Geotechnical Data Report

Tenas Creek Alluvial Fan Restoration Project

Skagit County, Washington



Prepared for:

Skagit River System Cooperative

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This report has been prepared under the direction of a Professional Engineer registered in the State of Washington.

Signature Date

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ACRONYMS

A	
AASHTO	American Association of State Highway and Transportation Officials
ASTM	ASTM International
B	
bgs	Below ground surface
D	
DNR	Department of Natural Resource
E	
EL	Elevation
F	
FEI	FEI Inspection and Testing, Inc.
ft	feet
G	
GDR	Geotechnical Data Report
K	
Ka	Kilo-annum
L	
LL	Liquid limit
M	
Ma	Mega-annum
mi	miles
mm/yr	Millimeter per year
mya	million years ago
N	
NAVD88	North American Vertical Datum of 1988
NF	National Forest
NSHM	National Seismic Hazard Mapping
P	
PI	Plasticity index
PL	Plastic limit
psf	Pound(s) per square foot
psi	Pound(s) per square inch
S	
SPT	Standard Penetration Test
SRSC	Skagit River System Cooperative
SS	Split-spoon sampler
s_u	Undrained shear strength
U	
UCS	Unconfined compressive strength
UCSC	Unified Soil Classification System
USFS	United States Forest Service
USGS	U.S. Geological Survey
W	
WSDOT	Washington State Department of Transportation
WSSC	Western States Soil Conservation

1.0 INTRODUCTION

Kleinschmidt Associates (Kleinschmidt) has been requested by Skagit River System Cooperative (SRSC) to provide engineering services for the Tenas Creek Alluvial Fan Process Restoration Project (project) along Suitable River Road (NF-26) in Skagit County, Washington. In addition to a feasibility study of two different alternatives, the engineering services included a geotechnical exploration program to explore subsurface conditions and to collect geotechnical data to support the final design. This Geotechnical Data Report (GDR) describes the geotechnical exploration program that was conducted at the project site and presents the geotechnical field data collected from the exploration program.

1.1 Project Description

Tenas Creek is one of nine important spawning tributaries for Suiattle River Spring Chinook Salmon and represents a high priority restoration opportunity. The SRSC performed a feasibility study and preliminary design to identify and evaluate roadway crossing and stream channel restoration options for Tenas Creek as it passes beneath the existing Suiattle River Road in Skagit County, Washington with the purpose of restoring spawning habitat while improving resiliency of the existing road.

The Project Vicinity and Location Map is presented in **Figure 1-1**.

The existing Suiattle River Road (also referred to as NF-26) is owned and maintained by the U.S. Forest Service (USFS). The road crosses lower Tenas Creek with an 80-foot-long concrete bridge that was built in 1963. However, this portion of Tenas Creek is in an area where the floodplain and channel migration zone are approximately 600 to 700 feet wide, far surpassing the span length of the bridge. Consequently, habitat conditions in and around the stream have degraded as the channel was artificially straightened and constrained with a levee and riprap structure, installed when the bridge was originally constructed. The levee extends approximately 800 feet upstream from the roadway on the left bank. During flooding in 1995, the primary Tenas Creek channel avulsed upstream of the levee, and flowed over Suiattle River Road approximately 430 feet east of the bridge. Although the levee was repaired, the risk of future avulsions and road damage still exist.

Objectives of the project include removing hydromodifications along the channel to restore or enhance channel migration processes without adversely affecting the integrity of the road. Options considered in the feasibility study (Kleinschmidt, 2022) included a replacement or relocation of the bridge and road alignment, lengthening the bridge, and/or constructing additional channels and bridges. The preferred option developed for the preliminary design report (Kleinschmidt, 2023) involves removal of the existing 80-foot bridge and replacing with a 120-foot, single-span bridge, and then constructing a second bridge spanning 330 feet, supported by two abutments and two intermediate piers. The existing levee, which would separate the two bridges, would remain but would be reduced in size. To support the final design and to collect supporting foundation data for the bridges, geotechnical borings were performed at each

proposed abutment and pier location. The Project Site Plan and Geotechnical Investigation Locations are presented in **Figure 1-2**.

1.2 Purpose and Scope

The purpose of this GDR is to present the collected field and laboratory testing data from the geotechnical exploration that was performed to support the project. The scope of work for this GDR includes:

1. Review available geologic and geotechnical information from published sources and from previous geotechnical investigations and construction documentation.

2. Conduct a geotechnical investigation at the site that includes:

    a. Six geotechnical borings advanced along the proposed bridge alignments at each abutment and intermediate pier location.

    b. Collecting soils samples for classification and laboratory testing.

    c. Performing laboratory testing on select soil samples.

1.3 Limitations

This report has been prepared for the exclusive use of SRSC and Kleinschmidt, for specific application to this project. It has been prepared in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made.

The findings contained in this report are based on the data obtained from available published literature, and on data obtained from subsurface explorations and laboratory testing. Exploration data indicate soil and rock conditions and water levels only at specific locations and times, and only to the depths penetrated. Subsurface conditions and water levels at other locations may differ from conditions occurring at these explored locations. In addition, the passage of time may result in a change of conditions at these locations. Some of the information provided is based on interpretation. The information reflects the opinion of the geotechnical engineer for the specific evaluation presented herein. Any use of interpreted information for other purposes could lead to erroneous assumptions and faulty conclusions.

Kleinschmidt is not responsible for any claims, damages, or liability associated with the interpretation of the subsurface data or for reuse of the subsurface data, without Kleinschmidt's express written authorization.

2.0 TECHNICAL DATA

2.1 Existing Data

2.1.1 Previous Geotechnical Studies

There are no records of geotechnical investigations for the existing bridge across Tenas Creek. Additionally, no geotechnical investigations such as borings or monitoring wells are listed in the DNR *Geological Information Portal* (DNR, 2023) in the vicinity of the project.

2.1.2 Historical Data and Construction Documentation

Drawings and photographs from the construction of the USFS Tenas Creek bridge were provided by the USFS (dated 1961/1962) and are included in **Appendix A** of this GDR. The drawings initially included plans for concrete 4.25-foot square footings bearing on native sand, gravel and boulders with a bearing capacity of three tons/square foot.

The drawings from 1961 show approximately 9 to 12 feet of fill material overlying native ground. During construction in 1962, the drawings were updated to show the foundation design was changed to timber piles and a concrete cap due to the presence of silty clay with sand, gravel and boulders. Each abutment was supported by 15 timber piles with an assumed length of 40 feet and bearing capacity of 20 tons. The piles were capped with an 8-ft by 28-ft concrete pile cap, with a bottom elevation near EL 105 ft NGVD29[1].

The photographs of the original construction of the bridge show the grading and estimated fill volumes required to bring the road to its current grade.

2.2 Field Exploration

2.2.1 Geotechnical Borings

Geotechnical borings were advanced at the site to characterize the subsurface conditions and to collect soil samples for soil classification and laboratory testing. The geotechnical drilling was performed by Western States Soil Conservation, Inc. (WSSC) of Hubbard, Oregon, under contract to Kleinschmidt. A Kleinschmidt geotechnical engineer was onsite during the exploration.

The drilling plan was developed based on the minimum requirements for bridge foundation investigations specified by AASHTO LRFD Bridge Design Specifications (2020) and Washington State Department of Transportation (WSDOT) Geotechnical Design Manual (2022), in addition to the State of Washington Administrative Code Chapter 173-160.

[1] Datum is assumed based on the year the drawings were produced. No specific datum reference is provided in the as-built drawings.

Several days prior to drilling, all exploration locations were marked in the field by a representative from SRSC and OneCall utility location services was notified. All utilities present at the site were marked in the field prior to drilling and drilling locations were adjusted in the field when in conflict with the marked utilities.

The field exploration occurred between June 5, 2023, and June 13, 2023. Details of the investigation are provided in the following sections, and a summary of all explorations are presented in **Table 2.1**. Geotechnical boring locations are presented in **Figure 1-2**.

Photographs from the field exploration are provided in **Appendix B**.

Geotechnical boring logs are included in **Appendix C**.

Table 2.1 Summary of Geotechnical Borings

Boring No.	Location Description	Ground Surface Elevation, NAVD88 (ft.) (approx.)	Latitude (deg.)	Longitude (deg.)	Completion Depth (ft.)
B23-1	10-ft West of Exist. Bridge, Westbound Lane Shoulder	796	48.3282	-121.4373	90.9
B23-2	40-ft East of Exist. Bridge, Westbound Lane Shoulder	794	48.3280	-121.4369	91.5
B23-3	150-ft East of Exist. Bridge, Westbound Lane Shoulder	792	48.3278	-121.4366	91.5
B23-4	270-ft East of Exist. Bridge, Westbound Lane Shoulder	789	48.3275	-121.4363	90.9
B23-5	415-ft East of Exist. Bridge, Westbound lane Shoulder	784	48.3271	-121.4360	90.9
B23-6	510-ft East of Exist. Bridge, Westbound Lane Shoulder	780	48.3269	-121.4358	91.0

WSSC advanced the borings using a CME 850 track-mounted drill rig using the mud rotary drilling method. All borings were performed at a vertical orientation. Different sized tri-cone bits were used ranging from 3.88-inch diameter to 6-inch diameter, with larger bits required to advance casing in the upper portions of the boring. Bedrock was not encountered during the exploration and therefore, no rock coring was performed at the site. When larger cobbles and boulders were encountered, the drilling was still advanced with a tri-cone bit but at a slower rate.

The drill rig was equipped with an automatic hammer for performing standard penetration tests (SPTs) and soil sampling, in accordance with ASTM D1586, Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils (ASTM 2019). SPTs and soil sampling were performed in 5-foot intervals with a 2-inch outside diameter split spoon (SS) sampler or a 3-inch outside diameter Modified California Sampler, based on the direction of the geotechnical engineer.

SPTs were performed for each sample. The SPT characterizes the consistency or density of in-situ soil by measuring the penetration resistance expressed as "blow counts." The blow count is the number of blows required to advance the standard split spoon sampler 6 inches using a 140-pound hammer falling 30 inches. The sampler is driven a total of 18 inches, and the blow count is recorded for each 6-inch increment. The sum of the blows for the second and third increments is referred to as the N-value. Low N-values indicate soft or loose soil deposits, while high N-values indicate hard or dense materials. If a sampler requires more than 50 blows to penetrate 6 inches, the test is then stopped, and the measured penetration is recorded on the boring logs for 50 blows. More than 50 blows is referred to as "refusal." Where the Modified California Sampler was used, a conversion factor of 0.422 was applied to the field SPT N-value to normalize the N-values for comparison with the standard sampler, based on the Burmister Energy Correction factor.

Soil samples from the borings were examined and visually classified in accordance with ASTM D2488, *Practice for Description and Identification of Soils (Visual-Manual Procedure)* (ASTM, 2019), following the Unified Soil Classification System (USCS). After logging soil samples, representative portions of each sample were placed in watertight plastic bags and marked for laboratory testing.

In addition to soil sampling, drilling observations such as drill rate, rig chatter and drilling conditions (which could indicate layer transitions), as well as the occurrence of boulders and cobbles, or observed changes in material layering, were recorded and used to help define the geologic subsurface profile. These observations are included on the boring logs in **Appendix C**.

The borings were backfilled in accordance with WSDOT requirements. Following completion of the borings, a lean grout was mixed and placed inside each of the open boreholes. The borings were backfilled with grout from the bottom of the boring to 15 feet below ground surface (bgs), with bentonite chips to 2.5 feet bgs, and with gravel to 6 inches bgs. Finally, the borings were filled to the road surface with an asphalt cold patch.

All drill cuttings were collected by WSSC and disposed of in discrete areas onsite, as instructed by SRSC.

2.3 Laboratory Testing

FEI Testing & Inspection, Inc. (FEI) of Corvallis, Oregon performed the laboratory testing on soil samples collected during the geotechnical investigation. The laboratory testing program included measurement of index properties of soil samples for classification and engineering analysis. The specific tests performed are summarized in the following subsections and the results listed in **Table 2.2**.

Attachment D contains the complete laboratory results.

Table 2.2 Summary of Laboratory Testing Results – Index Testing

Boring No.	Sample No.	Depth (ft)	USCS	Water Content (%)	Atterberg Limits		Particle Size Analysis		
					Liquid Limit	Plasticity Index	Gravel (%)	Sand (%)	Fines (%)
Boring B23-1									
B23-1	3-SS	15-16.5	ML	28.7	--	--	--	--	50.6
B23-1	3-SS	15-16.5	ML	28.7	--	--	--	--	50.6
B23-1	5-SS	25-26.5	SM	14.0	--	--	--	--	19.4
B23-1	6-SS	30-31.5	SP-SM	--	--	--	21.7	67.7	10.6
B23-1	8-SS	40-41.5	GW-GM	--	--	--	51.9	37.3	10.8
B23-1	9-SS	45-46.5	SM	25.7	--	--	--	--	21.2
B23-1	10-SS	50-51.5	CL	30.3 (A)[1] 44.3 (B)	31.1 (B)	8.2 (B)	--	--	74.4 (A)
B23-1	12-SS	60-61.5	CL	36.0	46.0	24.9	--	--	
B23-1	13-SS	65-66.5	CL	23.0	--	--	--	--	76.9
B23-1	14-SS	70-71.5	CL-ML	16.1	24.3	4.6	--	--	
B23-1	15-SS	75-76.5	SM	20.1	--	--	--	--	49.9
B23-1	18-SS	90-91.0	SW-SM	--	--	--	10.7	78.0	11.3
Boring B23-2									
B23-2	5-SS	25-26.5	SW-SM	--	--	--	44.7	47.9	7.4
B23-2	7-SS	35-36.5	SW-SM	--	--	--	23.6	69.0	7.4
B23-2	8-SS	40-41.5	SM	24.9	--	--	--	--	24.0
B23-2	12-SS	60-61.5	ML	38.4	--	--	--	--	
B23-2	14-SS	70-71.5	SM	19.8	--	--	--	--	48.7
B23-2	15-SS	75-75.8	SM	--	--	--	17.5	69.1	13.4
B23-2	18-SS	90-91.5	SP-SM	--	--	--	0.4	89.7	9.9
Boring B23-3									
B23-3	6-SS	30-31.5	SM	24.7	--	--	--	--	46.4
B23-3	7-SS	35-36.5	SW-SM	--	--	--	10.7	82.5	6.8
B23-3	9-SS	45-46.5	SM	28.8	--	--	--	--	43.7
B23-3	10-SS	50-51.5	ML	30.5	--	--	--	--	--
B23-3	11-SS	55-56.5	ML	37.8	--	--	--	--	--

Boring No.	Sample No.	Depth (ft)	USCS	Water Content (%)	Atterberg Limits		Particle Size Analysis		
					Liquid Limit	Plasticity Index	Gravel (%)	Sand (%)	Fines (%)
B23-3	13-SS	65-66.5	ML	30.5	--	--	--	--	81.6
B23-3	18-SS	90-91.5	SW-SM	--	--	--	5.1	84.6	10.3
Boring B23-4									
B23-4	4-SS	20-20.9	SW-SM	--	--	--	44.2	46.5	9.3
B23-4	8-SS	40-41.5	SC	22.4	--	--	--	--	25.7
B23-4	10-SS	50-51.5	SC	30.8	--	--	--	--	--
B23-4	11-SS	55-56.5	CL	36.6	31.6	11.4	--	--	--
B23-4	13-SS	65-66.5	SC	18.9	--	--	--	--	20.3
B23-4	16-SS	80-81.5	CL	19.0	--	--	--	--	59.1
B23-4	17-SS	85-86.5	SP-SM	--	--	--	0	90.4	9.6
Boring B23-5									
B23-5	4-SS	20-21.5	GW-GM	--	--	--	55.9	35.9	8.2
B23-5	7-SS	35-36.5	SM	30.5	--	--	--	--	37.5
B23-5	9-SS	45-46.5	CL-ML	30.8 (A)[1] 30.1 (B)	26.4 (B)	6.4(B)	--	--	78.1 (A)
B23-5	10-SS	50-51.5	ML	35.9	--	--	--	--	--
B23-5	11-SS	55-56.5	ML	39.3	--	--	--	--	89.0
B23-5	13-SS	65-66.5	SM	27.0	--	--	--	--	24.4
B23-5	17-SS	85-86.5	SW-SM	--	--	--	1.4	86.9	11.7
Boring B23-6									
B23-6	6-SS	30-31.5	ML	27.7	--	--	--	--	61.1
B23-6	7-SS	35-36.5	ML	50.2	36.8	10.1	--	--	--
B23-6	8-SS	40-41.5	ML	32.8	--	--	--	--	--
B23-6	9-SS	45-46.5	ML	28.3	--	--	--	--	70.5
B23-6	10-SS	50-51.5	ML	33.6	--	--	--	--	62.9
B23-6	18-SS	90-91.0	SM	--	--	--	1.5	85.7	12.8

Notes:

1. The sample was split into two different sub-samples, Sample A and Sample B, and notation indicates which sample that was tested.
2. Cells marked with "--" indicate that the specific index test was not performed for that sample.

2.3.1 Moisture Content

Moisture content tests estimate the weight of water contained in a given weight of soil. If properly sealed in a watertight container following sampling, this test can assess the field moisture content. Comparing the field water content between different soil layers allows for development of the soil stratigraphy and can estimate soil parameters. This test was performed in accordance with ASTM D2216, *Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass* (ASTM, 2019). Results are summarized in **Table 2.2.**

2.3.2 Particle Size Analysis

Particle size analysis is used when classifying soils and correlates to other soil parameters such as permeability. The particle size analysis was performed in general accordance with ASTM D422, *Standard Test Method for Particle Size Analysis of Soils* and ASTM D1140, *Standard Test Method for Determining the Amount of Material Finer than 75-µm (No. 200 sieve) in Soils by Washing* (ASTM 2019). Results are summarized in **Table 2.2.**

2.3.3 Atterberg Limits

Atterberg limits are used to define soil plasticity, and include measuring the liquid limit, plastic limit, and plasticity index. Atterberg limits are a key index test for fine-grained soils and provide correlation to other soil parameters. This test was performed in accordance with ASTM D4318, *Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils* (ASTM 2019). The results of the Atterberg limits tests are summarized in **Table 2.2.**

3.0 SITE CONDITIONS

This section presents the topographic and geologic setting of the project site, a description of the site's seismicity, and the subsurface conditions encountered during the geotechnical field investigation.

3.1 Site Description

The project site is located within the floodplain and historic channel migration zone of Tenas Creek, which was once 600 to 700 feet wide. The channel was limited to approximately 80 feet wide with the installation of the concrete bridge and levee in 1963. Tenas Creek is one of the nine tributaries to the Suiattle River. The creek originates at Boulder Lake, near Hurricane Peak in the Cascade Range, where it generally flows west to meet the Suiattle River. The area is characterized by steep incisions from the rivers and creeks of the mountain region. In the general vicinity of the project site, the area slopes down from northeast to southwest, toward the Suiattle River channel. The slopes to the northeast of the project site are near EL 940 ft, and creek bed is near EL 780 ft in the vicinity of the bridge[2]. The creek bed slopes down gradually to the Suiattle River, where the riverbed is near EL 685 ft.

The historic road and bridge across Tenas Creek were abandoned and replaced with the current bridge and road prism in 1962 in response to erosion problems, where it is suspected that Tenas Creek was generally forced by topography into the base of the east side of the road prism (Kleinschmidt, 2022). The levee was constructed to train the channel under the new bridge and extends approximately 800 feet upstream from the roadway on the left bank of Tenas Creek. The constructed road prism creates a slope greater than 1H:1V on the downstream side of the project site. Beyond that slope, the terrain is relatively flat. The slope on the upstream side of the project site varies from relatively flat to approximately 1H:1V.

The only access road to the site is Suiattle River Road (NF-26), which runs along the project site. There are two culverts in the project area which run under the road southeast of the concrete bridge. The roadway of Suiattle River Road is paved and in relatively good condition. There is limited daily vehicular traffic across the project site.

3.2 Regional Geology

The project site is situated within the North Cascades complex, which is part of the larger volcanic Cascade Range that stretches from northern California to southern British Columbia. The North Cascades are a complex assembly of rock and terranes, and largely consists of plutonic and metamorphic rock, as opposed to the volcanic rock typical in the High Cascades (Haugerud and Tabor 2009). Bedrock in the project area is comprised predominately of metamorphic greenschist, which is considered to be relatively weak, is prone to rapid weathering, and can be highly fractured. Past earthwork activities in this area such as timber harvesting and road construction

[2] Note that all elevations referenced in this section are based on the 1988 North American Vertical Datum (NAVD88)

have encountered mass wasting and hillslope failures due to the degradation of this rock (AFM, 2022).

Geologic maps of the project area show the near-surface geology at the project site to be underlain by laharic deposits from the Holocene and Pleistocene epochs following a series of eruptions from nearby Glacier Peak (Tabor et al, 2002). These laharic deposits surround the Suiattle River channel in the vicinity of the project site, and generally consist of boulders to poorly graded sand and gravels with clasts of pumice and volcanic rocks from Glacier Peak. A geologic map of the project area is presented in **Figure 3-1**.

During the last ice age (approximately 15,000 years ago), large glacial outwash was deposited on top of glacio-lacustrine clays and laharic deposits, creating unstable hillslopes and terraces. The outwash and high flows caused deep, channelized incisions, that often create very steep, unstable side slopes. This condition is not as prevalent within the Tenas Creek watershed but is present in the adjacent watersheds. From **Figure 3-1**, these outwash deposits are shown as alpine glacial deposits, with the nearest mapped occurrence located along Tenas Creek just upstream of the project site. Based on the Washington State Department of Natural Resources (DNR, 2023) *Geological Information Portal*, there are no mapped landslides on the hillsides around the proposed crossing options. However, landslides were mapped in the surrounding areas. Landslides are attributed to steep slopes, loose soil, and high rainfall. In the lower regions of the Tenas Creek watershed, the potential landslide susceptibility is low, indicating stable terrain. However, in the upper portions of the watershed, this susceptibility increases, particularly along the exposed streambanks (USFS, 2011). The proposed roadway alignment for Selected Alternative (Alternative 1A) is considered to be stable.

3.3 Regional Tectonic Geology and Historical Seismicity

Seismic activity in Western Washington is associated with the subduction of the Juan de Fuca plate under the North American plate. The area is subject to three potential seismic sources, including interface (shallow and large magnitude earthquakes directly associated with the subduction zone), intraplate (deep earthquakes within the subducted Juan de Fuca plate) and shallow crustal earthquakes within the North American plate. However, at the project site, the seismic hazard is controlled by smaller magnitude crustal faults that are closer to the site. The crustal faults based on USGS National Seismic Hazard Mapping (NSHM) data (USGS, 2014).

The nearest fault is the Straight Creek Fault Zone, located approximately 0.8 miles east of the project and identified as Class B (not active). This fault zone runs north-south, immediately east of the site as shown in **Figure 3-1**. The nearest active fault is the Darrington-Devils Mountain Fault Zone, located approximately 12 miles southwest of the project near Darrington. This fault zone trends east-to-west towards the Strait of Juan de Fuca. Numerous crustal faults are present west of the project site, with several large crustal faults in the Puget Sound area, approximately 40 to 50 miles southwest of the project site. A summary of these nearby faults (within 20 miles of the site) is listed in **Table 3.1** (USGS 2023).

Table 3.1 Summary of Nearby Crustal Faults

Fault Name	USGS Fault No.	Fault Type	Distance to Site (mi)	Mapped Length (mi)	Most Recent Deformation	Slip Rate (mm/yr)	Max M_w (Note 1)
Straight Creek Fault Zone (Class B, Inactive)	553	Reverse	0.8	75	< 1.6 mya	< 0.2	7.5
Darrington-Devils Mountain Fault Zone (Class A)	574	Left Lateral, Thrust	12	76	< 130 ka	< 0.2	7.5

Notes:
1. Maximum magnitude is based on Wells & Coppersmith (1994) and reported as moment magnitude (M_w)

Abbreviations:
mi – miles
mya – million years ago
ka – kilo-annum (1,000 years)
mm/yr – millimeters per year

3.4 Subsurface Conditions

The subsurface conditions encountered at the project site during the geotechnical exploration are generalized into four distinct soil groups.

- Embankment Fill
- Upper Alluvium
- Lacustrine Deposits
- Glacial Outwash

3.4.1 Embankment Fill

Fill encountered at this site is generally a poorly graded to a well-graded sand with silt, gravel, cobbles, and occasional large boulders. The material appeared to be similar to the underlying Upper Alluvium layer but lacked the fine-to-coarse grained sequencing indicative of natural deposition processes. From photographs during construction (see **Appendix A**), substantial amounts of fill were required to bring the ground surface to its current grade. Across the project area, fill thicknesses varied, from approximately 13 feet to a maximum height close to 20 feet near the center of the project area. SPT blowcounts varied significantly due to encountering large cobbles or boulders, with a range of 6 to 50 blows per 3 inches. Overall, the material was generally medium dense to dense, and consisted of a matrix of fine to coarse grained sand. In borings B23-3 and B23-5, organics including decomposed wood and bark were retrieved in the sampler. During drilling, wood fibers were present within the drill cuttings, and suggested that larger woody debris may be present within the embankment fill. In most of the borings, the bottom of the fill layer was near the groundwater level.

3.4.2 Upper Alluvium

The upper layer of the native subsurface profile consists of alluvium from the Tenas Creek stream channel. The Upper Alluvium layer consists of sandy silt, silty sand, poorly graded sands and gravels, well-graded sands and gravels, with occasional cobbles encountered during drilling. The color of the alluvium was often brown and gray and wet in moisture content due to it being directly beneath the groundwater table. Many of the recovered samples included non-plastic silt mixed with the sands and gravels. Blowcounts within this layer were similar to the Embankment Fill – highly variable and often misrepresented due to the presences of cobbles and boulders. Gradation tests within this layer reported fines content ranging from 7 to 51 percent, with an average near 20 percent for the samples tested. The Upper Alluvium layer was thickest near the present stream channel, with an estimated thickness of approximately 35 feet. Further east, the alluvium layer became thinner, with an estimated minimum thickness of 10 feet.

3.4.3 Lacustrine Deposits

In each of the six borings, fine-grained silts and clays were encountered just below the Upper Alluvium layer. These fine-grained soils were interbedded with low plasticity silt and clay, with varying amounts of fine sand. The consistency and layering of these soils were characteristic of glacio-lacustrine soils. Lacustrine soils are generally poorly graded (well sorted), fine grained soils that are placed in low-energy depositional environments, such as lakes. Glacio-lacustrine soils are sediments that may be deposited by glacial meltwater or created by lakes formed by glaciers. Cobbles and boulders are absent in this layer. Generally, the material is very consistent with gradual transitions between interbeddings.

From the borings, the top of this layer was near EL 755± NAVD88 and ranged in thickness from approximately 35 to 50 feet thick. Retrieved samples were typically brown-gray in color, and then transitioning to a dark gray with depth. Blowcounts within this layer ranged significantly, requiring the layer to be grouped into two different sublayers – Lacustrine Deposits and Lacustrine Deposits (very hard). The upper Lacustrine Deposits were encountered in each boring, and had blowcounts ranging from 11 to 29, with an average of approximately 18 blows per foot, indicating the material was stiff to very stiff.

The lower Lacustrine Deposits (very hard) layer was only encountered in borings B23-1 and B23-4 and ranged in thickness from 5 feet to 22 feet, approximately. The blowcounts within this sublayer increased significantly, ranging from 61 to 50 blows/5 inches, indicating that the material was very hard based on consistency.

Atterberg limits testing within this layer reported liquid limits ranging from 24 to 46 percent, and plasticity indices ranging from 5 to 25. Based on the Atterberg limits, the material classified as a lean clay or silt – typically low to medium plasticity. Fines content ranged from 38 to 89, with the coarser material consisting of fine sand.

3.4.4 Glacial Outwash

At the bottom of each of the borings, a clean, coarse-grained layer was encountered. The top of this layer ranged in elevation across the borings, with the lowest occurring near the existing channel near boring B23-1 at EL 708 feet NAVD88 and in boring B23-4 at EL 707 feet NAVD88, approximately. The highest elevation was in boring B23-2, encountered near EL 722 feet NAVD88. Glacial outwash material generally consists of coarse-grained sediment deposits placed during glacial melting and other high-flow events were occurring. In the samples retrieved for the project, the material generally consisted of well-graded to poorly graded sands with gravels and silts to silty sands. Blowcounts were generally high, often mispresented due to the presence of cobbles. During the investigation, blowcounts ranged from 69 to 50 blows/3 inches, indicating the layer is very dense.

This material primarily consisted of medium to coarse grained sand. Gradations performed on select samples reported fines contents generally ranging from 10 to 13 percent, with fines consisting of non-plastic silt. The gravel content was similar, typically close to 10 percent.

Interpretations of this layering are shown in **Figure 3-2**.

3.5 Groundwater and Surface Water Conditions

The groundwater at the site is anticipated to correspond closely to the water level of Tenas Creek. Due to the proximity of the creek and the coarse alluvium soils encountered in the subsurface profile, groundwater levels are anticipated to be at similar elevations throughout the area of interest for the project. At the time of drilling, the water level in Tenas Creek was approximately 18 feet below the concrete bridge deck, corresponding to approximate elevation EL 777 feet NAVD88. Reported groundwater depths in the boring logs are based on notes from the driller and observed water content in the samples, based on sample intervals of 5-feet. They may not represent actual groundwater elevations. However, a general observation was that the groundwater elevations trended lower with increasing distance from the creek. During the investigation, water was encountered in each of the borings, at depths ranging from 13 to 20 feet bgs. These depths correspond to elevations ranging from EL 783 feet to 760 feet NAVD88, respectively.

4.0 REFERENCES

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Tabor, R.W., Booth, D.B., Vance, J.A., and Ford, A.B. 2002. Geologic Map of the Sauk River 30- by 60-minute Quadrangle, Washington. U.S. Geological Survey, (USGS), Series I-2592.

U.S. Forest Service (USFS). 1961/1962. Mt Baker National Forest, Tenas Creek Bridge 1 Drawings.

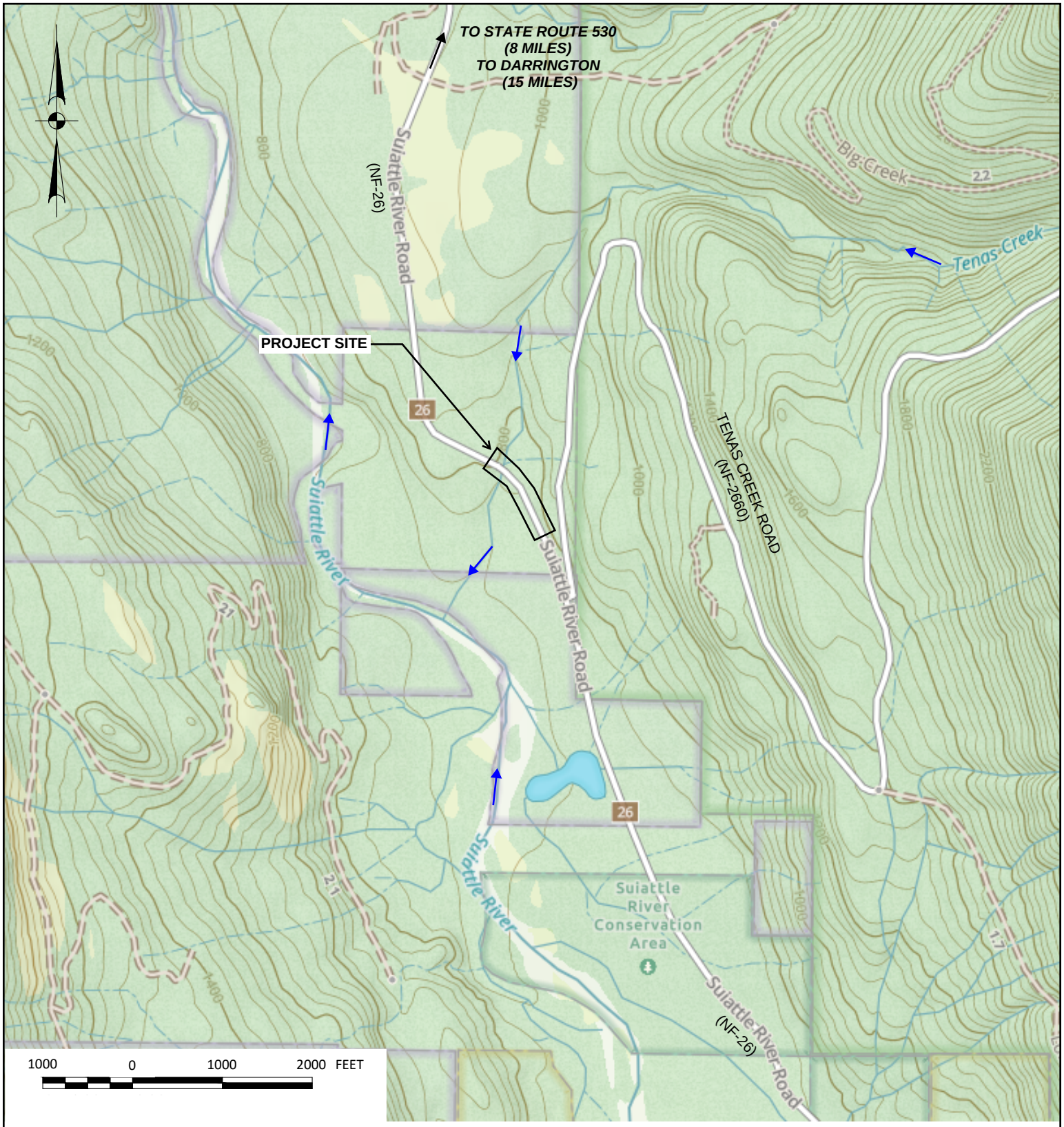
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Figures



PROJECT LOCATION

SOURCE: GAIA GPS, 2023

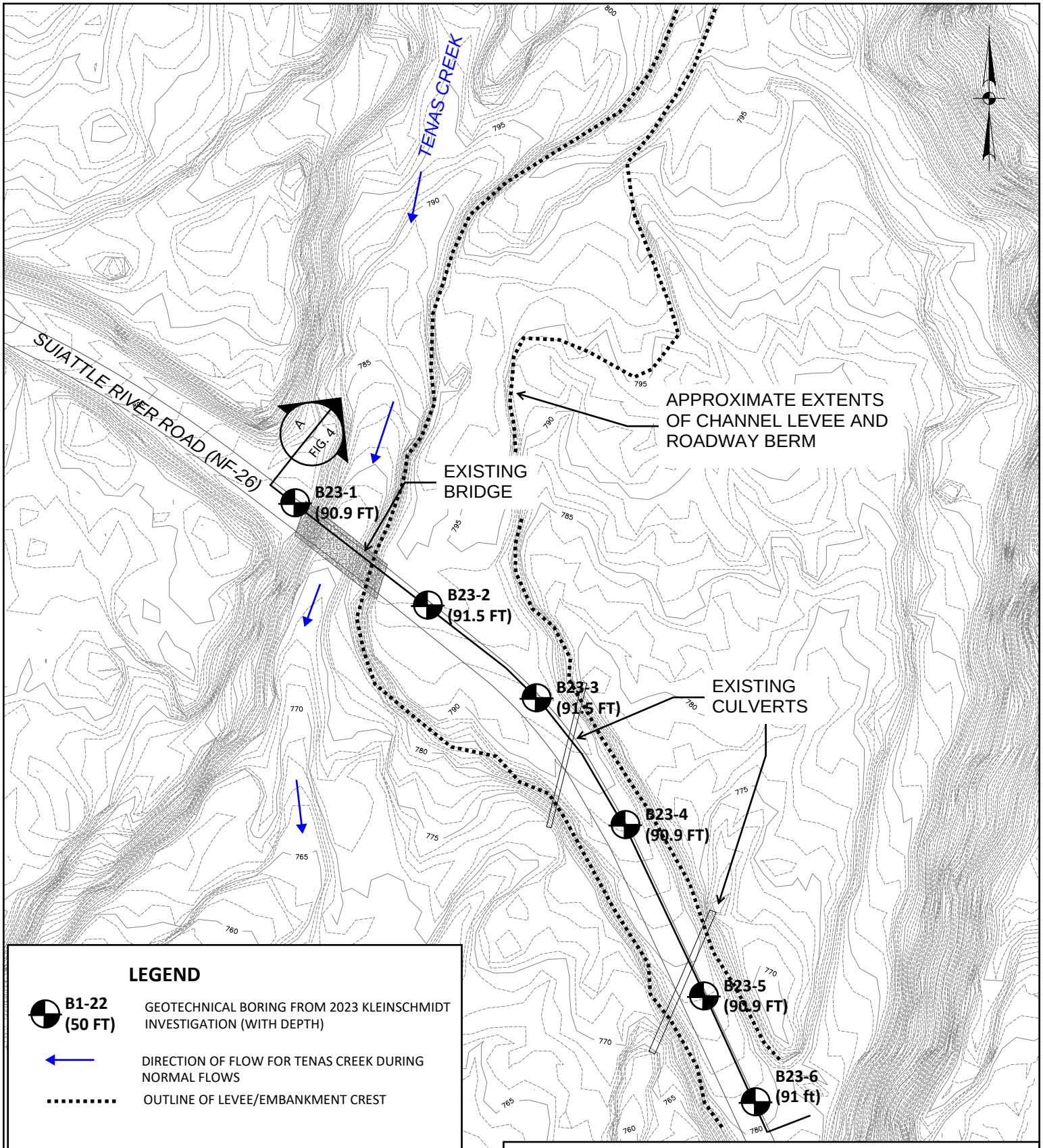


PROJECT VICINITY

FIGURE 1-1
PROJECT VICINITY & LOCATION MAP

GEOTECHNICAL DATA REPORT
TENAS CREEK ALLUVIAL FAN RESTORATION PROJECT
SKAGIT RIVER SYSTEM COOPERATIVE
SKAGIT COUNTY, WASHINGTON
SEPTEMBER 2023
PROJECT NO. 4976238

Kleinschmidt



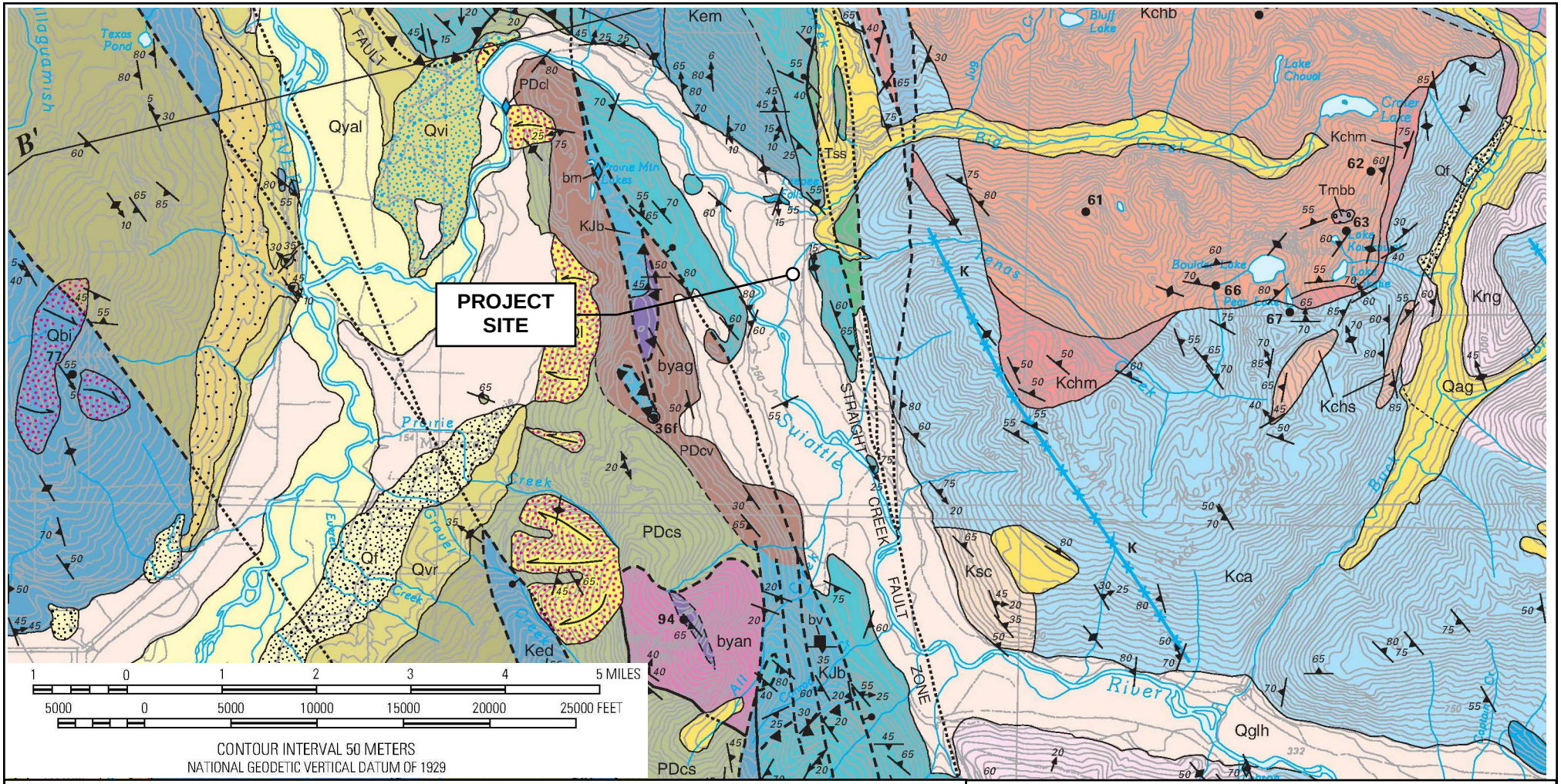
NOTES:

1. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 1988).
2. BORING LOCATIONS ARE APPROXIMATE. REFER TO GEOTECHNICAL DATA REPORT FOR LATITUDE AND LONGITUDE LOCATIONS.

FIGURE 1-2
EXISTING SITE PLAN AND GEOTECHNICAL EXPLORATION LOCATIONS

GEOTECHNICAL DATA REPORT
TENAS CREEK ALLUVIAL FAN RESTORATION PROJECT
SKAGIT RIVER SYSTEM COOPERATIVE
SKAGIT COUNTY, WASHINGTON
SEPTEMBER 2023
PROJECT NO. 4976238

Kleinschmidt



GLACIAL DEPOSITS

Qag — **Alpine glacial deposits (Holocene and Pleistocene)**

ROCKS AND DEPOSITS OF THE CASCADE MAGMATIC ARC

Rocks of Glacier Peak volcano and associated volcanic rocks and deposits (Holocene and Pleistocene)—Divided into:

Qglh — **Laharic deposits (Holocene and Pleistocene)**

SEDIMENTARY AND IGNEOUS ROCKS

Tss — **Sandstone associated with the Straight Creek Fault (middle and (or) early Eocene)**

Rocks northeast of the Darrington-Devils Mountain Fault Zone

Northwest Cascades System

Kem — **Mixed greenschist and phyllite (Early Cretaceous)**—Locally includes:

Kems — **Mixed greenschist and silver-colored phyllite**

KJb — **Bell Pass mélange (Early Cretaceous and Late Jurassic)**

SOURCE: TABOR, R.W., BOOTH, D.B., VANCE, J.A., AND FORD, A.B. 2002. GEOLOGIC MAP OF THE SAUK RIVER 30- BY 60-MINUTE QUADRANGLE, WASHINGTON. U.S.G.S. SERIES I-2592.

NOTES:
1. FOR BREVITY, ONLY GEOLOGIC UNITS NEAR PROJECT SITE ARE LISTED

FIGURE 3-1
REGIONAL GEOLOGIC MAP

GEOTECHNICAL DATA REPORT
TENAS CREEK ALLUVIAL FAN RESTORATION PROJECT
SKAGIT RIVER SYSTEM COOPERATIVE
SKAGIT COUNTY, WASHINGTON
SEPTEMBER 2023
PROJECT NO. 4976238

Kleinschmidt

NW

SE

EXISTING GRADE

PROPOSED GRADE

SUIATTLE RIVER ROAD (NF-26)

B23-1
EL. 796 FT

USCS	SPT N-VALUE
SP	20
SP	35
ML	8
SM	11
SM	15
SP-SM	32
SP	25
GW-GM	39
SW	35
CL	18
CL	17
CL	21
CL	88
CL-ML	84
SM	80/11"
ML	50/5"
ML	87
SW-SM	50/5"

GW: 13 FT

Q100 WSE

BTM OF BORING EL. 705.1 FT

B23-2
EL. 794 FT

USCS	SPT N-VALUE
SM	12
SP	20
SP	80
n/a	71
SW-SM	30
n/a	50/2"
SW-SM	32
SM	24
SM	21
n/a	28
ML	21
ML	24
ML	50/1"
ML	19
SP	50/4"
n/a	50/3"
SP-SM	50/6"
SP-SM	87

GW: 20 FT

BTM OF BORING EL. 702.5 FT

B23-3
EL. 792 FT

USCS	SPT N-VALUE
SP	33
SP	20
SP	22
GP	50/3"
SP	50/5.5"
SM	44
SW-SM	25
SM	21
SM	24
ML	18
ML	11
ML	24
ML	22
ML	29
ML	20
ML to SP	54
SW-SM	98/8"
SW-SM	82

GW: 15 FT

BTM OF BORING EL. 700.5 FT

B23-4
EL. 789 FT

USCS	SPT N-VALUE
SP	71
SP	6
SP-SM	63/10"
SW-SM	50/4.5"
SP	50/2"
n/a	50/3"
SM	23
SM	22
SM	17
ML	15
CL	22
CL	26
SC	28
SC	25
SC	38
CL	61
SP-SM	85
SP-SM	50/5"

GW: 15 FT

BTM OF BORING EL. 698.1 FT

B23-5
EL. 784 FT

USCS	SPT N-VALUE
SP	58
SP	45
SP-SM	15
GW-GM	46
n/a	50/4"
n/a	50/5"
SM	19
ML	12*
CL	11
ML	18
ML	18
SM	23
SM	27
SP	50/5"
SP	78
SM	69
SW-SM	83
SW-SM	50/5"

Q100 WSE

GW: 20 FT

BTM OF BORING EL. 693.1 FT

B23-6
EL. 780 FT

USCS	SPT N-VALUE
n/a	50/3"
n/a	13
SP	53*
SP	27
n/a	18
ML	13
ML	9
ML	6
ML	16
ML	17
SP	26
SP	26
SP	77
SP	70
SP	94
SM	79
SP	64/12"*
SP	50/6"

GW: 20 FT

BTM OF BORING EL. 689 FT

ELEVATION (FT, NAVD88)

820, 810, 800, 790, 780, 770, 760, 750, 740, 730, 720, 710, 700, 690, 680, 670

0, 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500, 520, 540, 560, 580, 600, 620, 640

BASELINE (FT)

NOTES:

1. SUBSURFACE PROFILES ARE INTERPRETATIONS BASED ON AVAILABLE GEOTECHNICAL DATA. VARIATIONS IN THE STRATA LAYERING MAY EXIST BETWEEN BORINGS.
2. SAMPLING OCCURRED EVERY 5 FEET IN EACH BORING
3. *n/a* FOR USCS INDICATES THAT NO SAMPLE WAS RETRIEVED
4. * INDICATES USE OF THE MODIFIED CALIFORNIA SAMPLER AND A CORRECTED SPT N-VALUE WAS ESTIMATED USING A FACTOR OF 0.422 BASED ON THE BURMISTER ENERGY CORRECTION FACTOR.
5. BORINGS ARE LOCATED NEAR THE PROPOSED LOCATIONS OF THE ABUTMENTS AND PIERS.
6. Q100 WSE: WATER SURFACE ELEVATION DURING THE 100-YEAR FLOOD, BASED ON PRELIMINARY DESIGN REPORT BY KLEINSCHMIDT, 2023

LEGEND

- EMBANKMENT FILL
- UPPER ALLUVIUM
- LACUSTRINE DEPOSITS
- LACUSTRINE DEPOSITS (VERY HARD)
- GLACIAL OUTWASH

FIGURE 3-2
CROSS SECTION A
INTERPRETED SUBSURFACE PROFILE
GEOTECHNICAL DATA REPORT
TENAS CREEK RESTORATION PROJECT
SKAGIT RIVER SYSTEM COOPERATIVE
SKAGIT COUNTY, WASHINGTON
SEPTEMBER 2023
PROJECT NO. 4976238

Kleinschmidt

Appendix A

Historical Data and Construction Documentation

OCT • 65



Tenas Creek Bridge, looking upstream - November 1962

OCT • 65



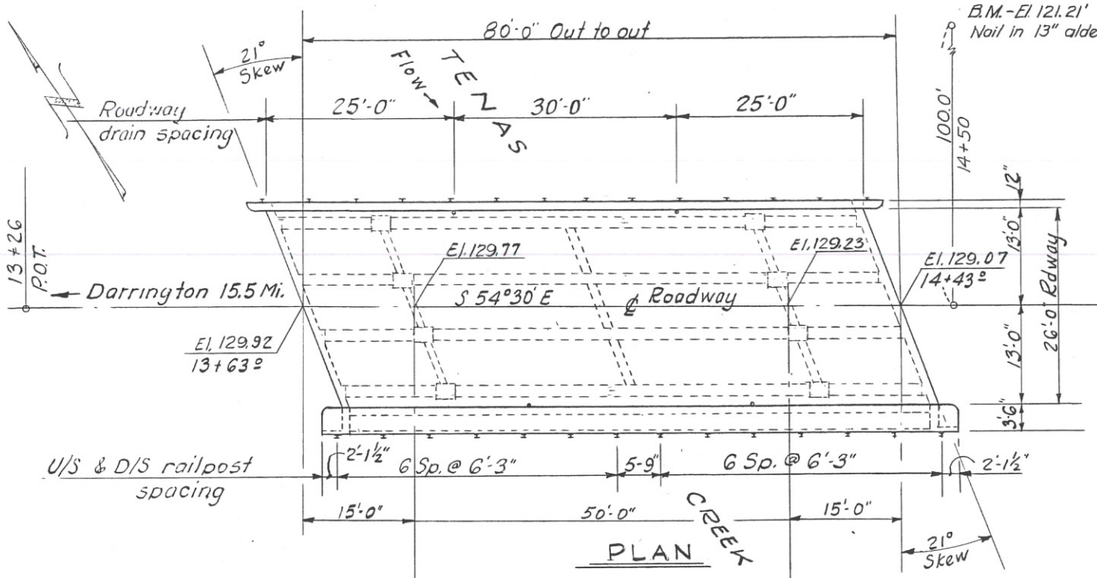
Tenas Creek Bridge, Looking up the road - November 1962

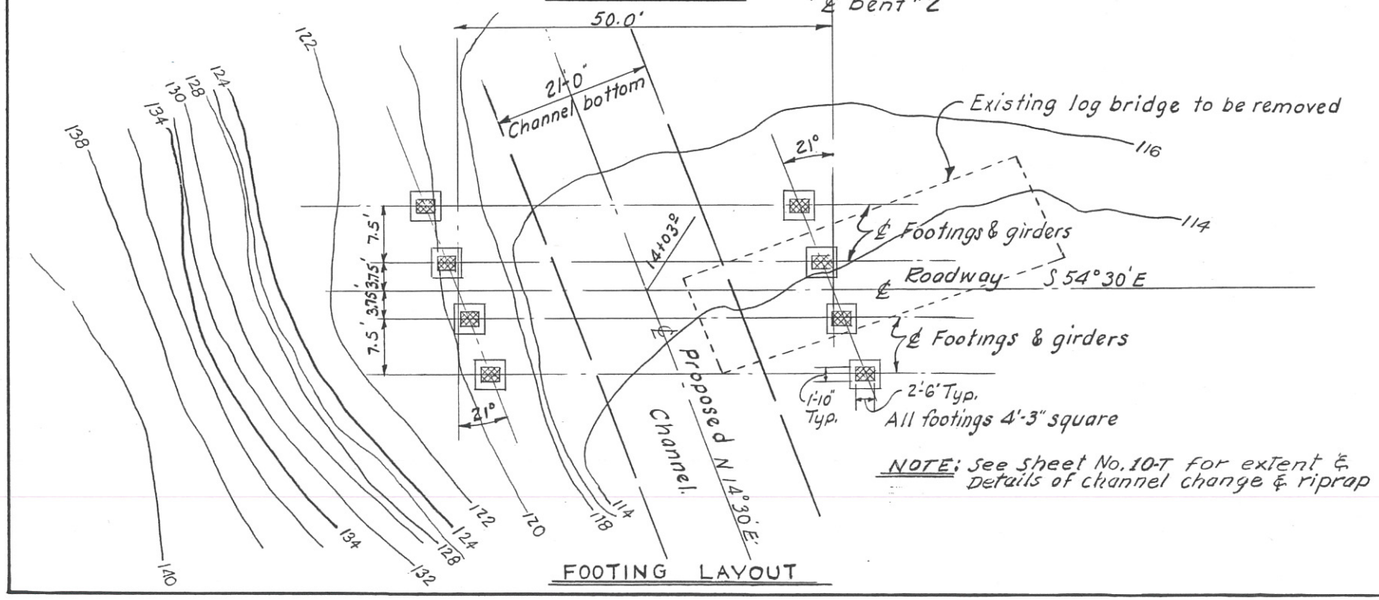


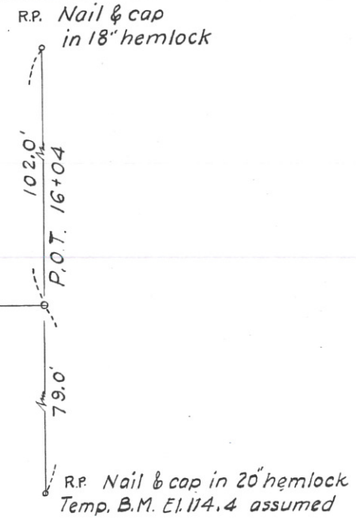
Tenas Creek Bridge - November 1962



Tenas Creek Bridge and Cut - September 1963







FOOTING DESIGN CHANGED TO PILES + CAP. (SEE SHEET 4)

GENERAL NOTES

SPECIFICATIONS-CONSTRUCTION: U.S. Forest Service Item Nos. 52, 203, 204, 223, 250, 256

DESIGN: A.A.S.H.O. Standard Specifications For Highway Bridges, Latest revision

DEAD LOAD CONCRETE: 150 lbs. per cu. ft.

LIVE LOAD: H20 S16 L70 Impact I = $\frac{50}{L+125}$ (L = Span length) Max I = 30%

Loader - 70 Ton No impact Stress increase 25%

UNIT STRESSES: f_c = 1320 p.s.i., f_s = 20,000 p.s.i., N = 10

CONCRETE: All concrete shall be class "A" with a minimum compressive strength of 3,300 p.s.i. at 28 days. Maximum size of coarse aggregate to be 1½". All concrete shall be mixed with Type II low alkali portland cement and with an "Air Entraining" Admixture. All class "A" concrete shall be vibrated. Corners shall be chamfered in accordance with specification 203 Par. 4.3

FINISHING CONCRETE: All concrete surfaces shall be finished according to specification 203 Par. 4.12

REINFORCING STEEL. All bars shall be deformed intermediate grade steel conforming to A.S.T.M. specification A15-54T. All bars in slab shall be supported on metal chairs. Except as shown, all dimensions refer to centers of bars.

BRIDGE RAIL All items of rail construction are included in the contract item for "Bridge Railing" and include the railing, posts, and all securing bolts. All steel shall be galvanized.

ESTIMATED QUANTITIES

No.	ITEM	QUANTITY
52	Structural Excavation	124.0 Cu. Yds.
203	Class A Concrete	151.0 Cu. Yds.
204	Reinforcing Steel *	37,200 Lbs.
223	Bridge Rail	161.5 Lin. Ft.
250	Loose Riprap	350.0 Cu. Yds.
256	Removal of Existing Bridge	Lump Sum

* Includes drains and nosing angles.

POURING ORDER

Concrete to be placed in one continuous operation for each of the following units, except for joints as shown.

1. Footings	8.0	Cu. Yds.
2. Columns	19.6	Cu. Yds.
3. Girders, Diaphragms and Beams	68.6	Cu. Yds.
4. Slab	43.4	Cu. Yds.
5. Curb & walk	11.4	Cu. Yds.

Reference Drawings:
R 28581
R 28591

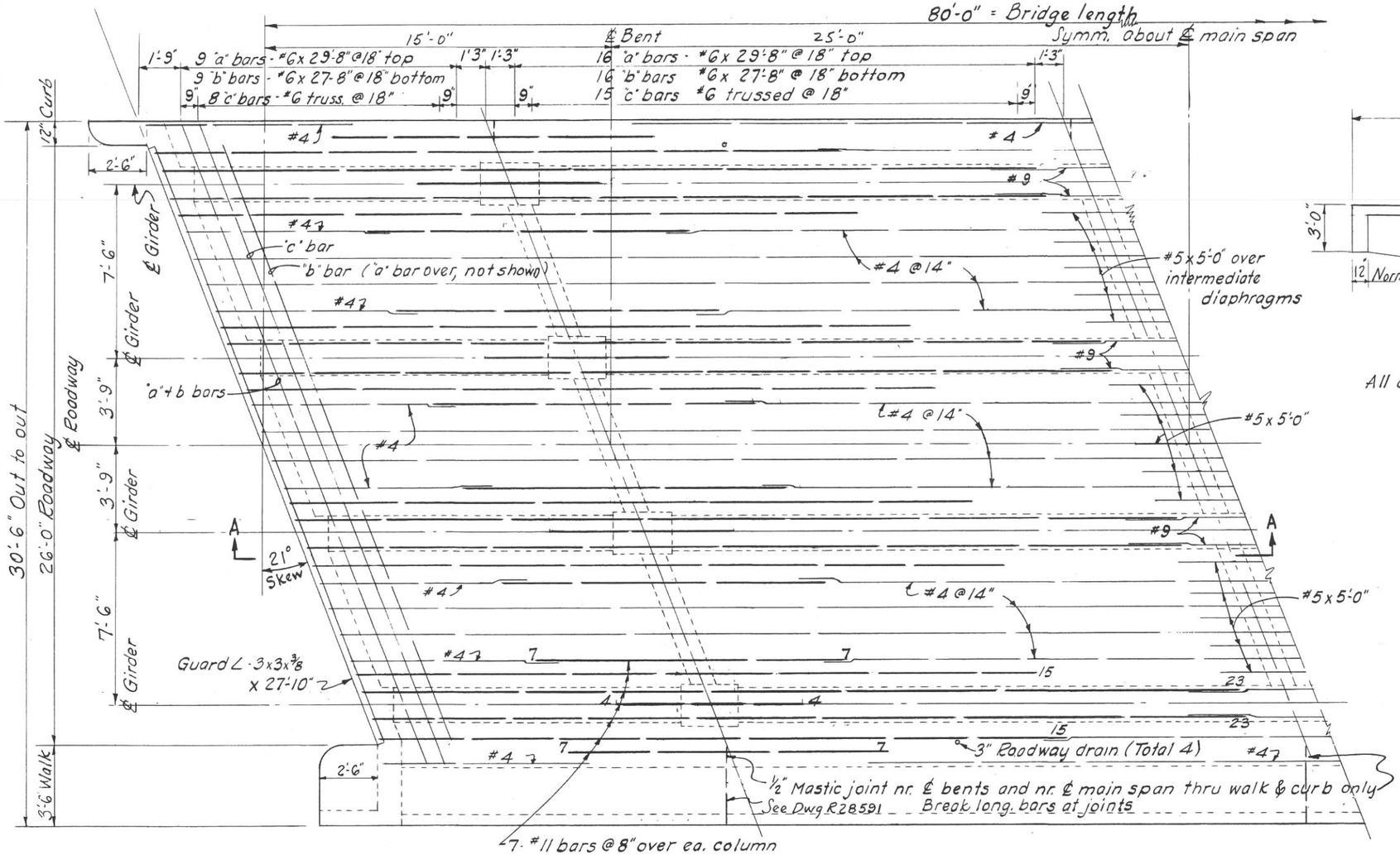
REV.	DESCRIPTION	BY	DATE
A	ADD SHEET 9 of 4; FOOTING PILES	TM	AUG. 9 '62

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX R. F. GREFE REGIONAL ENGINEER

M.T. BAKER
NATIONAL FOREST
TENAS CREEK BRIDGE 1
GENERAL PLAN & ELEVATION

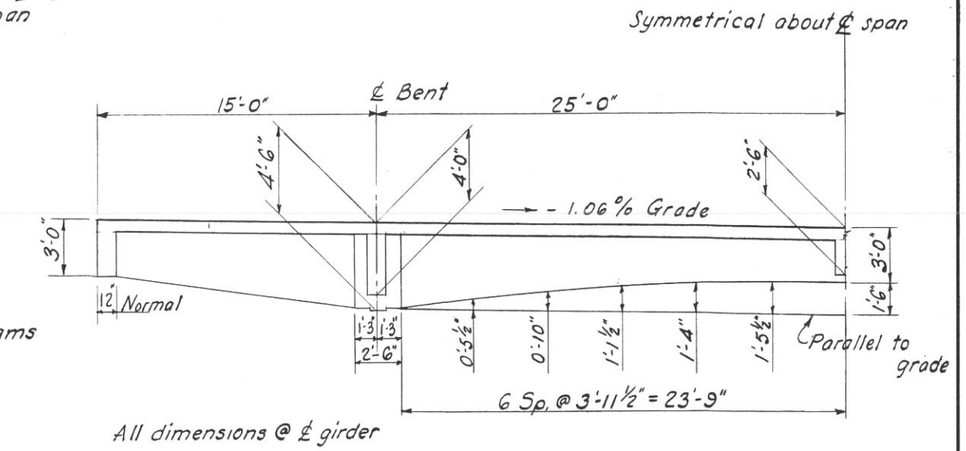
TWO LANE LOADING H20 S16 L70
ROAD NO. 345 / S. Side Swuttle Rd MILE 00.0 72
DESIGNED F.K.M. DRAWN J.E.W. TRACED
SCALE 1" = 10'-0" CHECKED
APPROVED [illegible] DATE 3-21-62
FOR ASSISTANT REGIONAL FORESTER

SHEET 1 OF 4 R-28941



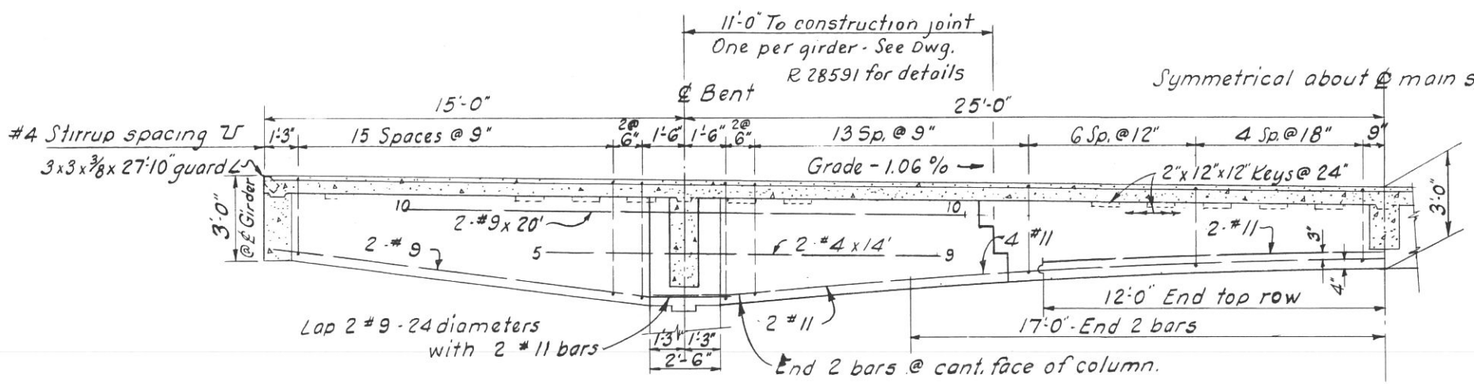
HALF-PLAN DECK SLAB

Longitudinal bars shown are all top bars.



All dimensions @ ℄ girder

HAUNCH ORDINATES



ELEVATION @ SEC. A-A - (Typ. girder details)

NOTE:

Bottom longitudinal bars in slab are shown in transverse section - Dwg R 28943.

For railing, roadway drain and guard angle details see Dwg. R 28581.

For end beam, diaphragm, sidewalk, curb details and reinforcing see Dwg R 28591.

All rebars to have 2" min. cover except noted otherwise

Lap rebars 24 diameters

Reference Drawings:

R 28581

R 28591

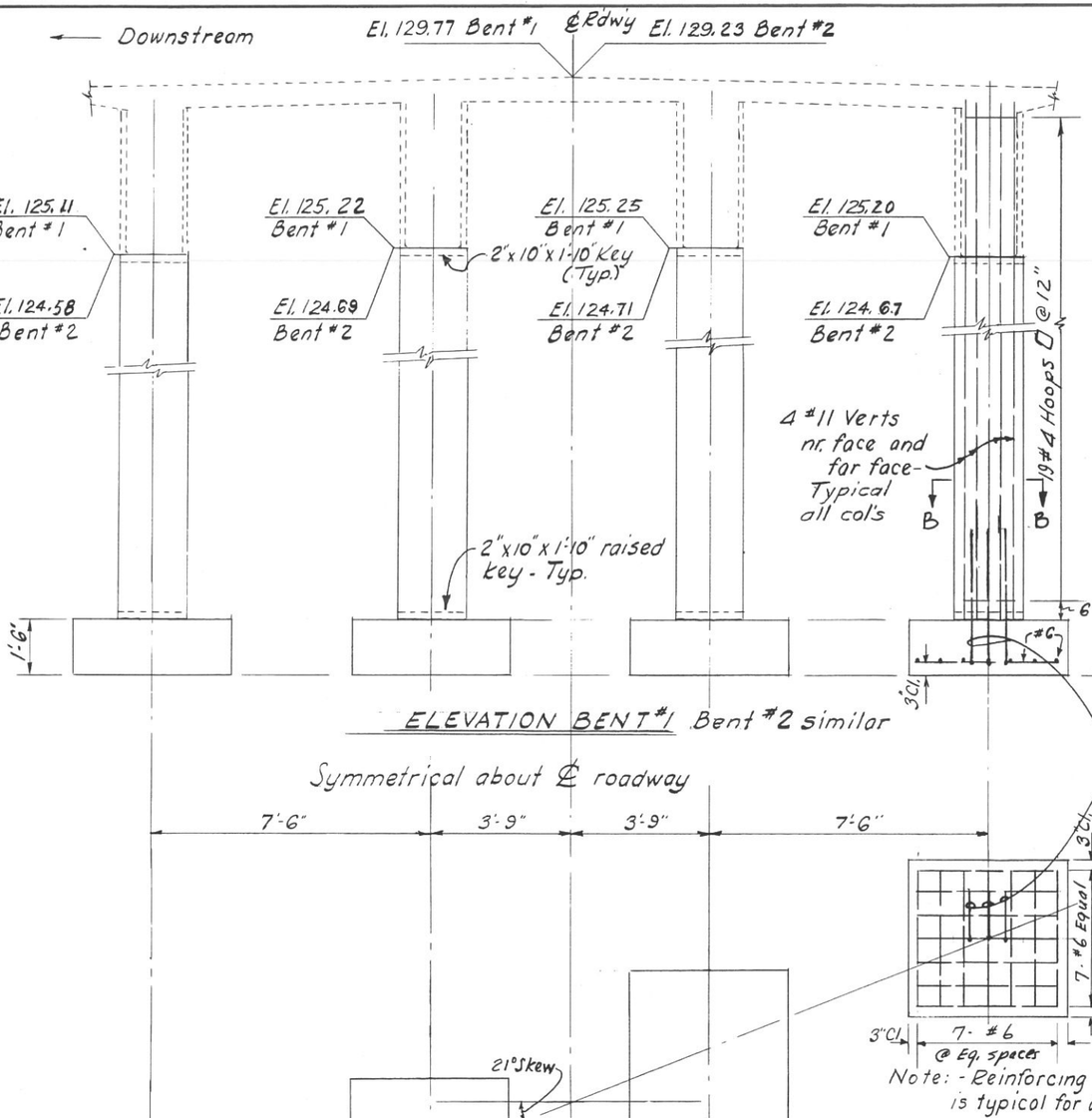
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX

MT. BAKER
NATIONAL FOREST
TENAS CREEK BRIDGE No. 1
SLAB and GIRDER DETAILS

BRIDGE NO. 345 10.0 7.9 LOADING H20 S16 L70
DESIGNED F.K.M. DRAWN T.E.W. CHECKED
APPROVED R. W. Crosby DATE 3-31-61
REGIONAL BRIDGE ENGINEER

SHEET 2 of 7 R- 28942

GPO 994210



ELEVATION BENT #1 Bent #2 similar

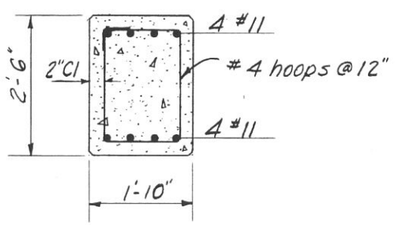
Symmetrical about ℄ roadway

Note: - Reinforcing shown is typical for all footings,

Details typ. @ all footings

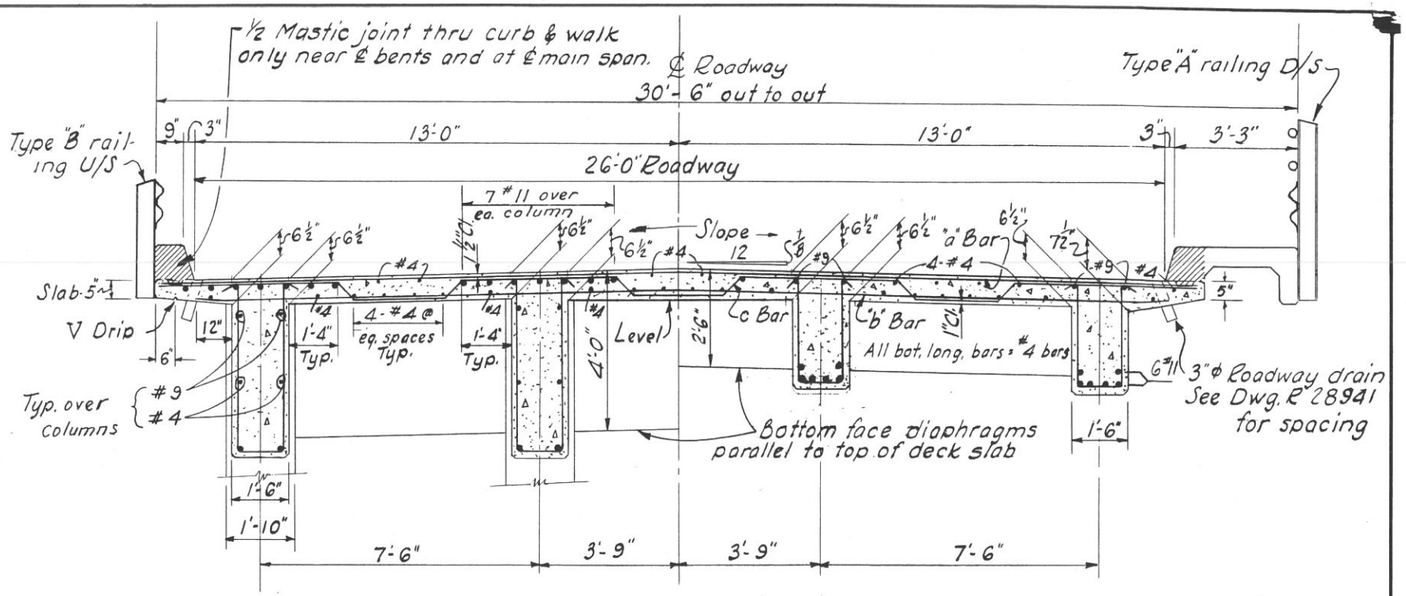
A Refer R-28944 for Cap & Piling Details

FOOTING DETAILS



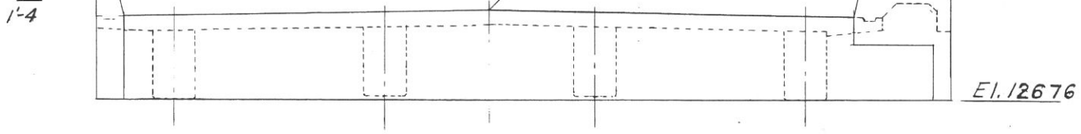
SEC. B-B

Typical all columns

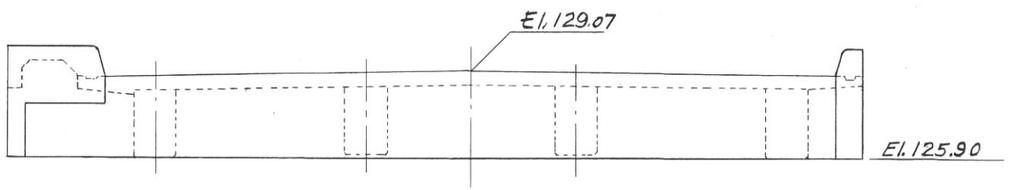


TRANSVERSE HALF-SEC. near ℄ BENT

TRANSVERSE HALF SEC. near ℄ MAIN SPAN



WEST END



EAST END

END BEAM ELEVATIONS

Rev.	Description	By	Date
A	Add Sheet 9 of 9: Footing Piles	GM	Aug 9 '62

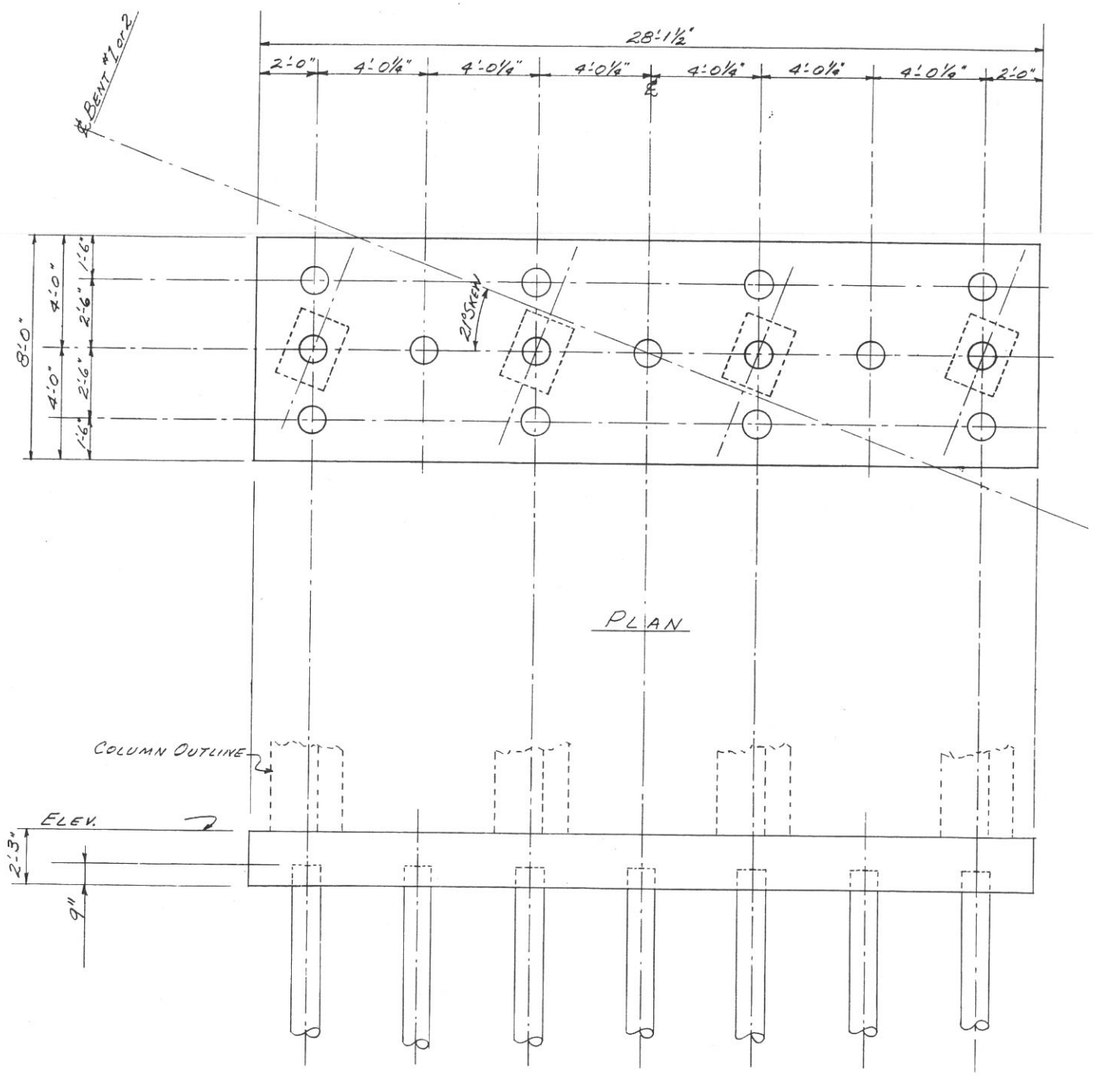
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX

MT. BAKER
NATIONAL FOREST
TENAS CREEK BRIDGE No. 1
SUBSTRUCTURE DETAILS & DECK SEC.

BRIDGE NO. 345-(10.0) 2.9 LOADING H20 S16 L70
DESIGNED F.K.M. DRAWN E.W. CHECKED
APPROVED ... DATE 3-31-61
REGIONAL BRIDGE ENGINEER

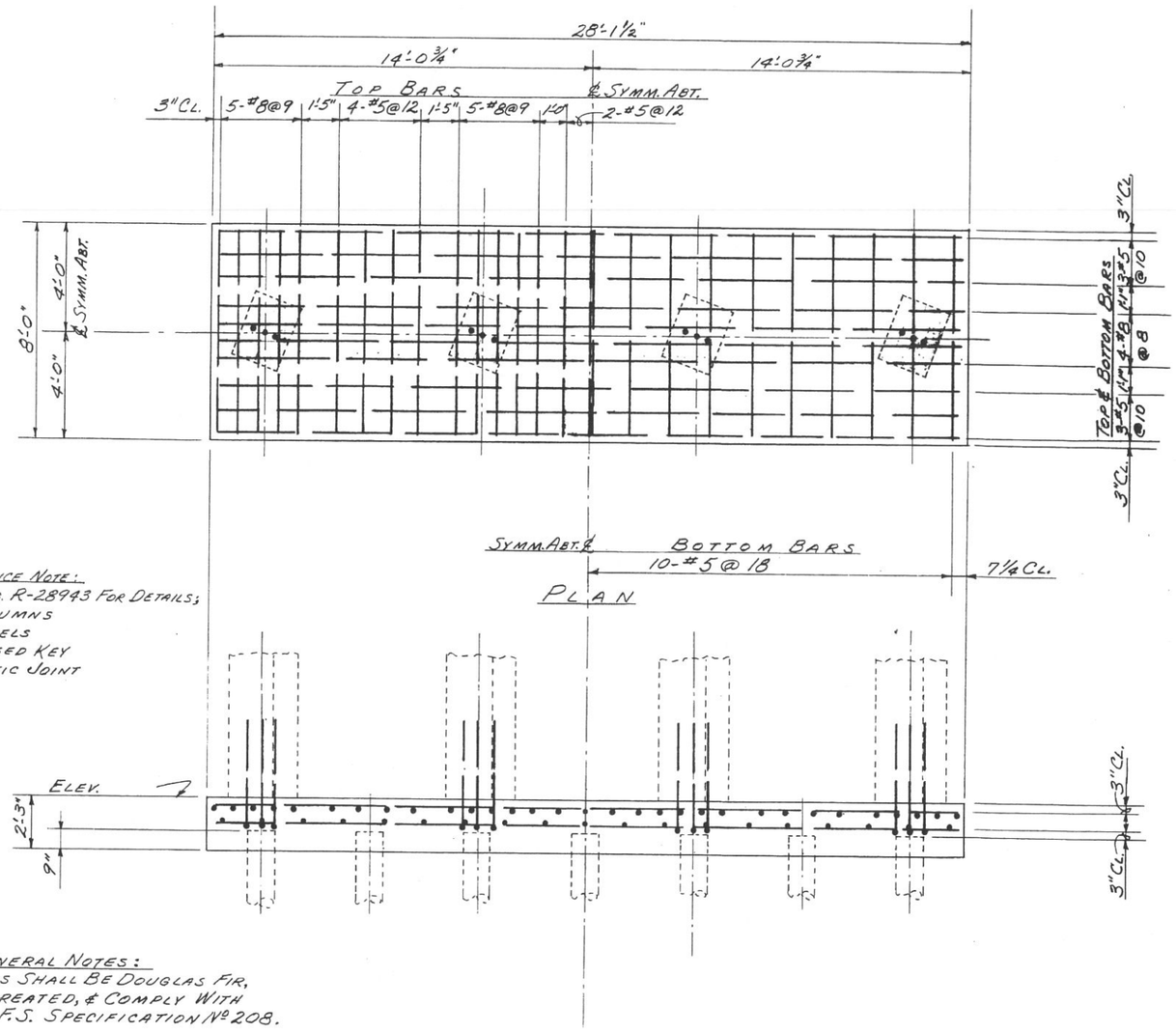
SHEET 3 of 4 R-28943

GPO 994210



PLAN

PILE - CAP LAYOUT
SCALE: 3/8"=1'-0"



PLAN

REFERENCE NOTE:
SEE DWG. R-28943 FOR DETAILS;
COLUMNS
DOWELS
RAISED KEY
MASTIC JOINT

GENERAL NOTES:
PILES SHALL BE DOUGLAS FIR, UNTREATED, & COMPLY WITH U.S.F.S. SPECIFICATION Nº 208.

PILE SHOES SHALL BE USED IF REQUIRED BY THE ENGINEER.

ASSUMED PILE BEARING VALUE = 20 TON.

PILE LENGTH = 40 FT. ASSUMED

PILE - CAP REINFORCING
SCALE: 3/8"=1'-0"

GPO 994210

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
REGION SIX
MT. BAKER
NATIONAL FOREST
TENAS CREEK BRIDGE
FOOTING PILES
BRIDGE NO. 345-(10.0)7.9 LOADING H20-S16-L70
DESIGNED F.K.M. DRAWN [illegible] CHECKED [illegible]
APPROVED [signature] DATE 2/14/62
REGIONAL BRIDGE ENGINEER

SHEET 4 of 4 R-28944

Appendix B

Site Photographs

Appendix B – Photo Log



Photo 1. View from the concrete bridge, looking east towards the levee constructed to confine the Tenas Creek channel. The levee extends approx. 800 feet upstream from the roadway on the left bank of Tenas Creek.



Photo 2. View from downstream, looking southeast towards the concrete bridge.



Photo 3. View from below the concrete bridge, showing existing structure and abutment. Large riprap has been placed for slope protection during construction of the bridge, roadway berm and levee.



Photo 4. View from concrete bridge looking upstream to the north. Levee is shown on the left bank of Tenas Creek.



Photo 5. Drill rig setup on B23-1. WSSC advanced the borings using a CME 850 track-mounted drill rig with the mud rotary drilling method. Support truck shown in foreground.



Photo 6. Sample from B23-1, 1-SS at 5.0 – 6.5 ft. Sample was collected within the fill layer near the west abutment of the existing bridge. Material consisted of Poorly Graded Sand with Gravel and Cobbles (SP), and was relatively clean of any fines.



Photo 7. Sample from B23-1, 3-SS at 15.0 – 16.5 ft. Sample was collected within the upper alluvium layer near the west abutment of the existing bridge. Material consisted of non-plastic Sandy Silt (ML).



Photo 8. Sample from B23-1, 9-SS at 45.0 – 46.5 ft. Sample was collected within the upper alluvium layer near the west abutment of the existing bridge. This alluvium layer was highly interbedded, transitioning from silty sand, to coarser poorly graded sand with gravel. No cobbles were encountered within this layer. Material from this sample consisted of well-graded fine sand.



Photo 9. Sample from B23-1, 12-SS at 60.0 – 61.5 ft. Sample was collected within a layer referred to as "Glacio-Lacustrine" which consisted of low to high plasticity silt. The material was very still in blowcounts and appeared to have many interbeddings, varying in low to high plasticity and in fine sand content.



Photo 10. View looking east along Suiattle River Road, with boring B23-3 in the foreground (white markings on road). Along the road, the berm's height decreases as the road extends west.



Photo 11. Cracking and settlement along NF-26 roadway between B23-5 and B23-6 looking northwest towards concrete bridge. The cause of the cracking and settlement is unknown but may indicate water movement within the berm.



Photo 12. Sample from B23-3, 3-SS at 15-16.5 ft below the ground surface. Material consists of organics (wood) and alluvium found within the fill layer at the site.



Photo 13. Sample from B23-2, 12-SS at 60-61.5 ft below the ground surface. Sample is representative of interbedded layers of silty sand and sandy silt present across the site. In this photo, there are 4 interbeddings within the 18-inch sample. The material was medium dense/very stiff based on blowcounts.



Photo 14. Sample from B23-3, 17-SS at 85-86.5 ft below the ground surface. Material is coarse alluvium consisting of poorly graded sand, very dense, with gravel up to 1-inch diameter. This layer was referred to as the "Native Lower Alluvium" layer and was encountered near the bottom of each of the borings.

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Appendix C

Geotechnical Boring Logs

BORING NO.:

B23-1

SOIL BORING LOG

LAT. (DEG):	-121.43735	**START DATE:**	June 5, 2023	**LOGGER:**	M. Eller
LONG. (DEG.):	48.32821	**END DATE:**	June 6, 2023	**NOTES:**	NF-26 Roadway, 10-ft west of Exist. Bridge, WB Lane shoulder. Elevations based on NAVD88.
ELEVATION:	796 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	13	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

NF-26 Roadway — EL 796 ft

AC PAVEMENT - 4 INCHES
0.33 ft
EL 795.67 ft

FILL

5 ft
EL 791 ft

Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist, medium dense, medium to coarse grained sand, fine gravels, cobble clasts, no cementation, subround

6.5 ft
EL 789.5 ft

10 ft
EL 786 ft

Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist, dense (likely due to cobble clast in shoe), medium to coarse grained sand, cobble clasts in sampler, similar to above except increase in quartz sand

11.5 ft
EL 784.5 ft
12 ft
EL 784 ft

UPPER ALLUVIUM

06 Jun 2023

15 ft
EL 781 ft

Sandy SILT (ML), brown, wet, firm, fine sand, non-plastic, no cementation, uniform, micaceous

16.5 ft
EL 779.5 ft

20 ft
EL 776 ft

Silty SAND (SM), light brown, wet, medium dense, mostly fine sand, non-plastic silt, trace fine gravel (<5%)

21.5 ft
EL 774.5 ft

Depth Scale	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
					On site at 1300. Driller is Richard. Helpers are Aaron and Morne. Archaeologist is Emma. Weather is 70 deg F and sunny. Start work at 1418. Core through AC pavement, setup rig and start drilling at 1442. Slow drilling through dense gravels.
5		1	SS	20	1-SS at 1457. Blows: 12-11-9. Rec. = 0.8 ft.
					Driller reports cobbles in upper 5 ft. 40 gal. mud lost at 6 ft. More mud mixed. Loose formation from 6 ft to 10 ft.
10		2	SS	35	2-SS at 1515. Blows: 19-17-18. Rec. = 0.4 ft.
					Less mud loss from 10 to 15 ft. Driller reports transition to softer material near 12.5 ft. Water table near 13 ft. Creek level is approx. 18 ft below bridge deck.
15		3	SS	8	3-SS at 1525. Blows: 5-3-5. Rec. = 1.4 ft. Lab results - W = 28.7%, P200 = 50.6%.
					Driller mixed more mud to stiffen upper 12 ft to prevent caving. Casing advanced to 15 ft. Drilling resumed at 1703.
20		4	SS	11	4-SS at 1711. Blows: 4-5-6. Rec. = 1.5 ft.
					End of day 6/5/23 at 1730. Back onsite 6/6/23 at 0800. Drilling resumed at 0845. Easy drilling.
25				15	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 1 of 4

BORING NO.:

B23-1

SOIL BORING LOG

LAT. (DEG):	-121.43735	**START DATE:**	June 5, 2023	**LOGGER:**	M. Eller
LONG. (DEG.):	48.32821	**END DATE:**	June 6, 2023	**NOTES:**	NF-26 Roadway, 10-ft west of Exist. Bridge, WB Lane shoulder. Elevations based on NAVD88.
ELEVATION:	796 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	13	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
25					15	5-SS at 0851. Blows: 6-7-8. Rec. =1.3 ft. Lab results - W = 14.0%, P200 = 19.4%.
26	Silty SAND (SM), light brown, moist, medium dense, fine to medium grained sand, trace fine gravels, non-plastic silt, similar to 4-SS except increasing coarseness		5	SS		
27	26.5 ft EL 769.5 ft					Switch to 3 7/8" tri cone bit. Driller reports gravel at 29 ft.
28						
29						
30	30 ft EL 766 ft				32	6-SS at 0905. Blows: 13-14-18. Rec. = 1.5 ft. Lab results - SA: Gravel = 21.7%, Sand = 67.7%, P200 = 10.6%.
31	Poorly Graded SAND with Silt and Gravel (SP-SM), gray, wet, dense, subround to subangular, up to 1" dia. gravel		6	SS		
32	31.5 ft EL 764.5 ft					Additional 10 ft of casing advanced for total of 25 ft of casing. Resumed drilling at 0935. Chatter while drilling with gravel in cuttings.
33						
34						
35	35 ft EL 761 ft				25	7-SS at 0947. Blows: 12-10-15. Rec. = 0.8 ft.
36	Poorly Graded SAND (SP), gray, wet, medium dense, mostly medium to coarse grained sand, gravel in top of sampler, similar to above except less gravel, uniform		7	SS		
37	36.5 ft EL 759.5 ft					Chatter due to fine to medium gravels from 35 to 40 ft.
38						
39						
40	40 ft EL 756 ft				39	8-SS at 1001. Blows: 10-15-24. Rec. = 1.2 ft. Lab results - SA: Gravel = 51.9%, Sand = 37.3%, P200 = 10.8%.
41	Well Graded GRAVEL with Sand and Silt (GW-GM), gray to brown, wet, dense, gravels fine to 1" dia., subangular to subround, fine to coarse sand, silt with some cohesion/plasticity, trace pumice		8	SS		
42	41.5 ft EL 754.5 ft					Driller reports smooth drilling from 42 to 45 ft.
43						
44						
45	45 ft EL 751 ft				35	9-SS at 1020. Blows: 10-16-19. Rec. = 1.5 ft. Lab results - W = 25.7%, P200 = 21.2%.
46	Well Graded SAND (SW), brown, wet, dense, fine sand, uniform, no gravel observed		9	SS		
47	46.5 ft EL 749.5 ft					Some clay within cuttings.
48	**LACUSTRINE DEPOSITS**					
49						
50					18	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 2 of 4

BORING NO.:

B23-1

SOIL BORING LOG

LAT. (DEG):	-121.43735	**START DATE:**	June 5, 2023	**LOGGER:**	M. Eller
LONG. (DEG.):	48.32821	**END DATE:**	June 6, 2023	**NOTES:**	NF-26 Roadway, 10-ft west of Exist. Bridge, WB Lane shoulder. Elevations based on NAVD88.
ELEVATION:	796 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	13	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
50						
51	Lean CLAY with Sand (CL), light brown, wet, very stiff, cohesive layers approx. 6" thick, uniform, fine sand, low to medium plasticity		10	SS	18	10-SS at 1036. Blows: 3-9-9. Rec. = 1.5 ft. PP = 1.0 TSF. Lab results - W = 44.3%, LL = 31.1, PI = 8.2, P200 = 74.4%.
52	51.5 ft EL 744.5 ft					
53						
54						
55	55 ft EL 741 ft				17	11-SS at 1052. Blows: 6-7-10. Rec. = 1.5 ft. TV = 1.0 TSF.
56	Lean CLAY with Sand (CL), brown, moist/wet, very stiff, medium to high plasticity, uniform (cobble clast in sampler)		11	SS		
57	56.5 ft EL 739.5 ft					Driller reports similar material from 55 to 60 ft.
58						
59						
60	60 ft EL 736 ft				21	12-SS at 1107. Blows: 5-7-14. Rec. = 1.5 ft. Lab results - W = 36.0%, LL = 46.0, PI = 24.9.
61	Lean CLAY with Sand (CL) with Sand, gray/brown, wet, very stiff, medium to high plasticity, similar to above, not as uniform as above		12	SS		
62	61.5 ft EL 734.5 ft					Driller reports chatter at 62 to 63.5 ft, likely fine gravels.
63						
64	64 ft EL 732 ft					
65	**LACUSTRINE DEPOSITS (VERY HARD)** 65 ft EL 731 ft				88	13-SS at 1124. Blows: 17-40-48. Rec. = 1.5 ft. Lab results - W = 23.0%, P200 = 76.9%.
66	Lean CLAY with Sand (CL) with Sand, gray, moist, very hard, fine sand, low plasticity, mostly uniform/consistent		13	SS		
67	66.5 ft EL 729.5 ft					Driller reports varying layers, chatter from 66.5 to 67 ft, then 69 to 70 ft.
68						
69						
70	70 ft EL 726 ft				84	14-SS at 1150. Blows: 25-38-46. Rec. = 1.5 ft. Lab results - W = 16.1%, LL = 24.3, PI = 4.6.
71	Silty CLAY with Sand (CL-ML), gray, moist, very hard, trace fine sand, low plasticity, uniform/consistent		14	SS		
72	71.5 ft EL 724.5 ft					Driller reports smooth drilling from 70 to 75 ft.
73						
74						
75					REFUSAL	

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 3 of 4

BORING NO.:

B23-1

SOIL BORING LOG

LAT. (DEG):	-121.43735	**START DATE:**	June 5, 2023	**LOGGER:**	M. Eller
LONG. (DEG.):	48.32821	**END DATE:**	June 6, 2023	**NOTES:**	NF-26 Roadway, 10-ft west of Exist. Bridge, WB Lane shoulder. Elevations based on NAVD88.
ELEVATION:	796 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	13	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
75	Silty SAND (SM), gray/brown, moist, very dense, quartz-rich sand, fine sand grading to sandy silt at bottom		15	SS	REFUSAL	15-SS at 1213. Blows: 27-30-50/5". Rec. = 1.5 ft. Lab results - W = 20.1%, P200 = 49.9%.
76	76.5 ft EL 719.5 ft					
77						Driller reports smooth drilling from 75 to 80 ft.
78						
79						
80	80 ft EL 716 ft				REFUSAL	16-SS at 1236. Blows: 35-50/5". Rec. = 1.0 ft.
81	Sandy SILT (ML), gray/brown, moist, very hard, less sand than previous sample, more silt		16	SS		
82	81 ft EL 715 ft					
83						
84						
85	85 ft EL 711 ft				87	17-SS at 1300. Blows: 36-37-50. Rec. = 1.5 ft.
86	Sandy SILT (ML), gray/brown, moist, very hard, fine sand, non-plastic silt, micaceous, very uniform throughout sampler, similar to previous sample		17	SS		
87	86.5 ft EL 709.5 ft					
88						
89						
90	90 ft EL 706 ft				REFUSAL	18-SS at 1324. Blows: 36-50/5". Rec. = 1.0 ft. Lab results - SA: Gravel = 10.7%, Sand = 78.0%, P200 = 11.3%.
91	**GLACIAL OUTWASH** Well Graded SAND with Silt (SW-SM), tan/gray, moist, very dense, mostly medium to coarse grained, gravels up to 3/4" dia., quartzite in origin, multicolor sand, silt clump		18	SS		Hole abandoned per WSDOT requirements. Grout hole to 15 ft bgs. Bentonite chips to 2.5 ft bgs. Gravel to 0.5 ft bgs. AC pavement cold patch to surface. Borehole at surface approx. 8" in diameter.
92	91 ft EL 705 ft					
93	Bottom of Boring at 91 ft					
94						
95						
96						
97						
98						
99						
100						

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 4 of 4

BORING NO.:

B23-2

SOIL BORING LOG

LAT. (DEG):	-121.43689	**START DATE:**	June 6, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32798	**END DATE:**	June 7, 2023	**NOTES:**	NF-26 Roadway, 40-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	794 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
	NF-26 Roadway — EL 794 ft					
0	**AC PAVEMENT - 3.5 INCHES**					Set up on boring at 1420. Driller is Richard. Helpers are Aaron and Morne. Archaeologist is Emma. Weather is 80 deg F and sunny. Core through AC pavement, setup rig and start drilling at 1445. Slow drilling through dense gravels.
	0.29 ft / EL 793.71 ft					
1	**FILL**					
2						
3						
4						
5	5 ft / EL 789 ft				12	1-SS at 1510. Blows: 6-7-5. Rec. = 1.25 ft.
6	Silty SAND with Gravel (SM), dark brown, moist, medium dense, medium sand, fine gravel, cobble clasts, transition to 3" of fine, brown sand in shoe		1	SS		
7	6.5 ft / EL 787.5 ft					Slow drilling, drill rig chattering. Driller reports some softer sections from 5 to 10 ft.
8						
9						
10	10 ft / EL 784 ft				20	2-SS at 1520. Blows: 7-9-11. Rec. = 0.75 ft.
11	Poorly Graded SAND with Gravel (SP), brown, moist, medium dense, fine to medium sand, fine gravel, cobble clasts		2	SS		
12	11.5 ft / EL 782.5 ft					Drill rig rattling to 15 ft. No mud loss.
13						
14						
15	15 ft / EL 779 ft				80	3-SS at 1540. Blows: 24-30-50. Rec. = 1 ft.
16	Poorly Graded SAND with Gravel (SP), brown, moist, very dense (likely due to cobble clast), medium to coarse sand, fine gravel, trace silt		3	SS		
17	16.5 ft / EL 777.5 ft					Sampler bouncing on cobble for last inch of 3-SS.
18						
19						
20	20 ft / EL 774 ft				71	4-SS at 1610. Blows: 18-28-43. Rec. = 0.17 ft.
21	2" cobble clast in sampler, no sample collected		4	SS		
22	21.5 ft / EL 772.5 ft 22 ft / EL 772 ft					Water table likely near 20 ft. Drill rig rattling. Smoother drilling at 22 ft and then rattling again.
23	**UPPER ALLUVIUM**					
24						
25					30	

07 Jun 2023

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 1 of 4

BORING NO.:

B23-2

SOIL BORING LOG

LAT. (DEG):	-121.43689	**START DATE:**	June 6, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32798	**END DATE:**	June 7, 2023	**NOTES:**	NF-26 Roadway, 40-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
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TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
25	Well Graded SAND with Silt and Gravel (SW-SM), brown, wet, medium dense, gravel up to 1", mostly medium to coarse sand, trace silt, subround to subangular, cobble clast in shoe		5	SS	30	5-SS at 1625. Blows: 15-12-18. Rec. = 1 ft. Lab results - SA: Gravel = 44.7%, Sand = 47.9%, P200 = 7.4%.
26						
27	26.5 ft EL 767.5 ft					Drill rig rattling.
28						
29						
30	30 ft EL 764 ft		6	SS	REFUSAL	6-SS at 1645. Blows: 50/2". Rec. = 0 ft.
31	NO RECOVERY 30.2 ft EL 763.8 ft					
32						Driller reported bit spinning on top of probable boulder. Driller reported some mud loss due to hole displacement. Rig refueled 1700 to 1710. Smooth drilling at 32 ft.
33						
34						
35	35 ft EL 759 ft				32	7-SS at 1720. Blows: 14-16-16. Rec. = 1 ft. Lab results - SA: Gravel = 23.6%, Sand = 69.0%, P200 = 7.4%.
36	Well Graded SAND with Silt and Gravel (SW-SM), gray, wet, dense, gravel up to 1" diameter, medium to coarse sand, trace fine sand, subround to subangular		7	SS		
37	36.5 ft EL 757.5 ft					Drill rig rattling 35 to 38 ft and then smooth drilling.
38	38 ft EL 756 ft					
39	**LACUSTRINE DEPOSITS**					
40	40 ft EL 754 ft				24	8-SS at 1740. Blows: 12-12-12. Rec. = 1.25 ft. Lab results - W = 24.9%, P200 = 24.0%.
41	Silty SAND (SM), dark brown, wet, medium dense, micaceous, fine sand, non-plastic silt		8	SS		
42	41.5 ft EL 752.5 ft					End of day 6/6/23. All offsite at 1800. Return 6/7/23 and begin drilling at 0830.
43						
44						
45	45 ft EL 749 ft				21	9-SS at 0835. Blows: 11-11-10. Rec. = 1.25 ft.
46	Silty SAND (SM), dark brown, wet, medium dense, fine sand TRANSITION TO SILT with Sand (ML), gray and olive, wet, very stiff, low to medium plasticity		9	SS		
47	46.5 ft EL 747.5 ft					
48						
49						
50					28	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 2 of 4

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BORING NO.:

B23-2

SOIL BORING LOG

LAT. (DEG):	-121.43689	**START DATE:**	June 6, 2023	**LOGGER:**	H. Russell
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ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
50	*(continued)*		10	SS	28	10-SS at 0850. Blows: 12-11-17. Rec. = 0 ft.
51	NO RECOVERY					
	51.5 ft / EL 742.5 ft					Driller reports smooth, fast drilling. Transition to fine-grained lacustrine deposits.
52						
53						
54						
55	55 ft / EL 739 ft				21	11-SS at 0905. Blows: 10-10-11. Rec. = 1.5 ft. PP = 1.0 TSF.
	SILT with Sand (ML), brown to gray, wet, very stiff, fine sand, low to medium plasticity		11	SS		
56	56.5 ft / EL 737.5 ft					
57						
58						
59						
60	60 ft / EL 734 ft				24	12-SS at 0920. Blows: 8-10-14. Rec. = 1.5 ft. Lab results - W = 38.4%.
	SILT with Sand (ML), light brown to light gray, wet, very stiff, fine sand, low to medium plasticity		12	SS		
61	61.5 ft / EL 732.5 ft					Driller reports smooth, fast drilling.
62						
63						
64						
65	65 ft / EL 729 ft				REFUSAL	13-SS at 0935. Blows: 9-50/1". Rec. = 0.5 ft.
	SILT with Sand (ML), gray, wet, very stiff, fine to medium sand, low to medium plasticity		13	SS		
66	65.6 ft / EL 728.4 ft					Rock in shoe likely due to fall in material. Driller breaks through fall in and then smooth, fast drilling.
67						
68						
69						
70	70 ft / EL 724 ft				19	14-SS at 0950. Blows: 9-10-9. Rec. = 1.25 ft. Lab results - W = 19.8%, P200 = 48.7%.
	SILT with Sand (ML), gray, wet, medium dense, fine sand, trace subround gravel up to 3/4", low to medium plasticity		14	SS		
71	71.5 ft / EL 722.5 ft					Driller reports potential gravel layers 72 to 75 ft.
72	72 ft / EL 722 ft					
	GLACIAL OUTWASH					
73						
74						
75					REFUSAL	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

BORING NO.:

B23-2

SOIL BORING LOG

LAT. (DEG):	-121.43689	**START DATE:**	June 6, 2023	**LOGGER:**	H. Russell
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ELEVATION:	794 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
75	Silty SAND with Gravel (SM), gray, moist, dense, medium to coarse grained sand, fine gravel up to 1/2" diameter, subround to subangular		15	SS	REFUSAL	15-SS at 1015. Blows: 45-50/4". Rec. = 0.75 ft. Lab results - SA: Gravel = 17.5%, Sand = 69.1%, P200 = 13.4%.
76	75.8 ft EL 718.2 ft					Driller reports smooth drilling from 75 to 80 ft.
77						
78						
79						
80	80 ft EL 714 ft		16	SS	REFUSAL	16-SS at 1040. Blows: 50/3". Rec. = 0.17 ft.
81	2" cobble clast in sampler, no sample collected 80.3 ft EL 713.7 ft					Driller reports some drill chattering 80 to 81 ft, then smooth drilling.
82						
83						
84						
85	85 ft EL 709 ft		17	SS	REFUSAL	17-SS at 1102. Blows: 44-50/6". Rec. = 1 ft.
86	Poorly Graded SAND with Silt (SP-SM), gray, moist, dense, fine sand, trace silt, gravel up to 1/2" diameter 86 ft EL 708 ft					Smooth drilling to 90 ft.
87						
88						
89						
90	90 ft EL 704 ft		18	SS	87	18-SS at 1130. Blows: 38-43-44. Rec. = 1.5 ft. Lab results - SA: Gravel = 0.4%, Sand = 89.7%, P200 = 9.9%.
91	Poorly Graded SAND with Silt (SP-SM), gray, moist, very dense, medium grained sand, non-plastic silt, similar to 17-SS above 91.5 ft EL 702.5 ft					Hole abandoned per WSDOT requirements. Grout hole to 15 ft bgs. Bentonite chips to 2.5 ft bgs. Gravel to 0.5 ft bgs. AC pavement cold patch to surface. Borehole at surface approx. 8" in diameter.
92	Bottom of Boring at 91.5 ft					
93						
94						
95						
96						
97						
98						
99						
100						

Kleinschmidt

PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 4 of 4

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BORING NO.:

B23-3

SOIL BORING LOG

LAT. (DEG):	-121.43656	**START DATE:**	June 7, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32777	**END DATE:**	June 8, 2023	**NOTES:**	N-26 Roadway, 150-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	792 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
	NF-26 Roadway EL 792 ft					
0	**AC PAVEMENT - 3 INCHES** 0.25 ft EL 791.75 ft					Set up on boring at 1215. Driller is Richard. Helpers are Aaron and Morne. Archaeologist is Emma. Weather is 75 deg F and sunny. Core through AC pavement, setup rig and start drilling at 1235. Slow drilling through dense gravels.
1	**FILL**					
2						
3						
4						
5	5 ft EL 787 ft					
6	Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist, dense (cobble clast in shoe), fine to medium grained sand, fine grained gravel up to 1" diameter, cobble clasts, subround		1	SS	33	1-SS at 1245. Blows: 37-21-12. Rec. = 1 ft.
7	6.5 ft EL 785.5 ft					Driller reports that drilling is smoother than in B23-1 and B23-2.
8						
9						
10	10 ft EL 782 ft					
11	Poorly Graded SAND (SP), brown, moist, medium dense, medium grained sand, trace gravel and cobbles		2	SS	20	2-SS at 1300. Blows: 10-9-11. Rec. = 0.75 ft.
12	11.5 ft EL 780.5 ft					Drill rig rattling but less than in previous borings.
13						
14						
15	15 ft EL 777 ft					
16	Poorly Graded SAND with Gravel & Organics (SP), black, wet, medium dense, medium grained sand, with decomposing wood/organics		3	SS	22	3-SS at 1315. Blows: 11-4-18. Rec. = 1 ft.
17	16.5 ft EL 775.5 ft					Groundwater table near 15 ft. Low blow counts likely due to organics. Slower drilling to 20 ft. Driller reports 2-ft-thick boulder from 17 to 19 ft.
18	18 ft EL 774 ft					
19	**UPPER ALLUVIUM**					
20	20 ft EL 772 ft				REFUSAL	
21	Poorly Graded GRAVEL with Sand (GP), gray to brown, dense (sampler likely bouncing on cobble), gravel up to 3/4" diameter, subround to subangular, medium grained sand		4	SS		4-SS at 1345. Blows: 30-50/3". Rec. = 0.5 ft.
22	20.8 ft EL 771.2 ft					Slow, rattling drilling to 22.5 ft, then driller reports smooth drilling. No abnormal mud loss.
23						
24						
25					REFUSAL	

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Kleinschmidt

PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 1 of 4

BORING NO.:

B23-3

SOIL BORING LOG

LAT. (DEG):	-121.43656	**START DATE:**	June 7, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32777	**END DATE:**	June 8, 2023	**NOTES:**	N-26 Roadway, 150-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	792 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
25	Poorly Graded SAND with Gravel (SP), gray and brown, wet, dense, medium grained sand, trace cobble clasts, subround to subangular, with gravels up to 1" diameter, similar to 4-SS above.		5	SS	REFUSAL	5-SS at 1410. Blows: 18-50/5.5". Rec. = 0.75 ft.
26	26 ft EL 766 ft					
27						
28						
29						
30	30 ft EL 762 ft				44	
31	Silty SAND (SM), brown, wet, dense, fine to medium grained sand, cobble clast in sampler shoe		6	SS		6-SS at 1440. Blows: 7-23-21. Rec. = 1 ft. Lab results - W = 24.7%, P200 = 46.4%.
	31.5 ft EL 760.5 ft					Fast drilling to 35 ft, some rig rattling, potential interbedded layers.
32						
33						
34						
35	35 ft EL 757 ft				25	
36	Well Graded SAND with Silt (SW-SM), gray, wet, medium dense, medium to coarse grained sand, fine grained gravel, subround		7	SS		7-SS at 1455. Blows: 12-15-10. Rec. = 1.25 ft. Lab results - SA: Gravel = 10.7%, Sand = 82.5%, P200 = 6.8%.
	36.5 ft EL 755.5 ft					
37	37 ft EL 755 ft					Some rig rattling to 37 ft, then smooth drilling.
	LACUSTRINE DEPOSITS					
38						
39						
40	40 ft EL 752 ft				21	
41	Silty SAND (SM), brown, wet, medium dense, uniform, no gravel, non-plastic silt		8	SS		8-SS at 1525. Blows: 9-11-10. Rec. = 1.25 ft.
	41.5 ft EL 750.5 ft					Smooth, fast drilling to 45 ft.
42						
43						
44						
45	45 ft EL 747 ft				24	
46	Silty SAND (SM), brown to gray, wet, medium dense, fine grained sand, no gravel, non-plastic silt		9	SS		9-SS at 1535. Blows: 10-12-12. Rec. = 1.25 ft. Lab results - W = 28.8%, P200 = 43.7%.
	46.5 ft EL 745.5 ft					Smooth, fast drilling to 50 ft.
47						
48						
49						
50					18	

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 2 of 4

BORING NO.:

B23-3

SOIL BORING LOG

LAT. (DEG):	-121.43656	**START DATE:**	June 7, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32777	**END DATE:**	June 8, 2023	**NOTES:**	N-26 Roadway, 150-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	792 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
50			10	SS	18	10-SS at 1550. Blows: 3-8-10. Rec. = 1.25 ft. Lab results - W = 30.5%.
51	SILT (ML), gray, wet, medium dense, fine grained sand, no gravel, low to medium plasticity					
	51.5 ft EL 740.5 ft					Smooth, fast drilling to 55 ft.
52						
53						
54						
55	55 ft EL 737 ft		11	SS	11	11-SS at 1600. Blows: 4-5-6. Rec. = 1.5 ft. Lab results - W = 37.8%.
	SILT (ML), gray, wet, stiff, medium plasticity					
56	56.5 ft EL 735.5 ft					
57						
58						
59						
60	60 ft EL 732 ft		12	SS	24	12-SS at 1615. Blows: 8-10-14. Rec. = 1.25 ft.
	SILT (ML), gray, wet, very stiff, fine grained sand, medium plasticity					
61	61.5 ft EL 730.5 ft					
62						
63						
64						
65	65 ft EL 727 ft		13	SS	22	13-SS at 1630. Blows: 4-7-15. Rec. = 1.5 ft. Lab results - W = 30.5%, P200 = 81.6%.
	SILT with Sand (ML), gray, wet, very stiff, fine grained sand, medium plasticity					
66	66.5 ft EL 725.5 ft					
67						
68						
69						
70	70 ft EL 722 ft		14	SS	29	14-SS at 1650. Blows: 11-13-16. Rec. = 1 ft.
	Poorly Graded SAND (SP), brown, wet, medium dense, fine grained sand, trace silt					
71	71.5 ft EL 720.5 ft					Bit placed into borehole to stay overnight. End of day 6/7/23, all offsite at 1715. Start of day 6/8/23 at 0730.
72						
73						
74						
75					20	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 3 of 4

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BORING NO.:

B23-3

SOIL BORING LOG

LAT. (DEG):	-121.43656	**START DATE:**	June 7, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32777	**END DATE:**	June 8, 2023	**NOTES:**	N-26 Roadway, 150-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	792 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91.5				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
75						
76	Sandy SILT (ML), gray, wet, very stiff, fine grained sand, low plasticity, similar to 14-SS except for a change in color		15	SS	20	15-SS at 0820. Blows: 7-8-12. Rec. = 1.5 ft.
	76.5 ft EL 715.5 ft					Driller reports choppy drilling at 78.5 to 79.5 ft.
77						
78						
79						
80	80 ft EL 712 ft				54	
	GLACIAL OUTWASH		16	SS		16-SS at 0845. Blows: 7-22-32. Rec. = 1 ft.
81	Sandy SILT (ML), gray, wet, very stiff, fine grained sand, low plasticity TRANSITION TO Poorly Graded SAND with Gravel (SP), gray, wet, very dense, fine to medium grained sand, medium grained gravel up to 1" diameter					Gravel present in sampler shoe. Driller reports choppy drilling 81 to 82.5 ft and 84.5 to 85 ft.
82						
	81.5 ft EL 710.5 ft					
83						
84						
85	85 ft EL 707 ft				REFUSAL	
	Well Graded SAND with Silt (SW-SM), black/tan/gray, wet, very dense, medium to coarse grained sand, gravel up to 1" diameter		17	SS		17-SS at 0900. Blows: 33-48-50/2". Rec. = 1.25 ft.
86	86.2 ft EL 705.8 ft					Driller reports choppy drilling at 87 to 88 ft.
87						
88						
89						
90	90 ft EL 702 ft				82	
	Well Graded SAND with Silt (SW-SM), gray, moist/wet, very dense, medium grained sand, trace gravel up to 3/4" diameter, similar to 17-SS		18	SS		18-SS at 0920. Blows: 34-35-47. Rec. = 1.5 ft. Lab results - SA: Gravel = 5.1%, Sand = 84.6%, P200 = 10.3%.
91	91.5 ft EL 700.5 ft					Hole abandoned per WSDOT requirements. Grout hole to 15 ft bgs. Bentonite chips to 2.5 ft bgs. Gravel to 0.5 ft bgs. AC pavement cold patch to surface. Borehole at surface approx. 8" in diameter.
92	Bottom of Boring at 91.5 ft					
93						
94						
95						
96						
97						
98						
99						
100						

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 4 of 4

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BORING NO.:

B23-4

SOIL BORING LOG

LAT. (DEG):	-121.43628	**START DATE:**	June 8, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.3275	**END DATE:**	June 8, 2023	**NOTES:**	NF-26 Roadway, 270-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	789 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
	NF-26 Roadway EL 789 ft					
0	**AC PAVEMENT - 2.5 INCHES**					Set up on boring at 1010. Driller is Richard. Helpers are Aaron and Morne. Archaeologist is Emma. Weather is 65 deg F and sunny. Core through AC pavement, setup rig and start drilling at 1020. Slow drilling through dense gravels.
	0.21 ft EL 788.79 ft					
	FILL					
5	5 ft EL 784 ft				71	
	Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist, very dense, fine to medium grained sand, fine grained gravel, cobble clasts, no cementation, subround		1	SS		1-SS at 1050. Blows: 20-27-44. Rec. = 1.25 ft.
	6.5 ft EL 782.5 ft					Driller reports that drilling is smoother than in B23-1, B23-2 and B23-3.
10	10 ft EL 779 ft				6	
	Poorly Graded SAND (SP), brown, moist, very loose, medium grained sand, trace fine grained gravel, no cementation		2	SS		2-SS at 1110. Blows: 10-6-WOH. Rec. = 0.5 ft.
	11.5 ft EL 777.5 ft					Driller reports very soft drilling 11 to 12 ft. Split spoon fell 12 inches on last blow. No abnormal mud loss. Some drill rig rattling to 15 ft, but still easy drilling.
15	15 ft EL 774 ft				REFUSAL	
	Poorly Graded SAND with Silt and Gravel (SP-SM), brown, wet, very dense (cobble in sampler shoe), cobble clasts, gravels up to 3/4" diameter		3	SS		3-SS at 1125. Blows: 12-13-50/4". Rec. = 1 ft.
	16.3 ft EL 772.7 ft					Groundwater table near 15 ft. Driller reports hard drilling except between 17.5 and 18.5 ft where drilling is smooth.
20	20 ft EL 769 ft				REFUSAL	
	UPPER ALLUVIUM		4	SS		4-SS at 1145. Blows: 41-50/4.5". Rec. = 0.75 ft. Lab results - SA: Gravel = 44.2%, Sand = 46.5%, P200 = 9.3%.
	Well Graded SAND with Silt and Gravel (SW-SM), brown, wet, very dense, cobble clasts, medium to coarse grained sand					Driller reports more difficult drilling.
	20.9 ft EL 768.1 ft					
25					REFUSAL	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 1 of 4

BORING NO.:

B23-4

SOIL BORING LOG

LAT. (DEG):	-121.43628	**START DATE:**	June 8, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.3275	**END DATE:**	June 8, 2023	**NOTES:**	NF-26 Roadway, 270-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	789 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
25	Poorly Graded SAND with Gravel and Cobbles (SP), brown, wet, very dense (large gravel in sampler shoe), medium grained sand, fine to medium grained gravel, cobble clasts		5	SS	REFUSAL	5-SS at 1205. Blows: 46-50/2". Rec. = 0.5 ft.
26						Hard drilling to 30 ft bgs. Driller reports very hard drilling 28.5 to 30 ft, possibly a boulder.
27	25.7 ft EL 763.3 ft					
28						
29						
30	30 ft EL 759 ft		6	SS	REFUSAL	6-SS at 1235. Blows: 50/3". Rec. = 0.25 ft.
31	NO RECOVERY - Fragments of boulder in sampler shoe, no sample collected					
32	30.25 ft EL 758.75 ft					Split spoon appears to be bouncing on boulder for 6-SS. Hard drilling to 33 ft, then smooths out.
33	33 ft EL 756 ft					
34	**LACUSTRINE DEPOSITS**					
35	35 ft EL 754 ft				23	
36	Silty SAND (SM), brown, wet, medium dense, non-plastic silt		7	SS		7-SS at 1255. Blows: 10-10-13. Rec. = 1.25 ft.
37	36.5 ft EL 752.5 ft					Smooth, fast drilling to 40 ft.
38						
39						
40	40 ft EL 749 ft				22	
41	Silty SAND (SM), brown, wet, medium dense, mostly fine grained sand, non-plastic silt, similar to 7-SS		8	SS		8-SS at 1315. Blows: 6-10-12. Rec. = 1.5 ft. Lab results - W = 22.4%, P200 = 25.7%.
42	41.5 ft EL 747.5 ft					Smooth, fast drilling to 45 ft.
43						
44						
45	45 ft EL 744 ft				17	
46	Silty SAND (SM), gray, wet, medium dense, fine grained sand, non-plastic silt, similar to 8-SS		9	SS		9-SS at 1325. Blows: 3-6-11. Rec. = 1.5 ft.
47	46.5 ft EL 742.5 ft					Smooth, fast drilling to 50 ft.
48						
49						
50					15	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

BORING NO.:

B23-4

SOIL BORING LOG

LAT. (DEG):	-121.43628	**START DATE:**	June 8, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.3275	**END DATE:**	June 8, 2023	**NOTES:**	NF-26 Roadway, 270-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	789 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
50					15	
51	Sandy SILT (ML), gray, wet, very stiff, fine grained sand, non-plastic silt, similar to 9-SS		10	SS		10-SS at 1340. Blows: 5-5-10. Rec. = 1.5 ft. PP = 1 TSF. Lab results - W = 30.8%.
	51.5 ft EL 737.5 ft					
52						Lunch break, then smooth, fast drilling to 55 ft.
53						
54						
55	55 ft EL 734 ft				22	
	Lean CLAY with Sand (CL), gray, wet, very stiff, fine grained sand		11	SS		11-SS at 1405. Blows: 10-8-14. Rec. = 1.25 ft. Lab results - W = 36.6%, LL = 31.6, PI = 11.4.
56	56.5 ft EL 732.5 ft					
57						Smooth, fast drilling to 60 ft.
58						
59						
60	60 ft EL 729 ft				26	
	Lean CLAY with Sand (CL), gray, wet, very stiff, fine grained sand, low plasticity, similar to 11-SS except for increasing sand content		12	SS		12-SS at 1420. Blows: 7-11-15. Rec. = 1.25 ft.
61	61.5 ft EL 727.5 ft					
62						Smooth, fast drilling to 65 ft.
63						
64						
65	65 ft EL 724 ft				28	
	Clayey SAND (SC), gray, wet, medium dense, fine to medium grained sand, low plasticity		13	SS		13-SS at 1430. Blows: 12-14-14. Rec. = 1.5 ft. Lab results - W = 18.9%, P200 = 20.3%.
66	66.5 ft EL 722.5 ft					
67						Smooth, fast drilling to 70 ft.
68						
69						
70	70 ft EL 719 ft				25	
	Clayey SAND (SC), gray, wet, medium dense, fine grained sand, low plasticity, similar to 13-SS		14	SS		14-SS at 1500. Blows: 8-12-13. Rec. = 1.25 ft.
71	71.5 ft EL 717.5 ft					
72						Smooth, fast drilling to 75 ft.
73						
74						
75					38	

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 3 of 4

BORING NO.:

B23-4

SOIL BORING LOG

LAT. (DEG):	-121.43628	**START DATE:**	June 8, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.3275	**END DATE:**	June 8, 2023	**NOTES:**	NF-26 Roadway, 270-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	789 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	15	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
75						
76	Clayey SAND (SC), gray, wet, dense, fine to medium grained sand, low plasticity		15	SS	38	15-SS at 1520. Blows: 14-19-19. Rec. = 1.5 ft.
	76.5 ft EL 712.5 ft					Smooth drilling to 79.5 ft then driller reports harder drilling.
77						
78						
79						
80	80 ft EL 709 ft				61	
	Sandy CLAY (CL), gray, wet, hard, fine grained sand, low plasticity		16	SS		16-SS at 1540. Blows: 46-34-27. Rec. = 0.75 ft. Lab results - W = 19.0%, P200 = 59.1%.
81	81.5 ft EL 707.5 ft					Some drill rig rattling to 85 ft.
82						
83						
84						
85	85 ft EL 704 ft				85	
	GLACIAL OUTWASH					
86	Poorly Graded SAND with Silt (SP-SM), tan/gray, wet, very dense, medium grained sand		17	SS		17-SS at 1600. Blows: 29-35-50. Rec. = 1.5 ft. Lab results - SA: Gravel = 0.0%, Sand = 90.4%, P200 = 9.6%.
87	86.5 ft EL 702.5 ft					Consistent smooth, but slower drilling.
88						
89						
90	90 ft EL 699 ft				REFUSAL	
	Poorly Graded SAND with Silt (SP-SM), gray/tan, wet, very dense, fine grained sand		18	SS		18-SS at 1630. Blows: 48-50/5". Rec. = 0.75 ft.
91	90.9 ft EL 698.1 ft					
	Bottom of Boring at 90.9 ft					Hole abandoned per WSDOT requirements. Grout hole to 15 ft bgs. Bentonite chips to 2.5 ft bgs. Gravel to 0.5 ft bgs. AC pavement cold patch to surface. Borehole at surface approx. 8" in diameter. Team offsite for week at 1730.
92						
93						
94						
95						
96						
97						
98						
99						
100						

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 4 of 4

BORING NO.:

B23-5

SOIL BORING LOG

LAT. (DEG):	-121.43602	**START DATE:**	June 12, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32713	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 415-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	784 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
	NF-26 Roadway — EL 784 ft					
0	**AC PAVEMENT - 2.25 INCHES**					Onsite at 1230. Driller is Richard. Helpers are Aaron and Wyatt. Archaeologist is Emma. Weather is 80 deg F and sunny. Boring offset 27 ft due to tree limbs overhead. Core through AC pavement, setup rig and start drilling at 1355. Slow drilling through dense gravels.
	0.19 ft / EL 783.81 ft					
1	**FILL**					
5	5 ft / EL 779 ft					
	Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist, very dense (cobble clast in sampler shoe), fine grained sand, medium grained gravel, cobble clasts		1	SS	58	1-SS at 1415. Blows: 11-27-31. Rec. = 1 ft.
	6.5 ft / EL 777.5 ft					Slow, chattering drilling.
10	10 ft / EL 774 ft					
	Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist, dense, medium grained sand, cobble clasts		2	SS	45	2-SS at 1430. Blows: 23-26-19. Rec. = 0.75 ft.
	11.5 ft / EL 772.5 ft					Easy drilling from 10 to 15 ft, drillller reported a few short chattering sections, but mostly smooth.
15	15 ft / EL 769 ft					
	Poorly Graded SAND with Silt and Organics (SP-SM), dark brown, moist, medium dense, fine grained sand, little to no gravel or cobbles, organics include wood and bark		3	SS	15	3-SS at 1440. Blows: 9-8-7. Rec. = 1 ft.
	16.5 ft / EL 767.5 ft					Cuttings at 17 ft are organics, likely a tree stump. Driller reported hard drilling at 18.5 ft.
20	20 ft / EL 764 ft					
	UPPER ALLUVIUM					
	Well Graded GRAVEL with Silt and Sand (GW-GM), brown, wet, dense, fine to medium grained sand, fine grained gravel, cobble clasts, subround to subangular, gravel up to 1" diameter		4	SS	46	4-SS at 1450. Blows: 27-26-20. Rec. = 0.5 ft. Lab results - SA: Gravel = 55.9%, Sand = 35.9%, P200 = 8.2%.
	21.5 ft / EL 762.5 ft					Slow, chattering drilling at 25 ft.
25					REFUSAL	

13 Jun 2023

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 1 of 4

BORING NO.:

B23-5

SOIL BORING LOG

LAT. (DEG):	-121.43602	**START DATE:**	June 12, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32713	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 415-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	784 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
25	NO RECOVERY - Granite cobble fragments present in sampler shoe, no sample collected		5	SS	REFUSAL	5-SS at 1510. Blows: 50/4". Rec. = 0.25 ft.
26	25.4 ft EL 758.6 ft					
27						Slow, chattering drilling, likely cobbles around 28 ft.
28						
29						
30	30 ft EL 754 ft		6	SS	REFUSAL	6-SS at 1525. Blows: 50/5". Rec. = 0.25 ft.
31	NO RECOVERY - Granite cobble fragments present in sampler shoe, no sample collected					
32	30.5 ft EL 753.5 ft **LACUSTRINE DEPOSITS**					Driller reported smooth drilling at 31.5 ft, easy drilling to 35 ft.
33						
34						
35	35 ft EL 749 ft				19	
36	Silty SAND (SM), brown, wet, medium dense, fine grained sand, non-plastic silt		7	SS		7-SS at 1545. Blows: 6-9-10. Rec. = 1.25 ft. Lab results - W = 30.5%, P200 = 37.5%.
37	36.5 ft EL 747.5 ft					Smooth, fast drilling to 40 ft.
38						
39						
40	40 ft EL 744 ft				12	
41	Sandy SILT (ML), brown to gray, wet, very stiff, fine grained sand, non-plastic silt		8	MC		8-MC at 1605. Blows: 12-11-18. Rec. = 1.5 ft.
42	41.5 ft EL 742.5 ft					Two ring samples collected from MC sampler.
43						
44						
45	45 ft EL 739 ft				11	
46	Silty CLAY with Sand (CL-ML), gray, wet, stiff, fine grained sand, low plasticity		9	SS		9-SS at 1635. Blows: 4-4-7. Rec. = 1.5 ft. Lab results - W = 30.1%, LL = 26.4, PI = 6.4, P200 = 78.1%.
47	46.5 ft EL 737.5 ft					Smooth, fast drilling to 50 ft.
48						
49						
50					18	

Kleinschmidt

	PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
	CLIENT: Skagit River System Cooperative	**SHEET:** 2 of 4

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BORING NO.:

B23-5

SOIL BORING LOG

LAT. (DEG):	-121.43602	**START DATE:**	June 12, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32713	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 415-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	784 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
50						
51	SILT with Sand (ML), gray, wet, very stiff, trace fine grained sand, low plasticity		10	SS	18	10-SS at 1645. Blows: 4-8-10. Rec. = 1.5 ft. Lab results - W = 35.9%.
	51.5 ft EL 732.5 ft					
52						Lunch break, then smooth, fast drilling to 55 ft.
53						
54						
55	55 ft EL 729 ft				18	
	SILT (ML), gray, wet, very stiff, trace fine grained sand, low plasticity		11	SS		11-SS at 1655. Blows: 8-8-10. Rec. = 1.5 ft. Lab results - W = 39.3%, P200 = 89.0%.
56	56.5 ft EL 727.5 ft					
57						End of day 6/12/23. All offsite at 1715. Start of day 6/13/23 at 0730.
58						
59						
60	60 ft EL 724 ft				23	
	Silty SAND (SM), brown, wet, medium dense, fine grained sand		12	SS		12-SS at 0805. Blows: 11-9-14. Rec. = 1.25 ft.
61	61.5 ft EL 722.5 ft					
62						Smooth, fast drilling to 65 ft.
63						
64						
65	65 ft EL 719 ft				27	
	Silty SAND (SM), brown, wet, medium dense, fine grained sand		13	SS		13-SS at 0825. Blows: 9-12-15. Rec. = 1.25 ft. Lab results - W = 27.0%, P200 = 24.4%.
66	66.5 ft EL 717.5 ft					
67						Smooth, fast drilling to 69 ft 8 in. Driller reported hard drilling at 69 ft 8 in.
68						
69						
70	70 ft EL 714 ft				REFUSAL	
	GLACIAL OUTWASH		14	SS		14-SS at 0840. Blows: 41-50/5". Rec. = 0.75 ft.
71	Poorly Graded SAND with Gravel (SP), brown to gray, wet, very dense (gravel in sampler shoe), medium to coarse grained sand, fine to medium grained gravel, trace silt, subround to subangular, gravel up to 1" diameter					
72						Smooth but slow drilling to 75 ft.
73	70.9 ft EL 713.1 ft					
74						
75					78	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 3 of 4

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BORING NO.:

B23-5

SOIL BORING LOG

LAT. (DEG):	-121.43602	**START DATE:**	June 12, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32713	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 415-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	784 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	90.9				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
75						
76	Poorly Graded SAND (SP), gray, wet, very dense, fine to medium grained sand		15	SS	78	15-SS at 0855. Blows: 36-36-42. Rec. = 1 ft.
	76.5 ft EL 707.5 ft					Driller reports smooth drilling to 80 ft.
77						
78						
79						
80	80 ft EL 704 ft				69	16-SS at 0920. Blows: 25-29-40. Rec. = 1.25 ft. PP = 2.5 to 4.5 TSF.
81	Silty SAND (SM), gray, wet, very dense, low to no plasticity, fine grained sand		16	SS		
	81.5 ft EL 702.5 ft					Smooth but slow drilling to 85 ft.
82						
83						
84						
85	85 ft EL 699 ft				83	17-SS at 0940. Blows: 28-36-47. Rec. = 1.25 ft. Lab results - SA: Gravel = 1.4%, Sand = 86.9%, P200 = 11.7%.
86	Well Graded SAND with Silt (SW-SM), gray, wet, very dense, fine to medium grained sand		17	SS		
	86.5 ft EL 697.5 ft					Smooth but slow drilling to 90 ft. Driller reports some small gravel layers around 88.5 ft.
87						
88						
89						
90	90 ft EL 694 ft				REFUSAL	18-SS at 1000. Blows: 45-50/5". Rec. = 0.75 ft.
91	Well Graded SAND with Silt and Gravel (SW-SM), gray, wet, very dense, fine to coarse grained sand, medium grained gravel, cobble clasts		18	SS		
	90.9 ft EL 693.1 ft					Hole abandoned per WSDOT requirements. Grout hole to 15 ft bgs. Bentonite chips to 2.5 ft bgs. Gravel to 0.5 ft bgs. AC pavement cold patch to surface. Borehole at surface approx. 8" in diameter.
92	Bottom of Boring at 90.9 ft					
93						
94						
95						
96						
97						
98						
99						
100						

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 4 of 4

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BORING NO.:

B23-6

SOIL BORING LOG

LAT. (DEG):	-121.43584	**START DATE:**	June 13, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32687	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 510-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	780 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
	NF-26 Roadway — EL 780 ft					
0	**AC PAVEMENT - 4 INCHES** — 0.33 ft / EL 779.67 ft					Driller is Richard. Helpers are Aaron and Wyatt. Archaeologist is Emma. Weather is 65 deg F and partly cloudy. Core through AC pavement, setup rig and start drilling at 1050. Slow drilling through dense gravels.
1	**FILL**					
2						
3						
4						
5	5 ft / EL 775 ft		1	SS	REFUSAL	1-SS at 1055. Blows: 50/3". Rec. = 0.25 ft.
6	NO RECOVERY - Cobble clast in shoe, no sample collected — 5.3 ft / EL 774.7 ft					Slow, rattling drilling, dense material, driller reports some thin looser layers. Driller reports much looser material at 9 ft.
7						
8						
9						
10	10 ft / EL 770 ft		2	SS	13	2-SS at 1115. Blows: 7-6-7. Rec. = 0 ft.
11	NO RECOVERY — 11.5 ft / EL 768.5 ft					After last blow, sampler dropped approx. 6 in. Lost full talk of mud in the borehole. Void appears to be open at approx. 10 ft bgs. Casing pushed to 15 ft bgs.
12						
13						
14						
15	15 ft / EL 765 ft		3	MC	53	3-MC at 1225. Blows: 34-26-100/6". Rec. = 0.5 ft.
16	Poorly Graded SAND with Gravel and Cobbles (SP), brown, moist/wet, very dense (cobble clast in sampler shoe), cobble clasts throughout — 16.5 ft / EL 763.5 ft					Driller reports hard drilling to 17 ft and then another loose area. Lost another full tank of mud. Hole caved in 15 to 20 ft. Casing pushed to 20 ft.
17						
18						
19						
20 ▽ 13 Jun 2023	20 ft / EL 760 ft		4	SS	27	4-SS at 1310. Blows: 12-13-14. Rec. = 1 ft.
21	**UPPER ALLUVIUM**					
22	Poorly Graded SAND with Gravel and Cobbles (SP), brown/red, wet, medium dense, fine to medium grained sand, medium gravel up to 1" dia., cobble clasts present throughout, subround to subangular — 21.5 ft / EL 758.5 ft					Slow, consistent drilling to 25 ft.
23						
24					18	
25						

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Kleinschmidt

PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 1 of 4

BORING NO.:
B23-6

SOIL BORING LOG

LAT. (DEG):	-121.43584	**START DATE:**	June 13, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32687	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 510-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	780 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
25	*(continued)*		5	SS	18	5-SS at 1320. Blows: 19-9-9. Rec. = 0.25 ft.
26	26 ft / EL 754 ft **LACUSTRINE DEPOSITS** NO RECOVERY - Cobble clasts present in sampler shoe, no sample collected					Driller reported easy drilling at 26 ft.
27	27.5 ft / EL 752.5 ft					
28						
29						
30	30 ft / EL 750 ft					
31	Sandy SILT (ML), brown/gray, wet, stiff, fine grained sand, no to low plasticity		6	SS	13	6-SS at 1335. Blows: 10-6-7. Rec. = 1 ft. Lab results - W = 27.7%, P200 = 61.1%.
32	31.5 ft / EL 748.5 ft					Smooth, fast drilling to 35 ft.
33						
34						
35	35 ft / EL 745 ft					
36	SILT (ML), brown/gray, wet, stiff, trace fine grained sand, low to medium plasticity, similar to 6-SS except for an increase in silt content		7	SS	9	7-SS at 1345. Blows: 3-4-5. Rec. = 1.5 ft. PP = 0.5 to 0.75 TSF. Lab results - W = 50.2%, LL = 36.8, PI = 10.1.
37	36.5 ft / EL 743.5 ft					Smooth, fast drilling to 40 ft. Lost full tank of mud in the borehole. Looking down borehole, mud level appears to be at base of casing.
38						
39						
40	40 ft / EL 740 ft					
41	SILT (ML), gray, wet, firm, trace fine grained sand, low to medium plasticity, similar to 7-SS		8	SS	6	8-SS at 1355. Blows: 2-2-4. Rec. = 1.5 ft. Lab results - W = 32.8%.
42	41.5 ft / EL 738.5 ft					Casing pushed to 30 ft to seal casing in silt. Lost 3/4 tank of mud.
43						
44						
45	45 ft / EL 735 ft					
46	Sandy SILT (ML), gray, wet, very stiff, fine grained sand, low to medium plasticity, similar to 8-SS except for an increase in sand content		9	SS	16	9-SS at 1455. Blows: 4-6-10. Rec. = 1.25 ft. Lab results - W = 28.3%, P200 = 70.5%.
47	46.5 ft / EL 733.5 ft					Fill water tank.
48						
49						
50					17	

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 2 of 4

BORING NO.:

B23-6

SOIL BORING LOG

LAT. (DEG):	-121.43584	**START DATE:**	June 13, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32687	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 510-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	780 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
50						
51	Sandy SILT (ML), gray, wet, very stiff, fine grained sand, low to medium plasticity, similar to 9-SS		10	SS	17	10-SS at 1515. Blows: 5-6-11. Rec. = 1.5 ft. Lab results - W = 33.6%, P200 = 62.9%.
	51.5 ft EL 728.5 ft					
52						Smooth, fast drilling to 55 ft.
53						
54						
55	55 ft EL 725 ft				26	
	Poorly Graded SAND (SP), brown, wet, medium dense, fine grained sand, low to no plasticity		11	SS		11-SS at 1530. Blows: 8-12-14. Rec. = 1 ft.
56	56.5 ft EL 723.5 ft					
57						Lost 1/2 tank of mud, likely due to flaw in casing. Mix more mud. Smooth, fast drilling to 60 ft.
58						
59						
60	60 ft EL 720 ft				26	
	Poorly Graded SAND (SP), brown, wet, medium dense, fine grained sand, low to no plasticity		12	SS		12-SS at 1545. Blows: 7-12-14. Rec. = 1 ft.
61	61.5 ft EL 718.5 ft					
62						Smooth, fast drilling to 65 ft.
63						
64						
65	65 ft EL 715 ft				77	
	GLACIAL OUTWASH					
66	Poorly Graded SAND (SP), gray, wet, very dense, fine grained sand, no cementation		13	SS		13-SS at 1610. Blows: 26-34-43. Rec. = 1 ft.
67	66.5 ft EL 713.5 ft					Smooth, fast drilling to 70 ft.
68						
69						
70	70 ft EL 710 ft				70	
	Poorly Graded SAND (SP), gray, wet, very dense, medium grained sand, no cementation		14	SS		14-SS at 1620. Blows: 33-32-38. Rec. = 1.5 ft.
71	71.5 ft EL 708.5 ft					
72						Smooth, fast drilling to 75 ft.
73						
74						
75					94	

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PROJECT TITLE: Tenas Creek Restoration Project

PROJECT NO.: 4976238

CLIENT: Skagit River System Cooperative

SHEET: 3 of 4

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BORING NO.:

B23-6

SOIL BORING LOG

LAT. (DEG):	-121.43584	**START DATE:**	June 13, 2023	**LOGGER:**	H. Russell
LONG. (DEG.):	48.32687	**END DATE:**	June 13, 2023	**NOTES:**	NF-26 Roadway, 510-ft east of Exist. Bridge, WB lane shoulder. Elevations based on NAVD88.
ELEVATION:	780 ft	**DRILLER:**	Western States Soil Conservation, Inc. (Hubbard, OR)		
TOTAL DEPTH (FT):	91				
WATER DEPTH (FT):	20	**EQUIPMENT:**	CME 850 Track, Mud Rotary, SPT Auto-Hammer, 3.88" to 6" dia.		
ORIENTATION:	90				

Depth Scale	Lithologic Description	Symbol	Samples No.	Samples Type	Standard Penetration Test (SPT) 25 50 75	Comments
75						
76	Poorly Graded SAND (SP), gray, wet, very dense, fine to medium grained sand, no cementation, similar to 14-SS		15	SS	94	15-SS at 1635. Blows: 40-44-50/6". Rec. = 1.5 ft.
	76.5 ft EL 703.5 ft					
77						Smooth, fast drilling to 80 ft.
78						
79						
80	80 ft EL 700 ft				79	16-SS at 1650. Blows: 31-39-40. Rec. = 1.5 ft.
81	Silty SAND (SM), gray, wet, very dense, fine grained sand, micaceous, non-plastic silt		16	SS		
	81.5 ft EL 698.5 ft					
82						Smooth, fast drilling to 85 ft.
83						
84						
85	85 ft EL 695 ft				REFUSAL	17-MC at 1710. Blows: 74-78. Rec. = 1 ft.
86	Poorly Graded SAND (SP), gray, wet, very dense, fine to medium grained sand, no fines observed		17	MC		
	86 ft EL 694 ft					
87						Dropped hammer over 50 blows to collect sample. One ring collected from MC sampler. Driller reported choppy drilling at 88 ft.
88						
89						
90	90 ft EL 690 ft				REFUSAL	18-SS at 1730. Blows: 43-50/6". Rec. = 1 ft. Lab results - SA: Gravel = 1.5%, Sand = 85.7%, P200 = 12.8%.
91	Poorly Graded SAND (SP), gray, wet, very dense, medium grained sand, no fines observed		18	SS		
	91 ft EL 689 ft					
92	Bottom of Boring at 91 ft					Hole abandoned per WSDOT requirements. Grout hole to 15 ft bgs. Bentonite chips to 2.5 ft bgs. Gravel to 0.5 ft bgs. AC pavement cold patch to surface. Borehole at surface approx. 8" in diameter. All offsite at 1915.
93						
94						
95						
96						
97						
98						
99						
100						

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PROJECT TITLE: Tenas Creek Restoration Project	**PROJECT NO.:** 4976238
CLIENT: Skagit River System Cooperative	**SHEET:** 4 of 4

Appendix D

Laboratory Testing Results

FEI TESTING & INSPECTION, INC.
Geotechnical & Construction Services

LETTER OF TRANSMITTAL

Date: August 3, 2023

Project No.: 2236175

Re: Tenas Creek Restoration

To: Kleinschmidt Group
141 Main Street
Pittsfield, ME 04967

Attn: Michael Eller, P.E., G.E.

Enclosed are:

☐ Report ☐ Drawings ☑ Test Results (20 Pages Total Incl. Cover)
☐ Copy of Letter ☐ Specifications
☐ Other

These are transmitted as checked below:

☑ For your use ☐ For your review/approval
☑ As requested ☐ For your files

Remarks: Requested laboratory testing results attached. Please call if you have any questions.

Location of Testing: Corvallis Laboratory
Date Sampled: unknown
Sample No.: 9081

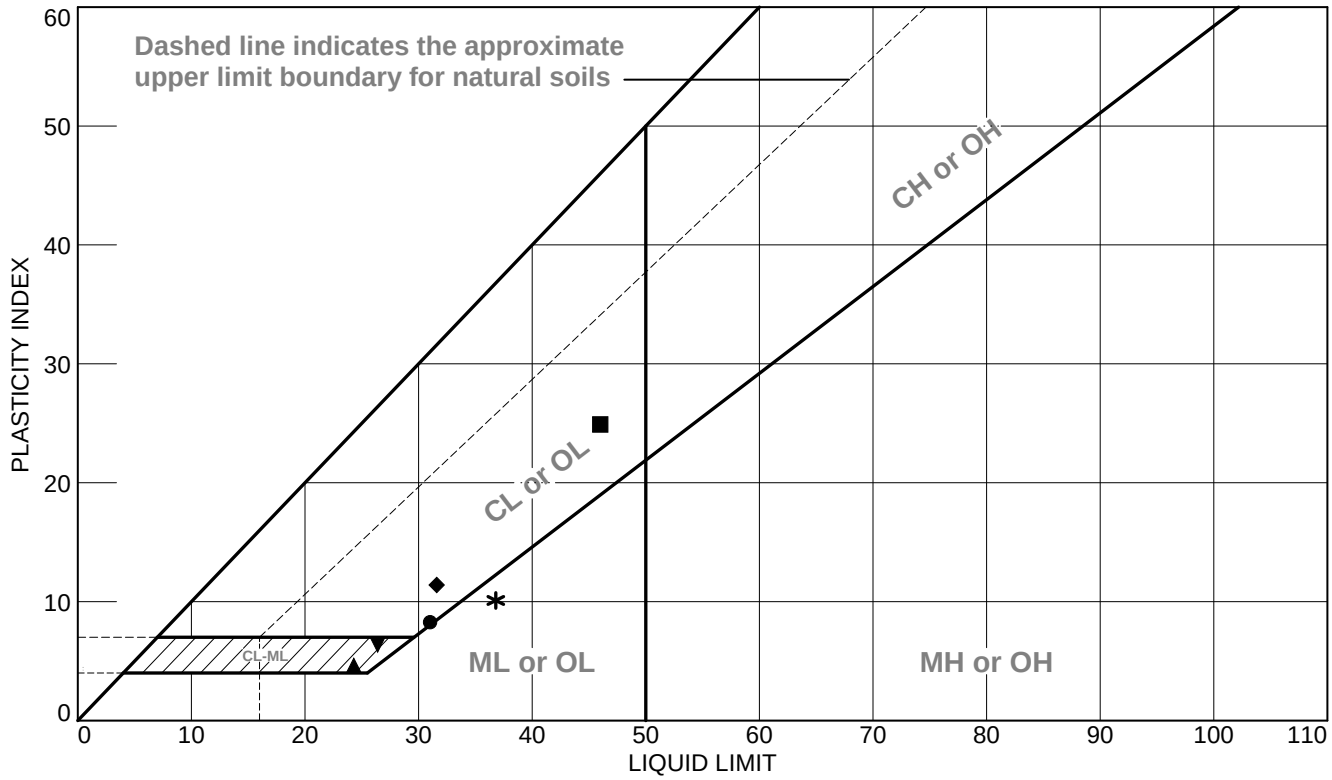
Copy to:

Signature:

Rachel Ray
President

This report and/or enclosed test data is the confidential property of the client to whom it is addressed and pertains to the specific process and/or material evaluated. As such, information contained herein shall not be reproduced in part or full and/or any part thereof be disclosed without FEI Testing & Inspection, Inc.'s written authorization.

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	9081	B23-1, 10-SS	50.0-51.5'	44.3	22.9	31.1	8.2	CL
■	9081	B23-1, 12-SS	60.0-61.5'	36.0	21.1	46.0	24.9	CL
▲	9081	B23-1, 14-SS	70.0-71.5'	16.1	19.7	24.3	4.6	CL-ML
◆	9081	B23-4, 11-SS	55.0-56.5'	36.6	20.2	31.6	11.4	CL
▼	9081	B23-5, 9-SS	45.0-46.5'	30.1	20.0	26.4	6.4	CL-ML
✳	9081	B23-6, 7-SS	35.0-36.5'	50.2	26.7	36.8	10.1	ML

FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No.: 2236175 **Figure**

FEI TESTING & INSPECTION, INC.
Geotechnical & Construction Services

Percent Fines & Water Content Test (ASTM D 1140)

PROJECT NAME	***Tenas Creek Restoration***	*PROJECT NUMBER*	***2236175***
		FEI SAMPLE NUMBER	
RECORDED BY		*DATE*	***7/20/2023***
CLIENT	***Kleinschmidt***	*CLIENT PROJECT NUMBER*	***4976238***

WATER CONTENT DIR or AUX*	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***
SAMPLE DESIGNATION	**B23-1, 3-SS**	**B23-1, 5-SS**	**B23-1, 9-SS**	**B23-1, 10-SS**	**B23-1, 13-SS**	**B23-1, 15-SS**	**B23-2, 8-SS**
SAMPLE DEPTH (FT)	**10.0-11.5**	**25.0-26.5**	**45.0-46.5**	**50.0-51.5**	**65.0-66.5**	**75.0-76.5**	**40.0-41.5**
Pan Number	18	#6	61	Z10	Z13	Z2	50
Wt. of Wet Soil + Pan (g)	247.16	288.52	265.31	376.30	347.34	340.92	275.86
Wt. of Dry Soil + Pan (g)	207.71	262.37	227.27	316.68	305.72	304.79	236.89
Wt. of Water (g)	39.45	26.15	38.04	59.62	41.62	36.13	38.97
Wt. of Pan (g)	70.08	75.81	79.28	120.07	124.81	124.95	80.63
Wt. of Dry Soil (g)	137.63	186.56	147.99	196.61	180.91	179.84	156.26
Water Content (%)	**28.7%**	**14.0%**	**25.7%**	**30.3%**	**23.0%**	**20.1%**	**24.9%**

TEST SAMPLE DATA							
TEST METHOD A or B	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Length of Time Sample Soaked (hrs	**24**	**24**	**24**	**24**	**24**	**24**	**24**
Pan Number	18	#6	61	Z10	Z13	Z2	50
Wet Wt. + Pan (g)	247.16	288.52	265.31	376.30	347.34	340.92	275.86
Wet Wt. (g)	177.08	212.71	186.03	256.23	222.53	215.97	195.23
Wt. of Pan (g)	70.08	75.81	79.28	120.07	124.81	124.95	80.63
(A) Dry Soil (g) (Total Sample)	137.63	186.56	147.99	196.61	180.91	179.84	156.26

AFTER WASHING							
Pan Number	18	#6	61	Z10	Z13	Z2	50
Dry Wt. + Pan (g)	138.13	226.21	195.85	170.32	166.64	215.05	199.44
Wt. of Pan (g)	70.08	75.81	79.28	120.07	124.81	124.95	80.63
(B) Wt. of Dry Soil	68.05	150.40	116.57	50.25	41.83	90.10	118.81
(C) Total Loss (g) (No. 200) (C=A-B)	69.58	36.16	31.42	146.36	139.08	89.74	37.45
% Fines (C/A)	**50.6%**	**19.4%**	**21.2%**	**74.4%**	**76.9%**	**49.9%**	**24.0%**

*DIR=Dry mass was determined directly by drying the test specimen

*AUX=Dry mass was determined using an auxiliary water content specimen

Equipment Used

Oven ID #	**6060**
Scale ID #	**6067**
Sieve ID #	**LS30B**

Reviewed By Rachel Ray

FEI TESTING & INSPECTION, INC.
Geotechnical & Construction Services

Percent Fines & Water Content Test (ASTM D 1140)

PROJECT NAME	***Tenas Creek Restoration***	*PROJECT NUMBER*	***2236175***
		FEI SAMPLE NUMBER	
RECORDED BY		*DATE*	***7/20/2023***
CLIENT	***Kleinschmidt***	*CLIENT PROJECT NUMBER*	***4976238***

WATER CONTENT DIR or AUX*	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***
SAMPLE DESIGNATION	**B23-2, 14-SS**	**B23-3, 6-SS**	**B23-3, 9-SS**	**B23-3, 13-SS**	**B23-4, 8-SS**	**B23-4, 13-SS**	**B23-4, 16-SS**
SAMPLE DEPTH (FT)	**70.0-71.5**	**30.0-31.5**	**45.0-46.5**	**65.0-66.5**	**40.0-41.5**	**65.0-66.5**	**80.0-81.5**
Pan Number	55	8	33	20	15	#6	34
Wt. of Wet Soil + Pan (g)	289.17	283.80	324.93	282.64	273.75	281.41	250.10
Wt. of Dry Soil + Pan (g)	254.88	242.62	270.13	232.88	236.56	248.72	222.87
Wt. of Water (g)	34.29	41.18	54.80	49.76	37.19	32.69	27.23
Wt. of Pan (g)	81.37	76.17	80.04	69.66	70.45	75.81	79.82
Wt. of Dry Soil (g)	173.51	166.45	190.09	163.22	166.11	172.91	143.05
Water Content (%)	**19.8%**	**24.7%**	**28.8%**	**30.5%**	**22.4%**	**18.9%**	**19.0%**

TEST SAMPLE DATA							
TEST METHOD A or B	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Length of Time Sample Soaked (hrs	**24**	**24**	**24**	**24**	**24**	**24**	**24**
Pan Number	55	8	33	20	15	#6	34
Wet Wt. + Pan (g)	289.17	283.80	324.93	282.64	273.75	281.41	250.10
Wet Wt. (g)	207.80	207.63	244.89	212.98	203.30	205.60	170.28
Wt. of Pan (g)	81.37	76.17	80.04	69.66	70.45	75.81	79.82
(A) Dry Soil (g) (Total Sample)	173.51	166.45	190.09	163.22	166.11	172.91	143.05

AFTER WASHING							
Pan Number	55	8	33	20	15	#6	34
Dry Wt. + Pan (g)	170.31	165.42	187.03	99.70	193.94	213.65	138.30
Wt. of Pan (g)	81.37	76.17	80.04	69.66	70.45	75.81	79.82
(B) Wt. of Dry Soil	88.94	89.25	106.99	30.04	123.49	137.84	58.48
(C) Total Loss (g) (No. 200) (C=A-B)	84.57	77.20	83.10	133.18	42.62	35.07	84.57
% Fines (C/A)	**48.7%**	**46.4%**	**43.7%**	**81.6%**	**25.7%**	**20.3%**	**59.1%**

*DIR=Dry mass was determined directly by drying the test specimen

*AUX=Dry mass was determined using an auxiliary water content specimen

Equipment Used

Oven ID #	**6060**
Scale ID #	**6067**
Sieve ID #	**LS30B**

Reviewed By Rachel Ray

FEI TESTING & INSPECTION, INC.
Geotechnical & Construction Services

Percent Fines & Water Content Test (ASTM D 1140)

PROJECT NAME	***Tenas Creek Restoration***	*PROJECT NUMBER*	***2236175***
		FEI SAMPLE NUMBER	
RECORDED BY		*DATE*	***7/20/2023***
CLIENT	***Kleinschmidt***	*CLIENT PROJECT NUMBER*	***4976238***

WATER CONTENT DIR or AUX*	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***	***DIR***
SAMPLE DESIGNATION	**B23-5, 7-SS**	**B23-5, 9-SS**	**B23-5, 11-SS**	**B23-5, 13-SS**	**B23-6, 6-SS**	**B23-6, 9-SS**	**B23-6, 10-SS**
SAMPLE DEPTH (FT)	**35.0-36.5**	**45.0-46.5**	**50.0-56.5**	**65.0-66.5**	**30.0-31.5**	**45.0-46.5**	**50.0-51.5**
Pan Number	63	Lyell	23	#11	15	52	64
Wt. of Wet Soil + Pan (g)	304.73	271.60	244.41	272.05	262.04	237.88	252.48
Wt. of Dry Soil + Pan (g)	251.97	225.71	195.22	230.49	220.47	202.87	208.90
Wt. of Water (g)	52.76	45.89	49.19	41.56	41.57	35.01	43.58
Wt. of Pan (g)	78.84	76.61	69.97	76.79	70.30	78.97	79.06
Wt. of Dry Soil (g)	173.13	149.10	125.25	153.70	150.17	123.90	129.84
Water Content (%)	**30.5%**	**30.8%**	**39.3%**	**27.0%**	**27.7%**	**28.3%**	**33.6%**

TEST SAMPLE DATA							
TEST METHOD A or B	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Length of Time Sample Soaked (hrs	**24**	**24**	**24**	**24**	**24**	**24**	**24**
Pan Number	63	Lyell	23	#11	15	52	64
Wet Wt. + Pan (g)	304.73	271.60	244.41	272.05	262.04	237.88	252.48
Wet Wt. (g)	225.89	194.99	174.44	195.26	191.74	158.91	173.42
Wt. of Pan (g)	78.84	76.61	69.97	76.79	70.30	78.97	79.06
(A) Dry Soil (g) (Total Sample)	173.13	149.10	125.25	153.70	150.17	123.90	129.84

AFTER WASHING							
Pan Number	63	Lyell	23	#11	15	52	64
Dry Wt. + Pan (g)	187.04	109.20	83.69	192.95	128.72	115.49	127.29
Wt. of Pan (g)	78.84	76.61	69.97	76.79	70.30	78.97	79.06
(B) Wt. of Dry Soil	108.20	32.59	13.72	116.16	58.42	36.52	48.23
(C) Total Loss (g) (No. 200) (C=A-B)	64.93	116.51	111.53	37.54	91.75	87.38	81.61
% Fines (C/A)	**37.5%**	**78.1%**	**89.0%**	**24.4%**	**61.1%**	**70.5%**	**62.9%**

*DIR=Dry mass was determined directly by drying the test specimen

*AUX=Dry mass was determined using an auxiliary water content specimen

Equipment Used

Oven ID #	**6060**
Scale ID #	**6067**
Sieve ID #	**LS30B**

Reviewed By Rachel Ray

FEI TESTING & INSPECTION, INC.
Geotechnical & Construction Services

Water Content Determination (ASTM D 2216)

PROJECT NAME	***Tenas Creek Restoration***	*PROJECT NUMBER*	***2236175***
		FEI SAMPLE NUMBER	***9081***
RECORDED BY		*DATE*	***7/25/2023***
CLIENT	***Kleinschmidt***	*CLIENT PROJECT NUMBER*	***4976238***
REMARKS			
TEST METHOD A or B	**B**		

SAMPLE DESIGNATION	B23-2, 12-SS	B23-3, 10-SS	B23-3, 11-SS	B23-4, 10-SS	B23-5, 10-SS	B23-6, 8-SS	
SAMPLE DEPTH (FT)	**60.0-61.5**	**50.0-51.5**	**55.0-56.5**	**50.0-51.5**	**50.0-51.5**	**40.0-41.5**	
Pan Number	z2	z13	z11	z10	z6	z11	
Wt. of Wet Soil + Pan (g)	371.90	379.80	421.82	367.20	355.41	357.20	
Wt. of Dry Soil + Pan (g)	303.46	320.19	361.30	309.07	294.34	318.70	
Wt. of Water (g)	68.44	59.61	60.52	58.13	61.07	38.50	
Wt. of Pan (g)	125.05	124.90	201.33	120.07	124.03	201.33	
Wt. of Dry Soil (g)	178.41	195.29	159.97	189.00	170.31	117.37	
Water Content (%)	**38.4%**	**30.5%**	**37.8%**	**30.8%**	**35.9%**	**32.8%**	

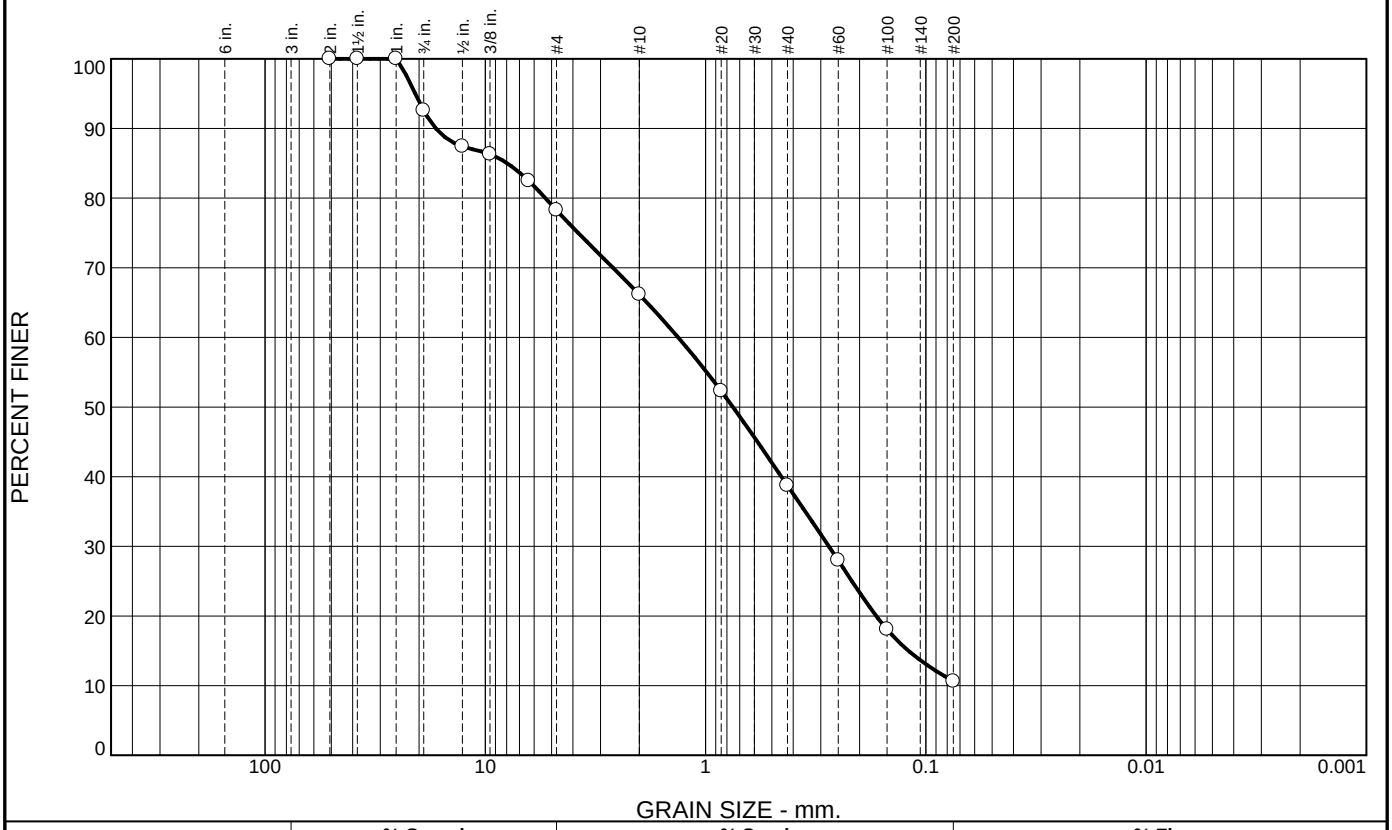
SAMPLE DESIGNATION							
SAMPLE DEPTH (FT)							
Pan Number							
Wt. of Wet Soil + Pan (g)							
Wt. of Dry Soil + Pan (g)							
Wt. of Water (g)							
Wt. of Pan (g)							
Wt. of Dry Soil (g)							
Water Content (%)							

SAMPLE DESIGNATION							
SAMPLE DEPTH (FT)							
Pan Number							
Wt. of Wet Soil + Pan (g)							
Wt. of Dry Soil + Pan (g)							
Wt. of Water (g)							
Wt. of Pan (g)							
Wt. of Dry Soil (g)							
Water Content (%)							

Equipment Used
Oven ID # **6060**
Scale ID # **6067**

Reviewed By Rachel Ray

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.4	14.3	12.1	27.5	28.1	10.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
1.5	100.0		
1	100.0		
3/4	92.6		
1/2	87.4		
3/8	86.3		
1/4	82.5		
#4	78.3		
#10	66.2		
#20	52.3		
#40	38.7		
#60	28.0		
#100	18.1		
#200	10.6		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.7607 D_{85}= 7.9589 D_{60}= 1.3322
D_{50}= 0.7513 D_{30}= 0.2756 D_{15}= 0.1199
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

7-24-2023

Source of Sample: 9081 **Depth:** 30.0-31.5'
Sample Number: B23-1, 6-SS **Date:**

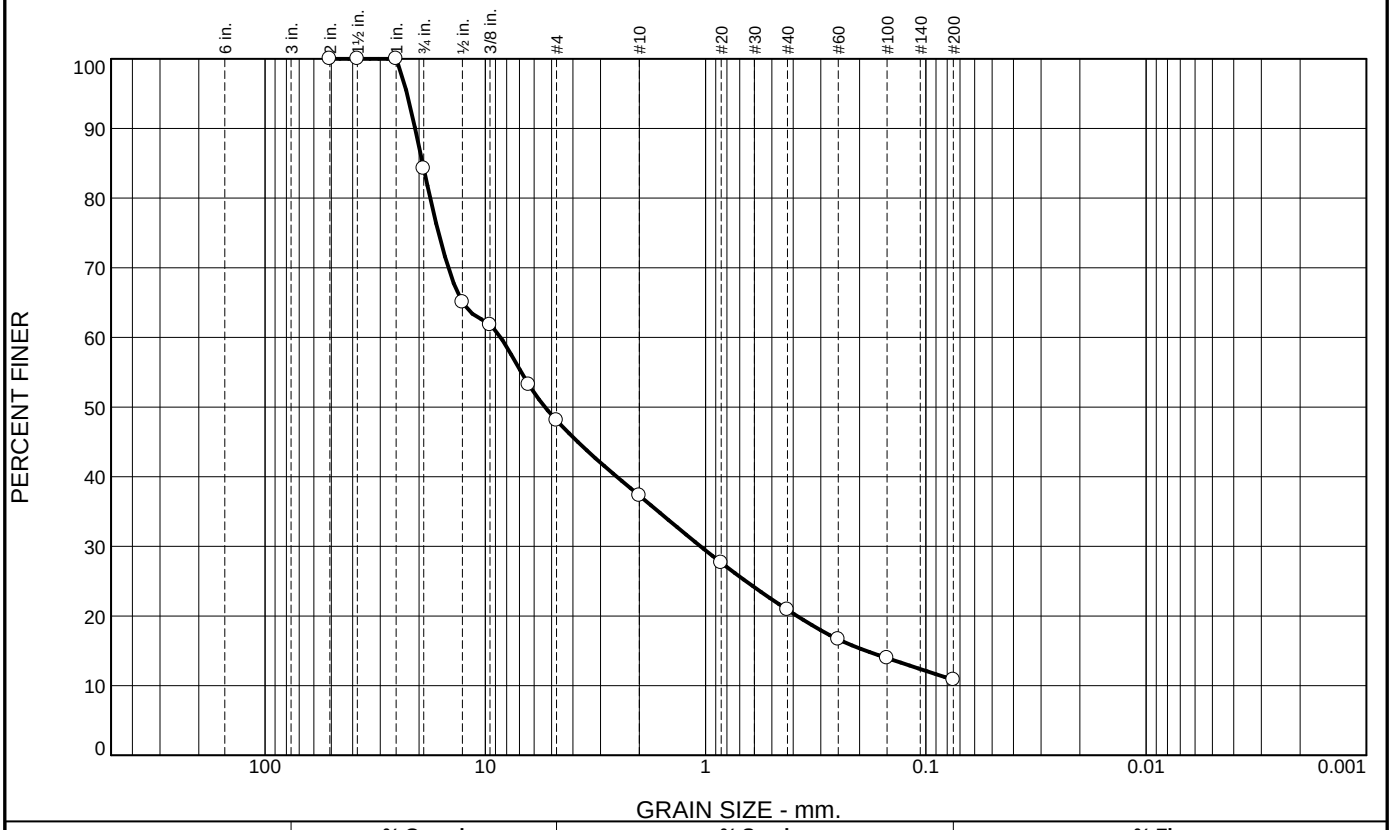
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.7	36.2	10.8	16.4	10.1	10.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
1.5	100.0		
1	100.0		
3/4	84.3		
1/2	65.0		
3/8	61.8		
1/4	53.2		
#4	48.1		
#10	37.3		
#20	27.7		
#40	20.9		
#60	16.7		
#100	14.0		
#200	10.8		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.8355 D_{85}= 19.2729 D_{60}= 8.5251
D_{50}= 5.3603 D_{30}= 1.0540 D_{15}= 0.1868
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

7-24-2023

Source of Sample: 9081 **Depth:** 40.0-41.5'
Sample Number: B23-1, 8-SS **Date:**

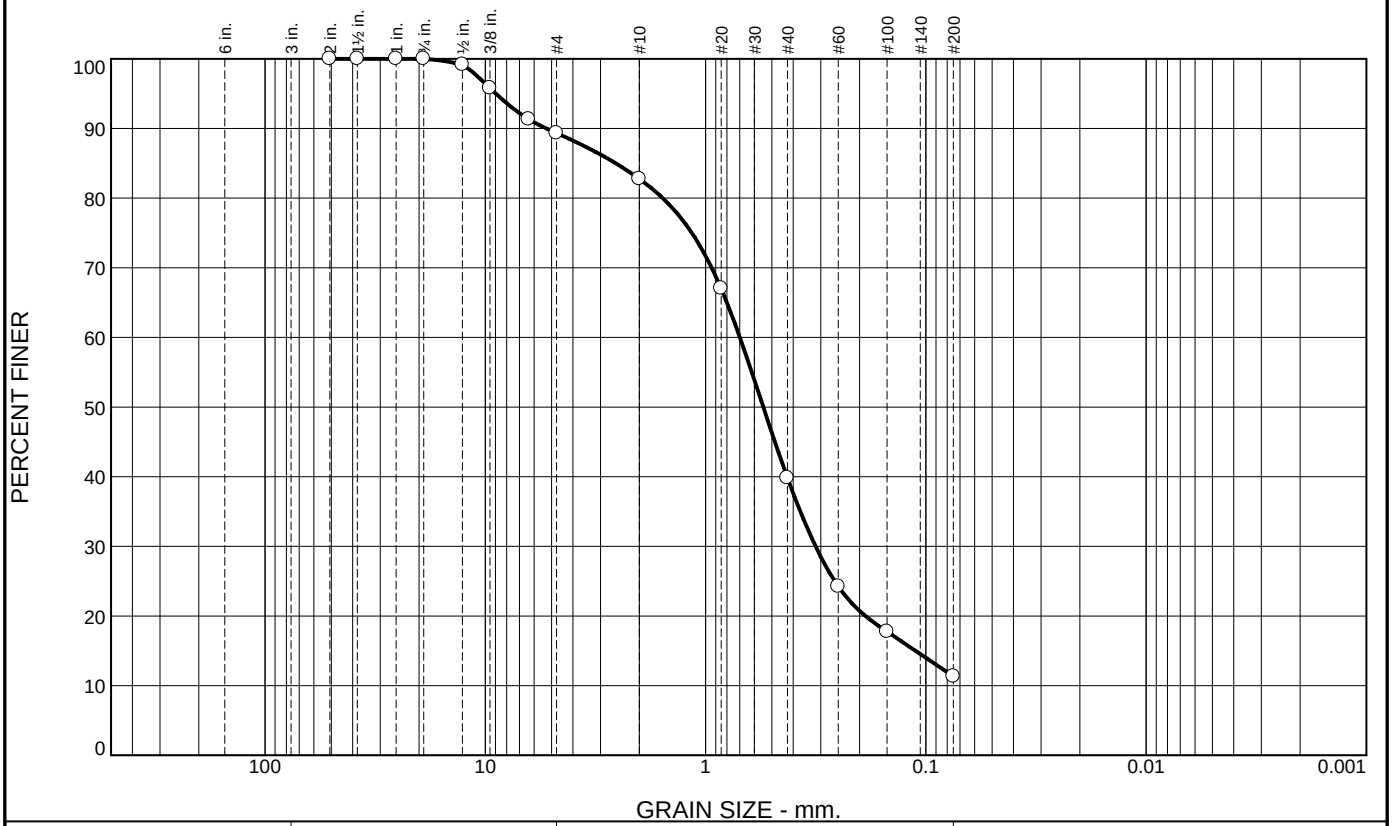
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.7	6.5	43.0	28.5	11.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	99.2		
3/8	95.8		
1/4	91.3		
#4	89.3		
#10	82.8		
#20	67.0		
#40	39.8		
#60	24.3		
#100	17.8		
#200	11.3		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.2919 D_{85}= 2.5586 D_{60}= 0.6986
D_{50}= 0.5467 D_{30}= 0.3167 D_{15}= 0.1114
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

7-24-2023

Source of Sample: 9081 **Depth:** 90.0-91.0
Sample Number: B23-1, 18-SS **Date:**

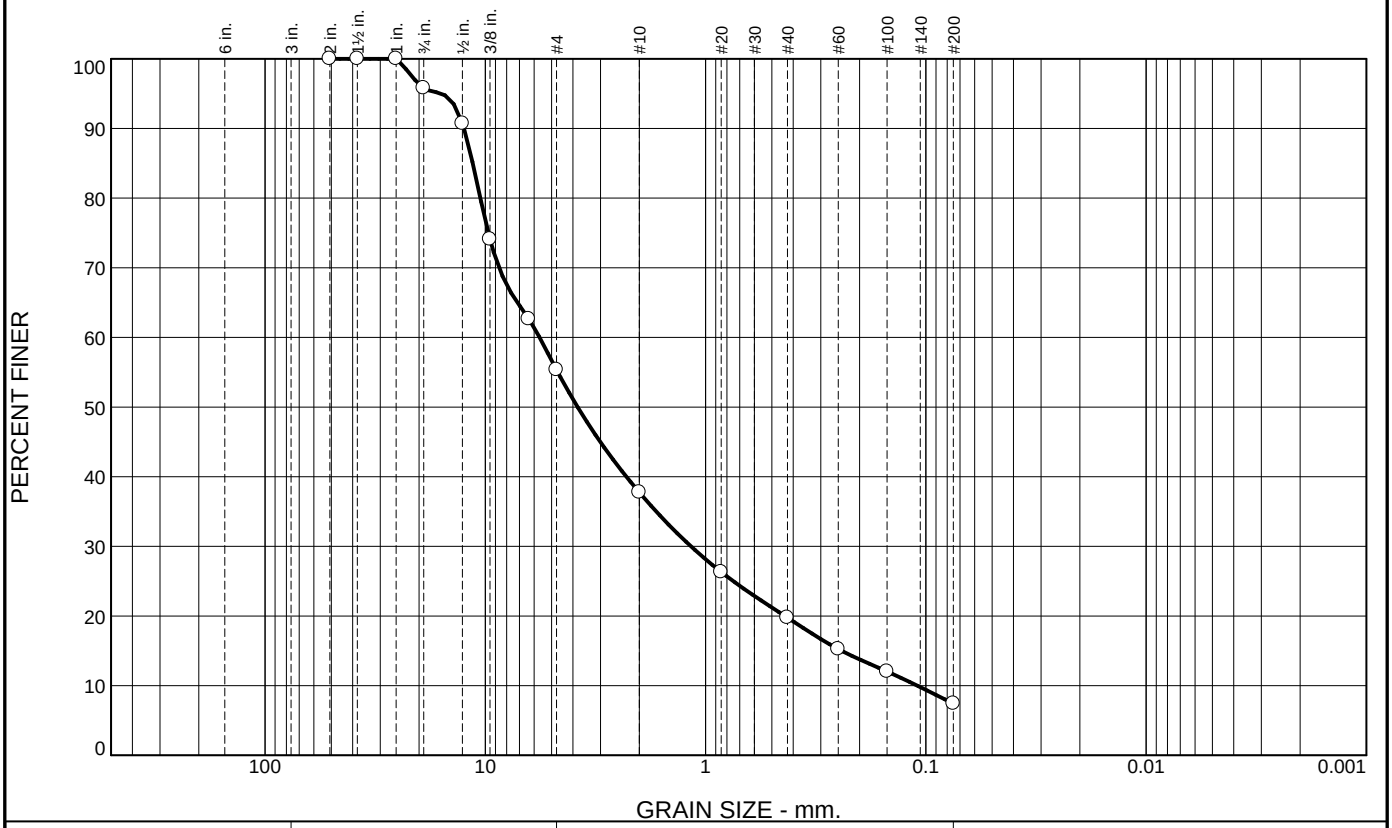
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.2	40.5	17.5	18.0	12.4	7.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	95.8		
1/2"	90.7		
3/8"	74.1		
1/4"	62.7		
#4	55.3		
#10	37.8		
#20	26.3		
#40	19.8		
#60	15.3		
#100	12.0		
#200	7.4		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.4944 D_{85}= 11.3992 D_{60}= 5.6735
D_{50}= 3.8091 D_{30}= 1.1646 D_{15}= 0.2411
D_{10}= 0.1093 C_u= 51.89 C_c= 2.19

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 25.0-26.5'
Sample Number: B23-2, 5-SS **Date:**

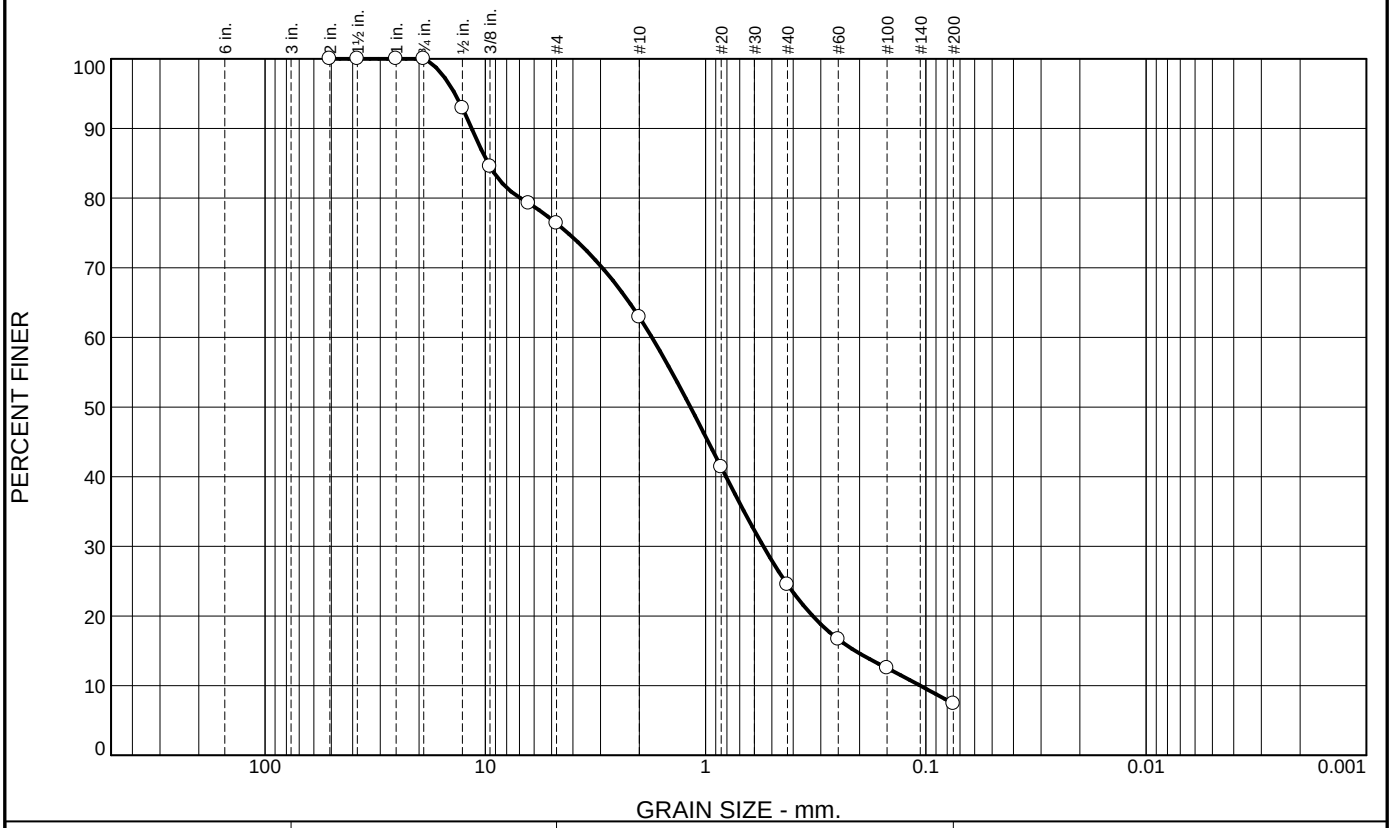
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	23.6	13.5	38.4	17.1	7.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	92.9		
3/8"	84.5		
1/4"	79.3		
#4	76.4		
#10	62.9		
#20	41.4		
#40	24.5		
#60	16.7		
#100	12.5		
#200	7.4		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.5251 D_{85}= 9.7051 D_{60}= 1.7520
D_{50}= 1.1721 D_{30}= 0.5464 D_{15}= 0.2093
D_{10}= 0.1060 C_u= 16.53 C_c= 1.61

Classification

USCS= AASHTO=

Remarks

Source of Sample: 9081 **Depth:** 35.0-36.5'
Sample Number: B23-2, 7-SS **Date:**

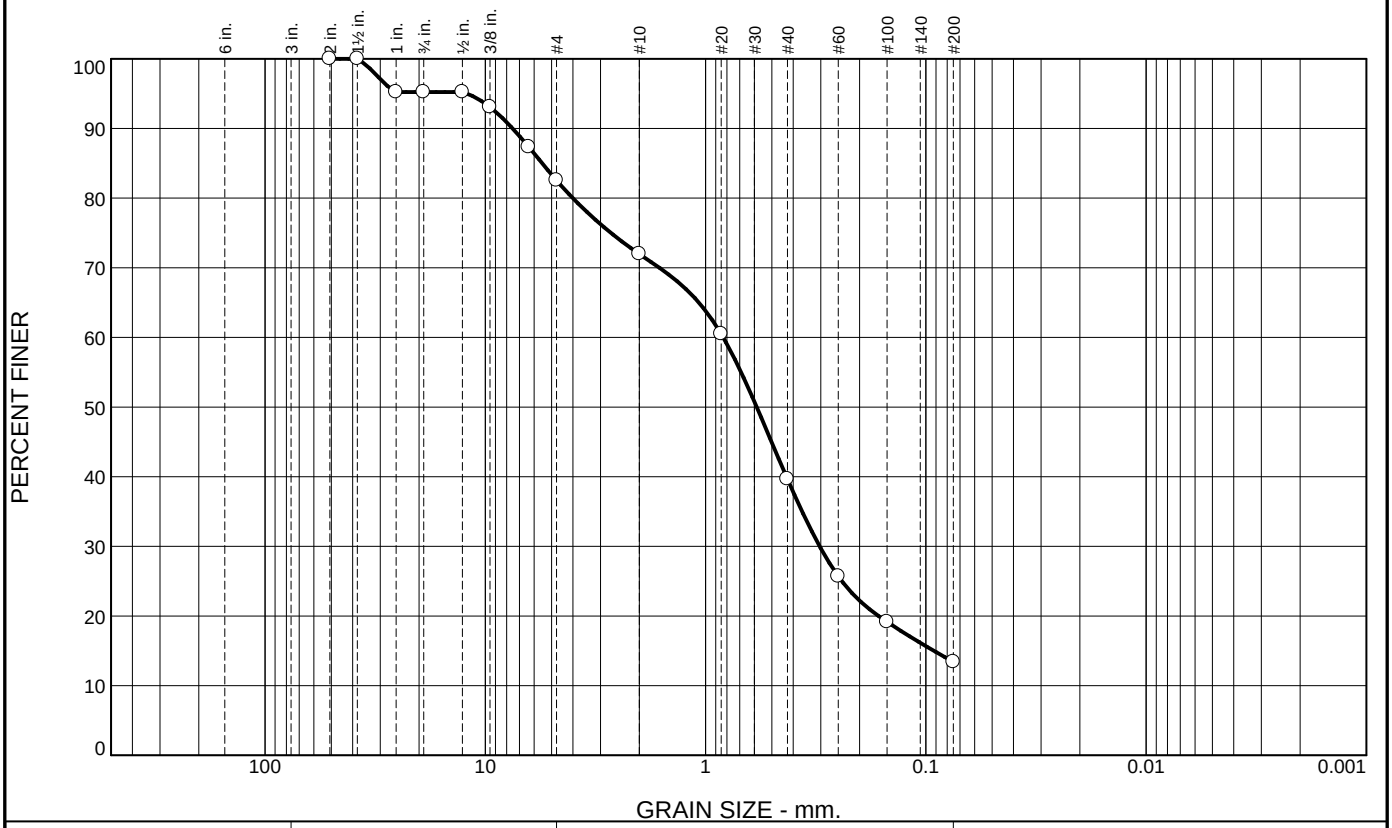
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.8	12.7	10.5	32.3	26.3	13.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	95.2		
3/4"	95.2		
1/2"	95.2		
3/8"	93.1		
1/4"	87.3		
#4	82.5		
#10	72.0		
#20	60.5		
#40	39.7		
#60	25.7		
#100	19.2		
#200	13.4		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.5202 D_{85}= 5.5175 D_{60}= 0.8321
D_{50}= 0.5858 D_{30}= 0.3033 D_{15}= 0.0918
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 75.0-75.8'
Sample Number: B23-2, 15-SS **Date:**

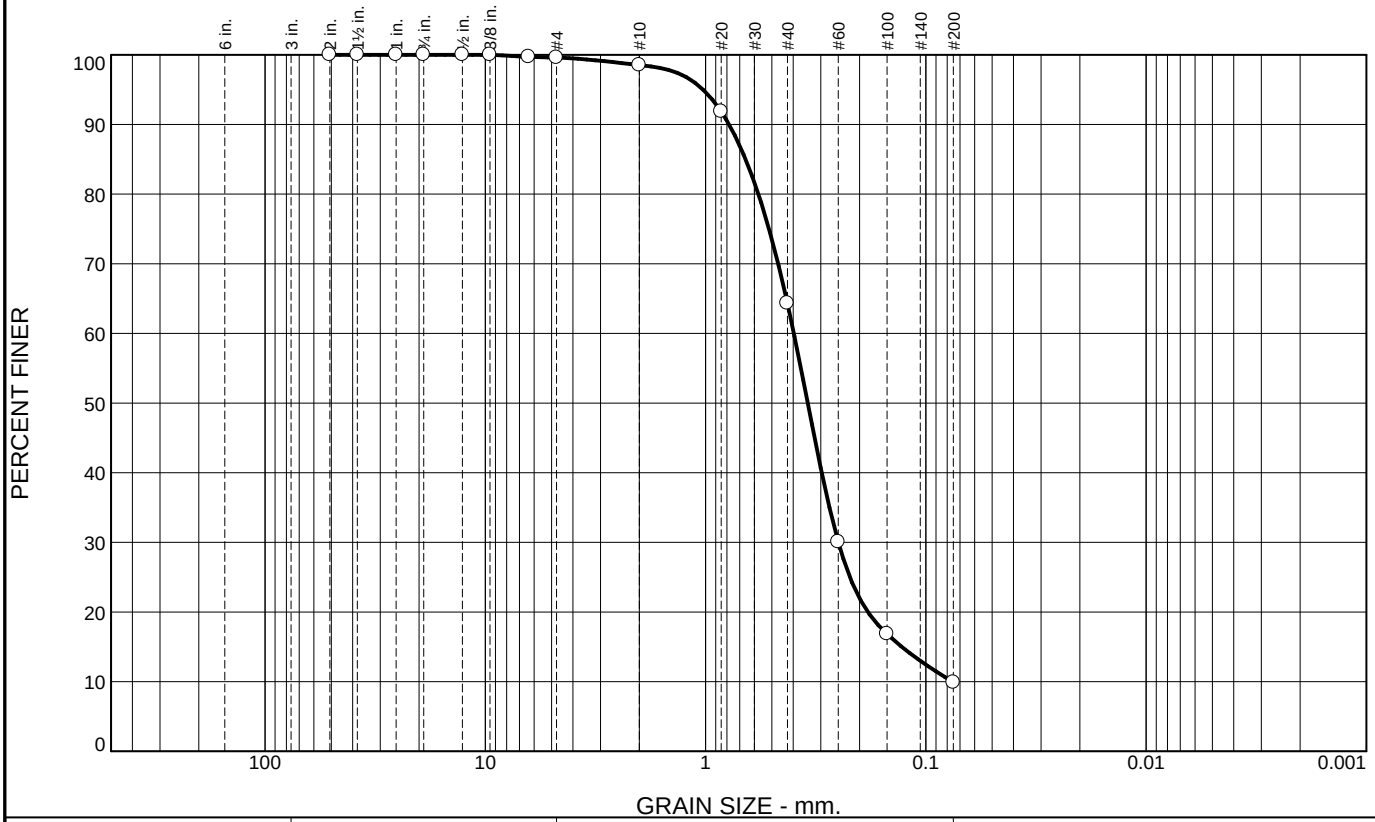
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	1.1	34.2	54.4	9.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
1/4"	99.7		
#4	99.6		
#10	98.5		
#20	91.9		
#40	64.3		
#60	30.1		
#100	16.9		
#200	9.9		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.7824 D_{85}= 0.6580 D_{60}= 0.3975
D_{50}= 0.3438 D_{30}= 0.2497 D_{15}= 0.1285
D_{10}= 0.0759 C_u= 5.23 C_c= 2.06

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 90.0-91.5'
Sample Number: B23-2, 18-SS **Date:**

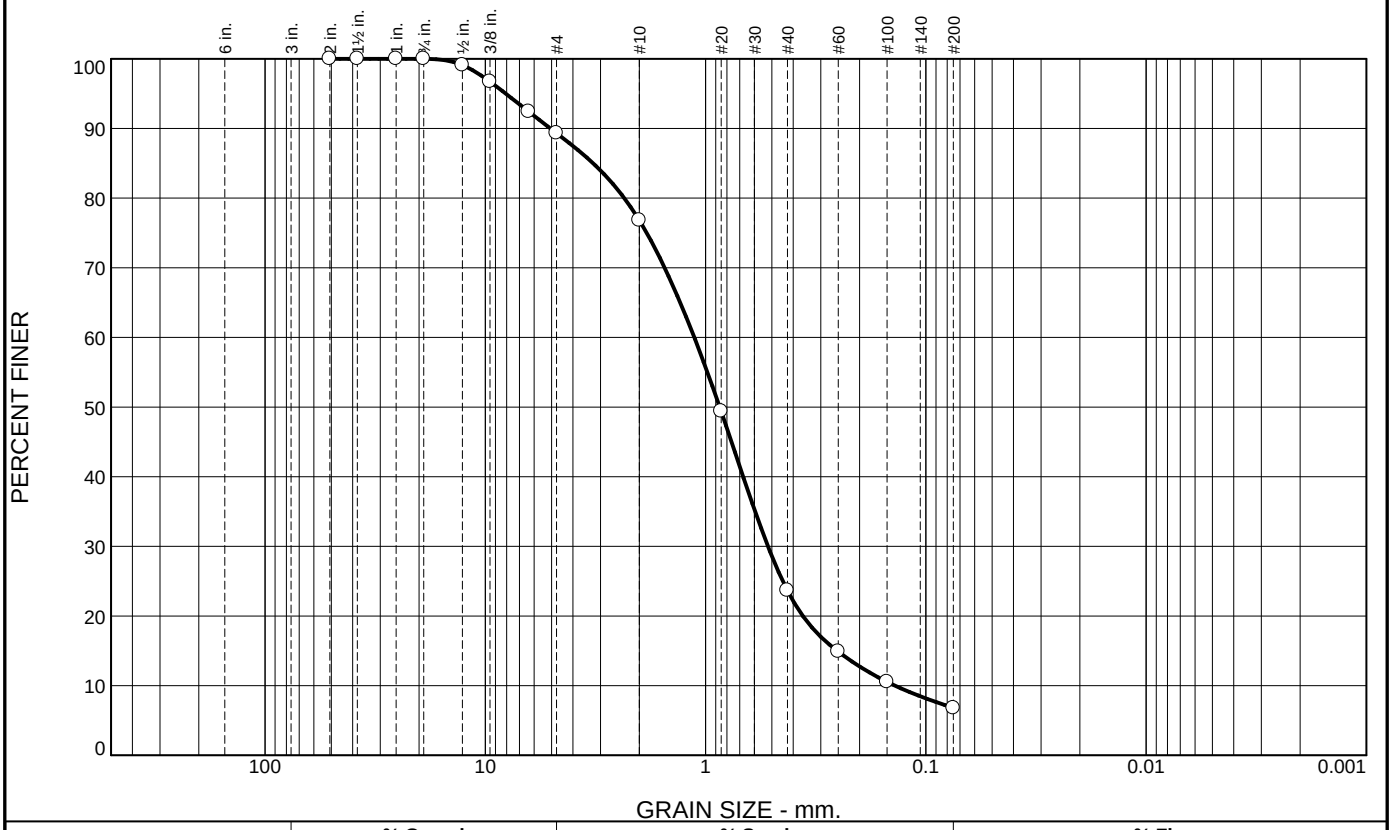
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Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	10.7	12.5	53.1	16.9	6.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	99.1		
3/8"	96.7		
1/4"	92.4		
#4	89.3		
#10	76.8		
#20	49.4		
#40	23.7		
#60	14.9		
#100	10.5		
#200	6.8		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.0636 D_{85}= 3.2405 D_{60}= 1.1255
D_{50}= 0.8631 D_{30}= 0.5206 D_{15}= 0.2526
D_{10}= 0.1383 C_u= 8.14 C_c= 1.74

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 35.0-36.5'
Sample Number: B23-3, 7-SS **Date:**

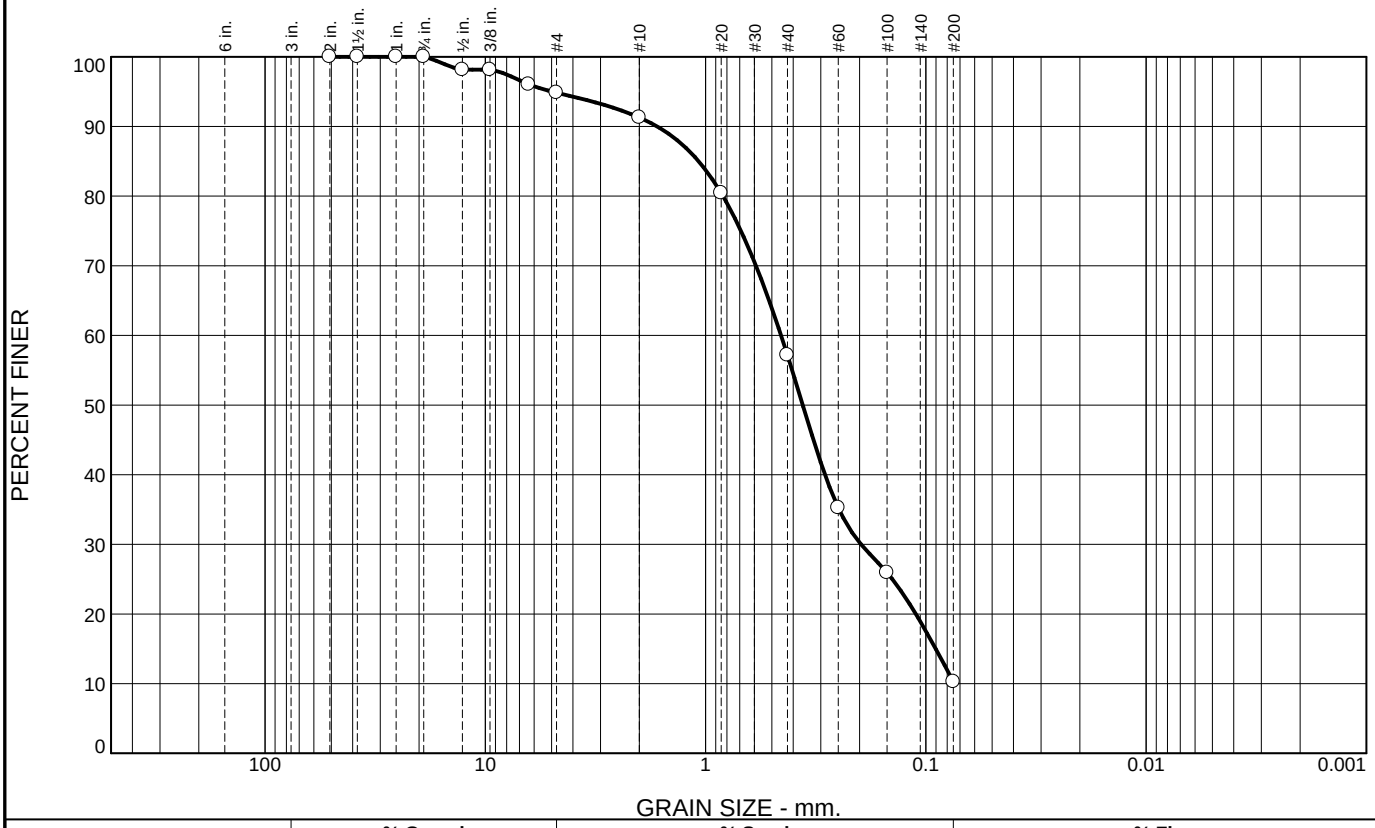
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.1	3.6	34.1	46.9	10.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	98.1		
3/8"	98.1		
1/4"	96.0		
#4	94.9		
#10	91.3		
#20	80.4		
#40	57.2		
#60	35.2		
#100	25.9		
#200	10.3		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.6602 D_{85}= 1.0754 D_{60}= 0.4542
D_{50}= 0.3623 D_{30}= 0.1968 D_{15}= 0.0902
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: 9081 **Depth:** 90.0-91.5'
Sample Number: B23-3, 18-SS **Date:**

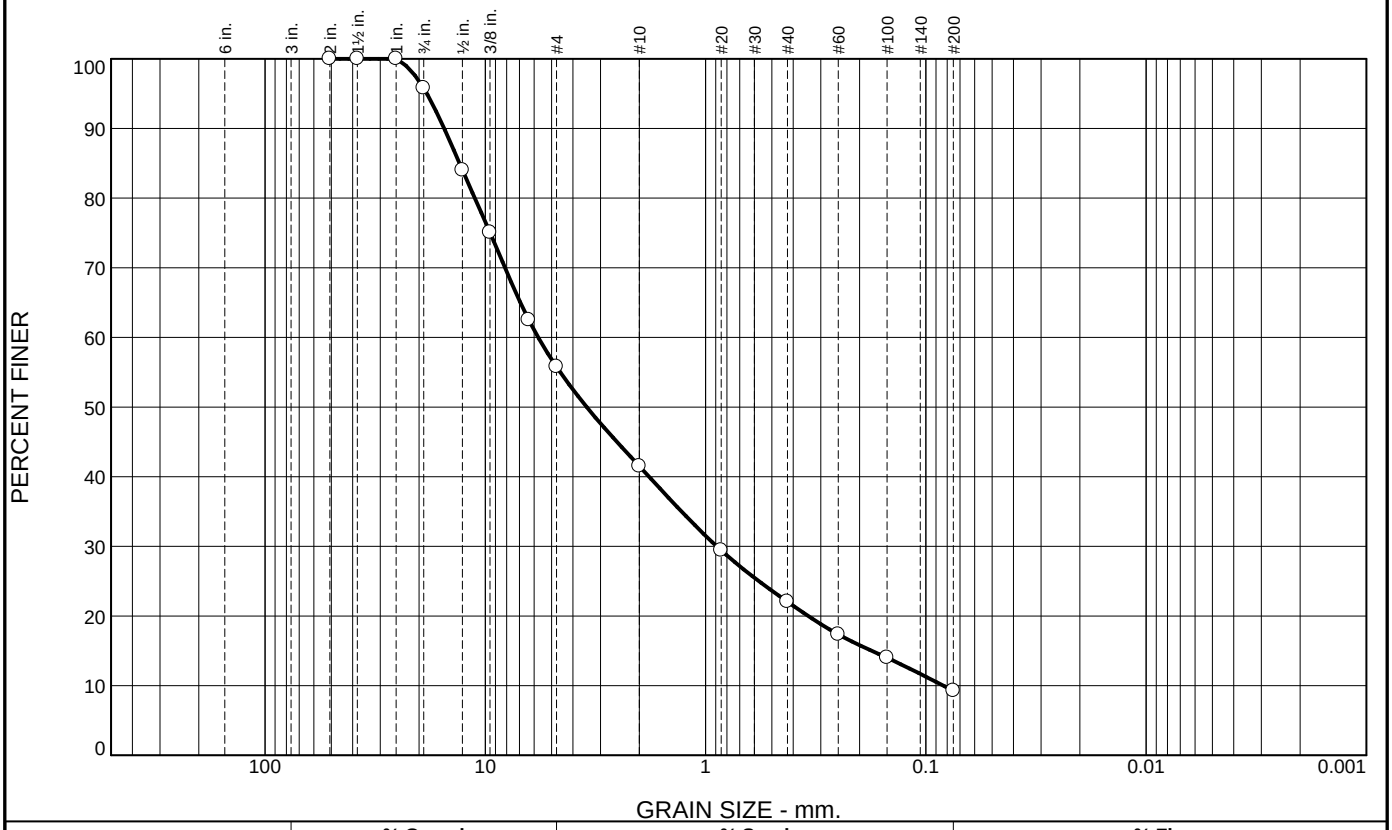
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Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.2	40.0	14.3	19.5	12.7	9.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	95.8		
1/2"	84.0		
3/8"	75.1		
1/4"	62.5		
#4	55.8		
#10	41.5		
#20	29.4		
#40	22.0		
#60	17.4		
#100	14.0		
#200	9.3		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.3704 D_{85}= 13.0992 D_{60}= 5.7547
D_{50}= 3.4650 D_{30}= 0.8897 D_{15}= 0.1758
D_{10}= 0.0833 C_u= 69.10 C_c= 1.65

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 20.0-20.9'
Sample Number: B23-4, 4-SS **Date:**

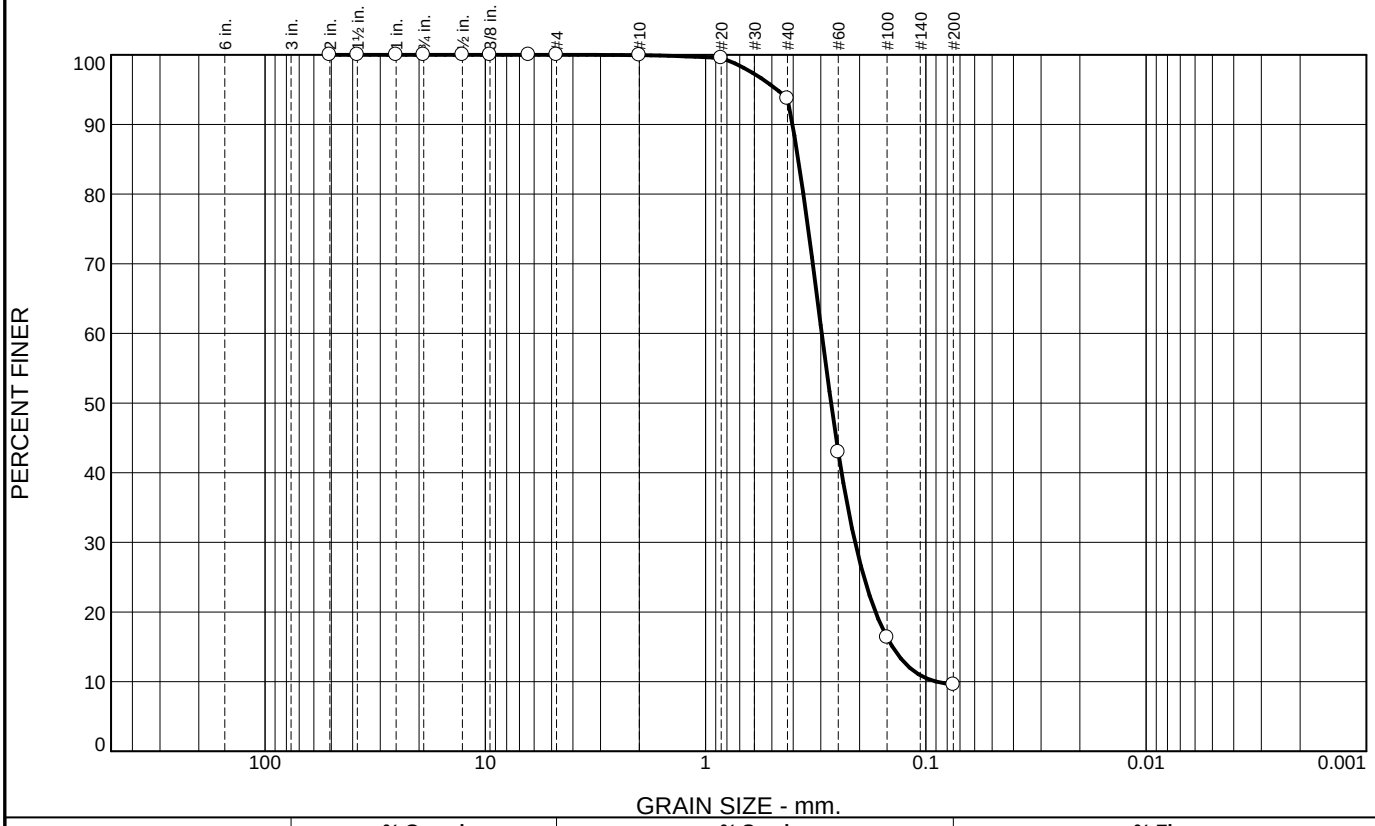
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	6.3	84.1	9.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
1/4"	100.0		
#4	100.0		
#10	100.0		
#20	99.6		
#40	93.7		
#60	43.0		
#100	16.3		
#200	9.6		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4031 D_{85}= 0.3796 D_{60}= 0.2969
D_{50}= 0.2694 D_{30}= 0.2095 D_{15}= 0.1417
D_{10}= 0.0895 C_u= 3.32 C_c= 1.65

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 85.0-86.5'
Sample Number: B23-4, 17-SS **Date:**

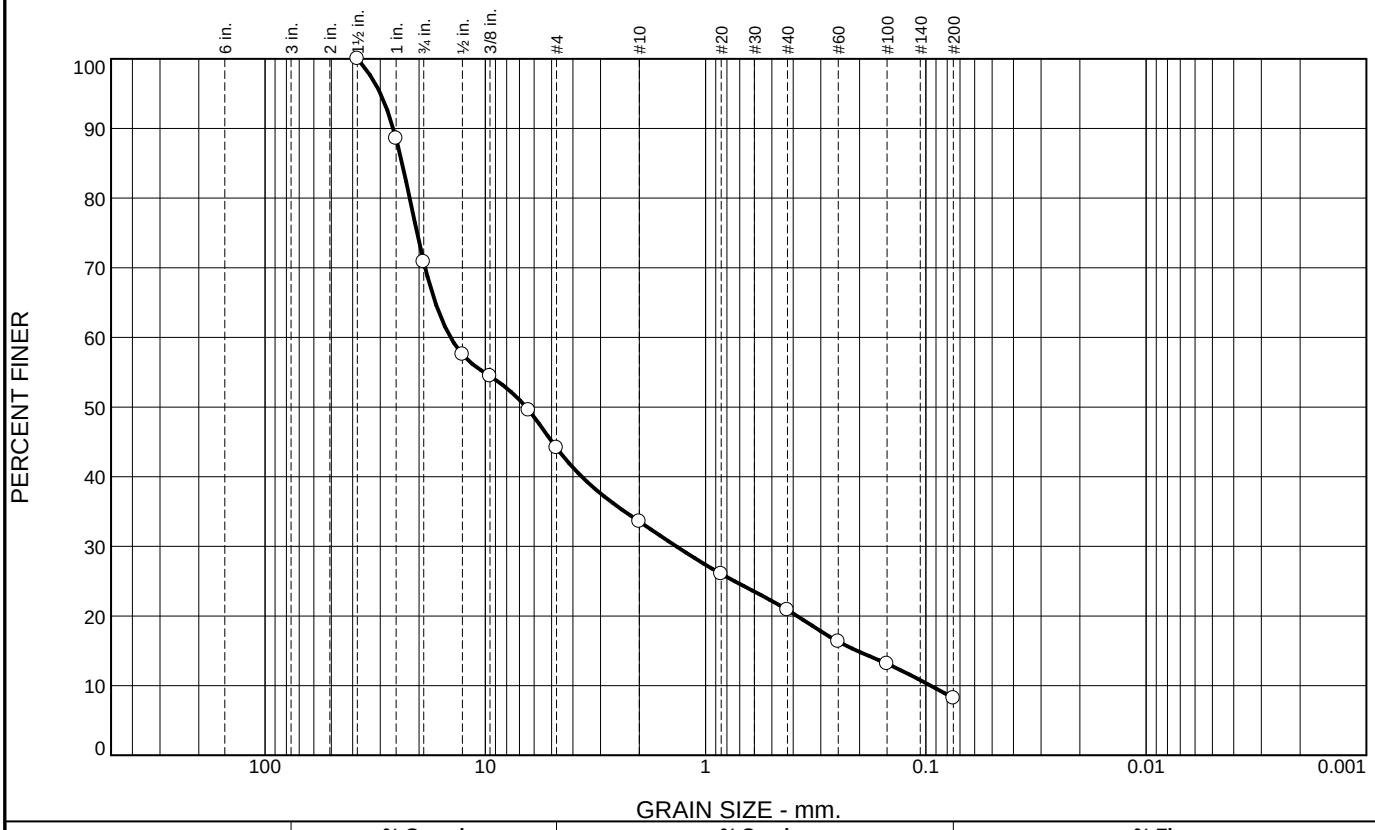
FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	29.2	26.7	10.5	12.7	12.7	8.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	88.6		
3/4	70.8		
1/2	57.6		
3/8	54.5		
1/4	49.6		
#4	44.1		
#10	33.6		
#20	26.1		
#40	20.9		
#60	16.3		
#100	13.1		
#200	8.2		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 26.1513 D_{85}= 23.8500 D_{60}= 14.3875
D_{50}= 6.5266 D_{30}= 1.3576 D_{15}= 0.2050
D_{10}= 0.0951 C_u= 151.21 C_c= 1.35

Classification

USCS= AASHTO=

Remarks

Source of Sample: 9081 **Depth:** 20.0-21.5'
Sample Number: B23-5, 4-SS **Date:**

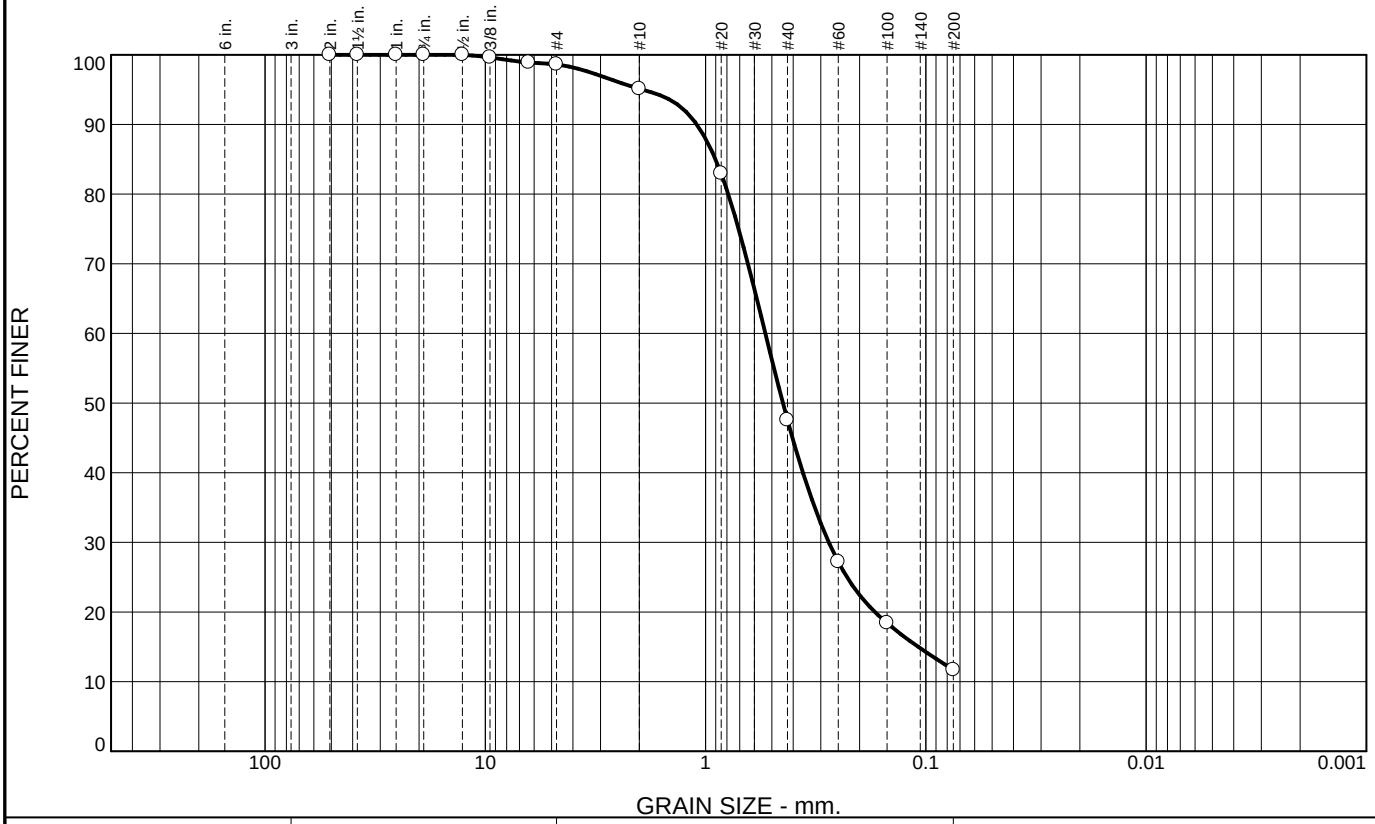
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Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	3.5	47.5	35.9	11.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5'	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	99.6		
1/4"	98.9		
#4	98.6		
#10	95.1		
#20	83.0		
#40	47.6		
#60	27.2		
#100	18.4		
#200	11.7		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.0969 D_{85}= 0.9014 D_{60}= 0.5352
D_{50}= 0.4455 D_{30}= 0.2758 D_{15}= 0.1083
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

7-31-2023

Source of Sample: 9081 **Depth:** 85.0-86.5'
Sample Number: B23-5, 17-SS **Date:**

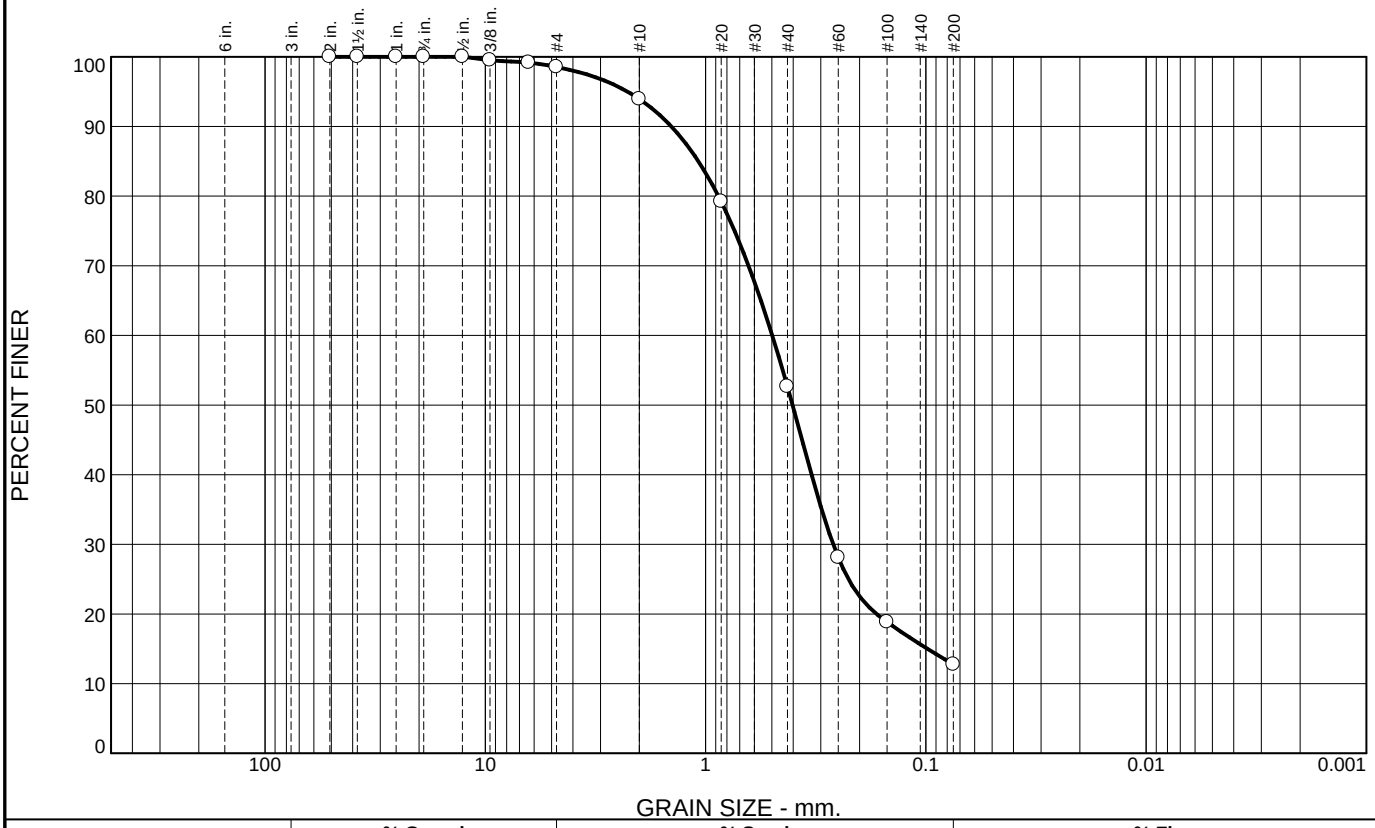
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Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**

Sieve Analysis ASTM C 136/C 117



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	4.6	41.2	39.9	12.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	99.5		
1/4	99.2		
#4	98.5		
#10	93.9		
#20	79.2		
#40	52.7		
#60	28.1		
#100	18.8		
#200	12.8		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.4306 D_{85}= 1.0785 D_{60}= 0.4980
D_{50}= 0.4028 D_{30}= 0.2635 D_{15}= 0.0982
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

7-24-2023

Source of Sample: 9081 **Depth:** 90.0-91.5
Sample Number: B23-6, 18-SS **Date:**

FEI Testing & Inspection, Inc.

Corvallis, OR

Client: Kleinschmidt (4976238)
Project: Tenas Creek Restoration

Project No: 2236175 **Figure**