ADDENDUM NO. 1

October 22, 2020

Attention All Bidders and Plan Holders:

Townsend Bridge No. 223 Replacement Project
Project Federal Aid Project No. BROS-2021(056)
F.A. Contract No. TA-6340
CRP 2186

The following shall be supplemented in the Contract:

The attached Special Provision 8-02.3(9) shall be added to Division 8 of the Special Provisions

The following shall be replaced in the Contract:

The attached Page 83 (Notice to Contractors) Extending Opening an additional week.

The attached Page 86 (Second page of the Proposal) adding a Bid Item for "Seeding and Mulching".

The attached Summary of Geotechnical Engineering is for additional information to Contract

All bidders will be required to furnish evidence of the receipt of this addendum. This addendum will be incorporated in and made a part of the contract when awarded, and when formally executed.

END OF
ADDENDUM NO. 1

Geoff Soderquist, P.E.
Assistant County Engineer

GEOFF RIDGEMAN SODERQUIST
50126

10/22/2020

8-02.3(9) Seeding, Fertilizing, and Mulching

8-02.3(9)B Seeding and Fertilizing

(******)

Section 8-02.3(9)B is supplemented with the following:

Seed Mix - Roadside: Grass seed, of the following composition, proportion, and quality shall be applied at the rate of ***80 *** pounds of pure live seed per acre on all areas requiring permanent roadside seeding within the project limits.

Kind and Variety of Seed in Mixture by Common Name and (Botanical name)	Pounds Pure Live Seed (PLS) Per Acre
Deschampsia elongata Slender Hairgrass	5.88
Elymus glaucus Blue Wildrye	39
Festuca idahonesis Idaho Fescue	12.74
Festuca ovina Sheep Fescue	4.21
Hordeum brachyantherum Meadow Barley	16.86
Koeler cristata Prairie Junegrass	1.31
Total Pounds PLS Per Acre	80

After seeding the Contractor shall be responsible to ensure a healthy stand of grass, otherwise, the Contractor shall, restore eroded areas, clean up materials, and reapply the seed, at no cost to the Contracting Agency.

Seeds shall be certified “Weed Free,” indicating there are no noxious or nuisance weeds in the seed.

8-02.3(11) Mulching

(******)

8-02.3(11)A Mulch for Seeding Areas

Section 8-02.3(11)A is supplemented with the following:

Long-Term Wood Cellulose Fiber mulch shall be applied at a rate of 4,000 pounds per acre with all permanent seed mixes and shall conform to Section 9-14.5(2)A Long-Term Mulch of the Standard Specifications. No more than 2,000 pounds shall be applied in any single lift.

8-02.4 Measurement

Section 8-02.4 is supplemented with the following:

(******)

“Seeding and Mulching” shall be measured per Acre.

8-02.5 Payment

Section 8-02.5 is supplemented with the following:

(******)

The unit contract price per Acre for “Seeding and Mulching” shall be full pay for furnishing and installing the specified seed mix, mulch, and PAM, chemical weed and grass control/removal immediately prior to seeding to produce the specified surface conditions, scarification of compacted areas, minor filling of ruts, and all material and equipment necessary and incidental to the approved application of the specified seed.

LEWIS COUNTY
Washington's First County
est. 1845

Lewis County Department of Public Works

Josh S. Metcalf, PE, Director
Tim Fife, PE, County Engineer

NOTICE TO CONTRACTORS

NOTICE IS HERBY GIVEN that the Board of County Commissioners of Lewis County or designee will open sealed proposals and publicly read them aloud on or after 12:30 P.M. on **Tuesday, November 3, 2020**, at the Lewis County Courthouse in Chehalis, Washington, for the Townsend Bridge No. 223 Replacement Project, CRP 2186. This contract provides for the improvement of *** Townsend Road MP 0.229 by replacing Bridge No. 223**,** *** and other work, all in accordance with the attached Contract Plans, these Contract Provisions, and the Standard Specifications.

SEALED BIDS MUST BE DELIVERED BY OR BEFORE
12:30 P.M. on Tuesday, November 3, 2020

(Lewis County official time is displayed on Axxess Intertel phones in the office of the Board of County Commissioners. **Bids submitted after 12:30 PM will not be considered for this project**.)

Sealed proposals must be delivered to the Lewis County Commissioners Office (351 N.W. North Street, Room 209, CMS-01, Chehalis, Washington 98532), by or before **12:30 P.M.** on the date specified for delivery, and in an envelope clearly marked: ***"SEALED BID FOR THE TOWNSEND BRIDGE NO. 223 REPLACEMENT PROJECT, CRP 2186, F. A. PROJECT NO. BROS-2021(056), TO BE OPENED ON OR AFTER 12:30 P.M. ON NOVEMBER 3, 2020."***

All bid proposals shall be accompanied by a bid proposal deposit in cash, certified check, cashier's check or surety bond in an amount equal to five percent (5%) of the amount of such bid proposal. Should the successful bidder fail to enter into such contract and furnish satisfactory performance bond within the time stated in the specifications, the bid proposal deposit shall be forfeited to the Lewis County Public Works Department.

Informational copies of maps, plans and specifications are on file for inspection in the office of the County Engineer of Lewis County in Chehalis, Washington. The contract documents may be viewed and downloaded from Lewis County's Web Site @ www.lewiscountywa.gov or you may call the Lewis County Engineers office @ (360)740-2612 and request a copy be mailed to you.

The Lewis County Public Works Department in accordance with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d to 2000d-4 and Title 49, Code of Federal Regulations, Department of Transportation, subtitle A, Office of the Secretary, Part 21, nondiscrimination in Federally assisted programs of the Department of Transportation issued pursuant to such Act, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises as defined at 49 CFR Part 26 will be afforded full opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin, or sex in consideration for an award.

ITEM NO.	PLAN QUANTITY		ITEM DESCRIPTION	UNIT PRICE DOLLARS CENTS	AMOUNT DOLLARS CENTS
25	1	EA.	Beam Guardrail Anchor Type 10	$	$
26	1	EA.	Beam Guardrail Type 31 Non-Flared Terminal	$	$
27	38	L.F.	Beam Guardrail Type 31	$	$
28	2	EA.	Beam Guardrail Transition Section Type 24	$	$
29	1	L.S.	Project Temporary Traffic Control	LUMP SUM	$
30	100	S.F.	Construction Signs Class A	$	$
31	4	C.Y.	Gravel Backfill for Drain	$	$
32	31	L.F.	Chain Link Fence, Type 4	$	$
33	1	EA.	Access Control Gate	$	$
34	1	L.S.	Trimming and Cleanup	LUMP SUM	$
35	0	Calc.	Reimbursement For Third Party Damage	ESTIMATED	$0.00
36	1	EST.	Minor Change	CALCULATED	$25,000.00
37	1	L.S.	SPCC Plan	LUMP SUM	$
38	0.1	ACRE	Seeding and Mulching	$	$
				TOTAL BID	$

Technical Memorandum

TO: Mr. Gregory Hess, PE, SE, KPFF Consulting Engineers

FROM: Calvin McCaughan, PE

DATE: October 9, 2019

RE: **Summary of Geotechnical Engineering Services**
Townsend Road Bridge Replacement
Cinebar, Washington
Project No. 0121040.010.011

This technical memorandum summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (LAI) in support of the proposed Townsend Road Bridge Replacement project near Cinebar, Washington (site; Figure 1). Geotechnical services were provided in accordance with the scope outlined in the Agreement for Subconsultant Services, dated April 22, 2019.

This memorandum has been prepared based on discussions with, and information provided by, representatives of KPFF Consulting Engineers (KPFF) and Lewis County (County); data collected during the field investigation; and LAI's experience with similar projects.

Project Understanding

The County plans to remove and replace an aged road bridge that spans Mill Creek. The single-lane bridge consists of a recycled railroad flat car with a timber lagging deck and 46-foot (ft) span. The replacement structure will have an 18-ft width (from curb to curb) and a 55- to 65-ft span. New abutment support will consist of shallow spread footings, approximately 14 ft wide. KPFF's 60 percent design drawings show a scour and bottom-of-footing elevation of 787.5 ft.

LAI also evaluated driven piling and a Geosynthetic Reinforced Soil–Integrated Bridge System (GRS–IBS), although this foundation type was not selected for final design.

Site Conditions

The site consists of a single-lane gravel road with a crossing over Mill Creek. The road and bridge approach are generally level with the surrounding ground. The side slopes of the creek bank have an average incline of approximately 2 horizontal to 1 vertical (2H:1V); local areas protected by rock armor are steeper. The site is bordered by coniferous and deciduous trees with an understory of vegetation native to the area.

Geologic Conditions

Geologic information for the site was obtained from the *Geologic Map of the Centralia Quadrangle, Washington* (Schasse 1987). Surficial deposits in the vicinity of the site are mapped as pre-Fraser age alpine glacial outwash (Qoh). This unit generally consists of massive to laminated silt and clay and variably oxidized, bedded sand and gravel. Pre-Fraser glacial till (Qdht) deposits are also mapped in the vicinity of the site.

Subsurface Conditions

On May 30, 2019, LAI explored subsurface conditions at the site by advancing and sampling one hollow-stem auger boring (B-1) 51.0 ft below ground surface (bgs). Subsurface conditions were described using the soil classification system shown on Figure 3, and in general accordance with ASTM International (ASTM) standard test method D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedures). A summary log of the subsurface conditions observed in boring B-1 is presented on Figure 4.

Alpine outwash was observed beneath existing surface conditions (i.e., gravel road), and extended to the maximum depth explored. The outwash consisted of fine to coarse sand or gravel with varying silt and cobbles. Silt with sand was observed from 9.0 ft bgs to 22.5 ft bgs. Site soils were typically very dense below 20 ft bgs.

During the May 2019 field investigation, groundwater was observed in boring B-1 at 6.5 ft bgs (the approximate surface elevation of Mill Creek). Groundwater conditions will vary depending on local subsurface conditions, weather conditions, and other factors. Furthermore, groundwater levels in the project area are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring. Groundwater levels at the site will likely approximate the surface water elevation of nearby Mill Creek.

Seismic Design

The seismic design parameters summarized in Table 1 were determined in accordance with the American Association of State Highway and Transportation Officials' (AASHTO's) *Load and Resistance Factor Design (LRFD) Bridge Design Specifications* (2017). AASHTO recommends using a 7 percent probability of exceedance in 75 years (nominal 1,000-year earthquake) design event to develop a design spectrum for bridges (2017).

Table 1. Seismic Conditions

Site Class	M	PGA (g)	A_s (g)	S_s (g)	S_1 (g)	F_a	F_v	F_{PGA}
C	8.94	0.327	0.351	0.742	0.255	1.103	1.545	1.073

A_s = site-adjusted peak ground acceleration
F_a, F_v = acceleration (0.2-second period) and velocity (1.0-second period) site coefficients, respectively
F_{PGA} = peak ground acceleration coefficient
G = acceleration due to gravity
M = design earthquake moment magnitude
PGA = peak ground acceleration
S_s, S_1 = 0.2-second and 1.0-second period spectral accelerations, respectively

Based on the subsurface conditions observed in boring B-1, LAI concludes that there is a low risk for soil liquefaction and lateral spreading during a design-level earthquake. Considering the proximity of the site to the nearest known active crustal faults and the thick layer of glacial deposits observed in boring B-1, there is a low risk of ground rupture due to surface faulting.

Conclusions and Recommendations

Based on the subsurface conditions observed in boring B-1, site soils will provide adequate support for the replacement structure, provided the following recommendations are incorporated into the foundation design. Three foundation types were considered during preliminary design: shallow foundations, pile foundations, and GRS–IBS. Shallow spread foundations were selected for final design.

Shallow Foundations

The nominal ultimate bearing capacities in Table 2 can be used to design shallow foundations. Table 3 includes resistance factors for shallow foundations (AASHTO 2017). Excavations could expose moisture-sensitive silt, and a 1-ft-thick bearing pad should be placed beneath shallow foundations to limit subgrade disturbance during construction.

Table 2. Shallow Foundation Design Nominal Bearing Resistance

Foundation Width (ft)	Strength and Extreme Limit States (ksf)	Service Limit State (1-inch settlement; ksf)
4	17.6	6.3
6	20.4	4.8
8	23.1	4.2
10	24.8	3.9
12	26.5	3.6
14	28.2	3.3

ft = feet
ksf = kips per square foot

Table 3. Shallow Foundation Resistance Factors

Limit State	Bearing	Sliding
Strength	0.45	Pre-cast concrete: 0.90 Cast-in-place concrete: 0.80
Extreme	0.90	0.90
Service	1.0	1.0

Pile Foundations

Driven H-piles are a feasible alternative to shallow foundations, and could be used to limit the size of the excavation and/or to provide scour protection. In LAI's opinion, site soils are too dense to drive steel pipe or timber piles. Table 4 includes parameters for H-pile design. Because piles driven in very dense materials may not achieve a design tip elevation, LAI does not recommend relying on piles for lateral resistance, especially where pile fixity is required.

Table 4. H-Pile Design Parameters

Pile Section	Allowable Capacity (kips)[(a)]	Estimated Tip Elevation at Driving Refusal (ft)
HP 14×89	125	770 to 780

(a) = Allowable capacity with an assumed safety factor of two.
Overdriving may be required for additional pile embedment.
ft = feet

GRS–IBS Design Parameters

The following sections provide design parameters in general accordance with the Federal Highway Administration's *Geosynthetic Reinforced Soil–Integrated Bridge System Interim Implementation Guide* (Design Manual; FHWA 2012a). These parameters should be used in conjunction with the seismic design parameters and construction recommendations provided herein. Please note, information regarding allowable stress design was culled from the Design Manual, and recommendations are formatted accordingly. If GRS–IBS is the foundation type selected, LAI will convert recommendations to LRFD.

GRS Abutment Design Assumptions

For conceptual design purposes, LAI has assumed a maximum GRS abutment height of 14 ft (includes embedded depth). A minimum soil-reinforcement length (abutment width) of 10 ft should be used for 14-ft-tall abutments. Analysis indicates that these parameters satisfy global stability requirements for static and seismic cases.

The GRS abutment should be supported by a reinforced soil foundation (RSF). LAI estimates that the RSF should be 2.5 ft thick and 10 ft wide.

GRS Abutment Bearing Capacity and Settlement

LAI recommends a net allowable soil bearing pressure of 6,000 pounds per square foot (psf) for the GRS abutment foundations and RSFs. The net allowable bearing pressure corresponds to the maximum pressure imposed on the soil at the foundation, and includes the weight of the GRS abutment, bridge deck, and any surcharges. The recommended net allowable bearing pressure may be increased by one-third for transient wind or seismic loads. The allowable bearing pressure includes a factor of safety (FS) of at least 3.0 on the calculated ultimate bearing capacity. The Design Manual requires an FS against bearing capacity failure greater than or equal to 2.5.

LAI estimates 1 to 2 inches of total settlement for GRS abutments that are designed and constructed as recommended herein. Differential settlement could be ½ inch or less along 30 ft of continuous footing. Settlement is likely to occur as GRS abutment loads are applied during construction.

GRS Abutment Lateral Resistance and Earth Pressures

Lateral loads on GRS abutments can be resisted by friction acting on the base of abutment footings. Passive resistance should not be used for lateral resistance, given the potential for scour at the face of the abutment. Section 4.3.6.1 of the Design Manual recommends an ultimate frictional resistance (μ) of 0.54 for the coefficient of base friction. The Design Manual recommends an FS against direct sliding greater than or equal to 1.5.

For the GRS abutments, LAI has assumed that the walls are in an active state, and free to rotate (i.e., allowed to rotate at least 0.001 times the wall height). LAI recommends using an active earth pressure with an equivalent fluid density of 37 pounds per cubic foot (pcf). For seismic-loading conditions, a rectangular earth pressure equal to 6H psf, where H is the height of the wall, should be added to the active pressure. This seismic earth pressure is based on the Mononobe-Okabe theory, and assumes one-half of the peak ground surface acceleration for the site.

The lateral soil pressures provided above do not include traffic surcharges. A level backslope and fully drained backfill conditions have been assumed. For uniform surcharge pressures, a uniformly distributed lateral load of 0.28 times the vertical surcharge pressure should be added for GRS abutment walls.

GRS Abutment Drainage

Mill Creek will rise above the base of the GRS abutment. To limit buildup of hydrostatic pressures, open-graded, free-draining backfill material should be used from the base of the GRS abutment to at least 1 ft above the 100-year flood elevation. The backfill should meet the requirements outlined in Section 3.3.1.2 of the Design Manual. From 1 ft above the 100-year flood elevation to the top of the GRS abutment, the backfill material should consist of Gravel Borrow for Structural Earth Wall as defined in Section 9-03.14(4) of the Washington State Department of Transportation’s 2018 *Standard Specifications for Road, Bridge, and Municipal Construction* (*2018 WSDOT Standard Specifications*).

Retaining Wall Design Parameters

Table 5 provides soil parameters that can be used to design retaining walls. Passive resistance should not be included on the creek side of retaining walls, given the potential for scour at the face of retaining walls.

When preparing recommendations for shallow foundation design, LAI assumed backfill within the structure's excavation zone would consist of Gravel Borrow conforming to the requirements in Section 9-03.14(1) of the *2018 WSDOT Standard Specifications.* LAI also assumed that the Gravel Borrow would be compacted to at least 95 percent of its maximum dry density.

Table 5. Retaining Wall Design Parameters

Parameter	Value	
	Level Backslope	3H:1V Backslope
Backfill soil unit weight (pcf)	125	
Backfill soil submerged unit weight (pcf)	63	
Backfill soil internal angle of friction (degrees)	36	
Foundation soil internal angle of friction (degrees)	36	
Active earth pressure coefficient (K_a)	0.26	0.32
At-rest earth pressure coefficient (K_0)	0.41	0.50
Seismic earth pressure coefficient – Unrestrained (K_{ae})	0.37	0.53
Seismic earth pressure coefficient – Restrained (K_{ae})	0.70	N/A
Ultimate coefficient of sliding	Cast-in-place: 0.57 Pre-cast: 0.46	
Passive Pressure Coefficient (K_p)	3.85	

H = horizontal
N/A = not applicable
pcf = pounds per cubic foot
V = vertical

Retaining walls may be supported on shallow foundations designed in accordance with the parameters in Tables 2 and 3.

Construction Considerations

The following construction considerations should be reviewed during preparation of project specifications:

- **Foundation bearing pads:** Moisture-sensitive soils were observed at the approximate elevation of shallow foundation bridge supports. To provide a firm working surface, LAI recommends overexcavating at least 12 inches of moisture-sensitive material and replacing with a structural fill bearing pad. Crushed Surfacing Base Course, conforming to the recommendations in Section 9-03.9(3) of the *2018 WSDOT Standard Specifications,* is acceptable for use as structural fill. Quarry spalls can be used as a foundation bearing pad, but a choker course will be needed to provide a level working surface. The bearing pad should extend within the limits of the excavation.

- **Reuse of onsite soil:** The majority of site soil is moisture sensitive, and should not be reused as structural fill.
- **Structural fill:** Gravel Borrow, as described in Section 9-03.14(1) of the *2018 WSDOT Standard Specifications,* is a suitable source of structural fill. During periods of wet weather, the fines content should not exceed 5 percent, based on the minus ¾-inch fraction. Structural fill should be used as backfill within the limits of structural excavation.
- **Dewatering:** LAI anticipates that groundwater encountered during construction can be managed with sumps, pumps, cutoff walls, and/or diversion systems. The contractor should be responsible for controlling groundwater and surface water and for providing a dry, stable work area. Construction should be completed during the summer and early fall to reduce dewatering needs.
- **Oversized material:** Cobbles and boulders are often present in glacial soils, and may be encountered during excavation. The contractor should be prepared to handle such oversized material.
- **Temporary excavations:** Temporary excavations should be completed in accordance with the guidelines set forth in Section 2-09 of the *2018 WSDOT Standard Specifications.* Actual excavation trench configurations and the maintenance of safe working conditions, including temporary excavation stability, are the responsibilities of the contractor. Temporary excavations in excess of 4 ft should be shored or sloped in accordance with the requirements outlined in Safety Standards for Construction Work, Part N (Washington State Department of Labor and Industries, Chapter 296-155 of the Washington Administrative Code). The material likely to be exposed in the structural excavations should be considered Type C soil with a maximum allowable excavation inclination of 1.5H:1V. The parameters provided in Table 6 can be used to design engineered shoring systems, if needed.

Table 6. Recommended Soil Parameters for Design of Temporary Shoring

Soil Unit	Moist Unit Weight (pcf)	Submerged Unit Weight (pcf)	Cohesion (psf)	Internal Angle of Friction (degrees)
Outwash	130	68	0	36

pcf = pounds per cubic foot
psf = pounds per square foot

Use of This Technical Memorandum

This technical memorandum has been prepared for the exclusive use of KPFF Consulting Engineers and Lewis County for specific application to the Townsend Road Bridge Replacement project in

Cinebar, Washington. Use of the information contained in this technical memorandum by others or for another project is at the user's sole risk. The findings, recommendations, and opinions presented herein are based on the field investigation completed for the project.

Closing

We trust that this technical memorandum provides you with sufficient information to proceed with the project. If you have questions or comments, or if we may be of further service, please contact the undersigned at (360) 791-3178.

LANDAU ASSOCIATES, INC.

CALVIN ALAN MCCAUGHAN
44709
10-9-2019

Calvin McCaughan, PE
Principal

BJM/CAM/mcs
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Attachments: Figure 1. Vicinity Map
Figure 2. Site and Exploration Plan
Figure 3. Soil Classification System and Key
Figure 4. Log of Boring B-1

References

AASHTO. 2017. *Load and Resistance Factor Design Bridge Design Specifications, Customary U.S. Units.* 8th Edition. American Association of State Highway and Transportation Officials. September.

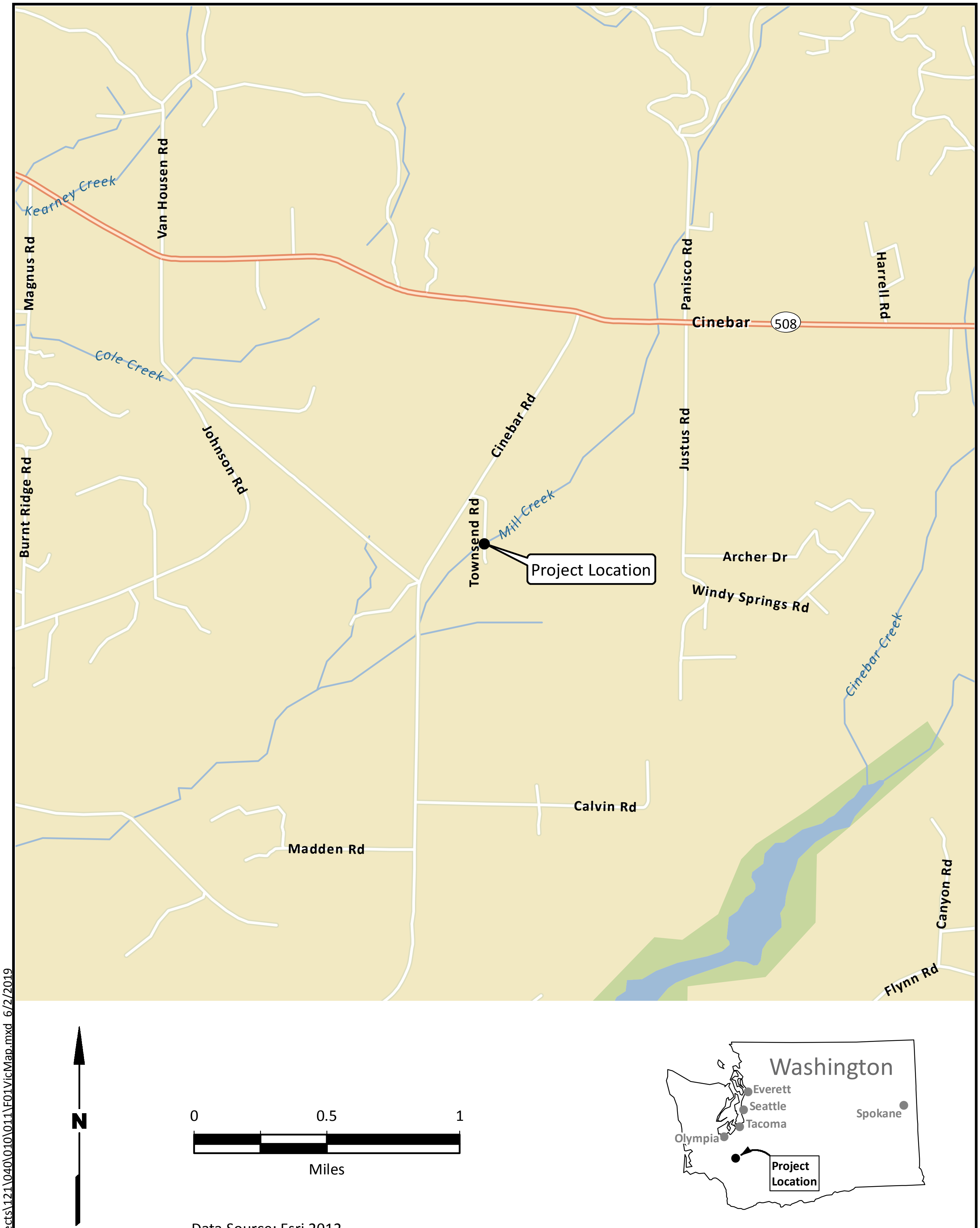
ASTM. 2009. D2488-09A: Standard Practice for Description and Identification of Soils (Visual-Manual Procedures). ASTM International. West Conshohocken, PA.

FHWA. 2012. Publication No. FHWA-HRT-11-026: Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide. McLean, VA: U.S. Department of Transportation Federal Highway Administration.

Schasse, H.W. 1987. *Geologic Map of the Centralia Quadrangle, Washington.* Washington State Department of Natural Resources. Open File Report 87-11.

Washington State Department of Labor and Industries. 2016. Construction Work. Chapter 296-155 WAC; Part N. Excavation, Trenching, and Shoring. Washington State Department of Labor and Industries. May 20.

WSDOT. 2017. M41-10: Standard Specifications for Road, Bridge, and Municipal Construction 2018. Washington State Department of Transportation. December 1.



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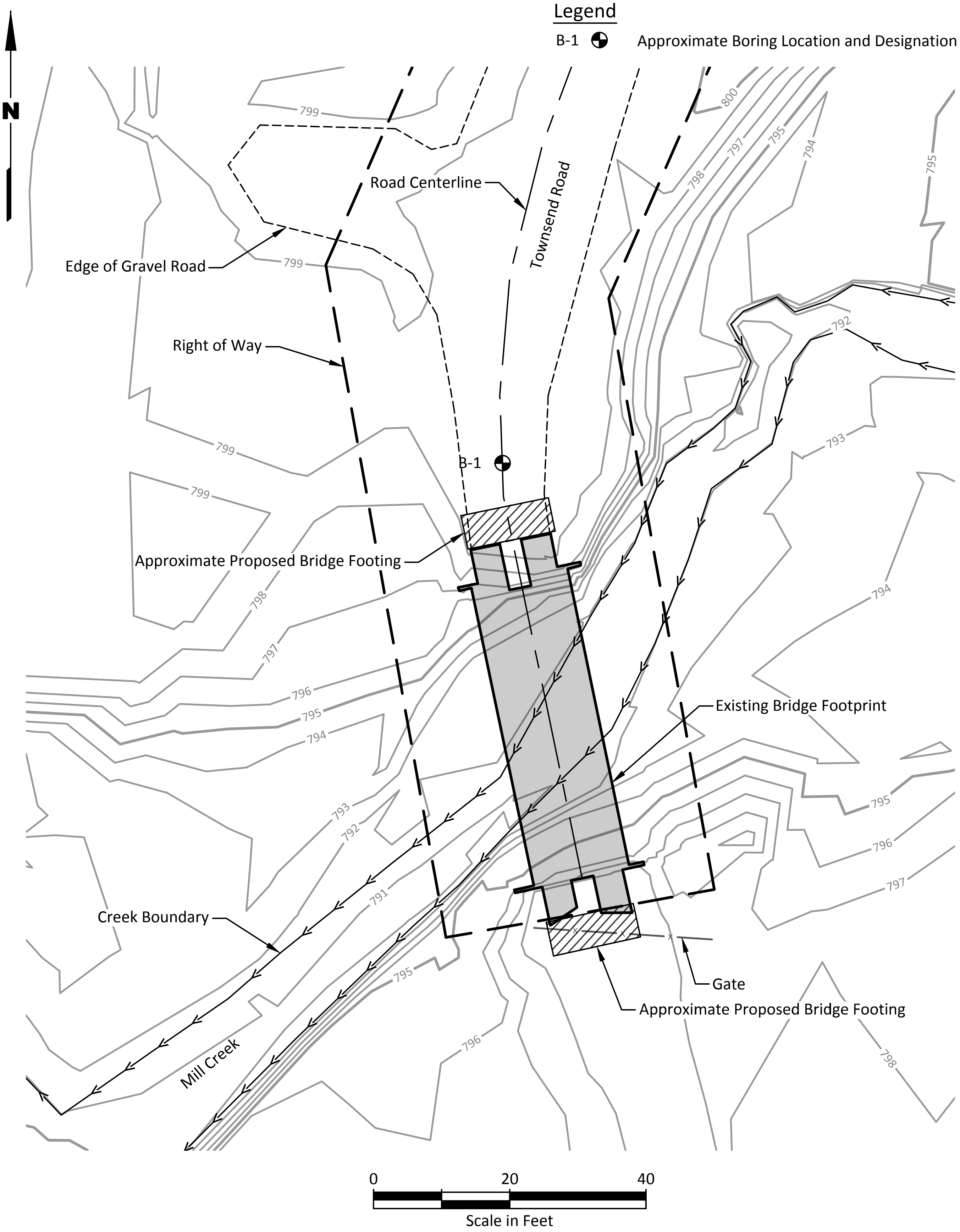
LANDAU ASSOCIATES

Townsend Road
Bridge Replacement
Cinebar, Washington

Vicinity Map

Figure
1



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Landau Associates

Townsend Road
Bridge Replacement
Cinebar, Washington

Site and Exploration Plan

Figure
2

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL$^{(1)}$	TYPICAL DESCRIPTIONS $^{(2)(3)}$
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)	▨	GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
			▨	GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)	▨	GM	Silty gravel; gravel/sand/silt mixture(s)
			▨	GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)	▨	SW	Well-graded sand; gravelly sand; little or no fines
			▨	SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)	▨	SM	Silty sand; sand/silt mixture(s)
			▨	SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)		▨	ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
			▨	CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
			▨	OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)		▨	MH	Inorganic silt; micaceous or diatomaceous fine sand
			▨	CH	Inorganic clay of high plasticity; fat clay
			▨	OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL		▨	PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT	■ ▨	AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK	▨	RK	Rock (See Rock Classification)
WOOD	▨	WD	Wood, lumber, wood chips
DEBRIS	▨	DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	- "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	- "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	- "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	- "with gravel," "with sand," "with silt," etc.
	≤ 5%	- "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

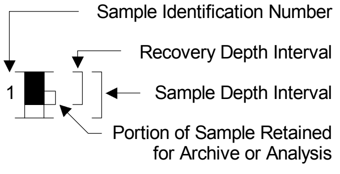
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽	Approximate water level at time of drilling (ATD)
▼	Approximate water level at time after drilling/excavation/well

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Soil Classification System and Key

Figure
3

B-1

LAI Project No: 0121040.010

SAMPLE DATA

Sample Number & Interval	Sampler Type	Blows/Foot	Test Data
S-1	b2	5	
S-2	b2	13	
S-3	b2	17	
S-4	b2	8	
S-5a S-5b	b2	29	
S-6	b2	50/ 5"	
S-7	b2	50/ 6"	
S-8	b2	33	

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35

Elevation (ft): 795, 790, 785, 780, 775, 770, 765

SOIL PROFILE

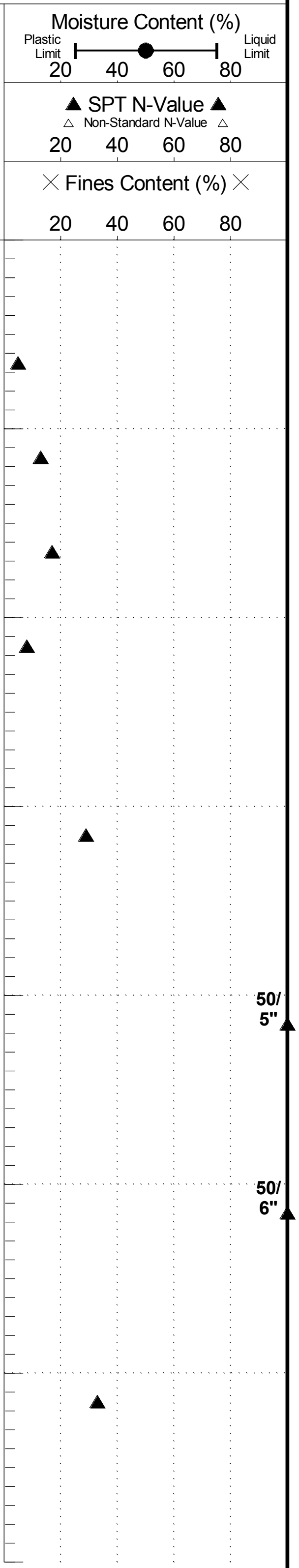
Drilling Method: Hollow-Stem Auger

Ground Elevation (ft): 799.5

Logged By: BJM Date: 05/30/19

USCS Symbol	Description
GM	3 inches of GRAVEL (loose, moist) **(FILL)**
SM	Brown, silty, fine to medium SAND with trace organics (loose, moist) **(OUTWASH)** -Grades to medium dense, fine to coarse, and with gravel
GP-GM	Brown, sandy, fine to coarse GRAVEL with silt (medium dense, wet)
ML	Mottled gray SILT with sand (medium stiff, moist to wet) -Grades to very stiff -At 16.0 ft bgs, drillers noted difficult drilling -Rock in sampler shoe -Grades to hard, brown-mottled gray, and with gravel
GP-GM	Gray, sandy, fine to coarse GRAVEL with silt and cobbles (very dense, wet)
SM	Brown, silty, fine to coarse SAND with gravel (dense, wet)
SM	Gray, very gravelly, silty, fine to coarse SAND (very dense, wet)

Groundwater: ▽ ATD



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

121040.01 10/9/19 C:\USERS\MSKINNER\DESKTOP\0121040.010.GPJ SOIL BORING LOG WITH GRAPH

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Cinebar, Washington

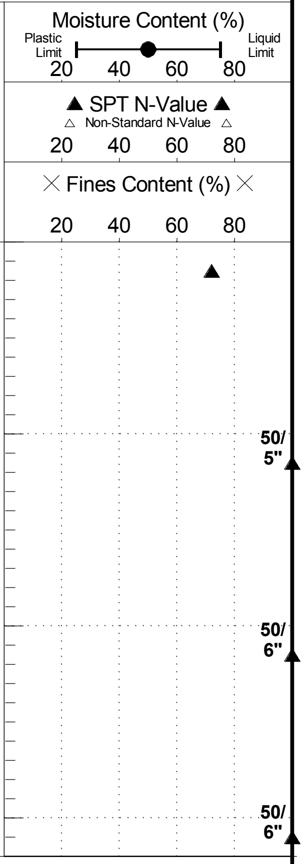
Log of Boring B-1

Figure
4
(1 of 2)

B-1

LAI Project No: 0121040.010

SAMPLE DATA						SOIL PROFILE			
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-Stem Auger Ground Elevation (ft): 799.5 Logged By: BJM Date: 05/30/19	Groundwater
35		S-9	b2	72			SM	Gray, very gravelly, silty, fine to coarse SAND (very dense, wet)	
							GP-GM	Gray, very sandy, fine to coarse GRAVEL with silt (very dense, wet)	
40	760	S-10	b2	50/ 5"					
							SM	Brown, gravelly, silty, fine to coarse SAND (very dense, wet)	
45	755	S-11	b2	50/ 6"					
50	750	S-12	b2	50/ 6"					



Boring Completed 05/30/19
Total Depth of Boring = 51.0 ft.

55

60

65

70

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-1

Figure
4
(2 of 2)