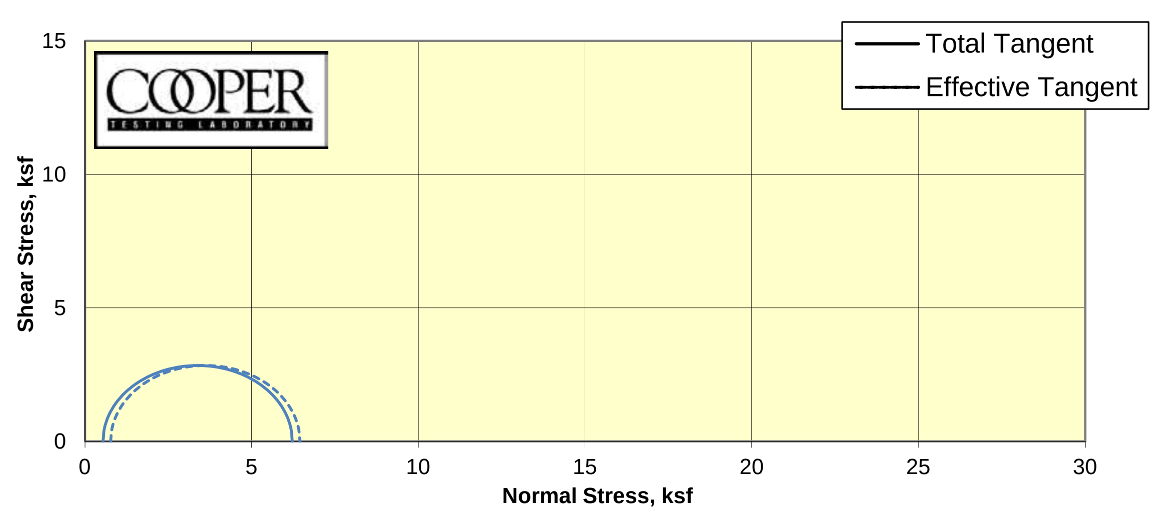


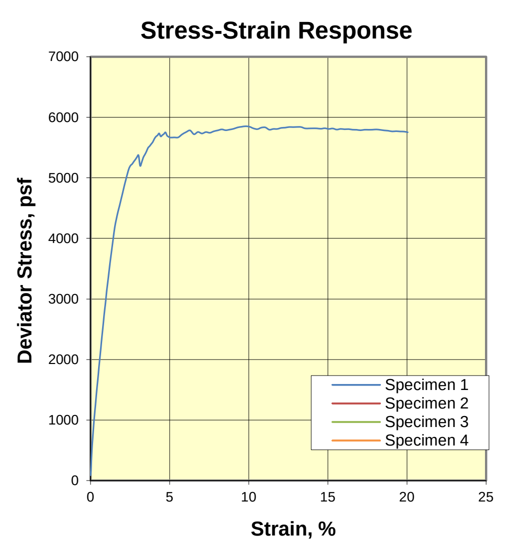


CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	6/6/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-04	BC-04		
Sample	S-04	S-04		
Depth	12.5-14(Tip-15")	12.5-14.5(Tip-4")		
Visual Description	Brown Weathered Rock	Dark Brown Clayey GRAVEL (Weathered Rock)		
MC (%)	60.8	53.9		
Dry Density (pcf)	59.2	65.0		
Saturation (%)	90.8	93.7		
Void Ratio	1.740	1.497		
Diameter (in)	2.87	2.86		
Height (in)	6.06	6.06		
	Final			
MC (%)	61.4	54.7		
Dry Density (pcf)	62.5	67.0		
Saturation (%)	100.0	100.0		
Void Ratio	1.597	1.422		
Diameter (in)	2.80	2.82		
Height (in)	6.04	6.04		
Cell Pressure (psi)	83.2	82.9		
Back Pressure (psi)	79.2	79.1		
	Effective Stresses At:			
Strain (%)	5.0	5.0		
Deviator (ksf)	15.130	9.485		
Excess PP (psi)	-8.1	-7.3		
Sigma 1 (ksf)	16.872	11.080		
Sigma 3 (ksf)	1.741	1.594		
P (ksf)	9.306	6.337		
Q (ksf)	7.565	4.743		
Stress Ratio	9.688	6.949		
Rate (in/min)	0.0005	0.0005		

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

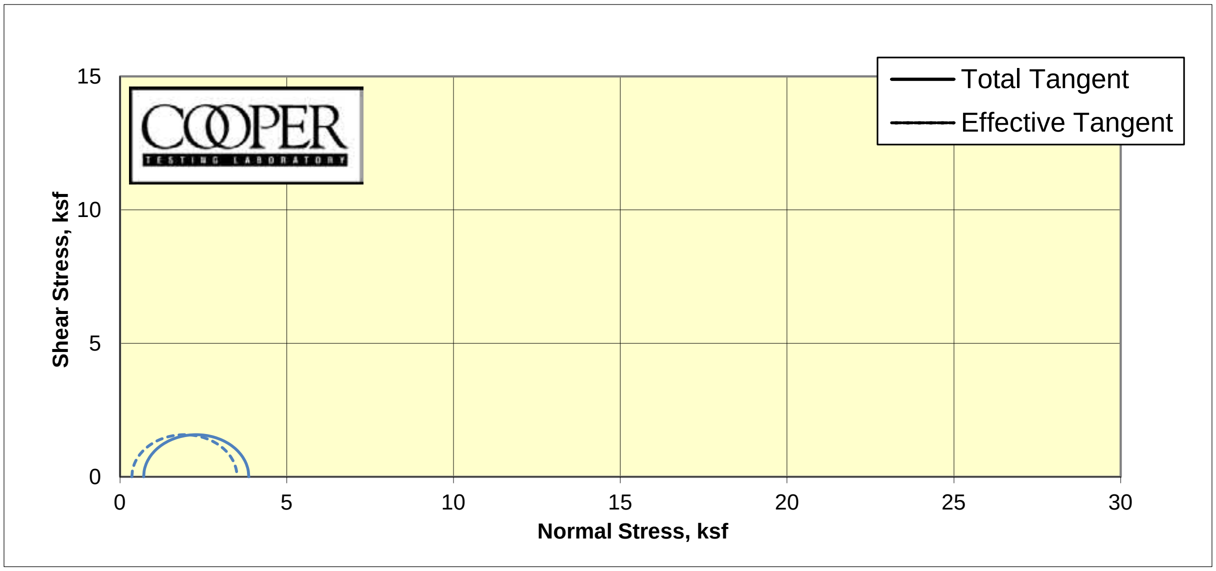


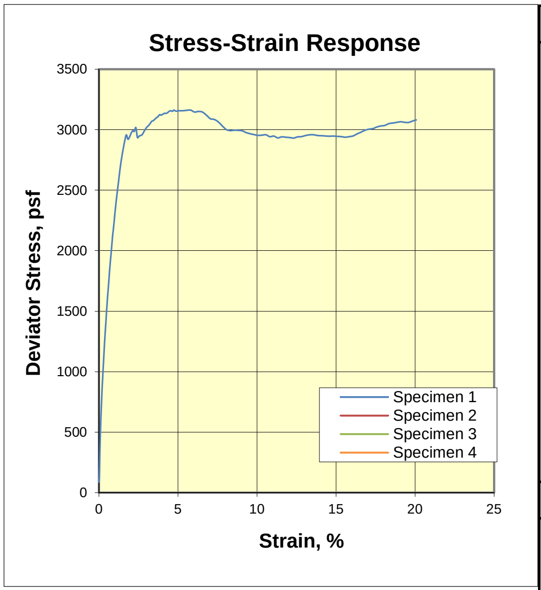


CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/14/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-04			
Sample	S-5			
Depth	17.5(Tip-6")			
Visual Description	Light Gray CLAY			
MC (%)	104.7			
Dry Density (pcf)	42.1			
Saturation (%)	94.2			
Void Ratio	3.000			
Diameter (in)	2.87			
Height (in)	6.08			
	Final			
MC (%)	105.4			
Dry Density (pcf)	43.8			
Saturation (%)	100.0			
Void Ratio	2.846			
Diameter (in)	2.82			
Height (in)	6.07			
Cell Pressure (psi)	84.0			
Back Pressure (psi)	80.2			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	5.677			
Excess PP (psi)	-1.6			
Sigma 1 (ksf)	6.450			
Sigma 3 (ksf)	0.774			
P (ksf)	3.612			
Q (ksf)	2.838			
Stress Ratio	8.336			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

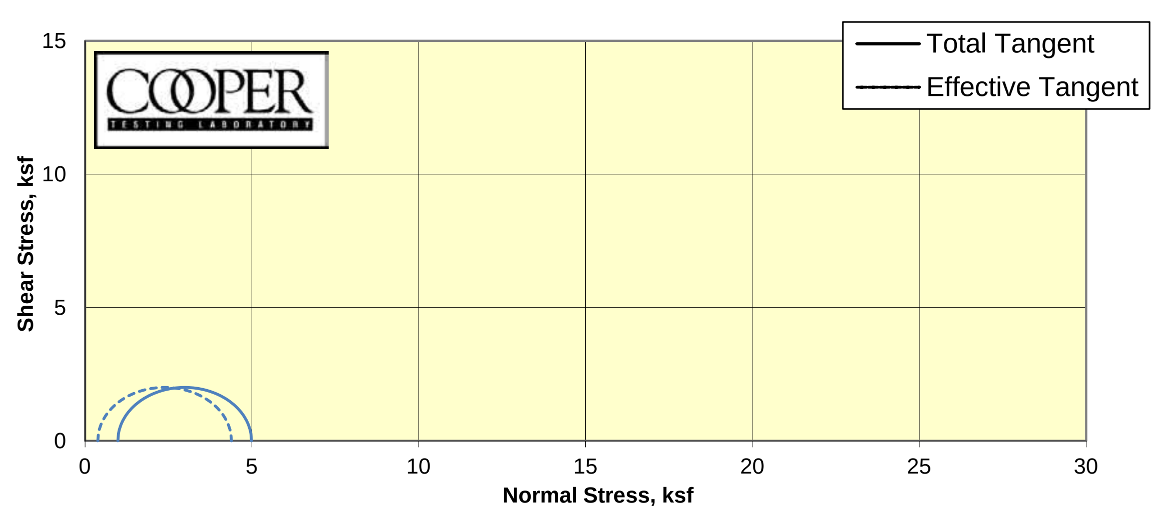


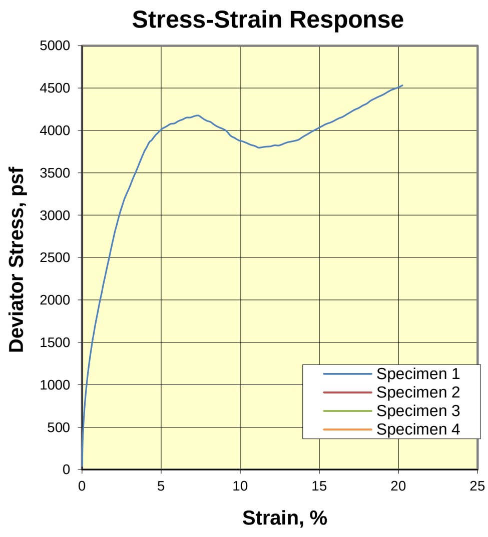


CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/30/2018	By:	MD/DC
Total C	**#DIV/0!**	**ksf**	
Total phi	**#DIV/0!**	**degrees**	
Eff. C	**#DIV/0!**	**ksf**	
Eff. Phi	**#DIV/0!**	**degrees**	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-04			
Sample	S-06			
Depth	22.5(Tip-2")			
Visual Description	Greenish Gray CLAY (Silty)/ SILT (slightly plastic)			
MC (%)	154.6			
Dry Density (pcf)	31.7			
Saturation (%)	97.4			
Void Ratio	4.127			
Diameter (in)	2.87			
Height (in)	6.07			
	Final			
MC (%)	152.8			
Dry Density (pcf)	32.6			
Saturation (%)	100.0			
Void Ratio	3.974			
Diameter (in)	2.83			
Height (in)	6.05			
Cell Pressure (psi)	85.0			
Back Pressure (psi)	80.1			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	3.153			
Excess PP (psi)	2.5			
Sigma 1 (ksf)	3.511			
Sigma 3 (ksf)	0.358			
P (ksf)	1.935			
Q (ksf)	1.576			
Stress Ratio	9.796			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767





CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/17/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-04			
Sample	S-08			
Depth	32.5(Tip-10")			
Visual Description	Pale Brown Mottled Gray Elastic SILT			
MC (%)	117.2			
Dry Density (pcf)	36.9			
Saturation (%)	89.7			
Void Ratio	3.397			
Diameter (in)	2.87			
Height (in)	6.08			
	Final			
MC (%)	115.5			
Dry Density (pcf)	40.5			
Saturation (%)	100.0			
Void Ratio	3.004			
Diameter (in)	2.76			
Height (in)	6.01			
Cell Pressure (psi)	86.8			
Back Pressure (psi)	80.0			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	4.005			
Excess PP (psi)	4.2			
Sigma 1 (ksf)	4.390			
Sigma 3 (ksf)	0.385			
P (ksf)	2.388			
Q (ksf)	2.003			
Stress Ratio	11.403			
Rate (in/min)	0.0005			

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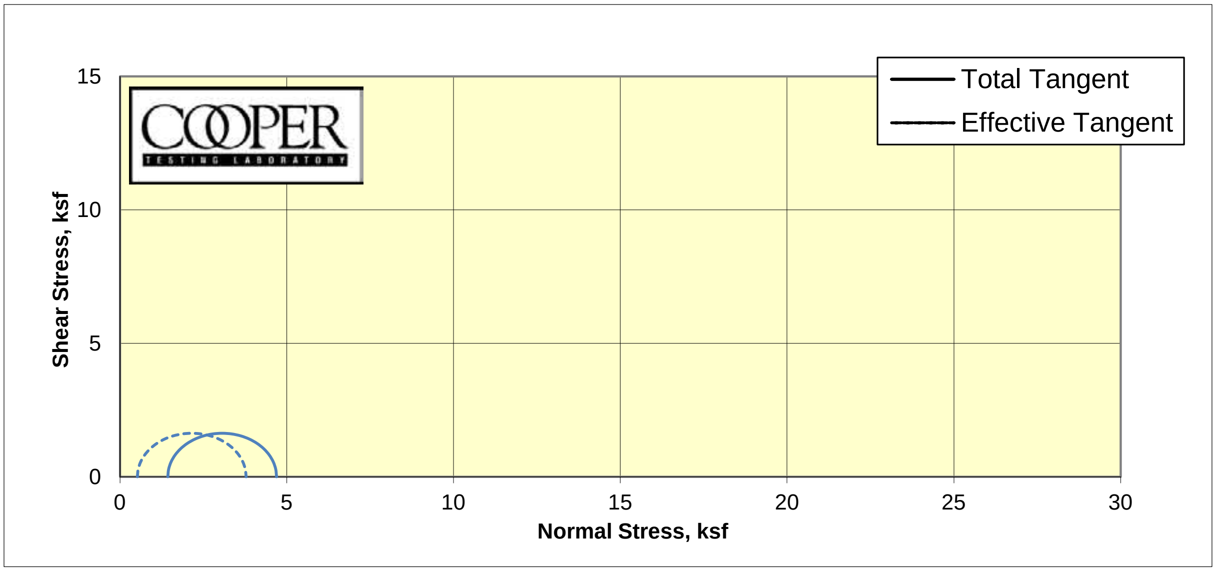

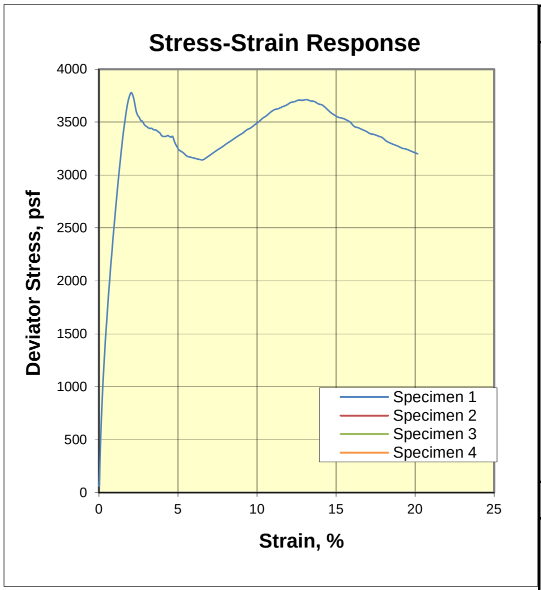

CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/25/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	1	2	3	4
Boring	BC-04			
Sample	S-10			
Depth	52.5(Tip-4")			
Visual Description	Bluish Gray CLAY (Silty)/ SILT (slightly plastic)			
MC (%)	153.6			
Dry Density (pcf)	32.1			
Saturation (%)	97.9			
Void Ratio	4.156			
Diameter (in)	2.87			
Height (in)	6.08			
	Final			
MC (%)	151.2			
Dry Density (pcf)	33.0			
Saturation (%)	100.0			
Void Ratio	4.007			
Diameter (in)	2.84			
Height (in)	6.03			
Cell Pressure (psi)	90.6			
Back Pressure (psi)	80.6			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	3.260			
Excess PP (psi)	6.3			
Sigma 1 (ksf)	3.784			
Sigma 3 (ksf)	0.523			
P (ksf)	2.154			
Q (ksf)	1.630			
Stress Ratio	7.229			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
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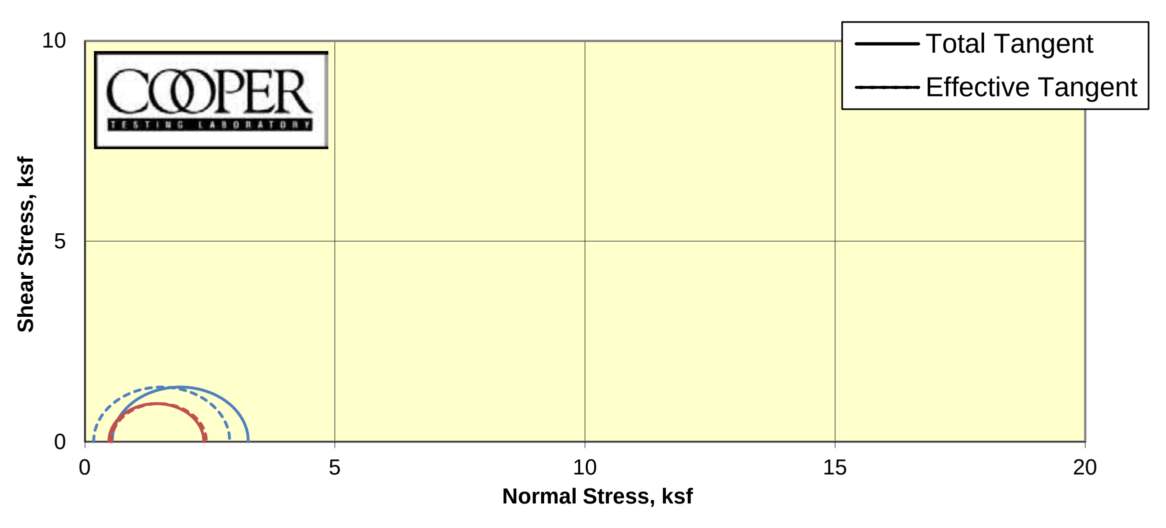
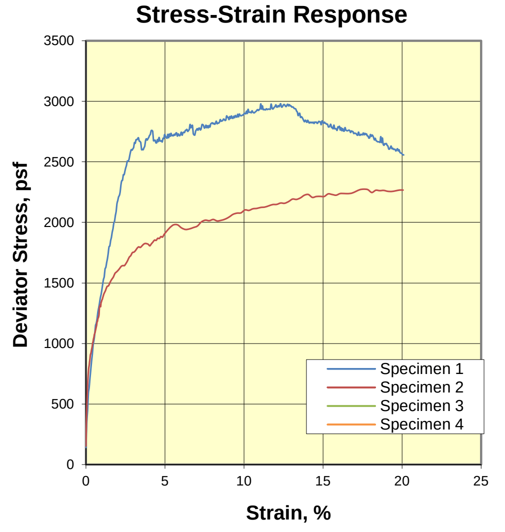


Stress-Strain Response



CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/24/2018	By:	MD/DC
Total C	**#DIV/0!**	**ksf**	
Total phi	**#DIV/0!**	**degrees**	
Eff. C	**#DIV/0!**	**ksf**	
Eff. Phi	**#DIV/0!**	**degrees**	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-05	BC-05		
Sample	S-04	S-04		
Depth	14.5(Tip-16")	14.5(Tip-1")		
Visual Description	Olive CLAY (Silty)/SILT (slightly plastic)	Olive Mottled Yellow Clayey SAND/ Sandy CLAY		
MC (%)	135.1	30.0		
Dry Density (pcf)	35.4	92.8		
Saturation (%)	97.0	99.2		
Void Ratio	3.760	0.816		
Diameter (in)	2.87	2.87		
Height (in)	5.83	6.09		
	Final			
MC (%)	135.4	29.8		
Dry Density (pcf)	36.2	93.4		
Saturation (%)	100.0	100.0		
Void Ratio	3.656	0.805		
Diameter (in)	2.85	2.87		
Height (in)	5.80	6.07		
Cell Pressure (psi)	84.2	84.1		
Back Pressure (psi)	80.4	80.8		
	Effective Stresses At:			
Strain (%)	5.0	5.0		
Deviator (ksf)	2.725	1.900		
Excess PP (psi)	2.6	-0.4		
Sigma 1 (ksf)	2.899	2.431		
Sigma 3 (ksf)	0.173	0.531		
P (ksf)	1.536	1.481		
Q (ksf)	1.363	0.950		
Stress Ratio	16.726	4.577		
Rate (in/min)	0.0005	0.0005		

Consolidated Undrained Triaxial Compression with Pore Pressure
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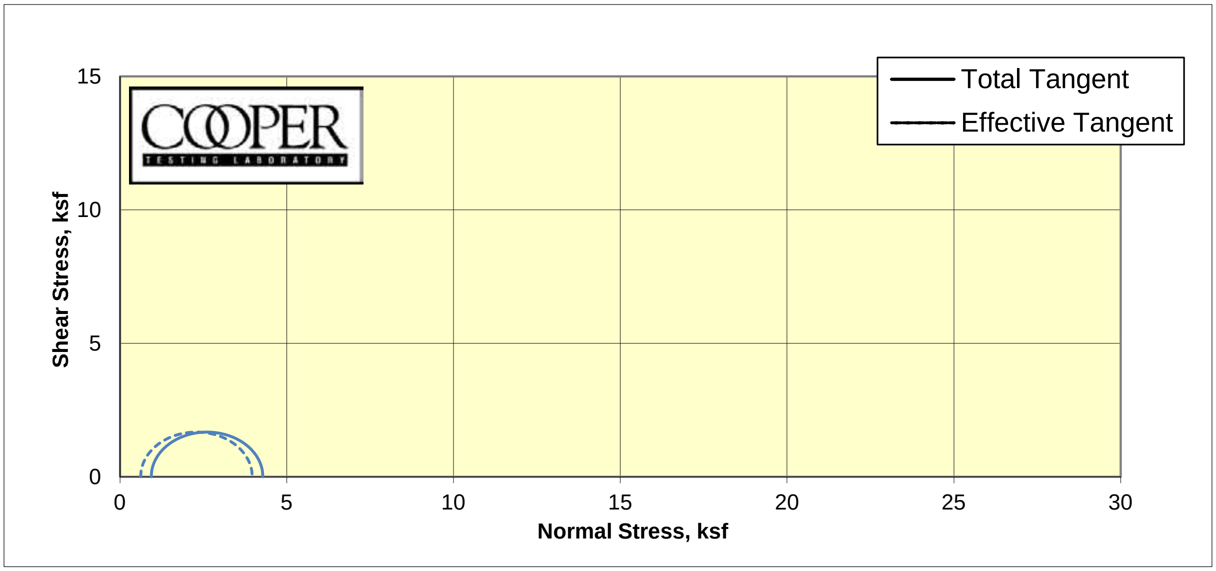
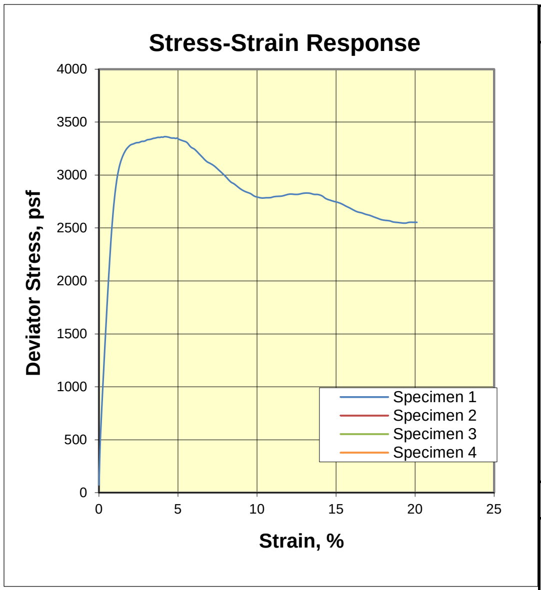
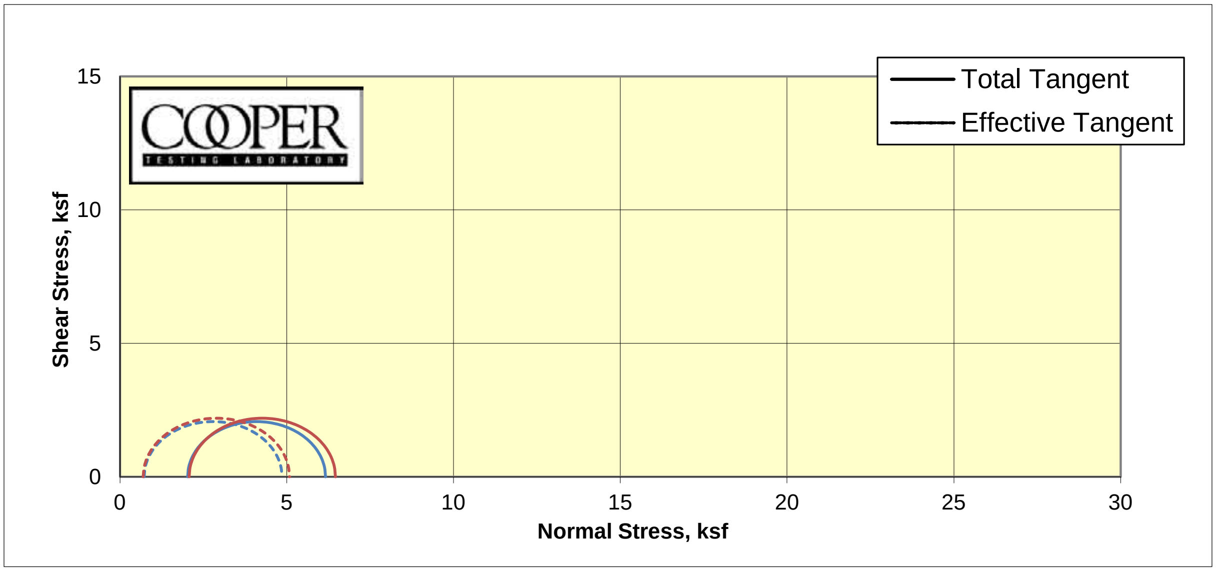


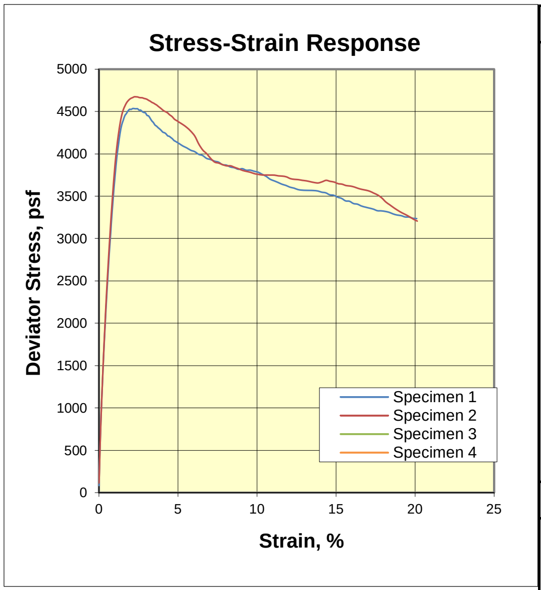

Stress-Strain Response

CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/30/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-09			
Sample	S-05			
Depth	23(Tip-5")			
Visual Description	Dark Gray Elastic SILT			
MC (%)	79.5			
Dry Density (pcf)	51.9			
Saturation (%)	97.1			
Void Ratio	2.130			
Diameter (in)	2.87			
Height (in)	6.07			
	Final			
MC (%)	79.4			
Dry Density (pcf)	53.0			
Saturation (%)	100.0			
Void Ratio	2.065			
Diameter (in)	2.85			
Height (in)	6.04			
Cell Pressure (psi)	86.8			
Back Pressure (psi)	80.3			
	Effective Stresses At:			
Strain (%)	5.0			
Deviator (ksf)	3.348			
Excess PP (psi)	2.2			
Sigma 1 (ksf)	3.969			
Sigma 3 (ksf)	0.621			
P (ksf)	2.295			
Q (ksf)	1.674			
Stress Ratio	6.396			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

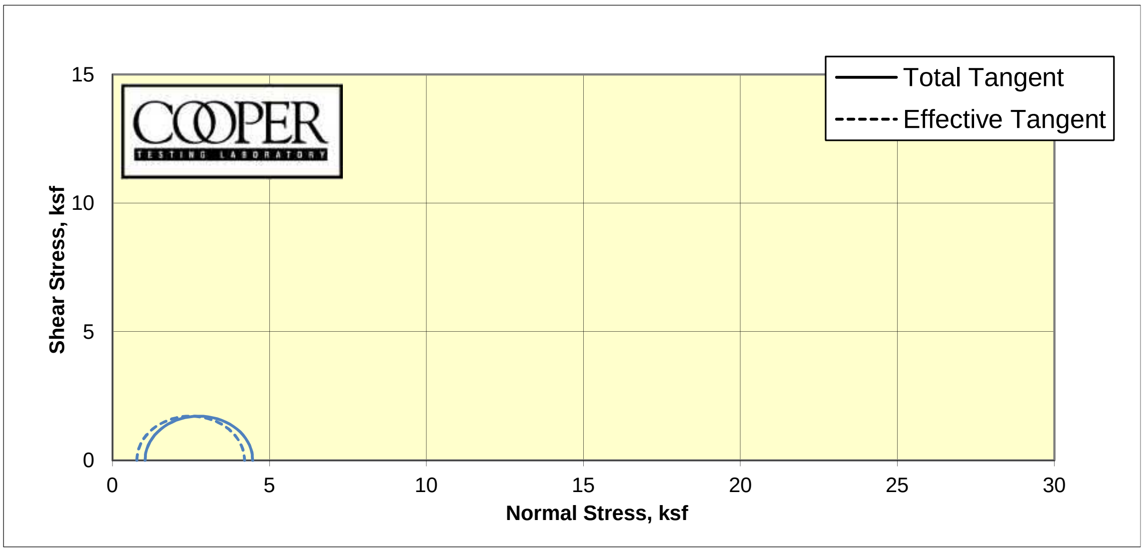


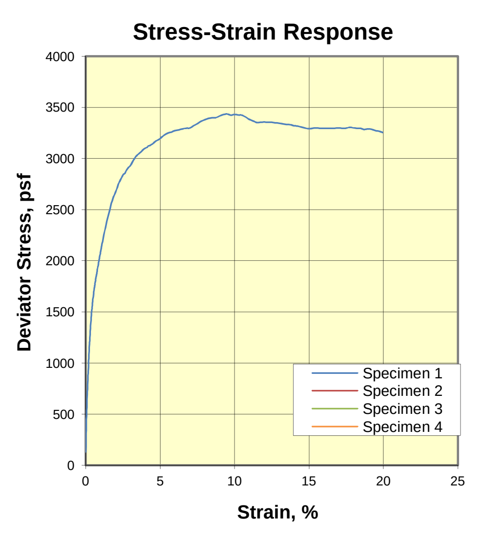


CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	6/6/2018	By:	MD/DC
Total C	#DIV/0!	**ksf**	
Total phi	#DIV/0!	**degrees**	
Eff. C	#DIV/0!	**ksf**	
Eff. Phi	#DIV/0!	**degrees**	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-09	BC-09		
Sample	S-09	S-09		
Depth	68-70.5(Tip-10")	68-70.5(Tip-4")		
Visual Description	Dark Greenish Gray CLAY (Silty)/ SILT (slightly plastic)	Dark Greenish Gray CLAY (Silty)/ SILT (slightly plastic)		
MC (%)	92.0	95.5		
Dry Density (pcf)	47.2	46.1		
Saturation (%)	98.2	98.5		
Void Ratio	2.436	2.520		
Diameter (in)	2.87	2.87		
Height (in)	6.06	6.06		
	Final			
MC (%)	90.6	93.7		
Dry Density (pcf)	48.4	47.2		
Saturation (%)	100.0	100.0		
Void Ratio	2.355	2.436		
Diameter (in)	2.84	2.85		
Height (in)	6.03	6.02		
Cell Pressure (psi)	94.2	94.1		
Back Pressure (psi)	80.1	79.7		
	Effective Stresses At:			
Strain (%)	5.0	5.0		
Deviator (ksf)	4.134	4.387		
Excess PP (psi)	9.1	9.6		
Sigma 1 (ksf)	4.860	5.084		
Sigma 3 (ksf)	0.726	0.697		
P (ksf)	2.793	2.891		
Q (ksf)	2.067	2.194		
Stress Ratio	6.693	7.293		
Rate (in/min)	0.0005	0.0005		

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

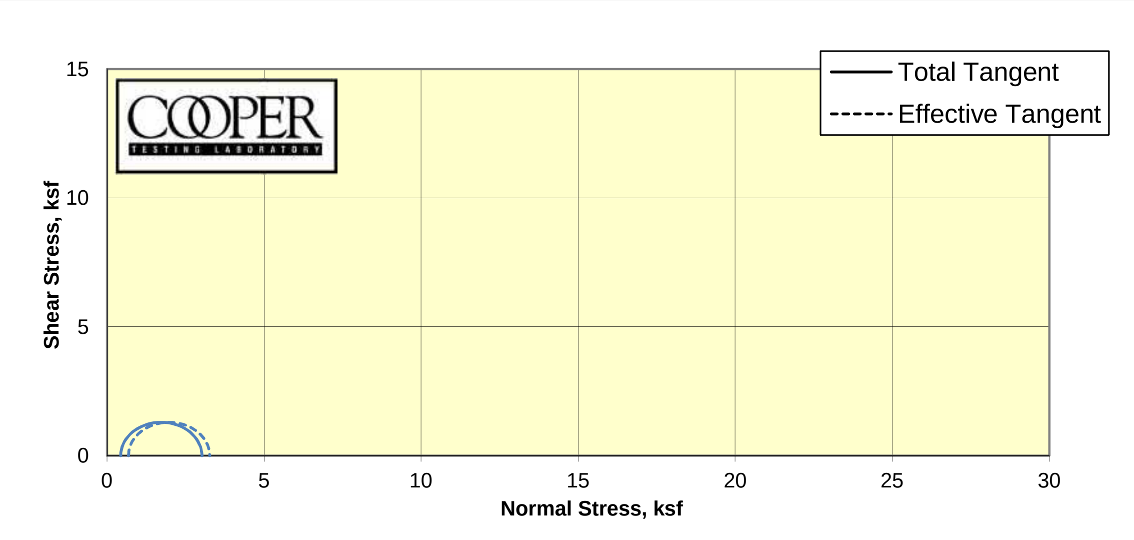


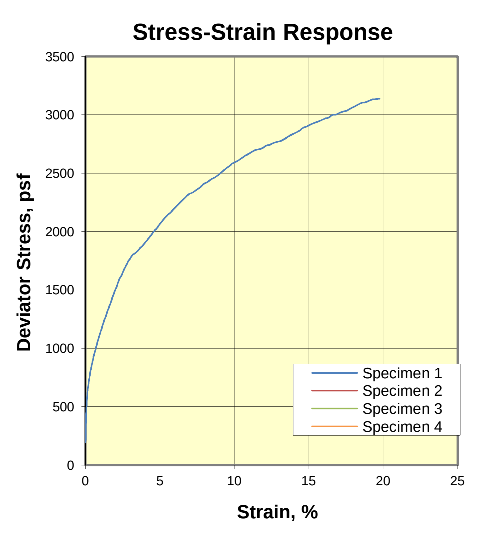


CTL Number:	020-272		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	1/2/2019	By:	MD/DC
Total C	**#DIV/0!**	**ksf**	
Total phi	**#DIV/0!**	**degrees**	
Eff. C	**#DIV/0!**	**ksf**	
Eff. Phi	**#DIV/0!**	**degrees**	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-13			
Sample	S02			
Depth	12(Tip-0.5')			
Visual Description	Pale Brown SILT (slightly plastic) (Weathered Rock)			
MC (%)	23.3			
Dry Density (pcf)	59.6			
Saturation (%)	35.1			
Void Ratio	1.725			
Diameter (in)	2.87			
Height (in)	6.09			
	Final			
MC (%)	63.5			
Dry Density (pcf)	61.2			
Saturation (%)	100.0			
Void Ratio	1.651			
Diameter (in)	2.83			
Height (in)	6.11			
Cell Pressure (psi)	136.9			
Back Pressure (psi)	129.7			
	Effective Stresses At:			
Strain (%)	10.0			
Deviator (ksf)	3.431			
Excess PP (psi)	1.8			
Sigma 1 (ksf)	4.206			
Sigma 3 (ksf)	0.775			
P (ksf)	2.491			
Q (ksf)	1.716			
Stress Ratio	5.425			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

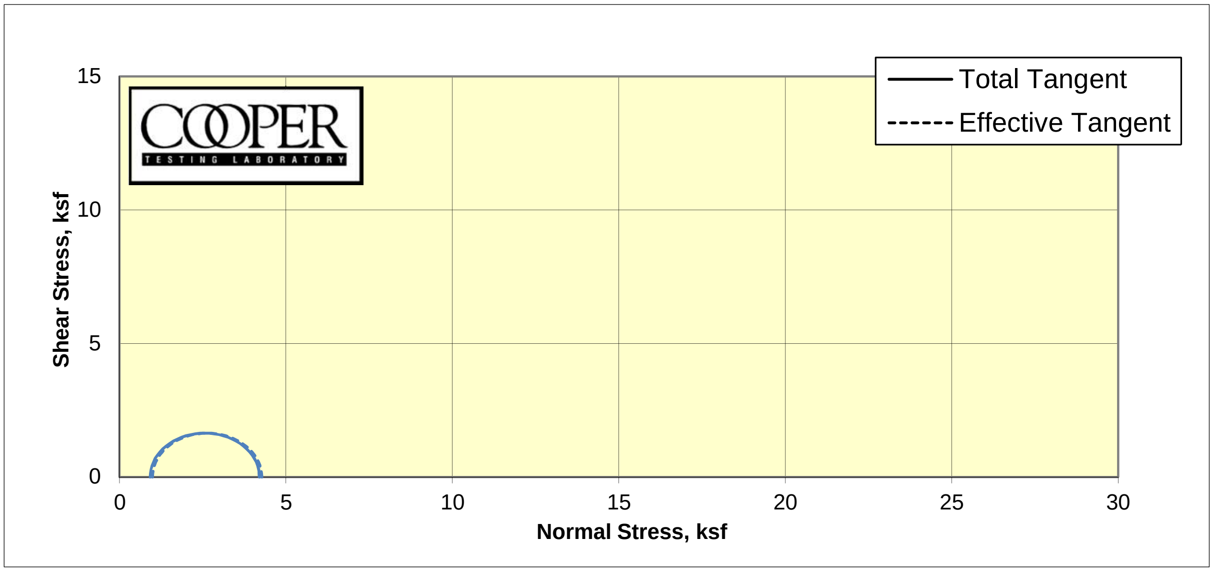


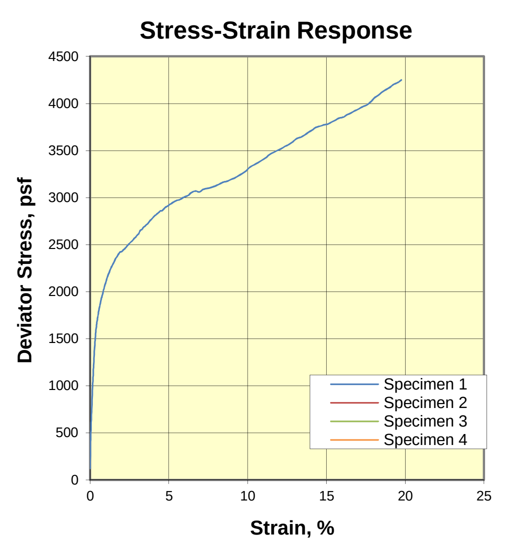


CTL Number:	020-272		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	1/3/2019	By:	MD/DC
Total C	**#DIV/0!**	**ksf**	
Total phi	**#DIV/0!**	**degrees**	
Eff. C	**#DIV/0!**	**ksf**	
Eff. Phi	**#DIV/0!**	**degrees**	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-14			
Sample	S01			
Depth	5(Tip-1")			
Visual Description	Pale Brown SILT w/ Gravel (Weathered Rock)			
MC (%)	23.3			
Dry Density (pcf)	59.7			
Saturation (%)	34.5			
Void Ratio	1.823			
Diameter (in)	2.87			
Height (in)	6.09			
	Final			
MC (%)	66.8			
Dry Density (pcf)	60.1			
Saturation (%)	100.0			
Void Ratio	1.804			
Diameter (in)	2.84			
Height (in)	6.16			
Cell Pressure (psi)	132.4			
Back Pressure (psi)	129.4			
	Effective Stresses At:			
Strain (%)	10.0			
Deviator (ksf)	2.587			
Excess PP (psi)	-1.7			
Sigma 1 (ksf)	3.269			
Sigma 3 (ksf)	0.682			
P (ksf)	1.976			
Q (ksf)	1.293			
Stress Ratio	4.791			
Rate (in/min)	0.0005			

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767





CTL Number:	020-272		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	1/3/2019	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

Specimen	**1**	**2**	**3**	**4**
Boring	BC-14			
Sample	S04			
Depth	12(Tip-1")			
Visual Description	Olive Brown Sandy SILT w/ Gravel (Weathered Rock)			
MC (%)	24.2			
Dry Density (pcf)	63.5			
Saturation (%)	39.5			
Void Ratio	1.653			
Diameter (in)	2.86			
Height (in)	6.09			
	Final			
MC (%)	61.1			
Dry Density (pcf)	63.6			
Saturation (%)	100.0			
Void Ratio	1.649			
Diameter (in)	2.84			
Height (in)	6.17			
Cell Pressure (psi)	136.6			
Back Pressure (psi)	130.2			
	Effective Stresses At:			
Strain (%)	10.0			
Deviator (ksf)	3.284			
Excess PP (psi)	-0.5			
Sigma 1 (ksf)	4.272			
Sigma 3 (ksf)	0.989			
P (ksf)	2.630			
Q (ksf)	1.642			
Stress Ratio	4.322			
Rate (in/min)	0.0005			

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Photo 31: 202-251 BC-02 S08 @ 34.5' (tip-6'') After TXCUPP #2.JPG
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Photo 62: 202-251 BC-05 S04 @ 14.5' (tip-1'') After TXCUPP #1.JPG
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Photo 65: 202-251 BC-05 S04 @ 14.5' (tip-16'') After TXCUPP #1.JPG
Photo 66: 202-251 BC-05 S04 @ 14.5' (tip-16'') After TXCUPP #2.JPG
Photo 67: 202-251 BC-05 S04 @ 14.5' (tip-16'') Before TXCUPP.JPG
Photo 68: 202-251 BC-09 S05 @ 23' (tip-5'') After TXCUPP #1.JPG
Photo 69: 202-251 BC-09 S05 @ 23' (tip-5'') After TXCUPP #2.JPG
Photo 70: 202-251 BC-09 S05 @ 23' (tip-5'') Before TXCUPP.JPG
Photo 71: 202-251 BC-09 S05 @ 23' (tip-13'') After TXCUPP #1.JPG
Photo 72: 202-251 BC-09 S05 @ 23' (tip-13'') After TXCUPP #2.JPG
Photo 73: 202-251 BC-09 S05 @ 23' (tip-13'') Before TXCUPP.JPG
Photo 74: 202-251 BC-09 S09 @ 68' (tip-4'') After TXCUPP #1.JPG
Photo 75: 202-251 BC-09 S09 @ 68' (tip-4'') After TXCUPP #2.JPG
Photo 76: 202-251 BC-09 S09 @ 68' (tip-4'') Before TXCUPP.JPG
Photo 77: 202-251 BC-09 S09 @ 68' (tip-10'') After TXCUPP #1.JPG
Photo 78: 202-251 BC-09 S09 @ 68' (tip-10'') After TXCUPP #2.JPG
Photo 79: 202-251 BC-09 S09 @ 68' (tip-10'') Before TXCUPP.JPG

Photo 1: 020-272 BC-13 S01 @ 7' (Tip-4'') After TXUU.JPG

Photo 2: 020-272 BC-13 S01 @ 7' (Tip-4'') Before TXUU.JPG

Photo 3: 020-272 BC-13 S02 @ 12' (Tip-0.5'') After TXCUPP #1.JPG

Photo 4: 020-272 BC-13 S02 @ 12' (Tip-0.5'') After TXCUPP #2.JPG

Photo 5: 020-272 BC-13 S02 @ 12' (Tip-0.5'') Before TXCUPP.JPG

Photo 6: 020-272 BC-13 S04 @ 22' (Tip-12'') After TXUU.JPG

Photo 7: 020-272 BC-13 S04 @ 22' (Tip-12'') Before TXUU.JPG

Photo 8: 020-272 BC-13 S04 @ 22' (Tip-18.5'') After TXUU.JPG

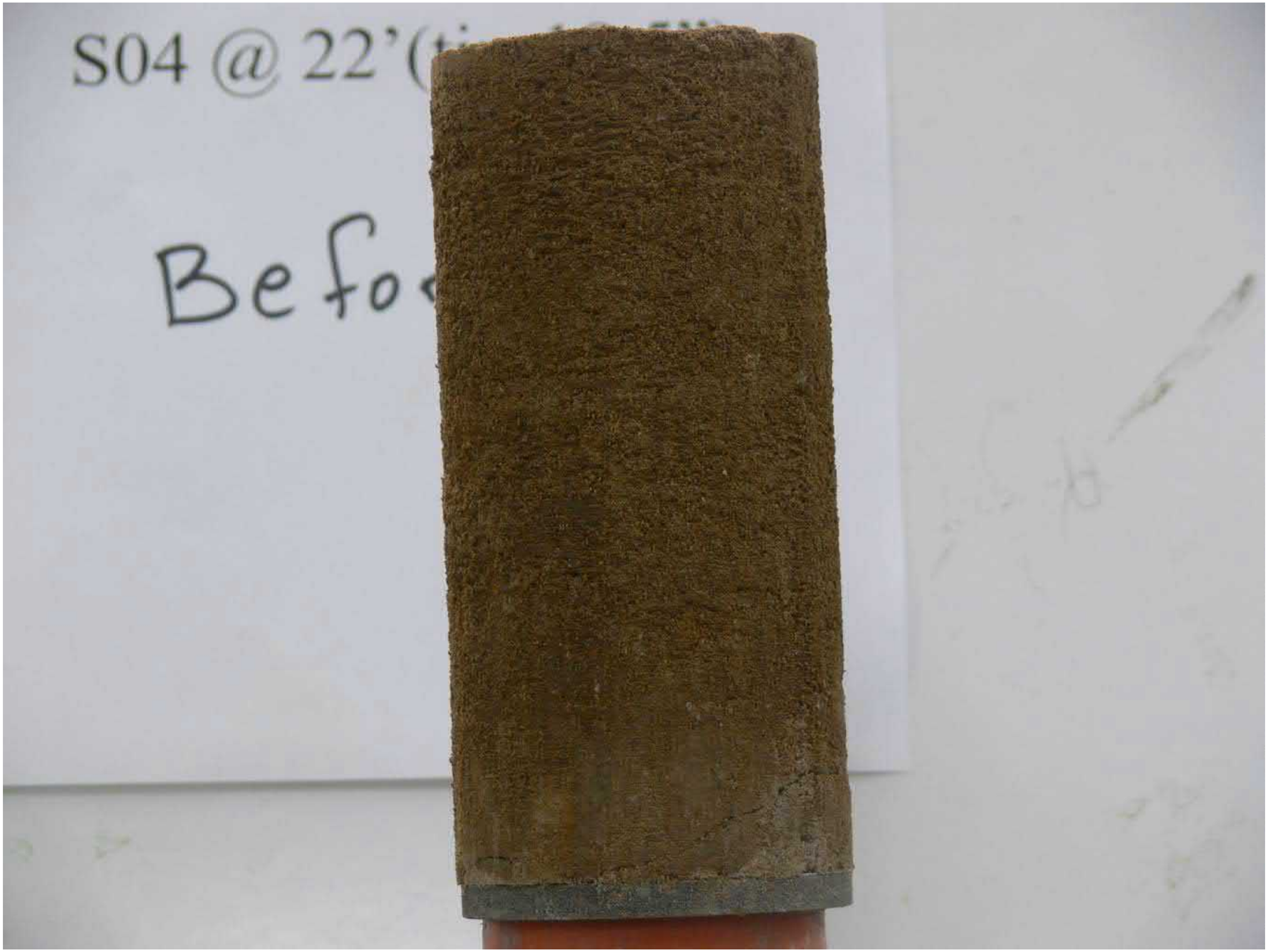


Photo 9: 020-272 BC-13 S04 @ 22' (Tip-18.5'') Before TXUU.JPG

Photo 10: 020-272 BC-13 S05 @ 30.5' (Tip-0.5'') Before TXCUPP.JPG

Photo 11: 020-272 BC-13 S05 @ 30.5' (Tip-11'') After TXUU #1.JPG

Photo 12: 020-272 BC-13 S05 @ 30.5' (Tip-11'') After TXUU #2.JPG

Photo 13: 020-272 BC-13 S05 @ 30.5' (Tip-11'') Before TXUU.JPG

Photo 14: 020-272 BC-14 S01 @ 5' (Tip-1'') After TXCUPP #1.JPG

Photo 15: 020-272 BC-14 S01 @ 5' (Tip-1'') After TXCUPP #2.JPG

Photo 16: 020-272 BC-14 S01 @ 5' (Tip-1'') Before TXCUPP.JPG

Photo 17: 020-272 BC-14 S02 @ 7' (Tip-1'') After TXUU #1.JPG

Photo 18: 020-272 BC-14 S02 @ 7' (Tip-1'') After TXUU #2.JPG

Photo 19: 020-272 BC-14 S02 @ 7' (Tip-1'') Before TXUU.JPG

Photo 20: 020-272 BC-14 S03 @ 9' (Tip-1'') After TXUU #1.JPG

Photo 21: 020-272 BC-14 S03 @ 9' (Tip-1'') After TXUU #2.JPG

Photo 22: 020-272 BC-14 S03 @ 9' (Tip-1'') After TXUU #3.JPG

Photo 23: 020-272 BC-14 S03 @ 9' (Tip-1'') Before TXCUPP.JPG

Photo 24: 020-272 BC-14 S04 @ 12' (Tip-1'') After TXCUPP #1.JPG

Photo 25: 020-272 BC-14 S04 @ 12' (Tip-1'') After TXCUPP #2.JPG

Photo 26: 020-272 BC-14 S04 @ 12' (Tip-1'') Before TXCUPP.JPG

Photo 27: 202-251 BC-02 S06 @ 19.5' (tip-2'') After TXCUPP #1.JPG

Photo 28: 202-251 BC-02 S06 @ 19.5' (tip-2'') After TXCUPP #2.JPG

Photo 29: 202-251 BC-02 S06 @ 19.5' (tip-2'') Before TXCUPP.JPG

Photo 30: 202-251 BC-02 S08 @ 34.5' (tip-6'') After TXCUPP #1.JPG

Photo 31: 202-251 BC-02 S08 @ 34.5' (tip-6'') After TXCUPP #2.JPG

Photo 32: 202-251 BC-03 S06 @ 39.5' (tip-4'') After TXCUPP #1.JPG

Photo 33: 202-251 BC-03 S06 @ 39.5' (tip-4'') After TXCUPP #2.JPG

Photo 34: 202-251 BC-03 S06 @ 39.5' (tip-4'') Before TXCUPP.JPG

Photo 35: 202-251 BC-03 S06 @ 39.5' (tip-11'') After TXCUPP #1.JPG

Photo 36: 202-251 BC-03 S06 @ 39.5' (tip-11'') After TXCUPP #2.JPG

Photo 37: 202-251 BC-03 S06 @ 39.5' (tip-11'') Before TXCUPP.JPG

Photo 38: 202-251 BC-03 S10 @ 90' (tip-13'') After TXCUPP #1.JPG

Photo 39: 202-251 BC-03 S10 @ 90' (tip-13'') After TXCUPP #2.JPG

Photo 40: 202-251 BC-03 S10 @ 90' (tip-13'') Before TXCUPP.JPG

Photo 41: 202-251 BC-04 S04 @ 12.5' (tip-4'') After TXCUPP #1.JPG

Photo 42: 202-251 BC-04 S04 @ 12.5' (tip-4'') After TXCUPP #2.JPG

Photo 43: 202-251 BC-04 S04 @ 12.5' (tip-4'') Before TXCUPP.JPG

Photo 44: 202-251 BC-04 S04 @ 12.5' (tip-15'') After TXCUPP #1.JPG

Photo 45: 202-251 BC-04 S04 @ 12.5' (tip-15'') After TXCUPP #2.JPG

Photo 46: 202-251 BC-04 S04 @ 12.5' (tip-15'') Before TXCUPP.JPG

Photo 47: 202-251 BC-04 S05 @ 17.6' (tip-6'') After TXCUPP #1.JPG

Photo 48: 202-251 BC-04 S05 @ 17.6' (tip-6'') After TXCUPP #2.JPG

Photo 49: 202-251 BC-04 S05 @ 17.6' (tip-6'') Before TXCUPP.JPG

Photo 50: 202-251 BC-04 S06 @ 22.5' (tip-2'') After TXCUPP #1.JPG

Photo 51: 202-251 BC-04 S06 @ 22.5' (tip-2'') After TXCUPP #2.JPG

Photo 52: 202-251 BC-04 S06 @ 22.5' (tip-2'') Before TXCUPP.JPG

Photo 53: 202-251 BC-04 S08 @ 32.5' (tip-10'') After TXCUPP #1.JPG

Photo 54: 202-251 BC-04 S08 @ 32.5' (tip-10'') After TXCUPP #2.JPG

Photo 55: 202-251 BC-04 S08 @ 32.5' (tip-10'') Before TXCUPP.JPG

Photo 56: 202-251 BC-04 S10 @ 52.5' (tip-4'') After TXCUPP #1.JPG

Photo 57: 202-251 BC-04 S10 @ 52.5' (tip-4'') After TXCUPP #2.JPG

Photo 58: 202-251 BC-04 S10 @ 52.5' (tip-4'') Before TXCUPP.JPG

Photo 59: 202-251 BC-04 S10 @ 52.5' (tip-18'') After TXCUPP #1.JPG

Photo 60: 202-251 BC-04 S10 @ 52.5' (tip-18'') After TXCUPP #2.JPG

Photo 61: 202-251 BC-04 S10 @ 52.5' (tip-18'') Before TXCUPP.JPG

Photo 62: 202-251 BC-05 S04 @ 14.5' (tip-1'') After TXCUPP #1.JPG

Photo 63: 202-251 BC-05 S04 @ 14.5' (tip-1'') After TXCUPP #2.JPG

Photo 64: 202-251 BC-05 S04 @ 14.5' (tip-1'') Before TXCUPP.JPG

Photo 65: 202-251 BC-05 S04 @ 14.5' (tip-16'') After TXCUPP #1.JPG

Photo 66: 202-251 BC-05 S04 @ 14.5' (tip-16'') After TXCUPP #2.JPG

Photo 67: 202-251 BC-05 S04 @ 14.5' (tip-16'') Before TXCUPP.JPG

Photo 68: 202-251 BC-09 S05 @ 23' (tip-5'') After TXCUPP #1.JPG

Photo 69: 202-251 BC-09 S05 @ 23' (tip-5'') After TXCUPP #2.JPG

Photo 70: 202-251 BC-09 S05 @ 23' (tip-5'') Before TXCUPP.JPG

Photo 71: 202-251 BC-09 S05 @ 23' (tip-13'') After TXCUPP #1.JPG

Photo 72: 202-251 BC-09 S05 @ 23' (tip-13'') After TXCUPP #2.JPG

Photo 73: 202-251 BC-09 S05 @ 23' (tip-13'') Before TXCUPP.JPG

Photo 74: 202-251 BC-09 S09 @ 68' (tip-4'') After TXCUPP #1.JPG

Photo 75: 202-251 BC-09 S09 @ 68' (tip-4'') After TXCUPP #2.JPG

Photo 76: 202-251 BC-09 S09 @ 68' (tip-4'') Before TXCUPP.JPG

Photo 77: 202-251 BC-09 S09 @ 68' (tip-10'') After TXCUPP #1.JPG

Photo 78: 202-251 BC-09 S09 @ 68' (tip-10'') After TXCUPP #2.JPG

Photo 79: 202-251 BC-09 S09 @ 68' (tip-10'') Before TXCUPP.JPG

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-02 S06 @ 19.5'

BC-02 S08 @ 34.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-02 S06 @ 19.5'

BC-02 S08 @ 34.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

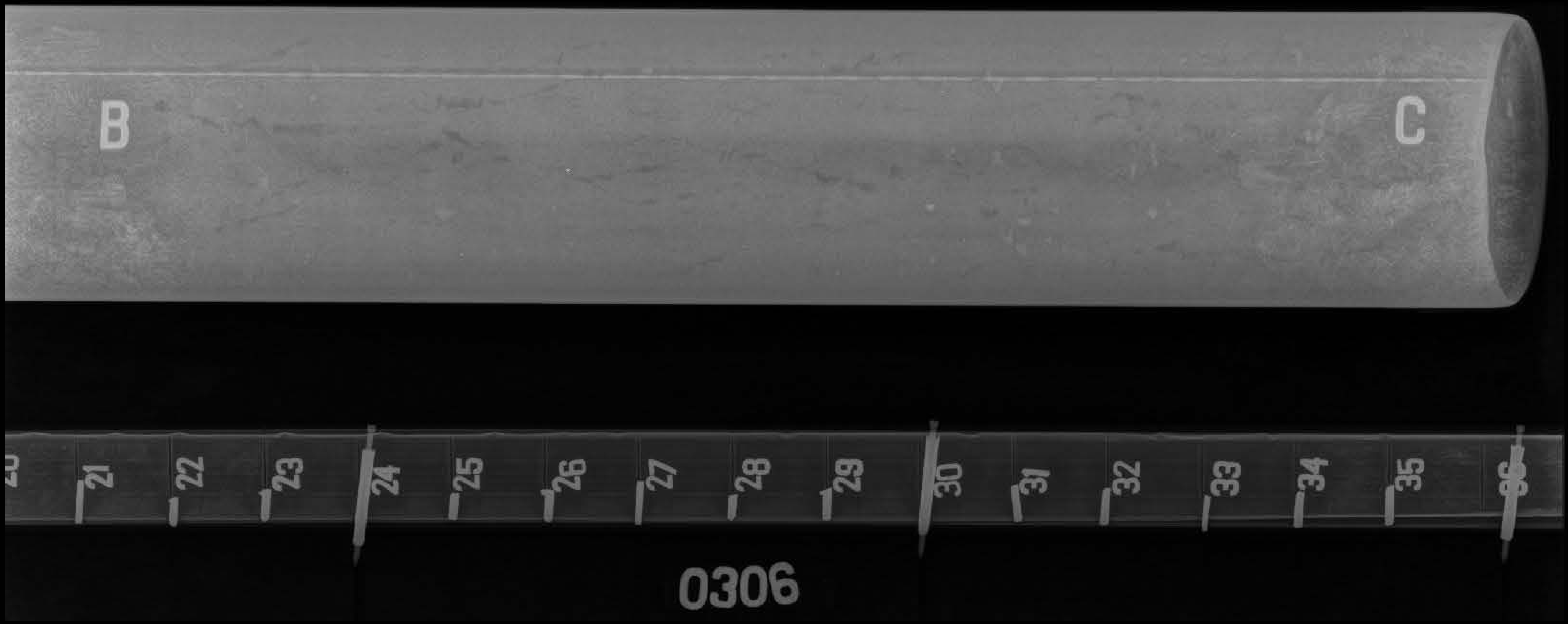
Scale in inches
0 = Top of Tube

BC-03 S06 @ 39.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

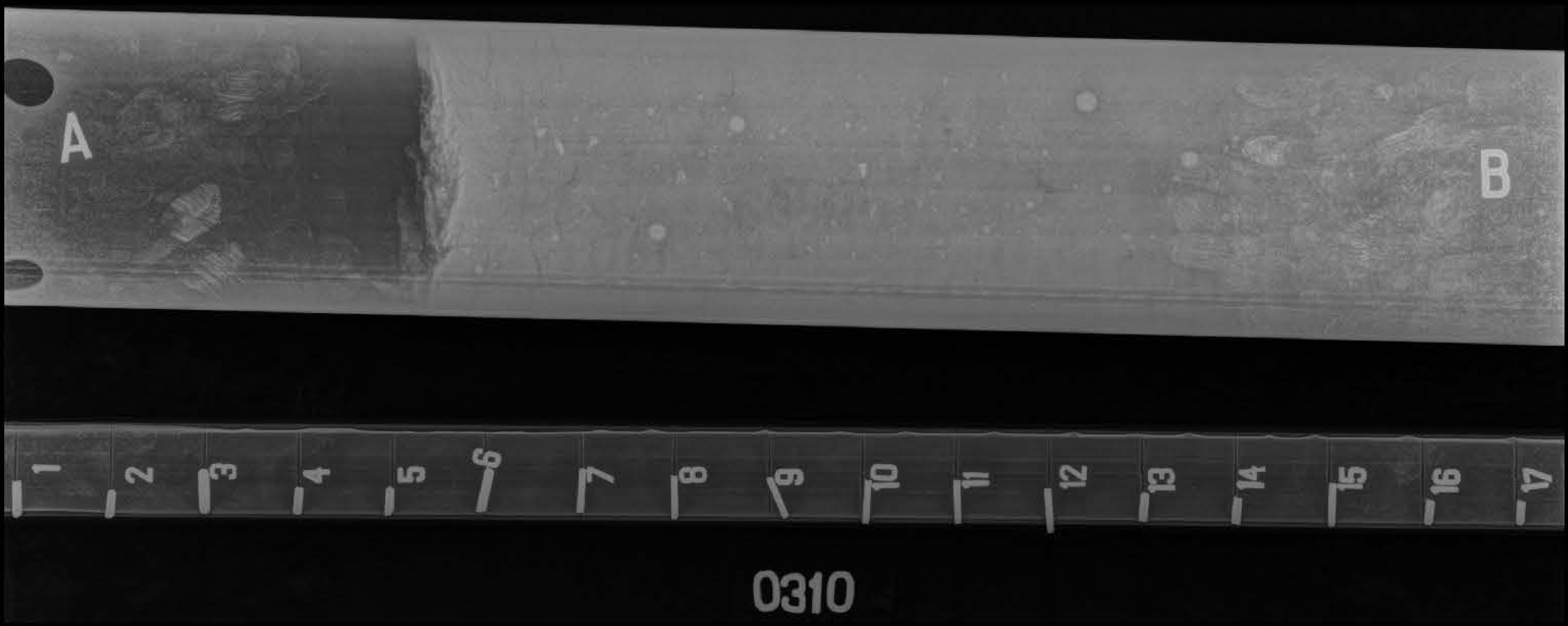
BC-03 S06 @ 39.5'



CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

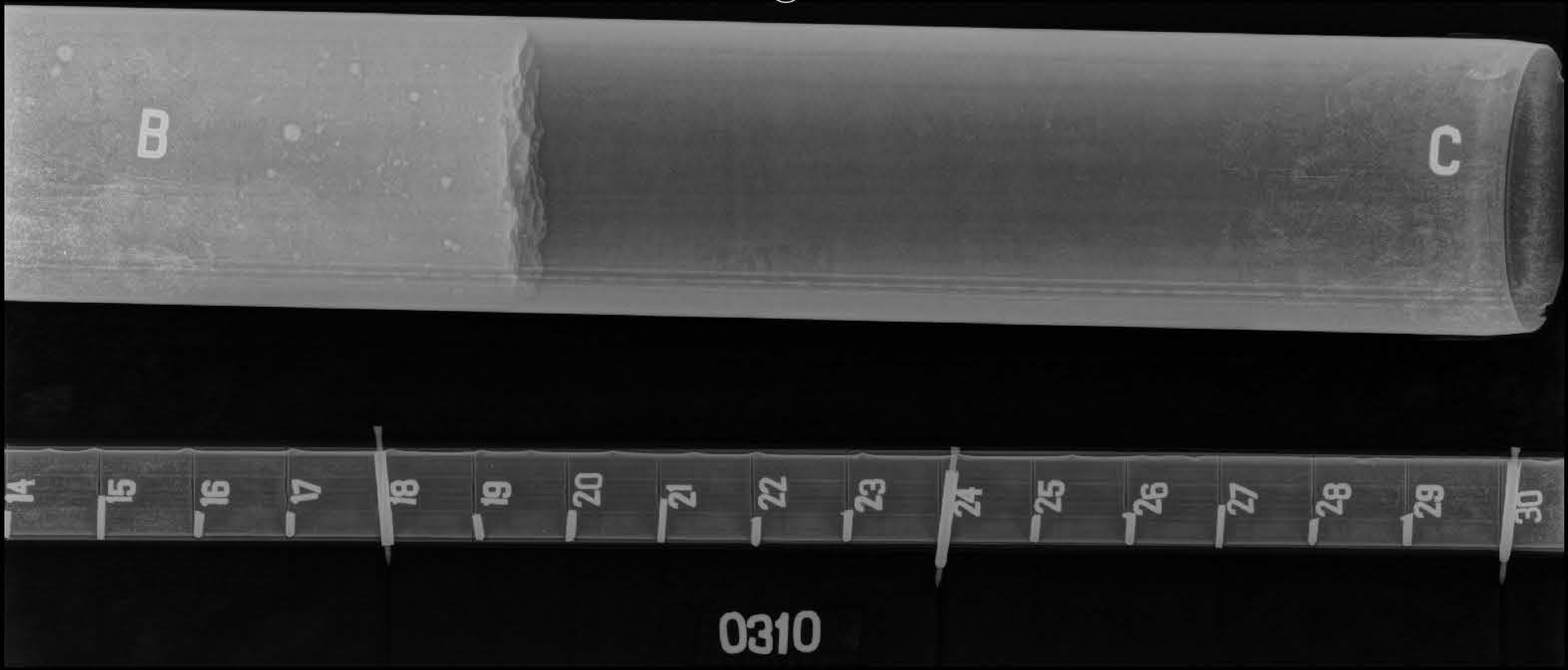
BC-03 S10 @ 90'



CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

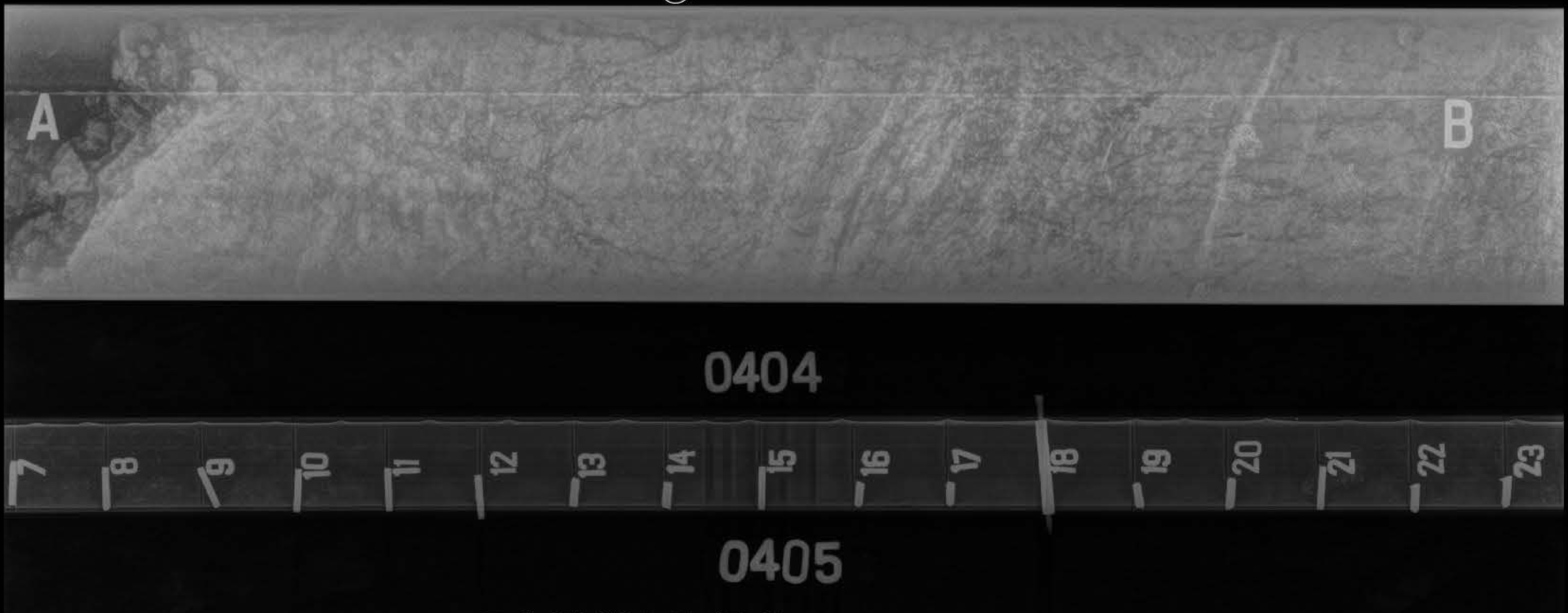
BC-03 S10 @ 90'



CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S04 @ 12.5'



BC-04 S05 @ 17.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

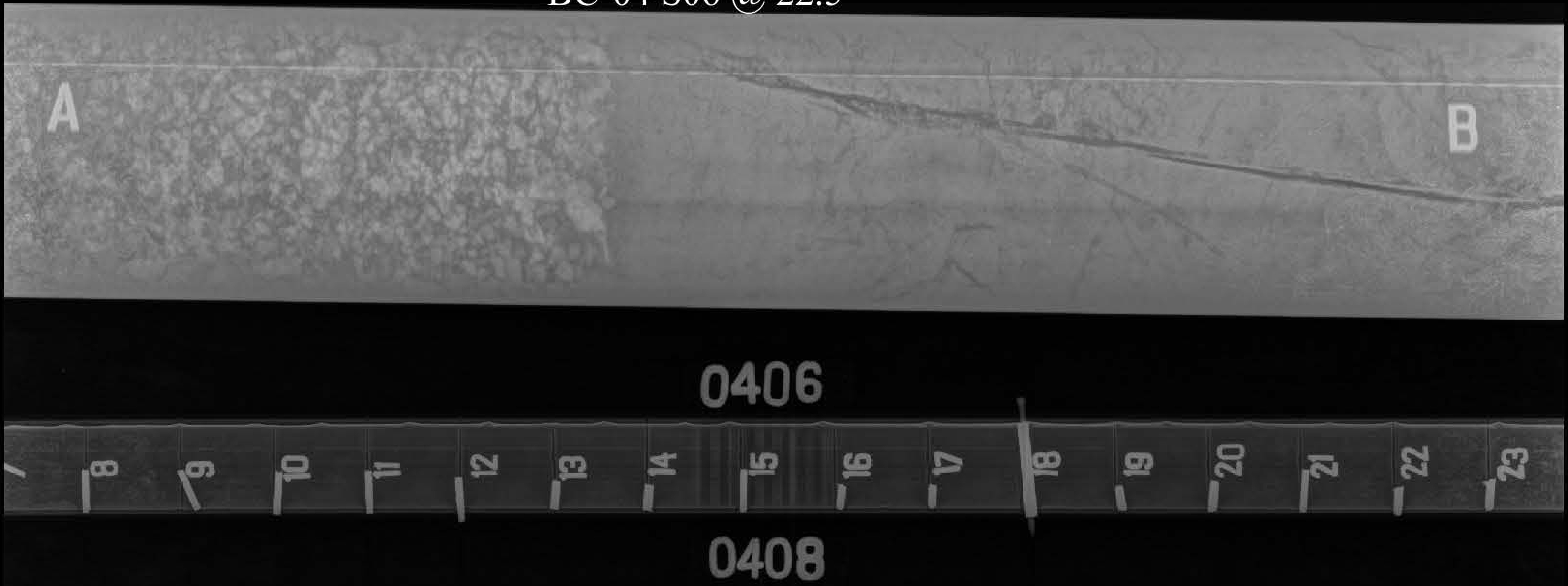
BC-04 S04 @ 12.5'

BC-04 S05 @ 17.5'

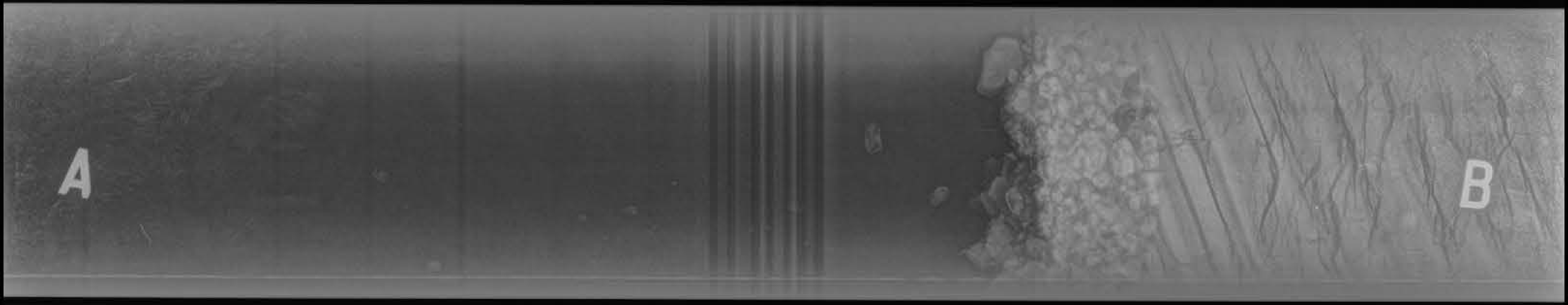
CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S06 @ 22.5'



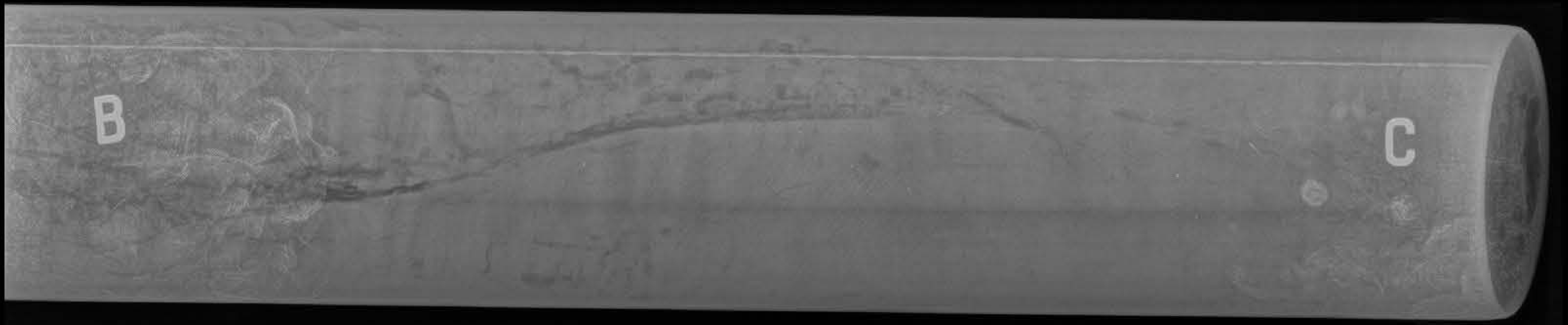
BC-04 S08 @ 32.5'



CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S06 @ 22.5'

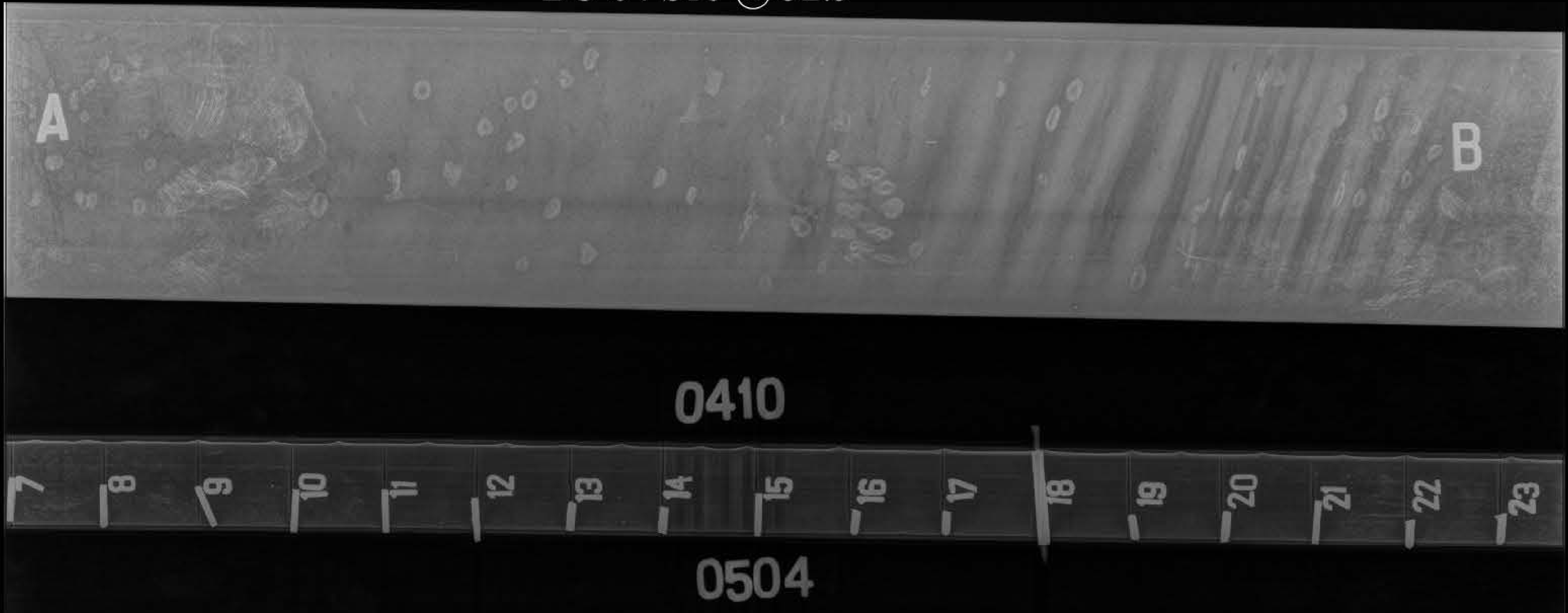


BC-04 S08 @ 32.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S10 @ 52.5'

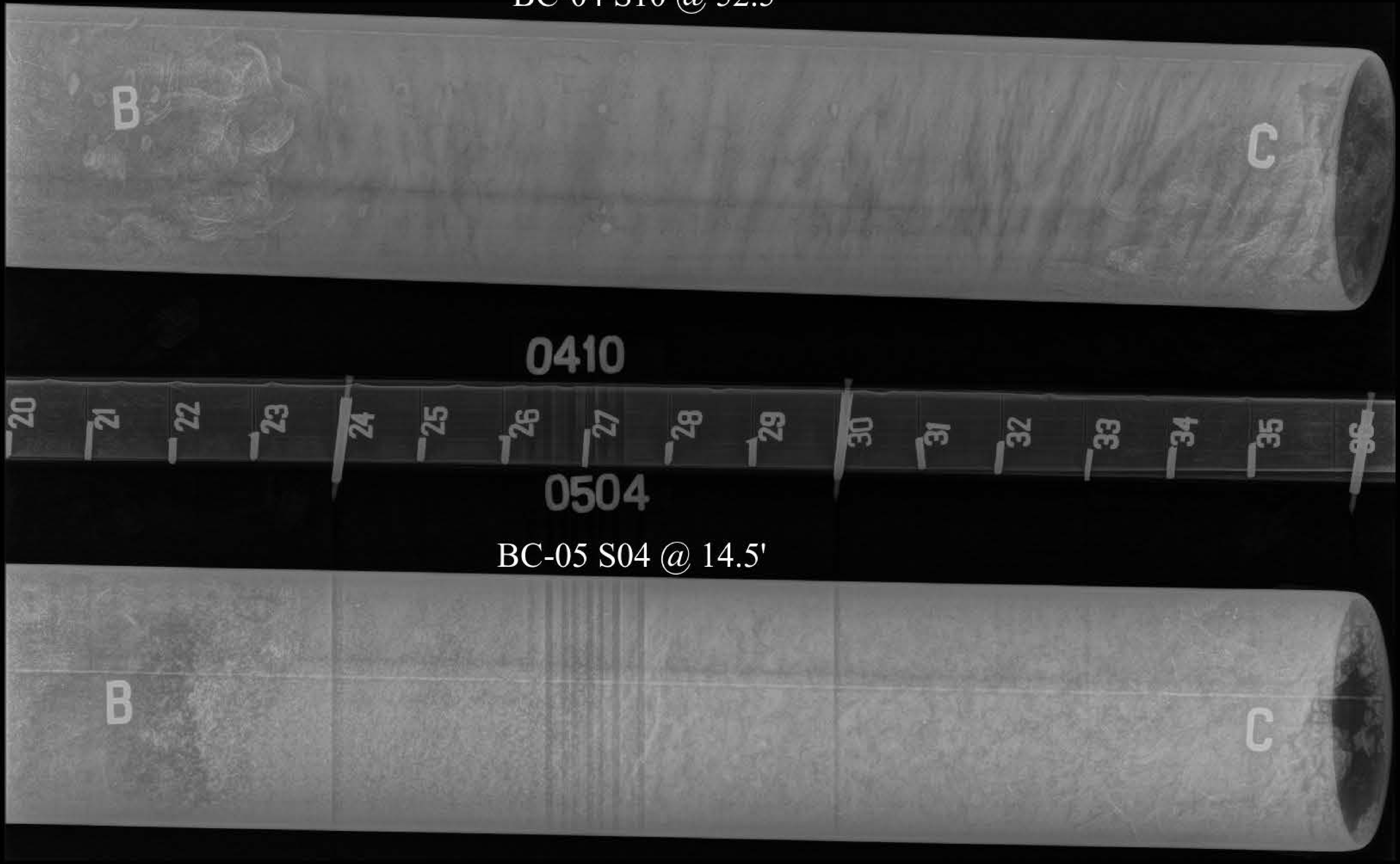


BC-05 S04 @ 14.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S10 @ 52.5'

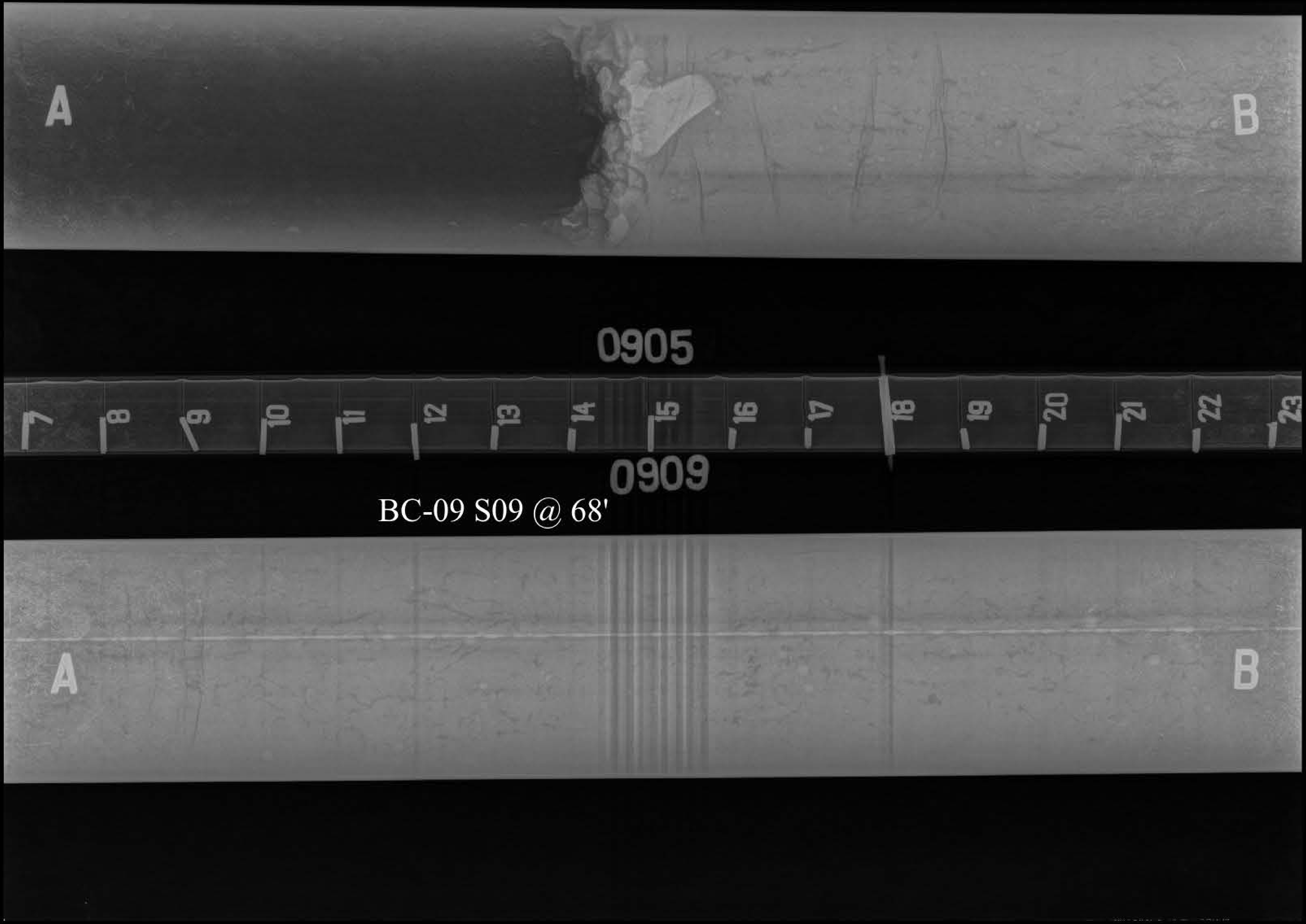


BC-05 S04 @ 14.5'

CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-09 S05 @ 23'

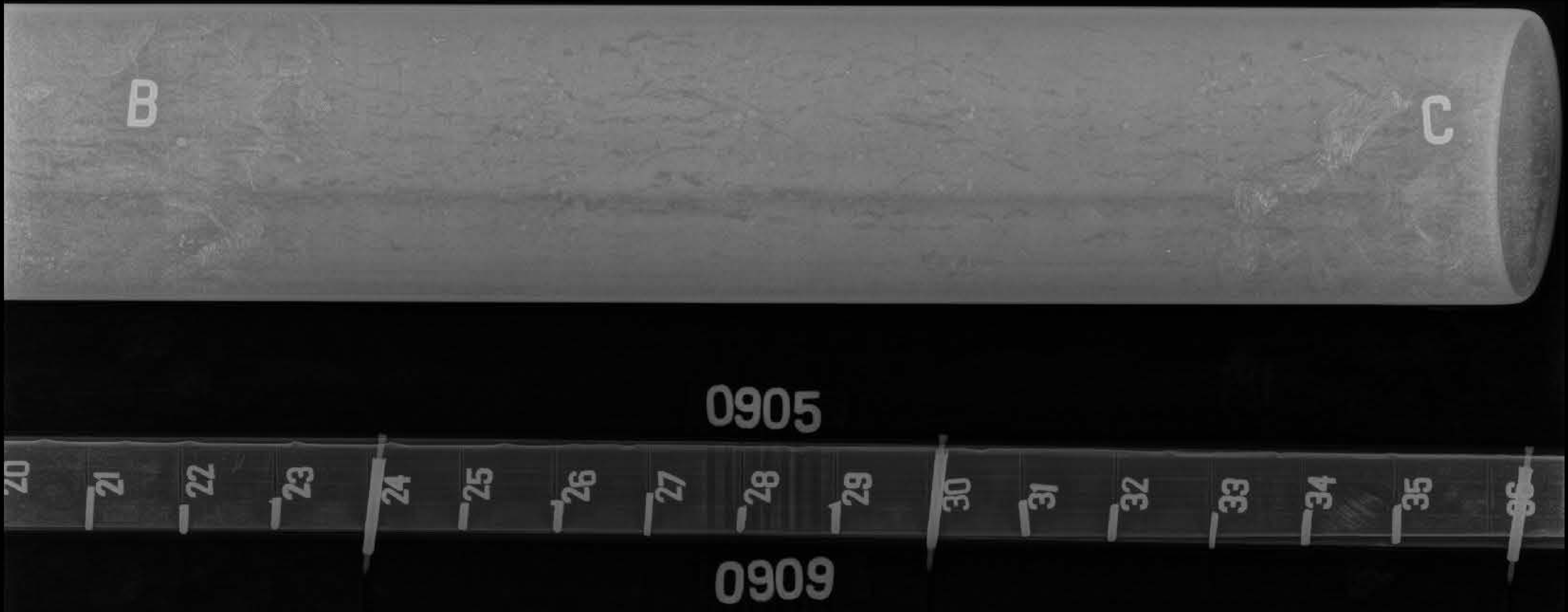


BC-09 S09 @ 68'

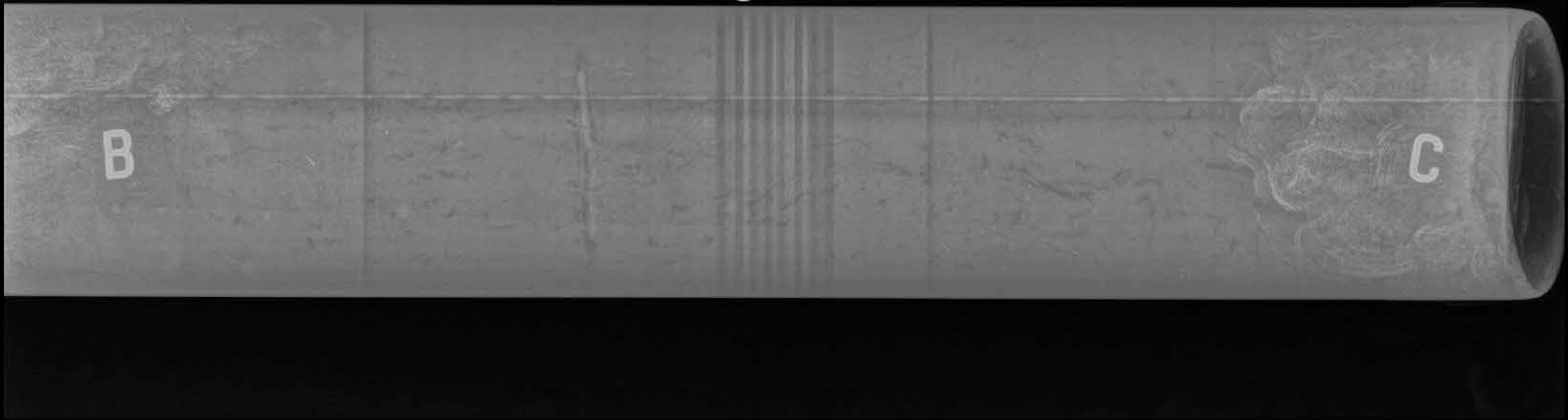
CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-09 S05 @ 23'



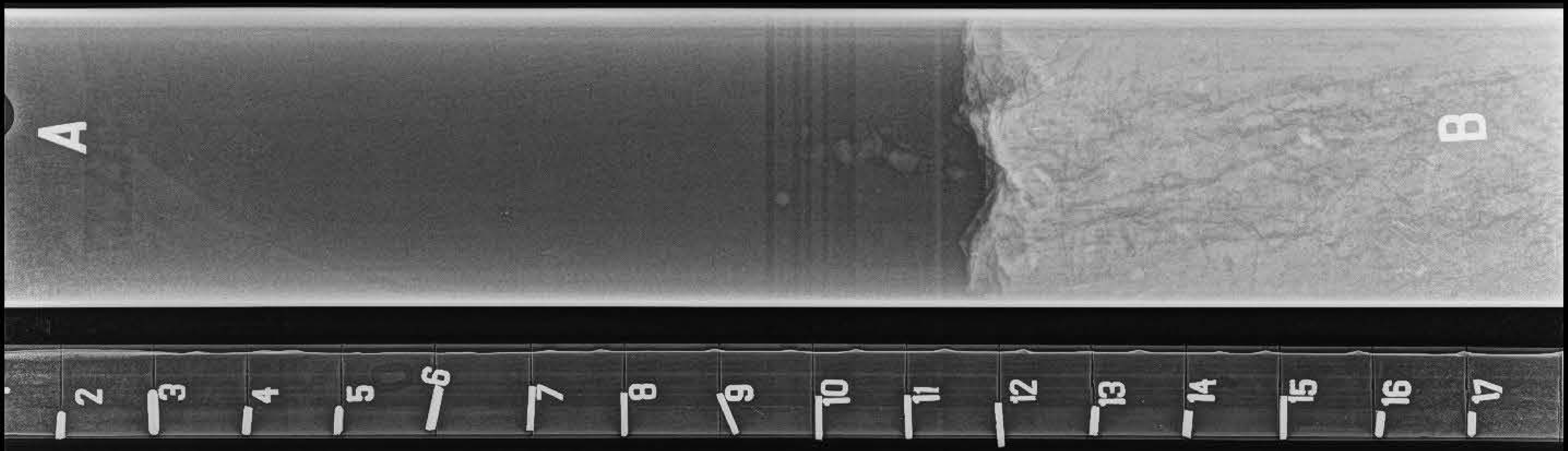
BC-09 S09 @ 68'



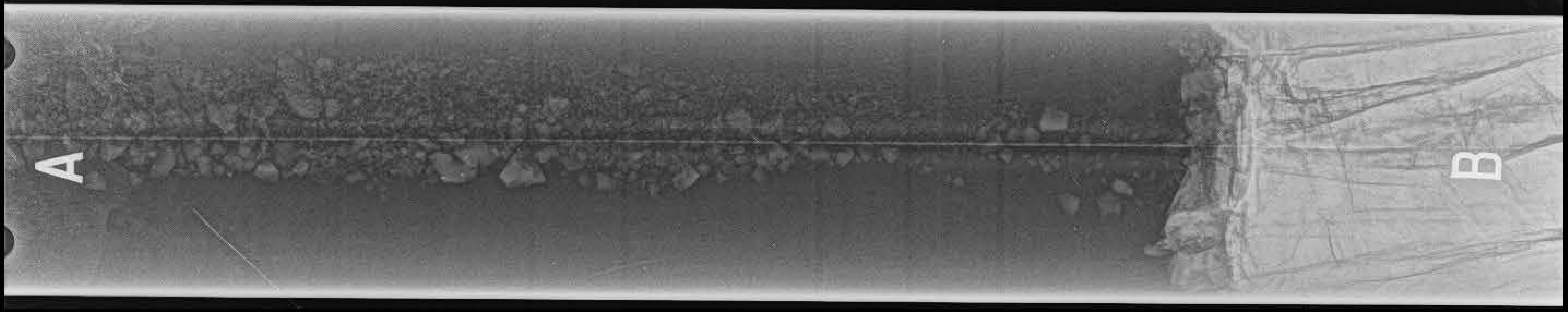
CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

Scale in inches
0 = Top of Tube

BC-13 S02 @ 12'



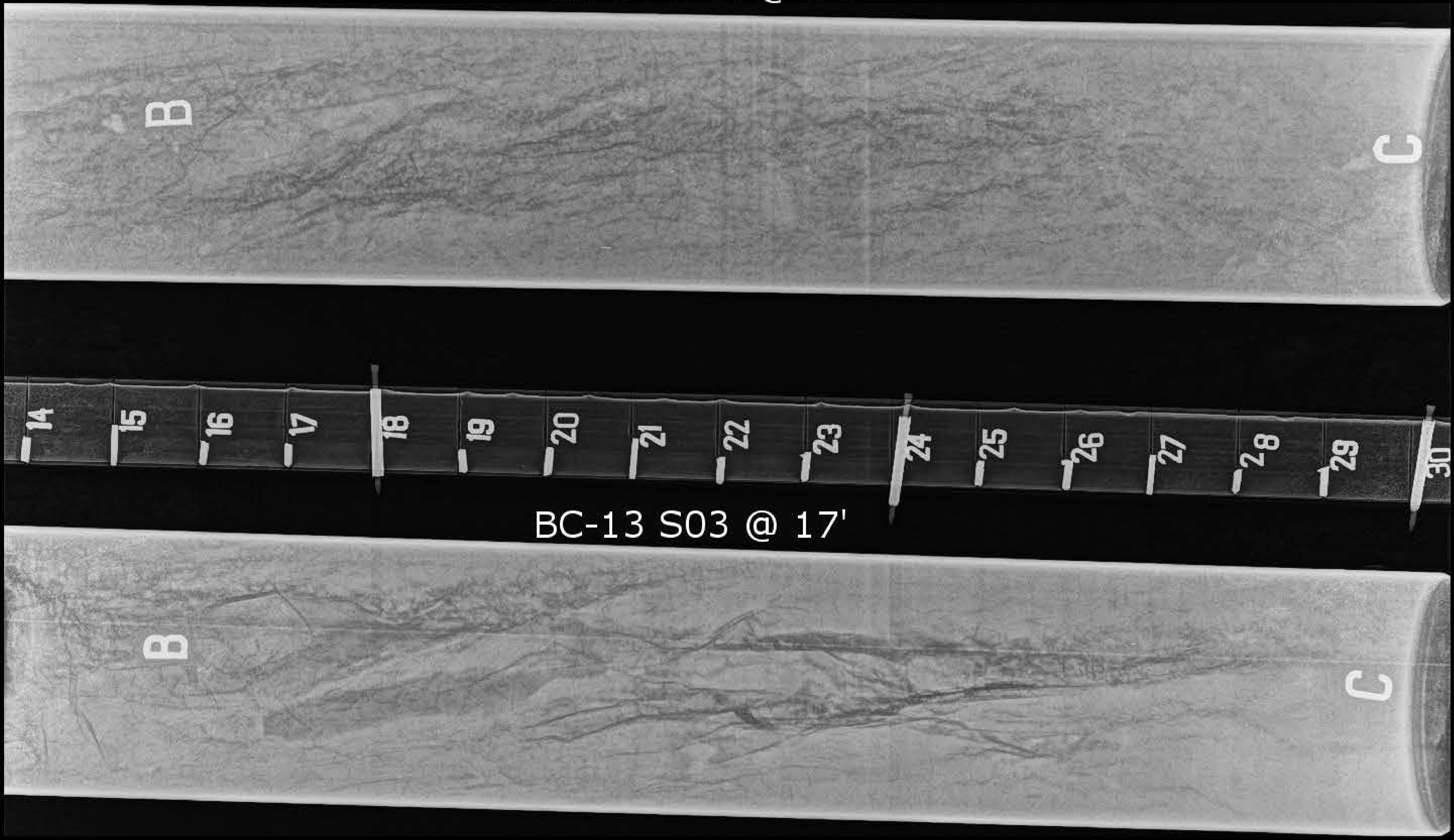
BC-13 S03 @ 17'



CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

Scale in inches
0 = Top of Tube

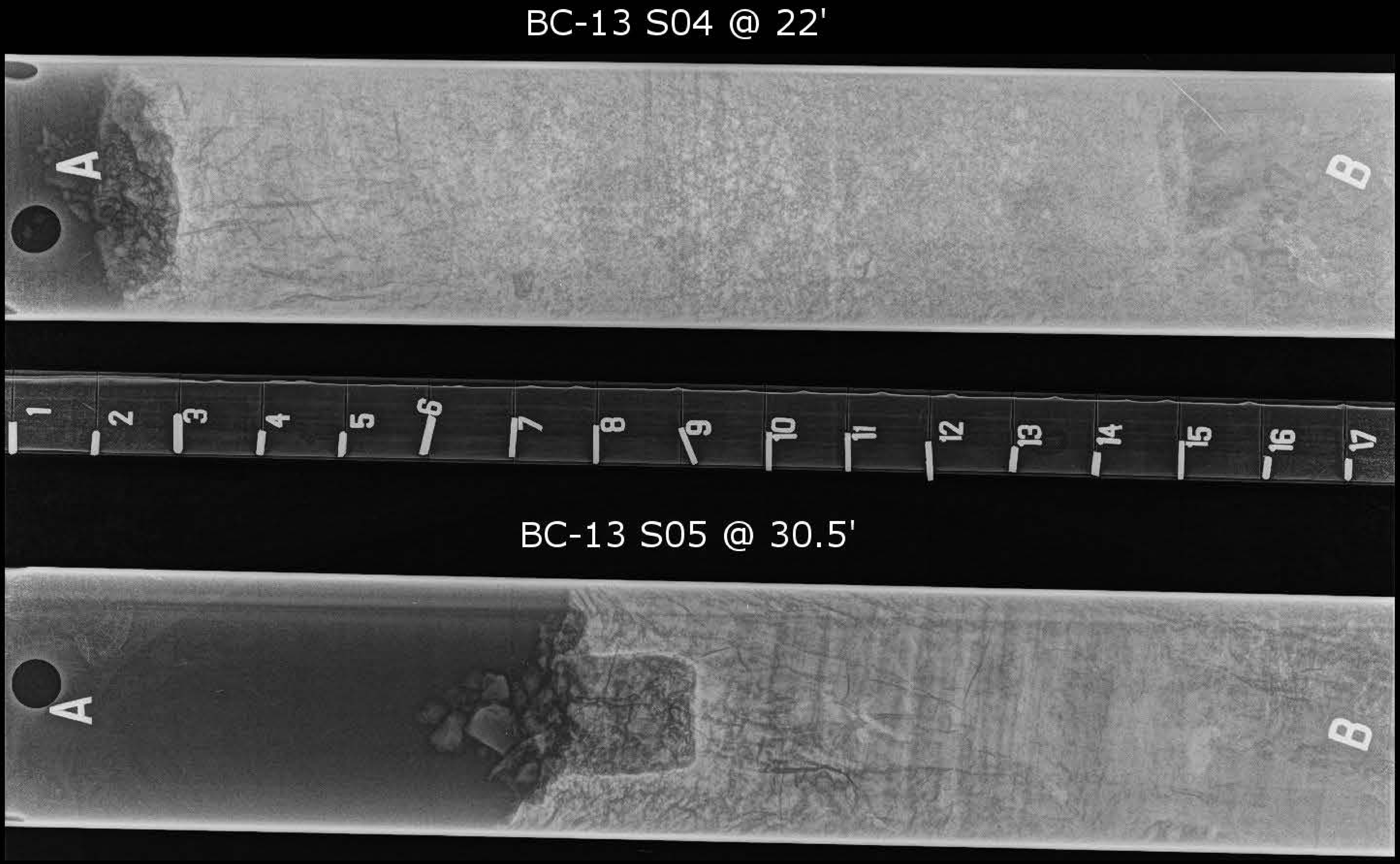
BC-13 S02 @ 12'



BC-13 S03 @ 17'

CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

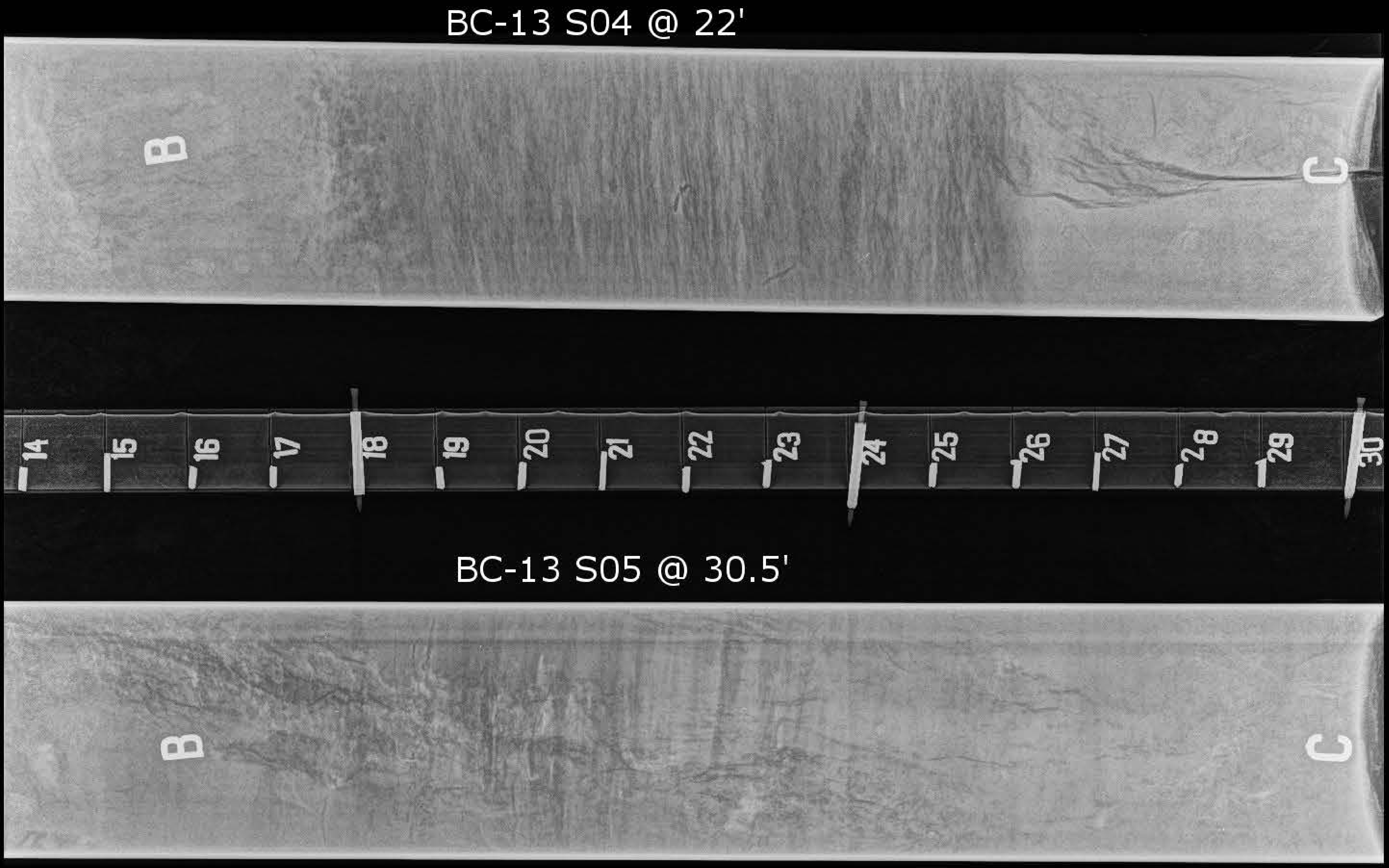
Scale in inches
0 = Top of Tube


BC-13 S04 @ 22'

BC-13 S05 @ 30.5'

CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

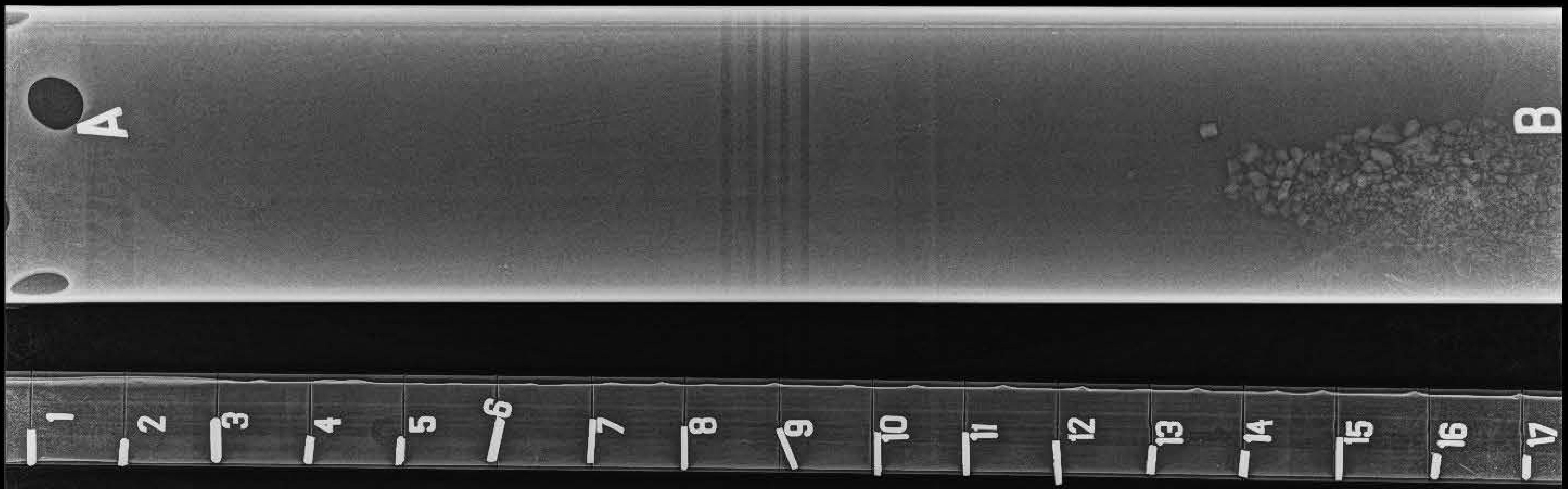
Scale in inches
0 = Top of Tube



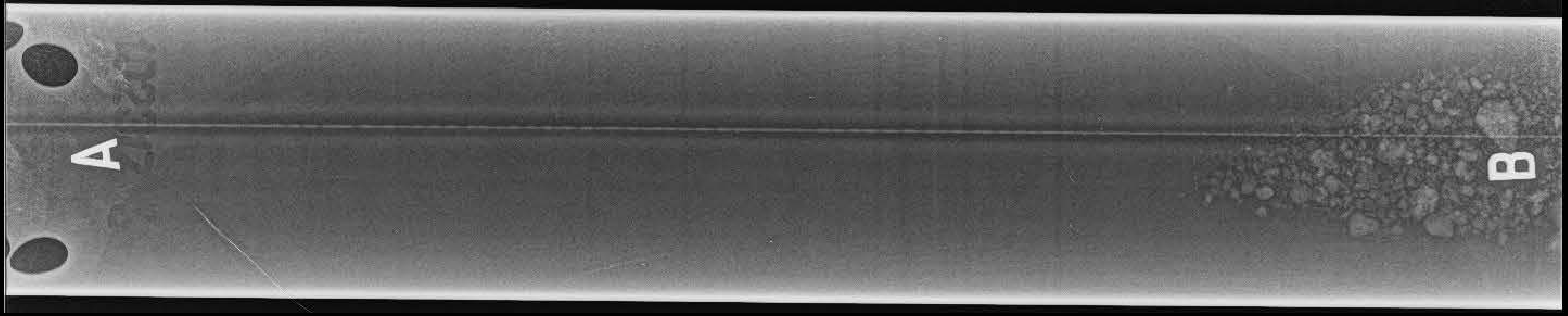
CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

Scale in inches
0 = Top of Tube

BC-14 S01 @ 5'



BC-14 S04 @ 12'

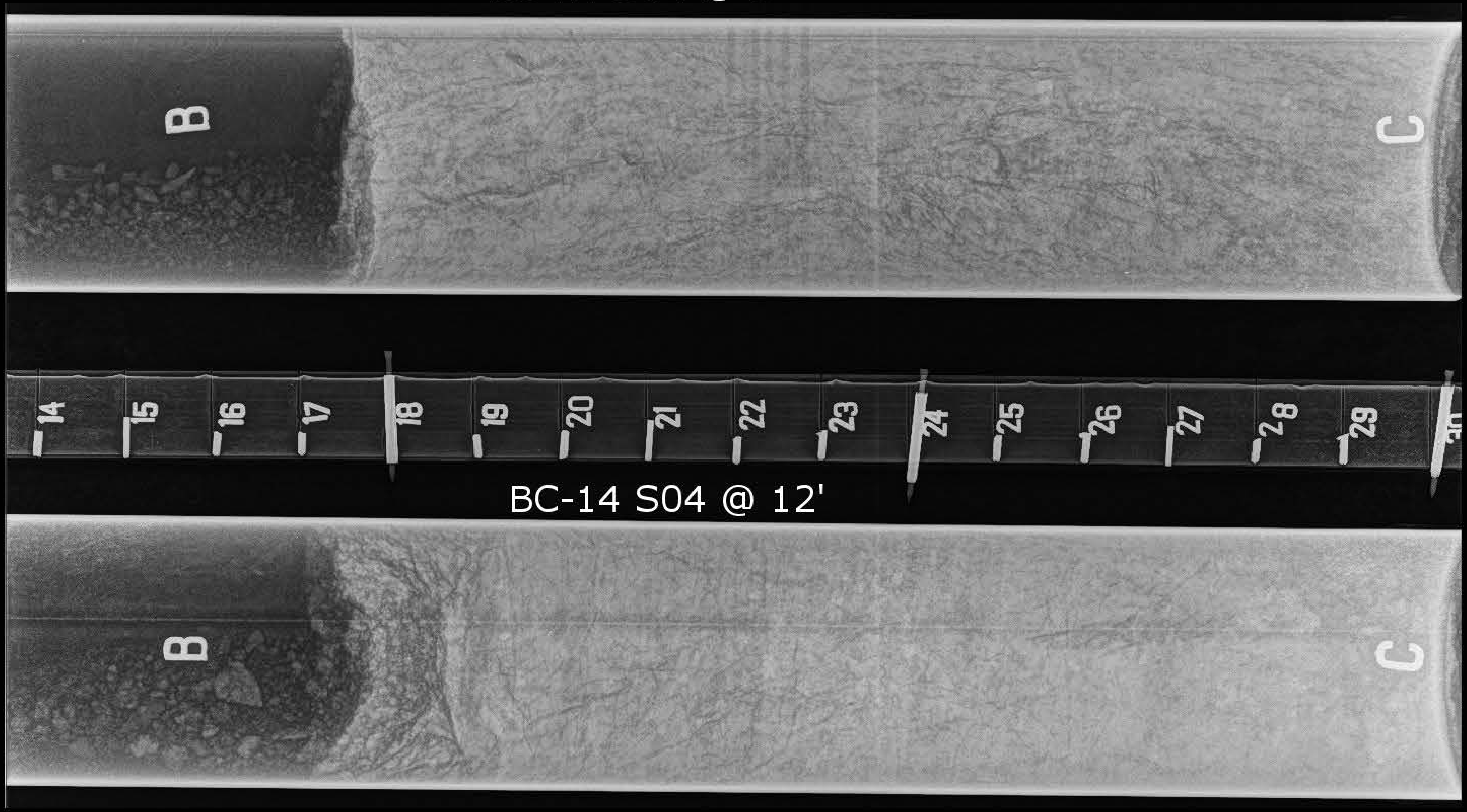


CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

Scale in inches
0 = Top of Tube

BC-14 S01 @ 5'

BC-14 S04 @ 12'



Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-4-1
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 27-27.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/27-30/2018

Method A: Caliper

Diameter (mm)	Length (mm)	Initial Weight (g)	Dry Weight (g)
		202.50	193.13

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**
4.85				

Method B: Buoyancy

Weight (g)	Saturated Weight (g)	Suspended Weight (g)	Dry Weight (g)

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-4-2
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 48.9-50.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/27-30/2018

Method A: Caliper

Diameter (mm)	Length (mm)	Initial Weight (g)	Dry Weight (g)
		180.47	169.63

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**
6.39				

Method B: Buoyancy

Weight (g)	Saturated Weight (g)	Suspended Weight (g)	Dry Weight (g)

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-4-3
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 55.4-56.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/27-30/2018

Method A: Caliper

Diameter (mm)	Length (mm)	Initial Weight (g)	Dry Weight (g)
		175.36	165.73

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**
5.81				

Method B: Buoyancy

Weight (g)	Saturated Weight (g)	Suspended Weight (g)	Dry Weight (g)

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-4-4
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 17.4-18.4 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/27-30/2018

Method A: Caliper

Diameter (mm)	Length (mm)	Initial Weight (g)	Dry Weight (g)
		84.27	74.93

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**
12.46				

Method B: Buoyancy

Weight (g)	Saturated Weight (g)	Suspended Weight (g)	Dry Weight (g)

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-4-5
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 21.5-22.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/27-30/2018

Method A: Caliper

Diameter (mm)	Length (mm)	Initial Weight (g)	Dry Weight (g)
		177.06	160.77

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**
10.13				

Method B: Buoyancy

Weight (g)	Saturated Weight (g)	Suspended Weight (g)	Dry Weight (g)

Moisture Content (%)	**Unit Weight (kN/m^3)**	**Unit Weight (pcf)**	**Dry Unit Weight (kN/m^3)**	**Dry Unit Weight (pcf)**

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-3-1
Report Date	5/17/2018
Drill Hole and Depth (ft)	BI-02; 27-27.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/30/2018

Diameter	Length	Weight	Bulk Density	Bulk Density
(mm)	(mm)	(g)	(kN/m^3)	(pcf)
60.54	97.72	637.28	22.22	141.42

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-3-2
Report Date	5/17/2018
Drill Hole and Depth (ft)	BI-02; 48.9-50.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/30/2018

Diameter	Length	Weight	Bulk Density	Bulk Density
(mm)	(mm)	(g)	(kN/m^3)	(pcf)
60.85	127.87	891.59	23.51	149.67

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-3-3
Report Date	5/17/2018
Drill Hole and Depth (ft)	BI-02; 55.4-56.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/30/2018

Diameter	Length	Weight	Bulk Density	Bulk Density
(mm)	(mm)	(g)	(kN/m^3)	(pcf)
60.68	128.33	882.58	23.32	148.46

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-3-4
Report Date	5/17/2018
Drill Hole and Depth (ft)	BI-03; 17.4-18.4 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/30/2018

Diameter	Length	Weight	Bulk Density	Bulk Density
(mm)	(mm)	(g)	(kN/m^3)	(pcf)
60.59	129.81	830.07	21.75	138.44

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-3-5
Report Date	5/17/2018
Drill Hole and Depth (ft)	BI-03; 21.5-22.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/30/2018

Diameter	Length	Weight	Bulk Density	Bulk Density
(mm)	(mm)	(g)	(kN/m^3)	(pcf)
60.58	125.67	783.13	21.20	134.96

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-1
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 48.9-50.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date Received: 4/24/2018	Date Opened: 4/24/2018	Date Tested: 4/30/2018

Distance, D		**Load, P**		**Corrected Point Load Index** $(D/50)^{0.45}$ P/D^2		**Direction of Loading**	
mm	**in**	**kN**	**lbf**	**MPa**	**psi**	**A**	**B**
60.86	2.40	0.74	166.352	0.22	31.66	1	
62.20	2.45	1.65	370.92	0.47	68.24		1
47.58	1.87	0.98	220.304	0.42	61.40	1	
79.15	3.12	3.23	726.104	0.63	91.95		1
82.44	3.25	3.00	674.4	0.55	80.18		1
39.71	1.56	0.86	193.328	0.49	71.31	1	

Average Point Load Strength in Direction A	0.38 MPa	54.79 psi
Average Point Load Strength in Direction B	0.55 MPa	80.12 psi

Point Load Strength Anisotropy Index
1.46

A = Parallel to core axis

B = Orthogonal to core axis

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

POINT LOAD TEST RESULTS
BI-02 and BI-03

Test Number	Test Order	Depth of Test	Boring Number	Date	Depth Interval		Rock Type[1]	Diameter (D)		Distance Between Contact Points (cm)	Distance Between Contact Points (in)	Length - Contact Points to End of Sample, L (in)	L/D[2]	Test Type[3]	Failure Load, P (kN)[4]	Uncorrected Point Load, I_S (Mpa)[5]	Size Correction Factor, F[6]	Point Load, $I_{S(50)}$ (MPa)[7]	Uniaxial Compressive Strength, s_c (Mpa)[8]	Uniaxial Compressive Strength, psi	Weathering	Notes
					Bottom	Top		(mm)	(in)													
BI02-1-22.1	1	22.1	BI-02	4/11/2018	22.6	21.9	Volcanic Breccia	59.94	2.36	6.00	2.36	1.97	0.83	d	0.51	0.14	1.09	0.15	3	504	MW/SW	Bottom 3.5" broke on preexisting fracture plane prior to test. Sample broke on preexisting fracture plane during testing.
BI02-2-28.2	2	28.2	BI-02	4/11/2018	28.6	27.9	Volcanic Breccia	59.94	2.36	6.00	2.36	3.54	1.50	d	1.99	0.55	1.09	0.60	14	1968	MW/SW	Fractured between platens (see photo)
BI02-3-32.8	3	32.8	BI-02	4/11/2018	33.4	32.2	Volcanic Breccia	59.94	2.36	6.00	2.36	7.01	2.97	d	2.59	0.72	1.09	0.78	18	2561	MW/SW	Fractured between platens (see photo). Other breaks from rock core falling on table after testing.
BI02-4-37.4	4	37.4	BI-02	4/11/2018	37.7	37.2	Volcanic Breccia	59.94	2.36	6.00	2.36	2.68	1.13	d	2.53	0.70	1.09	0.76	17	2502	MW/SW	Fractured between platens (see photo)
BI02-5-42.8	5	42.8	BI-02	4/11/2018	43.1	42.5	Volcanic Breccia	59.94	2.36	6.00	2.36	3.86	1.63	d	2.00	0.56	1.09	0.60	14	1978	MW/SW	Fractured between platens (see photo). 1" long fracture propagated along the length of sample from the point load application.
BI02-7-55	7	55.0	BI-02	4/11/2018	55.4	54.7	Volcanic Breccia	59.94	2.36	6.00	2.36	3.74	1.58	d	1.41	0.39	1.09	0.43	10	1394	MW/SW	Fractured between platens (see photo). Platen penetrated into rock 3mm at failure.
BI02-8-57.3	8	57.3	BI-02	4/11/2018	57.6	57.0	Volcanic Breccia	59.94	2.36	6.00	2.36	3.23	1.37	d	1.5-2.0		1.09				MW/SW	Peak load not recorded. One of the broken halfs was retested in test BI02-9-57.1.
BI02-9-57.1	9	57.1	BI-02	4/11/2018	57.6	57.0	Volcanic Breccia	59.94	2.36	6.00	2.36	1.69	0.72	d	1.80	0.50	1.09	0.54	12	1780	MW/SW	Fractured between platens (see photo)
BI02-10-64.2	10	64.2	BI-02	4/11/2018	64.7	63.7	Volcanic Breccia	59.94	2.36	6.00	2.36	6.10	2.59	d	1.05	0.29	1.09	0.32	7	1038	MW/SW	Fractured between platens (see photo)
BI03-11-10.3	11	10.3	BI-03	4/11/2018	10.5	10.1	Volcanic Breccia	59.94	2.36	6.00	2.36	2.17	0.92	d	0.60	0.17	1.09	0.18	4	593	MW	Fractured between platens (see photo)
BI03-12-17.2	12	17.2	BI-03	4/11/2018	17.4	17.0	Volcanic Breccia	59.94	2.36	6.00	2.36	2.17	0.92	d	0.56	0.16	1.09	0.17	4	554	MW	Fractured between platens (see photo)
BI03-13-21.3	13	21.3	BI-03	4/11/2018	21.5	21.0	Volcanic Breccia	59.94	2.36	6.00	2.36	2.56	1.08	d	0.76	0.21	1.09	0.23	5	752	MW	Fractured between platens (see photo)
BI03-14-29.8	14	29.8	BI-03	4/11/2018	30.1	29.5	Volcanic Breccia	59.94	2.36	6.00	2.36	3.54	1.50	d	0.73	0.20	1.09	0.22	5	722	MW	Fractured between platens (see photo)
BI03-15-32.7	15	32.7	BI-03	4/11/2018	33.5	32.0	Volcanic Breccia	59.94	2.36	6.00	2.36	8.58	3.64	d	0.77	0.21	1.09	0.23	5	761	MW	Fractured between platens (see photo)

Notes:

[1] Based on Drill Logs

[2] ASTM D5731 calls for L/D > 0.5 for diametral test.

[3] d = diametral, a = axial, b = block, ir = irregular lump

[4] Reading from testing apparatus

[5] $I_S = P/D^2$ (ASTM D5731 - for diametral test)

[6] $F = (D/50)^{0.45}$ (ASTM D5731 - for diametral test)

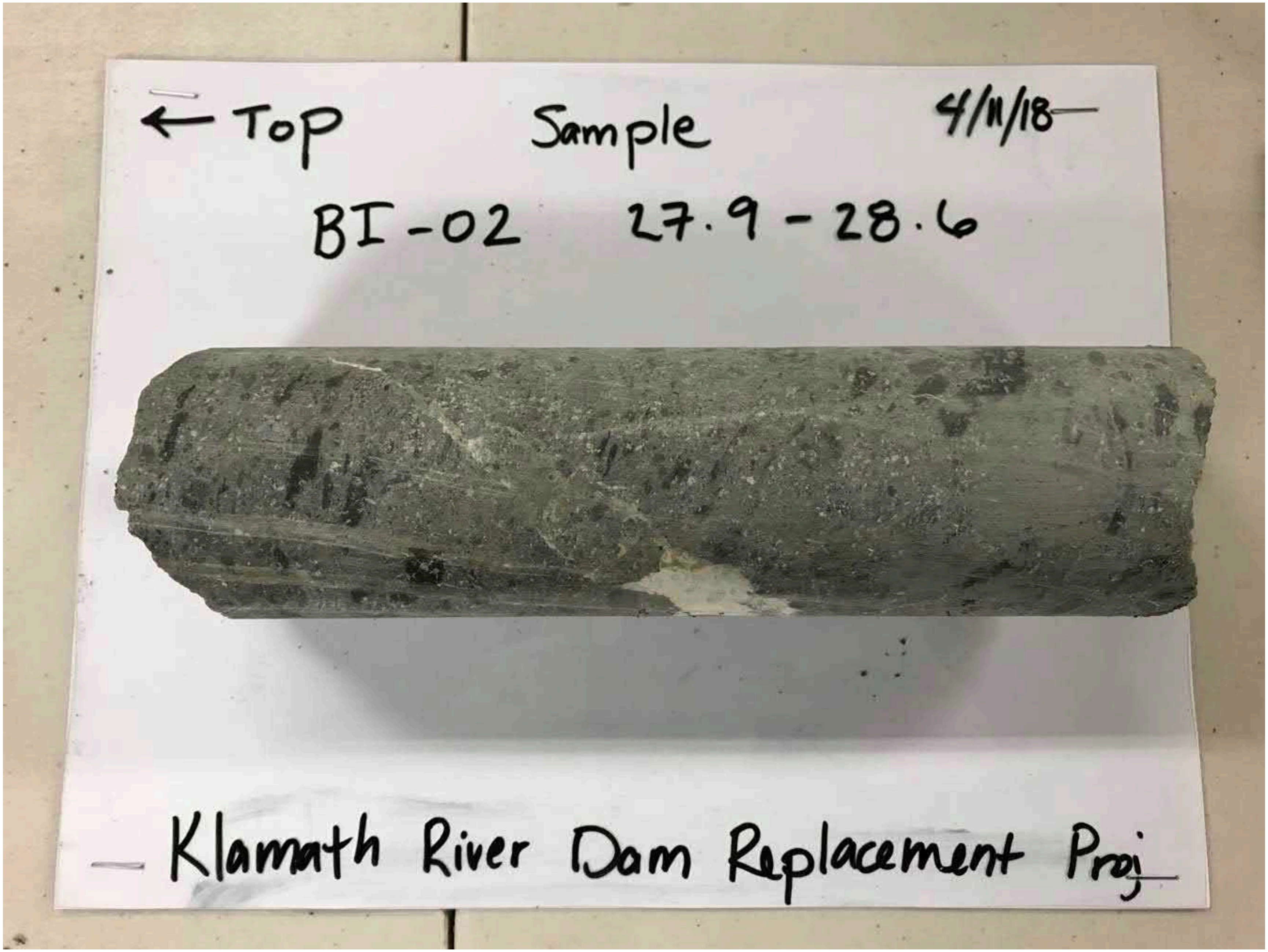
[7] $I_{S(50)} = I_S \times F$ (ASTM D5731)

[8] $s_c = I_S \times K$; I_s is uncorrected point load index; K=24.5 for ~60 mm diameter cores (ASTM D5731)

F	Fresh
SW	Slightly Weathered
MW	Moderately Weathered
HW	Highly Weathered
CW	Completely Weathered


←Top
Sample
4/11/18
BI-02 21.9-22.6
Klamath River Dam Removal


←Top
Sample
4/11/18
BI-02 21.9-22.6
Klamath River Dam Removal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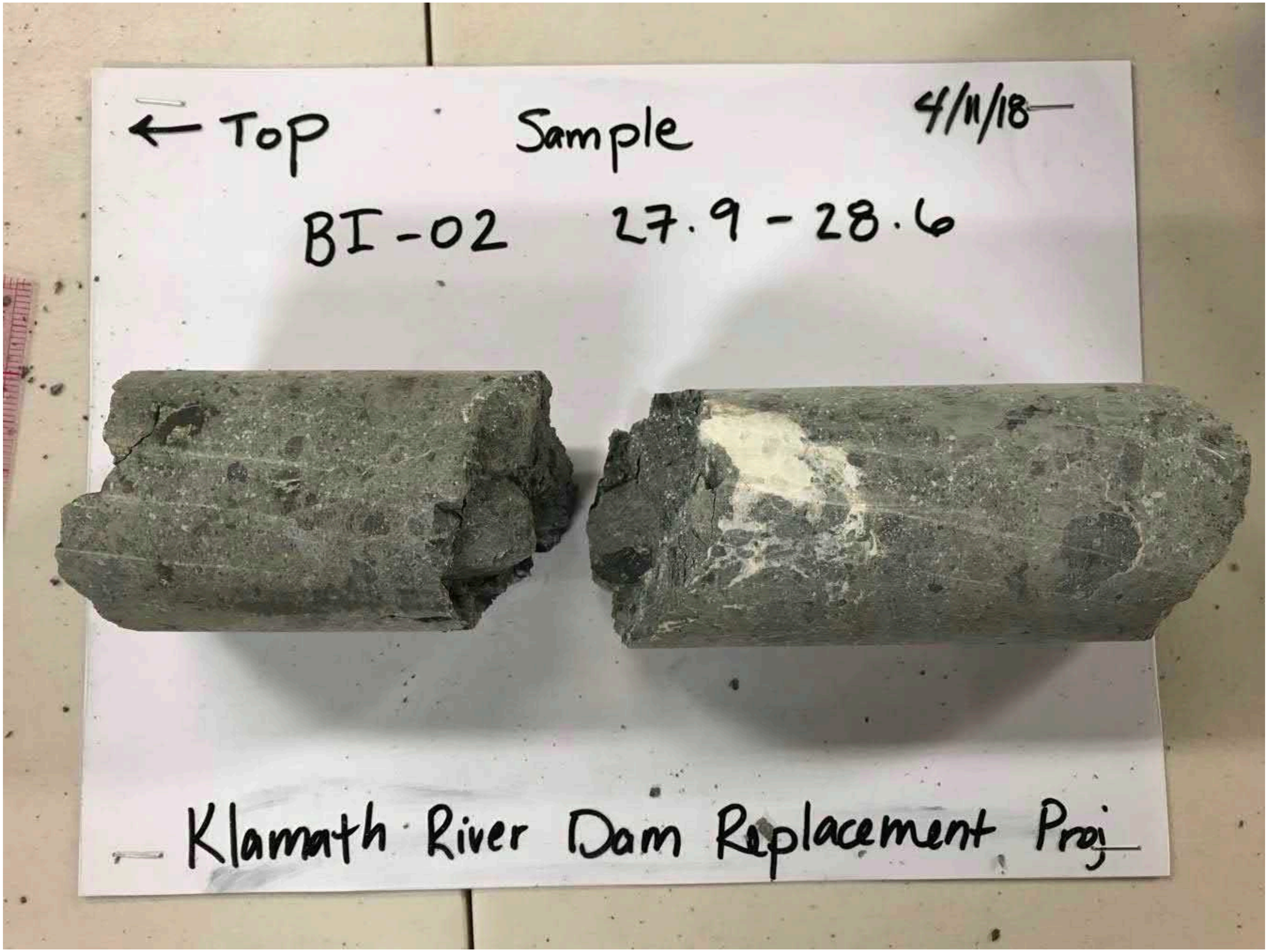
Sample
4/11/18
BI-02 27.9 - 28.6
Klamath River Dam Replacement Proj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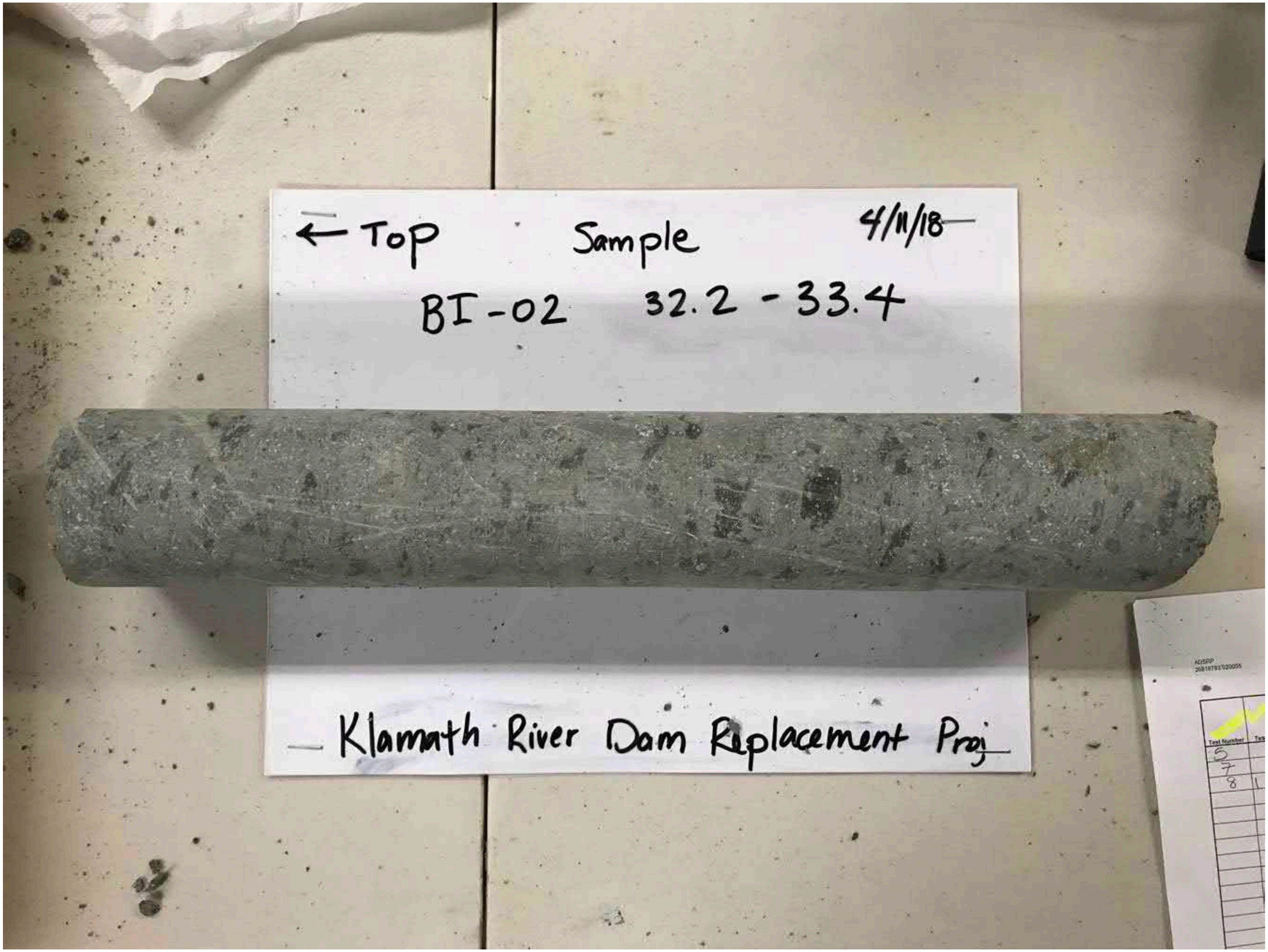
Sample
4/11/18
BI-02 27.9 - 28.6
Klamath River Dam Replacement Proj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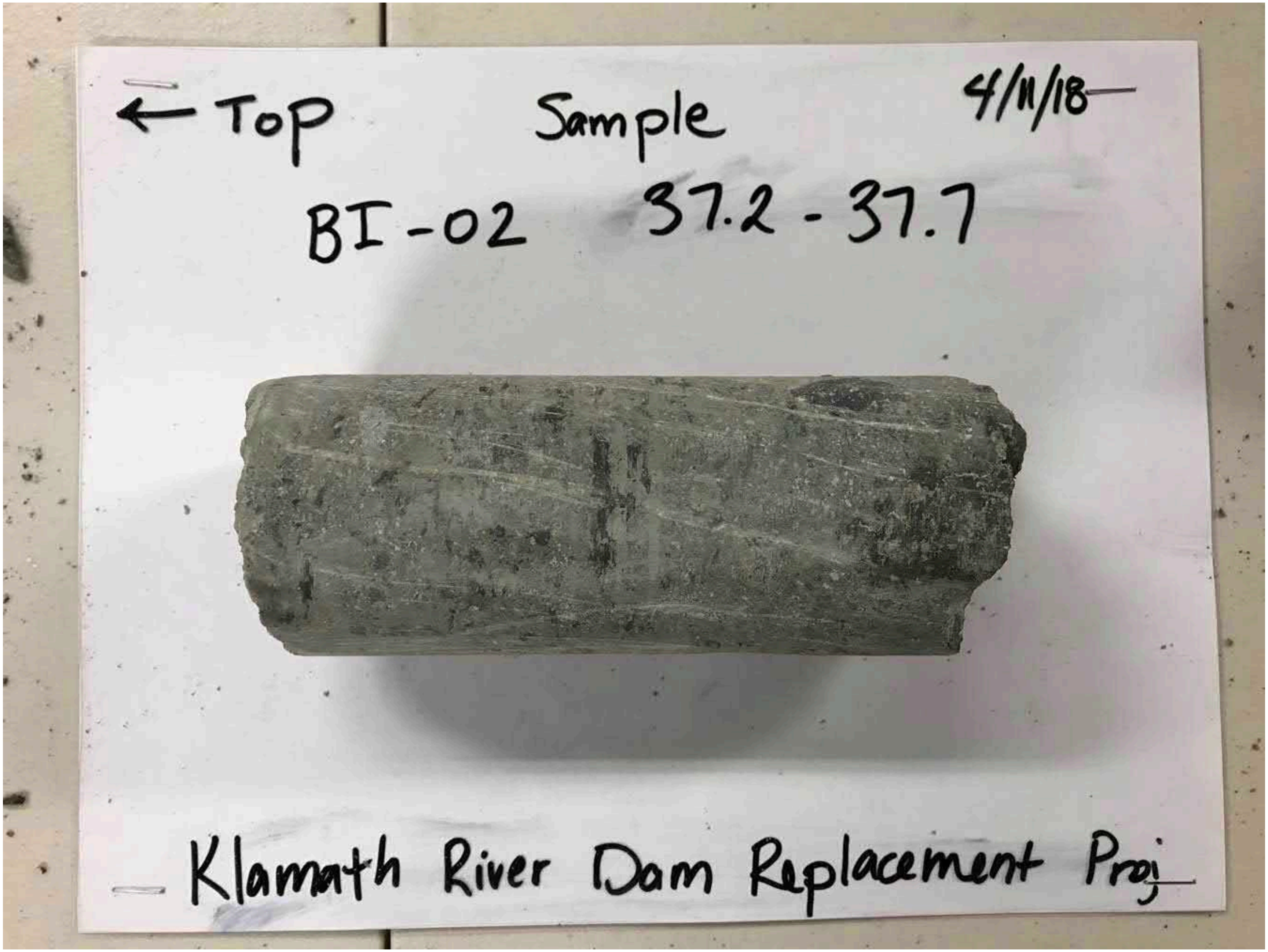
Sample
4/11/18
BI-02 32.2 - 33.4
Klamath River Dam Replacement Proj
Test Number


← Top
Sample
4/11/18
BI-02
32.2 - 33.4
Klamath River Dam Replacement Proj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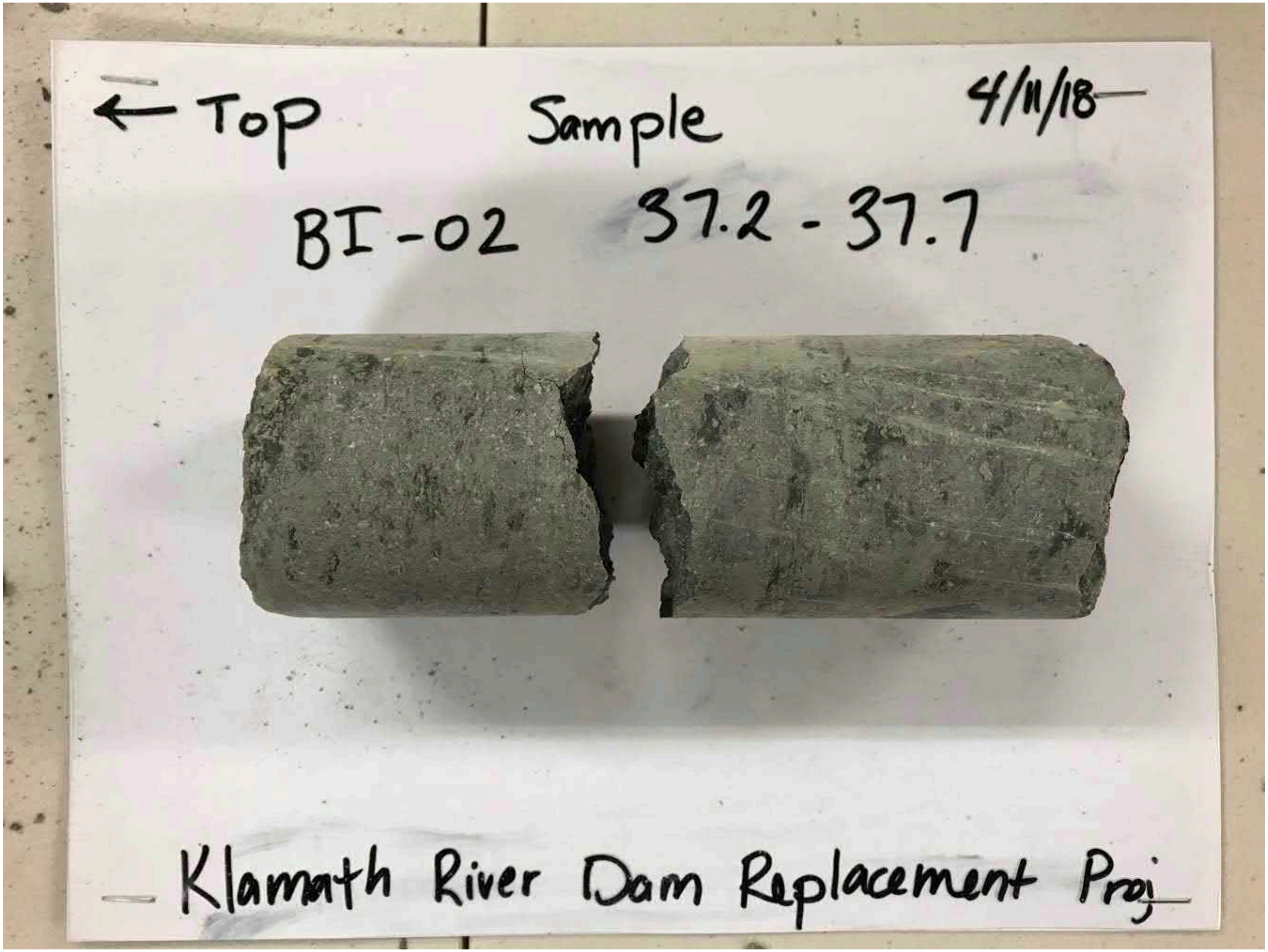
Sample
4/11/18
BI-02
37.2 - 37.7
Klamath River Dam Replacement Proj



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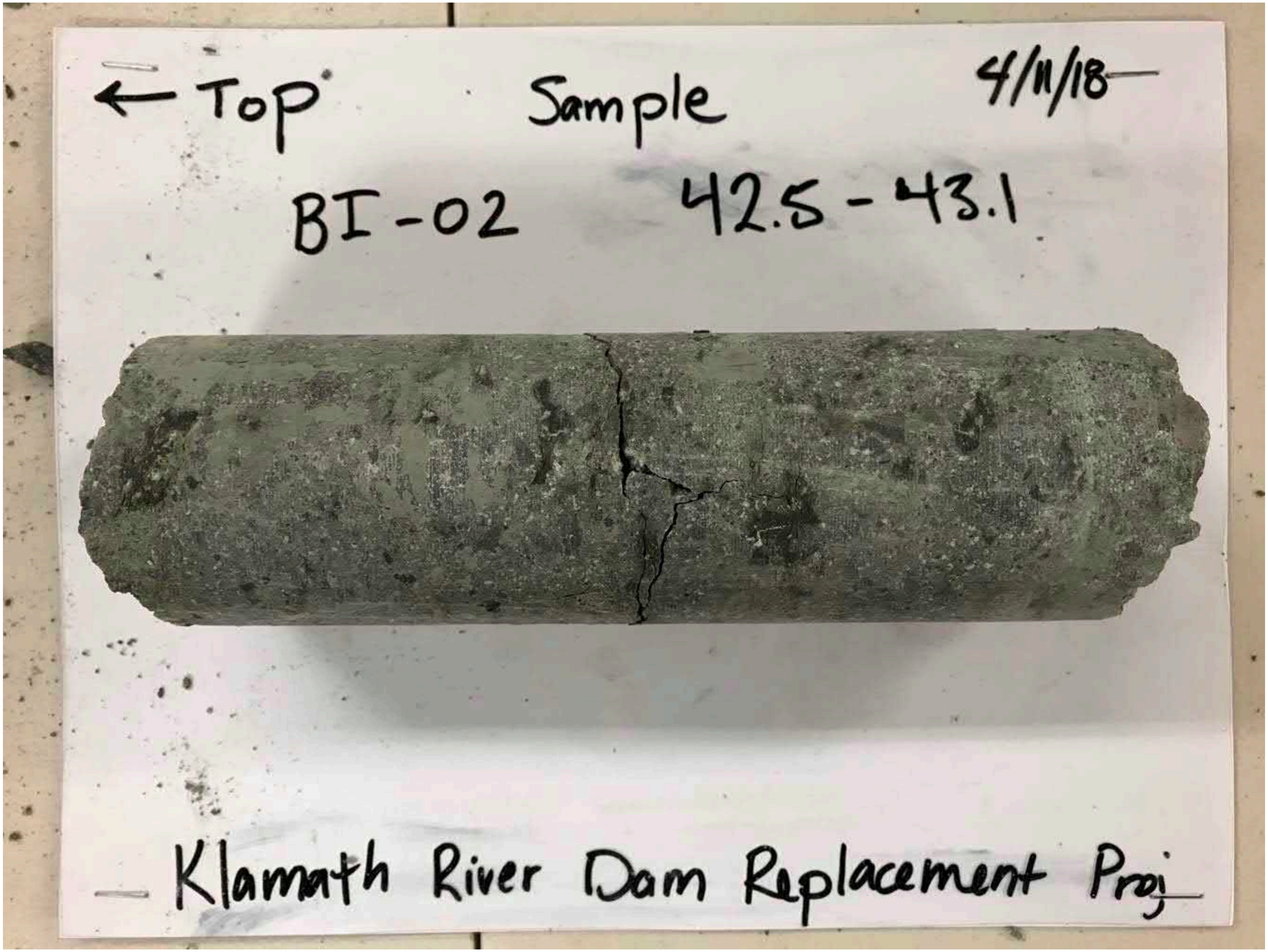
Sample
4/11/18
BI-02 37.2 - 37.7
Klamath River Dam Replacement Proj


← Top
Sample
4/11/18
BI-02
42.5 - 43.1
Klamath River Dam Replacement Proj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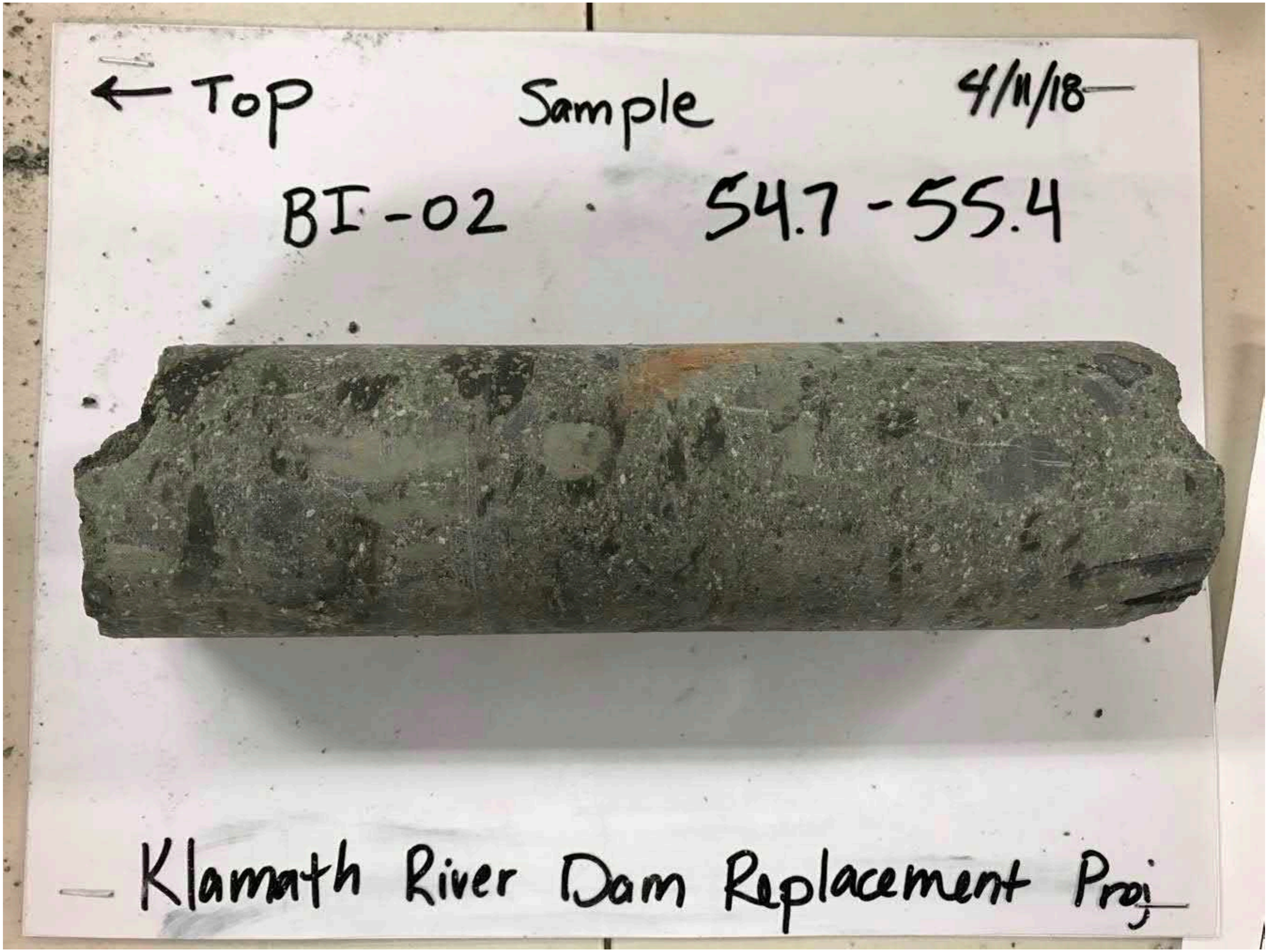
Sample
4/11/18
BI-02
42.5 - 43.1
Klamath River Dam Replacement Proj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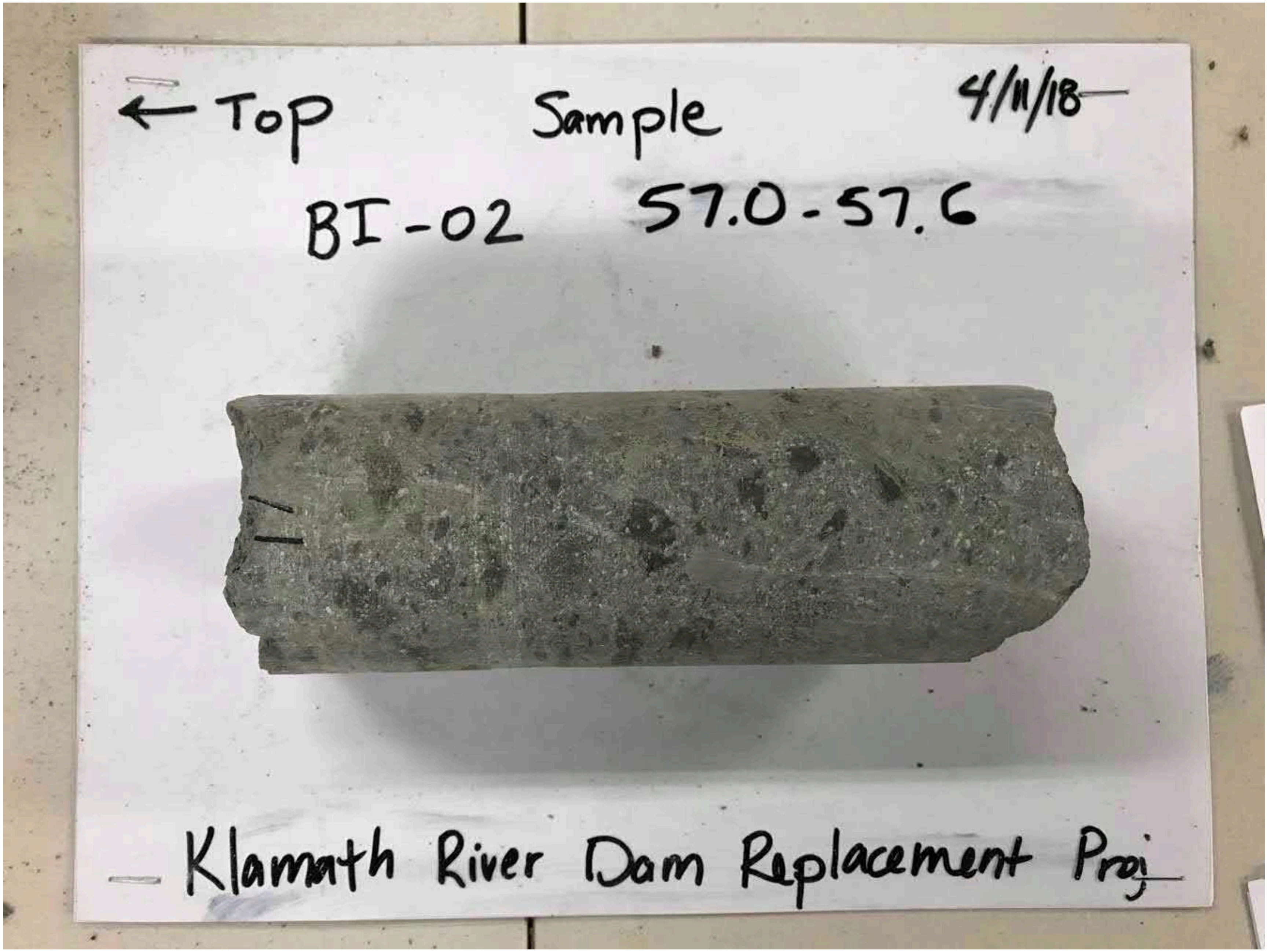
Sample
4/11/18
BI-02
54.7-55.4
Klamath River Dam Replacement Proj


← Top
Sample
4/11/18
BI-02
54.7 - 55.4
Klamath River Dam Replacement Proj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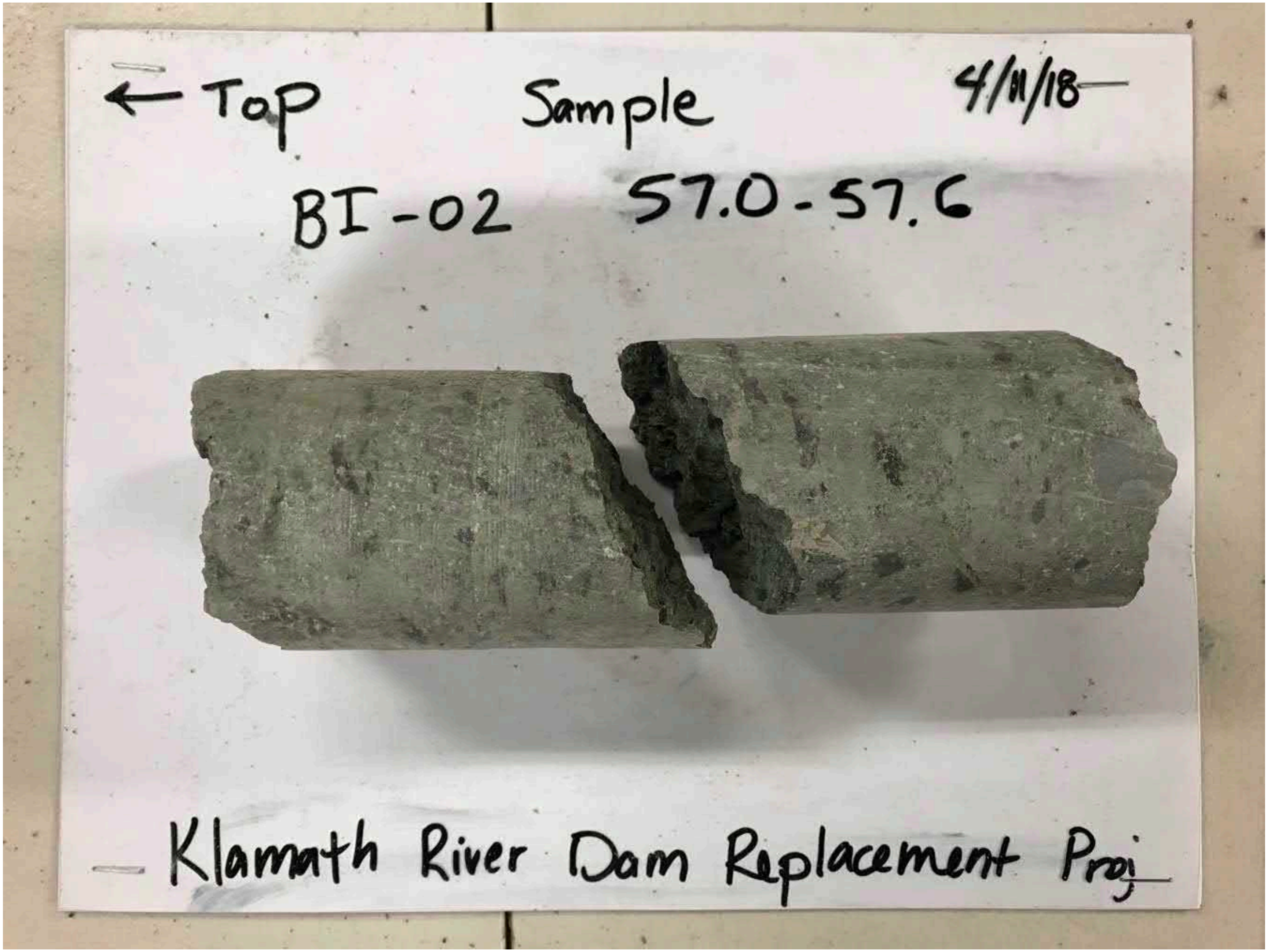
Sample
4/11/18
BI-02
57.0-57.6
Klamath River Dam Replacement Proj



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Sample
4/11/18
BI-02 57.0-57.6
Klamath River Dam Replacement Proj


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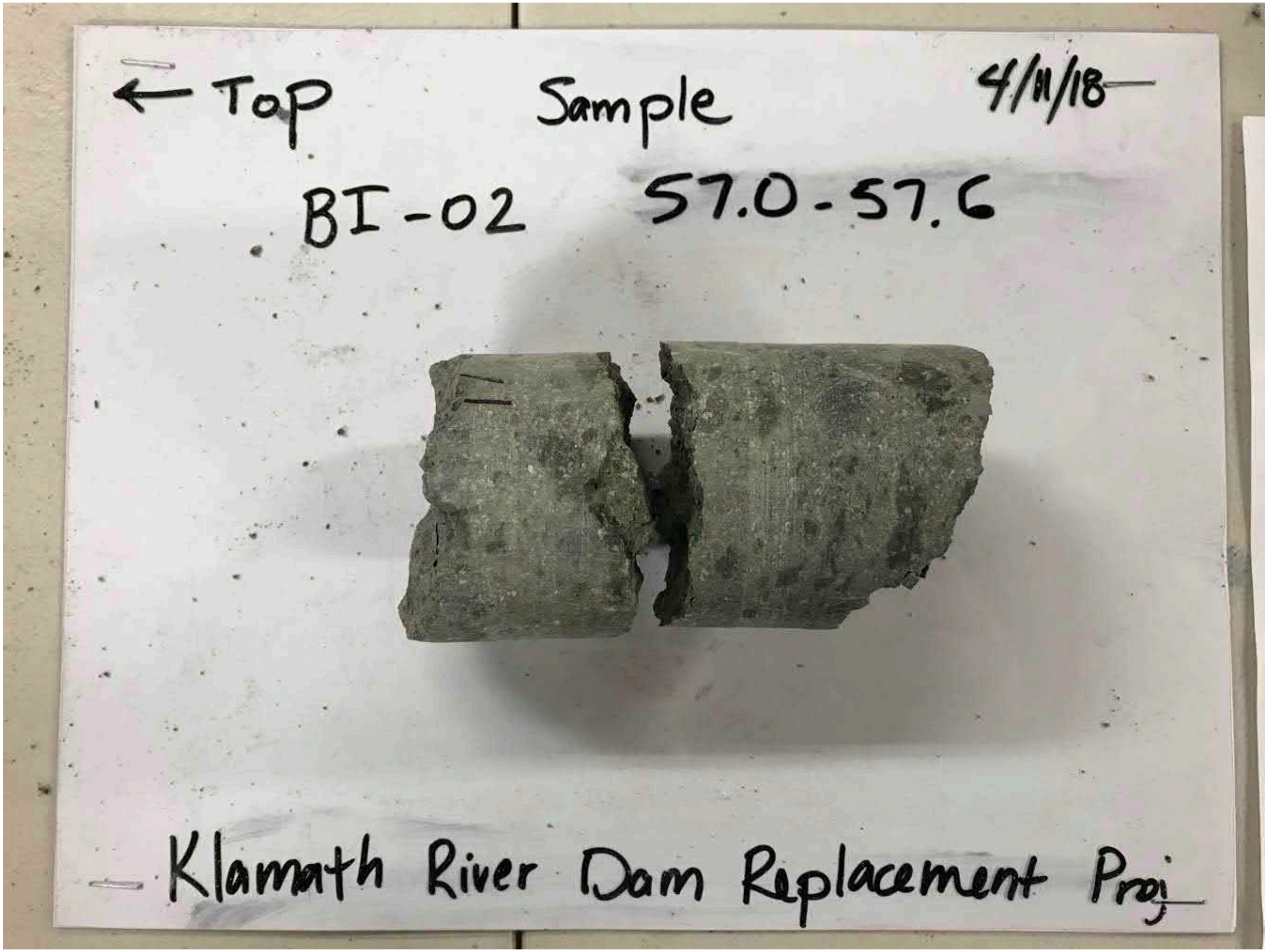
Sample
4/11/18
BI-02
57.0-57.6
Klamath River Dam Replacement Proj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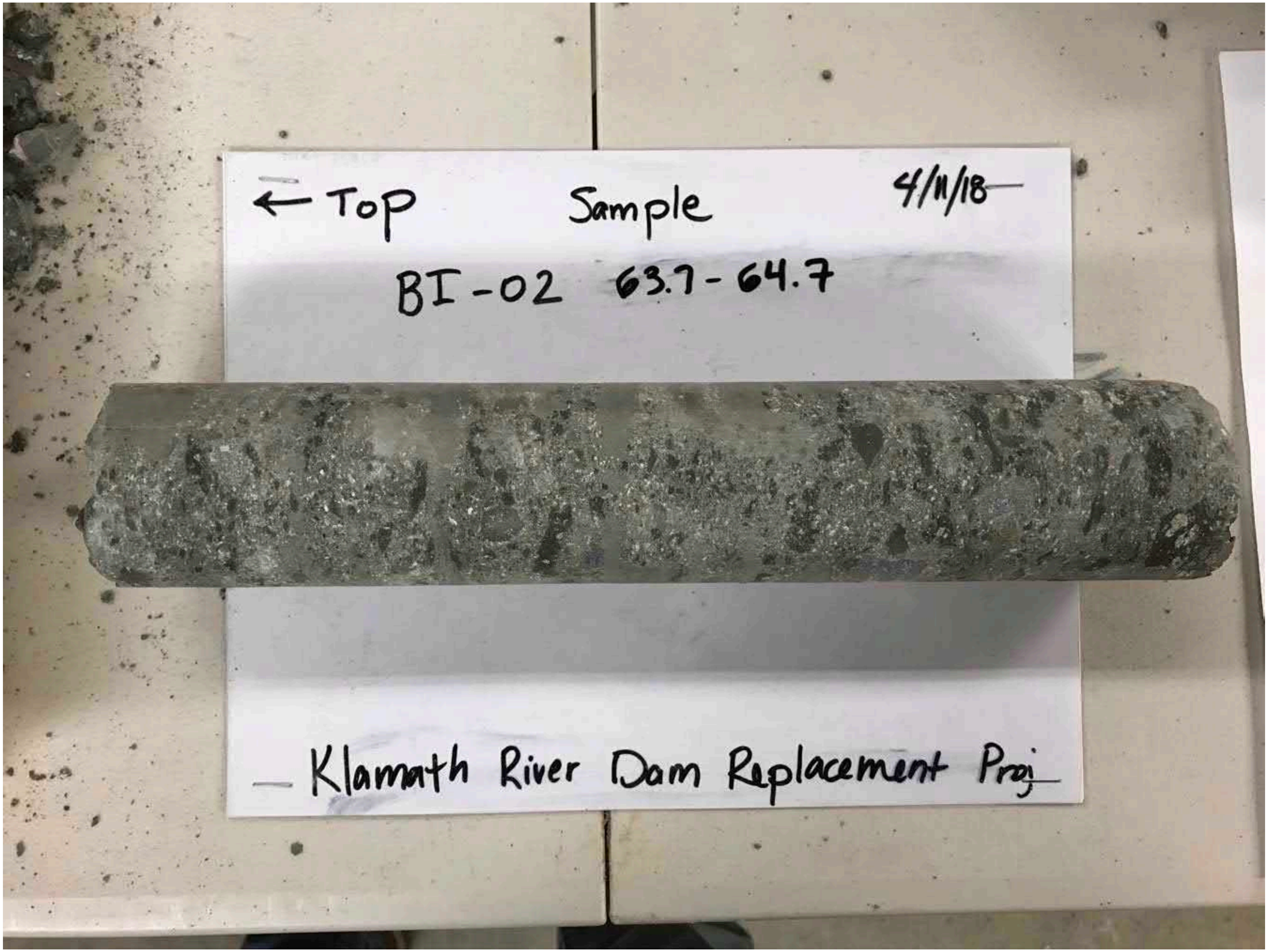
4/11/18
BI-02
57.0-57.6
Klamath River Dam Replacement Proj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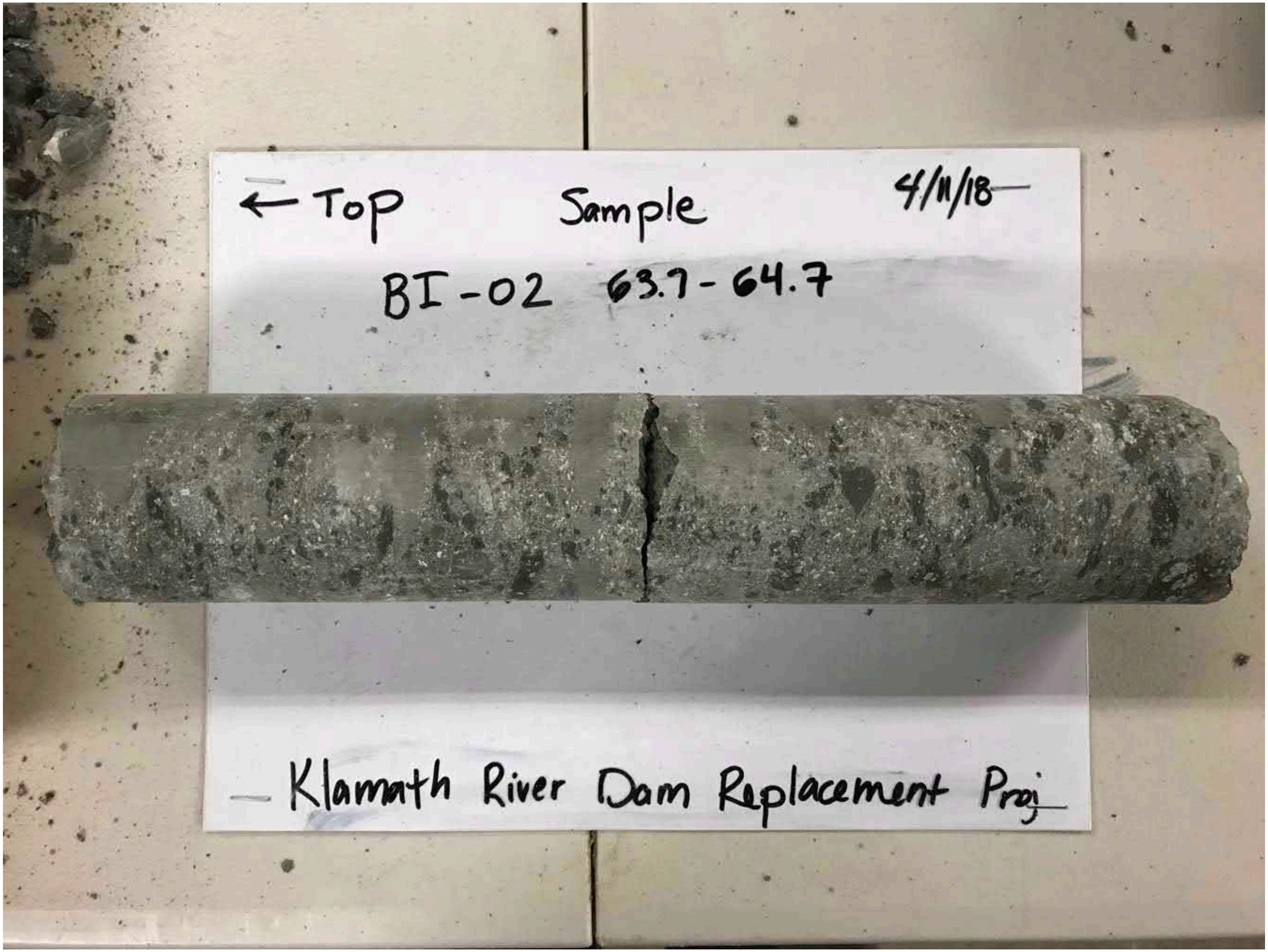
Sample
4/11/18
BI-02 63.7-64.7
Klamath River Dam Replacement Proj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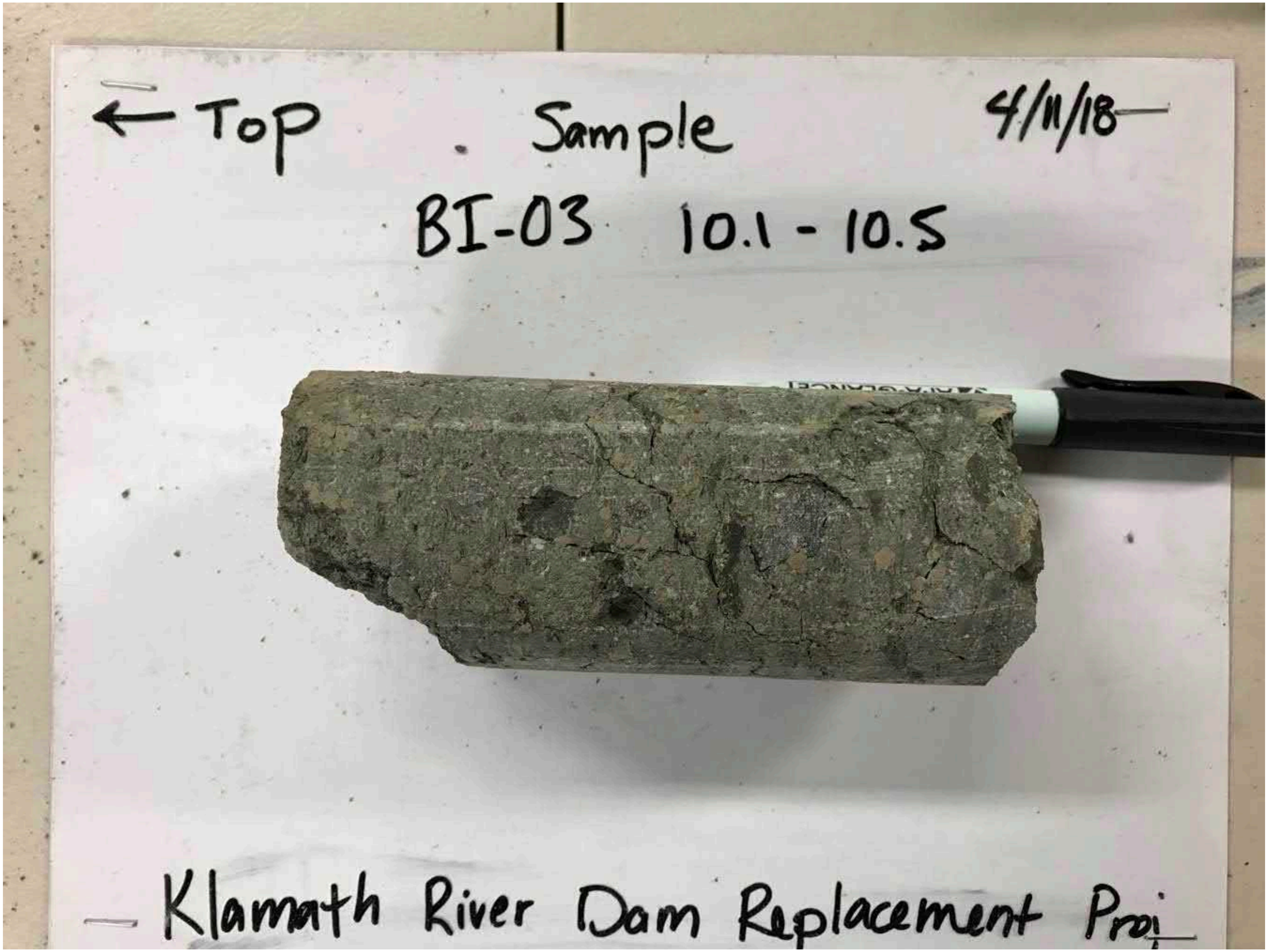
4/11/18
BI-02 63.7-64.7
Klamath River Dam Replacement Proj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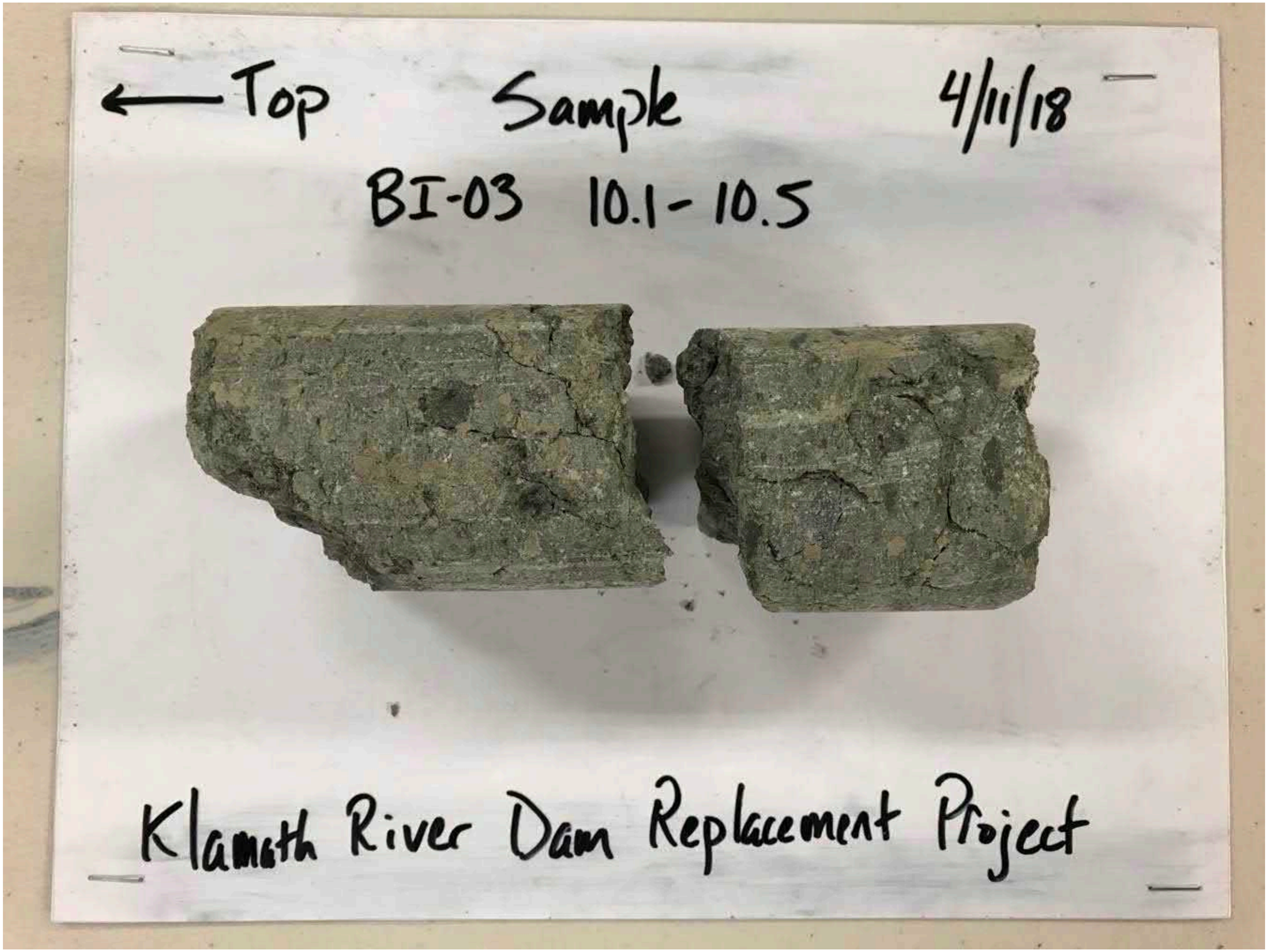
Sample
4/11/18
BI-03 10.1 - 10.5
Klamath River Dam Replacement Proj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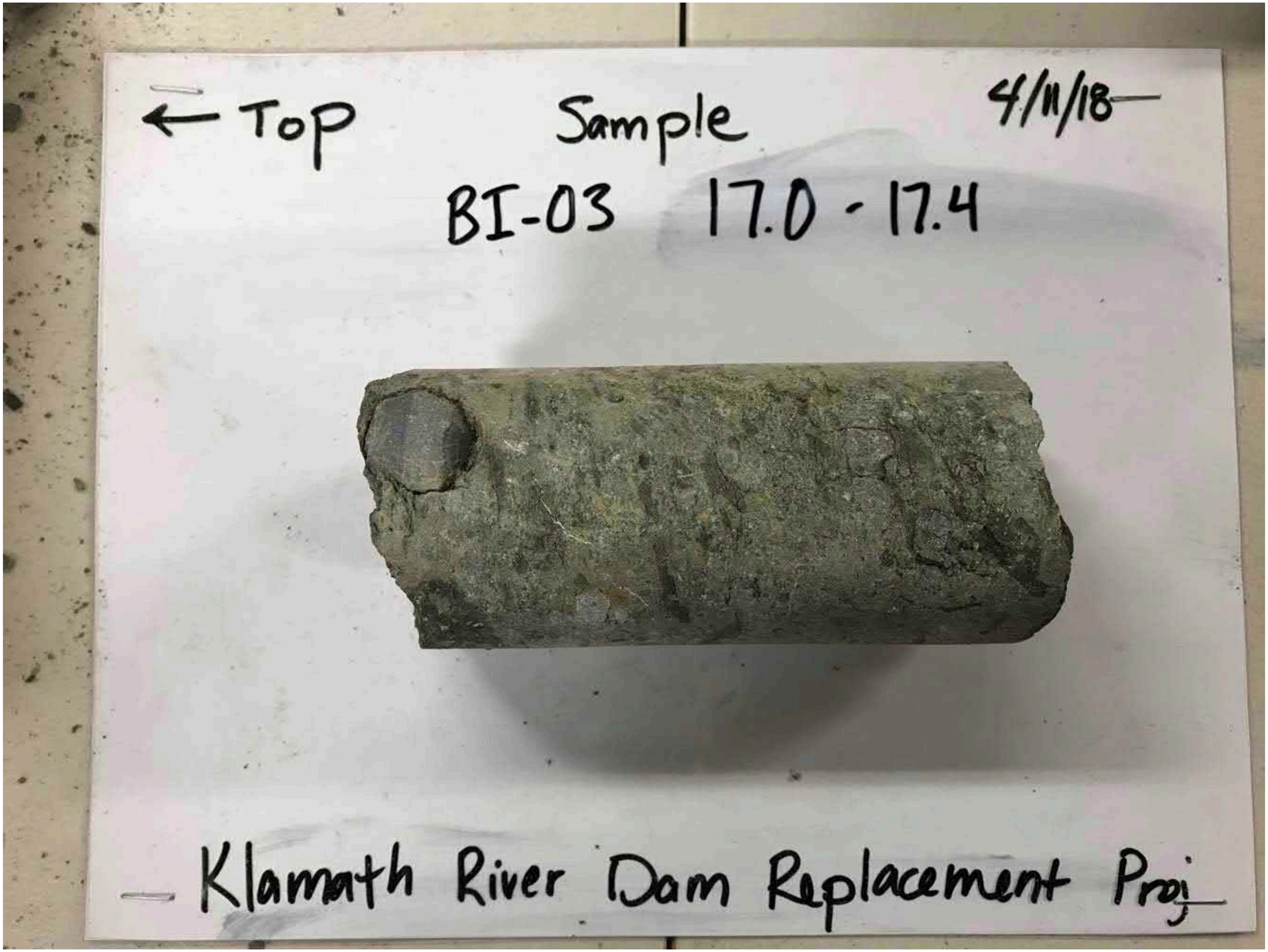
4/11/18
BI-03 10.1- 10.5
Klamath River Dam Replacement Project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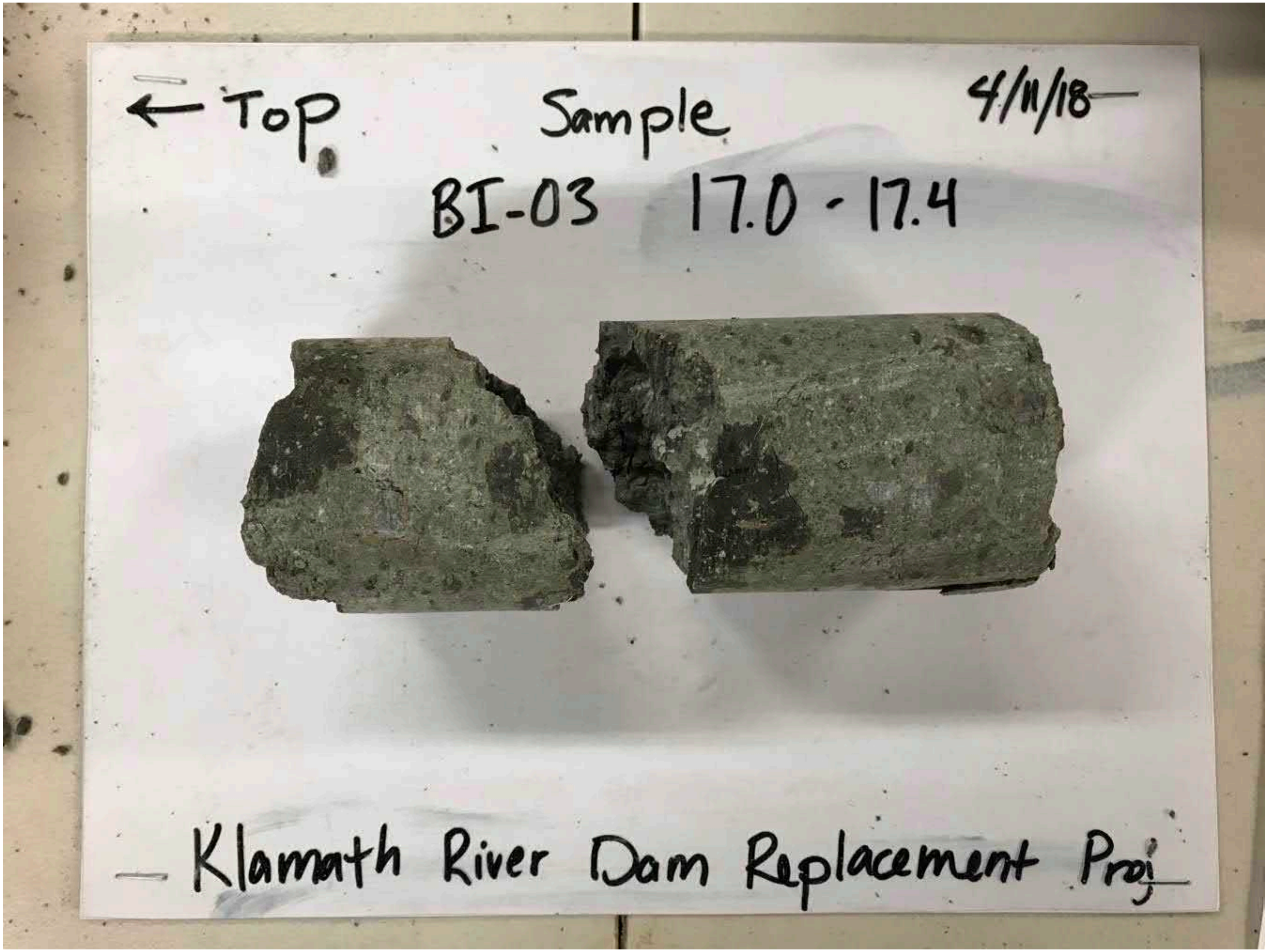
Sample
4/11/18
BI-03 17.0 - 17.4
Klamath River Dam Replacement Proj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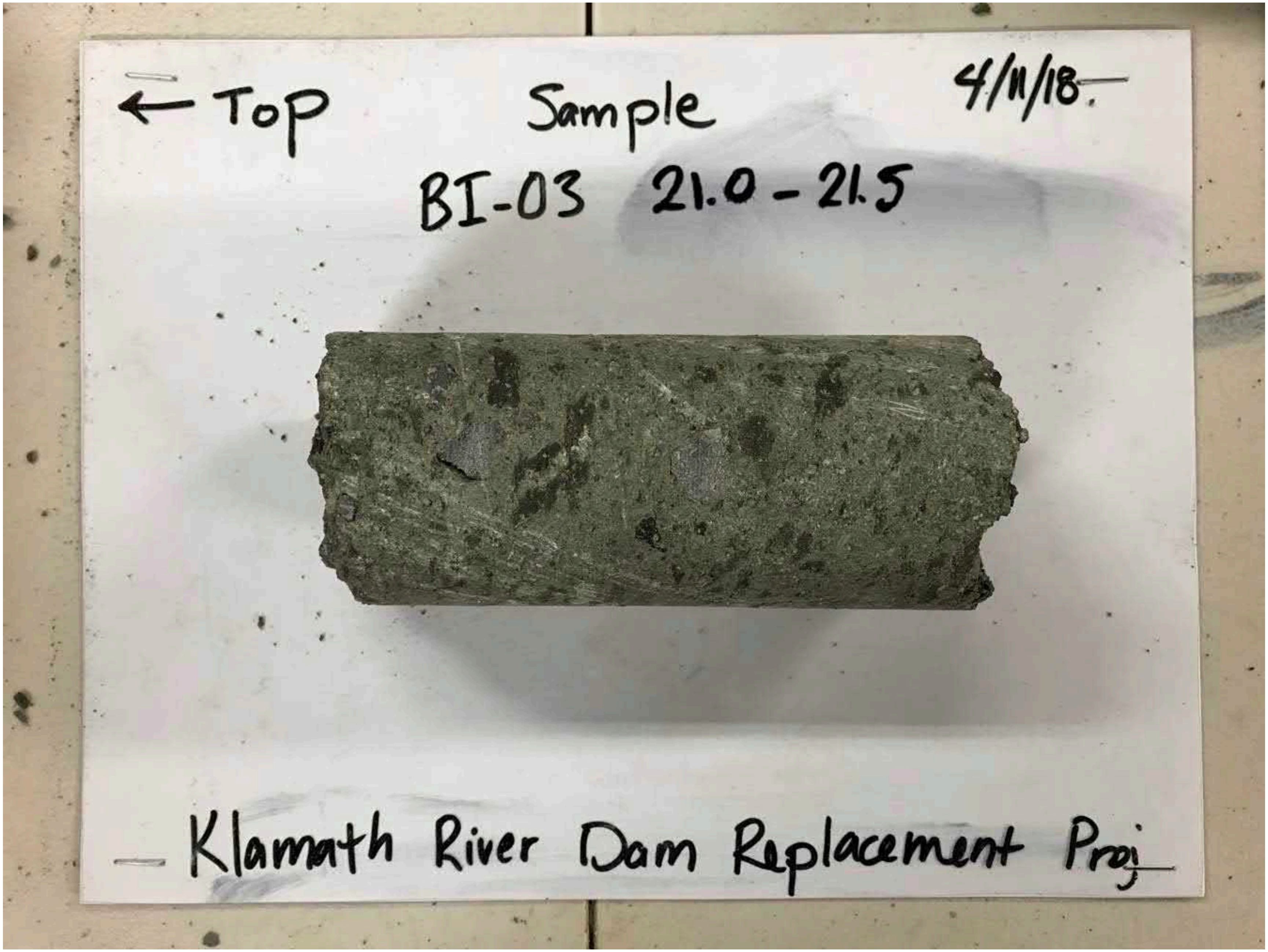
4/11/18
BI-03 17.0 - 17.4
Klamath River Dam Replacement Proj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Sample
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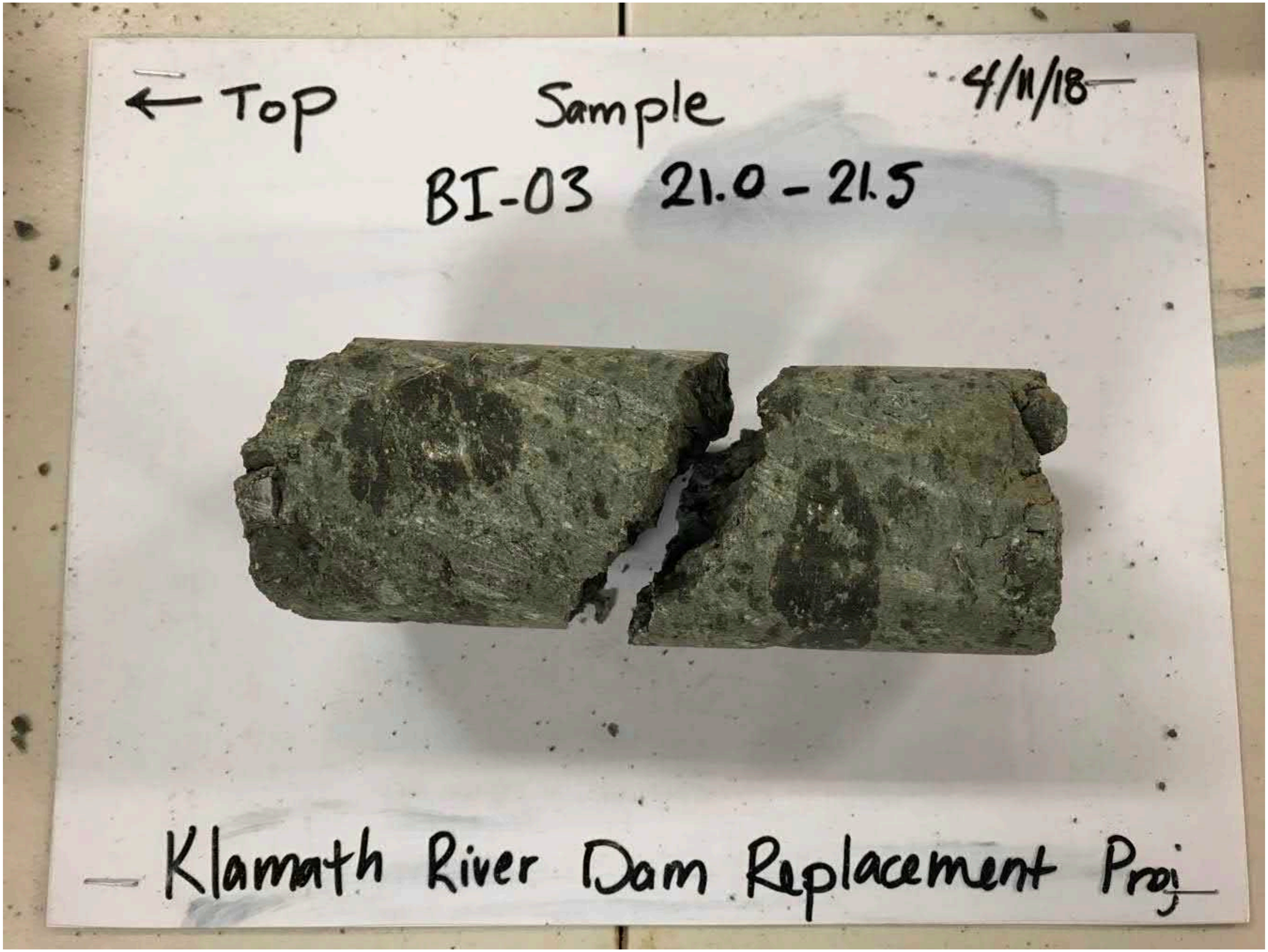
BI-03 21.0 - 21.5
Klamath River Dam Replacement Proj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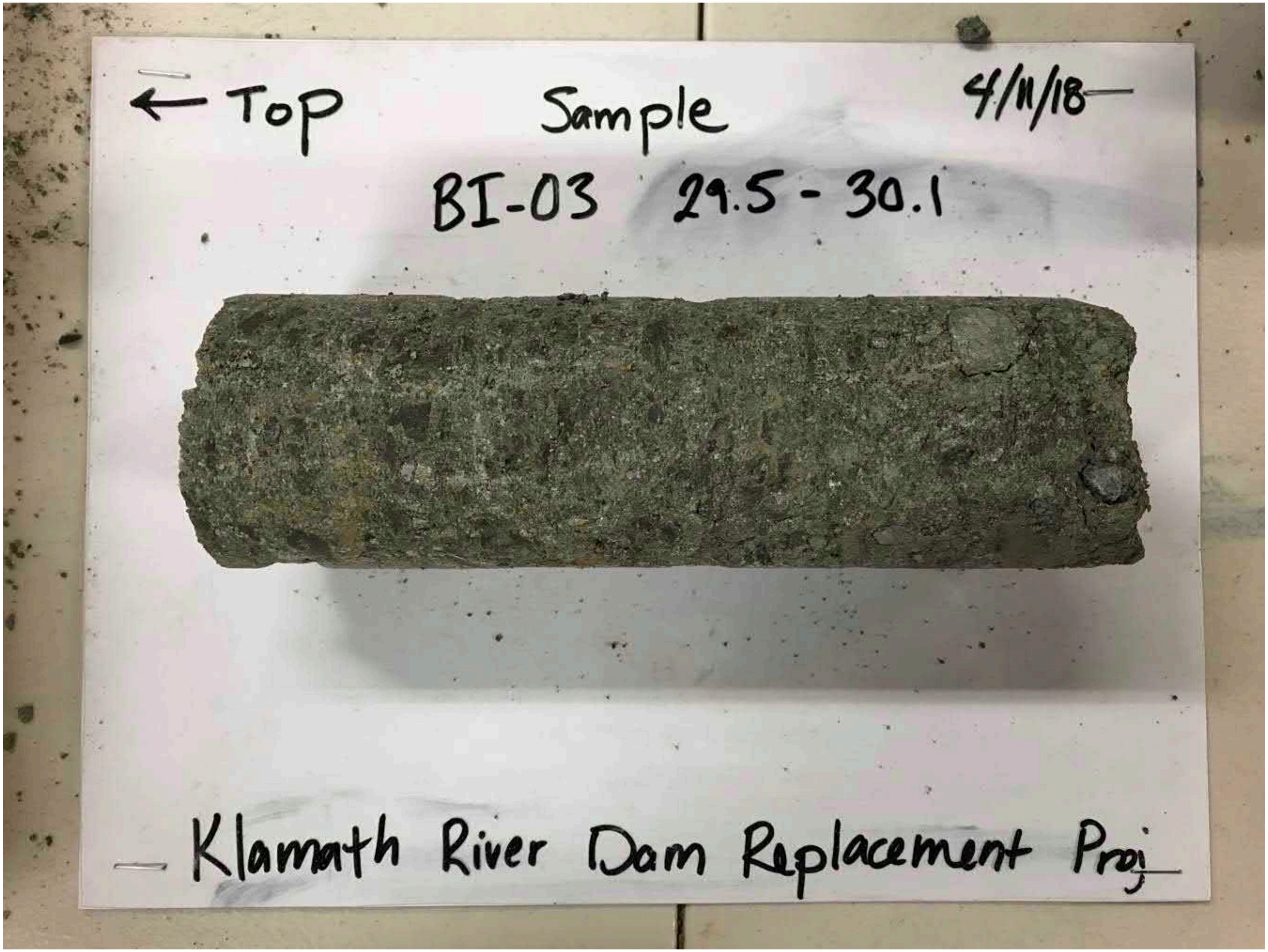
BI-03 21.0 - 21.5
Klamath River Dam Replacement Proj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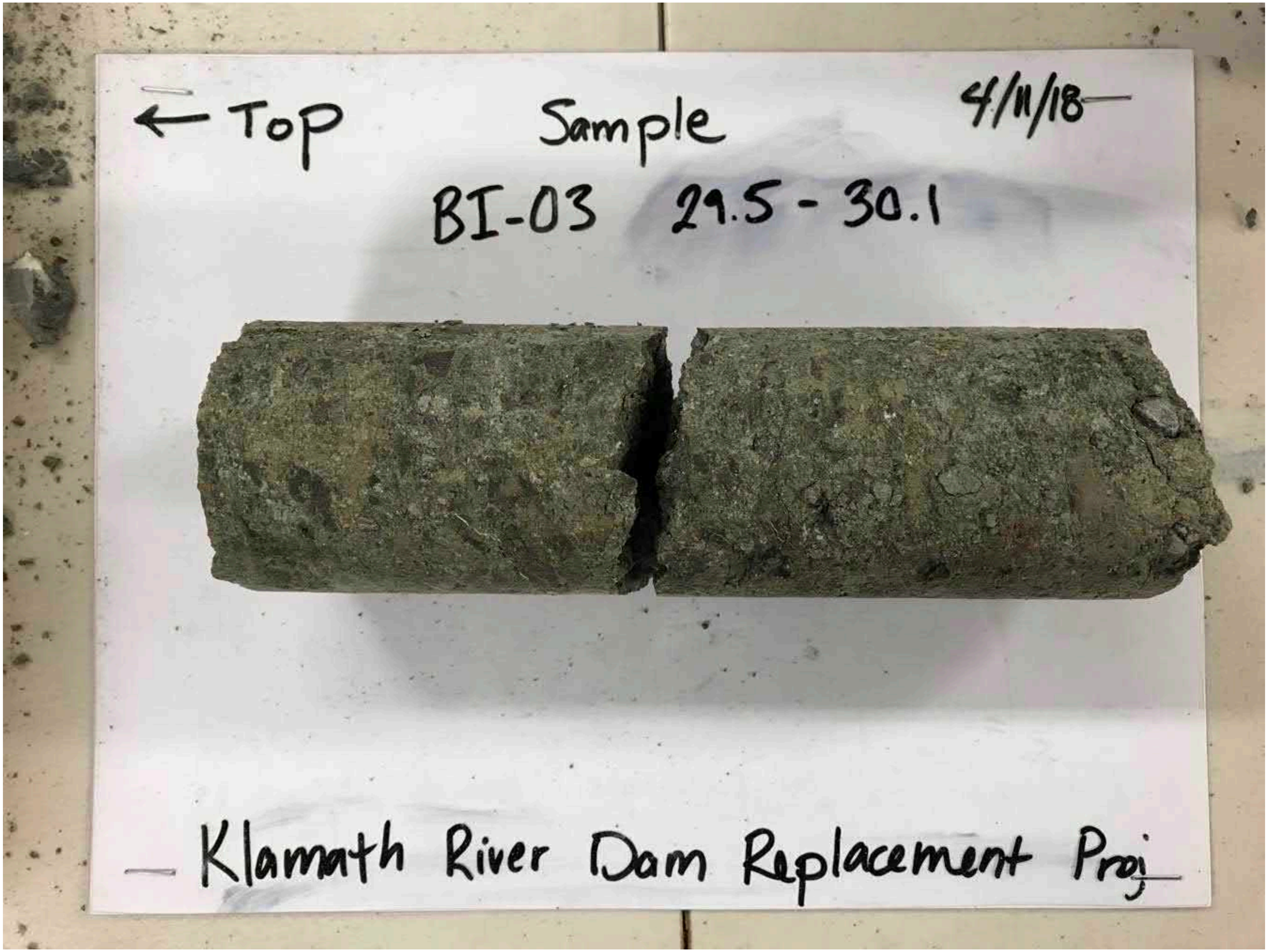
Sample
4/11/18
BI-03 29.5 - 30.1
Klamath River Dam Replacement Proj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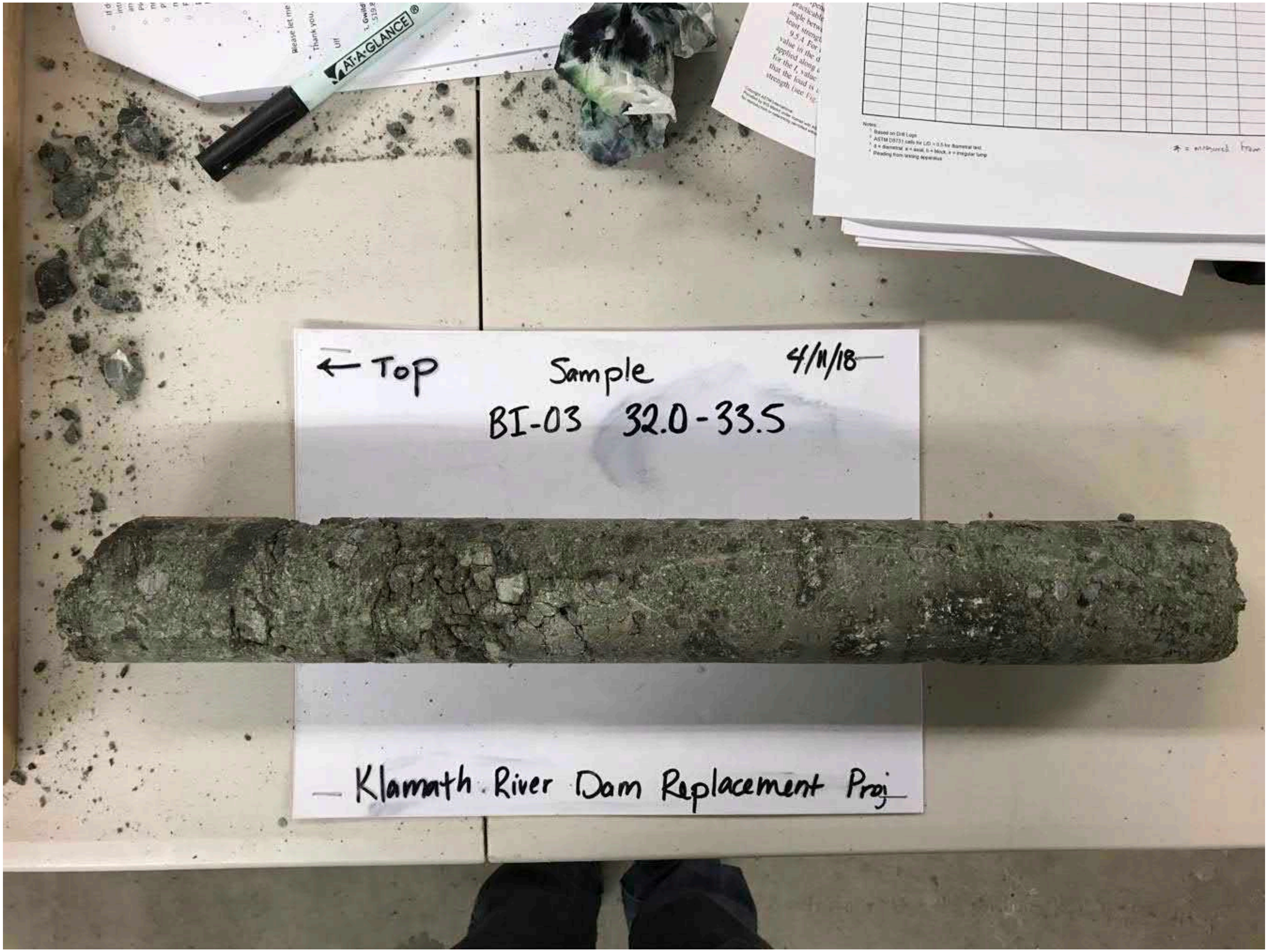
BI-03 29.5 - 30.1
Klamath River Dam Replacement Proj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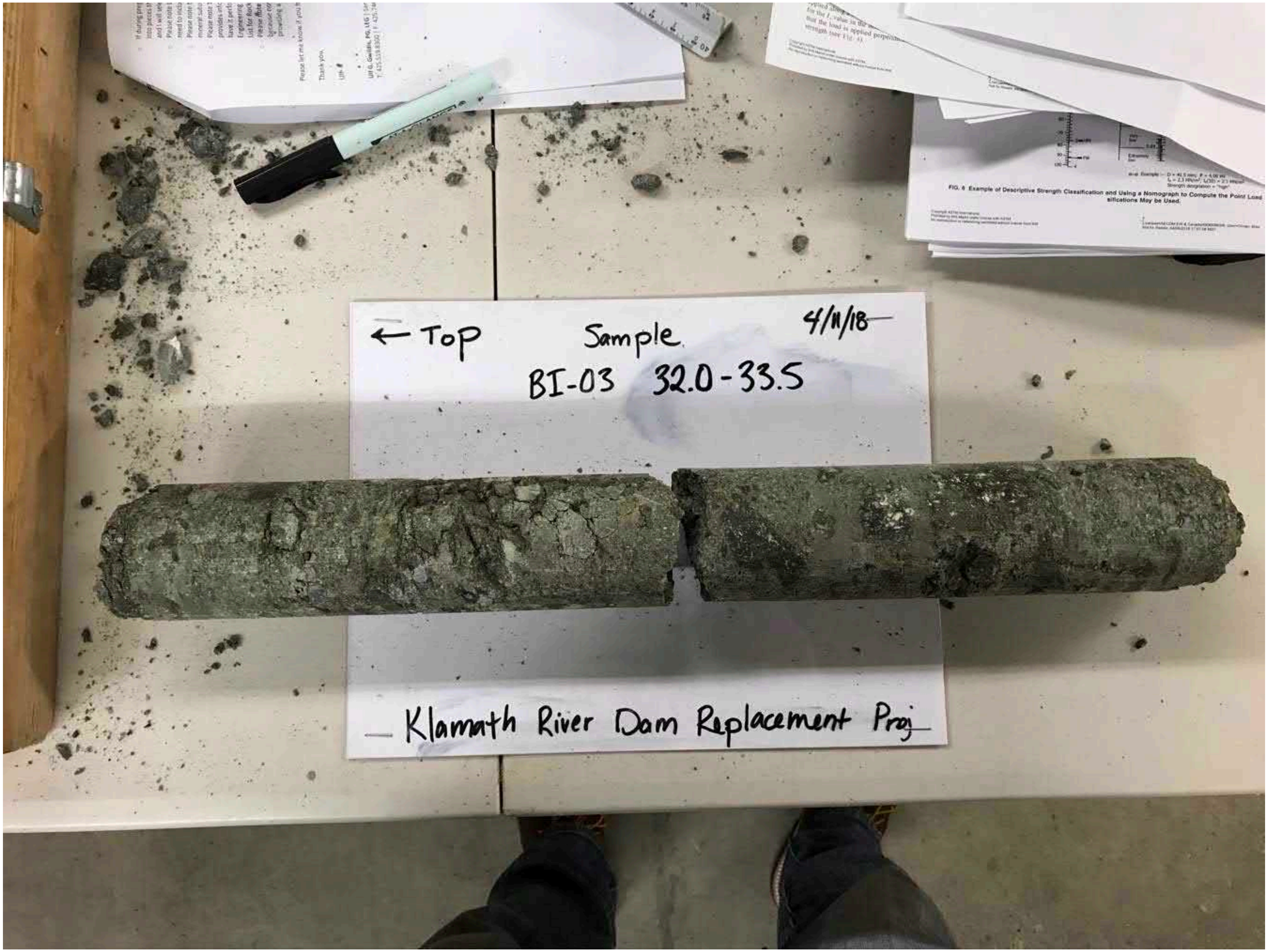
Sample
4/11/18
BI-03 32.0-33.5
Klamath River Dam Replacement Proj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Sample
4/11/18
BI-03 32.0-33.5
Klamath River Dam Replacement Proj

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/12/2019
By: PJ

Boring:	B-01					
Sample:	R5					
Depth, ft:	15.6					
Visual Description:	Brown Rock					
Test Type	Diametral					
Test Type ID	1					
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60					
Diameter at Failure, D', mm	54					
STRENGTH DATA						
Peak Load, P, kN	0.17					
Peak Load, P, lbs	38.2					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.052					
Uncorr. Pt. Load Strength Index,I_S, psi	**7.6**					
Size Correction Factor, F	1.06					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.06					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**8**					
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	20.16					
Total wet wt. (g)	142.33					
Total dry wt (g)	131.89					
Moisture Content, %	**9.3**					
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER
TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/12/2019
By: PJ

Boring:	B-01	B-01	B-01	B-01		
Sample:	R6	R6	R6	R6		
Depth, ft:	17.2-17.5	17.2-17.5	17.2-17.5	17.2-17.5		
Visual Description:	Brown Rock	Brown Rock	Brown Rock	Brown Rock		
Test Type	Diametral	Axial	Axial	Axial		
Test Type ID	1	2	2	2		
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None		
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A		
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	58	58	58	58		
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	58	40	35	23		
Diameter at Failure, D', mm	55	40	30	20		
STRENGTH DATA						
Peak Load, P, kN	0.148	0.346	0.272	0.187		
Peak Load, P, lbs	33.3	77.8	61.1	42.0		
Uncorr. Pt. Load Strength Index,I_S, MPa	0.046	0.117	0.123	0.127		
Uncorr. Pt. Load Strength Index,I_S, psi	**6.7**	**17.0**	**17.8**	**18.4**		
Size Correction Factor, F	1.06	1.04	0.97	0.89		
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.05	0.12	0.12	0.11		
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**7**	**18**	**17**	**16**		
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received		
Pan No.						
Pan wt. (g)	20.56	20.56	20.56	20.56		
Total wet wt. (g)	152.32	152.32	152.32	152.32		
Total dry wt (g)	145.93	145.93	145.93	145.93		
Moisture Content, %	**5.1**	**5.1**	**5.1**	**5.1**		
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/12/2019
By: PJ

Boring:	B-04					
Sample:	R5					
Depth, ft:	26.2-26.5					
Visual Description:	Brown Rock					
Test Type	Diametral					
Test Type ID	1					

FOR ANISOTROPIC ROCK:

Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					

SAMPLE DIMENSIONS

Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60					
Diameter at Failure, D', mm	69					

STRENGTH DATA

Peak Load, P, kN	0.137					
Peak Load, P, lbs	30.8					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.033					
Uncorr. Pt. Load Strength Index,I_S, psi	**4.8**					
Size Correction Factor, F	1.12					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.04					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**5**					

MOISTURE CONTENT DATA

Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	19.85					
Total wet wt. (g)	116.78					
Total dry wt (g)	107.55					
Moisture Content, %	**10.5**					
Comments:	Invalid point. Did not fail through both loading points.					

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/12/2019
By: PJ

Boring:	B-05	B-05	B-05	B-05	B-05	B-05
Sample:	R7	R7	R7	R7	R7	R7
Depth, ft:	26.2-26.9	26.2-26.9	26.2-26.9	26.2-26.9	26.2-26.9	26.2-26.9
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock
Test Type	Diametral	Diametral	Diametral	Diametral	Axial	Axial
Test Type ID	1	1	1	1	2	2
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None	None	None
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	N/A
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60	60	60
Length Perpendicular to Loading, L, mm	30	30	30	30		
Diameter Parallel to Loading, D, mm	60	60	60	60	26	43
Diameter at Failure, D', mm	54	54	56	55	30	38
STRENGTH DATA						
Peak Load, P, kN	26.016	27.563	24.68	19.511	19.242	21.155
Peak Load, P, lbs	5848.6	6196.4	5548.3	4386.2	4325.8	4755.8
Uncorr. Pt. Load Strength Index,I_S, MPa	8.030	8.507	7.345	5.912	8.396	7.287
Uncorr. Pt. Load Strength Index,I_S, psi	**1164.6**	**1233.9**	**1065.3**	**857.5**	**1217.7**	**1056.9**
Size Correction Factor, F	1.06	1.06	1.07	1.06	0.98	1.03
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	8.51	9.02	7.85	6.29	8.23	7.54
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**1235**	**1308**	**1139**	**913**	**1194**	**1093**
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	As Received
Pan No.						
Pan wt. (g)	22.43	22.43	22.43	22.43	22.43	22.43
Total wet wt. (g)	187.35	187.35	187.35	187.35	187.35	187.35
Total dry wt (g)	186.12	186.12	186.12	186.12	186.12	186.12
Moisture Content, %	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277

Project No.: 60537920

Client: AECOM

Date: 3/12/2019

Project Name: Klamath River Renewal Project

By: PJ

Boring:	B-05	B-05	B-05	B-05		
Sample:	R11	R11	R11	R11		
Depth, ft:	36.9-37.3	36.9-37.3	36.9-37.3	36.9-37.3		
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock		
Test Type	Diametral	Diametral	Axial	Axial		
Test Type ID	1	1	2	2		
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None		
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A		
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60		
Length Perpendicular to Loading, L, mm	30	30				
Diameter Parallel to Loading, D, mm	60	60	30	40		
Diameter at Failure, D', mm	56	55	26	32		
STRENGTH DATA						
Peak Load, P, kN	33.123	32.033	14.521	18.344		
Peak Load, P, lbs	7446.3	7201.3	3264.5	4123.9		
Uncorr. Pt. Load Strength Index,I_S, MPa	9.858	9.707	7.311	7.504		
Uncorr. Pt. Load Strength Index,I_S, psi	**1429.8**	**1407.9**	**1060.3**	**1088.3**		
Size Correction Factor, F	1.07	1.06	0.95	0.99		
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	10.54	10.33	6.94	7.47		
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**1528**	**1499**	**1007**	**1083**		
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received		
Pan No.						
Pan wt. (g)	22.95	22.95	22.95	22.95		
Total wet wt. (g)	152.73	152.73	152.73	152.73		
Total dry wt (g)	152.3	152.3	152.3	152.3		
Moisture Content, %	**0.3**	**0.3**	**0.3**	**0.3**		
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/12/2019
By: PJ

Boring:	B-05	B-05	B-05	B-05	B-05	B-05
Sample:	R15	R15	R15	R15	R15	R15
Depth, ft:	46.1-46.8	46.1-46.8	46.1-46.8	46.1-46.8	46.1-46.8	46.1-46.8
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock
Test Type	Diametral	Diametral	Diametral	Diametral	Axial	Axial
Test Type ID	1	1	1	1	2	2
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None	None	None
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	N/A
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60	60	60
Length Perpendicular to Loading, L, mm	30	30	30	30		
Diameter Parallel to Loading, D, mm	60	60	60	60	36	34
Diameter at Failure, D', mm	56	56	57	56	35	28
STRENGTH DATA						
Peak Load, P, kN	24.093	33.912	27.929	24.365	22.269	21.115
Peak Load, P, lbs	5416.3	7623.7	6278.7	5477.5	5006.3	4746.8
Uncorr. Pt. Load Strength Index,I_S, MPa	7.171	10.093	8.166	7.251	8.329	9.871
Uncorr. Pt. Load Strength Index,I_S, psi	**1040.0**	**1463.8**	**1184.4**	**1051.7**	**1208.0**	**1431.7**
Size Correction Factor, F	1.07	1.07	1.07	1.07	1.02	0.97
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	7.66	10.79	8.76	7.75	8.46	9.53
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**1112**	**1565**	**1271**	**1124**	**1226**	**1382**
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	As Received
Pan No.						
Pan wt. (g)	19.79	19.79	19.79	19.79	19.79	19.79
Total wet wt. (g)	138.47	138.47	138.47	138.47	138.47	138.47
Total dry wt (g)	137.97	137.97	137.97	137.97	137.97	137.97
Moisture Content, %	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/12/2019
By: PJ

Boring:	B-07					
Sample:	R6					
Depth, ft:	29.3-29.6					
Visual Description:	Red Rock					
Test Type	Diametral					
Test Type ID	1					
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60					
Diameter at Failure, D', mm	56					
STRENGTH DATA						
Peak Load, P, kN	0.22					
Peak Load, P, lbs	49.5					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.065					
Uncorr. Pt. Load Strength Index,I_S, psi	**9.5**					
Size Correction Factor, F	1.07					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.07					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**10**					
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	21.71					
Total wet wt. (g)	148.91					
Total dry wt (g)	139.87					
Moisture Content, %	**7.7**					
Comments:	Invalid point. Did not fail through both loading points.					

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Project No.: 60537920
Client: AECOM
Date: 3/12/2019
Project Name: Klamath River Renewal Project
By: PJ

Boring:	B-08	B-08	B-08			
Sample:	R1	R1	R1			
Depth, ft:	37.1-37.6	37.1-37.6	37.1-37.6			
Visual Description:	Gray Rock	Gray Rock	Gray Rock			
Test Type	Diametral	Diametral	Axial			
Test Type ID	1	1	2			
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None			
Loading Orientation Rel. to Bedding	N/A	N/A	N/A			
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60			
Length Perpendicular to Loading, L, mm	30	30				
Diameter Parallel to Loading, D, mm	60	60	36			
Diameter at Failure, D', mm	58	59	46			
STRENGTH DATA						
Peak Load, P, kN	0.692	0.484	0.327			
Peak Load, P, lbs	155.6	108.8	73.5			
Uncorr. Pt. Load Strength Index,I_S, MPa	0.199	0.137	0.093			
Uncorr. Pt. Load Strength Index,I_S, psi	**28.8**	**19.8**	**13.5**			
Size Correction Factor, F	1.08	1.08	1.08			
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.21	0.15	0.10			
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**31**	**21**	**15**			
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received			
Pan No.						
Pan wt. (g)	19.25	19.25	19.25			
Total wet wt. (g)	168.79	168.79	168.79			
Total dry wt (g)	156.2	156.2	156.2			
Moisture Content, %	**9.2**	**9.2**	**9.2**			
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Project No.: 60537920
Client: AECOM
Date: 3/12/2019
Project Name: Klamath River Renewal Project
By: PJ

Boring:	B-08					
Sample:	R2					
Depth, ft:	38.6-38.9					
Visual Description:	Gray Rock					
Test Type	Diametral					
Test Type ID	1					
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60					
Diameter at Failure, D', mm	58					
STRENGTH DATA						
Peak Load, P, kN	1.122					
Peak Load, P, lbs	252.2					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.322					
Uncorr. Pt. Load Strength Index,I_S, psi	**46.8**					
Size Correction Factor, F	1.08					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.35					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**50**					
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	20.6					
Total wet wt. (g)	298.27					
Total dry wt (g)	282.19					
Moisture Content, %	**6.1**					
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-08					
Sample:	R4					
Depth, ft:	50.2-50.6					
Visual Description:	Gray Rock					
Test Type	Diametral					
Test Type ID	1					

FOR ANISOTROPIC ROCK:

Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					

SAMPLE DIMENSIONS

Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60					
Diameter at Failure, D', mm	59					

STRENGTH DATA

Peak Load, P, kN	3.384					
Peak Load, P, lbs	760.8					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.956					
Uncorr. Pt. Load Strength Index,I_S, psi	**138.6**					
Size Correction Factor, F	1.08					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	1.03					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**150**					

MOISTURE CONTENT DATA

Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	22.27					
Total wet wt. (g)	391.5					
Total dry wt (g)	378.35					
Moisture Content, %	**3.7**					
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER
TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-10					
Sample:	R1					
Depth, ft:	30.4-30.7					
Visual Description:	Gray Rock					
Test Type	Diametral					
Test Type ID	1					
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60					
Diameter at Failure, D', mm	56					
STRENGTH DATA						
Peak Load, P, kN	9.55					
Peak Load, P, lbs	2146.9					
Uncorr. Pt. Load Strength Index,I_S, MPa	2.842					
Uncorr. Pt. Load Strength Index,I_S, psi	**412.2**					
Size Correction Factor, F	1.07					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	3.04					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**441**					
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	22.44					
Total wet wt. (g)	267.19					
Total dry wt (g)	259.78					
Moisture Content, %	**3.1**					
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-10	B-10				
Sample:	R3	R3				
Depth, ft:	33.4-33.7	33.4-33.7				
Visual Description:	Gray Rock	Gray Rock				
Test Type	Diametral	Axial				
Test Type ID	1	2				
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None				
Loading Orientation Rel. to Bedding	N/A	N/A				
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60				
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60	44				
Diameter at Failure, D', mm	56	42				
STRENGTH DATA						
Peak Load, P, kN	0.374	0.101				
Peak Load, P, lbs	84.1	22.7				
Uncorr. Pt. Load Strength Index,I_S, MPa	0.111	0.031				
Uncorr. Pt. Load Strength Index,I_S, psi	**16.1**	**4.6**				
Size Correction Factor, F	1.07	1.06				
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.12	0.03				
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**17**	**5**				
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received				
Pan No.						
Pan wt. (g)	22.32	22.32				
Total wet wt. (g)	159.18	159.18				
Total dry wt (g)	144.98	144.98				
Moisture Content, %	**11.6**	**11.6**				
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: 3/13/2019

Boring:	B-10	B-10	B-10	B-10		
Sample:	R4	R4	R4	R4		
Depth, ft:	37.1-37.4	37.1-37.4	37.1-37.4	37.1-37.4		
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock		
Test Type	Diametral	Diametral	Axial	Axial		
Test Type ID	1	1	2	2		
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None		
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A		
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60		
Length Perpendicular to Loading, L, mm	30	30				
Diameter Parallel to Loading, D, mm	60	60	37	36		
Diameter at Failure, D', mm	58	56	33	28		
STRENGTH DATA						
Peak Load, P, kN	0.435	0.521	0.225	0.313		
Peak Load, P, lbs	97.8	117.1	50.6	70.4		
Uncorr. Pt. Load Strength Index,I_S, MPa	0.125	0.155	0.089	0.146		
Uncorr. Pt. Load Strength Index,I_S, psi	**18.1**	**22.5**	**12.9**	**21.2**		
Size Correction Factor, F	1.08	1.07	1.00	0.97		
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.13	0.17	0.09	0.14		
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**20**	**24**	**13**	**20**		
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received		
Pan No.						
Pan wt. (g)	22.12	22.12	22.12	22.12		
Total wet wt. (g)	154	154	154	154		
Total dry wt (g)	140.19	140.19	140.19	140.19		
Moisture Content, %	**11.7**	**11.7**	**11.7**	**11.7**		
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-10	B-10				
Sample:	R7	R7				
Depth, ft:	49-49.5	49-49.5				
Visual Description:	Gray Rock	Gray Rock				
Test Type	Diametral	Axial				
Test Type ID	1	2				
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None				
Loading Orientation Rel. to Bedding	N/A	N/A				
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60				
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60	30				
Diameter at Failure, D', mm	58	29				
STRENGTH DATA						
Peak Load, P, kN	2.077	1.996				
Peak Load, P, lbs	466.9	448.7				
Uncorr. Pt. Load Strength Index,I_S, MPa	0.597	0.901				
Uncorr. Pt. Load Strength Index,I_S, psi	**86.6**	**130.7**				
Size Correction Factor, F	1.08	0.97				
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.64	0.88				
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**93**	**127**				
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received				
Pan No.						
Pan wt. (g)	22.33	22.33				
Total wet wt. (g)	379.89	379.89				
Total dry wt (g)	357.27	357.27				
Moisture Content, %	**6.8**	**6.8**				
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-13	B-13	B-13	B-13	B-13	
Sample:	R4	R4	R4	R4	R4	
Depth, ft:	11.9-12.4	11.9-12.4	11.9-12.4	11.9-12.4	11.9-12.4	
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	
Test Type	Diametral	Diametral	Diametral	Axial	Axial	
Test Type ID	1	1	1	2	2	
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None	None	
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60	60	
Length Perpendicular to Loading, L, mm	30	30	30			
Diameter Parallel to Loading, D, mm	60	60	60	46	40	
Diameter at Failure, D', mm	59	57	59	45	36	
STRENGTH DATA						
Peak Load, P, kN	12.808	20.405	17.108	16.519	15.518	
Peak Load, P, lbs	2879.4	4587.2	3846.0	3713.6	3488.6	
Uncorr. Pt. Load Strength Index,I_S, MPa	3.618	5.966	4.833	4.805	5.643	
Uncorr. Pt. Load Strength Index,I_S, psi	**524.8**	**865.4**	**700.9**	**696.9**	**818.4**	
Size Correction Factor, F	1.08	1.07	1.08	1.07	1.02	
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	3.91	6.40	5.23	5.16	5.76	
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**567**	**929**	**758**	**749**	**836**	
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	
Pan No.						
Pan wt. (g)	22.32	22.32	22.32	22.32	22.32	
Total wet wt. (g)	215.87	215.87	215.87	215.87	215.87	
Total dry wt (g)	215.69	215.69	215.69	215.69	215.69	
Moisture Content, %	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-14	B-14	B-14	B-14	B-14	B-14
Sample:	R6	R6	R6	R6	R6	R6
Depth, ft:	14.2-14.9	14.2-14.9	14.2-14.9	14.2-14.9	14.2-14.9	14.2-14.9
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock
Test Type	Diametral	Diametral	Diametral	Axial	Axial	Axial
Test Type ID	1	1	1	2	2	2

FOR ANISOTROPIC ROCK:

Bedding Angle Relative to Axis	None	None	None	None	None	None
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	N/A

SAMPLE DIMENSIONS

Width Perpendicular to loading, W, mm	60	60	60	60	60	60
Length Perpendicular to Loading, L, mm	30	30	30			
Diameter Parallel to Loading, D, mm	60	60	60	49	50	41
Diameter at Failure, D', mm	56	57	58	39	48	36

STRENGTH DATA

Peak Load, P, kN	0.196	0.188	0.169	0.046	0.053	0.054
Peak Load, P, lbs	44.1	42.3	38.0	10.3	11.9	12.1
Uncorr. Pt. Load Strength Index, I_S, MPa	0.058	0.055	0.049	0.015	0.014	0.020
Uncorr. Pt. Load Strength Index, I_S, psi	**8.5**	**8.0**	**7.0**	**2.2**	**2.1**	**2.8**
Size Correction Factor, F	1.07	1.07	1.08	1.04	1.09	1.02
Corr. Pt. Load Strength Index, $I_{S(50)}$, Mpa	0.06	0.06	0.05	0.02	0.02	0.02
Corr. Pt. Load Strength Index, $I_{S(50)}$, psi	**9**	**9**	**8**	**2**	**2**	**3**

MOISTURE CONTENT DATA

Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	As Received
Pan No.						
Pan wt. (g)	21.71	21.71	21.71	21.71	21.71	21.71
Total wet wt. (g)	209.08	209.08	209.08	209.08	209.08	209.08
Total dry wt (g)	195.76	195.76	195.76	195.76	195.76	195.76
Moisture Content, %	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**	**7.7**
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-14					
Sample:	R7					
Depth, ft:	20.8-21.2					
Visual Description:	Gray Rock					
Test Type	Diametral					
Test Type ID	1					
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	58					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	58					
Diameter at Failure, D', mm	56					
STRENGTH DATA						
Peak Load, P, kN	0.284					
Peak Load, P, lbs	63.8					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.087					
Uncorr. Pt. Load Strength Index,I_S, psi	**12.7**					
Size Correction Factor, F	1.06					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.09					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**13**					
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	21.98					
Total wet wt. (g)	194.83					
Total dry wt (g)	185.6					
Moisture Content, %	**5.6**					
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-14					
Sample:	R8					
Depth, ft:	23.7-23.9					
Visual Description:	Gray Rock					
Test Type	Axial					
Test Type ID	2					

FOR ANISOTROPIC ROCK:

Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					

SAMPLE DIMENSIONS

Width Perpendicular to loading, W, mm	60					
Length Perpendicular to Loading, L, mm						
Diameter Parallel to Loading, D, mm	51					
Diameter at Failure, D', mm	49					

STRENGTH DATA

Peak Load, P, kN	0.037					
Peak Load, P, lbs	8.3					
Uncorr. Pt. Load Strength Index, I_S, MPa	0.010					
Uncorr. Pt. Load Strength Index, I_S, psi	**1.4**					
Size Correction Factor, F	1.10					
Corr. Pt. Load Strength Index, $I_{S(50)}$, Mpa	0.01					
Corr. Pt. Load Strength Index, $I_{S(50)}$, psi	**2**					

MOISTURE CONTENT DATA

Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	22.23					
Total wet wt. (g)	109.95					
Total dry wt (g)	104.99					
Moisture Content, %	**6.0**					
Comments:	Invalid test. Did not fail through both loading points.					

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-14	B-14				
Sample:	R9	R9				
Depth, ft:	26.1-26.4	26.1-26.4				
Visual Description:	Grayish Brown Rock	Grayish Brown Rock				
Test Type	Diametral	Axial				
Test Type ID	1	2				
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None				
Loading Orientation Rel. to Bedding	N/A	N/A				
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60				
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	60	51				
Diameter at Failure, D', mm	57	49				
STRENGTH DATA						
Peak Load, P, kN	1.627	2.247				
Peak Load, P, lbs	365.8	505.1				
Uncorr. Pt. Load Strength Index,I_S, MPa	0.476	0.600				
Uncorr. Pt. Load Strength Index,I_S, psi	**69.0**	**87.1**				
Size Correction Factor, F	1.07	1.10				
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.51	0.66				
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**74**	**95**				
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received				
Pan No.						
Pan wt. (g)	22.3	22.3				
Total wet wt. (g)	127.05	127.05				
Total dry wt (g)	124.19	124.19				
Moisture Content, %	**2.8**	**2.8**				
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

COOPER TESTING LABORATORY

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Project No.: 60537920
Client: AECOM
Date: 3/13/2019
Project Name: Klamath River Renewal Project
By: PJ

Boring:	B-15	B-15	B-15	B-15	B-15	B-15
Sample:	R4	R4	R4	R4	R4	R4
Depth, ft:	33-33.5	33-33.5	33-33.5	33-33.5	33-33.5	33-33.5
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock
Test Type	Diametral	Diametral	Diametral	Axial	Axial	Axial
Test Type ID	1	1	1	2	2	2
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None	None	None
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	N/A
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60	60	60
Length Perpendicular to Loading, L, mm	30	30	30			
Diameter Parallel to Loading, D, mm	60	60	60	44	45	30
Diameter at Failure, D', mm	59	57	57	42	39	26
STRENGTH DATA						
Peak Load, P, kN	0.72	0.84	1.048	1.447	1.044	0.099
Peak Load, P, lbs	161.9	188.8	235.6	325.3	234.7	22.3
Uncorr. Pt. Load Strength Index,I_S, MPa	0.203	0.246	0.306	0.451	0.350	0.050
Uncorr. Pt. Load Strength Index,I_S, psi	**29.5**	**35.6**	**44.4**	**65.4**	**50.8**	**7.2**
Size Correction Factor, F	1.08	1.07	1.07	1.06	1.04	0.95
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.22	0.26	0.33	0.48	0.36	0.05
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**32**	**38**	**48**	**69**	**53**	**7**
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	As Received
Pan No.						
Pan wt. (g)	21.63	21.63	21.63	21.63	21.63	21.63
Total wet wt. (g)	128.99	128.99	128.99	128.99	128.99	128.99
Total dry wt (g)	124.4	124.4	124.4	124.4	124.4	124.4
Moisture Content, %	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**	**4.5**
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

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POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project

Project No.: 60537920
Date: 3/13/2019
By: PJ

Boring:	B-15	B-15	B-15	B-15	B-15	B-15
Sample:	R6	R6	R6	R6	R6	R6
Depth, ft:	43.1-43.6	43.1-43.6	43.1-43.6	43.1-43.6	43.1-43.6	43.1-43.6
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock
Test Type	Diametral	Diametral	Diametral	Axial	Axial	Axial
Test Type ID	1	1	1	2	2	2
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None	None	None
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	N/A
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60	60	60
Length Perpendicular to Loading, L, mm	30	30	30			
Diameter Parallel to Loading, D, mm	60	60	60	32	35	30
Diameter at Failure, D', mm	57	57	55	30	32	27
STRENGTH DATA						
Peak Load, P, kN	1.129	1.549	1.129	1.336	1.359	0.771
Peak Load, P, lbs	253.8	348.2	253.8	300.3	305.5	173.3
Uncorr. Pt. Load Strength Index,I_S, MPa	0.330	0.453	0.342	0.583	0.556	0.374
Uncorr. Pt. Load Strength Index,I_S, psi	**47.9**	**65.7**	**49.6**	**84.5**	**80.6**	**54.2**
Size Correction Factor, F	1.07	1.07	1.06	0.98	0.99	0.96
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.35	0.49	0.36	0.57	0.55	0.36
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**51**	**70**	**53**	**83**	**80**	**52**
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	As Received
Pan No.						
Pan wt. (g)	20.45	20.45	20.45	20.45	20.45	20.45
Total wet wt. (g)	238.89	238.89	238.89	238.89	238.89	238.89
Total dry wt (g)	228.86	228.86	228.86	228.86	228.86	228.86
Moisture Content, %	**4.8**	**4.8**	**4.8**	**4.8**	**4.8**	**4.8**
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/13/2019
Project Name: Klamath River Renewal Project **By:** PJ

Boring:	B-17	B-17	B-17	B-17	B-17	B-17
Sample:	R3	R3	R3	R3	R3	R3
Depth, ft:	25.1-25.7	25.1-25.7	25.1-25.7	25.1-25.7	25.1-25.7	25.1-25.7
Visual Description:	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock	Gray Rock
Test Type	Diametral	Diametral	Diametral	Axial	Axial	Axial
Test Type ID	1	1	1	2	2	2
FOR ANISOTROPIC ROCK:						
Bedding Angle Relative to Axis	None	None	None	None	None	None
Loading Orientation Rel. to Bedding	N/A	N/A	N/A	N/A	N/A	N/A
SAMPLE DIMENSIONS						
Width Perpendicular to loading, W, mm	60	60	60	60	60	60
Length Perpendicular to Loading, L, mm	30	30	30			
Diameter Parallel to Loading, D, mm	60	60	60	33	41	34
Diameter at Failure, D', mm	59	60	59	30	38	29
STRENGTH DATA						
Peak Load, P, kN	0.583	0.78	0.413	1.206	2.038	1.52
Peak Load, P, lbs	131.1	175.4	92.8	271.1	458.2	341.7
Uncorr. Pt. Load Strength Index,I_S, MPa	0.165	0.217	0.117	0.526	0.702	0.686
Uncorr. Pt. Load Strength Index,I_S, psi	**23.9**	**31.4**	**16.9**	**76.3**	**101.8**	**99.5**
Size Correction Factor, F	1.08	1.09	1.08	0.98	1.03	0.97
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.18	0.24	0.13	0.52	0.73	0.67
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**26**	**34**	**18**	**75**	**105**	**97**
MOISTURE CONTENT DATA						
Moisture Condition of Specimen	As Received	As Received	As Received	As Received	As Received	As Received
Pan No.						
Pan wt. (g)	20.98	20.98	20.98	20.98	20.98	20.98
Total wet wt. (g)	165.97	165.97	165.97	165.97	165.97	165.97
Total dry wt (g)	158.36	158.36	158.36	158.36	158.36	158.36
Moisture Content, %	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**	**5.5**
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

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POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

CTL Job No: 020-277
Client: AECOM
Project Name: Klamath River Renewal Project
Project No.: 60537920
Date: 3/20/2019
By: PJ

Boring:	B-19					
Sample:	R1					
Depth, ft:	31.3-32.2					
Visual Description:	Brown Rock					
Test Type	Diametral					
Test Type ID	1					

FOR ANISOTROPIC ROCK:

Bedding Angle Relative to Axis	None					
Loading Orientation Rel. to Bedding	N/A					

SAMPLE DIMENSIONS

Width Perpendicular to loading, W, mm	61					
Length Perpendicular to Loading, L, mm	30					
Diameter Parallel to Loading, D, mm	61					
Diameter at Failure, D', mm	59					

STRENGTH DATA

Peak Load, P, kN	0.582					
Peak Load, P, lbs	130.8					
Uncorr. Pt. Load Strength Index,I_S, MPa	0.162					
Uncorr. Pt. Load Strength Index,I_S, psi	**23.5**					
Size Correction Factor, F	1.09					
Corr. Pt. Load Strength Index,$I_{S(50)}$, Mpa	0.18					
Corr. Pt. Load Strength Index,$I_{S(50)}$, psi	**25**					

MOISTURE CONTENT DATA

Moisture Condition of Specimen	As Received					
Pan No.						
Pan wt. (g)	19.52					
Total wet wt. (g)	97.66					
Total dry wt (g)	91.38					
Moisture Content, %	**8.7**					
Comments:						

Test types: 1- Diametral, 2- Axial, 3- Block,4- Irregular Lump
Diametral - L/D ratio>1
Axial - L/D ratio 1/3 to 1
Block or Irregular Lumps, D= 30-85 mm; D/W between 1/3 and 1

Uniaxial Compression Test without
Stress-Strain Curves and Moduli
ASTM D7012 - 14e1

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Web: tononeng.com

Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-1-1
Report Date	5/17/2018
Drill hole and Depth	BI-02; 27-27.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Stress Rate	0.5 MPa/s	
Diameter of Specimen	60.54 mm	2.38 in
Height of Specimen	97.72 mm	3.85 in
Load at Peak	16.69 kN	3,752 lbf
Unconfined Compressive Strength	5.80 MPa	841 psi
Type of Failure	Non-Structural	

Note: The provided sample had a height-to-diameter ratio less than 2

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Picture of the sample upon arrival at Tonon USA Laboratory: no core piece allowed preparation of a specimen with a height-to-diameter ratio between 2 and 2.5.

Uniaxial Compression Test without Stress-Strain Curves and Moduli
ASTM D7012 - 14e1

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL
= ISO 9001 =

Tonon USA:
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Web: tononeng.com

Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-1-2
Report Date	5/17/2018
Drill hole and Depth	BI-02; 48.9-50.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Stress Rate	0.5 MPa/s	
Diameter of Specimen	60.85 mm	2.40 in
Height of Specimen	127.87 mm	5.03 in
Load at Peak	34.80 kN	7,823 lbf
Unconfined Compressive Strength	11.97 MPa	1,736 psi
Type of Failure	Non-Structural	

Date Received : 4/24/2018

Date Opened : 4/24/2018

Date Tested: 4/30/2018

Photo Before Test

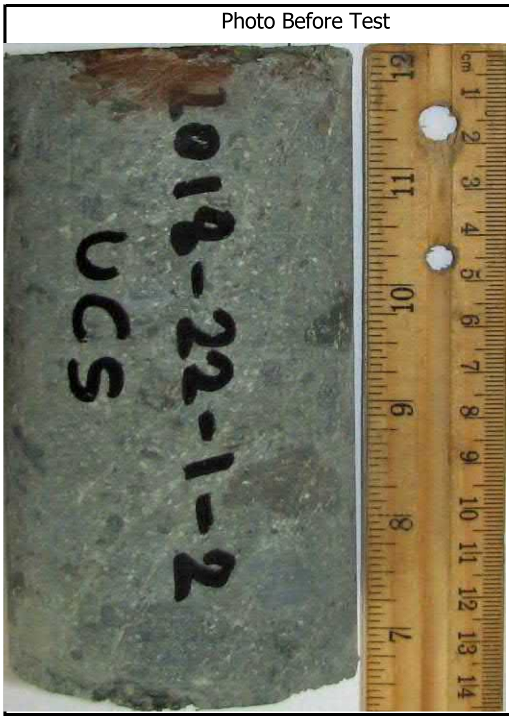

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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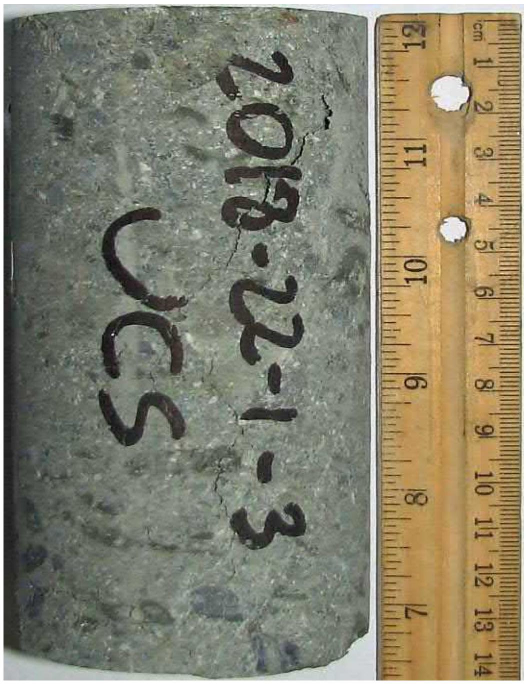
Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-1-3
Report Date	5/17/2018
Drill hole and Depth	BI-02; 55.4-56.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Stress Rate	0.5 MPa/s	
Diameter of Specimen	60.68 mm	2.39 in
Height of Specimen	128.33 mm	5.05 in
Load at Peak	45.59 kN	10,248 lbf
Unconfined Compressive Strength	15.77 MPa	2,288 psi
Type of Failure	Non-Structural	

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-1-4
Report Date	5/17/2018
Drill hole and Depth	BI-03; 17.4-18.4 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Stress Rate	0.5 MPa/s	
Diameter of Specimen	60.59 mm	2.39 in
Height of Specimen	129.81 mm	5.11 in
Load at Peak	4.39 kN	987 lbf
Unconfined Compressive Strength	1.52 MPa	221 psi
Type of Failure	Non-Structural	

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 5/4/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-1-5
Report Date	5/17/2018
Drill hole and Depth	BI-03; 21.5-22.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Stress Rate	0.5 MPa/s	
Diameter of Specimen	60.58 mm	2.39 in
Height of Specimen	125.67 mm	4.95 in
Load at Peak	6.99 kN	1,571 lbf
Unconfined Compressive Strength	2.43 MPa	352 psi
Type of Failure	Non-Structural	

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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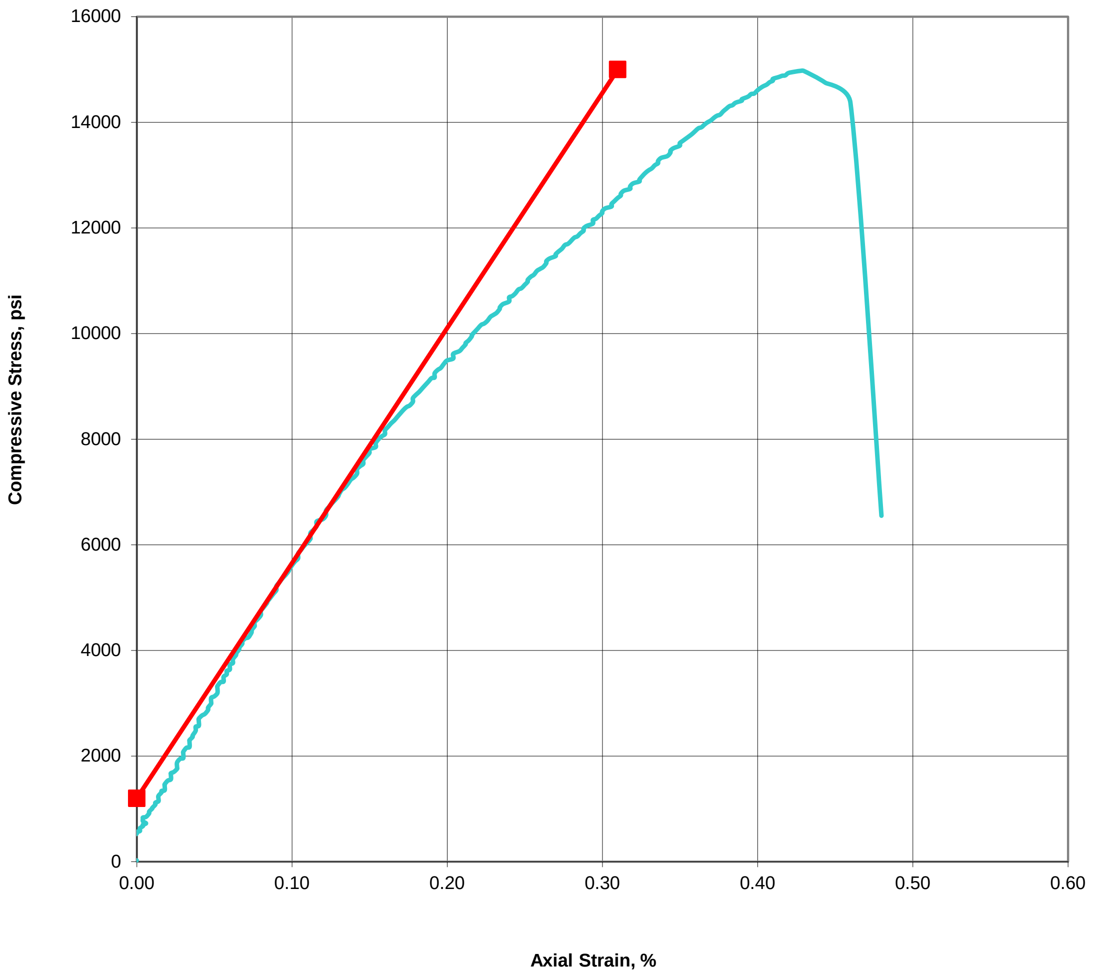
COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.: 020-277B
Boring: B-05
Date: 3/12/2019
Client: AECOM
Sample: R4
By: PJ
Project Name: Klamath River Renewal Project
Depth,ft.: 19.6-20.2
Checked: DC
Project No.: 60537920
Visual Description: Gray Rock
Moisture Condition at Test Sample was washed and in a moist state.
Test Temperature, (^{o}C) Ambient
Remarks:

Sample Height, in.	5.00
Sample Diameter, in.	2.39
Height / Diameter	2.1
Sample Area, in^2	4.50
Wet Density, pcf	160.2
Dry Density, pcf	159.1
Moisture Content, %	0.7
Strain Rate, % / min	0.25

Unconfined Compressive Strength (psi)	**14975**
Young's Modulus (E) (psi)	**4,450,000**



COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.:	020-277C	Boring:	B-08	Date:	3/12/2019
Client:	AECOM	Sample:	R3	By:	PJ
Project Name:	Klamath River Renewal Project	Depth,ft.:	46.1-47	Checked:	DC
Project No.:	60537920				

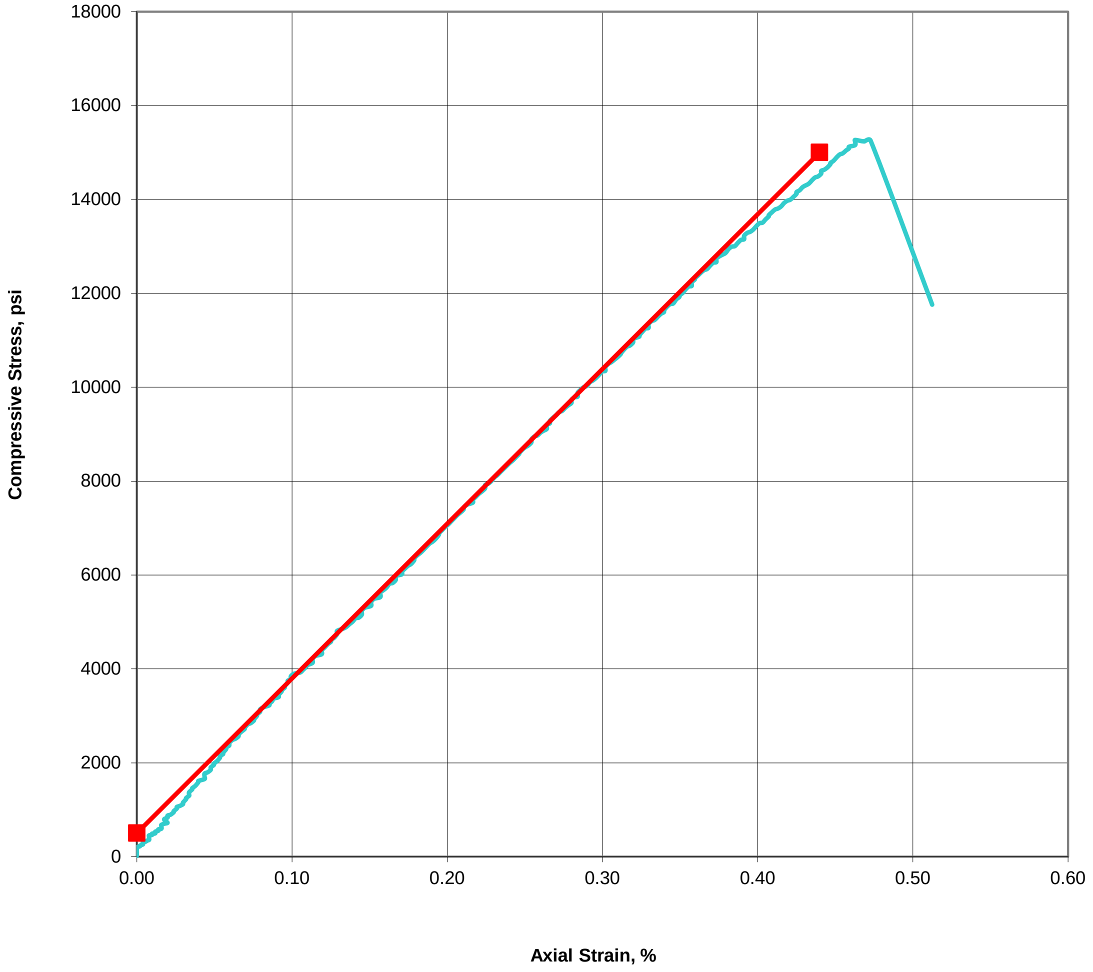
Visual Description: Gray Rock

Moisture Condition at Test Sample was washed and in a moist state.

Test Temperature, (^{o}C) Ambient

Remarks:

Sample Height, in.	5.03	**Unconfined Compressive Strength (psi)**	**15268**
Sample Diameter, in.	2.40		
Height / Diameter	2.1		
Sample Area, in^2	4.54		
Wet Density, pcf	162.2	**Young's Modulus (E) (psi)**	**3,300,000**
Dry Density, pcf	159.3		
Moisture Content, %	1.8		
Strain Rate, % / min	0.25		



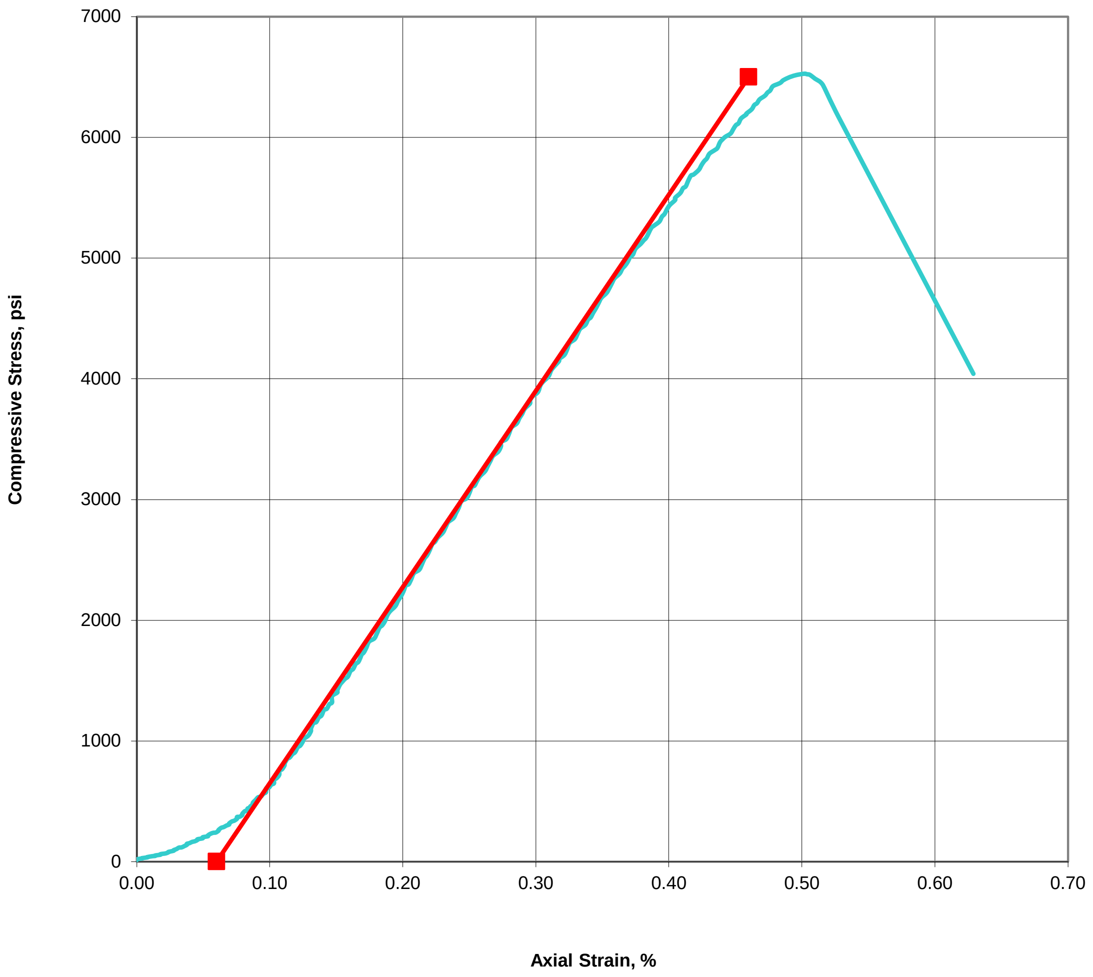
COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.: 020-277E
Boring: B-13
Date: 3/12/2019
Client: AECOM
Sample: R5
By: PJ
Project Name: Klamath River Renewal Project
Depth,ft.: 17.6-18.5
Checked: DC
Project No.: 60537920
Visual Description: Gray Rock
Moisture Condition at Test: Sample was washed and in a moist state.
Test Temperature, (^{o}C): Ambient
Remarks:

Sample Height, in.	5.04
Sample Diameter, in.	2.40
Height / Diameter	2.1
Sample Area, in^2	4.52
Wet Density, pcf	141.3
Dry Density, pcf	140.1
Moisture Content, %	0.9
Strain Rate, % / min	0.25

Unconfined Compressive Strength (psi)	**6528**
Young's Modulus (E) (psi)	**1,630,000**



COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.: 020-277H

Boring: B-20

Date: 3/12/2019

Client: AECOM

Sample: R1

By: PJ

Project Name: Klamath River Renewal Project

Depth,ft.: 40.1-40.6

Checked: DC

Project No.: 60537920

Visual Description: Gray Rock

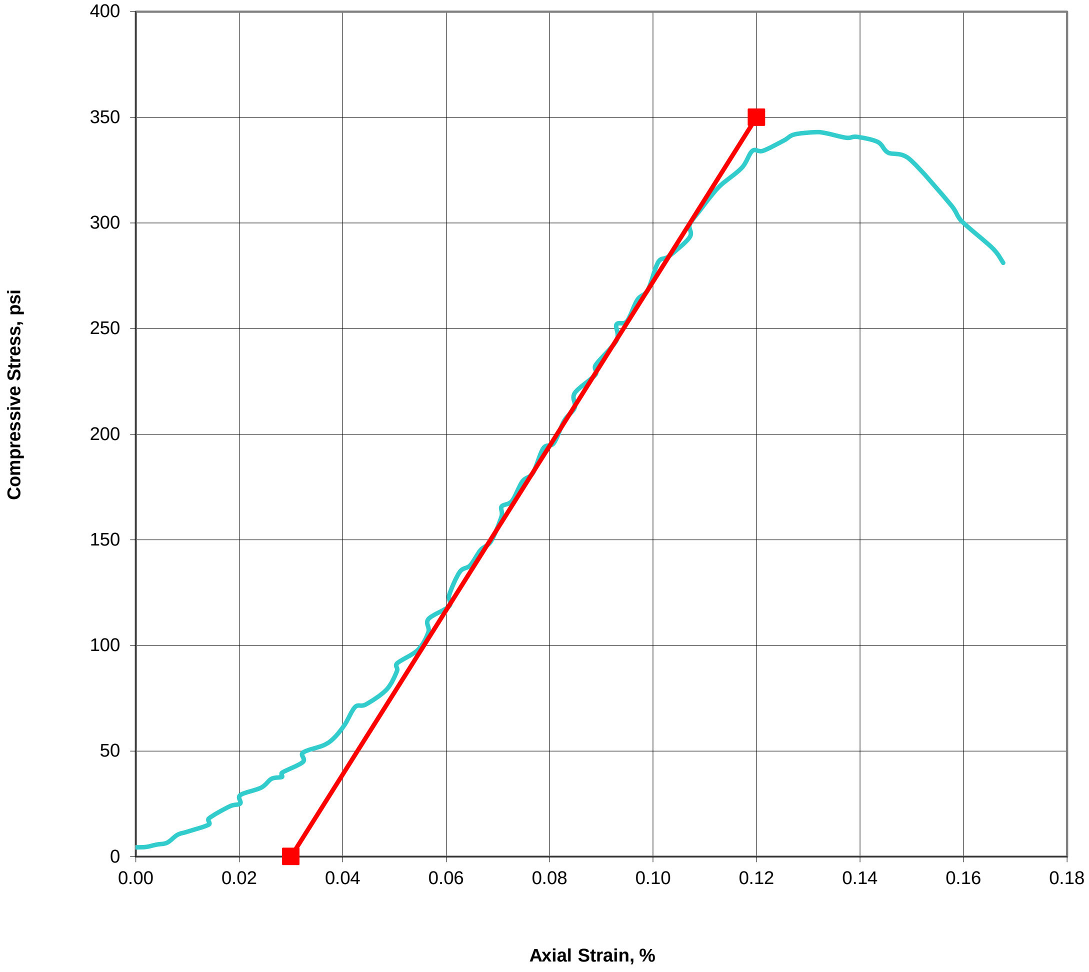
Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^{o}C): Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	4.95
Sample Diameter, in.	2.40
Height / Diameter	2.1
Sample Area, in^2	4.53
Wet Density, pcf	163.7
Dry Density, pcf	157.9
Moisture Content, %	3.7
Strain Rate, % / min	0.25

Unconfined Compressive Strength (psi)	**343**
Young's Modulus (E) (psi)	**388,900**



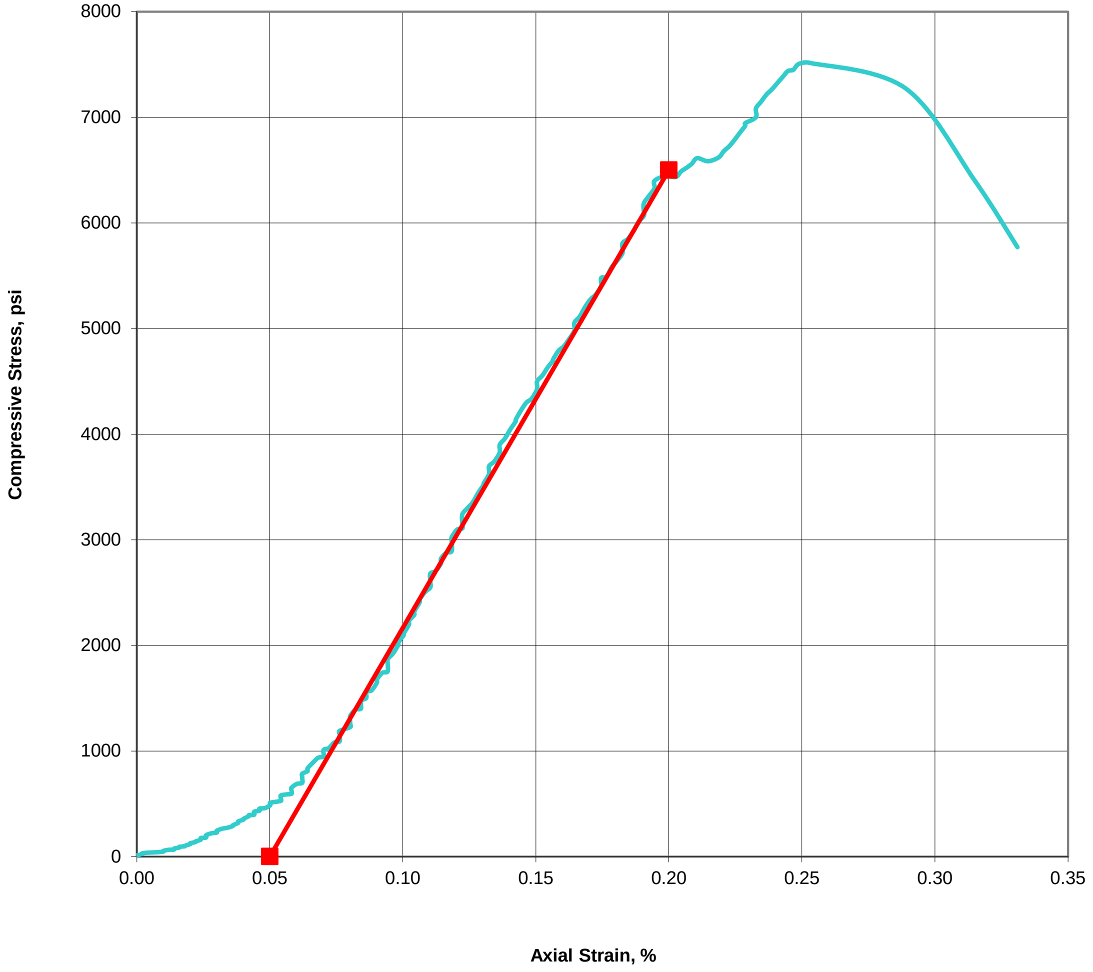
COOPER
TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.: 020-277I
Boring: B-20
Date: 3/12/2019
Client: AECOM
Sample: R2
By: PJ
Project Name: Klamath River Renewal Project
Depth,ft.: 45.3-46.3
Checked: DC
Project No.: 60537920
Visual Description: Gray Rock
Moisture Condition at Test Sample was washed and in a moist state.
Test Temperature, (^{o}C) Ambient
Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	4.98
Sample Diameter, in.	2.40
Height / Diameter	2.1
Sample Area, in^2	4.54
Wet Density, pcf	165.7
Dry Density, pcf	160.3
Moisture Content, %	3.4
Strain Rate, % / min	0.25

Unconfined Compressive Strength (psi)	**7517**
Young's Modulus (E) (psi)	**4,330,000**



COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.: 020-277J

Boring: B-15

Date: 3/12/2019

Client: AECOM

Sample: R6/R7

By: PJ

Project Name: Klamath River Renewal Project

Depth,ft.: 46.5-47.1

Checked: DC

Project No.: 60537920

Visual Description: Gray Rock

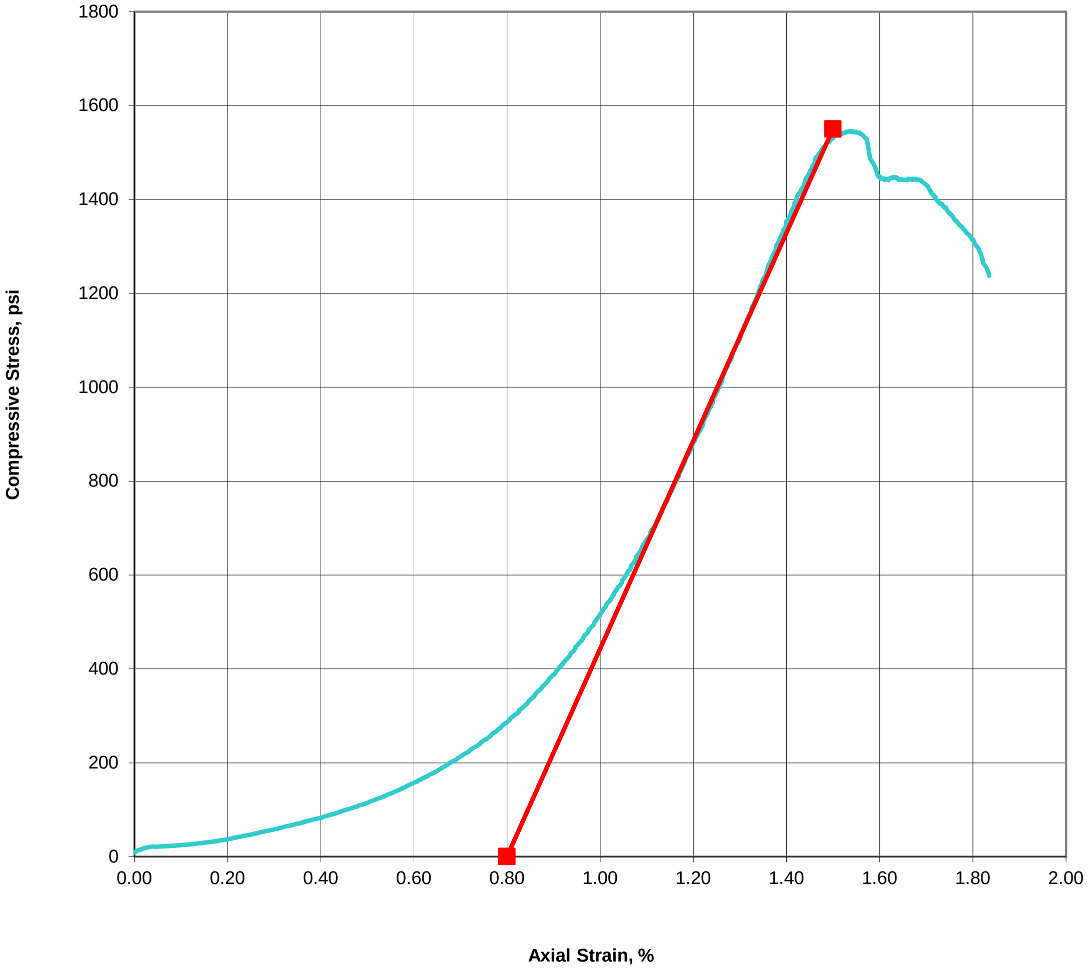
Moisture Condition at Test Sample was washed and in a moist state.

Test Temperature, (^{o}C) Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	4.95
Sample Diameter, in.	2.34
Height / Diameter	2.1
Sample Area, in^2	4.30
Wet Density, pcf	144.2
Dry Density, pcf	136.3
Moisture Content, %	5.8
Strain Rate, % / min	0.25

Unconfined Compressive Strength (psi)	**1546**
Young's Modulus (E) (psi)	**221,400**



Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.:	020-277L	Boring:	B-17	Date:	3/12/2019
Client:	AECOM	Sample:	R2	By:	PJ
Project Name:	Klamath River Renewal Project	Depth,ft.:	40-41.5	Checked:	DC
Project No.:	60537920				

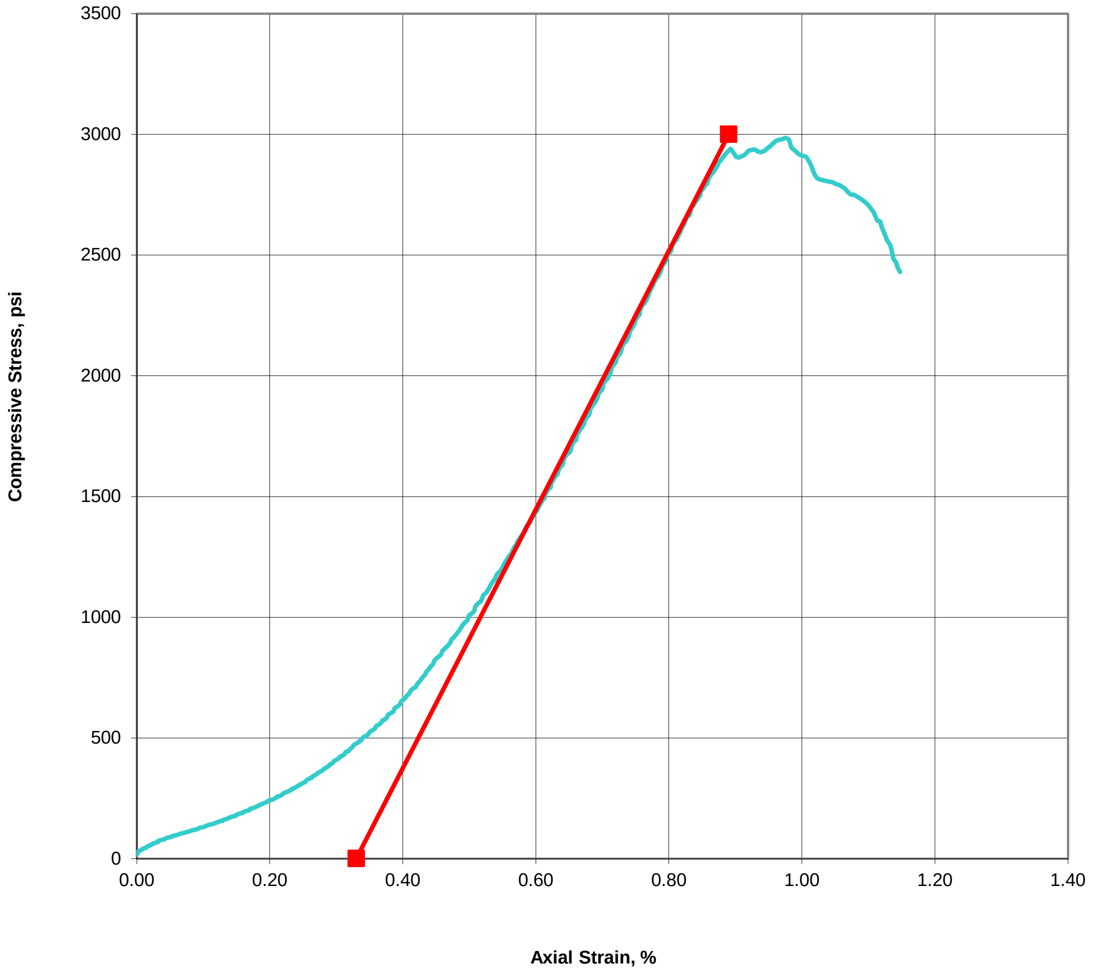
Visual Description: Gray Rock

Moisture Condition at Test Sample was washed and in a moist state.

Test Temperature, (^{o}C) Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	5.03	**Unconfined Compressive Strength (psi)**	**2985**
Sample Diameter, in.	2.37		
Height / Diameter	2.1		
Sample Area, in^2	4.41		
Wet Density, pcf	145.6	**Young's Modulus (E) (psi)**	**535,700**
Dry Density, pcf	140.1		
Moisture Content, %	3.9		
Strain Rate, % / min	0.25		



COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.:	020-277M	Boring:	B-17	Date:	3/12/2019
Client:	AECOM	Sample:	R2	By:	PJ
Project Name:	Klamath River Renewal Project	Depth,ft.:	17.9-18.6	Checked:	DC
Project No.:	60537920				

Visual Description: Gray Rock

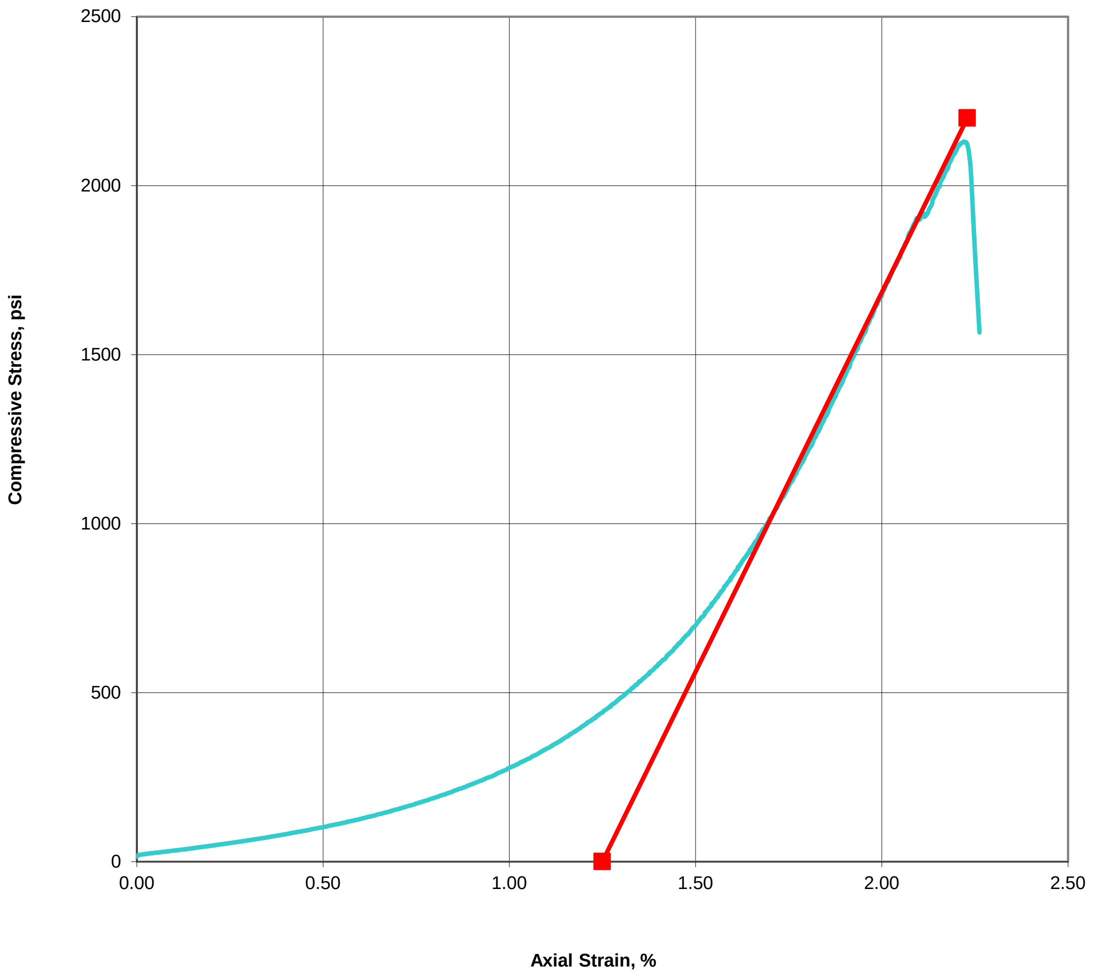
Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^oC): Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	5.09
Sample Diameter, in.	2.35
Height / Diameter	2.2
Sample Area, in^2	4.33
Wet Density, pcf	142.9
Dry Density, pcf	134.9
Moisture Content, %	5.9
Strain Rate, % / min	0.25

Unconfined Compressive Strength (psi)	**2130**
Young's Modulus (E) (psi)	**224,500**



Brazilian Tensile Strength Test

ASTM D3967 - 16

COMPANY WITH
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CERTIFIED BY DNV GL
= ISO 9001 =

Tonon USA:
Engineering, Measurements and Testing, LLC

Web: tononeng.com

Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-2-1
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 47-48.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Diameter (D)	60.94 mm	2.40 in
Thickness (t)	22.88 mm	0.90 in
Maximum Load (P)	6.53 kN	1,468 lbf
Tensile strength (flat platens) $\sigma_t = 2P/\pi tD$	N/A	N/A
Tensile strength (curved platens) $\sigma_t = 1.272P/\pi tD$	1.90 MPa	275 psi
Direction of Loading	Orthogonal to the Borehole Axis	
Type of Failure	Non-Structural	
Conformance to dimensional Requirements $0.2 \leq \frac{t}{D} \leq 0.75$	$\frac{t}{D} =$ 0.38	OK

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-2-2
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 52-54.7 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Diameter (D)	60.84 mm	2.40 in
Thickness (t)	24.67 mm	0.97 in
Maximum Load (P)	5.25 kN	1,180 lbf
Tensile strength (flat platens) $\sigma_t = 2P / \pi t D$	N/A	N/A
Tensile strength (curved platens) $\sigma_t = 1.272P / \pi t D$	1.42 MPa	206 psi
Direction of Loading	Orthogonal to the Borehole Axis	
Type of Failure	Non-Structural	
Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.41	OK

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-2-3
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 18.4-20.1 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Diameter (D)	60.74 mm	2.39 in
Thickness (t)	26.84 mm	1.06 in
Maximum Load (P)	1.51 kN	339 lbf
Tensile strength (flat platens) $\sigma_t = 2P/\pi tD$	N/A	N/A
Tensile strength (curved platens) $\sigma_t = 1.272P/\pi tD$	0.38 MPa	54 psi
Direction of Loading	Orthogonal to the Borehole Axis	
Type of Failure	Non-Structural	
Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.44	OK

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Brazilian Tensile Strength Test

ASTM D3967 - 16

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

Tonon USA:
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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-2-4
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 22.9-24.2 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Diameter (D)	60.26 mm	2.37 in
Thickness (t)	33.83 mm	1.33 in
Maximum Load (P)	0.55 kN	124 lbf
Tensile strength (flat platens) $\sigma_t = 2P/\pi tD$	N/A	N/A
Tensile strength (curved platens) $\sigma_t = 1.272P/\pi tD$	0.11 MPa	16 psi
Direction of Loading	Orthogonal to the Borehole Axis	
Type of Failure	Non-Structural	
Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.56	OK

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo Before Test

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-5-1
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 51.3-51.7 ft
Rock Type	Volcanic Breccia
Formation	N/A
Surface Condition	Cut by Slab Saw

Apparatus, Pin R.-H.	West Cerchar, 55/56	
Direction of Scratch	Perpendicular to Core Axis	
Pin Wear (mm)	0.156	0.145
	0.142	0.124
	0.144	0.133
	0.162	0.129
	0.150	0.140
Average (mm)	0.143	
CAIs	**1.43**	
CAI	**1.89**	
Classification	**Medium Abrasiveness**	

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-5-2
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 25.1-26.1 ft
Rock Type	Volcanic Breccia
Formation	N/A
Surface Condition	Cut by Slab Saw

Apparatus, Pin R.-H.	West Cerchar, 55/56	
Direction of Scratch	Perpendicular to Core Axis	
Pin Wear (mm)	0.046	0.037
	0.083	0.069
	0.104	0.090
	0.087	0.098
	0.100	0.093
Average (mm)	0.081	
CAIs	**0.81**	
CAI	**1.28**	
Classification	**Medium Abrasiveness**	

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/30/2018

Photo After Test

Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Project location	Klamath River
Client	Klamath River Renewal Corporation
Client's Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-7-1
Report Date	5/17/2018
Borehole and Depth	BI-02; 51.7-52 ft
Studied by	Lidia Scavo and Fulvio Tonon
Reviewed by	Gloria Tonon-Kozma

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 5/17/2018

A sample from borehole BI-02; 51.7-52 ft was analyzed under the polarized microscope to determine its mineralogical composition from a 25 X 40 mm (0.9 X 1.58 in) thin section.

Visual inspection of the sample suggests an igneous origin.

ROCK NAME: **BRECCIATED-ALTERED BASALT** (according to EN 12670).

Fig. 1 - Aspect of the studied sample (hand specimen).

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Hand specimen – Visual inspection: It is a mafic, greenish and dusty material with a very weak behavior. It is composed of a dark and very fine groundmass with phenocrysts that are millimetric in size, and light to dark colored.

According to the Rock-Color Chart of the Geological Society of America, the groundmass color is Grayish Green (5G 5/2), and the phenocrysts are Grayish Green (10G 4/2) to Light Bluish Gray (5B 7/1).

The rock fizzes under hydrochloric acid, and it can be scratched by a metal tip.

Probable Origin: It is an altered Plagioclase-rich basaltic rock.

Mineralogy: Plagioclase, Clay Minerals, Olivine, Opaque Minerals, Volcanic Glass, Carbonates

Textures: The rock has a porphyric texture with a very fine and dark groundmass, in which there are Plagioclase crystals, rare Olivine crystals, Opaque Minerals, and many alteration Clay Minerals (predominantly Phyllosilicates such as Chlorite).
Plagioclase is the most common mineral phase: crystals are quite large and well zoned. Because of their golden color, clay minerals can be hardly distinguished from the groundmass, except for Chlorite that can be locally seen in amorphous greenish individuals.
Opaque Minerals are mainly made up of Oxides of the Hematite group.
Spotted Carbonates may be also identified.

Alteration and Mineral Suturing Condition: The rock is highly altered: even the largest phenocrysts show traces of intense alteration acted upon by clayey minerals; Plagioclase crystals are intensively fractured. These fractures are commonly filled with secondary clayey material in a "quasi-stylolithic" pattern.

Discontinuities: The rock shows a very pervasive fracture system: many of these fractures have not been filled with secondary mineralization, and they predominantly cross the groundmass. Fractures crossing phenocrysts are instead filled with clay minerals.

Description of Individual Minerals:

Minerals	Mineral Content (%)	Mohs Hardness	Grain Size (mm)	Description and Comments
Plagioclase	33.3	6	1.10	As individual crystals
Chlorite	1.67	2.5	0.05	Very variable in size, alteration single crystals
Oxides	6.67	5.5	0.02-0.8	Spotted Hematite individuals
Glass	50	5	Sub-micrometric	Makes up the groundmass
Clay	8.33	4	Sub-micrometric	Phyllosilicates, unresolvable at a microscopic scale
Weighted Average:		4.2	-	

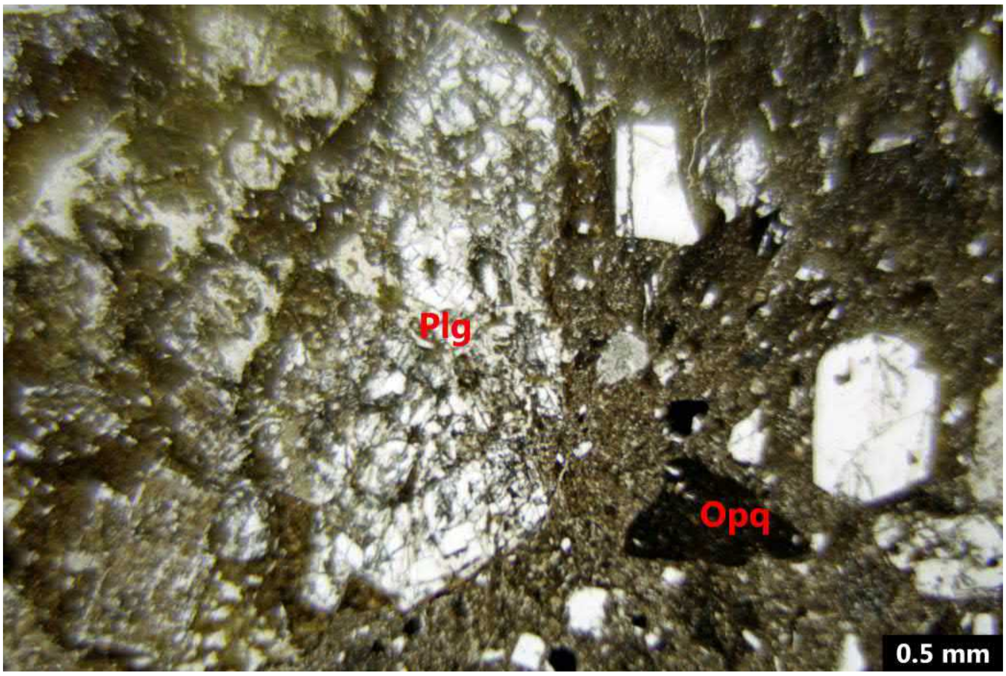

Fig. 2 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of the studied sample, showing an altered Plagioclase (Plg) crystal near to a big Hematite crystal (Opq).

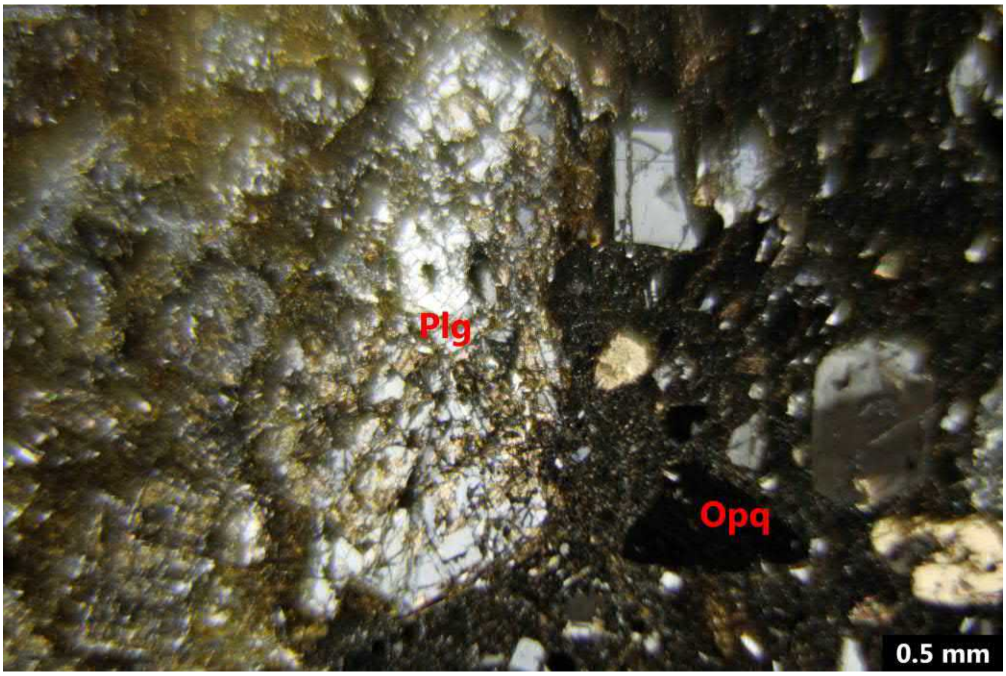

Fig. 3 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 2, but under crossed polars.

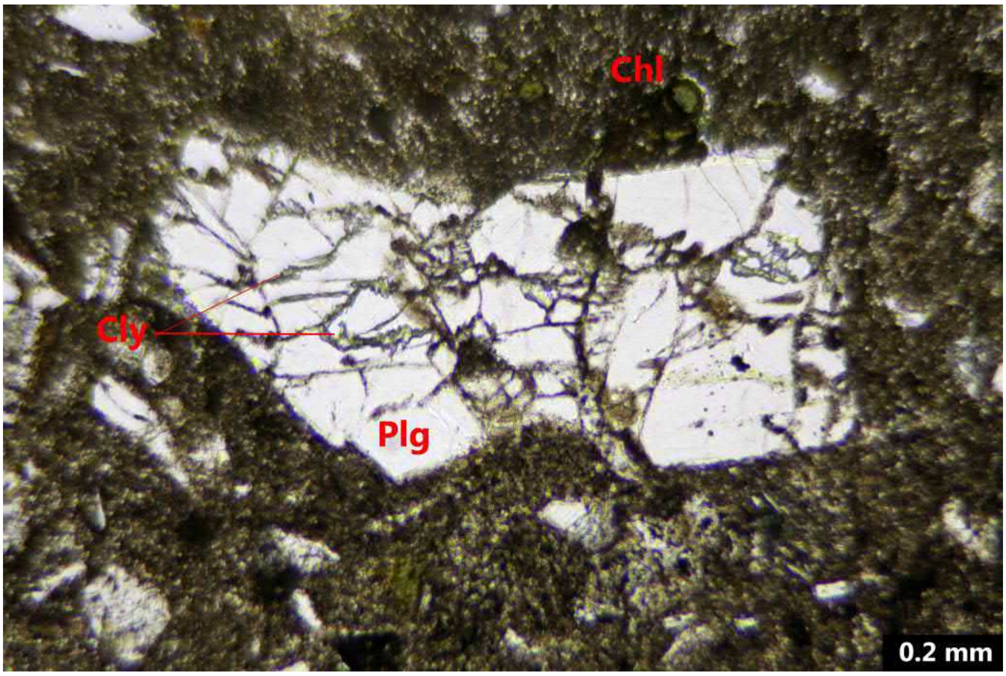

Fig. 4 - Plane polarized light. Field of view = 1.7 mm wide (magnification 10X). A detail of a Plagioclase grain, crossed by many fractures, all filled with Clay Minerals (Cly). Some Chlorite individuals (Chl) may be identified in the upper part of the picture.

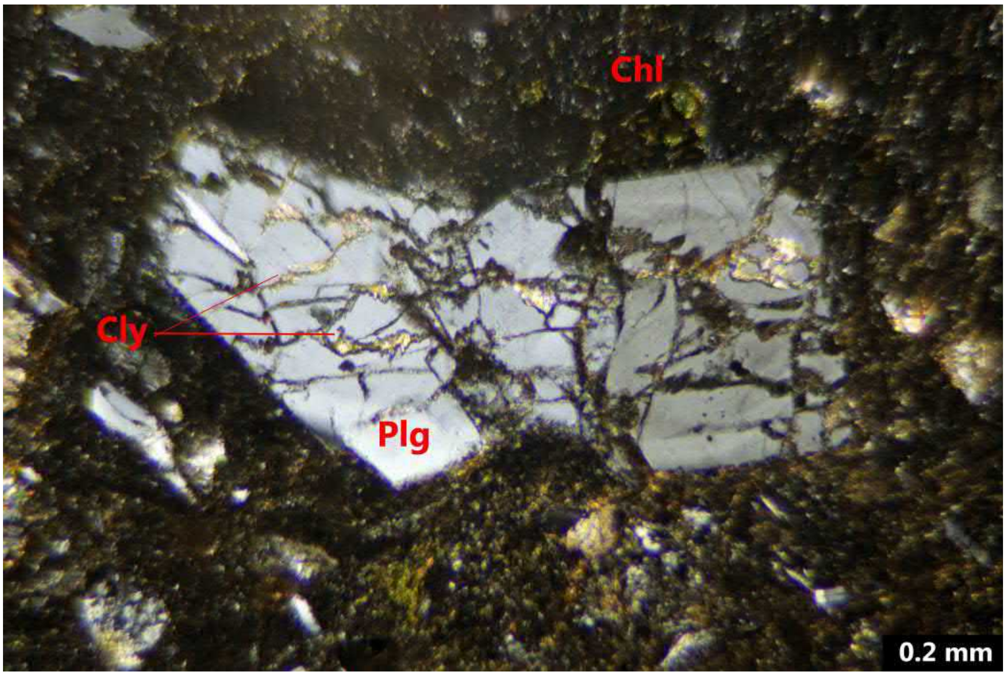

Fig. 5 - Cross polarized light. Field of view = 1.7 mm wide (magnification 10X). Same as Figure 4, but under crossed polars.

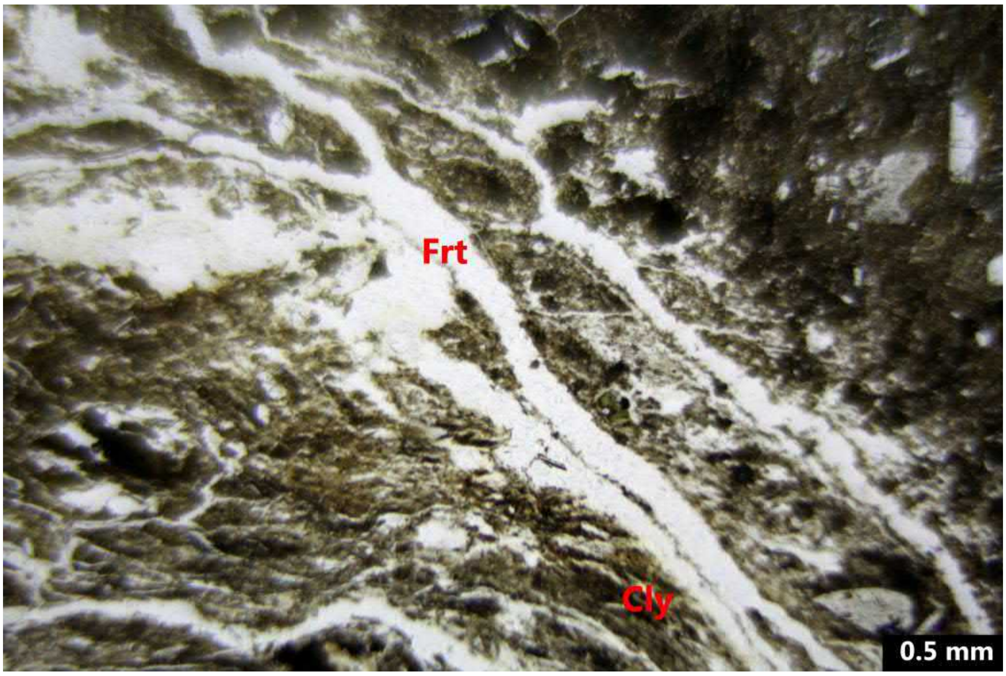

Fig. 6 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A selected area of the section with a well-developed fracture system (Frt).

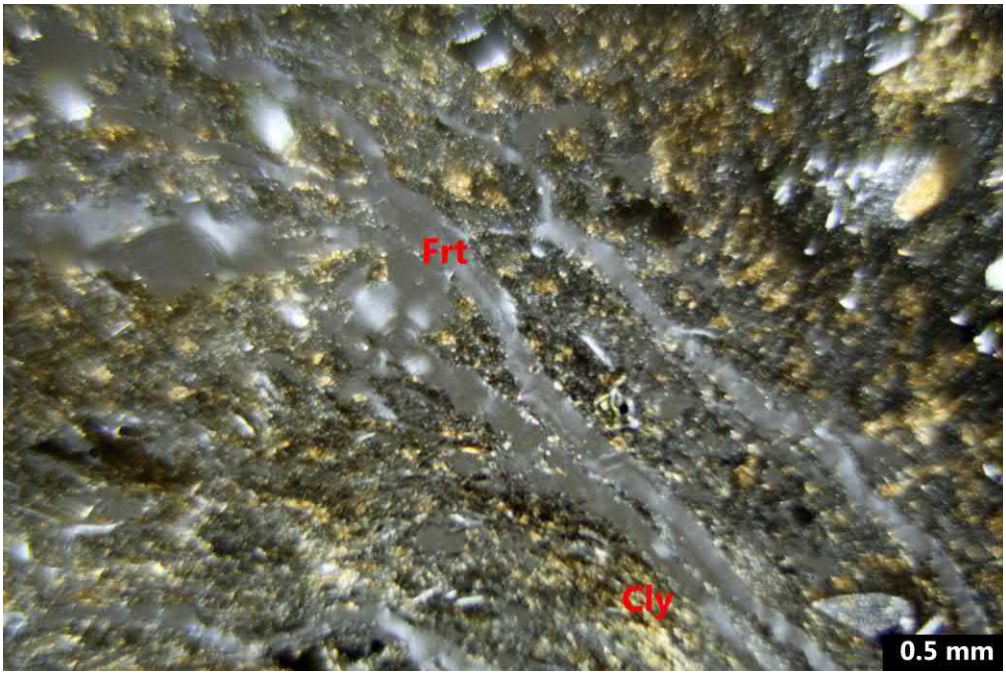

Fig. 7 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 6, but under crossed polars.

Project Name	Klamath River Dam Removal
Project location	Klamath River
Client	Klamath River Renewal Corporation
Client's Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-7-2
Report Date	5/17/2018
Borehole and Depth	BI-03; 20.8-21 ft
Studied by	Lidia Scavo and Fulvio Tonon
Reviewed by	Gloria Tonon-Kozma

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 5/17/2018

A sample from borehole BI-03; 20.8-21 ft was analyzed under the polarized microscope to determine its mineralogical composition from a 25 X 40 mm (0.9 X 1.58 in) thin section.

Visual inspection of the sample suggests an igneous origin.

ROCK NAME: **ALTERED VOLCANIC BRECCIA** (according to EN 12670).

Fig. 1 - Aspect of the studied sample (hand specimen).

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Hand specimen – Visual inspection: It is a greenish mafic rock. It appears to be very weak, and it shows a dusty appearance. It is composed of a dark green groundmass with spotted whitish to bluish phenocrysts.

According to the Rock-Color Chart of the Geological Society of America, the groundmass color is Grayish Green (5G 5/2); clasts have colors ranging from Dark Greenish Gray (4G 4/1) to Light Bluish Gray (5B 7/1). The matter also shows alterations that are Dark Greenish Yellow (10Y 6/6).

The rock fizzes under hydrochloric acid, and it can be scratched by a metal tip.

Probable Origin: It is an altered volcanic breccia.

Mineralogy: Plagioclase, Volcanic Glass, Pyroxene, Chlorite, Clay Minerals, Opaque Minerals, Carbonates.

Textures: It is a mafic porphyritic rock with a chaotic structure: no preferred orientation may be identified.
Plagioclase is the most common constituent mineral: its crystals range from sub-millimetric in size to glassy and are usually well shaped. Zonation is irregular.
Some of the clasts are made up of extraneous volcanic clasts; they can be easily identified because of their color variation when compared to the rest of the thin section: these clasts display a different mafic content.
Secondary mineral phases are made up of rare Augite-Pyroxene, Chlorite, Carbonates and Opaque Minerals.
Very common, but not resolvable at a microscopic observation scale, are Volcanic Glass and Clay Minerals. Clay Minerals also represent the main alteration substance of the rock, which affects both the groundmass and the clasts.

Alteration and Mineral Suturing Condition: The sample shows a substaintial clayey alteration, with clear Chlorite individuals associated with very fine-grained Clay Minerals. Spotted secondary Carbonates can be found as fracture filling material.
Crystals in this thin section have well defined rims, but they are also affected by pervasive fractures both within the crystals and all around their boundaries.

Discontinuities: The rock is heavily fractured, with two classes of discontinuities: a first one made up of empty cracks crossing the groundmass and the crystals, and a second one made up of Carbonate-filled fractures, sometimes surrounding single crystals or clasts.

Description of Individual Minerals:

Minerals	Mineral Content (%)	Mohs Hardness	Grain Size (mm)	Description and Comments
Plagioclase	28.33	6	0.6	As single individuals or as the main part of many external clast groundmass
Chlorite	1.67	2	0.3	As individuals of secondary crystallization
Opaque Minerals	5	5.5	0.1	Spotted individuals of Hematite
Glass	41.67	5	Sub-micrometric	Makes up the groundmass
Pyroxene	1.67	5.5	0.2	Rare sub-euhedral crystals
Carbonates	5	4	0.06	As fracture filling material
Clay Minerals	16.67	2	Sub-micrometric	Phyllosilicates of secondary alteration
Weighted Average:		4.3	-	

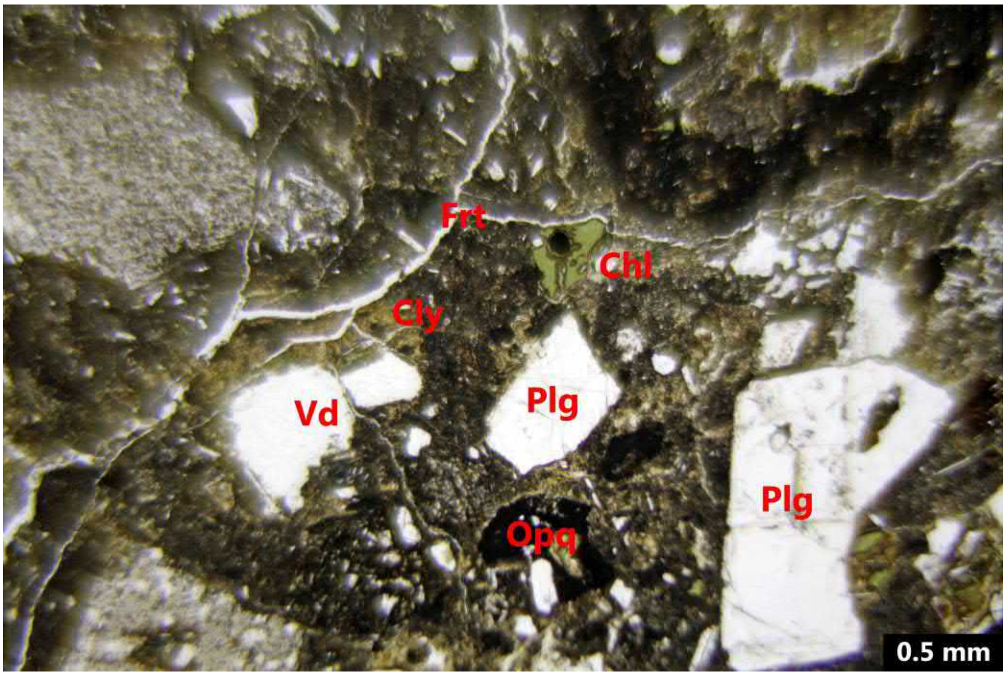

Fig. 2 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of the studied sample. The most common minerals are: Plagioclase (Plg), Clay Minerals (Cly), Opaque Minerals (Opq), and Chlorite (Chl). Also highlighted here are some structural features, such as fractures (Frt) and voids (Vd).

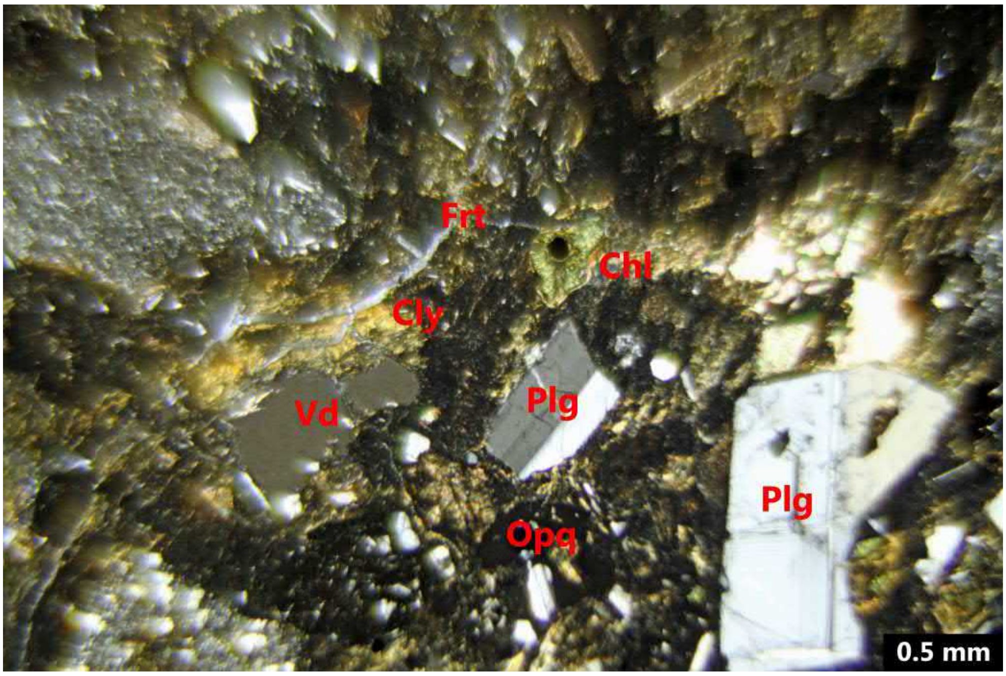

Fig. 3 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 2, but under crossed polars.

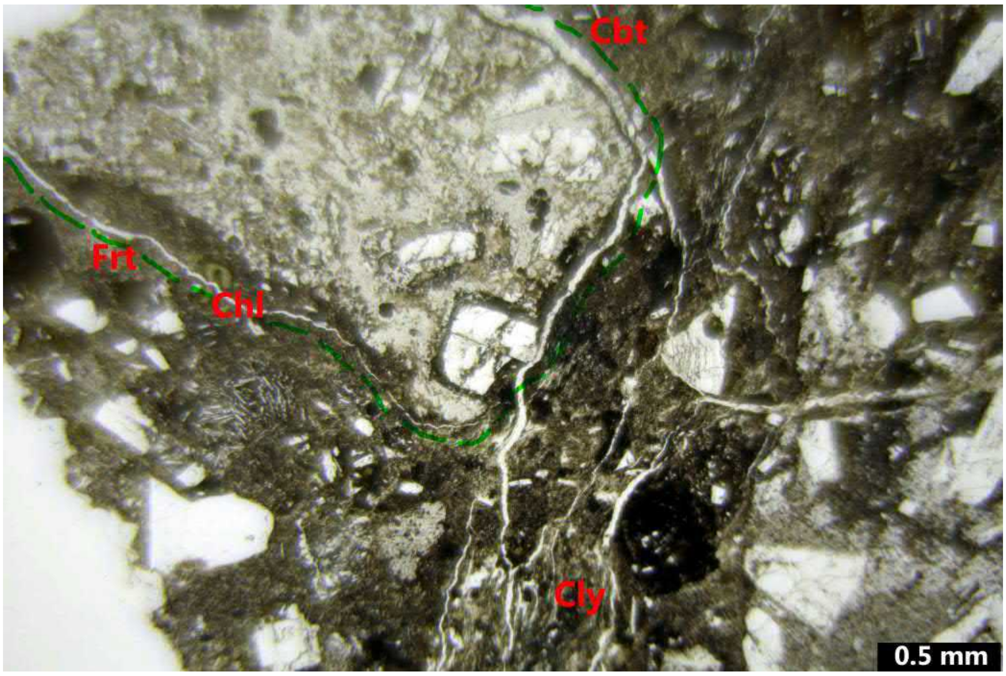

Fig. 4 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of a volcanic clast. A common feature of all the clasts in this thin section is the presence of fractures surrounding clast boundaries (follow the green dashed line). In this case the fracture is filled with secondary Carbonates (Cbt).

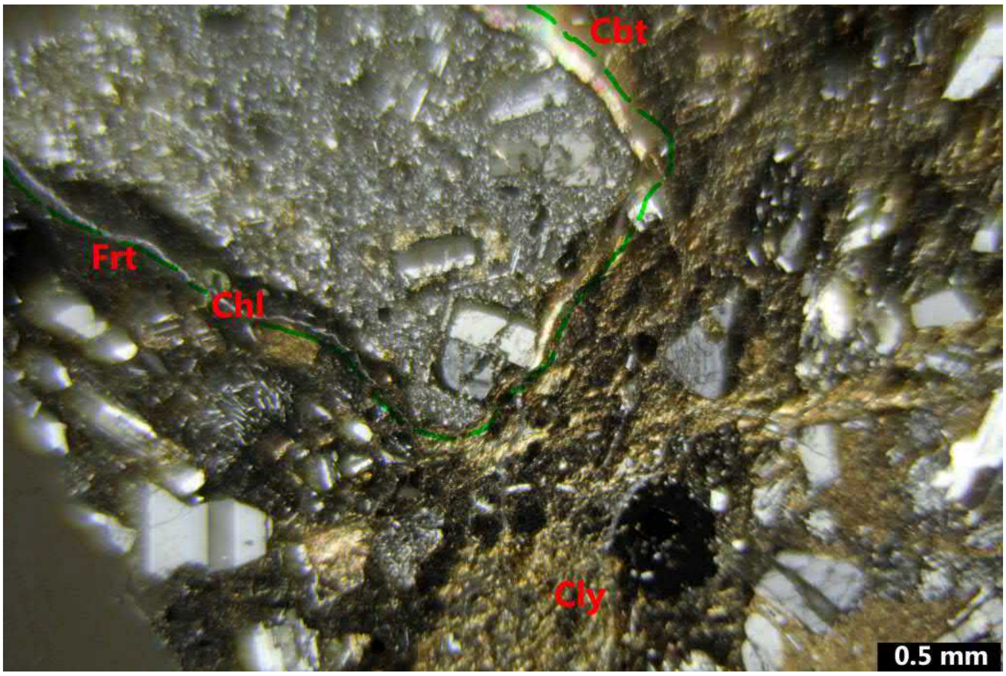

Fig. 5 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 4, but under crossed polars.

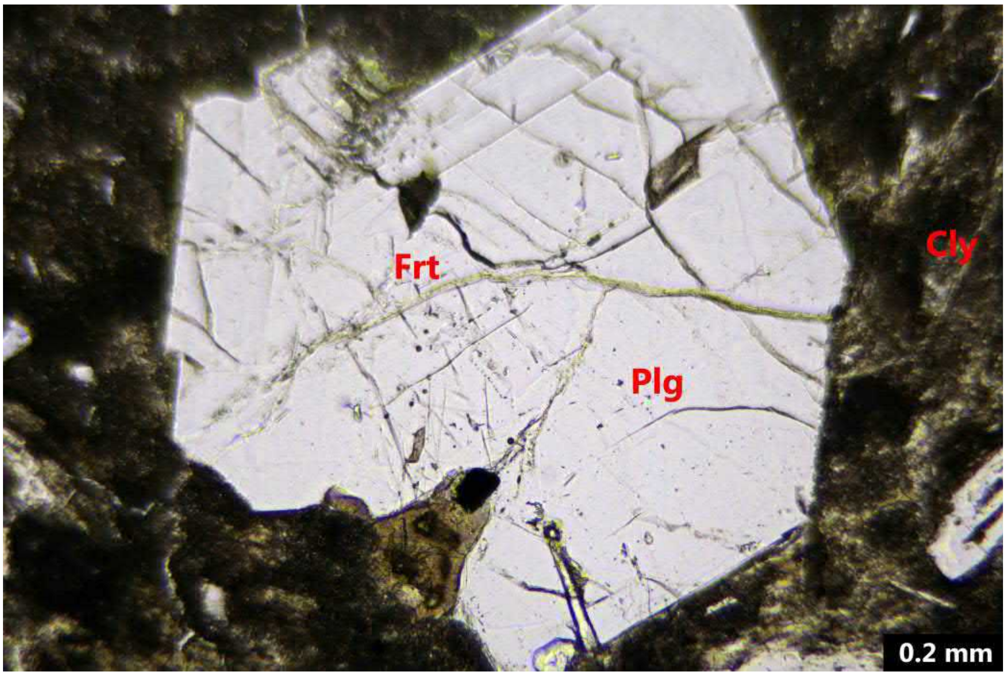

Fig. 6 - Plane polarized light. Field of view = 1.7 mm wide (magnification 10X). A detail of a Plagioclase crystal, showing grain alteration and suturing features: fractures cross the crystal and are also filled with Clay Minerals.

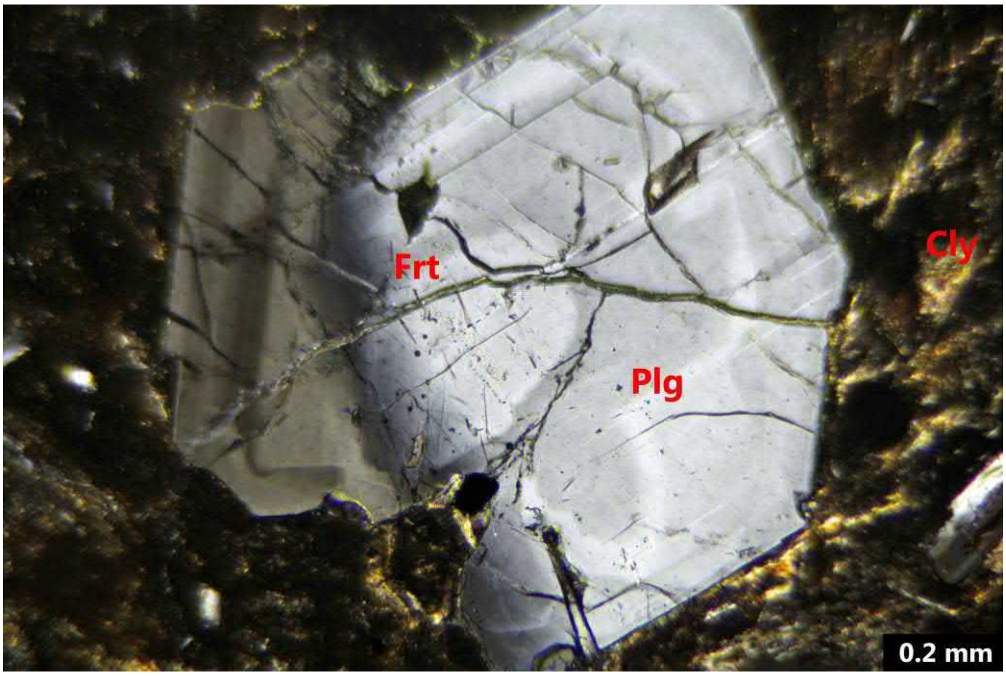

Fig. 7 - Cross polarized light. Field of view = 1.7 mm wide (magnification 10X). Same as Figure 6, but under crossed polars.

Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-8-1
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 27-27.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/24/2018

Mohs Hardness
3

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-8-2
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 48.9-50.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/24/2018

Mohs Hardness
3

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-8-3
Report Date	5/17/2018
Drill Hole and Depth	BI-02; 55.4-56.3 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/24/2018

Mohs Hardness
3

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-8-4
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 17.4-18.4 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/24/2018

Mohs Hardness
3

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal
Location	Klamath River
Client	Klamath River Renewal Corporation
Client Project No.	60537920
Registry No.	2018-22
Report No.	2018-22-8-5
Report Date	5/17/2018
Drill Hole and Depth	BI-03; 21.5-22.9 ft
Rock Type	Volcanic Breccia
Geologic Unit	N/A
Moisture Condition	As-received

Date received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 4/24/2018

Mohs Hardness
3

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	Klamath River Dam Removal	Penetration rate	0.001 in/sec			
Location	Klamath River	Diameter of specimen	60.65	mm	2.39	in
Client	Klamath River Renewal Corporation	Height of specimen	64.62	mm	2.54	in
Client Project No.	60537920	Load at peak	27.81	kN	6,251	lbf
Registry No.	2018-22	45 Degree (Standard) Index	175			
Report No.	2018-22-8-1	Peak Slope Index	39			
Report Date	5/17/2018					
Drill Hole and Depth	BI-02; 50.3-51.3 ft					
Rock Type	Volcanic Breccia					
Geologic Unit	N/A					
Moisture Condition	As-received					

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 5/4/2018

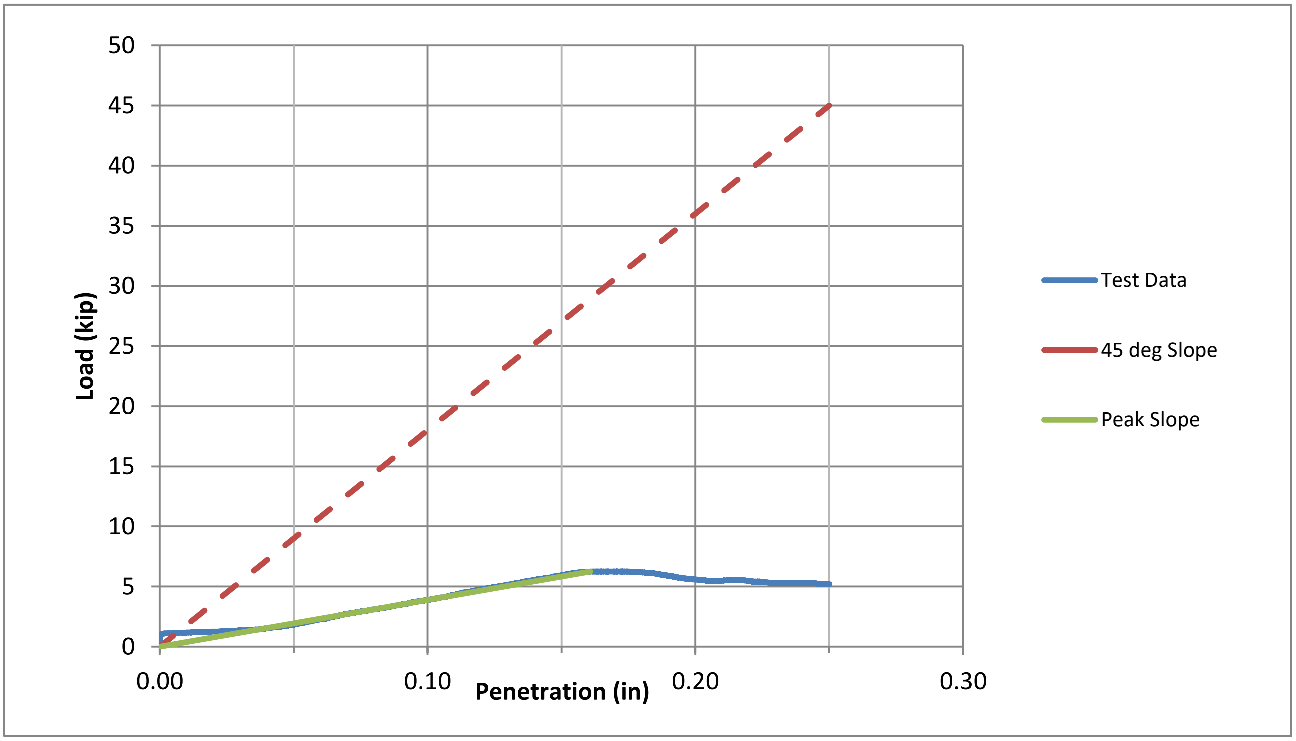

Photo After Test

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

Project Name	Klamath River Dam Removal	Penetration rate	0.001 in/sec			
Location	Klamath River	Diameter of specimen	60.4	mm	2.38	in
Client	Klamath River Renewal Corporation	Height of specimen	67.53	mm	2.66	in
Client Project No.	60537920	Load at peak	19.46	kN	4,373	lbf
Registry No.	2018-22	45 Degree (Standard) Index	175			
Report No.	2018-22-8-2	Peak Slope Index	18			
Report Date	5/17/2018					
Drill Hole and Depth	BI-03; 24.2-25.1 ft					
Rock Type	Volcanic Breccia					
Geologic Unit	N/A					
Moisture Condition	As-received					

Date Received : 4/24/2018	Date Opened : 4/24/2018	Date Tested: 5/4/2018

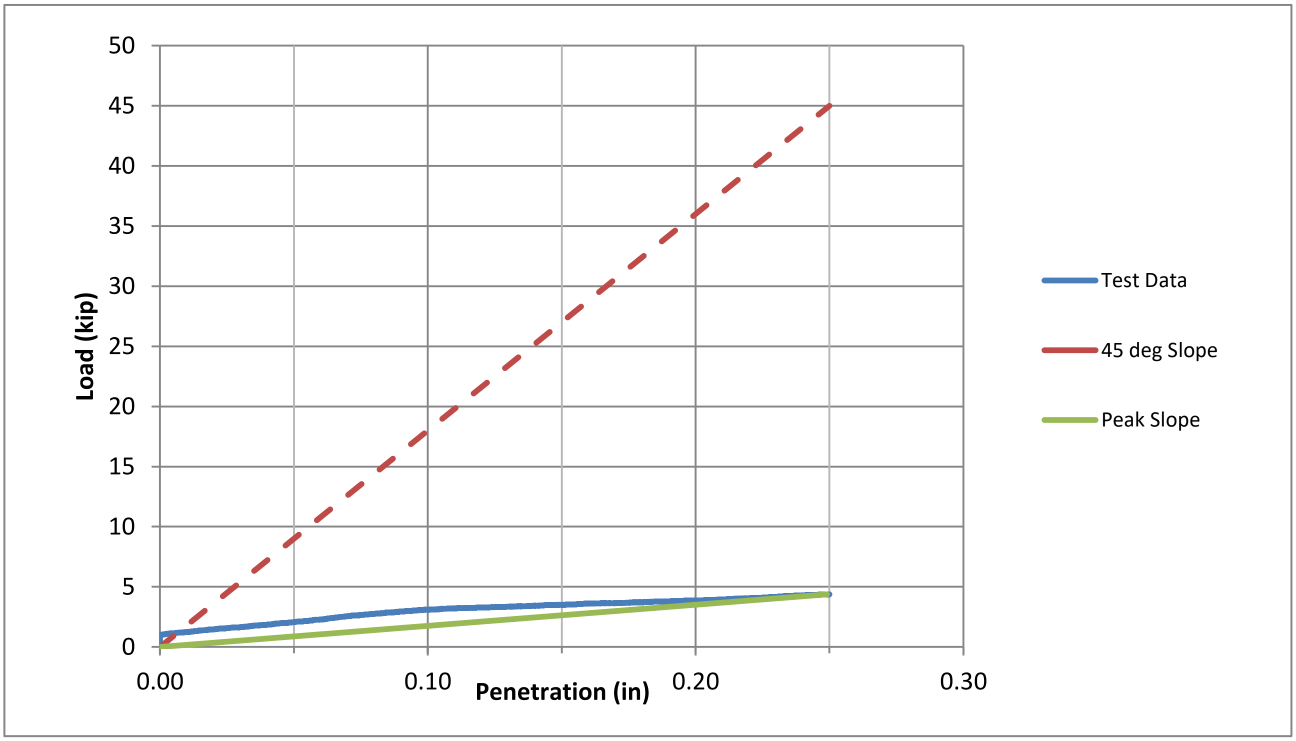

Photo After Test

Performed by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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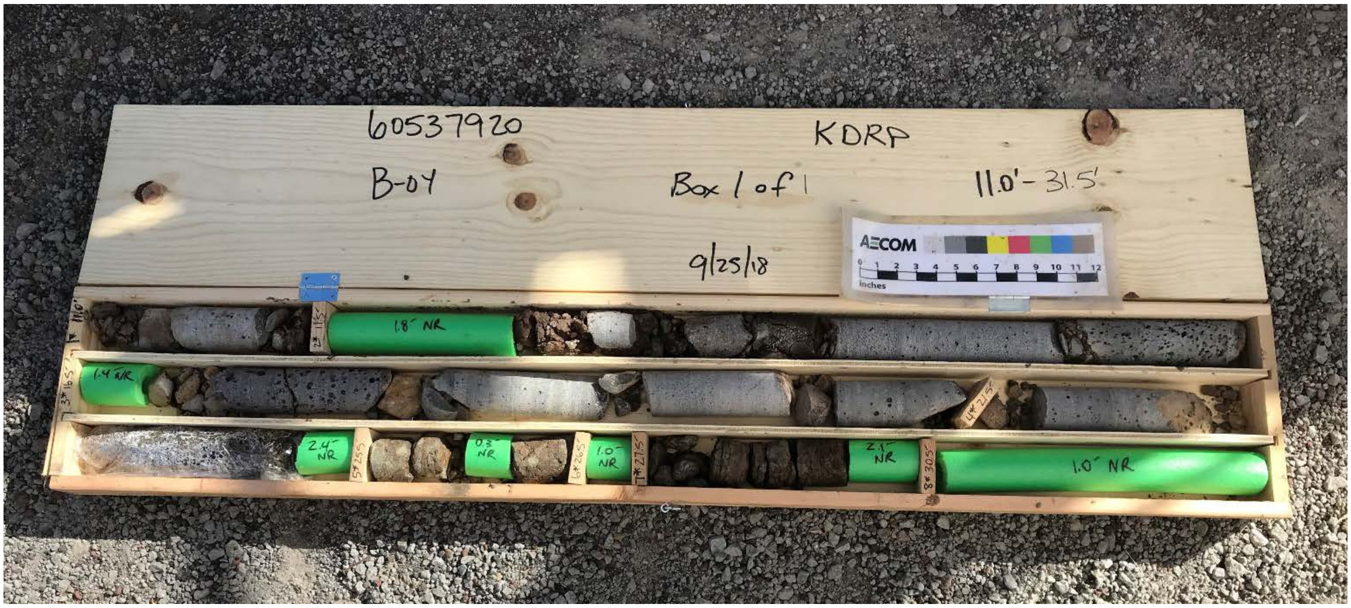
APPENDIX E CORE BOX PHOTOGRAPHS

B-01: 9.0 feet to 25.5 feet Depth (Box 1 of 1)

B-03: 22.3 feet to 27.3 feet Depth (Box 1 of 1)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Borings B-01 and B-03 Box 1	Appendix E-1



B-04: 11.0 feet to 31.5 feet Depth (Box 1 of 1)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-04 Box 1	Appendix E-2
	Project No. 6038551		

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B-05: 7.0 feet to 37.3 feet Depth (Box 1 of 2)

B-05: 37.3 feet to 50.0 feet Depth (Box 2 of 2)

B-06: 52.0 feet to 57.0 feet Depth (Box 1 of 1)

B-07: 19.0 feet to 31.8 feet Depth (Box 1 of 1)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Borings B-06 and B-07 Box 1	Appendix E-4

B-08: 35.8 feet to 47.8 feet Depth (Box 1 of 2)

B-07: 47.8 feet to 52.8 feet Depth (Box 2 of 2)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-08 Box 1 and 2	Appendix E-5

B-10: 29.5 feet to 44.3 feet Depth (Box 1 of 2)

B-10: 44.3 feet to 52.0 feet Depth (Box 2 of 2)

Klamath River Renewal Project

Project No. 6038551

Rock Core Photos
Boring B-10
Box 1 and 2

Appendix
E-6

B-13: 2.0 feet to 21.1 feet Depth (Box 1 of 1)

B-14: 8.0 feet to 28.6 feet Depth (Box 1 of 1)

Klamath River Renewal Project

Project No. 6038551

Rock Core Photos
Borings B-13 and B-14
Box 1

Appendix
E-7

B-15: 21.0 feet to 40.6 feet Depth (Box 1 of 2)

B-15: 40.6 feet to 51.5 feet Depth (Box 2 of 2)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-15 Box 1 and 2	Appendix E-8
	Project No. 6038551		

B-16: 0.0 feet to 15.4 feet Depth (Box 1 of 2)

B-16: 15.4 feet to 24.5 feet Depth (Box 2 of 2)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-16 Box 1 and 2	Appendix E-9

B-17: 15.0 feet to 29.1 feet Depth (Box 1 of 2)

B-17: 29.1 feet to 41.5 feet Depth (Box 2 of 2)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-17 Box 1 and 2	Appendix E-10

B-19: 30.0 feet to 37.5 feet Depth (Box 1 of 1)

B-20: 40.0 feet to 47.0 feet Depth (Box 1 of 1)

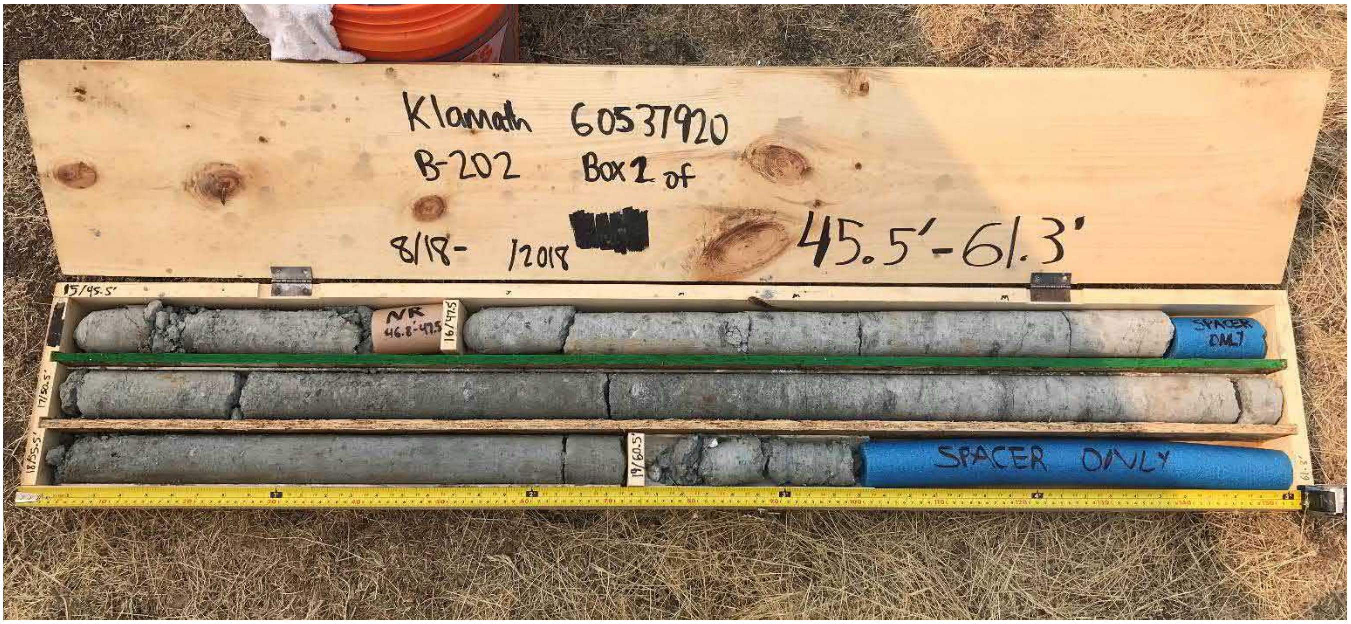
AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Borings B-19 and B-20 Box 1	Appendix E-11

B-201: 23.5 feet to 37.5 feet Depth (Box 1 of 2)

B-201: 37.5 feet to 50.5 feet Depth (Box 2 of 2)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-201 Box 1 and 2	Appendix E-12

B-202: 14 feet to 45 feet Depth (Box 1 of 6)



B-202: 45.5 feet to 61.3 feet Depth (Box 2 of 6)

AECOM

Klamath River Renewal Project

Project No. 6038551

Rock Core Photos
Boring B-202
Box 1 and 2

Appendix
E-13

B-202: 61.3 feet to 71.7 feet Depth (Box 3 of 6)

B-202: 71.7 feet to 83.9 feet Depth (Box 4 of 6)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-202 Box 3 and 4	Appendix E-14

B-202: 83.9 feet to 95.5 feet Depth (Box 5 of 6)

B-202: 95.5 feet to 100.5 feet Depth (Box 6 of 6)

AECOM

Klamath River Renewal Project

Project No. 6038551

Rock Core Photos
Boring B-202
Box 5 and 6

Appendix
E-15

B-203: 2.0 feet to 31.5 feet Depth (Box 1 of 7)

B-203: 31.5 feet to 46.5 feet Depth (Box 2 of 7)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-203 Box 1 and 2	Appendix E-16
	Project No. 6038551		

B-203: 46.5 feet to 60.5 feet Depth (Box 3 of 7)

B-203: 60.5 feet to 75.5 feet Depth (Box 4 of 7)

	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-203 Box 3 and 4	Appendix E-17

B-203: 75.5 feet to 90.5 feet Depth (Box 5 of 7)

B-203: 90.5 feet to 105.5 feet Depth (Box 6 of 7)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-203 Box 5 and 6	Appendix E-18

B-203: 105.5 feet to 120 feet Depth (Box 7 of 7)

B-205: 19.5 feet to 30.6 feet Depth (Box 1 of 5)

B-205: 30.6 feet to 39.7 feet Depth (Box 2 of 5)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-205 Box 1 and 2	Appendix E-20

B-205: 39.7 feet to 49.5 feet Depth (Box 3 of 5)

B-205: 49.5 feet to 59.5 feet Depth (Box 4 of 5)

B-205: 59.5 feet to 62 feet Depth (Box 5 of 5)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-205 Box 5	Appendix E-22
	Project No. 6038551		

B-206: 20 feet to 36.5 feet Depth (Box 1 of 6)

B-206: 36.5 feet to 47.4 feet Depth (Box 2 of 6)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-206 Box 1 and 2	Appendix E-23
	Project No. 6038551		

B-206: 47.4 feet to 60.0 feet Depth (Box 3 of 6)

B-206: 60.0 feet to 73.6 feet Depth (Box 4 of 6)

B-206: 73.6 feet to 88.8 feet Depth (Box 5 of 6)

B-206: 88.8 feet to 100.0 feet Depth (Box 6 of 6)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-206 Box 5 and 6	Appendix E-25
	Project No. 6038551		

B-207: 15.2 feet to 30.8 feet Depth (Box 1 of 5)

B-207: 30.8 feet to 49.4 feet Depth (Box 2 of 5)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-207 Box 1 and 2	Appendix E-26

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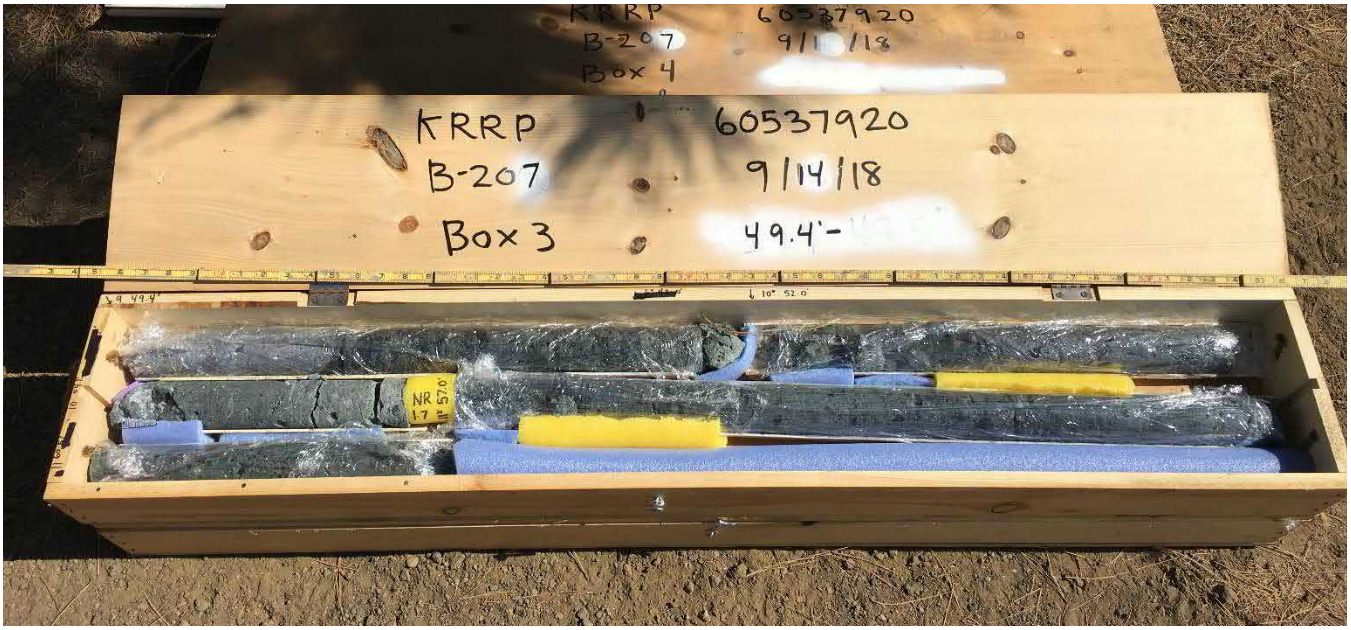
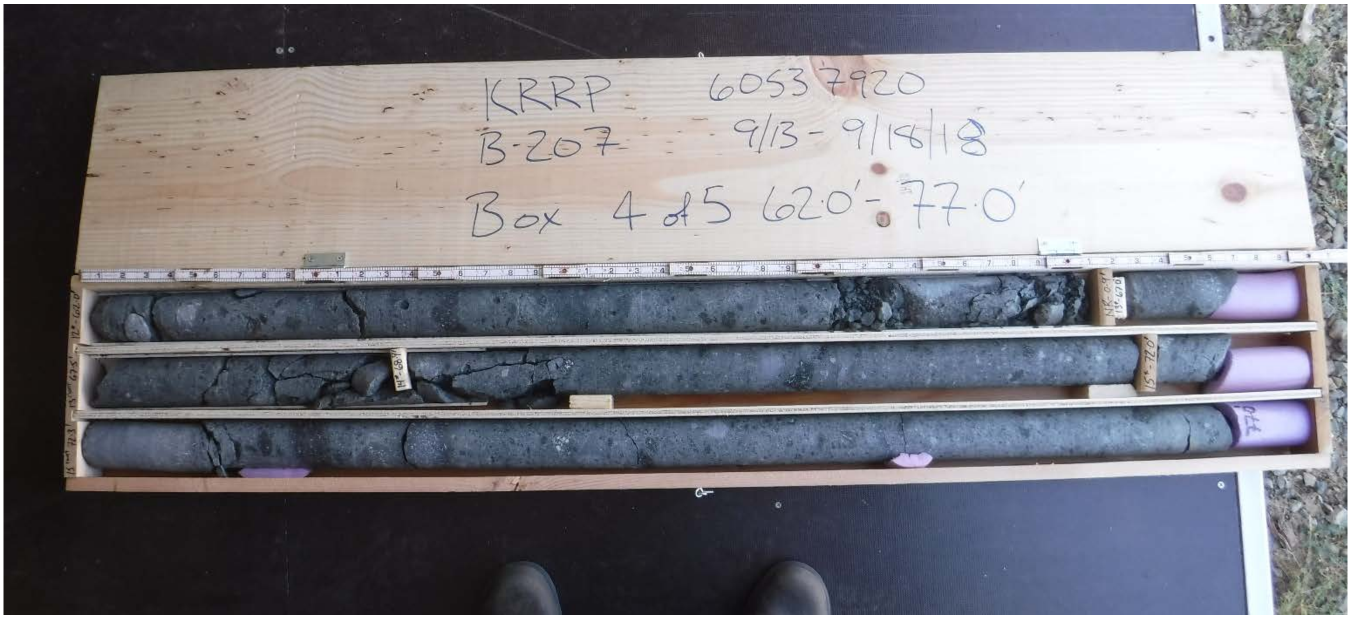


B-207: 49.4 feet to 62.0 feet Depth (Box 3 of 5)

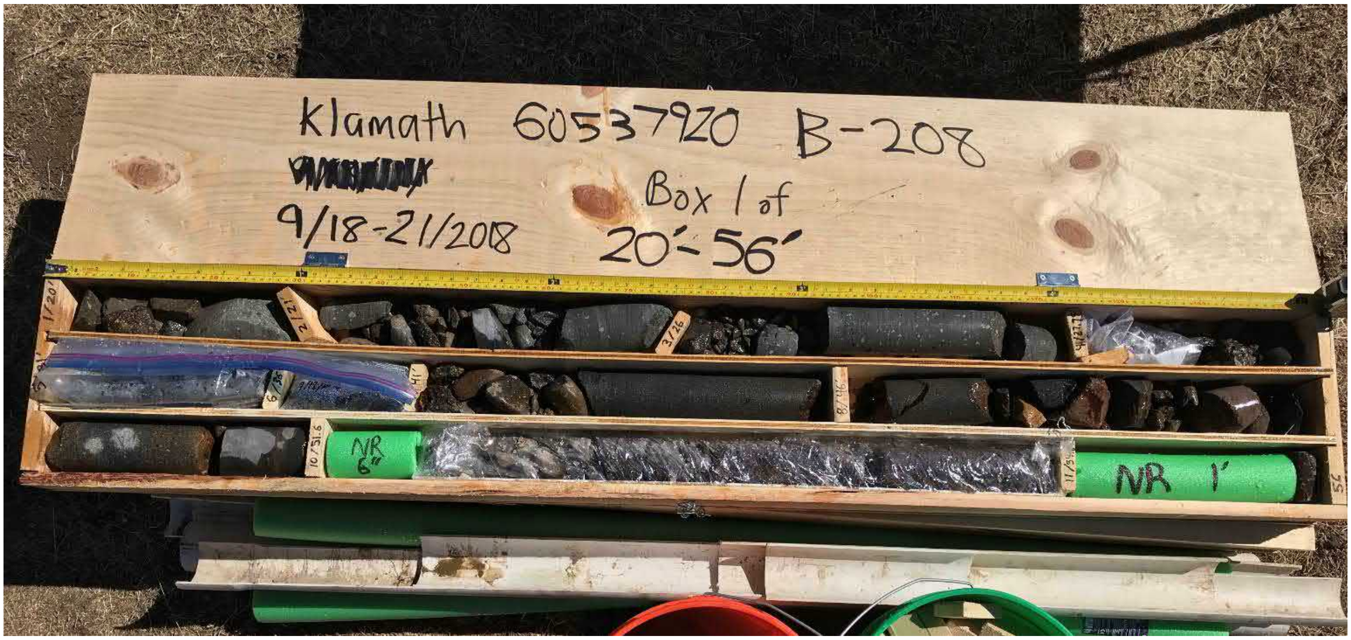


B-207: 62.0 feet to 77.0 feet Depth (Box 4 of 5)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-207 Box 3 and 4	Appendix E-27
	Project No. 6038551		

B-207: 77.0 feet to 81.1 feet Depth (Box 5 of 5)

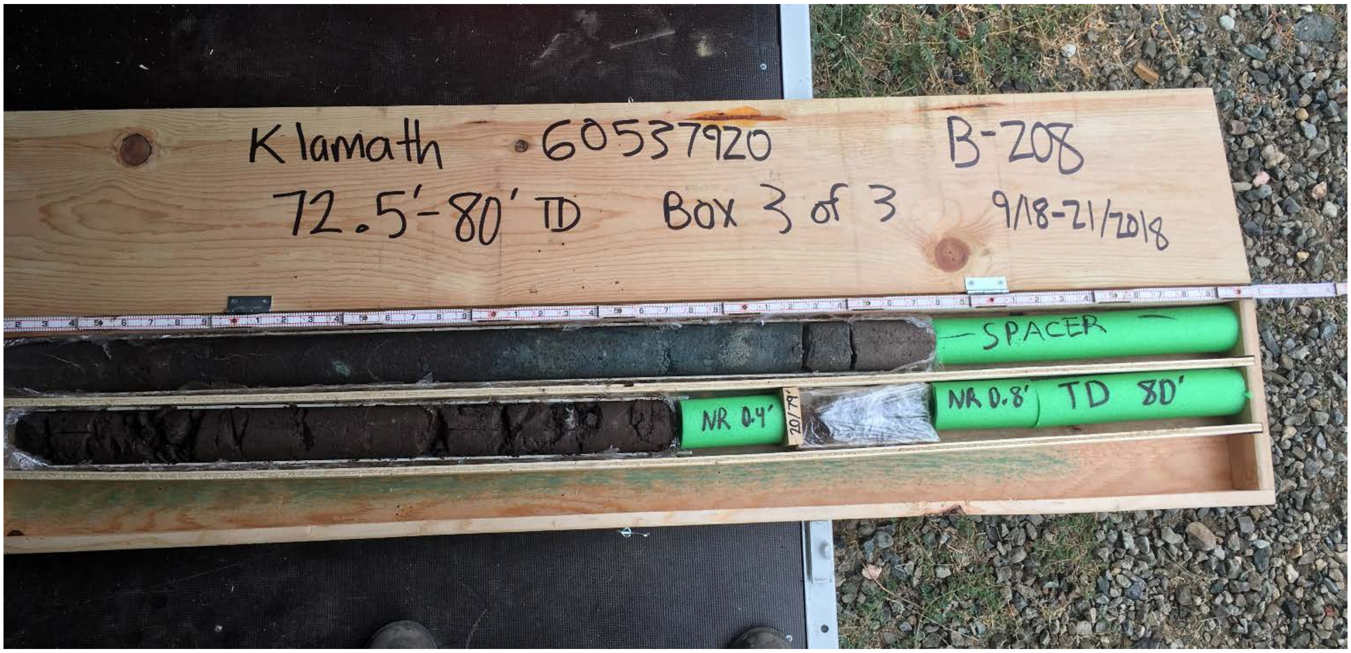
AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-207 Box 5	Appendix E-28



B-208: 20.0 feet to 56.0 feet Depth (Box 1 of 3)

B-208: 56.0 feet to 72.5 feet Depth (Box 2 of 3)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-208 Box 1 and 2	Appendix E-29



B-208: 72.5 feet to 80.0 feet Depth (Box 3 of 3)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-208 Box 3	Appendix E-30
	Project No. 6038551		

BI-02: 17.5 feet to 34.0 feet Depth (Box 1 of 4)

BI-02: 34.0 feet to 46.7 feet Depth (Box 2 of 4)

BI-02: 46.7 feet to 61.1 feet Depth (Box 3 of 4)

BI-02: 61.1 feet to 67.0 feet Depth (Box 4 of 4)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring BI-02 Box 3 and 4	Appendix E-32

BI-03: 5.5 feet to 20.1 feet Depth (Box 1 of 2)

BI-03: 20.1 feet to 35.1 feet Depth (Box 2 of 2)

AECOM

Klamath River Renewal Project

Project No. 6038551

Rock Core Photos
Boring BI-03
Box 1 and 2

Appendix
E-33

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