



## King County

### Road Services Division

Materials Laboratory

Department of Transportation

RSD-TR-0100

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www.metrokc.gov/roads

April 18, 2013

TO: Rachel Berryessa, P.E., Senior Engineer, Capital Services Unit,  
Stormwater Services, Water and Land Resources Division, KCDNRP

VIA: <sup>all</sup> Alan D. Corwin, P.E., Materials Engineer, Materials Laboratory,  
Traffic and Engineering Services Section, Road Services Division, KCDOT

FM: <sup>D&W</sup> Doug Walters, P.E., Senior Engineer, Materials Laboratory  
Traffic and Engineering Services Section, Road Services Division, KCDOT

RE: **Fairwood 11 Culvert Replacement 2: Project #1117559**

## BACKGROUND

As requested, we have completed our subsurface investigation associated with the Fairwood 11 Culvert Replacement 2 Project. The existing 48" diameter CMP to be replaced is approximately 150 feet in length. The purpose of this memorandum is to evaluate the site-specific soil and groundwater conditions in order to aid in the design and construction of the new culvert. The general project location is shown on the Vicinity Map, Figure 1, following the conclusion of the written text.

## SUBSURFACE CONDITIONS

### Geologic Map Review

We reviewed the March 2007 Geologic Map of King County compiled by D.B. Booth, K.A. Troost, and A. P. Wisher. This map was provided online by the Pacific Northwest Center for Geologic Mapping Studies in a scale of 1:100,000. Vashon glacial till and wetland deposits were identified as the predominant surficial geologic units in the general project area. A brief description of the mapped units is as follows:

### Pleistocene: Vashon Stade of Fraser Glaciation Deposits

***Vashon glacial till (Qvt):*** Vashon glacial till deposits generally consist of a thin blanket of ablation till ranging from two to ten feet in thickness overlying a much thicker layer of denser lodgment till. Ablation till is chiefly comprised of a loose to medium dense, unsorted mixture of sand, silt, clay, and gravel, deposited by the

retreating glacier. Lodgment till, commonly referred to as “hardpan,” is similar in composition to the ablation till. However, it is much denser since the material was deposited in front of, and overridden by, the advancing glacier.

### **Holocene Postglacial Deposits**

***Wetland Deposits (Qw):*** Very soft to medium stiff and very loose to medium dense peat and alluvium or organic rich sediment, poorly drained and intermittently wet. Wetland deposits range from 1 to 22 feet in thickness with layers often 7 to 11 feet in thickness.

### **Geotechnical Drilling**

Four borings were drilled to depths ranging from 21.5 to 24 feet utilizing a Diedrich B-50 track mounted drill with hollow stem auger. Standard Penetration Tests (SPT) were taken at 2.5 foot intervals as each boring was advanced. The SPT provides a measure of compaction or relative density of granular soils, and consistency or stiffness of cohesive fine-grained soils. Representative soil samples were collected and returned to our laboratory for identification. No laboratory testing was performed at this time. However, soil samples will be stored in sealed plastic bags for later testing if requested. Approximate boring locations are shown in Figure 2 followed by copies of the borehole logs (Plates 1 through 4).

#### ***Boring B-1***

In B-1, very loose to loose sandy silt fill was encountered to a depth of approximately 9 feet. Below the sandy silt, very loose organic silt intermixed with fibrous peat fill was observed to 13 feet. From 13 feet, loose to dense silty sand was found to the termination depth of the boring at 21.5 feet. Groundwater was observed in the boring at 9 feet below the ground surface at the time of drilling.

#### ***Boring B-2***

In B-2, loose to medium dense sandy silt fill was observed to a depth of 10 feet. Underlying the sandy silt, very loose organic silt intermixed with fibrous peat fill was encountered to 18 feet. From 18 feet, medium dense silty sand was found to the termination depth of the boring at 21.5 feet. Groundwater was observed in the boring at 8 feet below the ground surface at the time of drilling.

#### ***Boring B-3***

In B-3, medium dense silty sand to sandy silty fill was encountered to a depth of approximately 7.5 feet. At 7.5 feet, we observed very loose organic silt intermixed with peat fill to a depth of 11 feet. Below the fill, medium dense to dense silty sand was found to the termination depth of the boring at 21.5 feet. Groundwater was observed in the boring at 11 feet below the ground surface at the time of drilling.

**Boring B-4**

In B-4, medium dense silty sand fill was encountered to a depth of approximately 10.0 feet. Underlying the silty sand, very loose organic silt and fibrous peat fill was observed to a depth of 20 feet. Below 20 feet, very loose to dense silt to sandy silt was found to the termination depth of the boring at 24.0 feet. Groundwater was observed in the boring at 20 feet below the ground surface at the time of drilling.

**RECOMMENDATIONS AND CONCLUSIONS**

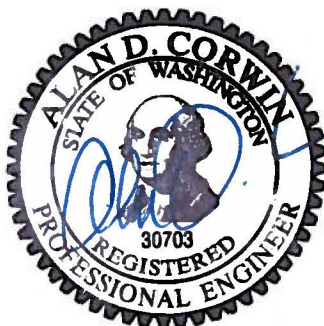
**Backfill**

Based on our subsurface investigation, in general, we encountered very loose sandy silt and organic fill soils to the approximate invert depths of the existing culvert. In our opinion, due to the high moisture and organic content of these fill soils, we would recommend against their reuse during replacement of the existing culvert. We instead recommend backfilling the new culvert with reasonably well graded Common Borrow as specified in WSDOT 9-03.14(3). We further recommend specifying the Common Borrow contain gravel no larger than 4 inches in diameter with a maximum 30 percent fines passing the number 200 sieve. Pipe zone backfill shall be placed in 8 inch maximum loose lifts and compacted to a minimum 90% of the maximum dry density. All compaction shall be in accordance with the Compaction Control Test of Section 2-03.3(14)D.

We trust this report meets your current request. Please call Doug Walters at 206-296-7708, or Alan Corwin at 206-296-7711, if you have any questions or if we may be of further assistance.

Sincerely,

King County Materials Laboratory

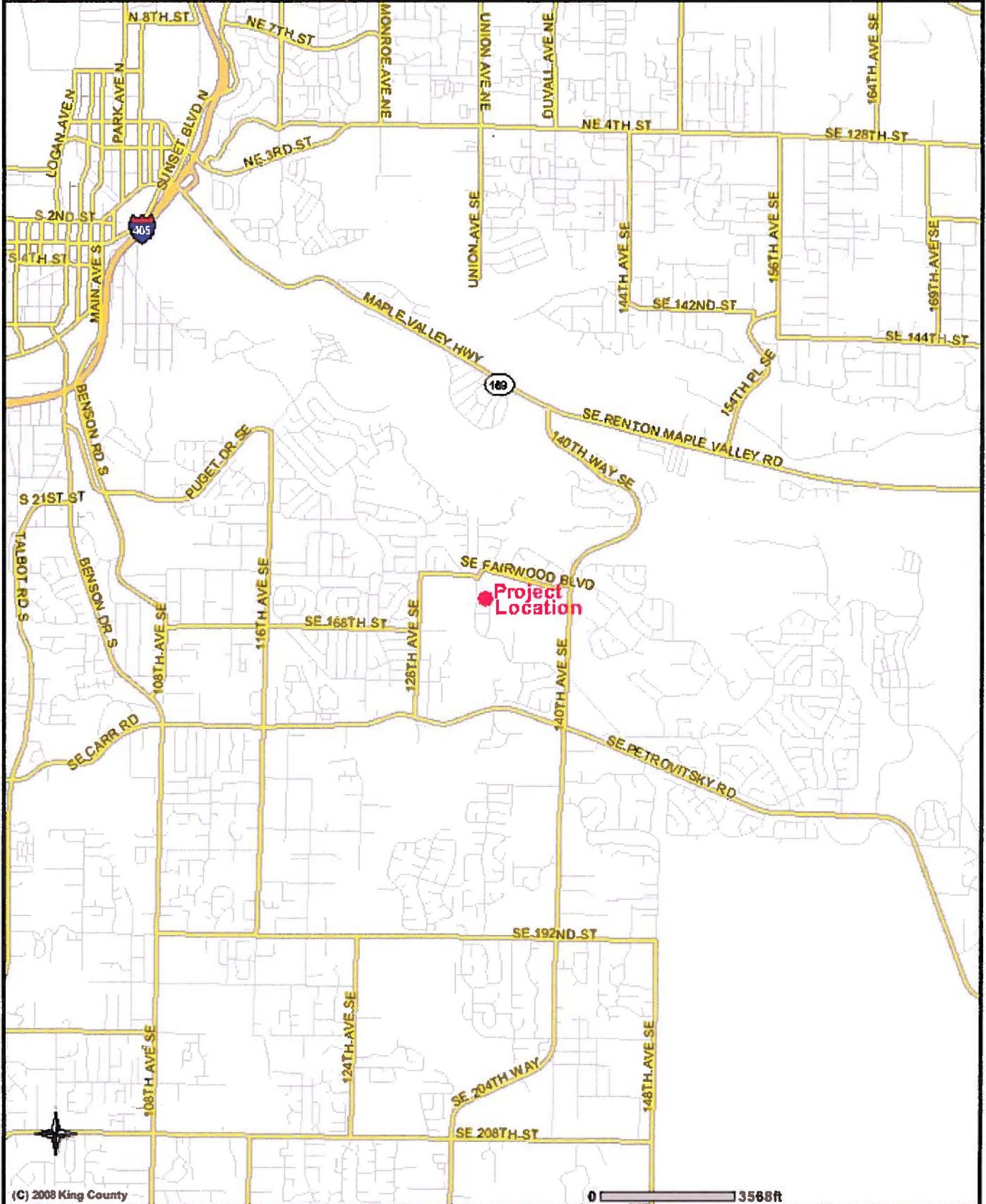


4/18/13

exp: 01/17/15

Alan D. Corwin, P.E.  
King County Materials Engineer

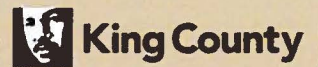
# Figure 1: Fairwood 11 Vicinity Map



(C) 2008 King County

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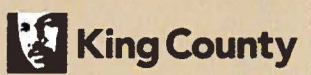
# Figure 2: Fairwood 11 Boring Locations



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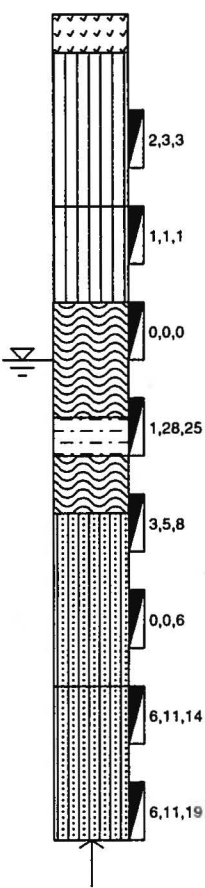
# BORING LOG

## BORING B-1

PROJECT: Fairwood 11 Culvert Replacement  
 BORING LOCATION: Fairwood Division 11 (see location map)  
 BORING METHOD: Hollow Stem Auger  
 DRILLER: Holocene Drilling  
 DEPTH TO - Water: 9'

DATE: 2/7/2013  
 START: 2/7/2013  
 FINISH: 2/7/2013  
 LOGGER: DW  
 DATE CHECKED: N/A

Caving: N/A

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
100 0			Dark brown silty sand to sandy silt, scattered organics and roots, wet, loose.			
	2,3,3	ML	Brown to gray sandy silt, scattered organics, mottled, wet, loose. (fill)			
95 5	1,1,1	ML	Brown sandy silt, scattered organics, mottled, wet, very loose. (fill)			
	0,0,0	OL	Dark brown organic silt intermixed with fibrous peat, wet, very loose.			
90 10	1,28,25		Wood debris			Sampler driven on log.
	3,5,8	OL	Dark brown organic silt intermixed with fibrous peat, wet, very loose. (fill?)			
	0,0,6	SM	Gray silty sand, trace gravel, wet, loose to medium dense. (fill?)			
85 15	6,11,14	SM	Gray silty sand to sandy silt, trace gravel, wet, medium dense to dense.			
80 20	6,11,19					
75 25						
70 30						
65 35						

Groundwater was encountered at 9 feet below the ground surface during drilling.

# BORING LOG BORING B-2

**PROJECT: Fairwood 11 Culvert Replacement**  
**BORING LOCATION: Fairwood Division 11 (see location map)**  
**BORING METHOD: Hollow Stem Auger**  
**DRILLER: Holocene Drilling**  
**DEPTH TO - Water: 8'**

**DATE: 2/7/2013**  
**START: 2/7/2013**  
**FINISH: 2/7/2013**  
**LOGGER: DW**  
**DATE CHECKED: N/A**

Caving: **N/A**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
100 0  95 5  90 10  85 15  80 20  75 25  70 30  65 35		ML  ML  OL  SM	Dark brown silty sand to sandy silt, scattered organics and roots, wet, loose.  Gray to brown sandy silt, scattered organics, trace wood debris, mottled, wet, medium dense. (fill)  Gray sandy silt, trace organics and wood debris, disturbed, wet, loose to medium dense. (fill)  Dark brown organic silt intermixed with fibrous peat, wet, very loose. (fill?)  Gray silty sand to poorly graded sand with silt, trace gravel, wet, medium dense.			

Groundwater was encountered at 8 feet below the ground surface during drilling.

# BORING LOG

## BORING B-3

PROJECT: **Fairwood 11 Culvert Replacement**  
 BORING LOCATION: **Fairwood Division 11 (see location map)**  
 BORING METHOD: **Hollow Stem Auger**  
 DRILLER: **Holocene Drilling**  
 DEPTH TO - Water: **11'**

DATE: **2/7/2013**  
 START: **2/7/2013**  
 FINISH: **2/7/2013**  
 LOGGER: **DW**  
 DATE CHECKED: **N/A**

Caving: **N/A**

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
100 0  95 5  90 10  85 15  80 20  75 25  70 30  65 35		  SM  ML  OL  SM	Sod/Spalls/Topsoil  Brown silty sand, scattered gravel, trace organics, disturbed, wet, medium dense. (fill)  Dark brown sandy silt, trace peat, mottled, wet, medium dense. (fill)  Dark brown organic silt, scattered intermixed peat, wet, very loose to loose. (fill?)  Gray silty sand, trace gravel, iron stained, wet, medium dense to dense.			  Rock in tip of sampler, blow count maybe overstated.

*Groundwater was encountered at 11 feet below the ground surface during drilling.*

PLATE NUMBER 3



# BORING LOG

## BORING B-4

**PROJECT: Fairwood 11 Culvert Replacement**  
**BORING LOCATION: Fairwood Division 11 (see location map)**  
**BORING METHOD: Hollow Stem Auger**  
**DRILLER: Holocene Drilling**  
**DEPTH TO - Water: 20'**

**DATE: 2/7/2013**  
**START: 2/7/2013**  
**FINISH: 2/7/2013**  
**LOGGER: DW**  
**DATE CHECKED: N/A**

Caving: N/A

ELEVATION/ DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Moist (%)	-200 (%)	Remarks
100 0			Sod/Topsoil			
		SM	Brown silty sand, scattered gravel, trace organics, mottled, wet, medium dense. (fill)			
95 5		SM	Gray silty sand with trace gravel, disturbed, wet, medium dense. (fill)			
		SM	Brown silty sand, scattered gravel, trace organics, mottled, wet, medium dense. (fill)			
90 10		OL	Dark brown organic silt intermixed with silty sand, disturbed, wet, loose. (fill)			
			Dark brown fibrous peat intermixed with organic silt, wet, very loose. (fill?)			
85 15		OL	Dark brown organic silty intermixed with fibrous peat, wet, very loose. (fill?)			
80 20		ML	Gray silt, wet, very soft. (low plasticity)			
	SM	Gray silty sand, wet, dense.				
75 25						
70 30						
65 35						

Groundwater was encountered at 20 feet below the ground surface during drilling.

# KEY TO SYMBOLS

Symbol Description

## Strata symbols



Topsoil



Silt



Low plasticity  
organic silts



Log



Silty sand



Peat

## Misc. Symbols



Water table during  
drilling



End of boring

## Soil Samplers



Standard penetration test

## Notes:

1. B-1 through B-4 were drilled on 2/7/2013 using a track mounted Diedrich D50 drill equipped with hollow stem auger.
2. An elevation of 100 feet was chosen for logging purposes and do not reflect actual site elevations.
3. These logs are subject to the limitations, conclusions, and recommendations in this report.