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 12 of 12)

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

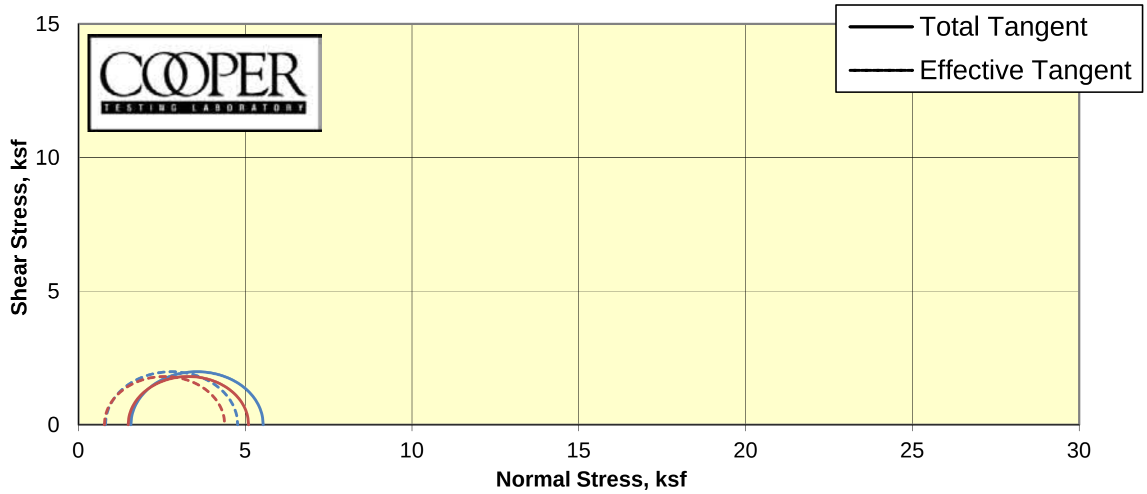
Klamath River Renewal Corporation	**Project Nos. 14803-001;**
PacifiCorp	**2082-063**

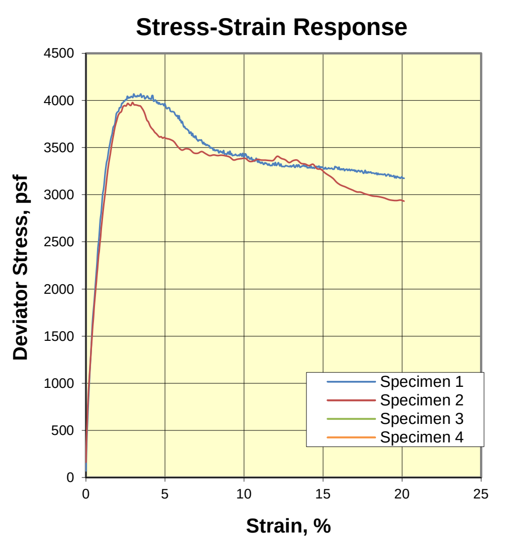
AMENDED APPLICATION FOR SURRENDER OF LICENSE FOR MAJOR PROJECT AND REMOVAL OF PROJECT WORKS

EXHIBIT R-6
City of Yreka Waterline
(continued)

City of Yreka Waterline Modification 100% Design Drawings (continued)

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767

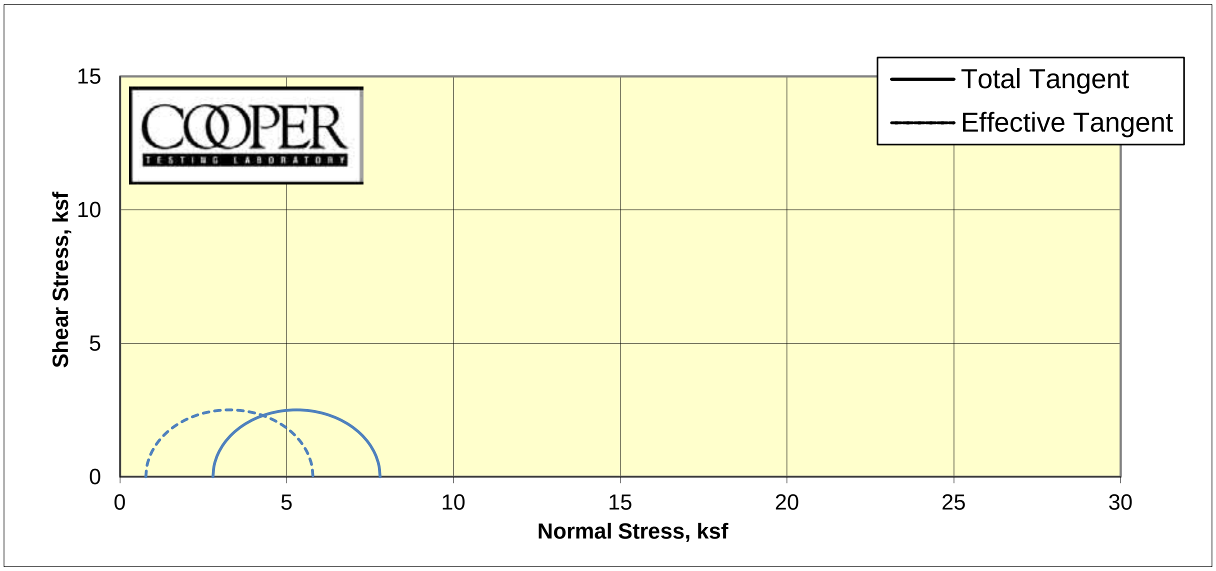


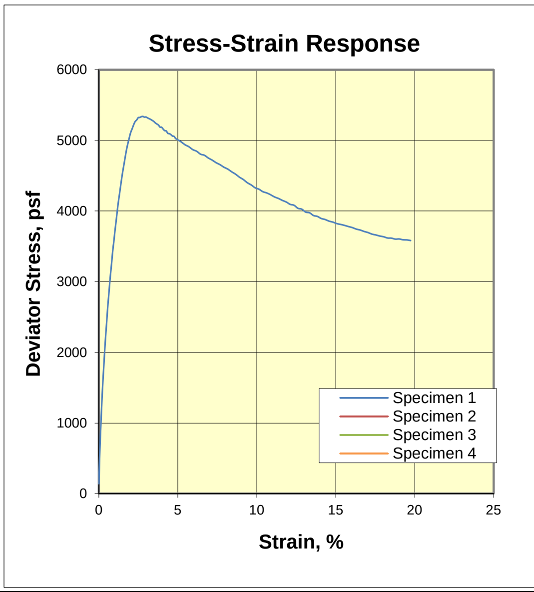


CTL Number:	020-251
Client Name:	Klamath River Dam Removal Project
Project Name:	60537920
Project Number:	43237
Date:	5/17/2018 By: MD/DC
Total C	#DIV/0! ksf
Total phi	#DIV/0! degrees
Eff. C	#DIV/0! ksf
Eff. Phi	#DIV/0! degrees ©

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



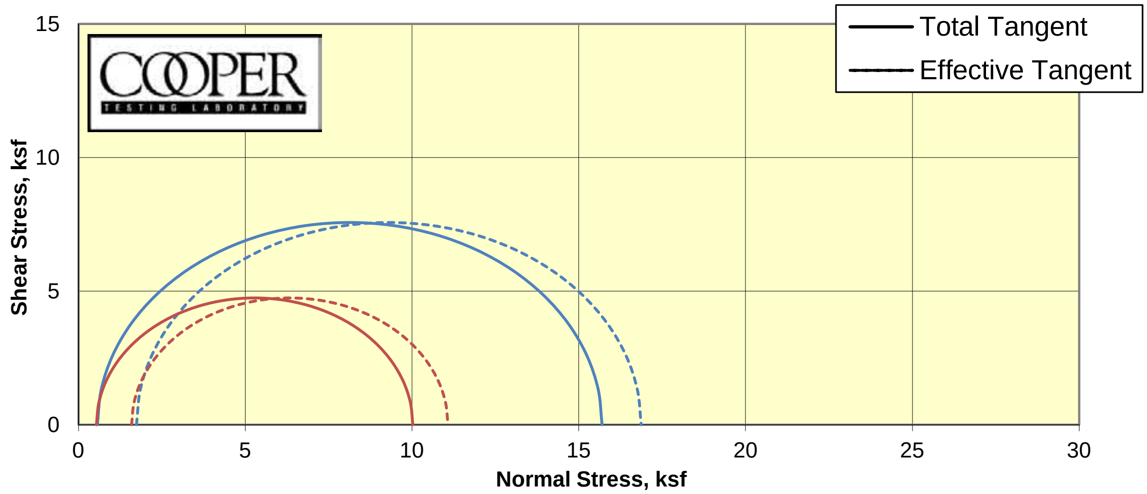


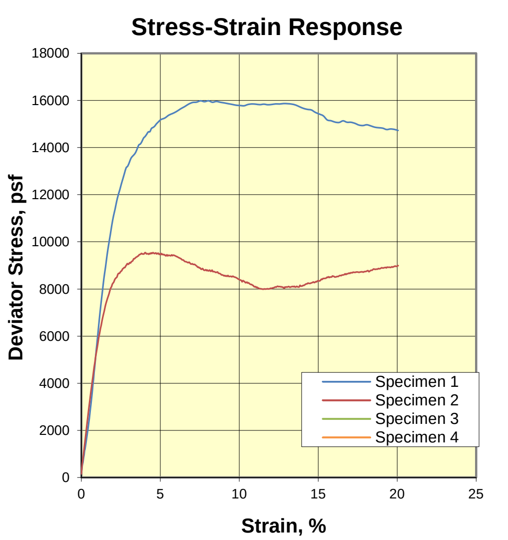
CTL Number:	020-251
Client Name:	AECOM
Project Name:	Klamath River Dam Removal Project
Project Number:	60537920
Date:	5/21/2018 By: MD/DC

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
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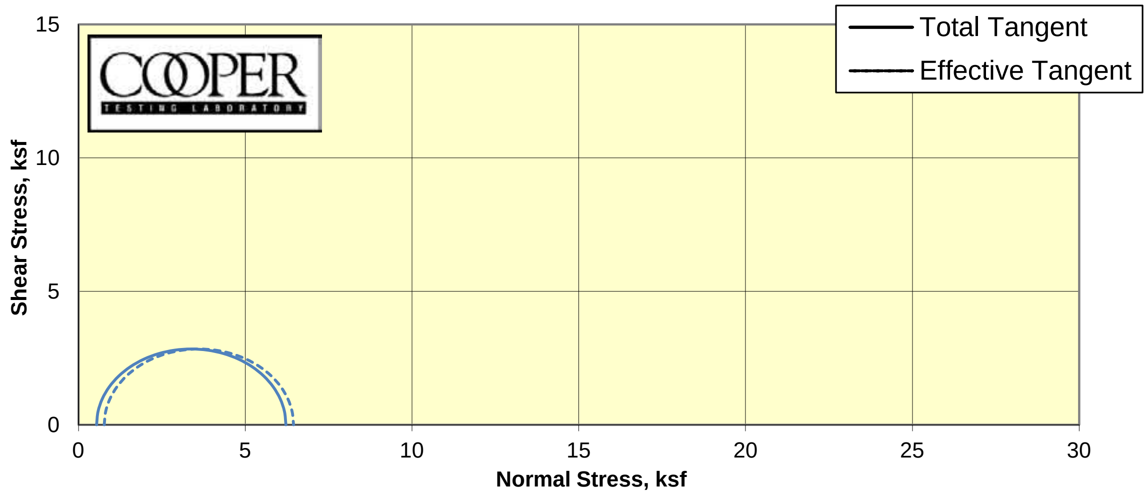
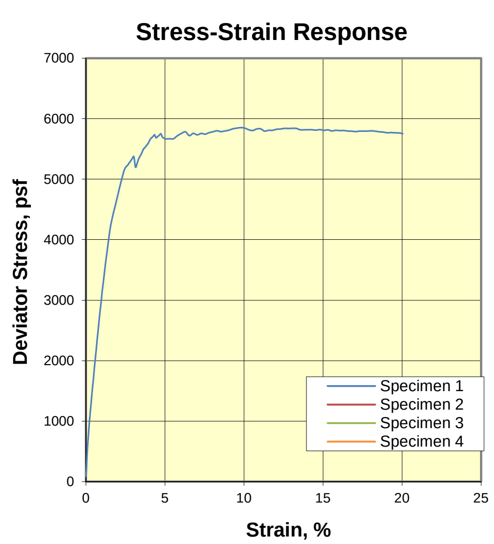
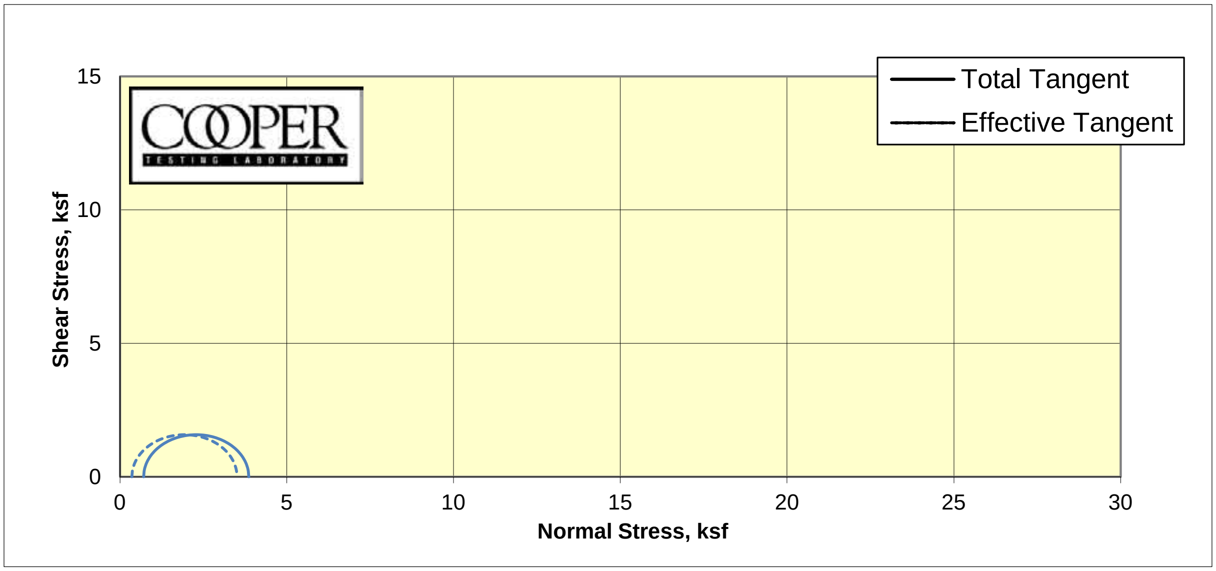


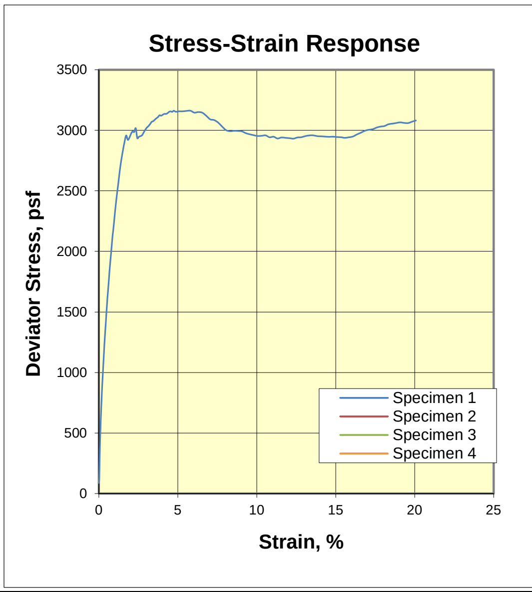


Specimen	1	2	3	4
Boring	BC-04			
Sample	S-5			
Depth	17.5(Tip-6")			
Visual Description	Light Gray CLAY			
MC (%)	104.7			
Dry Density (pcf)	42.1			
Saturation (%)	94.2			
Void Ratio	3.000			
Diameter (in)	2.87			
Height (in)	6.08			
	Final			
MC (%)	105.4			
Dry Density (pcf)	43.8			
Saturation (%)	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			

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	©

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767





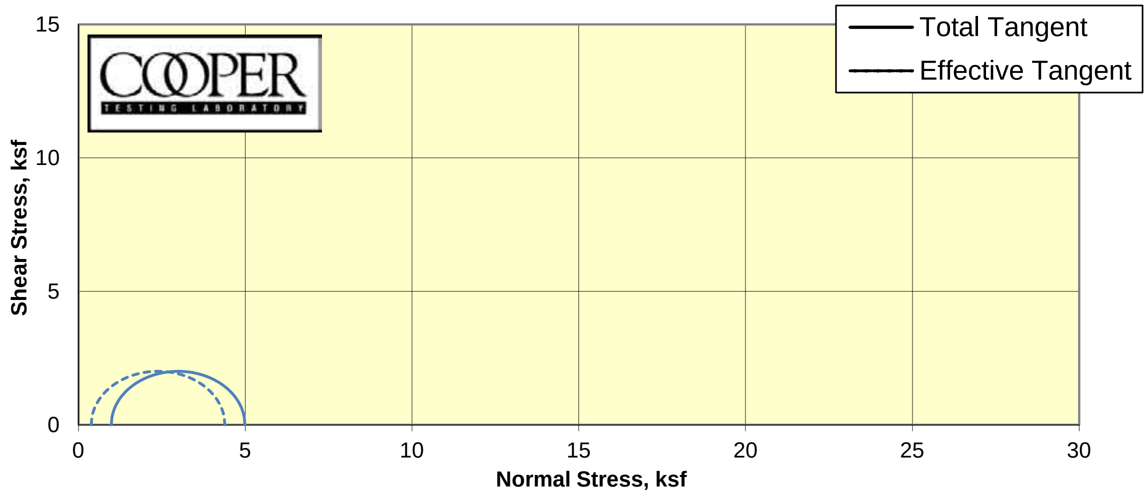
CTL Number:	020-251
Client Name:	AECOM
Project Name:	Klamath River Dam Removal Project
Project Number:	60537920
Date:	5/30/2018 By: MD/DC

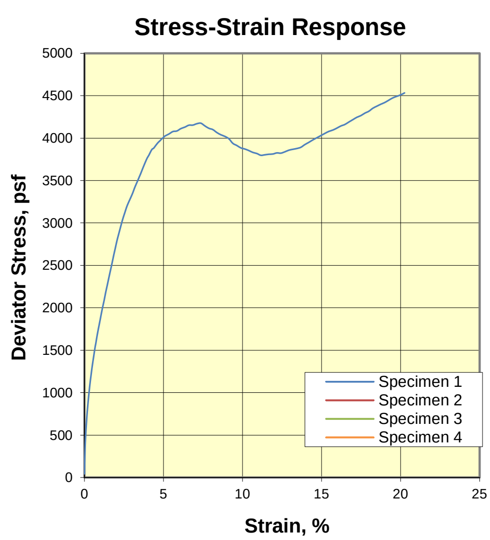
Total C	#DIV/0!	ksf
Total phi	#DIV/0!	degrees
Eff. C	#DIV/0!	ksf
Eff. Phi	#DIV/0!	degrees

©

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			

Consolidated Undrained Triaxial Compression with Pore Pressure
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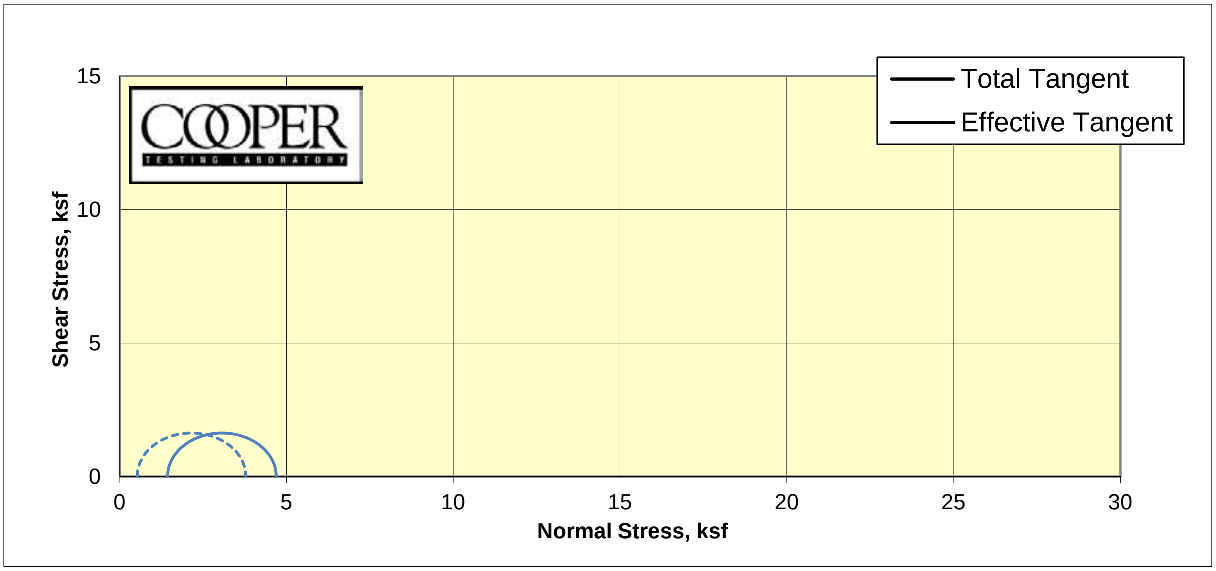
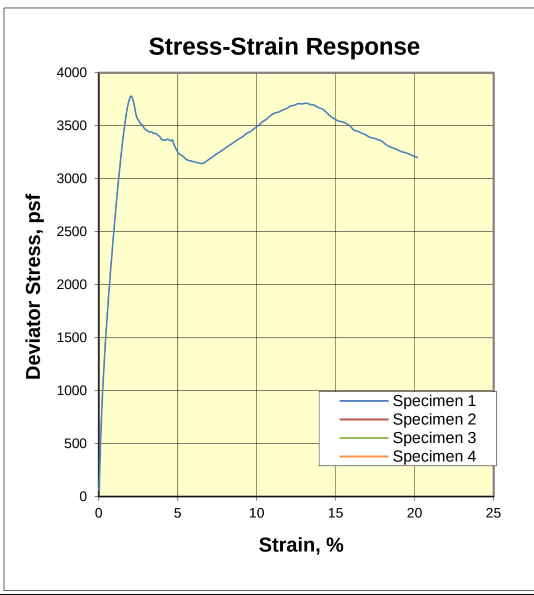
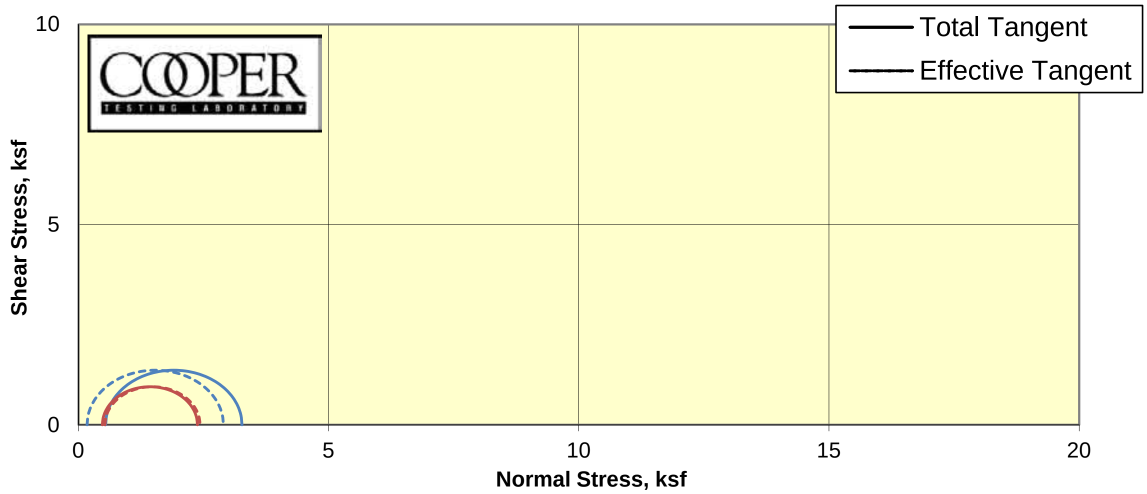


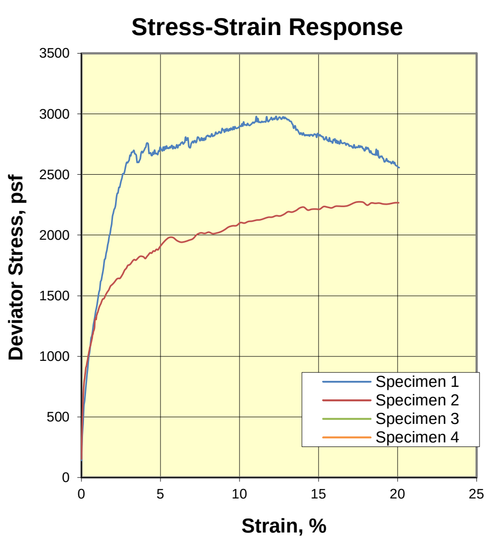


CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	5/25/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

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
ASTM D4767

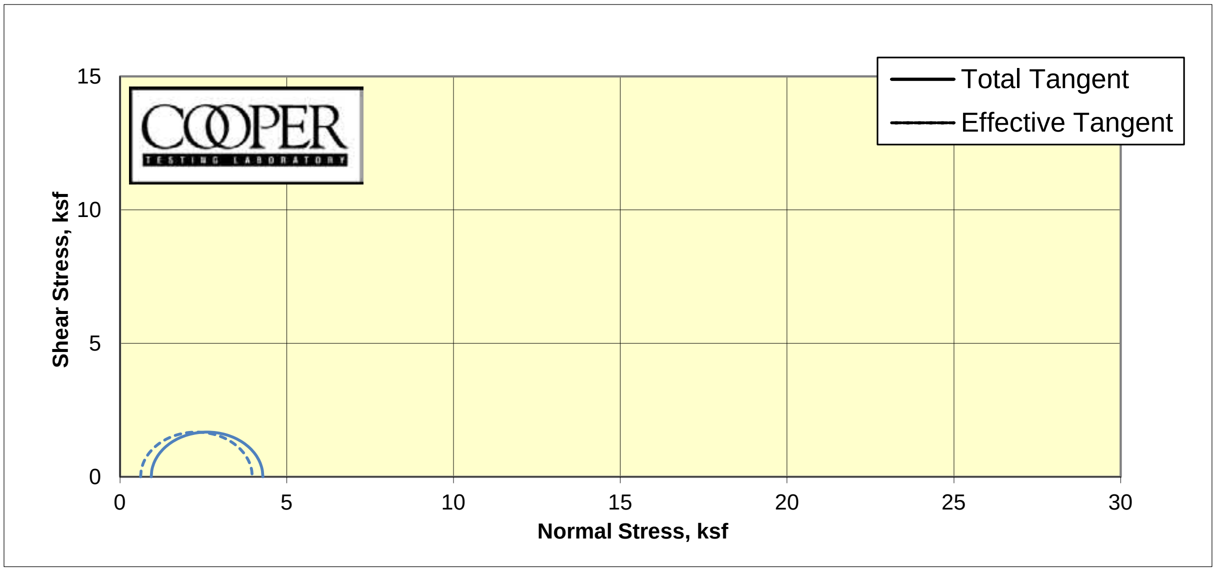


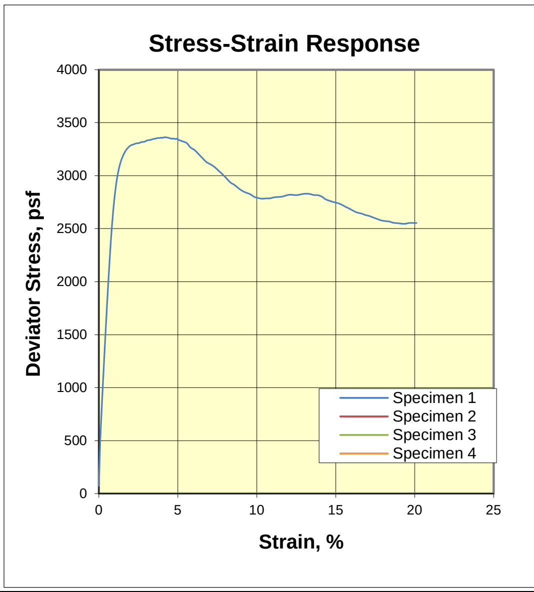


Specimen	1	2	3	4
Boring	BC-05	BC-05		
Sample	S-04	S-04		
Depth	14.5(Tip-16")	14.5(Tip-1")		
Visual Description	Olive CLAY (Silty)/SILT (slightly plastic)	Olive Mottled Yellow Clayey SAND/ Sandy CLAY		
MC (%)	135.1	30.0		
Dry Density (pcf)	35.4	92.8		
Saturation (%)	97.0	99.2		
Void Ratio	3.760	0.816		
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		

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	©

Consolidated Undrained Triaxial Compression with Pore Pressure
ASTM D4767



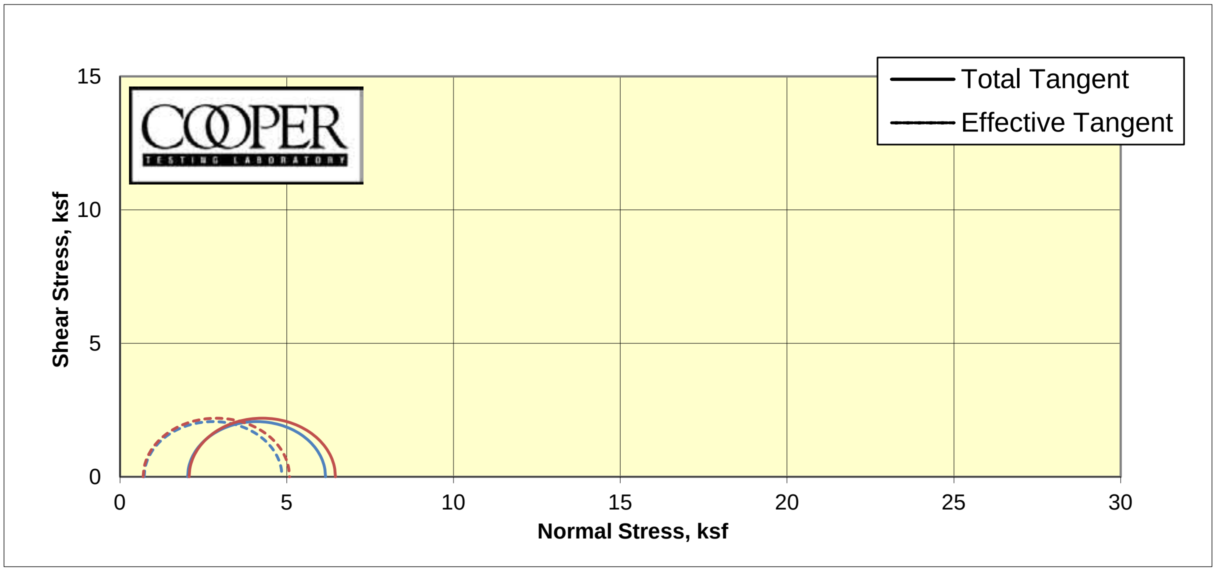


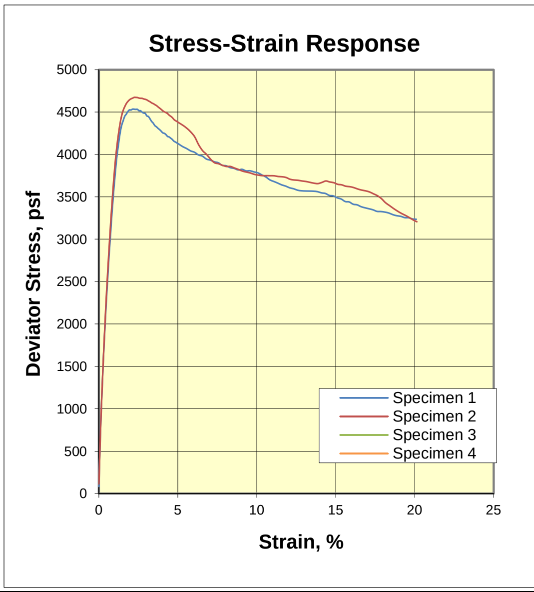
CTL Number:	020-251
Client Name:	AECOM
Project Name:	Klamath River Dam Removal Project
Project Number:	60537920
Date:	5/30/2018 By: MD/DC

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-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

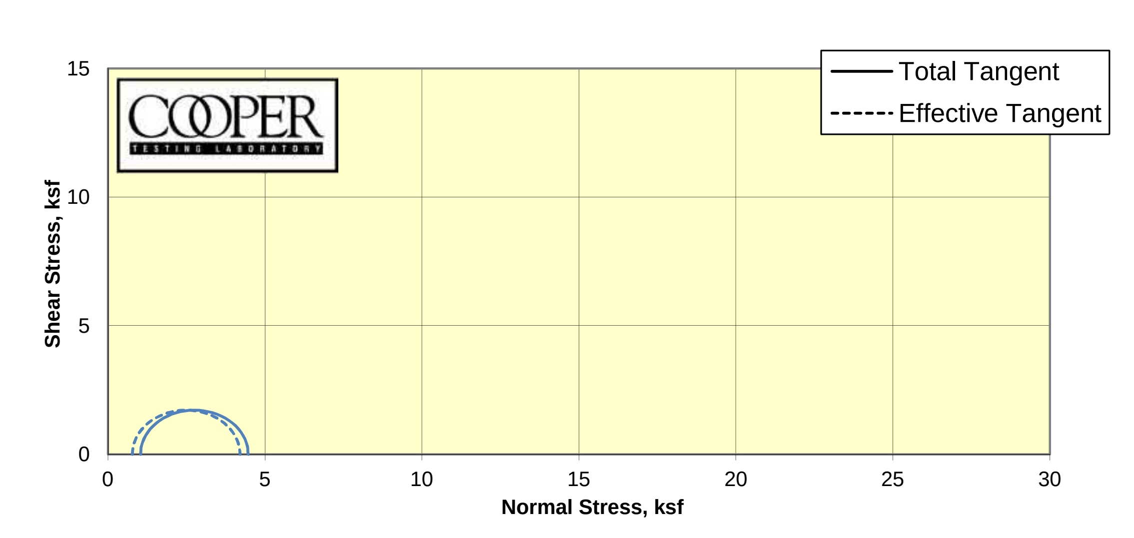


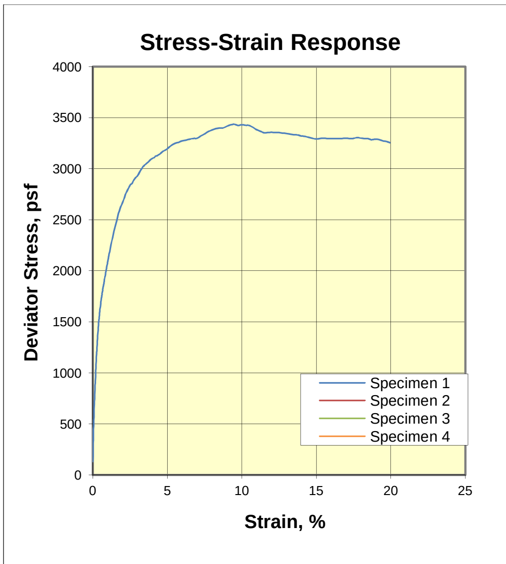


CTL Number:	020-251		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	6/6/2018	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

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

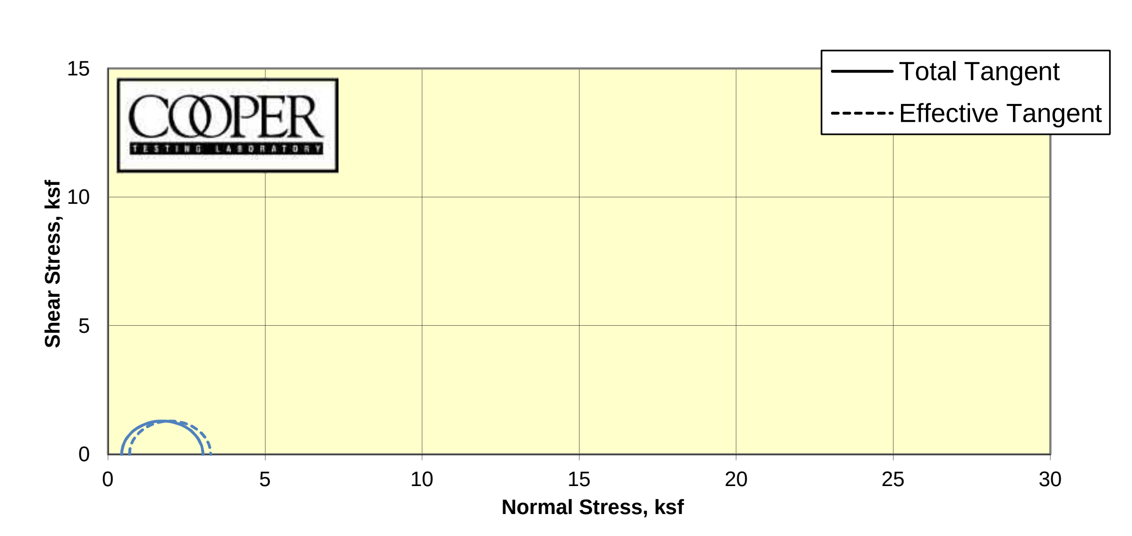


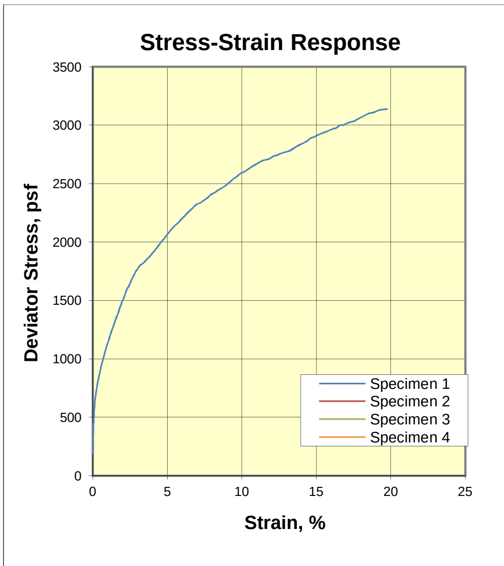


CTL Number:	020-272		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	1/2/2019	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

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

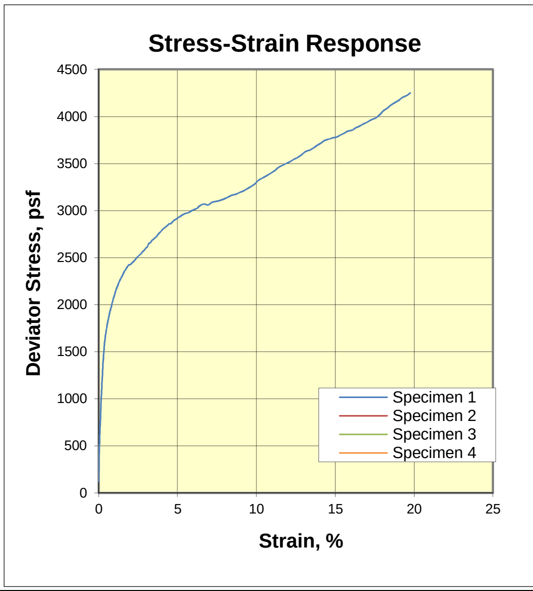




CTL Number:	020-272		
Client Name:	AECOM		
Project Name:	Klamath River Dam Removal Project		
Project Number:	60537920		
Date:	1/3/2019	By:	MD/DC
Total C	#DIV/0!	ksf	
Total phi	#DIV/0!	degrees	
Eff. C	#DIV/0!	ksf	
Eff. Phi	#DIV/0!	degrees	©

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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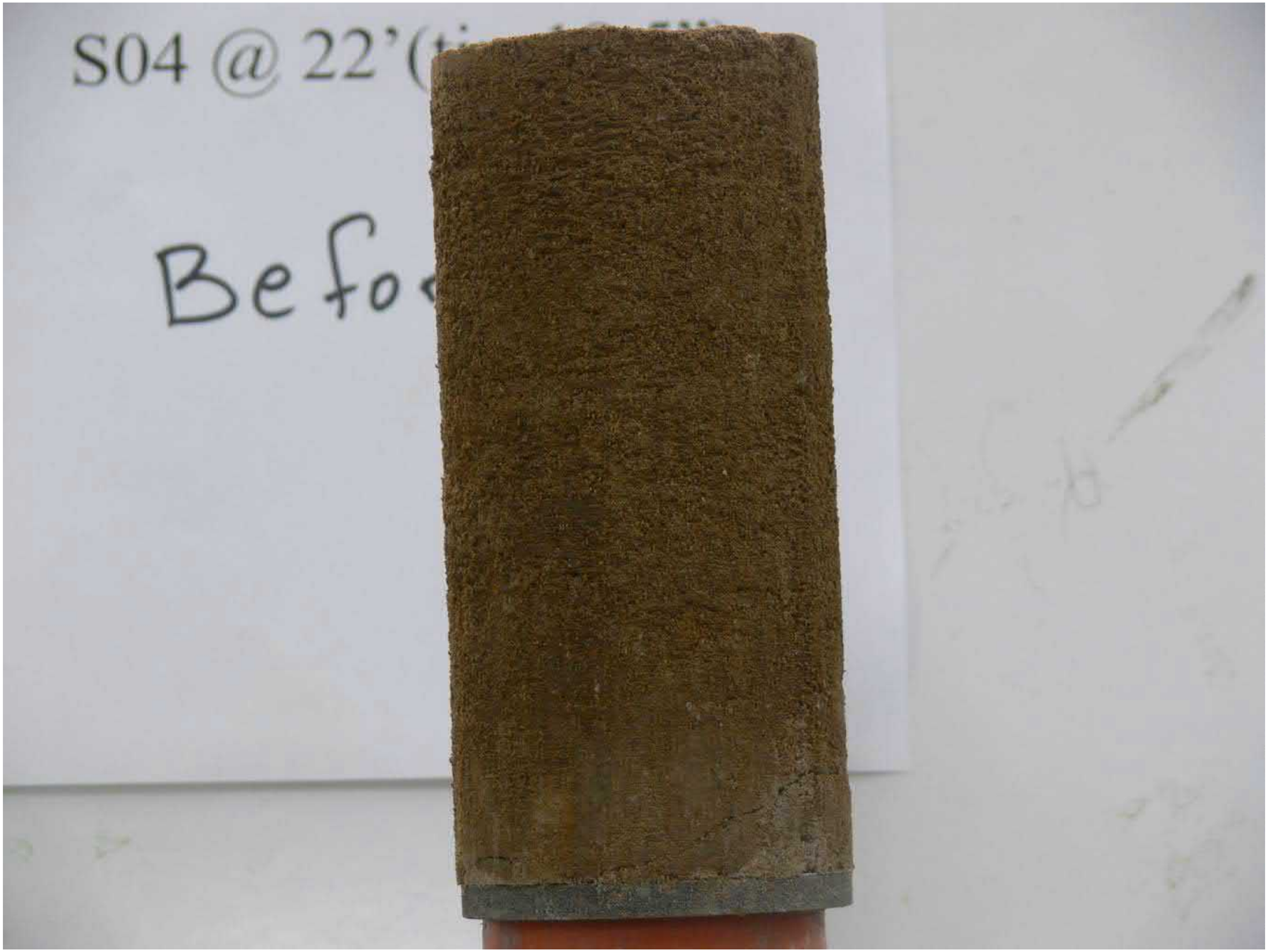

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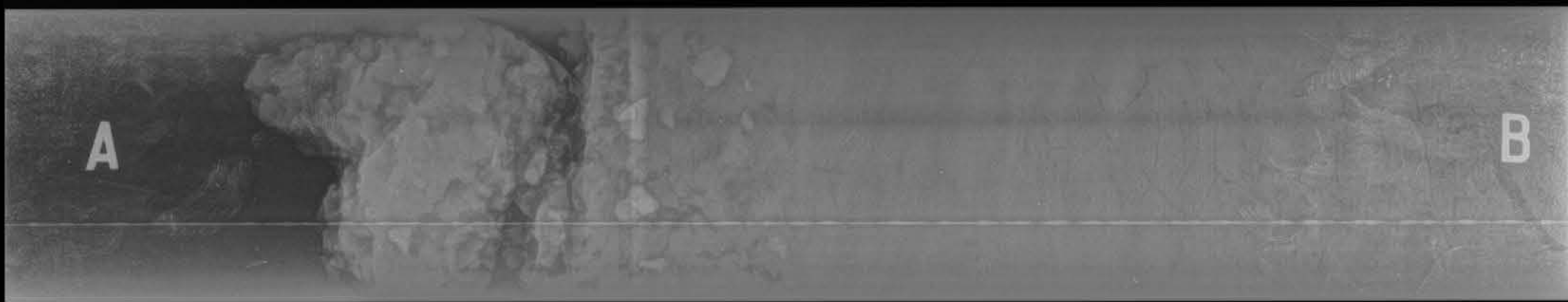
CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

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

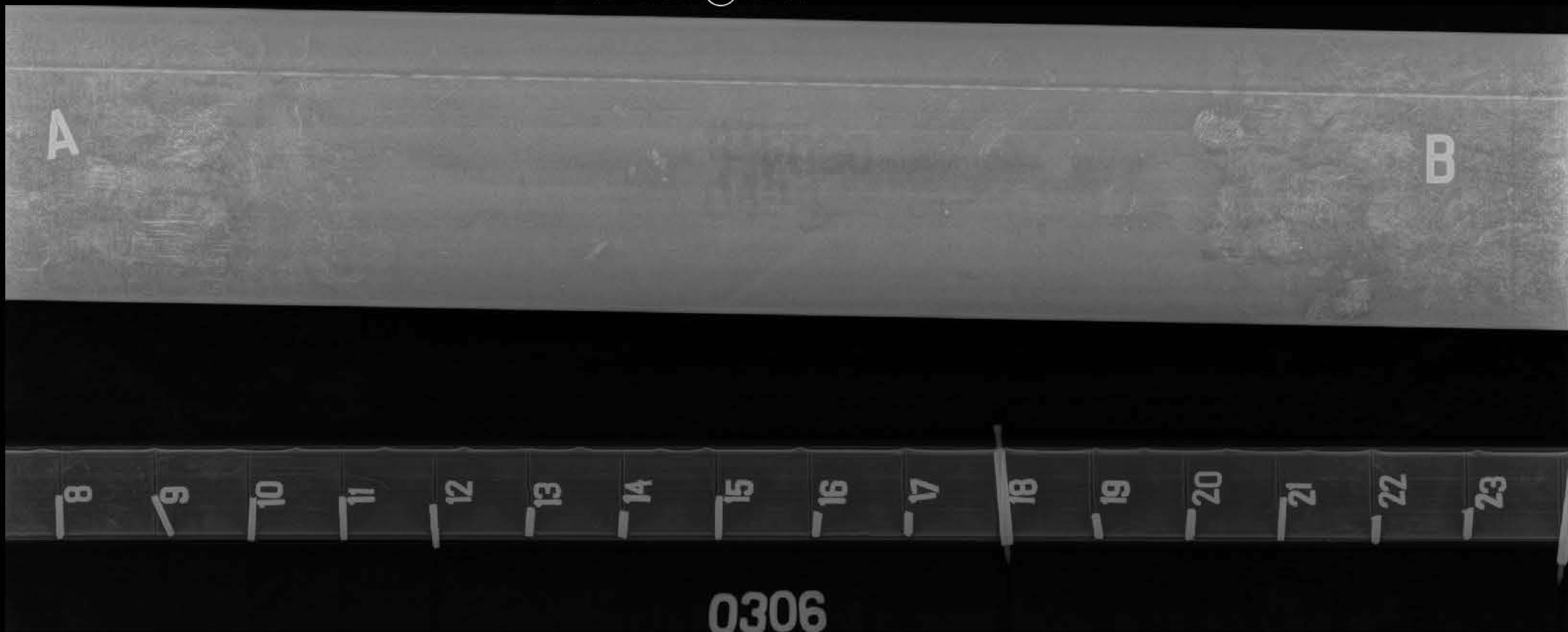
BC-02 S06 @ 19.5'

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'



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Klamath River Dam Removal
60537920

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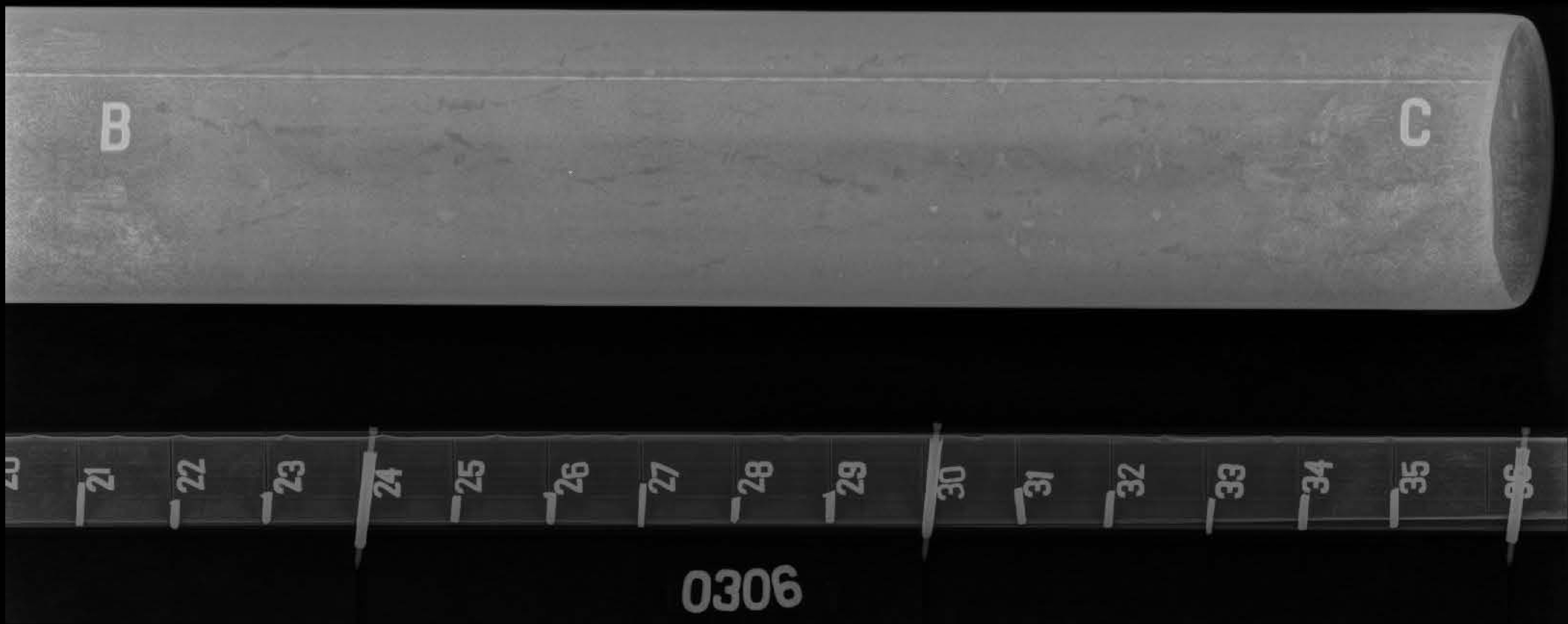

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AECOM
Klamath River Dam Removal
60537920

Scale in inches
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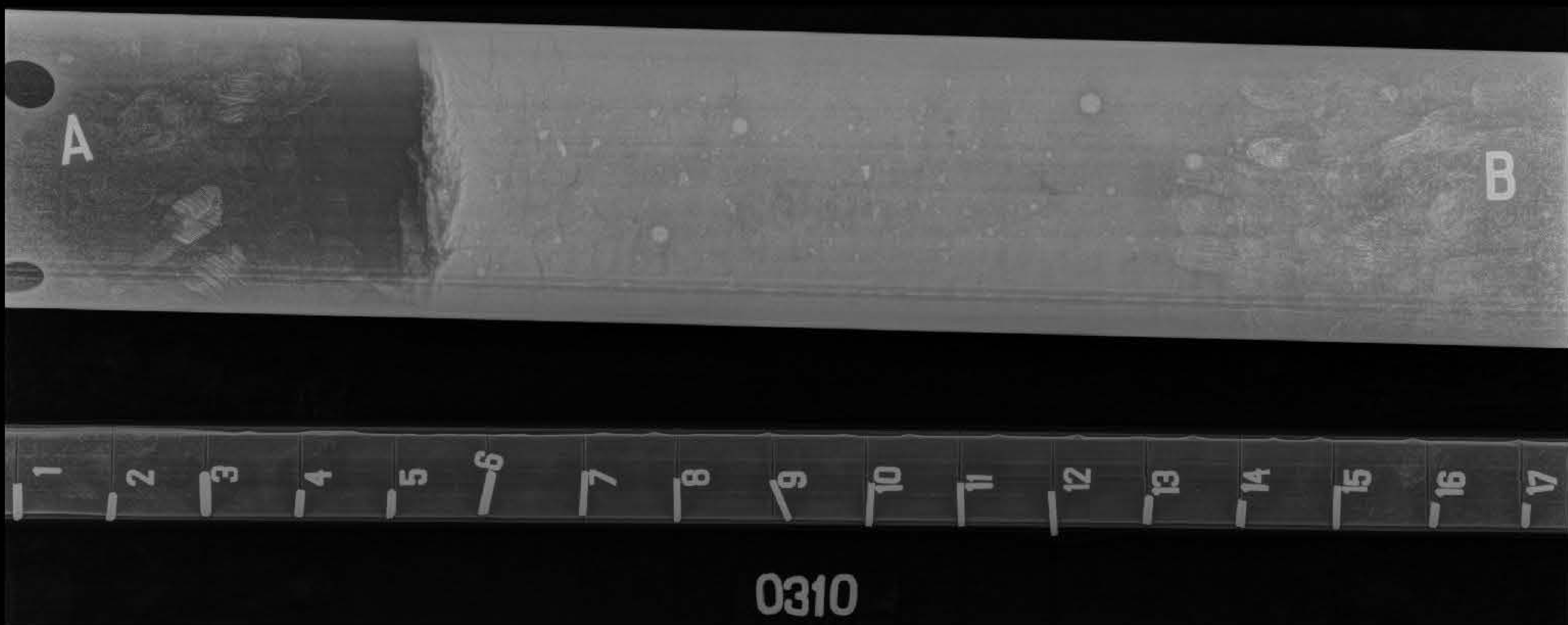
BC-03 S10 @ 90'



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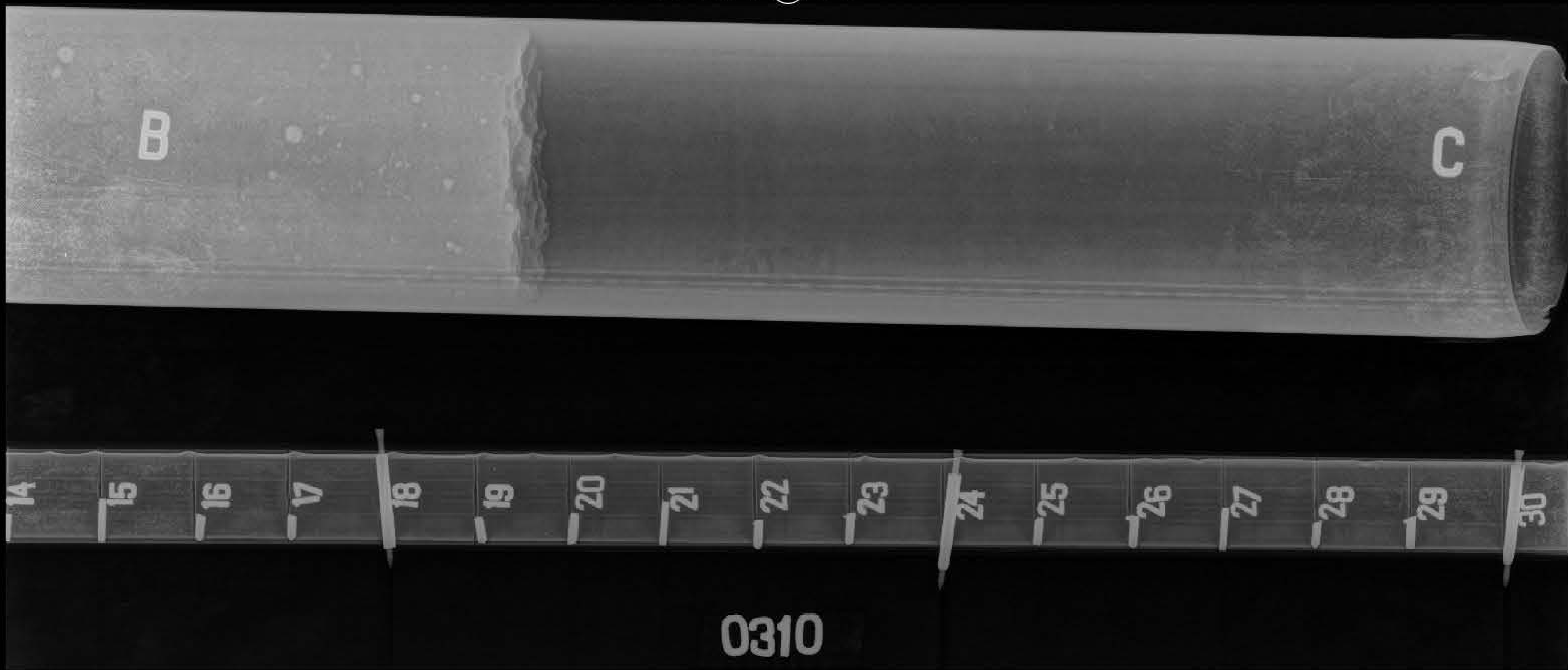
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

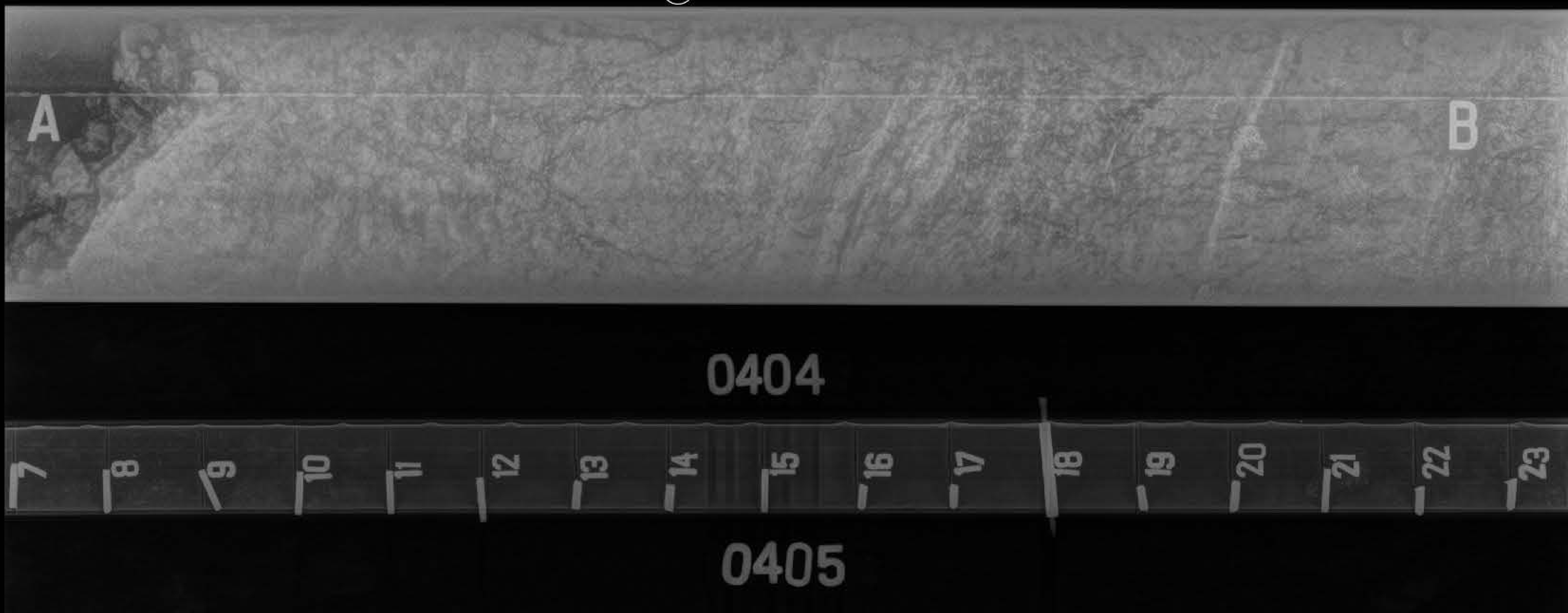
BC-03 S10 @ 90'



CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S04 @ 12.5'

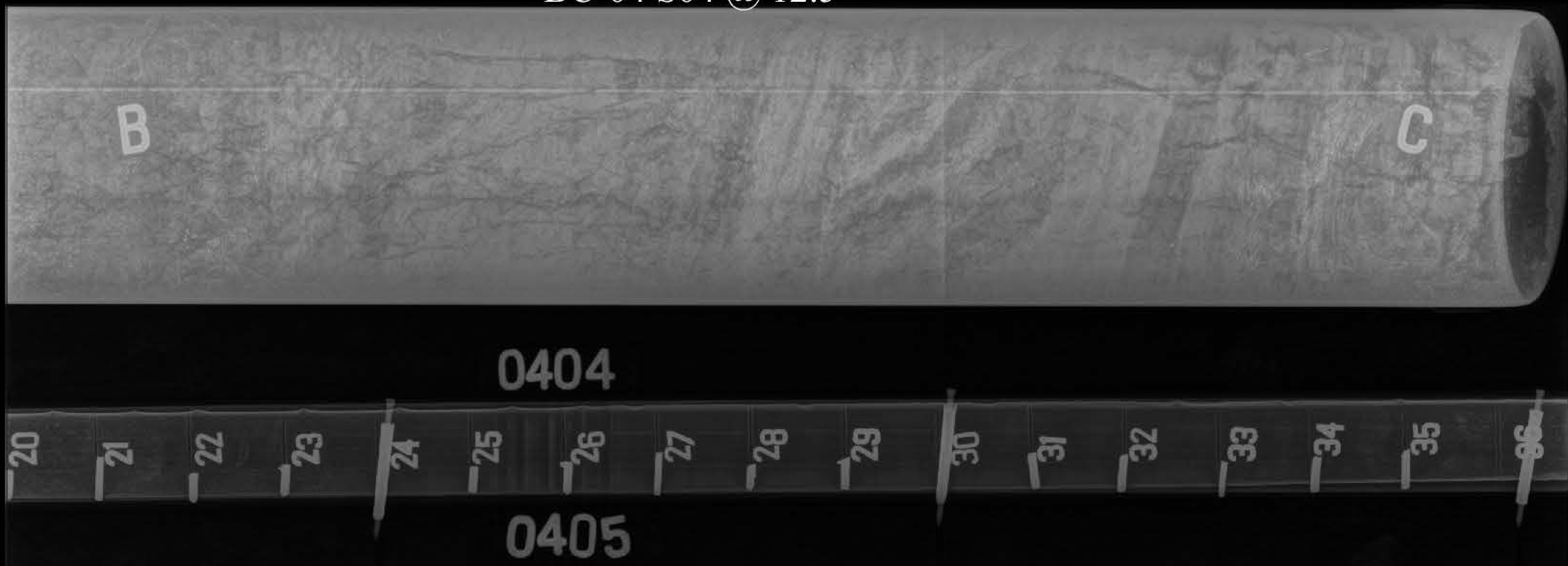


BC-04 S05 @ 17.5'

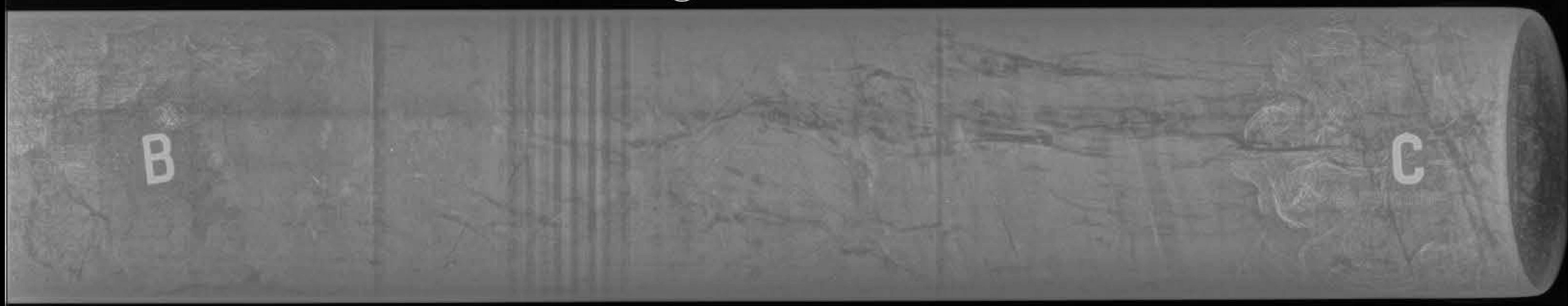
CTL# 020-251
AECOM
Klamath River Dam Removal
60537920

Scale in inches
0 = Top of Tube

BC-04 S04 @ 12.5'



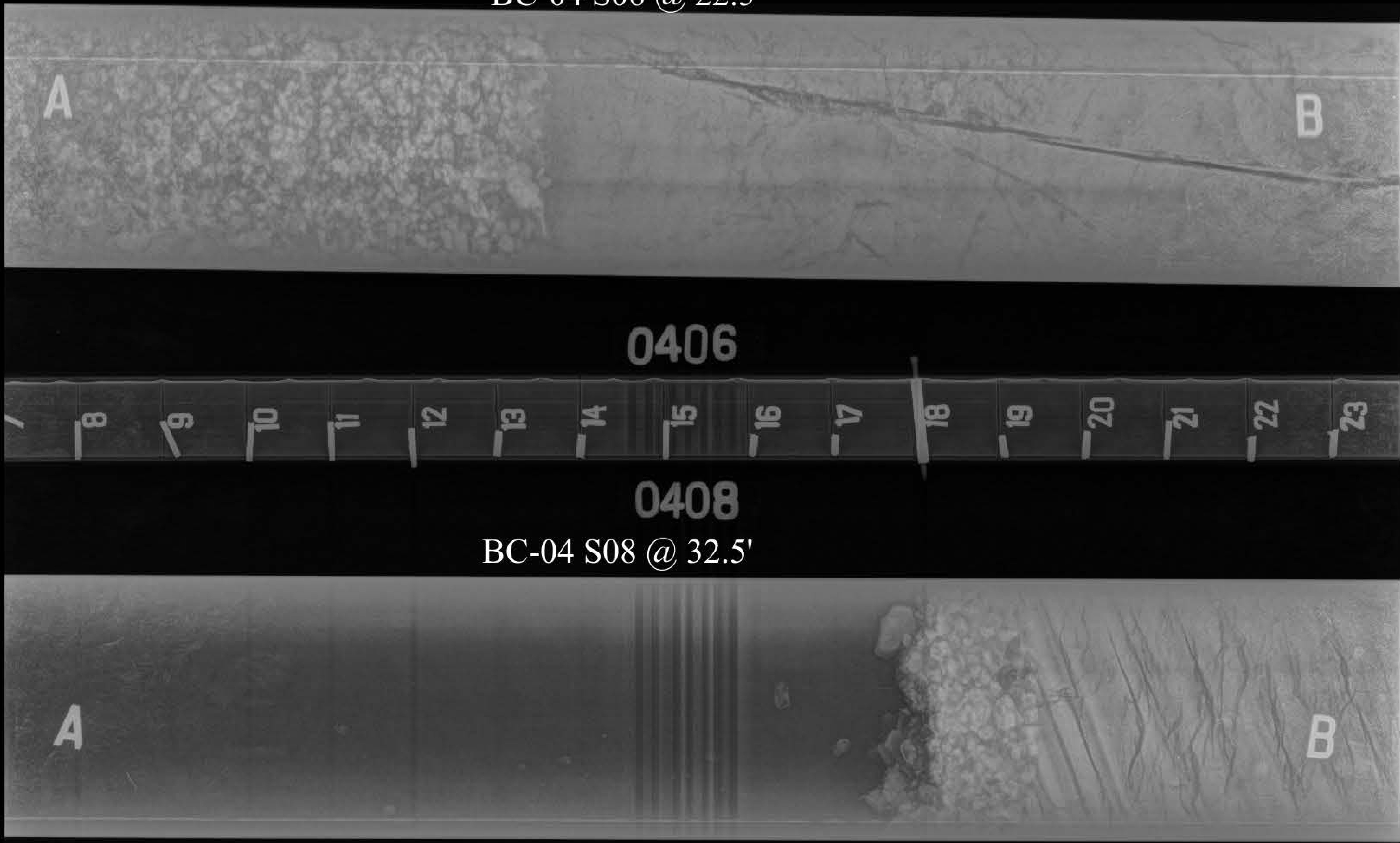
BC-04 S05 @ 17.5'



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'

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'

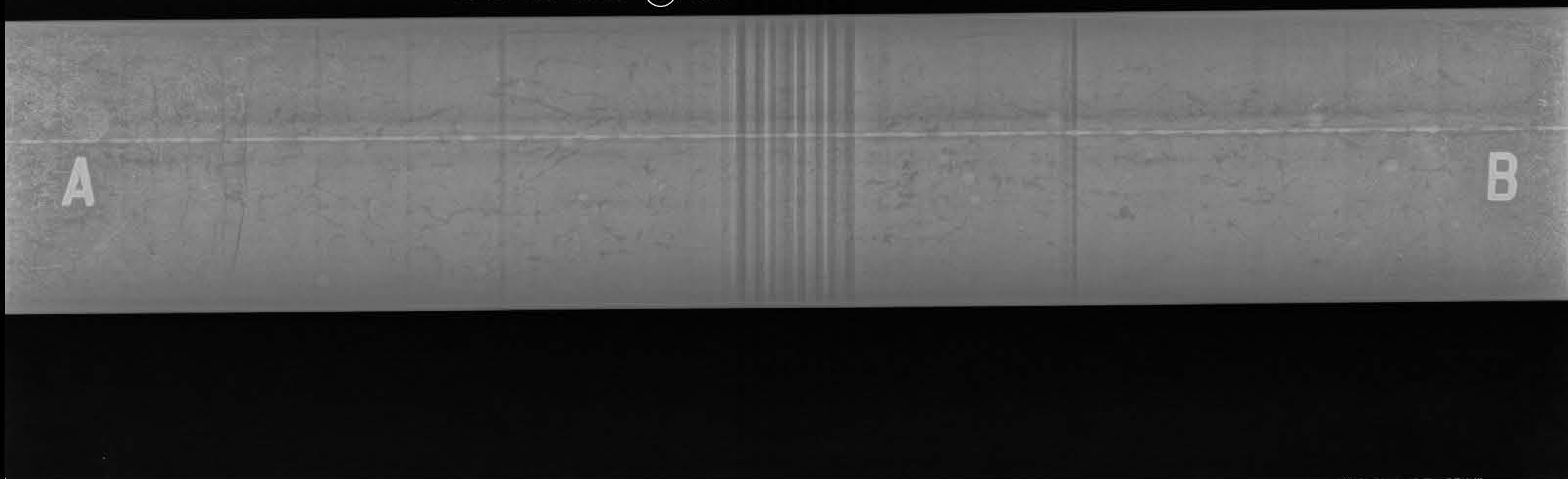
BC-05 S04 @ 14.5'

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

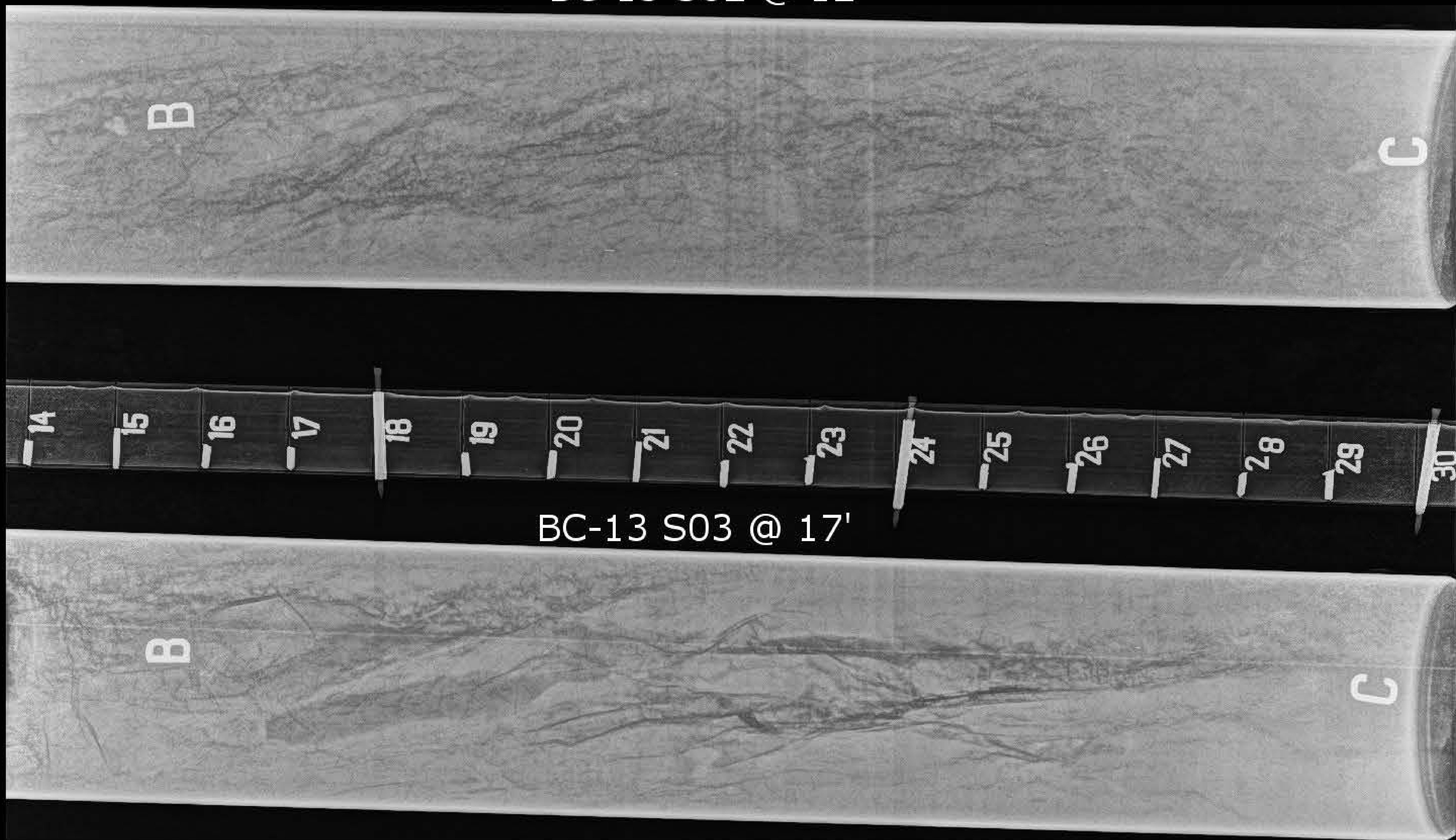
BC-13 S02 @ 12'

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'

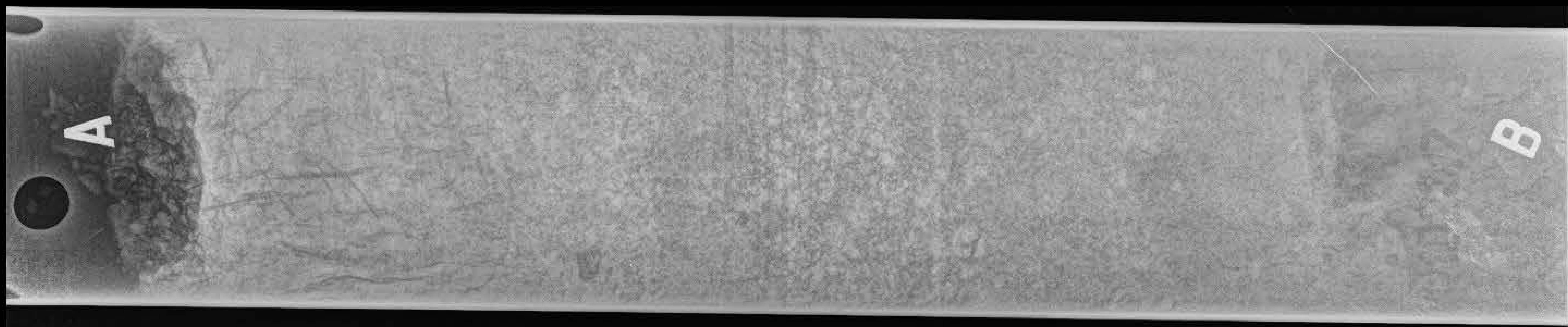


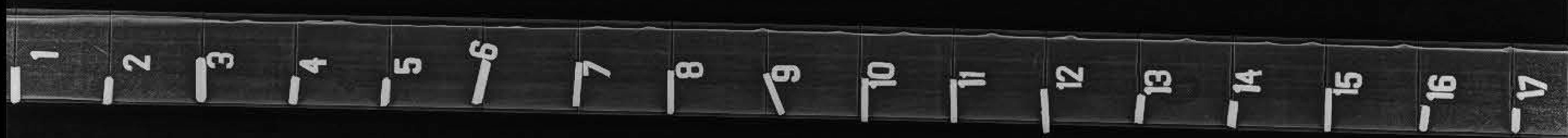
BC-13 S03 @ 17'

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

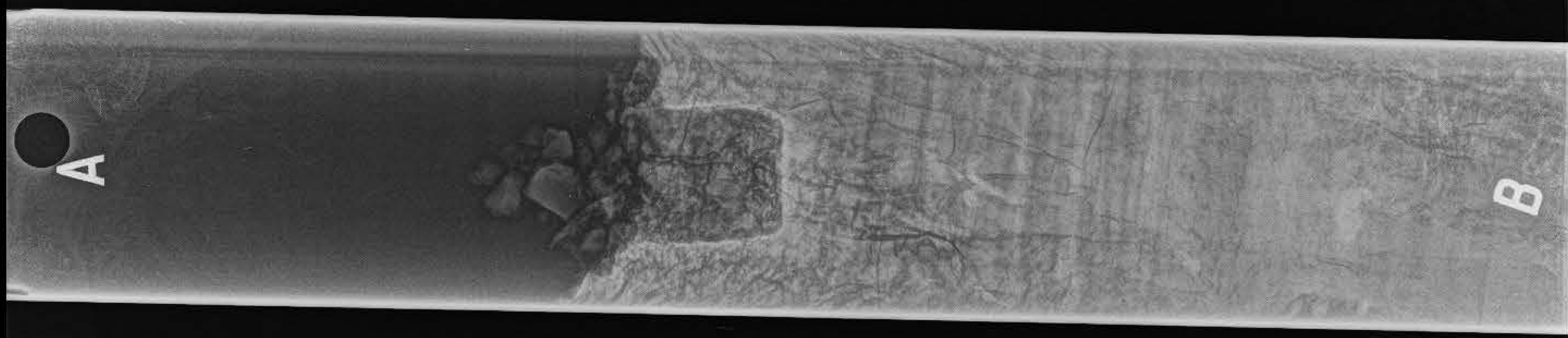
Scale in inches
0 = Top of Tube

BC-13 S04 @ 22'





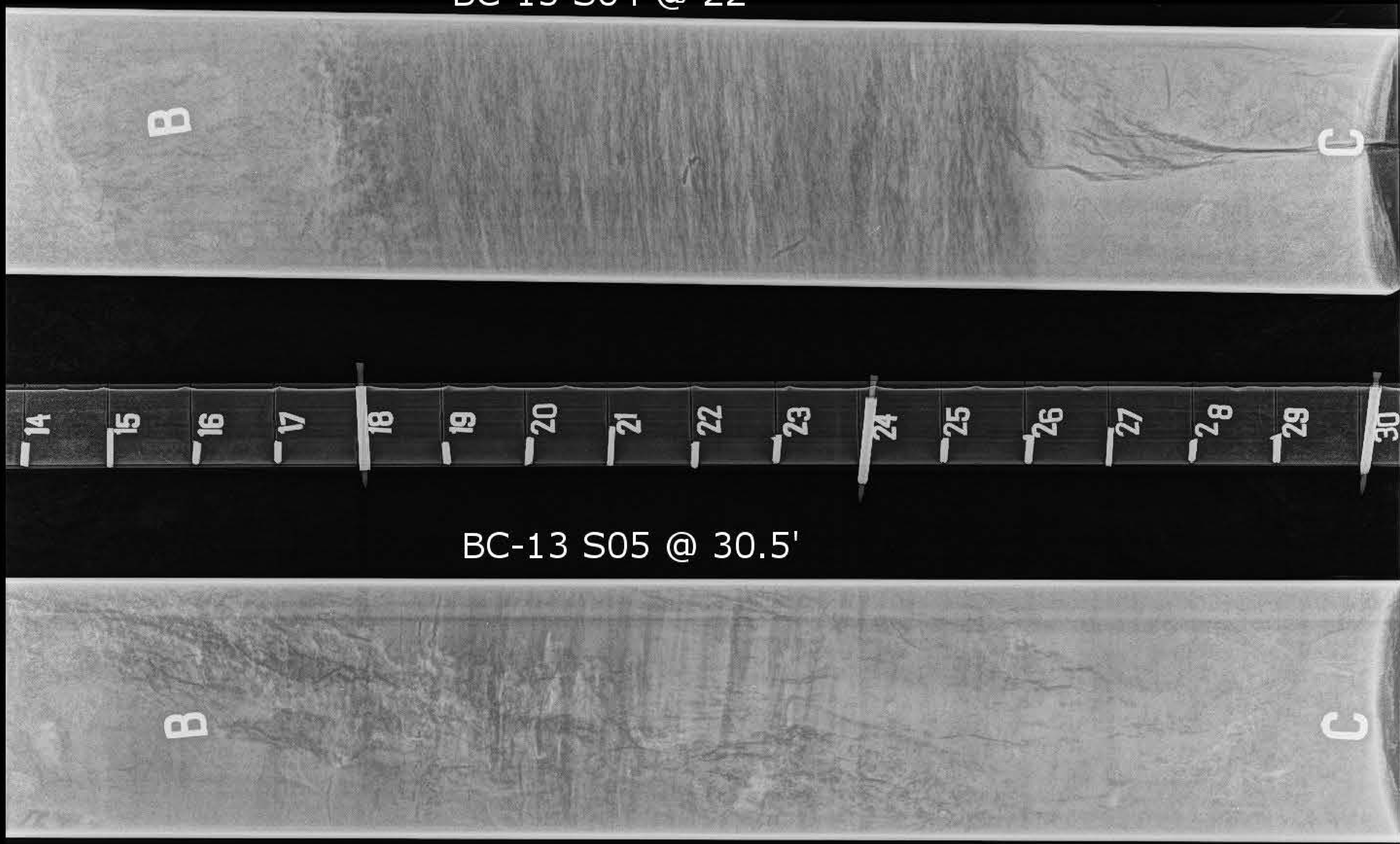
BC-13 S05 @ 30.5'



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

Scale in inches
0 = Top of Tube

BC-13 S04 @ 22'

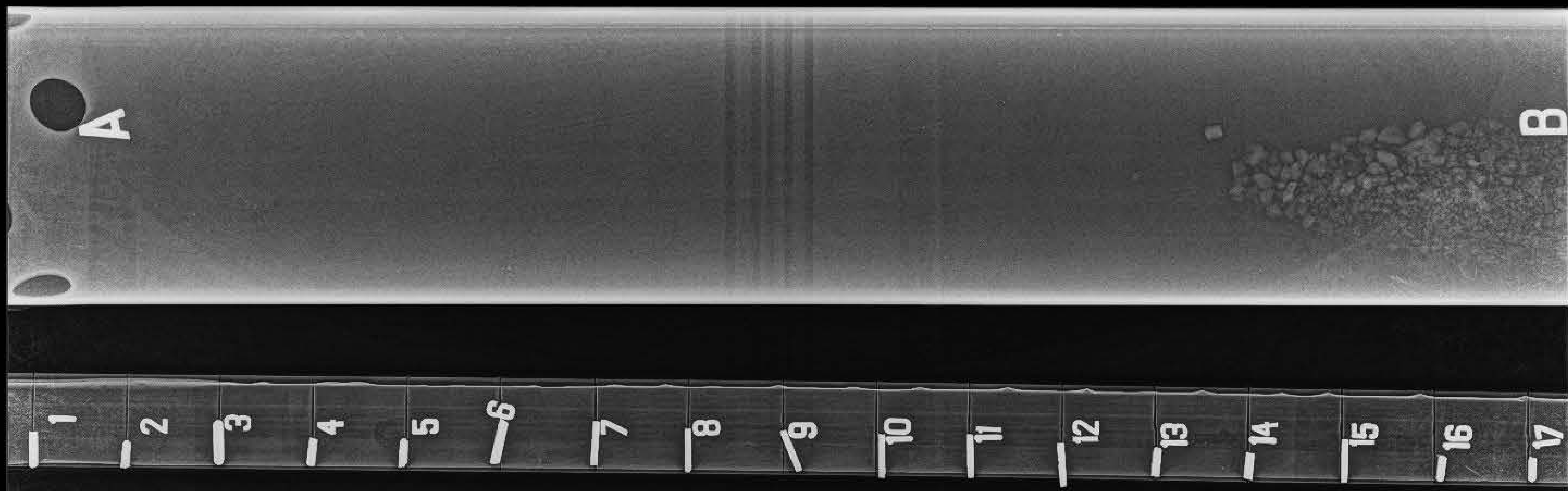


BC-13 S05 @ 30.5'

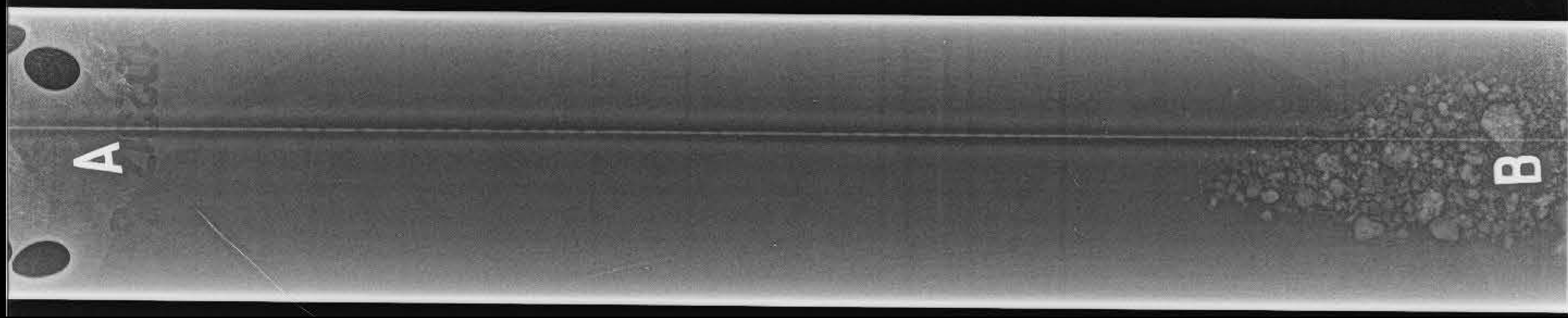
CTL# 020-271
AECOM
Klamath River Dam
Removal Project
60537920

Scale in inches
0 = Top of Tube

BC-14 S01 @ 5'



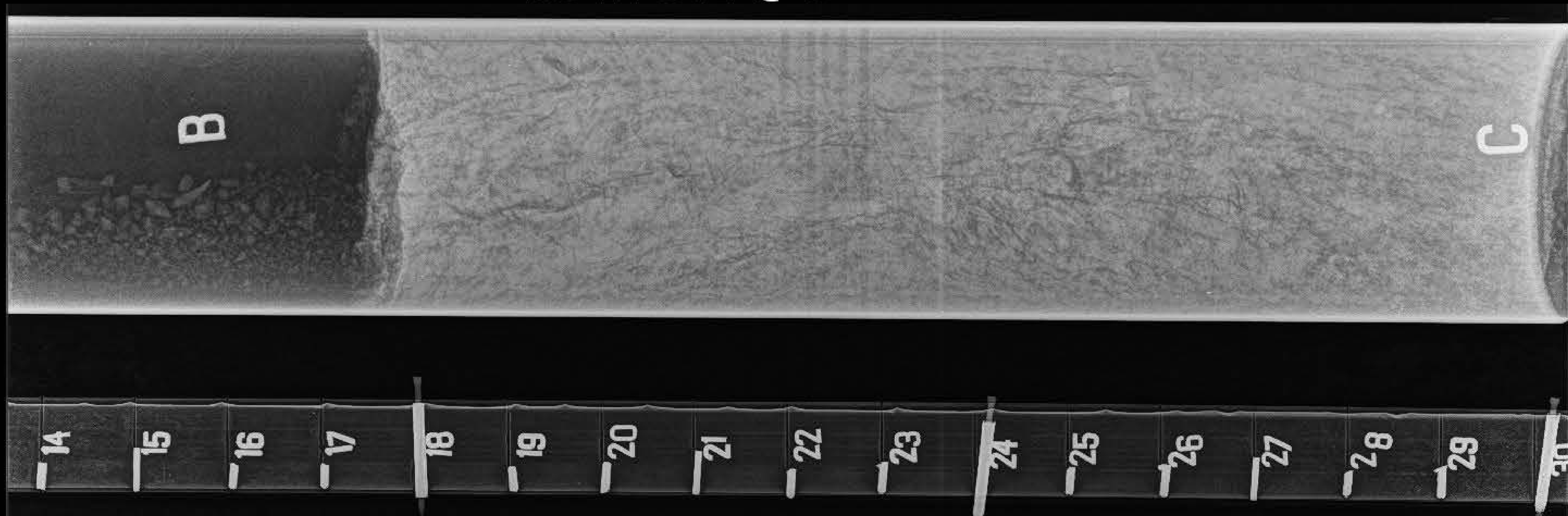
BC-14 S04 @ 12'



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'

COMPANY WITH
QUALITY SYSTEM
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.	2018-22-4-1
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.

2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@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.	2018-22-4-2
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.

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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Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
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COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

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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.	2018-22-4-4
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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Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
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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.

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

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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.	2018-22-3-1
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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Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E.
Phone: +1-512-200-3051
E-mail: fulvio@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.	2018-22-3-2
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.

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.

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.

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.

Point Load Strength Test
ASTM D 5731 - 08

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

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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.	2018-22-1
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.

2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E.
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POINT LOAD TEST RESULTS
BI-02 and BI-03

Test Number	Test Order	Depth of Test	Boring Number	Date	Depth Interval Bottom	Depth Interval Top	Rock Type[1]	Diameter (D) (mm)	Diameter (D) (in)	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
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)

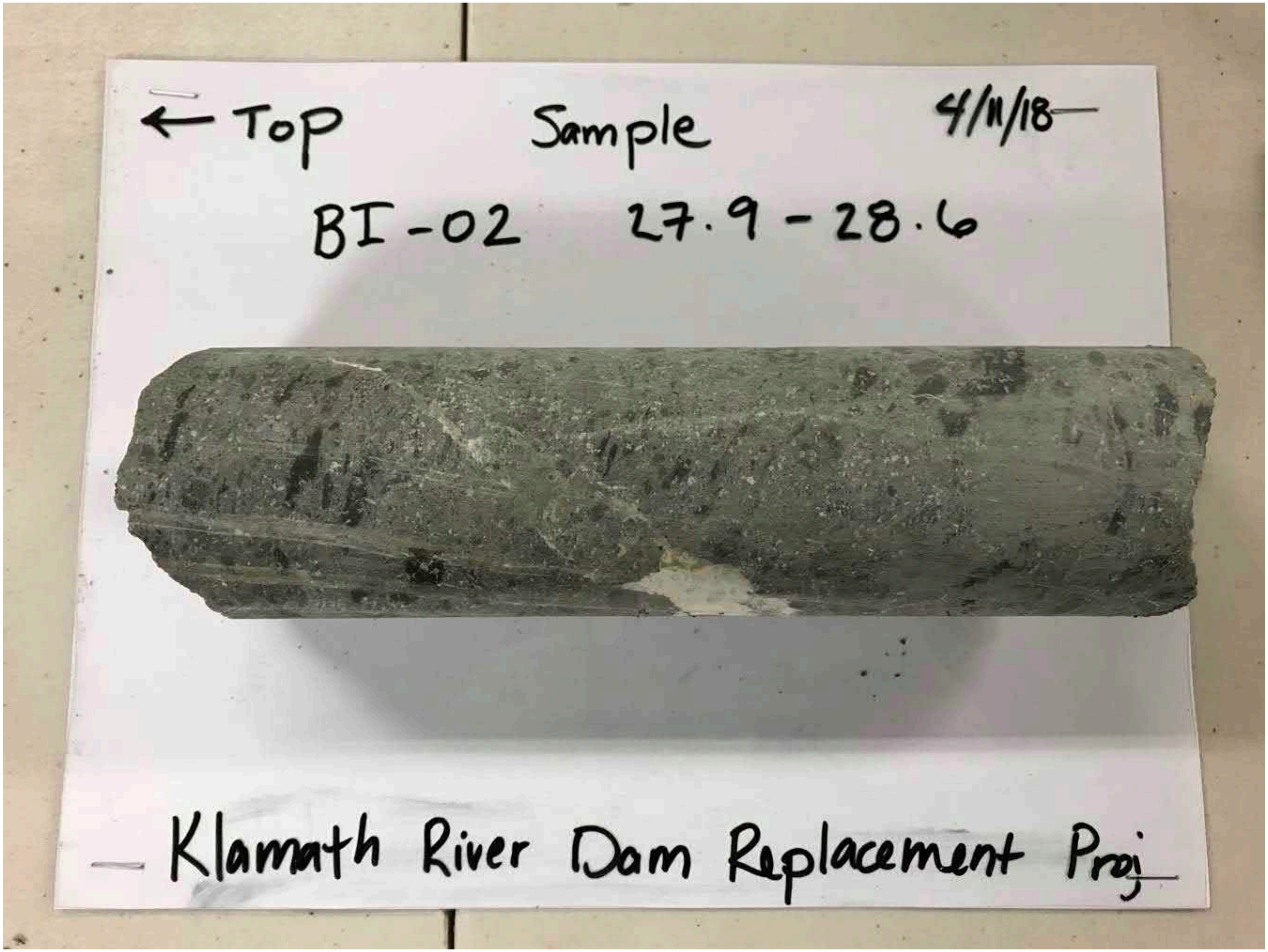
Notes:

[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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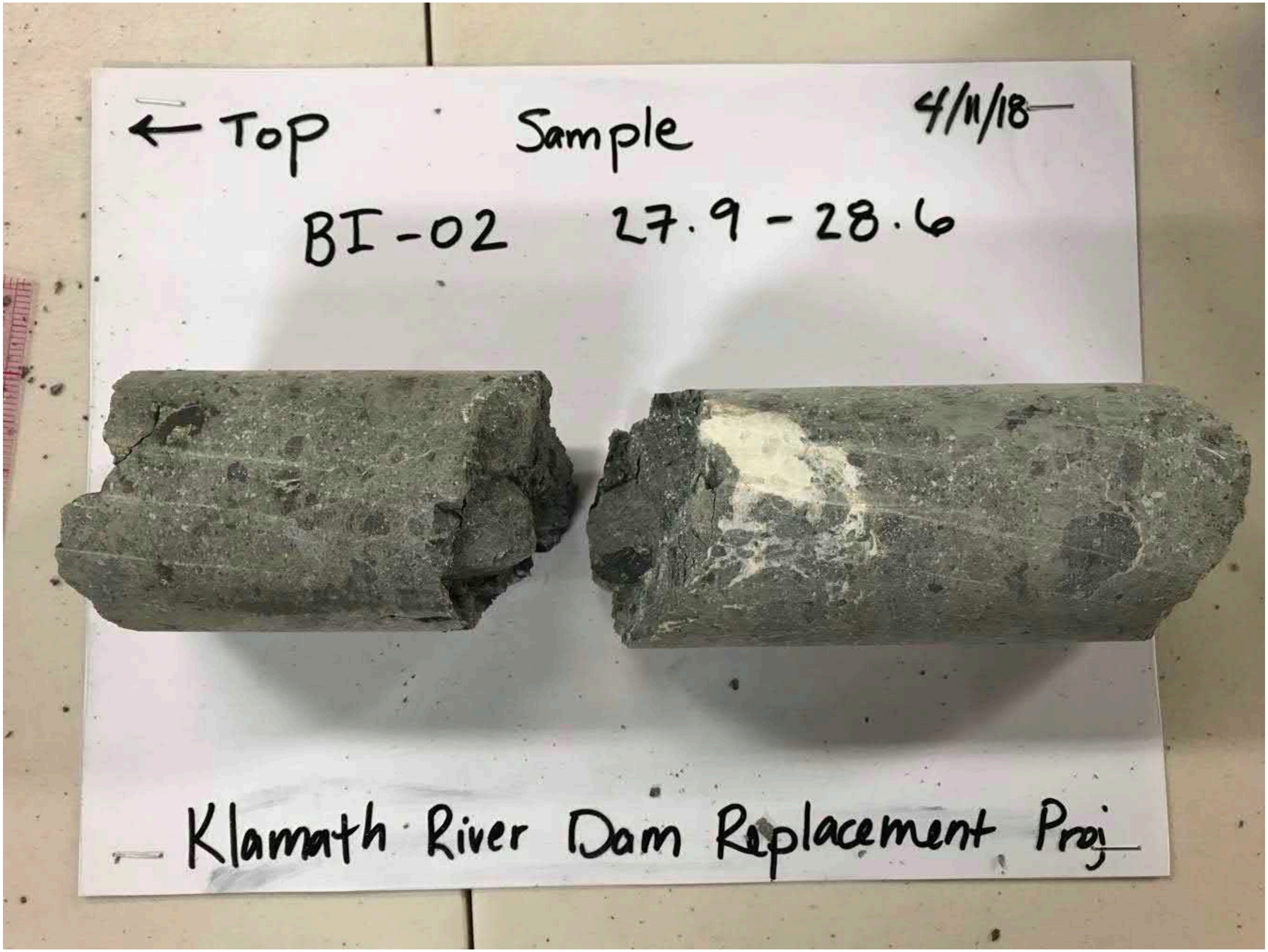
Sample
4/11/18
BI-02 27.9 - 28.6
Klamath River Dam Replacement Proj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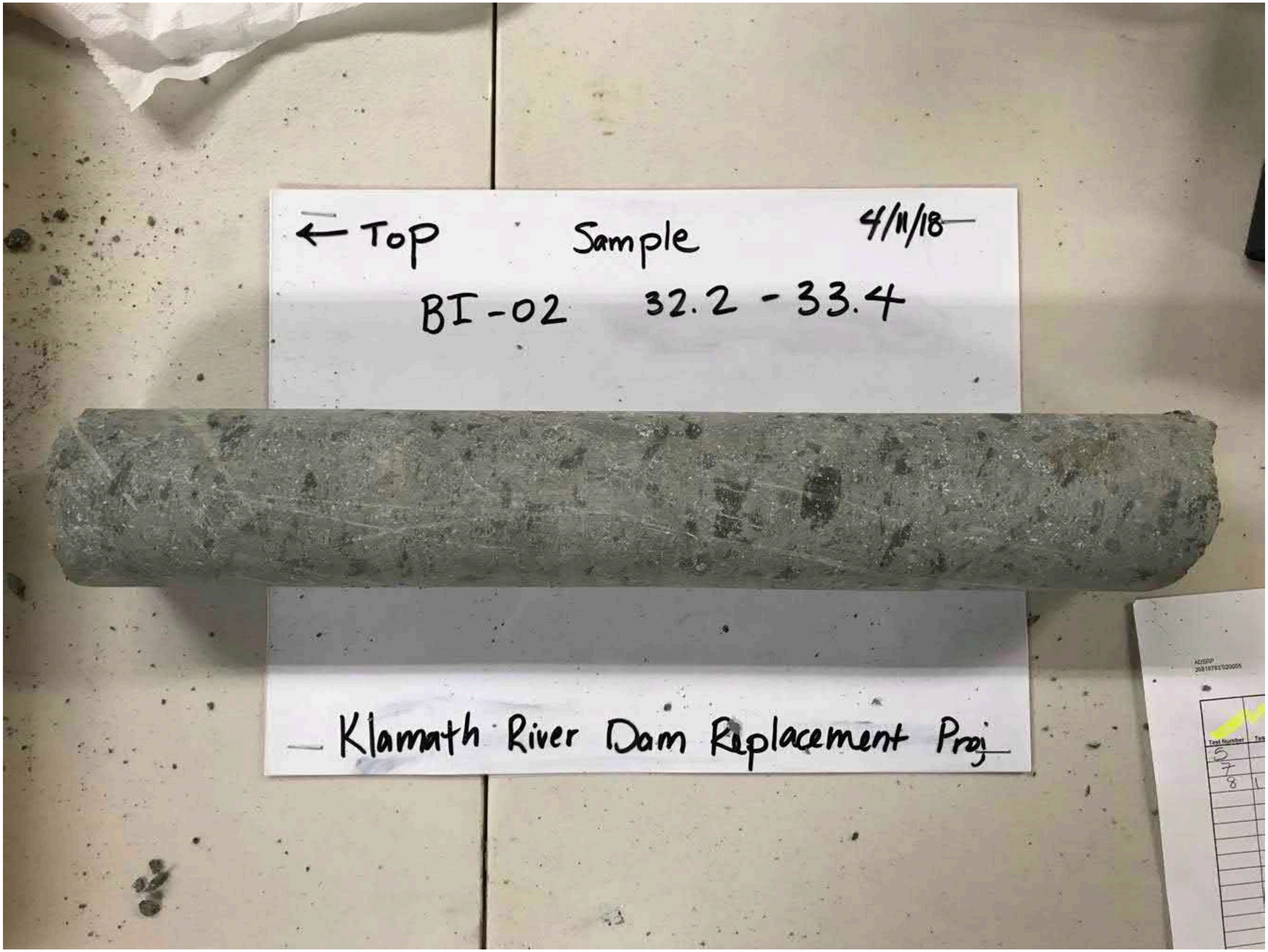
4/11/18
BI-02 27.9 - 28.6
Klamath River Dam Replacement Proj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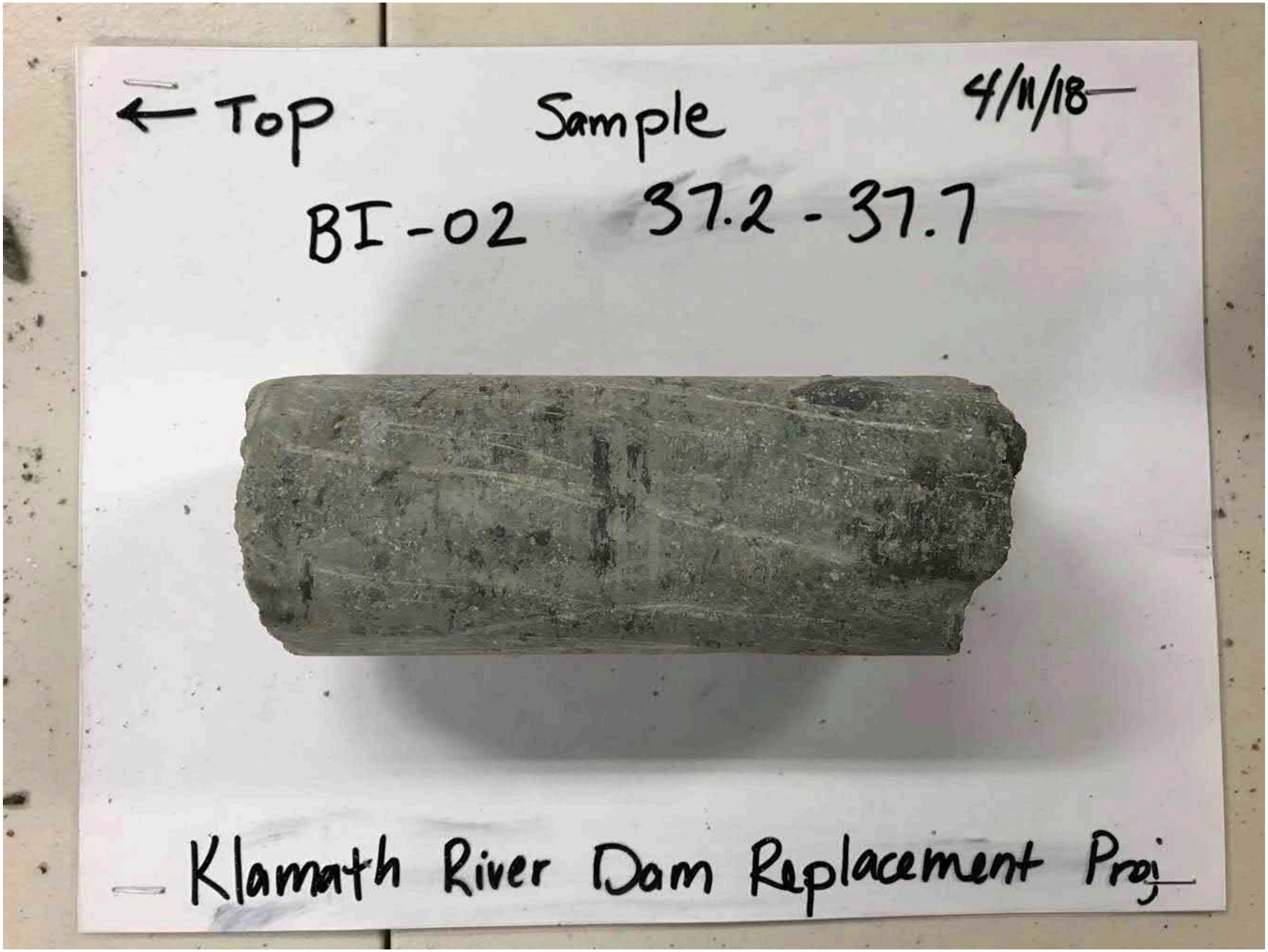
Sample
4/11/18
BI-02 32.2 - 33.4
Klamath River Dam Replacement Proj


← Top
Sample
4/11/18
BI-02 32.2 - 33.4
Klamath River Dam Replacement Proj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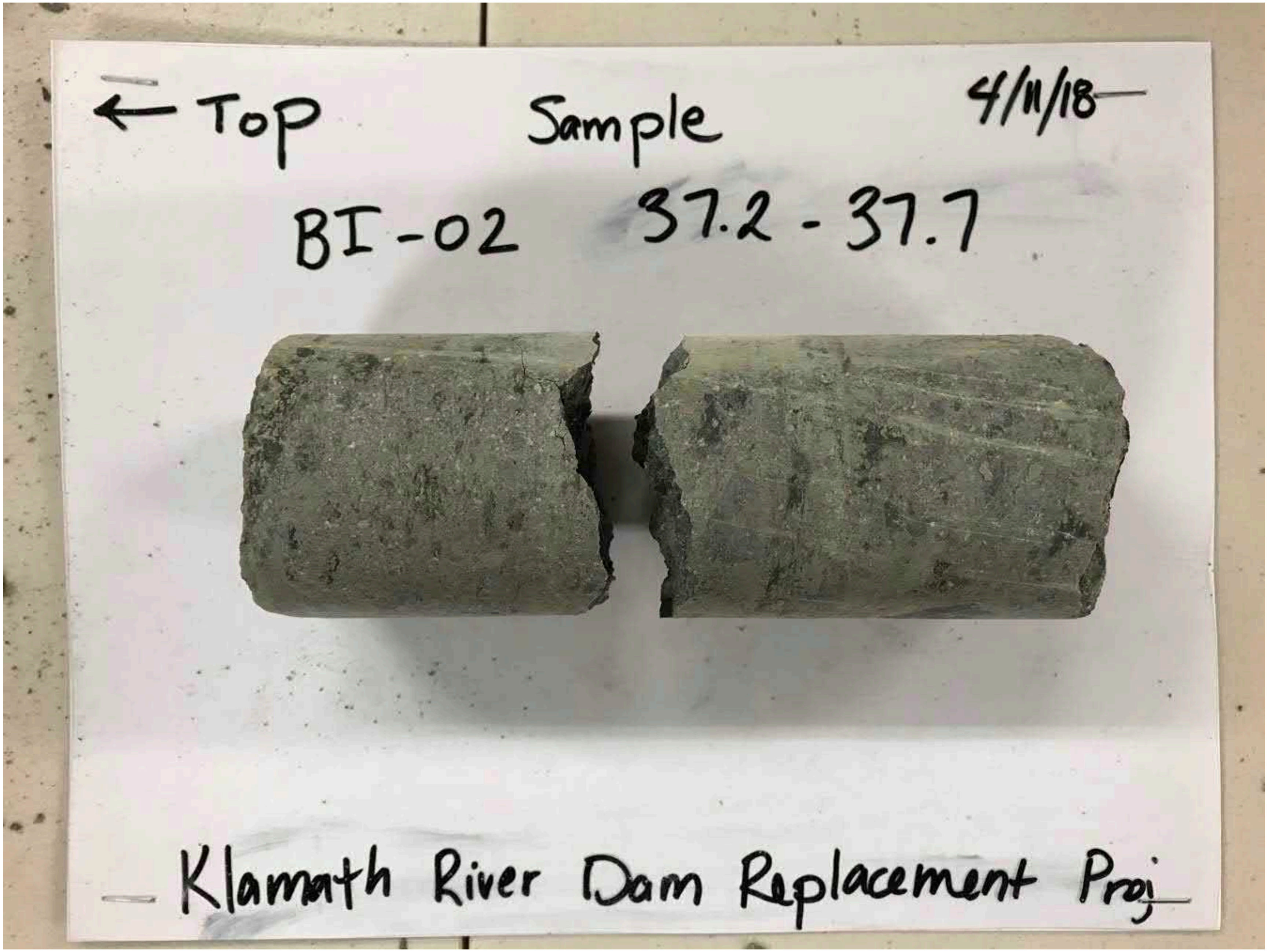
4/11/18
BI-02
37.2 - 37.7
Klamath River Dam Replacement Proj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Sample
4/11/18
BI-02 37.2 - 37.7
Klamath River Dam Replacement Proj


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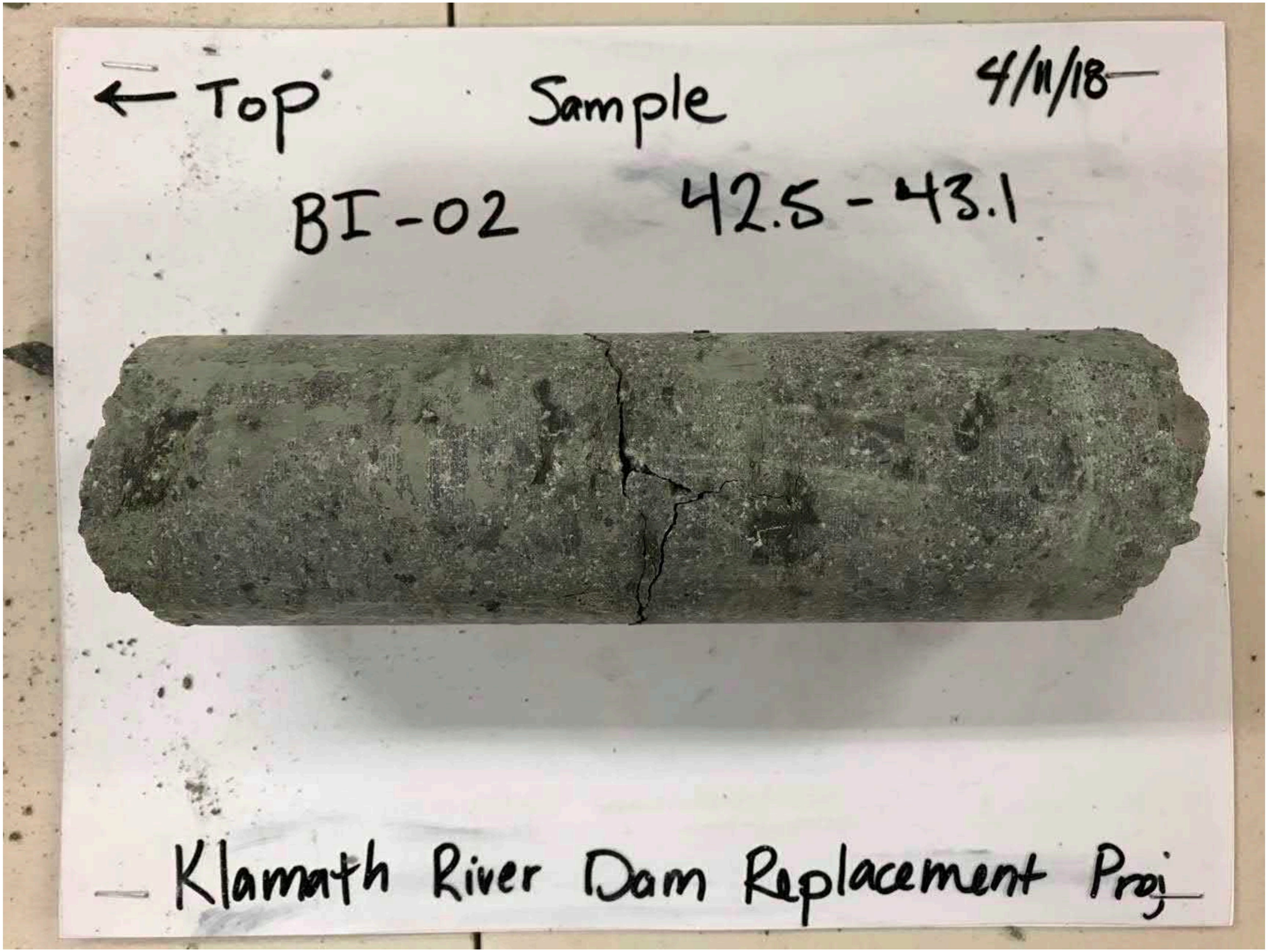
Sample
4/11/18
BI-02
42.5 - 43.1
Klamath River Dam Replacement Proj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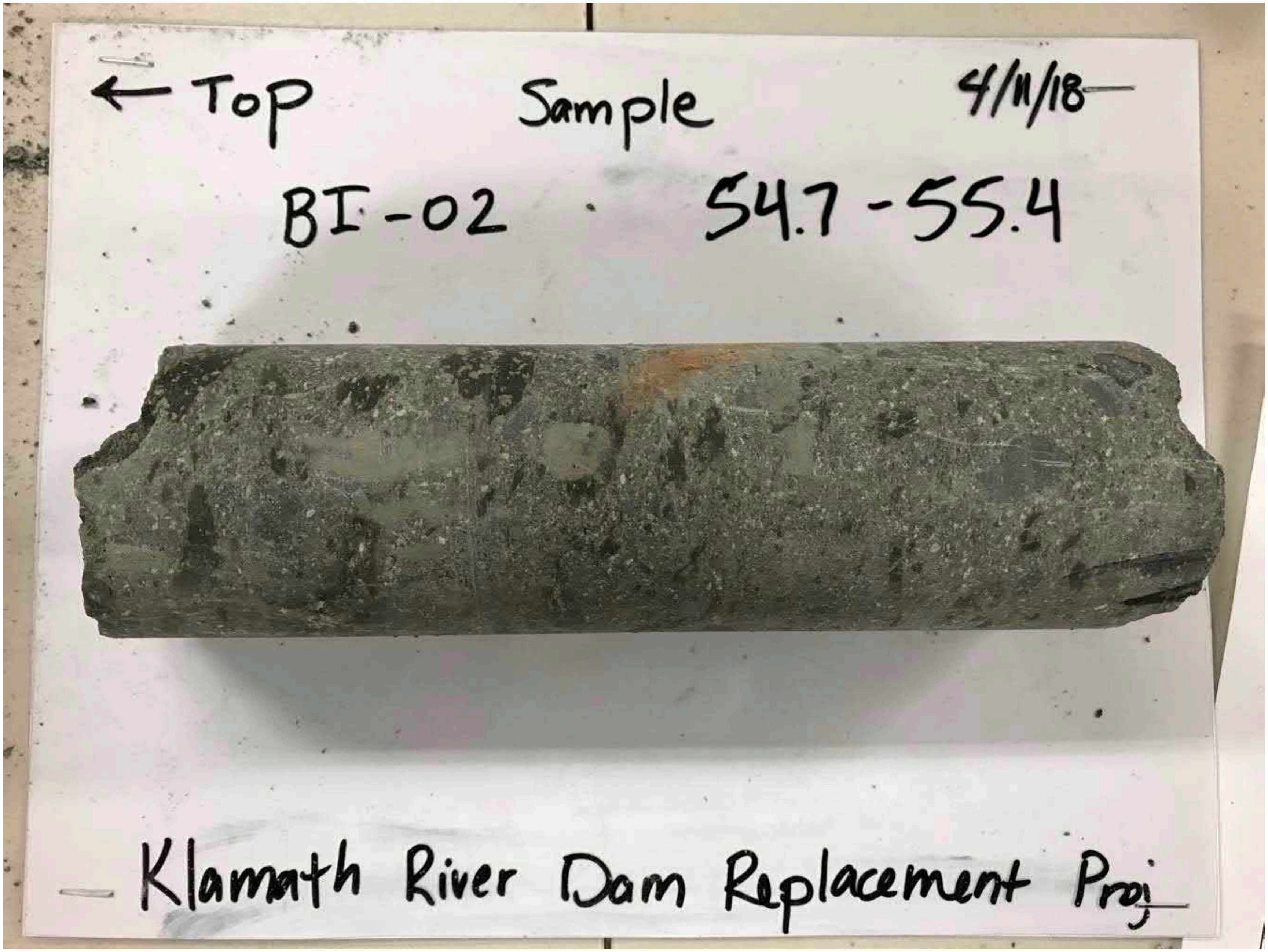
4/11/18
BI-02
42.5 - 43.1
Klamath River Dam Replacement Proj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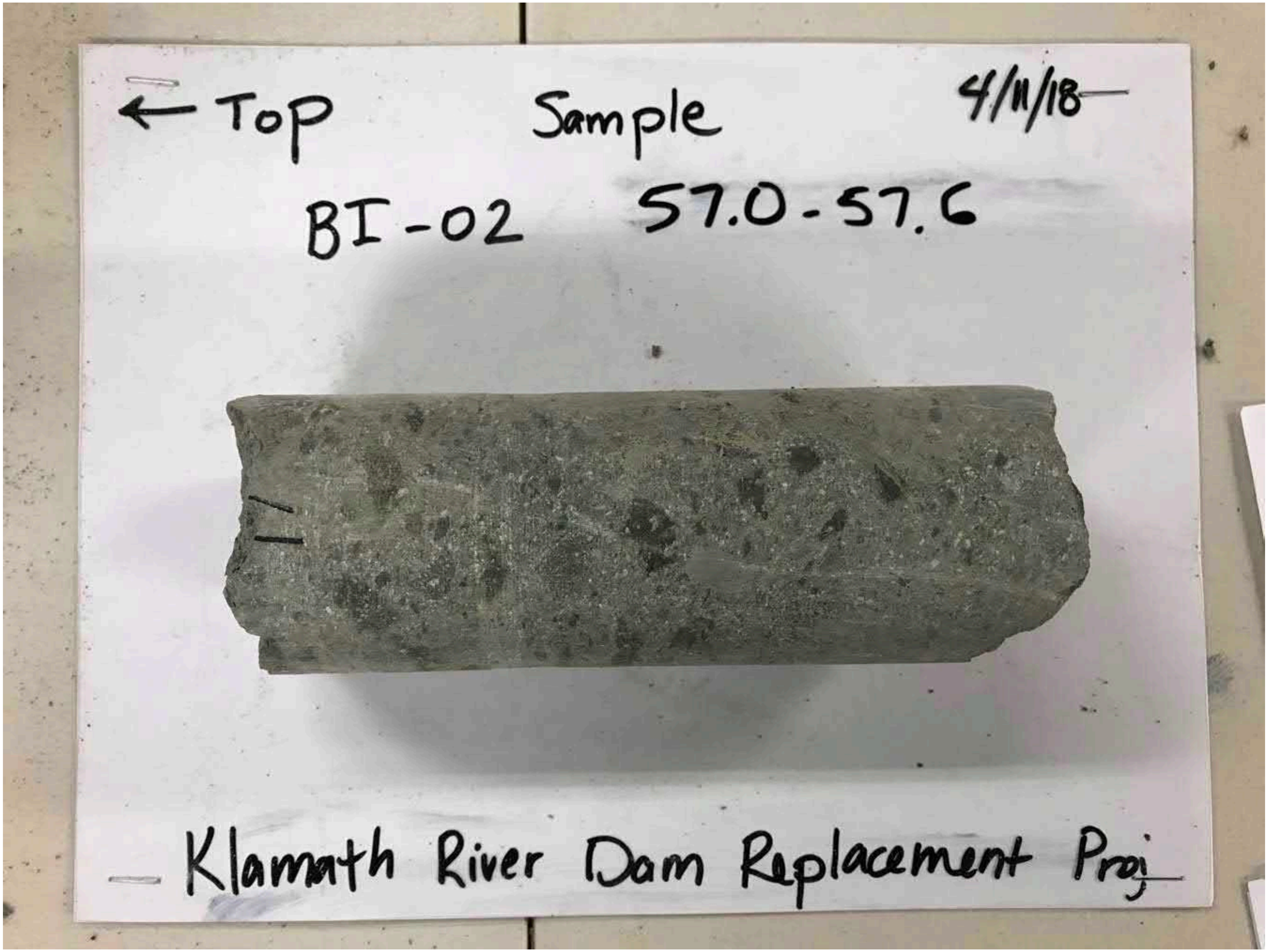
Sample
4/11/18
BI-02
54.7 - 55.4
Klamath River Dam Replacement Proj


← Top
Sample
4/11/18
BI-02
54.7 - 55.4
Klamath River Dam Replacement Proj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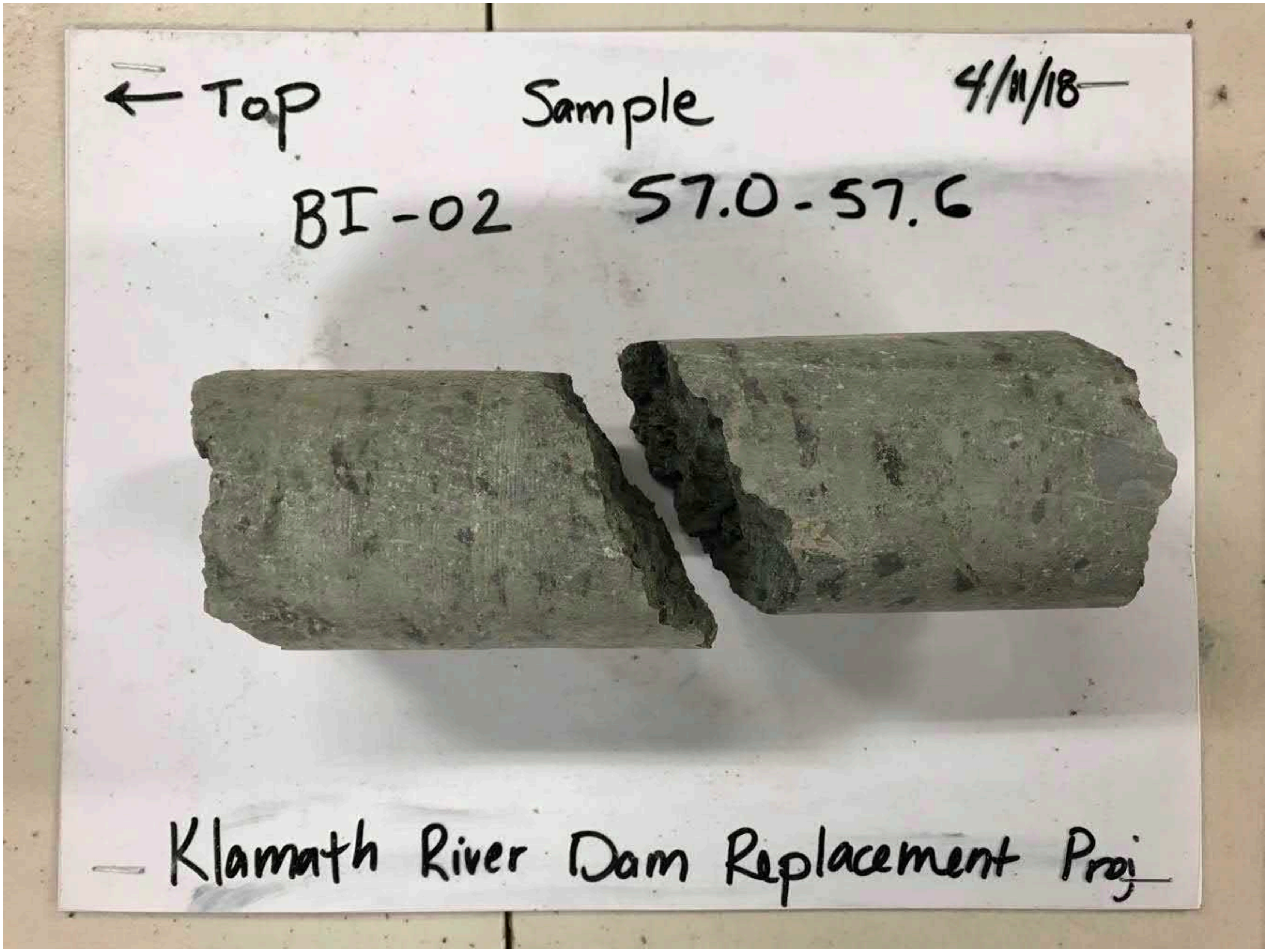
4/11/18
BI-02
57.0-57.6
Klamath River Dam Replacement Proj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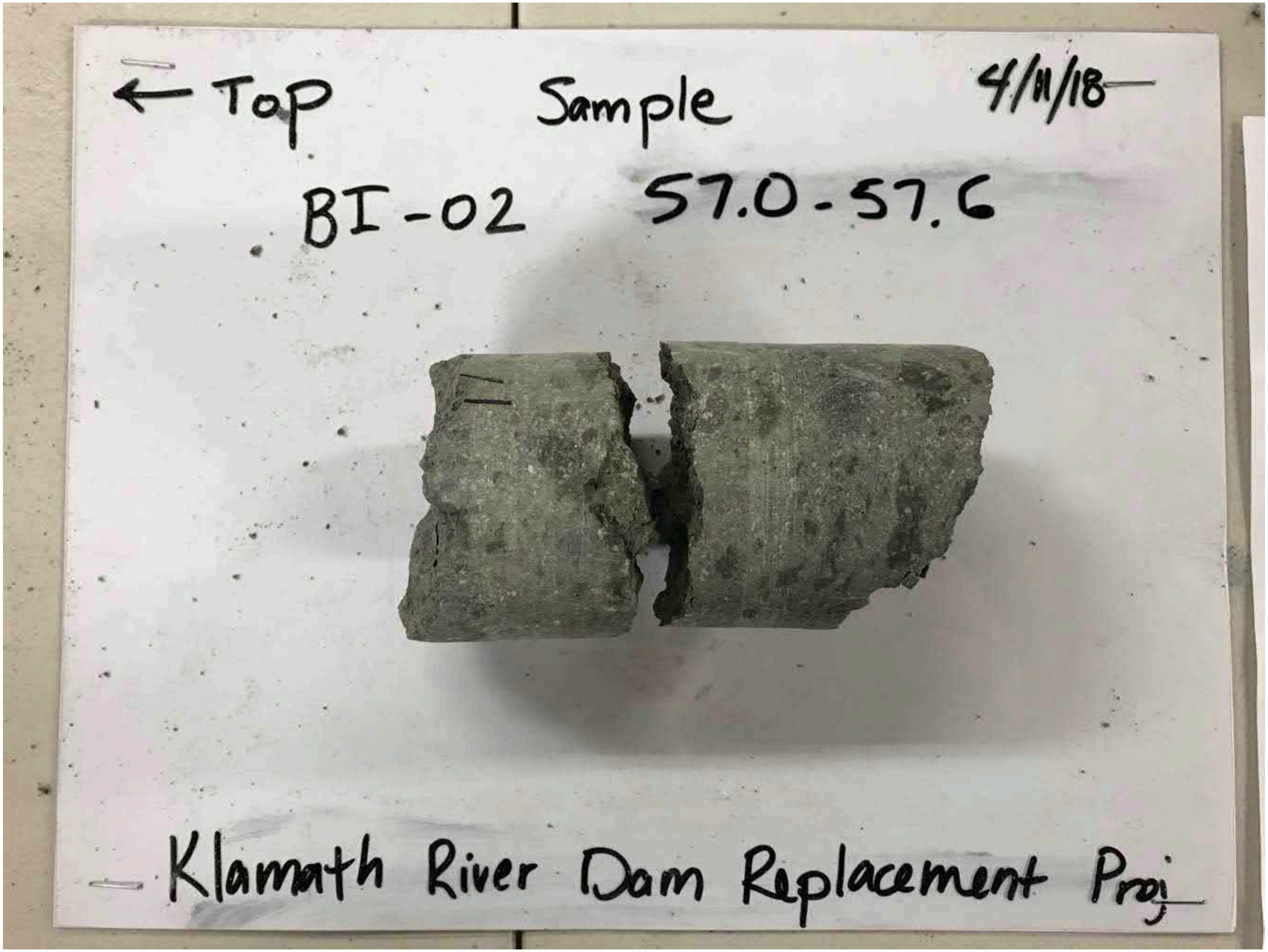
Sample
4/11/18
BI-02 57.0-57.6
Klamath River Dam Replacement Proj


← Top
Sample
4/11/18
BI-02
57.0-57.6
Klamath River Dam Replacement Proj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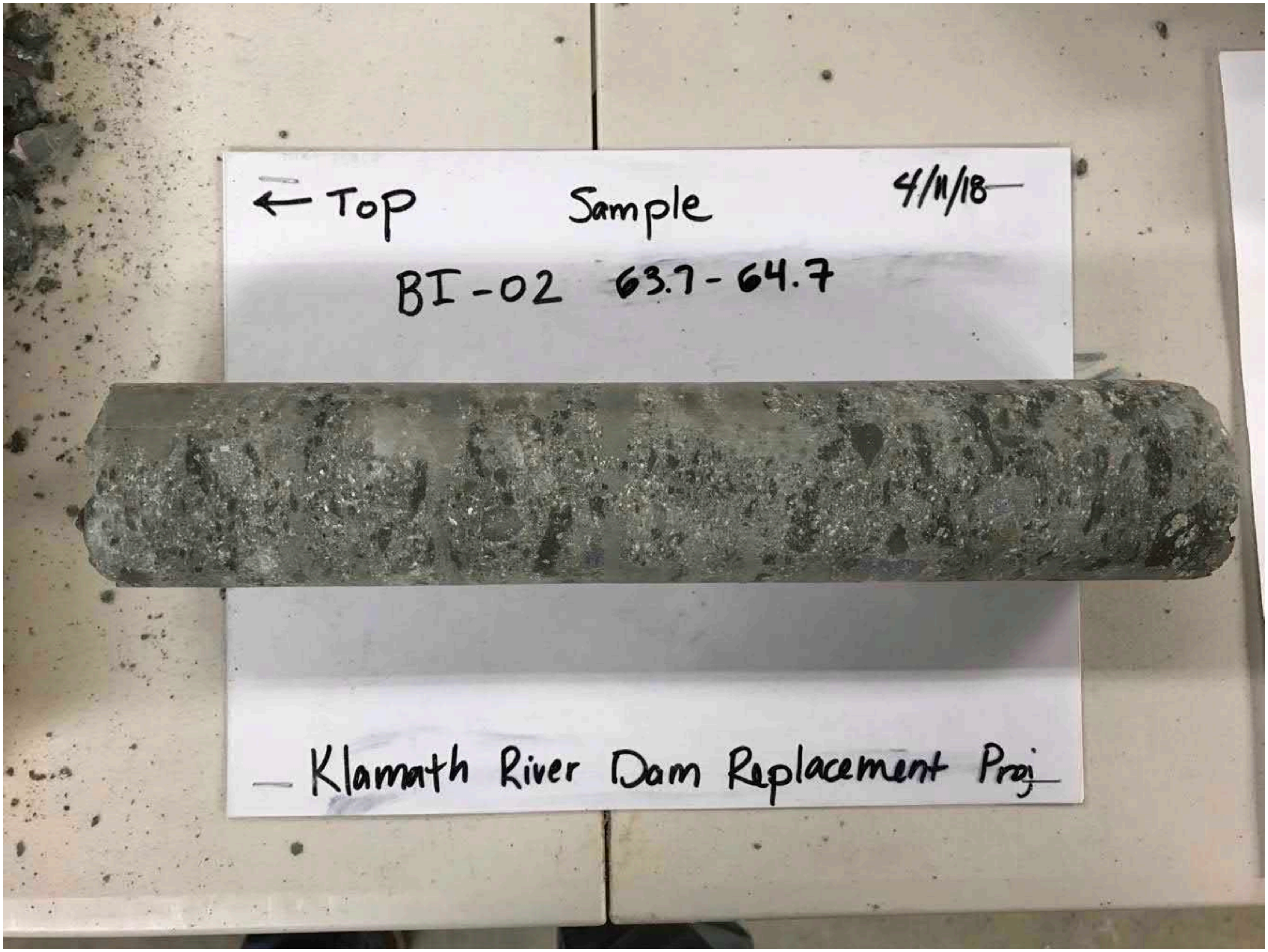
4/11/18
BI-02
57.0-57.6
Klamath River Dam Replacement Proj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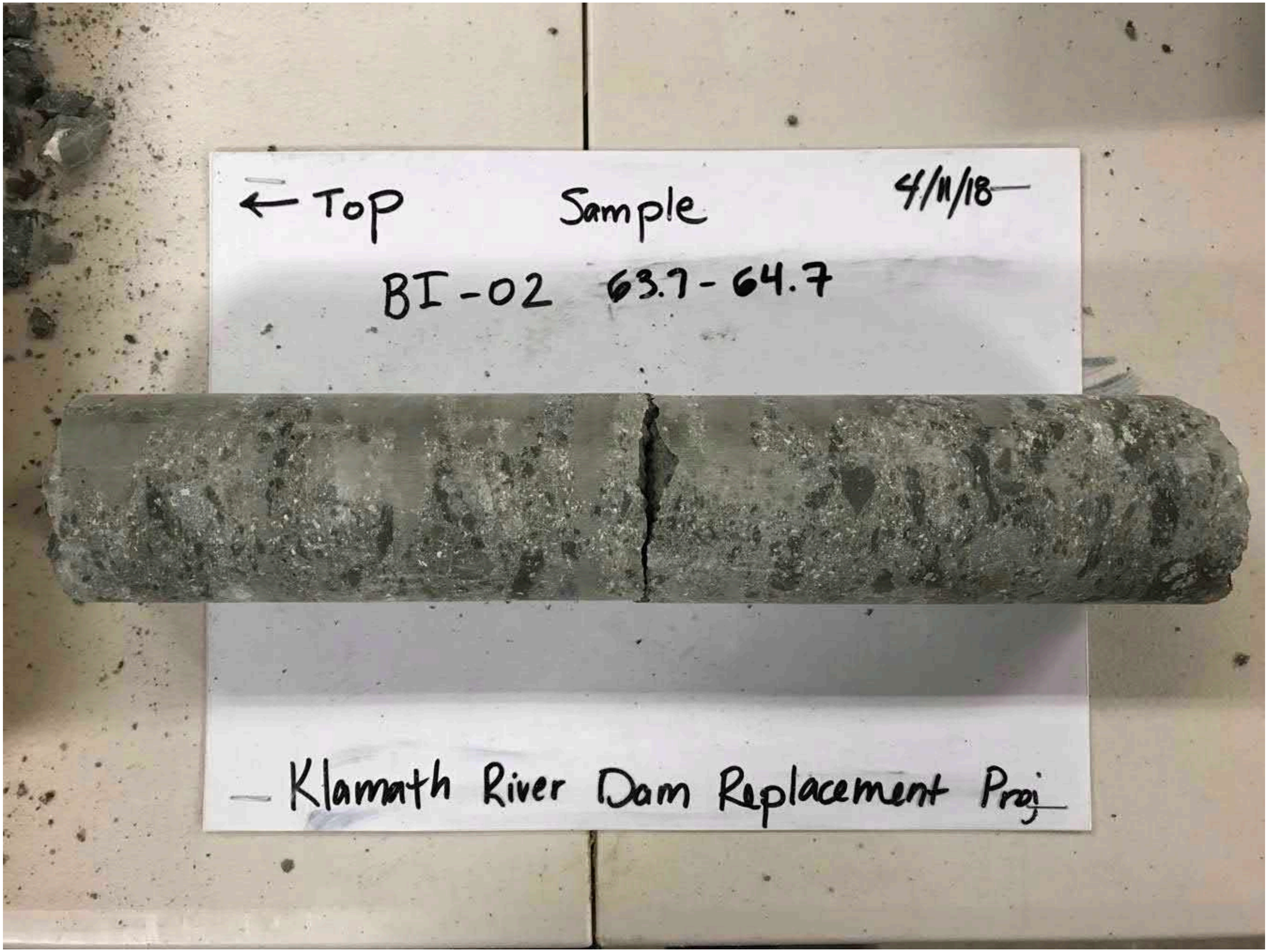
Sample
4/11/18
BI-02 63.7-64.7
Klamath River Dam Replacement Proj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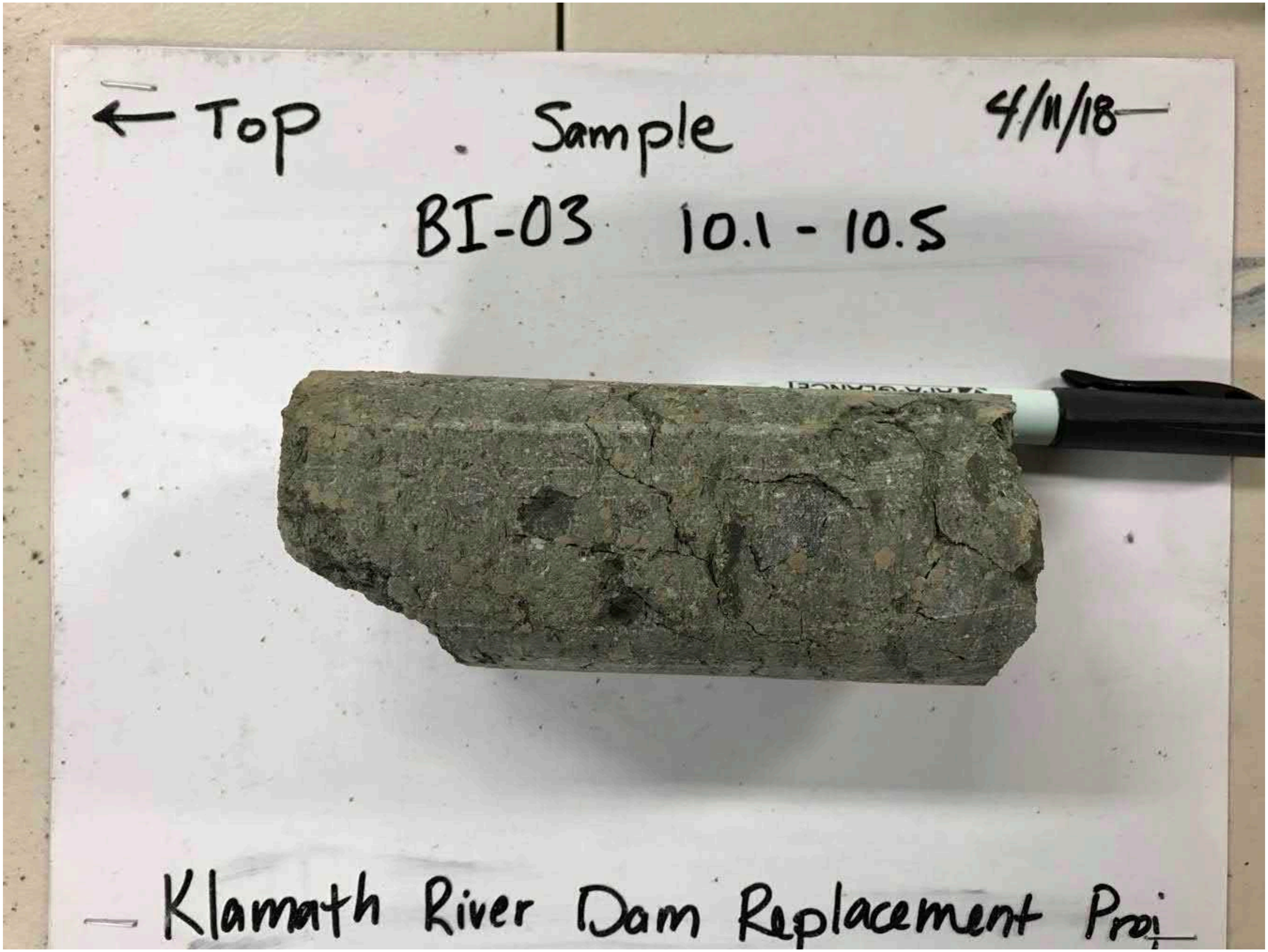
Sample
4/11/18
BI-02 63.7-64.7
Klamath River Dam Replacement Proj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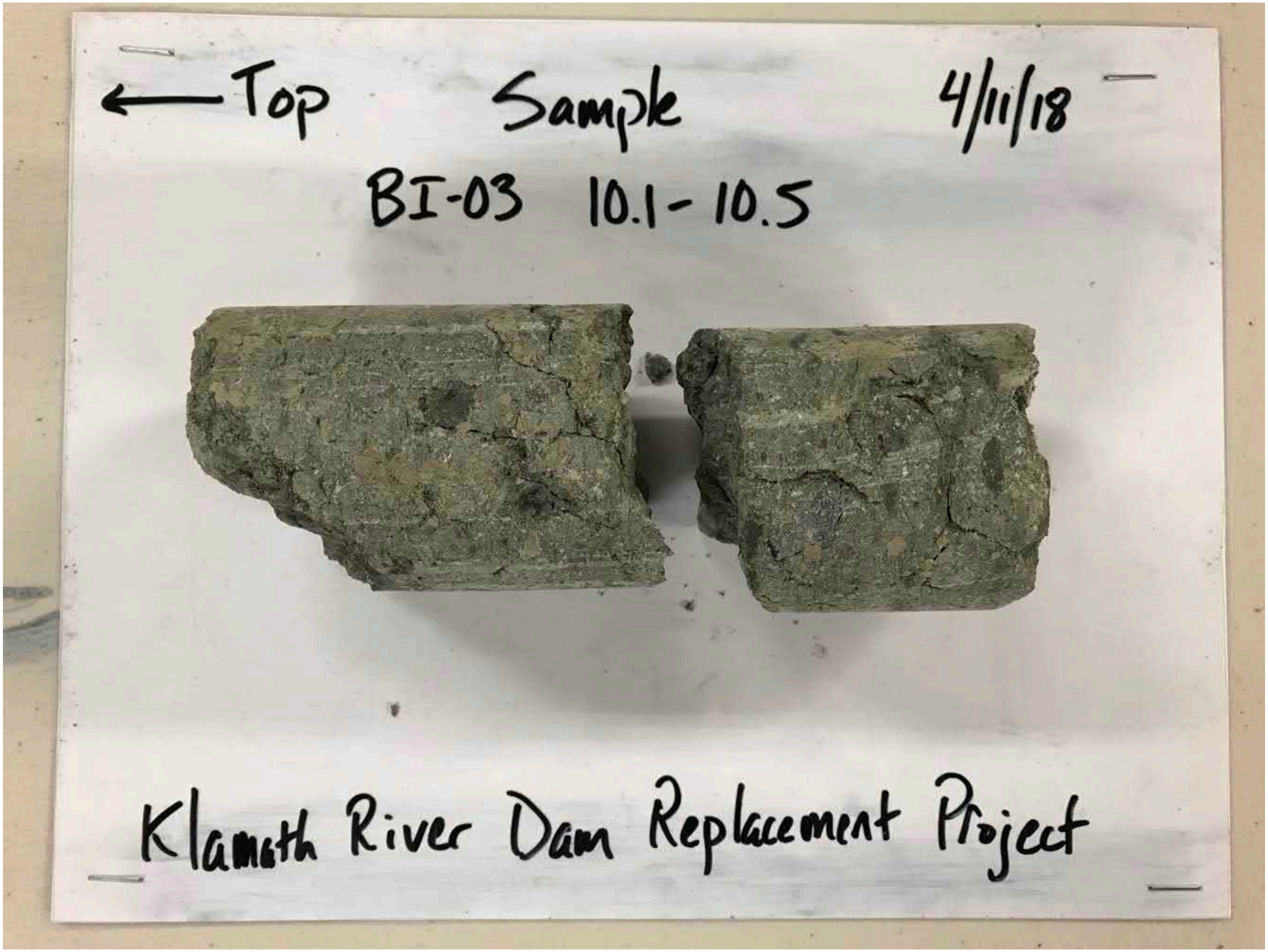
Sample
4/11/18
BI-03 10.1 - 10.5
Klamath River Dam Replacement Proj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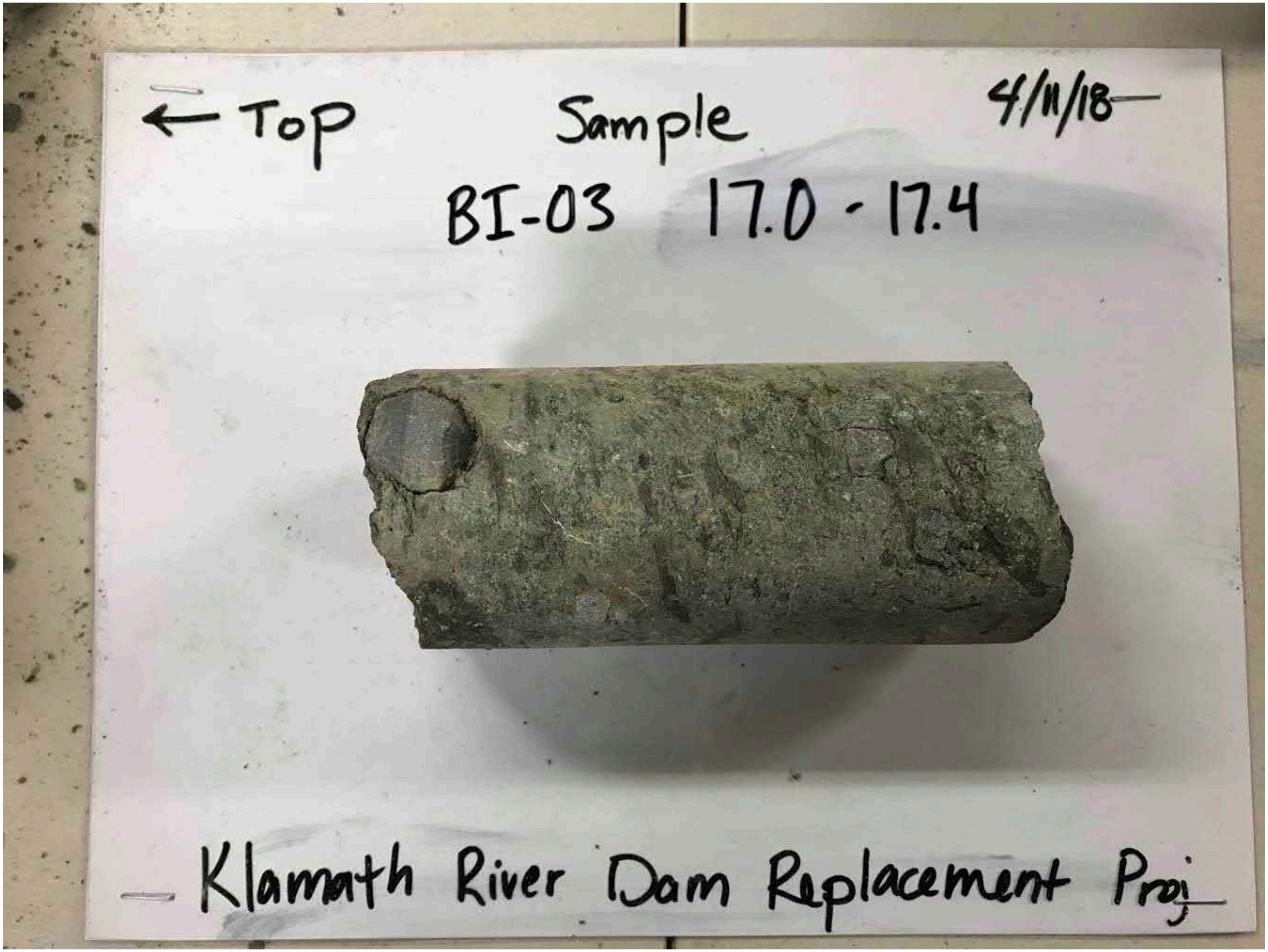
Sample
4/11/18
BI-03 10.1- 10.5
Klamath River Dam Replacement Project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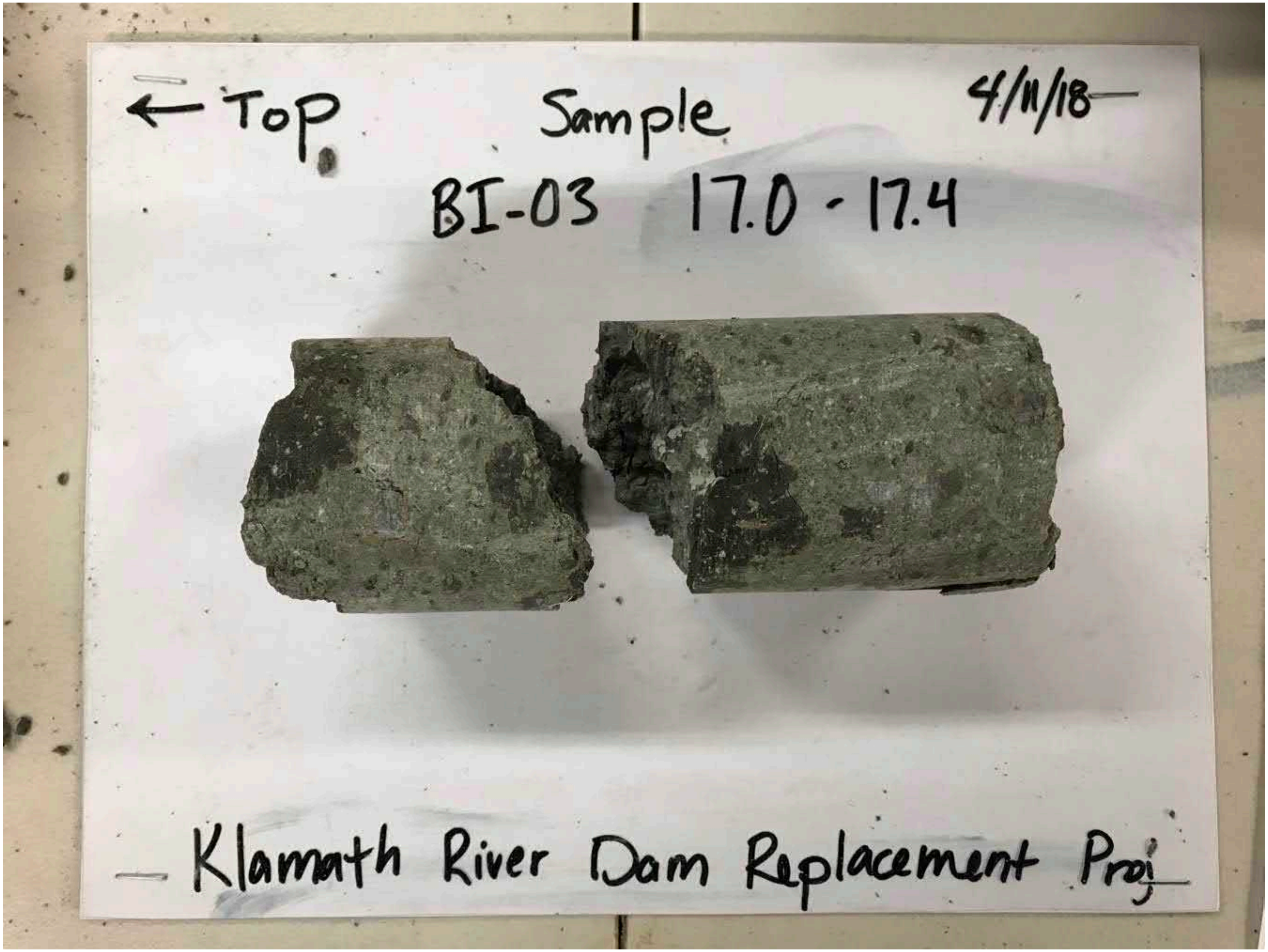
Sample
4/11/18
BI-03 17.0 - 17.4
Klamath River Dam Replacement Proj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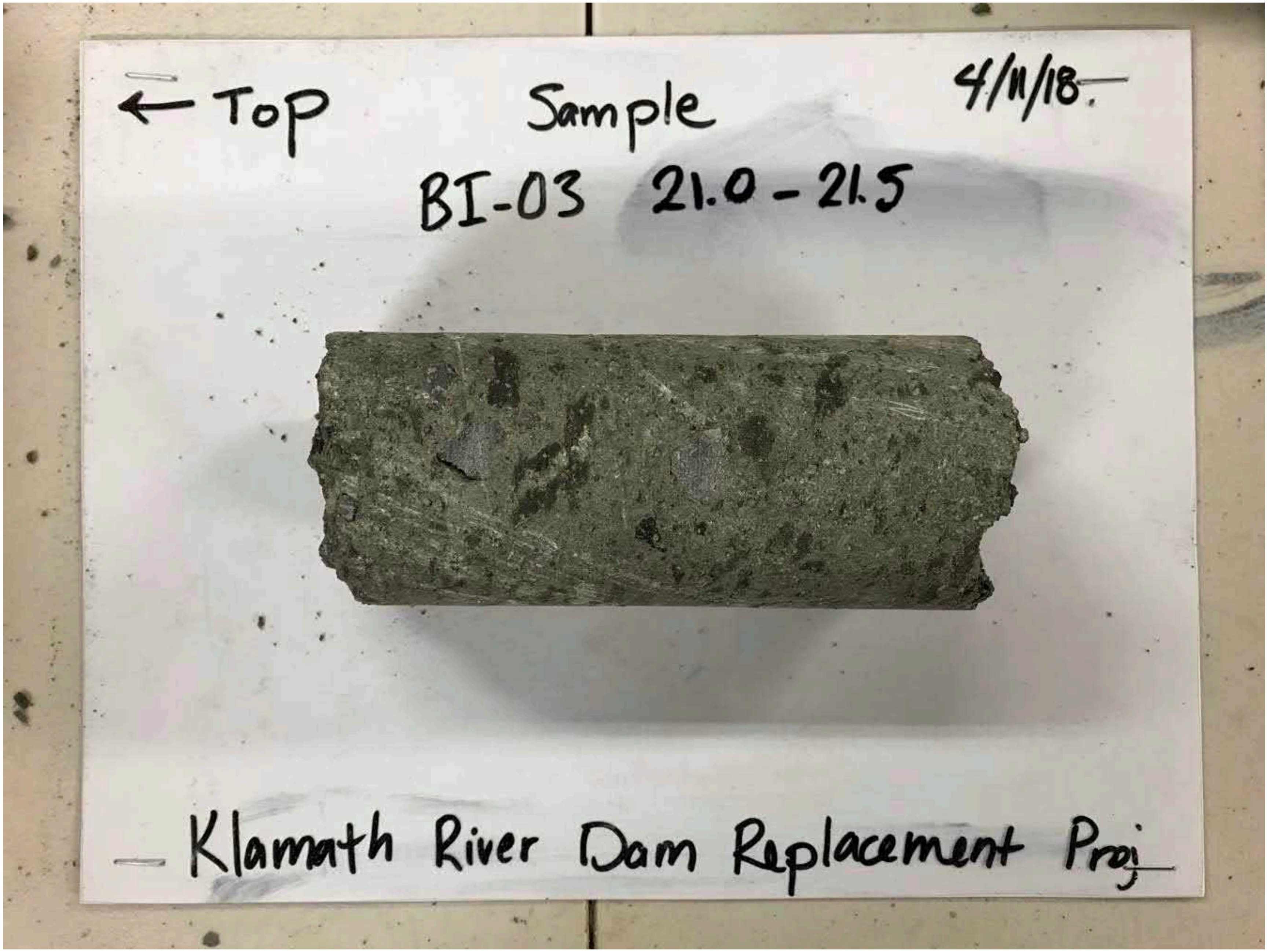
Sample
4/11/18
BI-03 17.0 - 17.4
Klamath River Dam Replacement Proj



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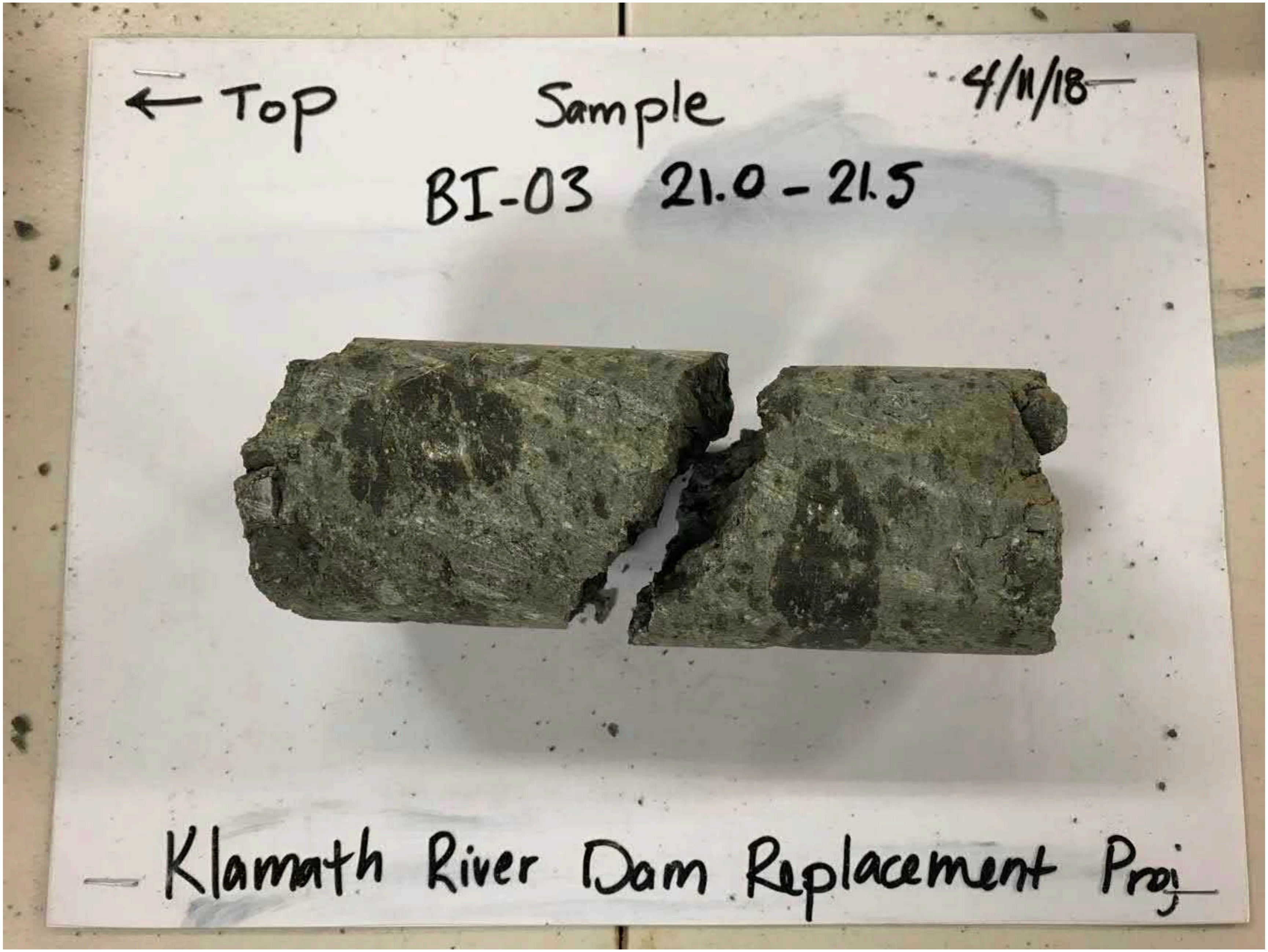
Sample
4/11/18
BI-03 21.0 - 21.5
Klamath River Dam Replacement Proj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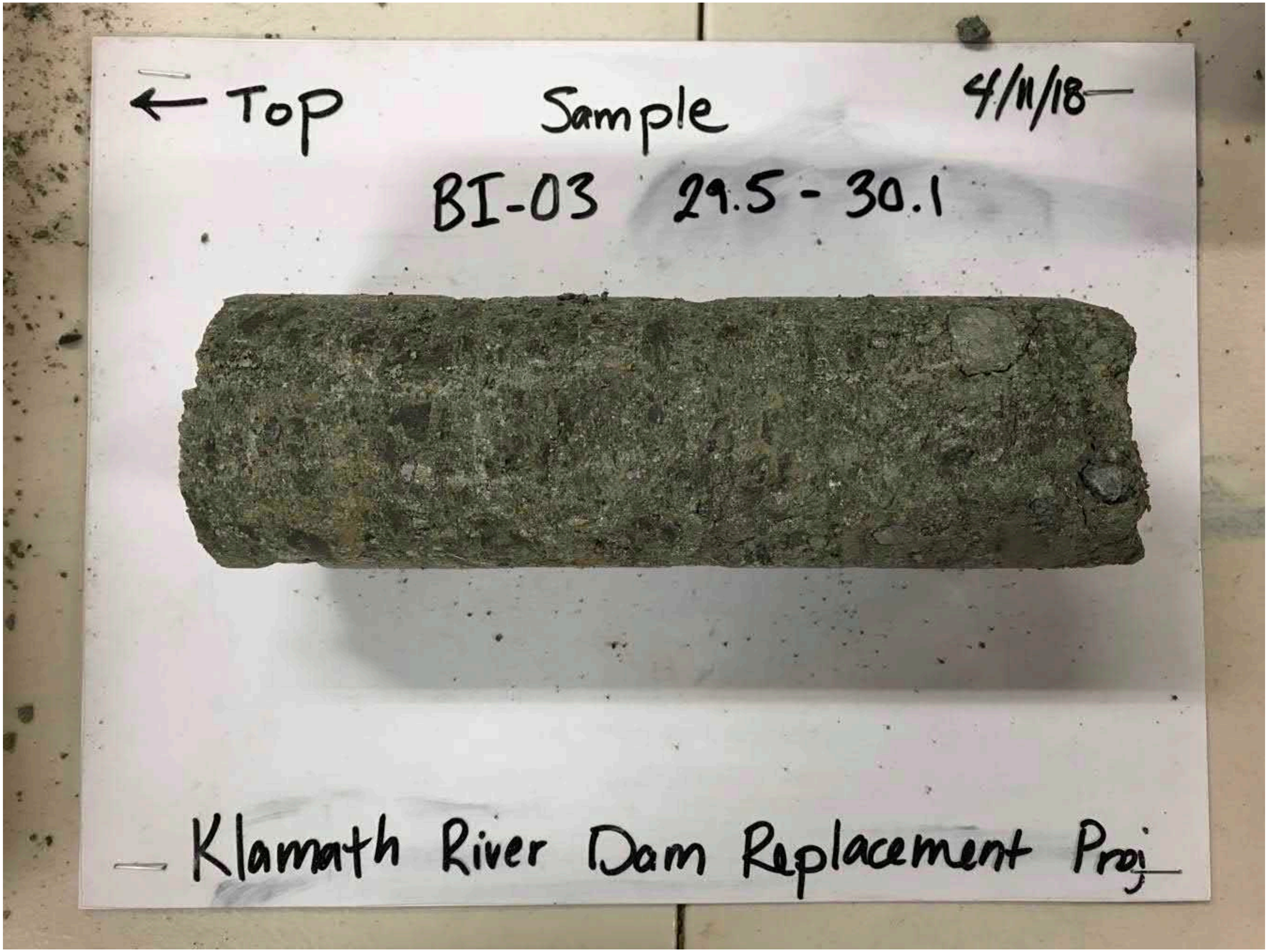
Sample
4/11/18
BI-03 21.0 - 21.5
Klamath River Dam Replacement Proj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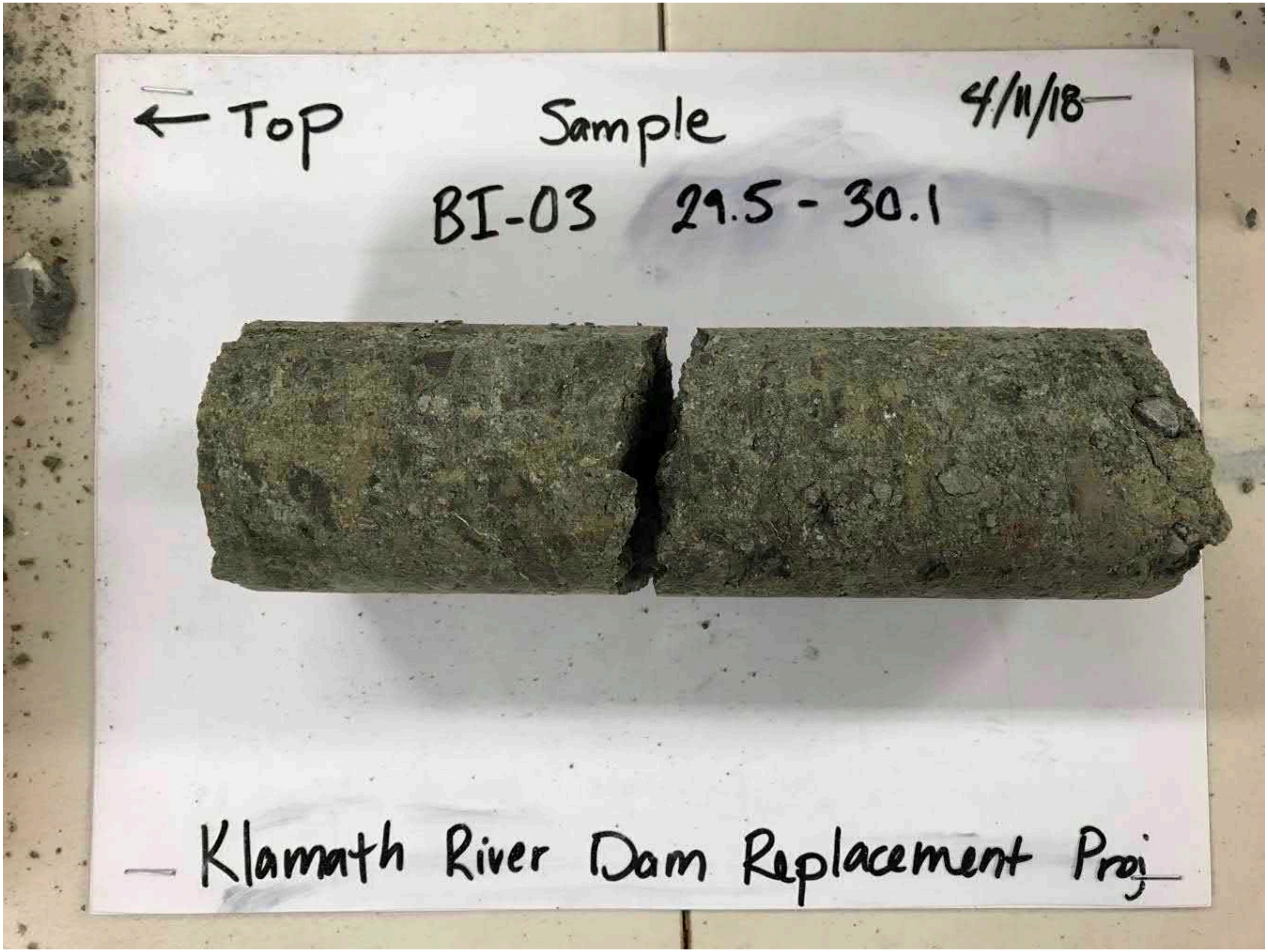
Sample
4/11/18
BI-03 29.5 - 30.1
Klamath River Dam Replacement Proj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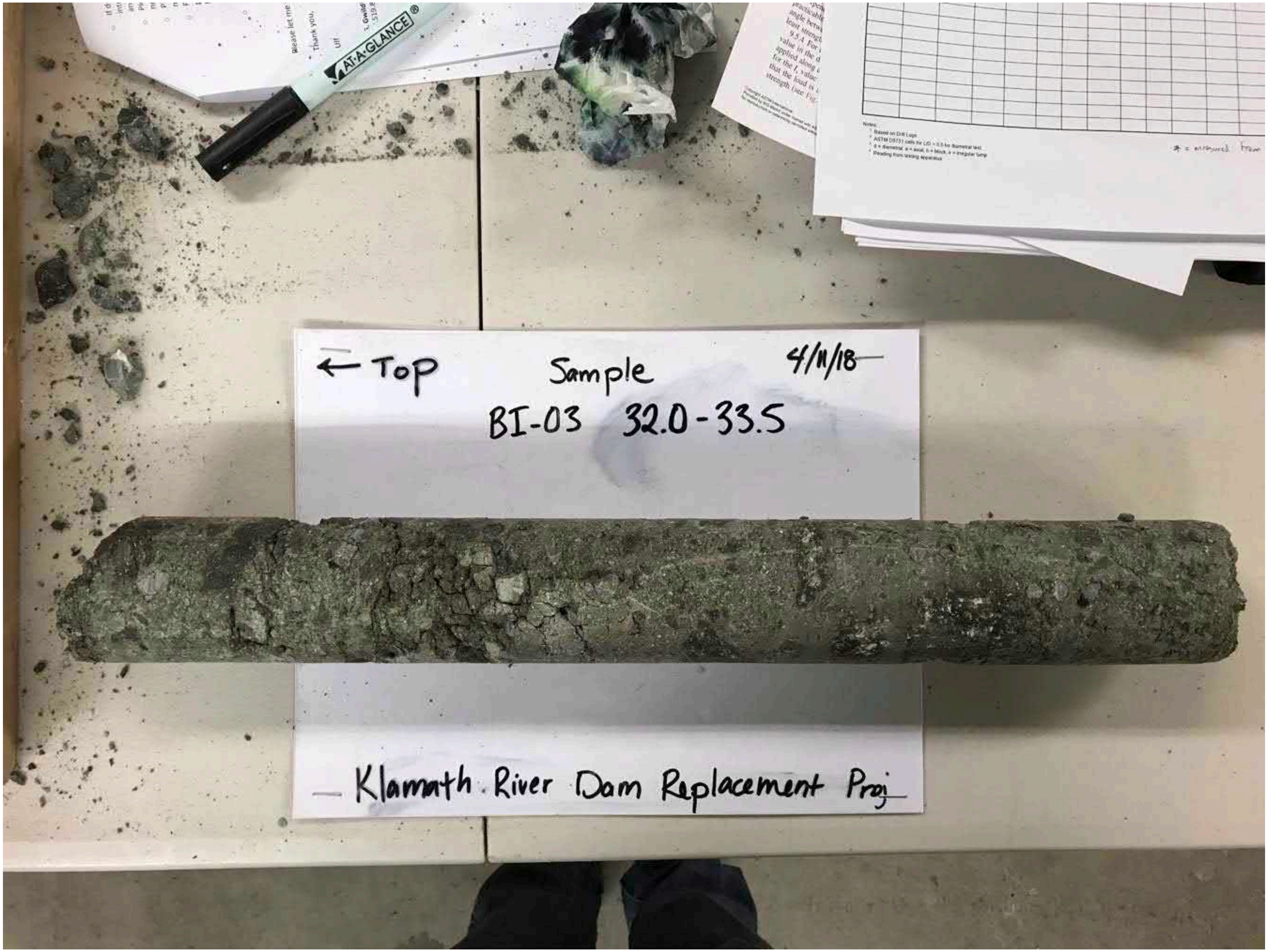
Sample
4/11/18
BI-03 29.5 - 30.1
Klamath River Dam Replacement Proj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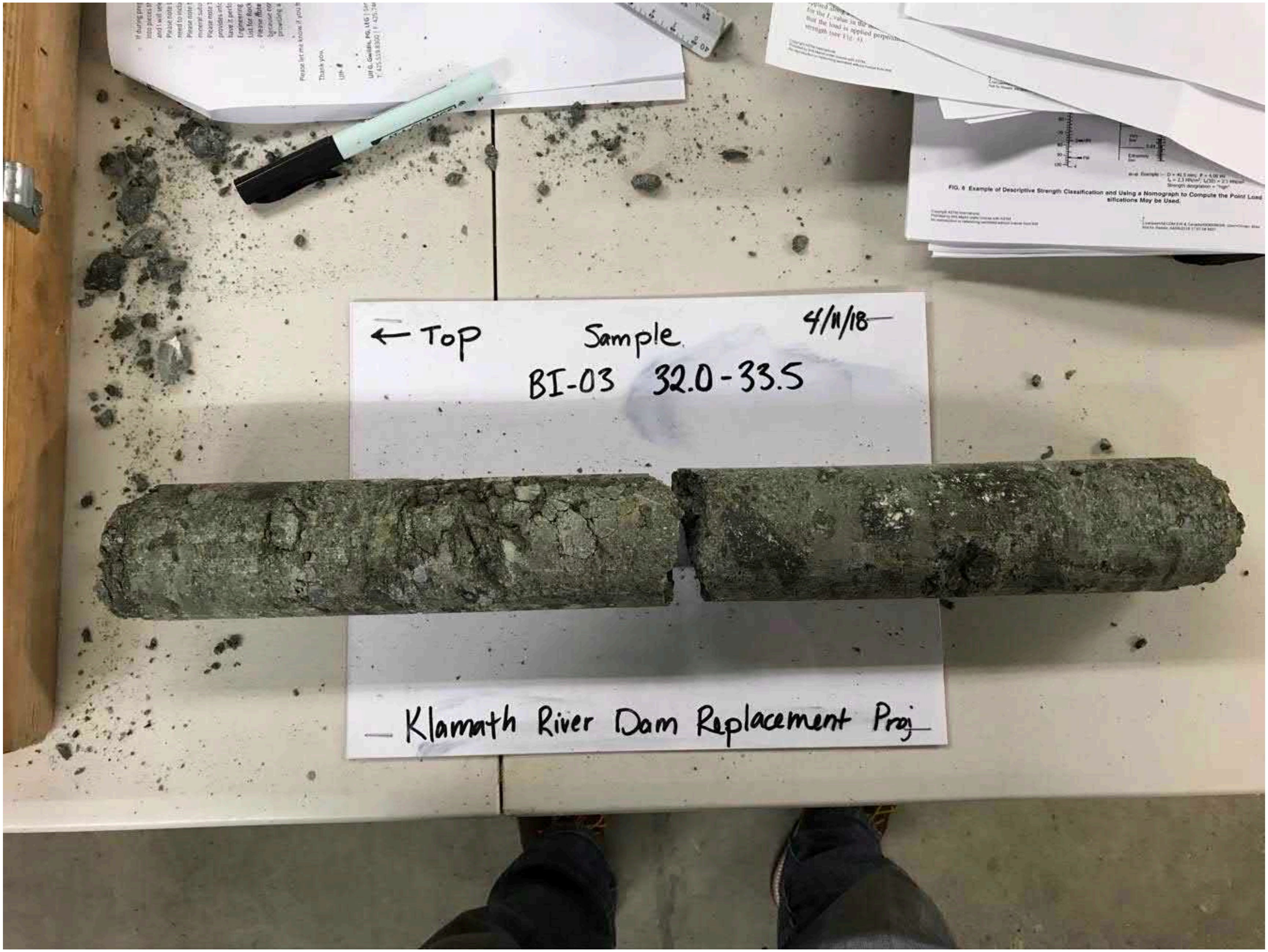
Sample
4/11/18
BI-03 32.0-33.5
Klamath River Dam Replacement Proj
AT-A-GLANCE



← Top
Sample
4/11/18
BI-03 32.0-33.5
Klamath River Dam Replacement Proj

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-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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/12/2019
Project Name: Klamath River Renewal Project **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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

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

COOPER TESTING LABORATORY

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	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

COOPER TESTING LABORATORY

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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

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	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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/12/2019
Project Name: Klamath River Renewal Project **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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

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

COOPER TESTING LABORATORY

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

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-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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

CTL Job No:	020-277	**Project No.:**	60537920
Client:	AECOM	**Date:**	3/13/2019
Project Name:	Klamath River Renewal Project	**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

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-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

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/13/2019
Project Name: Klamath River Renewal Project **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

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/13/2019
Project Name: Klamath River Renewal Project **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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/13/2019
Project Name: Klamath River Renewal Project **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

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/13/2019
Project Name: Klamath River Renewal Project **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

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-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

COOPER TESTING LABORATORY

CTL Job No:	020-277	**Project No.:**	60537920
Client:	AECOM	**Date:**	3/13/2019
Project Name:	Klamath River Renewal Project	**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

COOPER TESTING LABORATORY

CTL Job No: 020-277 **Project No.:** 60537920
Client: AECOM **Date:** 3/13/2019
Project Name: Klamath River Renewal Project **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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

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

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:	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

COOPER TESTING LABORATORY

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

POINT LOAD STRENGTH INDEX OF ROCK - ASTM D 5731

COOPER TESTING LABORATORY

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

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

Tonon USA:
Engineering, Measuraments 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.	2018-22-1-1
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.

2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@tononeng.com

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:
Engineering, Measuraments 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.	2018-22-1-2
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

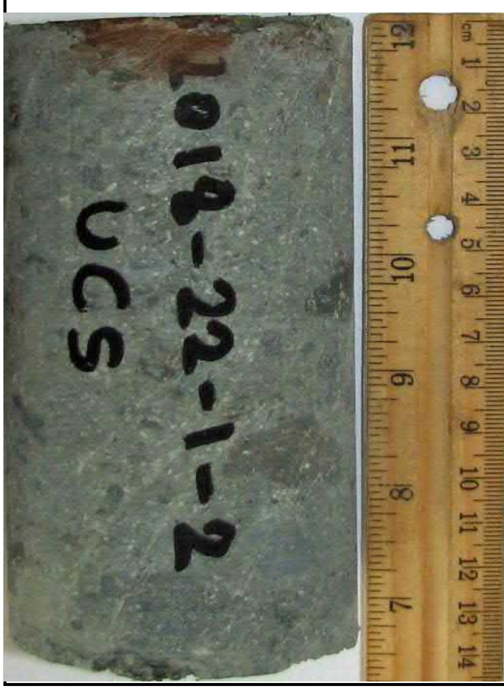


Photo After Test

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

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

2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@tononeng.com

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

Tonon USA:
Engineering, Measuraments 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.	2018-22-1-3
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.

2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@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.	2018-22-1-4
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.

2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@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.	2018-22-1-5
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.

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				

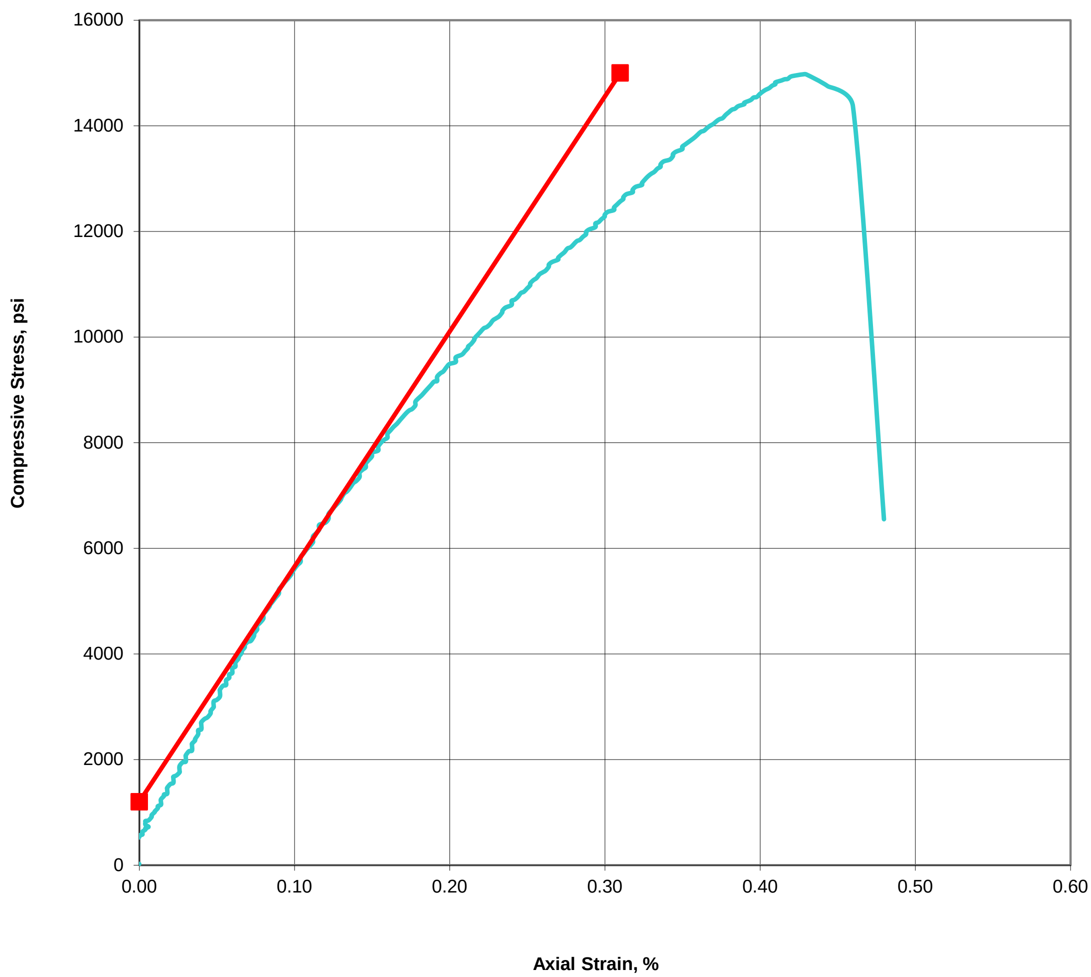
Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^oC): Ambient

Remarks:

Sample Height, in.	5.00	**Unconfined Compressive Strength (psi)**	**14975**
Sample Diameter, in.	2.39		
Height / Diameter	2.1		
Sample Area, in^2	4.50		
Wet Density, pcf	160.2	**Young's Modulus (E) (psi)**	**4,450,000**
Dry Density, pcf	159.1		
Moisture Content, %	0.7		
Strain Rate, % / min	0.25		



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				

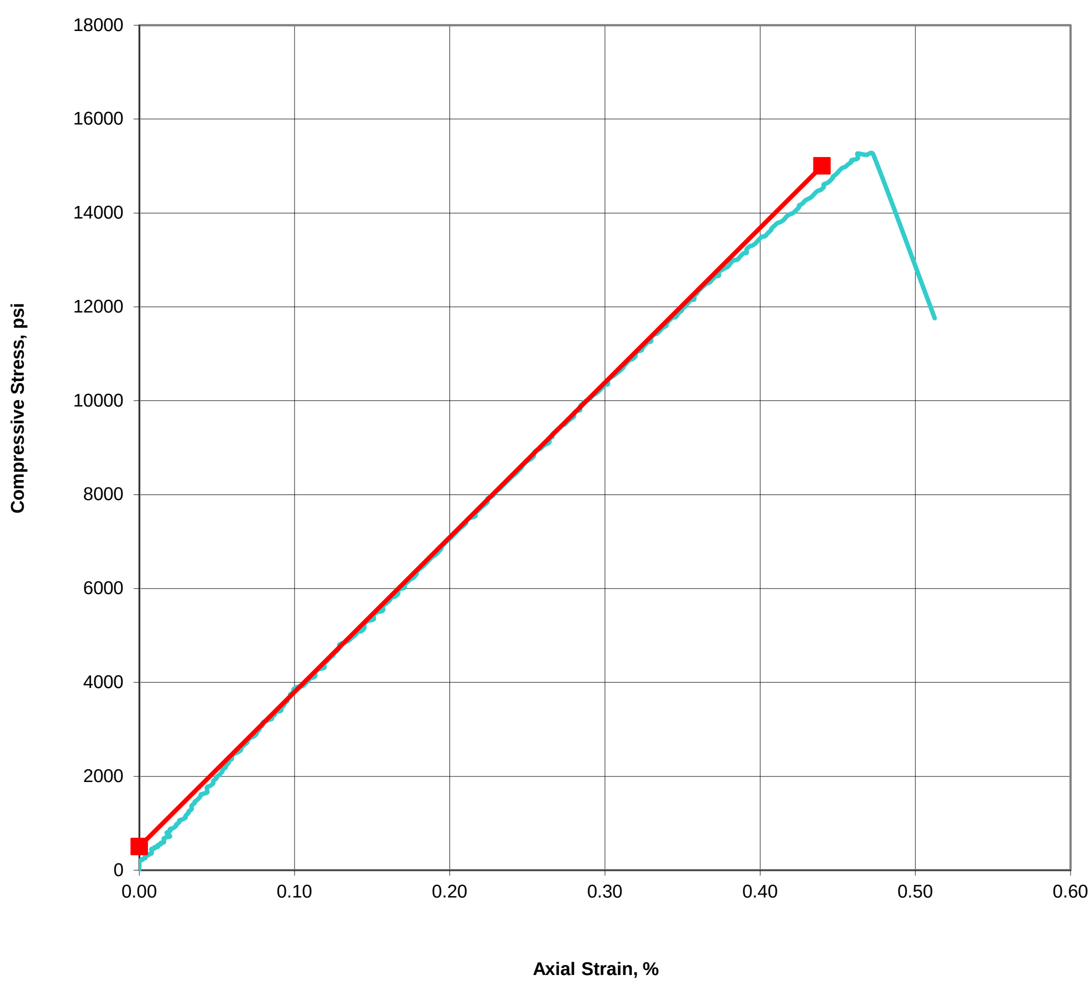
Visual Description: Gray Rock

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				

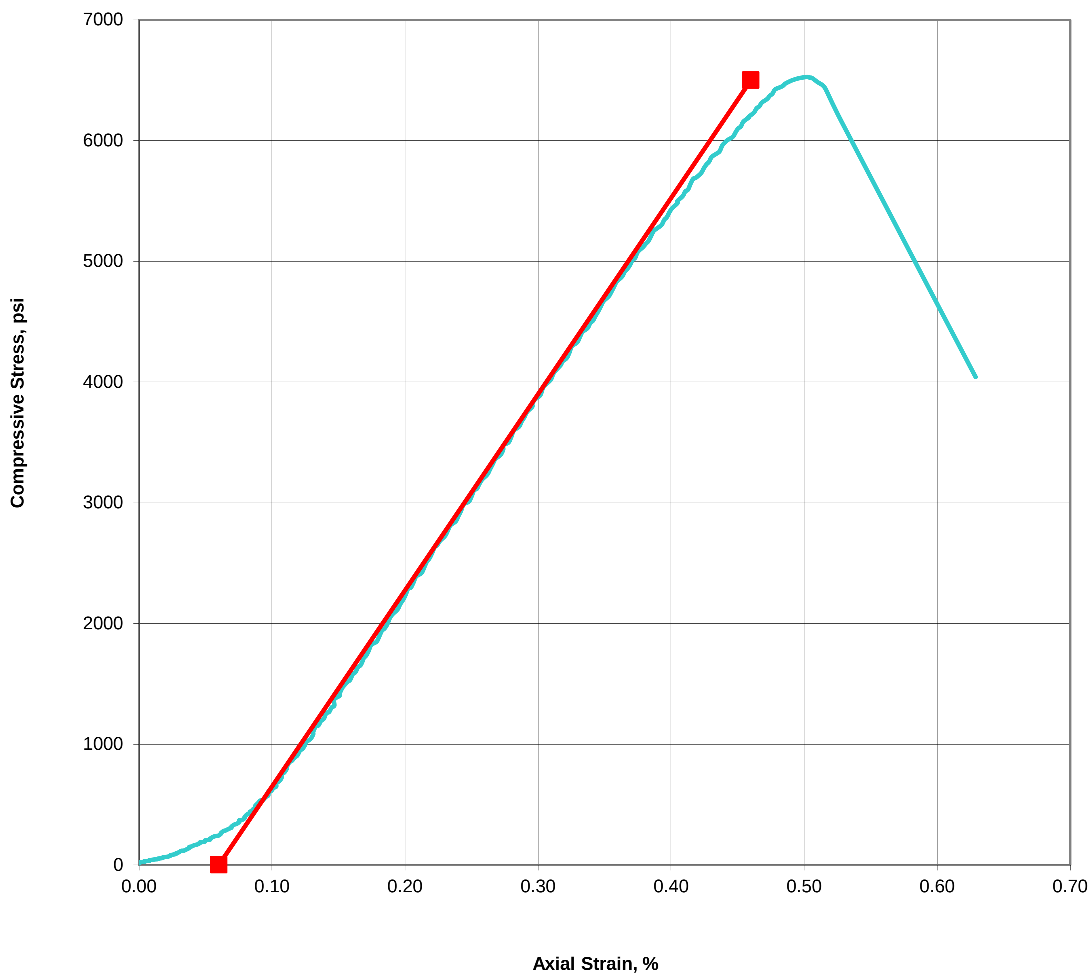
Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^{o}C): Ambient

Remarks:

Sample Height, in.	5.04	**Unconfined Compressive Strength (psi)**	**6528**
Sample Diameter, in.	2.40		
Height / Diameter	2.1		
Sample Area, in^2	4.52		
Wet Density, pcf	141.3	**Young's Modulus (E) (psi)**	**1,630,000**
Dry Density, pcf	140.1		
Moisture Content, %	0.9		
Strain Rate, % / min	0.25		



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				

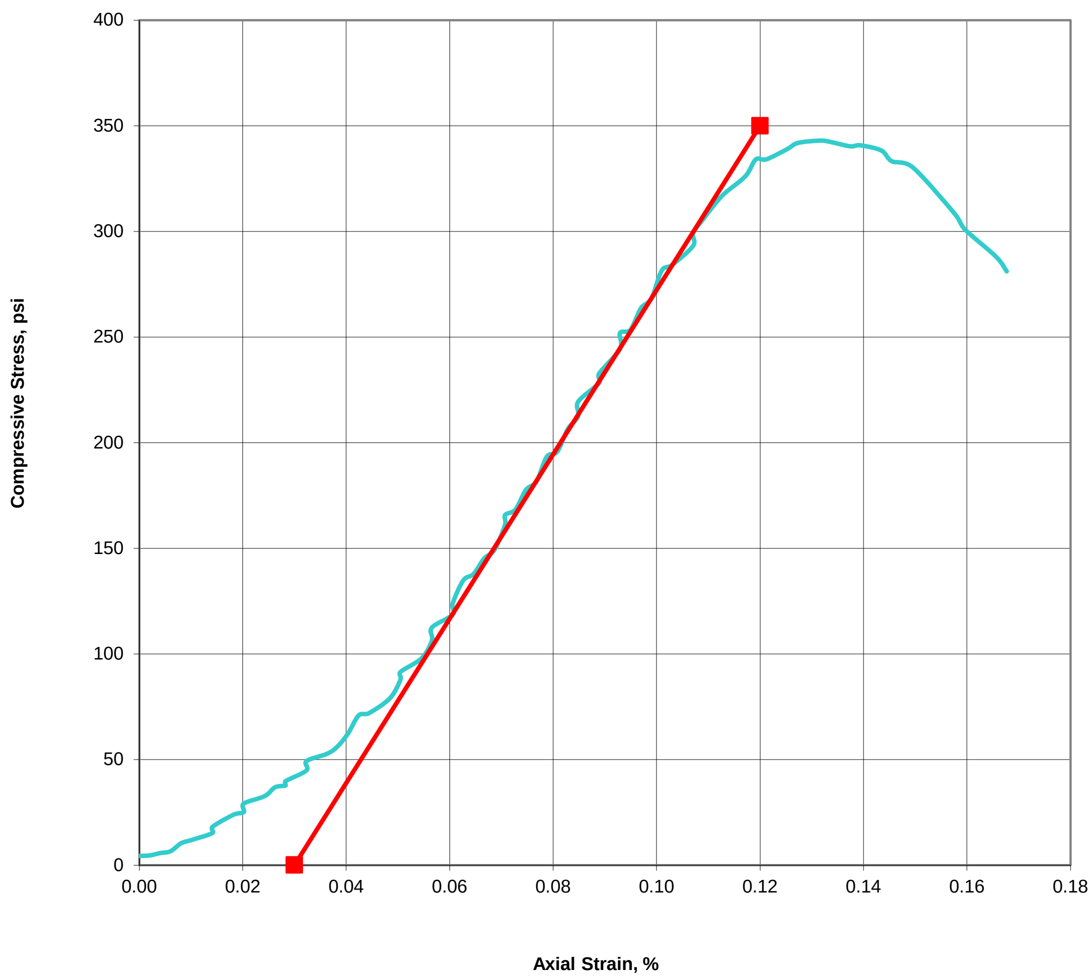
Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^oC): Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	4.95	**Unconfined Compressive Strength (psi)**	**343**
Sample Diameter, in.	2.40		
Height / Diameter	2.1		
Sample Area, in^2	4.53		
Wet Density, pcf	163.7	**Young's Modulus (E) (psi)**	**388,900**
Dry Density, pcf	157.9		
Moisture Content, %	3.7		
Strain Rate, % / min	0.25		



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				

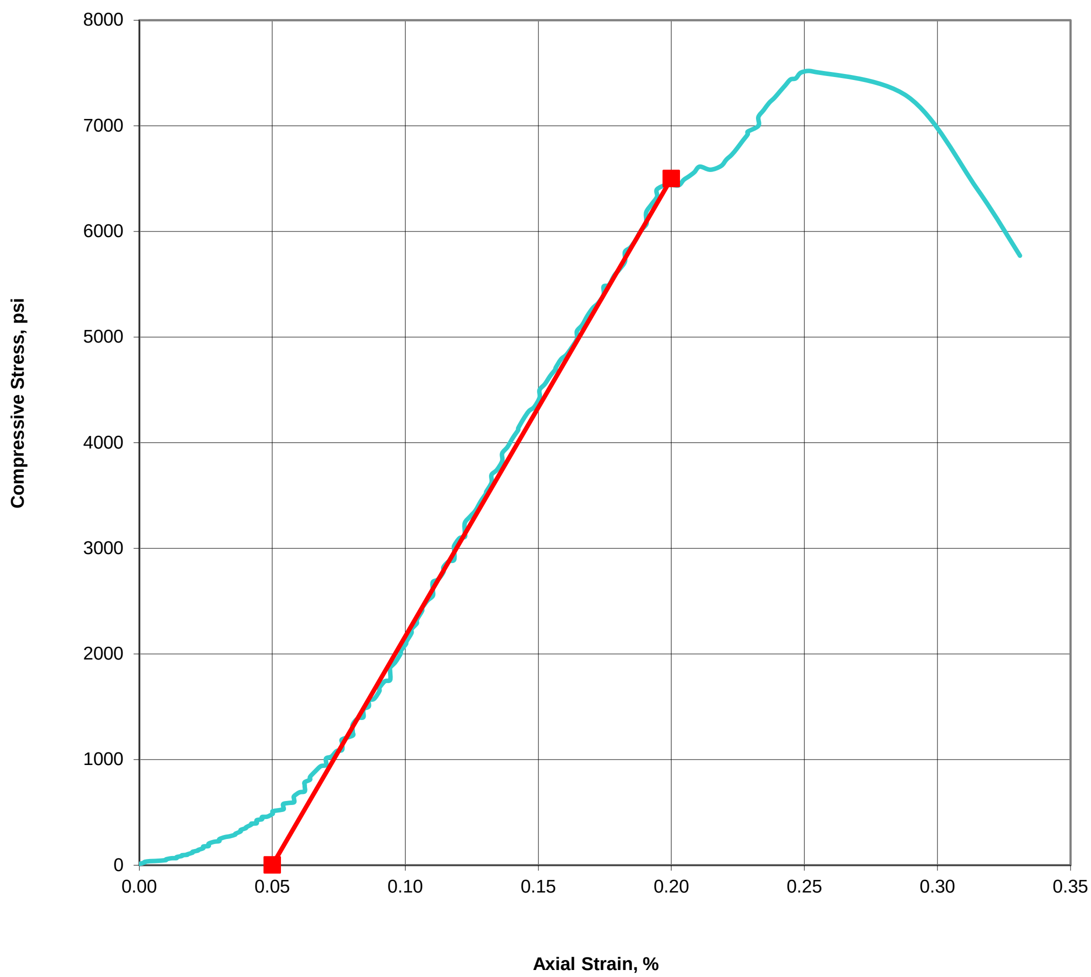
Visual Description: Gray Rock

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	**Unconfined Compressive Strength (psi)**	**7517**
Sample Diameter, in.	2.40		
Height / Diameter	2.1		
Sample Area, in^2	4.54		
Wet Density, pcf	165.7	**Young's Modulus (E) (psi)**	**4,330,000**
Dry Density, pcf	160.3		
Moisture Content, %	3.4		
Strain Rate, % / min	0.25		



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				

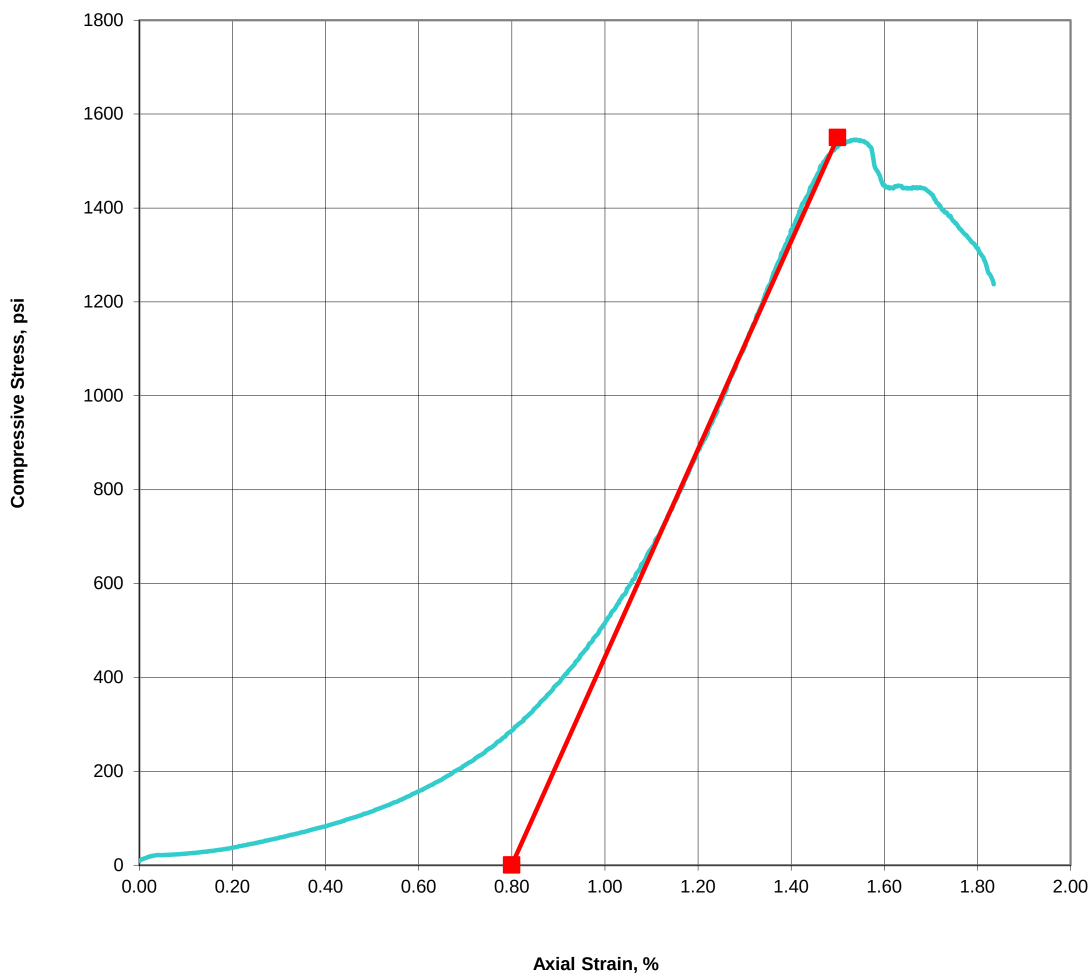
Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^oC): Ambient

Remarks: Spalling occurred at ends of sample during trimming. Therefore, the measured density is approximate.

Sample Height, in.	4.95	**Unconfined Compressive Strength (psi)**	**1546**
Sample Diameter, in.	2.34		
Height / Diameter	2.1		
Sample Area, in^2	4.30		
Wet Density, pcf	144.2	**Young's Modulus (E) (psi)**	**221,400**
Dry Density, pcf	136.3		
Moisture Content, %	5.8		
Strain Rate, % / min	0.25		



COOPER TESTING LABORATORY

Unconfined Compressive Strength and Young's Modulus of Rock Core (ASTM D7012D)

CTL Job No.:	020-277L	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				

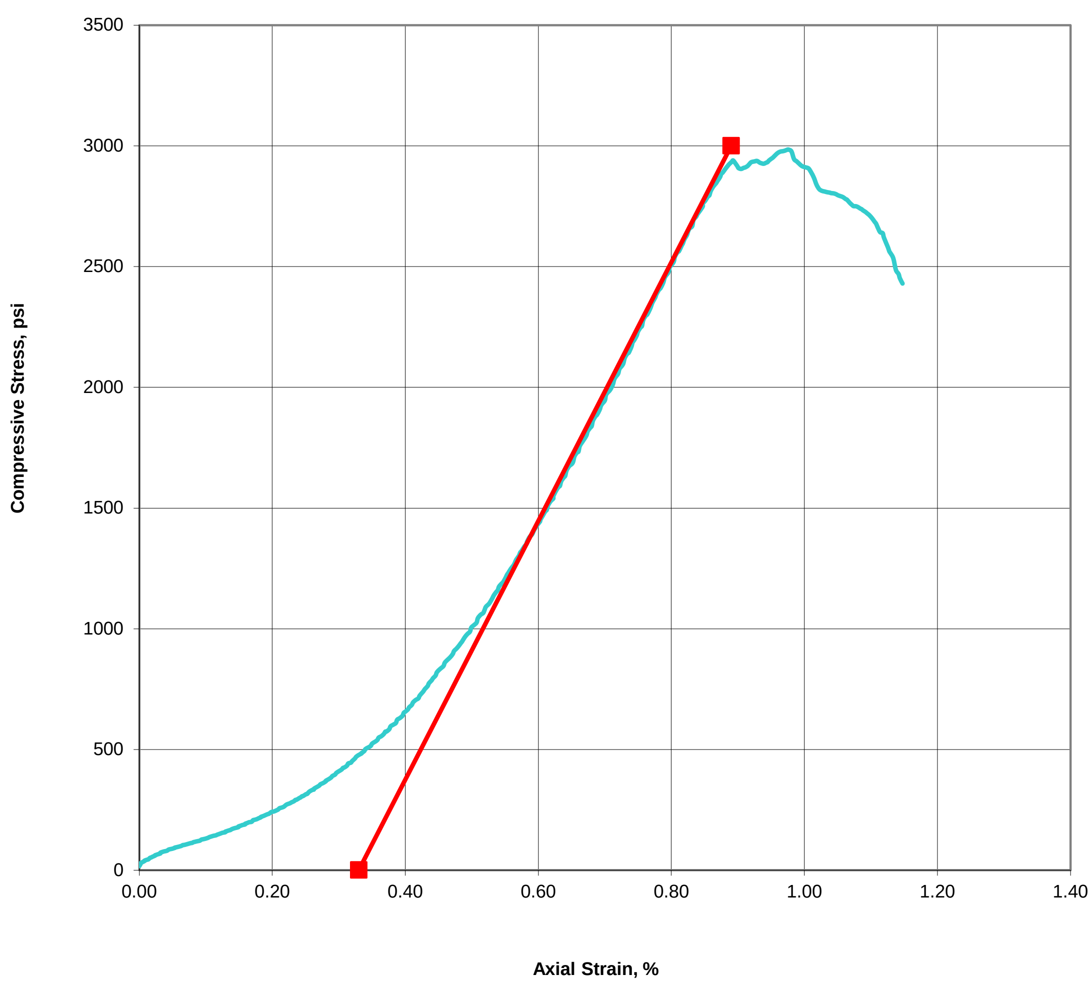
Visual Description: Gray Rock

Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^oC): 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

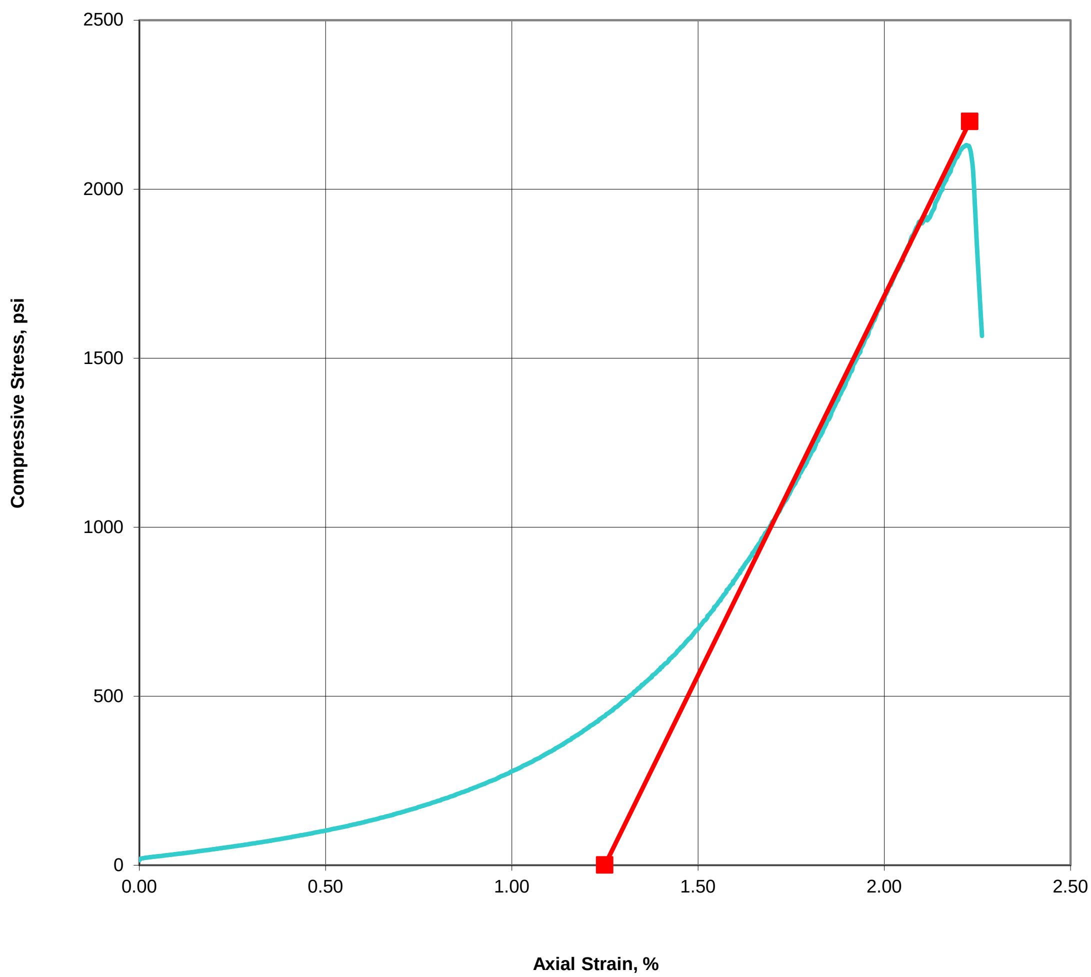
Moisture Condition at Test: Sample was washed and in a moist state.

Test Temperature, (^{o}C): 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**



Project Name	Klamath River Dam Removal	Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Location	Klamath River	Diameter (D)	60.94 mm	2.40 in
Client	Klamath River Renewal Corporation	Thickness (t)	22.88 mm	0.90 in
Client Project No.	60537920	Maximum Load (P)	6.53 kN	1,468 lbf
Registry No.	2018-22	Tensile strength (flat platens) $\sigma_t = 2P/\pi t D$	N/A	N/A
Report No.	2018-22-2-1	Tensile strength (curved platens) $\sigma_t = 1.272P/\pi t D$	1.90 MPa	275 psi
Report Date	5/17/2018	Direction of Loading	Orthogonal to the Borehole Axis	
Drill Hole and Depth	BI-02; 47-48.9 ft	Type of Failure	Non-Structural	
Rock Type	Volcanic Breccia	Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.38	OK
Geologic Unit	N/A			
Moisture Condition	As-received			

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.

Project Name	Klamath River Dam Removal	Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Location	Klamath River	Diameter (D)	60.84 mm	2.40 in
Client	Klamath River Renewal Corporation	Thickness (t)	24.67 mm	0.97 in
Client Project No.	60537920	Maximum Load (P)	5.25 kN	1,180 lbf
Registry No.	2018-22	Tensile strength (flat platens) $\sigma_t = 2P / \pi t D$	N/A	N/A
Report No.	2018-22-2-2	Tensile strength (curved platens) $\sigma_t = 1.272P / \pi t D$	1.42 MPa	206 psi
Report Date	5/17/2018	Direction of Loading	Orthogonal to the Borehole Axis	
Drill Hole and Depth	BI-02; 52-54.7 ft	Type of Failure	Non-Structural	
Rock Type	Volcanic Breccia	Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.41	OK
Geologic Unit	N/A			
Moisture Condition	As-received			

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.

Project Name	Klamath River Dam Removal	Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Location	Klamath River	Diameter (D)	60.74 mm	2.39 in
Client	Klamath River Renewal Corporation	Thickness (t)	26.84 mm	1.06 in
Client Project No.	60537920	Maximum Load (P)	1.51 kN	339 lbf
Registry No.	2018-22	Tensile strength (flat platens) $\sigma_t = 2P/\pi t D$	N/A	N/A
Report No.	2018-22-2-3	Tensile strength (curved platens) $\sigma_t = 1.272P/\pi t D$	0.38 MPa	54 psi
Report Date	5/17/2018	Direction of Loading	Orthogonal to the Borehole Axis	
Drill Hole and Depth	BI-03; 18.4-20.1 ft	Type of Failure	Non-Structural	
Rock Type	Volcanic Breccia	Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.44	OK
Geologic Unit	N/A			
Moisture Condition	As-received			

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.

Project Name	Klamath River Dam Removal	Rate of loading (0.05-0.35 MPa/s or 500-3,000 psi/min)	0.11 MPa/sec	957 psi/min
Location	Klamath River	Diameter (D)	60.26 mm	2.37 in
Client	Klamath River Renewal Corporation	Thickness (t)	33.83 mm	1.33 in
Client Project No.	60537920	Maximum Load (P)	0.55 kN	124 lbf
Registry No.	2018-22	Tensile strength (flat platens) $\sigma_t = 2P/\pi tD$	N/A	N/A
Report No.	2018-22-2-4	Tensile strength (curved platens) $\sigma_t = 1.272P/\pi tD$	0.11 MPa	16 psi
Report Date	5/17/2018	Direction of Loading	Orthogonal to the Borehole Axis	
Drill Hole and Depth	BI-03; 22.9-24.2 ft	Type of Failure	Non-Structural	
Rock Type	Volcanic Breccia	Conformance to dimensional Requirements $0.2 \le \frac{t}{D} \le 0.75$	$\frac{t}{D} =$ 0.56	OK
Geologic Unit	N/A			
Moisture Condition	As-received			

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.

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

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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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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.	2018-22-5-2
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.

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).

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	-	

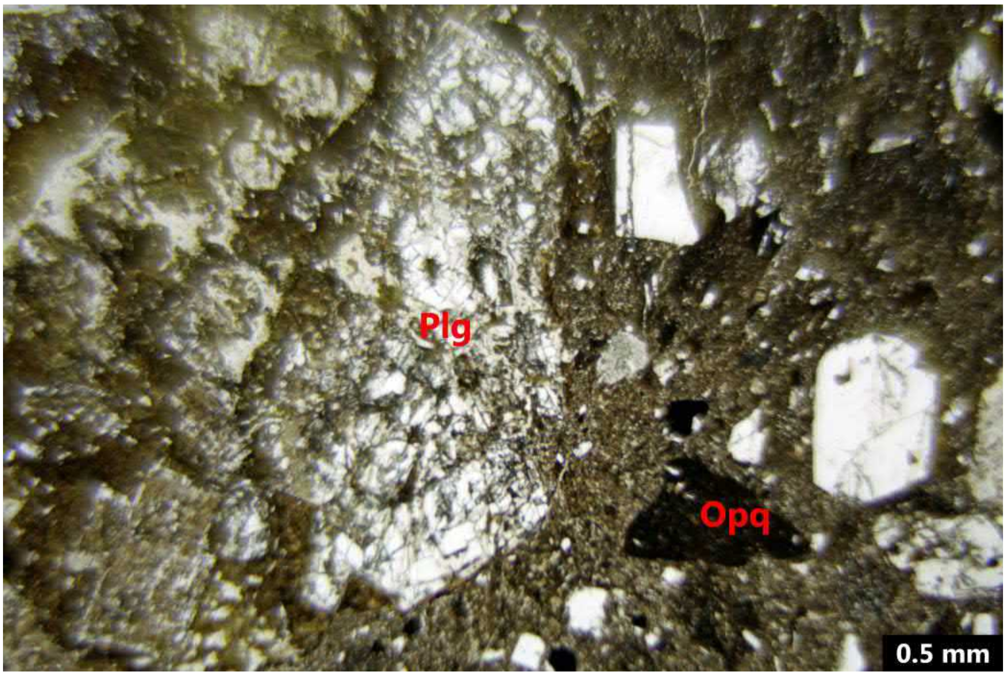

Fig. 2 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of the studied sample, showing an altered Plagioclase (Plg) crystal near to a big Hematite crystal (Opq).

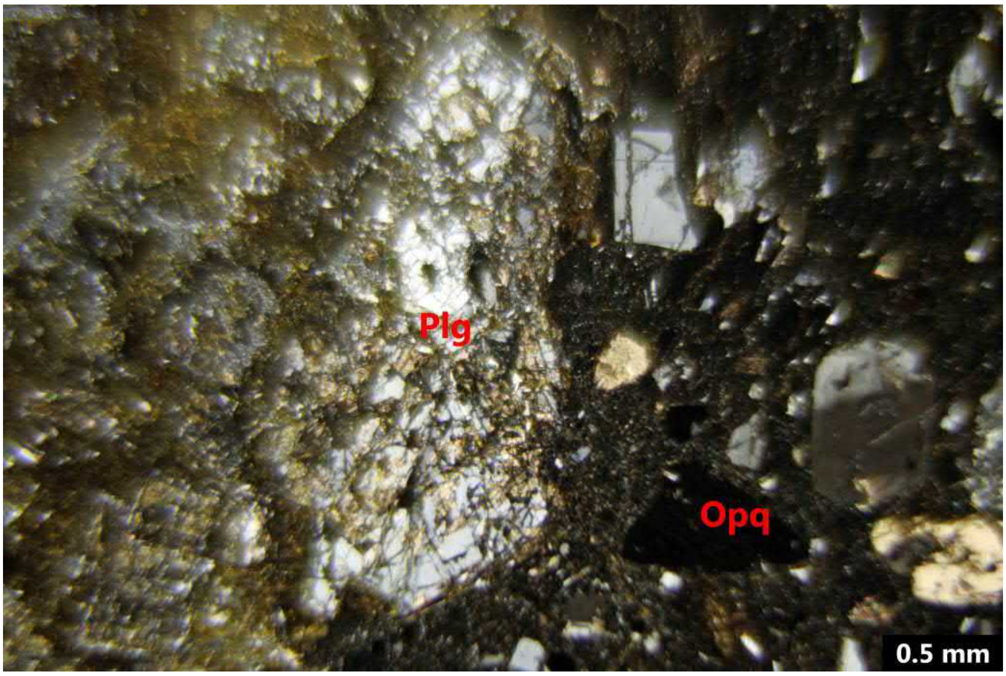

Fig. 3 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 2, but under crossed polars.

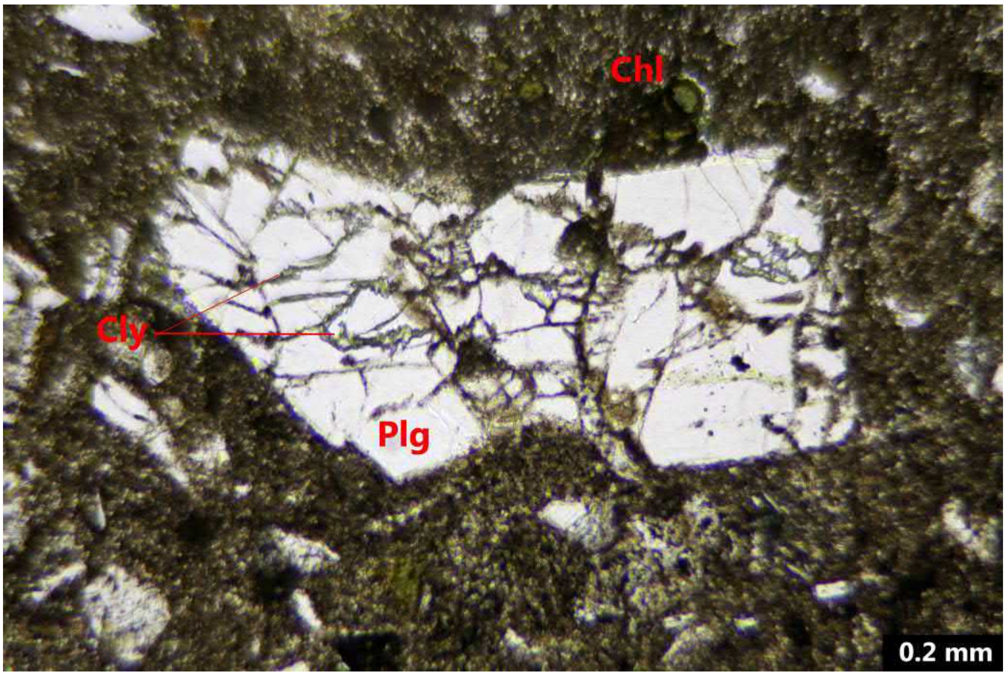

Fig. 4 - Plane polarized light. Field of view = 1.7 mm wide (magnification 10X). A detail of a Plagioclase grain, crossed by many fractures, all filled with Clay Minerals (Cly). Some Chlorite individuals (Chl) may be identified in the upper part of the picture.

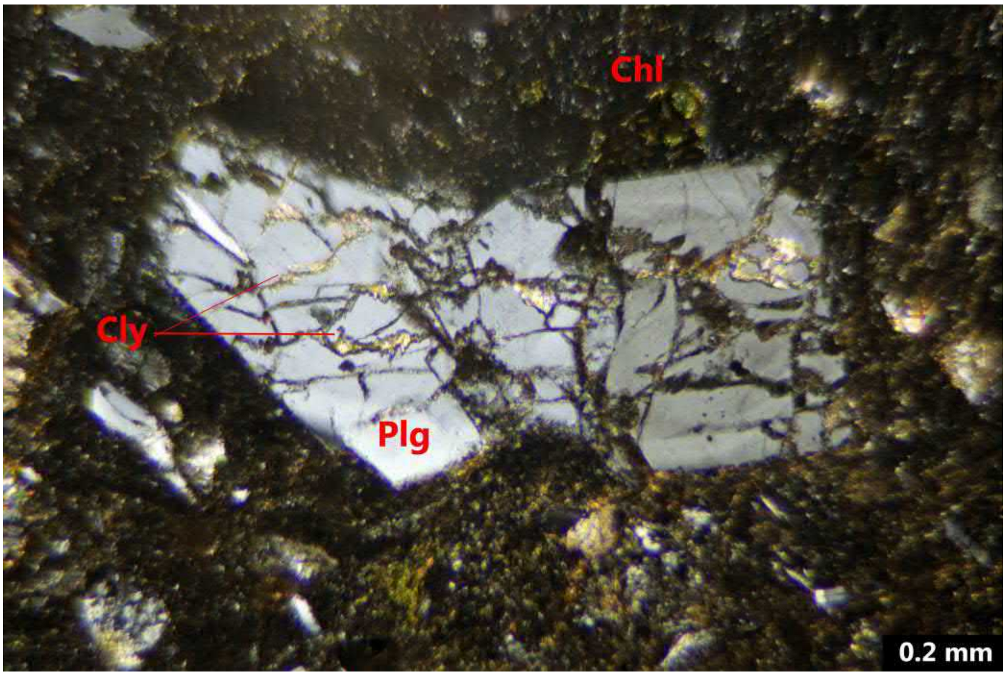

Fig. 5 - Cross polarized light. Field of view = 1.7 mm wide (magnification 10X). Same as Figure 4, but under crossed polars.

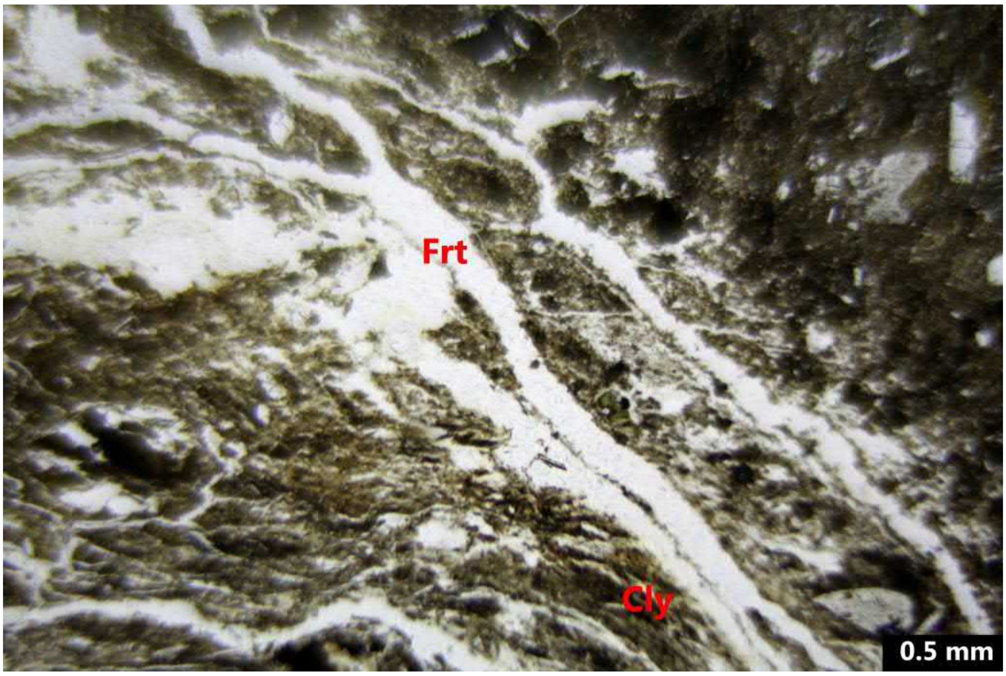

Fig. 6 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A selected area of the section with a well-developed fracture system (Frt).

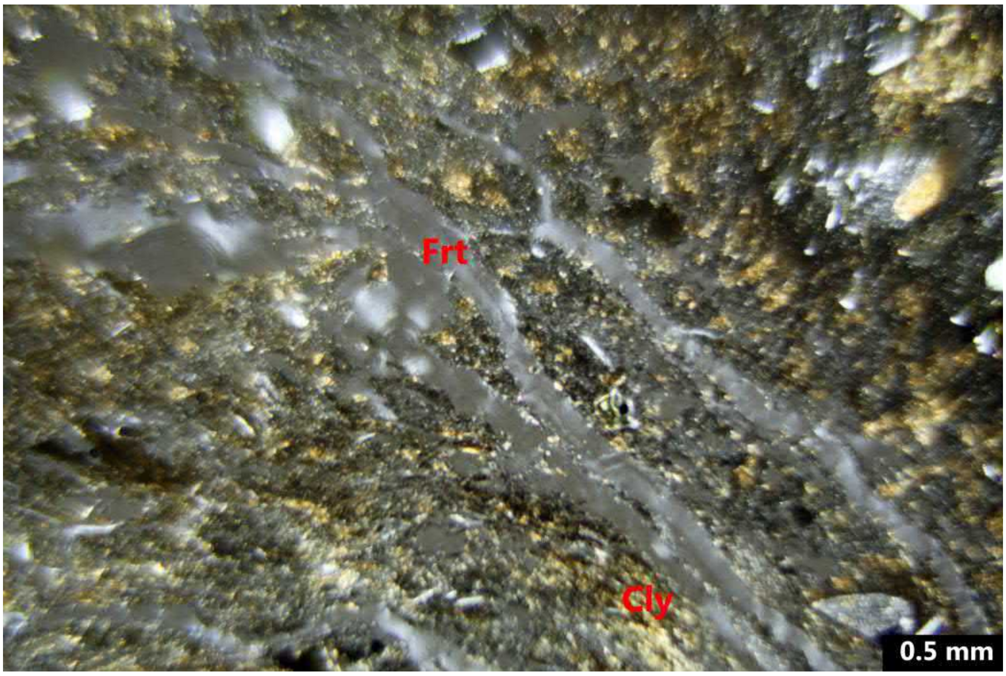

Fig. 7 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 6, but under crossed polars.

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).

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	-	

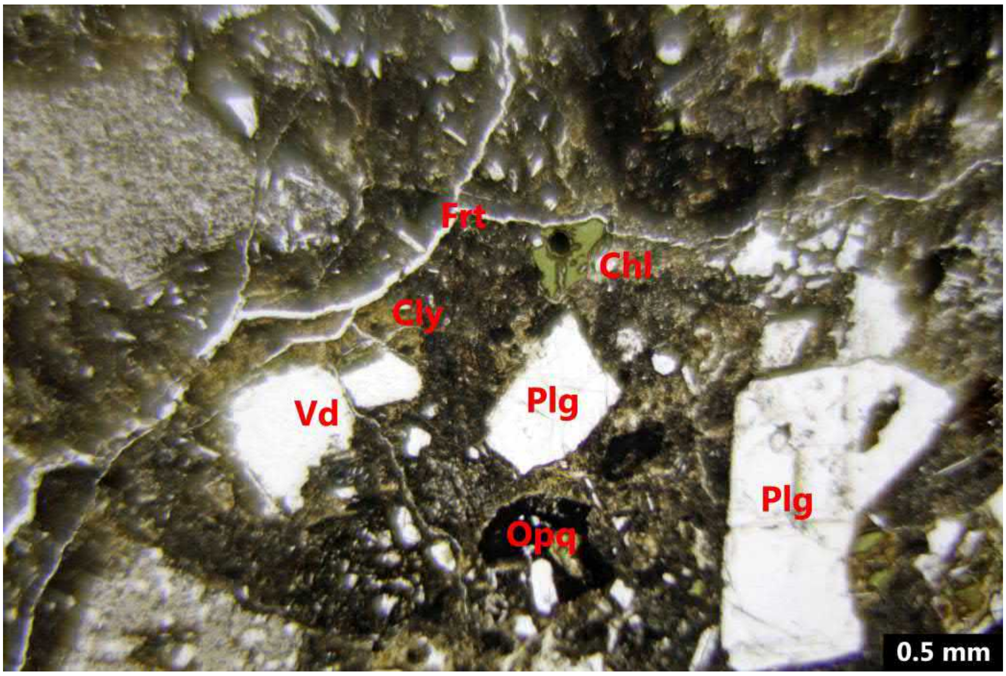

Fig. 2 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of the studied sample. The most common minerals are: Plagioclase (Plg), Clay Minerals (Cly), Opaque Minerals (Opq), and Chlorite (Chl). Also highlighted here are some structural features, such as fractures (Frt) and voids (Vd).

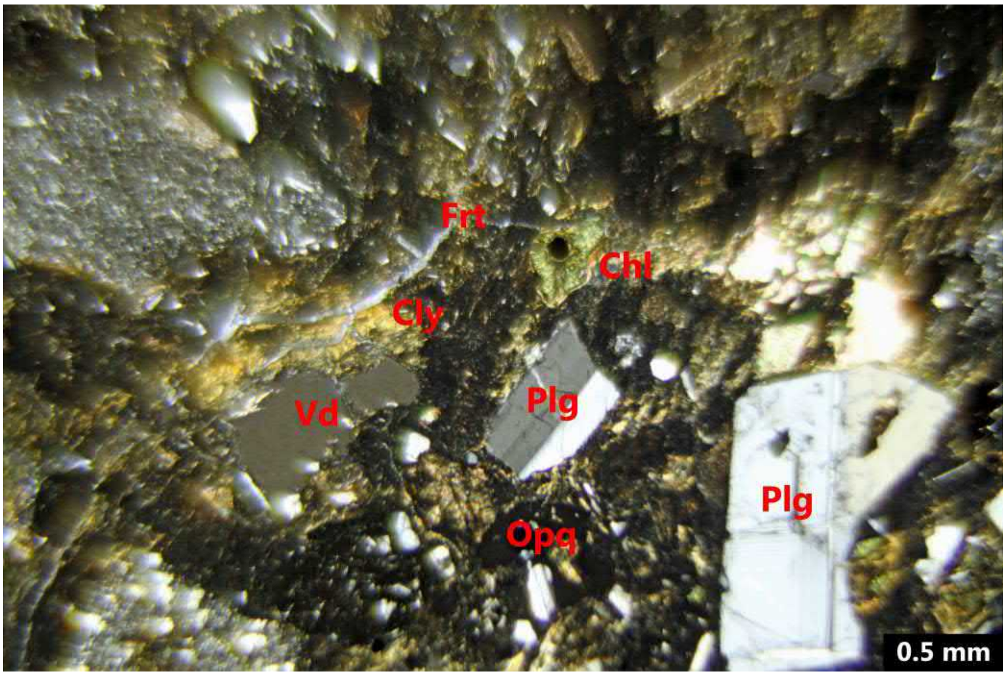

Fig. 3 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 2, but under crossed polars.

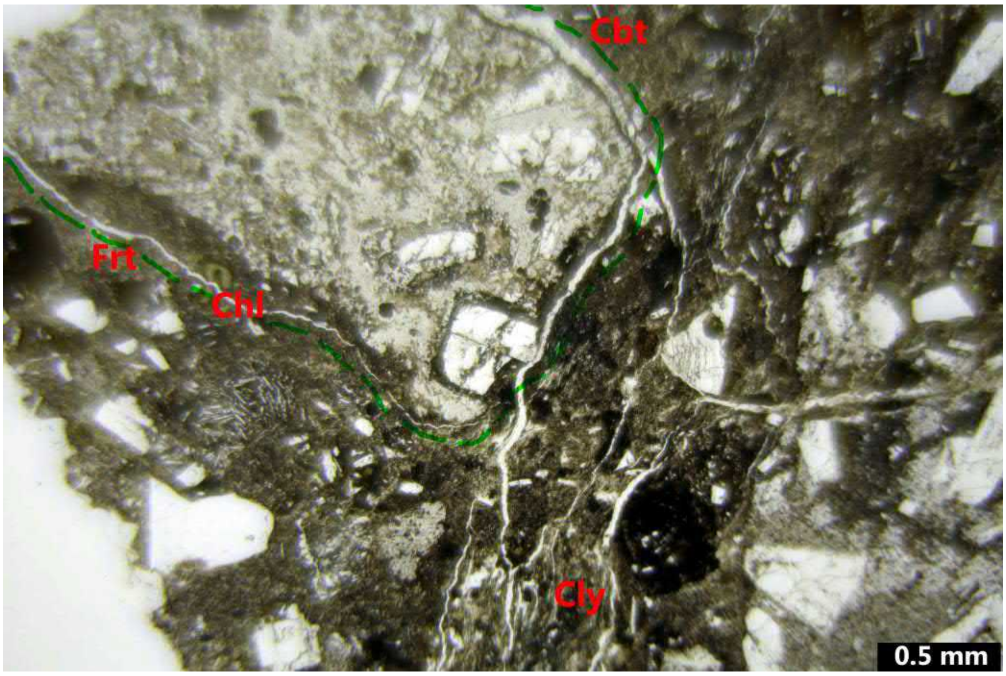

Fig. 4 - Plane polarized light. Field of view = 4 mm wide (magnification 4X). A view of a volcanic clast. A common feature of all the clasts in this thin section is the presence of fractures surrounding clast boundaries (follow the green dashed line). In this case the fracture is filled with secondary Carbonates (Cbt).

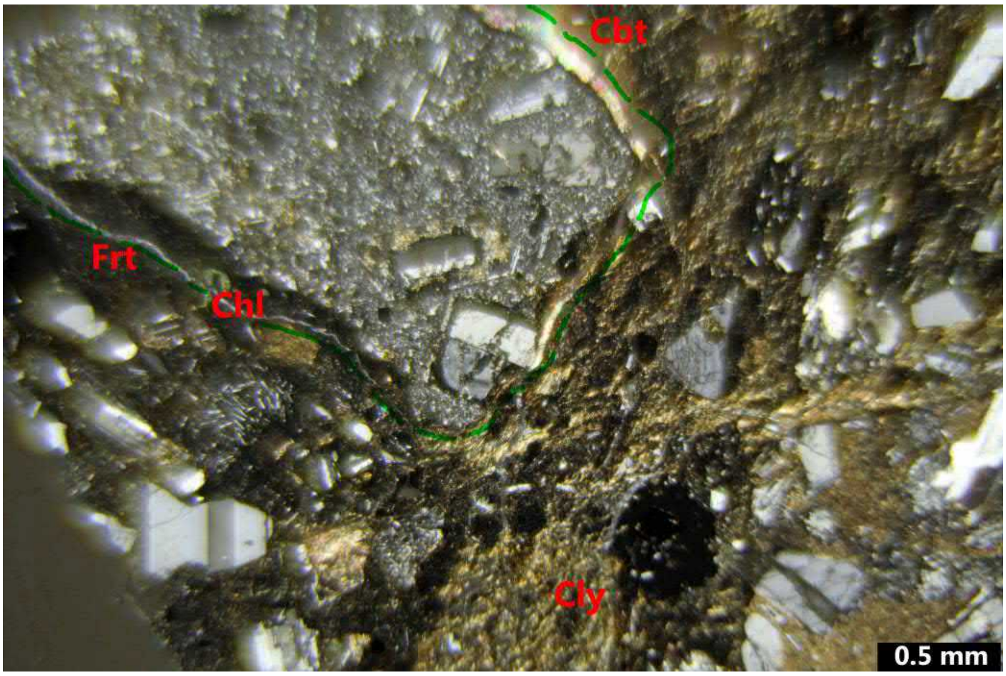

Fig. 5 - Cross polarized light. Field of view = 4 mm wide (magnification 4X). Same as Figure 4, but under crossed polars.

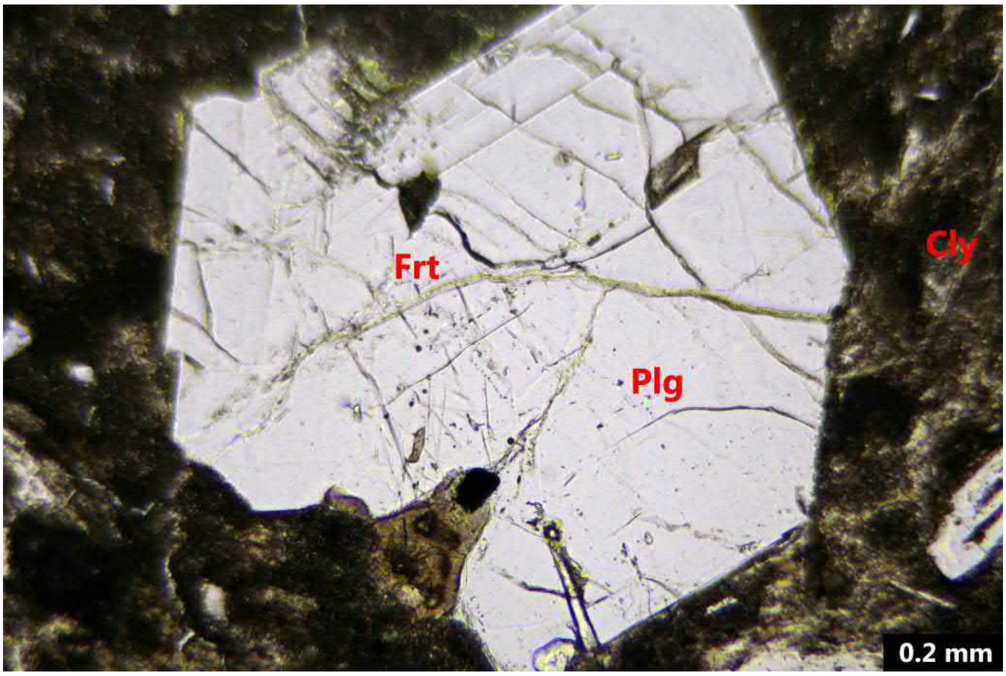

Fig. 6 - Plane polarized light. Field of view = 1.7 mm wide (magnification 10X). A detail of a Plagioclase crystal, showing grain alteration and suturing features: fractures cross the crystal and are also filled with Clay Minerals.

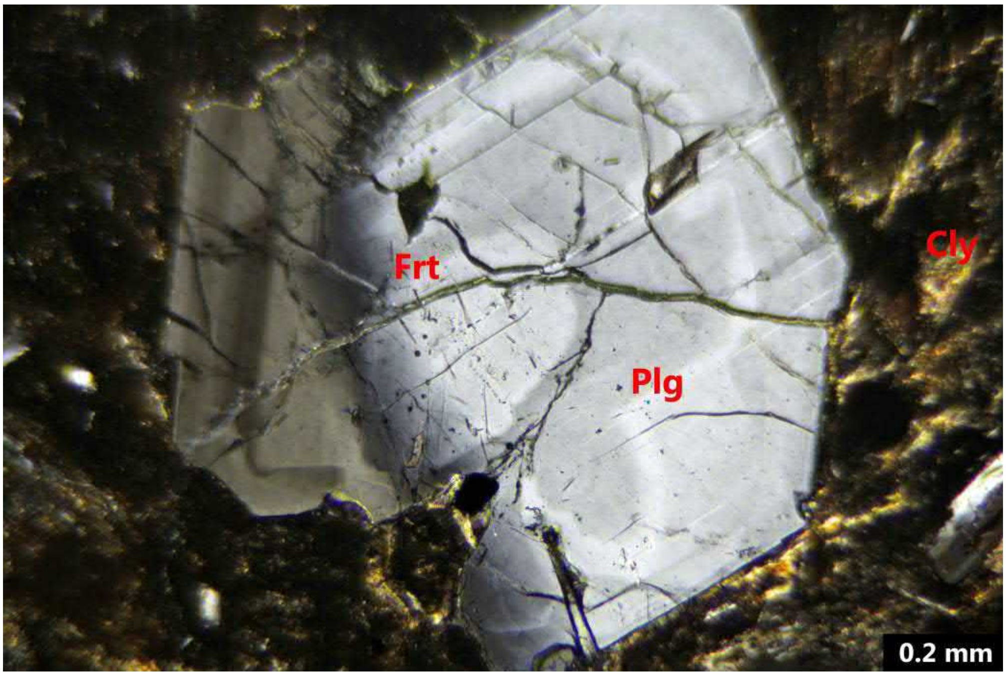

Fig. 7 - Cross polarized light. Field of view = 1.7 mm wide (magnification 10X). Same as Figure 6, but under crossed polars.

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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.	2018-22-8-1
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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COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

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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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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.	2018-22-8-3
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.

2028 E Ben White BLVD #240-2660
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Laboratory Director:Dr. Fulvio Tonon, P.E., Ph.D.
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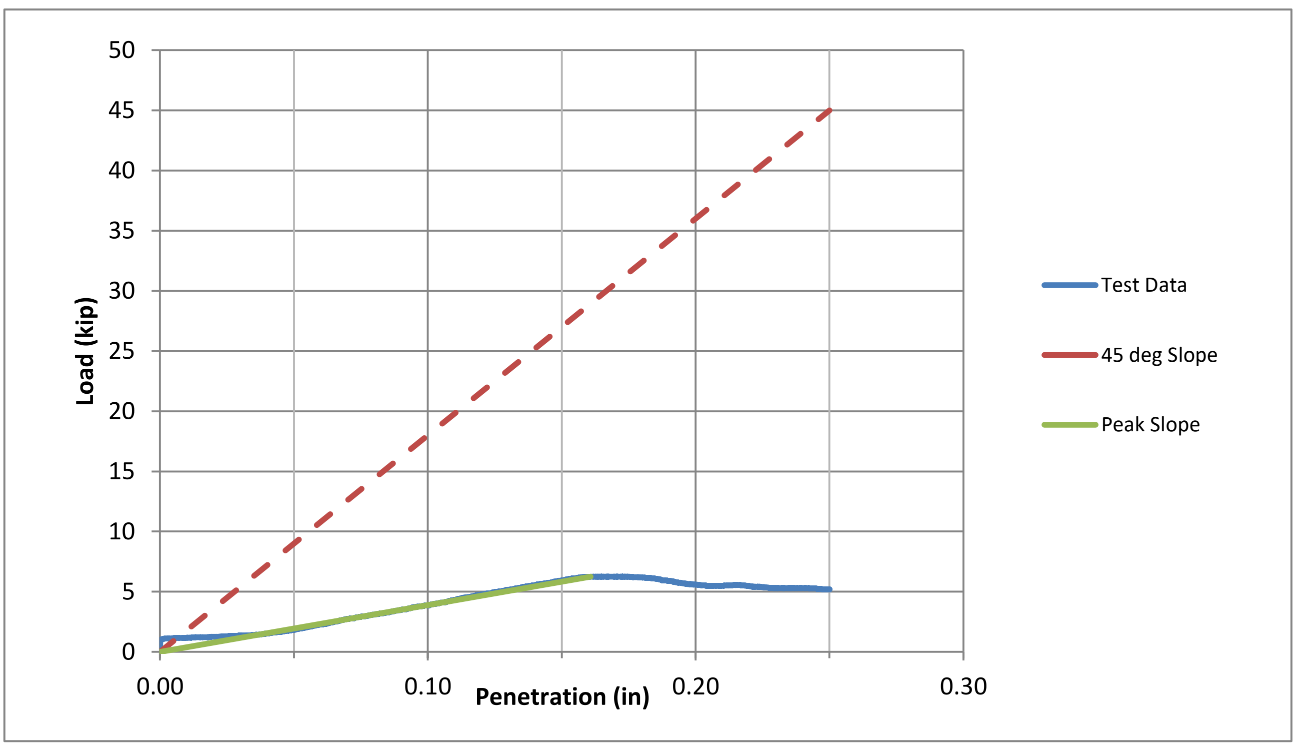
Project Name	Klamath River Dam Removal	Penetration rate	0.001 in/sec			
Location	Klamath River	Diameter of specimen	60.65	mm	2.39	in
Client	Klamath River Renewal Corporation	Height of specimen	64.62	mm	2.54	in
Client Project No.	60537920	Load at peak	27.81	kN	6,251	lbf
Registry No.	2018-22	45 Degree (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



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Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
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Photo After Test

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

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

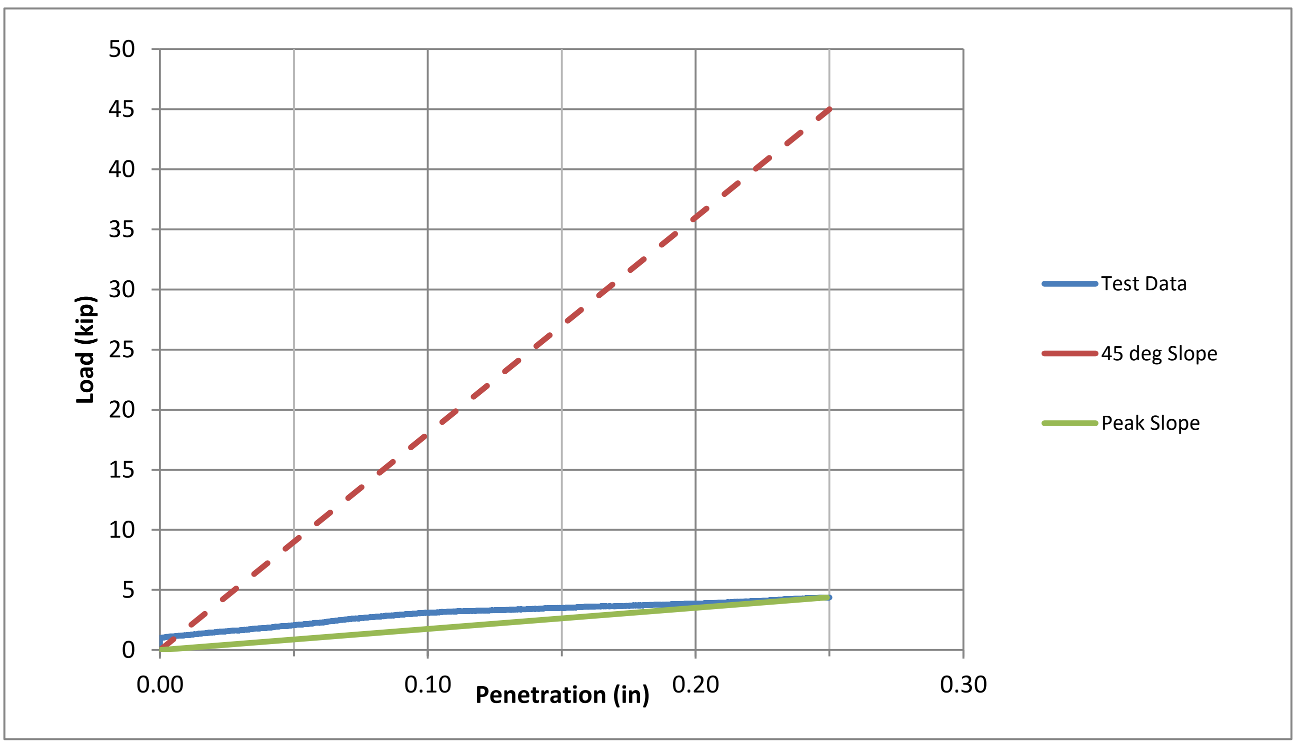
COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV GL = ISO 9001 =

Tonon USA
Engineering, Measurements and Testing, LLC

Web: tononeng.com

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



2028 E Ben White BLVD #240-2660
Austin, TX 78741

Laboratory Director: Dr. Fulvio Tonon, P.E., Ph.D.
Phone: +1-512-200-3051
E-mail: fulvio@tononeng.com

Photo After Test

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

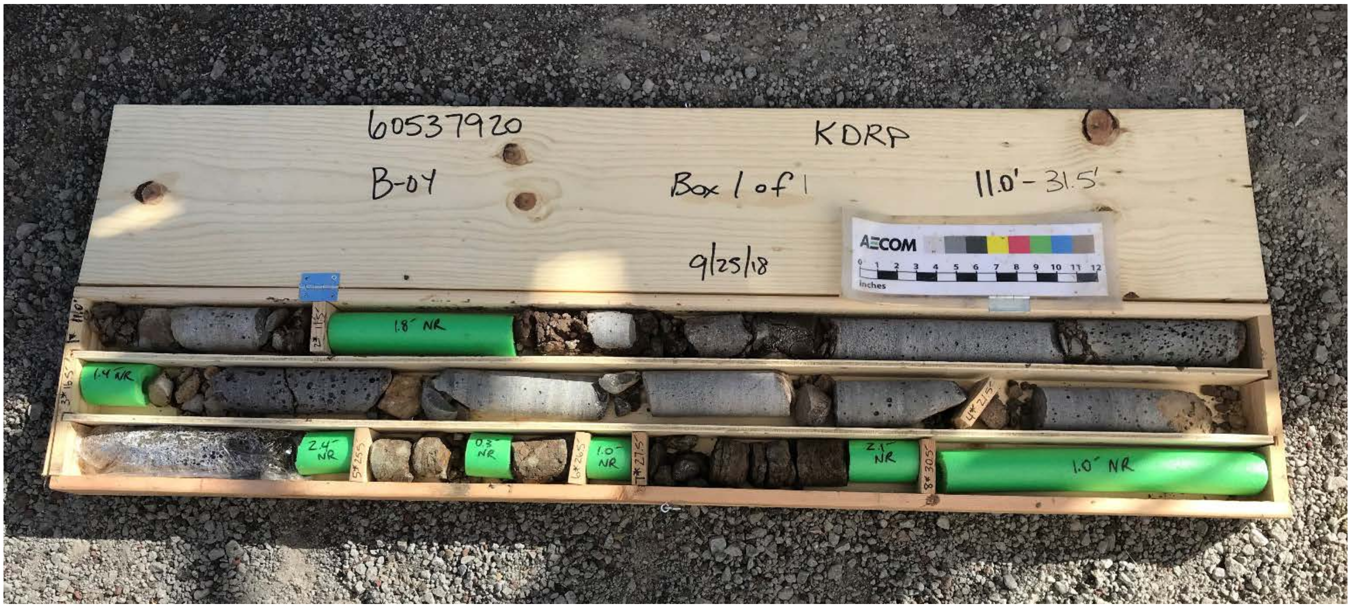
Checked by: Gloria Tonon-Kozma, P.E.

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 Project No. 6038551	Rock Core Photos Boring B-04 Box 1	Appendix E-2

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)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-05 Box 1 and 2	Appendix E-3

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	Rock Core Photos Borings B-06 and B-07 Box 1	Appendix E-4
	Project No. 6038551		

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)

AECOM	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)

AECOM	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		

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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

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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	Rock Core Photos Boring B-17 Box 1 and 2	Appendix E-10
	Project No. 6038551		

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	Rock Core Photos Borings B-19 and B-20 Box 1	Appendix E-11
	Project No. 6038551		

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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	Rock Core Photos Boring B-201 Box 1 and 2	Appendix E-12
	Project No. 6038551		

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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	Rock Core Photos Boring B-202 Box 3 and 4	Appendix E-14
	Project No. 6038551		

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	Rock Core Photos Boring B-202 Box 5 and 6	Appendix E-15
	Project No. 6038551		

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)

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)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-203 Box 7	Appendix E-19
	Project No. 6038551		

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)

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)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-205 Box 3 and 4	Appendix E-21
	Project No. 6038551		

B-205: 59.5 feet to 62 feet Depth (Box 5 of 5)

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)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-206 Box 3 and 4	Appendix E-24
	Project No. 6038551		

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		

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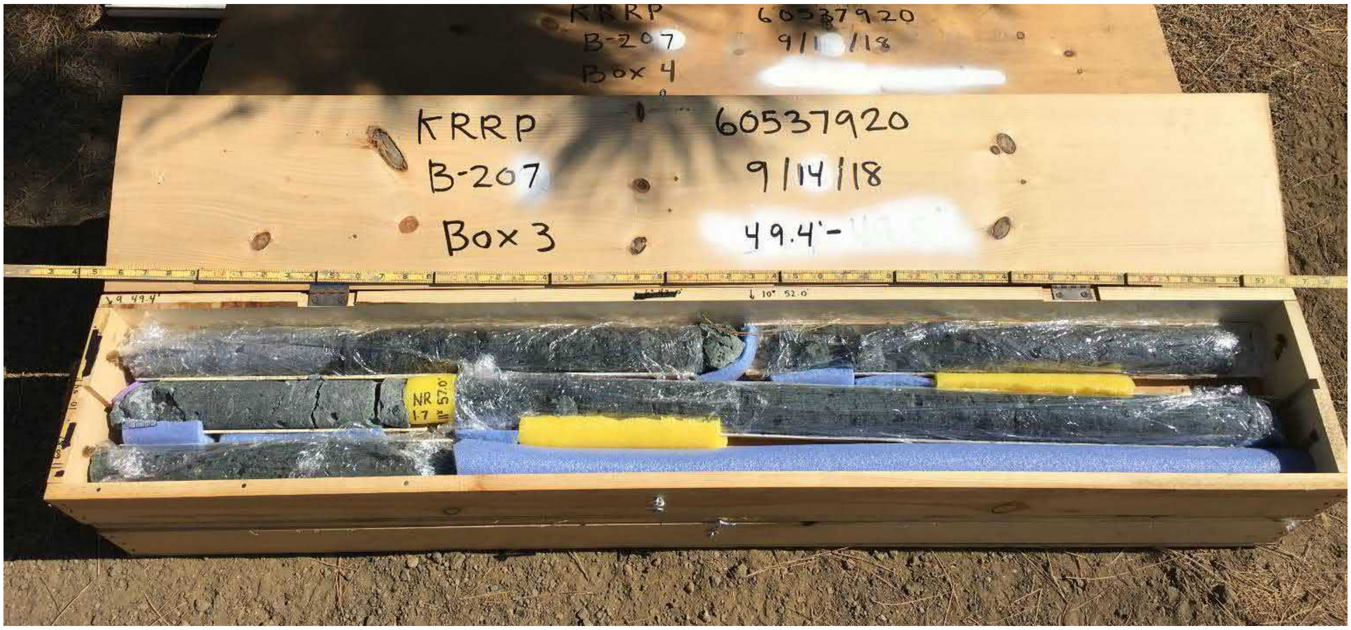
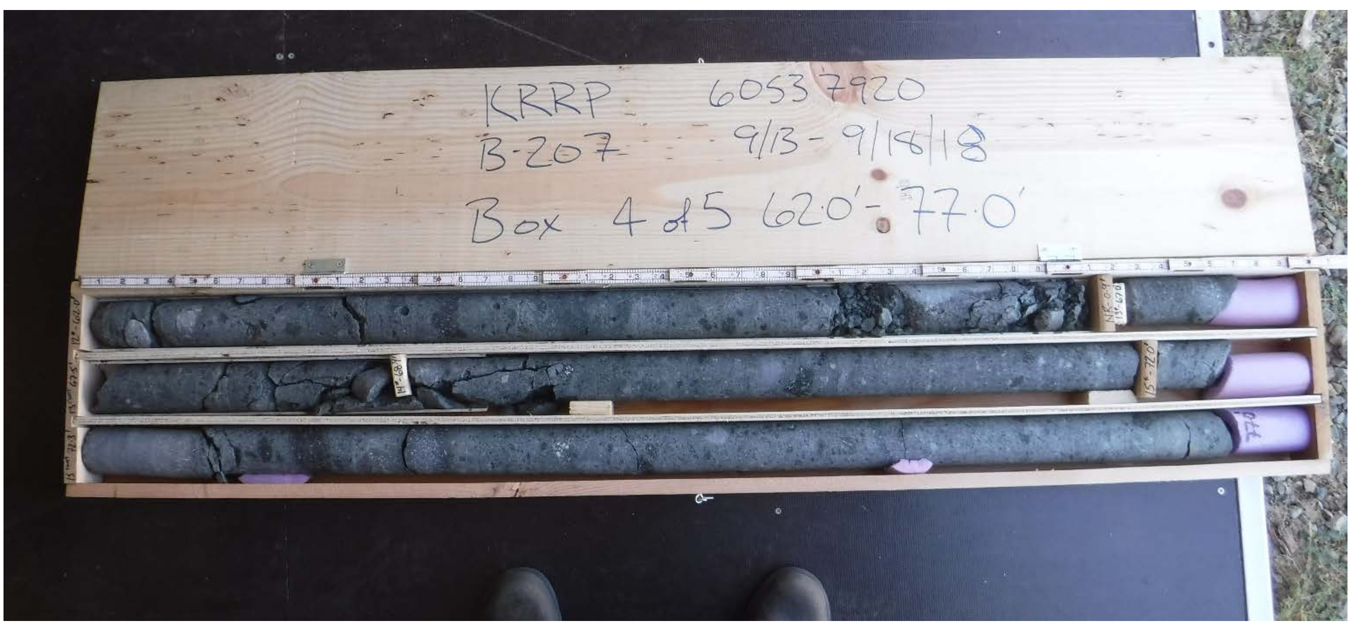
B-207: 15.2 feet to 30.8 feet Depth (Box 1 of 5)

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



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	Appendix
	Project No. 6038551	Boring B-207 Box 3 and 4	E-27

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

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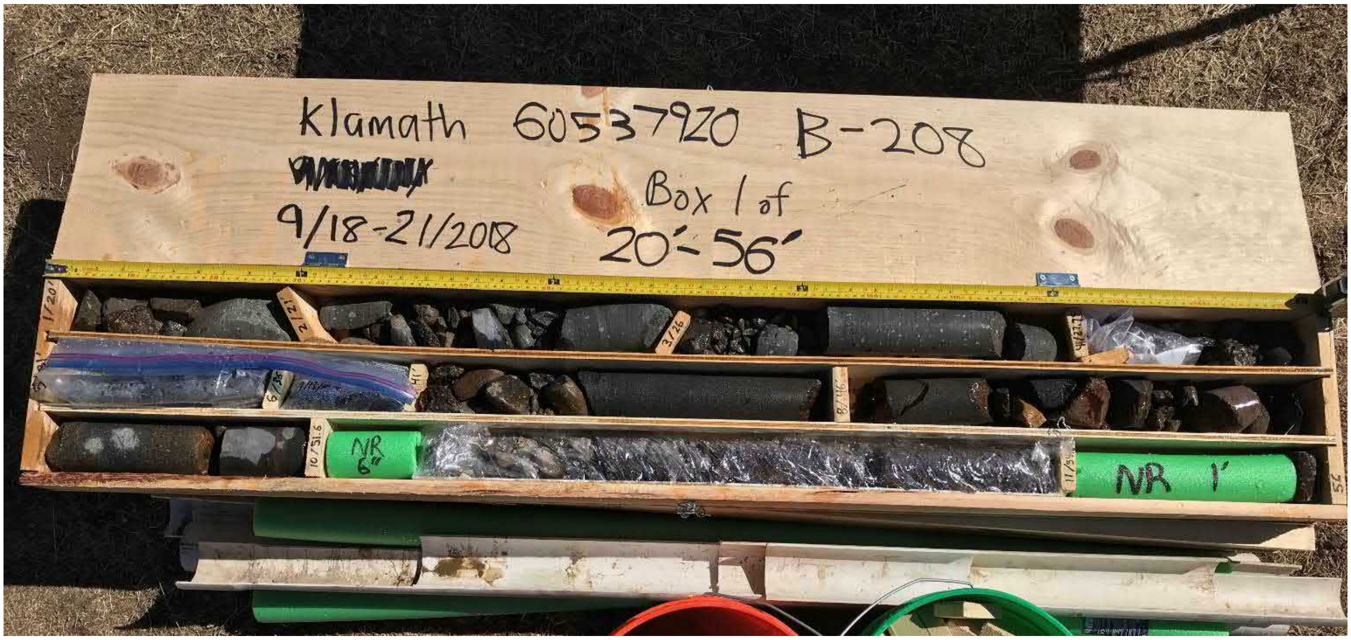
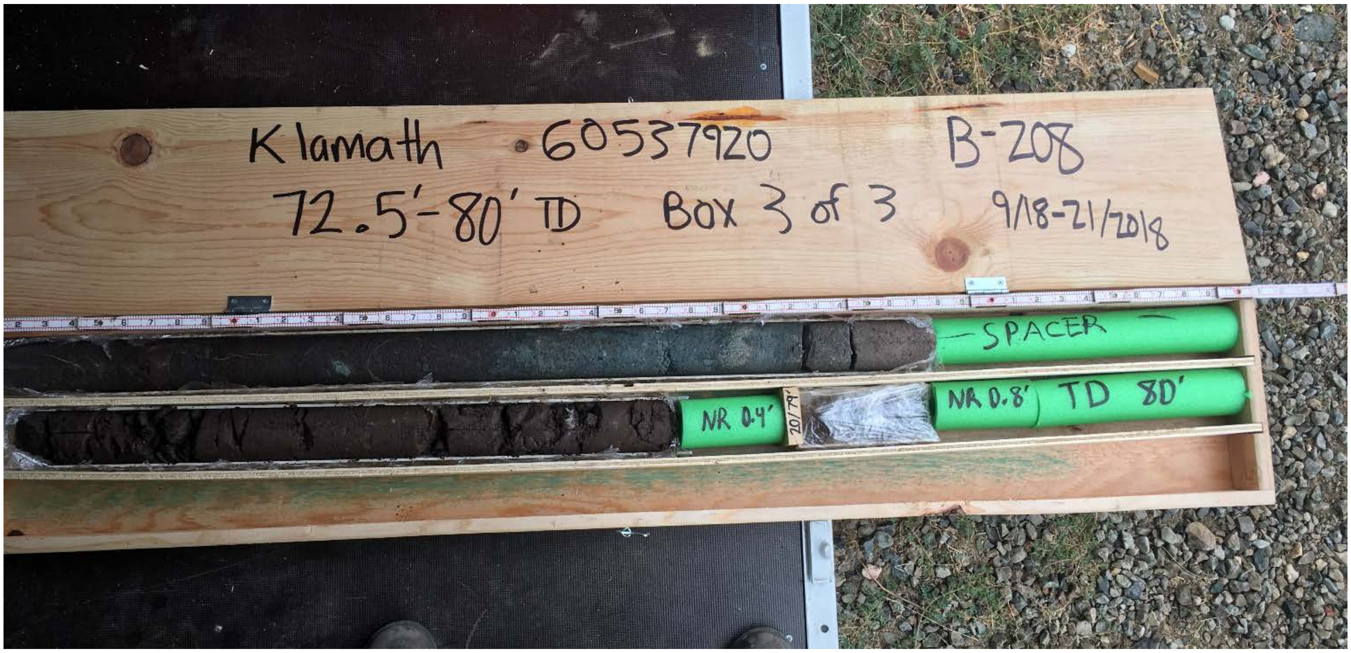


B-208: 20.0 feet to 56.0 feet Depth (Box 1 of 3)

B-208: 56.0 feet to 72.5 feet Depth (Box 2 of 3)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring B-208 Box 1 and 2	Appendix E-29
	Project No. 6038551		



B-208: 72.5 feet to 80.0 feet Depth (Box 3 of 3)

AECOM	Klamath River Renewal Project Project No. 6038551	Rock Core Photos Boring B-208 Box 3	Appendix E-30

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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)

AECOM	Klamath River Renewal Project	Rock Core Photos Boring BI-02 Box 1 and 2	Appendix E-31
	Project No. 6038551		

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	Rock Core Photos Boring BI-02 Box 3 and 4	Appendix E-32
	Project No. 6038551		

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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