AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES	
J	1	24

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0002	29-Oct-2015		

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
NAVFAC NORTHWEST 1101 TAUTOG CIRCLE SILVERDALE WA 98315-1101	N44255	**See Item 6**	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)			
		X	9A. AMENDMENT OF SOLICITATION NO. N44255-15-R-6006
		X	9B. DATED (SEE ITEM 11) 30-Sep-2015
			10A. MOD. OF CONTRACT/ORDER NO.
			10B. DATED (SEE ITEM 13)
CODE	FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [X] is extended, [ ] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Subject: P-993 TPS Forward Operating Location, USCG Station, Port Angeles, WA

Description continues on page two.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 29-Oct-2015

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION SF 30 - BLOCK 14 CONTINUATION PAGE

The following have been added by full text:

AMENDMENT 0002

1. Note the phone number for the POC listed in the RFP has changed. Contact information is below:

   POC: Andy Hart, Contract Specialist
   Email: andrew.e.hart@navy.mil
   Phone: 360-396-0061

2. The following Pre-Proposal Inquiries were received in response to the solicitation:

PPI 0002
Marine Concrete, Specification 03 31 29

This specification has several references to the Stadium testing program, including but not limited to paragraph 1.2 (Definitions), and paragraphs 1.7.3 (Concrete Mixture Qualifications) and paragraph 3.8.2 (Hardened Concrete Properties) which reference the collection and submittal of concrete specimens for transport properties. However, the majority of language typically used to incorporate Stadium testing is not in present in this specification. Please confirm if Stadium testing is NOT required, including all aspects of the Stadium process (i.e., prequalification and production testing)

Response
STADIUM testing is not required in any aspect of this project. See attached revised specification pages from Section 03 31 29.

PPI 0003
Drawings

Can you make the drawings available to us in CAD Format?

Response
No, CAD drawings will be made available to the awardee.

PPI 0004
We would like to request that the Geotchnical Report be made available for contractors to review prior to bidding. Please provide as an attachment to an addendum.

Response
Geotechnical report is attached.

PPI 0007

Specification Section 01 57 19.00 20 para. 3.15 Noise. Pile driving is restricted to 8:00 am to 4:00 pm Monday to Friday. With the limited number of days for pile driving operations (December 1st to February 15th) can pile driving be allowed on Saturdays?

Response
See Section 01 14 00, paragraph 1.3.2 and 1.3.3. With prior Contracting Officer approval work may be allowed on Saturdays.

PPI 0008
ESA and MMPA Monitoring. For shutdowns required by marine mammal, marbled murrelet and sea state conditions in exceedance of Beaufort Seat State 2, how will the contractor be compensated?

Response
See revised page 6 Section 01 32 17.00 20, paragraph 1.6.2.4.1 - Endangered Species/Marine Mammal Monitoring Delays.

PPI 0009
ESA and MMP Monitoring. Marine mammal monitoring is required for all in-water work. Please define what is considered in-water work. For example, are the following activities considered in-water work – anode installation, underwater pile inspection, work from floating equipment, tug boat and crew boat use?

Response
Monitors are only needed for in-water work associated with pile driving- vibratory pile driving, impact pile driving, and initial placement of piles on substrate, pile cutting and removal during demolition. Monitors are not needed for the other activities in question (anode installation, underwater pile inspection, work from floating equipment, tug boat and crew boat use).

PPI 0010
ESA and MMP Monitoring. The marine mammal monitoring and marbled murrelet monitoring require “up to four marine mammal” and “up to four USFWS qualified marbled murrelet monitors”. How many of each monitor type is to included in the bid? Please clarify.

Response
See revised Section 01 57 19.01 20 - ESA/MMPA Monitoring and Construction Restriction Requirements. One monitoring coordinator, three marine mammal monitors, and two marbled murrelet monitors are required. The monitoring coordinator may also servce as either a marine mammal monitor or a marbled murrelet monitor.

PPI 0011
Drawings C113, C123, C133, and C163 show work around/adjacent to the Alert Force Facility. It appears that all the work in these drawings is part of the BASE BID. Please confirm.

Response
See attached AFF LEED Boundary Plan; which defines the work limits included in CLIN0002 for the AFF. All work outside of the boundary shall be included as part of the pier and its supporting facilities.

PPI 0012

On page 10 of 69 of the RFP, in section (b) Technical Factors, line (i), it is stated that "Projects submitted for the offeror shall be substantially complete within the past five (5) years of the date of issuance of this RFP."

We respectfully request that NAVFAC consider projects complete within the last ten (10) years of issuance of the RFP.

Response
A ten year timeframe cannot be accommodated, but the requirement is hereby extended to seven years. Revised section 00100 is provided.

PPI 0013
Reference Specification Section 01 14 00, Part 1.3e, which states "Impact pile driving shall only occur between December 1, 2016 and February 15, 2017. See section 01 57 19.01 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS for further restrictions."

In part 2.1 and 2.1.1 of the Endangered Species Act (ESA)/Marine Mammal Protection Act (MMPA) Monitoring and Construction Restriction Requirements document attached to section 01 57 19.01 20 it states that "All in-water work shall be limited to occur between July 16 and February 15 with daylight restrictions for impact pile driving from July 16 to September 23.

Is impact pile driving allowed to begin July 16?

Response
No, impact driving shall only occur between December 1, 2016 and February 15, 2017.

PPI 0014
On the waterline ductile iron fittings, are MJ fittings with Megalugs allowed? Spec section 33 11 00 page 3, 2.1.1.3 doesn't mention them, but its going to be hard to make a lot of the field connections if MJ fittings with Megalugs are not allowed. An option would be to allow TR-Flex Grip rings to make TR-Flex short "make-up pieces" in the field without having to wait for extra pipe pieces from the factory which can take a very lon time. Also, on plan sheet C146, the 6" on 6" wet tap described in Note 7 says Ductile Iron tapping sleeve. We strongly reccomend a full circle Stainless Steel Tapping sleeve on PVC pipe like the Romac SST. Ductile Iron tapping sleeves do not give nearly as much support to the pipe as a stainless steel tapping sleeve.

Response
1. MJ fittings with Megalugs are not allowed.

2. TR-Flex Gripper rings are allowed for field cut pipe.

3. A full circumferential seal stainless steel tapping sleeve on PVC pipe is acceptable. See revised Section 33 11 00 pages 3 and 4.

PPI 0015
A. On plan sheet C146 is the fire line between the FDC and the approach trestle 6" or 4"? Pipe is shown as 4" but fittings are noted at 6"? B. Regarding the hydrant assemblies, WSDOT B-90.10 Type A mentions mechanical joint with joint restraint (i.e. megalugs) so I am hoping mj fittings can be used throughout the water and fireline. And it is possible to provide 316 SS MJ t-bolts with those to

satisfy the bolt requirement in section 33 11 00, page 3, 2.1.1.1. Will this be considered? C. Is there a spec section covering the 2 7,000 gallon FRP Sanitary Holding Tanks?

Response
A. Fire line is 6". See revised drawing C146. Associated fittings noted as 6" are correct as shown.

B. MJ style joints, MJ t-bolts, and Megalugs are not acceptable as a restrained joint on this project. Note 2 of the referenced standard plan refers to restrained joints, and the restrained joints on this project, including hydrant installations shall meet the project specifications. TR-Flex Gripper Rings may be used as required for cut pieces of TR-Flex pipe, following manufacturer's installation instructions.

C. Specification section for the sanitary sewer holding tanks is 06 90 00

PPI 0017
Section 26 27 14.00 20, Page 9, Section 2.2 states that the meter is required to be connected to the AMI Network. Drawing E-601, Key Note 8 states that metering requirements are to be coordinated with the USCG Port Angeles Facility. Does the USCGS Port Angeles have an AMI Meter network currently? Please provide information on the existing metering system so that the contractor can coordinate properly and bid the project correctly. Also, please confirm that the USCGS “owns” the utility distribution system on the station and the contractor is not required to provide utility meters to meet the City of Port Angeles metering requirements.

Response
The City of Port Angeles delivers 12.47kV primary to a metering point near the main gate. The Coast Guard owns and operates the system from that point on. No additional metering for the City of Port Angeles is required. USCGS Port Angeles does not have an AMI Meter Network and has no standard. Provide metering per UFC guidance and industry standards, and in accordance with UFGS specifications.

PPI 0018
The RFP Bid Schedule on Page 3 of the RFP lists CLIN001 as relating to the pier and support facilities and CLIN0002 as relating to the AFF building. Does CLIN0002 relate only to the area within the 5’ line of the AFF facility, or also the supporting site work for that facility?

Response
See response to PPI 0011.

PPI 0019
Drawing E-651, Key Note 2 states that the contractor is responsible to provide interior and exterior light fixtures with 8 hours of battery backup. Light fixtures with 8-hours of battery backup do not exist. Should we provide a UPS or Lighting Invertor which provides the 8-hours of battery backup inside the armory, or in an exterior enclosure nearby?

Response
No. Market research has indicated multiple sources to satisfy the contract requirements.

PPI 0020

Drawing E-101, General Note #4 states that the armory and security fencing around the armory shall be grounded in accordance with NAVSEA OP5 requirements. We cannot locate this requirement in the RFP or on the internet. Please provide the latest version of this document for bidding purposes.

Response
All applicable grounding requirements of NAVSEA OP5 are included in the design documents.

PPI 0021
Per the organized site visit on October 15, 2015, it was mentioned the contractor would be responsible for setting the owner furnished armory unit.

Please provide additional information regarding this activity including how and when it will arrive on site, will the contractor be responsible for offloading it as well as setting it in place and how is to be handled (ie forklift, crane etc). Provide drawings with weights, dimensions and pick point information to assist the contractor in pricing this work.

Response
The armory unit is already located at the USCG base. See provided drawing showing approximate armory location. Contractor is responsible for moving the armory from its current location and placing at the new location. Available armory information is shown on E-652, weight is approximately 31,700 lbs.

PPI 0023
Reference page 1 and 7 of the RFP regarding the Bid Date and Pre-Proposal Inquires, we respectfully request a minimum of two (2) weeks extension to both the due date for offers and Pre-Proposal Inquires to adequately develop a thorough understanding of the plans and specifications in an effort to provide the lowest price possible.

Response
The proposal due date is extended to November 24, 2015 at 2pm local time. The PPI due date is extended to November 9, 2015.

PPI 0024
Please identify where in the plans and specifications the limits of Carbon Steel and Stainless Steel piping for the diesel fuel system are to be used. Section 33 52 10 only identifies that Carbon Steel and Stainless Steel are to be utilized, but does not detail the locations of these different types of piping.

Response
See revised P101: Diesel fuel piping shall be carbon steel from the diesel fuel tank to the transition sump near match line to P102. Construction note 4 notes use of a dielectric flange at this location which serves to separate the carbon and stainless steel piping. All piping between this transition sump and the fuel hose reels on the floats shall be stainless steel.

PPI 0025
Specification Section 09 29 00 para. 3.4 Finishing of Gypsum Board states, in part: "Unless otherwise specified, finish gypsum board walls, partitions, and ceilings to Level 5 in accordance with GA 214."

Request to remove all reference to Level 5 finish requirements, and require Level 4 at all areas unless otherwise specified.

Response
A Level 4 finish is acceptable. See revised Section 09 29 00 page 8.

PPI 0026
Specification Section 05 05 23.16 Structural Welding, para. 1.3.1 Quality Assurance –General Requirements States "Fabricate work in an AISC Certified Fabrication Plant, Category Standard. Work shall be erected by an AISC certified erector, Category ASCE.
In addition, Specification Section 05 12 00, para. 1.3 Quality Assurance also states "Fabricate work in an AISC Certified Fabrication Plant, Category Standard. Submit AISC erector quality certification."

This is to request that the NAVFAC remove the AISC certified plant and erector qualification requirements from this contract in that they appear to be beyond the intent of the project design. Please clarify.

Response
The AISC Certified Fabrication Plant requirement remains unchanged.

AISC Certified Erector requirement is modified to Category CSE, per attached Section 05 12 00 page 3.

PPI 0028
The AWS D1.1 ultrasonic test is designed for statistical weld analysis (i.e., 5%, 10% or 25% of the welds). Using AWS D1.1 as a 100% weld test will take longer than a day to inspect each pile. Due to the labor involved, the cost of the piles will see a substantial increase. API 5L describes an ultrasonic test that is routinely performed by API monogrammed certified production facilities and not by structural pipe production facilities. The specification as written will limit the suppliers to API certified mills only. This alone would increase material costs and cause availability issues since most API mills require order minimums per diameter well in excess of the quantities in this bid. ASTM A53 describes an ultrasonic test routinely performed by structural steel pipe producers. Every indication found using the API 5L ultrasonic method would also be found utilizing the ASTM A53 ultrasonic method. Once a flaw is detected, the magnitude of that flaw will be determined by the methods of AWS D1.1 regardless of the in-line method used for ultrasonic testing. Once the magnitude is determined, the repair procedure for both inline testing procedures is the same and in accordance with specifications. Ultra Sonic Testing per ASTM A53 was approved as an acceptable method on P-857 aboard NBK, Bangor.

Request the Government accept ultrasonic testing per ASTM A53, section 9.

Response
Ultrasonic testing per ASTM A53 is acceptable.

PPI 0029
Drawing G004

The large-scale drawing shows existing fish pens west and south of the proposed building site. During the October 15 site visit, we observed fish pens anchored at roughly the foot of the proposed pier. These pens may impede movement of marine construction equipment and barges.

Will the fish pens be moved prior to construction? Are there any special requirements associated with the fish pens?

Response
No the fish pens will not be moved prior to construction. The fish pens are located approximately 400 feet from the head of the planned pier. The contract contains no special requirements with regard to construction near the fish pens. The contractor will be expected to exercise the necessary level of care to avoid damaging adjacent or nearby property during construction.

PPI 0030
Metal Sheet Piling Section 31 41 16

The AZ14-770 and AZ19-700 are hot rolled sheet pile sections that meet and exceed the thickness, grade, swing angle, section modulus, and moment of inertia of a PZC13 sheet pile section.

Are AZ14-770 and AZ19-700 hot rolled sheet pile sections an acceptable alternate to a PZC13 sheet pile section?

Response
These sheet pile sections are acceptable alternates, provided they meet or exceed the material and section properties of the PZC13 sheet pile section.

PPI 0031
In order to have adequate estimating and proposal writing time to prepare a competitive bid that is technically acceptable, we request a two week bid postponement for the following reasons:

1. Additional estimating time is needed due to the complexity of the project.
2. Subcontractors and suppliers are saying the need additional estimating time and the building subcontractors need additional time to prepare technical qualification packages. The small business quote solicitation process results in the need for additional time.
3. Additional time is needed to prepare the technical proposal, in conjunction with estimating.
4. Additional bid time will provide adequate evaluation of PPI's for NAVFAC and for contractors evaluating NAVFAC responses when received.

Response
See PPI 0023.

PPI 0032
Reference: PZC13 Hot rolled sheet piling section identified on Sheet 95 of 330 drawing SW 112, and specification section 31 41 16 Metal Sheet Piling. One of our sheet pile suppliers has the following request for substitution: The AZ14-770 and AZ 19-700 are hot rolled pile sections that meet and exceed the thickness, grade, swing angle, section modulus and moment of inertia of a PZC13 sheet pile section. (SEE ATTACHED DATA SHEETS)

Is an AZ14-770 and/or AZ19-700 hot rolled sheet pile section an acceptable alternate to a PZC13 sheet pile section?

Response
See PPI 0030 response.

PPI 0033
Section 05 05 23.16, Structural Welding Paragraph 1.3.1 states that steel fabrication and steel erection must be performed by AISC certified shops. For steel erection there are only 5 companies in the state, two in Spokane and one bidding the project as a prime contractor leaving only two that may bid the project as subcontractors and neither has confirmed yet. Is it acceptable to erect the limited steel of the AFF Building using non-AISC certified erectors as long as all erection meets AISC and AWS standards?

Response
See PPI 0026 response.

PPI 0034
AFF Building – Both washers and dryers are shown on floor plans and interior elevation views of the Male and Female Heads however, there are no specifications for these. Please confirm the clothes washers and dryers are by others and are not part of this project.

Response
Washers and dryers are part of the FF&E package (CLIN 0003).

PPI 0035
Has there been any consideration of using Porous/ pervious asphalt instead of pervious concrete?

Response
Porous asphalt is not allowed by Navy UFC.

PPI 0036
Drawing B001

Drawing B001 indicates that four test pits were dug but the test data is not included in the contract documents. Please provide.

Response
Test pit data is shown on the tables on B009 and geotechnical report.

PPI 0037
Drawings C504 through C506

Was a boring taken at the future location of the underground storage tanks (depicted on drawings C504 through C506)? Since this is the deepest excavation on the project and the excavation requires a shoring design it would seem that a boring would have been taken here.

Response
No boring was taken at the future underground storage tanks. Refer to note 3 on drawing C513 for sheet pile design requirements and parameters.

PPI 0038
Drawings C145 and C505

Drawings C145 and C505 indicate the presence of a tremie seal beneath the FRP Sanitary Sewer tanks. Please either provide the details of the seal (i.e., mix design, thickness, amount of reinforcing

steel if any) or confirm that the stabilization of the bottom of the tank excavation is a "contractor's means and methods" issue.

Response
Refer to drawing C513. Notes on Section A2 indicate depth of tremie seal shall be determined by Contractor, and is considered part of the overall cofferdam shoring design. The quality and thickness of the tremie seal will have a direct impact on the amount of ground water that leaks through and would need to be pumped out of the cofferdam. Contractor shall balance the cost of tremie seal design / thickness to the anticipated cost of the resulting amount of groundwater. Groundwater will be required to be pumped out before placing tank anchors, bedding material, tank, backfill, etc.

PPI 0039
Specifications Section 00 01 15 "List of Drawings", Paragraph 1.3.2.a

Specifications Section 00 01 15 "List of Drawings", Paragraph 1.3.2.a states that the Geotechnical Engineering Report dated 29 June 2015 by PanGEO is available upon request from the Contracting Officer. We hereby request that the Geotechnical Report by PanGEO be made available to all bidders prior to bid.

Response
See response to PPI 0004. .

PPI 0040
Specifications Section 01 33 29 "Third Party Certification (TPC) Documentation" Paragraph 1.4.4.a

Specifications Section 01 33 29 "Third Party Certification (TPC) Documentation" Paragraph 1.4.4.a states: "Refer to Attachment 2, TPC Checklist at the end of this specification." No such checklist was included at the stated location. Please provide.

Response
See attached 01 33 29 Leed checklist.

PPI 0041
Specifications Section 01 45 35 "Special Inspections", paragraph 1.2

Specifications Section 01 45 35 "Special Inspections", paragraph 1.2 states that the required special inspections "…are included on the structural drawings." Drawings SB004 and SB005 itemize the requirements for the AFF building. Please confirm that the special inspections requirements apply only to the building structure.

Response
The special inspections requirements in Section 01 45 35 apply only to construction of the AFF. Inspection requirements for other structures are indicated elsewhere in the specifications.

PPI 0042
Specifications Section 01 78 24.00 20

Attached at the end of Specifications Section 01 78 24.00 20 are five essentially indecipherable pages entitled "Model and Facility Data Matrix." Please explain the significance of these pages and how they apply to this contract.

Response
The eOMSI facility data workbook is explained in section 01 78 24.00 20 paragraph 2.3

PPI 0043
Specification 01 11 00 (1.4.1.1) and Specification 01 33 29 (1.4a)

Specification 01 11 00 (1.4.1.1) states silver level requirements. Specification 01 33 29 (1.4a) states to refer to Attachment 1 HPSB Checklist, but the document is not included. Please provide the missing specification.

Response
See attached HPSB checklist.

PPI 0044
General (LEED)

Please confirm the LEED registration fees are paid and the contractor is only responsible for the certification feed.

Response
The building registration for LEED and the fee associated with review of the design credits have been paid. Contractor shall be responsible for the fee associated with the construction review credits.

PPI 0045
Drawing SB101

Drawing SB101 (Note 4) states to see C137 for Datumn Elevation Conversion, but drawing C137 does not exist. Is this actually referring to Drawing C131?

Response
The conversion is given in note 1 on sheet C133.

PPI 0046
Drawing SB101

"Division 02 – Existing Conditions," which typically describes the criteria related to demolition of items onsite, appears to be missing in its entirety.

Response
The demolition required for the project site is minimal. Demolition requirements are adequately covered in applicable Division 01 specs, in addition to the discipline specific specifications.

PPI 0047
Drawings C-111 through C-116

Drawings C-111 through C-116 indicate Silt Fence to be installed inside of the Clear and Grubb limits. Please confirm that Clearing and Grubbing can be completed prior to installation of Silt Fence and that no additional Linear Sediment Barriers are required to be installed before grading operations begin.

Response
Silt fence is to be installed adjacent to, and as close to as possible, the clearing and grubbing limits. Clearing and grubbing near the perimeter shall be performed first so the silt fence can be installed and protect the area while the remaining portion of the site undergoes clearing, grubbing, grading activities. Reference TESC General Notes C501. Contractor shall provide additional or upgraded TESC measures as necessary to ensure sediments are contained within the site.

PPI 0048
Drawing B001

On Drawing B001 it shows the Boring locations for the project. We noticed that there are no bores located where the new trestle and pier is to be constructed. Can you provide us with geotechnical information at the location on the new pier? If not, what are we to assume for the type of material we are to encounter for pile driving?

Response
No borings were taken at the pier location. The borings advanced at the site west of the pier encountered similar subsurface conditions of marine deposits consisting of medium dense to dense sands and gravels. Depositionally, these materials are similarly expected at the current location of the pier.

PPI 0049
Specification Section 09 97 13.26, Paragraph 2.2.2

In Specification Section 09 97 13.26, Paragraph 2.2.2, Blasting Media, it states: "Blasting material shall meet MIL-A_22262B and shall be arsenic-free and contain no free silica. Do not include Blastox in any MIL-A-22262 grit supplied with written approval form the contracting officer. Do not reuse blasting material." This requirement basically means all blasting for surface restoration needs to be done by hand-blasting, with no reuse of the blasting material (sand). There are several other methods of obtaining the near-white blast surface profile of 1.5 to 2.5 mils thickness as specified in paragraph 3.1.2 with an automated process (wheelabrator) and reusing the blast media, making it much more economical to install the coating on the steel pipe piles and sheet piling required by this specification. Will the owner allow this process to be used on this project? Or, will the owner modify the specification to allow metal grit for the blast media?

Response
The proposed alternates are not accepable. Provide per RFP.

PPI 0052
Specifications Section 31 62 16.19, Paragraph 3.8

On specification section 31 62 16.19 paragraph 3.8 Field Splices it states: "One field splice per pile is allowed." Some of these piles are 190 feet long and will require 2 to 3 field splices to complete to the required length. Will these additional splices be allowed?

Response
Provide per RFP. One field splice is allowed per paragraph 3.8. Up to four total splices are allowed per paragraph 2.3.3. Therefore, three spices could be made in the shop and one in the field, or up to

four splices in the shop if no field splices are required. A field splice is one that occurs at the project site. A shop splice is one that is performed at a fabrication facility.

PPI 0054
Specification Section 31 62 16.19, Paragraph 1.5

In Specification Section 31 62 16.19, Paragraph 1.5 states: "Manufacturer of steel pipe shall be certified by the Steel Plate Fabricator's Association (SPFA) when plates are used to fabricate pipe." Would it be acceptable if the fabricator held a current ISO 9001 Certification in lieu of the SPFA certification?

Response
It would be acceptable for the fabricator to hold a current ISO 9001 certification in lieu of the SPFA certification. See updated Section 31 62 16.19 page 2.

PPI 0055
Specification Section 01 14 00, Paragraph 1.2 E and Specification Section 01 57 19.01 20, Paragraph 2.1

In Specification Section 01 14 00, Paragraph 1.2 E, it states: "Impact pile driving shall only occur between December 1, 2016 and February 15, 2017." Yet in the Endangered Species ACT (ESA)/Marine Mammal Protection ACT attached to the specifications after Specification Section 01 57 19.01 20, Paragraph 2.1, it states: "All in-water work shall be limited to occur between July 16 to February 15." Which of these restrictions are we to use for installing the piles?

Response
See PPI #13 response.

PPI 0056
Drawings C101 through C116, C121 through C126, and C131 through C136

To aid us in preparing our bid, we request AutoCAD versions of the following specific drawings: C101 through C116, C121 through C126, and C131 through C136.

Response
See PPI #03 response.

PPI 0057
General (Due Date)

Because of the complexity of the project and the need to get information to and from subcontractors, we request a one-week extension of the due date in order to provide the government with the best possible value for this important project.

Response
See PPI 0023.

PPI 0058
The AZ14-770 and AZ19-700 are hot rolled sheet pile section that meet and exceed the thickness, grade, swing angle, section modulus and moment of inertia of a PZC13 sheet pile section.

Is an AZ14-770 and/or AZ19-700 hot rolled sheet pile sections an acceptable alternate to a PZC13 sheet pile section?

See attached data sheets for reference.

Response
See response to PPI #30.

PPI 0059
CLIN 0002, Alert Force Facility Boundaries – Typically for building construction it is common for work to be included out to five feet from the building perimeter. So we can allocate monies to each CLIN correctly, is the work of CLIN 0002 to be the building and out to five feet from the building perimeter and if not, what are the CLIN 0002 boundaries?

Response
See response to PPI #11.

3. Summary of Revised Documents Attached
   00100
   01 11 00 HPSB Checklist
   01 32 17.00 20 page 6
   01 33 29 Leed Checklist
   01 57 19.01 20 - ESA/MMPA Monitoring and Construction Restriction Requirements
   03 31 29 Pages 5-8, 10-13, 27, 33
   05 12 00 page 3
   09 29 00 page 8
   31 62 16.19 page 2
   33 11 00 pages 3 and 4
   Geotechnical Report
   Drawing C146
   Drawing P101
   Draing showing AFF LEED Boundary Plan Noted in PPI #11
   Drawing showing Armory Building

4. All other terms and conditions remain unchanged. Offerors are reminded to acknowledge this amendment in accordance with the RFP instructions when submitting proposals.

SECTION 00010 - SOLICITATION CONTRACT FORM
The required response date/time has changed from 05-Nov-2015 02:00 PM to 24-Nov-2015 02:00 PM.

SECTION 00100 - BIDDING SCHEDULE/INSTRUCTIONS TO BIDDERS

The following have been modified:

SECTION 00100

1. Pre-Proposal Inquiries. Offerors who determine that the technical and/or contractual requirements of this RFP require clarification(s) in order to permit submittal of a responsive proposal shall submit all questions in writing. The pre-proposal inquiry format is provided in Section 00100 **Attachment A**, Pre Proposal Inquiry Form. Pre-Proposal Inquiries shall be submitted via email to andrew.e.hart@navy.mil. Pre-proposal inquiries will be accepted **up to November 9, 2015.**

2. Solicitation Information on NECO Website. The solicitation and all amendments will be available for viewing and downloading at https://www.neco.navy.mil and www.fbo.gov upon issuance. Prospective Offerors must register on the NECO website. This is the only method of distribution for the solicitation and amendments. It is the OFFEROR'S RESPONSIBILITY TO CHECK THE NECO AND/OR FBO WEBSITES PERIODICALLY FOR ANY AMENDMENTS ISSUED TO THE SOLICITATION. The Plan Holders List is available at the NECO website.

3. Small Business Subcontracting Plan. In accordance with FAR 19.703 and 52.219-9 Small Business Subcontracting Plan, large businesses are required to submit an acceptable small business subcontracting plan that meets the requirements of FAR 19.704 prior to award. Large business Offerors shall submit a subcontracting plan utilizing the format provided in **Attachment G.**

The subcontracting plan (if applicable) shall be submitted electronically to Andy Hart at Andrew.e.hart@navy.mil no later than close of business two business days after receipt of proposals.

The minimum subcontracting targets for Fiscal Year (FY) 2016 are:

Small Business Target	FY 2016 Goal
Small Business	66.94%
Small Disadvantaged Business	17.44%
Woman Owned Small Business	14.45%
HUBZone	9.03%
Veteran Owned Small Businees	3.06%
Service Disabled Veteran Owned Small Business	3.06%

4. Proposal Format and Due Date. Proposals submitted in response to this solicitation shall be formatted as follows and furnished as stated herein:

4.1 Proposal Due Date, Submission Instructions, and Format. Offerors shall submit proposals in hard copy as follows:

Offerors shall affix their names and return addresses to the upper left corner of the proposal packages. Each package shall include the solicitation number and clearly identify the contents (i.e., "N44255-15-R-6006 ~ PROPOSAL – (Insert Company Name)"), and must be sealed.

Submit proposals to:

Naval Facilities Engineering Command, Northwest
Attn: Mr. Andy Hart
1101 Tautog Circle, Suite 313
Silverdale, WA 98315-1101

Email or Facsimile transmissions of proposals, acknowledgement of amendments or modifications of proposals is *NOT* allowed.

If the Offeror is mailing its proposal, mail to the address above. It is the Offeror's responsibility to ensure the package is delivered prior to the time specified. If the Offeror has access to Naval Base Kitsap-Bangor and is hand delivering its proposal to NAVFAC Northwest building 1101, **please call Andy Hart at (360) 396-0061** to make arrangements prior to your arrival, to be met at the lobby. Contractors shall not arrive at the building unannounced.

PLEASE NOTE: The address listed above is within a controlled area (badge access). Allow yourself ample time for parking and security delays.

For Offerors who are hand-delivering its proposal and have not made prior arrangements, a NAVFAC Northwest employee will be at Pass & ID, Building 1035, Naval Base Kitsap-Bangor, one hour prior to the proposal submittal deadline, and will remain there until the proposal submittal deadline.

Whenever required by the factors, use the factor mandated attachments. For narratives aside from the required forms, the paper dimension shall be 8 ½ x 11". The font size shall be no smaller than 11 pitch. Each copy of the proposal shall be securely fastened/ bound. Tab and label all sections and attachments. Provide a table of contents. For recycling purposes, a soft cover or title sheet is sufficient.

- Technical Proposal: one (1) original with original signature and date, two (2) additional hardcopies, and one (1) copy on CD, of Factors 1, 2, 3, and 4.
- Price Proposal: one (1) original with original signature and date, one (1) additional hardcopy.
- The original proposals shall be identified as "Original" on the cover. See Proposal submission requirements for additional details.

CLOSING DATE AND LATE SUBMISSIONS. The closing date and time for receipt of Proposals shall be as follows:

Proposals shall be received no later than <u>2pm local time on November 24, 2015</u>. NO EMAIL or FACSIMILE PROPOSALS WILL BE ALLOWED.

4.2 A cover letter shall accompany the technical and price proposals and shall include:

1. The solicitation number;
2. The names, addresses, telephone and facsimile numbers, and e-mail address of the Offeror;
3. Names, titles, phone numbers, facsimiles numbers, and e-mail addresses of person(s) authorized to negotiate on the Offeror's behalf with the Government in connection with this solicitation, and;
4. Name, title, and signature of person(s) authorized to sign the proposal;
5. DUNS # as required by FAR 52.204-7;
6. Tax ID Number; and
7. Acknowledgement of all amendments.

5. Basis of Award

1. The Government reserves the right to eliminate from consideration for award any or all offers at any time prior to award of the contract; to negotiate with Offerors in the competitive range; and to award the contract to the Offeror submitting the lowest priced, technically acceptable offer.

2. As stated in the solicitation, the Government intends to evaluate proposals and award a contract without discussions with Offerors (except clarifications as described in FAR 15.306(a)). The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. In addition, if the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

3. The Lowest Price Technically Acceptable (LPTA) process is selected as appropriate for this acquisition because the best value is expected to result from selection of the technically acceptable proposal with the lowest evaluated price. Proposals will initially be screened for price and placed in order of price (lowest price to highest price). The Government will then evaluate the technical factors of the three (3) lowest priced offers in accordance with the criteria for acceptability set forth in the solicitation. However, the Government, at its sole discretion, reserves the right to increase the number of proposals it will review under this methodology. If the number of proposals to be

evaluated is limited, technical proposals shall be provided to the evaluators without any identification of prices or any rank order of prices. If no proposals are found to be technically acceptable within the first group of proposals, then the process described will be conducted again as many times as necessary, until such time as the Government identifies a technically acceptable proposal. Accordingly, under this methodology, the technical factors of some proposals may not be evaluated by the Navy. If discussions are deemed necessary by the Contracting Officer, all proposals will be evaluated (both technical and price) for the purposes of establishing a competitive range.

4. An overall non-price factor rating must be at least "ACCEPTABLE" in order to be eligible for award. An "UNACCEPTABLE" rating in any factor results in the overall non-price factors proposal being rated "UNACCEPTABLE" unless corrected through discussions. An overall non-price factors rating of "UNACCEPTABLE" makes a proposal ineligible for award. If an Offeror receives an "UNACCEPTABLE" rating in any non-price factor, no additional proposal evaluation will be performed. Accordingly, under this methodology, some of the technical factors of some of the evaluated proposals may not be evaluated by the Navy.

5.1 Evaluation Factors for Award

1. The solicitation requires the evaluation of price and the following non-price factors:

Factor 1 – Experience
Factor 2 – Past Performance
Factor 3 – Safety
Factor 4 – Technical Solution

2. The distinction between experience and past performance is experience pertains to the types of work and volume of work completed by a contractor that are comparable to the types of work covered by this requirement, in terms of size, scope, and complexity. Past performance pertains to both the relevance of recent efforts and how well a contractor has performed on the contracts.

5.2 Evaluation:

1. The price proposal shall be separate from the technical proposals.
2. Firms must demonstrate that they possess the proven competence and experience to perform the subject solicitation.
3. While the Government may elect to consider data obtained from other sources, the burden of providing detailed, current, accurate, and complete past performance, experience, safety, and management information rests with the Offeror.

5.3 Proposal Submittal Requirements and Basis of Evaluation for Each Factor:

a. Price:

(1) Submittal Requirements:

(a) Cover letter in accordance with FAR 52.215-1(c)(2), including DUNS number;
(b) Standard Form 1442 (Solicitation, Offer, and Award) – Blocks 14 through 20c completed;
(c) Complete Representations and Certifications in the RFP; including the supplemental certifications included in Section 00600, and ensure SAM is updated or current;
(d) Completed Section 00010, Attachment B, Schedule of Prices. CLINs 0001 -0003 shall be the entire work complete and in accordance with the solicitation; and
(e) Bid Bond in accordance with FAR 52.228-1; and
(f) Acknowledgement of all amendments.

(2) Basis of Evaluation: In accordance with FAR provision 52.217-4 Evaluation of Options Exercised at Time of Contract Award (Jun 1988), the Government will evaluate the total price for the basic requirement (CLIN 0001) together with any option(s) exercised at the time of award (CLINs 0002 and 0003, if applicable). Analysis will be performed by one or more of the following techniques to ensure a fair and reasonable price:

(a) Comparison of proposed prices received in response to the RFP;
(b) Comparison of proposed prices with the IGCE;
(c) Comparison of proposed prices with available historical information; and
(d) Comparison of market survey results.

Evaluation of the price proposal will determine the reasonableness of the Offeror's proposal in accordance with FAR 15.404. The total evaluated price will determine the Offeror's comprehension of the requirements of the RFP and the degree to which the proposed price accurately reflects proposed performance. A price found to be either unreasonably high or unrealistically low in relation to the proposed work may negatively impact the Offeror's ranking.

The Bid Bond will be evaluated for accuracy and completeness in accordance with FAR 28.101.

Representations and Certifications will be reviewed in SAM to ensure they are complete.

(b) Technical Factors:

(1) Factor 1 – Experience

(a) Solicitation Submittal Requirements:

The Offeror shall submit the following information:

Submit a minimum of two (2) and a maximum of five (5) construction projects for the Offeror that best demonstrates your experience on relevant projects that are similar in size, scope, and complexity to the RFP. Any projects submitted in excess of the five (5) will not be considered. For purposes of this evaluation, a relevant project is further defined as:

Size: See dollar values as specified under Scope.
Scope:
- Construction of administrative, berthing, or support facilities with a minimum project cost of $2,000,000 and 4,000 square feet.
- Construction of pile supported piers with a minimum project cost of $8,000,000 and 8,000 square feet.

Complexity: Construction that is subject to compliance with complex environmental regulations.

i. Projects submitted for the Offeror shall be substantially complete within the past seven (7) years of the date of issuance of this RFP.

ii. A project is defined as a construction project performed under a single task order or contract. For multiple award and indefinite delivery/indefinite quantity type contracts, the contract as a whole shall not be submitted as a project for evaluation; rather Offerors shall submit the work performed under a task order as a project.

iii. The attached Construction Experience Project Data Sheet (Attachment C-DBB) is MANDATORY and SHALL be used to submit project information. Except as specifically requested, the Government will not consider information submitted in addition to this form. Individual blocks on this form may be expanded; however, total

length for each project data sheet shall not exceed one (1) double-sided page (or two (2) single-sided pages).

iv. For all submitted projects, the description of the project shall clearly describe the scope of work performed and the relevancy to the project requirements of this RFP (i.e., unique features, area, construction methods).

v. If the Offeror is a Joint Venture (JV), relevant project experience should be submitted for projects completed by the Joint Venture entity or the Joint Venture partners. Offerors are still limited to a total of five (5) projects combined. Any projects submitted in excess of the five (5) will not be considered. If the Offeror is a joint venture with no combined experience, at least one project from each member shall be submitted.

vi. The Offeror may submit relevant experience from a subcontractor or any other entity they plan to use that will perform major or critical aspects of the requirement to demonstrate construction experience under this evaluation factor. A minimum of two projects must be submitted by the Offeror (matching the DUNS number on the Cover Letter).

vii. If the Offeror presents experience from any entity that does not match the name, DUNS, and/or address as exactly stated on the cover letter, the Offeror shall establish a nexus or connection between itself and the other entity. The Offeror MUST clearly explain how the resources of the other entity will be provided and relied upon for contract performance such that the other entity will have meaningful involvement in contract performance. The proposal shall state specific commitments of technical resources (e.g. personnel or equipment) that the entity will commit to performance of this contract. This explanation shall be provided in box 10 of Attachment C for each applicable project submitted under Factor 1, Experience.

viii. In addition to the narrative, the Offeror shall submit a signed copy of a JV agreement, partnership agreement, teaming agreement, approved mentor protégé agreement (MPA), or letter of commitment from each member of the Offeror's team (e.g. joint venture member, partner, team member, subcontractor, parent company, sibling company, subsidiary, or other affiliated company, etc.)

ix. Failure to comply with these requirements will result in the project being considered not relevant and may result in lower ratings.

(a) **Basis of Evaluation:**

The requirement for acceptability will be based upon the projects submitted by the Offeror in its proposal. The Offeror must meet the following criteria:

Size: See dollar values as specified under Scope.
Scope:
- Construction of administrative, berthing, or support facilities with a minimum project cost of $2,000,000 and 4,000 square feet.
- Construction of pile supported piers with a minimum project cost of $8,000,000 and 8,000 square feet.

Complexity: Construction that is subject to compliance with complex environmental regulations.

Every project shall meet the applicable size (i.e. dollar value) to be relevant. Every project shall meet at least one of the scope elements to be relevant. The construction of administrative, berthing, or support facilities scope requirement must be demonstrated at least once within the submitted requirements. The construction of pile supported piers scope requirement must be demonstrated at least twice within the submitted projects. The

complexity elements must be demonstrated at least once within the submitted projects. Failure to meet all of the stated criteria will result in an Unacceptable rating.

(2) Factor 2 – Past Performance:

(a) **Solicitation Submittal Requirements:**

IF A COMPLETED CONSTRUCTION CONTRACTOR APPRAISAL SUPPORT SYSTEM (CCASS) EVALUATION IS AVAILABLE, IT SHALL BE SUBMITTED WITH THE PROPOSAL FOR EACH PROJECT INCLUDED IN FACTOR 1. If there is not a completed CCASS evaluation, then submit Past Performance Questionnaires (Attachment D) for each project included in Factor 1. The Offeror should provide completed Past Performance Questionnaires (PPQ) in the proposal. Offerors shall not incorporate by reference into their proposal PPQs previously submitted for other RFPs. However, this does not preclude the Government from utilizing previously submitted PPQ information in the past performance evaluation. IF THE OFFEROR IS UNABLE TO OBTAIN A COMPLETED PPQ FROM A CLIENT FOR A PROJECT(S) BEFORE PROPOSAL CLOSING DATE, THE OFFEROR SHOULD COMPLETE AND SUBMIT WITH THE PROPOSAL THE FIRST PAGE OF THE PPQ, which will provide contract and client information for the respective project(s). The Government may make reasonable attempts to contact the client noted for that project(s) to obtain the PPQ information.

However, Offerors should follow-up with clients/references to help ensure timely submittal of questionnaires. If the client requests, questionnaires may be submitted directly to the Government's point of contact, Andy Hart, Andrew.e.hart@navy.mil.

Offerors may provide any information on problems encountered and the corrective actions taken on projects submitted under Factor 1 – Experience. Offerors may also address any adverse past performance issues. Explanations shall not exceed two (2) double-sided pages (or four (4) single-sided pages) in total.

The Government reserves the right to contact references for verification or additional information. The Government's inability to contact any of the Offeror's references or the references unwillingness to provide the information requested may affect the Government's evaluation of this factor. In addition to the above, the Government reserves the right to obtain information for use in the evaluation of past performance from any and all sources including sources outside of the Government. Other sources may include, but are not limited to, past performance information retrieved through the Past Performance Information Retrieval System (PPIRS) using all CAGE/DUNS numbers of Contractors who are part of a partnership or joint venture identified in the Offeror's proposal, inquiries of owner representative(s), Federal Awardee Performance and Integrity Information System (FAPIIS), Electronic Subcontract Reporting System (eSRS), and any other known sources not provided by the Offeror.

Performance award or additional information submitted will not be considered.

(b) **Basis of Evaluation:**

This evaluation focuses on how well the Offeror performed on the relevant projects submitted under Factor 1 – Experience and past performance on other projects currently documented in known sources. Based on the Offeror's performance record, the Government has a reasonable expectation that the Offeror will successfully perform the required effort, or the Offeror's performance record is unknown.

The Government will consider the currency and relevance of the information, the source of the information, context of the data, and general trends in the Contractor's performance. This evaluation is separate and distinct from the Contracting Officer's responsibility determination.

In the case of an Offeror without a record of relevant past performance or for whom information on past performance is not available or so sparse that no meaningful past performance rating can be reasonably assigned, the Offeror may not be evaluated favorably or unfavorably on past performance. Therefore, the Offeror shall be

determined to have unknown past performance. In the context of acceptability/unacceptability, “unknown” shall be considered “acceptable.”

(3) Factor 3 – Safety

(a) Solicitation Submittal Requirements:

The Offeror shall submit the Past Performance Worksheet for Safety (Attachment E). (For a partnership or joint venture, the following submittal requirements are required for each Contractor who is part of the partnership or joint venture; however, only one safety narrative is required. TRC and DART Rates shall not be submitted for subcontractors.

(1) OSHA Total Recordable Case (TRC) Rate:

For the five (5) [2010, 2011, 2012, 2013, 2014] previous complete calendar years, submit your OSHA Total Recordable Case (TRC) Rate, as defined by the U.S. Department of Labor, Occupational Safety and Health Administration. If you cannot submit an OSHA TRC Rate, affirmatively state so, and explain why. Any extenuating circumstances that affected the OSHA TRC Rate data should be addressed as part of this element. OSHA TRC rates above 4.0, in any of the previous five years, will be considered UNACCEPTABLE, unless an adequate explanation is provided to address the extenuating circumstances that affected the rate.

(2) OSHA Days Away from Work, Restricted Duty, or Job Transfer (DART) Rate:

For the five (5) [2010, 2011, 2012, 2013, 2014] previous complete calendar years, submit your OSHA Days Away from Work, Restricted Duty, or Job Transfer (DART) Rate, as defined by the U.S. Department of Labor, Occupational Safety and Health Administration. If you cannot submit an OSHA DART Rate, affirmatively state so, and explain why. Any extenuating circumstances that affected the OSHA DART Rate data should be addressed as part of this element. OSHA DART rates above 3.0, in any of the previous five years, will be considered UNACCEPTABLE, unless an adequate explanation is provided to address the extenuating circumstances that affected the rate.

(3) Technical Approach for Safety:

Describe the plan that the Offeror will implement to qualify, evaluate, select and oversee its potential subcontractors. The Safety narrative shall be limited to one page. Information in excess of one page will not be considered. Offerors must submit both (1) a plan to include the safety performance of subcontractors in the selection process for all levels of subcontractors and (2) a plan to monitor the safety of those subcontractors during contract performance, highlighting what specific management practices will be in place for providing deliberate safety program management and mishap prevention support to those sub-contractors whose EMR is greater than 1.0, whose TRC is greater than 4.0 and whose DART rate is greater than 3.0. Offerors who fail to submit either of these will be rated UNACCEPTABLE.

(b) Basis of Evaluation:

The Government is seeking to determine whether the Offeror has an acceptable safety record. The Government will evaluate the Offeror’s overall safety record as evidenced by the TRC and DART rates, if the Offeror’s plan includes safety in the evaluation and selection of subcontractors, and if the narrative includes a plan to monitor the safety performance of subcontractors during performance. The evaluation will collectively consider the following:

- OSHA Total Recordable Case (TRC) Rate
- OSHA Days Away from Work, Restricted Duty, or Job Transfer (DART) Rate
- Offeror Technical Approach to Safety

(1) OSHA Total Recordable Case (TRC) Rate:

The Government will evaluate the OSHA TRC Rate to determine if the Offeror's OSHA TRC rate is above 4.0 and extenuating circumstances that impact the rates. OSHA TRC rates above 4.0, in any of the previous five years, will be considered UNACCEPTABLE, unless an adequate explanation is provided to address the extenuating circumstances that affected the rate.

(2) OSHA Days Away from Work, Restricted Duty, or Job Transfer (DART) Rate:

The Government will evaluate the OSHA DART Rate to determine if the Offeror's OSHA DART rate is above 3.0 and extenuating circumstances that impact the rates. OSHA DART rates above 3.0, in any of the previous five years, will be considered UNACCEPTABLE, unless an adequate explanation is provided to address the extenuating circumstances that affected the rate.

(3) Technical Approach to Safety:

The Government will evaluate the narrative to determine if subcontractor safety performance will be considered in the qualification, evaluation, selection, of all levels of subcontractors on the upcoming project, and both the plan to monitor the safety of those subcontractors during contract performance, highlighting what specific management practices will be in place for providing deliberate safety program management and mishap prevention support to those sub-contractors whose EMR is greater than 1.0, whose TRC is greater than 4.0 and whose DART rate is greater than 3.0. Offerors who fail to address either of these items (i.e. whether the safety performance of subcontractors will be evaluated in the selection process for all levels of subcontractors and whether the safety of those subcontractors will be monitored during contract performance) will be rated UNACCEPTABLE.

(4) Factor 4 – Technical Solution

(a) Solicitation Submittal Requirements:

Provide a narrative describing the technical approach that meets the requirements of the RFP. Narrative shall not exceed two (2) double-sided pages (or four (4) single-sided pages), and shall be no smaller than 11 pitch font in 8 ½" x 11" format. The submission shall be in narrative form only. Gantt Charts, Critical Path Method (CPM) schedules, etc. are not desired and will not be evaluated. The narrative shall include the following:

- A description of the Offeror's plan to account for: the construction period (clearly identify the number of calendar days), including consideration for the contract required work restrictions, supplemental temporary environmental controls, special inspection and testing, administrative submittals, long lead items, construction sequencing, commissioning, and any critical path construction items including those submittals that must be accepted/approved before construction work can begin.

- A description of the Offeror's critical path of their proposed schedule. The Offeror shall include a discussion of at least three (3) elements that have the potential to negatively impact the critical path and what measures will be taken to mitigate impacts to time and resources.

(b) Basis of Evaluation:

Evaluation of this factor will be a subjective assessment of the Offeror's approach to complete the project within the proposed timeframe thereby demonstrating the Offeror's ability to properly accomplish the requirements of the project. Failure to address the submission requirement will result in an Unacceptable rating. Restating the RFP requirements will result in an Unacceptable rating.

6. Responsibility Determination Information Submission

A. Additional Methods of Evaluation

1. In accordance with FAR 9.104 and DFARS 209.104, the Government will use, but is not limited to, the following sources of information to support a determination that a prospective Offeror meets the general and

applicable special standards of responsibility:

i. System for Award Management (SAM)
ii. Veterans' Employment and Training Service (VETS) 100 Website.
iii. Past Performance Information Retrieval System (PPIRS) Website.
iv. State databases.

7. Definitions

A supplemental list of definitions applicable to this solicitation is provided as **Attachment F**.

8. Pre-Proposal Conference –

A pre-proposal conference and site visit will be scheduled. See Section 00100 FAR Clause 52.236-27 Site Visit (Construction) (FEB 1995) – Alternate I (FEB 1995) for specific site visit information.

EXHIBITS FOR SUBMISSION REQUIREMENTS ARE PROVIDED AS SEPARATE ATTACHMENTS ON THE NAVY ELECTRONIC COMMERCE ONLINE (NECO) WEBSITE AT https://www.neco.navy.mil/

V. ATTACHMENTS

Attachment A – Pre-Proposal Inquiry Form

Attachment B – Schedule of Prices

Attachment C – Construction Experience Project Data Sheet

Attachment D – Past Performance Questionnaire, Construction Projects

Attachment E – Past Performance Worksheet for Safety

Attachment F – Definitions

Attachment G – Small Business Subcontracting Plan (Large Businesses)

Attachment H – Site Visit Map

Attachment I - Site Visit Personnel Request

(End of Summary of Changes)

NAVFAC SUSTAINABILITY AND ENERGY DATA --- *NEW CONSTRUCTION & MAJOR RENOVATION*

PROJECT INFORMATION

Work Order No.: FY 2015 MILCON P No. / Customer Reference No.: 993
Project Title: TPS Port Angeles Forward Operating Location
Location/UIC: Naval Base Kitsap/N68436
NAVFAC Project Manager: Teresa Erickson Project Dollar Amount $: 2,520,000
Project Type: Alert Force Building Project Design Level: 100%
Facility Area: 8,200 U/M: SQ. FT. Category Code: 14347 Facility #:
AE Contract # & T.O. N44255-13-D-8003-0010 AE Firm Sustainability Coordinator: Lee Davenport (Helix Design Group)
AE Firm Name: BergerABAM
Project Phase: ☐ Solicitation Documents Complete (Draft) ☐ Construction Complete (Final)
Construction Contract & T.O. Award Date (P/A): BOD (P/A):
Construction Contractor:
Contractor's Sustainability Coordinator:

SUSTAINABILITY DATA - GUIDING PRINCIPLES for SUSTAINABLE NEW CONSTRUCTION and MAJOR RENOVATION

Use this form to collect design and as-constructed project information to be recorded on the Sustainable and Energy Tab in eProjects

Provide justification for each target missed:

Daylighting could not be achieved due to ATFP setback limitations which reduced window sizes and locations in order to be feasible for the project.

Sustainability Third Party Rating System: ☑ USGBC LEED ☐ GBI Green Globes ☐ Not Applicable ☐ Other

A Sustainability Certification Level - Target
☑ LEED Silver ☐ 2 Globes ☐ Other

Identify "Other" certification system and target level

B Sustainability Certification Level - Achieved
☐ LEED Certified ☐ LEED Silver ☐ LEED Gold ☐ LEED Platinum ☐ Not Met
☐ 1 Globe ☐ 2 Globes ☐ 3 Globes ☐ 4 Globes ☐ Other

Identify "Other" certification system and level achieved

I. Employ Integrated Design Principles
I.a Integrated Assessment, Operation, and Management ☑ Included ☐ Not Included
I.b Commissioning (Select one)
☑ Commissioning ☐ No Commissioning

Systems Commissioned: Domestic Water, HVAC, Lighting

II. Optimize Energy Performance
II.a Energy Efficiency
i Energy Reduction 30% target 34.50
ii Efficiency Standard
☐ 90.1 - 2004 ☑ 90.1 - 2007 ☐ 90.1 - 2010
a. Total Design Energy Use Intensity (EUI): kBTU/Sq Ft/Year 29
iii New Technology: Provide description Used VRF systems and high performance envelope. Looked at VRF heat rejection for domestic water heating and solar water heating but both were deemed uneconomical.

II.b On-Site Renewable Energy
i. Solar Hot Water 30% target 0.00
ii. Renewable energy technology types (select all that apply)
☐ Daylighting ☐ Ground Source Heat Pumps ☐ Solar Photovoltaic
☐ Geothermal ☐ Mechanical (i.e., direct water pumping) ☐ Solar Thermal -domestic hot water
☐ Wind ☐ Solar Thermal -space conditioning
iii. Sustainable Roof Attribute (Select all that apply)
☐ Cool - white ☑ Cool - reflective ☐ Solar PV ☐ Solar Thermal ☐ Vegetated
II.c Building-level Metering (Measurement) ☐ Included ☑ Not Included

III. Protect and Conserve Water
III.a Indoor Water
i Reduce potable water 55.00
ii Building-level Metering (Measurement) ☐ Included ☑ Not Included
a. Total Design Indoor Water Use Intensity (WUI): Gallons/Sq Ft/Year 16

III.b Outdoor Water
i Reduce landscape water ☐ 50% below conventional ☑ 100% ☐ Not Met

IV. Enhance Indoor Environmental Quality
IV.a Ventilation and Thermal Comfort
i Thermal Environmental Conditions ☑ Met ☐ Not Met
ii Ventilation ☑ Met ☐ Not Met
IV.b Moisture Control Plan ☑ Included ☐ Not Included
IV.c Daylighting
i Minimum Daylight ☐ Met ☑ Not Met
ii Automatic dimming controls ☑ Included ☐ Not Included
IV.d Low-Emitting Materials ☑ Met ☐ Not Met

NAVFAC SUSTAINABILITY AND ENERGY DATA --- *NEW CONSTRUCTION & MAJOR RENOVATION*

IV.e Protect Indoor Air Quality during Construction ☐ Met ☐ Not Met

V. Reduce Environmental Impact of Materials

V.a Recycled Content: www.epa/gov/cpg ☑ Met ☐ Not Met

V.b Biobased Products ☑ Met ☐ Not Met

V.c Waste and Materials Management

i. Waste Diversion (50% targett) 0%

ii. Waste Management ☑ Included ☐ Not Included

V.d Ozone Depleting Compounds ☑ Met ☐ Not Met

To maintain prior project sustainability information, print and upload a copy of the completed worksheet to the Notes tab as Design & Criteria note BEFORE updating the tab.

GUIDANCE ON CALCULATION FOR EUI & WUI

1 The EUI must be calculated as the total Design Energy Consumption per year (including savings from renewables) divided by the total Building Area (including unconditioned indoor space).

a. The total Design Energy Consumption can be found in the Energy Cost Budget (ECB) Compliance Report. The Design Energy Consumption is in the Energy Summary by End Use Table at the bottom of page 2 of the ECB Report. The value is listed as Total Including Solar for the Proposed Building. It is the first field on the bottom row. (Units in the ECB Report are 10^6 Btu/yr, so multiply by 1000 to yield kBtu/yr

b. The total Building Area (including unconditioned indoor spaces) can be found in the Energy Cost Budget (ECB) Compliance Report in the Space Summary Table on page 1 of the ECB Report. The value is listed as Total (area) including Conditioned area and Unconditioned area. Insure the units are in square feet

2 The WUI must be calculated as the total Design Indoor Potable Water Consumption per year divided by the total Building Area (including unconditioned space).

a. The total Design Water Consumption can be found in the LEED WE P1 water consumption calculation *or* Green Globes 3.4.1.1 Water Consumption calculation. The value is the Design Case – Annual Potable Water Consumption. It is listed in units of Gallons/year

b. The total Building Area (including unconditioned spaces) can be found in the Energy Cost Budget (ECB) Compliance Report in the Space Summary Table on page 1 of the ECB Report. The value is listed as Total (area) including Conditioned area and Unconditioned area. Insure the units are in square feet

MONTHLY ANTICIPATED ADVERSE WEATHER DELAYS											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4	4	3	2	1	0	0	0	1	2	3	4

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities are critical to contract completion. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity.

1.6.2.4.1 Endangered Species/Marine Mammal Monitoring Delays

A lost workday, due to endangered species/marine mammal monitoring delays as defined in Section 01 57 19.01 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS, is defined as a scheduled workday activity(s) in which the Contractor's workforce cannot work 50 percent or more of the day on the impacted activity(s). The Contractor shall immediately notify the Contracting Officer when a lost workday due to monitoring delays has occurred and shall identify the activity(s) impacted; the restricted condition encountered and the reason for resultant activity(s) impacted. The Contractor shall record on Quality Control and Production Daily Reports the occurrence; the adverse restricted condition encountered, and reason for resultant activity(s) impacted.

Approved lost workdays due to endangered species/marine mammal monitoring delays shall be actualized by an added as-built schedule activity(s) with activity ID including MM/DD/YEAR of occurrence, and as predecessor to the impacted activity(s). The Contractor may request an adjustment in accordance with the contract clauses and the terms of this section (including the allocation of Float) for approved lost workdays.

1.6.2.4.2 In-Water Work Period

The Contractor shall use the requirements listed in Specification Section 01 57 19.01 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS to account for non-working days due to in-water environmental restrictions within calendars assigned to work activities affected by this restriction.

1.6.2.5 Cost Loading

1.6.2.5.1 Cost Loading Activities

Assign Material and Equipment Costs, for which payment will be requested in advance of installation, to their respective procurement activity (i.e., the material/equipment on-site activity). Assign cost for material/equipment, paid for after installation; labor; and construction equipment to their respective Construction Activities. The value of commissioning, testing and closeout WBS section must not be less than 10 percent of the total costs for Procurement and Construction Activities. Evenly disperse overhead and profit to each activity over the duration of the project.

1.6.2.5.2 Quantities and Units of Measure

Each cost loaded activity must have a detailed quantity breakdown and unit of measure. Lump sum costing is not acceptable.

1.6.3 Schedule Software Settings and Restrictions

a. Activity Constraints: Date/time constraint(s), other than those required by the contract, are not allowed unless accepted by the Contracting Officer. Identify any constraints proposed and provide an explanation for the purpose of the constraint in the Narrative Report as described in Paragraph REQUIRED TABULAR REPORTS..

b. Default Progress Data Disallowed: Actual Start and Actual Finish dates on the CPM schedule must match the dates on the Contractor Quality Control and Production Reports.

c. Software Settings: Handle schedule calculations and Out-of-Sequence progress (if applicable) through Retained Logic, not Progress Override. Show all activity durations and float values in days. Show activity progress using Remaining Duration. Set default activity type to "Task Dependent".

d. At a minimum, include the following settings and parameters in Baseline Schedule preparation:

(1) General: Define or establish Calendars and Activity Codes at the

LEED 2009 for New Construction and Major Renovations

Project Checklist

P-993 TPS Port Angeles Forward Operation Location AFF

######

Sustainable Sites — Possible Points: 26

Y	?	N			
11	1	14			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
		5	Credit 2	Development Density and Community Connectivity	5
		1	Credit 3	Brownfield Redevelopment	1
		6	Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
3			Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
2			Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
1			Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
1			Credit 6.2	Stormwater Design—Quality Control	1
	1		Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
		1	Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y	?	N			
8		2			
Y			Prereq 1	Water Use Reduction—20% Reduction	
4			Credit 1	Water Efficient Landscaping	2 to 4
		2	Credit 2	Innovative Wastewater Technologies	2
4			Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y	?	N			
13	1	21			
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
11	1	7	Credit 1	Optimize Energy Performance	1 to 19
		7	Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
		2	Credit 4	Enhanced Refrigerant Management	2
		3	Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y	?	N			
6	1	7			
Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
2			Credit 4	Recycled Content	1 to 2
1	1		Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y	?	N			
11	1	3			
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
1			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
1			Credit 5	Indoor Chemical and Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems—Lighting	1
		1	Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
	1		Credit 7.2	Thermal Comfort—Verification	1
		1	Credit 8.1	Daylight and Views—Daylight	1
		1	Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

Y	?	N			
3	3				
1			Credit 1.1	Innovation in Design: Specific Title	1
1			Credit 1.2	Innovation in Design: Specific Title	1
	1		Credit 1.3	Innovation in Design: Specific Title	1
	1		Credit 1.4	Innovation in Design: Specific Title	1
	1		Credit 1.5	Innovation in Design: Specific Title	1
1			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

Y	?	N			
3		1			
1			Credit 1.1	Regional Priority: Specific Credit	1
1			Credit 1.2	Regional Priority: Specific Credit	1
1			Credit 1.3	Regional Priority: Specific Credit	1
		1	Credit 1.4	Regional Priority: Specific Credit	1

Total — Possible Points: 110

Y	?	N			
55	7	48			

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Endangered Species Act (ESA)/Marine Mammal Protection Act (MMPA) Monitoring and Construction Restriction Requirements

PART 1 GENERAL

1.1 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. These documents shall be provided to the Contractor prior to the start of construction. Monitoring and baseline surveys shall be conducted and implemented in accordance with the final version of the following documents:

IC/BiOp USFWS	Informal Concurrence and/or Biological Opinion - U.S. Fish and Wildlife Service
IC/BiOp NMFS	Informal Concurrence and/or Biological Opinion - National Marine Fisheries Service
IHA	Incidental Harassment Authorization
MARMAM MP	Marine Mammal Monitoring Plan
AMP	Acoustic Monitoring Plan
MAMU MP	Marbled Murrelet Monitoring Plan

1.2 General Requirements

This enclosure describes the required acoustic measuring, marine mammal monitoring, and marbled murrelet monitoring associated with construction of P-993 Transit Protection System at the USCG Air Station/Sector Field Office Port Angeles, WA in compliance with the references.

The contractor shall conduct work in strict compliance with the requirements stated in this section and the reference documents. Reference documents will be made available to the contractor when finalized. Government personnel will conduct periodic observations of the contractor's environmental monitoring activities to ensure authority is in place to maintain environmental compliance for the Navy during construction of the project.

The Navy will continually update the Regulatory Agencies regarding the status of the project and compliance with regulations. The Navy has established an adaptive management strategy with the Regulatory Agencies which may produce changes to the permits and monitoring plans as determined per discussions. The contractor is required to comply with the current edition of the respective permits and plans. If terms of the permits or monitoring plans are revised after award of the contract, the contractor may request an adjustment in accordance with the contract clauses.

The contractor shall be required to shut down impact and vibratory pile driving activities if marine mammals are observed within the designated shut down zones. Pile driving shall not resume until the species of concern leaves the area, or 15 minutes have passed without sightings. Pile driving start, shutdown, and restart shall be determined by the monitoring coordinator.

The contractor shall be required to shut down impact pile driving activities if a marbled murrelet is observed within the designated shut down zone. Work activities shall not resume until the the marbled murrelet leaves the area. Pile driving start, shutdown, and restart shall be determined by the monitoring coordinator.

Marine mammal observers and marbled murrelet observers shall be specific personnel dedicated to either monitoring for marine mammals or marbled murrelets.

The contractor will be required to shutdown construction activities should -any bird, marine mammal, or fish be observed as being injured or killed during construction activities. If any injury or death occurs, all associated construction activities shall be shutdown until the appropriate Navy personnel (including the construction manager and Navy biologist) have been notified and an account of the observation can be recorded and provided to the appropriate Regulatory Agencies. All communications with the Agencies shall be performed by the Navy.

1.3 Definitions

1.3.1 Shut Down Zone

Area around each pile which shall require the stoppage of pile driving in accordance with the permits. The size of the areas described below reflect the anticpated distances to the appropriate species threshold and may need to be adjusted during actual construction based on results of acoustic monitoring.

1.3.1.1 Marine Mammal Shut Down Zones

For harbor porpoise (Phocoena phocoena), Steller sea lion (Eumetopias jubatus), California sea lion (Zalophus californianus), northern elephant seal (Mirounga angustirostris), and harbor seal (Phoca vitulina) both vibratory and impact pile driving shall cease if any animal is observed approaching or within a 30 m radius ~~around the~~of the pile driving activity.

For all ~~other species of marine mammals~~killer whale (Orcinus orca), humpback whale (Megaptera novaeangliae), and gray whale (Eschrichtius robustus), all pile driving shall cease should any animal be present or approach within 13.5 sq km of vibratory pile driving (all of Port Angeles Harbor) or a 631 sq m area of impact driving.

Pile driving shall not begin or resume until the species of concern leaves the shutdown area, or 15 minutes have passed without sightings. Pile driving start, shutdown, and restart shall be determined by the monitoring coordinator.

1.3.1.2 Marbled Murrelet Shut Down Zone

All impact pile driving shall cease should a marbled murrelet approach or enter within a 92 m radius ~~around each pile during~~of impact pile driving.

1.3.1.3 Marine Mammal Disturbance Zone

The marine mammal disturbance zone applies only for harbor porpoise, Steller sea lion, California sea lion, northern elephant seal, and harbor seal. The disturbance zone is a 13.5 sq km area during vibratory and a 631 sq m area during impact driving. The disturbance zone shall be monitored but shall not require stoppage of pile driving operations. Pile driving shall cease if any species of marine mammal not listed above enters the disturbance zone.

PART 2 RESTRICTIONS

2.1 Environmental Restrictions

All in-water work shall be limited to occur between July 16 and February 15.

2.1.1 Daylight Restrictions

a. July 16 - September 23: ~~Impact pile driving shall not begin until 2 hours after sunrise and shall end 2 hours before sunset during the marbled murrelet breeding season (July 16 through September 23).~~ All ~~other~~ in-water work shall be conducted during daylight hours (sunrise to sunset). Sunrise and sunset are to be determined based on the National Oceanic and Atmospheric Administration data which can be found at:

http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html.

b. September 24 – February 15

All work, including pile driving, shall be conducted from sunrise to sunset hours. Refer to: http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html for determining sunrise/sunset hours.

2.1.2 Impact Hammer Restrictions

Impact hammer driving shall be limited to ~~1600~~ 3500 impact hammer strikes or less per day of pile driving~~, and shall average 200 strikes or less per pile~~. Total number of impact hammer strikes per day shall not be surpassed. Total duration of actual impact driving shall not exceed ~~80~~ 180 minutes per day.

2.1.3 Total Pile Driving Days

Total days of pile driving shall not exceed ~~75 days~~requirement shown in Section 01 14 00 WORK RESTRICTIONS paragraph 1.2.e. Any pile driving operation, regardless of the number of hammer strikes or vibratory duration, shall be considered a pile driving day.

2.1.4 Sound Attenuation

Sound attenuation measures are required during all impact pile driving activities. The system shall be determined by the contractor and submitted to the government for approval. The contractor shall provide the necessary equipment/materials. The contractor must employ measures to ensure adequate sound attenuation. These measures consist primarily of technical checks that will be conducted in the absence of pile driving sound, such as visual inspection to ensure proper seating of the bubble curtain, air flow pressure testing, ring spacing measurements, etc. If a bubble curtain will be used the contractor must supply documentation within 48 hours prior to pile driving that the bubble curtain provides at least 8 dB of attenuation. If a device other than a bubble curtain is used, information regarding the proposed system, including previous attenuation levels achieved, shall be submitted to the government for approval prior to use.

2.1.5 Beaufort Wind Scale Restrictions

No impact pile driving shall occur when the sea-state conditions exceed a Beaufort Sea State 2 within the Marbled Murrelet Shutdown Zone.

2.1.6 Water Quality Protection

A floating surface boom and silt curtains shall be deployed during demolition and construction activities to contain and collect debris.

PART 3 EXECUTION

3.1 Period of Monitoring Activities

a. Monitoring Coordinator

A monitoring coordinator is required to be present for all in water construction activities. All in water work activities includes but is not limited to: vibratory pile driving, impact pile driving, and initial placement of piles on substrate as well as pile cutting and removal during demolition.

b. Acoustic Monitoring

c. Hydroacoustic monitoring will be conducted for 12 piles (3 piles of each size) struck with an impact hammer. Piles chosen to be monitored are driven in water depths that are representative of mid-channel or typical water depths at the project location where piles will be driven.

d. Marine Mammal Monitoring
Marine mammal monitoring is required to be present for all in water construction activities. All in water work activities includes but is not limited to: vibratory pile driving, impact pile driving, and initial placement of piles on substrate.

e. Marbled Murrelet Monitoring
Marbled murrelet monitoring is required during all impact pile driving.

3.2. Monitoring Services and Reporting

3.2.1 Monitoring Coordinator
The monitoring coordinator is responsible for daily coordination between the three monitoring teams (acoustic, marine mammal, and marbled murrelet) and the construction contractor. The Monitoring Coordinator shall receive schedule information from the construction contractor and is responsible for coordinating the acoustic, marine mammal, and marbled murrelet monitoring efforts so that all regulatory requirements are met. The Monitoring Coordinator shall be responsible for informing the monitoring teams which piles and hammers will be in operation and any other information necessary to support the field team's data collection efforts. The Monitoring Coordinator may also serve as either, but not both, a Marine Mammal Monitor or a Marbled Murrelet Monitor.

The pile driving supervisor shall be responsible for maintaining radio communication with the monitoring coordinator during start-up, operation, shut-down, and restarts.

3.2.2 Acoustic Monitoring
All acoustic monitoring activities shall be in accordance with the Acoustic Monitoring Plan (AMP). The AMP shall be provided to the Contactor prior to the start of construction and the Monitoring Coordinator shall ensure that all monitors have received a copy of the AMP, and have reviewed and understand the requirements of the plan, prior to the start of monitoring activities.

Underwater noise levels during impact pile driving and the effectiveness of the noise attenuation device shall be monitored by placing 1 hydrophone at a distance of 10 meters from the pile to be monitored. This hydrophone can be tethered to a barge or other structure but shall be located approximately mid-water depth. A second hydrophone shall be located from an autonomous floating raft at a distance of three times the depth of the pile to be monitored. There should be a direct line of sight between the pile and the hydrophone(s) in all cases.

The hydrophone calibration(s) shall be checked at the beginning of each day of monitoring activity.

Underwater sound levels shall be continuously monitored during the entire duration of each pile being driven. Peak levels of each strike shall be monitored in real time.

3.2.2.1 Data Analysis
Post-analysis of the sound level signals shall be in accordance with the Acoustic Monitoring Plan (AMP). Analysis will include determination of the maximum absolute value of the instantaneous pressure within each strike, Root Mean Square (RMS) value for each absolute peak pile strike, mean and standard deviation/error of the RMS for all pile strikes of each pile, rise time, number of strikes per pile and per day, number of strikes exceeding 206 dB_{peak}, number or percent of individual strikes exceeding 183 dB Sound Exposure Level (SEL) and 187 dB SEL, SEL of the pile strike with the absolute peak sound pressure, mean SEL, and cumulative SEL (cumulative SEL = single strike

SEL + 10*log (# hammer strikes)) and a frequency spectrum both with and without mitigation, between a minimum of 20 and 10,000 Hz for up to eight successive strikes with similar sound levels.

Background sound levels shall be analyzed by calculating 30-second RMS values and plotted on a Cumulative Distribution Function (CDF). The average background sound level shall be estimated using the 50% CDF.

3.2.2.2 Completion Report

The Contractor shall prepare a completion report and submit it to the Navy at the conclusion of the impact pile driving period. The report shall provide an analysis of the change in the waveform and sound levels with and without the noise attenuation device operating. The report shall provide data collected and summarized from all monitoring locations. The results shall be summarized in graphical form and include summary statistics and time histories of impact sound values for each pile. The report shall include:

- Size and type of piles.
- A detailed description of the noise attenuation device, including design specifications.
- The impact hammer energy rating used to drive the piles, make and model of the hammer.
- A description of the sound monitoring equipment.
- The distance between hydrophone*(s)* and pile.
- The depth of the hydrophone*(s)* and depth of water at hydrophone locations.
- The distance from the pile to the water's edge.
- The depth of water in which the pile was driven.
- The depth into the substrate that the pile was driven.
- The physical characteristics of the bottom substrate into which the piles were driven.
- The total number of strikes to drive each pile and for all piles driven during a 24-hour period.
- The background sound pressure level reported as the 50% CDF.
- The results of the hydroacoustic monitoring, including the frequency spectrum, ranges and means including standard deviation/error for peak and RMS SPL's, single-strike and cumulative SEL with and without the attenuation system, an estimation of the number of strikes that exceeded the cumulative SEL threshold and an estimation of the distance at which the peak and cumulative SEL values reach the respective thresholds and the distance at which the RMS values reach the relevant marine mammal thresholds and background sound levels.

a. Draft Report

A draft report, including data collected and summarized from all phases, shall be submitted to the Navy within 45 work days of the completion of acoustic monitoring. The Navy shall have 5 work days to review the draft report and provide comments/feedback to the contractor for revisions. The contractor shall have 5 work days to revise the draft report and re-submit it to the Navy. The contractor is not responsible for submitting draft report to the Regulatory Agencies.

b. Final Report

A final report shall be prepared and submitted to the Navy within 15 work days following receipt of comments on the draft report by the Regulatory Agencies. The contractor is to submit the final reports to the Navy, who shall have 5 work days to review the draft report and provide comments to the contractor for revisions. The contractor shall have 5 work days to revise the final report and re-

submit it to the Navy. The contractor is not responsible for submitting the final report to the Regulatory Agencies.

3.2.3 Marine Mammal Monitoring

All marine mammal monitoring activities shall be in accordance with the Marine Mammal Monitoring Plan (MARMAM MP). The MARMAM MP shall be provided to the Contactor prior to the start of construction and the Monitoring Coordinator shall ensure that all monitors have received a copy of the MARMAM MP, and have reviewed and understand the requirements of the plan, prior to the start of monitoring activities.

3.2.3.1 Monitoring

Marine mammal monitoring shall occur during all pile driving activities. ~~Up to four~~Three marine mammal monitors operating both on land and from 1 boat shall monitor the disturbance zone and shutdown zone for the presence of marine mammals.

As described in the Marine Mammal monitoring plan, the shutdown zone is defined as a 30 m radius around each pile during both vibratory/impact pile driving for all species of marine mammals. The shutdown zone also includes a 13.5 sq km area during vibratory and a 631 sq m area during impact driving for species which the Navy has not received incidental take authorization (all species except harbor porpoise, Steller sea lion, California sea lion, northern elephant seal, or harbor seal) or any species that cannot be positively identified. The shutdown zones shall be monitored for 15 minutes prior to commencing pile driving. If marine mammal(s) are present within or approaching the shutdown zones prior to pile driving, the start of pile installation/removal shall be delayed until the animal(s) leave the shutdown zone voluntarily and have been visually confirmed beyond the shutdown zone, or 15 minutes has elapsed without re-detection of the animal.

The disturbance zone only applies to species for which the Navy has received incidental take authorization from NMFS. These species are harbor porpoise, Steller sea lion, California sea lion, northern elephant seal, or harbor seal The disturbance zone for these species is defined as 13.5 sq km area during vibratory and a 631 sq m area during impact driving. If a species for which the Navy has received “take” for is observed within or entering the disturbance zone during pile driving, exposure would be recorded, behaviors documented, and the shutdown zone monitor alerted to the position of the animal. However, that pile segment would be completed without cessation.

If a marine mammal is observed entering the shutdown zones during pile driving, all pile driving activities shall be halted. Once a shutdown has been initiated, pile driving activities and other in-water construction activities shall be delayed until the animal has voluntarily left the shutdown zone and has been visually confirmed beyond the shutdown zone, or 15 minutes have passed without re-detection of the animal.

If marine mammals are detected outside the shutdown zones, the observers shall continue to monitor these individuals and record their behavior, but pile driving and other in-water construction may proceed.

3.2.3.2 Data collection

Each marine mammal monitor shall use a National Marine Fisheries-Approved Sighting Form, which shall be provided in the monitoring plan and provided prior to the start of construction. The form shall be completed by each observer for each survey day. The following data will be collected on the form:

- The date and time that pile driving begins and ends and method of installation shall be recorded for each pile.
- Time and duration of marine mammal sighting.
- Construction activities occurring during each marine mammal sighting.

- Weather parameters (e.g., percent cover, percent glare, visibility).
- Water conditions (e.g., Tidal state [incoming (flood), slack (neither direction), or outgoing (ebb)], and sea state) during each sighting. The Beaufort Sea State Scale shall be used to determine sea-state.
- Species, numbers, and if possible, sex and age class of marine mammals.
- Marine mammal behavior patterns observed, including bearing from observer and direction of travel. If possible, include the correlation to sound pressure levels for context.
- Distance from pile driving activities to marine mammals and distance from the marine mammal to the observation point.
- Occurrence of pile driving delay or shutdown due to marine mammal presence in shutdown zones.
- Locations of all marine mammal observations.
- Other human activity in the area. Record the hull numbers of fishing vessels if possible.

3.2.3.3 Daily Summary Reports

Daily summary reports shall be complied by the monitoring coordinator and submitted to the contracting officer no later than the next morning from the date of the monitoring surveys. The summary report compiles information collected on the individual sighting forms and provides additional details about construction activities during marine mammal monitoring. A Daily Summary Report form shall be included in the monitoring plan and provided prior to the start of construction.

3.2.3.4 Completion Report

The Contractor shall prepare a completion report and submit it to the Navy at the conclusion of the pile driving period. To the extent possible, all sightings should be correlated with the acoustic results based on the representative data collected during the acoustic monitoring period to try to indicate the received level of the sound at each animal's position. Acoustic information (if collected) should be incorporated as necessary to detail the number of marine mammal observations which qualified as takes, based on the sound propagation data from the representative pile driving scenarios obtained during the acoustic monitoring period.

a. Report Content

- General data:
  - Date and time of activities.
  - Water conditions (e.g., sea-state, tidal state).
  - Weather conditions (e.g., percent cover, visibility).
- Specific pile data:
- Description of the pile driving activities including the size and type of pile,
- The installation methods used for each pile and the duration each method was used per pile,
- Impact or vibratory hammer force used to drive/extract piles
- Detailed description of the sound attenuation system, including the design specifications
- Depth of water in which the pile was driven
- Depth into the substrate that the pile was driven
- Pre-activity observational survey specific data:
- Dates and time survey is initiated and terminated.
- Description of any observable marine mammal behavior in the immediate area during monitoring.

- If possible, the correlation to underwater sound levels occurring at the time of the observable behavior.
- Actions performed to minimize impacts to marine mammals.
- During-activity observational survey-specific data:
- Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding monitoring zones including the following:
- Distance from animal to source.
- Reason why shutdown was or was not implemented.
- If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown.
- If a shutdown is implemented, the distance from animal to source at the time of the shutdown.
- Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start.
- Distance to the animal from the source during soft start.
- If possible, the correlation to underwater or airborne sound levels occurring at the time of this observable behavior.
- Actions performed to minimize impacts to marine mammals.
- Times when pile extraction is stopped due to presence of marine mammals within the shutdown zones and time when pile driving resumes.
- Post-activity observational survey specific data:
- Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of safety zones.
- A refined take estimate based on the number of marine mammals observed during the course of construction.

b. Draft Report

A draft report, including data collected and summarized from all phases, shall be submitted to the Navy within 45 work days of the completion of acoustic monitoring and in-water work. The Navy shall have 5 work days to review the draft report and provide comments/feedback to the contractor for revisions. The contractor shall have 5 work days to revise the draft report and re-submit it to the Navy. The contractor is not responsible for submitting draft report to the Regulatory Agencies.

c. Final Report

A final report shall be prepared and submitted to the Navy within 15 work days following receipt of comments on the draft report by the Regulatory Agencies. The contractor is to submit the final reports to the Navy, who shall have 5 work days to review the draft report and provide comments to the contractor for revisions. The contractor shall have 5 work days to revise the final report and re-submit it to the Navy. The contractor is not responsible for submitting the final report to the Regulatory Agencies.

3.2.4 Marbled Murrelet Monitoring

All Marbled Murrelet monitoring activities shall be in accordance with the Marbled Murrelet Monitoring Plan (MAMU MP). The MAMU MP shall be provided to the Contactor prior to the start of construction and the Monitoring Coordinator shall ensure that all monitors have received a copy of the MAMU MP, and have reviewed and understand the requirements of the plan, prior to the start of monitoring activities.

3.2.4.1 Monitoring

~~Up to four~~Two USFWS qualified marbled murrelet monitors ~~operating both on land and from 1 boat~~ shall monitor the disturbance zone and shutdown zone for the presence of marbled murrelets. Each ~~land-based~~ observer can cover a 180º arc over a 50 m area. ~~Each boat observer can cover a 50 m transect on one side of the boat.~~

Monitoring shall begin at least 30 minutes prior to commencement of impact pile driving. If marbled murrelet(s) are present within or approaching the shutdown zone prior to impact pile driving, the start shall be delayed until the animal(s) leave the shutdown zone voluntarily and at least 2 full sweeps of the shutdown area have confirmed murrelets are not present.

The shutdown zone shall be monitored throughout all impact pile driving activities. If a marbled murrelet is observed within or entering or approaching the shutdown zone during impact pile driving, all impact pile driving activities shall be halted. Once a shutdown has been initiated, impact pile driving activities shall be delayed until the animal has voluntarily left the shutdown zone and and at least 2 full sweeps of the shutdown area have confirmed murrelets are not present.

If marbled murrelets are detected outside the shutdown zone, the observers shall continue to monitor these individuals and record their behavior, but impact pile driving and other in-water construction may proceed.

3.2.4.2 Data Collection

The marbled murrelet observers shall use the USFWS-approved Bird Observation Record Form, which would be completed by each observer for each survey day. The following information will be collected on the sighting form:

- The date and time that pile driving begins and ends and method of installation shall be recorded for each pile.
- Time and duration of marbled murrelet sighting.
- Construction activities occurring during each marbled murrelet sighting.
- Weather parameters (e.g., percent cover, percent glare, visibility).
- Water conditions (e.g., Tidal state [incoming (flood), slack (neither direction), or outgoing (ebb)], and sea state) during each sighting. The Beaufort Sea State Scale shall be used to determine sea-state.
- Visibility;
- Numbers and, if possible, sex and age class of marbled murrelet;
- Observed marbled murrelet behavior patterns, including bearing and direction of travel;
- Distance from construction activity to marbled murrelets and distance from the marbled murrelets to the observation point;
- Locations of all alcid observations; and
- Other human activity in the area.

3.2.4.3 Daily Summary Reports

Daily summary reports shall be complied by the monitoring coordinator and submitted to the contracting officer no later than the next morning from the date of the monitoring surveys. The summary report compiles information collected on the individual sighting forms and provides additional details about construction activities during marbled murrelet monitoring.

3.2.4.4 Completion Report

The Contractor shall prepare a completion report and submit it to the Navy at the conclusion of the impact pile driving period. To the extent possible, all sightings should be correlated with the acoustic results based on the representative data collected during the acoustic monitoring period to try to

indicate the received level of the sound at each animal's position. Acoustic information should be incorporated as necessary to detail the number of marine mammal observations which qualified as takes, based on the sound propagation data from the representative pile driving scenarios obtained during the acoustic monitoring period.

Report Content

- General data:
    - Date and time of activities.
    - Water conditions (e.g., sea-state, tidal state).
    - Weather conditions (e.g., percent cover, visibility).
- Specific pile data:
    - Description of the pile driving activities including the size and type of pile,
    - The installation methods used for each pile and the duration each method was used per pile,
    - Impact or vibratory hammer force used to drive/extract piles
    - Detailed description of the sound attenuation system, including the design specifications
    - Depth of water in which the pile was driven
    - Depth into the substrate that the pile was driven
- Pre-activity observational survey specific data:
    - Dates and time survey is initiated and terminated.
    - Description of any observable marine mammal behavior in the immediate area during monitoring.
    - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior.
    - Actions performed to minimize impacts to marbled murrelets.
- During-activity observational survey-specific data:
    - Description of any observable marbled murrelet behavior within monitoring zones or in the immediate area surrounding monitoring zones including the following:
        - Distance from animal to source.
        - Reason why shutdown was or was not implemented.
        - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown.
        - If a shutdown is implemented, the distance from animal to source at the time of the shutdown.
        - Behavioral reactions noted during soft starts and if they occurred before or after implementation of the soft start.
        - Distance to the animal from the source during soft start.
    - If possible, the correlation to underwater or airborne sound levels occurring at the time of this observable behavior.
    - Actions performed to minimize impacts to marbled murrelets.
- Post-activity observational survey specific data:
    - Results, which include the detections of marbled murrelets, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of safety zones.

A refined take estimate based on the number of marbled murrelets observed during the course of construction.

a. Draft Report

A draft report, including data collected and summarized from all phases, shall be submitted to the Navy within 45 work days of the end of monitoring. The Navy shall have 5 work days to review the draft report and provide comments/feedback to the contractor for revisions. The contractor shall have 5 work days to revise the draft report and re-submit it to the Navy. The contractor is not responsible for submitting draft report to the Regulatory Agencies.

b. Final Report

A final report shall be prepared and submitted to the Navy within 15 work days following receipt of comments on the draft report by the Regulatory Agencies. The contractor is to submit the final reports to the Navy, who shall have 5 work days to review the draft report and provide comments to the contractor for revisions. The contractor shall have 5 work days to revise the final report and re-submit it to the Navy. The contractor is not responsible for submitting the final report to the Regulatory Agencies.

3.3 Meetings

The "Environmental Monitoring Team Kickoff Meeting" and the "Construction – Environmental Team Coordination Meeting" will likely be separate meetings. Ongoing project and data review meetings should be expected biweekly.

PART 4 QUALIFICATIONS

4.1 Personnel Qualifications

4.1.1. Monitoring coordinator

The monitoring coordinator must possess a Bachelor of Science Degree in biology, or closely related field and have 8 years of specifically related experience. The monitoring coordinator must have at least 4 years of pile driving biological monitoring experience over the past 8 years. Biological monitoring must specifically include experience in marine mammal and marbled murrelet monitoring for marine construction projects or surveys. This individual should have prior experience and demonstrated ability to lead a complex team of marine mammal and marbled murrelet biological observers, as well as acoustic engineers during a pile driving project while understanding the complexities of working in a construction area in the marine environment. Observers and acoustics personnel will be stationed on small vessels and/or fixed structures while the Monitoring Coordinator will likely be located separately on the construction pile driving barge. Individual must have the ability to communicate with the construction contractor regarding upcoming pile driving/construction activity and then relay the information to the monitoring team via handheld radios. The monitoring coordinator must fully understand the terms and conditions of the biological consultation permit documents to ensure that conditions are met and monitors are in place in order to comply with the marine mammal, marbled murrelet, fisheries, and acoustic permit conditions. The monitoring coordinator shall be required to keep a log of pile driving activity and notify the monitoring team if marine species are seen near a pile. The individual needs to demonstrate the ability (provide prior examples of situations) where they have been in this position before and had to communicate effectively with the construction contractor/engineers to resolve conflicting or divergent situations (such as pile driving timing or pile driving sequence). The individual must have the ability to coordinate the pre-monitoring (before pile driving begins) with post-monitoring and complete all the work required by the permits in the daytime hours as stated in the biological permits and consultations. The monitoring coordinator shall have the authority to shutdown construction/pile

driving if a permit violation is about to occur or in order to comply with the permit requirements and avoid a permit violation. The coordinator must have attended any species identification classes required for both the marine mammal observers and marbled murrelet observers; certification in each class is not required. Qualifications must be submitted for the monitoring coordinator for approval by the Contracting Officer.

4.1.2 Acoustical Firm

The acoustical firm should have successfully completed the following activities on other projects: 1) measured underwater sounds from pile driving in the marine environment and preferably deep water areas; 2) conducted measurements to characterize a variety of steel pipe pile sizes; 3) measured airborne sounds from pile driving; 4) have experience in setting up hydrophones at appropriate distances in order to determine propagation and characterize the sound field; 5) be able to measure and convey acoustic results in real-time; 6) have experience in setting up stationary raft-like underwater recording stations; 7) have experience in working in high current areas; and 8) completed reports, in accordance with the monitoring plan, that accurately and clearly present the results of the monitoring and could be used to communicate findings to regulatory agencies regarding potential impacts on fish, marine mammals, and diving seabirds. Qualifications must be submitted for the acoustic firm for approval by the Contracting Officer.

4.1.2.1 Marine Bioacoustician

Acoustic monitoring shall be conducted by a qualified, trained marine bioacoustician. At minimum, a marine bioacoustician must possess a Bachelor's of Science in biology/physics/engineering, or a closely related field and have 4-5 years of specifically related experience. A Master's Degree and 2-3 years experience, or a PhD focused specifically on the practical applications of bioacoustics research in the marine environment would be acceptable substitutes. Qualifications must be submitted for approval by the Contracting Officer.

4.1.3 Marine Mammal Observers

All marine mammal observers shall be biologists with prior training and experience in conducting marine mammal monitoring or surveys, and who have the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities. Qualifications must be submitted for the monitoring coordinator for approval by the Contracting Officer.

4.1.4 Marbled Murrelet Observers

All marbled murrelet observers must be certified under the U. S. Fish and Wildlife Service, Washington Fish and Wildlife Office, Marbled Murrelet Marine Protocol. Observers will have appropriate qualifications, including education or work experience in biology, ornithology, or a closely related field; at least one season (2-3 months) of work with bird identification being the primary objective (i.e. not incidental to other work). Observers must have experience identifying marine birds in the Pacific Northwest, as well as understanding and documenting bird behavior. Qualifications for all observers must be submitted for approval by the Contracting Officer.

PART 5 EQUIPMENT

5.1 Equipment Specifications

5.1.1 Survey boats

Survey boats used for marine mammal, marbled murrelet, or acoustic monitoring shall meet the following minimum specifications:

- ~~Two (2) Survey boats for marine mammal and marbled murrelet monitoring; e~~Equipped with ~~a flying bridge for~~ an elevated observational platform. These vessels must carry the following equipment: a depth finder, measuring tape, navigational plotting equipment, and both fixed and hand-held GPS Units.
- One (1) autonomous floating raft.

5.1.2 Acoustic Monitoring Recording Equipment

- Hydrophone Receiving Sensitivity- 211dB re 1V/µPa
  - Hydrophone Receiving Sensitivity - 200dB re 1/µPaTwo
  - Signal Conditioning Amplifiers (4-channel) with Amplifier Gain- 0.1 mV/pC to 10 V/pC Transducer Sensitivity Range- 10-12 to 103 C/MU
  - One (1) Calibrator (pistonphone-type)
  - One (1) Portable Dynamic Signal Analyzer (4-channel) Sampling Rate 48kHz or greater
  - (one) Microphone (free field type) Range- 30 – 120 dBA Sensitivity- -29 dB ± 3 dB (0 dB = 1 V/Pa)
  - Flow shield (If water velocity ~> 1m/s)- Open cell foam cover or functional equivalent
  - Laptop computer or Digital Audio Recorder compatible with digital signal analyzer
  - Real Time and Post-analysis software

5.1.3 Marine Mammal and Marbled Murrelet Monitoring Observing Equipment

- Hand-held GPS units;
- Hearing protection for biologists and boat operators working near heavy construction equipment;
- Portable marine radios and headsets for the observers to communicate with the monitoring coordinator, construction contractor, and other observer(s);
- Cellular phones, without a camera (one per boat/observing location), and the contact information for the other observer(s), monitoring coordinator, and NMFS point of contact;
- Green flags (one per boat/observing location) as back-up for radio communication;
- Red flags (one per boat/observing location) as back-up for radio communication;
- Nautical charts;
- Daily tide tables for the project area within the Hood Canal;
- Watch or Chronometer;
- Binoculars with built-in rangefinder or reticles – (quality 7 x 50 or better);
- Spotting scopes;
- Monitoring plans, IHA permit, and/or other relevant permit requirement specifications in sealed clear plastic cover;
- Notebook with pre-standardized monitoring forms on non-bleeding paper (e.g Rite-in-the Rain);
- Marine mammal & seabird identification guides on waterproof paper;
- Large zip-lock bags;
- Clipboard;
- Pen / Pencil

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6. PART 6 DELIVERABLES

6.1 Deliverable Format

It is the responsibility of the Contractor to ensure that all electronic deliverables are fully compatible and functional based on the current applications used by the Navy Marine Corps Intranet (NMCI).

6.1.1 Text, Spreadsheet, and Database Files

The Navy Marine Corps standard desktop computing software is Microsoft Office 2007. Reports and other text documents shall be provided in Microsoft Word 2007 format and Portable Document Format (PDF) readable with Adobe Acrobat 9 unless other mutually agreeable formats are determined. Adobe PDF files should include a complete linked table of contents and all tables or figures within the test of the report should be linked directly to the referenced table or figure. Spreadsheet files shall be provided in Microsoft Excel 2007 format. Database files shall be provided in Microsoft Access format, unless specified otherwise, as approved by the Contracting Officer. Literature search and reference information shall be provided in file format for Endnote X1.

All text, spreadsheet and database files shall be delivered on CD-ROM, DVD or other electronic media as approved by the Contracting Officer. All graphics used for report and CD covers shall be delivered in Adobe Photoshop (PSD) format. In addition to plots contained within associated MS Word report, separate digital raster graphics of all plots shall also be submitted in high resolution > 600 dpi Tagged Image Format (TIF) as separate files from any embedded in reports.

All hard-copy reports must be submitted bound in a “D” type three ring binder. The binder shall have clear exterior pockets suitable for document labels and interior pockets suitable for storing additional paper sheets. Both spine and front cover shall be labeled. Deliverables shall be made by express mail (USPS/UPS/Fedex) and/or by electronic delivery as specified by the Contracting Officer.

6.1.2 Geospatial Data, Maps, Drawings, and Sketches

6.1.2.1 Geographic Data Delivery Format

Digital geographic maps and the related vector data sets shall be developed using double precision and the data sets shall be delivered in a personal geo-database format that is Microsoft® SQL Server-compatible using ArcGIS 9.3.1 or higher and must be importable to an Microsoft® SQL Server geodatabase using ArcGIS Server 9.3.1 or higher. ArcInfo, ArcGIS, and ArcSDE are geographic information system software applications produced by the Environmental Systems Research Institute (ESRI) of Redlands, California.

6.1.2.1.1 Scale-dependent Mapping Guidelines

a. Installation and Sub-Regional Level Mapping

   See NAVFAC Guidelines for Installation Mapping and GeoSpatial Data published by NAVFACENGCOM.

b. Regional, Theatre-Level Mapping

   Geospatial data for regional, theatre-level mapping (1:24K) shall be provided using precise geographic coordinates in decimal degree format with four decimal precision. Geographic data shall generally be provided in: nautical miles (nm.) for expansive marine areas, and statute miles (mi.) for expansive land areas, and projected into the Universal Transverse Mercator (UTM) coordinate system. Regional maps and data shall use the appropriate UTM Zone(s), the GRS 1980 spheroid and the North American Datum 1983

(WGS-84). No offsets shall be used. Each data set shall have a projection file if appropriate based on format.

Map or drawing scales shall be determined by the Contracting Officer. Mapping accuracy for the agreed scales shall conform to the American Society for Photogrammetry and Remote Sensing (ASPRS), "Accuracy Standards for Large-Scale Maps" and “Interim Accuracy Standards for Large-Scale Maps” (ASPRS, 1991). Copies of the ASPRS Accuracy Standards can be obtained by contacting:

American Society for Photogrammetry and Remote Sensing
5410 Grosvenor Lane, Suite 210
Bethesda, MD 20814-216

ASPRS accuracy standards can also be found on the Internet at: http://www.asprs.org

Any system specific requirements in terms of data compatibility should be addressed. Any geospatial data delivered should be fully compatible with existing government enterprise systems.

6.1.2.2 Geographic Data Structure

The Contractor shall develop all geographic information in a structure consistent with the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE), Version 2.6, released in January, 2007, or a higher version if available at the time of this project. The Contractor shall consult with the Government concerning modifications or additions to the SDSFIE. The Government may approve modifications to the Standard if it is determined that SDSFIE does not adequately address subject datasets. The American National Standards Institute’s (ANSI) Committee for Information Technology Standards has approved the Spatial Data Standard for Facilities, Infrastructures, and Environment (SDSFIE) as ANSI standard NCITS 353. Copies of the SDSFIE may be obtained by contacting:

Director, U.S. Army Engineer Waterways Experiment Station
CADD/GIS Technology Center
Attn: CEWES-IM-DA/Smith
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Electronic copies of the Standards are also available from the SDSFIE homepage at URL address: http://www.sdsfie.org/

6.1.2.3 Content Specifications for Geospatial Data

The Contractor shall develop all geographic information in a structure consistent with the latest version of Spatial Data Standards (SDS). Specific content for environmental planning and range planning themes supplemental SDS is available from the NAVFAC Data Committee. The Contractor shall consult with the Government concerning modifications or additions to the SDS.

The environmental data themes and attributes developed by the NAVFAC Data Committee have been specified to augment the existing standards in order to make geospatial data more useful to the specific business functions involved in environmental and ranges planning. Subject matter experts identified these themes to add value and relevancy to geospatial data deliverables. “Best available data” shall be provided, and shall be evaluated based on whether appropriate regulatory or other authoritative sources were used to acquire raw or complete data for specific themes (see Geographic Data Review below).

6.1.2.4 Geographic Data Documentation

For each digital file delivered containing geographic information (regardless of format), the Contractor shall provide documentation consistent with the "Content Standards for Digital Geospatial Metadata, June 1998" published by the Federal Geographic Data Committee. The documentation shall include but is not limited to the following: the name and description of the map layer or coverage, the source of the data and any related data quality information such as accuracy and time period of content, description of equipment or instruments used in the data collection, the type of data coverage (point, line, polygon, etc.), the field names of all attribute data and a description of each field name, the definition of all codes used in the data fields, the ranges of numeric fields and the meaning of these numeric ranges, the creation date of the map layer and the name of the person who created it. A point of contact shall be provided to answer technical questions. Metadata generation tools included in the ArcGIS suite of software shall be used in the production of the required metadata in XML format. Alternately, another metadata generation tool called document.aml is available from ESRI for use with ARC/INFO to produce the required metadata. If neither of these tools is used, the Contractor must insure that the metadata is delivered in a format which can be easily translated to the XML format. All metadata needs to comply with the Federal Geographic Data Committee (FGDC) format. Copies of the FGDC metadata standard can be obtained by contacting:

Federal Geographic Data Committee
590 National Center
Reston, Virginia 20192

USNG: 18STJ94731361
FAX: 703-648-5755
E-mail: fgdc@fgdc.gov

FGDC metadata standards can also be found on the Internet at: http://www.fgdc.gov/metadata

6.1.2.5 Geographic Data Review

The digital geographic maps, related data, and text documents shall be included for review in the draft and final contract submittals. The reviews shall include a visual demonstration of the geographic data on one of the Sun Sparc or Windows computer systems supported by the Geographic Information System (GIS) Section, Business and Logistics Support Department. Contractor shall have a technical consultant available at each review to assist with any digital data discrepancies. The data shall be analyzed for subject content and system compatibility. Review of comments to data and text shall be incorporated by the Contractor prior to approval of the final submittal.

LIST OF REFERENCES

The below listed reports are referenced within this Enclosure. The requirements of this enclosure and the references shall be read and complied with as a whole. Copies shall be provided to the contractor prior to the start of construction.

a. Endangered Species Act – Biological Opinion and/or Section 7 informal concurrence, P-993 Transit Protection System at USCG Air Station/Sector Field Office Port Angeles, Port Angeles Harbor on the Ediz Hook Peninsula, Clallam County, Washington. U.S. Fish and Wildlife Service; xxx. Reference Number xxx.

b. Endangered Species Act Biological Opinion and/or Section 7 informal concurrence and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation, P-993 Transit Protection System at USCG Air Station/Sector Field Office Port Angeles. National Marine Fisheries Service; xxx. Consultation Number xxx.

c. Request for Incidental Harassment Authorization for the Incidental Harassment of Marine Mammals Resulting from the P-993 Transit Protection System project at USCG Air Station/Sector Field Office Port Angeles, Washington. Naval Facilities Engineering Command Northwest; xxxx.

d. Incidental Harassment Authorization for the Incidental Harassment of Marine Mammals Resulting from the P-993 Transit Protection System project at USCG Air Station/Sector Field Office Port Angeles, Washington. National Marine Fisheries Service; xxx.

e. Marine Mammal Monitoring Plan, P-993 Transit Protection System project. Department of the Navy; 2015.

f. Marbled Murrelet Monitoring Plan, P-993 Transit Protection System project. Department of the Navy; xxxx.

g.

h. Acoustic Monitoring Plan, P-993 Transit Protection System project. Department of the Navy; xxxx.

ASTM D512	(2012) Chloride Ion in Water
ASTM D516	(2011) Sulfate Ion in Water
ASTM D6690	(2012) Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM D75/D75M	(2014) Sampling Aggregates
ASTM E329	(2014a) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2009; 28th Ed) Manual of Standard Practice

1.2 DEFINITIONS

~~a. "Aging factor" is used to estimate the change in the ionic diffusion coefficient over time. The aging factor is defined as the ratio of the ultimate ionic diffusion coefficient (D_{oh}) to the 28-day D_{oh}.~~

b. "Atmospheric zone" is any portion of the waterfront structure above the splash zone.

~~c. "Boundary condition" is the environmental conditions in contact with the concrete. The service life modeling tool shall account for short-term and long-term changes in environmental conditions at the boundary interface between the specific concrete element and the environment, including wetting and drying due to daily tidal cycles and/or changes over its lifecycle.~~

d. "Cementitious material" as used herein includes portland cement and any pozzolanic material such as fly ash, ground granulated blast-furnace slag and silica fume.

e. "Complementary cementing materials" (CCM) include coal fly ash, granulated blast-furnace slag, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in considerable improvement to sustainability, durability and in some cases a reduction in initial cost.

~~f. "Chloride threshold" (CTH) is the concentration of chloride ions in concrete that is generally assumed to be the minimum necessary to initiate corrosion of the reinforcing steel when all other necessary conditions are satisfied. The threshold value is expressed in parts per million (ppm) by mass of concrete.~~

g. "Concrete system" is the term describing a structural element comprised of concrete, reinforcing steel and concrete cover.

~~h. "Corrosion initiation period" (Ti) is the number of years assumed before the chloride ion reaches the chloride threshold for the reinforcing steel at the depth of the steel. The corrosion initiation period will be determined by STADIUM® software.~~

~~i. "Corrosion propagation period" (Tp) is the number of years after the~~

~~corrosion initiation period before corrosion manifest as visible cracking and spalling of the concrete cover to a degree that will require extensive concrete repair. Based on evidence provided by the Contractor and reviewed by the Government's Subject Matter Expert in Concrete Materials, on a case-by-case basis the Contracting Officer may approve extension to the typical corrosion propagation period of 15 years. Use of supplemental corrosion protection methods and benign environmental conditions are two ways to extend the assumed propagation period.~~

j. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified to meet structural design criteria.

~~k. "Effective diffusion coefficient" (D_{eff}) is a coefficient that combines the ionic diffusion coefficient D_{oh} and volume of permeable voids.~~

~~l. "Exposure conditions" are the environmental parameters used in service life modeling for each type of concrete element based on the structure location and anticipated boundary conditions.~~

m. "Field test strength" (fcr) is the required compressive strength of concrete to meet structural and durability criteria. Determine (fcr) during mixture proportioning process.

n. "High-volume fly ash concrete" has a minimum of 50 percent Class F fly ash as a partial replacement to portland cement.

~~o. "Ionic diffusion coefficient" (D_{oh}) is the ionic diffusion coefficient as determined per the ionic diffusion coefficient migration testing forthe service life modeling.~~

p. "Marine concrete" is concrete that will be in contact with seawater or brackish water, tidal variations, splash, or spray from water in navigable waterways. Concrete in piles driven on land that extend below the water table that contains saltwater or brackish water is marine concrete. All concrete for the work marine concrete and shall be designed using marine concrete requirements.

q. "Mass concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.

r. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements and of the project while minimizing the initial and life-cycle cost.

s. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic yard or meter) of concrete.

~~t. "Moisture transport coefficient" (MTC) is the value determined per the moisture transport coefficient drying test.~~

~~u. "Permeability" (K) is the intrinsic permeability of the concrete evaluated from the moisture transport coefficient drying test.~~

v. "Pozzolan" is a siliceous or siliceous and aluminous material, which in

itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

w. "Process control sampling" is sampling and testing conducted by the Contractor to monitor the quality of materials or processes. Process control sampling is intended to indicate the quality of materials at critical steps in production that allow intervention prior to using a material on the project.

x. "Quality Acceptance Limit" (QAL) is the limiting value of a test result that indicates acceptable material quality. Quality acceptance limits are based on design criteria that may be either upper-bound limits ~~where smaller values indicate acceptable material, such as D_{eh};~~ or lower-bound limits. ~~where larger values indicate acceptable material, such as compressive strength.~~

y. "Quality acceptance sampling" is sampling and testing conducted by the Contractor, or an independent testing agency, to evaluate the quality of materials used on the project. Quality acceptance sampling is conducted at regular intervals identified as "lots" to represent the quality of that portion of the material used in the project.

z. "Required compressive strength" (f'cr) is the mean compressive strength of concrete required to meet structural criteria. The required strength is the mean concrete strength for tests of properly batched concrete at the age specified herein.

~~aa. "Service life" is the Owner's stated expectation for the number of years that the structure will function without needing major concrete rehabilitation. Service life shall be 75 years for the work. Service life shall be further defined as the summation of the corrosion initiation period (Ti) and the corrosion propagation period (Tp) for a given concrete system.~~

~~bb. "Service life modeling" in the context of this document refers to a methodology using STADIUM® finite element software. It predicts the time before the chloride ion contamination will reach a level of reinforcing that is likely to result in the initiation of steel corrosion. It also predicts delayed ettringite reaction, sulfate attack and other chemical deterioration mechanisms.~~

~~cc. "Specified effective diffusion coefficient" (D_{spec}) is the calculated effective diffusion coefficient at which the chloride ion content is within 10 percent (50 ppm) of the chloride threshold, at the steel cover depth, for the given exposure.~~

dd. "Splash zone" is the portion of the structure just above the tidal zone. This portion of the structure is predominantly dry, but is likely to intermittently wet by wave action and wind driven spray. For the purposes of this specification section, the splash zone is defined as follows:

(1) for locations protected by seawalls or otherwise sheltered from open-ocean waves, the 6 feet area just above the tidal zone;

(2) for unprotected locations, the 20 feet area just above the tidal zone.

ee. "Submerged zone" is defined as the submerged portion of the structure. For the purposes of this specification section, any element or portion thereof that is located below Mean Lower Low Water (MLLW).

ff. "Supplemental corrosion protection" includes (but not limited to) fusion-bonded epoxy-coated steel reinforcing steel, galvanized steel reinforcing steel, stainless reinforcing steel, corrosion inhibitors, barrier coatings to the concrete surface, and cathodic protection.

gg. "Test section" is a slab or wall separate from the main structure and constructed prior to main construction as an all inclusive demonstration of methods and materials. The adequacy of the Test Section shall be approved by the owner's representative prior to construction of the project.

hh. "Tidal zone" is defined as the portion of the structure regularly wetted by wave action. For the purposes of this specification section, any element or portion thereof that is located between Mean Lower Low Water (MLLW) and Mean Higher High Water (MHHW) is in the tidal zone.

ii. "Tolerance limit" is defined for each transport parameter as the characteristic value that will be surpassed in 1 of 10 batches, at a 90 percent confidence level. This definition is provided for reference only, additional documentation and evaluation is needed prior to it being suggested as prescriptive criteria.

~~jj. "Transport properties" refers to the properties that characterize the rate of chloride penetration into a concrete element. These properties include: volume of permeable voids (phi), ionic diffusion coefficient (D_{oh}), aging factor, and moisture transport coefficient (MTC).~~

~~kk. "Transport property testing" refers to the testing procedures that characterize the rate of chloride penetration into a concrete element. These properties are used as input data for the service life modeling.~~

~~ll. "Volume of permeable voids" (phi) is the porosity of the concrete as determined by ASTM C642.~~

~~mm. "50 percent saturation water content" (S50 percent) is the degree of saturation of the saturated concrete after being allowed to come to equilibrium at 50 percent relative humidity. It is defined as the volume of the water in the concrete at equilibrium divided by the volume of permeable voids (phi) as determined by ASTM C642.~~

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REQUIREMENTS. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Concrete Curing Plan; G
Concrete Qualification Program; G

Aggregate Moisture Content;
Aggregate Sampling;
Concrete Test Reports; G

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, PLACING, STORAGE, AND HANDLING OF CONCRETE

Follow ACI 301, ACI 304R, and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor barrier, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground. Protect materials from contaminants such as grease, oil, and dirt. Ensure materials can be accurately identified after bundles are broken and tags removed.

1.6 CONCRETE QUALITY CONTROL

The objective of the concrete quality control program is for the Contractor to outline its procedures, oversight, sampling, and testing that will be used to construct a structure that meets the requirements herein. ~~will obtain the design service life.~~ Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. Include approved laboratories in the program. Provide direct oversight for the concrete qualification program inclusive of ~~service life modeling,~~ associated sampling and testing. If concrete cylinders tested during production indicate inadequate strength~~, excessive ion-transport properties,~~ or inadequate mixing, then the Government may require concrete core samples extracted from the hardened concrete for analysis at the Contractor's expense to assure that the quality of the concrete as placed and cured ~~will satisfy the defined service life~~.

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R ~~and able to meet the defined service life using the methodology herein.~~ Maintain a copy of ACI SP-15 and CRSI 10MSP at the project site.

1.6.1 Quality Control Personnel

Submit for approval an organizational chart defining the quality control hierarchy, the responsibilities of the various positions, including the names and qualifications of the individuals in those positions.

Submit American Concrete Institute certification for the following:

a. CQC personnel responsible for inspection of concrete operations.

b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.

c. Field Testing Technicians: ACI Concrete Field Testing Technician,

Grade I.

d. Laboratory Testing Technicians: ACI Concrete Strength Testing Technician and Laboratory Testing Technician, Grade I or II.

~~e. STADIUM® certified laboratory and users of STADIUM® software.~~

~~f. Petrographer: Bachelor of Science degree in geology or petrography, trained in petrographic examination of concrete aggregate according to ASTM C294 and ASTM C295/C295M, and trained in identification of the specific deleterious processes and tests identified in this specification. Resume shall detail the education, training and experience related to the project-specific test methods and deleterious materials and shall be submitted at least 20 days before start of the petrographic examination and deleterious materials.~~

g. Concrete Batch Plant Operator: National Ready Mix Concrete Association (NRMCA) Plant Manager Certification at the Plant Manager level.

1.6.1.1 Quality Manager Qualifications

Hold a current license as a professional engineer in the United States with experience on at least five (5) similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

1.6.1.2 Field Testing Technician and Testing Agency Qualifications Submit

data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete meeting the following requirements.

a. ACI Concrete Field Testing Technician Grade 1 in accordance with ACI SP-2 or equivalent for technicians testing concrete. Equivalent certification programs may be considered by the Contracting Officer, include requirements for written and performance examinations as stipulated in ACI SP-2.

b. ASTM E329 for agencies testing reinforcing steel.

c. ASTM C1077 for agencies testing concrete materials.

~~d. STADIUM® certified qualifications or pre-approval by the Contracting Officer for testing agencies or engineering companies that characterize the transport properties of the concrete or conduct service life modeling analysis. If pre-approved by the Contracting Officer, provide documentation showing concurrence of the Government's Subject Matter Expert in Concrete Materials identified by the Contracting Officer.~~

1.6.2 Laboratory Qualifications for Concrete Qualification Testing As a

minimum, meet the following requirements.

a. Have the necessary equipment and experience to accomplish required testing.

b. Meet the requirements of ASTM C1077.

c. Cement and Concrete Reference Laboratory (CCRL) inspected.

~~d. STADIUM© certified laboratory.~~

1.6.3 Laboratory and Testing Facilities and Accreditations

Provided by and at the expense of the Contractor as follows.

a. General: Currently accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260 including the required test methods, as specified.

b. Aggregate Testing and Mix Proportioning: Performed under the direction of a licensed civil engineer in a United States, who shall sign all reports and designs.

c. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

d. Contractor Quality Control: Perform all sampling and testing using an approved, onsite, independent, accredited laboratory.

1.7 CONCRETE DURABILITY

1.7.1 Concrete Mixture Proportions

At least 60 days prior to concrete placement, submit concrete mixture proportions, ingredient material certificates and test data, and trial batch test data for each class of concrete proposed for use on the project. Clearly indicate where each mixture will be used when more than one mixture is submitted. Obtain approval from Contracting Officer prior to placement.

1.7.2 Concrete Design Requirements

Proportion concrete mixtures to meet the requirements listed in Table 1 in accordance with the procedures outlined in ACI 201.2R and ACI 211.1.

Develop the mixture proportions for concrete to produce the required compressive strength (f'cr), drying shrinkage, and constructability for mixtures that have the potential to accomplish a structure with the design service life.

Table 1 - Concrete Design Requirements		
Prescriptive requirements	Minimum	Maximum
ASTM C666/C666M Method A Durability Factor at 300 cycles	90	--
Concrete ASTM C157/C157M Drying Shrinkage percent, as modified per ACI 364.3R at 28 days except for high volume fly ash (HVFA) at 56 days.	--	0.04 percent

Table 1 - Concrete Design Requirements		
Prescriptive requirements	Minimum	Maximum
Initial acid-soluble chloride content in concrete determined following ASTM C1152/C1152M, percent/cement	--	0.06

1.7.3 Concrete Mixture Qualifications

1.7.3.1 Previously Approved Concrete Mixtures

For identical concrete mixtures previously approved for use within the past 12 months, the previous mixture qualification submittal may be re-submitted without further trial batch testing if accompanied by:

a. A copy of the prior approvals indicating the project name, project number, and location.

b. Ingredient material test data conducted within 6 months of the submittal date.

c. Copies of the previously approved trial batch test data~~, including phi, D_{oh}, S50 percent, K, and D_{spec}~~.

d. A log containing at least fifteen sequential test results with the calculated mean and standard deviation of the production concrete for air content, and compressive strength~~, phi, D_{oh}, and D_{eff}~~.

If changes are made to material type, class, sources, or suppliers; chemical composition; and/or mix proportions, provide a written opinion of the significance of the change(s). The change(s) may require additional testing at the discretion of the Contracting Officer in consultation with the Government's Subject Matter Expert in Concrete Materials and at the Contractor's expense

1.7.3.2 New Concrete Mixtures

a. Submit complete test data for new ingredients, including applicable reference specifications. Submit additional data regarding concrete aggregates if the source of aggregate changes.

b. Submit new concrete mixture of test reports by independent test lab conforming to ASTM C1077 showing that the mixture has been successfully tested to produce concrete with the properties specified and that mixture will be suitable for the job conditions as described. Submit test reports along with the concrete mixture proportions. Obtain approval by the Contracting Officer before concrete placement.

~~c. Test a minimum of three trial batches of production concrete to establish the tolerance limits and D_{spec}. If batching facilities are located such that the haul-time will exceed 30 minutes, include a simulated haul time in the trial batch.~~

the concrete has reached a minimum of 85 percent of the design compressive strength.

3.2 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

3.2.1 Reinforcement Supports

Place reinforcement and secure with non-corrodible chairs, spacers, and hangers. Metal hangers may be used, but shall be of similar material to the reinforcing steel. Support reinforcement on the ground with concrete or other non-corrodible material, having a compressive strength equal to or greater than the concrete being placed and having permeability equal or less than the concrete being placed.

3.2.2 Splicing

As indicated. For splices not indicated, comply with ACI 301. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches. Comply with AWS D1.4/D1.4M for welded splices and be approved by the Contracting Officer prior to use.

3.2.3 Cover

As a minimum, comply with ACI 318 for concrete cover over the steel reinforcement unless a larger cover is indicated. ~~The cover may be greater than that required by ACI 318 based on the results from service life modeling.~~ Use ACI 117 to determine allowable tolerances for the placement of reinforcing steel.

3.2.4 Setting Miscellaneous Material and Prestress Anchorages

Place and secure anchors, bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Set anchor bolts plumb and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete. Electrically isolate exposed steel work and its anchor systems from the primary steel reinforcement with at least 2 inches of concrete. Coat exposed steel work to reduce corrosion with a coating suitable for preventing corrosion in a marine environment. Prevent corrosion on edges and horizontal surfaces.

3.2.5 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated. Provide 1/4-inch amplitude of roughness on the entire joint surface of hardened concrete. Final joint locations are subject to Government approval or substantiating calculations from the Contractor.

3.3 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C94/C94M, ACI 301, and ACI 304R, except as modified herein. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish batch tickets imprinted with mix identification, batch size, batch design and measured weights, moisture in the aggregates, and time batched for each load of ready mix concrete. When a pozzolan is batched cumulatively with the cement, batch the pozzolan after the cement has entered the weight hopper.

3.8.1.4 Unit Weight Test

ASTM C138/C138M. Take concrete samples during concrete placement. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 50 cubic yards (maximum) of concrete.

3.8.2 Hardened Concrete Properties

Sample and test each lot at 100 cubic yards.

Cast and cure specimens in accordance with ASTM C172/C172M, ASTM C31/C31M, and applicable requirements of ACI 305R and ACI 306R.

For each lot, record the date and time sampled, the batch ticket code, cylinder ID code the location of placement, total volume of concrete represented by the sample, and fresh concrete properties; ASTM C143/C143M for slump or ASTM C1611/C1611M for slump flow and visual stability index (VSI), ASTM C231/C231M for air content, ASTM C1064/C1064M for temperature, and ASTM C138/C138M unit weight.

For each lot sample, cast twelve 6 by 12 inch cylinder specimens for strength ~~and seven 4 by 8 inch cylinder specimens for transport property testing. Use special handling for shipments of transport property specimens. Wrap these cylinders completely with slightly damped paper towels with spring water only. Place wrapped cylinders in either a vacuum package or double layers of sealed plastic bags.~~ Package cylinders to prevent damage and ship priority mail to the approved testing laboratory.

3.8.2.1 Compressive Strength Tests

ACI 214R tests for compressive strength - conduct strength tests of concrete during construction in accordance with the following procedures:

a. Test cylinders in accordance with ASTM C39/C39M. Test three cylinders at 3 days, three cylinders at 7 days, and three cylinders at the age when the compressive strength requirement was specified. Hold the remaining three cylinders in storage. If one specimen in a test shows evidence of improper sampling, molding or testing, discard the specimen and consider the strength of the remaining cylinder to be the test result. If more than one specimen shows excess defects, the Contracting Officer may allow the entire test to be discarded. Test results shall not exceed the specified compressive strength by more than 20 percent for the age specified.

b. If the average strength test results are less than the specified strength f'c extract three core samples from the structure in accordance with ASTM C42/C42M, from the area that correlates to the low test results. These extracted cores shall not contain steel reinforcing. Repair core holes with non-shrink grout. Match color and finish of adjacent concrete. For concrete not meeting strength criteria the Contractor shall prepare a remediation strategy for the review by the Contracting Officer.

c. Provide strength test reports within 7 days of test completion.

3.8.2.2 Chloride Ion Concentration

Comply with ACI 318. Determine water soluble chloride ion concentration. Perform test once for each mix design. The limits for average chloride ion

SD-03 Product Data

Shop primer
Welding electrodes and rods
Non-Shrink Grout
Tension control bolts

SD-06 Test Reports

Bolts, nuts, and washers
Weld Inspection Reports
Bolt Testing Reports

SD-07 Certificates

Steel; G
Bolts, nuts, and washers; G
AISC Fabrication Plant Quality Certification; G
AISC Erector Quality Certification
Welding procedures and qualifications; G
Welding electrodes and rods; G

1.3 AISC QUALITY CERTIFICATION

Fabricate word in an AISC Certified Fabrication Plant, Category Std. Submit AISC fabrication plant quality certification.

Erect work using an AISC Certified Erector, Category ~~ASCE~~ CSE. Submit AISC erector quality certification.

1.4 QUALITY ASSURANCE

1.4.1 Preconstruction Submittals

1.4.1.1 Erection Drawings

Conform to AISC 303. Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing. Erection drawings shall be reviewed, stamped and sealed by a professional engineer currently licensed in the United States.

1.4.2 Fabrication Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Do not use reproductions of contract drawings for fabrication drawings. Provide complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Include shoring and temporary bracing, designed, stamped, and sealed by a professional engineer currently licensed in the State of Washington, and submitted for record purposes, with calculations, as part of the drawings. On these drawings, clearly highlight any deviations from the details shown on the contract drawings and explain the reasons for deviations.

accordance with ASTM C840, System XIII or GA 216. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with ANSI A108.11. Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

3.3.2 Joint Treatment ANSI A108.11.

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Finish plenum areas above ceilings to Level 1 in accordance with GA 214. Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214. Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3 in accordance with GA 214. ~~Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214.~~ Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

~~3.4.1 Uniform Surface~~

~~Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.~~

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling framing in accordance with the specifications contained in

SD-06 Test Reports

Non-destructive testing of pile splice welds; Visual inspection of pile connection welds; Pipe Weld NDT records;
Non-destruction testing of pile connection welds;

SD-07, Certificates Fabricator's certification;
Mill certificates for pipe materials; G

SD-11 Closeout Submittals Pile driving records; G
As-driven pile locations; G
Final Inspection Report; G

Submit complete and accurate pile driving records as specified in the paragraph "Pile Driving Records by the Contractor" and after completion of driving submit an inspection report as specified in the paragraph "Written Final Inspection Report by the Contractor".

1.3 BASIS FOR BIDS

Base bids on the number, size, and length of piles from tip to cutoff as indicated, including batter. Add 5 feet of additional length at each pile and add additional length as determined by the Contractor to account for cutoff of the driving ends as indicated on the drawings and for damage to the driving ends from installation. Should the total number of piles or number of each length vary from that specified as the basis for bidding, or the number of pile restrikes vary from that specified as the basis for bidding, the contract price will be adjusted in accordance with Contract Clause entitled "Changes." Adjustment in contract price will not be made for cutting off piles, for any portion of a pile remaining above the cutoff elevation, for over-driving piles, or for damaged or rejected piles.

1.4 HANDLING, DELIVERY, AND STORAGE

a. Protection: Use all means necessary to protect the materials of this section including coatings before, during and after installation and to protect the installed work and materials of all other trades.

b. Replacements: In the event of damage to piling or coatings, immediately make all repairs and replacements necessary to the approval of the Contracting Officer and its Technical Representative at no additional cost to the Government.

1.5 FABRICATOR'S CERTIFICATION

Manufacturer of steel pipe shall be certified by the Steel Plate Fabricator's Association (SPFA) or hold a current ISO 9001 certification when plates are used to fabricate pipe.

1.6 PILE DRIVING INSPECTOR

For inspection work, the Contractor shall employ a pile driving inspector with at least five years of experience in inspection of driving piles in a

sunlight.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN, FIRE MAIN, AND SERVICE LINE MATERIALS

2.1.1 Piping System Materials

2.1.1.1 General

All system components shall have National Sanitation Foundation certification. All pipe and fittings shall be clearly marked with the manufacturer's name, type, class, and thickness as applicable and shall be marked on the component at the place of manufacture. Marking shall be legible and permanent under normal conditions of handling and storage. All bolts, nuts, rods and any miscellaneous hardware shall be stainless steel 316. Bolts and nuts shall be in accordance with ASTM F 593 and F 594.

2.1.1.2 Pipe

Pipe for watermains, fire mains, and service lines shall be ductile iron of the sizes indicated and shall meet the requirements of AWWA C151 and WSDOT Sections 9-30.1 and 9-30.1(1) unless otherwise noted. Pipe shall have a double thick cement lining and a 1-mil thick seal coat conforming to AWWA C104. Ductile iron pipe shall be Thickness Class 54. Pipe shall have an asphaltic exterior coating. All piping shall have flexible boltless restrained joints, with a gland that inserts into the bell of joint to provide a positive axial lock between the interior surface of the bell and the spigot end of the pipe to restrain the joint. TR-Flex by U.S. Pipe or approved equivalent. Contractor shall submit water piping product information and installation procedures from manufacturer.

Field cut pipe as required for make-up short sections of pipe. Field cuts shall be performed in accordance with manufacturer’s instructions. To restrain field cut end of TR-Flex pipe, use TR-Flex Gripper Ring (or similar product of the same manufacturer as RJ pipe) and install in accordance with manufacturer’s instructions. Where possible, use Gripper Ring and field cut end of pipe in pipe sockets rather than fitting sockets, as it may be difficult to keep fitting-to-pipe joint in alignment during assembly and installation. Alternatively for field cut pipe, weld a preformed round steel bar to the plain end of field cut TR-Flex pipe, which when completed shall function the same as factory applied weld bead furnished with TR-Flex pipe. Procedure for this option shall strictly follow manufacturer’s instructions. Mechanical joint (MJ) pipe shall not be allowed. MJ pipe in combination with Megalug joint restraint shall not be allowed.

2.1.1.3 Fittings

Ductile iron fittings shall be in accordance with AWWA C110 and WSDOT Sections 9-30.2 and 9-30.2(1), unless otherwise specified. Fittings shall be of the sizes indicated with a double thick cement lining and a 1-mil thick seal coat conforming to AWWA C104. Ductile iron fittings shall be of a Thickness Class compatible with the piping. Fittings shall have an asphaltic exterior coating. All fittings shall have flexible boltless restrained joints, with a gland that inserts into the bell of joint to provide a positive axial lock between the interior surface of the bell and the spigot end of the pipe or fitting to restrain the joint. TR-Flex by U.S. Pipe or approved equivalent.

Mechanical joint (MJ) fittings shall not be allowed. MJ fittings in combination with Megalug joint restraint shall not be allowed.

2.1.1.4 Polyethylene Encasement

WSDOT Sections 9-30.1(2).

2.1.2 Gate Valves and Valve Stem Extensions

WSDOT Sections 9-30.3, 9-30.3(1), and 9-30.3(6). Gate valves for buried use shall have standard 2-inch operating nut and valve box extended to surface. Valve boxes in gravel or grass areas shall be constructed with 8" thick by 1'-6" diameter or square concrete collar.

2.1.3 Fire Hydrants

Landside fire hydrants shall be dry-barrel type hydrant in accordance with

WSDOT Section 9-30.5. Fire hydrants fed from potable water line shall come from manufacturer red in color. Fire hydrants fed from fire water line shall come from manufacturer yellow in color.

2.1.4 Upland Fire Department Connection (FDC)

Pedestal mount fire department connection; UL listed or FM approved for fire protection service. For the AFF, provide FDC with 2-way siamese connections for a total of (2) 2-1/2 inch hose connections. For the FDC near the pier approach road, provide FDC with (2) 2-way Siamese connections for a total of (4) 2-1/2 inch hose connections. Provide separate clapper for each 2-1/2 inch hose connection on all FDC's. Color of FDC and signage shown on the drawings for the FDC supporting the pier, including the adjacent hydrant signage, shall be coordinated with Contracting Officer and local Fire Department for final acceptability and approval. FDC's shall meet the following requirements:

a. Cast brass two way male inlet body, drop clappers and pin lug swivels; cast brass female caps and chains; hose outlet threads shall be in accordance with Coast Guard Station requirements, coordinate with Contracting Officer.

b. Fire department connection riser piping shall be galvanized steel, painted in a color to be coordinated with Contracting Officer. Provide connection approximately 3 feet above finish grade.

c. A nameplate lettered "Fire Department Connection" shall be affixed to fire department connection riser piping. Nameplate shall be brass and shall be rectangular shape with height and width dimensions as required to allow for 1 inch stamped, black enamel filled text Nameplate shall be attached to the fire department connection riser piping with galvanized steel U-bolt and nuts.

2.1.5 Tapping Sleeve and Valve Assembly

WSDOT Section 9-30.3(8). For connections to PVC pipe, use full circumferential seal, all stainless steel tapping sleeve with triangular side bars and stainless steel flange, ROMAC Industries SSTIII Tapping Sleeve or approved equal.

2.1.6 Water Meter for Pier Potable Water

Upland water meter for pier potable water service line shall be magnetic drive turbine type for cold water service sizes 2 inch through 12 inches. Turbine meter shall consist of a cast bronze case containing the measuring mechanism with a strainer housing attached. Meters shall meet the requirements of AWWA C701, Class II type. Registration shall be in cubic feet. Measuring mechanism shall be inline type, and so designed it can be readily removed from the main case as a complete unit. Measuring mechanism shall be capable of accuracy of 100% +/- 2% at flows ranging from 15 to 800 gpm for 4 inch pipe. Maximum headloss shall not exceed 7 psi at the flow rates listed above for 4 inch pipe. Meter shall be supplied with strainer attached. Strainers shall be short pattern, iron body, with heavy gauge 1/4 inch perforated, stainless steel screen having an effective straining area at least double that of the meter main case inlet.

Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories. The water meter shall have pulse output to the DDC system. Meter shall be capable of providing a 4-20 mA analog output signal that are compatible with the base's existing Energy Management and Control System.

GEOTECHNICAL ENGINEERING REPORT
P-993 TPS FORWARD OPERATING LOCATION
Port Angeles, Washington

PROJECT NO. 14-007
June 29, 2015

Prepared for:
BergerABAM

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Geotechnical & Earthquake
Engineering Consultants

June 30, 2015
File No. 14-007

Mr. Sieu Quan, P.E.
BergerABAM
33301 9th Avenue South #300
Federal Way WA 98003-2600

Subject: **Geotechnical Engineering Report**
P-993 TPS Forward Operating Location
Port Angeles, Washington

Dear Mr. Quan,

The following report contains geotechnical recommendations for the foundation design of the proposed P-993 TPS Forward Operating Location (FOL) at Port Angeles, Washington. The purpose of this report is to provide geotechnical design recommendations for a fixed pier and upland facilities including an armory pad, a fuel storage and distribution system, and a low-rise Alert Force Facility (AFF) building. The pier will be supported on 18 to 30 inch diameter, open end steel pipe piles extending to depths of 70 to 120 feet below mudline. 36 inch diameter open end piles may be used for mooring dolphins. The upland AFF may be supported on conventional spread footings that are tied together with grade beams to improve building performance during a strong earthquake. Detailed design recommendations are presented in the attached report.

Please call with any questions.

Sincerely,

W. Paul Grant, P.E.
Principal

Encl.: Geotechnical Engineering Report

3213 Eastlake Avenue East Suite B
Seattle, WA 98102-7127
Tel (206) 262-0370
Fax (206) 262-0374

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GEOTECHNICAL ENGINEERING REPORT
P-933 TPS FORWARD OPERATING LOCATION
PORT ANGELES, WASHINGTON

1.0 INTRODUCTION

This report contains geotechnical recommendations for the foundation design of the proposed P-933 Forward Operating Location (FOL) Fixed Pier and support facilities at United States Coast Guard Station (USCGS) Port Angeles. The scope of our work included reviewing existing geologic data to gain an understanding of the site conditions, performing a site reconnaissance, conducting two off-shore and six on-shore borings to explore subsurface conditions, conducting down-hole shear wave testing in one 100-foot boring and developing the recommendations presented in this report.

Our initial studies for a floating pier configuration of the FOL were performed in accordance with your Task Order No. 0003 which was issued on January 30, 2014. The results of our studies for the floating pier, which was located about 1,600 feet west of the currently proposed fixed pier, are contained in our report dated January 20, 2015. With general consistency of the offshore borings for the floating pier, our current studies for the fixed pier relied upon our explorations with some additional upland explorations for pavements and stormwater infiltration. Accordingly, the following provides design recommendations for the new fixed pier and the revised upland facilities.

2.0 SITE AND PROJECT DESCRIPTION

The P-933 fixed pier will be located on USCGS property at the east end of Ediz Hook in Port Angeles, Washington (see Figure 1). Ediz Hook is the westernmost of two large sand spits that have been formed by longshore currents in the Strait of Juan de Fuca. The spits are sustained by sand draining into the Strait from the Elwha River and other drainages along the north coast of the Olympic Peninsula, and from erosion of the sandy shore bluffs west of the Hook. Ediz Hook begins along the shoreline east of the Elwha River delta, and trends north and east to form the bay of Port Angeles. The Hook is roughly 3.45 miles in length, and the exposed land surface of the spit is less than 200 feet wide along most of its length.

The U.S. Coast Guard Station is located at the east end of the spit and includes the last 1.14 miles of the spit. In this area the width of the spit increases to almost 800 feet wide. Approximately 450 feet east of the base gate, an artificial jetty of land has been constructed, that extends 200 feet southward into the Port Angeles bay.

The existing pier facilities are located roughly 3,000 feet from the base entry gate, along with the main buildings that make up the base. A 4,500 foot airstrip occupies the north side of the base. The spit is armored with rip-rap along the ocean side, and the rip-rap is supported by sheet piles in some areas. The bay side shoreline is also protected by rip-rap on the base. The topography is generally level to gently sloping and grass covered where not paved.

The new fixed pier will be located about 2,000 feet east of the base gate to the facility. The pier will be supported on 18 to 30 inch diameter, open end steel pipe piles and 36 inch diameter piles will be used as mooring dolphins. Open end pipe piles will be used as they may be installed to large depths with a vibratory pile driving hammer and thus avoid noise and fish restrictions on the use of conventional impact hammers. However, impact hammers will be needed to confirm pile capacities in the last few feet of pile driving.

Support facilities such as water, power, fuel storage tanks, and sanitary sewer lines, will serve the new pier. Other support facilities, such as an armory pad, will be located along the shoreline on the south side of the airstrip, roughly 950 feet east of the jetty. Finally, a single story, slab on grade, AFF building will be constructed near the armory.

3.0 SUBSURFACE EXPLORATIONS

Field explorations completed for the study included two deep off-shore explorations at the formerly proposed location of the floating pier, as shown on Figure 2, and upland borings in areas of proposed support facilities. The off-shore borings were drilled between February 10 and February 13, 2014 at locations shown on Figure 2, to a depth of 100 feet below mudline. The off-shore borings were drilled using a truck-mounted, mud rotary drill supplied by Cascade Drilling of Fife, Washington. The drill was loaded onto a Seahorse barge supplied by Northern Marine Salvage of Seattle, Washington. Boring B-1 was begun on February 10, 2014 and advanced to a depth 36.5 feet below mudline by the end of the day. During the night, high winds moved the barge off the drill hole and required the barge to be repositioned and the boring was re-advanced from the mudline to the planned depth of 100 feet. Weather prevented drilling on February 12. Boring B-2 was drilled to the planned depth of 100 feet below mudline on February 13, 2014. Standard Penetration Tests (SPT) samples were taken at intervals of between 5 and 20 feet, as needed to complete the borings and characterize the sediments.

Six land borings were drilled between September 29 and October 3, 2014, at the locations shown on Figure 2. The borings were drilled using a truck mounted drill rig supplied by Holocene Drilling of Puyallup, Washington. The borings were drilled using both hollow stem auger and mud rotary drill strings. Two test borings, B-3 and B-4, were drilled on the jetty to depths of 100 and 50 feet, respectively.

Short, 10-foot deep borings (B-5, B-6 and B-7) were drilled in areas of the planned upland support facilities. To provide data for the seismic analysis of the AFF, Boring B-8 was drilled just west of the CPO mess facility as shown in Figures 2 and 3. The boring was drilled initially with mud rotary equipment but was abandoned due to difficulties in flushing cuttings to the ground surface. Consequently, the boring (B-8a) was moved 17 feet to the east and completed to the planned depth using hollow stem auger drilling equipment. Following completion of the boring, an inclinometer casing was installed in the hole for the purpose of conducting downhole

seismic shear wave velocity testing which was completed on October 7th by Phil Duoos, Geophysical Consultant.

Soil samples were taken in the upland borings at intervals of 2½ and 5 feet. Most samples were taken using a 2-inch OD SPT split spoon sampler. To improve sample recovery, a 3-inch OD California sampler was used in selected borings.

Finally, on December 15, 2014, three hand holes were advanced to depths of at least 4 feet below the ground surface in the uplands area adjacent to existing borings B-5, B-6 and B-7, to obtain additional soil samples suitable for testing for surface runoff infiltration characteristics. .

As a result of the relocation of the pier in 2015, four additional shallow explorations, designated as TP-1-15 thru TP-4-15 on Figure 3, were conducted at new areas proposed for stormwater infiltration. An air/vacuum truck, operated by Applied Professional Services of North Bend, Washington, was used to obtain soil samples at these locations between depths of 2 to 6 feet below the ground surface. Because of the manner in which the soil was extracted, it was not possible to visually log the soil at discrete depths. However, based on vertical exposures of the soil along the shoreline, there is no distinct bedding in the near surface soils. Consequently, the bulk samples obtained from the vactor truck provide a realistic representation of the underlying soils. Groundwater was not encountered in any of the new explorations.

An engineering geologist from PanGEO was present throughout the field exploration program to observe the drilling, log the materials encountered in the borings, and obtain representative samples from the explorations for laboratory testing. The soils were described in the field in general accordance with ASTM D 2488-00, following the guidelines of the Unified Soil Classification System, as shown on Figure A-1 of Appendix A. Summary logs from the borings are presented in Appendix A as Figures A-2 to A-11. Logs of the hand excavation near borings B-5 thru B-7 are shown on Figure A-12 and logs of the recent air knife excavations (TP-1-15 thru TP-4-15) are shown on Figure A-13.

Detailed information from the field exploration program including is presented in Appendix A. The results of the laboratory tests are presented in Appendix B and the results of the field downhole shear wave velocity testing are presented in Appendix C.

4.0 SUBSURFACE CONDITIONS

4.1 SITE GEOLOGY

The project site is within the area covered by the Geologic Map of the Port Angeles and Ediz Hook 7.5-minute quadrangles (Schasse, et al, 2004) which has been mapped as being underlain by shallow surficial fill. “Beach Deposits (Qb)”, which is described as “sand and cobbles, may include silt, pebbles and boulders” has been mapped as underlying the main base facilities.

4.2 SOILS

In general, the soil conditions encountered in the site explorations are consistent with the mapped surface geologic units. The soils encountered in the site borings have been generalized and graphically depicted in two subsurface profiles whose alignments are shown in Figures 2 and 3 and where the profiles are shown in Figures 4 and 5. The soil units identified in both profiles are described below:

Unit 1 Fill: Fill was encountered in all the on-shore borings. The fill consisted of loose to medium dense, brown, silt to silty, fine to medium sand with gravel, sometimes with a trace of organic material. The fill generally extended to a depth of 6 feet below the ground surface except at the jetty where the fill thickness increased to as much as 17 feet at the outboard extent of the jetty. In Boring B-3, the fill consisted of a 6-foot surface layer of medium dense, brown, quarry spalls and crushed rock with silt in a sand matrix. The surficial fill was underlain by fill consisting of about 6 feet of medium dense, brown gray, silty and clayey gravel with low plastic fines. Finally, at the base of the fill is a 5-foot layer of dense, dark brown, gravel and quarry spalls with silt and clay matrix. In B-4 the fill consisted of medium dense, brown, silty sand with angular gravel to gravel with silt.

Unit 2 Near Shore Deposits: The near shore deposits include marine marsh deposits and beach deposits such as gravel and cobble layers. These deposits are usually thin, only a few feet thick. Underlying the fill in borings B-5, B-6, B-7 and B-8, is a thin layer of soil with some organics. Based on a 1917 map of the Coast Guard Base, the area around these borings was a marsh. In B-5 the material consisted of medium dense, brown, silty gravel and sand with fine organics and organic fibers. In B-6 the unit contained medium dense dark brown gray sand with occasional lumps of organic clay. In B-7, the organic layer is 1-foot thick and consists of medium dense, brown, peaty sand. In B-8 the unit includes 2 beds, an upper bed of medium dense, sandy gravel with a trace of organic fibers and a lower bed of medium dense, silty sand with abundant organic fiber. The unit is 2 feet thick or less, except in B-8 where the aggregate thickness is 4 feet.

Below the fill in some locations and below the thin marsh deposit soils the borings generally encountered a bed of medium dense to dense, gravelly sand to sandy gravel and gravel. The gravel was usually sub-rounded and blocky to tabular, and mainly consisted of basaltic material. This soil was interpreted as recent beach deposits, similar to what is currently visible below the shoreline rip-rap. The beach deposits were also generally thin, on the order of 4 to 8 feet thick. The unit was not identified in B-3 or the off-shore borings.

Unit 3 Recent Marine Deposits: In all off-shore borings, including B-3 at the end of the jetty, the borings penetrated a layer of loose to medium dense, gray to green gray, silty fine sand to fine to medium sand. This unit contains varying amounts of wood debris and shell fragments, especially in borings B-1 and B-1a, the furthest off-shore borings. This unit is interpreted to be the most recent material deposited in the bay.

Unit 4 Marine Deposits: Marine sand was encountered in all on-shore and off-shore borings that extended deeper than 15 feet. The sand varied from a medium dense to dense, dark gray to green gray, fine to coarse sand with gravelly beds. The sand appeared to be bedded, with finer and coarser beds and gravel lenses. In general, the sand was relatively uniform. This layer extended to a depth of approximately 43 feet in boring B-8/8a, and to depths of 55 to 65 feet in borings B-1/1a and B-2, respectively.

Unit 5 Older Marine Deposits: At depth, all deep borings encountered a unit of sand that was interpreted as older than the overlying sand, and possibly related to a lower sea level than that which is present today. Texturally, this sand is similar to the Unit 4 material. The older sand tends to be slightly more coarse and dense than the younger marine sand, though this trend is inconsistent. However, the results of the downhole seismic survey clearly suggest that there are at least two layers of marine sand in B-8a. According to the seismic survey, the two units are separated by a thin possible third unit, which may be an old beach deposit, as indicated by the log which was encountered in boring B-8 at a depth of 43 feet.

4.3 GROUNDWATER

In the uplands borings, groundwater was generally encountered at a depth of 7 feet as based upon direct observation of free water in the split spoon samples and/or on the sampling rods or by measuring the level or the water in the auger or open hole following drilling. Higher groundwater levels (i.e. depth of 4 feet) were observed in the hand borings which were advanced during a high tide. Groundwater was not encountered in any of the test pits (TP-1-15 thru TP-4-15) all of which were advanced to a depth of 6 feet during a low tide. Consequently, the groundwater at the site is expected to be brackish and rise and fall with tidal fluctuations.

5.0 SEISMIC CONSIDERATIONS

5.1 DESIGN CRITERIA

We understand that the seismic design of the pier and trestle will be conducted in accordance with the criteria developed for marine oil terminal facilities in California (MOTEMS, 2010). The MOTEMS criteria have provisions for a two level earthquake design corresponding to events with a 72-year and 475-year return intervals. The following briefly describes the MOTEMS design earthquakes:

> **Level 1** - This design earthquake is also referred to as the Operating Level Earthquake (OLE) and corresponds to ground motions that have a 50-percent probability of exceedance in 50 years (average return period of 72 years). Under this level, the structure is designed such that the damage would not interrupt operations and that any structural damage could be repaired within a short time.

Level 2 - This design earthquake is also referred to as the Contingency Level Earthquake (CLE) and corresponds to ground motions that have a 10-percent probability of exceedance in 50 years (average return period of 475 years). Under this level, the structure is designed to sustain damage that is economically repairable and is not a threat to life safety.

Seismic design of the uplands structures, including the AFF, will be conducted using the 2012 International Building Code (IBC), which is based on a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years).

5.2 Design Ground Motions

Ground motions associated with the design earthquakes for the waterfront and uplands structures were developed based upon the 2008 USGS probabilistic seismic hazard maps for the Pacific Northwest. Based on the shear wave velocity measurements conducted in Boring B-8\8a in the vicinity of the AFF, as presented in Appendix C, a Site Class D designation is appropriate for the seismic design of the waterfront and uplands facilities. In accordance with the above, the following presents ground motion parameters for the design of the various structures at the site:

Location	Recurrence Interval	Site Class	S_S	S_1	Site Coefficients		Spectral Response Parameters*		Control Periods (sec.)		PGA (S_{xs}/2.5)
					F_a	F_v	S_{xs}	S_{x1}	T_O	T_S	
Pier (MOTEMS)	72 yr.	D	0.22	0.08	1.6	2.4	0.35	0.19	0.11	0.54	0.14
	475 yr.	D	0.73	0.29	1.22	1.81	0.89	0.53	0.12	0.60	0.36
AFF (IBC)	2475 yr.	D	1.47	0.60	1.0	1.5	1.47*	0.90*	.12	0.61	0.59

*Design Values = 2/3 of values shown in table

As subsequently discussed, the marine deposits underlying the site are susceptible to liquefaction. Consequently, the potentially liquefiable soils would correspond to a Site Class F which would require a site specific ground response analyses. Based on our experience on conducting site specific response analyses at locations underlain by potentially liquefiable soils, we've found that the computed ground motions for the liquefied conditions were conservatively

represented with a Site Class D response spectrum. Consequently, we believe that the Site Class D designation provides a realistic reflection of the expected site ground motions for conditions with or without liquefaction.

5.3 FAULT RUPTURE

The project site is located along the northern Olympic Peninsula coastline of Washington State. Major earthquakes in the region are generally associated with subduction zone plate tectonic activity off the coast. Research within the last few decades indicates that subduction zone earthquakes with magnitudes of about 9.0 are capable of occurring in the coastal areas. No large (i.e. M>6) shallow crustal earthquakes have been recorded within the region in recent history. The most recent large (at least magnitude 8 or more) event appears to have occurred in 1700, based on ethnographic and geologic data.

Closest to the project area, several potentially active faults are present within the Strait of Juan de Fuca (Mosher and Johnson, 2000). Seismic events on these faults are generally attributed to the intraplate seismicity within the Juan de Fuca plate. Also, the eastern Strait of Juan de Fuca is an area of crustal boundary between pre-Tertiary Cascade province rocks to the east and the Coast Range Eocene rocks on the Olympics (Mosher and Johnson, 2000). Several named faults have been identified along this boundary, including the South Whidbey Fault Zone, the Devils Mountain Fault and the Leech River Fault (on Vancouver Island).

As a result of northward movement of the Washington block of the North American Plate, Eocene sedimentary and volcanic rocks have uplifted on the north flank of the Olympic Mountains through a series of east-west trending thrust faults. The trace of one of these faults has been mapped by Schasse (2003) and Schasse and others (2004) to the south of the project site, and is not currently thought to be active in the Holocene. At least two of these faults, the Little River Fault, along the south side of the Port Angeles drift plain area and the River Road scarp near Sequim, have fault scarps that suggest Holocene movement.

No active faults are mapped within the project area. The nearest mapped fault is the Lower Elwha Fault which is an inferred thrust fault that is located about 5 km south of the site. The last movement of the fault is expected to have occurred over 15,000 years ago. The USGS has not designated a magnitude for this fault, based on lack of information on the age of the fault and the magnitude of the last movement of the fault.

5.4 LIQUEFACTION ASSESSMENT

Liquefaction analyses were conducted for the site using the simplified procedures originally developed by Seed and subsequently modified by others (Youd et al., 2001). These procedures determine the liquefaction potential of the soil based on parameters reflecting the strength of the underlying soil as determined from the standard penetration test (SPT) N-values from the site

explorations, the fines content of the soil, the location of the water table, and parameters reflecting the strength of the ground shaking at the site as reflected in the expected peak ground surface acceleration and the corresponding magnitude of the design earthquake.

Liquefaction analyses for the pier and trestle were conducted for two levels of ground shaking in compliance with MOTEMS (2010). The first analyses was conducted for the Level 1 earthquake in which the design earthquake was modeled as having a magnitude of 6.8 with a corresponding peak ground acceleration of about 0.14 g. Analyses were also conducted for the Level 2 earthquake which would have a recurrence interval of 475 years. The Level 2 earthquake was characterized as a Magnitude 7.2 event with a peak ground acceleration of 0.36g.

Finally, liquefaction analyses were conducted for the uplands AFF for a design earthquake with a recurrence interval of 2,475 years. This event was characterized as having a Magnitude of 7.5 and a peak ground acceleration of 0.59g.

The results of the liquefaction analyses for the pier for the 72 and 475 year earthquakes are presented in Figures 6 and 7, respectively. While the borings used for this analysis (i.e. borings B-1 and B-2) are located at the original site for the pier, we believe that the subsurface conditions at the revised location of the pier (i.e. about 1,600 feet to the east) and not materially different than those encountered in Borings 1 and 2 as based on the topography, and bathymetry of the spit and the consistent conditions encountered in borings B-1 and B-2. Consequently, as indicated in Figures 6 and 7, liquefaction during the Level 1 event would typically develop in the upper 10 feet of the soil profile. During the stronger Level 2 earthquake, liquefaction would typically extend to a depth of about 50 feet below the mudline.

Finally, the results of the liquefaction analyses for the uplands AFF, which are presented in Figure 8, indicate 3 distinct zones of liquefaction at the following depths:

- 5 to 10 feet
- 22 to 32 feet
- 55 to 70 feet

5.5 Potential Impacts of Soil Liquefaction

Implications of liquefaction would include downdrag loads on pile supported structures and settlement of the ground at the AFF. As subsequently discussed, the magnitude of ground movement associated with potential liquefaction could be readily accommodated in the facility design.

6.0 SLOPE STABILITY

6.1 METHODOLOGY

Global slope stability analyses were conducted to evaluate the stability of the slopes along the alignment of the trestle to the pier (Section A in Figures 3 and 4) and adjacent to the AFF (Section B in Figures 3 and 5) under both static and seismic conditions to determine if the slopes had adequate factors of safety or if remedial measures would be required to improve the performance of the slopes.

All analyses were completed using the computer program SLIDE v.6, by RocScience. All slopes were first analyzed for static stability with an objective of achieving a minimum factor of safety of 1.5.

Next, pseudo-static analyses were conducted to determine the stability of the slopes under conditions of earthquake ground shaking. The pseudo-static analyses were conducted using a horizontal seismic coefficient (k_h) equal to one-half the design peak ground acceleration with the objective of achieving a minimum factor of safety of 1.0. Analyses yielding a factor of safety below 1.0 would require a dynamic displacement analysis to determine the magnitude of ground displacement that could occur as a result of ground shaking from the design earthquake. Factors of safety of 1.0 or greater imply that ground movement would not occur during the earthquake ground shaking.

Finally, we conducted stability analyses of post-liquefaction conditions corresponding to the cessation of earthquake ground shaking (i.e. k_h and $k_v = 0$) and the use of residual strengths to model the performance of liquefied soil. Residual strengths of the liquefiable soils were estimated from relationships developed by Idriss and Boulanger (2007). The performance objective of the post-liquefaction analyses was to achieve a minimum factor of safety of 1.1.

6.2 PIER AND TRESTLE STABILITY

The stability of the slope below the trestle leading to the pier was analyzed for the most critical section that extends along the longitudinal axis of the trestle as reflected in Section A-A' on Figures 2 and 4. Engineering properties of the underlying soils were derived using the results of the boring logs, laboratory test data, and engineering judgment. Our analyses conservatively ignored the lateral resistance capacity of the piles used to support the trestle leading to the pier.

Based upon the above generalizations and assumptions, we computed the stability of the pier for static, pseudo-static, and post-liquefaction conditions as represented in Figures 9, 10, and 11, respectively. The results of the analyses are summarized in the table below.

Seismic Design Parameters	Analysis Case	Target Factor of Safety	Computed Factor of Safety
Site Class D 475 yr. (MOTEMS) $K_h = 0.18g$	Static	1.5	3.27
	Pseudo-Static	1.0	1.11
	Post Liquefaction	1.1	3.0

The results of our analyses indicate that the slope beneath the pier and trestle has adequate factors of safety for static, pseudo-static (seismic), and post liquefaction conditions and remedial measures are not required.

6.3 BUILDING STABILITY

The stability of the shoreline slope was analyzed adjacent to the location of the AFF as represented by the location of Section B-B' which is shown in plan on Figure 3 and in profile as shown in Figure 5. Engineering properties were derived for the geologic units along the section alignment using the results of the boring logs, laboratory test data, and engineering judgment. Additionally, our analyses were conducted assuming the application of a uniform pressure of 240 psf to represent the loading of the AFF. Differing from the pier stability analyses that is based on MOTEMS seismic criteria (i.e. 475 year design earthquake), the stability analyses for the slope below the AFF was conducted for a larger earthquake (i.e. 2,475 year return) as required by the IBC.

Based upon the above generalizations and assumptions, we computed the stability of the slope for static, pseudo-static, and post-liquefaction conditions as represented in Figures 12, 13, and 14, respectively. The results of the analyses are summarized in the table below.

Seismic Design Parameters	Analysis Case	Target Factor of Safety	Computed Factor of Safety
Site Class D 2,475 yr. (IBC) $K_h = 0.295g$	Static	1.5	2.77
	Pseudo-Static	1.0	1.0
	Post Liquefaction	1.1	1.90

The results of our analyses indicate that the off shore slope below the AFF has adequate factors of safety for static, pseudo-static (seismic), and post liquefaction conditions and remedial measures are not required.

7.0 BULKHEAD

A permanent, cantilever sheet pile bulkhead may be constructed for the abutment of the trestle leading to the fixed pier. The following parameters are recommended for the design of the bulkhead:

- **Active Earth Pressure** (equivalent fluid weights):
  - 35 pcf (Top of wall or ground surface behind wall to water table)
  - 17 pcf (below water table)
- **Passive Earth Pressure**: (equivalent fluid weights – includes ~1.5 factor of safety and assume an offshore slope no steeper than 2(H):1(V))
  - 150 pcf (Zone above water table)
  - 75 pcf (Zone below water table)

In addition to the above soil pressures, the following will need to be considered in the design:

- **Water Table** – Fluid pressure from the water table or water table differentials will need to be considered on both sides of the wall
- **Traffic Surcharge** – Traffic surcharge on the roadway may be simply modeled as an additional 2 feet of fill. Alternatively, the traffic surcharge may be computed using an equivalent uniform pressure for the traffic load and multiplied by a factor of 0.3 to obtain a uniform lateral wall pressure. The traffic surcharge load should be terminated at a depth of 10 feet below the top of the wall.
- **Incremental Seismic Load** – A uniform pressure of 7H (psf) should be applied over the exposed height of the wall to reflect the incremental load from earthquake ground shaking, where H represents the exposed wall height in feet.

8.0 PILE FOUNDATIONS

8.1 OVERVIEW

Pile foundations will be required to support the trestle and pier. The lighter loads of the trestle may generally be support by 18 or 24 inch diameter steel pipe piles. Heavier loads of the pier will likely require 24 or 30 inch diameter pipe piles. Finally, large lateral loads on mooring dolphins will likely require support from 36 inch diameter piles. The liquefaction potential of the underlying soils will likely require piles extending about 100 feet below the mudline. For construction expediency and environmental considerations, piles may be partially driven with a vibratory hammer. However, an impact hammer should be used in the last stage of pile driving to confirm pile capacities. Details for the pile design are provided below.

8.2 Axial Pile Capacities

Analyses were conducted to provide axial resistance for open-end, driven pipe piles with diameters of 18, 24, 30 and 36 inches with the results of the analyses presented in Figures 15 thru 18. Each of these figures present nominal (ultimate) resistances in axial compression and tension, as well as post-liquefaction compression as a function of depth of the pile driven below the mudline. Provided that the piles are driven to the required ultimate driving resistance and to any minimum tip elevation required for post-liquefaction or lateral resistance demands, service limit state resistance is expected to be less than ½-inch. Extreme event axial loads may be evaluated using the nominal (ultimate) resistance on the figures and a resistance factor of 1.0.

Please note that the axial resistances provided on the figures are predominantly for the purpose of estimating pile quantities. Actual pile lengths should be based on verification of axial resistance of driven test piles during construction using pile dynamic measurements (pile driving analyzer, PDA) and signal matching analyses (CAse Pile Wave Analysis Program, CAPWAP™). PanGEO should review final pile length estimates relative to both the required axial driving resistance and minimum tip elevations associated with post-liquefaction conditions and/or lateral pile resistance demands in order to evaluate the potential for overdriving and to provide overdriving estimates, if deemed necessary.

8.3 Downdrag Loads

Post-liquefaction downdrag is possible as a result of volumetric strain following expulsion of excess pore water after a design earthquake. The downdrag loads presented below should be combined with Service I limit state loads and compared to the post-liquefaction (ultimate) resistances on Figures 15 thru 18 for this transient condition to be consistent with the "no collapse" philosophy of LRFD seismic design.

Estimated Post-Liquefaction Downdrag Loads

Location	**Pile Diameter** (inches)	**Downdrag Load (Q_{DD})** (kips/pile)
Trestle & Pier	18	130
	24	175
	30	220
Mooring Dolphins	36	260

8.4 GROUP EFFECTS

The following provides group reduction factors for laterally loaded piles to account for pile interaction effects as based on pile center-to-center spacing and the direction of loading. The factors are outside the range provided in AASHTO (2012) and were based on the research by Brown, et al. (1987, 1988) and McVay, et al. (1995). Group effects for axial loads will not be significant for piles spaced at 2.5D or more.

Group Reduction Factors for Lateral Analysis

Pile Spacing[(1)]	Reduction Factor for Load Applied Parallel to Pile Row	Reduction Factor for Load Applied Perpendicular to Pile Row[(2)]
5D	0.8	1.0
4D	0.65	0.9
3D	0.5	0.8
2.5D	0.4	0.7

(1) As a function of pile diameter, D.
(2) For a single row of piles; if two or more rows of piles are used, the reduction factors for load applied parallel to the pile row should be used.

8.5 LATERAL RESISTANCE

Recommended parameters for analysis of lateral pile resistance using the program LPILE™ or COM624 are presented below. Note that the soil layers are referenced to the general mudline elevation at the location of the reference piles. The reference elevations in the tables are the existing ground surface elevations. For pile top elevations that differ, the thickness of the top layer(s) should be adjusted accordingly.

It is cautioned that in using the parameters for the liquefied conditions in conjunction with the full seismic load from the design earthquake may result in an excessively conservative design as liquefaction typically develops near the end of the earthquake ground shaking where ground accelerations are well below the peak values. Accordingly, we would suggest using the liquefied parameters with a seismic load corresponding to 25% of the peak load, unless otherwise specified in the code used for the facility design.

Recommended p-y Curve Parameters
Trestle and Pier (Borings B-1, B-1a & B-2)

Reference Elevation: mudline				STATIC ANALYSIS						
Soil Layer	**Layer Thickness**	**Soil Unit**	**Soil Type (KSOIL)**	**Effective Unit Weight of Soil**		**Cohesion**		**Axial Strain ε50**	**Friction Angle ϕ**	**Modulus of Subgrade Reaction**
	(ft.)			**(pci)**	**(pcf)**	**(psi)**	**(psf)**		**(deg)**	**(pci)**
1	10	Recent Marine	4	0.034	58	--	--	--	30	30
2	20	Recent Marine	4	0.034	58	--	--	--	33	60
3	20	Marine	4	0.034	58	--	--	--	36	95
4	50+	Older Marine	4	0.036	63	--	--	--	38	115
				LIQUEFIED ANALYSIS						
1	10	Recent Marine	4	0.034	58	--	--	--	7	10
2	20	Recent Marine	4	0.034	58	--	--	--	7	10
3	20	Marine	4	0.034	58	--	--	--	10	16
4	50+	Older Marine	4	0.036	63	--	--	--	38	115

9.0 ALERT FORCE FACILITY

9.1 OVERVIEW

The AFF may be supported on conventional spread footing foundations tied together with grade beams provided that the building can tolerate differential settlements of up to 2 inches and potential lateral movement of up to 2 inches resulting from ground shaking from the 2,475 year design earthquake. In our opinion, movements of this order of magnitude will likely result in some architectural damage and possibly some structural damage to the building. However, the potential damage should not be a life safety issue. Because of the limited size and weight of the building, the predicted settlements could be remediated with slab jacking.

9.2 FOOTING DESIGN PARAMETERS

The AFF may be supported on conventional spread and strip footings bearing on the existing underlying fill or an imported structural fill with the footings designed for an allowable bearing capacity of 3 ksf with a one-third increase for seismic loading. All footings should be founded a minimum depth of 12 inches below the floor slab. Footings should also be located above high tide levels of approximately 8 feet (MLLW). Spread and continuous footings should have minimum widths of 24 and 18 inches, respectively.

Total and differential settlements under static loads are anticipated to be within tolerable limits for footings designed and constructed as discussed above. Footing settlements under static loading conditions are estimated to be less than about 1-inch and differential settlement should be less than about ½-inch. Most settlement will occur during construction as loads are applied.

Settlements related to potential liquefaction during the 2,475 year design earthquake may be on the order of 2 inches with differential settlement of about half this amount. Such movements are not expected to affect life safety, but they may result in building or utility damage.

Considering the potential for vertical and lateral movement during the design earthquake, we recommend that all footings be connected with grade beams to provide more rigidity to the structure and reduce potential structural damage. Additionally, we recommend that footings located within about 15 feet of the shoreline be supported on lean concrete filled trenches that extend at least 3 feet below the footing to enhance footing performance.

All footing subgrades should be carefully prepared. The soil exposed at the base of all footing excavations should be compacted to a dense and unyielding condition with a Ho-Pac or a jumping jack compactor. Any loose or softened soil should be removed from the footing excavations. Footing excavations should be observed by PanGEO to confirm that the exposed footing subgrade is consistent with the expected conditions and adequate to support the design bearing pressure.

Lateral forces from wind or seismic loading may be resisted by a combination of passive earth pressures acting against the embedded portions of the foundations and walls, and by friction acting on the base of the foundations. Passive resistance values may be determined using an equivalent fluid weight of 350 pounds per cubic foot (pcf). This value includes a factor safety of at least 1.5 assuming that properly compacted structural fill will be placed adjacent to the sides of the footings. A friction coefficient of 0.5 may be used to determine the frictional resistance at the base of the footings. This coefficient includes a factor safety of approximate 1.5.

9.3 Concrete Slab on Grade

Conventional slab on grade construction may be used for floor slabs. While we anticipate that the AFF site will be underlain by medium dense to dense soil, areas underlain by weak or soft soil or areas where the existing soils cannot be adequately compacted to a firm condition, should be over-excavated and backfilled with imported structural fill (i.e. WSDOT Gravel Borrow). We recommend a modulus of subgrade reaction of 150 pci for the floor slab design over the existing medium dense to dense fill or compacted fill.

All floor slabs should be constructed on a minimum 4-inch thick capillary break consisting of free-draining, crushed rock or well-graded gravel compacted to a firm and unyielding condition. The capillary break material should have no more than 10 percent passing the No. 4 sieve and less than 5 percent by weight of the material passing the U.S. Standard No. 100 sieve. Clean

crushed 5/8 inch rock meets this gradation requirement. A 10-mil polyethylene vapor barrier should be placed below the slab.

9.4 PERMANENT DRAINAGE

Permanent control of surface water and roof runoff should be incorporated in the final grading design. All collected runoff should be directed into conduits that carry the water away from the building and into a storm drain, infiltration trench, or an appropriate outlet. Adequate surface gradients should be incorporated into the grading design such that surface runoff is directed away from structures.

10.0 UNDERGROUND UTILITIES

10.1 CORROSION POTENTIAL

Underground utilities will be installed in fill consisting of medium dense silty sand to sandy gravel. The fill soils are nominally about 6 to 7 feet thick. Groundwater was typically encountered at a depth of 4 to 7 feet in the uplands borings at the time of drilling. Groundwater levels at the site are expected to be strongly controlled by tidal fluctuations.

Select samples of the fill were submitted for corrosion testing and the results are presented in Appendix B and summarized below. The samples submitted for testing were held at the testing laboratory for a period in excess of one month and, consequently, the excessive holding time may be a factor regarding inconsistency of test results.

Corrosivity Tests				
Boring / Sample / Depth (feet)	**pH** (std. units)	**Redox** (mV)	**Sulfides** (mg/kg) All results below detection limits	**Resistivity** (ohm-cm)
B-3 / S1 / 5’	8.48	237.3	<1.12	150
B-4 / S1+2/ 5-7.5’	7.5	257.3	<1.17	
B-5 / S2 / 5’	7.39	305.5	<1.03	1700
B-6 / S2 / 5’	7.09	425.6	<1.14	775
B-7 / S2 / 5’	6.82	215.8	<1.04	9600
B-8 / S1 / 5’	6.76	223.2	<1.06	530

In general, we believe that the site soils present an average to aggressive environment for corrosion potential. While the samples submitted for corrosion tests were obtained from borings drilled west of the AFF, we believe that the test results are also applicable to the segment of the site between the AFF and the new pier on the east.

10.2 TRENCHING AND BACKFILLING

Underground piping should be bedded in crushed rock with a gradation similar to the Washington State Department of Transportation (WSDOT) Gravel Backfill for Pipe Zone Bedding (9-03.12(3)). The backfill should extend up to the spring line of the pipe. Select native material with a maximum size of 1½ inches may be used as backfill above the spring line to a point that is 12 inches above the top of the pipe. Above this level, the trench excavation spoil maybe be used as backfill provided that the backfill can be compacted to at least 90% of the materials maximum dry density except that the upper two feet of fill beneath pavements should be compacted to 95% of the material's maximum dry density as determined by the Modified Proctor compaction test (ASTM D 1557).

11.0 POLE FOUNDATIONS

Pole foundations may be used for light poles, signs or security fencing in the new construction. Such foundations will typically encounter fill material consisting of medium dense, well graded sand with gravel. Pole foundations with a minimum embedment of 3 feet in the granular fill may be designed for an allowable lateral bearing capacity of 1,400 psf.

12.0 EARTHWORK

12.1 FILL

New fill for roadways or embankments that do not require pervious pavement should consist of WSDOT (2014) Gravel Borrow (09.03.14(1)). The embankment fill should be placed in loose, horizontal lifts less than 12 inches in thickness and systemically compacted to 95% of the material's maximum dry density as determined by the Modified Proctor compaction test (ASTM D 1557).

12.2 GRADING

We recommend that all new permanent cut and fill slopes at the site be graded no steeper than 2(H):1(V). At locations of new fill, the existing ground surface should be cleared of vegetation prior to fill placement.

13.0 STORMWATER INFILTRATION

Pervious pavement will be used for new parking areas west of the trestle. When pervious pavements are used for pollution generating surfaces, such as roads, there must be at least 12 inches of soil below the pavement that is suitable for treating the infiltrating water before the water reaches the groundwater table. The 2012 Ecology Manual specifies soils suitable for treatment have a long term infiltration rate of less than 3 inches per hour, a cation exchange capacity (CEC) greater than or equal to 5.0 meq/100g, and an organic content (OC) of greater

than 1 percent. However, the 2012 LID Technical Guidance Manual for Puget Sound (WSU 2012) indicates that an organic content of 0.5% would be acceptable provided that the layer is at least 18" thick. If the above criteria are not meet, the upper 12 (or 18) inches of soil below the pavement section would need amendment with organics or fertilizer to fall below the maximum infiltration rate and above the minimum CEC and OC.

Laboratory tests conducted on the site soils at the locations of proposed pervious pavements include grain size analyses for estimating long term infiltration rates and CEC and OC testing. The results of the laboratory testing are summarized below. Because of limited sample recovery in the original site borings, it was not possible to run a complete suite of tests on recovered samples from select depths. Hence, the hand hole explorations (denoted by suffix of H) were conducted to obtain samples of sufficient volume for the infiltration tests.

Boring No.	**Sample Depth** (Ft.)	**CEC** (meq/100 g)	**OC** (%)	**D_{10}** (mm)	**D_{60}** (mm)	**D_{90}** (mm)	**Est. Long Term (Design) Infiltration Rate** (in/hr.)
B-4	3.5	15.39					
B-5H	2 - 4	2.01	0.45	0.15	4.7	38	3.0
B-5	3.5	4.63		0.155	27.7	46	4.2
B-6H	2 - 4	1.89	0.86	0.18	1.1	30	3.8
B-6	3.5	3.05		0.161	21.0	45	3.5
B-6	6.0			0.166	0.63	14	4.5
B-7H	2 - 4	1.00	0.39	0.22	4.9	42	3.4
B-7	3.5		1.43	0.164	4.75	31	3.1
B-8	6.0		0.63	0.124	25.9	35	4.8
TP-1-15	2-6'	1.46	0.6	0.434	9.29	40	12.0
TP-2-12	2-6'	1.62	0.4	0.348	6.47	40	7.2
TP-3-15	2-6'	2.16	0.9	0.304	3.69	23	8.9
TP-4-15	2-6'	2.00	1.1	0.319	4.75	40	6.1

The above table presents data from tests that were conducted on materials obtained from explorations that are located west of the AFF (borings B-4 thru B-8) and also east of the AFF (TP-1-15 thru TP-4-15). The estimated long term infiltration rates corresponding to materials east of the AFF are substantially higher that the rates derived for soils located west of the AFF.

In our opinion, there is no difference in the soils on either side of the AFF. However, the difference in the test results may be attributed to the fact that the recent explorations on the east side of the AFF were able to obtain a larger bulk sample of the soil for laboratory testing and these larger samples provide greater consistency in test results regarding grain size distribution as opposed to materials retrieved from borings to the west inch which the size of the samples was constrained by the diameter of the split spoon sampler. Consequently, the samples obtained from the borings reflected a disproportionally higher percentage of fines and a correspondingly lower infiltration rate. As such, we believe that the test results from the new explorations (TP-1-15 thru TP-4-15) provide a more representative assessment of the infiltration characteristics of the surficial fill at the site.

We also understand that trench drains will be used to infiltrate roof runoff from the AFF. In designing the trench for conformance with Ecology guidelines (WSDOE, 2012) we recommend that the trench design be based on "medium sand" as representing the surficial fill at the building site.

14.0 CONSTRUCTION CONSIDERATIONS

14.1 PILE DRIVING

The non-load bearing steel piles may be installed with either a vibratory hammer or an impact hammer. The load bearing steel piles may be started with a vibratory hammer but must be finished with an impact hammer to confirm the load bearing resistance of the piles. For preliminary planning purposes, a diesel hammer with a minimum rated energy of 50,000 foot-lbs. and a minimum ram weight of 7,500 lbs., such as that developed with a Delmag D 46-32 pile-driving hammer, may be used to install the pipe piles.

During the initial phase of production pile driving, a Pile Dynamic Analyzer (PDA) should be used to monitor the stress in the piles and to confirm that the driven piles meet the load requirements of the design.

We also recommend re-striking at least 5% of each type of production pile at least 2 days after its initial installation. PDA testing should be used during re-strike to provide a more accurate assessment of pile capacities. Based on PDA measurements, CAPWAP analyses should be performed to determine the pile capacities. The results from the PDA measurements and CAPWAP analyses will then be used to establish the bearing graph (pile capacity versus penetration resistance) and driving criteria for the production pile driving. The recommended pile capacities may be revised if necessary based on results of the PDA evaluation. PDA and CAPWAP analyses should be conducted on at least six of the production piles to confirm the adequacy of the driven pile capacities.

Prior to selecting a pile-driving hammer, the contractor should perform appropriate evaluations, such as a preliminary dynamic wave equation analysis, to verify that the selected hammer will

have adequate energy to drive the piles to the specified minimum tip elevations and ultimate capacities without overstressing the piles. PanGEO should be contacted to review the pile hammer and driving system proposed for use by the contractor. A pre-construction meeting is recommended prior to driving indicator piles to coordinate the geotechnical monitoring.

We don't anticipate that any tip reinforcement will be needed on any of the driven steel pipe piles. However, if any tip reinforcement is required, plates should be flush and not extend beyond the pile diameter to avoid reductions in skin friction.

14.2 EXCAVATIONS

Open cut excavations can be used in conjunction with construction of utilities. We anticipate that most excavations will be relatively shallow with depths typically less than 4 feet. Most shallow excavations above the water table might be cut with near vertical side slopes. However, near vertical cuts will likely ravel to slopes on the order of 1(H):1(V).

14.3 GROUNDWATER

Groundwater was observed in all upland borings at a depth of about 7 feet. Groundwater at the site will be controlled by tidal elevations. Consequently, groundwater will need to be addressed in the construction of any utilities that extend more that about 6 feet below the existing ground surface. Shallow excavations extending no more than 2 feet below the water table may be dewatered using conventional sumps and pumps. Deeper excavations may require well points or deep wells for dewatering. Dewatering should be accomplished to the extent required to maintain the water table a minimum of 2 feet below the base of the planned excavations.

14.4 MATERIAL REUSE

The granular soils comprising the site fill may be suitable for reuse as common borrow for utility trench backfill provided that the soil does not have an excessive fines content and that the soil can be compacted to the requirements for structural fill as discussed below. Any soil that is planned for reuse should be stockpiled and protected with plastic sheeting to prevent softening from rainfall.

14.5 STRUCTURAL FILL

As currently envisaged, we do not anticipate the need for large quantities of fill. If needed, WSDOT Gravel Borrow may be used as structural fill.

14.6 EROSION AND DRAINAGE CONSIDERATIONS

Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms to collect

runoff and prevent water from entering the excavation. All collected water should be directed to a positive and permanent discharge system such as an on-site infiltration system. It should be noted that some of the site soils are prone to surficial erosion.

15.0 ADDITIONAL SERVICES

To confirm that our recommendations are properly incorporated into the design and construction of the new building, PanGEO should conduct a review of the final project plans and specifications, and perform a field-monitoring program during construction. Specifically, we anticipate that the following construction support services may be needed:

- Review final project plans and specifications
- Verify implementation of erosion control measures
- Evaluate and confirm the stability of temporary excavation slopes
- Observe installation of all piling
- Verify adequacy of footing, slab and pavement subgrade
- Confirm the adequacy of the compaction of structural backfill
- Other consultation as may be required during construction

Modifications to our recommendations presented in this report may be necessary, based on the actual conditions encountered during construction.

16.0 LIMITATIONS

We have prepared this report for use by the BergerABAM project team. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of work.

Variations in soil conditions may exist between the locations of our explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our work specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants

nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

Within the limitation of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time the Report or its contents were prepared. No warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please feel free to contact our office with any questions you have regarding our study, this report, or any geotechnical engineering related project issues.

W. Paul Grant, P.E.
Principal Geotechnical Engineer

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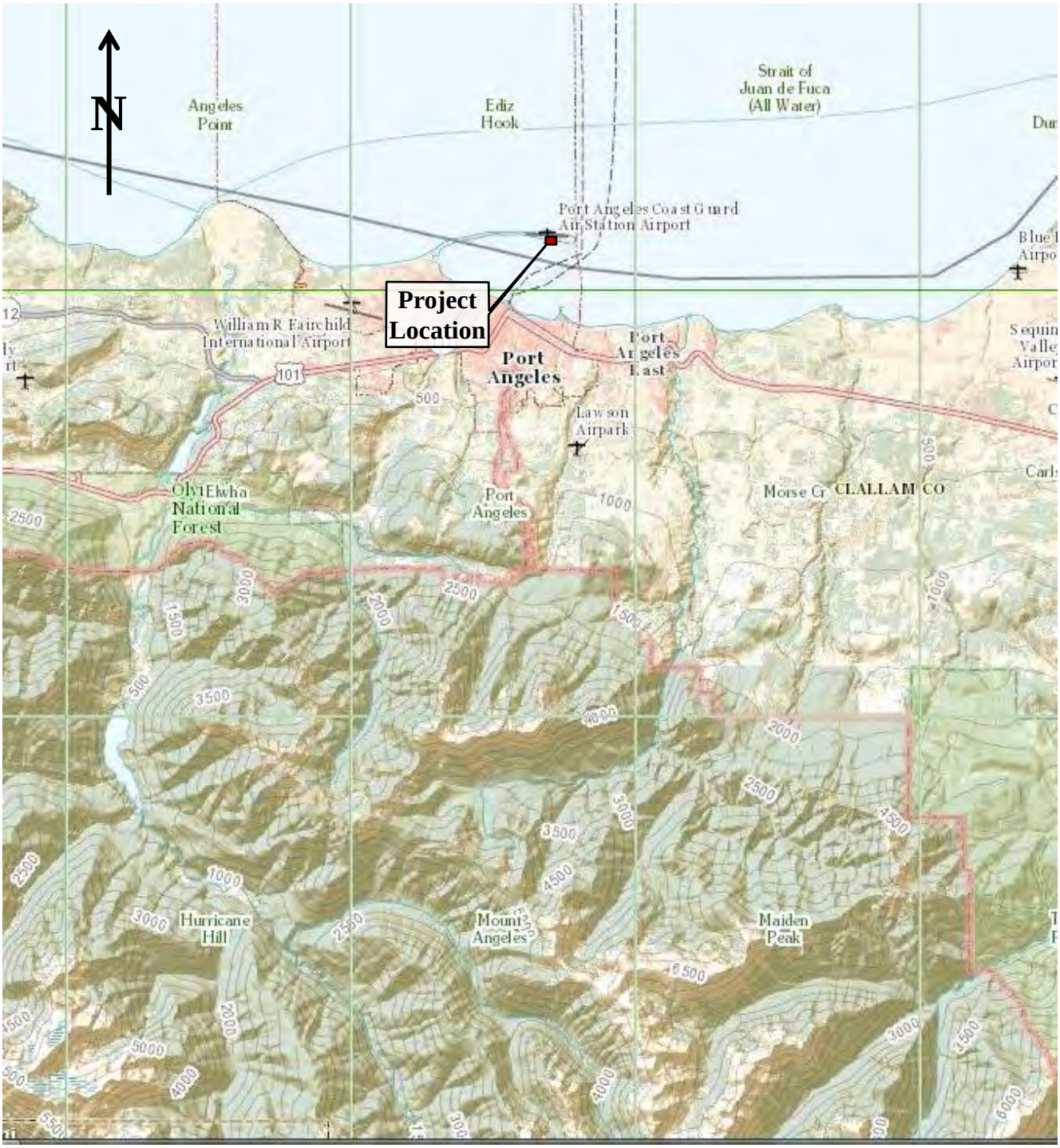

Approximate Scale

3 Miles

Base map from The National Seamless Map database

PanGEO INCORPORATED	**P-933 TPS Forward Operating Location Port Angeles, Washington**	**VICINITY MAP**	
		Project No. 14-007	Figure No. 1

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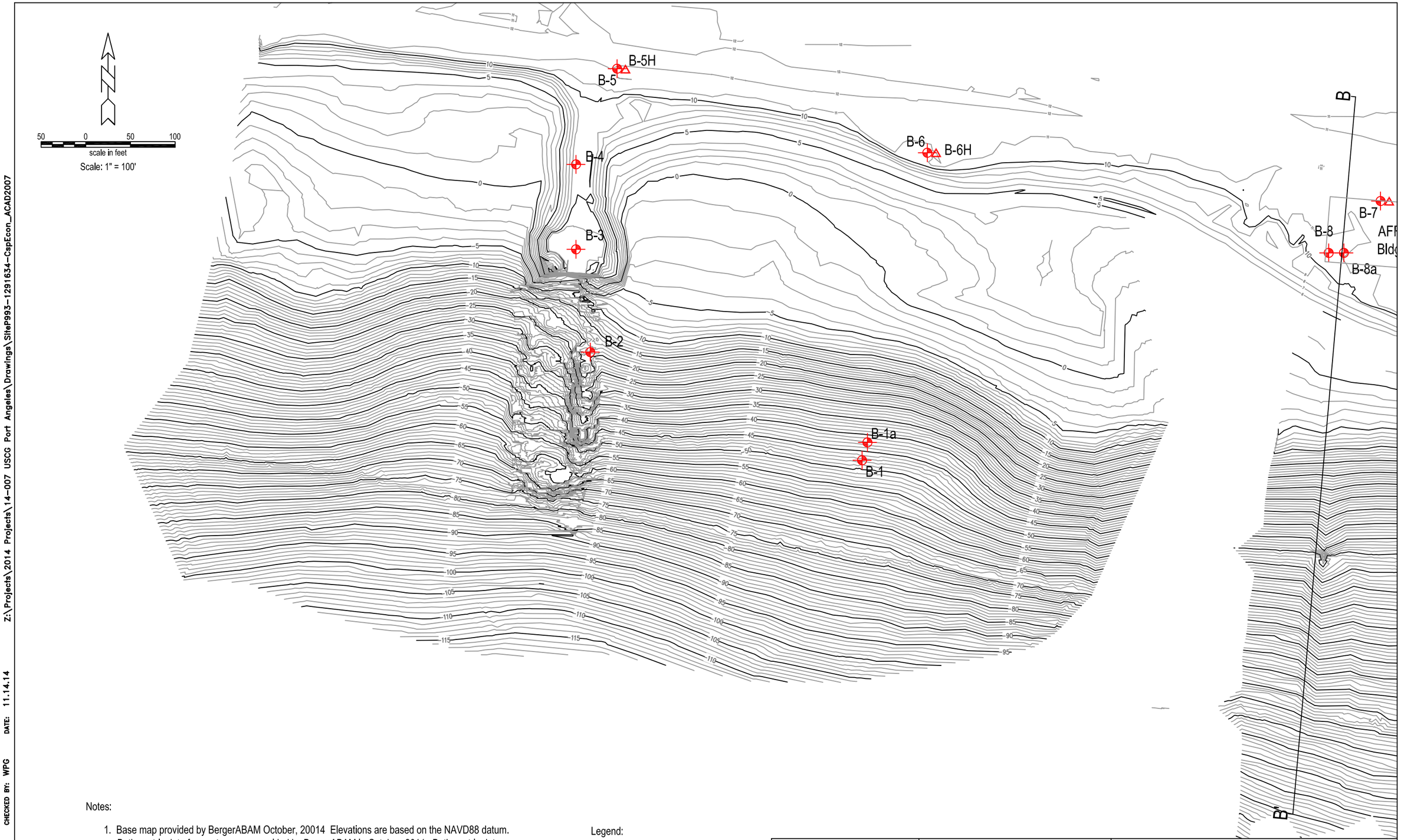

Notes:

1. Base map provided by BergerABAM October, 20014 Elevations are based on the NAVD88 datum. Bathymetric data for western area provided by BergerABAM in October, 2014. Bathymetric data for the east project area provided by BergerABAM in May, 2015.
2. Boring logs for PanGEO borings B-1 through B-8 and hand sampling excavations are located in Appendix A. Locations for these borings are approximate and measured in with a map grde GPS instrument. Locations are accurate to with 3 to 6 feet horizontally.

Legend:

B-1	PanGEO Borings
TP-1-15	PanGEO Test Pits
A A'	PanGEO Profile

PanGEO INCORPORATED

P993 Forward Operating Location
Port Angeles, Washington

SITE AND EXPLORATION PLAN
ORIGINAL PIER LOCATION

PROJECT NO. 14-007

FIGURE NO. 2

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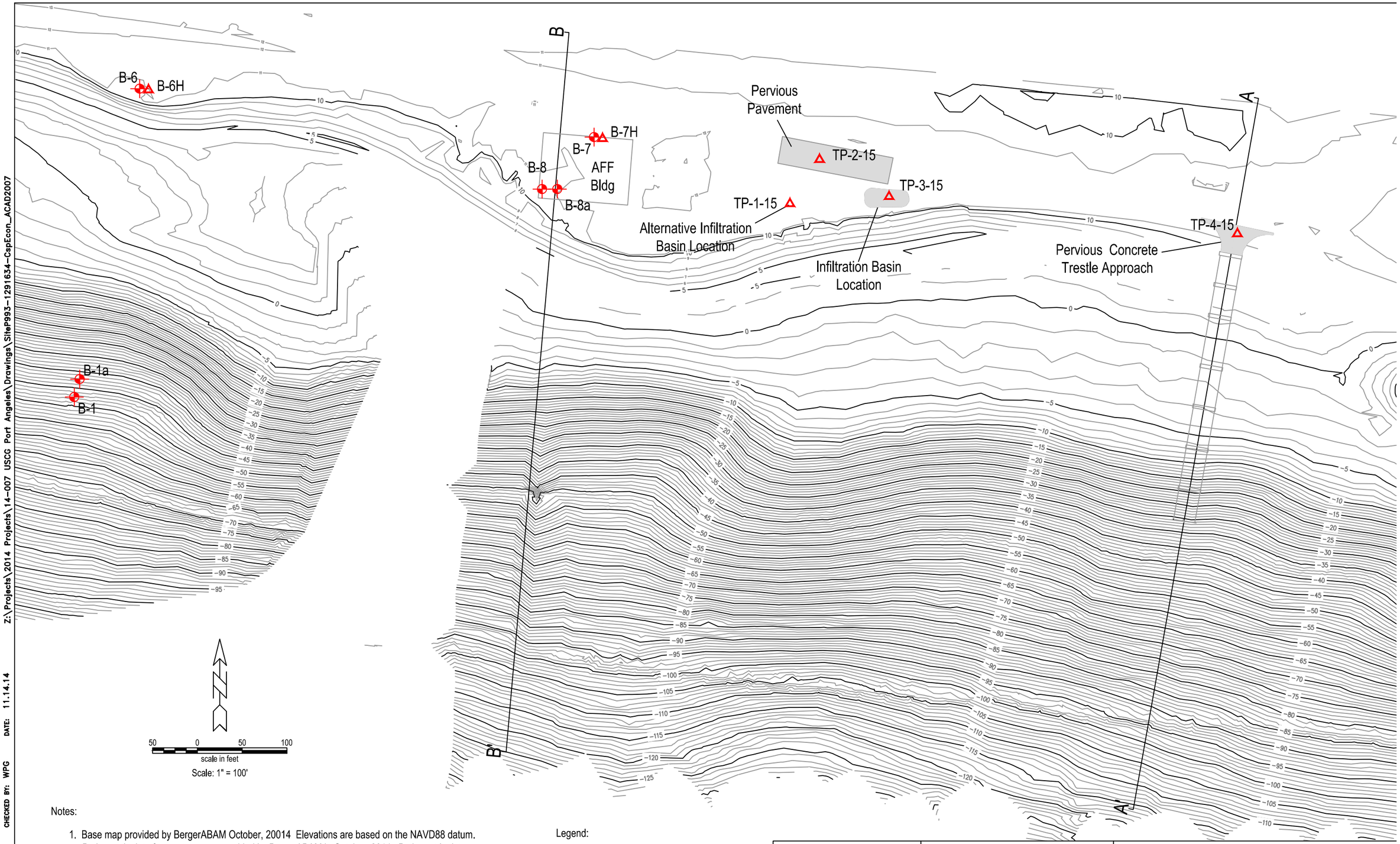

Notes:

1. Base map provided by BergerABAM October, 20014 Elevations are based on the NAVD88 datum. Bathymetric data for western area provided by BergerABAM in October, 2014. Bathymetric data for the east project area provided by BergerABAM in May, 2015.
2. Boring logs for PanGEO borings B-1 through B-8 and hand sampling excavations are located in Appendix A. Locations for these borings are approximate and measured in with a map grde GPS instrument. Locations are accurate to with 3 to 6 feet horizontally.

Legend:

B-1	PanGEO Borings
TP-1-15	PanGEO Test Pits
A A'	PanGEO Profile

PanGEO INCORPORATED

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PROJECT NO. [illegible]

FIGURE NO. [illegible]

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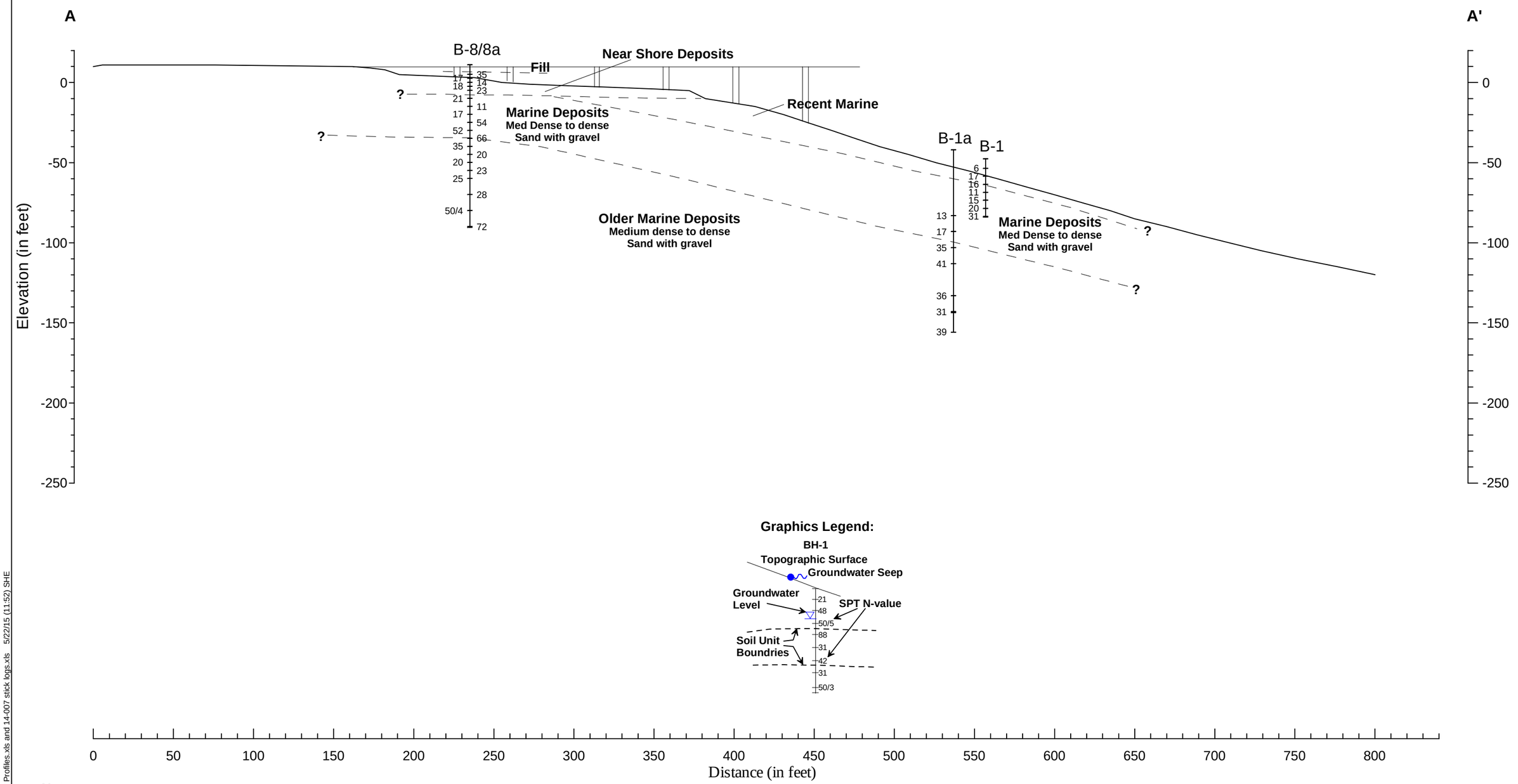


Notes:

1. Section based on bathymetry and topography obtained from BergerABAM.
2. Elevations based on NAVD 88.

PanGEO INCORPORATED

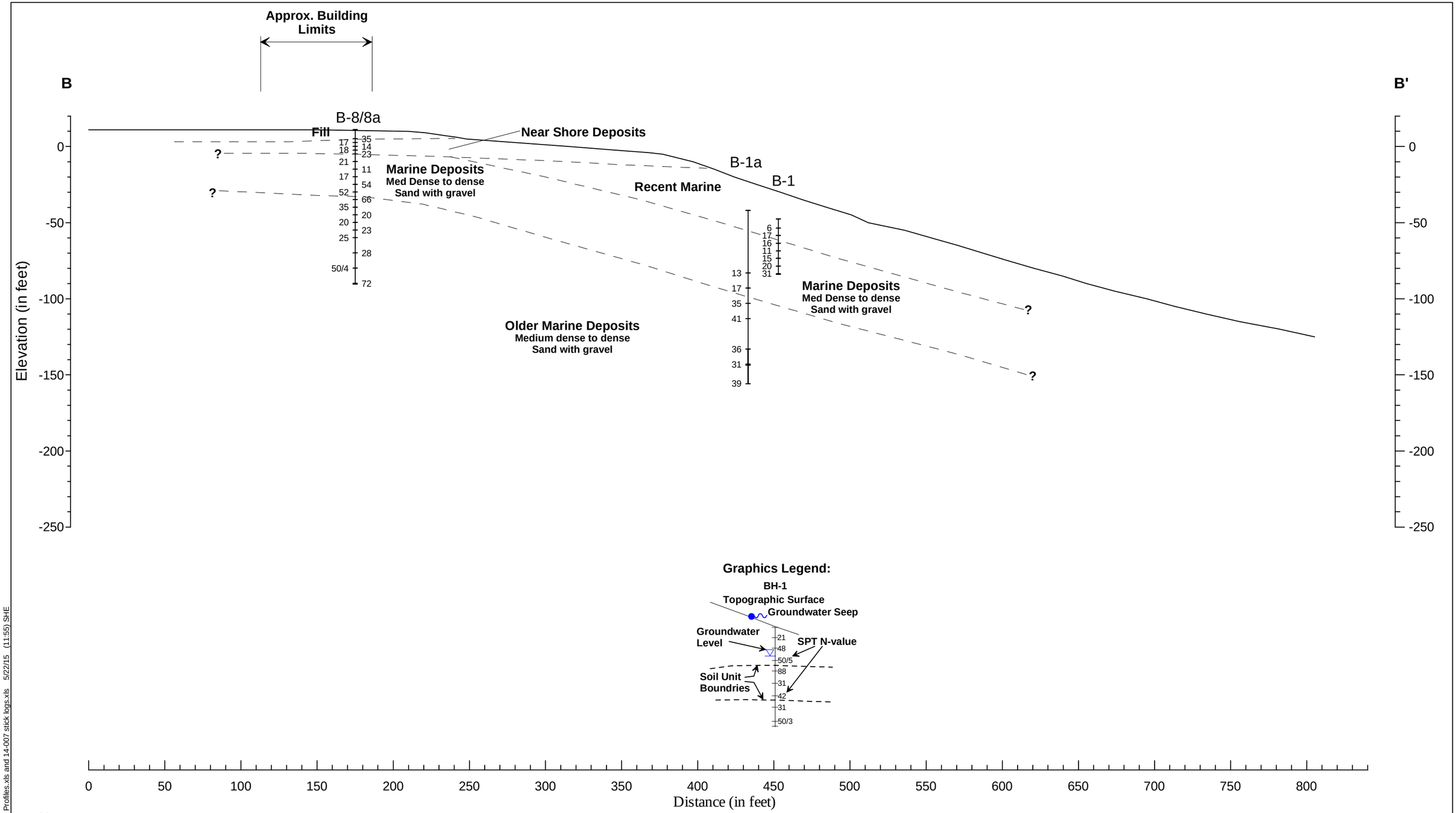
P993 TPS
Forward Operating Location
Port Angeles, Washington

GENERALIZED SUBSURFACE PROFILE
SECTION A-A' - PIER

Project No. **14-007**

Figure No. **4**

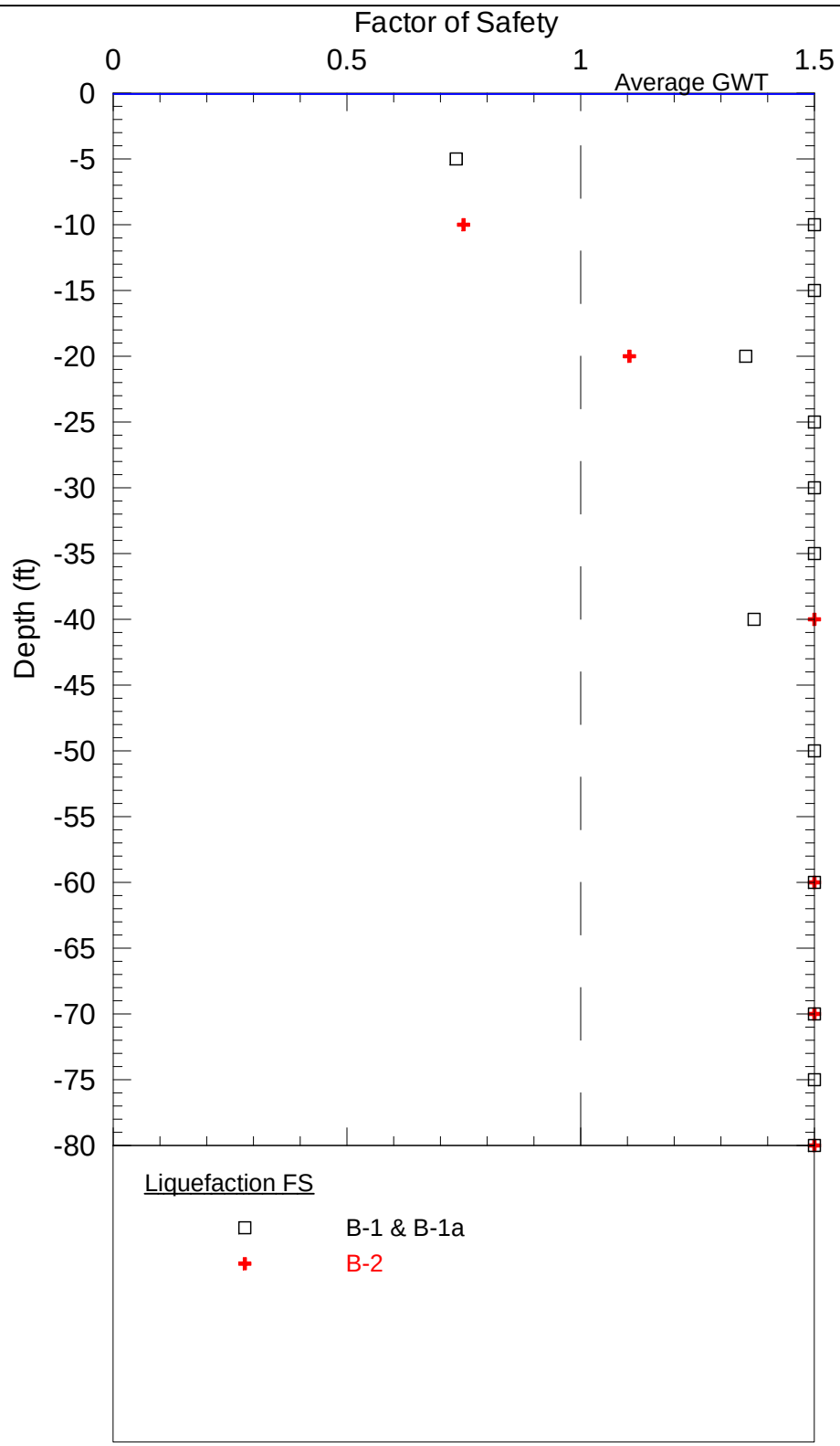
14-007 Profile B.grf w/ 14-007 Profiles.xls and 14-007 stick logs.xls 5/22/15 (11:52) SHE



Notes:
1. Section based on bathymetry and topography obtained from BergerABAM.
2. Elevations based on NAVD 88.

PanGEO INCORPORATED	P993 TPS Forward Operating Location Port Angeles, Washington	GENERALIZED SUBSURFACE PROFILE SECTION B-B' - BUILDING
		Project No. 14-007 / Figure No. 5

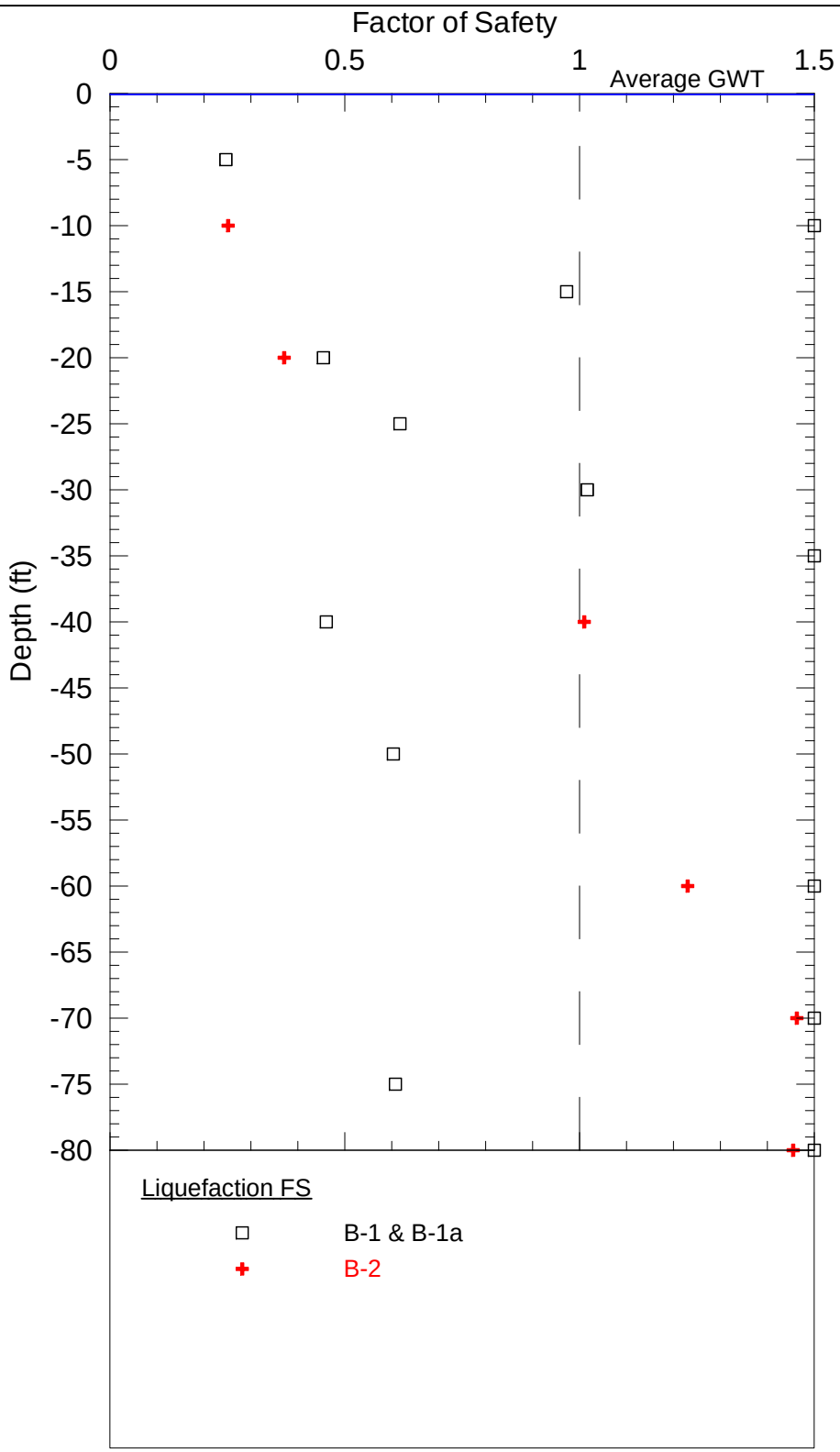
14-007 Profile B.grf w/ 14-007 Profiles.xls and 14-007 stick logs.xls 5/22/15 (11:55) SHE



Notes:
1) Design event: 72 years (M=6.8 event, with a PGA of 0.14g).
2) Samples with computed $(N_1)_{60cs}$ values greater than 30 or computed factors of safety greater than 1.5 were considered not liquefiable and are plotted on this chart as FS=1.5

PanGEO INCORPORATED	**P-993 TPS Forward Operating Location Port Angeles, Washington**	**LIQUEFACTION ASSESSMENT ORIGINAL & REVISED PIER 72 YR. EQ - BORINGS B-1 & B-2**
		Project No. **14-007** / Figure No. **6**

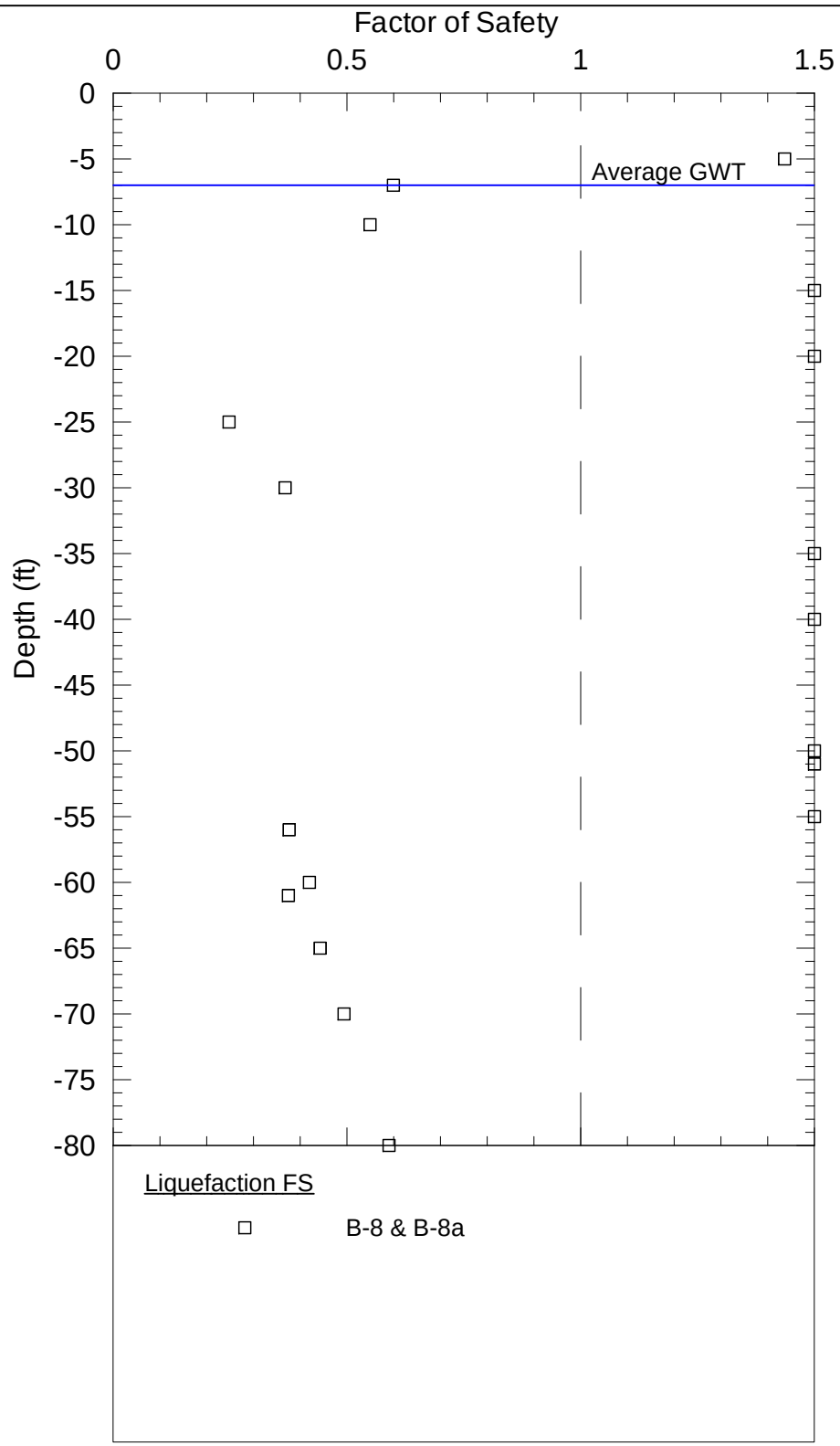
14-007 Pier Borings Liquefaction.grf 5/27/15 (13:07) NTW



Notes:
1) Design event: 475 years (M=7.2 event, with a PGA of 0.36g).
2) Samples with computed $(N_1)_{60cs}$ values greater than 30 or computed factors of safety greater than 1.5 were considered not liquefiable and are plotted on this chart as FS=1.5

PanGEO INCORPORATED	**P-993 TPS Forward Operating Location Port Angeles, Washington**	**LIQUEFACTION ASSESSMENT ORIGINAL & REVISED PIER 475 YR. EQ - BORINGS B-1 & B-2**
		Project No. **14-007** / Figure No. **7**

14-007 Pier Borings Liquefaction.grf 5/27/15 (11:04) NTW



Notes:
1) Design event: 2475 years (M=7.5 event, with a PGA of 0.65g).
2) Samples with computed $(N_1)_{60cs}$ values greater than 30 or computed factors of safety greater than 1.5 were considered not liquefiable and are plotted on this chart as FS=1.5

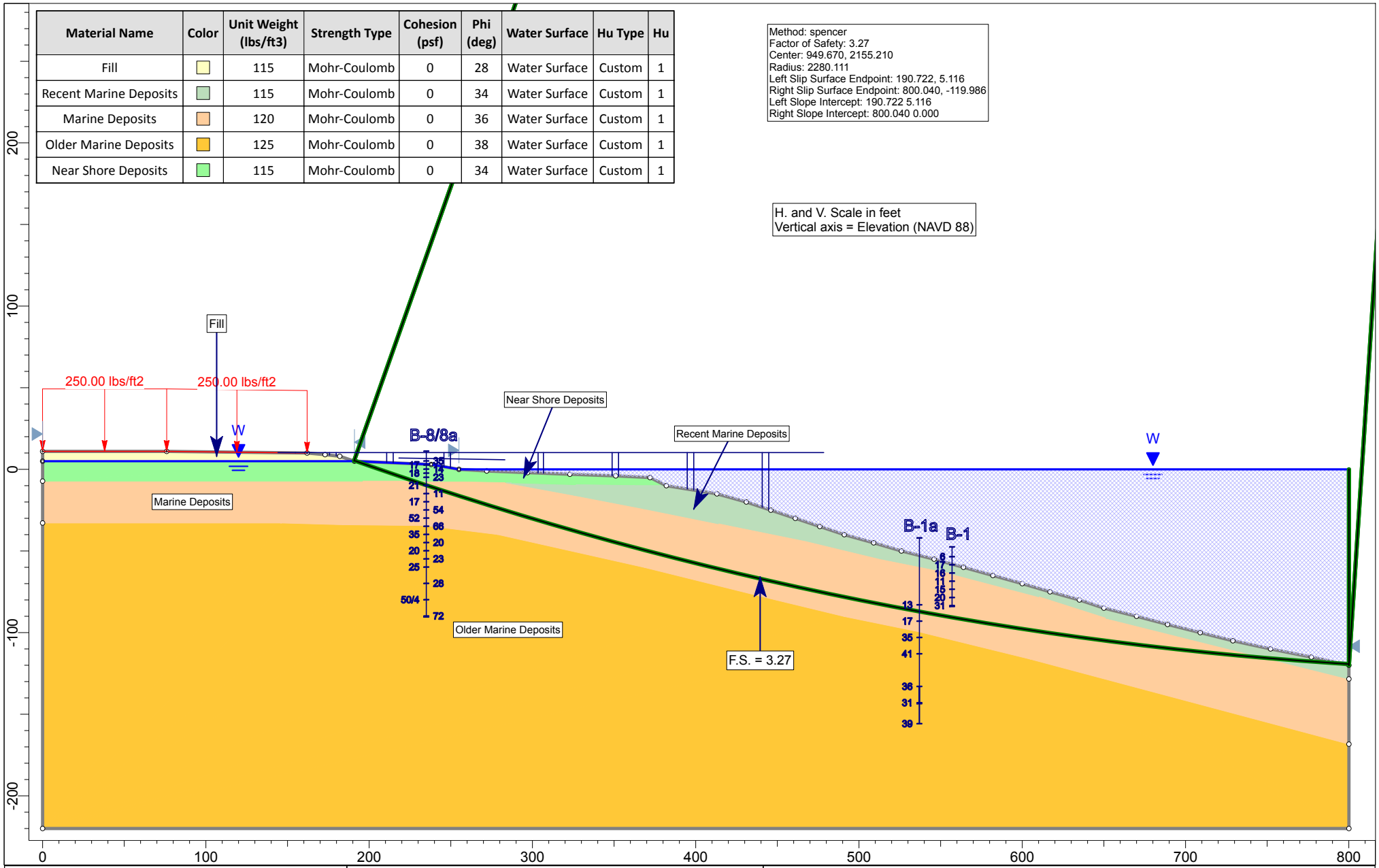
PanGEO INCORPORATED	**P-993 TPS Port Angeles Forward Operating Location Port Angeles, Washington**	**LIQUEFACTION ASSESSMENT ALERT FORCE BUILDING 2475 YR. EQ - BORING B-8 & 8a**
		Project No. **14-007** / Figure No. **8**

14-007 Pier Borings Liquefaction.grf 5/27/15 (13:11) NTW

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	0	28	Water Surface	Custom	1
Recent Marine Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1
Marine Deposits		120	Mohr-Coulomb	0	36	Water Surface	Custom	1
Older Marine Deposits		125	Mohr-Coulomb	0	38	Water Surface	Custom	1
Near Shore Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1

Method: spencer
Factor of Safety: 3.27
Center: 949.670, 2155.210
Radius: 2280.111
Left Slip Surface Endpoint: 190.722, 5.116
Right Slip Surface Endpoint: 800.040, -119.986
Left Slope Intercept: 190.722 5.116
Right Slope Intercept: 800.040 0.000

H. and V. Scale in feet
Vertical axis = Elevation (NAVD 88)



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P-993 TPS
Forward Operating Location
Port Angeles, Washington

Pier Static Global Stability Analysis

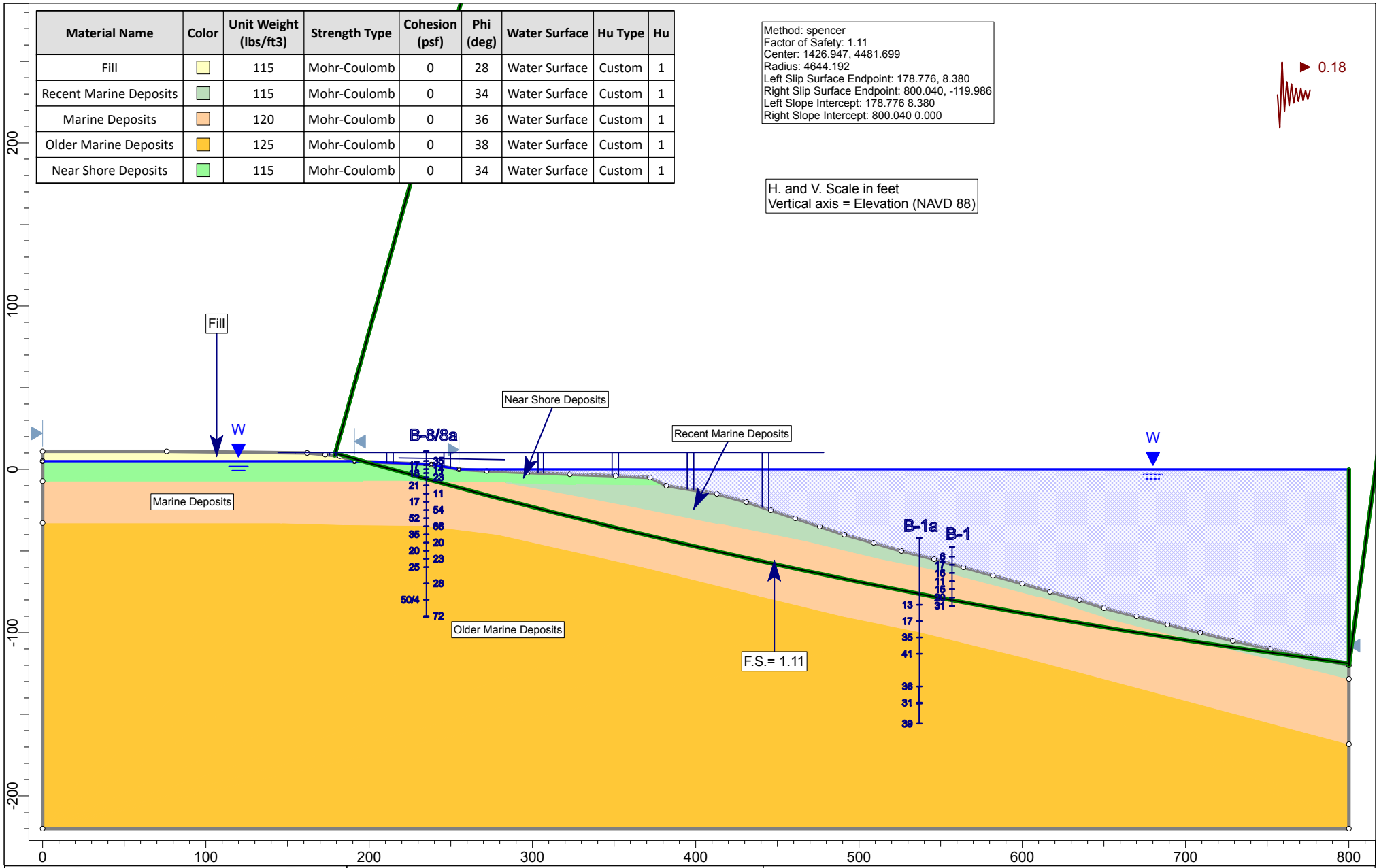
Project No. **14-007**

Figure No. 9

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	0	28	Water Surface	Custom	1
Recent Marine Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1
Marine Deposits		120	Mohr-Coulomb	0	36	Water Surface	Custom	1
Older Marine Deposits		125	Mohr-Coulomb	0	38	Water Surface	Custom	1
Near Shore Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1

Method: spencer
Factor of Safety: 1.11
Center: 1426.947, 4481.699
Radius: 4644.192
Left Slip Surface Endpoint: 178.776, 8.380
Right Slip Surface Endpoint: 800.040, -119.986
Left Slope Intercept: 178.776 8.380
Right Slope Intercept: 800.040 0.000

H. and V. Scale in feet
Vertical axis = Elevation (NAVD 88)



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P-993 TPS
Forward Operating Location
Port Angeles, Washington

Pier Pseudo-Static Global Stability Analysis

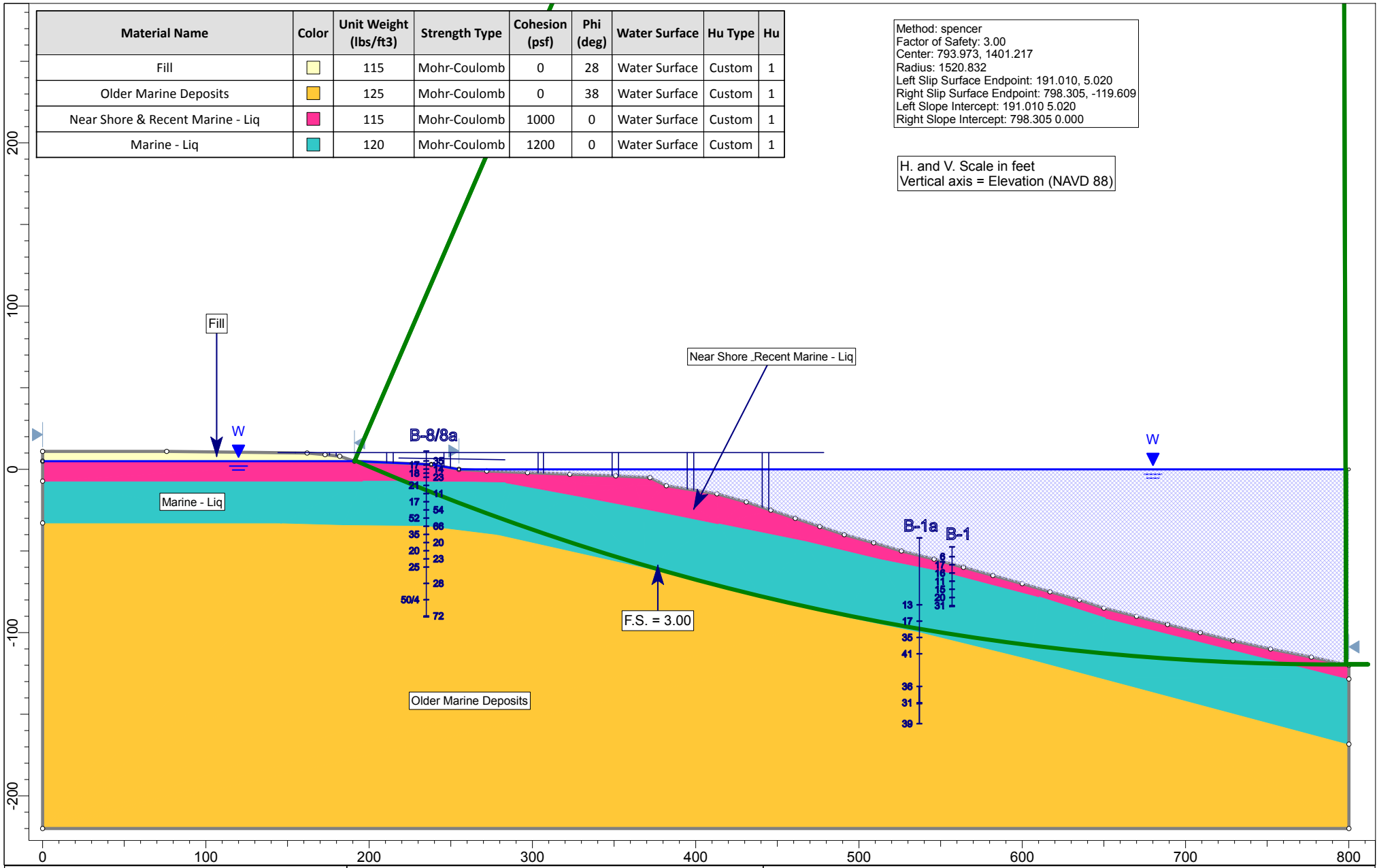
Project No. **14-007**

Figure No. 10

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	0	28	Water Surface	Custom	1
Older Marine Deposits		125	Mohr-Coulomb	0	38	Water Surface	Custom	1
Near Shore & Recent Marine - Liq		115	Mohr-Coulomb	1000	0	Water Surface	Custom	1
Marine - Liq		120	Mohr-Coulomb	1200	0	Water Surface	Custom	1

Method: spencer
Factor of Safety: 3.00
Center: 793.973, 1401.217
Radius: 1520.832
Left Slip Surface Endpoint: 191.010, 5.020
Right Slip Surface Endpoint: 798.305, -119.609
Left Slope Intercept: 191.010 5.020
Right Slope Intercept: 798.305 0.000

H. and V. Scale in feet
Vertical axis = Elevation (NAVD 88)



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SLIDEINTERPRET 6.035

P-993 TPS
Forward Operating Location
Port Angeles, Washington

Pier Post-Liquefaction (Residual) Stability Analysis

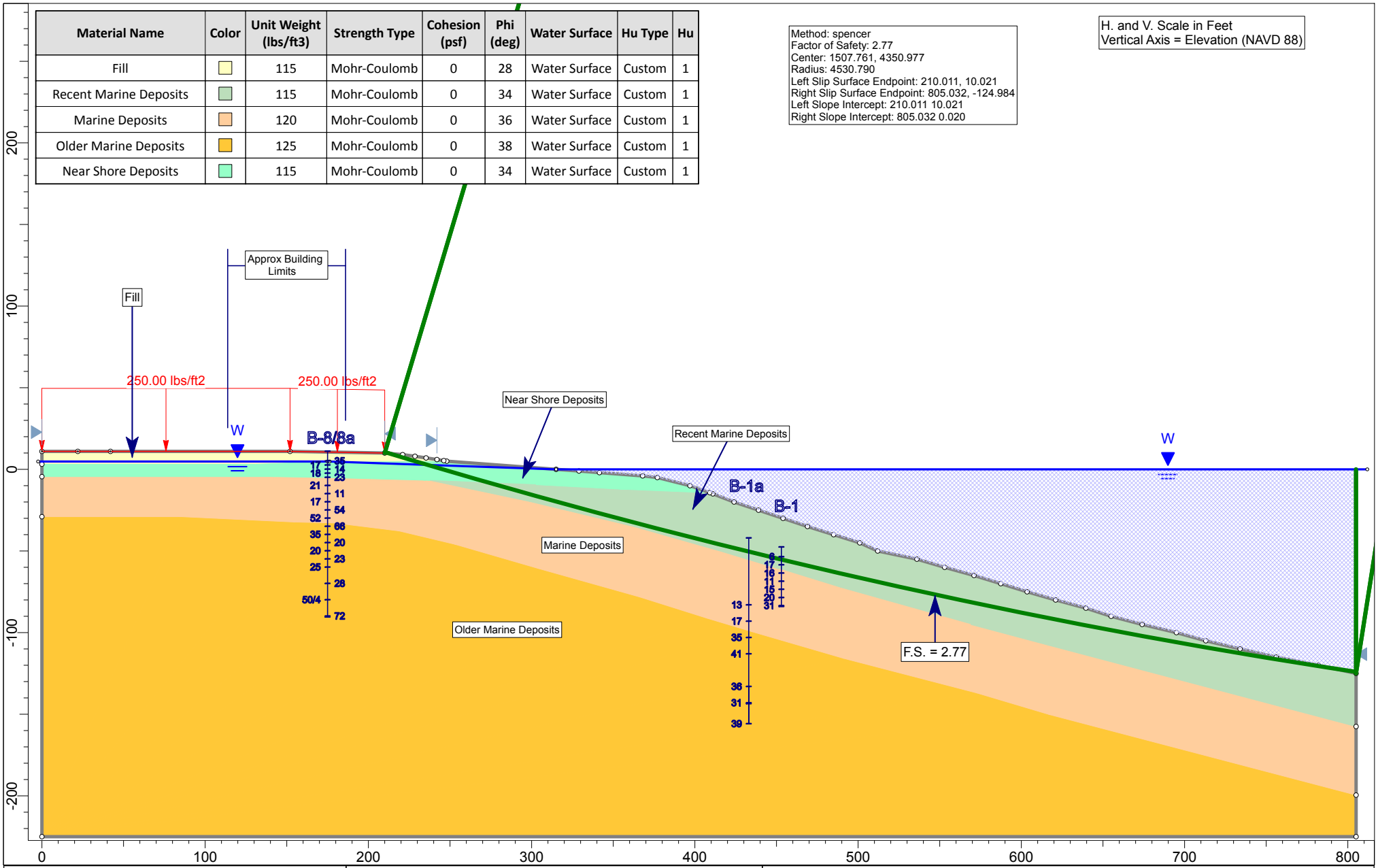
Project No. **14-007**

Figure No. 11

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	0	28	Water Surface	Custom	1
Recent Marine Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1
Marine Deposits		120	Mohr-Coulomb	0	36	Water Surface	Custom	1
Older Marine Deposits		125	Mohr-Coulomb	0	38	Water Surface	Custom	1
Near Shore Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1

Method: spencer
Factor of Safety: 2.77
Center: 1507.761, 4350.977
Radius: 4530.790
Left Slip Surface Endpoint: 210.011, 10.021
Right Slip Surface Endpoint: 805.032, -124.984
Left Slope Intercept: 210.011 10.021
Right Slope Intercept: 805.032 0.020

H. and V. Scale in Feet
Vertical Axis = Elevation (NAVD 88)



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SLIDEINTERPRET 6.035

P-993 TPS
Forward Operating Location
Port Angeles, Washington

Building Static Global Stability Analysis

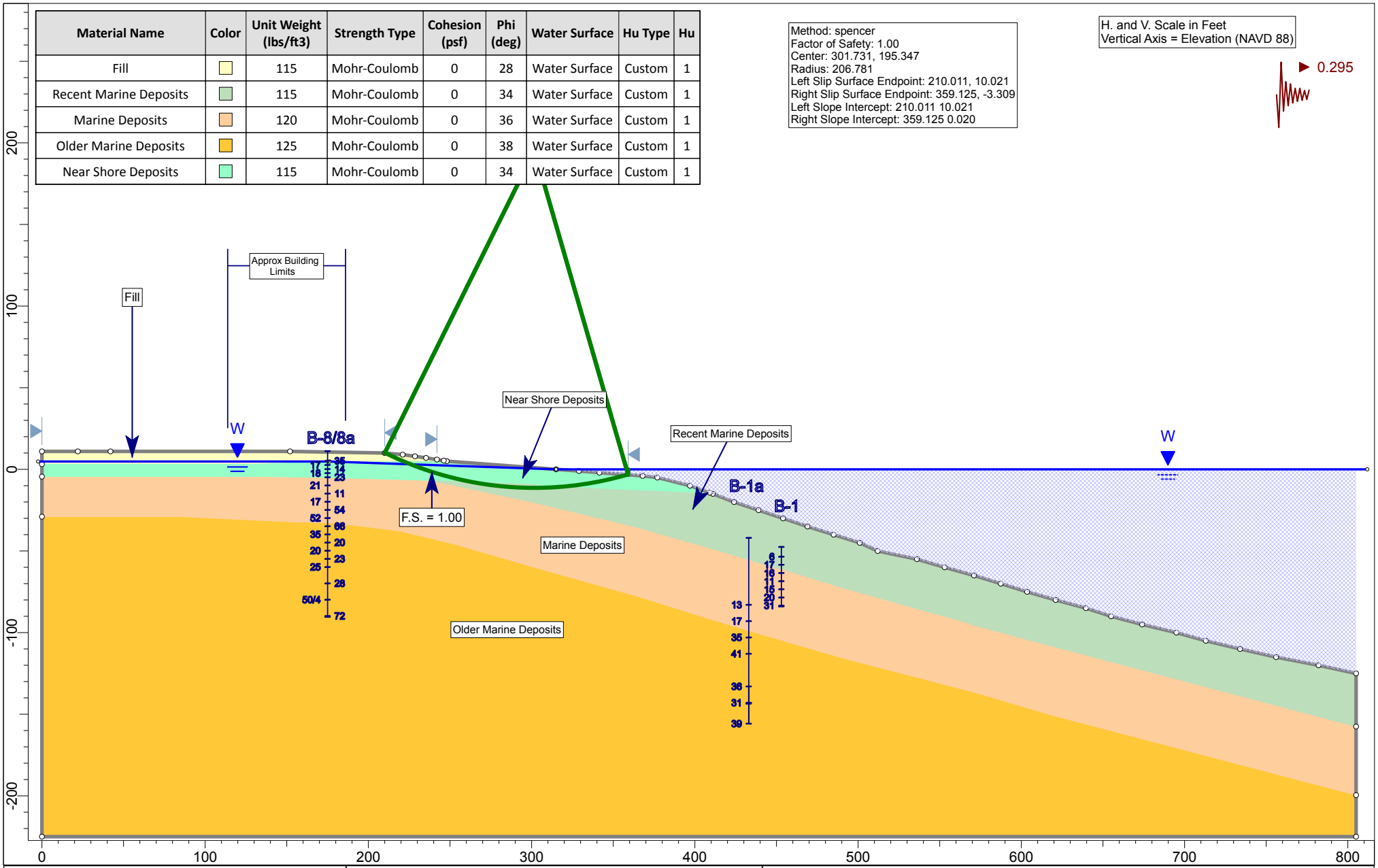
Project No. **14-007**

Figure No. 12

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	0	28	Water Surface	Custom	1
Recent Marine Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1
Marine Deposits		120	Mohr-Coulomb	0	36	Water Surface	Custom	1
Older Marine Deposits		125	Mohr-Coulomb	0	38	Water Surface	Custom	1
Near Shore Deposits		115	Mohr-Coulomb	0	34	Water Surface	Custom	1

Method: spencer
Factor of Safety: 1.00
Center: 301.731, 195.347
Radius: 206.781
Left Slip Surface Endpoint: 210.011, 10.021
Right Slip Surface Endpoint: 359.125, -3.309
Left Slope Intercept: 210.011 10.021
Right Slope Intercept: 359.125 0.020

H. and V. Scale in Feet
Vertical Axis = Elevation (NAVD 88)



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SLIDEINTERPRET 6.035

P-993 TPS
Forward Operating Location
Port Angeles, Washington

Building Pseudo-Static Global Stability Analysis

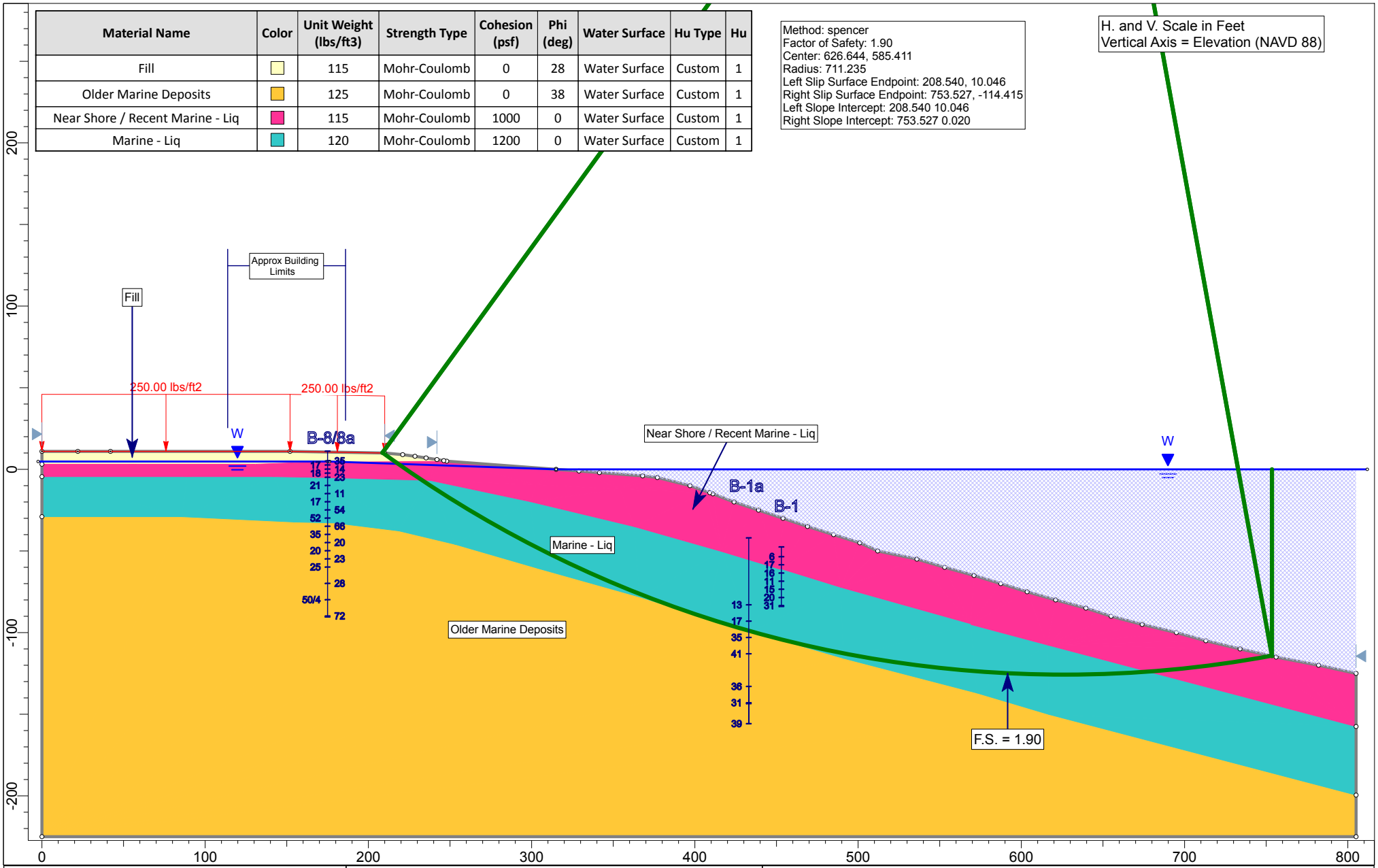
Project No. **14-007**

Figure No. 13

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Fill		115	Mohr-Coulomb	0	28	Water Surface	Custom	1
Older Marine Deposits		125	Mohr-Coulomb	0	38	Water Surface	Custom	1
Near Shore / Recent Marine - Liq		115	Mohr-Coulomb	1000	0	Water Surface	Custom	1
Marine - Liq		120	Mohr-Coulomb	1200	0	Water Surface	Custom	1

Method: spencer
Factor of Safety: 1.90
Center: 626.644, 585.411
Radius: 711.235
Left Slip Surface Endpoint: 208.540, 10.046
Right Slip Surface Endpoint: 753.527, -114.415
Left Slope Intercept: 208.540 10.046
Right Slope Intercept: 753.527 0.020

H. and V. Scale in Feet
Vertical Axis = Elevation (NAVD 88)



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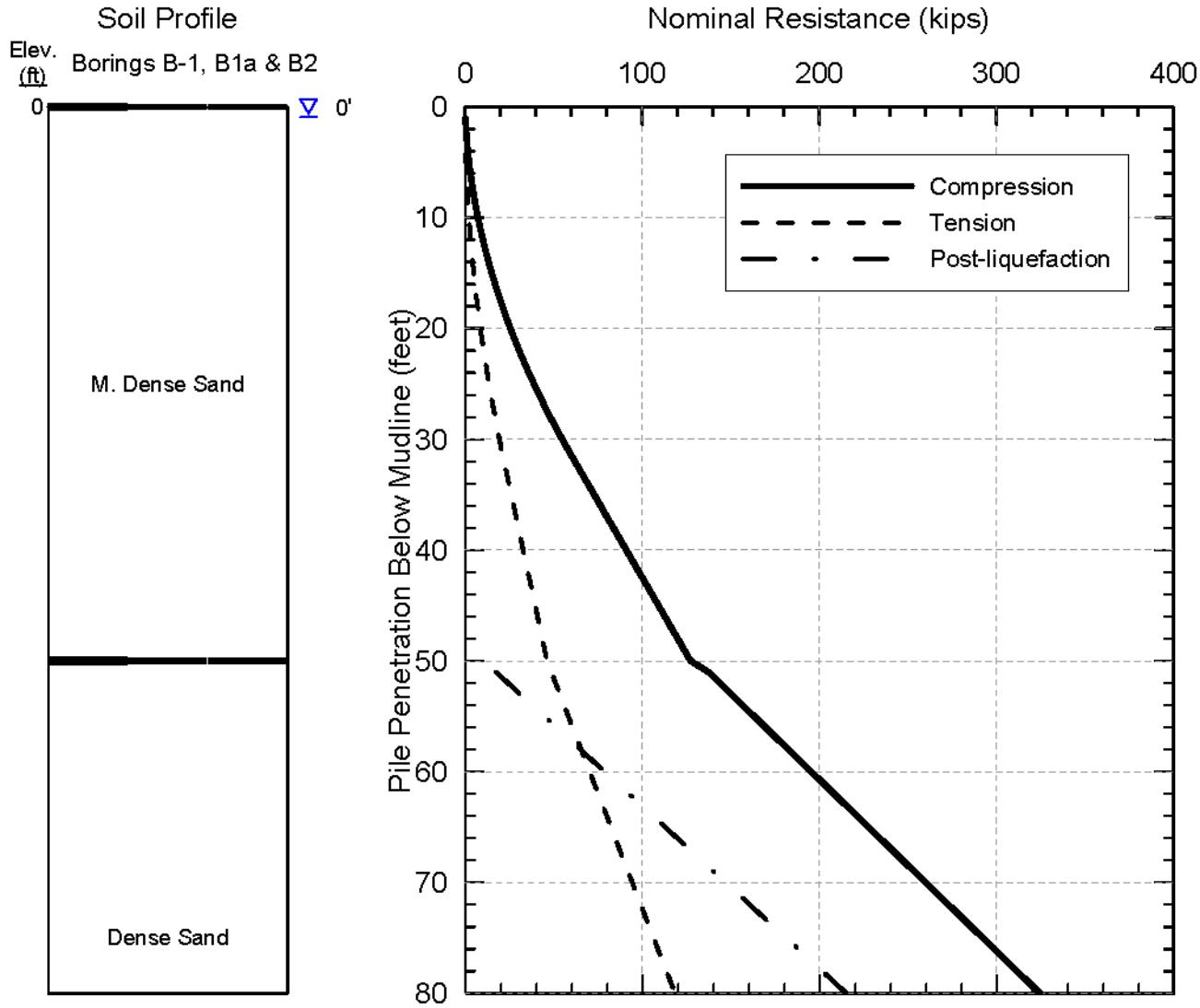
SLIDEINTERPRET 6.035

P-993 TPS
Forward Operating Location
Port Angeles, Washington

Building Post-Liquefaction (Residual) Stability Analysis

Project No. **14-007**

Figure No. 14



Notes:

1) Axial resistance values are for a 18-inch diameter, open-end, steel pipe pile.
2) Axial resistance values are nominal (ultimate) values.
3) LRFD resistance factors:

	Strength	Extreme	
φ_{dyn}	0.65	1.0	(axial resistance verified using pile dynamic measurements and signal matching analysis [PDA & CAPWAP])
φ_{up}	0.50	1.0	(piles loaded in axial tension; Poisson's effect included in resistance calculations)
$\varphi_{post\text{-}liquefaction}$		1.0	

4) For piles driven to the required axial compressive resistance and/or to the minimum tip elevation required, service limit state settlement is expected to be less than 1-inch.
5) Pile tip elevations provided in this chart for piles in compression are for pile quantity estimation purposes only. Actual pile penetrations should be determined on the basis of test piles and field verification using the dynamic method associated with the strength limit state resistance factor selected from Note 3, above.
6) Tip elevations deeper than shown on this plot are not recommended due to the potential for a a plug to develop inside the pile during driving. If a plug develops, impact driving may be necessary to drive the pile deeper.

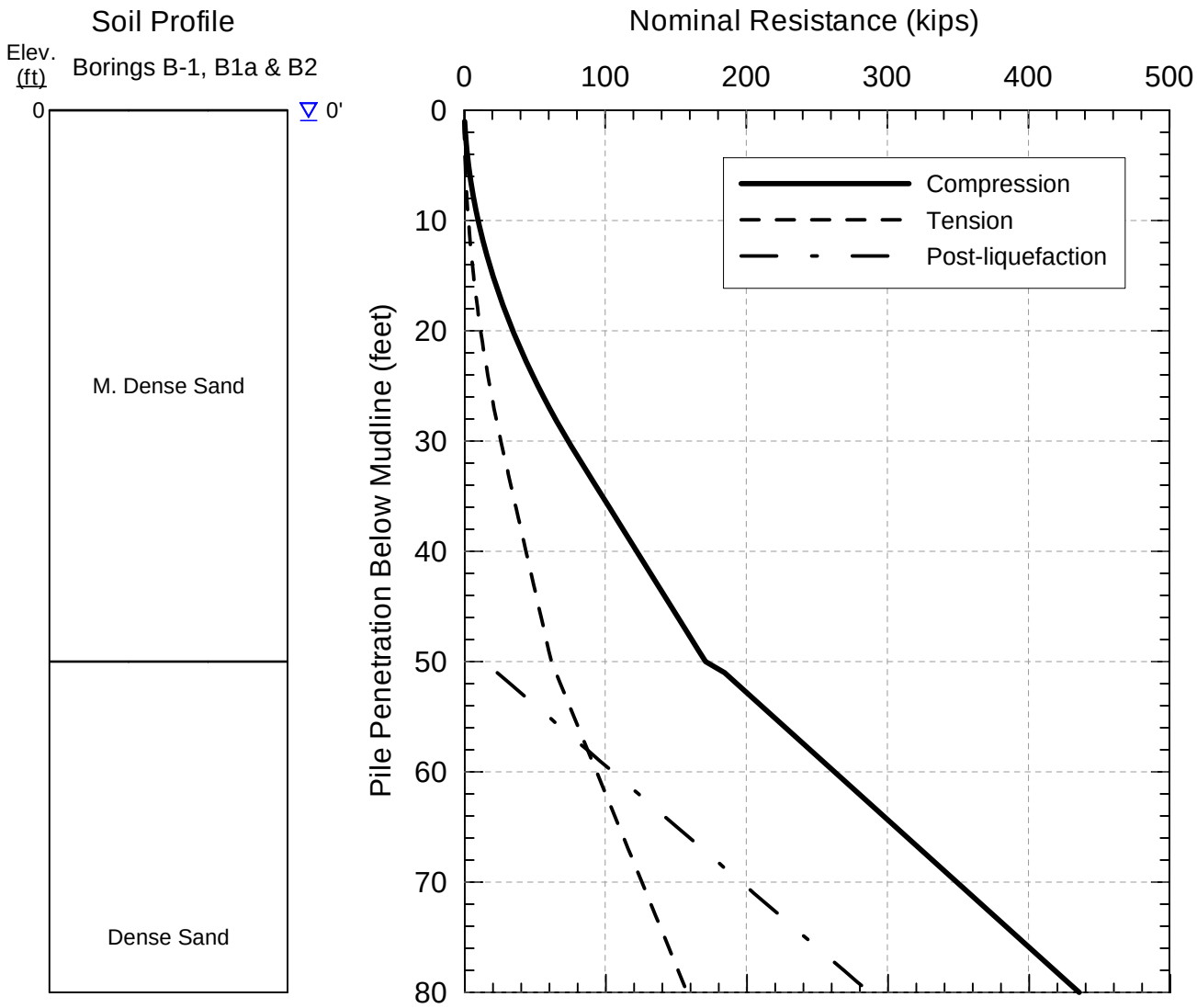
PanGEO INCORPORATED

P-933 TPS Forward Operating Location
Port Angeles, Washington

NOMINAL AXIAL RESISTANCE
18-INCH OPEN-END PILES

Project No.	Figure No.
14-007	15

14-007_Fig-1.ppt 5/27/2015(10:12 AM) SHE



Notes:

1) Axial resistance values are for a 24-inch diameter, open-end, steel pipe pile.
2) Axial resistance values are nominal (ultimate) values.
3) LRFD resistance factors:

	Strength	Extreme	
φ_{dyn}	0.65	1.0	(axial resistance verified using pile dynamic measurements and signal matching analysis [PDA & CAPWAP])
φ_{up}	0.50	1.0	(piles loaded in axial tension; Poisson's effect included in resistance calculations)
$\varphi_{post\text{-}liquefaction}$		1.0	

4) For piles driven to the required axial compressive resistance and/or to the minimum tip elevation required, service limit state settlement is expected to be less than 1-inch.
5) Pile tip elevations provided in this chart for piles in compression are for pile quantity estimation purposes only. Actual pile penetrations should be determined on the basis of test piles and field verification using the dynamic method associated with the strength limit state resistance factor selected from Note 3, above.
6) Tip elevations deeper than shown on this plot are not recommended due to the potential for a a plug to develop inside the pile during driving. If a plug develops, impact driving may be necessary to drive the pile deeper.

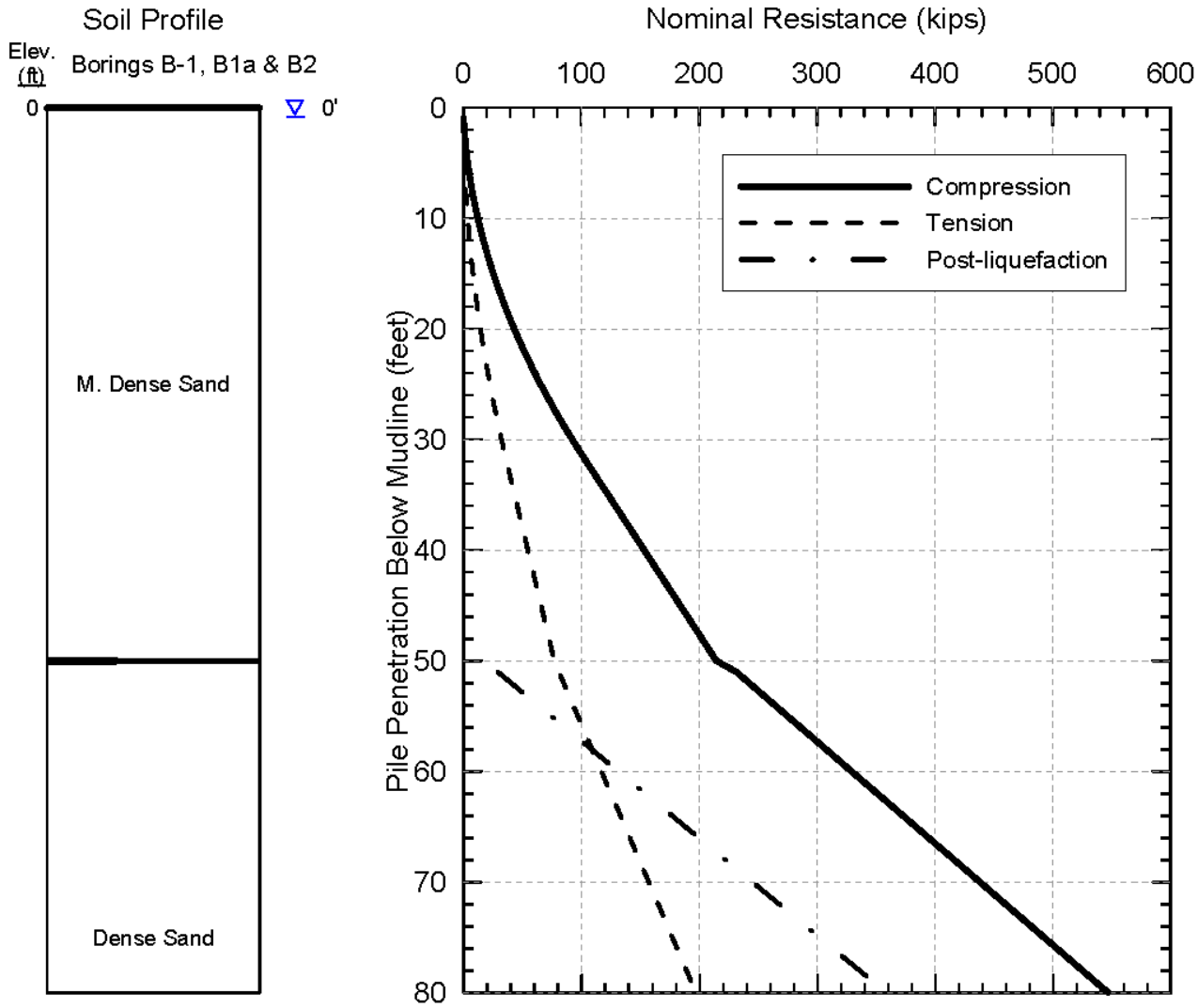
PanGEO INCORPORATED

P993 TPS Forward Operating Location
Port Angeles, Washington

NOMINAL AXIAL RESISTANCE
24-INCH OPEN-END PILES

Project No.	Figure No.
14-007	**16**

14-007 24-in OE Pile Capacity El.grf w/ 14-007 24-in OE Pile Capacity.xls & 14-007 24-in OE Pile Uplift Capacity.xls & 14-007 24-in OE Pile Capacity Post Liq.xls 5/27/15 (16:27) REK



Notes:

1) Axial resistance values are for a 30-inch diameter, open-end, steel pipe pile.
2) Axial resistance values are nominal (ultimate) values.
3) LRFD resistance factors:

	Strength	Extreme	
φ_{dyn}	0.65	1.0	(axial resistance verified using pile dynamic measurements and signal matching analysis [PDA & CAPWAP])
φ_{up}	0.50	1.0	(piles loaded in axial tension; Poisson's effect included in resistance calculations)
$\varphi_{post\text{-}liquefaction}$		1.0	

4) For piles driven to the required axial compressive resistance and/or to the minimum tip elevation required, service limit state settlement is expected to be less than 1-inch.
5) Pile tip elevations provided in this chart for piles in compression are for pile quantity estimation purposes only. Actual pile penetrations should be determined on the basis of test piles and field verification using the dynamic method associated with the strength limit state resistance factor selected from Note 3, above.
6) Tip elevations deeper than shown on this plot are not recommended due to the potential for a a plug to develop inside the pile during driving. If a plug develops, impact driving may be necessary to drive the pile deeper.

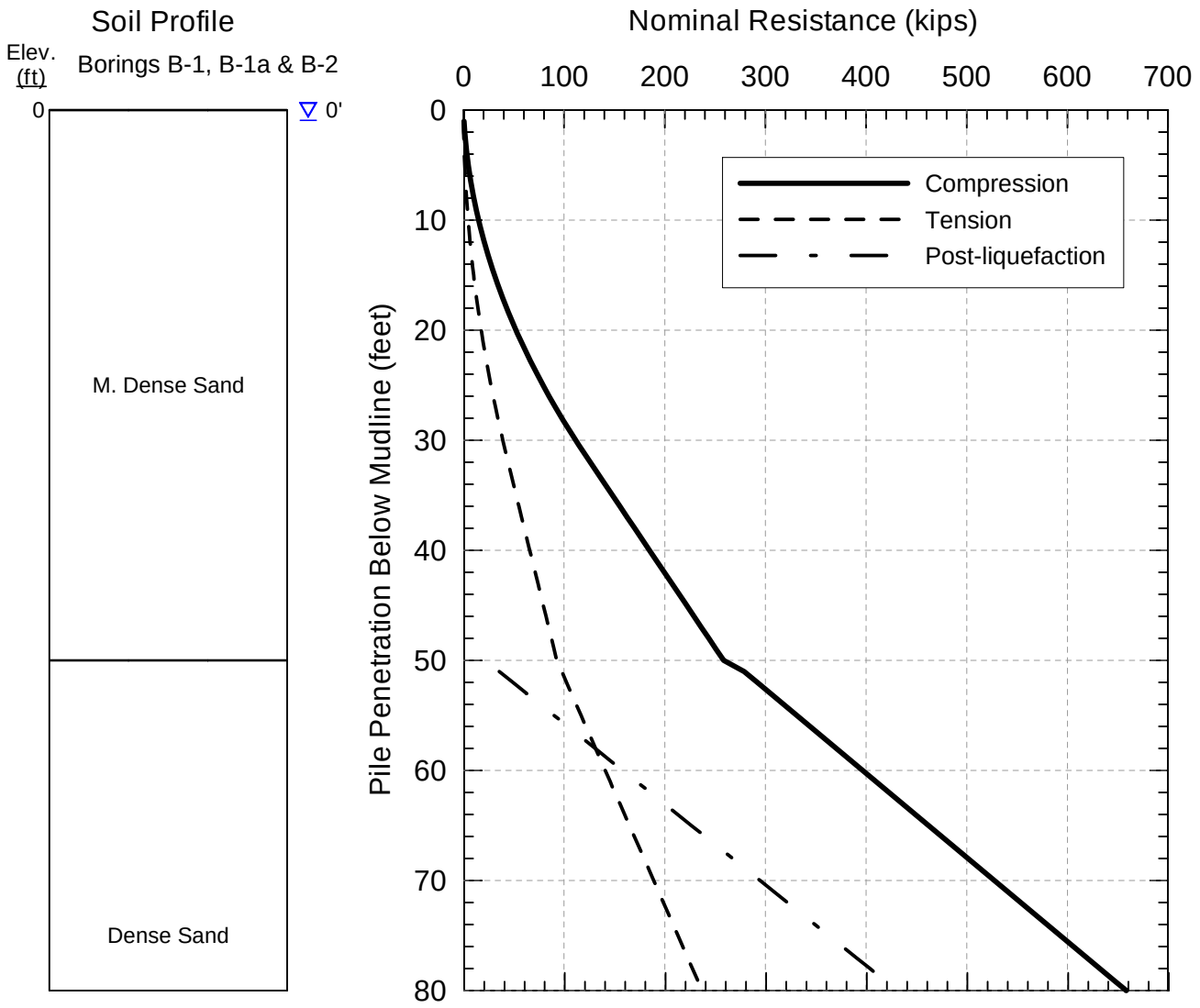
PanGEO INCORPORATED

P-933 TPS Forward Operating Location
Port Angeles, Washington

NOMINAL AXIAL RESISTANCE
30-INCH OPEN-END PILES

Project No.	Figure No.
14-007	17

14-007_Fig-1.ppt 6/17/2015(10:12 AM) SHE



Notes:

1) Axial resistance values are for a 36-inch diameter, open-end, steel pipe pile.
2) Axial resistance values are nominal (ultimate) values.
3) LRFD resistance factors:

	Strength	Extreme	
φ_{dyn}	0.65	1.0	(axial resistance verified using pile dynamic measurements and signal matching analysis [PDA & CAPWAP])
φ_{up}	0.50	1.0	(piles loaded in axial tension; Poisson's effect included in resistance calculations)
$\varphi_{post\text{-}liquefaction}$		1.0	

4) For piles driven to the required axial compressive resistance and/or to the minimum tip elevation required, service limit state settlement is expected to be less than 1-inch.
5) Pile tip elevations provided in this chart for piles in compression are for pile quantity estimation purposes only. Actual pile penetrations should be determined on the basis of test piles and field verification using the dynamic method associated with the strength limit state resistance factor selected from Note 3, above.
6) Tip elevations deeper than shown on this plot are not recommended due to the potential for a a plug to develop inside the pile during driving. If a plug develops, impact driving may be necessary to drive the pile deeper.

PanGEO INCORPORATED

P993 TPS Forward Operating Location
Port Angeles, Washington

NOMINAL AXIAL RESISTANCE
36-INCH OPEN-END PILES

Project No.	Figure No.
14-007	**18**

14-007 36-in OE Pile Capacity El.grf w/ 14-007 36-in OE Pile Capacity.xls & 14-007 36-in OE Pile Uplift Capacity & 14-007 36-in OE Pile Capacity Post Liq.xls 5/27/15 (17:04) REK

APPENDIX A

FIELD EXPLORATIONS

APPENDIX A: FIELD EXPLORATIONS

This appendix presents factual and interpretive results of our exploratory drilling program. The descriptions of the materials encountered in the subsurface explorations are based on the samples extracted from the borings, hand holes, and test pits. The sample descriptions are augmented by observation of the drilling action and drill cuttings brought to the surface during field operations. The following describes the field operations and sampling procedures used during the geotechnical field explorations.

FIELD EXPLORATIONS

The subsurface exploration program consisted of drilling 8 test borings in support of the design of the upland and offshore structures. Two over water borings (B-1 and B-2) were drilled by Cascade Drilling of Fife, Washington, using a truck mounted drill stationed on a Seahorse self-supported mobile barge operated by Northern Marine Salvage of Seattle, Washington. The borings were advanced using a mud rotary drill string. The barge was held on station by means of anchors or spuds.

On February 10, 2014, drilling started on the offshore boring B-1 and the hole was advanced to a depth of 36.5 feet below mudline by the end of the day. During the night, high winds caused the barge anchors to drag and the boring had to be abandoned. Boring B-1a was re-spudded roughly 20 feet from B-1 on February 11, and the hole was advanced to the planned depth of 100 feet below mudline. Weather prevented drilling on February 12. Drilling resumed on February 13th where Boring B-2 was drilled to the planned depth of 100 feet at a location off the end of the jetty or projection of land that was planned for use as the abutment for the access ramp. At this location, the barge was held in place by spuds and by lowering the barge ramp onto the bulkhead at the end of the jetty. Standard Penetration Tests (SPT) samples were taken in both borings at intervals of between 5 and 20 feet, as needed to complete the borings in a timely manner and characterize the sediments. The tide level was monitored by the drilling crew, and drilling intervals were adjusted as needed to maintain accurate depths below mudline during sampling. The locations of the off shore borings are shown on Figure 2.

Six land borings (B-3 thru B-8) were drilled between September 29 and October 3, 2014, at the locations shown on Figure 2. The borings were drilled using a truck mounted drill rig operated by Holocene Drilling of Puyallup, Washington. The borings were drilled using both hollow stem auger and mud rotary drill strings. Two test borings (B-3 and B-4) were drilled on the jetty to depths of 100 and 50 feet, respectively. Short, 10-foot borings (B-5, B-6 and B-7) were drilled in the areas of planned support facilities.

To provide data for the seismic evaluation of the Alert Force Building, boring B-8was drilled to a depth of 100 feet at the location shown on Figure 2. Boring B-8 was started using mud rotary

equipment but the hole was subsequently abandoned at a depth of 60 feet because of difficulties removing cuttings from the hole. Consequently, the boring was moved 17 feet to the east and was completed as B-8a to the planned depth of 100 feet using 6-inch hollow stem auger drilling equipment. Following completion of the boring, inclinometer casing was installed full depth of the hole for the purpose of conducting downhole seismic shear wave testing. The downhole seismic testing was completed on October 7th by Phil Duoos, Geophysical Consultant.

A representative of PanGEO logged the test borings and collected from samples from the borings at selected intervals. The boring logs included in this appendix provide the specifics of drill rig and equipment used for each location. The locations of the borings were measured using map grade GPS equipment which should be accurate to within 3 to 5 feet. Boring coordinates obtained in the field are indicated on the individual boring logs.

To collect additional shallow soil samples for corrosivity testing and evaluation of infiltration characteristics, three shallow hand excavations were conducted on December 15, 2014, at locations adjacent to borings B-5 thru B-7. These hand holes are designated as B-5H thru B-7H. These explorations were excavated with a shovel to a depth of 2 feet and a posthole digger was used between depths of 2 and 4 feet. Approximate one gallon of soil from each hole below a depth of 2 feet was retrieved for laboratory testing. The excavation was then backfilled to surface.

After the plans were altered and the infiltration facilities were re-located, additional samples were required to assess the infiltration capacity at the new sites. On May 7, 2015, an engineering geologist visited the site to collect samples from four locations designated by BergerABAM and staked in the field by others. The soil samples were collected using an air/vacuum truck provided by Applied Professional Services of North Bend, Washington. Samples were collected from 2 feet to 6 feet below ground surface. The soil from the surface to 2 feet was extracted using the air vacuum and soil knife. Upon reaching a depth of 2 feet, the soil stream was re-directed into a separate containment chamber, and the soil from 2 to 6 feet was collected. Once a depth of 6 feet was reached, excavation stopped. The collected sample was dumped into a wheel barrow and mixed. A representative sample of the soil was extracted from the mixed pile and placed in a sample bag. Due to the coarse nature of the material, samples were up to 40 pounds in weight. Because the samples were extracted with the air/vacuum truck, it was not possible to logs the soils. However, the soils were similar in composition from the surface to the full depth of the excavation, consisting of gravelly sand fill. No signs of bedding or soil layering were observed, and native soils were not penetrated. No groundwater was encountered during sampling, but sampling took place at low tide. If the tide had been high, groundwater may have been encountered.

SAMPLING METHODS FOR DRILLING OPERATIONS

Standard penetration tests (SPT) were generally taken in the over water borings (B-1 and B-2) at 5-foot intervals, starting at 5 feet below the mudline. Due to changeable weather conditions and time constraints, the sampling interval was increased to 10 and 20 feet as needed to complete the boring and characterize the sediments. At boring B-1a, sampling began at roughly the last depth sampled in B-1. Water levels in the bay were monitored by the drilling crew to provide a reference datum for conducting the sampling.

Sampling in the upland borings was typically conducted at intervals of 2½ feet to a depth of 20 feet and 5 foot intervals thereafter. However, because of the coarse nature of the underlying materials, sample recovery in the upland borings tended to be relatively. Consequently, sampling in borings B-3, B-5, B-6 and B-7 was conducted at alternating intervals using SPT 2" OD split spoons and 3" OD California samplers. Selected samples in boring B-8a were conducted using the California Sampler.

SPT testing consists of advancing a 2 inch outside diameter (OD), steel, split spoon sampler 18 inches into the undisturbed soil below the deepest soil penetrated by the drill bit by striking it with a 140 pound hammer dropped 30 inches. During SPT sampling, the number of blows to drive the sampler each 6 inches over an 18-inch interval was recorded and indicated on the boring log. The number of blows to drive the sampler the final 12 inches is termed the SPT resistance, or N-value, and is used to evaluate the strength and consistency or relative density of the soil.

The hammer used to perform SPT sampling was an automatic trip-release mechanism, which generally delivers a higher energy than a "standard" hammer equipped with a rope and cathead mechanism. The efficiency of the hammer mechanism is considered when evaluating the liquefaction potential of a soil. The SPT N-values reported on the borehole logs are field values, and are therefore not corrected for hammer efficiency, overburden stress or rod lengths.

The California sampler was advanced using the same 140 pound hammer as the SPT. Since the California sampler has a larger OD than the SPT, the resulting blow counts are not directly comparable with the SPT blow counts.

Soils samples were identified and described in general accordance with the guidelines shown on Figure A-1. Summary boring logs are included as Figures A-2 to A-11. The logs of the hand excavations are shown in Figure A-12 and the results of the air/vacuum test pits are shown on Figure A-13. The stratigraphic contacts shown on the summary logs and subsurface profiles in Figures 4 and 5 of the main report represent the approximate boundaries between soil types; actual stratigraphic contacts encountered at other locations in the field may differ from the contact elevations shown on the logs, and may be gradual rather than abrupt. The soil and groundwater conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily representative of other locations and times.

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes: 1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.

2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered: Units of material distinguished by color and/or composition from material units above and below

Laminated: Layers of soil typically 0.05 to 1mm thick, max. 1 cm

Lens: Layer of soil that pinches out laterally

Interlayered: Alternating layers of differing soil material

Pocket: Erratic, discontinuous deposit of limited extent

Homogeneous: Soil with uniform color and composition throughout

Fissured: Breaks along defined planes

Slickensided: Fracture planes that are polished or glossy

Blocky: Angular soil lumps that resist breakdown

Disrupted: Soil that is broken and mixed

Scattered: Less than one per foot

Numerous: More than one per foot

BCN: Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (140-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

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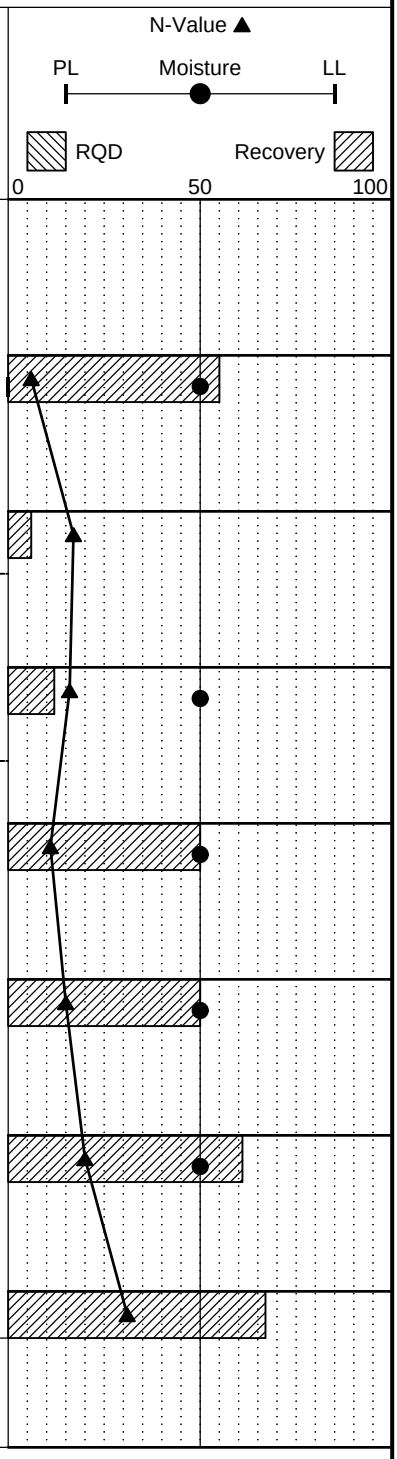
Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-47.5ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426545, Easting: 1008383	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0					Loose to medium dense, gray to green gray, silty, fine SAND (SM): wet, poorly graded, laminated, abundant shell and wood fragments. (Recent Marine Deposits).
5	S-1		1 3 3	GS	
10	S-2		9 8 9		
					Medium dense, gray to green gray, fine to coarse gravel with silt and sand: wet, with shell fragments. (Recent Marine Deposits).
15	S-3		7 8 8		4.1% Fines.
					Medium dense, gray to green gray, fine to coarse SAND (SP) with gravel: wet, with silt in some layers, poorly graded, some shell fragments, laminated, homogeneous. (Marine Deposits).
20	S-4		5 5 6	GS	
25	S-5		7 5 10	GS	
30	S-6		10 10 10		5.4% Fines.
35	S-7		22 14 17		
					Bottom of Boring.
40					



Completion Depth:	36.5ft
Date Borehole Started:	2/10/14
Date Borehole Completed:	2/10/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 57 feet from water surface at 11:50 am. Anchors dragged overnight, reset for B-1a. Sample depths adjusted for tidal flux during drilling.

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LOG OF TEST BORING B-1

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-42.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426565, Easting: 1008389	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Loose to medium dense, gray to green gray SILT and silty, fine SAND: wet, abundant wood debris to ~16 feet, shell fragments. (Recent Marine Deposits).
20						Medium dense, gray to green gray, GRAVEL with silt: wet, some shell fragments and wood. (Marine Deposits).
25						Fine, rounded, tabular gravel.
30						Abundant, fine, rounded, tabular gravel and fine to coarse sand, some shell fragments.
40						

N-Value ▲

PL — Moisture — LL

RQD — Recovery

0 — 50 — 100

Completion Depth:	101.5ft
Date Borehole Started:	2/11/14
Date Borehole Completed:	2/11/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 52.5 feet from surface at 08:45. Note: soil descriptions above 40 feet based on cuttings, drilling action, and interpolation from B-1. Sample depths adjusted for tidal flux during drilling.

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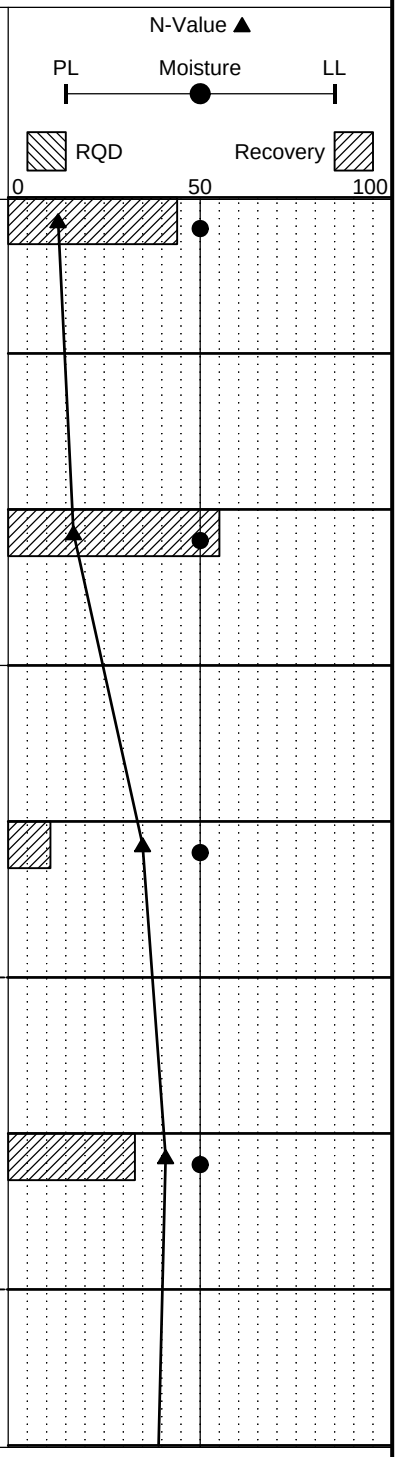
LOG OF TEST BORING B-1a

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-42.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426565, Easting: 1008389	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
40	S-7		8 6 7	GS	Medium dense, gray to green gray, fine to coarse SAND (SP) with gravel: wet, poorly graded, trace non-plastic silt, gravel rounded to sub-rounded, tabular to blocky, laminated, small shell fragments. (Marine Deposits). *(Continued)*
45					
50	S-8		11 8 9		Indistinctly laminated, small sub-angular to sub-rounded shell fragments, 4.0% Fines.
55					Dense, gray to green gray, fine to medium SAND with silt: wet, some coarse gravel, small white shell grains. (Older Marine Deposits).
60	S-9		16 17 18		5.0% Fines.
65					Dense, gray to green gray, silty, fine SAND with silt and gravel: wet, poorly graded, gravel rounded and blocky to tabular, massive, occasional shell fragments. (Older marine Deposits).
70	S-10		17 21 20		5.4% Fines.
75					Dense, gray to green gray, fine to medium SAND (SP-SM) with silt and gravel: wet, poorly graded, homogeneous, laminated with occasional shell fragments along laminae. (Older Marine Deposits).
80					



Completion Depth:	101.5ft
Date Borehole Started:	2/11/14
Date Borehole Completed:	2/11/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 52.5 feet from surface at 08:45. Note: soil descriptions above 40 feet based on cuttings, drilling action, and interpolation from B-1. Sample depths adjusted for tidal flux during drilling.

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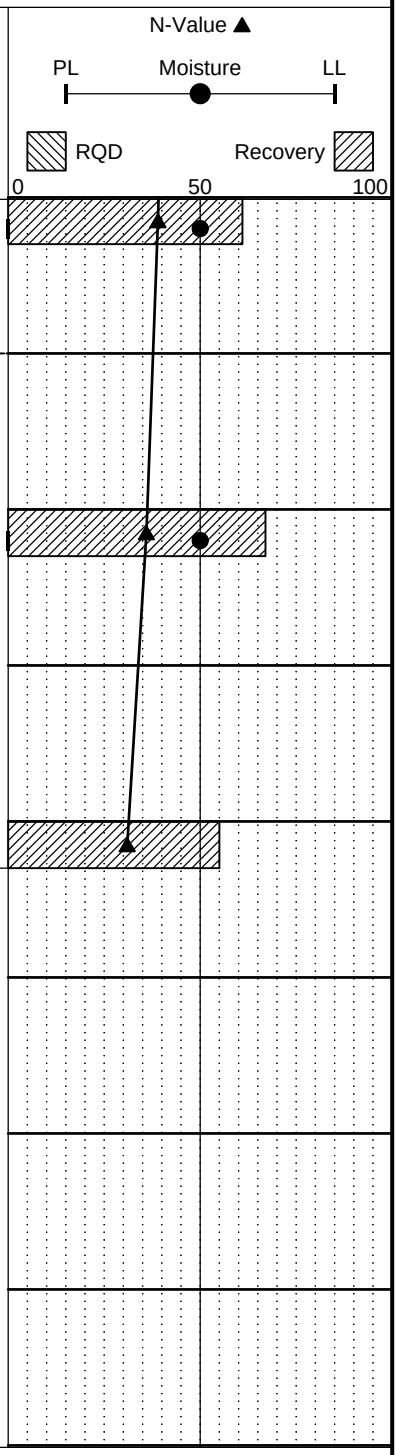
LOG OF TEST BORING B-1a

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-42.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426565, Easting: 1008389	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
80	S-11		19 17 22	GS		Dense, gray to green gray, fine to medium SAND (SP-SM) with silt and gravel: wet, poorly graded, homogeneous, laminated with occasional shell fragments along laminae. (Older Marine Deposits). *(Continued)*
85						Dense, gray to green gray, fine to coarse SAND (SW-SM) with silt and gravel: wet, well graded, laminated, scattered shell fragments. (Older Marine Deposits).
90	S-12		14 16 20	GS		
95						
100	S-13		19 14 17			
						Bottom Of Boring.
105						
110						
115						
120						



Completion Depth:	101.5ft
Date Borehole Started:	2/11/14
Date Borehole Completed:	2/11/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 52.5 feet from surface at 08:45. Note: soil descriptions above 40 feet based on cuttings, drilling action, and interpolation from B-1. Sample depths adjusted for tidal flux during drilling.

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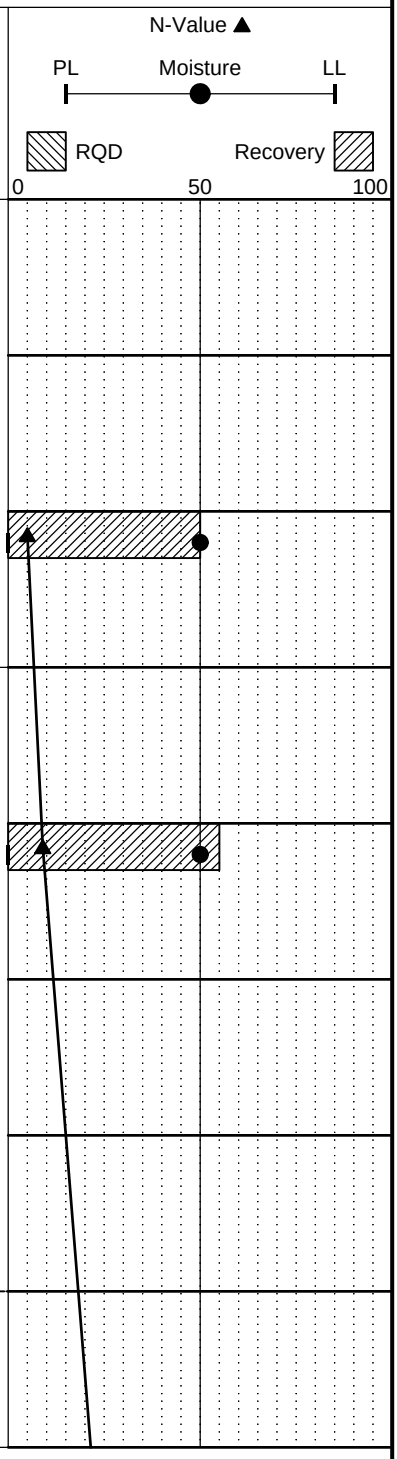
LOG OF TEST BORING B-1a

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-23.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426666, Easting: 1008079	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0					Loose, dark gray, fine to medium SAND (SP-SM) with silt: wet, poorly graded, homogeneous, indistinctly laminated to massive, abundant wood debris at top, some wood and shell fragments below. (Recent Marine Deposits).
10	S-1		3 3 2	GS	
15					Loose to medium dense, dark gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, minor silt, poorly graded, occasional shell fragments, gravel rounded and tabular, homogenous, laminated. (Marine Deposits).
20	S-2		5 5 4	GS	
30					Grading to fine SAND and silt, trace gravel.
35					Medium dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, occasional wood fragments, trace shell fragments, gravel rounded and tabular, homogenous, laminated. (Marine Deposits).
40					



Completion Depth:	101.5ft
Date Borehole Started:	2/13/14
Date Borehole Completed:	2/13/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 32 feet from surface at 09:46. Sample depths adjusted for tidal flux during drilling.

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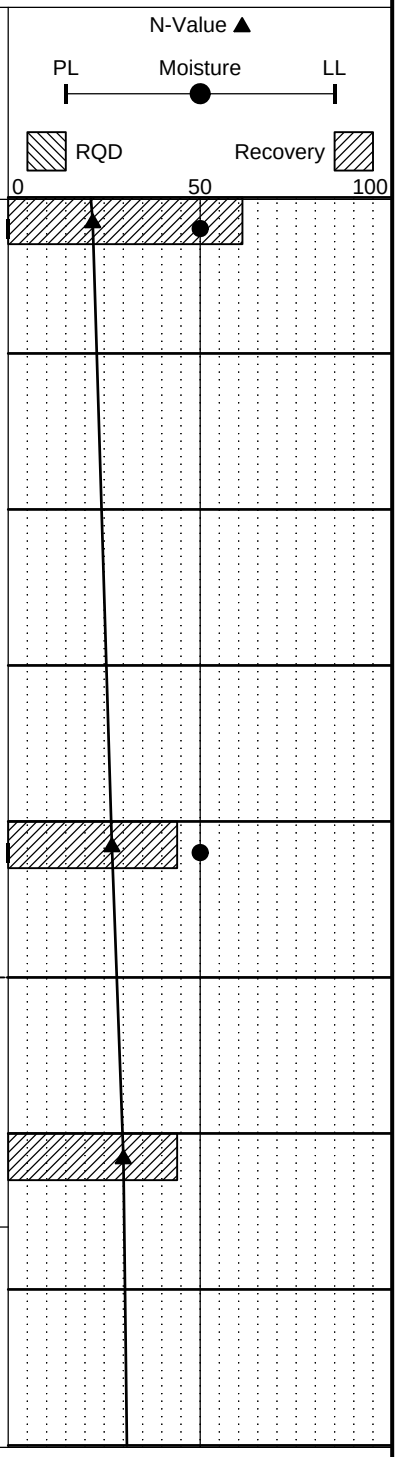
LOG OF TEST BORING B-2

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-23.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426666, Easting: 1008079	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
40	S-3		11 11 11	GS	Medium dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, occasional wood fragments, trace shell fragments, gravel rounded and tabular, homogenous, laminated. (Marine Deposits). *(Continued)*
45					
50					
55					
60	S-4		15 11 16	GS	SAND with coarse, rounded, blocky to tabular gravel.
65					Dense, gray to green gray, fine to coarse SAND: wet, well graded, trace fine gravel, sub-rounded and tabular, laminated, occasional shell fragments. (Marine Deposits).
70	S-5		11 13 17		Driller reports harder drilling at 73 feet.
75					Dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, homogeneous, laminated, occasional shell fragments, trace weathering. (Older Marine Deposits).
80					



Completion Depth:	101.5ft
Date Borehole Started:	2/13/14
Date Borehole Completed:	2/13/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 32 feet from surface at 09:46. Sample depths adjusted for tidal flux during drilling.

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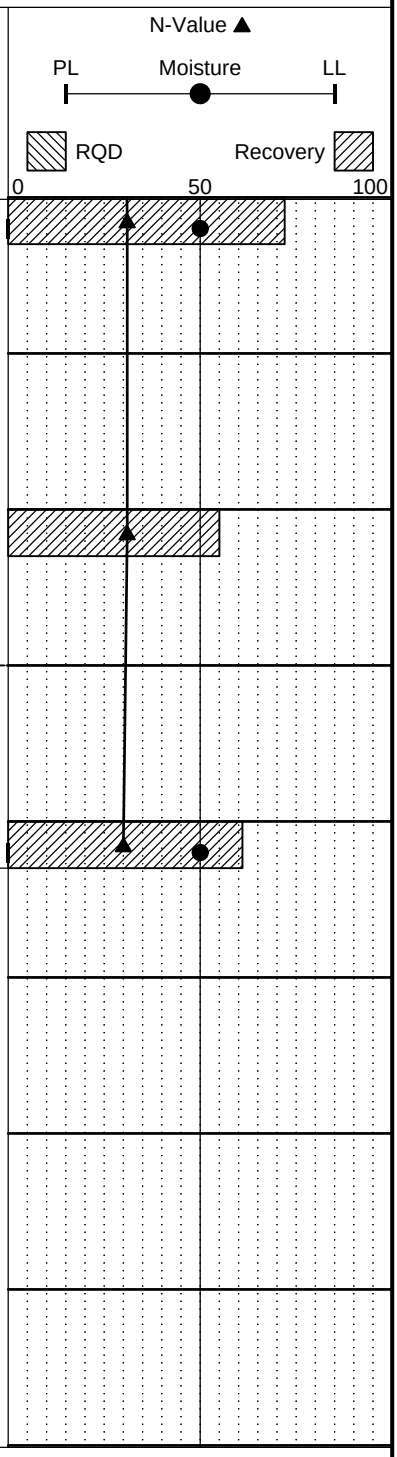
LOG OF TEST BORING B-2

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	-23.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426666, Easting: 1008079	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
80	S-6		12 16 15	GS		Dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, homogeneous, laminated, occasional shell fragments, trace weathering. (Older Marine Deposits). *(Continued)*
85						Gravel beds at 87 and 90.
90	S-7		22 14 17			Grading to gravelly, fine to coarse SAND with silt, poorly graded.
95						Dense, gray to green gray, fine to coarse SAND (SP-SM) with silt: wet, some gravel, poorly graded, homogeneous, laminated, occasional shell fragments. (Older Marine Deposits).
100	S-8		14 14 16	GS		
						Bottom of Boring.
105						
110						
115						
120						



Completion Depth:	101.5ft
Date Borehole Started:	2/13/14
Date Borehole Completed:	2/13/14
Logged By:	S. Evans
Drilling Company:	Cascade Drilling

Remarks: Mudline 32 feet from surface at 09:46. Sample depths adjusted for tidal flux during drilling.

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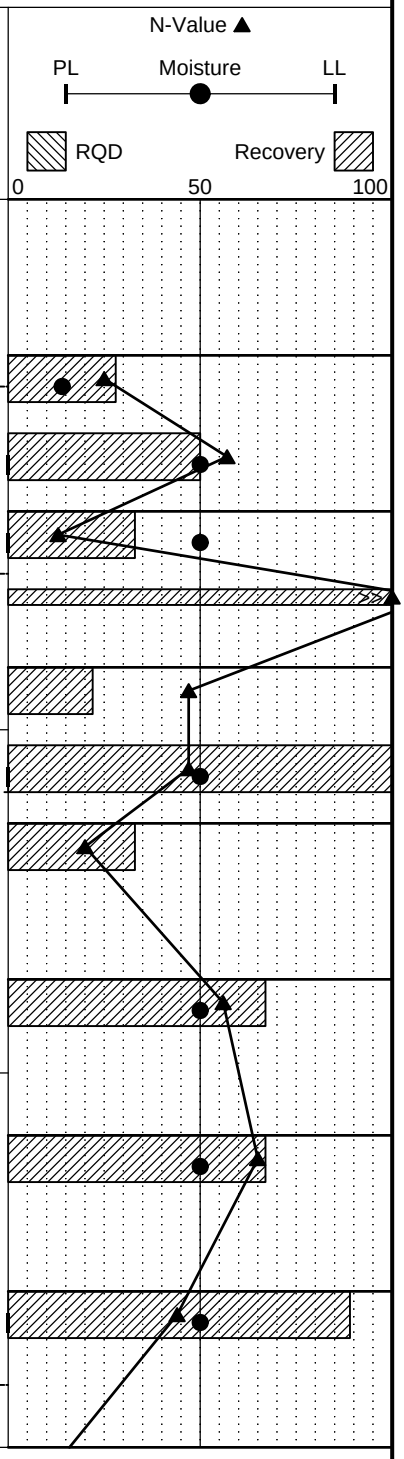
LOG OF TEST BORING B-2

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426781, Easting: 1008063	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0					Medium dense, brown, QUARRY SPALLS and CRUSHED ROCK with sand and silt: moist, slightly plastic fines, sub-angular and blocky material, mixed textures. (Fill).
5	S-1		11 15 10		Dense to medium dense, brown gray, silty GRAVEL (GM) with sand: moist to wet, low plastic fines, some clay, sub-angular and blocky gravel. (Fill).
	S-2		6 23 34	GS	
10	S-3		4 7 6	GS	Angular to sub-angular, mixed, silty plastic fines, silty GRAVEL (GM) with sand.
	S-4		50/6		Dense, dark brown gray, GRAVEL and QUARRY SPALLS with silt and clay matrix, wet, angular to sub-angular, blocky, slightly plastic fines, mixed textures, mainly basalt clasts. (Fill).
15	S-5		21 20 27		
	S-6		20 19 28	GS	Dense, brown gray, fine to coarse SAND (SP-SM) with silt and gravel beds: wet, poorly graded, sub-rounded and tabular to blocky gravel, massive. (Recent Marine Deposits).
20	S-7		2 9 11		Medium dense to very dense, dark gray to green gray, fine to coarse SAND: wet, gravel bands, trace to some silt, well graded, sub-rounded and tabular, aligned gravel, possible finer / coarser bedding, wood fibers. (Recent Marine Deposits).
25	S-8		12 27 29		2.3% Fines.
30	S-9		7 15 50		Dense to very dense, gray to green gray, fine to coarse SAND (SW-SM) with silt: wet, well graded, some finer / coarser bedding, trace to some gravel with gravel beds, trace silt, homogeneous, massive to laminated. (Marine Deposits). Silt band, gravel sub-rounded and tabular. 4.2% Fines.
35	S-10		9 24 20	GS	
40					



Completion Depth:	101.5ft
Date Borehole Started:	10/3/14
Date Borehole Completed:	10/3/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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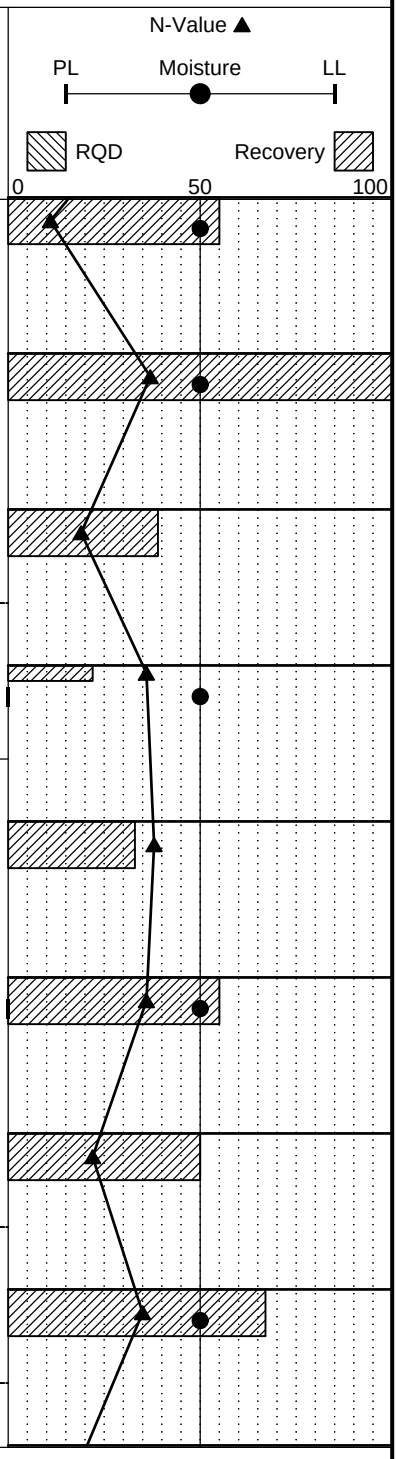
LOG OF TEST BORING B-3

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426781, Easting: 1008063	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-11		3 3 8	GS		Medium dense to dense, gray to green gray, fine to coarse SAND (SP) with gravel: wet, poorly graded, some finer / coarser bedding, gravel beds, trace silt, homogeneous, massive to laminated. (Marine Deposits). *(Continued)*
45	S-12		16 23 14	GS		Massive to indistinctly laminated, homogeneous, well graded, 4.5% Fines.
50	S-13		2 7 12			Soft at top.
55	S-14		9 18 18	GS		Medium dense to dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, some finer / coarser bedding, gravel beds, homogeneous, massive to laminated. (Marine Deposits).
60	S-15		8 18 20			Medium dense to dense, brown gray to gray, gravelly, fine to coarse SAND (SP-SM) with silt and gravel: wet, well graded, sub-rounded and blocky gravel, massive. (Older Marine Deposits).
65	S-16		4 16 20	GS		Fine to coarse SAND with gravel.
70	S-17		6 10 12			Gravel sub-rounded, tabular to blocky.
75	S-18		9 17 18			Dense, gray to green gray, fine to coarse SAND: wet, some fine, sub-rounded, prismatic to tabular gravel, trace silt, homogenous, massive, rapid dilatancy. (Older Marine Deposits). 4.5% Fines.
80						



Completion Depth:	101.5ft
Date Borehole Started:	10/3/14
Date Borehole Completed:	10/3/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

PanGEO INCORPORATED

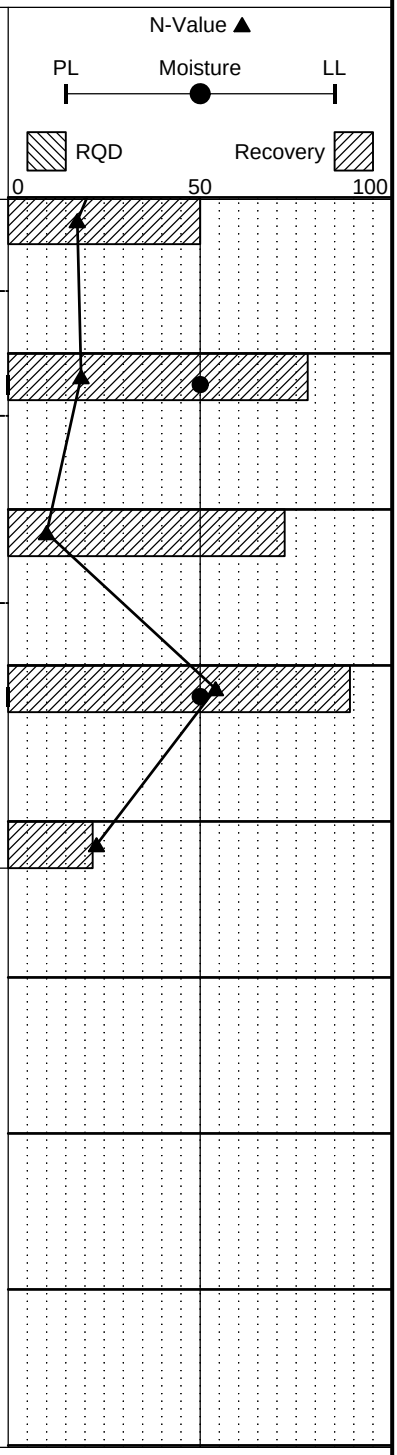
LOG OF TEST BORING B-3

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426781, Easting: 1008063	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
80	S-19		2 5 13			Medium dense, gray to green gray, fine to medium SAND: wet, poorly graded, trace fine, sub-rounded, blocky gravel, trace silt, homogeneous, massive. (Older Marine Deposits). *(Continued)*
						Medium dense, gray to green gray, fine to coarse SAND (SP-SM) with silt: wet, well graded, some fine gravel, grading coarser downward, homogeneous. (Older Marine Deposits).
85	S-20		10 8 11	GS		
						Loose to medium dense, gray to green gray, fine to medium SAND: wet, poorly graded, occasional coarse sand and fine tabular gravel in beds, trace silt, massive. (Older marine Deposits).
90	S-21		4 4 6			
						Medium dense, gray to green gray, fine to coarse SAND (SP) with gravel: wet, poorly graded, sub-rounded tabular gravel beds, trace silt, fine bedded to massive. (Older Marine Deposits).
95	S-22		17 28 26	GS		
100	S-23		4 5 18			Possible finer and coarser beds.
						Bottom of Boring.
105						
110						
115						
120						



Completion Depth:	101.5ft
Date Borehole Started:	10/3/14
Date Borehole Completed:	10/3/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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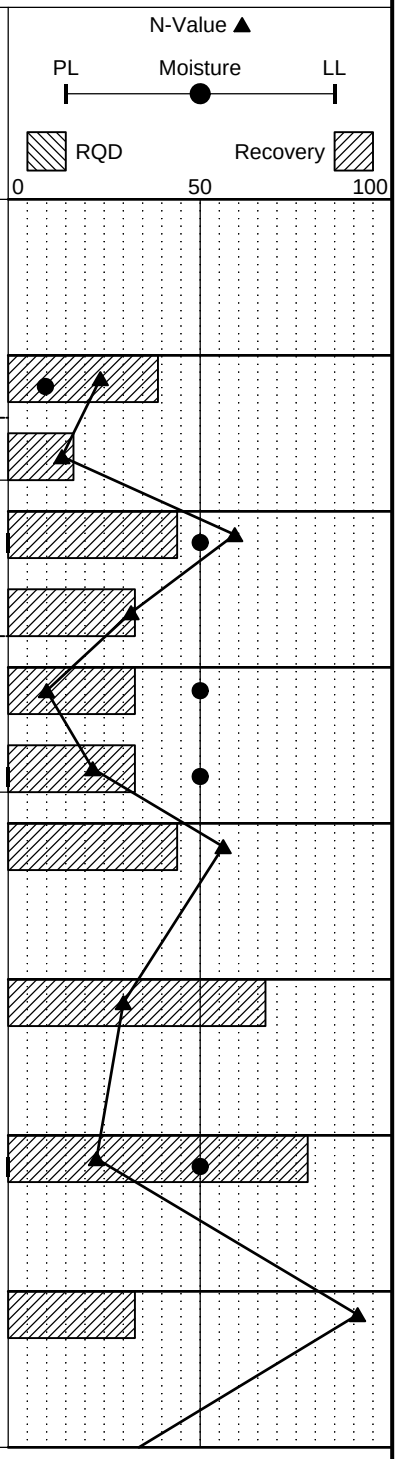
LOG OF TEST BORING B-3

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	9.5ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426876, Easting: 1008063	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Dense to medium dense, brown, silty SAND with angular gravel: moist, poorly graded. mixed. (Fill).
5	S-1		43 16 8			
	S-2		12 9 5			Medium dense, brown, coarse GRAVEL with silt: wet, slightly plastic fines, rounded and blocky. (Fill).
10	S-3		7 35 24	GS		Medium dense, brown gray, silty, fine to coarse SAND (SM) with gravel: wet, sub-rounded, blocky,, non-plastic fines. (Near Shore Deposits).
	S-4		15 20 12			
15	S-5		5 4 6			Medium dense, brown gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, gravel sub-rounded, massive. (Near Shore Deposits). 4.1% Fines.
	S-6		13 13 9	GS		Trace non-plastic silt.
20	S-7		10 22 34			Medium dense to very dense, gray to green gray, fine to coarse SAND (SW) with gravel: wet, well graded, trace silt, laminated to massive, homogeneous. (Marine Deposits).
25	S-8		12 16 14			
30	S-9		6 10 13	GS		Some fine sand interbeds, trace fine gravel, some quartz, mostly basalt, 8 inches of heave.
35	S-10		47 47 44			2 feet of heave, lift augers to flush disturbed material, trace fine gravel, non-plastic silt.
40						



Completion Depth:	51.5ft
Date Borehole Started:	9/29/14
Date Borehole Completed:	9/29/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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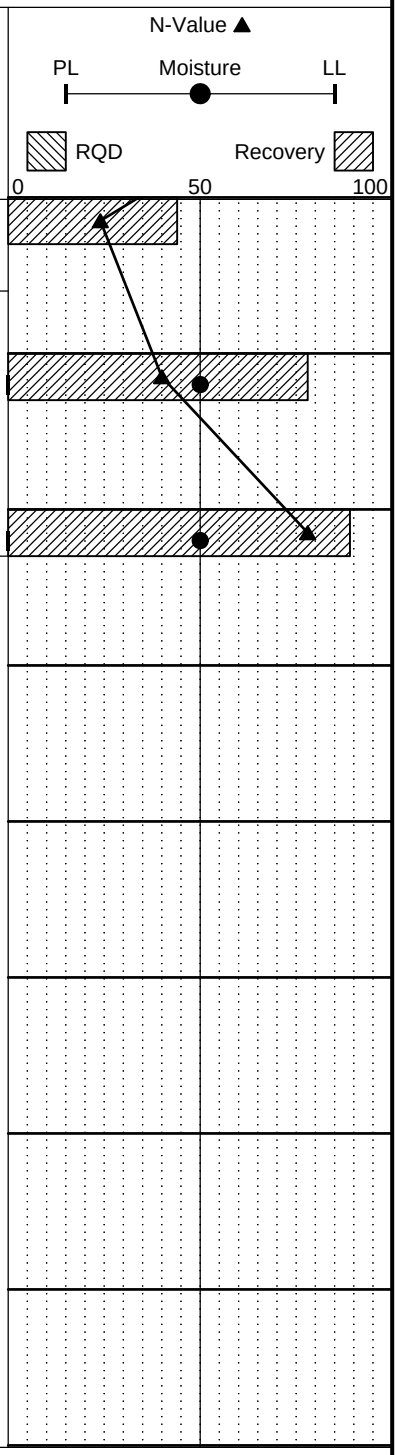
LOG OF TEST BORING B-4

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	9.5ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426876, Easting: 1008063	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-11		23 12 12			Medium dense to very dense, gray to green gray, fine to coarse SAND (SW) with gravel: wet, well graded, trace silt, laminated to massive, homogeneous. (Marine Deposits). *(Continued)*
						Occasional tabular to blocky gravel, trace non-plastic silt.
45	S-12		17 14 26	GS		Dense to very dense, gray to green gray, fine to medium SAND (SP-SM) with silt and gravel: wet, poorly graded, fine, sub-rounded and tabular gravel, laminated. (Older Marine Deposits).
50	S-13		21 28 50	GS		1 foot heave, grading to poorly graded SAND (SP-SM) with silt.
						Bottom of Boring.
55						
60						
65						
70						
75						
80						



Completion Depth:	51.5ft
Date Borehole Started:	9/29/14
Date Borehole Completed:	9/29/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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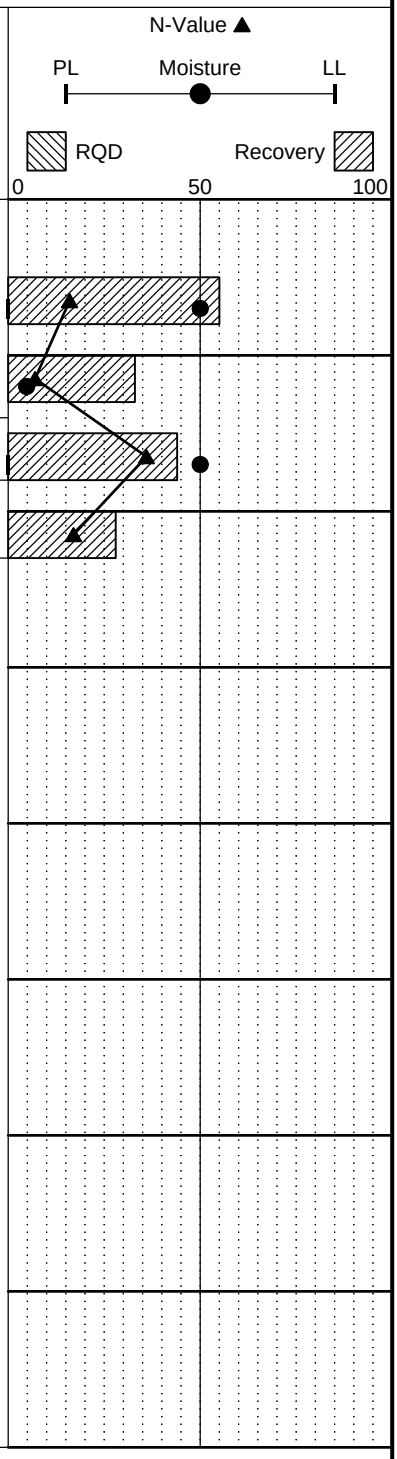
LOG OF TEST BORING B-4

Figure A-6

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	12.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426969, Easting: 1008116	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		12 8 8	GS		Loose to medium dense, brown gray GRAVEL (GP) with silt and sand: dry to moist, poorly graded, trace silt, massive with a trace of organics. (Fill).
5	S-2		5 5 2			Some gravel.
	S-3		15 17 19	GS		Medium dense to dense, brown, GRAVEL (GP-GM) with silt and sand: wet, poorly graded, non-plastic fines, gravel sub-rounded and prismatic to tabular, trace fine organics and organic fibers. (Near Shore Deposits).
10	S-4		8 8 9			Medium dense, dark brown, fine to coarse SAND with gravel: wet, well graded, gravel sub-rounded and blocky, scattered organic fibers. (Near Shore Deposits).
						Bottom of Boring.
15						
20						
25						
30						
35						
40						



Completion Depth:	11.5ft
Date Borehole Started:	9/30/14
Date Borehole Completed:	9/30/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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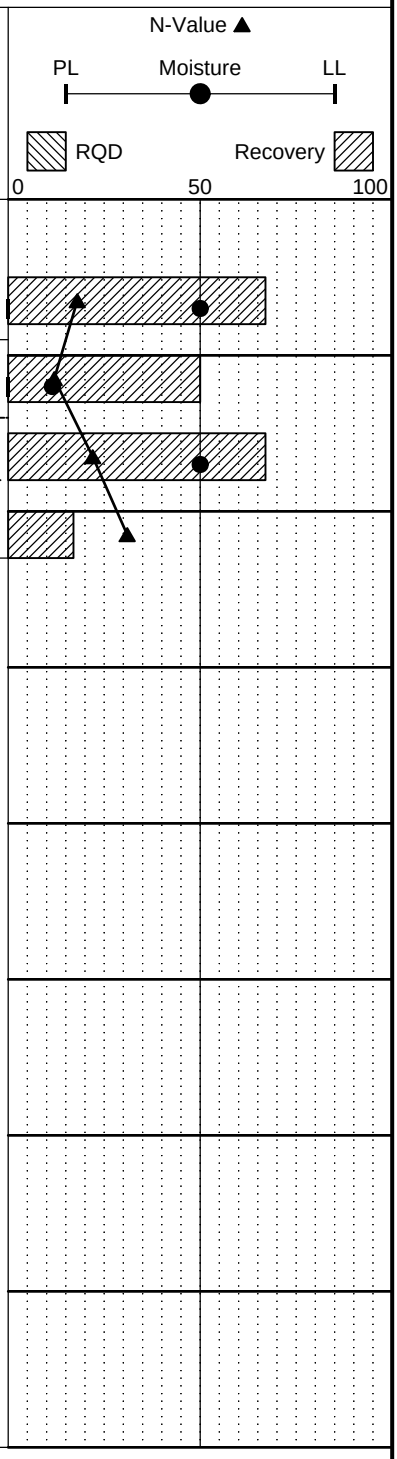
LOG OF TEST BORING B-5

Figure A-7

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426889, Easting: 1008456	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Medium dense, light brown gray SAND (SP) with gravel: dry, poorly graded, trace silt, massive, occasional organics. (Fill).
	S-1		15 10 8	GS		
5	S-2		4 6 6	GS		Medium dense dark brown gray, fine to medium SAND (SP-SM) with silt and gravel: wet, poorly graded, sub-rounded, tabular to blocky gravel, massive. (Near Shore Deposits).
	S-3		14 11 11	GS		Medium dense, dark brown gray, fine to coarse SAND (SP) with gravel: wet, poorly graded, some gravel, trace silt, laminated, occasional lumps of clayey organics. (Near Shore Deposits).
10	S-4		11 18 13			Dense, dark brown gray, GRAVEL with silt: wet, some fine to coarse sand, poorly graded, sub-rounded to sub-angular and blocky, massive, trace of organic fibers. (Recent Marine / Beach Deposits).
						Bottom of Boring.
15						
20						
25						
30						
35						
40						



Completion Depth:	11.5ft
Date Borehole Started:	9/30/14
Date Borehole Completed:	9/30/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Alternated SPT and modified California sampler to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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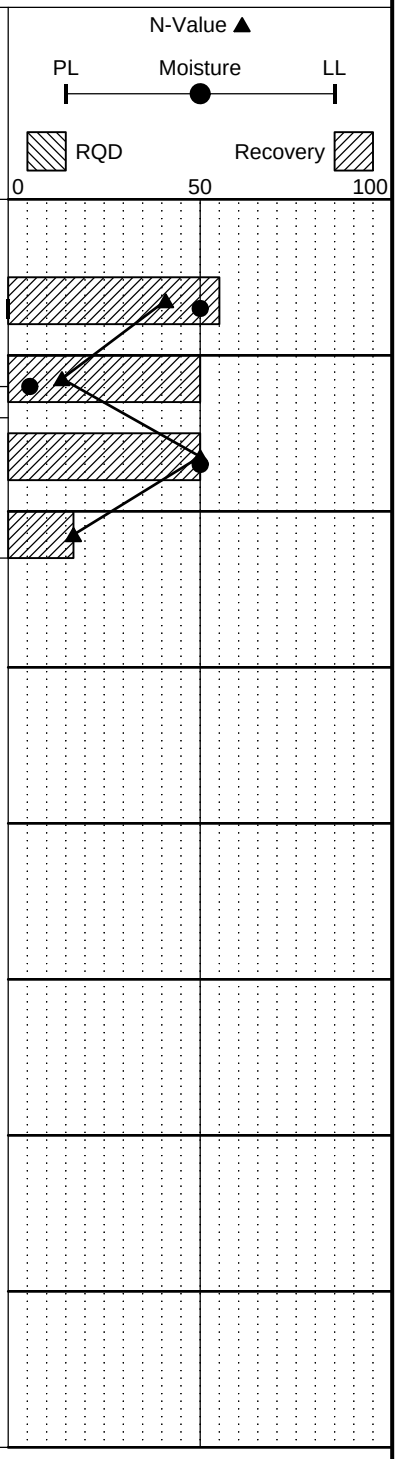
LOG OF TEST BORING B-6

Figure A-8

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.5ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426835, Easting: 1008963	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Medium dense, gray, fine to coarse SAND (SP-SM) with silt and fine gravel: dry to moist, poorly graded, trace silt, gravel sub-rounded and platy. (Fill).
	S-1		18 22 19	GS		
5	S-2		6 8 6			Becoming well graded.
						Medium dense, brown, peaty SAND: moist. (Near Shore Deposits).
	S-3		8 20 30	GS		Medium dense, gray to brown gray GRAVEL (GP) with sand: wet, poorly graded, gravel sub-rounded and tabular, trace to some silt, massive. (Near Shore Deposits).
10	S-4		7 10 7			Grading to fine to coarse SAND with gravel.
						Bottom of Boring.
15						
20						
25						
30						
35						
40						



Completion Depth:	11.5ft
Date Borehole Started:	9/30/14
Date Borehole Completed:	9/30/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. SPT and modified California sampler at selected intervals to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer.

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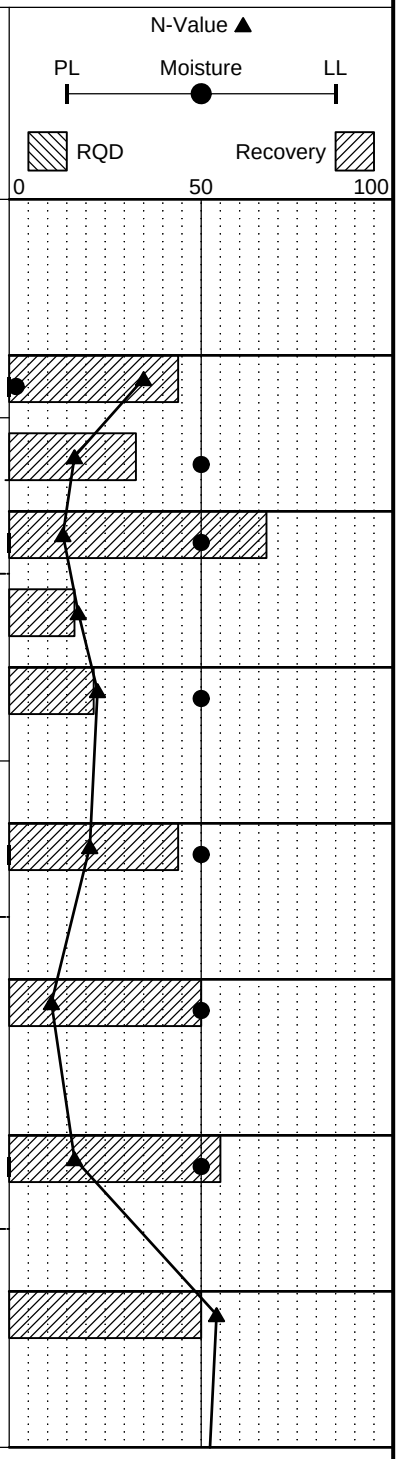
LOG OF TEST BORING B-7

Figure A-9

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	10.5ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426777, Easting: 1008905	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	MATERIAL DESCRIPTION
0					Medium dense to dense, light gray and brown GRAVEL (GP-GM) with silt and sand: dry, poorly graded, fine to coarse sub-angular and blocky gravel. (Fill).
5	S-1		8 24 11	GS	
	S-2		8 5 12	GS	Medium dense, gray, sandy, fine GRAVEL (GP) with sand: wet, poorly graded, sub-rounded, tabular to blocky, trace of organic fibers. (Near Shore Deposits).
10	S-3		7 7 7	GS	Medium dense, brown gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, some sub-rounded gravel, non-plastic fines, abundant organic fibers, massive. (Near Shore Deposits).
	S-4		3 8 10		Medium dense, gray, fine to coarse GRAVEL: wet, some sand, trace silt, sub-rounded, tabular to blocky. (Near Shore Deposits).
15	S-5		12 13 10		1.8% Fines.
					Medium dense, brown gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, silt non-plastic, gravel sub-rounded and tabular, laminated. (Marine Deposits).
20	S-6		13 12 9	GS	
					Medium dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, non-plastic silt, laminated with brown bands at top. (Marine Deposits).
25	S-7		7 4 7		5.8% Fines.
30	S-8		8 8 9	GS	Grading dark gray.
					Dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, non-plastic silt, gravel sub-rounded and tabular, gravel beds, massive to laminated. (Marine Deposits).
35	S-9		13 18 36		
40					



Completion Depth:	61.5ft
Date Borehole Started:	9/30/14
Date Borehole Completed:	10/1/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Collapsing condition caused boring abandonment. Moved 17 feet east.

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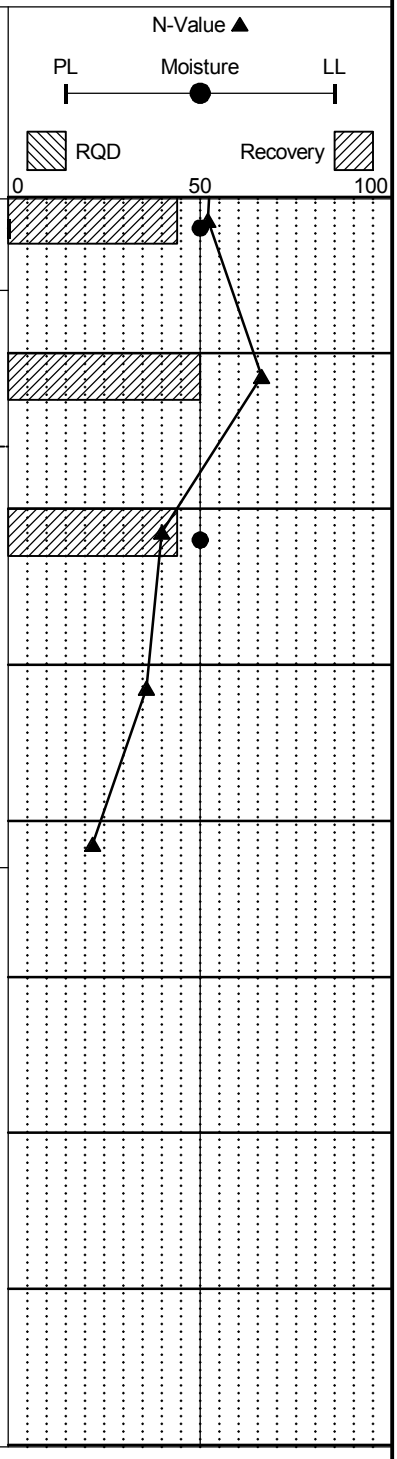
LOG OF TEST BORING B-8

Figure A-10

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	10.5ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	Mud Rotary
Coordinates:	Northing: 426777, Easting: 1008905	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
40	S-10		17 25 27	GS		Dense, gray to green gray, fine to coarse SAND (SP-SM) with silt and gravel: wet, poorly graded, non-plastic silt, gravel sub-rounded and tabular, gravel beds, massive to laminated. (Marine Deposits). *(Continued)*
						Very dense, gray, fine to coarse GRAVEL with sand: wet, poorly graded, sub-rounded, trace silt, massive. Possible beach old deposit unit. Abundant wood fibers at 43 feet. (Older Marine Deposits).
45	S-11		24 26 40			
						Dense, gray to green gray, fine to coarse SAND with silt: wet, some sub-rounded and tabular gravel, massive. (Older Marine Deposits).
50	S-12		12 15 25	GS		6.1% Fines.
55	S-13		22 16 20			Casing advanced after every drilling interval, boring collapsing.
60	S-14		11 12 10	%Fines		8.7% Fines.
						Bottom of Boring.
						Boring abandoned due to caving condition, moved 17 feet east for B-8a.
65						
70						
75						
80						



Completion Depth:	61.5ft
Date Borehole Started:	9/30/14
Date Borehole Completed:	10/1/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. Collapsing condition caused boring abandonment. Moved 17 feet east.

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LOG OF TEST BORING B-8

Figure A-10

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426760, Easting: 1008905	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION	N-Value ▲ / PL Moisture LL / RQD Recovery (0 50 100)	Instrument
0						See log for B-8 for stratigraphy between 0 and 50 feet..		
5								
10								
15								
20								
25								
30								
35								
40								

Completion Depth:	101.5ft
Date Borehole Started:	10/1/14
Date Borehole Completed:	10/1/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. SPT and modified California sampler at selected intervals to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer. Slope inclinometer casing installed for seismic testing.

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LOG OF TEST BORING B-8a

Figure A-11

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426760, Easting: 1008905	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION	N-Value ▲ / PL Moisture LL / RQD Recovery (0 50 100)	Instrument
40						See log for B-8 for stratigraphy between 0 and 50 feet.. *(Continued)*		
45								
50	S-1		28 17 18			Medium dense to dense, gray to green gray, gravelly, fine to coarse SAND (SW) with gravel: wet, well graded, minor silt, sub-rounded and tabular, laminated and clast aligned. (Marine Deposits).		
55	S-2		5 9 11	GS		Grading to SAND with gravel.		
60	S-3		8 8 12			Medium dense, gray, fine GRAVEL with sand: wet, poorly graded, sub-rounded and blocky, massive, multiple lithologies. (Marine Deposits). 3.7% Fines.		
65	S-4		9 11 12					
						Medium dense, gray to green gray, fine to coarse SAND with gravel: wet, well graded, minor silt, sub-rounded and tabular, laminated and clast aligned. (Marine Deposits).		
70	S-5		10 11 14					
75	S-6		12 23 14	GS		Dense, green gray, interbedded, fine to coarse SAND (SP-SM) with silt: wet, poorly graded, non-plastic fines, fine bedded (3 to 4 inches), with finer / coarser beds, occasional sub-rounded, fine gravel. (Older Marine Deposits).		
80								

Completion Depth:	101.5ft
Date Borehole Started:	10/1/14
Date Borehole Completed:	10/1/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. SPT and modified California sampler at selected intervals to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer. Slope inclinometer casing installed for seismic testing.

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LOG OF TEST BORING B-8a

Figure A-11

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	P993 TPS Forward Operating Location	Surface Elevation:	11.0ft
Job Number:	14-007.100	Top of Casing Elev.:	
Location:	1 Ediz Hook Road, Port Angeles, WA	Drilling Method:	HSA
Coordinates:	Northing: 426760, Easting: 1008905	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION	N-Value ▲ / PL–Moisture–LL / RQD / Recovery (0–50–100)	Instrument
80	S-7		6 12 16			Medium dense, green gray, fine to coarse SAND: wet, well graded, trace silt and sub-rounded, blocky gravel, laminated. (Older Marine Deposit). *(Continued)*		
						Medium dense, green gray, fine to coarse SAND (SP) with gravel: wet, poorly graded, trace silt, gravelly beds, fine bedded and laminated with brown laminae. (Older Marine Deposits).		
85	S-8		13 16 19	GS				
						Dense, green gray, interbedded, fine to coarse SAND and fine SAND with silt: wet, some fine blocky gravel in coarse beds, well and poorly graded, laminated with slightly weathered clay band. (Older Marine Deposits).		
90	S-9		11 39 50/4				>>▲	
						Medium dense, green gray, fine to coarse SAND (SP) with gravel: wet, poorly graded, gravelly beds, gravel sub-rounded and blocky, fine bedded. (Older marine Deposits).		
95	S-10		13 12 17	GS				
						Very dense. green gray, fine to coarse SAND: wet, well graded, minor silt, occasional gravel, homogeneous, laminated. (Older marine Deposits).		
100	S-11		11 22 50					
						Bottom of Boring.		
105								
110								
115								
120								

Completion Depth:	101.5ft
Date Borehole Started:	10/1/14
Date Borehole Completed:	10/1/14
Logged By:	S. Evans
Drilling Company:	Holocene Drilling

Remarks: Land boring. SPT and modified California sampler at selected intervals to obtain better soil sample recovery for index testing. Sampler driven with 140-pound safety hammer. Slope inclinometer casing installed for seismic testing.

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LOG OF TEST BORING B-8a

Figure A-11

The stratification lines represent approximate boundaries. The transition may be gradual.

Figure A-12

Hand Excavation Logs

B-5H, located approximately 5 feet east of B-5	
Depth (feet)	Description
0.0 – 0.25	Sod
0.25 – 0.5	Very dense, gravelly, fine to medium SAND with quarry spalls: moist, trace silt
0.5 – 4.0	Medium dense to dense, brown to gray, fine to coarse SAND (SP) with gravel: moist to wet at 4 feet, trace silt, rounded, tabular to platy gravel, cobbles. One gallon grab sample 2'-4'. (Fill)

B-6H, located approximately 4 feet east of B-6	
Depth (feet)	Description
0.0 – 0.25	Sod
0.25 – 0.5	Very dense, gravelly, fine to medium SAND with quarry spalls: moist, trace silt
0.5 – 4.1	Medium dense to dense, brown, fine to coarse SAND (SP) with gravel: moist to wet at 4 feet, poorly graded, trace silt, rounded, tabular to platy gravel, cobbles. One gallon grab sample 2'-4'. (Fill)

B-7H, located approximately 5 feet east of B-7	
Depth (feet)	Description
0.0 – 0.3	Sod
0.3 – 4.5	Loose to dense, brown to gray, fine to coarse SAND (SP) with gravel: moist to wet at 4 feet, poorly graded, trace silt, rounded, tabular to platy gravel, cobbles. Groundwater at 4.0 feet. One gallon grab Sample 2'-4'. (Fill)

Figure A-13

Test Pit (Air-Vacuum) Excavations

Materials encountered in test pits TP-1-15 through TP-4-15 consisted of medium dense to dense, gravelly fine to coarse SAND which was moist with cobbles and trace fines. All excavation for the test pits was conducted using an Air Vacuum truck equipped with a high pressure soil knife. The upper 2 feet of soil from the test pits was not retrieved for sampling. The soil from 2 to 6 feet was collected and a 40 pound composite sample was retrieved for laboratory testing.

Ground water was not encountered in any of the test pits. However, the test pits were excavated at low tide.

APPENDIX B

LABORATORY TESTING

LABORATORY TESTING

This appendix contains descriptions of the procedures and results of physical (geotechnical) laboratory testing conducted on soil samples recovered during the field exploration program. The selected samples were tested to determine basic physical index properties of the soils for purposes of classifying the material types encountered and to measure or correlate parameters used in the geotechnical design.

The laboratory tests were performed in general accordance with the following ASTM Standard Test Methods:

D 2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

D 421/422 – Standard Test Method for Particle-Size Analysis of Soils

D 2974 – Standard Test Method for Moisture. Ash, and Organic Matter of Peat and Other Organic Soils

Test methodology for determining cation exchange capacity:

EPA Method 980

Test Methodology for Determining the Corrosivity of Soils, per Appendix A of AWWA C105, includes the following tests:

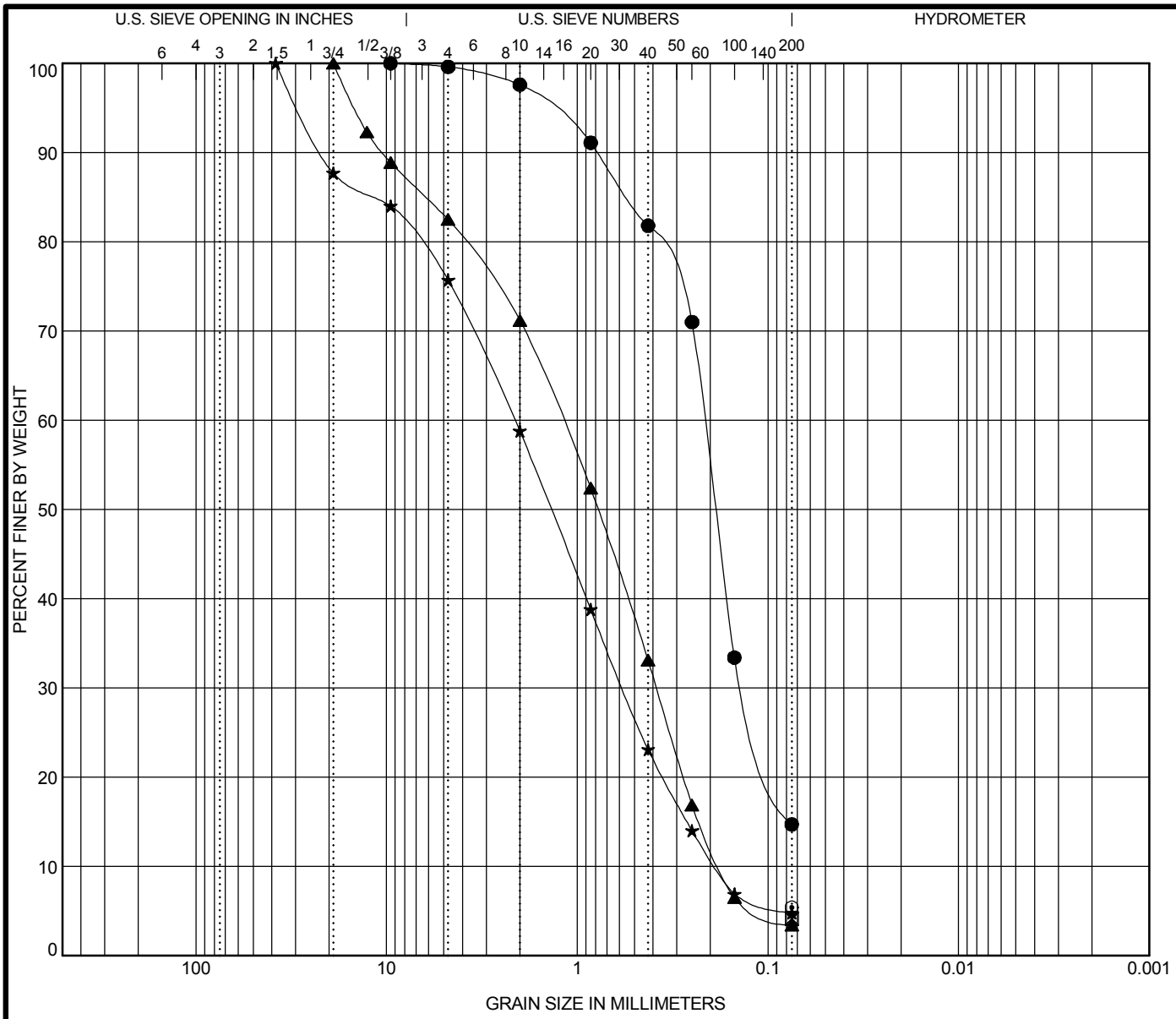
AASHTO T288 - Soil resistivity

SW 9045 - pH

SM 2580 - Oxidation-reduction (redox) potential

SM 4500-S2D - Sulfides

Moisture contents (where determined) are shown on the summary boring logs. The results of particle-size analyses (grain size distribution) are presented on Figures B-1thru B-14. Corrosivity and other test results are included on Figure B-15.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-1	@ 6.0 ft.	SILTY SAND(SM)					
⊠	B-1	@ 16.0 ft.						
▲	B-1	@ 21.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.69	6.74
★	B-1	@ 26.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.83	11.34
⊙	B-1	@ 31.0 ft.						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	6.0	9.525	0.215	0.132		0.4	84.9	14.7	
⊠	B-1	16.0	0.075				0.0	0.0	4.1	
▲	B-1	21.0	19.05	1.201	0.384	0.178	17.5	79.1	3.4	
★	B-1	26.0	38.1	2.127	0.576	0.187	24.3	70.9	4.8	
⊙	B-1	31.0	0.075				0.0	0.0	5.4	

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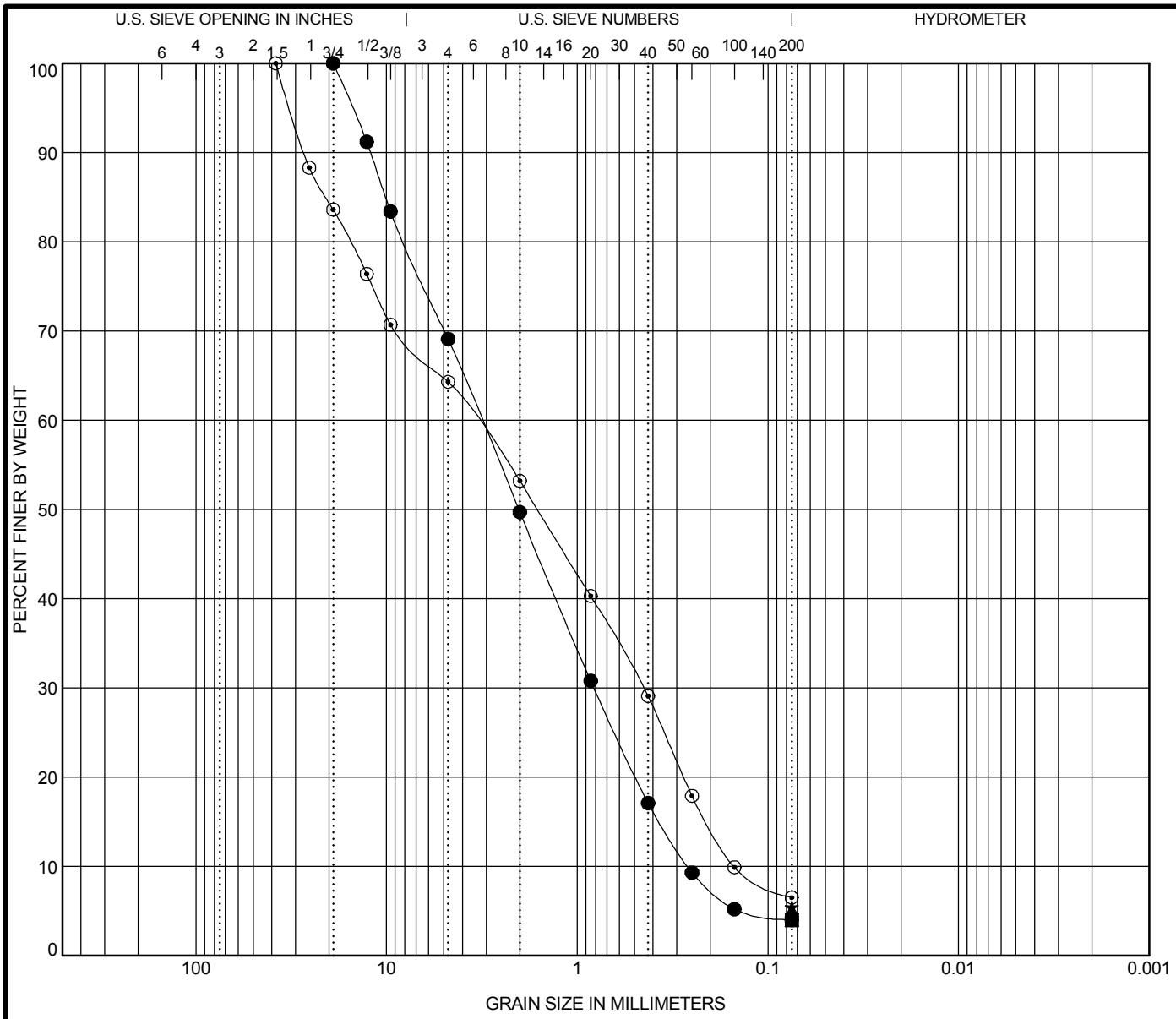
GRAIN SIZE DISTRIBUTION

Project: P993 TPS Forward Operating Location
Job Number: 14-007.100
Location: 1 Ediz Hook Road, Port Angeles, WA

Figure B-1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-1a	@ 41.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.80	12.07
⊠	B-1a	@ 51.0 ft.						
▲	B-1a	@ 61.0 ft.						
★	B-1a	@ 71.0 ft.						
⊙	B-1a	@ 81.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.39	22.51

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1a	41.0	19.05	3.166	0.816	0.262	30.9	65.1	4.0	
⊠	B-1a	51.0	0.075				0.0	0.0	4.0	
▲	B-1a	61.0	0.075				0.0	0.0	5.0	
★	B-1a	71.0	0.075				0.0	0.0	5.4	
⊙	B-1a	81.0	38.1	3.398	0.449	0.151	35.7	57.8	6.5	

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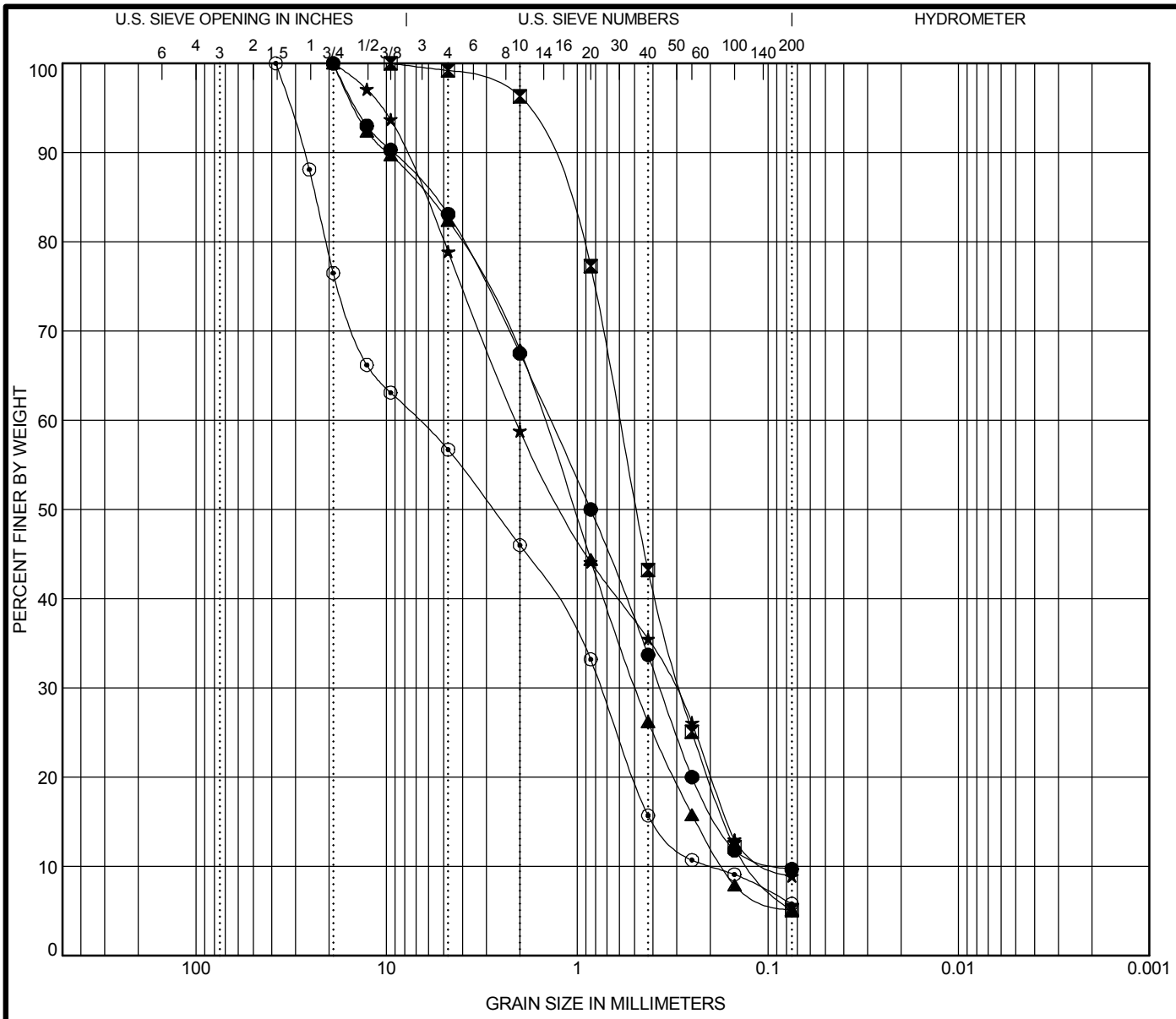
GRAIN SIZE DISTRIBUTION

Project: P993 TPS Forward Operating Location
Job Number: 14-007.100
Location: 1 Ediz Hook Road, Port Angeles, WA

Figure B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-1a	@ 91.0 ft.	WELL-GRADED SAND with SILT and GRAVEL(SW-SM)				1.18	16.74
⊠	B-2	@ 11.0 ft.	POORLY GRADED SAND with SILT(SP-SM)				1.15	4.94
▲	B-2	@ 21.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.94	8.73
★	B-2	@ 41.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.51	23.31
⊙	B-2	@ 61.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.41	34.01

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1a	91.0	19.05	1.386	0.368	0.083	16.9	73.4	9.7	
⊠	B-2	11.0	9.525	0.598	0.289	0.121	0.8	94.1	5.1	
▲	B-2	21.0	19.05	1.5	0.491	0.172	17.6	77.3	5.1	
★	B-2	41.0	19.05	2.106	0.312	0.09	21.1	70.0	8.9	
⊙	B-2	61.0	38.1	6.8	0.749	0.2	43.3	50.9	5.8	

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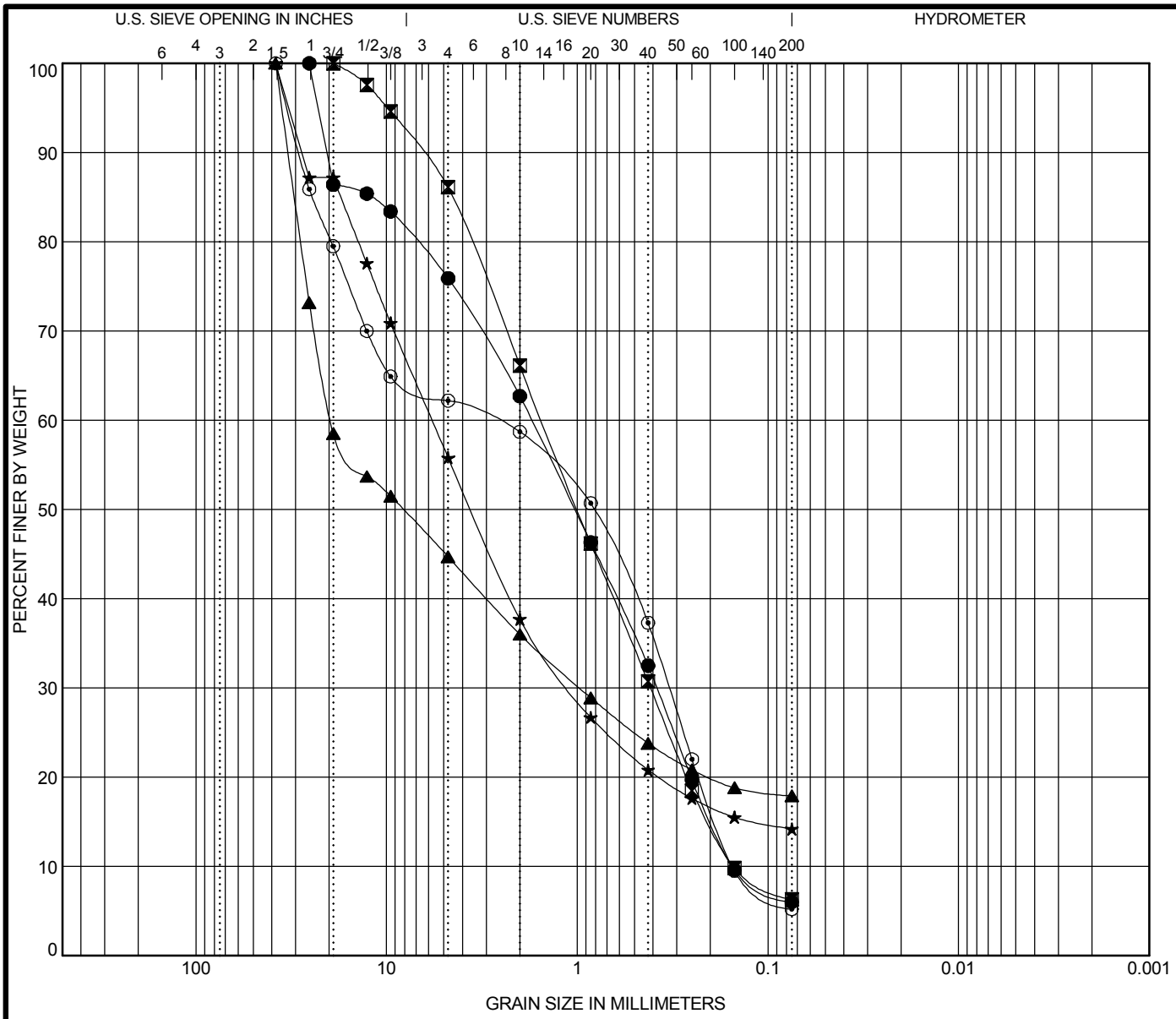
Figure B-3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-2	@ 81.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.55	11.35
⊠	B-2	@ 101.0 ft.	POORLY GRADED SAND with SILT(SP-SM)				0.73	10.14
▲	B-3	@ 8.5 ft.	SILTY GRAVEL with SAND(GM)					
★	B-3	@ 11.0 ft.	SILTY GRAVEL with SAND(GM)					
⊙	B-3	@ 18.5 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.26	18.01

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2	81.0	25.4	1.737	0.383	0.153	24.1	69.9	6.0	
⊠	B-2	101.0	19.05	1.539	0.412	0.152	13.9	79.8	6.3	
▲	B-3	8.5	38.1	19.618	0.97		55.3	26.8	17.9	
★	B-3	11.0	38.1	5.764	1.099		44.2	41.6	14.2	
⊙	B-3	18.5	38.1	2.758	0.33	0.153	37.8	57.0	5.2	

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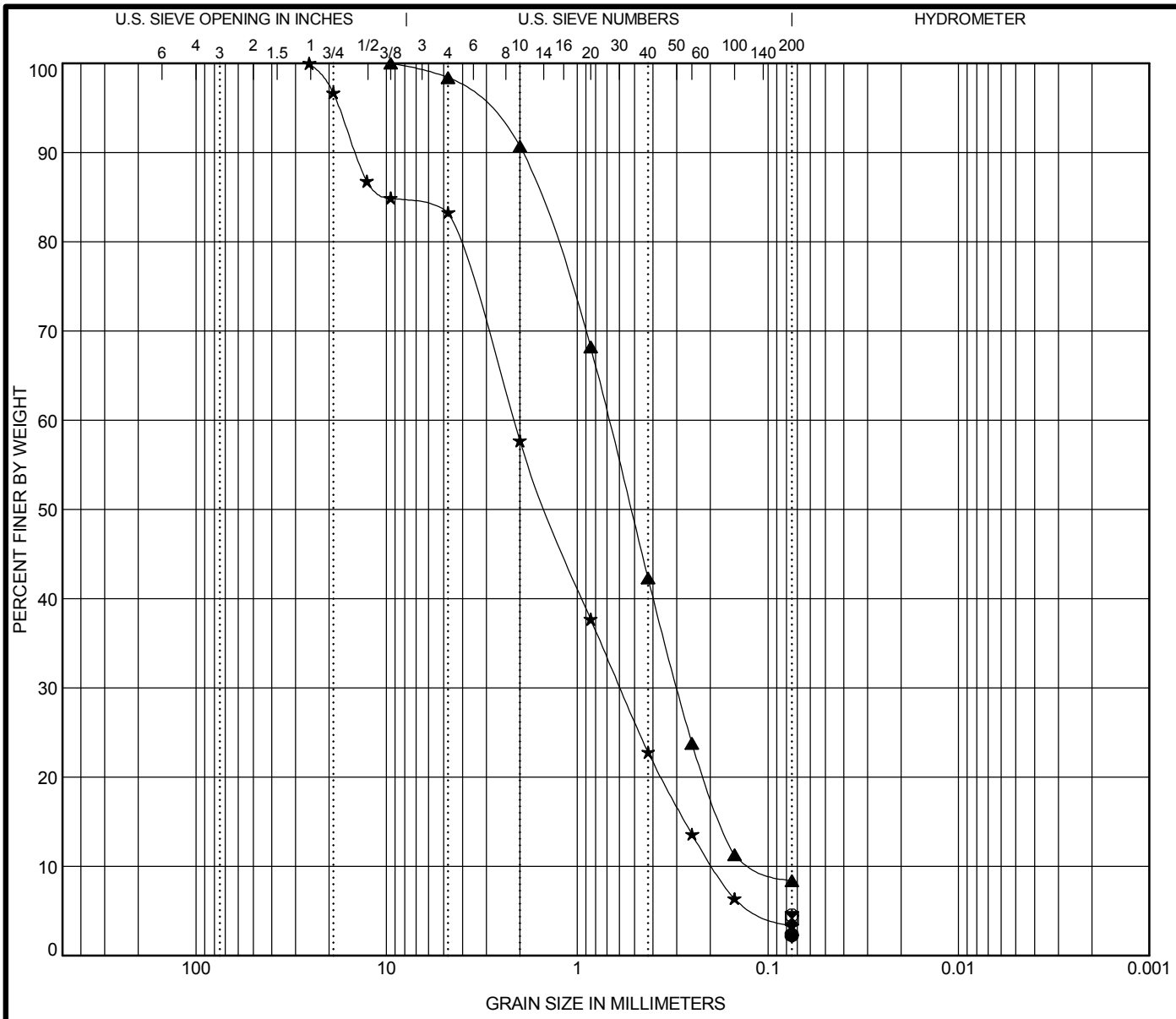
Figure B-4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-3	@ 26.0 ft.						
⊠	B-3	@ 31.0 ft.						
▲	B-3	@ 36.0 ft.	**WELL-GRADED SAND with SILT(SW-SM)**				**1.19**	**6.21**
★	B-3	@ 41.0 ft.	**POORLY GRADED SAND with GRAVEL(SP)**				**0.84**	**11.16**
⊙	B-3	@ 46.0 ft.						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3	26.0	0.075				0.0	0.0	2.3	
⊠	B-3	31.0	0.075				0.0	0.0	4.2	
▲	B-3	36.0	9.525	0.683	0.299	0.11	1.6	90.0	8.4	
★	B-3	41.0	25.4	2.162	0.594	0.194	16.7	80.0	3.3	
⊙	B-3	46.0	0.075				0.0	0.0	4.5	

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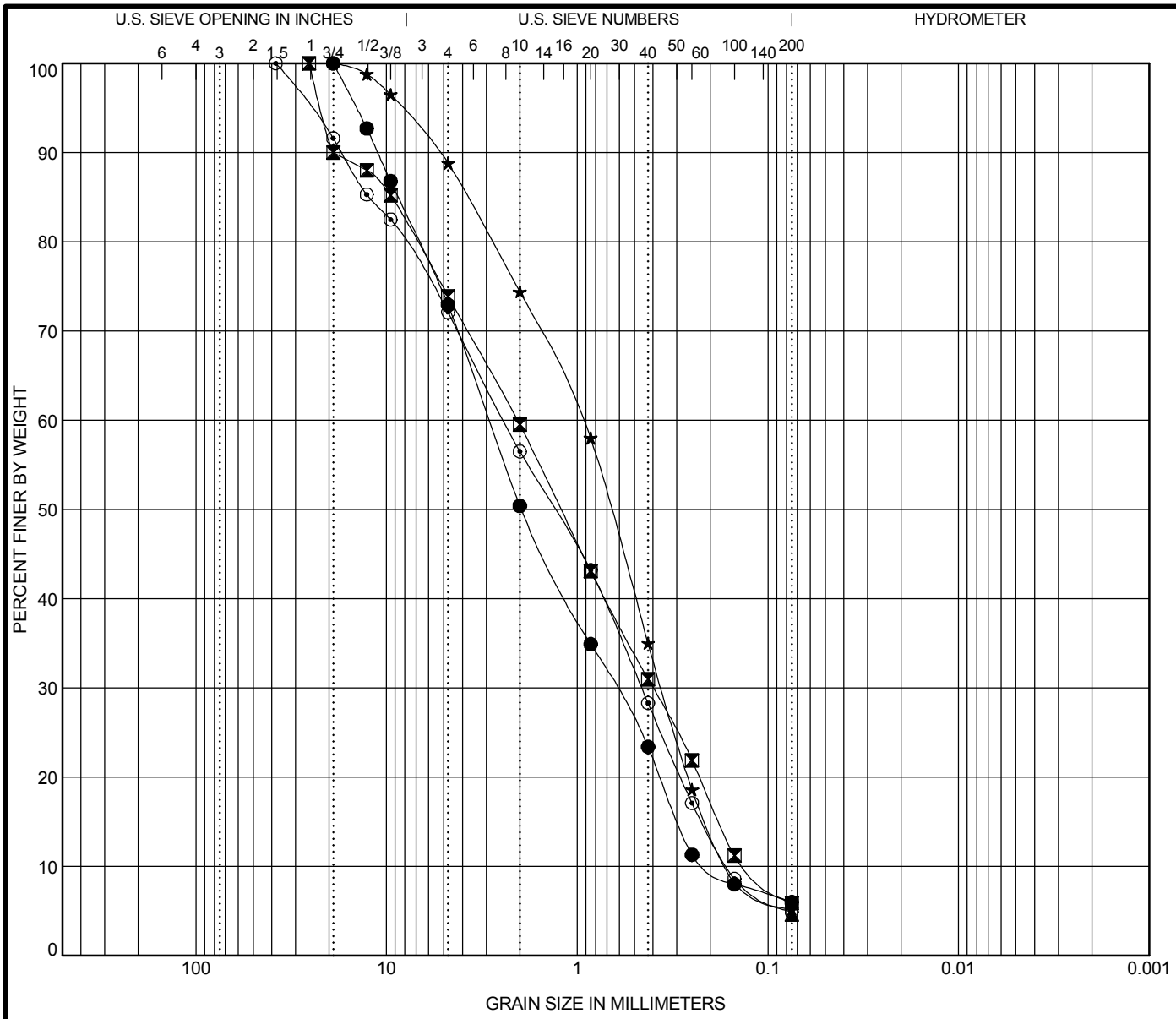
Figure B-5



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-3	@ 56.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.68	14.15
⊠	B-3	@ 66.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.61	16.07
▲	B-3	@ 76.0 ft.						
★	B-3	@ 86.0 ft.	POORLY GRADED SAND with SILT(SP-SM)				0.84	5.73
⊙	B-3	@ 96.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.53	14.88

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-3	56.0	19.05	2.893	0.633	0.204	27.1	66.9	6.0	
⊠	B-3	66.0	25.4	2.061	0.401	0.128	26.1	68.0	5.9	
▲	B-3	76.0	0.075				0.0	0.0	4.5	
★	B-3	86.0	19.05	0.943	0.362	0.165	11.2	83.6	5.2	
⊙	B-3	96.0	38.1	2.428	0.46	0.163	27.9	67.2	4.9	

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Project: P993 TPS Forward Operating Location
Job Number: 14-007.100
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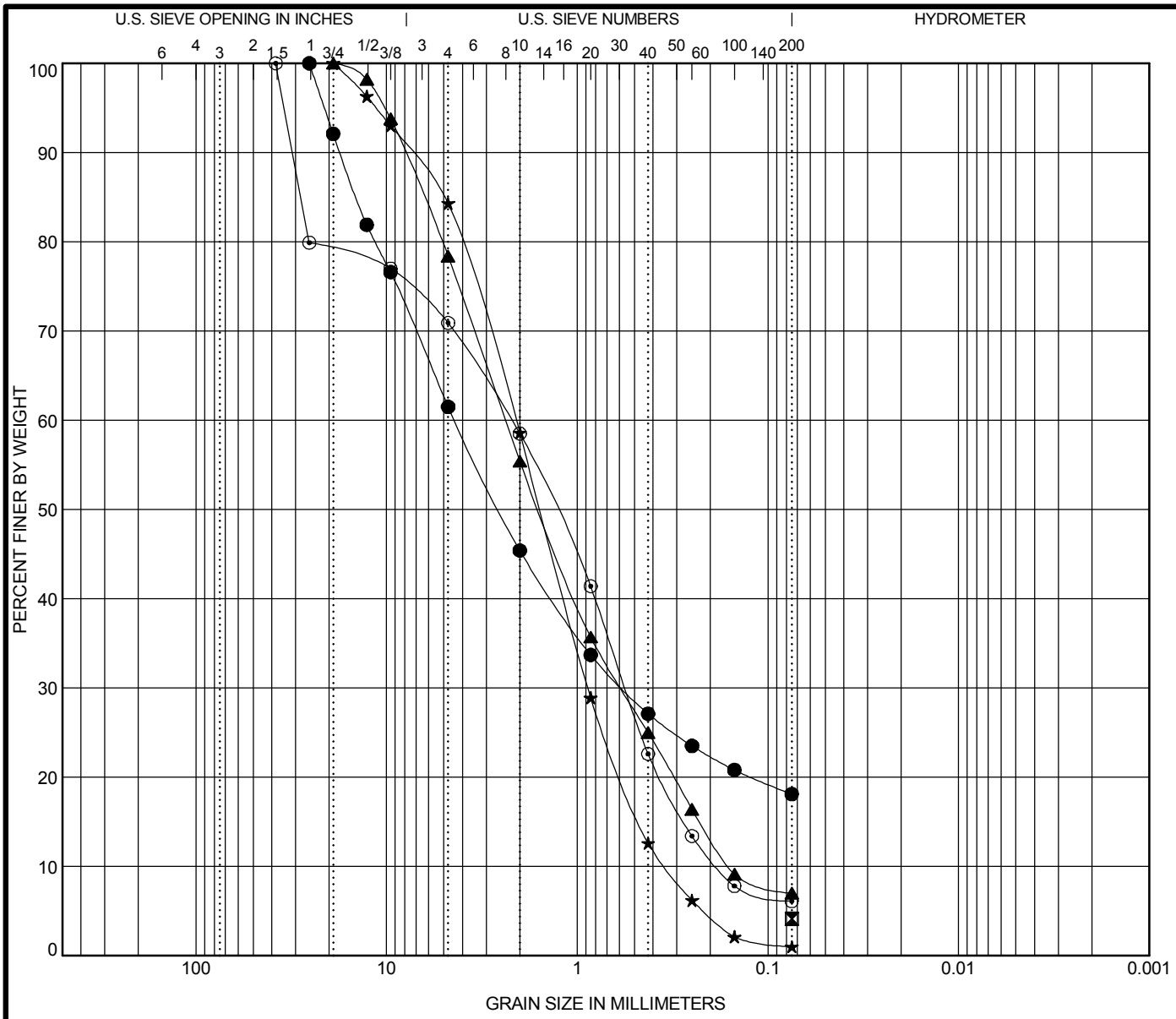
Figure B-6



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-4	@ 11.0 ft.	SILTY SAND with GRAVEL(SM)					
⊠	B-4	@ 15.0 ft.						
▲	B-4	@ 18.5 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.91	14.88
★	B-4	@ 31.0 ft.	WELL-GRADED SAND with GRAVEL(SW)				1.07	6.12
⊙	B-4	@ 46.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.77	12.11

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4	11.0	25.4	4.382	0.576		38.5	43.4	18.1	
⊠	B-4	15.0	0.075				0.0	0.0	4.1	
▲	B-4	18.5	19.05	2.378	0.588	0.16	21.6	71.4	7.0	
★	B-4	31.0	19.05	2.096	0.877	0.343	15.7	83.3	1.0	
⊙	B-4	46.0	38.1	2.221	0.558	0.183	29.1	64.8	6.1	

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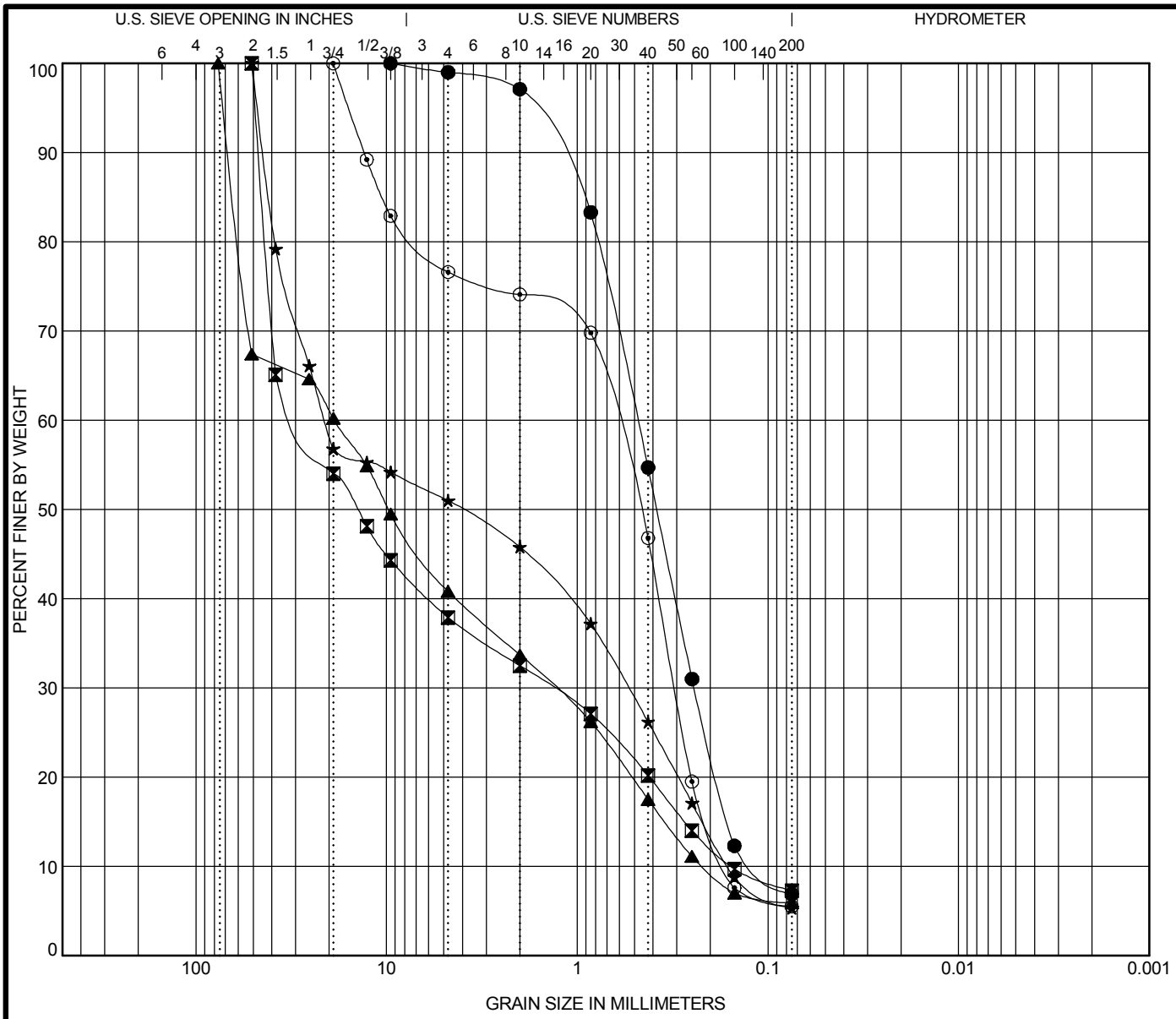
Figure B-7



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-4	@ 51.0 ft.	POORLY GRADED SAND with SILT(SP-SM)				1.10	4.33
⊠	B-5	@ 3.5 ft.	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)				0.42	178.26
▲	B-5	@ 8.5 ft.	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)				0.42	86.07
★	B-6	@ 3.5 ft.	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)				0.09	130.23
⊙	B-6	@ 6.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.89	3.80

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-4	51.0	9.525	0.483	0.243	0.112	1.0	92.1	6.9	
⊠	B-5	3.5	50.8	27.709	1.346	0.155	62.1	30.6	7.3	
▲	B-5	8.5	76.2	18.761	1.311	0.218	57.9	34.9	5.9	
★	B-6	3.5	50.8	21.032	0.54	0.161	49.0	45.7	5.3	
⊙	B-6	6.0	19.05	0.633	0.307	0.166	23.4	71.1	5.5	

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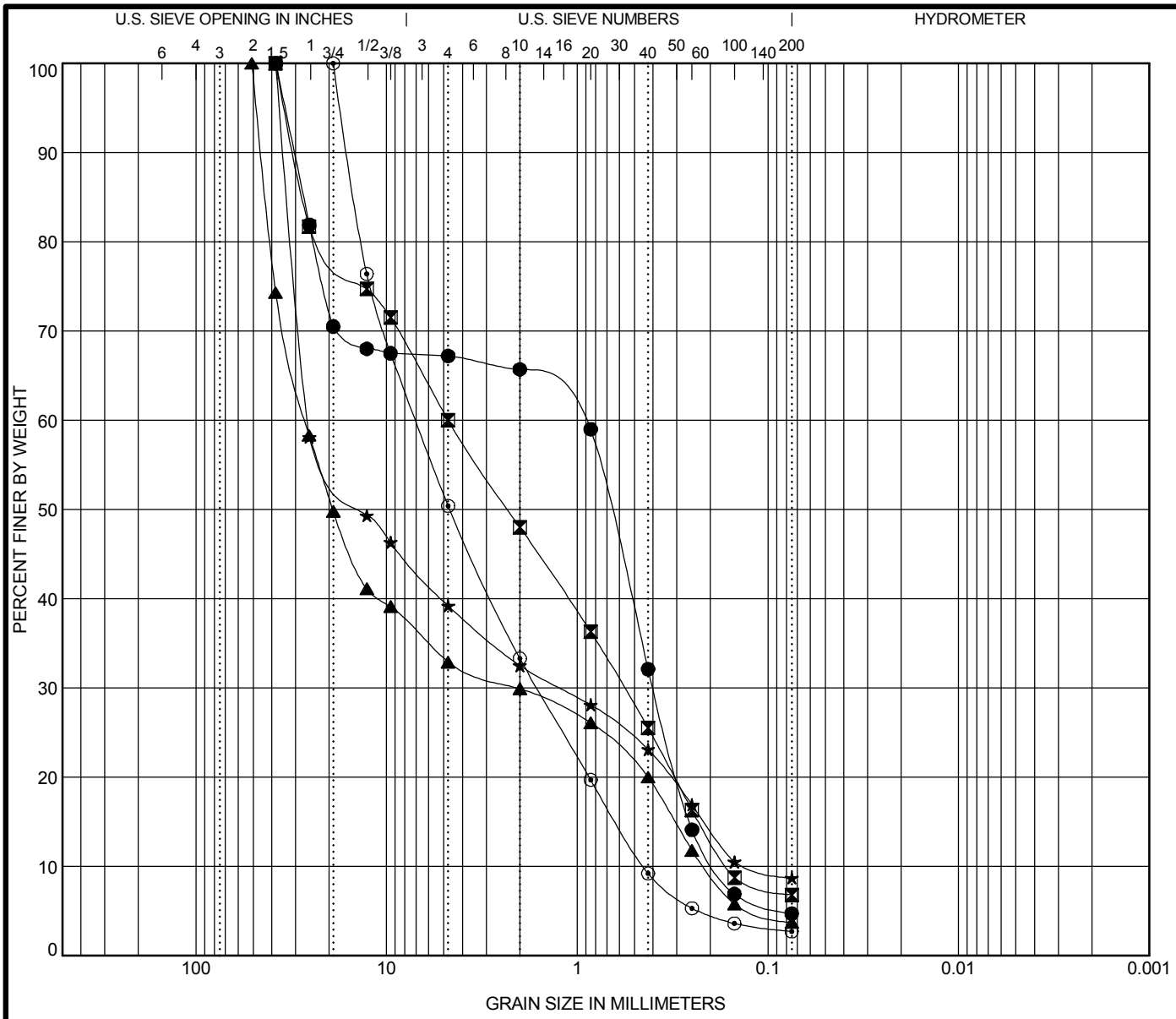
Figure B-8



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-6	@ 8.5 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.88	5.17
⊠	B-7	@ 3.5 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.41	29.02
▲	B-7	@ 8.5 ft.	POORLY GRADED GRAVEL with SAND(GP)				0.75	123.64
★	B-8	@ 6.0 ft.	POORLY GRADED GRAVEL with SILT and SAND(GP-GM)				0.47	209.10
⊙	B-8	@ 8.5 ft.	POORLY GRADED GRAVEL with SAND(GP)				0.84	15.67

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-6	8.5	38.1	0.966	0.399	0.187	32.8	62.5	4.7	
⊠	B-7	3.5	38.1	4.75	0.567	0.164	40.0	53.2	6.8	
▲	B-7	8.5	50.8	26.518	2.059	0.214	67.1	29.2	3.7	
★	B-8	6.0	38.1	25.871	1.23	0.124	60.8	30.5	8.7	
⊙	B-8	8.5	19.05	7.02	1.625	0.448	49.6	47.7	2.7	

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Project: P993 TPS Forward Operating Location
Job Number: 14-007.100
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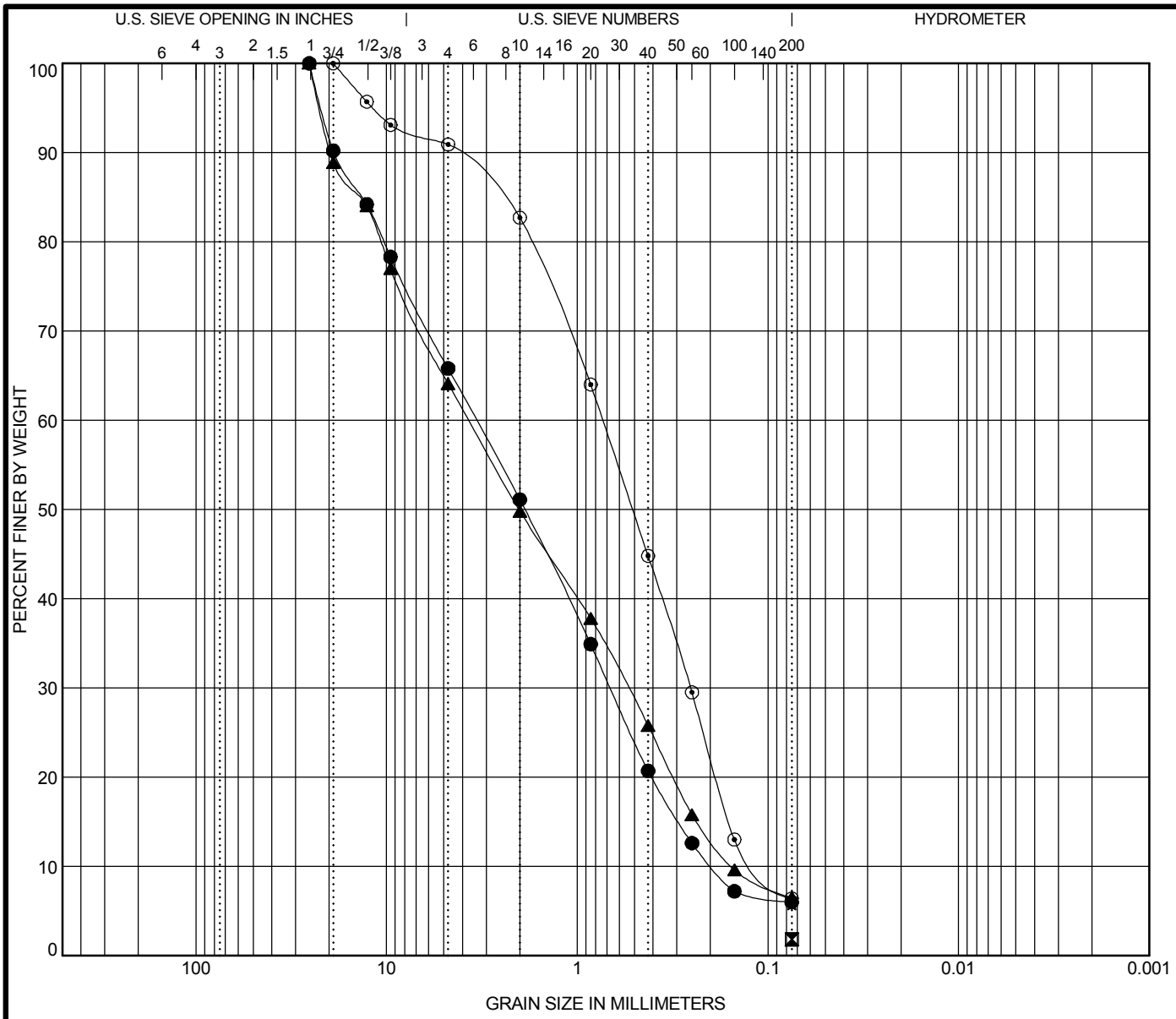
Figure B-9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-8	@ 11.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.68	17.27
⊠	B-8	@ 16.0 ft.						
▲	B-8	@ 21.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.51	23.91
★	B-8	@ 26.0 ft.						
⊙	B-8	@ 31.0 ft.	POORLY GRADED SAND with SILT(SP-SM)				0.80	6.72

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8	11.0	25.4	3.377	0.669	0.195	34.2	59.8	6.0	
⊠	B-8	16.0	0.075				0.0	0.0	1.8	
▲	B-8	21.0	25.4	3.707	0.542	0.155	35.9	57.6	6.5	
★	B-8	26.0	0.075				0.0	0.0	5.8	
⊙	B-8	31.0	19.05	0.736	0.254	0.109	9.1	84.5	6.4	

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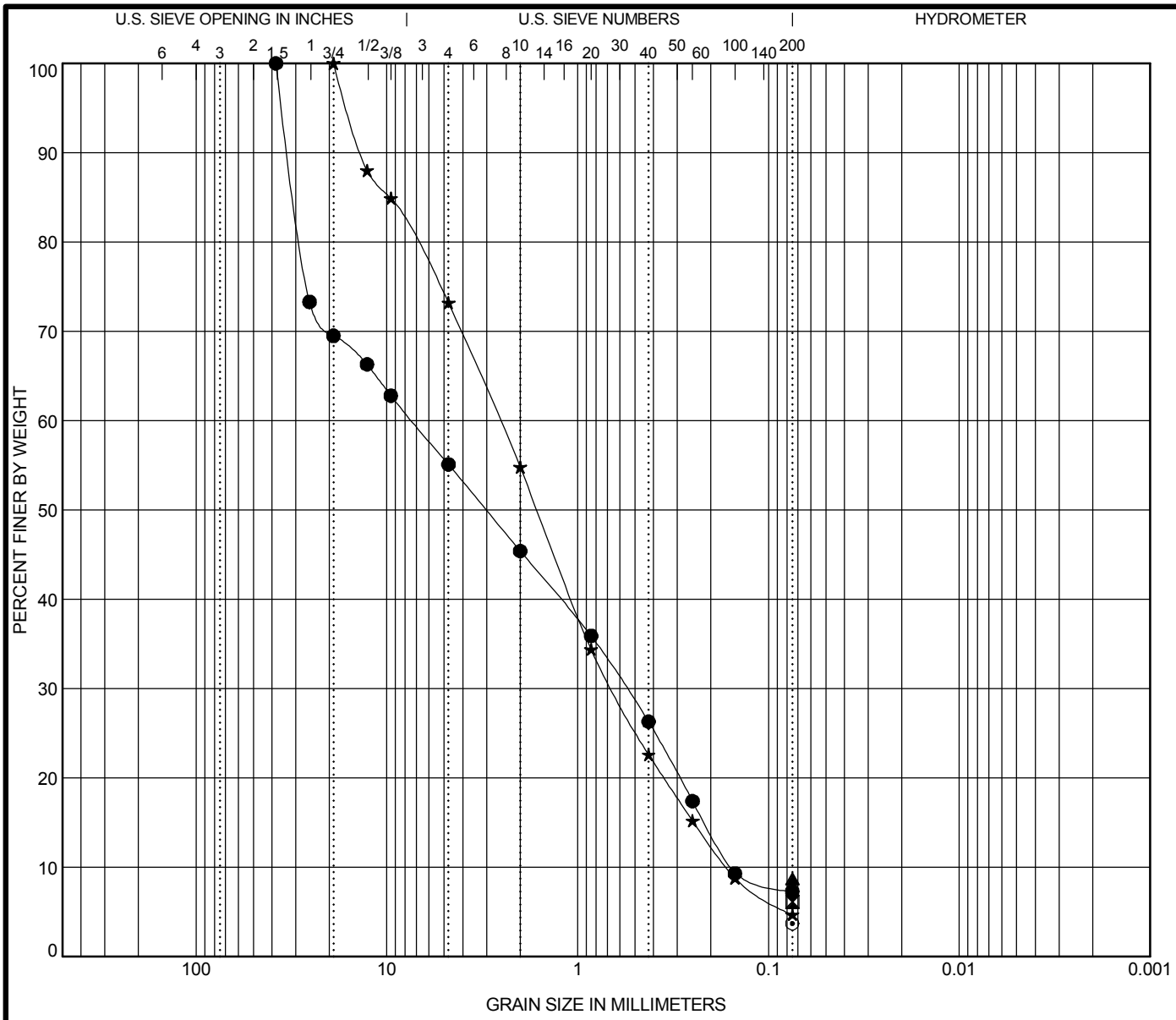
Figure B-10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-8	@ 41.0 ft.	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)				0.27	47.18
⊠	B-8	@ 51.0 ft.						
▲	B-8	@ 61.0 ft.						
★	B-8a	@ 56.0 ft.	WELL-GRADED SAND with GRAVEL(SW)				1.02	15.47
⊙	B-8a	@ 61.0 ft.						

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8	41.0	38.1	7.396	0.555	0.157	44.9	47.8	7.3	
⊠	B-8	51.0	0.075				0.0	0.0	6.1	
▲	B-8	61.0	0.075				0.0	0.0	8.7	
★	B-8a	56.0	19.05	2.554	0.656	0.165	26.8	68.5	4.7	
⊙	B-8a	61.0	0.075				0.0	0.0	3.7	

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Project: P993 TPS Forward Operating Location
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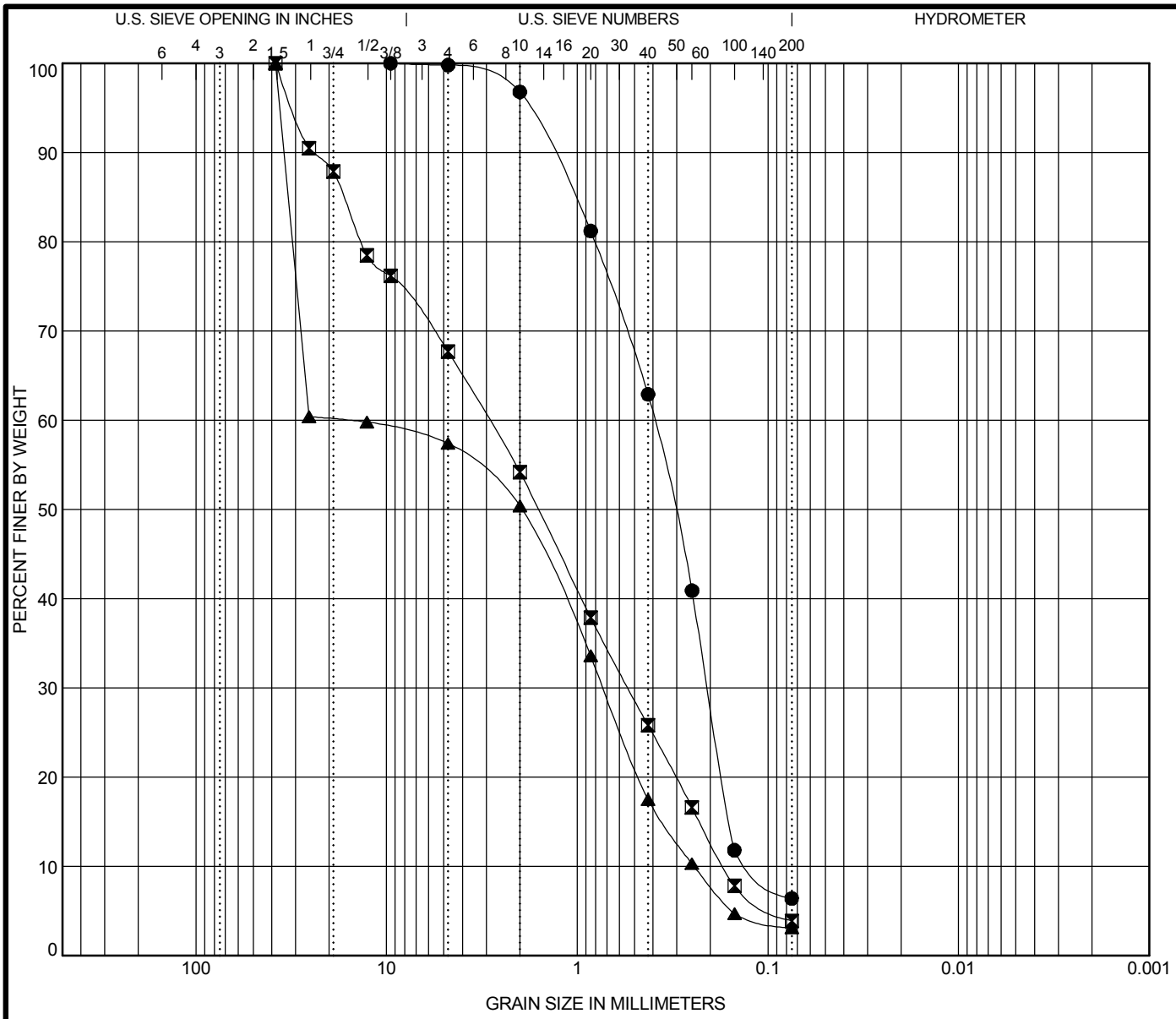
Figure B-11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B-8a	@ 76.0 ft.	POORLY GRADED SAND with SILT(SP-SM)				0.90	3.33
⊠	B-8a	@ 86.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.59	17.02
▲	B-8a	@ 96.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.14	65.78

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-8a	76.0	9.525	0.396	0.206	0.119	0.2	93.4	6.4	
⊠	B-8a	86.0	38.1	2.9	0.541	0.17	32.3	63.8	3.9	
▲	B-8a	96.0	38.1	16.001	0.728	0.243	42.6	54.3	3.1	

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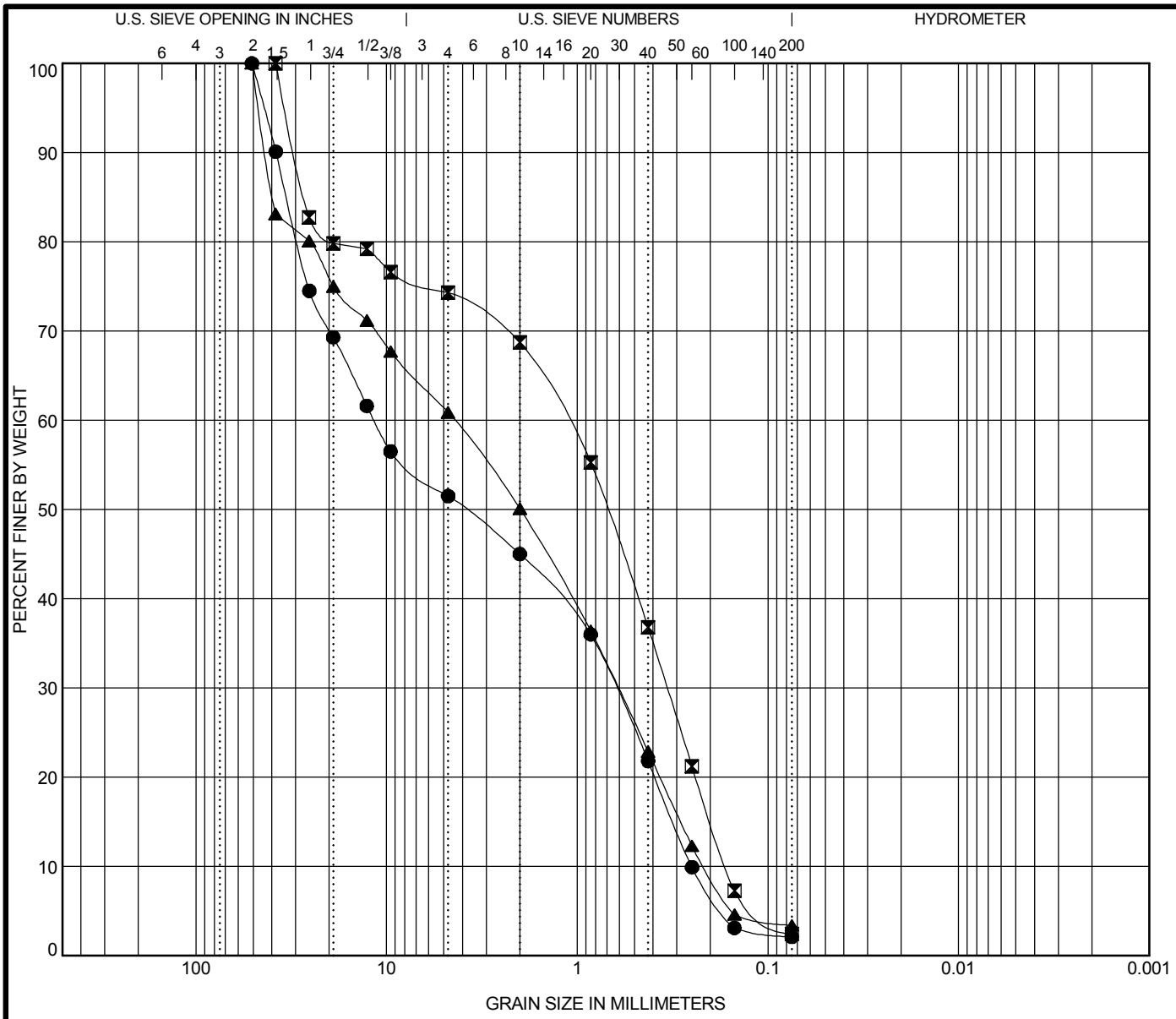
GRAIN SIZE DISTRIBUTION

Project: P993 TPS Forward Operating Location
Job Number: 14-007.100
Location: 1 Ediz Hook Road, Port Angeles, WA

Figure B-12



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	B5-H	@ 2.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.14	46.21
⊠	B6-H	@ 2.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.60	6.93
▲	B7-H	@ 2.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.39	20.59

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B5-H	2.0	50.8	11.604	0.634	0.251	48.5	49.4	2.1	
⊠	B6-H	2.0	38.1	1.148	0.337	0.166	25.7	71.9	2.4	
▲	B7-H	2.0	50.8	4.42	0.612	0.215	39.1	57.5	3.4	

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GRAIN SIZE DISTRIBUTION

Project: P993 TPS Forward Operating Location
Job Number: 14-007.100
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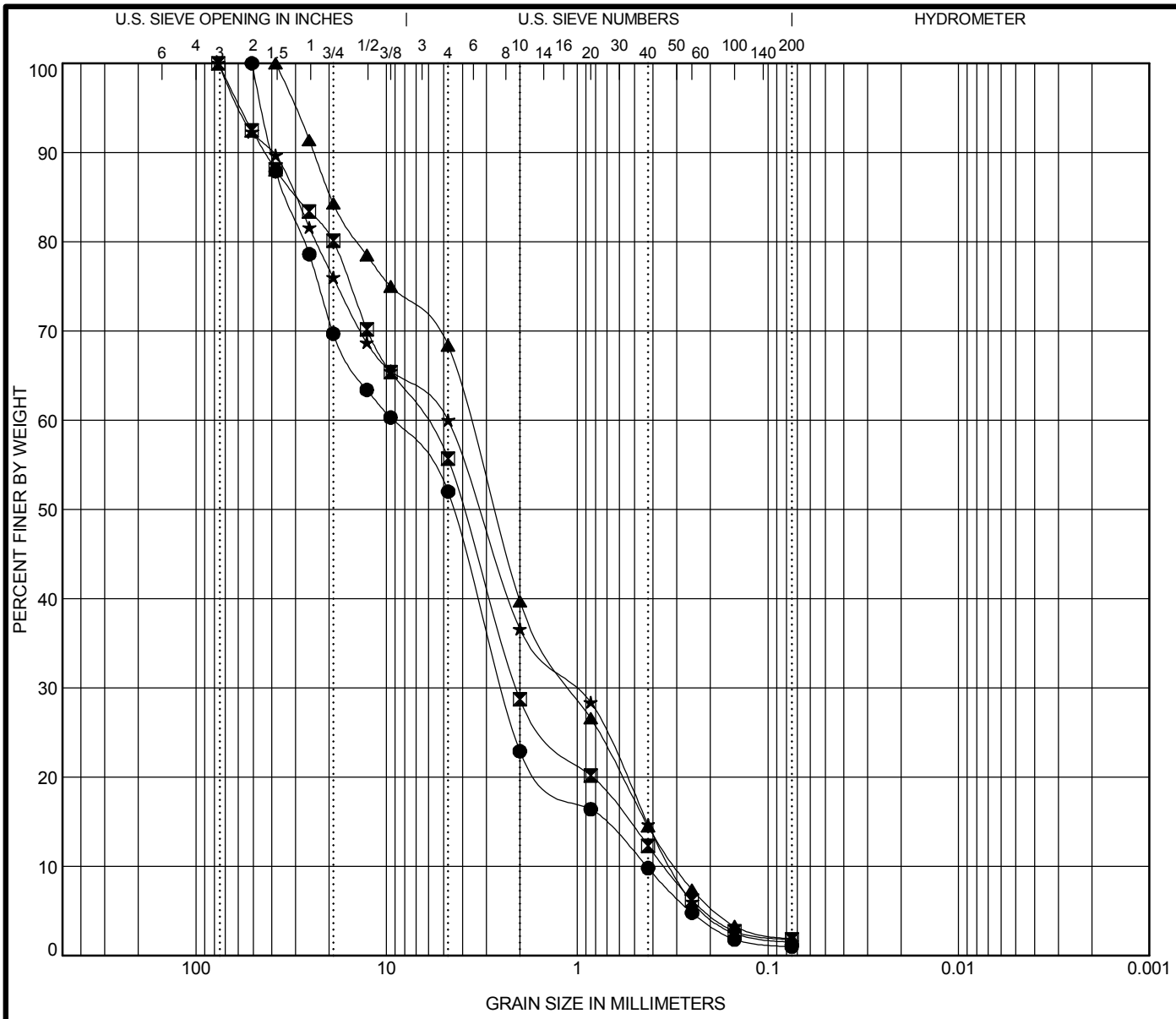
Figure B-13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TP-1-15	@ 3.0 ft.	WELL-GRADED SAND with GRAVEL(SW)				1.51	21.40
⊠	TP-2-15	@ 3.0 ft.	WELL-GRADED SAND with GRAVEL(SW)				1.93	18.58
▲	TP-3-15	@ 3.0 ft.	WELL-GRADED SAND with GRAVEL(SW)				1.01	12.15
★	TP-4-15	@ 3.0 ft.	POORLY GRADED SAND with GRAVEL(SP)				0.67	14.89

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-1-15	3.0	50.8	9.288	2.47	0.434	48.0	51.0	1.0	
⊠	TP-2-15	3.0	76.2	6.466	2.085	0.348	44.0	53.9	1.8	
▲	TP-3-15	3.0	38.1	3.688	1.061	0.304	31.6	66.5	1.9	
★	TP-4-15	3.0	76.2	4.75	1.004	0.319	39.7	58.5	1.5	

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GRAIN SIZE DISTRIBUTION

Project: P993 TPS Forward Operating Location
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Figure B-14

Figure B-15

Corrosivity and Other Test Results						
Boring	Test					
	pH (std. units)	Redox (mV)	Sulfides (mg/kg)	Resistivity (ohm-cm)	Cation Exchange (meq/100 g)	Organic Content (%)
B-3 S1 5’	8.48	237.3	<1.12	150		
B-4 S1+2 5-7.5’	7.5	257.3	<1.17		15.39	
B-5H G1 2-4’					2.01	0.45
B-5 S2 5’	7.39	305.5	<1.03	1700	4.63	
B-6H G1 2-4’					1.89	0.86
B-6 S2 5’	7.09	425.6	<1.14	775	3.05	
B-6 S-3 10’						1.32
B-7H G1 2-4’					1.00	0.39
B-7 S2 5’	6.82	215.8	<1.04	9600		1.43
B-8 S1 5’	6.76	223.2	<1.06	530		0.63
TP-1-15 2-6’					1.46	0.6
TP-2-15 2-6’					1.62	0.4
TP-3-15 2-6’					2.16	0.9
TP-4-15 2-6’					2.00	1.1

APPENDIX C

DOWNHOLE SHEAR WAVE VELOCITY MEASUREMENTS

DOWNHOLE SHEAR WAVE SEISMIC SURVEY

BORING B-8a

U.S. COAST GUARD
AIR STATION / SECTOR FIELD OFFICE
PORT ANGELES, WASHINGTON

FOR

PANGEO, INC.
SEATTLE, WASHINGTON

OCTOBER 2014

PHILIP H. DUOOS
GEOPHYSICAL CONSULTANT

October 16, 2014 Our Ref: 1147-14

Mr. Steve Evans
PanGeo, Inc.
3213 Eastlake Ave E, Ste B
Seattle, WA 98102-7127

REPORT: Downhole Seismic Shear Wave Study
Boring B-8a
U.S. Coast Guard Air Station / Sector Field Office
Port Angeles, Washington
PanGeo Project No. 24-007.100

Dear Mr. Evans:

This letter report summarizes the results of the downhole seismic study in Boring B-5 at the site. Initial field activities were performed on Friday, October 3, 2014. Due to a malfunction in the downhole cable, the data collection was performed on the following Tuesday, October 7 with a different cable. Shear wave data were measured in the boring at 2.5-foot intervals to a depth of 96.4 below the top of the ground surface. Compressional wave (P-wave) data were measured at 5-foot intervals to a depth of 94.8 feet. The field measurements were referenced to the top of the casing monument which is 0.2 feet above the ground surface, and then adjusted to depth below ground surface.

INTERPRETATION RESULTS

The shear wave first-arrival travel times were measured using a triaxial geophone located at 2.5-foot increments in the boring, and are referenced to the top ground surface. The travel times shown have been corrected for the horizontal offset of the seismic source.

The data are relatively free of noise from vibrations such as vehicles. The shear wave data were recorded using two orientations of the impulse wave and the average of the two arrival times was used. The two shear wave arrival times recorded at each depth location were very similar, usually within about 0.5 milliseconds (ms).

Figure 1 shows my interpreted shear wave layer velocities (blue lines) for a three layer velocity model. This interpretation includes a thin, higher velocity layer between depths of about 34 – 45 feet. This interpretation attempts to honor all of the data points. The higher velocity layer (1,385 ft/sec) may be caused by coarser-grained materials.

Figure 2 shows an interpreted two layer velocity model (red lines). This interpretation does not include three data points that may show possible delayed travel times at depths between about 27 – 35 feet. These possible delayed times may be related to poor grout coupling with the casing. Your knowledge of the geologic conditions at the boring location may help decide whether the two layer or three layer interpretation is most reasonable.

Figure 3 shows my interpreted layer velocities of the compressional (P-Wave) data, which were recorded at 5-foot intervals in the boring. The P-wave layers correlate fairly well with the layers interpreted from the shear wave data, and are reasonable seismic velocities for the geologic materials.

Philip H. Duoos **13503 NE 78th Place, Redmond, Washington, 98052**
PH/FAX: (425) 882-2634 , CELL: (425) 765-6316 **Email: geopyg@aol.com**

FIELD METHODOLOGY

The first-arrival travel times were measured using a triaxial geophone located at 2.5-foot (shear wave) and 5-foot (compressional wave) increments in the boring; and are referenced to the ground surface. The shear wave energy was generated by hitting both ends of a wood beam (8 feet long) placed on the ground surface about 8 feet east from the borehole. The borehole casing was standard Slope Indicator casing (2.75-inch inside diameter) with vertical grooves which allowed us to maintain a constant orientation with the downhole geophone tool. The casing was bailed dry to about 47 feet which allowed for easier data acquisition and minimized the possibility of surface waves traveling down the borehole.

The beam was placed parallel to one set of the grooves (approximately north-south). The grass sod was cut slightly larger than the beam and carefully removed. The loose soil was removed and the trench for the beam made level. With the beam in solid contact with the underlying firm soils a vehicle was then parked on the beam. Hitting the beam on both ends, and recording both of the orientations of the impulse wave, helps to identify the shear wave and also provides an idea on the quality of the data. The soil and sod were replaced upon completion of the study.

After the shear wave survey, the beam was removed and replaced by a small metal plate resting on the exposed firm soil. The triaxial geophone was then placed in the boring again, and P-wave data were recorded at 5-foot intervals, with the metal plate struck vertically with the sledge hammer. The seismic data were recorded using a Geostuff Instruments BHG-2 triaxial geophone and a Geometrics Strataview seismograph. The BHG-2 downhole geophone obtains firm coupling with the borehole using a mechanical clamping spring arm.

I am confident that the recorded data and interpreted velocities and layer depths are representative of the earth materials at this boring location within the constraints of this geophysical method. As with any geophysical method, bulk properties are measured and may not discern small variations in geology. Please feel free to contact me if you have any questions or comments regarding this information.

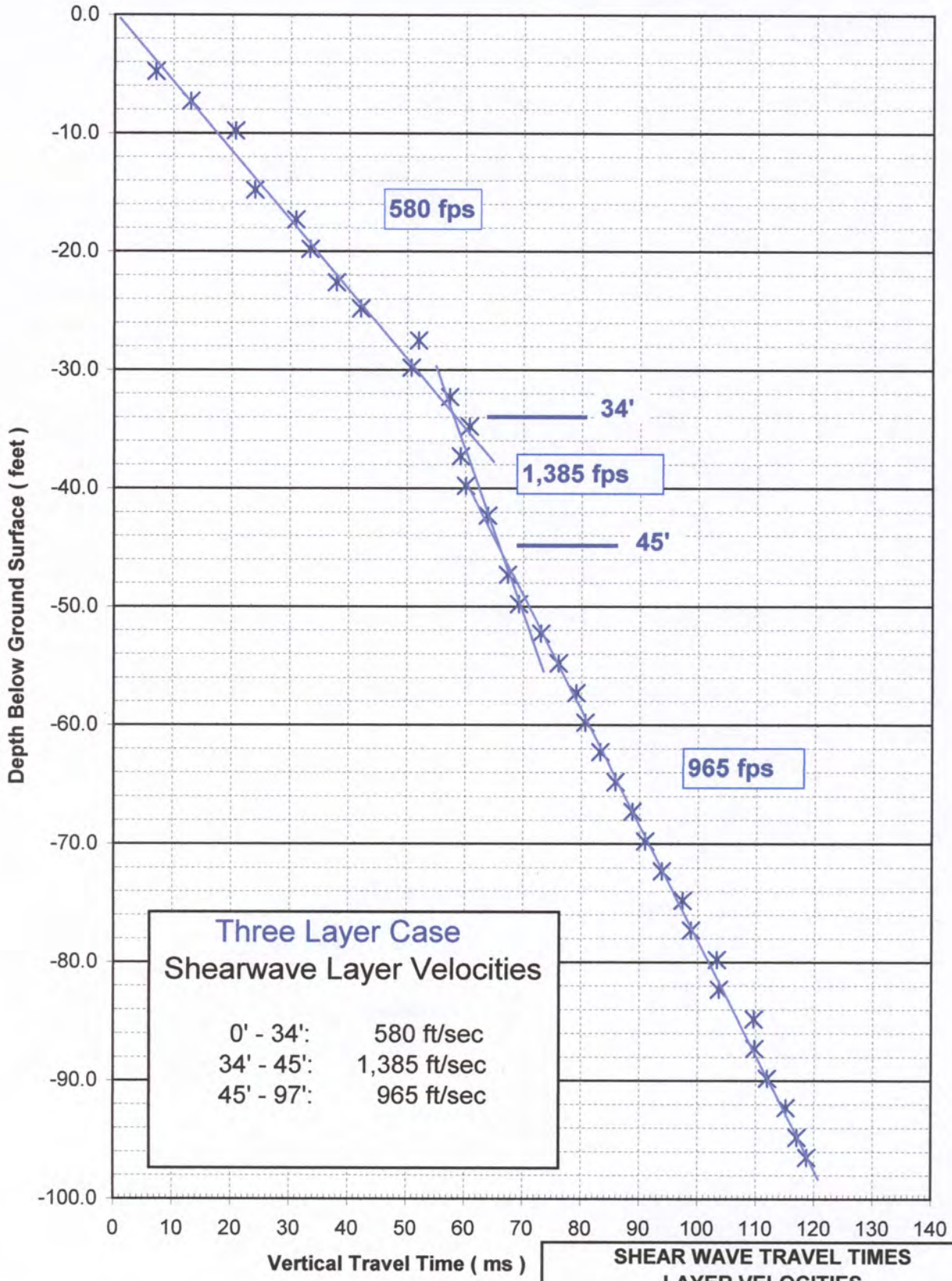
Sincerely,

Philip H. Duoos
Geophysical Consultant

State of Washington
561
Licensed Geologist
Philip H. Duoos

Attachments:

Figure 1: Shear Wave Travel Times with Three Layer Interpretation
Figure 2: Shear Wave Travel Times with Two Layer Interpretation
Figure 3: Compressional Wave Travel Times with Two Layer Interpretation

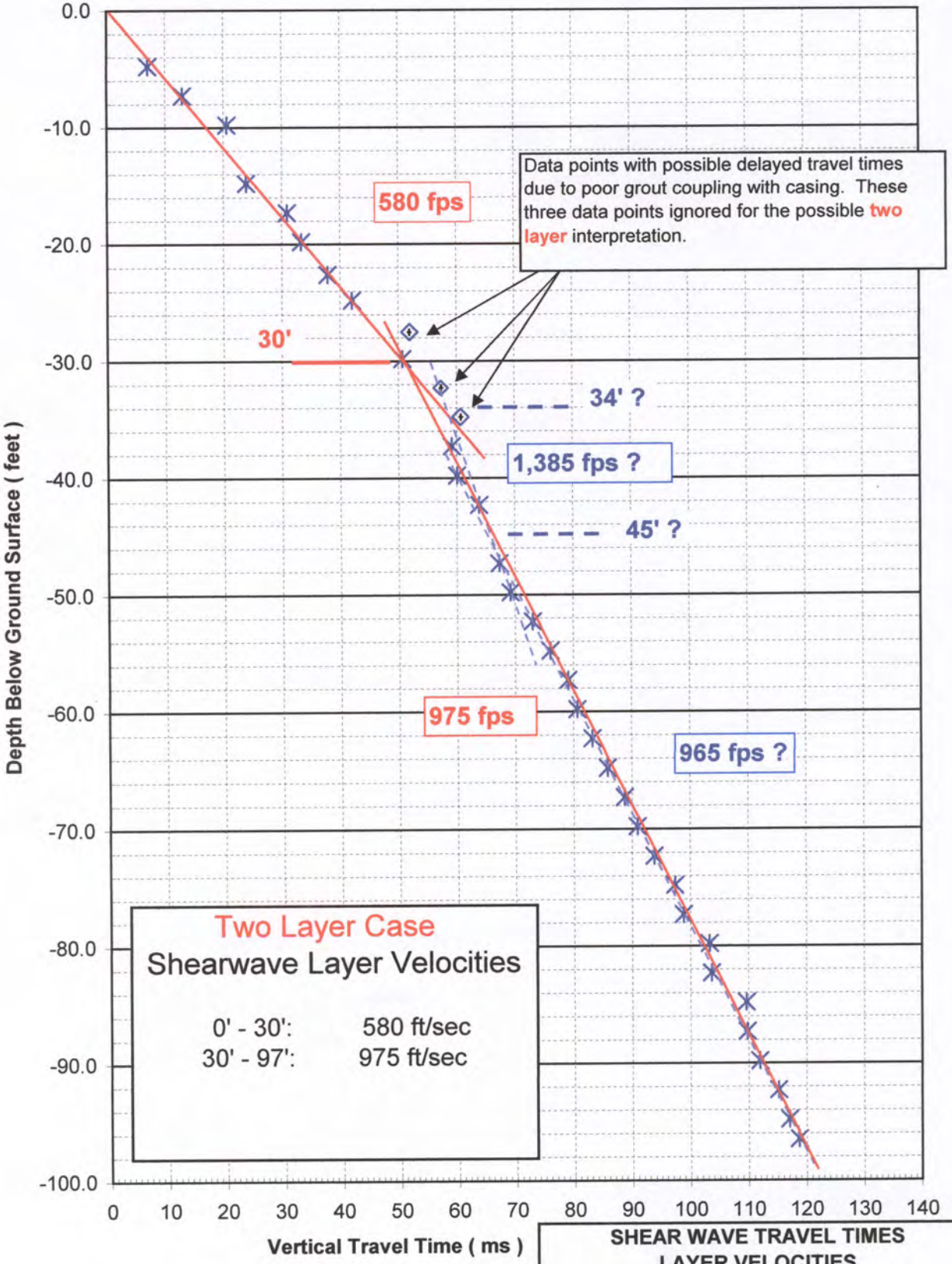


SHEAR WAVE TRAVEL TIMES
LAYER VELOCITIES
BORING B-8a

U.S. Coast Guard
Air Station/Sector Field Office
Port Angeles, Washington

Figure 1

Philip H. Duoos, Geophysical Consultant
for PanGeo, Inc.
My Proj. #1147-14, October, 2014

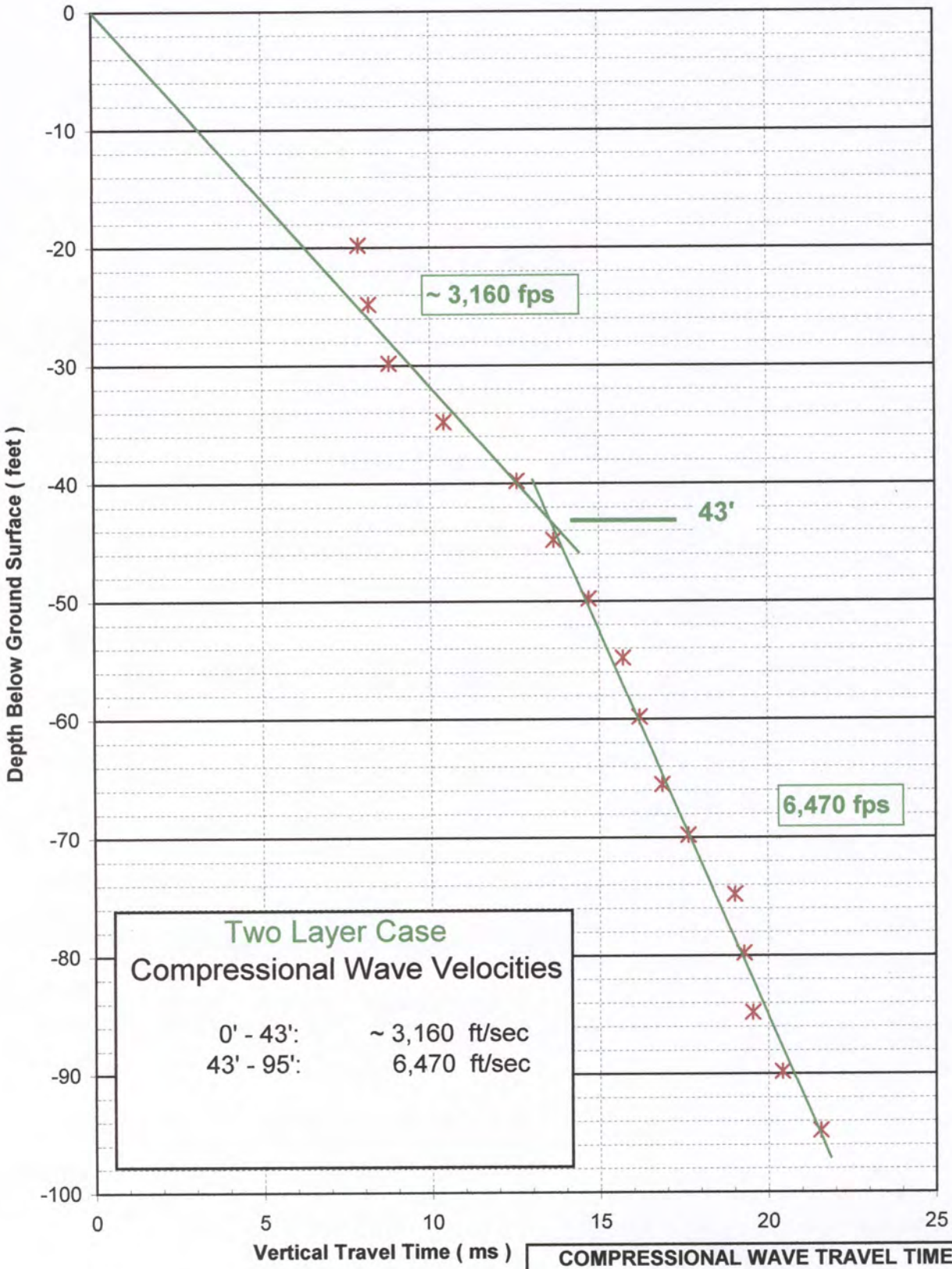


SHEAR WAVE TRAVEL TIMES
LAYER VELOCITIES
BORING B-8a

U.S. Coast Guard
Air Station/Sector Field Office
Port Angeles, Washington

Figure 2

Philip H. Duoos, Geophysical Consultant
for PanGeo, Inc.
My Proj. #1147-14, October, 2014

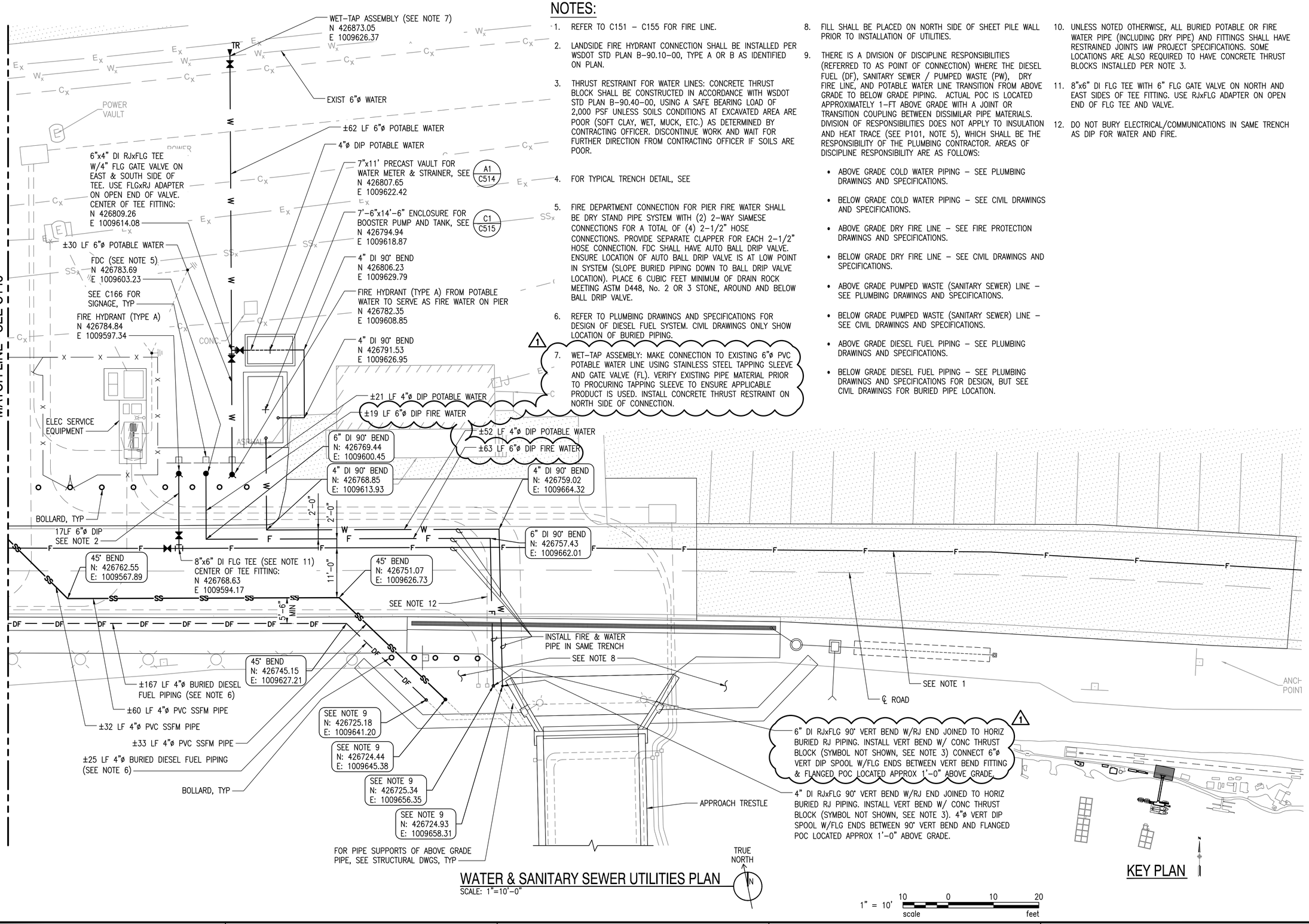


COMPRESSIONAL WAVE TRAVEL TIMES
LAYER VELOCITIES
BORING B-8a

U.S. Coast Guard
Air Station/Sector Field Office
Port Angeles, Washington

Figure 3

Philip H. Duoos, Geophysical Consultant
for PanGeo, Inc.
My. Proj. #1147-14, October, 2014



WATER & SANITARY SEWER UTILITIES PLAN

SCALE: 1"=10'-0"

KEY PLAN

NOTES:

1. REFER TO C151 – C155 FOR FIRE LINE.
2. LANDSIDE FIRE HYDRANT CONNECTION SHALL BE INSTALLED PER WSDOT STD PLAN B-90.10-00, TYPE A OR B AS IDENTIFIED ON PLAN.
3. THRUST RESTRAINT FOR WATER LINES: CONCRETE THRUST BLOCK SHALL BE CONSTRUCTED IN ACCORDANCE WITH WSDOT STD PLAN B-90.40-00, USING A SAFE BEARING LOAD OF 2,000 PSF UNLESS SOILS CONDITIONS AT EXCAVATED AREA ARE POOR (SOFT CLAY, WET, MUCK, ETC.) AS DETERMINED BY CONTRACTING OFFICER. DISCONTINUE WORK AND WAIT FOR FURTHER DIRECTION FROM CONTRACTING OFFICER IF SOILS ARE POOR.
4. FOR TYPICAL TRENCH DETAIL, SEE
5. FIRE DEPARTMENT CONNECTION FOR PIER FIRE WATER SHALL BE DRY STAND PIPE SYSTEM WITH (2) 2-WAY SIAMESE CONNECTIONS FOR A TOTAL OF (4) 2-1/2" HOSE CONNECTIONS. PROVIDE SEPARATE CLAPPER FOR EACH 2-1/2" HOSE CONNECTION. FDC SHALL HAVE AUTO BALL DRIP VALVE. ENSURE LOCATION OF AUTO BALL DRIP VALVE IS AT LOW POINT IN SYSTEM (SLOPE BURIED PIPING DOWN TO BALL DRIP VALVE LOCATION). PLACE 6 CUBIC FEET MINIMUM OF DRAIN ROCK MEETING ASTM D448, No. 2 OR 3 STONE, AROUND AND BELOW BALL DRIP VALVE.
6. REFER TO PLUMBING DRAWINGS AND SPECIFICATIONS FOR DESIGN OF DIESEL FUEL SYSTEM. CIVIL DRAWINGS ONLY SHOW LOCATION OF BURIED PIPING.
7. WET-TAP ASSEMBLY: MAKE CONNECTION TO EXISTING 6"ø PVC POTABLE WATER LINE USING STAINLESS STEEL TAPPING SLEEVE AND GATE VALVE (FL). VERIFY EXISTING PIPE MATERIAL PRIOR TO PROCURING TAPPING SLEEVE TO ENSURE APPLICABLE PRODUCT IS USED. INSTALL CONCRETE THRUST RESTRAINT ON NORTH SIDE OF CONNECTION.
8. FILL SHALL BE PLACED ON NORTH SIDE OF SHEET PILE WALL PRIOR TO INSTALLATION OF UTILITIES.
9. THERE IS A DIVISION OF DISCIPLINE RESPONSIBILITIES (REFERRED TO AS POINT OF CONNECTION) WHERE THE DIESEL FUEL (DF), SANITARY SEWER / PUMPED WASTE (PW), DRY FIRE LINE, AND POTABLE WATER LINE TRANSITION FROM ABOVE GRADE TO BELOW GRADE PIPING. ACTUAL POC IS LOCATED APPROXIMATELY 1-FT ABOVE GRADE WITH A JOINT OR TRANSITION COUPLING BETWEEN DISSIMILAR PIPE MATERIALS. DIVISION OF RESPONSIBILITIES DOES NOT APPLY TO INSULATION AND HEAT TRACE (SEE P101, NOTE 5), WHICH SHALL BE THE RESPONSIBILITY OF THE PLUMBING CONTRACTOR. AREAS OF DISCIPLINE RESPONSIBILITY ARE AS FOLLOWS:
   - ABOVE GRADE COLD WATER PIPING – SEE PLUMBING DRAWINGS AND SPECIFICATIONS.
   - BELOW GRADE COLD WATER PIPING – SEE CIVIL DRAWINGS AND SPECIFICATIONS.
   - ABOVE GRADE DRY FIRE LINE – SEE FIRE PROTECTION DRAWINGS AND SPECIFICATIONS.
   - BELOW GRADE DRY FIRE LINE – SEE CIVIL DRAWINGS AND SPECIFICATIONS.
   - ABOVE GRADE PUMPED WASTE (SANITARY SEWER) LINE – SEE PLUMBING DRAWINGS AND SPECIFICATIONS.
   - BELOW GRADE PUMPED WASTE (SANITARY SEWER) LINE – SEE CIVIL DRAWINGS AND SPECIFICATIONS.
   - ABOVE GRADE DIESEL FUEL PIPING – SEE PLUMBING DRAWINGS AND SPECIFICATIONS.
   - BELOW GRADE DIESEL FUEL PIPING – SEE PLUMBING DRAWINGS AND SPECIFICATIONS FOR DESIGN, BUT SEE CIVIL DRAWINGS FOR BURIED PIPE LOCATION.
10. UNLESS NOTED OTHERWISE, ALL BURIED POTABLE OR FIRE WATER PIPE (INCLUDING DRY PIPE) AND FITTINGS SHALL HAVE RESTRAINED JOINTS IAW PROJECT SPECIFICATIONS. SOME LOCATIONS ARE ALSO REQUIRED TO HAVE CONCRETE THRUST BLOCKS INSTALLED PER NOTE 3.
11. 8"x6" DI FLG TEE WITH 6" FLG GATE VALVE ON NORTH AND EAST SIDES OF TEE FITTING. USE RJxFLG ADAPTER ON OPEN END OF FLG TEE AND VALVE.
12. DO NOT BURY ELECTRICAL/COMMUNICATIONS IN SAME TRENCH AS DIP FOR WATER AND FIRE.

SYM	DESCRIPTION	DATE	APPR
1	AMENDMENT 0002	10/23/15	VHN

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PM/DM
BRANCH MANAGER
CHIEF ENG/ARCH
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DEPARTMENT OF THE NAVY
NAVFAC NW
UNITED STATES COAST GUARD AIR STATION/SECTOR FIELD OFFICE
NAVAL FACILITIES ENGINEERING COMMAND
NAVFAC NORTHWEST
SILVERDALE, WASHINGTON
PORT ANGELES, WASHINGTON

FY 2015 MCON P-993, TPS PORT ANGELES
FORWARD OPERATING LOCATION

WATER & SANITARY SEWER UTILITIES PLAN - SHEET 2

SCALE: AS SHOWN
EPROJECT NO.: 1291634
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
16033012
SHEET 49 OF 330
C146

DRAWFORM REVISION: 10 MAY 2014

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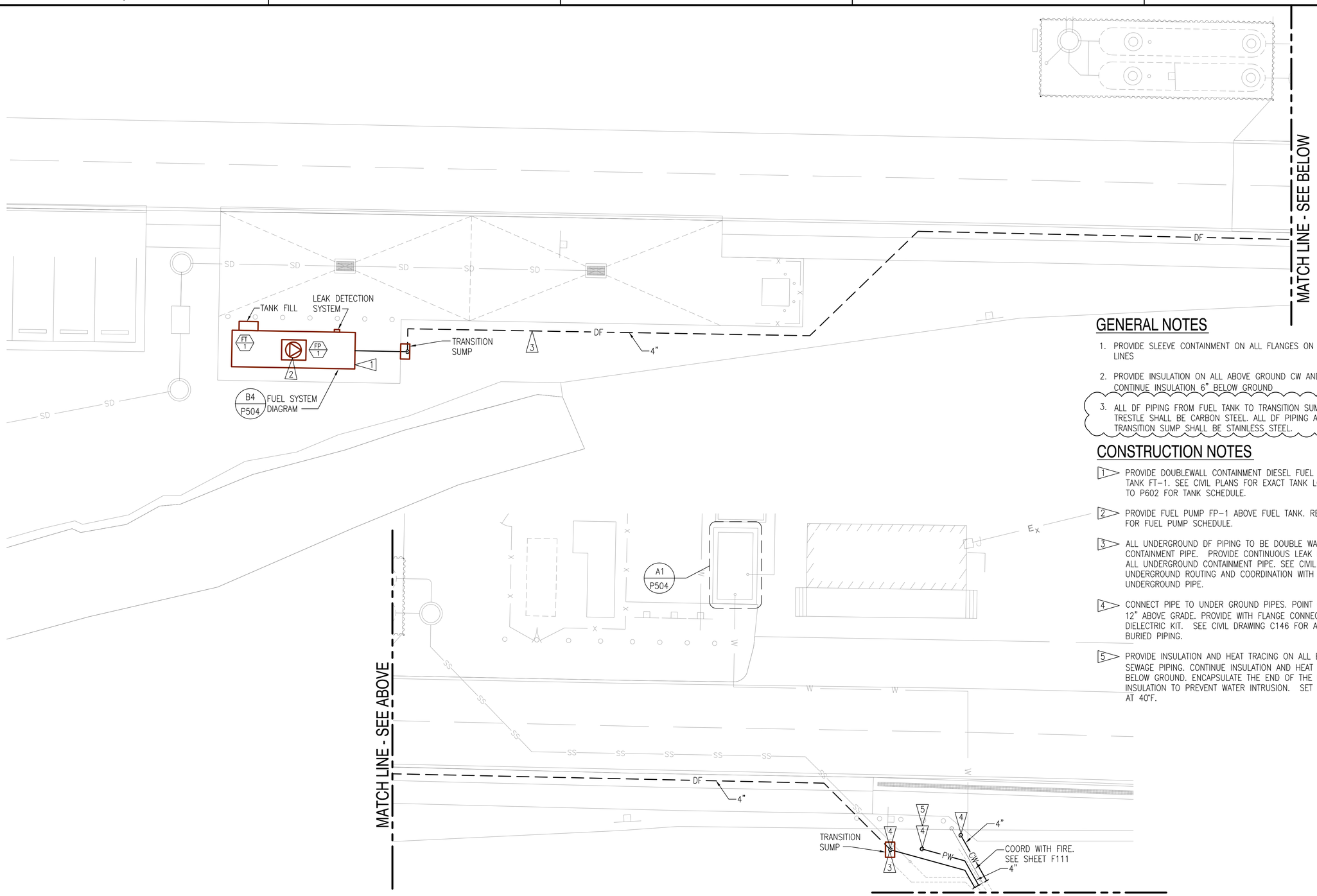

APPROACH STRUCTURES UTILITES PLAN

SCALE: 3/32"=1'-0"

GENERAL NOTES

1. PROVIDE SLEEVE CONTAINMENT ON ALL FLANGES ON DIESEL FUEL LINES
2. PROVIDE INSULATION ON ALL ABOVE GROUND CW AND DF LINES. CONTINUE INSULATION 6" BELOW GROUND
3. ALL DF PIPING FROM FUEL TANK TO TRANSITION SUMP AT TRESTLE SHALL BE CARBON STEEL. ALL DF PIPING AFTER TRANSITION SUMP SHALL BE STAINLESS STEEL. (1)

CONSTRUCTION NOTES

1. PROVIDE DOUBLEWALL CONTAINMENT DIESEL FUEL MARINE STORAGE TANK FT-1. SEE CIVIL PLANS FOR EXACT TANK LOCATION. REFER TO P602 FOR TANK SCHEDULE.
2. PROVIDE FUEL PUMP FP-1 ABOVE FUEL TANK. REFER TO P601 FOR FUEL PUMP SCHEDULE.
3. ALL UNDERGROUND DF PIPING TO BE DOUBLE WALLED CONTAINMENT PIPE. PROVIDE CONTINUOUS LEAK DETECTION ON ALL UNDERGROUND CONTAINMENT PIPE. SEE CIVIL C146 FOR UNDERGROUND ROUTING AND COORDINATION WITH OTHER UNDERGROUND PIPE.
4. CONNECT PIPE TO UNDER GROUND PIPES. POINT OF CONNECTION 12" ABOVE GRADE. PROVIDE WITH FLANGE CONNECTION AND DIELECTRIC KIT. SEE CIVIL DRAWING C146 FOR ALIGNMENT OF BURIED PIPING.
5. PROVIDE INSULATION AND HEAT TRACING ON ALL EXPOSED SEWAGE PIPING. CONTINUE INSULATION AND HEAT TRACING 6" BELOW GROUND. ENCAPSULATE THE END OF THE UNDER GROUND INSULATION TO PREVENT WATER INTRUSION. SET HEAT TRACING AT 40°F.

3/32" = 1'-0" 16' 8' 0 16' scale feet

FSi consulting engineers
Seattle, Washington
Solutions & Service

SYM	DESCRIPTION	DATE	APPR
1	AMENDMENT 002	10/23/15	CMC

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UPLANDS UTILITIES PLAN

SCALE: AS SHOWN
EPROJECT NO.: 1291634
CONSTR. CONTR. NO.
NAVFAC DRAWING NO. 16033205
SHEET 242 OF 330

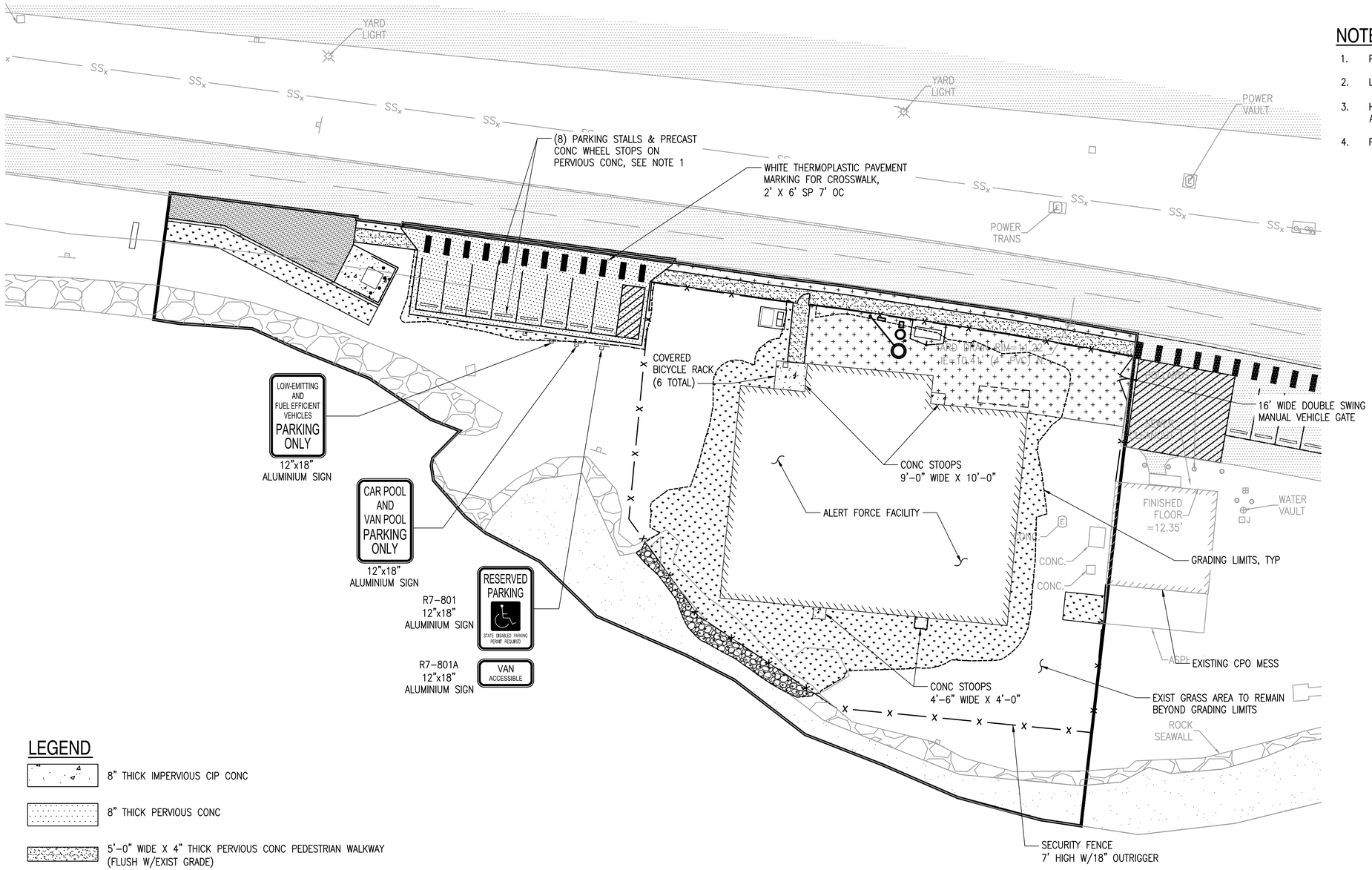
P101

DRAWFORM REVISION: 10 MAY 2014

FILE NAME: L:\14002 P993 USCG Port Angeles\Working Drawings\P993-1291634-P101.dwg PLOTTED: 10/23/15 - 4:18pm BY: Chris

NOTES:

1. PARKING AREA = 2,610 SF.
2. LEED PROJECT BOUNDARY = 40,753 SF.
3. HARDSCAPE (EXCEPT ROOF), INCLUDING SIDWALK, PAVING, AND GRAVEL SURFACE AREA = 7,666 SF.
4. PARKING STALLS = 8 TOTAL.



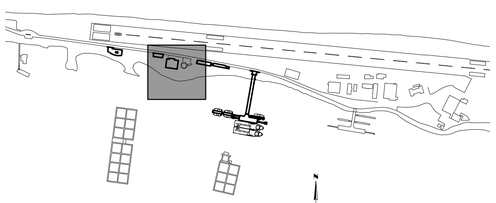
LEGEND

- 8" THICK IMPERVIOUS CIP CONC
- 8" THICK PERVIOUS CONC
- 5'-0" WIDE X 4" THICK PERVIOUS CONC PEDESTRIAN WALKWAY (FLUSH W/EXIST GRADE)
- HYDROSEED W/ DWARF SEED MIX
- GRAVEL SURFACE FOR MAINTENANCE TRUCK ACCESS
- EXIST PAVEMENT
- —— x —— SECURITY FENCE 7'-0" HIGH W/ 18" OUTRIGGER,
- LEED BOUNDARY

AFF LEED BOUNDARY PLAN

SCALE: 1"=20'-0"

N



KEY PLAN

1" = 20' 20 0 20 40 scale feet

APPR	DATE	DESCRIPTION	SYM

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PORT ANGELES, WASHINGTON

FY 2015 MCON P-993, TPS PORT ANGELES FORWARD OPERATING LOCATION

AFF LEED BOUNDARY PLAN

SCALE: AS SHOWN

EPROJECT NO.:

CONSTR. CONTR. NO.

NAVFAC DRAWING NO.

SHEET 1 OF 1

PPI #11

DRAWFORM REVISION: 10 MAY 2014

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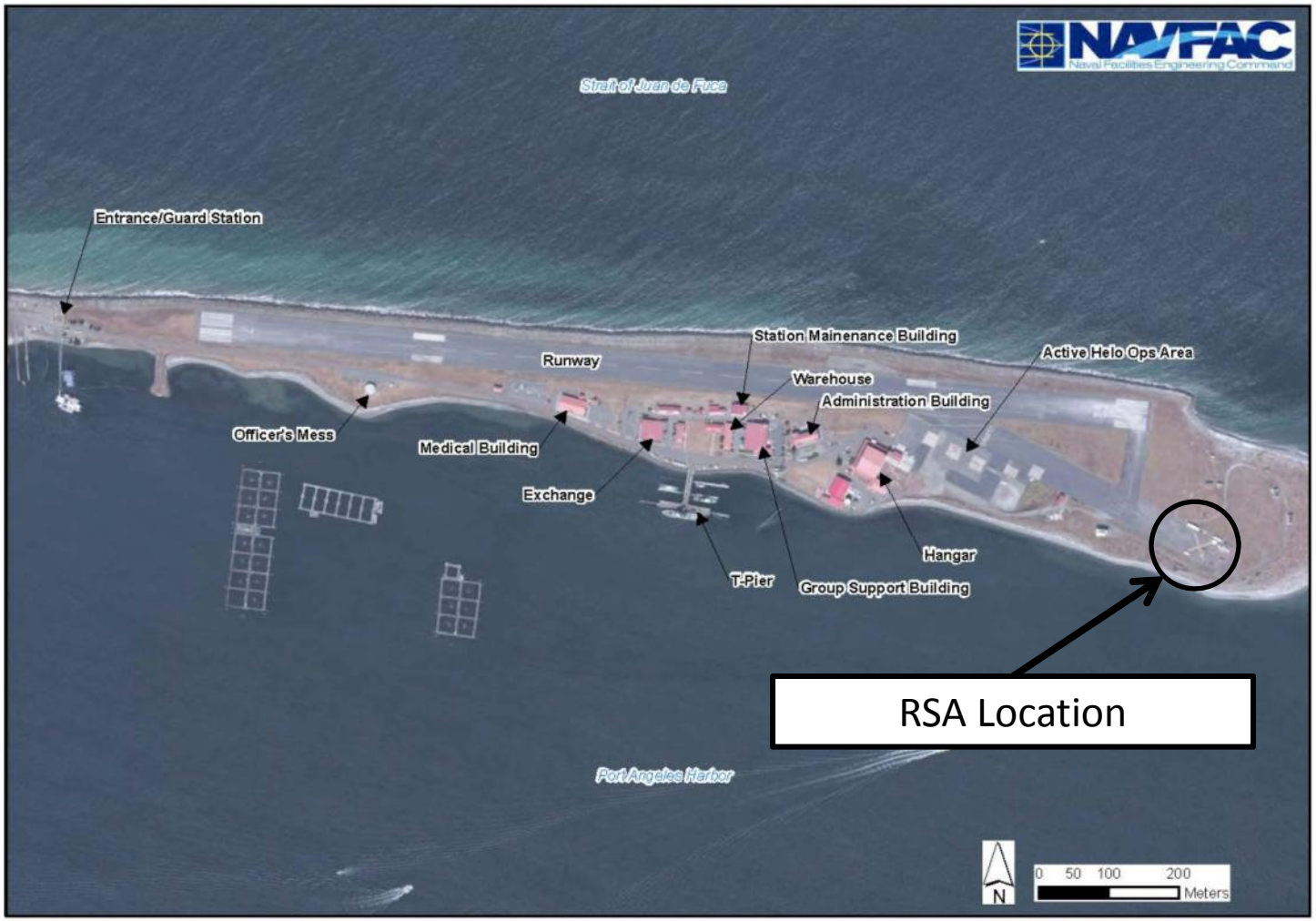
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Station Mainenance Building
Active Helo Ops Area
Runway
Warehouse
Administration Building
Officer's Mess
Medical Building
Exchange
Hangar
T-Pier
Group Support Building
RSA Location
Port Angeles Harbor
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