

June 16, 2017

Otak, Inc. 700 Washington Street, Suite 401 Vancouver, Washington 98660 Attn: Allen Hendy, PE

# RE: GEOTECHNICAL MEMORANDUM FOR 30 PERCENT DESIGN 5<sup>TH</sup> STREET TO KINSMAN ROAD EXTENTION PROJECT WILSONVILLE, OREGON

This project memorandum is to support Otak, Inc., with their 30 percent design submittal for the 5<sup>th</sup> Street to Kinsman Road Extension project. The project site is located in the City of Wilsonville, Oregon, just north of the Willamette River and West of Interstate 5, as shown on Figure 1, Vicinity Map. This project memorandum includes summary of field explorations and laboratory testing, discussions of site geology and subsurface conditions, and evaluations of seismic hazards, and bridge foundation alternatives.

## **Field Explorations**

The subsurface conditions at the project site were explored with 12 drilled borings, designated B-1 through B-12. The locations of the borings are shown in Figure 2, Site and Exploration Plan.

The drilling of Borings B-1, B-2, B-4 through B-7, and B-9 was subcontracted by Shannon & Wilson, Inc., to Western States Soil Conservation of Hubbard, Oregon. The borings were drilled between April 17 and 21, 2017, using the mud-rotary technique with a track-mounted CME-75 drill rig. Samples were collected using a standard split spoon sampler and an automatic hammer with a hammer efficiency of 88 percent. One undisturbed sample was collected at Boring B-2 using an Osterberg piston sampler.

The drilling of Borings B-3, B-8, and B-10 through B-12 was subcontracted by Shannon & Wilson to Dan J Fisher Excavating of Forest Grove, Oregon. The borings were drilled between April 17 and 21, 2017, using the solid-stem auger technique with a trailer-mounted Buck Rogers drill rig. Samples were collected using a standard split spoon sampler and a manual cat-head hammer.

A Shannon & Wilson geology staff member logged the materials encountered during drilling and collected soil samples. Table 1 summarizes exploration data including drilling dates, depths, and

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surveyed elevations. The logs of the materials encountered, as well as DCP test results, are presented in Attachment A. Infiltration test results will be provided in the Geotechnical Design Report.

Boring <sup>1</sup>	Depth (feet)	Purpose	Date Completed	Surface Elevation (feet)	Bottom Elevation (feet)	Infiltration Test (y/n)	Dynamic Cone Penetration Test (y/n)
B-1	56.5	Kinsman Road Bridge	4/17/2017	143.7	87.2	n	у
B-2	54.0	Kinsman Road Bridge	4/18/2017	143.6	89.6	n	у
B-3	12.1	Pavement Design	4/24/2017	153.7	141.6	n	у
B-4	51.5	5 <sup>th</sup> Street Bridge	4/21/2017	140.6	89.1	n	у
B-5	51.5	5 <sup>th</sup> Street Bridge	4/20/2017	135.3	83.8	n	n
B-6 <sup>2</sup>	41.5	Railroad Undercrossing	4/19/2017	144.5	103.0	n	у
B-7	41.5	Railroad Undercrossing	4/19/2017	148.0	106.5	n	у
B-8	11.5	Pavement Design	4/24/2017	148.2	136.7	n	у
B-9	6.5	Infiltration	4/21/2017	147.4	140.9	у	у
B-10	6.5	Pavement Design	4/24/2017	148.1	141.6	n	у
B-11	5.0	Infiltration	4/24/2017	153.5	148.5	у	у
B-12	5.0	Infiltration	4/24/2017	147.9	142.9	У	у

TABLE 1:	SUMMARY	OF EXPLORATIONS
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<sup>1</sup>Boring locations were surveyed by Otak. Elevations are in NAVD 88, feet.

<sup>2</sup> A Groundwater monitoring well (vibrating wire piezometer) was installed at boring B-6.

In addition to drilling and soil sampling, we also conducted a total of 11 dynamic cone penetration (DCP) tests and 3 field infiltration tests at or near the boring locations shown in Table 1. Results from DCP tests are correlated to parameters used for pavement design. Field infiltration tests were conducted to determine infiltration capacity for potential stormwater management design.

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## Laboratory Tests

Geotechnical laboratory tests were performed on selected samples retrieved from the borings to determine basic index and engineering properties of the soils encountered. The geotechnical laboratory testing program included visual-manual classifications, moisture content, grain size distributions, Atterberg limits, and an undisturbed dry unit weight test. Laboratory testing was performed in general accordance with the ASTM International standard test procedures. Results of the laboratory tests are presented in Attachment B.

### Site Geology and Subsurface Conditions

The project site is situated over Missoula Flood Deposits which generally consist of 4 to 10 feet of fine grain silty clay and sandy silt deposits underlain by a 40- to 50-foot-thick layer of Missoula Flood Deposits -Gravel Facies consisting of clayey gravel with cobbles and boulders. The Gravel Facies are underlain by additional fine-grain flood deposits to an unknown depth. Near Coffee Lake Creek, the upper fine-grain flood deposits have been eroded away, and the creek has channeled into the Gravel Facies. In recent times, portions of the site have been graded and filled during the course of development.

The Fine-Grained Facies was present at or near the surface in Borings B-03, B-06, and B-08 through B-12, but was not observed at or near the surface in any of the bridge abutment borings (B-1, B-2, B-4, or B-5). The surface soils at the bridge sites consist of 4.5 to 7 feet of fill. The fill material at the Kinsman Road Bridge consists of up to 7 feet of silty/clayey gravel which was likely placed for the existing Ore Pac access road bridge approaches. The fill material at the proposed 5<sup>th</sup> Street Bridge site consists of 4.5 feet of sandy silt and silty clay.

Missoula Flood Deposits – Gravel Facies was encountered in all bridge abutment borings below the fill material. The thickness of the Gravel Facies unit ranged from 38.5 to 44 feet. The unit consists of medium dense to very dense gravels, with varying amounts of sands and fines, including USCS group designations GC, GP-GC, GM and GP-GM. Cobbles and boulders are present throughout the unit. Trace lenses of clay and sand may also be present.

The Missoula Flood Deposits – Fine-Grained Facies was encountered in all the bridge abutment borings below the Gravel Facies at depths ranging from 45 to 50 feet with an observed upper elevation of 95.6 feet in Boring B-2. The Fine-Grained Facies at these depths consisted of medium stiff to stiff Silty CLAY to CLAY with trace sand. Boring B-05 encountered medium

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stiff to stiff SILT with trace sand. SPT N-Values ranged from 6 to 8 blows per foot (bpf), except for B-05, N-13, where the blow count of 30 bpf was most likely influenced by gravel in the shoe of the sampler.

The six deeper geotechnical boring were drilled using mud rotary drilling techniques, which make it difficult to discern the depth to groundwater, if it is encountered. A vibrating wire piezometer was installed in Boring B-6 near the proposed railroad utility undercrossing approximately 800 feet west of Coffee Lake Creek. Daily Piezometer readings were logged between May 5 and June 15, 2017. During this time the ground water elevation decreased from 128.1 feet to 124.2 feet. The groundwater table at the bridge locations is likely hydraulically connected to Coffee Lake Creek. The Coffee Lake Creek ordinary high water elevation varies between approximately 137 feet at the proposed Kinsman Road Bridge to approximately 131 feet at the proposed 5<sup>th</sup> Street Bridge. The Coffee Lake Creek ordinary high water elevations were assumed for the design of bridge foundations and approach embankments.

# Seismic Hazards

Based on the subsurface conditions encountered in the borings, our evaluation indicates that the site is classified as Seismic Site Class D. The expected seismic hazard at the project site is strong ground shaking. The on-site materials do not appear to be susceptible to liquefaction or related effects, based upon the design groundwater levels. Potential for slope instability appears to be low given the relatively competent nature of the subsurface soils at the bridge locations. The potential for fault rupture is low given the distance (approximately 4 miles) between the bridge site and nearest potentially active fault. The risk of seismically induced tsunami and seiche is also very low at the site.

# **Bridge Foundation Alternatives**

The selection of an appropriate foundation system for the proposed bridge structures is dependent upon several factors, including foundation capacities, tolerance to total and differential settlement resulting from static loads, scour potential, and construction considerations. Based on the explored subsurface conditions and the design loads, we considered driven pile, drilled shaft, and spread footing foundations.

We understand that if deep foundations were used, the pile caps would need to extend into the clayey gravel layer to protect the approach embankments from scour; a longer bridge may be

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required to accommodate the scour protection riprap. The gravel layer may support the proposed bridge loads on spread footings. Spread footings are typically more cost effective and generally are constructed using conventional construction equipment. In addition, the presence of cobbles and boulders would create difficulties during drilled shaft excavations or pile installation and construction delays could arise.

Based on the current bridge design concept, the bottom of the footings for both bridges will be located outside of scour zones defined by the design team hydraulic engineer and founded at the coffee lake creek streambed elevation. We understand that the creek is not expected to scour below the current streambed. ODOT GDM requires that spread footing be founded below the scour depth. However, we understand that permanent scour protection will be designed by Otak to guard the spread footings from undermining during flooding.

The footing excavations will most likely extend below the groundwater table. Based on our limited number of explorations near the bridge abutments, the clayey gravel layer appears to have a low hydraulic conductivity which would allow for relatively simple dewatering of footing excavations using a drainage pad and series of embedded submersible pumps. However, due to the variability of soils near stream channels, there is a heightened risk of encountering zones of more permeable soil within the footing excavations. If significant dewatering measures are needed, then deep foundations may be more cost effective and provide a reduction in risk during construction. We recommend digging test pits at each bridge abutment to observe seepage conditions at the proposed footing elevations.

The factored bearing resistance of the clayey gravels at the proposed footing elevations is approximately 6 to 8 kips per square feet (ksf). The bearing resistance of the spread footings is dependent on its proximity to a slope. If the full factored bearing resistance is to be used, the footings should bear below a plane extending from the outside lower edge of the scour prism away from the creek at an inclination of 2 horizontal to 1 vertical (2H:1V).

# **Pedestrian Bridge Foundations**

We understand that a separate pedestrian bridge at the 5<sup>th</sup> Street Coffee Lake Creek crossing is proposed south of the planned roadway bridge. We understand that the bridge will have an approximate span of 84 feet, and the preferred foundations are shallow spread footings. Undocumented fill was observed at the surface in both the 5<sup>th</sup> Street Bridge abutment borings.

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Founding footings on undocumented fill significantly increases the risk of bearing and/or global stability failure. We recommend over-excavating the undocumented fill to the Missoula Flood Deposits – Gravel Facies and replacing it with structural fill (i.e. 1 <sup>1</sup>/<sub>2</sub>-inch minus or <sup>3</sup>/<sub>4</sub>-inch minus crushed rock) at 1H:1V slopes. A factored bearing resistance of 2.5 ksf should be used If the footings are founded on the structural fill. If the footings are founded on the native clayey gravel, a factored bearing resistance of 4 ksf may be used. As with the roadway bridge footings, the pedestrian bridge footings should bear below a plane extending from the outside lower edge of the scour prism away from the creek at an inclination of 2H:1V.

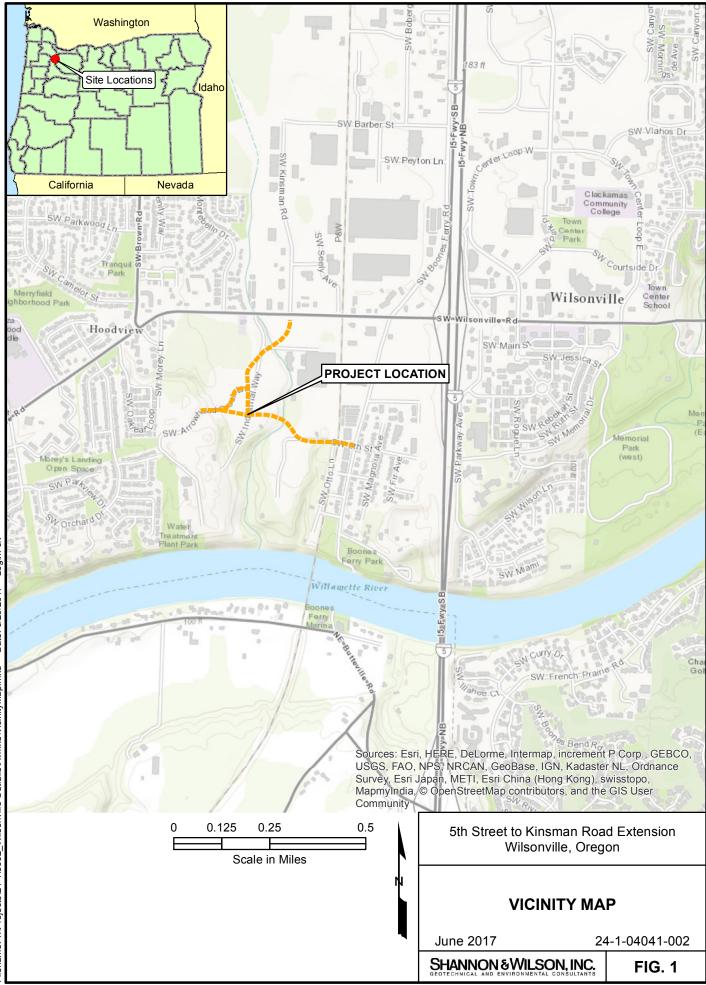
Sincerely,

### SHANNON & WILSON, INC.

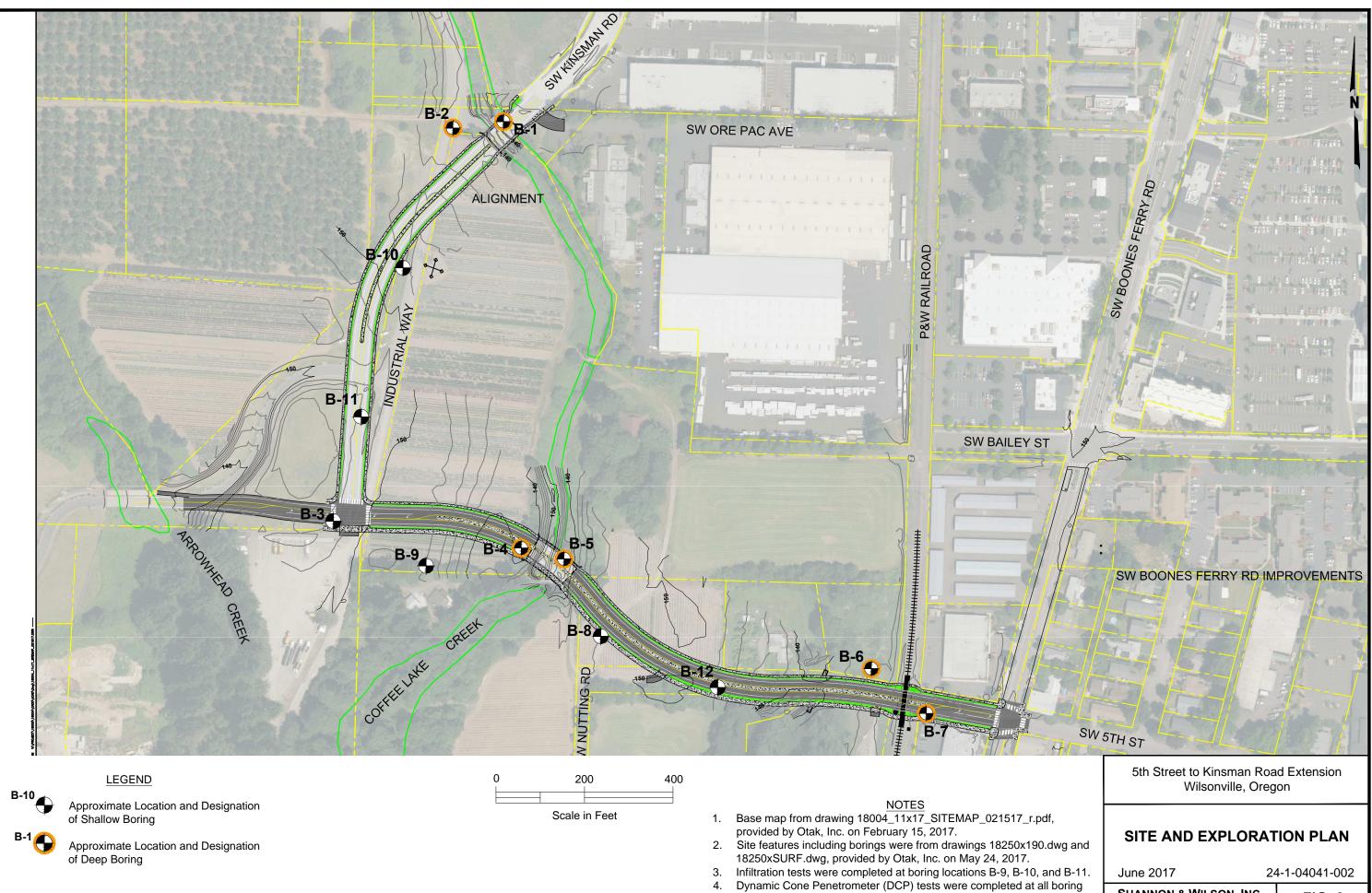
Risheng (Park) Piao, PE, GE Vice President | Geotechnical Engineer James Walters, PE Senior Engineer

JJW:RPP/hrr

Attachments: Figure 1 – Vicinity Map
Figure 2 – Site and Exploration Plan
Attachment A – Subsurface Explorations
Attachment B – Laboratory Test Results
Attachment C – Important Information about you Geotechnical/Environmental
Report



Filename: T:\Projects\24-1\3952\_Wilsonville Outfalls\Avmxd\VicinityMap.mxd Date: 3/29/2017 Login: clv



locations except boring B-5.

SHANNON & WILSON, INC. Geotechnical and Environmental Consultants

FIG. 2

SHANNON & WILSON, INC.

# ATTACHMENT A

# SUBSURFACE EXPLORATIONS

Figure A1 of **2** 

Page 1

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	H	

						OKEGON DEFAKTME		011111	1011			0	1 2
										-	Iole No.	B-01	
Project	t 5th S	treet to	Kinsman Road	Exte	ension		Purpose Bridge	e		E	E.A. No.	N/A	
Highw	ay <b>N/A</b>						County Clack	amas Co	ounty		Key No.	N/A	
Hole L	ocation	No	orthing: ~ 604,	353		Easting: ~7	,615,841			S	tart Card No.	N/A	
Equipr	ment C	ME-75 T	ruck Rig (Ham	mer E	Efficier	ncy = 88%)	Driller Hard	Core Dri	lling	E	Bridge No.	N/A	
Project	t Geolog	sist <b>Adr</b>	ian A.J. Holme	s			Recorder Natha	n Villen	euve	0	Ground Elev.	~ 144 ft.	
Start D	Date Ap	ril 17, 2	017	]	End Da	ate April 17, 2017	Total Depth 56.	50 ft		-	ube Height	N/A	
Test Type         "A" - Auger Core       "GP" - GeoProbe <sup>®</sup> Discontinuit         "X" - Auger       J - Joint         "C" - Core, Barrel Type       F - Fault         "N" - Standard Penetration       B - Bedding         "U" - Undisturbed Sample       Fo - Foliati         "T" - Test Pit       S - Shear				J - Join F - Fau B - Bee Fo - Fo	nt Pl - Planar Ilt C - Curved dding U - Undulating sliation St - Stepped	Typical Drilling Abbreviat           Surface Roughness         Drilling Methods         Drilling           P - Polished         WL - Wire Line         LW - L           SI - Slickensided         HS - Hollow Stem Auger         WR - W           Sm - Smooth         SA - Solid Auger         DP - D           R - Rough         CA - Casing Advancer         DR - D           VR - Very Rough         HA - Hand Auger         DA - D							
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data		Percent Natural Moisture	Material Descripti SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Re Texture, Cementation, Str ROCK: Rock Name, Color, Weathe Discontinuity Spacing, Jo Core Recovery, Formatio	asticity, elative Density, ructure, Origin. ering, Hardness, pint Filling,	U	nit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/
0								Asph	- 0.50 alt Concrete; 6 s thick	، ک ر	Mud rotary technique ( hole)		<i>.</i> ,
-	N1	66	6-13-50/5"			N- 1 (2.50-3.90) Silty / Clayey GRAVE GM/GC; Dark brown; Low to medium j Very dense; Fine to coarse, angular to gravel; Fine to coarse sand; Disturbed	plasticity fines; Wet; subrounded	Base inche 1.00 Silty	- 1.00 Aggregate; 6 es thick - 7.00 / Clayey				
5 -	N2	66	17-12-9		28	N- 2 (5.00-6.50) Silty / Clayey GRAVE GM/GC; Dark brown; Low to medium µ Moist to wet; Medium dense; Fine to c subrounded gravel; Fine to coarse sar texture; (Fill)	plasticity fines; oarse, angular to	sand brow medi fines	VEL with some ; GM/GC; Dark n; Low to um plasticity ; Moist to wet; um dense to very c				
-	N3	40	16-7-8			N- 3 (7.50-9.00) Clayey GRAVEL with Brown; Medium plasticity fines; Wet; N to coarse, subangular to subrounded o coarse sand; (Missoula Flood Deposit	Nedium dense; Fine gravel; Fine to	dens coars subre	e; Fine to se, angular to bunded gravel; to coarse sand;				
10 -	N4	60	50/1st 4"			N- 4 (10.00-11.50) GRAVEL with som sand; GP-GC; Gray; Medium plasticity dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood I Facies)	fines; Wet; Very subrounded gravel;	7.00 Claye some cobb	- 49.50 By GRAVEL with Sand, with les and ders; GC; Brown		ft	om 11 to 49.5	
-	N5A N5B	100	6-14-13		33 31	N- 5A (12.50-13.10) Gravelly CLAY w Gray and brown; Medium to high plast stiff; Fine to coarse, subangular to sub Fine to coarse sand; (Missoula Flood I Facies)	icity; Moist; Very rounded gravel;	and g plast to we to ve	gray; Medium icity fines; Moist et; Medium dense ry dense; Fine to		Large cobb	ie at 12 m	
15 –	N6	66	19-17-27			<ul> <li>N- 5B (13.10-14.00) Clayey GRAVEL GC; Brown and gray; Medium to high µ Medium dense; Fine to coarse, suban, gravel; Fine to coarse sand; (Missoula Gravel Facies)</li> <li>N- 6 (15.00-16.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticit Dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood I</li> </ul>	plasticity fines; Wet; gular to subrounded Flood Deposits - vith some sand; y fines; Wet; subrounded gravel;	Subro Fine Trace 1.0-ft of Gr trace	se, subangular to bunded gravel; to coarse sand; e 0.5- to -thick interbeds avelly CLAY with sand; CH; soula Flood		Large cobb	le at 16 ft	
20 -	N7	66	11-12-50/5'			Facies) N- 7 (20.00-21.40) Clayey GRAVEL w GC; Brown, gray, and red-yellow mottl plasticity fines; Wet; Very dense; Fine subangular to subrounded gravel; Fine (Missoula Flood Deposits - Gravel Fac	ed; Medium to coarse, e to coarse sand;		sits - Gravel				
25													

			Soil R	lock		Material Description	Unit Description			
Depth (ft)	Test Type, No.	Percent Recovery		- I	Natural Moisture	<ul> <li>SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin.</li> <li>ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.</li> </ul>		Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date
25	N8	4 80	니 쓰 니 12-30-2:		<u> </u>	N- 8 (25.00-26.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Wet; Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)			Boulder from 2	Y
30 -	N9	73	18-17-3	2	19	N- 9 (30.00-31.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)				, , , , , , , , , , ,
35 -	N10	66	15-15-1:	3		N- 10 (35.00-36.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Wet; Medium dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)				
40 -	N11	0	50/1st 1			N- 11 (40.00-40.10) No recovery			Boulder from 3 41.5 ft	9.5 to
45 -	N12	73	13-18-1	4		N- 12 (45.00-46.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)				> > > > > > > > > >
50 -	N13	100	2-3-5		43	N- 13 (50.00-51.50) CLAY with trace sand; CH; Gray; Medium plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)	49.50 - 56.50 CLAY with trace sand; CH; Gray; Medium plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)			> > > > > > > > > > > > > >
55 -	N14	100	3-3-5			N- 14 (55.00-56.50) CLAY with trace sand; CH; Gray; Medium plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)	56.50 End of hole			
60 -										

					OREGON DEPARTME	NT OF TRANSPO	ORTA	TION		Pag	ge <b>1</b> o	f 2
									Н	ole No.	B-02	
Proje	ct 5th S	treet to	Kinsman Road Ex	tension		Purpose Bridge			E	.A. No.	N/A	
High	way <b>N/A</b>					County Clack	amas C	ounty	K	ey No.	N/A	
Hole	Location	No	orthing: ~ 604,33	9	Easting: ~7	,615,726			St	tart Card No.	N/A	
Equip	oment C	ME-75 T	Fruck Rig (Hamme	er Efficie	ncy = 88%)	Driller Hard	Core Dr	illing	В	ridge No.	N/A	
Proje	ct Geolog	sist <b>Adr</b>	rian A.J. Holmes	_		Recorder Natha	n Viller	euve	G	round Elev.	~ 144 ft.	
Start	Date Ap	ril 17, 2	017	End D	ate April 18, 2017	Total Depth 54.	00 ft		Т	ube Height	N/A	
Test Type     Discontinuity       "A" - Auger Core     "GP" - GeoProbe <sup>®</sup> "X" - Auger     J - Joint       "C" - Core, Barrel Type     F - Fault       "N" - Standard Penetration     B - Bedding       "U" - Undisturbed Sample     Fo - Foliation       "T" - Test Pit     S - Shear				nt Pl - Planar ult C - Curved edding U - Undulating oliation St - Stepped								
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data W Or RQD%	Percent Natural Moisture	<u>Material Descripti</u> SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Re Texture, Cementation, Str ROCK: Rock Name, Color, Weathe Discontinuity Spacing, Jo Core Recovery, Formatio	asticity, elative Density, ucture, Origin. ering, Hardness, int Filling,		Init Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
- 5	N1	60	3-8-17 5-8-9		N- 1 (2.50-4.00) Clayey GRAVEL with Brown and gray; Medium plasticity fine dense; Fine to coarse, angular to subr to coarse sand; Disturbed texture; (Fill N- 2 (5.00-6.50) Clayey GRAVEL with Brown and gray; Medium plasticity fine dense; Fine to coarse, angular to subr to coarse sand; (Missoula Flood Depo Facies)	is; Moist; Medium ounded gravel; Fine ) is some sand; GC; is; Moist; Medium ounded gravel; Fine	Aspl inch 0.50 Base inch 1.00 Clay som Brov Med fines dens	- 0.50 halt Concrete; 6 es thick - 1.00 Aggregate; 6 es thick - 4.50 ey GRAVEL with e sand; GC; /n and gray; um plasticity :; Moist; Medium e; Fine to se, angular to		Mud rotary d technique (5 hole)		
10	N3	47 53	20-40-31 13-9-10	26	N- 3 (7.50-9.00) Clayey GRAVEL with Brown and gray; Medium plasticity fine dense; Fine to coarse, angular to subri to coarse sand; (Missoula Flood Depo Facies) N- 4 (10.00-11.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticit Medium dense; Fine to coarse, angula gravel; Fine to coarse sand; (Missoula	is; Moist; Very ounded gravel; Fine sits - Gravel vith some sand; y fines; Moist; r to subrounded	Fine Distr (Fill) 4.50 Clay som cobb	ounded gravel; to coarse sand; urbed texture; - 42.00 ey GRAVEL with e sand, with bles and ders; GC; Brown				
	N5	40	13-15-13		Gravel Facies) N- 5 (12.50-14.00) Clayey GRAVEL w GC; Brown and gray; Medium plasticity wet; Medium dense; Fine to coarse, ar subrounded gravel; Fine to coarse san Deposits - Gravel Facies)	y fines; Moist to ngular to	and plast to we to ve coar	gray; Medium ticity fines; Moist et; Medium dense ery dense; Fine to se, subangular to ounded gravel;		Cobbles fron ft	n 12 to 49.5	
15	N6	55	16-50/5"		N- 6 (15.00-15.90) Clayey GRAVEL w GC; Brown and gray; Medium plasticit wet; Very dense; Fine to coarse, angui gravel; Fine to coarse sand; (Missoula Gravel Facies)	y fines; Moist to lar to subrounded	Fine (Mis:	to coarse sand; soula Flood osits - Gravel		Large cobble	e at 15 ft	
20	N7	80	17-22-19	21	N- 7 (20.00-21.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticity Dense; Fine to coarse, angular to subr Fine to coarse sand; (Missoula Flood I Facies)	y fines; Wet; ounded gravel;						
25										Large cobble	e at 24 ft	

Depth (ft)	Test Type, No.	Percent Recovery	lioS Resistance	Discontinuity Data & Or RQD%	Percent Natural Moisture	<u>Material Description</u> SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date
25	N8	60	10-3	J-26		N- 8 (25.00-26.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Wet; Very dense; Fine to coarse, angular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)				
30 -	N9	47	16-16	6-18		N- 9 (30.00-31.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Wet; Dense; Fine to coarse, angular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)			Large cobble at	32 ft
35 -	N10	47	13-14	4-12		N- 10 (35.00-36.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Wet; Medium dense; Fine to coarse, angular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)				
40 -	N11	40	13-14	4-17		N- 11 (40.00-41.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Wet; Dense; Fine to coarse, angular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	42.00 - 48.00 GRAVEL with some clay and some sand, with cobbles and boulders; GP-GC;		Boulder from 42	to 44 ft
45 -	N12	53	19-20-	50/5"		N- 12 (45.00-46.50) GRAVEL with some clay and some sand; GP-GC; Gray; Medium plasticity fines; Wet; Very dense; Fine to coarse, angular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	Gray; Medium plasticity fines; Wet; Very dense: Fine to			
50 -	N13	100	2-3	-3	41	N- 13 (50.00-51.50) Silty CLAY with trace sand; CL; Gray; Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies) U- 1 (52.00-54.00) Silty CLAY with trace sand; CL; Gray;	Silty CLAY with trace sand; CL; Gray; Medium plasticity; Moist; Medium stiff; Fine sand;		Sample U1: dry	unit
		100			71	Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)	Micaceous; (Missoula Flood Deposits - Fine-Grained Facies) 54.00 End of hole		weight = 79.5 lbs	;/ft <sup>3</sup>
55 -										
60 -										

#### DRILL LOG OREGON DEPARTMENT OF TRANSPORTATION

1 igui	0	A0	
Page	1	of	1

					OREGON DEPARTME		ORIMION			0	f 1		
р <sup>.</sup>						D. O.L.		_	le No.	B-03			
5			Kinsman Road Ext	tension		Purpose Subg			A. No.	N/A			
	ay N/A					,	amas County		y No.	N/A			
	ocation		orthing: ~ 603,450		Easting: ~7				rt Card No.				
1 1			dgers (Manual Ham	nmer)		Driller Dan F			dge No.	N/A			
Projec	t Geolog	gist <b>Adr</b>	rian A.J. Holmes			Recorder Natha	n Villeneuve		ound Elev.	~ 154 ft.			
Start I	Date Ap	oril 24, 2	017	End D	ate April 24, 2017	Total Depth 12.			be Height ing Abbrev	N/A			
"X" - Auger     J       "C" - Core, Barrel Type     F       "N" - Standard Penetration     B       "U" - Undisturbed Sample     F			"GP" - GeoProbe <sup>®</sup>	J - Join F - Fau B - Be	ult C - Curved edding U - Undulating oliation St - Stepped	<u>Surface Roughness</u> P - Polished SI - Slickensided Sm - Smooth R - Rough VR - Very Rough	Drilling Methods           - Polished         Drilling Methods           I - Slickensided         WL - Wire Line           m - Smooth         F - Drill Fluid           - Rough         CA - Casing Advancer			Drilling Remarks LW - Lost Water			
o Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data W Or RQD%	Percent Natural Moisture	<u>Material Descript</u> SOIL: Soil Name, USCS, Color, Pl Moisture, Consistency/R Texture, Cementation, St ROCK: Rock Name, Color, Weath Discontinuity Spacing, Jo Core Recovery, Formatio	lasticity, elative Density, ructure, Origin. ering, Hardness, pint Filling,	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/		
0	N1	87	3-3-5	32	N- 1 (2.50-4.00) Silty CLAY with som Medium plasticity; Moist; Medium stiff Micaceous, Trace organics; (Missoula Fine-Grained Facies)	to stiff; Fine sand;	0.00 - 4.50 Silty CLAY with some sand; CL; Brown; Medium plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; Trace organics; (Missoula Flood Deposits -		technique (	auger drilling 4.5-inch dia.			
5 -	N2	80	2-3-4		N-2 (5.00-6.50) Sandy SILT; ML; Bro low plasticity; Moist; Loose / medium : Micaceous; (Missoula Flood Deposits Facies)	stiff; Fine sand;	Fine-Grained Facies) / 4.50 - 11.70 Sandy SILT; ML; Brown; Nonplastic to low plasticity; Moist						
	N3	67	2-3-3	25	N- 3 (7.50-9.00) Silty SAND; SM; Bro fines; Moist; Loose; Fine sand; Micac Flood Deposits - Fine-Grained Facies	eous; (Missoula	to wet; Loose / medium stiff; Fine sand, Micaceous; Interbedded with layers of Silty SAND; SM; (Missoula Flood						
10 -	N4	100	3-3-4		N- 4 (10.00-11.50) Sandy SILT; ML; I plasticity; Wet; Medium stiff; Fine san Interbedded with Silty Sand; (Missoula Fine-Grained Facies)	d; Micaceous,	Deposits - Fine-Grained Facies) 10.00						
	N5	0	50/1st 1"		N- 5 (12.00-12.10) No recovery		Clayey GRAVEL with some sand, with cobbles and boulders; GC;	/~/ X			<u>* • /</u>		
15 -							inferred; (Missoula Flood Deposits - Gravel Facies) 12.10 End of hole						
- 20 -													
25													

# DRILL LOG

Figure **A**4

Project         Bitle No.         Bodd         EA. No.         NA           Highway NA         County         Clackames County         Ky No.         NA           Held Location         Northing:         = 603.453         Easting:         7.451,841         Start County         Bitdge No.         NA           Held Location         Northing:         = 603.453         Easting:         7.451,841         Start County         Bitdge No.         NA           Yes         Approved         Easting:         7.451,841         Start County         Bitdge No.         NA           Start Date:         Faile         Faile         Recorder Nation         Faile         Held Kook         NA           Yes         Faile         Faile         Faile         Faile         Held Kook         NA           Yes         Approved         Faile         Faile         Held Kook         NA         Faile         Held Kook         NA           Yes         Approved         Faile         Held Kook							OREGON DEPARTME	LL LOG NT OF TRANSPO	ORTAT	TION			gure A4 ge 1 o	of <b>2</b>	
Highway NA         County         Clasting         County         Key No.         NA           Hold Location         Northing         -603.453         Lasting         -7.815.814         Start Can No. NA           Figupment         CME-560 Track Rig Hammer Efficiency = 87%)         Driller         Herd Core Drilling         Bridge No. NA           Start Can No.         Figupment         CME-560 Track Rig Hammer Efficiency = 87%)         Total Depth 51.01         Total Figupment         <													-		
Bide Location         Northing         -683,453         Easting:         -7,615,821         Start Card No. NA           Equipment:         CME-589 Track Rig (Hammer Efficiency = 67%)         Differ Hard Core Drilling         Differ No. N/A           Project Geologist Adria A.J. Holmes         Recorder Nathan Villenouve         Groupe Bev 1411.           Start Clark A.P. Holmes         Recorder Nathan Villenouve         Groupe Bev 1411.           *** - Auge Core         "Groupe Bev 1411.         Tube Leight NA           *** - Auge Core         "Groupe Bev 1411.         Start Clark A.B.           *** - Auge Core         "Groupe Bev 1411.         Start Clark A.B.           *** - Auge Core         "Groupe Bev 1411.         Start Clark A.B.           *** - Auge Core         "Groupe Bev 1411.         Start Clark A.B.           *** - Tork Pro         Social Reck         Social Reck         Social Reck           *** - Tork Pro         Social Reck         Social Reck         Social Reck         Social Reck           ***         Social Reck         Social Reck         Social Reck         Social Reck         Social Reck           ***         Social Reck         Social Reck         Social Reck         Social Reck         Social Reck           ***         Social Reck         Social Reck<	5			Kinsman	Road Ext	ension									
Equipment     CME-850 Track Rig (Hammer Efficiency = 57%)     Dillor     Hard Core Drilling     Bridge No.     NA       Project Goodgeist     Adrian A.J. Holmes     Recorder     Recorder     Total Topic     Ground Elsev.     -141 ft.       Start Date     April 21, 2017     Total Depth 51.50 ft     Total Explored     -141 ft.       Start Date     April 21, 2017     Total Depth 51.50 ft     Total Explored     -141 ft.       Core Core Berney     Dissortining     Start Base April 21, 2017     Total Depth 51.50 ft     Total Base Mainthe Member       Core Core Berney     Dissortining     Start Base Mainthe Member     Dissortining Start Base Mainthe Member     Weiler Member       Core Core Berney     For Folding     Core Core Berney     Start Start Member     Net Core Depth 700       Core Bearser     Start Start Member     Net Core Depth 700     Net Core Depth 700     Net Core Depth 700       Core Bearser     Start Start Member     Start Start Member     Net Core Depth 700     Net Core Depth 700       Core Bearser     Start Start Member     Start Start Member     Start Start Member     Net Core Depth 700       V = Undepth 700     Start Start Member     Start Start Member     Net Core Depth 700     Net Core Depth 700       V = Undepth 700     Start Start Member     Start Start Member     Net Core Depth 700     Net	U	2							amas C	ounty		<u>,</u>			
Project Geologist Adrian A.J. Holmes       Recorder Nathan Villeneuve       Ground Elev 141 ft.         Start Date April 21, 2017       Total Depth 51.50 ft       Total Depth Adrian Villeneuve       Total Depth 121, 2017         Y - Arger Cores       "Ground Elev 141 ft.       Total Depth 51.50 ft       Total Depth 21, 2017       Total Depth 51.50 ft       Total Depth 51.50 ft       Total Depth 51.50 ft       Dallage McDolas f															
Start Date         April 21, 2017         Total Date         Total Depth         51.0 ft         Tube Height         NA           ***         Test Type: 'C - Core, Berrary - 'C - Core, Berrar	Equipm	nent C	ME-850	Track Rig	g (Hamme	er Efficie	ency = 87%)	Driller Hard C	Core Dr	illing					
Test Type Ar - Augr Cool V - Cool, Imm Type V -	Project	Geolog	ist <b>Adr</b>	rian A.J. H	lolmes			Recorder Natha	n Villen	euve	0	Bround Elev.	~ 141 ft.		
***         Auger Constraining         Constraining         Statuse Broadmann         Statuse Broadmann         Define Remarks IV         Define Remark IV         Define Remar	Start Da	ate Ap	ril 21, 2	017		End Da	ate April 21, 2017	Tranical Duilling Akharvistiana							
Solit     NORK     Solit     NORK     Solit     Solit <t< td=""><td colspan="5">"A" - Auger Core     "GP" - GeoProbe<sup>®</sup>     Discontinuity     Shape       "X" - Auger     J - Joint     Pl - Planar       "C" - Core, Barrel Type     F - Fault     C - Curved       "N" - Standard Penetration     B - Bedding     U - Undulatin       "U" - Undisturbed Sample     Fo - Foliation     St - Stepped</td><td>attinuity         Shape           nt         Pl - Planar           ult         C - Curved           dding         U - Undulating           pliation         St - Stepped</td><td>Surface Roughness P - Polished SI - Slickensided Sm - Smooth R - Rough</td><td></td><td>Drilling Methods WL - Wire Line HS - Hollow Stem Aug DF - Drill Fluid SA - Solid Auger CA - Casing Advancer</td><td>ger</td><td>Drilli LW - WR - WC - DP - DR -</td><td>ing Remarks - Lost Water - Water Return - Water Color Down Pressure Drill Rate</td><td></td></t<>	"A" - Auger Core     "GP" - GeoProbe <sup>®</sup> Discontinuity     Shape       "X" - Auger     J - Joint     Pl - Planar       "C" - Core, Barrel Type     F - Fault     C - Curved       "N" - Standard Penetration     B - Bedding     U - Undulatin       "U" - Undisturbed Sample     Fo - Foliation     St - Stepped					attinuity         Shape           nt         Pl - Planar           ult         C - Curved           dding         U - Undulating           pliation         St - Stepped	Surface Roughness P - Polished SI - Slickensided Sm - Smooth R - Rough		Drilling Methods WL - Wire Line HS - Hollow Stem Aug DF - Drill Fluid SA - Solid Auger CA - Casing Advancer	ger	Drilli LW - WR - WC - DP - DR -	ing Remarks - Lost Water - Water Return - Water Color Down Pressure Drill Rate			
N1     100     3-6-6     N-1 (2.50-4.00) Sardy SILT with trace grave: ML: Brown: Low plasticity; Moist; Sift; Fine to medium sard; Micaceous; (Fili)     Sardy SILT with trace grave: ML: Brown: Low plasticity; Moist; Sift; Fine to medium sard; Micaceous; (Fili)       5     N2     80     14-22-16     23     N-2 (5.00-6.50) Sardy Glayey GRAVEL; GC: Brown and page; Medium plasticity fines; Micit. During: Fine to coarse sand; Micaceous; GRID or and grav; Medium plasticity fines; Moist; Very Fine to coarse sand; Missuia Flood Deposits - Gravel Facies)     4.50 - 48.50 (Layey GRAVEL, with some sand to Sandy clayey GRAVEL, with some sand to Sandy clayey GRAVEL, with some sand; Missuia Flood Deposits - Gravel Facies)     Cobles from 9 to 50 f coarse, subangular to subrounded gravel; Fine to coarse sub-gravel fines; Moist; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse subangular to subrounded gravel; Fine to coarse,		Test Type, No.	Percent Recovery			Percent Natural Moisture	SOIL: Soil Name, USCS, Color, P Moisture, Consistency/R Texture, Cementation, St ROCK: Rock Name, Color, Weath Discontinuity Spacing, Jo	asticity, elative Density, ructure, Origin. ering, Hardness, pint Filling,			Graphic Log	Drilling Methods, and Remarks	: Water Level/ Date	Backfill/	
20     N7     14-14-22     N-7 (20.00-21.50) GRAVEL with some clay and some sand; GP-GC/GC; Brown and gray; Medium plasticity fines; Wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse, subangular to subrounded gra	5	N2 N3 N4	80 60 100	14-2 10-11 9-17	2-16 -50/4" 7-21	23	Brown; Low plasticity; Moist; Stiff; Fine Micaceous; (Fill) N- 2 (5.00-6.50) Sandy clayey GRAV gray; Medium plasticity fines; Moist; D coarse, subangular to subrounded gra sand; (Missoula Flood Deposits - Grav N- 3 (7.50-9.00) Clayey GRAVEL with Brown and gray; Medium plasticity fine dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood Facies) N- 4 (10.00-11.50) Clayey GRAVEL v GC; Brown and gray; Medium plasticit Dense; Fine to coarse, subangular to Fine to coarse sand; (Missoula Flood Facies) N- 5 (12.50-14.00) Clayey GRAVEL v GC; Brown and gray; Medium plasticit Dense; Fine to coarse, subangular to Fine to coarse sand; (Missoula Flood Facies)	e to medium sand; EL; GC; Brown and lense; Fine to wel; Fine to coarse vel Facies) n some sand; GC; es; Moist; Very subrounded gravel; Deposits - Gravel vith some sand; y fines; Moist; subrounded gravel; Deposits - Gravel vith some sand; y fines; Moist; subrounded gravel;	Sanc grav Low Stiff; sanc (Fill) 4.50 Clay som clay cobb boul and plasi to ve coar roun to co (Miss Depo	y SILT with trace el; ML; Brown; plasticity; Moist; Fine to medium ; Micaceous; - 48.50 ey GRAVEL with e sand to Sandy ey GRAVEL, with bles and ders; GC; Brown gray; Medium ticity fines; t; Medium dense ery dense; Fine to se, subangular to ded gravel; Fine barse sand; soula Flood osits - Gravel		technique ( hole)	5-inch dia. m 9 to 50 ft		
N7 14-14-22 N-7 (20.00-21.50) GRAVEL with some clay and some sand to Clayey GRAVEL with some sand; GP-GC/GC; Brown and gray; Medium plasticity fines; Wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to	15 —	N6	100	12-1	7-15		GC; Brown and gray; Medium plasticit Dense; Fine to coarse, subangular to Fine to coarse sand; (Missoula Flood	y fines; Moist; subrounded gravel;							
	20 -	N7		14-1	4-22		sand to Clayey GRAVEL with some sa Brown and gray; Medium plasticity find Fine to coarse, subangular to subroun	and; GP-GC/GC; es; Wet; Dense; ided gravel; Fine to							

					Material Description	Unit Description				
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data ayou Or RQD%	Percent Natural Moisture	<u>Material Description</u> SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	5 1 CH/
25	N8	73	9-11-11		N- 8 (25.00-26.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Moist; Medium dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)					
30 -	N9	67	11-15-13		N-9 (30.00-31.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Moist; Medium dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)			Large cobble at 32 f	t	
35 -	N10	47	18-21-17		N- 10 (35.00-36.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Moist; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)					
40 -	N11	47	21-20-15		N- 11 (40.00-41.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Moist to wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)			Large cobble at 39 f	t	
45 -	N12	40	28-50/1"		N- 12 (45.00-46.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Moist to wet; Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)			Large cobble at 46.5	5 ft	
50 -	N13	100	1-3-3		N- 13 (50.00-51.50) Silty CLAY with trace sand; CL; Gray; Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)	48.50 - 51.50 Silty CLAY with trace sand; CL; Gray; Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)				
55 –						51.50 End of hole				
60 -										

Figure A5 of **2** Page 1

Hole No.	B-05
<b>F</b> + 11	

										H	ole No.	B-05	
Project	5th St	treet to I	Kinsman	Road Ext	tension		Purpose Bridg	ge		E.	A. No.	N/A	
Highwa	ay <b>N/A</b>						County Clac	kamas C	ounty	K	ey No.	N/A	
Hole Lo	ocation	Nc	orthing: ~	- 603,364		Easting: ~7,	615,978			St	art Card No.	N/A	
Equipm	nent C	ME-75 T	ruck Rig	(Hammer	<sup>r</sup> Efficier	ncy = 88%)	Driller Hard	I Core Dr	illing	B	ridge No.	N/A	
Project	Geolog	ist Adr	ian A.J. H	lolmes			Recorder Nath	an Villen	euve	G	round Elev.	~ 135 ft.	
Start Da	ate Ap	ril 20, 2(	017		End Da	ate April 20, 2017	Total Depth 51	1.50 ft		Т	ube Height	N/A	
"A" - Au "X" - Au "C" - Co "N" - St	Auger Con Auger Core, Barr Standard I Jndisturb	<u>Test Ty</u> re	<u>ype</u> "GP" - ( n	GeoProbe <sup>®</sup>	Discor J - Joir F - Fau B - Be	Rock Abbreviatio           ttinuity         Shape           nt         Pl - Planar           ult         C - Curved           dding         U - Undulating           pliation         St - Stepped	1		Typic Drilling Methods WL - Wire Line HS - Hollow Stem Aug DF - Drill Fluid SA - Solid Auger CA - Casing Advancer HA - Hand Auger	er	lling Abbrev Drill LW WR WC DP - DR -		;
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance	Discontinuity Data 20 Or RQD%	Percent Natural Moisture	<u>Material Descripti</u> SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Re Texture, Cementation, Str ROCK: Rock Name, Color, Weathe Discontinuity Spacing, Joi Core Recovery, Formation	sticity, lative Density, ucture, Origin. ring, Hardness, int Filling,	Ľ	Init Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0	N1	33	2-4	I-4		N- 1 (2.50-4.00) Silty CLAY with some gravel; CL; Brown; Medium plasticity; N to stiff; Fine to coarse, subangular to su Fine to coarse sand; Trace organics; (f	Noist; Medium stiff ubrounded gravel;	Silty sand grav and Brov plast Medi	- 4.50 CLAY with some and trace el, with cobbles boulders; CL; vn; Medium ticity; Moist; um stiff to stiff; to coarse,		Mud rotary technique ( hole) Cobbles an visible on g surface	drilling 5-inch dia. d boulders	
5 —	N2	100	20-29	9-24		N- 2 (5.00-6.50) Clayey GRAVEL with Brown, gray, and red-yellow mottled; N fines; Moist; Very dense; Fine to coarse subrounded gravel; Fine to coarse san Deposits - Gravel Facies)	ledium plasticity e, subangular to	suba subr Fine Trac 4.50	ngular to ounded gravel; to coarse sand; e organics; (Fill) - 38.00		Possible bo 4.8 to 5.5 ft		
_	N3	100	26-3	1-39		N- 3 (7.50-9.00) Clayey GRAVEL with Brown, gray, and red-yellow mottled; M fines; Moist; Very dense; Fine to coars subrounded gravel; Fine to coarse san Deposits - Gravel Facies)	ledium plasticity e, subangular to	som cobb boul gray	ey GRAVEL with e sand, with oles and ders; GC; Brown, , and red-yellow led: Medium		Large cobb	le at 8 ft	
- 10 —	N4	66	21-5	0/5"		N- 4 (10.00-10.90) Clayey GRAVEL w GC; Brown, gray, and red-yellow mottli plasticity fines; Moist; Very dense; Fine subangular to subrounded gravel; Fine (Missoula Flood Deposits - Gravel Fac	ed; Medium to coarse, to coarse sand;	plast Mois dens coar	ticity fines; t; Dense to very e; Fine to se, subangular to		Large cobb	le at 11 ft	
_	N5	100	14/3	4/34		N- 5 (12.50-14.00) Clayey GRAVEL w GC; Brown, gray, and red-yellow mottle plasticity fines; Moist; Very dense; Fine subangular to subrounded gravel; Fine (Missoula Flood Deposits - Gravel Fac	ed; Medium e to coarse, to coarse sand;	to co (Mis:	ded gravel; Fine parse sand; soula Flood psits - Gravel es)				
- 15 —	N6	100	16-2	1-19	22	N- 6 (15.00-16.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticity Dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood E Facies)	fines; Moist; ubrounded gravel;	15.00 Grac gray	les to brown and				
- 20 -	N7	80	15-24	0-20		N-7 (20.00-21.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticity Dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood D Facies)	fines; Moist; ubrounded gravel;						
25													

Projec	t Name	5th Str	eet to Kinsman Ro	oad Exte	Hole No. <b>B-05</b>			Figure Page <b>2</b>	of 2
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data Or RQD%	Percent Natural Moisture	<u>Material Description</u> SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date
25 30 -	N8	67	17-22-21 18-14-30		<ul> <li>N- 8 (25.00-26.50) Clayey GRAVEL with some sand;</li> <li>GC; Brown and gray; Medium plasticity fines; Wet;</li> <li>Dense; Fine to coarse, subangular to subrounded gravel;</li> <li>Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)</li> <li>N- 9 (30.00-31.50) Clayey GRAVEL with some sand;</li> <li>GC; Brown and gray; Medium plasticity fines; Wet;</li> <li>Dense; Fine to coarse, subangular to subrounded gravel;</li> <li>Fine to coarse sand; 2-inch-thick interbed of nonplastic</li> <li>Sandy SILT; ML; (Missoula Flood Deposits - Gravel Facies)</li> </ul>				
35 -	N10	67	17-19-17		N- 10 (35.00-36.50) Clayey GRAVEL with some sand; GC; Gray; Medium plasticity fines; Moist; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	38.00 - 43.00			
40 -	N11	85	38-50/2"		N- 11 (40.00-40.60) GRAVEL with some clay and some sand; GP-GC; Gray; Medium plasticity fines; Moist; Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	GRAVEL with some clay and some sand, with cobbles and boulders; GP-GC; Brown and gray; Medium plasticity fines; Moist; Very dense; Fine to coarse, subangular to rounded gravel; Fine to coarse sand;		Lost approx. 60 gallo of drilling mud at 41	
45 -	N12	100	3-5-3		N- 12 (45.00-46.50) SILT with trace sand; ML; Gray; Low plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)	(Missoula Flood Deposits - Gravel Facies) 43.00 - 51.50 SILT grading down to Silty CLAY with trace sand; ML to CL; Gray; Low to medium			
50 -	N13	100	2/3/28		N- 13 (50.00-51.50) Silty CLAY with trace sand; CL; Gray; Medium plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; Gravel clast stuck in shoe; (Missoula Flood Deposits - Fine-Grained Facies)	plasticity; Moist; Medium stiff to stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies) 51.50 End of hole		Gravel clast stuck in shoe at 50 ft; N-valu possibly affected	
55 -									
60 -	-								
63									

Figure **A6** Page **1** of **2** 

										Н	ole No.	B-06	
Project	t 5th St	treet to	Kinsman	Road Ext	ension		Purpose Railro	ad Und	ercrossing	E	.A. No.	N/A	
Highw	ay N/A	L .					County Clack	amas C	ounty	K	ey No.	N/A	
Hole L	ocation	No	orthing: ~	603,116		Easting: ~7,	616,672			St	tart Card No.	N/A	
Equipr	ment C	ME-75 T	ruck Rig	(Hammer	Efficier	ncy = 88%)	Driller Hard (	Core Dr	illing	В	ridge No.	N/A	
Project	t Geolog	gist <b>Adr</b>	ian A.J. H	olmes			Recorder Natha	n Villen	euve	G	round Elev.	~ 144 ft.	
Start D	Date Ap	oril 18, 2	017		End Da	ate April 19, 2017	Total Depth 41.	50 ft			ube Height	N/A	
"X" - A "C" - C "N" - S	Core, Bari Standard I Undisturb		"GP" - C	GeoProbe <sup>®</sup>	Discon J - Joir F - Fau B - Bea Fo - Fo S - She	nt Pl - Planar Ilt C - Curved dding U - Undulating Jliation St - Stepped	ns Surface Roughness P - Polished SI - Slickensided Sm - Smooth R - Rough VR - Very Rough		<u>Typic</u> <u>Drilling Methods</u> WL - Wire Line HS - Hollow Stem Aug DF - Drill Fluid SA - Solid Auger CA - Casing Advancer HA - Hand Auger	ger	LW WR WC DP - DR	iations ing Remarks - Lost Water - Water Return - Water Color Down Pressure - Drill Rate - Drill Action	
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance	Discontinuity Data 20 Or RQD%	Percent Natural Moisture	<u>Material Descripti</u> SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Re Texture, Cementation, Str ROCK: Rock Name, Color, Weathe Discontinuity Spacing, Joi Core Recovery, Formation	sticity, lative Density, ucture, Origin. ring, Hardness, int Filling,		nit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0								Tops 1.00	- 1.00 oil - 2.50 VEL; GP; (Fill)		Mud rotary technique ( hole)	drilling 5-inch dia.	
	N1	66	1-3	-4		N- 1 (2.50-4.00) Silty CLAY with trace CL; Brown; Medium plasticity; Moist; M coarse, subangular to subrounded grav sand; (Missoula Flood Deposits - Fine-	ledium stiff; Fine to vel; Fine to coarse	Silty sand Medi	- 7.00 CLAY with trace ; CL; Brown; um plasticity;				
5 -	N2	100	3-4	-5	36	N- 2 (5.00-6.50) Silty CLAY with trace Medium plasticity; Moist; Stiff; Fine sar Deposits - Fine-Grained Facies)	sand; CL; Brown; ld; (Missoula Flood	stiff; (Miss Depo	t; Medium stiff to Fine sand; soula Flood sits - Grained Facies)				
	N3	87	27-25	5-21		N- 3 (7.50-9.00) Clayey GRAVEL with Brown and gray; Medium plasticity fine Fine to coarse, subangular to subround coarse sand; (Missoula Flood Deposits	s; Moist; Dense; led gravel; Fine to	Clay some cobb	- 28.00 by GRAVEL with be sand, with les and ders; GC; Brown;				
10 -	N4	100	13-18	8-17		N- 4 (10.00-11.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticity Dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood E Facies)	fines; Moist; ubrounded gravel;	Medi fines very coars	um plasticity ; Moist; Dense to dense; Fine to se, subangular to punded gravel;				
	N5	100	18-21	1-17	16	N- 5 (12.50-14.00) Clayey GRAVEL w GC; Brown and gray; Medium plasticity Dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood E Facies)	fines; Moist; ubrounded gravel;	(Miss	to coarse sand; soula Flood osits - Gravel os)			x. 30 gallons	
15 –	N6	73	13-13	3-21		N- 6 (15.00-16.50) Clayey GRAVEL w GC; Brown and gray; Medium plasticity Dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood D Facies)	fines; Moist; ubrounded gravel;				of drilling m		
20 -	N7	93	13-21-	50/4"		N- 7 (20.00-21.30) Clayey GRAVEL w GC; Brown and gray; Medium plasticity dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood D	fines; Moist; Very ubrounded gravel;						
25						Facies)							

Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data Or RQD%	Percent Natural Moisture	<u>Material Description</u> SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks Water Level/ Date	Backfill/
25	N8	66	31-12-19		N- 8 (25.00-26.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Moist to wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	28.00 - 38.00 Sandy silty GRAVEL; GM; Brown to gray;		Lost approx. 60 gallons of drilling mud at 25 ft	
30 -	N9	66	12-13-18		N- 9 (30.00-31.50) Sandy silty GRAVEL; GM; Brown and gray; Low plasticity fines; Moist to wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; Micaceous; 2-inch-thick interbed of Silty SAND; SM; (Missoula Flood Deposits - Gravel Facies)	Low plasticity fines; Moist to wet; Dense to very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; Trace 2- to 3-inch-thick interbeds of Silty SAND; SM; (Missoula Flood		Large cobble at 32 ft	
35 -	N10	66	15-21-36		N- 10 (35.00-36.50) Sandy silty GRAVEL; GM; Brown and gray; Low plasticity fines; Moist to wet; Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; Micaceous; (Missoula Flood Deposits - Gravel Facies)	Deposits - Gravel Facies)		Large cobble at 36 ft	
40 -	N11	66	3-40-37		N- 11 (40.00-41.50) Sandy SILT with some gravel; ML; Brown; Nonplastic; Wet; Very dense; Fine to coarse, subangular to subrounded gravel; Mostly fine sand; Micaceous	38.00 - 41.50 Sandy SILT with some gravel; ML; Brown; Nonplastic; Wet; Very dense; Fine to coarse, subangular to subrounded gravel; Mostly fine sand; Micaceous;		GeoKon 4500S Vibrating Wire SN: 1709934 installed at 39 ft	
45 -						(Missoula Flood Deposits - Fine-Grained Facies) 41.50 End of hole			
50 -									
55 -									
60 -									

Figure A7 Page 1 of 2

					OREGON DEPARTME	NI OF IF	CANSPU	DRIATION			0	of 2
Duciaci	4 E4b 04		Kinaman Daad Evi			Dumaga	Deilre			ole No. .A. No.	B-07	
			Kinsman Road Ext	ension		Purpose		od Undercrossing			N/A N/A	
0	ay <b>N/A</b>		orthing: ~ 603,015		Easting: ~7	County	Clacka	imas County		ey No. tart Card No.		
			ruck Rig (Hammer	Efficie		Driller	Hord C	Core Drilling		ridge No.	N/A N/A	
			ian A.J. Holmes	EIIICIE	ncy – 66 %)			n Villeneuve		round Elev.	~ 148 ft.	
				EndD	ata April 19 2017						~ 148 IL.	
Start L	Date <b>Ap</b>			End D	ate April 19, 2017	Total De	pun 41.			ube Height lling Abbrevi		
"X" - 4 "C" - 0 "N" - 9 "U" - 0	Auger Cor Auger Core, Barr Standard I Undisturb Fest Pit	rel Type Penetratio	"GP" - GeoProbe <sup>®</sup>	J - Join F - Fau B - Be	lıt C - Curved dding U - Undulating bliation St - Stepped	<u>Surface Ro</u> P - Polished Sl - Slicken Sm - Smoo R - Rough VR - Very	sided	Drilling Methods WL - Wire Line HS - Hollow Stem Auger DF - Drill Fluid SA - Solid Auger CA - Casing Advancer HA - Hand Auger		Drilli LW - WR - WC - DP - DR -	ing Remarks - Lost Water - Water Return - Water Color Down Pressure Drill Rate Drill Action	
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data Wayo Or RQD%	Percent Natural Moisture	<u>Material Descript</u> SOIL: Soil Name, USCS, Color, Pl Moisture, Consistency/R Texture, Cementation, St ROCK: Rock Name, Color, Weath Discontinuity Spacing, J Core Recovery, Formatic	asticity, elative Densi ructure, Orig ering, Hardno sint Filling,	in.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0	N1	33	1-2-3		N- 1 (2.50-4.00) Silty CLAY with trace CL; Brown; Medium plasticity; Moist; N subangular to subrounded gravel; Fino Micaceous; (Fill)	/ledium stiff;	Fine,	0.50 - 1.50 Base Aggregate; 12 inches thick 1.50 - 4.50 Silty CLAY with trace	, 0 °	Mud rotary ( technique ( hole)		
5 -	N2	47	18-50/5"		N- 2 (5.00-5.90) Silty GRAVEL with s Brown to gray; Low plasticity fines; Mo dense; Fine to coarse, angular to subr to coarse sand; Slight odor; (Fill)	ist to wet; V	ery	sand and gravel; CL; Brown; Medium plasticity; Moist; Medium stiff; (Fill) 4.50 - 7.00 Silty GRAVEL with				
	N3	60	9-11-16		N- 3 (7.50-9.00) Clayey GRAVEL with Brown to gray; Medium plasticity fines dense; Fine to coarse, subangular to s Fine to coarse sand; (Missoula Flood Facies)	; Moist; Med subrounded	ium gravel;	some sand; GM; Brown to gray; Low plasticity fines; Moist to wet; Very dense; Fine to coarse,				
10 -	N4	53	5-9-8		N-4 (10.00-11.50) Clayey GRAVEL v GC; Brown to gray; Medium plasticity Medium dense; Fine to coarse, suban gravel; Fine to coarse sand; Micaceou Deposits - Gravel Facies)	fines; Moist; gular to subr	ounded	subangular to subrounded gravel; Fine to coarse sand; Slight odor; (Fill) 7.00 - 17.80		Lost approx of drilling m	60 gallons ud at 10 ft	
	N5	53	5-15-14		N- 5 (12.50-14.00) GRAVEL with son sand; GP-GC; Brown to gray; Medium Moist; Medium dense; Fine to coarse, subrounded gravel; Fine to coarse san (Missoula Flood Deposits - Gravel Fac	plasticity fin subangular nd; Micaceou	es; to	Clayey GRAVEL with some sand to GRAVEL with some clay and some sand, with cobbles and		Lost mud ci 12.4 ft	rculation at	
15 -	N6	66	9-44-50	15	N- 6 (15.00-16.50) Clayey GRAVEL v GC; Red-brown to gray; Medium plast Very dense; Fine to coarse, subangula gravel; Fine to coarse sand; (Missoula Gravel Facies)	icity fines; M ar to subrour	oist; Ided	boulders; GC and GP-GC; Brown to gray; Moist; Medium dense to very dense; Fine to coarse,				
20 -	N7	80	5-8-12		N- 7 (20.00-21.50) Gravelly CLAY wit Brown; High plasticity; Moist; Very stif subangular to subrounded gravel; Fin (Missoula Flood Deposits - Gravel Fac	f; Fine to coa e to coarse s	irse,	subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies) 17.80 - 21.50 Gravelly CLAY with some sand; CH; Brown; High plasticity; Moist; Very stiff; Fine to coarse gravel; fine to coarse sand; (Missoula		Boulder at 2	21.5 ft	

					Material Description	Unit Description				
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data aou Or RQD%	Percent Natural Moisture	Material Description SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/
25	N8	60	21-27-27		N- 8 (25.00-26.50) GRAVEL with some silt and some sand; GP-GM; Brown and gray; Low plasticity fines; Wet; Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	Gravel Facies) 21.50 - 28.50 GRAVEL with some silt and some sand, with cobbles and boulders; GP-GM; Brown and gray; Low plasticity fines; Wet;		Large cobble at 28		///////////////////////////////////////
30 -	N9	47	9-15-29		N- 9 (30.00-31.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Wet; Dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies) 28.50 - 41.50				
35 -	N10	53	15-27-20		N- 10 (35.00-36.50) Clayey GRAVEL with some sand; GC; Brown and gray; Medium plasticity fines; Moist; Dense; Fine to coarse, subangular to rounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	Clayey GRAVEL with some sand, with cobbles and boulders; GC; Brown and gray; Medium plasticity fines; Moist to wet; Dense to very dense; Fine to coarse, subangular to subrounded gravel;				///////////////////////////////////////
40 -	N11	66	18-29-26		N- 11 (40.00-41.50) Clayey GRAVEL with some sand; GC; Brown; Medium plasticity fines; Moist; Very dense; Fine to coarse, subangular to subrounded gravel; Fine to coarse sand; (Missoula Flood Deposits - Gravel Facies)	41.50 End of hole			> > > >	
45 -										
50 -										
55 -										
60 -										

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						OREGON DEPARTMEN	NT OF TRANSPO	ORTA	FION		Ра	0	f 1
Ducient	E46 04	wo of fo	Vinomon	Dood Ext			Dumaga <b>Cuban</b>	odo			lole No.	B-08	
,		reet to	Kinsman	Road Ext	ension		Purpose Subgr				.A. No.	N/A	
	ay N/A						5	amas C	ounty		ley No.	N/A	
	ocation		orthing: ~	-		Easting: ~7,	_				tart Card No.		
			lgers (Ma		imer)		Driller Dan F				ridge No.	N/A	
Project	t Geolog	ist <b>Adr</b>	ian A.J. H	lolmes			Recorder Natha	n Viller	euve	G	round Elev.	~ 148 ft.	
"A" - A "X" - A "C" - C "N" - S	Core, Barr Standard F Undisturbe	<u>Test Ty</u> e el Type enetratio	<u>ype</u> "GP" - C n	GeoProbe <sup>®</sup>	<u>Discor</u> J - Join F - Fau B - Be	llt C - Curved dding U - Undulating bliation St - Stepped	Typic Drilling Methods WL - Wire Line HS - Hollow Stem Aug DF - Drill Fluid SA - Solid Auger CA - Casing Advancer HA - Hand Auger	al Dri	LW WR WC DP - DR	N/A itations ing Remarks - Lost Water - Water Return - Water Color - Down Pressure - Drill Rate - Drill Action			
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance	Discontinuity Data a Or RQD%	Percent Natural Moisture	<u>Material Descripti</u> SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Rei Texture, Cementation, Str ROCK: Rock Name, Color, Weather Discontinuity Spacing, Joi Core Recovery, Formation	sticity, lative Density, ucture, Origin. ring, Hardness, int Filling,		Jnit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/
0	N1	100	2-2 3-3			N- 1 (2.50-4.00) Silty CLAY with some gravel; CL; Brown; Low to medium plas Medium stiff; Fine to coarse gravel; Fin Micaceous; (Fill) N- 2 (5.00-6.50) Silty CLAY with trace	sticity; Moist; le to coarse sand; to some sand; CL;	Silty sanc grav Low plas Med coar Coar Mica	- 4.50 CLAY with some I and trace el; CL; Brown; to medium ticity; Moist; ium stiff; Fine to se gravel; Fine to se sand; cceous; (Fill) / - 10.00			auger drilling 4.5-inch hole)	
-	N3	100	4-5	5-7		Brown; Medium plasticity; Moist; Mediu sand; Micaceous; (Missoula Flood Dep Fine-Grained Facies) N- 3 (7.50-9.00) Silty CLAY with some Medium plasticity; Moist; Stiff; Fine san (Missoula Flood Deposits - Fine-Graine	osits - sand; CL; Brown; id; Micaceous;	to so Brow plas Med Fine Mica	CLAY with trace ome sand; CL; wn; Medium ticity; Moist; ium stiff to stiff; sand; ceous; (Missoula d Deposits -				
10 —	N4	93	16-20	6-35		N-4 (10.00-11.50) Clayey GRAVEL w Sandy clayey GRAVEL; GC; Brown an plasticity fines; Moist; Very dense; Fine subangular to rounded gravel; Fine to c Moderate iron oxidation; (Missoula Floo Gravel Facies)	d gray; Medium e to coarse, coarse sand;	Fine 10.0 Clay som clay Brov Med fines	-Grained Facies) 0 - 11.50 ey GRAVEL with e sand to Sandy ey GRAVEL; GC; vn and gray; ium plasticity s; Moist; Very se; Fine to				
15 -								coar roun to co Mod oxid Floo Grav	sé, subangular to ded gravel; Fine parse sand; erate iron ation; (Missoula d Deposits - rel Facies)				
20 -													
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### DRILL LOG REGON DEPARTMENT OF TRANSPORTATION

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ot 5th 9										lole No.	B-09	
	street to	Kinsman Road Ex	tension			Purpose Infiltra	tion		E	.A. No.	N/A	
way N/A						County Clacka	amas C	ounty		2	N/A	
Location	No	orthing: ~ 603,34	Ð		Easting: ~	7,615,666					N/A	
pment C	ME-850	Track Rig (Hamm	er Effici	ency = 87%	%)	Driller Hard C	Core Dri	illing	B	ridge No.	N/A	
ect Geolo	gist <b>Adr</b>	ian A.J. Holmes				Recorder Nathai	n Villen	euve	G	round Elev.	~ 147 ft.	
Date A			End D	Date April		*	) ft	Туріс			N/A ations	
- Auger - Core, Bar - Standard	rrel Type Penetratio	"GP" - GeoProbe	J - Joi F - Fa B - Be Fo - F	nt ult edding foliation	<u>Shape</u> Pl - Planar C - Curved U - Undulating St - Stepped Ir - Irregular	Surface Roughness P - Polished SI - Slickensided Sm - Smooth R - Rough VR - Very Rough		Drilling Methods WL - Wire Line		Start Card No.       N/A         Bridge No.       N/A         Ground Elev.       ~ 147 f         Tube Height       N/A         Drilling Abbreviations       Drilling Remains         LW - Lost W       WR - Water H         WC - Water O       DP - Down P         DR - Drill Ra       DA - Drill Ac         Start Card No.       N/A         Image: Start Card No.       N/A         Drilling Abbreviations       Drilling Remains         LW - Lost W       WR - Water H         WC - Water O       DP - Down P         DR - Drill Ra       DA - Drill Ac         Start	ng Remarks Lost Water Water Return Water Color Down Pressure Drill Rate	
Test Type, No.	Percent Recovery	Driving Resistance Discontinuity Data Wor RQD%	Percent Natural Moisture		Soil Name, USCS, Color, Moisture, Consistency/ Texture, Cementation, Rock Name, Color, Weat Discontinuity Spacing,	Plasticity, Relative Density, Structure, Origin. thering, Hardness, Joint Filling,			Graphic Log	Drilling Methods, and Remarks	Water Level/ Date	Backfill/ Instrumentation
0 Depth (ft) T est Type Percent R Resistance Resistance				N- 1 (2.50 Moist; Me	0-4.00) Sandy SILT; ML; B dium stiff; Fine sand; Mica	rown; Low plasticity; rown; Low plasticity; rown; (Fill) Sandy SILT; ML; Brown; Nonplastic to low plasticity; Moist; Loose / medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)				drilling tech		
N2	53	2-4-3		low plastic	city; Moist; Loose / medium			Grained Facies)		· · ·		· · · · · · · · · · · · · · · · · · ·
_								of hole				
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	ct Geolog Date Au Auger Co Auger Core, Ban Standard Undisturf Test Pit	Ct Geologist Adr Date April 21, 20 Test Ty Auger Core Auger Core, Barrel Type Standard Penetratio Undisturbed Sample Test Pit 	ct Geologist Adrian A.J. Holmes         Date April 21, 2017         Test Type         Auger Core       "GP" - GeoProbed"         Auger Core, Barrel Type         Standard Penetration         Undisturbed Sample         Test Pit         Soil         N1         47         2-2-3	Ct Geologist     Adrian A.J. Holmes       Date     April 21, 2017     End E       Test Type     Auger Core     "GP" - GeoProbe*       Auger     F - Fa       Core, Barrel Type     F - Fa       Standard Penetration     B - B       Undisturbed Sample     Fo - F       Test Pit     Soil       N1     47       2-2-3     N1	Orthogona in the second secon	Date     April 21, 2017     End Date     April 21, 2017       Test Type Auger Core     "GP" - GeoProbe <sup>®</sup> Auger     End Date     April 21, 2017       Auger Core     "GP" - GeoProbe <sup>®</sup> Auger     Discontinuity     Shape J - Joint     PI - Planar       Core, Barrel Type     Standard Penetration     B - Bedding     U - Undulating F o - Foliation     St - Stepped       Undisturbed Sample     Soil     Rock     B     B - Bedding     U - Undulating       For - Foliation     St - Stepped     S - Shear     Ir - Irregular       Soil     Rock     B     SOIL: Soil Name, USCS, Color, Moisture, Consistency/ Texture, Cementation, Unit Sign Sign Color       Variation     Soil     Soil     Material Descrip SOIL: Soil Name, USCS, Color, Wind Sign Sign Color       Variation     Soil     Soil     Material Descrip SOIL: Soil Name, Color, Weal Discontinuity Spacing, Core Recovery, Format       N1     47     2-2-3     N- 1 (2.50-4.00) Sandy SiLT; ML; B Moist; Medium stiff; Fine sand; Mica       N2     53     2-4-3     N- 2 (5.00-6.50) Sandy SiLT; ML; B	Recorder Nathal         Recorder Nathal         Date April 21, 2017       Total Depth 6.50         Test Type         Auger Core       "GP" - GeoProbe*         Discontinuity       Shape       Surface Roughness         Auger Core       "GP" - GeoProbe*       Discontinuity       Shape       Surface Roughness         Auger       Core, Barrel Type       Standard Penetration       Discontinuity       Shape       Surface Roughness         Standard Penetration       B - Bedding       U - Undulating       Sm - Smooth       Smooth         Undisturbed Sample       Soil       Rock       B - Bedding       U - Undulating       Sm - Smooth         Soil       Rock       Staget       I'' - I'''       Soill Colspan="2">Net Net Very Rough         Viation       Site Site Site Site Site Site Site Site	Control Conterectore conterin Control Control Control Control Contr	Recorder Nathan Villeneuve       Date Goologist Adrian A.J. Holmes       Recorder Nathan Villeneuve       Date April 21, 2017       Total Depth 6.50 ft       Test Type       Auger Core     "GP" - GeoProbe"       Discontinuity     Shape     Surface Roughness       J - Joint     PI - Planar     P - Polished       Standard Penetration     B - Bedding     U - Indulating     Sm - Smooth       Standard Penetration     B - Bedding     U - Indulating     Sm - Smooth       Test Pit     Soil     Rock     Material Description       Soil     Rock     Material Description     SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Crementation, Structure, Origin.     Unit Description       Viriation     Soil:     Soil:     N-1 (2:50-4:00) Sandy SILT; ML; Brown; Low plasticity; Moist; Loose / medium stiff; Fine sand; Micaceous; (Fill)     0.00 - 6.50       N1     47     2-2-3     N-1 (2:50-6:50) Sandy SILT; ML; Brown; Nonplastic to low plasticity; Moist; Loose / medium stiff; Fine sand; Micaceous; (Fill)     Micaceous; (Fill)	Recorder Nathan Villeneuve       G         Corde Geologist Adrian A.J. Holmes       Recorder Nathan Villeneuve       G         Date April 21, 2017       Total Depth 6.50 ft       T         Discontinuity       Shape       Surface Roughness         J - Joint       PI - Planar       P. Polished       T       T         Standard Penetration       B. Bedding       U- Undulating       Sn - Smooth       S- Solid Auger       CA - Casing Advancer         Test Pit       Soil       Rock       Material Description       SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, T Texture, Comentation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.       Unit Description       Soil Sandy SILT; ML; Brown; Nonplastic to low plasticity; Moist; Loose / medium stiff; Fine sand; Micaceous; (Fill)         N1       47       2-2-3       N-1 (2.50-4.00) Sandy SILT; ML; Brown; Nonplastic to low plasticity; Moist; Loose / medium stiff; Fine sand; Micaceo	ct Geologist Adrian A.J. Holmes       Recorder Nathan Villeneuve       Ground Elev.         Date April 21, 2017       End Date April 21, 2017       Total Depth 6.50 ft       Tube Height         Auger Core       "GP" - GeoProbe"       Discontinuity       Shape       Surface Roughness         J. Joint       P1 - Planar       P - Polished       Typical Drilling Mohorevi         Core, Barrel Type       J. Joint       P1 - Planar       P - Polished       Milling Mohorevi         Standard Penetration       Discontinuity       Shape       Surface Roughness       Dilling Mohorevi         Standard Penetration       F - Foult       C - Curved       Sistemped       R - Rough       SA - Solid Auger       DPI         Yes Pit       Soil       Rock       Material Description       S - Shear       Ir - Irregular       VR - Very Rough       SA - Solid Auger       DA -         Visture Consistency/Relative Density, Texture, Cementation, Structure, Origin.       SOIL: Soil Name, USCS, Color, Plasticity, Moistrue Consistency/Relative Density, Texture, Cementation, Structure, Origin.       Visture Consistency/Relative Density, Texture, Cementation, Structure, Origin.       Soil CK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing.       Unit Description       Soil Will Will Will Will Will Will Will W	Recorder Nathan Villeneuve     Ground Elev. ~ 147 ft.       Date April 21, 2017     End Date April 21, 2017     Total Depth 6.50 ft     Tube Height     N/A       Auger Core     "GP" - GeoProbe"     Discontinuity     Shape     Surface Roughness     Typical Drilling Abbreviations       Orce, Barrel Type     Discontinuity     Shape     Surface Roughness     Typical Drilling Abbreviations       Orce, Barrel Type     Discontinuity     Shape     Surface Roughness     Drilling Methods     Drilling Methods       Standard Penetration     B - Bedding     U - Undulating     Sn - Smooth     Tor Were Color     SA - Said Auger     DP - Don't Fuid       Test Pit     Soil     Rock     Material Description     Soil Soil Auger     DA - Drill Action       Vi, Yer Very Rough     Material Description     Soil Core Recovery, Formation Name.     Unit Description     Soil Soil Auger     DA - Drill Action       Vi, Yer Very Rough     Material Description     Soil Soil Name, USCS, Color, Plasticity, Moistrue, Origin, ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.     Sond - 6.50     Sandy SILT; ML; Brown; Nonplastic to low plasticity, Moist; Medium stiff, Fine sand; Micaceous; (Fill)     Sond - 6.50     Sandy SILT; ML; Brown; Nonplastic to low plasticity, Moist; Loose / medium stiff, Fine sand; Micaceous; (Fill)       N1     47     2-2-3     N-1 (

#### DRILL LOG EGON DEPARTMENT OF TRANSPORTATION

					OREGON DEPARTMEN	NT OF TRANSP	ORTA	ΓΙΟΝ	_		age 1 of	f 1
									Н	ole No.	B-10	
Project 5th	Street to	Kinsman	Road Ex	tension		Purpose Paver	nent		E	A. No.	N/A	
Highway N	/A					County Clack	amas C	ounty	K	ey No.	N/A	
Hole Locatio	on No	orthing:	~ 604,022		Easting: ~7,	615,614			St	art Card No.	N/A	
Equipment	Buck Roo	dgers (Ma	inual Han	nmer)		Driller Dan F	isher		В	ridge No.	N/A	
Project Geol	ogist <b>Adı</b>	rian A.J. H	lolmes			Recorder Natha	n Viller	euve	G	round Elev.	~ 148 ft.	
Start Date	April 24, 2	017		End D	ate April 24, 2017	Total Depth 6.5	0 ft	1		ube Height	N/A	
"A" - Auger ( "X" - Auger "C" - Core, E "N" - Standar "U" - Undistu "T" - Test Pit	arrel Type d Penetratic rbed Sampl	"GP" - 0	GeoProbe <sup>®</sup>	J - Join F - Fau B - Be	nt Pl - Planar ult C - Curved dding U - Undulating oliation St - Stepped	<u>ns</u> Surface Roughness P - Polished SI - Slickensided Sm - Smooth R - Rough VR - Very Rough	I	<u>Typi</u> <u>Drilling Methods</u> WL - Wire Line HS - Hollow Stem Au DF - Drill Fluid SA - Solid Auger CA - Casing Advancer HA - Hand Auger	ger	LW WR WC DP DR	viations ling Remarks - Lost Water - Water Return - Water Color - Down Pressure - Drill Rate - Drill Action	1
Depth (ft) Test Type, No.	Percent Recovery	Driving Resistance	Discontinuity Data & Or RQD%	Percent Natural Moisture	<u>Material Descripti</u> SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Re Texture, Cementation, Str ROCK: Rock Name, Color, Weathe Discontinuity Spacing, Joi Core Recovery, Formation	sticity, lative Density, ucture, Origin. ring, Hardness, int Filling,		Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0 N1 - 5 N24 N2E - 10 - - 10 -			4-5 -19		N- 1 (2.50-4.00) SILT with some sand; plasticity; Moist; Stiff; Fine sand; Micac Flood Deposits - Fine-Grained Facies) (5.00-6.50) N- 2A (5.00) SILT to Silty CLAY with s Olive-Brown; Low to medium plasticity; sand; Micaceous; (Missoula Flood Dep Fine-Grained Facies) N- 2B (6.30) Clayey GRAVEL with sor and brown; Low to medium plasticity fir dense; Fine to coarse, subangular to rc to coarse sand; (Missoula Flood Depos Facies)	eous; (Missoula ome sand; ML/CL; Moist; Stiff; Fine posits - me sand; GC; Gray nes; Moist; Medium Junded gravel, Fine	Aspl inch 0.50 Base inch 0.70 SILT with ML/C to m Mois Sanc (Mis- Depo Fine 6.30 Clay som and fines coar roun to cc (Mis- Depo Fine 6.30 Clay som and fines fine 6.30 Clay som and fines fine fine fine fine fine fine fine fine	- 0.50 nalt Concrete; 6 es thick - 0.70 Aggregate; 2.5 es thick - 6.30 to Silty CLAY some sand; CL; Brown; Low edium plasticity; t; Stiff; Fine l; Micaceous; soula Flood osits - - Grained Facies) - 6.50 ey GRAVEL with e sand; GC; Gray brown; Low to lum plasticity s; Moist; Medium se; Fine to se, subangular to ded gravel; Fine parse sand; soula Flood osits - Gravel es) of hole		Solid-stem technique ( hole)	auger drilling 4.5-inch dia.	

#### DRILL LOG OREGON DEPARTMENT OF TRANSPORTATION

Figure A11 Page 1 of

P" - GeoProbe <sup>®</sup> <u>E</u>	sion	DREGON DEPARTMEN Easting: ~7,	Purpose Infiltrat County Clackar	ion		E.	ole No. A. No.	e 1 oi B-11 N/A N/A	
g: ~ 603,686 (Manual Hamme J. Holmes Er 2" - GeoProbe <sup>®</sup>	er)	Easting: ~7,	County Clackar		ounty				
(Manual Hamme J. Holmes Er 2" - GeoProbe®		Easting: ~7,	,	mas Co	ounty	K	ev No	NI/A	
(Manual Hamme J. Holmes Er 2" - GeoProbe®		Easting: ~7,	615,519				<i>cy</i> 110.	IN/A	
J. Holmes Et P" - GeoProbe <sup>®</sup>						St	art Card No.	N/A	
Er P" - GeoProbe <sup>®</sup>	nd Date April		Driller Dan Fis	sher		Bi	ridge No.	N/A	
P" - GeoProbe <sup>®</sup> <u>E</u>	nd Date April		Recorder Nathan	Villen	euve	G	round Elev.	~ 153 ft.	
		l 24, 2017	Total Depth 5.00	ft			0	N/A	
B F	I - Joint F - Fault B - Bedding Fo - Foliation	Pl - Planar C - Curved U - Undulating St - Stepped	Surface Roughness P - Polished SI - Slickensided Sm - Smooth R - Rough		Drilling Methods WL - Wire Line		LW - WR - WC - DP - I DR -	ng <u>Remarks</u> Lost Water Water Return Water Color Down Pressure Drill Rate	I
ty Data	SOIL: Natural Moisture ROCK	<ul> <li>Soil Name, USCS, Color, Pla Moisture, Consistency/Rel Texture, Cementation, Stru-</li> <li>Rock Name, Color, Weather Discontinuity Spacing, Joi</li> </ul>	sticity, lative Density, ucture, Origin. ring, Hardness, nt Filling,			Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
3-3-4	N- 1 (2.5 Medium	50-4.00) Silty CLAY with some plasticity; Moist; Medium stiff; I us; (Missoula Flood Deposits -	sand; CL; Brown; Fine sand; Fine-Grained	Silty sand Media Moist Fine Micae Flood Fine- 5.00	CLAY with some ; CL; Brown; um plasticity; t; Medium stiff; sand; ceous; (Missoula I Deposits - Grained Facies)		Solid-stem a	uger drilling	
	Neststance Discontinuity Data Naou Or RQD%	J - Joint F - Fault B - Bedding Fo - Foliation S - Shear il Rock B - Bedding Fo - Foliation S - Shear il Rock SOIL: O D S: No N-1 (2. Medium Micazeo 3-3-4 N-1 (2. Medium	J - Joint     Pl - Planar       F - Fault     C - Curved       B - Bedding     U - Undulating       Fo - Foliation     St - Stepped       S - Shear     Ir - Irregular       il     Rock       and Construction     St - Stepped       Solit     Soil Name, USCS, Color, Pla       Moisture, Consistency/Rel     Texture, Cementation, Str       ROCK:     Rock Name, Color, Weather       Discontinuity Spacing, Joi     Core Recovery, Formation       Solit     A.Z	J - Joint     PI - Planar     P - Polished       F - Fault     C - Curved     SI - Slickensided       B - Bedding     U - Undulating     Sm - Smooth       Fo - Foliation     St - Stepped     R - Rough       S - Shear     Ir - Irregular     VR - Very Rough       il     Rock     Material Description       SolL:     Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin.       ROCK:     Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.       3-3-4     N- 1 (2.50-4.00) Silty CLAY with some sand; CL; Brown; Medium plasticity; Moist, Medium stiff, Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained	J - Joint       Pl - Planar       P - Polished         F - Fault       C - Curved       Sl - Slickensided         B - Bedding       U - Undulating       Sm - Smooth         Fo - Foliation       St - Stepped       R - Rough         S - Shear       Ir - Irregular       VR - Very Rough         il       Rock       SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin.       W         Noisture       Noisture, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.       0.00 - Silty         3-3-4       N-1 (2.50-4.00) Silty CLAY with some sand; CL; Brown; Medium plasticity; Moist; Medium stiff, Fine sand; Micaecous; (Missoula Flood Deposits - Fine-Grained Facies)       0.00 - Silty	J. Joint       Pl - Planar       P - Polished         J - Joint       Pl - Planar       P - Polished         F - Fault       C - Curved       Sl - Slickensided         B - Bedding       U - Undulating       Sm - Smooth         Fo - Foliation       St - Stepped       R - Rough         S - Shear       Ir - Irregular       VR - Very Rough         il       Rock       Material Description         SOIL:       Soil Name, USCS, Color, Plasticity,         Moisture, Consistency/Relative Density,       Texture, Cementation, Structure, Origin.         ROCK:       Rock Name, Color, Weathering, Hardness,       Discontinuity Spacing, Joint Filling,         Core Recovery, Formation Name.       0.00 - 5.00         Silty CLAY with some sand; CL; Brown;       Medium plasticity; Moist; Medium stiff; Fine sand;         Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)       Fine-Grained Facies)	J- Joint       Planar       P- Polished         J- Joint       Pl-Planar       P- Polished         F-Fault       C- Curved       Sl-Slickensided         B-Bedding       U- Undulating       Sm - Smooth         Fo-Foliation       St-Stepped       R-Rough         S-Shear       Ir - Irregular       VR - Very Rough         il       Rock       Material Description         SOIL:       Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin.         ROCK:       Rock Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin.       Unit Description         900       Unit Description       Unit Description         3-3.4       N-1 (2.50-4.00) Silty CLAY with some sand; CL; Brown; Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)       0.00 - 5.00         3-3.4       N-1 (2.50-4.00) Silty CLAY with some sand; CL; Brown; Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)       Solo	3-3-4       N-1 (2.50-4.00) Sitty CLAY with some sand; CL; Brown; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)       Unit Description       Unit Description         3-3-4       N-1 (2.50-4.00) Sitty CLAY with some sand; CL; Brown; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)       0.00 - 5.00       Sold - 5.00	Scheming       Subscription       PL - Planar       PL - Polished         J - Joint       PL - Planar       P - Polished         F - Fault       C - Curved       SL - Slickensided         B - Bedding       U - Undulating       Sm - Smooth         F - Foliation       St - Stepped       R - Rough         S - Shear       Ir - Irregular       VR - Very Rough         ill       Rock       Material Description         SOIL:       Soil Name, USCS, Color, Plasticity,         Moisture, Consistency/Relative Density,       Texture, Cementation, Structure, Origin.         ROCK:       Rock Name, Color, Weathering, Hardness,         Discontinuity Spacing, Joint Filling,       Core Recovery, Formation Name.         Out Supper Law       Out - 5.00         Sity QL       Solid-stem auger drilling technique (6-inch dia. hole)         a:3-3.4       N-1 (2.50-4.00) Sity CLAY with some sand; CL; Brown; Medium plasticity; Moist; Medium stiff; Fine sand; Micaceous; (Missoula Flood Deposits - Fine-Grained Facies)

#### DRILL LOG OREGON DEPARTMENT OF TRANSPORTATION

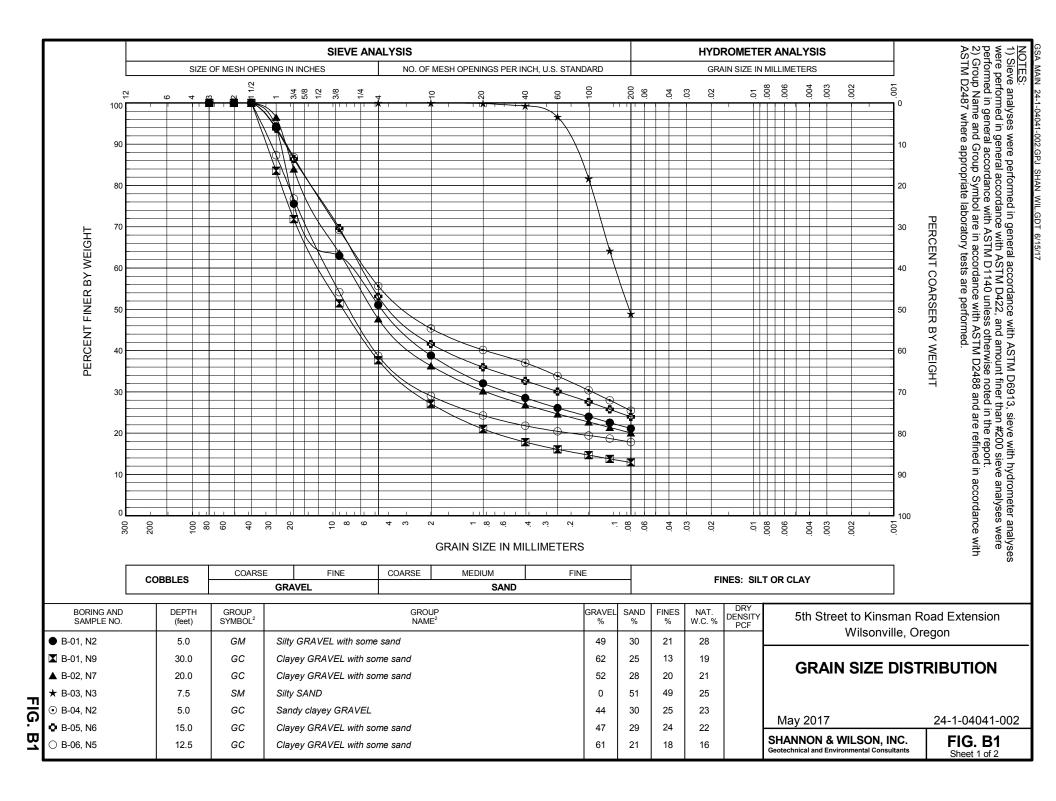
Figure A12 Page 1 of 1

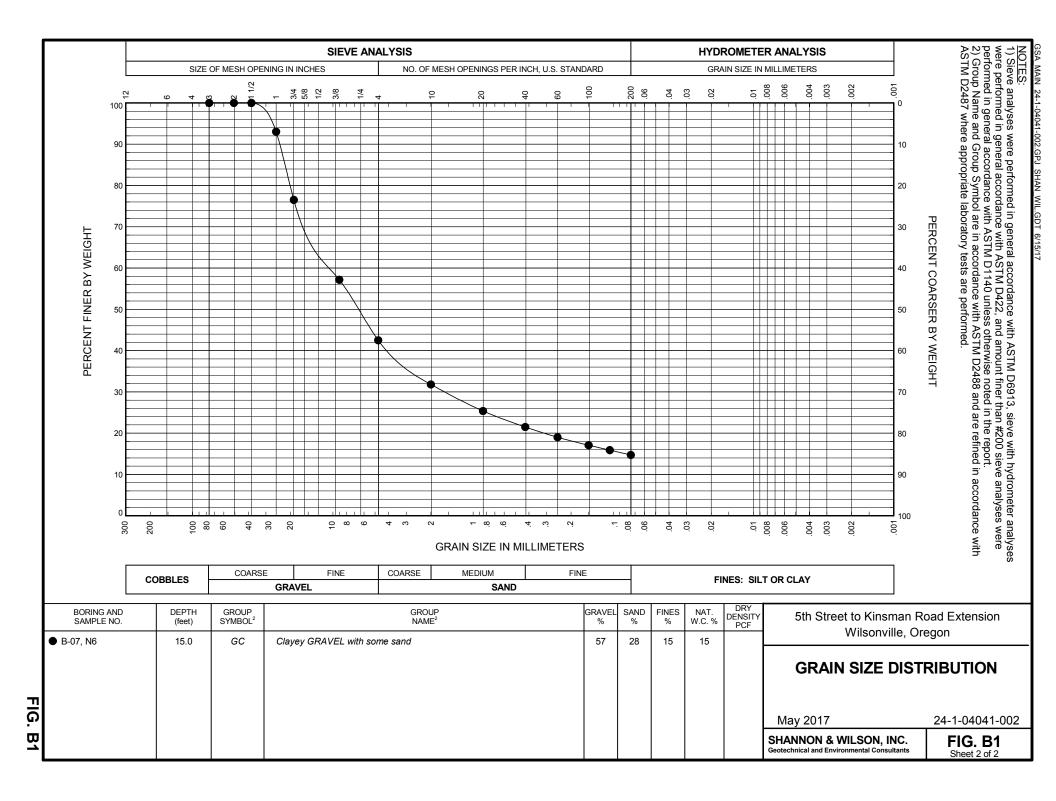
						OREGON DEPARTME	NT OF TR	ANSPO	ORTAT	ΓΙΟΝ			0	f 1
							_				_	ole No.	B-12	
5			Kinsman	Road Ext	ension		Purpose	Infiltra				.A. No.	N/A	
	ay N/A						County	Clacka	amas C	ounty		ey No.	N/A	
	ocation		orthing: ~	-		Easting: ~7					_	tart Card No.		
Equipn	nent <b>B</b>	uck Rod	lgers (Mai	nual Ham	mer)		Driller	Dan F			В	ridge No.	N/A	
Project	t Geolog	ist Adr	ian A.J. H	olmes			Recorder	Natha	n Villen	euve	G	round Elev.	~ 148 ft.	
Start D	ate Ap	ril 24, 20	017		End Da	ate April 24, 2017	Total Dep	oth 5.00	) ft			ube Height	N/A	
"X" - A "C" - C "N" - S	Auger Cor Auger Core, Barr Standard H Jndisturbe	el Type Penetratio	"GP" - C	GeoProbe®	Discon J - Joir F - Fau B - Beu Fo - Fo S - She	lt C - Curved dding U - Undulating blation St - Stepped	ns Surface Rou P - Polishec SI - Slicken Sm - Smoot R - Rough VR - Very I	sided		<u>Lypic</u> Drilling Methods WL - Wire Line HS - Hollow Stem Aug DF - Drill Fluid SA - Solid Auger CA - Casing Advancer HA - Hand Auger		LW WR WC DP DR	<u>Hations</u> - Lost Water - Water Return - Water Color - Down Pressure - Drill Rate - Drill Action	
Depth (ft)	Test Type, No.	Percent Recovery	Driving Resistance	Discontinuity Data Nor RQD% no Nor RQD%	Percent Natural Moisture	<u>Material Descripti</u> SOIL: Soil Name, USCS, Color, Pla Moisture, Consistency/Re Texture, Cementation, St ROCK: Rock Name, Color, Weathe Discontinuity Spacing, Jo Core Recovery, Formatio	asticity, lative Densir ucture, Orig tring, Hardne int Filling,	in.	Ľ	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0	N1	100	2-2	-3		N- 1 (2.50-4.00) Silty CLAY with some Medium plasticity; Moist; Medium stiff; Micaceous; (Missoula Flood Deposits Facies)	e sand; CL; E Fine sand; - Fine-Grain	3rown; ed	Silty sand Medi Mois Fine Mica Floo Fine	- 5.00 CLAY with some I; CL; Brown; ium plasticity; it; Medium stiff; sand; ceous; (Missoula d Deposits - -Grained Facies) of hole			auger drilling	
10 –														
15 -														
20 -														
25														

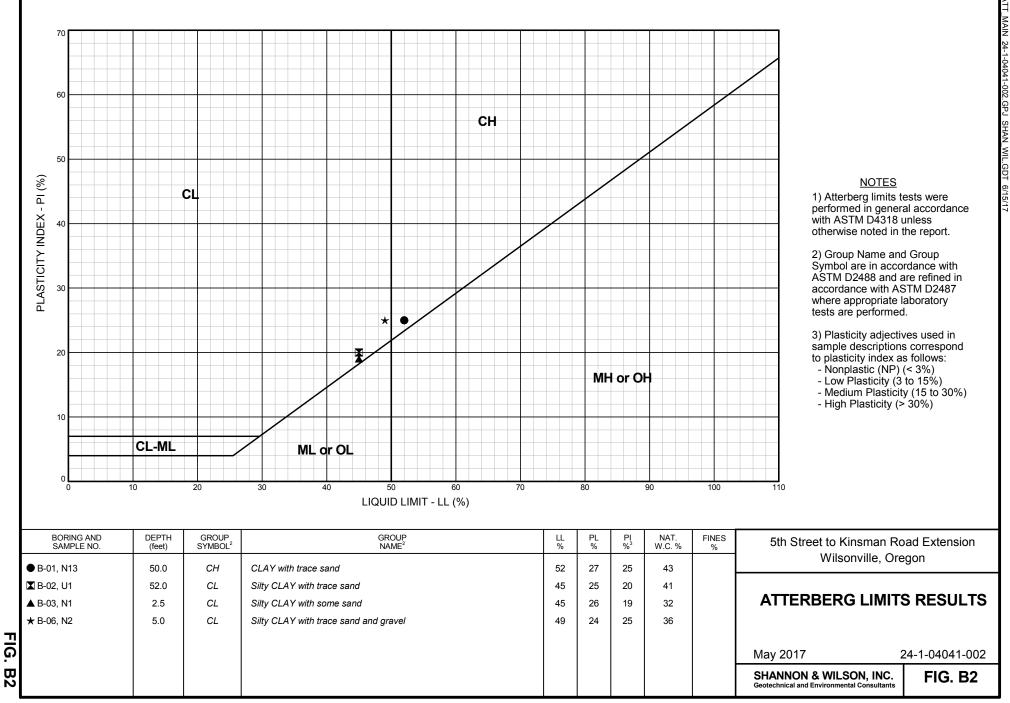
SHANNON & WILSON, INC.

# ATTACHMENT B

# LABORATORY TEST RESULTS







SHANNON & WILSON, INC.

# ATTACHMENT C

# IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

24-1-04041-002

Attachment to and part of Report 24-1-04041-002



Date: June 16, 2017

To: Allen Hendy, PE Otak

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

#### CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

#### THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

#### SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

#### MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

#### A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

#### THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

#### BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimation always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

#### READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland