



November 27, 2017

Ms. Laura Cooper  
SPS Parks Planner  
802 SE North Bend Way  
North Bend, WA 98045

Subject: Geotechnical Engineering Study  
Proposed Raging River Trailhead Project  
King County, Washington

Dear Ms. Cooper

This report presents the geotechnical engineering study completed for the proposed Raging River Trailhead Project located west of Snoqualmie Point Park and the city limits of North Bend, Washington. This report satisfies the King County requirements for a Soils Report for the proposed infiltration designs and provides conclusions and recommendations for the site grading, earthwork, retaining walls and pavements.

### **Project Description**

The Raging River Trailhead Project proposes to construct an additional parking lot and driveway adjacent to the US Forest Service Rattlesnake Mountain Trailhead parking lot. The project is located off Winery Road, approximately ½ mile south of Interstate 90 in King County. The site lies predominately within the NE ¼ of Section 1, T23N R07E with the eastern edge on the North/South Section line and the USFS boundary (Figure 1 – Vicinity Map).

The proposed paved lot will add approximately 68 paved parking spaces, a 28 ft by 40 ft covered shelter, a kiosk and a double vaulted latrine restroom. The proposed grading will require disturbance to approximately 1.3 acres. The proposed paved surface grades to the northwest at 4% with elevations ranging from a high of 1070 to a low of 1063 ft MSL. Conceptually, the desire is to balance the earthwork and reduce the amount of material that is imported for the project. As such, the proposed layout reflects a cut of about 15 ft at the southeast corner where the ground surface is the highest and embankment fills of 6 to 8 ft along the western side of the proposed lot. The middle of the proposed project is near grade. The proposed layout and design rely on dispersion and infiltration into the native soil. The proposed site layout is provided on Figure 2 – Proposed Grading and Drainage Plan.

### **Site Description**

The site is currently undeveloped and forested and is primarily access from gated Department of Natural Resource (DNR) mainline gravel road (P-800). From the existing Rattlesnake Mountain Trailhead parking, the grades gradually rises on a 33% to a high elevation of 1086 ft MSL. From this high point, the grade falls to the northwest at approximately 11%. There is a gully drainage feature west of the site that parallels the gravel surface mainline road to Winery Road. No standing water or distress slopes were observed within the vicinity of the project.

### **Field Investigation**

Seven exploratory test pits were excavated and examined on November 7, 2017. These were excavated to depth of approximately 4.5 ft using a Kubota Mini-Excavator. The holes were logged by a geologist and geotechnical engineer from DNR. Representative samples of the strata were collected from the sidewalls and noted on the field test pit logs. The test pit logs are provided in Appendix A.

Soil materials were classified in the field in general accordance with ASTM D2488 based on the Unified Soil Classification System (USCS). Bulk samples of the materials were collected from the bottom of the test pits for laboratory testing. The test pits were backfilled once the material was logged and testing was completed. .

### **Laboratory Testing**

Laboratory testing was conducted on representative samples collected from the test pit investigation. Tests were conducted under contract with the Washington Department of Transportation (WSDOT) Materials Laboratory. Tests included moisture content and sieve analysis. The moisture content results are provided in Table 1.0. Results of the sieve analysis are provided as Figure 3 and 4. The laboratory test sheets are provided in Appendix B

### **Site Conditions**

The test pits excavated across the site revealed similar subsurface conditions. The following paragraph provides a general description of the materials encountered.

#### **Subsurface**

The topsoil or duff layered varied from a depth of 6 to 20 inches. Generally, the duff layer or organic matter, accounted for the first 12 inches. This material was generally stripped prior to starting the excavation into underlying mineral soil. This organic layer was moist, consisting of highly decomposed fine matting of needles, leaves and other organic material. Below this layer was a dark brown silt with rootlet varying from ¼ to 1” in diameter. This was considered the TOPSOIL layer.

Below the TOPOIL was a 1 to 2.0 foot layer of dark brown SANDY SILT (ML). This is considered the B horizon of the soil profile. The material was damp to moist with a moisture content at the time of the investigation of 22 percent by weight. This layer had ¼” rootlets with an occasional rounded 1” gravels. Mottling was observed in this layer (TP-2, 4).

Beneath the SANDY SILT was a POORLY GRADED GRAVEL (GP) and SAND with silt (SM). The GP materials were slightly cemented and found near the southeast corner of the site

(higher elevation). These materials were found to have less than 12 percent fines so they are dual classified as GP-GM and SP-SM. The moisture content was 5 to 12 percent. The materials with more gravels tended to have a lower retained moisture content. The test pit logs are provided in Appendix A. Mottling and rootlets were also observed in this layer (TP-3, 4, 5, 6, 7) this layer.

The Natural Resources Conservation Service (NRCS) Soil Survey of Snoqualmie Pass Area, Washington lists the soil map unit as Tokul gravelly medial loam grading with depth to a gravelly medial fine sandy loam. As reflected in the test pits, 3 to 10 inch gravels can be anticipated at depths of 2 to 3 ft below the ground surface.

### **Groundwater**

The depth to the permanent groundwater level, based on nearby water wells, is greater than 100 ft. (USGS, 1995). Mounding of the water table due to infiltration from the site is not expected.

### **Infiltration Testing**

Two small scale pilot infiltration tests (PITs) were conducted to evaluate the infiltration at the site. Test Pits 2 and 6 were selected as being representative of the soil materials encountered across the site. Furthermore, these two locations had a completed pit depth that was near the proposed grade of the infiltration facilities and were stable, safe slopes for conducting the testing. The infiltration tests were conducted in general accordance with Appendix C the 2016 King County Surface Water Design Manual (KCSWM, 2016).

All of the test pits were excavated and logged prior to conducting the infiltration tests. No restrictive layers or indications of seasonal high groundwater were encountered in the test pit excavations. However, a hardpan layer of cobbles, as previously described, was encountered in Test Pit 1. This layer will likely be excavated during the construction and thus is not anticipated to be a barrier.

The base of the excavation in both Test Pits were 3 ft by 4 ft or 12 sq ft with depths of 4.5 feet below ground surface (BGS). A water truck and a portable tank with a pump were used to convey water to pits and maintain a water depth of at least 12 inches for the required pre-soak period. Generally, the flowrate stabilized within the first few hours and water was continually added to maintain the 12 inches during the six hour soaking period.

At the conclusion of the soaking period, a steady-state test was conducted and water was introduced to match the infiltration while maintaining a column of water of 12 inches. Flow rates were measured at 13.4 and 17 inches/hour. The lowest measured steady state infiltration rate ( $I_{\text{measured}}$ ) was used in the below equation.

The simplified method was used to determine the design infiltration rate for the project. Equation 5.11 from the manual is the following:

$$I_{design} = I_{measured} \times F_{testing} \times F_{geometry} \times F_{plugging} \quad (5-11)$$

Where  $F_{testing}=0.5$  for a small scale PIT test,  $F_{geometry}=1.0$  and  $F_{plugging}=0.9$  for medium sands. Thus,  $I_{design}=6$  inches/hour.

### **Conclusions and Recommendations**

The test pits excavated within the proposed footprint of the project revealed a Topsoil and Duff layer varying in from 8 inches to 20 inches. This material is not suitable for embankments and should be removed and re-used as topsoil once the earthwork is completed. Below this depth is a dark brown SANDY SILT (ML) with fine rootlets this material is not suitable under the pavement due to the organics and should be limited to the exterior fill slopes or used as a topsoil layer on the finished earth slopes. Coarse gravels and medium to fine sands (GP-GM, SM) were encountered at a 2 to 3 ft below the ground surface. This material is suitable for the embankments and infiltration. The recommended infiltration rate is 6 inches/hour.

#### **Earthwork**

Soils excavated from the site should be compacted in loose lifts not exceeded 12 inches to a density of 95% of Standard Proctor (ASTM D698). Gravels and boulders larger than 12 inches may be encountered and should be separated and used as fill outside of the pavement and where the fill depth is greater than 3 ft. Cut and Fill slopes should not exceed a 2 (horizontal) to 1 (vertical). However, it may be desirable to use a 3:1 slopes for establishing vegetation. It should be noted that the cut slopes in the adjacent parking areas are 3:1.

Erosion control measures should be put in place before the clearing and excavation are started. Some of the trees are to remain and should be clearly marked and fenced. Silt fencing should be placed below the fill slopes. Cut slopes and stockpiles should be covered during wet weather. Temporary erosion control measures such as hydro seeding may be required and will also depend upon the weather conditions at the time of construction.

No significant structures are planned at the site. Spread footings or slabs on grade are acceptable for the building foundations using an allowable bearing capacity of 2,000 pounds per square foot (PSF) (IBC, 2015).

#### **Drainage**

Infiltration and dispersion of runoff is feasible at the site. As discussed above, the design infiltration rate is 6 inches/hour. Any storm water channels constructed should be no steeper than a 6% gradient to reduce erosion.

#### **Rockerries/Retaining Walls**

The proposed project plan incorporates a rockery wall along the southwestern corner. The rockery is being used to protect trees and retain the driveway/parking. The walls should be limited to 6 ft in height and utilize a 24-36 inch flat angular rock at the base. The wall should

have a batter of less than 1(horizontal):6(vertical). The maximum void between adjacent rocks shall be less than 6 inches with tolerances in accordance with WSDOT Standard Specifications M41-18 Section 8-24. A typical detail of the rockery wall is provided as Figure 5.

#### Pavements

The pavement section may be sported on compacted subgrade or remolded native material below the topsoil layer. Pavement section consists of 2 inches of ½ inch Hot Mix Asphaltic Concrete (HMAC) over 8 inches of 1 ¼ inch Crushed Aggregate Base.

#### Limitations

The conclusions and recommendations contained in this report are based on the soil conditions at the time of the explorations. Based on our reconnaissance of the site and research we assume that the subsurface conditions encountered in the test pits are representative of the project site. If the subsurface conditions encountered are significantly different from those observed in our explorations, we should be notified at once so we review these conditions and our recommendations.

This report was prepared for exclusive us of the Washington Department of Natural Resources, and their representatives for the specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practices. No warranty is expressed or implied.

Please contact me if you have any questions regarding this report.

Sincerely,



Tom Szymonak, PE  
Natural Resource Engineer  
Forest Roads Division



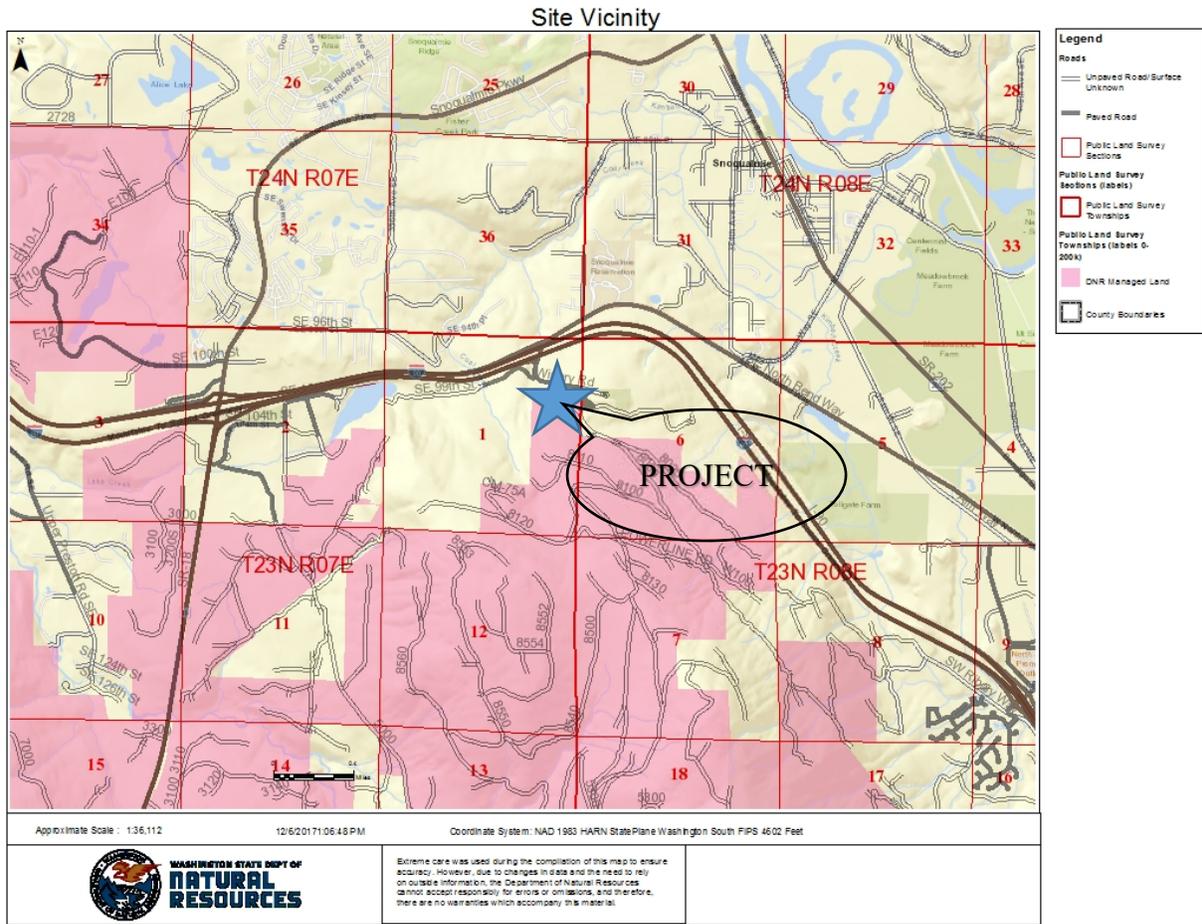
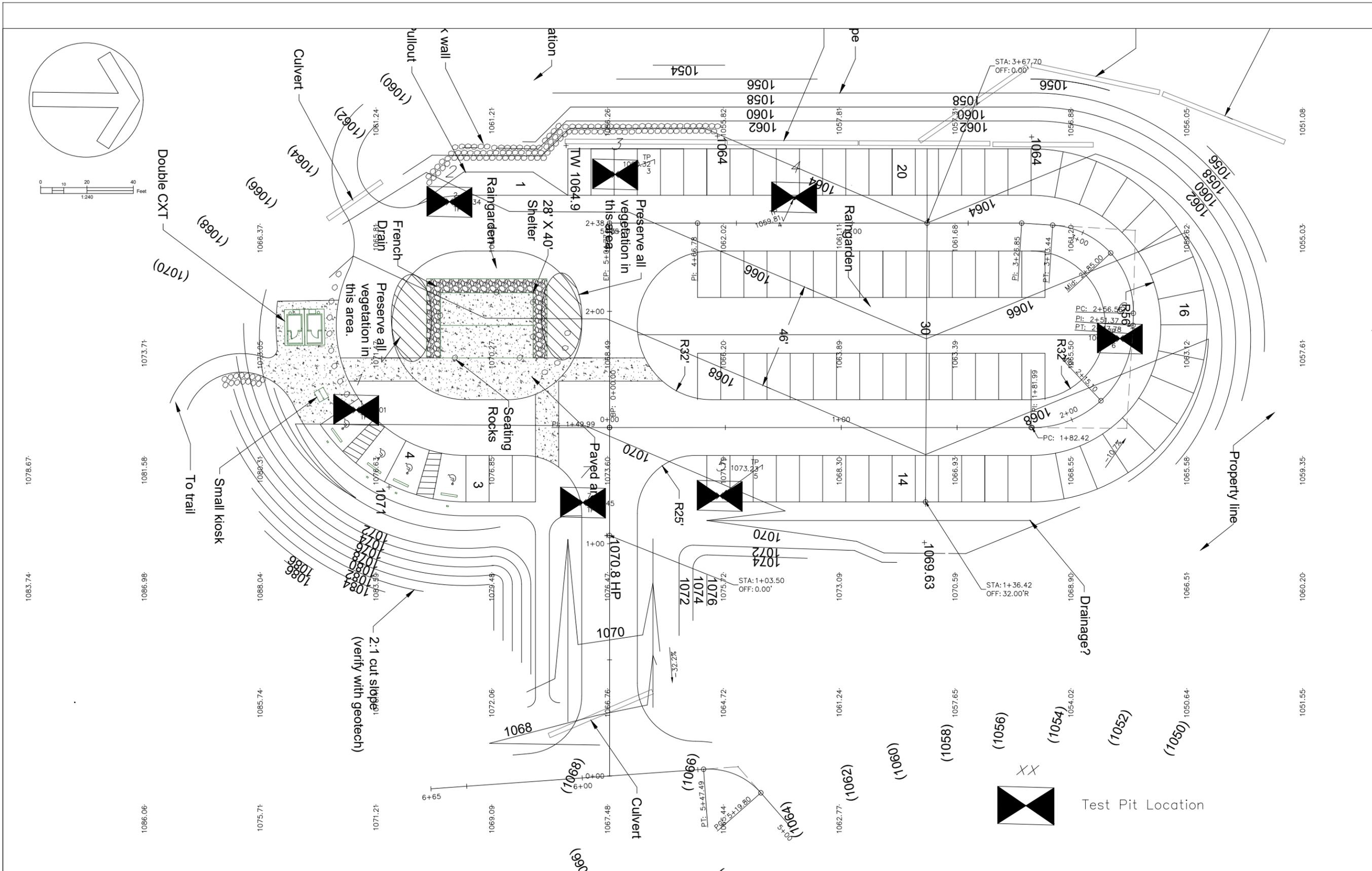
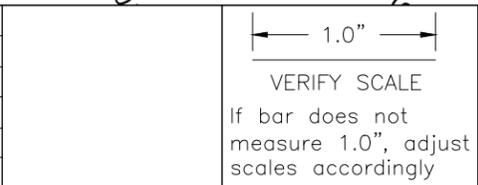


Figure 1- Site Vicinity Map



DESIGN BY:	Final
DRAWN BY:	T. Szymoniak
CHECKED BY:	
DATE:	9/22/17

NO.	REVISION DESCRIPTION	DATE	BY



Raging River TrailHead	SHEET 1
	OF 1
Test Pit Locations	



Figure 3- Soil Gradation

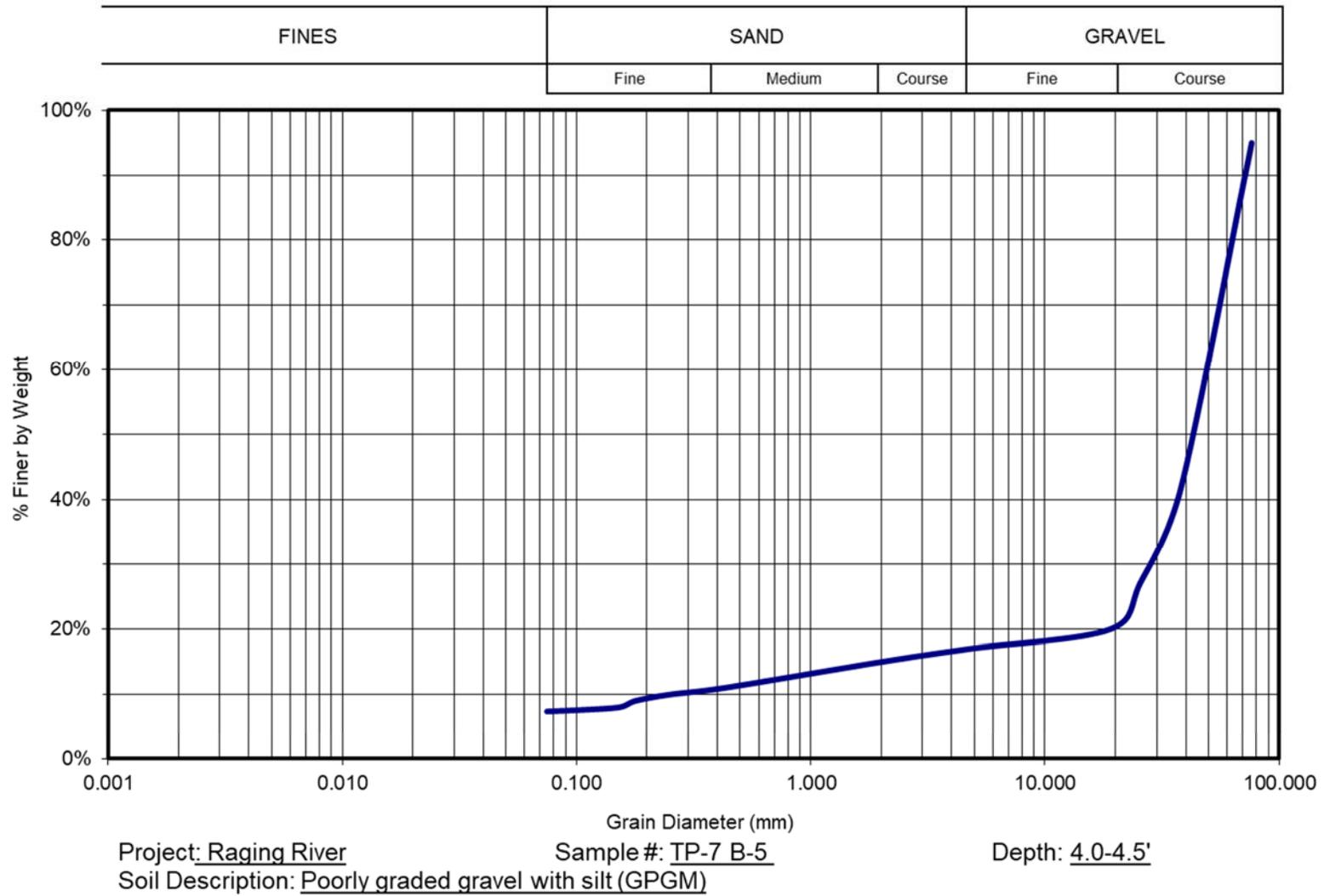


Figure 4 Soil Gradation



*Table 1- Moisture Content*

Test Pit #	Sample #	Depth	%
TP-2	S-1	0.5	24
TP-2	S-2	2.5	15
TP-5	S-11	4.0	5
TP-6	S-3	0.5	21
TP-6	S-4	3.0	12
TP-6	S-14	6.0	24
TP-7	S-13	2.5	12

## **Appendix A – Test Pit Logs**

## Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** T.Szymoniak **Test Pit Number:** TP-1

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 10% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'	TOPSOIL; dk brown, firm, occasional rounded to sub-rounded 1" to 2" gravels; damp to moist		S-1	1"-2" Rootlets
1.0'	SANDY SILT w/gravels; dk brown, firm, rounded 1" gravels, moist	ML	S-2	
2.5'	SILTY GRAVEL w/sand; lt. grey, cemented, v. hard; 2" - 4" rounded gravels	GM	S-3	difficult to dig with mini-excavator; hardpan
3.0'	Bottom of test pit @ 3.0' No freewater encountered and no caving observed during excavation			

### Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** S. Wisheart **Test Pit Number:** TP-2

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 3% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'	TOPSOIL; dk brown, very soft, homogeneous, damp			1/2 - 1/4" rootlets, occasional rounded cobbles and some rounded gravels
0.5'	SANDY SILT; dk brown, soft, homogenous, damp			1/4" rootlets, subrounded to rounded cobble (5-10% by vol.), some fine sand, occl mottles, tv=0.25 tsf
1.8'	SILTY SAND; yellowish brown to gray, med-dense, damp	ML	S-1	
			S-2	tv=2.0 tsf @2'
5.0'			B-1	tv=2.0 tsf @3'
6.0'			S-3	
	Bottom of test pit @ 6.0' No freewater encountered and no caving observed during excavation			test pit converted to infiltration testing

## Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** S. Wisheart **Test Pit Number:** TP-3

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 5% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'				
1.6'	TOPSOIL; dk brown, very soft, homogeneous, dry to damp		S-7	1/4" - 1" rootlets (40% by vol.), subrounded to some rounded gravels; trace fine sand tv=2.0 tsf@1.0'
3.5'	SANDY SILT; med. brown, soft, homogenous, dry to damp	ML	S-8	1/4" rootlets with fine to med sand (20% by vol.), with fine to medium sand, subrounded to rounded cobbles and gravels, med brown, w/drk brown mottling by roots tv=2.0 tsf @2.5'
4.5'	SILTY SAND; gray brown, med-dense, dry-damp	SM	B-4	5% by vol. 1/4" rootlets, reddish brown mottling, occ. rounder gravel tv=1.5 tsf @4.0'
	Bottom of test pit @4.5' observed during excavation	No freewater encountered and no caving		

### Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** S. Wisheart **Test Pit Number:** TP-4

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 5% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'				
1.5'	TOPSOIL; dk brown, very soft, homogeneous, damp		S-5	1/4" - 1" rootlets (25% by vol.), occ. subrounded to some rounded cobbles and gravels; trace fine sand
3.0'	SANDY SILT; yellow brown to dk brown, very soft, homogenous, damp	ML	S-6	mottled, subrounded to rounded gravels and cobbles (5% by vol.)
4.5'	SILTY SAND; gray to med. brown, med-dense, damp	SM	B-3	gradational contact mottled orange-med brown on primarily gray matrix, few 1/4" rootlets, occ. subrounded gravel and cobbles
	Bottom of test pit @4.5' No freewater encountered and no caving observed during excavation			

## Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** S. Wisheart **Test Pit Number:** TP-5

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 5% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'				
	TOPSOIL; dk brown, very soft, homogeneous, dry to damp		S-9	1/4" - 1" rootlets (15% by vol.), subrounded to some rounded gravels (20% by vol.) trace fine sand and occ. rounded cobbles tv=2.0 tsf @1.2'
1.6'	SANDY SILT with gravel; med. brown, soft, homogenous, dry to damp	ML	S-10	1/4" rootlets with fine to med sand (20% by vol.), with fine to medium sand, subrounded to rounded cobbles and gravels, med brown, w/drk brown mottling by roots tv=3.25 tsf @2.5'
3.0'	POORLY GRADED GRAVEL with SAND; gray brown, dense, dry-damp	GP	S-11	1' to 3" subrounded cobbles (cobbles increase with depth), occ. 1/4 rootlet, mottled
4.5'	Bottom of test pit @4.5' No freewater encountered and no caving observed during excavation			

### Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** S. Wisheart **Test Pit Number:** TP-6

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 5% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'	TOPSOIL; dk brown, very soft, homogeneous, damp			1/4" - 1" rootlets
0.5'	SANDY SILT; yellow brown to orange brown, soft, damp	ML	S-3	1/4" rootlets (10% by vol.) 1/2" to 1" roots some, sub-rounded gravels and cobbles tv=2.25 tsf @1.0'
2.5'	SILTY SAND; gray w/ yellow to orange brown, mottles, med-dense, homogeneous, damp	SM	S-4  B-2	1/4" rootlets (25% by vol.), orange mottling, occ. sub-rounded cobbles tv=2.0 tsf @3.5'
6.0'	Bottom of test pit @6.0'		S-14	No freewater encountered and no caving observed during excavation

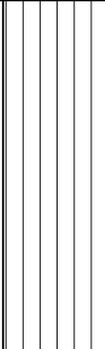
### Soil Test Pit Log

**Project:** Raging River Trailhead

**Location:** Winery Road

**Weather Conditions:** Partly Cloudy **Logged by:** S. Wisheart **Test Pit Number:** TP-7

**Method of Excavation:** Kubato KX 413V **Ground Surface Slope:** 5% **Date:** 11/7/17

DEPTH	SOIL CLASSIFICATION (COLOR, CONSISTENCY, STRUCTURE, DENSITY, MOISTURE)	USCS	SAMPLE #	REMARKS: (ORGANICS, MOTTLING etc)
0'				
1.3'	TOPSOIL; dk brown, very soft, homogeneous, dry to damp		S-12	1/4" - 1" rootlets (35% by vol.), subrounded to some rounded gravels (10% by vol.); 1" and 2" cobbles
3.0'	SANDY SILT with GRAVEL; med. brown, soft, homogenous, dry to damp	 ML	S-13	undulating contact 1/4" rootlets (25% by vol.), subrounded to rounded 1/2" to 1" gravels, tv=3.0 tsf @2.0'
4.5'	SILTY GRAVEL with SAND; gray to brown, med-dense, dry to damp	 GM	B-5	fine to med sand (15% by vol.), subrounded to rounded 5" cobbles, occ. 1/4" rootlets, some orange brown mottling
	Bottom of test pit @4.5'	No freewater encountered and no caving observed during excavation		

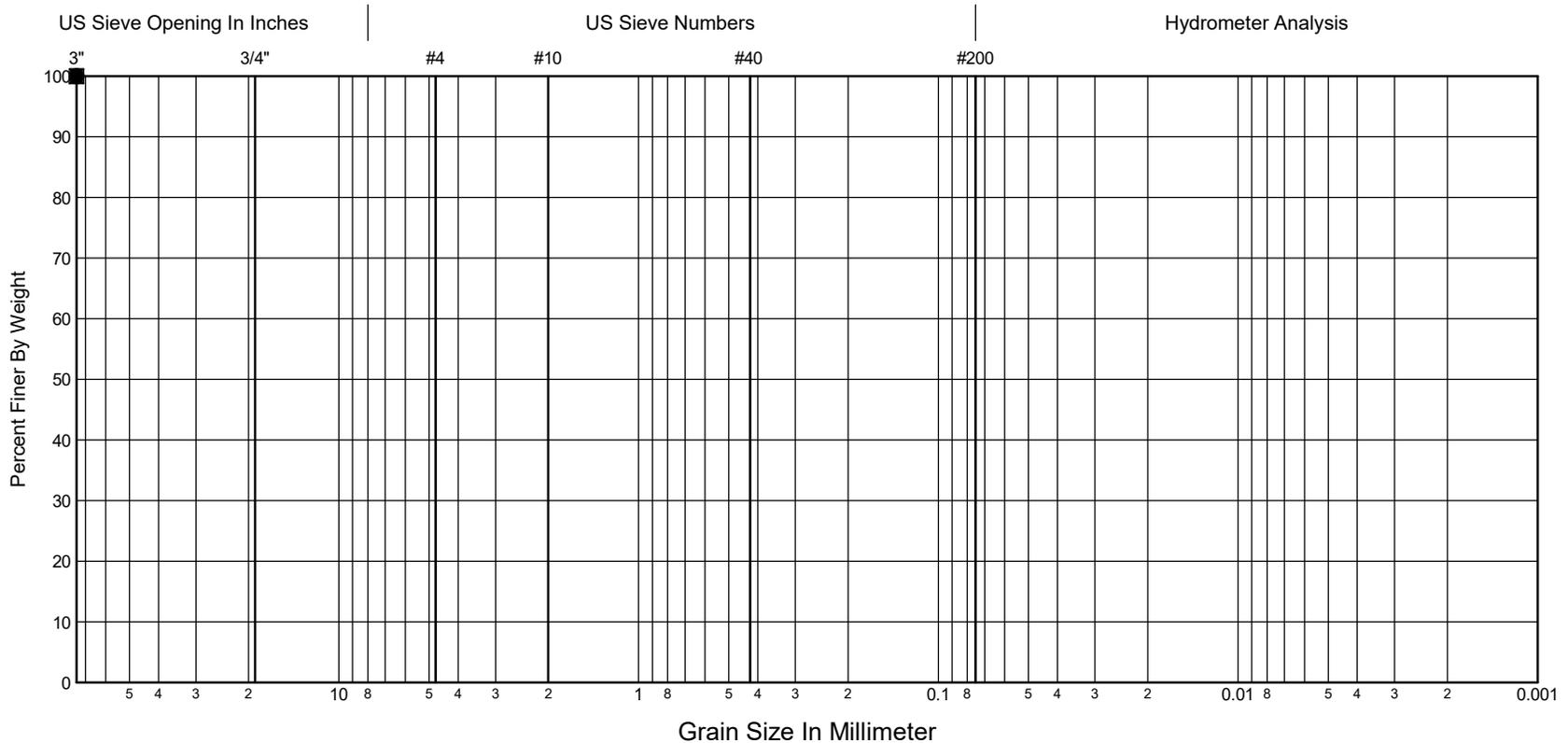
**Appendix B – Laboratory Tests.**

Job No. **NM-0078** Date **November 15, 2017**  
 Hole No. **TP-2** Sheet **1**  
 Project **DNR / Raging River Trailhead**

Laboratory Summary



Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft <sup>3</sup> )	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10	
● 0.0	S-1		MC Only	24																
☒ 2.5	S-2		MC Only	15																



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	

NM-0078 DNR RAGING RIVER TRAILHEAD.GPJ ENTERPRISE LIBRARY.GLB 11/15/17

Job No. **NM-0078**

Date **November 15, 2017**

Hole No. **TP-5**

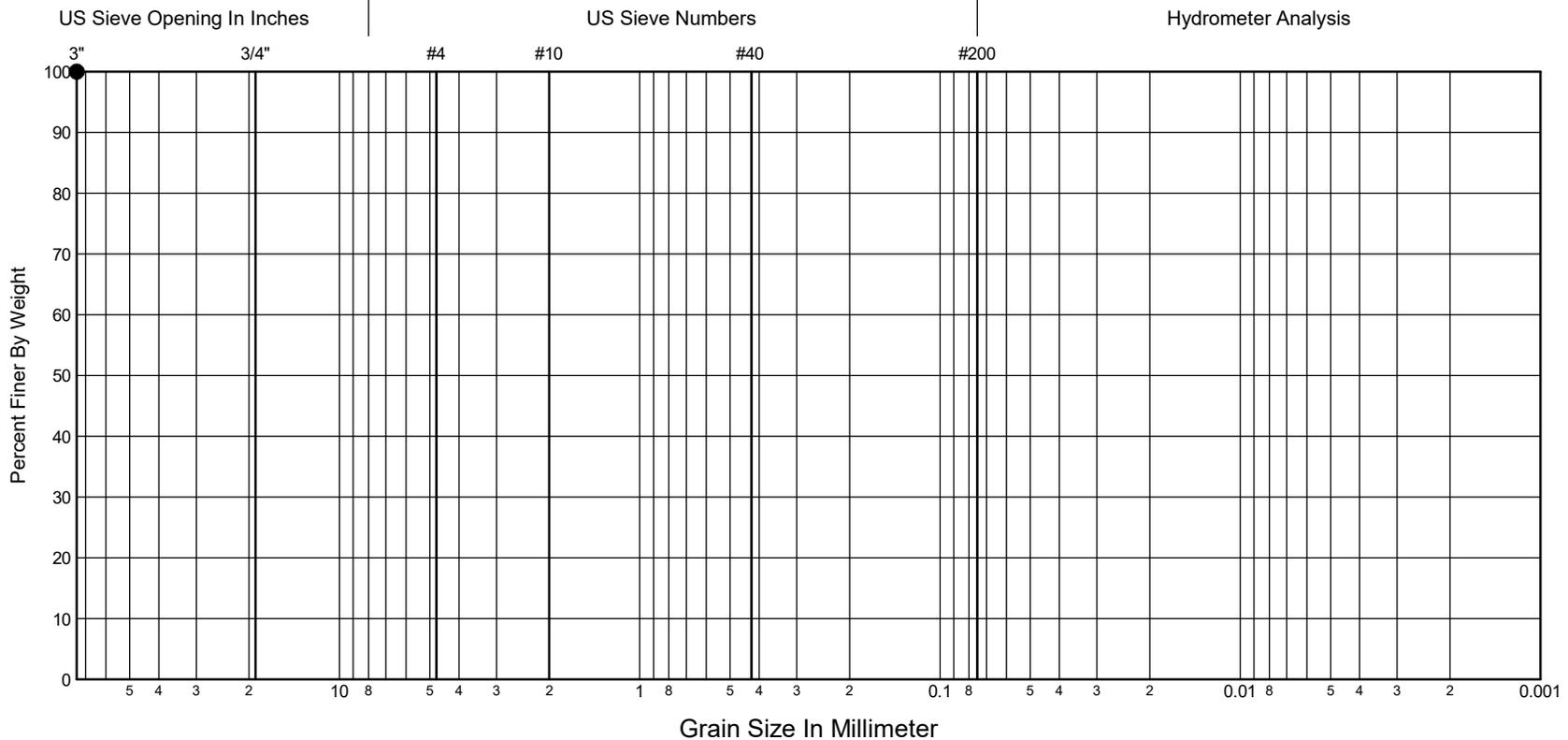
Sheet **1**

Laboratory Summary



Project **DNR / Raging River Trailhead**

Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft <sup>3</sup> )	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10	
● 4.0			MC Only	5																



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	

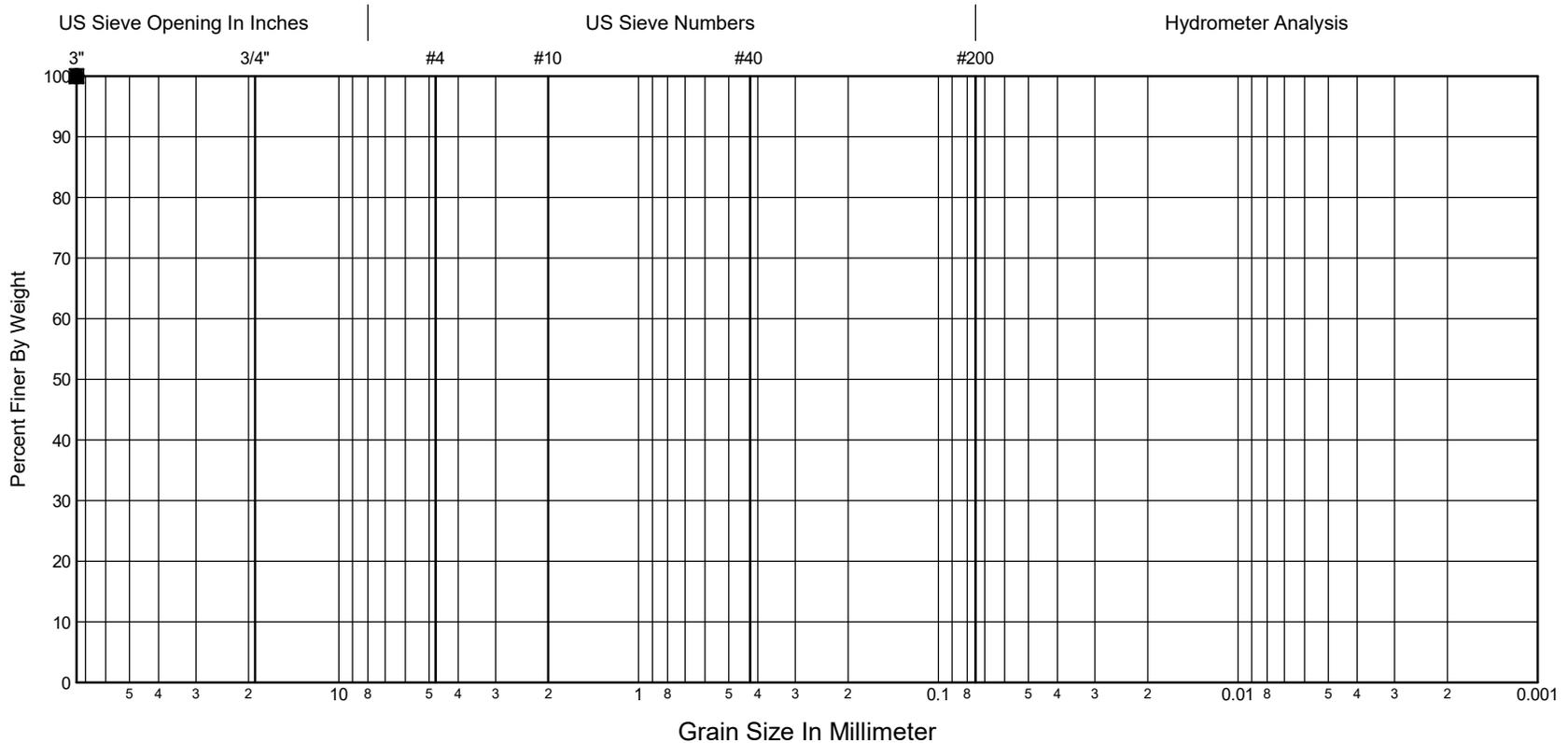
NM-0078 DNR RAGING RIVER TRAILHEAD.GPJ ENTERPRISE LIBRARY.GLB 11/15/17

Job No. **NM-0078** Date **November 15, 2017**  
 Hole No. **TP-6** Sheet **1**  
 Project **DNR / Raging River Trailhead**

Laboratory Summary



Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft <sup>3</sup> )	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10	
● 0.5			MC Only	21																
☒ 3.0			MC Only	12																
▲ 6.0			MC Only	24																



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	

NM-0078 DNR RAGING RIVER TRAILHEAD.GPJ ENTERPRISE LIBRARY.GLB 11/15/17

Job No. **NM-0078**

Date **November 15, 2017**

Hole No. **TP-7**

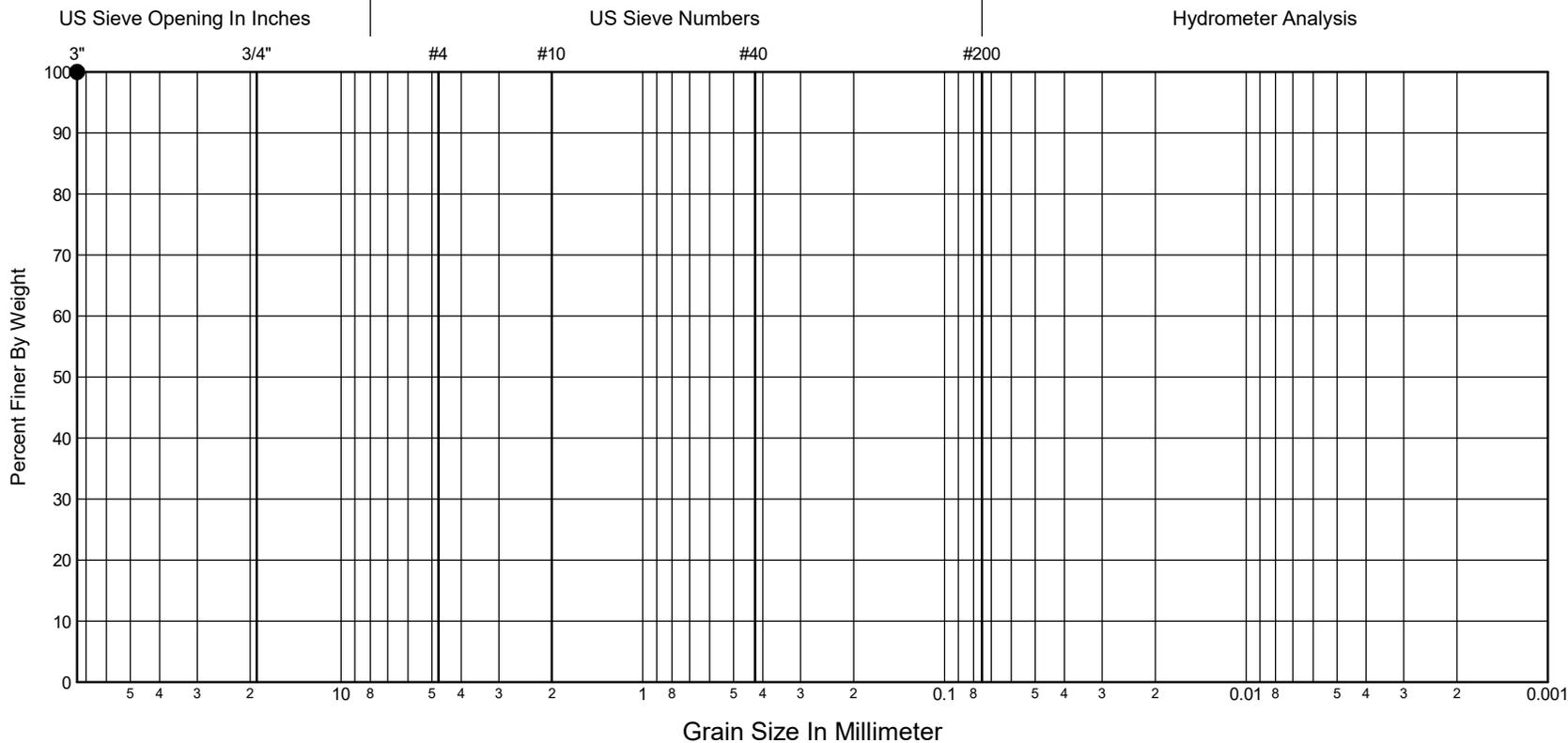
Sheet **1**

Laboratory Summary



Project **DNR / Raging River Trailhead**

Depth (ft)	Sample No.	USCS	Description	MC%	LL	PL	PI	Moist Density (lbs/ft <sup>3</sup> )	Specific Gravity	Gravel (%)	Sand (%)	Fines (%)	Cc	Cu	D60	D50	D30	D20	D10	
● 2.3			MC Only	12																



Gravel	Sand			Silt			Clay
	Coarse	Medium	Fine	Coarse	Medium	Fine	

NM-0078 DNR RAGING RIVER TRAILHEAD.GPJ ENTERPRISE LIBRARY.GLB 11/15/17

**Washington State Department of Transportation  
State Materials Laboratory  
PO Box 47365 Olympia WA 98504 / 1655 S. 2nd Ave Tumwater WA 98512  
Aggregate Test Report**

**Work Order :** NM0078

**Sample ID :** 000001222a6

**Section :** DNR / Raging River Trailhead

**Lab Number :** E0170035

**State Route No :**

**Bid Item No :**

**Project Engineer :** Tom Szymoniak

**Date Received :** 11/16/2017

**Org Code :** 412332

**Local Agency No :**

**Material :** Bag Sample for Gradation

**Pit No :** TP-6

**Supplier Name :**

**Date Sampled :** 11/09/2017

**Acceptance No :**

**Sampled By :** DNR

**IAS Sample No :** B-1

**Sampled At :** 4.0' to 4.5'

**Mix Design # :**

**Reported By :** HenderD

Sieves	Pct Passing	Spec Min	Spec Max
3 in	94		
1 1/2 in	93		
1 in	92		
3/4 in	92		
No. 4	90		
No. 10	88		
No. 40	46		
No. 60	22		
No. 80	14		
No. 100	11		
No. 200	7.3		

Test	Test Results	Spec Min	Spec Max
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**Result Code:** Informational

Kurt R. Williams, P.E.

**Remarks :** Moisture Content: 6.0%

State Materials Engineer

Tare: 4,415 grams

Garrett Webster By: \_\_\_\_\_

Wet Wt: 21,386 grams

Structural Material Testing Engineer

Dry Wt: 20,424 grams

Date : 11/29/2017

Phone : (360) 709-5446

**Billing Code**

T43B - 1

T44S - 1

**Washington State Department of Transportation  
State Materials Laboratory  
PO Box 47365 Olympia WA 98504 / 1655 S. 2nd Ave Tumwater WA 98512  
Aggregate Test Report**

**Work Order :** NM0078

**Sample ID :** 000001222a7

**Section :** DNR / Raging River Trailhead

**Lab Number :** E0170036

**State Route No :**

**Bid Item No :**

**Project Engineer :** Tom Szymoniak

**Date Received :** 11/16/2017

**Org Code :** 412332

**Local Agency No :**

**Material :** Bag Sample for Gradation

**Pit No :** TP-7

**Supplier Name :**

**Date Sampled :** 11/09/2017

**Acceptance No :**

**Sampled By :** DNR

**IAS Sample No :** B-5

**Sampled At :** 4.0' to 4.5'

**Mix Design # :**

**Reported By :** HenderD

Sieves	Pct Passing	Spec Min	Spec Max
3 in	95		
1 1/2 in	42		
1 in	27		
3/4 in	20		
No. 4	17		
No. 10	15		
No. 40	11		
No. 60	10		
No. 80	9		
No. 100	8		
No. 200	7.4		

Test	Test Results	Spec Min	Spec Max
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**Result Code:** Informational

Kurt R. Williams, P.E.

**Remarks :** Moisture Content: 2.0%

State Materials Engineer

Tare Wt: 4,433 grams

Garrett Webster By: \_\_\_\_\_

Wet Wt: 35,507 grams

Structural Material Testing Engineer

Dry Wt: 34,906 grams

Date : 11/29/2017

Phone : (360) 709-5446

**Billing Code**

T43B - 1

T44S - 1

## References

King County Department of Natural Resources and Parks, Surface Water Design Manual, April 24, 2016.

United States Geologic Survey, Groundwater Elevations in Alluvium and Vashon Recessional Outwash Aquifers East King County Groundwater Management Area, 1995.