November 10, 2023

Oregon Department of Environmental Quality
700 NE Multnomah St, Suite 600
Portland, OR 97232

Re: Seismic Vulnerability Assessment PDX Fuel Facility

To Whom It May Concern:

Project Background

The purpose of this document is to provide a Seismic Vulnerability Assessment (SVA) of the Portland International Airport (PDX) Fuel Facility in accordance with Or. Admin. R. section 340-300-0007. The PDX Fuel Facility is leased and operated by PDX Fuel Company, LLC (PFC). The lease requires PFC to complete the SVA and subsequent Mitigation Planning for the PDX Fuel Facility. As updated in September of 2023, Chapter 99 of the State of Oregon Laws now mandates the following:

> An Owner or Operator of a bulk oils or liquid fuels terminal must conduct and submit to the Department of Environmental Quality a comprehensive seismic vulnerability assessment for the entire bulk oils or liquid fuel terminal. PDX Fuel Facility is both a bulk oil and liquid fuel terminal. The law further describes that the term "Owner or Operator" does not include any person or entity that owns the land underlying a facility if the person or entity is not involved in the operations of the facility.

PFC has hired Burns & McDonnell to provide a comprehensive SVA on their behalf. Only assets leased by PFC are evaluated in this document.

Geotechnical data specific to the PDX Fuel Facility has been collected and analyzed by Haley & Aldrich with the summary of results provided to Burns & McDonnell. Those results are contained within the following documents which are provided as supplemental attachments to this assessment:

Appendix B - Enhanced Seismic Design Considerations
Appendix C - Geotechnical Data Report on PDX Fuel Project Tank Design

Analysis of the Geotechnical data and assessment of the existing infrastructure is pertained within this report.

The assessment of existing structures has been categorized into two parts for the purposes of this document:

1. Fuel Facility Structures (FFS)
2. Airport Hydrant System (AHS)

Summary of Fuel Facility Structures

The PDX Fuel Facility was designed and built in the early 1970's for Chevron for the purpose of storing and transporting fuel to aircraft at the PDX Airport. The Airport and Owner have provided Burns & McDonnell with all available drawings spanning back to the early 1970's. Refer to Appendix A, Figure-1 and Figure-2 for reference information.

After a thorough review of the facilities available existing drawings a summary of structures is as follows:

1971 Fuel Facility drawings show the following structures:

A. Above Ground Storage Tank 1 (T-1A)
B. Above Ground Storage Tank 2 (T-2A)
C. Perimeter Impoundment Dike Walls for AST Tank 1 & 2
D. Hydrant Pump Pad
E. Hydrant Cart Testing Facility
F. Control Room Building
G. 10,000 Gallon Underground Slop Tank
H. Pipeline Pigging Station

1988 Fuel Facility drawings show the following structure additions:

A. Concrete slab with perimeter curb and drain for the Pig Station.
B. Underground Sump
C. Cyclone Separator
D. Clay Filter

1994 Fuel Facility drawings show the following structure additions:

A. Above Ground Storage Tank 3 (T-1B)
B. Perimeter Impoundment Dike Wall for AST Tank 3
C. 10,000 Gallon Above Ground Jet Fuel Not for Aviation Use Tank (Slop Tank)
D. 2,000 Gallon below grade Oil Water Separator
E. Service Building
F. Sewage Holding Tank
G. Hydrant Pump Pad Steel Platform

1994 Fuel Facility drawings show the following structure was removed:

A. 10,000 Gallon Underground Slop Tank

2001 Fuel Facility drawings show the following structure additions:

A. Filter Separator Access Platform
B. Switch Gear
C. Diesel Generator
D. Sanitary Sewer Lift Station
E. Operations Building

2019 Fuel Facility drawings show the following structure additions:

A. Stand-by Generator Foundation
B. Power Distribution Center and HVAC equipment
C. Hydrant Pump Pad foundation extension
D. Hydrant Pump Pad access platform reconfiguration

Facility Structures where existing drawings are not readily available:

A. Kinder Morgan Office Building
B. Foam Building

Evaluation of Existing Fuel Related Structures

For the purpose of evaluating the existing structures at the PDX Fuel Facility, information was collected from existing facility drawings provided by the Owner and the Port of Portland as well as during a site visit of the existing facility. Based on the Geotechnical supporting documentation, the site is classified as Site Class F and a site response analysis was performed. Per Oregon Law Chapter 99, all structures at the facility are to be designed to ASCE 7-16 risk category IV. Based on a site-specific analysis the site seismicity consists of the following values:

S_s =	0.848	Short-Period Spectral Response Acceleration (at 0.2 second)
S_1 =	0.376	One-Second Spectral Response Acceleration (at 1 second)
T_L =	16	Long-Period Transition Period, sec (ASCE 7 Figure 22-15)
h_n =	13	Height of the highest level of structure above base, feet

Importance Factor, I =	1.50		(ASCE 7 Table 1.5-2)	
Site Coefficient:	F_a =	1.04	(IBC Table 1613.2.3(1))	(ASCE 7 Table 11.4-1)
(ASCE Table 11.4)	F_v =	2.95	(IBC Table 1613.2.3(2))	(ASCE 7 Table 11.4-2)
Max considered earthquake spectral response acceleration:				
$S_{MS} = F_a S_s$ =	0.885		(ASCE 7 11.4-1)	
$S_{M1} = F_v S_1$ =	1.109		(ASCE 7 11.4-2)	
Design Spectral Response Acceleration:				
$S_{DS} = 2/3\ S_{MS}$ =	0.590		(ASCE 7 11.4-3)	
$S_{D1} = 2/3\ S_{M1}$ =	0.739		(ASCE 7 11.4-4)	
Seismic Design Category based on S_{DS} =		D	(ASCE 7 Table 11.6-1)	
Seismic Design Category based on S_{D1} =		D	(ASCE 7 Table 11.6-2)	
Effective Seismic Design Category =		**D**		

The Level of Seismicity is considered High as the facility falls within Seismic Design Category D.

Further considerations pertaining to seismic include lateral spread and its influence on existing structures. Lateral spreading is defined as lateral movement of gently to steeply sloping, saturated soil deposits caused by earthquake-induced liquefaction. Lateral spreading occurs because of an increase in porewater pressure in the soil from an earthquake. An earthquake reduces the stiffness and shear strength of the soil.

Operations Building

The existing Operations building consists of a wood and steel framed modular building supported by a series of shallow spread footings.

The Operations Building (Ops Bldg) and foundation are not sufficiently designed to survive a design level earthquake. The Ops Bldg failure will not result in a spill greater than the maximum allowable uncontained amount.

The Ops Bldg will be decommissioned in the near-future and replaced with a building and foundation that is compliant with Oregon Law.

Hydrant Cart Testing Facility Building

The existing Hydrant Cart Testing Facility building is a steel supported and steel cladded building. The original building's lateral force resisting system based on field reconnaissance appears to consist of ordinary concentrically braced moment frames. The original conceptual drawings do not show enough detail to completely understand if this building relies solely on moment frames or also has a series of roof purlins with a diaphragm for the roof. The interior of the building is clad in steel which prevents inspection of portions of the building's structural system.

The dimensions of the building are 22' x 24' x 13' tall, with a series of glazed windows on the north and south side of the building. The foundation consists of a 6" slab on grade mat foundation with an integral 9" x 12" wide perimeter footing. The building is a single-story structure and utilized for miscellaneous facility maintenance operations and storage. The building also contains jet fuel piping and a high wing testing system.

Upcoming mitigation plans will remove all jet fuel piping within the shell of the Hydrant Cart Testing Facility Building. Once the existing piping is demolished this facility will not be capable of potentially causing a Maximum Allowable Uncontained spill resulting from a design level earthquake.

The building is small enough and has a large enough exit point such that any personnel within the building can quickly exit the facility during a seismic event. Furthermore, in the future this building will only be utilized as a maintenance garage. Because this building is not a permanently occupied structure, there is minimal risk to life-safety.

Hydrant Pump Pad

The Hydrant Pump Pad consists of a reinforced concrete slab on grade that is 8-inches thick with an integral one foot x one foot square thickened edge at the perimeter of the mat. The mat is approximately 36' x 85' in plan. There is an expansion joint at the approximate center point of the mat foundation.

Because this structure is supported on a shallow foundation system it is particularly susceptible to damage from a design level earthquake. Based on table 11 & 12 of the Enhanced Seismic Design Considerations report (Appendix B) provided by Haley & Aldrich the following settlement and lateral displacements are anticipated to occur at the Hydrant Pump Pad:

Table 11. Summary of Total Settlement and Lateral Displacement

Analysis Profile	Average Vertical Settlement (inches)	Average Lateral Surface Displacement (inches)
North (right)	8.1	18
Middle	10.2	20
South (left)	12.2	32

Notes:
Distance between north edge to south edge is 440 feet

Table 12. Summary of Differential Settlement and Lateral Displacement

Analysis Profile	Average Differential Settlement (inches/50 feet)	Average Differential Lateral Surface Displacement (inches/50 feet)
Between North and South Profiles	0.5	1.6

Notes:
Distance between north edge to south edge is 440 feet

Total settlement: 8.1 inches

Lateral surface displacement: 18 inches

Differential Settlement: 0.85 inches

Differential Lateral Surface Displacement: 2.72 inches

The Hydrant Pump Pad consists of ASME B31.1 welded carbon steel pipe that is supported on steel pipe supports that bear on the Pump Pad mat foundation. Five (5) hydrant pump trains are supported on concrete pedestals (housekeeping pads) along with various other jet fuel filtration equipment. Spacing has been allotted for an

additional two (2) hydrant pump trains in kind with the others. Based on the movements previously listed, it is anticipated that the Hydrant Pump Pad foundation will crack and settle during a design level seismic event. This is particularly true at locations where the hydrant system piping network penetrates the pump pad foundation and goes underground. Welded standard weight carbon steel pipe has significantly more flexibility than the concrete foundation and will behave in a more ductile manner. Based on these findings, it is not anticipated that a spill greater than the Maximum Allowable Uncontained Spill will occur from a design level earthquake. Double block-and-bleed plug valves are installed for positive isolation of each pump train in addition to the main supply to the hydrant system, which can be manually closed to isolate from the rest of the fuel system.

Pipeline Pigging Station with Overhead Canopy

This infrastructure is owned and maintained by Kinder Morgan and is not part of the PFC Leased Assets, and therefore is outside the scope of this document.

Above Ground Storage Tank 1 & 2

Existing above ground storage tanks (AST) 1 & 2 were constructed in 1971. According to measurements from the most recent American Petroleum Institute (API) 653 Out-of-service inspection, these tanks are 67'-0" in diameter and 31'-4" in overall height. Each tank can nominally store up to 20,000 BBLS (840,000 gallons) of Jet-A fuel. Existing drawings show that the foundation of these tanks consists of a ten-foot-thick compacted aggregate. The bottom eight feet of which consists of a bed of compacted sand and gravel. The remaining two feet directly below the tanks consists of a two-foot crushed rock base.

In 1996 the existing tank bottoms were retrofitted with a new steel tank bottom, flexible member liner for secondary containment and cathodic protection.

The existing tank construction and foundation are not sufficiently designed to prevent a spill that is less than the Maximum Allowable Uncontained Spill resulting from a design level earthquake. It is highly likely that the differential and lateral movement placed on the existing tanks will compromise the tank nozzles resulting in a release greater than the Maximum Allowable Uncontained Spill.

Tank 1 & 2 will be decommissioned and replaced with a tank system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project.

Tank 1 & 2 Dike Walls

The dike walls for tanks 1 and 2 were constructed in the early 1970's. Existing drawings show their construction as a reinforced concrete footing with 8-inch-thick lightweight grade "A" load bearing concrete masonry units (CMU), conforming to ASTM C90.

Information available to PDX Fuel indicates in the 1990's a flexible membrane liner was added to the dike areas. This liner exists to prevent any incidental spills from migrating into the surrounding subgrade.

The existing dike walls for tanks 1 and 2 are not sufficiently designed to prevent a spill that is less than the Maximum Allowable Uncontained Spill resulting from a design level earthquake. The CMU block cannot handle differential settlement and vertical stair-step cracks will likely form because of a design level event, compromising secondary containment. Failure at the attachment point between the flexible membrane liner and the CMU block wall is also likely, which would compromise containment.

Dike containment walls for tanks 1 & 2 will be demolished and replaced with a system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project.

Above Ground Storage Tank 3

Existing above ground storage tank (AST) 3 was constructed in 1995. According to measurements taken during the latest API 653 Out-of-service inspection, this tank is 95'-0" in diameter and 32'-1" in overall height. Tank 3 can nominally store up to 40,000 BBLS (1,680,000 gallons) of Jet-A fuel. Existing drawings show that the foundation of this tank consists of a reinforced concrete ringwall foundation beneath the perimeter of the storage tank. This foundation is 3'-0" thick and 1'-8" wide. The subgrade beneath the ringwall consists of a 2'-0" compacted layer of gravel.

The existing tank construction and foundation are not sufficiently designed to prevent a spill that is less than the Maximum Allowable Uncontained Spill resulting from a design level earthquake. It is highly likely that the differential and lateral movement placed on the existing tank will compromise the tank nozzles resulting in a spill.

Tank 3 will be decommissioned and replaced with a system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project.

Tank 3 Dike Walls

The dike walls for tank 3 were constructed alongside tank 3 in 1995. Existing drawings show its construction consisting of a reinforced concrete retaining wall. The retaining wall is 8 inches in thickness with a varied height. A flexible membrane liner that is attached to the concrete retaining (dike) wall exists to prevent any incidental spills from migrating into the surrounding subgrade.

The existing dike walls for tank 3 are not sufficiently designed to prevent a spill that is less than the Maximum Allowable Uncontained Spill resulting from a design level earthquake.

Dike containment walls for tank 3 will be demolished and replaced with a system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project.

10,000 Gallon Above Ground Off Spec Product Tank (Slop Tank)

The existing 10,000 gallon off spec product tank was installed in 1994 to replace the underground 10,000-gallon slop tank which was original to the fuel facility. Existing facility drawings lack information pertaining to its construction. Based on a visit to the facility it appears that the existing tank consists of a skid that is supported on a concrete mat foundation. The surrounding pipe supports are on 1'-6" diameter circular foundations that are 3'-3" in depth per existing facility drawings.

The primary tank itself is a cylindrical UL 142 horizontal steel tank, equipped with a rectangular steel secondary containment shell. All penetrations through the primary tank are through the top ("roof") portion of the tank, consistent with double-wall tank standards. The risk of a maximum allowable uncontained spill resulting from a design level earthquake is minimal.

The existing tank foundation tank nozzle connections and surrounding pipe supports and their foundation are not sufficiently designed to prevent a spill resulting from a design level earthquake. However, the low volume and infrequent use of the piping (normally not pressurized) would likely not result in a spill greater than the Maximum Allowable Uncontained Spill

2,000 Gallon Oil Water Separator

The existing 2,000-gallon oil water separator tank is situated at the northwest corner of the site. The tank is buried underground and attached to an 18-inch-thick concrete ballast pad. The overall length of the tank is approximately 10'-0". For stormwater and potential oil sheen to enter the tank, the operators must turn a series of post-indicator valves to allow liquid to enter the oil water separator.

The oil water separator will be demolished and replaced with an aboveground system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project.

Jet Fuel Pipe Supports

Because of the age of the facility and the number of additions to it, there are a large variety of pipe supports. All existing pipe supports under the leasehold responsibility of PFC are founded on shallow foundations. Most of these pipe supports are supported by structural steel that is anchored to the shallow foundation.

The majority of the existing pipe supports will be demolished and replaced with a system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project.

Operational Safety Measures

Safety of Operating Conditions:

The PDX Fuel System is monitored 24/7 by one or more on-site personnel. The PDX Fuel System is equipped with several redundant protection and alarm systems to ensure the safety of operating conditions.

All PDX fuel storage tanks are equipped with radar type automatic tank gauges (ATG) to constantly measure the liquid level inside each tank. The ATGs are equipped with redundant radar sensors such that an alarm is generated if liquid level readings for either sensor are different from the other. In the event a radar sensor fails completely; the redundant sensor will provide the primary liquid level reading and alert the Operator of the failed sensor. The ATG systems are programmed with separate high and high-high level alarm setpoints.

In the event the liquid level reaches the high level setpoint, an alarm will alert the Operator so they can manually stop the operation. If flow of fuel continues to the high-high level setpoint, an alarm will be sent to the Operator. Additionally the system will automatically shut closed the receipt (inlet) motor operated valve and stop all transfer and offload pumps at the Fuel Facility.

Further supplementing the ATG system, each tank is equipped with an independent high-high level alarm switch. Activation of the independent high-high level switch will also activate an alarm. This alarm will close the receipt valve and shutdown all transfer and offload pumps at the Fuel Facility. During a pipeline receipt, if either of the high-high level alarms (ATG or independent switch) are activated, the pipeline's ready to receive permissive will be removed, automatically shutting down the pipeline pumps and stopping flow of fuel into the storage tank.

The hydrant pumps are equipped with bearing temperature sensors to automatically alert the Operator of a high-temperature condition. If the bearing temperature continues to rise to the high-temperature threshold, the hydrant pump will automatically be shut down and an alarm is sent to the Operator to prevent or mitigate any fire risk.

The hydrant pumps are also equipped with two vibration transmitters (one for X-axis, one for Y-axis) to alert the Operator of any high vibration conditions. If vibration levels continue to rise to the threshold (as defined by the pump manufacturer), the hydrant pump will automatically be shut down and alarm sent to the Operator. A combination flow and temperature sensors exist downstream of each hydrant pump. If the flow sensor fails to detect flow, or a loss of flow is detected, the hydrant pump will be automatically shut down and an alarm sent to the Operator. The sensor will also detect fluid temperatures, and automatically shut down the hydrant pump and alert the Operator if the fluid temperature reaches the setpoint.

Safe Shutdown Procedures:

As noted, the Fuel Facility is manned 24/7. In the event of an accidental spill or emergency such as an earthquake, an emergency fuel shut-off (EFSO) button will be activated by the Operator. Activation of the EFSO system will shut down all delivery pumps at the Fuel Facility, stopping the flow of fuel within the facility and across the entirety of the Airport Hydrant System. Activation of an EFSO at the Fuel Facility will also trigger the tank motor operated valves (receipt and issue) to automatically close. These EFSO buttons are located throughout the Fuel Facility at all points of ingress and egress, and at each Airport gate at the Airport terminal buildings.

Potential Spills:

All fuel storage tanks are located within secondary containment. All flanged and threaded connections (mechanical joints) for fuel piping and equipment are located over curbed concrete containment pads or within concrete vaults. Fuel piping located outside of secondary containment is all buttwelded without mechanical joints. In the event of an accidental spill, sections of the system can be isolated from other portions to prevent further discharge of system contents. All isolation points are equipped with double block-and-bleed plug valves which provide verifiable positive isolation.

An Integrated Contingency Plan (ICP) prepared by Advanced Remediation Technologies, Inc. was developed for the PDX Fuel Facility and is updated in accordance with regulatory requirements. This ICP combines the required planning elements from the following regulating agencies:

1. Resource Conservation and Recovery Act (RCRA) Contingency Planning requirements (40 CFR 264 and 265)
2. Spill Prevention Control and Countermeasures Plan (SPCCP) (40 CFR 112)
3. Facility Response Plan (FRP) (40 CFR 112)
4. Oil & Hazardous Materials Emergency Response Requirement (OAR Div 142, ORS 468B)

The ICP will be followed and utilized by the Operator in the event of a spill to ensure that emergency incidents are responded to quickly, safely and effectively, and are properly reported and documented. The emergency incidents in the plan include pollutant release to the environment resulting from spills, as well as explosions, fires, and other dangerous incidents. All Operator personnel are trained and familiar with the ICP and process for contacting the Oil Spill Response Organization as required by the FRP. In addition, any emergency related to the PDX Fuel Facility requires the Operator to contact PDX Airport Operations, who in-turn engage emergency responders to assist.

In addition to the ICP, an Airlines for America (formerly known as Air Transport Association of American) [A4A] Fuel Facility Disruption Plan was developed and implemented in 2019. This plan provides guidance to the Fuel Consortium and Operator during a fuel disruption. The emergency incidents in the plan include natural

disasters such as earthquakes. The A4A is a trade association and lobbying group that works collaboratively with the airlines and government to ensure that all policies promote a safe, secure and healthy U.S. airline industry.

Existing Fire Suppression Systems:

The PDX Fuel Facility is supplied by a pressurized fire loop that is protected from the domestic loop by a single reduced pressure zone backflow preventer. There are three (3) supplemental foam-water fire department connections for internal fire suppression. They are on the north and south end of the site as well as just outside the foam building. None of these connections are firewater connections. A series of check valves are used to prevent foam from entering the fire department supply pipe sections.

The fire water loop supplies a bladder proportioning foam suppression system for the existing fuel tanks that are in the foam building. The foam building contains two (2) existing 3% Aqueous Film Forming Foam (AFFF) foam/water proportioners supplied from an 800-gallon foam concentrate bladder tank. The foam/water system is manually operated and supplies the foam chambers on Tanks 1, 2, and 3. Onsite signage exists for the purpose of instructing the responding emergency personnel through the operational sequence of the foam system.

Jet-A fuel has a flash point of 100.4 ºF and is considered a Class II combustible liquid in accordance with the Portland Fire Code E102.1.3. Two foam chambers are provided on tank 3 and one foam chamber is provided on tanks 1 and 2 providing total surface coverage with 3% AFFF foam/water in accordance with NFPA 11. Each of the two (2) foam chambers on tank 3 are assumed to discharge at least 357 gallon per minute (gpm) and tank 1 and 2 have a discharge of at least 353 gpm for a duration of 30 minutes in accordance with NFPA 11 Table 5.2.5.2.2.

The current truck loading rack is protected by two (2) wheeled ramp fire extinguishers. They are provided through the PDX fire department. These, in conjunction with 3% AFFF solution, satisfy Portland Fire Code requirements described in section 5706.5. The existing fire suppression system is located above grade and is seismically braced in accordance with NFPA 13.

The existing fire control and suppression systems are not sufficiently resilient to seismic. The existing fire control and suppression systems will be demolished and replaced with a system designed to meet Oregon Law within the next four years as part of the PDX Fuel Facility Improvements project. It is anticipated that the new system will utilize Fluorine Free Foam as certified for use by Federal Aviation Administration (FAA).

Emergency Response & Preparedness:

Fire Department Response and Access:

Emergency access to the site is provided through three (3) points of entry:

A. One (1) at the main entrance on the northeast side of the site.
B. One (1) on the north end of the side near the fire foam building.
C. One (1) on the southeast end of the site on the corner.

The entrance on the south side leads to a fire lane along the east side of the storage tank diked area. The north side of the site is accessible on the western side but is obstructed by buildings and the pump pad on the eastern half. The western and southern ends of the site are completely accessible without a fence for the fire department. The current fire lanes are approximately 240 feet long and approximately 20 feet wide per International Fire Code (IFC) section 503.2.1.

There are three (3) fire department staging locations at the site. The fire department connection for pressurizing the foam water system is located north of the site near the foam building. There is additionally a foam fire department connection on the foam building and south of the site for pumping foam/water directly into the infrastructure systems supplying the foam chambers and foam monitors.

There are fire hydrants located around the perimeter of the entire fuel facility for supplemental fire water connection. Supplemental foam/water hose connection's locations are not provided.

The existing signage is composed of maps of the site on the fire department connections and instructional signage in the foam building.

Electrical Systems That Isolate Fuel:

When activated the Emergency Fuel Shut Off (EFSO) system, stops hydrant pumps, sends close commands to electrically operated valves (including the ones located on operating tanks) and causes hydraulic valves (fail-safe, Cla-val) to close. The hydraulic valves can close by one of the following means:

1. Removing power from the electric solenoid.
2. Pressure in the pipe decreasing because of the pumps turning off.
3. The EFSO system is activated manually by pressing EFSO pushbuttons which are located at paths of egress and major fueling operations.
4. If power is removed from the electrical distribution system at site, the hydraulic valves (Cla-val) will close because of loss of pressure due to the hydrant pumps not running.
5. If power is removed from the EFSO system (which is fed by the electrical distribution system) the EFSO system will recover in a faulted state. This means that valves will be driven closed, and pumps will be unable to restart until active EFSO alarms are cleared and reset is pressed on the EFSO panel.

Overall Control System:

The control system at the Fuel Facility is a programmable logic controller (PLC) based system. The control system allows operators to monitor and control the fueling system. The control system reports alarms to operators.

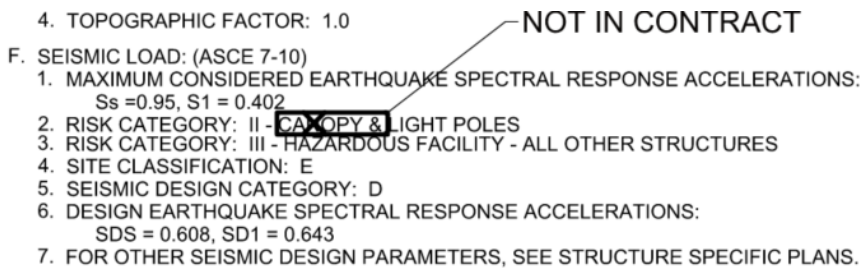
The control system has redundant logic controllers so that a failure on one controller allows seamless transition to the backup controller. The control system has a dedicated uninterruptible power supply (UPS). During a utility power outage, the UPS will continue to provide power to the EFSO Panel/System and the Control System for a minimum of 15 minutes. This UPS will provide power until the standby generator is running. The standby generator may take 30-60 seconds to come up to speed and become available to the system.

Systems in Place for Environmental and Personnel Protection:

1. Hydraulic valves (fail-safe, Cla-Val) at each hydrant pump train. (FC-HPX). Valves close on loss of pressure or loss of power to its solenoid.
2. Electrically operated valves are located at each operating tank. These valves are "fail in place." While the electric actuator is powered (480v), the valve can be closed remotely by removing an electrical input. The valves are closed locally by using a handwheel located on the actuator or if actuator is powered (480v) the valve can be closed with a selector switch located on the actuator.
    a. It takes approximately 45 seconds to fully close the valve from a close command. The site has a standby generator (seismic rating identified below) which will restore 480v if utility is down.
    b. The electrically operated valves are located at the tank shell. If there is a spill, the electrically operated valves will be in containment with the fuel. If they still have power, they will be able to be remotely closed.

Major equipment and their seismic rating (if applicable)

1. Details for site.
    a. Electrical component importance Factor is 1.5



2. Standby Generator
    a. Manufacturer: Kohler – KD1500
        i. Supports overall electrical distribution system.

ii. Seismic rating: Qualified. Products are rated to perform successfully during and after seismic activity.
iii. Sub-base tank, fuel volume, is sized to operate generator for 24 hours.

3. Panelboards within new Power Distribution Center (PDC)
    a. Manufacturer: ABB – ReliaGear neXT power panel
        i. Supports smaller loads (lighting, Electric operated valves, PLC)
        ii. Seismic rating: Qualified. Products are rated to perform successfully during and after seismic activity.
    b. Manufacturer: ABB – RE/RS Lighting Panel
        i. Supports smaller loads (lighting, Electric operated valves, PLC)
        ii. Seismic rating: Qualified. Products are rated to perform successfully during and after seismic activity.
4. Switchgear (Within new PDC)–
    a. Manufacturer: ABB – AKD-20 Entellisys
        i. Supports overall electrical distribution system.
        ii. Seismic rating: Qualified. Products are rated to perform successfully during and after seismic activity.
5. Switchboard (Within new PDC)
    a. Manufacturer: ABB – ReliaGear AV1
    b. Supports overall electrical distribution system.
    c. Seismic rating: Qualified. Products are rated to perform successfully during and after seismic activity.
6. Motor Control Center (MCC1) (Within new PDC) –
    a. Manufacturer: Rockwell Automation – Allen Bradley - Centerline 2100
        i. Supports overall electrical distribution system.
        ii. Seismic rating: Qualified. Products are rated to perform successfully during and after seismic activity.
7. Existing equipment outside new PDC
    a. The following equipment is existing and located outside of the new PDC. The following equipment provides power to some of the area lights, building lights, small pumps, lift stations, network equipment and computers. The seismic rating of the equipment identified below is unknown at this time. Some of the equipment identified below will be demolished in Phase 2 (2024) and some equipment will remain. If the equipment identified below were to fail during a seismic event, it would not impact the automated responses described above for the motor operated valves or the EFSO System.
        i. Equipment to be demolished and removed in Phase 2
            1. MCC Building
                a. Motor Control Center (MCC): serves no purpose at end of Phase 1.
                b. Panelboard LP-1: Serves some exterior lights. Exterior lights will be fully fed from the new PDC building and new Operations Building in Phase 2.

c. Panelboard 1: Fed from MCC. Serves no purpose at end of Phase 1. It did provide power to the motor operated valves but that is now fed from the new PDC building.

2. Foam Building
    a. Panelboard P3: Panel provides general lighting and heating for the Foam Building. This panel is fed by Panelboard P2 located in the Lab Room.
3. Module Office Building / Operations Building
    a. Panelboard PNL-4: Serves general building loads, network equipment and computer workstations. The module office will be replaced by a new operations building in Phase 2.

ii. Equipment to remain after Phase 2

1. Lab Building
    a. Backflow / Utility Room
        i. Panelboard "P1 Panel": Serves sump separator motors for fuel and water. Sump separator motors will be new and fed from PDC in Phase 2.
        ii. This panel also feeds Transformer T-2 which then feeds LP-1 located in MCC Building. At end of Phase 2 this panelboard will only serve the sanitary sewer lift stations P-16A and P-16B.
    b. Lab Room
        i. Panelboard P2 Panel:
            1. Equipment in lab room. Receptacles and Fume hood.
            2. The power for radar (ATG) is refed from the PLC Cabinet within the PDC.
            3. Feeds Panelboard P3 which is demolished in Phase 1 (see above).

Airport Hydrant System

The existing Airport Hydrant System was originally designed and built in the early 1970's for Chevron and begins at the northeast corner of the Hydrant Pump Pad at the PDX Fuel Facility. The existing line starts as a 20-inch standard weight carbon steel pipe that leaves the pump pad and penetrates the ground where it continues subsurface as shown in Figure 3.

The Airport Hydrant System is used for transporting fuel from the PDX Fuel Facility to gates located along all concourses at the PDX Terminal. Prior to aircraft taking off

from PDX Airport, the plane is refueled utilizing refueling valve pits that are situated at most of the concourse gates.

The Airport and Owner have provided Burns & McDonnell with all available drawings spanning back to the early 1970's.

The Airport Hydrant System consists of the following:

1. Standard weight buttwelded carbon steel pipe (12-inch and larger)
2. Schedule 40 carbon steel buttwelded pipe. (10-inch and smaller)
3. High Point Vents
4. Low Point Vents
5. Isolation Valve Vaults
6. Hydrant Valve Pits

Existing drawings for components of the Airport Hydrant System are incomplete. As a result, Burns & McDonnell was previously tasked with creating As-Built drawings for the Airport Hydrant System and corresponding appurtenances.

The Fuel Tank Seismic Stability Rules indicate the following qualifying criteria:

"The owners and operators of bulk fuel terminals or industrial facilities with at least 2-million-gallon oil or liquid fuel products storage capacity located in Columbia, Multnomah and Lane counties must comply with the Fuel Tank Seismic Stability Rules."

It is estimated that approximately 171,905 gallons of Jet-A fuel are contained within the underground Airport Hydrant System. This is less than the 2,000,000-gallon threshold indicated within the Seismic Vulnerability Assessment. Therefore, the Airport Hydrant System should not be considered applicable to the Fuel Tank Seismic Stability Rules.

A spill from the Airport Hydrant System in the event of a design level seismic event is contained within the surrounding soil. Releases of fuel from similar hydrant systems at other Airports in the U.S. demonstrate that such releases are not an immediate

threat to adjacent waterways, and emergency response resources can be deployed to mitigate or prevent releases to surface water.

This concludes the Seismic Vulnerability Assessment for the PDX Fuel Facility.

Sincerely,

Kaylea Michaelis – Structural Engineer of Record
Burns & McDonnell

EXPIRES:12-31-2024
11-10-2023

Adam Kral – Senior Structural Engineer
Burns & McDonnell

Doug Woodward – Senior Mechanical Engineer
Burns & McDonnell

Reid Unke – Project Manager
Burns & McDonnell

Attachments:

Figure 1 – PDX Fuel Facility Structural Identification Aerial
Figure 2 – Summary List of Structures at PDX Fuel Facility
Figure 3 – PDX Airport Aerial – Hydrant Loop
Appendix A – Reference Drawings
Appendix B – Enhanced Seismic Design Considerations
Appendix C – Geotechnical Data Report on PDX Fuel Project Tank Design

cc: Mark Soleta – Alaska Airlines
Mark Bourdeau – Delta Air Lines

FIGURE 1

PDX FUEL FACILITY STRUCTURAL IDENTIFICATION AERIAL

FIGURE 1 - PDX FUEL FACILITY STRUCTURAL IDENTIFICATION AERIAL

FIGURE 2

SUMMARY LIST OF STRUCTURES AT PDX FUEL FACILITY

SUMMARY LIST OF FUEL FACILITY STRUCTURES							
Structure	Facility Component	Construction	Age	Notes	Fuel Related	Facility Drawing	Facility Component
1	10,000 gallon underground slop tank	Underground storage tank ballasted by a reinforced concrete block	1972	Removed in 1995	Yes	MF-2166233-6	10,000 gallon underground slop tank
2	Control Building	Kinder Morgan Property - Aluminum Cladded building supported by slab on grade with perimeter turned down footing	1972	To Be Demolished	No	MF-2166233-6	Control Building
3	Hydrant Cart Testing Facility	Steel framed building with mat foundation and perimeter turned down edge	1972	Fuel System To Be Demolished, Building Shell Remodeled	Yes	MF-21662337-1 / MF-21662338-2	Hydrant Cart Testing Facility
4	Hydrant Pump Pad	8 inch slab on grade with thickened turn down edge at perimeter, approximately 36' x 70' in length, 2021 expanded length X'	1972	Expanded in 2019 drawings	Yes	MF-2166238-4	Hydrant Pump Pad
5	Pipeline Pigging Station	Kinder Morgan Property - Piping over slab on grade with overhead canopy	1972	Kinder Morgan	Yes	MF-2166233-6 / F-9017-0 / F-8644-6 / F-8958-2	Pipeline Pigging Station
6	Tank 1	Compacted Sand and Gravel Foundation Bedding	1972	To Be Demolished	Yes	MF-2166238-4 / MF-2166233-6	Tank 1
7	Tank 1 & 2 Dike Walls	8" concrete masonry unit block wall supported by continuous spreadfooting	1972	To Be Demolished	Yes	MF-2166238-4	Tank 1 & 2 Dike Walls
8	Tank 2	Compacted Sand and Gravel Foundation Bedding	1972	To Be Demolished	Yes	MF-2166238-4 / MF-2166233-6	Tank 2
9	MCC Building	Exact Construction Documents do not exist, however additions were made in the 1990's	1988	To Be Demolished	No	3405-C-02	MCC Building
10	Overhead Canopy	Kinder Morgan Property - Canopy consists of PEMB supported by isolated and perimeter shallow footings	1988	Kinder Morgan	No	F-9017-0	Overhead Canopy
11	10,000 gallon Off Spec Product Tank	Concrete pad with above ground storage tank	1995		Yes	94-1014-C2	10,000 gallon Off Spec Product Tank
12	2,000 gallon OWS	Underground storage tank ballasted by a reinforced concrete block	1995		Yes	94-1014-C6	2,000 gallon OWS
13	Hydrant Pump Pad Platform	Steel framed platform consisting of ordinary moment frames and cantilevered columns supported on Hydrant Pump Pad	1995	To be Demolished and replaced with new platform	No	94-1014-S-3	Hydrant Pump Pad Platform
14	Service Building / Lab	Light gauge steel framed building supported by perimeter strip shallow footing	1995		No	94-1014-A1 & 94-1014-S-2	Service Building / Lab
15	Sewage Holding Tank	Precast Concrete Vault	1995		No	94-1014-C6	Sewage Holding Tank
16	Tank 3	Concrete Ring Wall Foundation with interior sand bedding	1995	To Be Demolished	Yes	94-1014-S-2 / 94-1014-M2	Tank 3
17	Tank 3 Dike Walls	Concrete Retaining Walls	1995	To Be Demolished	Yes	94-1014-S-2	Tank 3 Dike Walls
18	Diesel Tank & Foundation	Mat foundation with turned down edge supporting a diesel powered stand-by generator	2001	To Be Demolished	No	2003-1023-3405-C-02	Diesel Tank & Foundation
19	Fire Suppression Piping	Steel pipe supports on shallow isolated spread footings	2001	To Be Demolished & Updated	No	3405-A-01 / 3405-P-04	Fire Suppression Piping
20	Foam Building	Information on the building construction is missing, however it appears to be a PEMB on shallow mat foundation	2001	To Be Demolished	No	3405-A-01	Foam Building
21	Operations Building	Wood and Cold Formed steel modular building supported by series of perimter and isolated shallow footings	2001	To be replaced in near future	No	2004-KM-04 (1-6)	Operations Building
22	Sanitary Sewer Lift Station	Concrete Vault with Lid	2001		No	3405-C-02 / 3406-P-02 / 3406-P-04	Sanitary Sewer Lift Station
23	Hydrant Filter Platform	Steel framed platform consisting of ordinary moment frame and ordinary concentrically braced frames	2019	Replaces 1995 platform	No	S-108	Hydrant Filter Platform
24	Power Distribution Center / HVAC	Preengineered Metal Building supported on shallow foundation system	2022	Phase 1	No	PDC PEMB	Power Distribution Center / HVAC
25	Stand-by Generator	Mat foundation with turned down edge supporting a diesel powered stand-by generator and belly tank	2022	Phase 1	No	S-107	Stand-by Generator
26	Jet Fuel Pipe Supports	Misceallenous Steel Frame Supports on Shallow supported spreadfootings	1972 - 2001	To Be Demolished & Updated	Yes	3405-P-04	Jet Fuel Pipe Supports
27	Crossover Stairs	Steel framed crossover stairs supported on shallow foundations	1972 - 2022	To Be Demolished	No	PDX Aerial	Crossover Stairs
28	Filter Separator Platform	Steel framed platform consisting of ordinary moment frames, additional seismic reinforcement provided in 2019 drawings	2001 / 2022		No	3405-S-01 / 3405-S-02 / S-101 / S-544	Filter Separator Platform

FIGURE 2 - SUMMARY LIST OF STRUCTURES AT PDX FUEL FACILITY

FIGURE 3

PDX AIRPORT AERIAL – HYDRANT LOOP

NOTES:
1. THE ALIGNMENT OF THE HYDRANT LOOP IS APPROXIMATE FOR ILLUSTRATIONS PURPOSES ONLY

PDX FUEL FACILITY

HYDRANT LOOP

Figure 3 - PDX AIRPORT AERIAL - HYDRANT LOOP

APPENDIX A

REFERENCE DRAWINGS

TABLE OF CONTENTS

10,000 gallon underground slop tank
- MF-2166233-6

Control Building
- MF-2166233-6
- MF-2166237-2

Hydrant Cart Testing Facility
- MF-21662337-1
- MF-21662338-2

Hydrant Pump Pad
- MF-2166238-4

Pipeline Pigging Station
- MF-2166233-6
- F-9017-0
- F-8644-6
- F-8958-2

Tank 1 & Tank 2
- MF-2166238-4
- MF-2166233-6

Tank 1 & 2 Dike Walls
- MF-2166238-4

MCC Building
- 3405-C-02

Overhead Canopy
- F-9017-0

10,000 gallon Off Spec Product Tank
- 94-1014-C2

2,000 Gallon OWS
- 94-1014-C6

Hydrant Pump Pad Platform
- 94-1014-S-3

Service Building / Lab
- 94-1014-A1
- 94-1014-S-2

Sewage Holding Tank
- 94-1014-C6

Tank 3
- 94-1014-S-2
- 94-1014-M2

Tank 3 Dike Walls
- 94-1014-S-2

Diesel Tank & Foundation
- 2003-1023-3405-C-02

Fire Suppression Piping
- 3405-A-01
- 3405-P-02
- 3405-P-04

Foam Building
- 3405-A-01

Operations Building
- 2004-KM-04 (1-6)

Sanitary Sewer Lift Station
- 3405-C-02
- 3406-P-04

Hydrant Filter Platform
- S-108

Power Distribution Center / HVAC
- PDC PEMB

Stand-by Generator
- S-107

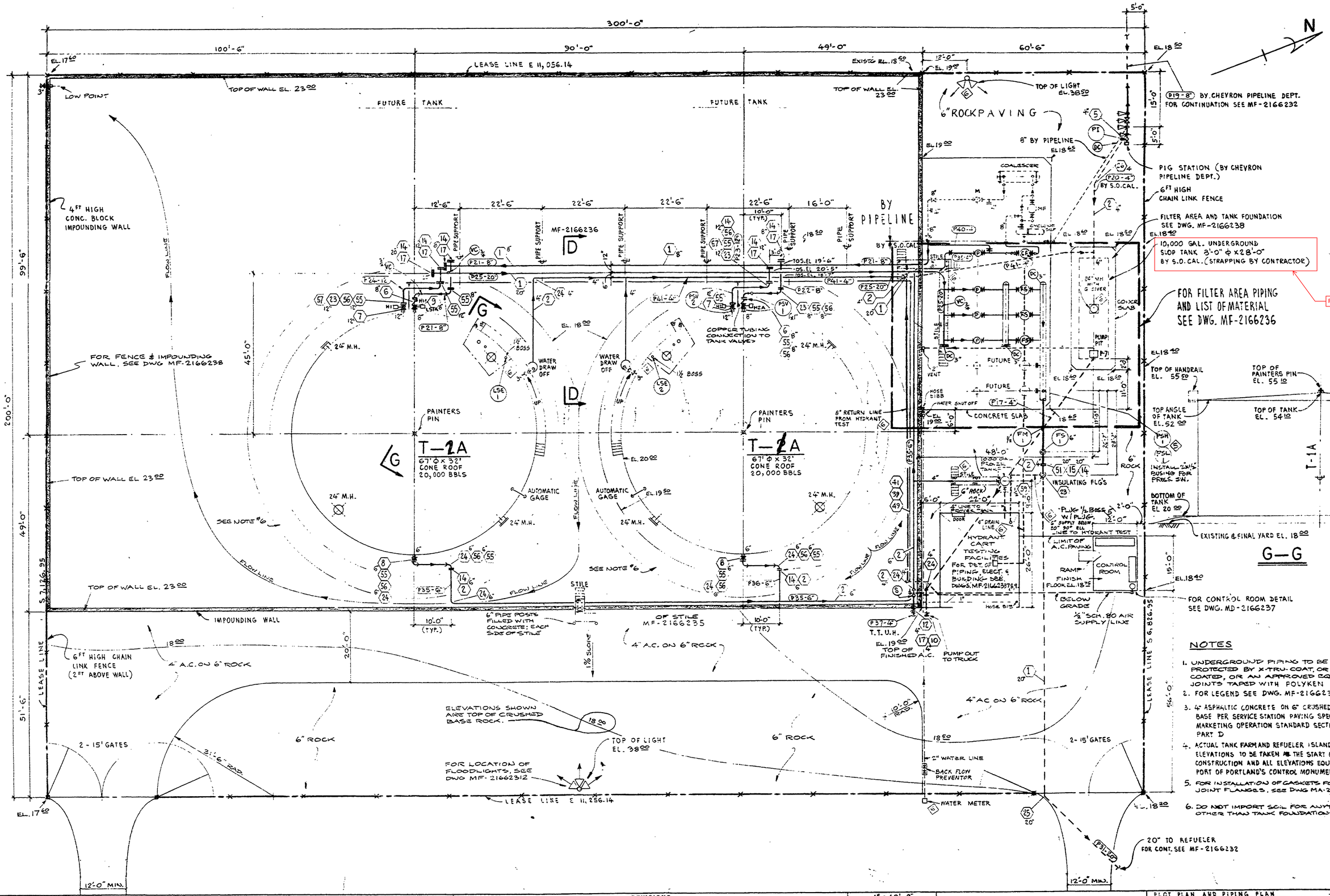
Jet Fuel Pipe Supports
- 3405-P-04

Crossover Stairs
- PDX Aerial

Filter Separator Platform
- 3405-S-01
- 3405-S-02
- S-101
- S-544

10,000 gallon underground slop tank

- MF-2166233-6



REFERENCE DRAWINGS			
SITE PLAN	MF-2166232	CONTROL ROOM PLAN, ELEV.	MD-2166237
TANK #1 & #2	MC-2166310	P & I D	MF-2166231
PIPING PLAN - FILTER AREA	MF-2166236	TYP. LAP JOINT FLG. INSTALLATION	MA-2166239
ELECTRICAL PLAN	MF-2166312	PIPING FOR HYDRANT CART TSTG. FAC.	MF-2166237
FOUNDATION PLAN & SECTIONS	MF-2166238	BLDG. FOR HYDRANT CART TESTG. FAC.	MF-2166239
SPECIFICATION	MA-2166230	CONTROL PANEL & LTG. ARRGT. - HYD. CART.	MF-2166231

REVISIONS

3	REVISED PIPELINE AREA, ADDED BLOCK VALVE AT PIG STATION AND METER, ADDED GREEN VALVE AT CYCLONE SEPARATOR AND METER, DELETED MASTER METER CONN. W.O. 9138/162	9-7-71	PS
6	REVISED T1A & T-2A, REPOSITION & REVISE STILES, RELOCATED FLOOD LIGHT & NW PROPERTY CORNER, ADDED DRAIN LINE & RELOCATED OTHER PIPING IN HYDRANT TEST, RELOCATED 6" RETURN LINE, ADDED WATER METER & SHUT OFF (AS BUILT)	5-4-72	SG MBA
5	REV'D FSH-1 TO TAKE FSL-1, USE ½" TIR PLUG AT OLD FSL-1 LOCATION (AT 6.80m) INSTALL BUSHING 2"x½" AT 2" BOSS FOR PRESSURES SW.	11-15-71	
4	ADDED A.C. PAVING OUTLINE, REPOUR RF HYDRANT CART TESTING FACILITIES, 10" 3 PUMP & F/S. FSH-1 WAS FSH-1 FS-1 WAS FSL-1.	11-1-71	

SCALE 1" = 10'-0"
DATE 6-2-71 DR. VS CK.
DR. APPR. ENG. APPROVED
OPER. DEPT.
ENG. DEPT.

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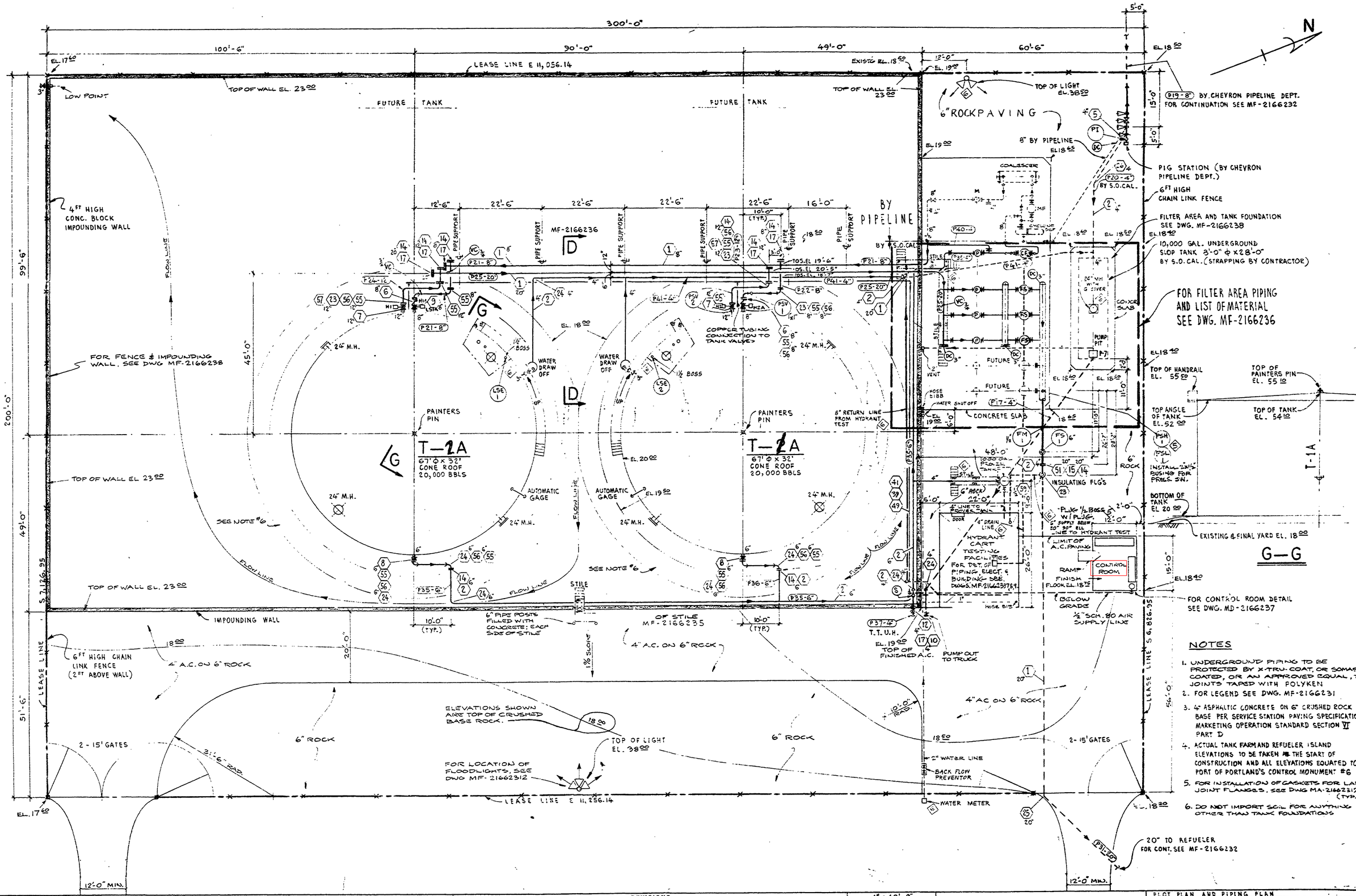
STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS, INC.
MARKETING OPERATIONS

PLOT PLAN AND PIPING PLAN
BULK FUEL STORAGE
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON
W.O. 11291
S.O.
MF-2166233-G

AS CONSTRUCTED
PIA 72-1002 3/23

Control Building

- MF-2166233-6
- MF-2166237-2



NOTES

1. UNDERGROUND PIPING TO BE PROTECTED BY X-TRU-COAT, OR SOMASTIC COATED, OR AN APPROVED EQUAL, ALL JOINTS TAPED WITH POLYKEN
2. FOR LEGEND SEE DWG. MF-2166231
3. 4" ASPHALTIC CONCRETE ON 6" CRUSHED ROCK BASE PER SERVICE STATION PAVING SPECIFICATION MARKETING OPERATION STANDARD SECTION VI PART D
4. ACTUAL TANK FARM AND REFUELER ISLAND ELEVATIONS TO BE TAKEN AS THE START OF CONSTRUCTION AND ALL ELEVATIONS EQUATED TO PORT OF PORTLAND'S CONTROL MONUMENT #6
5. FOR INSTALLATION OF GASKETS FOR LAP JOINT FLANGES, SEE DWG MA-2166231 (TYP.)
6. DO NOT IMPORT SOIL FOR ANYTHING OTHER THAN TANK FOUNDATIONS

REFERENCE DRAWINGS

SITE PLAN	MF-2166232	CONTROL ROOM PLAN, ELEV.	MD-2166237
TANK #1 & #2	MC-2166310	P & I D	MF-2166231
PIPING PLAN - FILTER AREA	MF-2166236	TYP. LAP JOINT FLG. INSTALLATION	MA-2166219
ELECTRICAL PLAN	MF-2166312	PIPING FOR HYDRANT CART TESTG. FAC.	MF-2166237
FOUNDATION PLAN & SECTIONS	MF-2166238	BLDG. FOR HYDRANT CART TESTG. FAC.	MF-2166239
SPECIFICATION	MA-2166230	CONTROL PANEL & LTG. ARRGT. - HYD. CART.	MF-2166231

REVISIONS

3	REVISED PIPELINE AREA, ADDED BLOCK VALVE AT PIG STATION AND METER, ADDED GREEN VALVE AT CYCLONE SEPARATOR AND METER, DELETED MASTER METER CONN. W.O. 9138/162	9-7-71	PS
5	REV'D PSH-1 TO TAKE PSL-1, USE ½" TIR PLUG AT OLD PSL-1 LOCATION (AT 6.80m) INSTALL BUSHING 2"x½" AT 2" BOSS FOR PRESSURES SW.	11-15-71	PS
6	REVISED T1A & T-2A, REPOSITION & REVISE STILES, RELOCATED FLOOD LIGHT & N/W PROPERTY CORNER, ADDED DRAIN LINE & RELOCATED OTHER PIPING IN HYDRANT TEST, RELOCATED 6" RETURN LINE, ADDED WATER METER & SHUT OFF (AS BUILT)	5-4-72	SG MBA
4	ADDED A.C. PAVING OUTLINE, REPOSITION HYDRANT CART TESTING FACILITIES, 10" 3 PUMP & F/S. FSH-1 WAS FSH-1 FS-1 WAS FSL-1.	11-1-71	TJR

SCALE	1" = 10'-0"
DATE	6-2-71
DR.	VS
CK.	
DR. APPR.	
ENG.	
OPER. DEPT.	
APPROVED	
ENG. DEPT.	

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PORTLAND, OREGON

W.O. 11291
S.O.

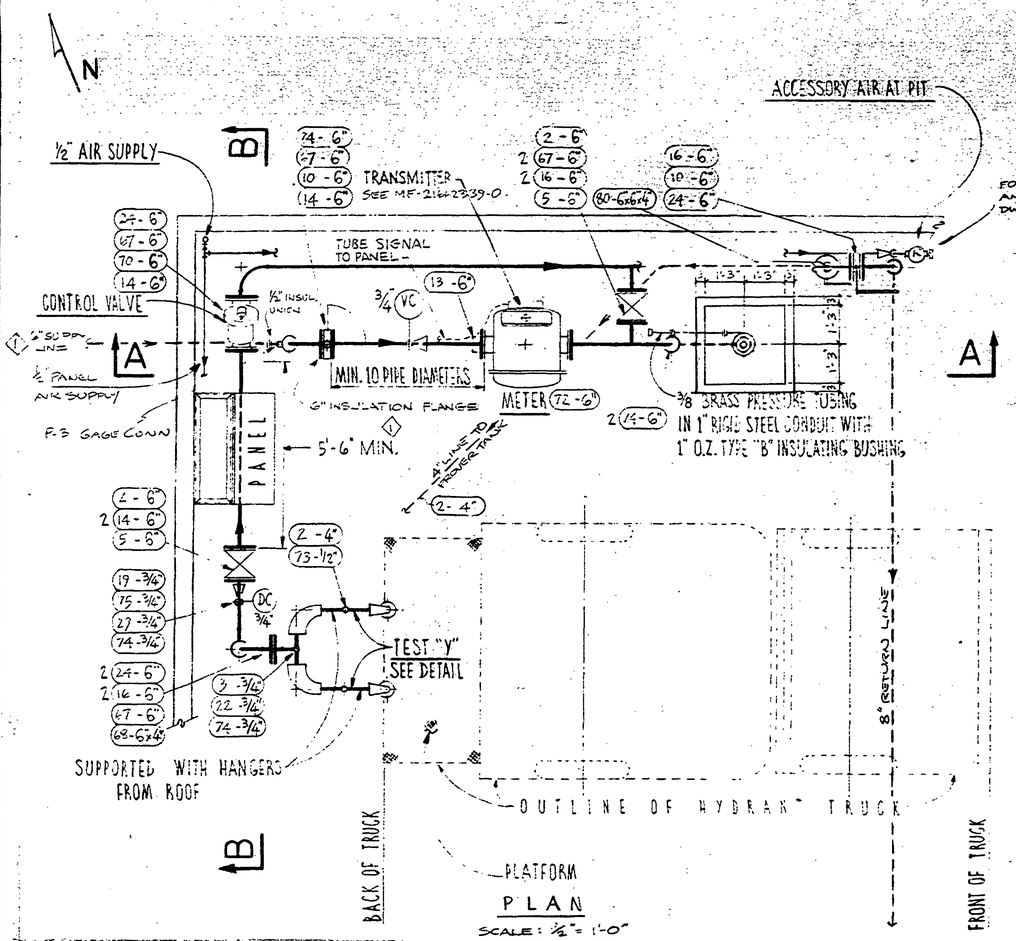
MF-2166233-6

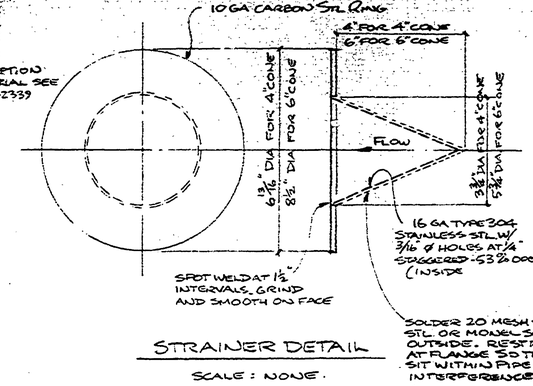
AS CONSTRUCTED

PIA 72-1002 3/23

Hydrant Cart Testing Facility

- MF-21662337-1
- MF-21662338-2





STRAINER DETAIL

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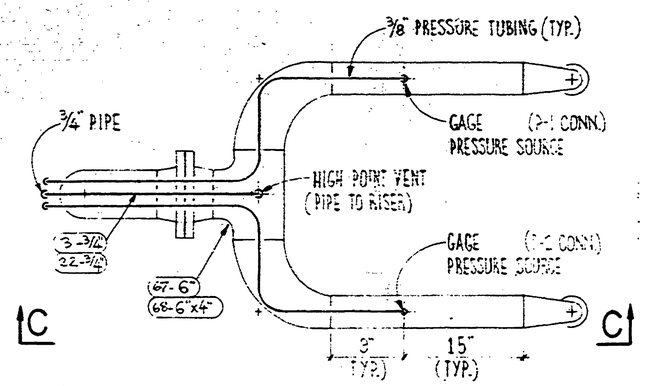

TEST "Y" DETAIL

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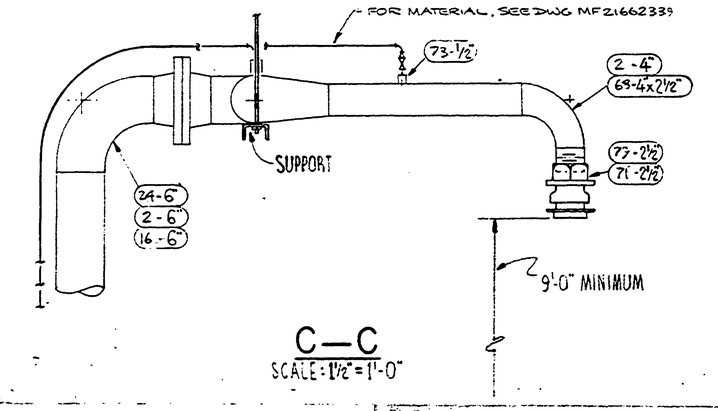

C—C

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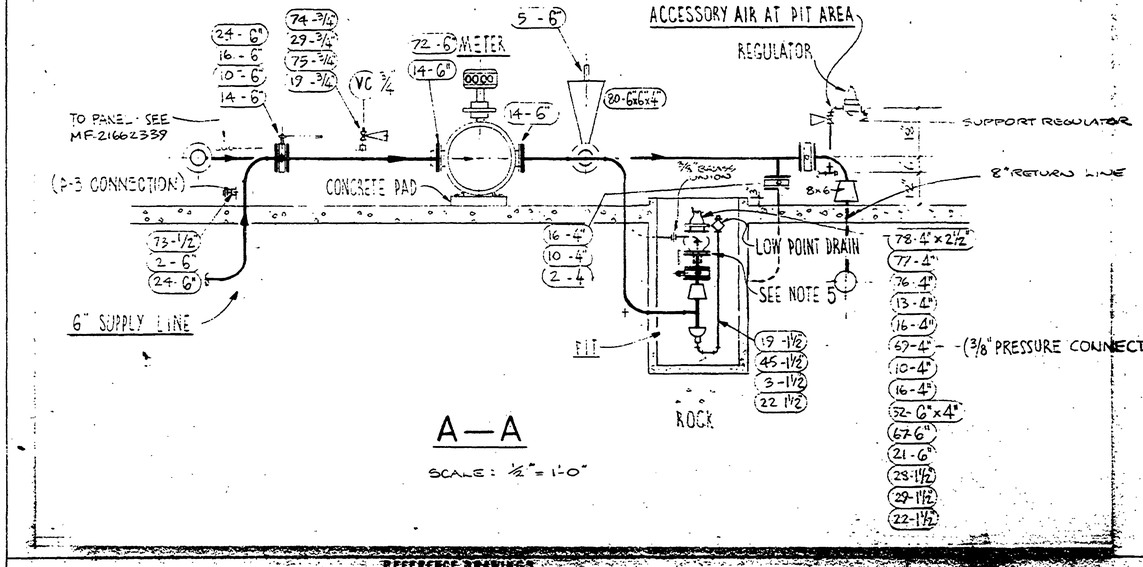

A—A

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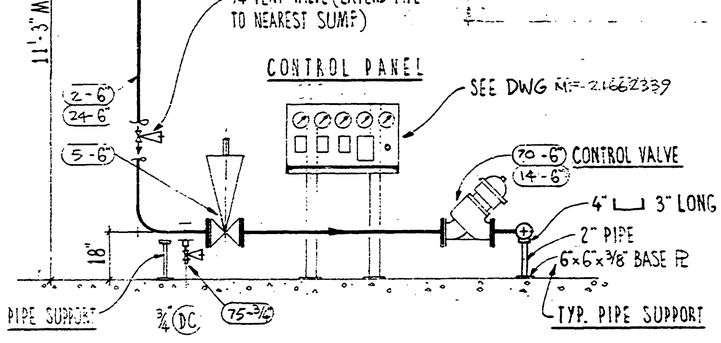

B—B

SCALE: ½" = 1'-0"

DESIGN AND CONSTRUCTION NOTES

1. UNDERGROUND PIPING TO BE PROTECTED BY X-TRU COAT OR SOMASTIC COATED OR AN APPROVED EQUAL
2. MAXIMUM LOSS IN DISCHARGE PIPING FROM CONTROL VALVE TO PUMP SUCTION CONN. OR TANK INLET MUST NOT EXCEED 20 PSI AT 1250 GPM. IF MORE THAN 20 PSI INCREASE SIZE OF DISCHARGE PIPING AS REQUIRED.
3. USE TEMPORARY STRAINER ON ALL NEW OR REVAMP INSTALLATIONS. KEEP IN PLACE UNTIL LOW POINT DRAINS ARE FREE AND CLEAR OF PARTICULATE MATTER
4. FOR INSTRUMENT AND ELECTRICAL MATERIALS REQUIRED SEE MF-21662339-0.
5. WHEN TESTING HYDRANT VALVES ONLY, A SPOOL MAY BE USED TO RAISE VALVE ABOVE GRADE. WHEN TESTING HYDRANT TRUCKS, USE A TESTED HYDRANT VALVE IN PIT AS SHOWN.
6. BONDING OF HYDRANT TRUCK IS NOT REQUIRED AT TEST FACILITY, BUT IS APPROVED TO MAINTAIN ESTABLISHED PROCEDURES BY OTHERS.
7. FOR MATERIAL LIST, SEE MF-2166234

LEGEND.

(DC) - DRAIN CONNECTIONS (LOW POINT)

(VC) - VENT CONNECTIONS (HIGH POINT)

REFERENCE DRAWINGS

BLDG FOR HYDRANT CART TESTING MF-2166233
CONTROL PANEL, LTG., ARREST, HYD. TEST. MF-21662339

REVISIONS

1 ADDED INSULATING UNION @ 6" SUPPLY LINE & REVD. 6" SUPPLY LINE & INSULATG FLANGE (AS BUILT) 5-4-72 RJR

SCALE AS SHOWN
DATE 11-1-71 DR. RE CK. JLS
DR. APPR. ENG. APPROVED
OPER. DEPT.
ENG. DEPT.

CHEVRON
STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS, INC.
MARKETING OPERATIONS

PIPING FOR HYDRANT CART TESTING FACILITIES
BULK FUEL STORAGE
PORTLAND INTERNATIONAL AIRPORT
PORTLAND OREGON

W.O. 11291
S.O.

MF-21662337-1

AS CONSTRUCTED

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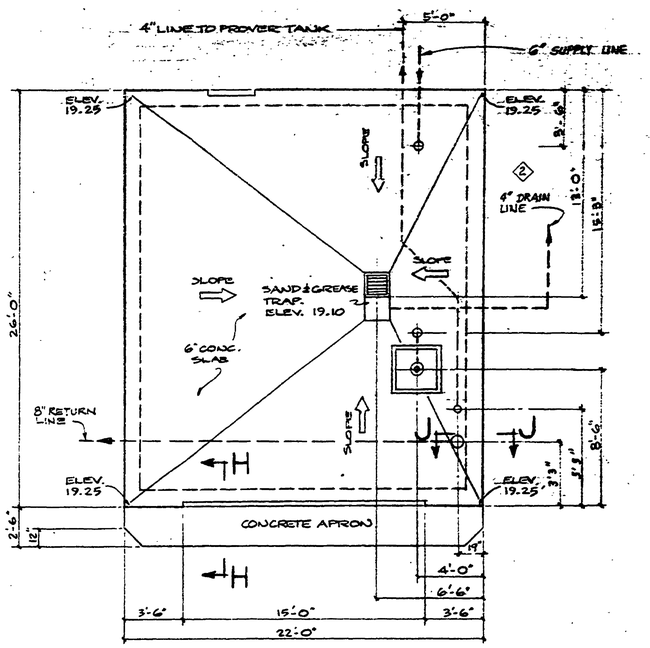

FOUNDATION PLAN.
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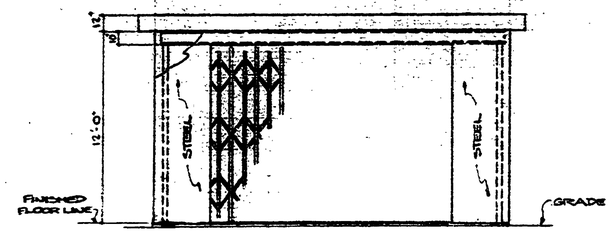
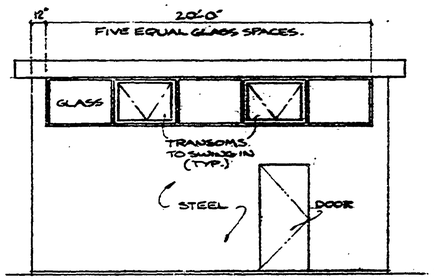


ELEVATION Ⓐ



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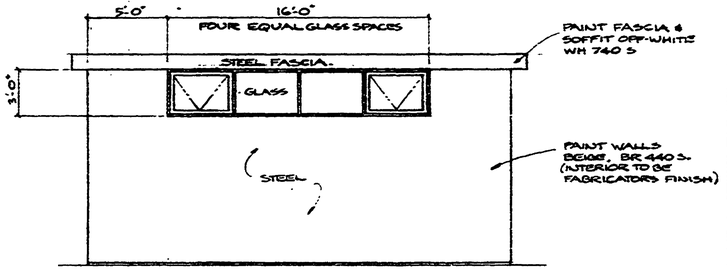
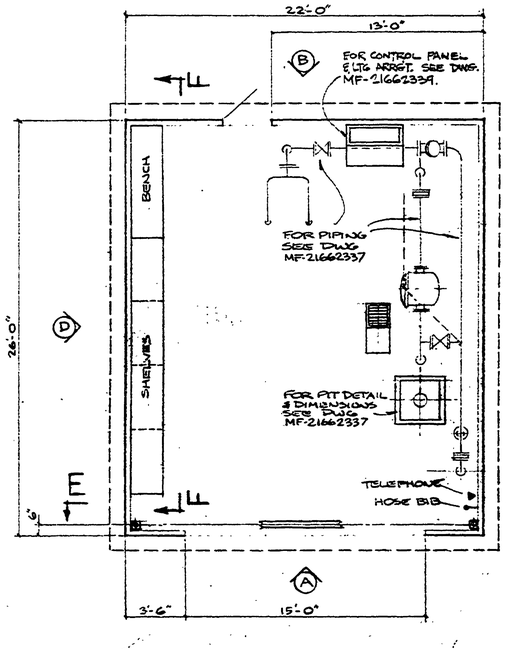
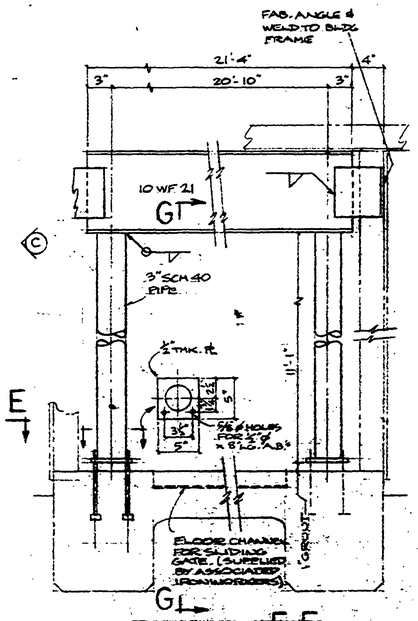


ELEVATION ⓒⓓ



FLOOR PLAN.
SCALE: ¼"=1'-0"



SECTION E-E
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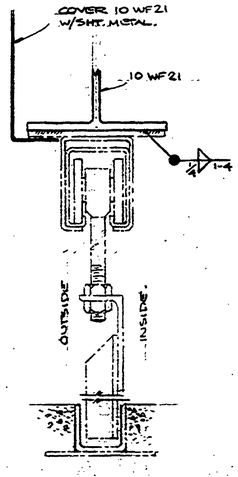

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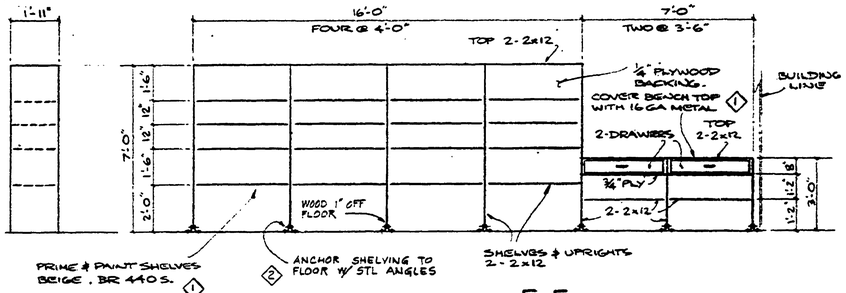

SHELVING ELEVATION F-F
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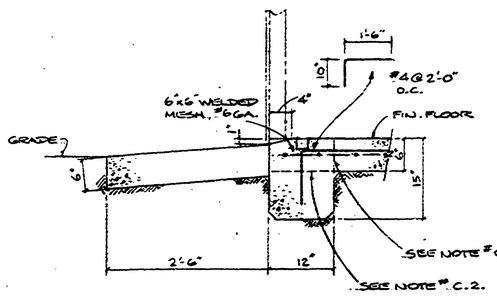

SECTION H-H
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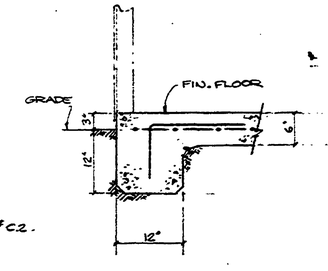


SECTION J-J
SCALE: 1"=1'-0"

DESIGN AND CONSTRUCTION NOTES

C.1. CONSTRUCTION TO CONFORM TO LOCAL GOVERNING CODE.

C.2. CONTRACTOR MAY USE CONSTRUCTION JOINT AT EITHER OF THESE POINTS.

REFERENCE DRAWINGS

PLOT PLAN & PIPING PLAN	MF-21662338
PIPING FOR HYD. CART TESTING FACILITIES	MF-21662337
CONTROL PANEL & LTG. ARRGT. HYD. CART	MF-21662339

REVISIONS

2	RELOCATE 6" SUPPLY LINE & 4" DRAIN LINE ON FOUNDATION PLAN. REPLACE 2x4's WITH STL ANGLES TO ANCHOR SHELVING, SECT. F-F (AS BUILT)	SG (MEI) R.W.	5-4-72
1	PAINT NOTE FOR SHELVES AND MECH. BENCH COVER ADDED. ADJUSTABLE SHELF NOTE REMOVED.	RC	10-3-71

SCALE AS SHOWN
DATE 11-1-71 DR. RF CK. RJG
DR. APPR. ENG. DAG
OPER. DEPT. APPROVED
ENG. DEPT.

Chevron

STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS, INC.
MARKETING OPERATIONS

BUILDING FOR HYDRANT CART TESTING FACILITIES
BULK FUEL SUPPLY SYSTEM
PORTLAND INTERNATIONAL AIRPORT
PORTLAND OREGON

W.O. 11221
S.O.
MF-21662338-2

AS CONSTRUCTED

PIA 72-1002

Hydrant Pump Pad

- MF-2166238-4

8" x 4'-0" HIGH CONC. BLOCK IMPOUNDING WALL W/ 2'-0" HIGH CHAIN LINK FENCE (SEE PLOT PLAN FOR LOCATION)

PROVIDE A 1" ø BUTYL ROD FULL HEIGHT OF WALL & SLAB AT JOINT BETWEEN WALL ON SLAB & IMPOUNDING WALL (TYP. @ ENDS)

#6 x 10'-0" (TYP @ FOUR CORNERS) 2" CLR. FROM TOP OF SLAB

COALESCER SEPARATOR

MICRONIC FILTER

NOTE: FOR DETAILS, LOCATIONS AND DIMENSIONS SEE PIPE LINE DEPARTMENT DWG. # PLT-A-036

CYCLONE SEPARATOR

CATCH BASIN

SLOPE DOWN

FOR ELEVATIONS SEE DWG. MF-2166233

8" CONC. BLOCK WALL

FOOTING LINE

36'-0"

2'-0" (TYP.)

2'-0" (TYP.)

10'-0"

B

EXPANSION JOINT

℄ PUMPS

SEE NOTE 6.

5/8" DEEP SAWCUT CONTROL JOINT DIVIDING SLAB INTO SECTIONS WITH AREAS NOT EXCEEDING 600 FT² & WITH LENGTH TO WIDTH RATIO NOT EXCEEDING 2:1

C

(FUTURE)

(FUTURE)

D

N

F

FOOTING LINE

HYDRANT PUMP PAD

20'-0"

4'-0"

16'-0"

5'-6"

7'-0"

7'-0"

7'-0"

11'-10"

FOUNDATION PLAN

1/4" = 1'-0"

FOR SLAB LOCATION - REFER TO DWG. MF-2166238.

TANK 1 & 2 DIKE / IMPOUNDMENT WALL

TOP RAIL 1½" ø O.D.

2" x 11 GAUGE FENCE FABRIC W/ 2" ø I.D. LINE POSTS @ 8'-0" O.C. (2½" ø I.D. CORNER & END POSTS)

WRAP #3 BAR AROUND #4 BARS IN BOND BEAM AT ER. POST (SEE DETAIL)

2'-0"

1'-6"

6'-0"

2#4 IN BOND BEAM

#4 @ 16" ℄

2-#4 IN BOND BEAM

3" CLR.

#4 @ 16" ℄

4" CLR.

#4 BARS

3" CLR.

10"

8" CLR.

3'-6"

FINISH GRADE

SECTION F

1" = 1'-0"

2" ø POST

2-#4 IN BOND BEAM

#3

DETAIL

NO SCALE

DEMOLISHED IN 1995

1'-0" TYP.

1'-0" TYP.

3'-0"

A

E

34'-0"

24" x 24" MANHOLES THRU SLAB

VERIFY

8'-0"

DETAIL H.

3" = 1'-0"

½" ℄ x 4'-0" LG.

4 ℄ 5.4 x 4'-0" LG. CAST IN SLAB. (TRIM TOP OF CHANNEL FLUSH TO CONCEAL BENEATH CONCRETE)

24" x 24" ROD JACKET MANHOLES (COAT EXPOSED UNDERGROUND SURFACE WITH ASBESTOS PAINT)

PROVIDE A CLOSURE PIECE EACH END

#3@8"

16" MIN. LAP

#4 @ 18" EA WAY

3" CLR.

1'-0" 3" CLR.

8"

#4 STOP ER SIDE OF EXPANSION JOINT

2'-0" MIN.

2'-0" MIN. 1'-0"

COMPACTED BACKFILL (NOTE 3)

ROLL EXPOSED SURFACE

TYP. EDGE SECTION A

1" = 1'-0"

#4 @ 18" EA. WAY STOP ER SIDE OF EXPAN. JOINT

2½"

1" PRE-MOLDED EXPANSION JOINT FILLER

8"

#4 EA. SIDE OF EXPANSION JOINT

3" CLR.

4" 6" 6" 4"

2'-0" MIN.

TYP. EXPANSION JOINT SECTION B

1"-1'-0"

4'-0"

#4

2-#4 BASSIE (8 TOTAL)

FILL FUTURE PUMP FOUNDS WITH SAND.

2 CL.

4 CL.

3½"

4" CLR.

#5 x 4'-0" EACH SIDE OPENING

20" ø SCH. 10 PIPE SLEEVE

NOTE: TYP. SLAB REINF. (SEE SECTION A).

℄ PUMP

SECTION C (TYP. AT PUMPS)

1" = 1'-0"

GROUT CAP 1" MAX. CROWN (TYP.)

2#4 IN BOND BEAM

#4 @ 16"

2-#4 IN BOND BEAM @ MID HT.

3" CLR.

NOTE: TYP. SLAB REINF. (SEE SECT A)

4'-0"

3" CLR.

SECTION D

1" = 1'-0"

GROUT CAP 1" MAX. CROWN (TYP.)

2-#4

#4 @ 16

3" CL.

8" CONC. BLOCK

2-#4

4'-0"

5'-6" MAX

2-#4

12" CONC. BLOCK

#5 @ 16

3" CL.

#5 @ 16

1'-0" 2'-0" MAX VARIES

2" MIN

#4 HORIZ. AS SHOWN

3" CL.

5'-0"

IMPOUNDING WALL

(APPLY FOR MAXIMUM WALL HEIGHT)

¾" = 1'-0"

GENERAL NOTES:

1. Concrete shall develop an ultimate strength of not less than 2500 P.S.I. @ 28 days.
2. All reinforcing steel shall conform to astm specifications A15 and A305.
3. Granular backfill material shall not have more than five percent fines passing the No. 200 sieve during wet weather construction, and not more than fifteen percent fines passing the No. 200 sieve during dry weather construction. The backfill shall be compacted in lifts not greater than 8 inches (loose).
4. Concrete blocks shall be lightweight grade "A" load bearing units conforming to astm C90.
5. Equipment shall be anchored w/ Phillips rot resistant anchors. Size shall be in accordance w/ mfg. recommendations.
6. FOR EXACT LOCATION OF PIPING RISERS & ELECTRICAL CONDUITS REFER TO DWGS. MF-2166236 & MF-2166238.

SYMETRICAL ABOUT ℄

TANK

6'-0" 6'-0"

2'-0"

SLOPE 1:12

2" A.C. PAVING

SLOPE ½" PER FT.

2' CRUSHED ROCK BASE

8'-0"

COMPACTED SAND OR SAND & GRAVEL

EXPOSED SUBGRADE (ROLLED SURFACE)

TYP. TANK FOUNDATION

1/10" = 1'-0"

FOR TANK LOCATION - REFER TO DWG. # MF-2166233-0.

16'-0"

5" x 1/16" x 0'-5" ℄ (TYPICAL)

SYMETRICAL ABOUT ℄

#4 @ 18" EA WAY

#6 x 1'-0" THRU EA. LEG OF L

#4 @ 18"

2" CLR.

#7 @ 12"

4" x 4" x 5/16" L HANGERS PAINT WITH ASBESTOS PAINT

3" CLR.

TACK

10"

2'-0"

DEMOLISHED IN 1995

START WELDS AT TOP OF STRAP

12"

TANK

SEE SADDLE FLANGE DETAIL BELOW

1/4 2-6

TANK SADDLES @ 4'-0" O.C. FLAT BARS 3" x 3/8". PAINT SADDLES AND TANK WITH ASBESTOS PAINT AFTER WELDING.

NOTE: TANK WITH SADDLES AND FLANGE SUPPLIED BY S.O. CAL. HANGERS FURNISHED BY GENERAL CONTRACTOR

NOTE 3 COMPACTED BACKFILL

ROLL EXPOSED SURFACE

2'-0"

TYP. U.G. TANK SECTION E

1/2" = 1'-0"

2- ¾" ø M.B.

4" x 4" x 5/16" L HANGER

TYP. TANK HANGER

1" = 1'-0"

TANK SADDLE

7" x 3½" x 3/8" CLIP ℄

3/4"

3½"

℄ OF CLIP & ℄ TANK

SADDLE FLANGE DET.

1" = 1'-0"

REFERENCE DRAWINGS

SITE PLAN	MF2166282
PLOT PLAN & PIPING PLAN (BULK)	MF2166233
PIPING PLAN & SECT. - FILTER AREA	MF2166236
FOUNDATION FOR DELIVERY FACILITIES	PLT-A-036

REVISIONS

3 ADDED PIPELINE EQUIPMENT FOUNDATIONS WITH NOTE REFERING TO THEIR DRAWING NO. PLT-A-036 — W.O. 9138/162 — 9-7-71

2 PUMP BASES REVISED IN PLAN AND AT SECTION "C". DETAIL H ADDED. MAX. IMPOUNDING WALL SECTION ADDED. — 7-26-71

4 ADDED NOTE TO U.G. TANK SECTION "E" — 6-29-71

5 ADDED 24" MANHOLE TO FOUNDATION PLAN (AS BUILT) — 5-4-72

SCALE: AS NOTED
DATE 5-21-71 DR. D.F. CK. L.L.
DR. APPR. ENG.
OPER. DEPT. APPROVED
ENG. DEPT.

Chevron

STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS, INC.
MARKETING OPERATIONS

FOUNDATION PLAN & SECTIONS
BULK FUEL STORAGE
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON

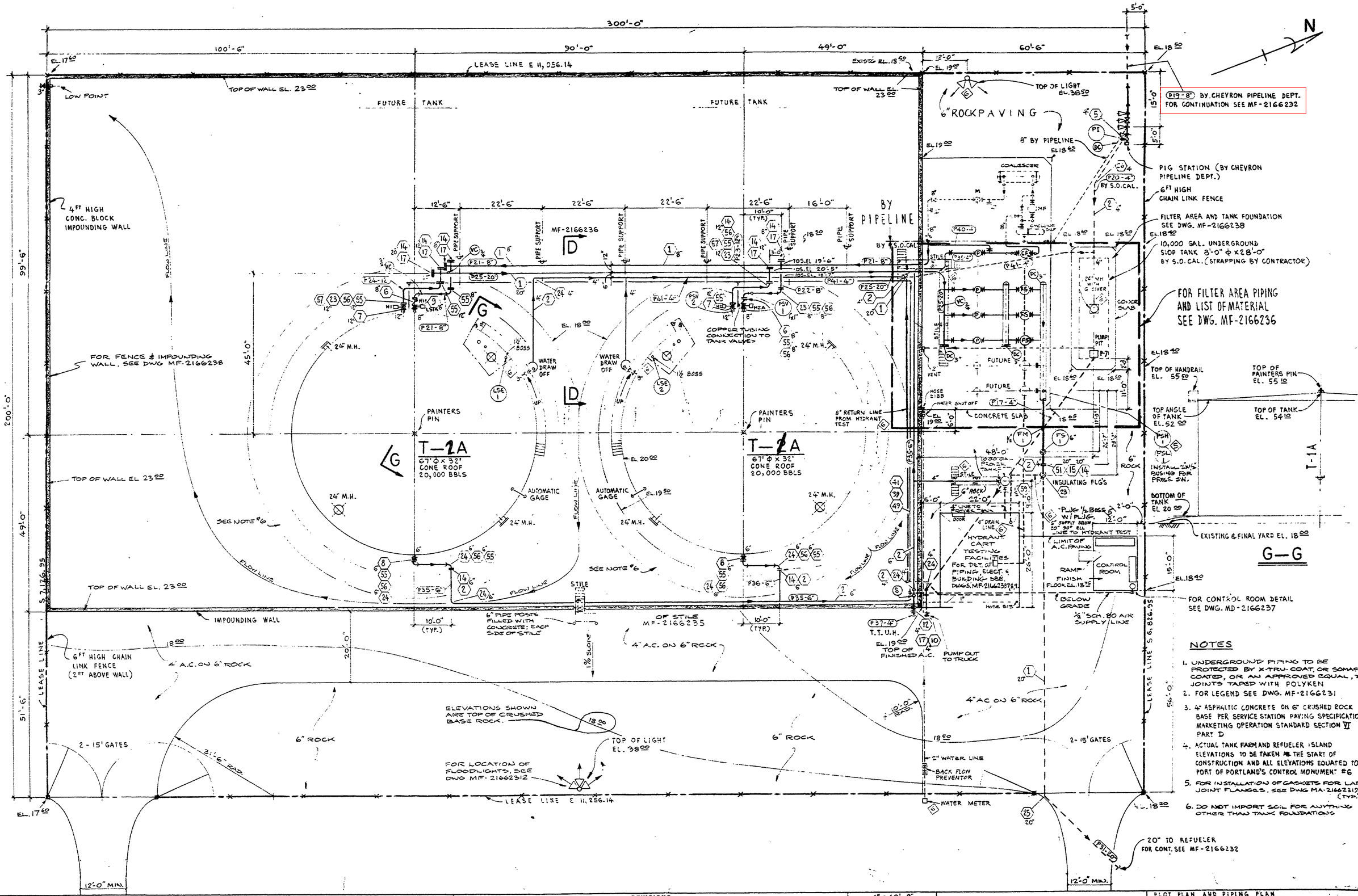
W.O. 11291
S.O.

MF-2166238-4

AS CONSTRUCTED PIA 72-1002 8/23

Pipeline Pigging Station

- MF-2166233-6
- F-9017-0
- F-8644-6
- F-8958-2



NOTES

1. UNDERGROUND PIPING TO BE PROTECTED BY X-TRU-COAT, OR SOMASTIC COATED, OR AN APPROVED EQUAL, ALL JOINTS TAPED WITH POLYKEN
2. FOR LEGEND SEE DWG. MF-2166231
3. 4" ASPHALTIC CONCRETE ON 6" CRUSHED ROCK BASE PER SERVICE STATION PAVING SPECIFICATION MARKETING OPERATION STANDARD SECTION VI PART D
4. ACTUAL TANK FARM AND REFUELER ISLAND ELEVATIONS TO BE TAKEN AS THE START OF CONSTRUCTION AND ALL ELEVATIONS EQUATED TO PORT OF PORTLAND'S CONTROL MONUMENT #6
5. FOR INSTALLATION OF GASKETS FOR LAP JOINT FLANGES, SEE DWG MA-2166231 (TYP.)
6. DO NOT IMPORT SOIL FOR ANYTHING OTHER THAN TANK FOUNDATIONS

REFERENCE DRAWINGS

SITE PLAN	MF-2166232	CONTROL ROOM PLAN, ELEV.	MD-2166237
TANK # 1 & # 2	MC-2166310	P & I D	MF-2166231
PIPING PLAN - FILTER AREA	MF-2166236	TYP. LAP JOINT FLG. INSTALLATION	MA-2166219
ELECTRICAL PLAN	MF-2166312	PIPING FOR HYDRANT CART TESTG. FAC.	MF-2166237
FOUNDATION PLAN & SECTIONS	MF-2166238	BLDG. FOR HYDRANT CART TESTG. FAC.	MF-2166239
SPECIFICATION	MA-2166230	CONTROL PANEL & LTG. ARRGT. - HYD. CART.	MF-2166231

REVISIONS

3	REVISED PIPELINE AREA, ADDED BLOCK VALVE AT PIG STATION AND METER, ADDED GREEN VALVE AT CYCLONE SEPARATOR AND METER, DELETED MASTER METER CONN. W.O. 9138/162	9-7-71	PS
6	REVISED THA & T-2A, REPOSITION & REVISE STILES, RELOCATED FLOOD LIGHT & NW PROPERTY CORNER, ADDED DRAIN LINE & RELOCATED OTHER PIPING IN HYDRANT TEST, RELOCATED 6" RETURN LINE, ADDED WATER METER & SHUT OFF (AS BUILT)	5-4-72	SG MBA
5	REV'D PSH-1 TO TAKE PSL-1, USE ½" TAP PLUG AT OLD PSL-1 LOCATION (AT 6.80m) INSTALL BUSHING 2"x½" AT 2" BOSS FOR PRESSURES SW.	11-15-71	
4	ADDED A.C. PAVING OUTLINE, REMOVED HYDRANT CART TESTING FACILITIES, 10" 3 PUMP & F/S. FSH-1 WAS FSH-1 FS-1 WAS FSL-1.	11-1-71	

SCALE 1" = 10'-0"
DATE 6-2-71 DR. JS CK.
DR. APPR. ENG. APPROVED
OPER. DEPT.
ENG. DEPT.

Chevron
STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS, INC.
MARKETING OPERATIONS

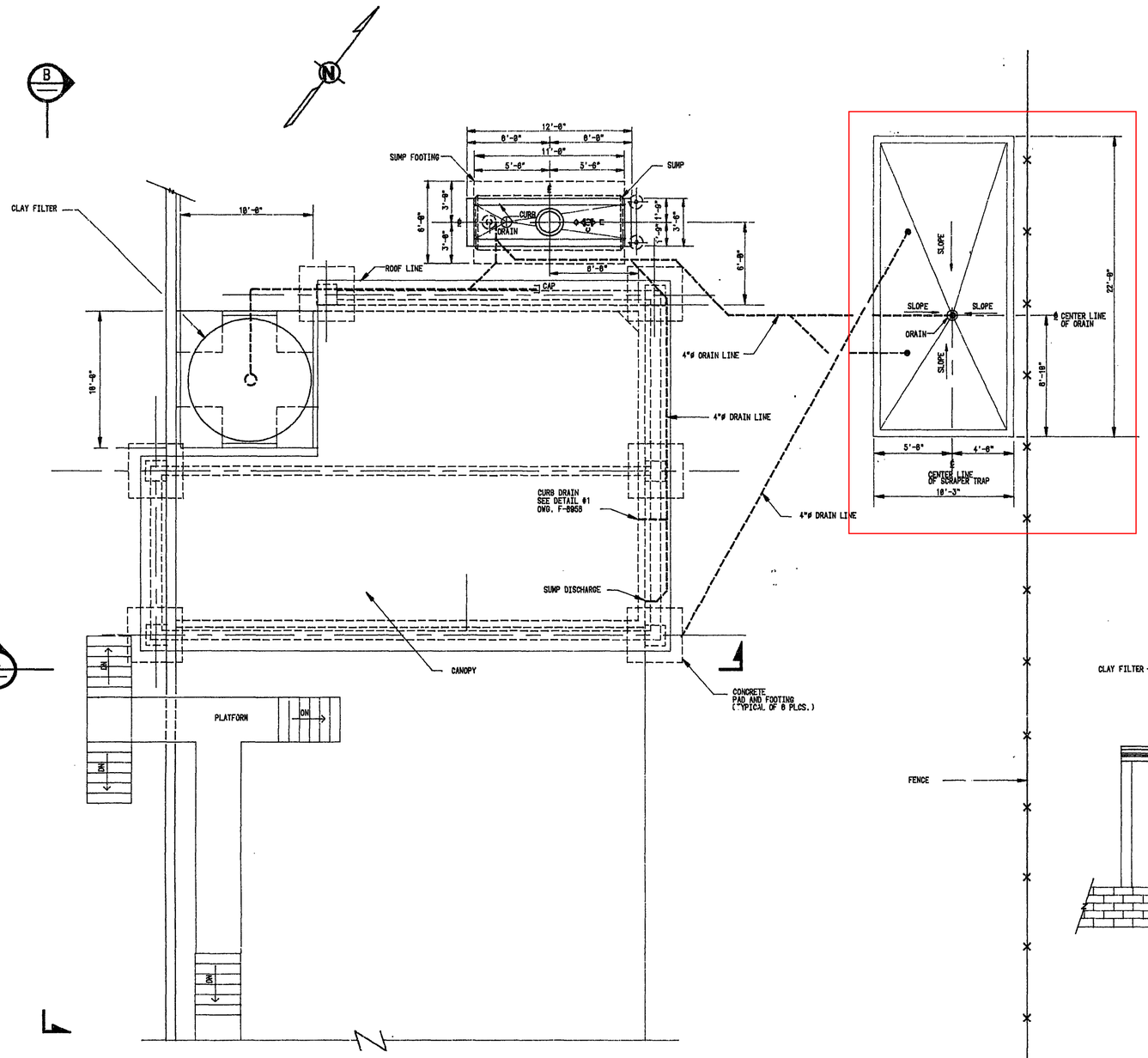
PLOT PLAN AND PIPING PLAN
BULK FUEL STORAGE
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON

W.O. 11291
S.O.

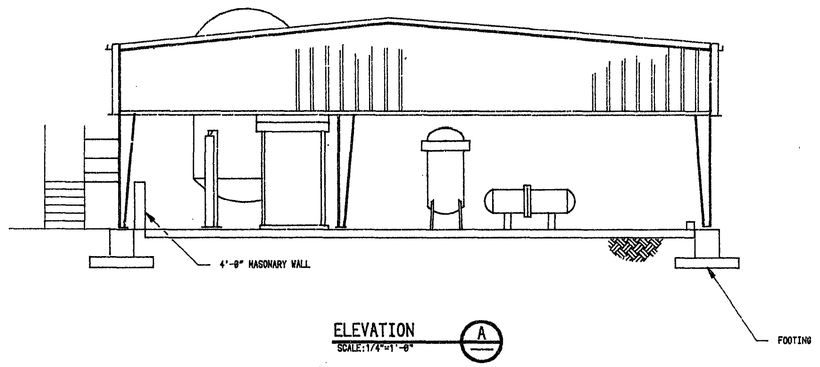
MF-2166233-G

AS CONSTRUCTED

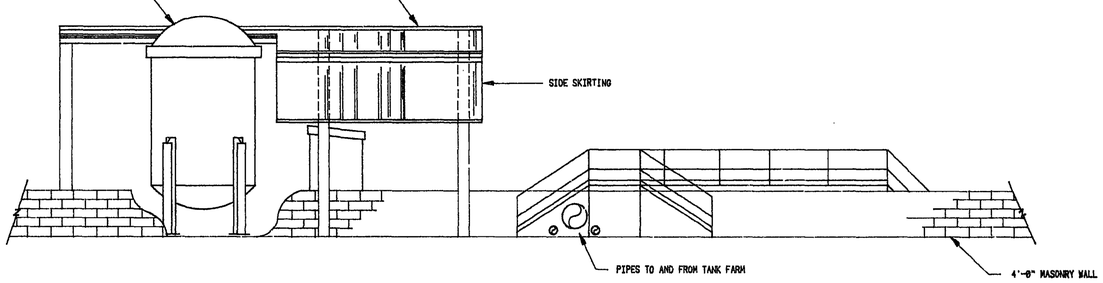
PIA 72-1002 3/23



PLAN VIEW
SCALE: 1/4"=1'-0"



ELEVATION A
SCALE:1/4"=1'-0"

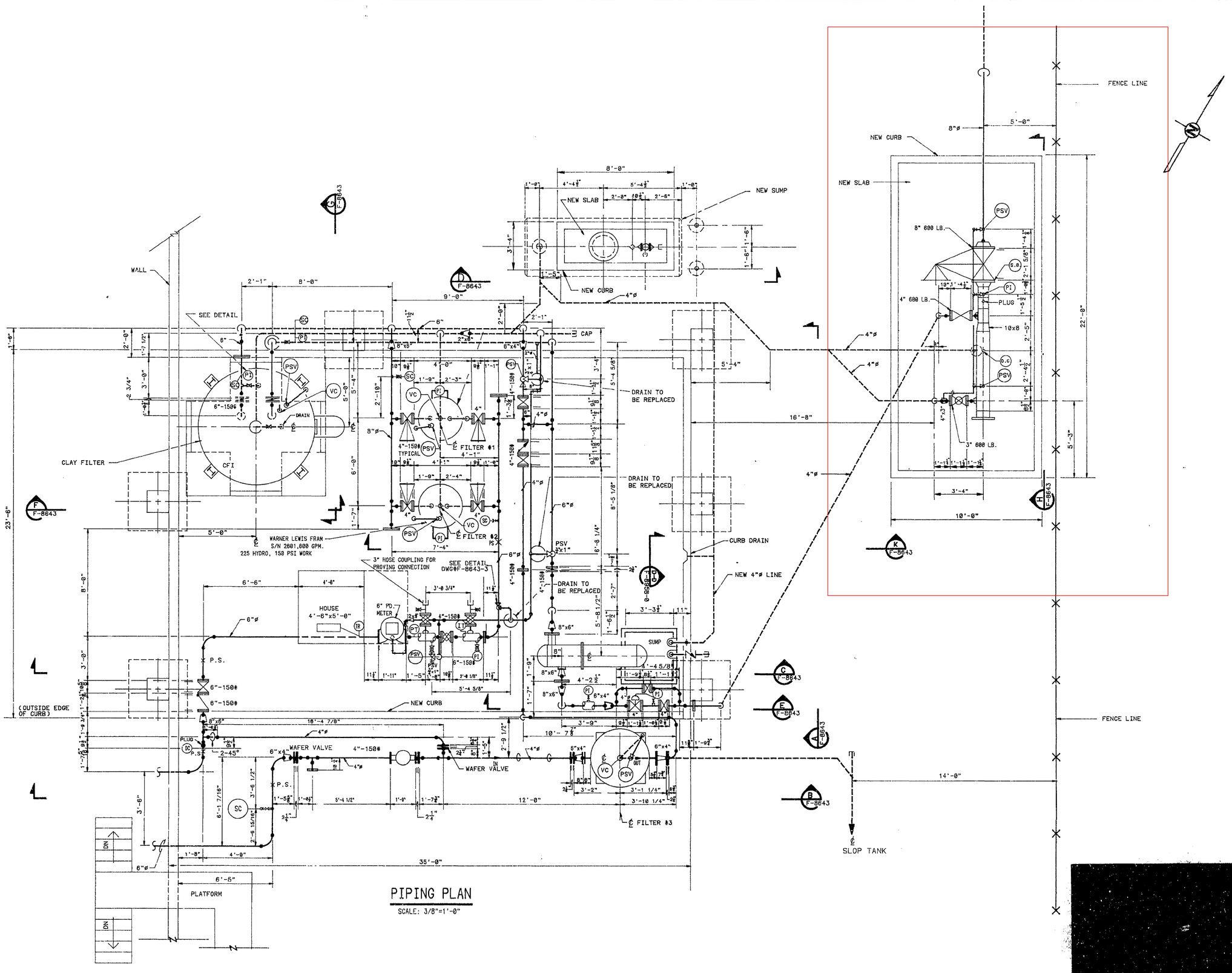


ELEVATION B
SCALE: 1/4"=1'-0"

[redacted]

REFERENCE DRAWINGS							REVISIONS							SCALE 1/4" = 1'-0"	Chevron Pipe Line Co. Salt Lake Division	GENERAL ARRANGEMENT OF PROPOSED FACILITY IMPROVEMENTS
PIPING PLAN AND DETAILS FOR DELIVERY	F-8644													DATE 12/19/87 DR. DR CK.		PORTLAND AIRPORT DELIVERY FACILTY
CONCRETE PADS AND FOUNDATIONS PLAN	F-8641													DR. APPR. ENG. JCG		A W.O. S.O. F-9017-0
CONCRETE SECTIONS AND DETAILS	F-8968													OPER. DEPT. APPROVED		
														ENG. DEPT.		

PDX 88-1011 K9 88-22



PIPING PLAN

SCALE: 3/8"=1'-0"

REFERENCE DRAWINGS	REVISIONS		
	5 DRAWING REDRAWN AND REVISED PER AS BUILT INFORMATION PROVIDED TO J.P. REDD INC. (12/11/87)	T.H	
	6 REVISED DRAIN SYSTEM TO INCLUDE SUMP PUMP DISCONNECT EXISTING SUMP FROM SLOP TANK BY J.P. REDD INC.	DKR	

SCALE 3/8"=1'-0"
DATE 12-11-87 DR T.H. CK
DR. APPR. ENG.
OPER. DEPT. APPROVED
ENG. DEPT.

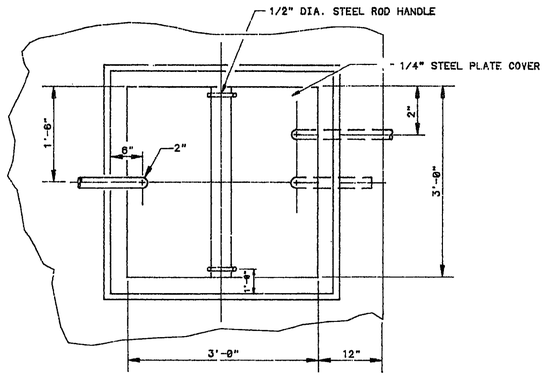
Chevron Pipe Line Co.
Salt Lake Division

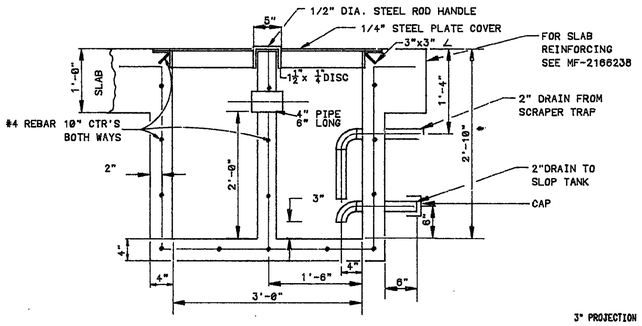
PIPING PLAN AND DETAILS FOR DELIVERY
FACILITIES AT BULK STORAGE SITE - PORTLAND
AIRPORT WILLBRIDGE - PORTLAND AIRPORT
JET FUEL PIPE LINE

L W.O.
S.O.

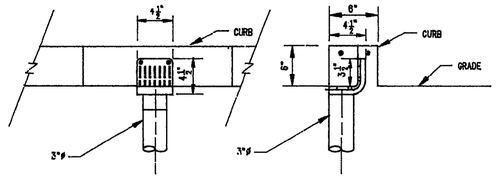
F-8644-6

PDX 88-1011 3/4

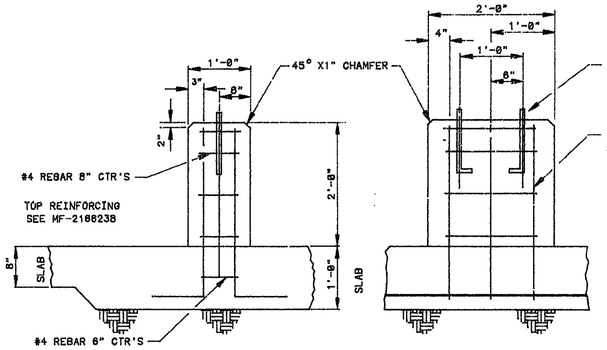




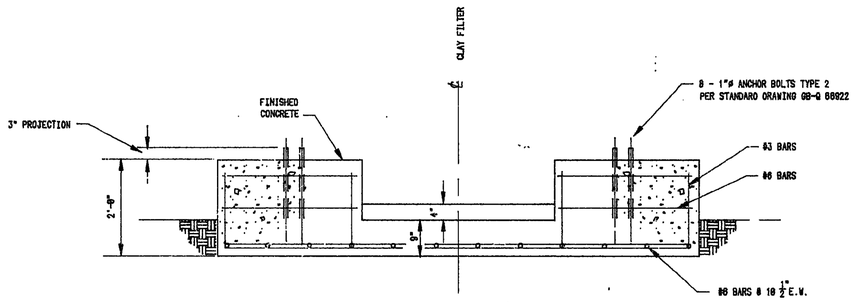
CATCH BASIN A
SCALE : 1"=1'-0" F-8641



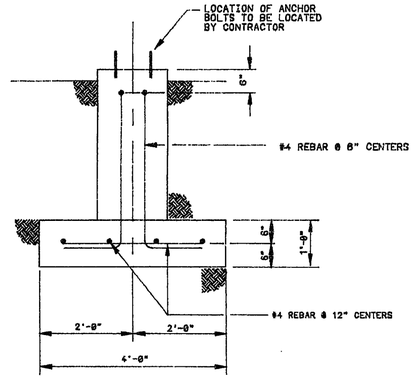
CURB DRAIN 1 F-9017
SCALE 1-1/2" = 1'-0"



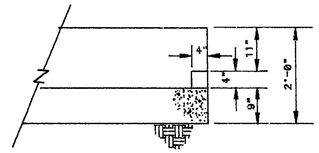
CYCLONE SEPARATOR FOUNDATION B F-8641
SCALE : 1"=1'-0"



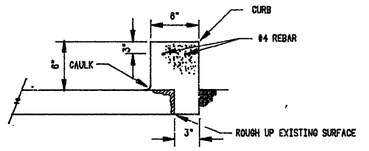
SECTION D F-8641
SCALE 3/4" = 1'-0"



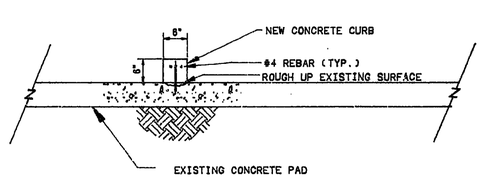
BUILDING FOOTING & FOUNDATION C F-8641
SCALE 3/4" = 1'-0"
FINAL DESIGN TO BE PROVIDED BY CONTRACTOR



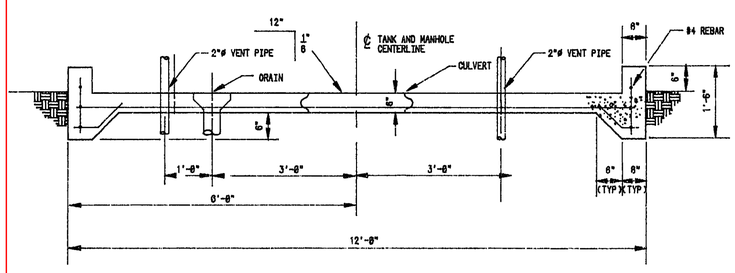
SECTION E F-8641
SCALE: 3/4" = 1'-0"



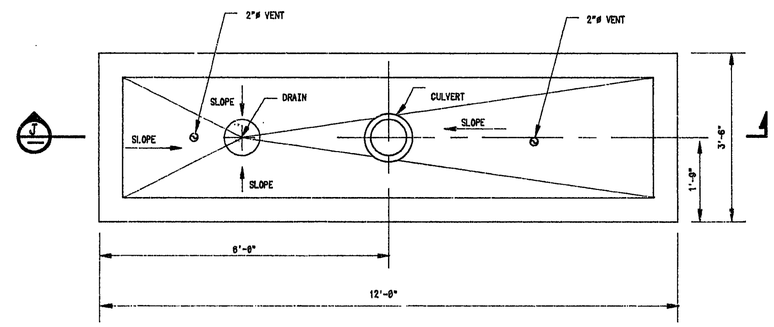
CURB SECTION G F-8641
SCALE: 1-1/2" = 1'-0"



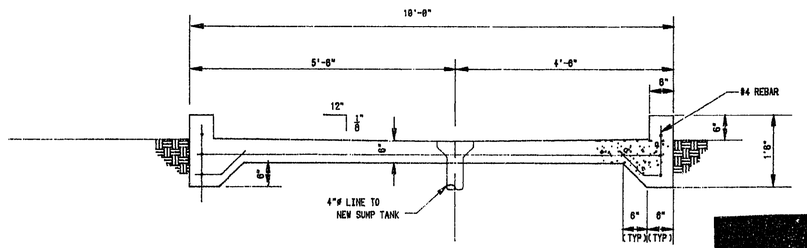
CURB F F-8641
SCALE 3/4" = 1'-0"



SECTION J J
SCALE 1-1/2" = 1'-0"



SUMP PAD AND CURB 2 F-8641
SCALE: 3/4" = 1'-0"



SCRAPER TRAP PAD AND CURB I F-8641
SCALE: 3/8" = 1'-0"

[redacted]

REFERENCE DRAWINGS						
GENERAL ARRANGEMENT	F-9017					
PIPING PLAN ANDETAILS FOR DELIVERY	F-8644					
CONCRETE PADS AND FOUNDATIONS PLAN	F-8641					

REVISIONS		
1	REDRAWN AND REVISED PER AS BUILT INFORMATION PROVIDED TO J.P. REED INC. 3/29/88	D.R.
2	ADDED SECTIONS; C,F,G,I,J,1 & 2 3/29/88	D.R.

SCALE AS NOTED
DATE 2-5-88 DR. D.R. CK.
DR. APPR. ENG. JGO
OPER. DEPT. APPROVED
ENG. DEPT.

Chevron Pipe Line Co.
Salt Lake Division

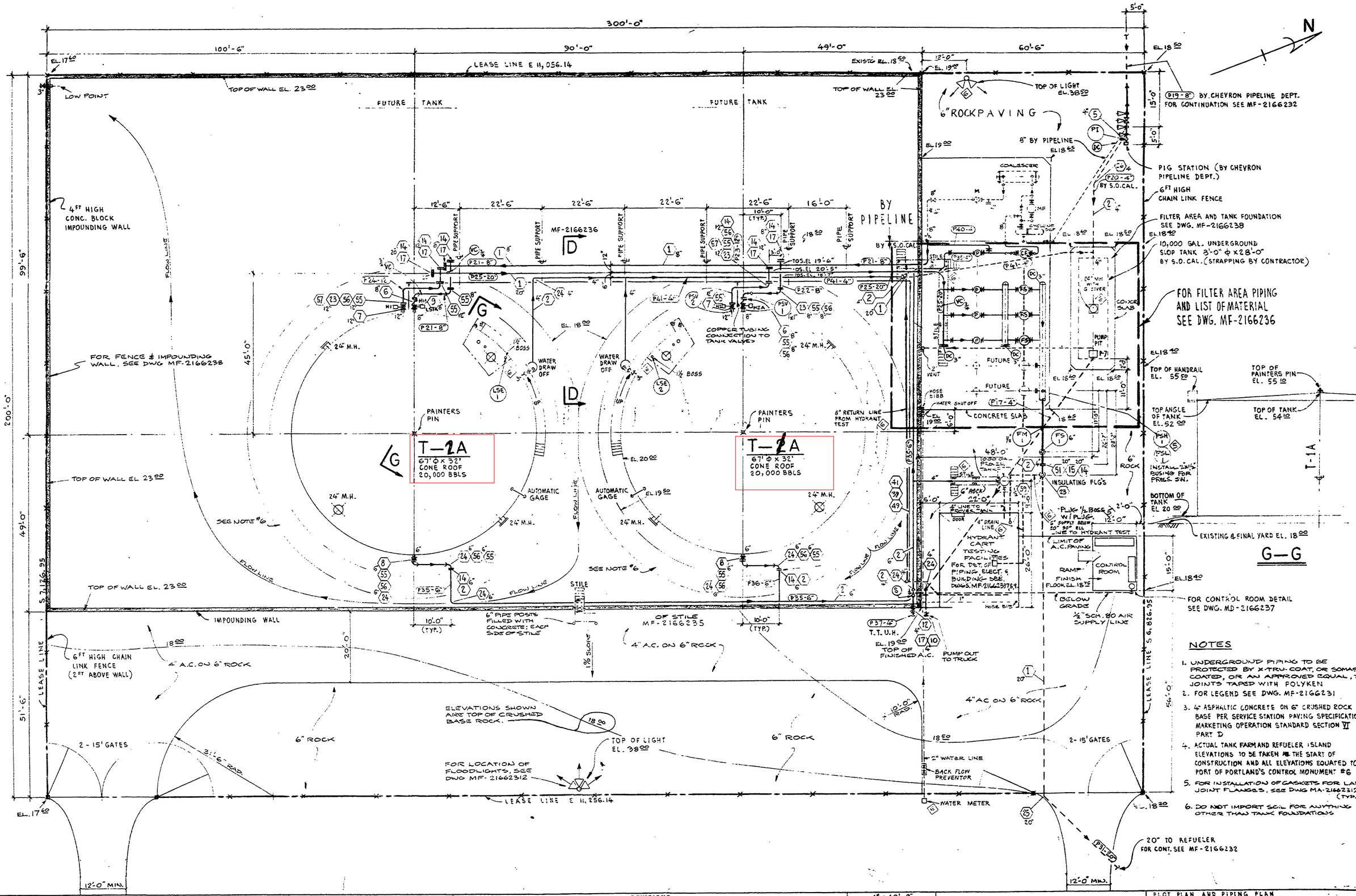
CONCRETE SECTIONS AND DETAILS
PORTLAND AIRPORT

Q W.O. S.O. F-8958-2

PDX 88-1011 4/4

Tank 1 & Tank 2

- MF-2166238-4
- MF-2166233-6


300'-0"
100'-6"
90'-0"
49'-0"
60'-6"
5'-0"
EL. 17.60
EL. 18.50
EXISTG EL. 18.50
EL. 19.00
LEASE LINE E 11,056.14
LOW POINT
TOP OF WALL EL. 23.00
FUTURE TANK
FUTURE TANK
TOP OF LIGHT EL. 38.50
6" ROCKPAVING
D19-8" BY CHEVRON PIPELINE DEPT. FOR CONTINUATION SEE MF-2166232
8" BY PIPELINE
EL. 18.65
PIG STATION (BY CHEVRON PIPELINE DEPT.)
6FT HIGH CHAIN LINK FENCE
FILTER AREA AND TANK FOUNDATION SEE DWG. MF-2166238
10,000 GAL. UNDERGROUND SLOP TANK 8'-0" ϕ x 28'-0" BY S.O.CAL. (STRAPPING BY CONTRACTOR)
FOR FILTER AREA PIPING AND LIST OF MATERIAL SEE DWG. MF-2166236
4FT HIGH CONC. BLOCK IMPOUNDING WALL
FOR FENCE & IMPOUNDING WALL, SEE DWG MF-2166238
99'-6"
45'-0"
200'-0"
FLOW LINE
MF-2166236
12'-6"
22'-6"
22'-6"
22'-6"
22'-6"
16'-0"
10'-0" (TYP.)
PIPE SUPPORT
BY PIPELINE BY S.O.CAL.
P21-8"
P25-20"
P41-4"
P22-8"
P40-4"
P20-4"
P17-4"
P35-6"
P36-6"
P37-4"
24" M.H.
WATER DRAW OFF
1½ BOSS
COPPER TUBING CONNECTION TO TANK VALVE
PAINTERS PIN
T-2A
67' ϕ x 32' CONE ROOF 20,000 BBLS
AUTOMATIC GAGE
EL. 19.50
EL. 20.00
SEE NOTE #6
TOP OF WALL EL. 23.00
IMPOUNDING WALL
6FT HIGH CHAIN LINK FENCE (2FT ABOVE WALL)
LEASE LINE
S 7,126.95
S 6,826.95
51'-6"
49'-0"
56'-0"
18.00
20'-0"
1% SLOPE
4" A.C. ON 6" ROCK
6" PIPE POSTS FILLED WITH CONCRETE; EACH SIDE OF STILE
STILE
OF STILE MF-2166235
ELEVATIONS SHOWN ARE TOP OF CRUSHED BASE ROCK.
6" ROCK
2 - 15' GATES
3'-6" RAD.
10'-0" RAD.
FOR LOCATION OF FLOODLIGHTS, SEE DWG MF-21662312
LEASE LINE E 11,256.14
EL. 17.60
12'-0" MIN.
T.T.U.H.
TOP OF FINISHED A.C.
PUMP OUT TO TRUCK
2" WATER LINE
BACK FLOW PREVENTOR
WATER METER
20" TO REFUELER FOR CONT. SEE MF-2166232
P1-20"
EL. 18.20
TOP OF HANDRAIL EL. 55.50
TOP OF PAINTERS PIN EL. 55.10
TOP OF TANK EL. 54.10
TOP ANGLE OF TANK EL. 52.00
BOTTOM OF TANK EL 20.00
EXISTING & FINAL YARD EL. 18.00
G—G
T-1A
COALESCER
CONCRETE SLAB
INSULATING FLG'S
HYDRANT CART TESTING FACILITIES
FOR DET. OF P'ING, ELECT. & BUILDING SEE DWGS. MF-2166233-8
CONTROL ROOM
RAMP FINISH FLOOR EL. 18.75
FOR CONTROL ROOM DETAIL SEE DWG. MD-2166237
½"SCH. 80 AIR SUPPLY LINE
BELOW GRADE
LIMIT OF A.C. PAVING
PUMP PIT
VENT
HOSE BIBB
WATER SHUT OFF
6" RETURN LINE FROM HYDRANT TEST
FUTURE
4" LINE TO COVER SUMP
6" DRAIN LINE
PLUG ½ BOSS W/ PLUG
2" SUPPLY ABOVE 50" 90° ELL LINE TO HYDRANT TEST
INSTALL ¾" S BUSHING FOR PRESS. SW.
FM 1
FS 1
PSH 1
PSL 1
PT 1
VC
PC
SS
CP
M
MF
4" MH W/ 4" SLOPED COVER
4" CONC. SLAB
6" ROCK
4'-0"
48'-0"
10,000 GAL PLOT TANK
EL. 18.40
EL. 18.50
EL. 18.80
EL. 19.00
EL. 19.80
EL. 18.65
EL. 18.75
EL. 18.40
EL. 18.20
EL. 18.40
EL. 18.40
EL. 18.40
EL. 18.20
EL. 18.40
EL. 18.40
EL. 18.40

Tank 1 & 2 Dike Walls

- MF-2166238-4

8" x 4'-0" HIGH CONC. BLOCK IMPOUNDING WALL W/ 2'-0" HIGH CHAIN LINK FENCE (SEE PLOT PLAN FOR LOCATION)

PROVIDE A 1" ø BUTYL ROD FULL HEIGHT OF WALL & SLAB AT JOINT BETWEEN WALL ON SLAB & IMPOUNDING WALL (TYP. @ ENDS)

#6 x 10'-0" (TYP. @ FOUR CORNERS) 2" CLR. FROM TOP OF SLAB

COALESCER SEPARATOR

MICRONIC FILTER

NOTE: FOR DETAILS, LOCATIONS AND DIMENSIONS SEE PIPE LINE DEPARTMENT DWG. # PLT-A-036

CYCLONE SEPARATOR

CATCH BASIN

SLOPE DOWN

FOR ELEVATIONS SEE DWG. MF-2166233

8" CONC. BLOCK WALL

FOOTING LINE

36'-0"

2'-0" (TYP.)

2'-0" (TYP.)

10'-0"

B

EXPANSION JOINT

℄ PUMPS

SEE NOTE 6.

5/8" DEEP SAWCUT CONTROL JOINT DIVIDING SLAB INTO SECTIONS WITH AREAS NOT EXCEEDING 600 FT² & WITH LENGTH TO WIDTH RATIO NOT EXCEEDING 2:1

C

(FUTURE)

(FUTURE)

FOOTING LINE

F

20'-0"

4'-0"

16'-0"

FOUNDATION PLAN

1/4" = 1'-0"

FOR SLAB LOCATION - REFER TO DWG. MF-2166238.

TANK 1 & 2 DIKE / IMPOUNDMENT WALL

TOP RAIL 1½" ø O.D.

2" x 11 GAUGE FENCE FABRIC W/ 2" ø I.D. LINE POSTS @ 8'-0" O.C. (2½" ø I.D. CORNER & END POSTS)

WRAP #3 BAR AROUND #4 BARS IN BOND BEAM AT ER. POST (SEE DETAIL)

2'-0"

1'-6"

6'-0"

2#4 IN BOND BEAM

#4 @ 16"

2-#4 IN BOND BEAM

3" CLR.

#4 @ 16"

4" CLR.

#4 BARS

3" CLR.

10"

8" CLR.

3'-6"

FINISH GRADE

2" ø POST

2-#4 IN BOND BEAM

#3

DETAIL

NO SCALE

SECTION F

1" = 1'-0"

DEMOLISHED IN 1995

1'-0" TYP.

1'-0" TYP.

3'-0"

A

E

34'-0"

24" x 24" MANHOLES THRU SLAB

8'-0"

VERIFY

11'-10"

SECTION E

1" = 1'-0"

½" ø x 4'-0" LG.

4 ø 5.4 x 4'-0" LG. CAST IN SLAB. (TRIM TOP OF CHANNEL LEGS TO CONCEAL BENEATH CONCRETE)

24" x 24" RED JACKET MANHOLES (COAT EXPOSED UNDERGROUND SURFACE WITH ASBESTOS PAINT)

PROVIDE A CLOSURE PIECE EACH END

DETAIL H.

3" = 1'-0"

#3 @ 8"

16" MIN. LAP

#4 @ 18" EA. WAY

3" CLR.

1'-0"

3" CLR.

8"

#4 STOP ER. SIDE OF EXPANSION JOINT

2'-0" MIN.

2'-0" MIN.

1'-0"

COMPACTED BACKFILL (NOTE 3)

ROLL EXPOSED SURFACE

TYP. EDGE SECTION A

1" = 1'-0"

#4 @ 18" EA. WAY STOP ER. SIDE OF EXPAN. JOINT

2½"

1" PRE-MOLDED EXPANSION JOINT FILLER

8"

#4 EA. SIDE OF EXPANSION JOINT

3" CLR.

4" 6" 6" 4"

2'-0" MIN.

TYP. EXPANSION JOINT SECTION B

1" = 1'-0"

4'-0"

#4

2-#4 BASE (8 TOTAL)

3"

FILL FUTURE PUMP FOUNDS WITH SAND.

2" CL.

2" CL.

4" CL.

3½"

4" CLR.

#5 x 4'-0" EACH SIDE OPENING

20" ø SCH. 10 PIPE SLEEVE

NOTE: TYP. SLAB REINF. (SEE SECTION A).

℄ PUMP

SECTION C (TYP. AT PUMPS)

1" = 1'-0"

GROUT CAP 1" MAX. CROWN (TYP.)

2#4 IN BOND BEAM

#4 @ 16"

2-#4 IN BOND BEAM @ MID HT.

4'-0"

3" CLR.

NOTE: TYP. SLAB REINF. (SEE SECT A)

3" CLR.

SECTION D

1" = 1'-0"

GROUT CAP 1" MAX. CROWN (TYP.)

2-#4

#4 @ 16

3" CL.

8" CONC. BLOCK

2-#4

4'-0"

5'-6" MAX.

2-#4

12" CONC. BLOCK

#5 @ 16

#5 @ 16

3" CL.

1'-0"

2'-0" MAX. VARIES

2" MIN.

#4 HORIZ. AS SHOWN

3" CL.

3" CL.

5'-0"

IMPOUNDING WALL

(APPLY FOR MAXIMUM WALL HEIGHT)

¾" = 1'-0"

GENERAL NOTES:

1. Concrete shall develop an ultimate strength of not less than 2,500 P.S.I. @ 28 days.
2. All reinforcing steel shall conform to astm specifications A15 and A305.
3. Granular backfill material shall not have more than five percent fines passing the No. 200 sieve during wet weather construction, and not more than fifteen percent fines passing the No. 200 sieve during dry weather construction. The backfill shall be compacted in lifts not greater than 8 inches (loose).
4. Concrete blocks shall be lightweight grade "A" load bearing units conforming to astm C90.
5. Equipment shall be anchored w/ Phillips rot resistant anchors. Size shall be in accordance w/ mfg. recommendations.
6. FOR EXACT LOCATION OF PIPING RISERS & ELECTRICAL CONDUITS REFER TO DWGS. MF-2166236 & MF-2166238.

SYMETRICAL ABOUT ℄

TANK

6'-0" 6'-0"

2'-0"

SLOPE 1:12

2" A.C. PAVING

SLOPE ½" PER FT.

2' CRUSHED ROCK BASE

8'-0"

COMPACTED SAND OR SAND & GRAVEL

EXPOSED SUBGRADE (ROLLED SURFACE)

TYP. TANK FOUNDATION

1/10" = 1'-0"

FOR TANK LOCATION - REFER TO DWG. # MF-2166233-0.

16'-0"

SYMETRICAL ABOUT ℄

#4 @ 18" EA. WAY

#6 x 1'-0" THRU EA. LEG OF L

#4 @ 18"

5" x 1/16" x 0'-5" ℄ (TYPICAL)

2" CLR.

#7 @ 12"

3" CLR.

TACK

4" x 4" x 5/16" L HANGERS PAINT WITH ASBESTOS PAINT

10"

9"

2'-0"

1/4"

DEMOLISHED IN 1995

START WELDS AT TOP OF STRAP

12"

TANK

SEE SADDLE FLANGE DETAIL BELOW

1/4 2-6

TANK SADDLES @ 4'-0" O.C. FLAT BARS 3" x 3/8". PAINT SADDLES AND TANK WITH ASBESTOS PAINT AFTER WELDING.

NOTE: TANK WITH SADDLES AND FLANGE SUPPLIED BY S.O. CAL. HANGERS FURNISHED BY GENERAL CONTRACTOR

NOTE 3 COMPACTED BACKFILL

ROLL EXPOSED SURFACE

2'-0"

TYP. U.G. TANK SECTION E

1/2" = 1'-0"

2- ¾" ø M.B.

4" x 4" x 5/16" L HANGER

TYP. TANK HANGER

1" = 1'-0"

TANK SADDLE

7" x 3½" x 3/8" CLIP ℄

3/4"

3/4"

℄ OF CLIP & ℄ TANK

SADDLE FLANGE DET.

1" = 1'-0"

REFERENCE DRAWINGS

SITE PLAN	MF2166282
PLOT PLAN & PIPING PLAN (BULK)	MF2166233
PIPING PLAN & SECT. - FILTER AREA	MF2166234
FOUNDATION FOR DELIVERY FACILITIES	PLT-A-036

REVISIONS

3	ADDED PIPELINE EQUIPMENT FOUNDATIONS WITH NOTE REFERING TO THEIR DRAWING NO. PLT-A-036 W.O. 9138/162	9-7-71	JS	4	ADDED NOTE TO U.G. TANK SECTION "E"	JS	
2	PUMP BASES REVISED IN PLAN AND AT SECTION "C". DETAIL H ADDED. MAX. IMPOUNDING WALL SECTION ADDED.	7-26-71	KK	5	ADDED 24" MANHOLE TO FOUNDATION PLAN (AS BUILT)	6-27-71 MGA	

SCALE: AS NOTED
DATE 5-21-71 DR. D.F. CK. L.L.
DR. APPR. ENG. APPROVED
OPER. DEPT.
ENG. DEPT.

Chevron

STANDARD OIL COMPANY OF CALIFORNIA
WESTERN OPERATIONS, INC.
MARKETING OPERATIONS

FOUNDATION PLAN & SECTIONS
BULK FUEL STORAGE
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON

W.O. 11291
S.O.

MF-2166238-4

AS CONSTRUCTED PIA 72-1002 8/23

MCC Building

- 3405-C-02

AREA LIMITS

SEWAGE HOLDING TANK (O.O.S.)

PPL SECTIONALIZER

CONC. CURB

GRAVEL

INSTALL PPL TRANSFORMER PADVAULT PER PPL REQUIREMENTS

2 DETAIL BALLARD POST (TYP. 6 PLCS)

NEW 750KVA XFMR

500KVA XFMR

25KVA XFMR

SS (NEW)

4" THK. SLAB WITH #4 REBAR 12"O.C. EW

THICKENED EDGE 12" MIN. (TYP.)

3'-6" 6" 2'-0" 5'-4"

LAB

CHANGING ROOM

MCC

MCC BLDG

CONTROL PANEL

GENERATOR

CHEVRON BUILDING

7'-2"

4'-7"

10'-9"

5'-0"

LAB DRAIN TANK SLAB

1 C-03 DETAIL LAB MODIFICATIONS

SWITCH GEAR SLAB

GENERATOR SLAB

4" THK. SLAB WITH #4 REBAR 12"O.C. EW

SS (NEW)

AREA LIMITS

AREA LIMITS

AREA LIMITS

PLAN

2' 0' 2' 4' 6' 8' 10' 12'

SCALE: 1/4"=1'-0" (22x34)
SCALE: 1/8"=1'-0" (11x17)

GRADE

12" MIN.

3/4" MINUS COMPACTED GRAVEL

TYPICAL THICKENED SLAB EDGE

SECTION A
SCALE: NTS

UNPAVED AREAS | PAVED AREAS

MOUND

SELECT NATIVE BACKFILL

6" (MIN.)

4" (MIN.)

SELECT GRANULAR BACKFILL @ 95% DENSITY

1 1/2" HDPE

SELECT GRANULAR MATERIAL @ 92% DENSITY

PIPE ID + 18"

TYPICAL TRENCH

SECTION B
SCALE: NTS

CRWON TOP

6" SCH. 40 PIPE FILLED WITH CONCRETE

ASPHALT

CONCRETE

3'-6"

3'-6"

1'-6"

ELEVATION

BALLARD

DETAIL 2
SCALE: NTS

4'-0" 5'-0" 6'-0"

4'-6"

3'-0"

2'-0"

B 1

SS (NEW)

DETAIL VALVE BOX 1 P-04

UNDERGROUND AVIATION FUEL TO FUELING ISLAND

DETAIL SANITARY SEWER LIFT STATION 1 P-04

NOTES:

1. SEE DWG. 3406-P-02 FOR UTILITY PIPING.

DRAWING NO.	REFERENCE DRAWINGS
3405-C-03	LAB FLOOR PLAN & SECTIONS

REV.	DATE	REVISED	DRAWN	CK'D.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	1/28/04	ISSUE FOR CONSTRUCTION	BDC	WHB					
1	10/08/04	RECORD DRAWING	QKB	DAB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER 3406

SCALE: 1/4"=1'		DATE
DRAWN BY	QKB	5/07/01
DESIGNED BY	REK	5/07/01
CHECKED BY		
WORK ORDER	34-06	22x34
DATE		
11/2/00		

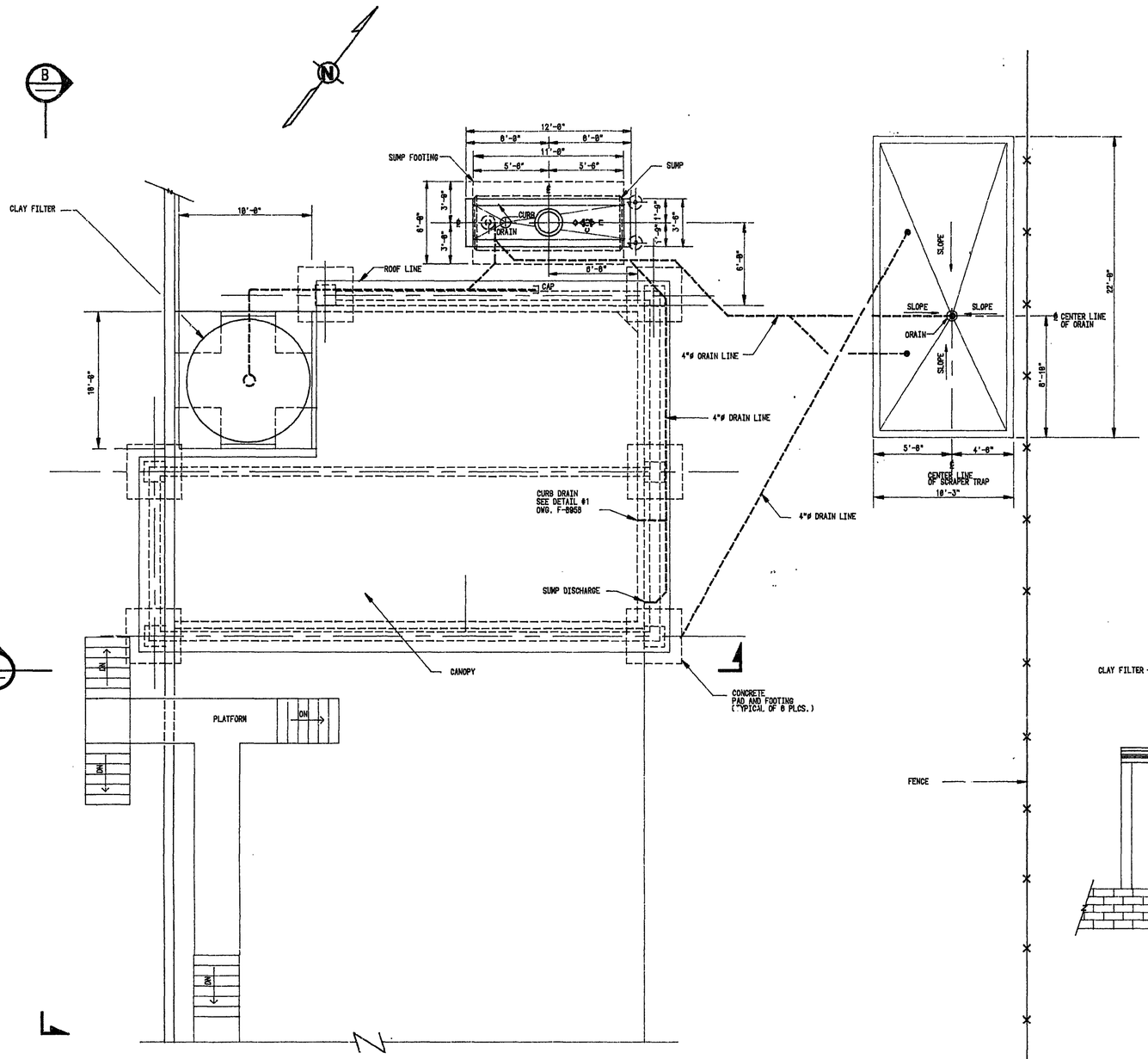
PDX BULK FUELING FACILITY
PORTLAND, OREGON
LAB AND OFFICE ADDITION
VAULT AND SLAB LOCATION PLAN

DRAWING NO.	SHEET	REV.
3405-C-02	1 OF 1	1

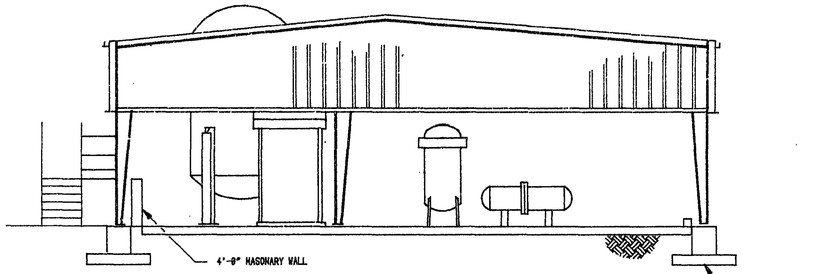
<CPD: 10/05/04 [TIME: 08:54 AM] >
c021.dwg.DWG

Overhead Canopy

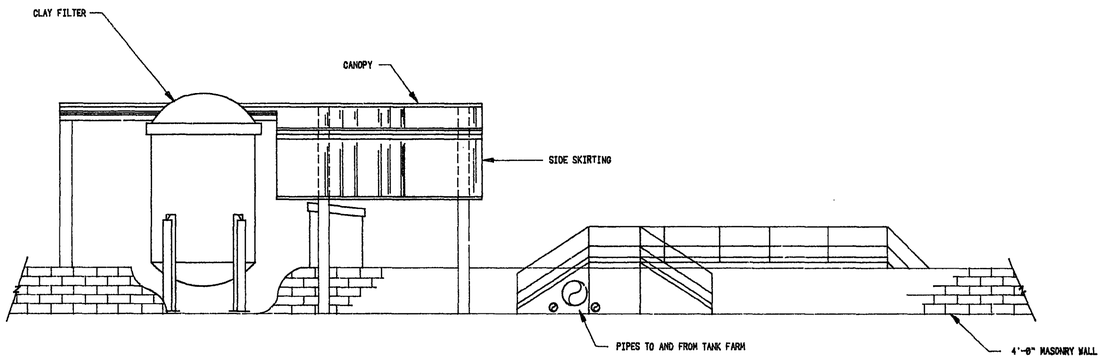
- F-9017-0



PLAN VIEW
SCALE: 1/4"=1'-0"



ELEVATION A
SCALE:1/4"=1'-0"



ELEVATION B
SCALE: 1/4"=1'-0"

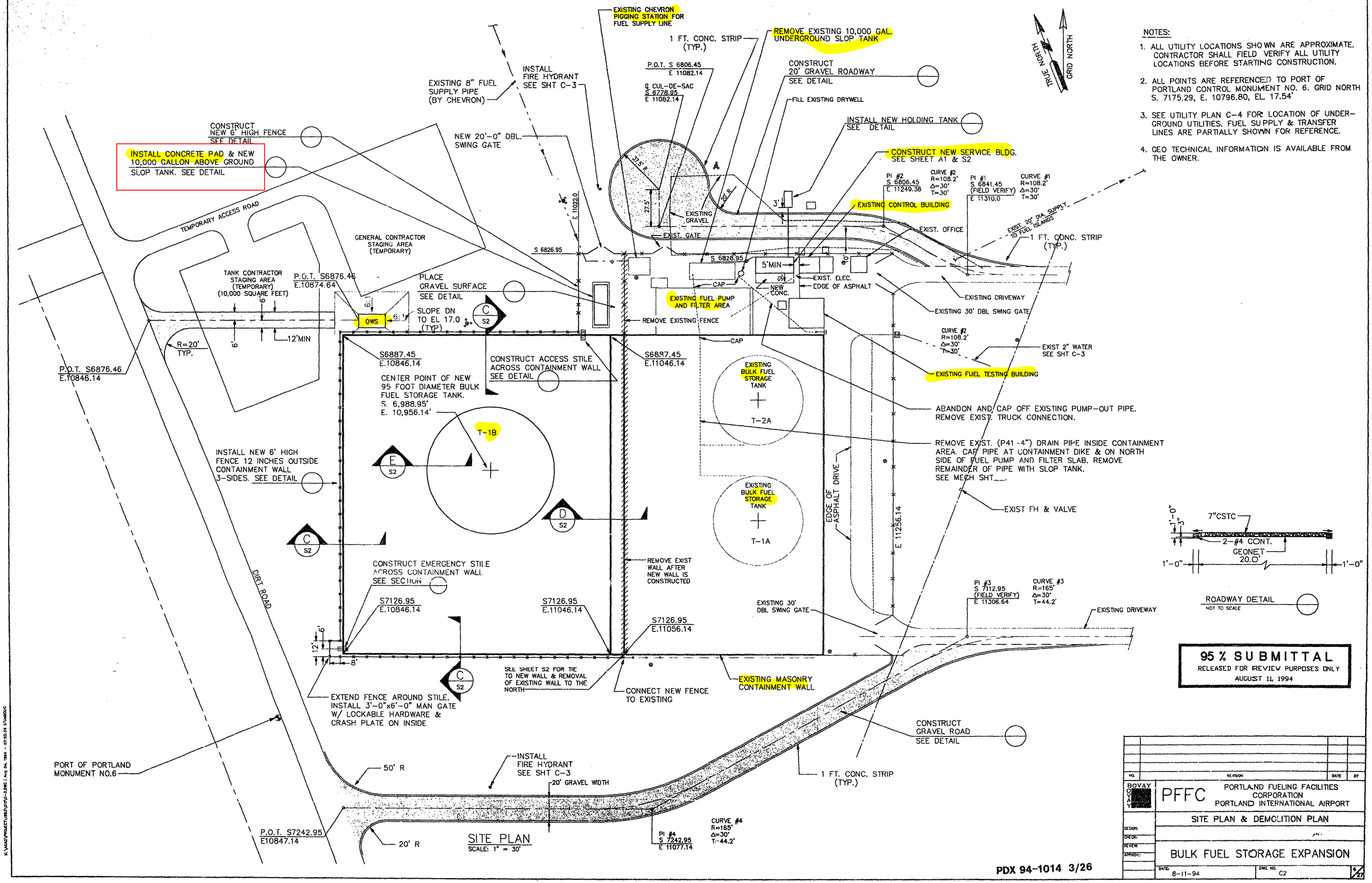
[redacted]

REFERENCE DRAWINGS							REVISIONS							SCALE 1/4" = 1'-0"	Chevron Pipe Line Co. Salt Lake Division	GENERAL ARRANGEMENT OF PROPOSED FACILITY IMPROVEMENTS
PIPING PLAN AND DETAILS FOR DELIVERY	F-8644													DATE 12/19/87 DR. DR CK.		PORTLAND AIRPORT DELIVERY FACILTY
CONCRETE PADS AND FOUNDATIONS PLAN	F-8641													DR. APPR. ENG. JCG		A W.O. S.O. F-9017-0
CONCRETE SECTIONS AND DETAILS	F-8968													OPER. DEPT. APPROVED		
														ENG. DEPT.		

PDX 88-1011 K9 88-22

10,000 gallon Off Spec Product Tank

- 94-1014-C2



NOTES:

1. ALL UTILITY LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY ALL UTILITY LOCATIONS BEFORE STARTING CONSTRUCTION.
2. ALL POINTS ARE REFERENCED TO PORT OF PORTLAND CONTROL MONUMENT NO. 6. GRID NORTH S. 7175.29, E. 10796.80, EL 17.54'
3. SEE UTILITY PLAN C-4 FOR LOCATION OF UNDERGROUND UTILITIES. FUEL SUPPLY & TRANSFER LINES ARE PARTIALLY SHOWN FOR REFERENCE.
4. GEO TECHNICAL INFORMATION IS AVAILABLE FROM THE OWNER.

95 % SUBMITTAL
RELEASED FOR REVIEW PURPOSES ONLY
AUGUST 11, 1994

PDX 94-1014 3/26

NO.	REVISION	DATE	BY

BOVAY ENGINEERS

PFFC PORTLAND FUELING FACILITIES CORPORATION
PORTLAND INTERNATIONAL AIRPORT

SITE PLAN & DEMOLITION PLAN

DESIGN:
CHECK:
REVIEW:
APPROV.:

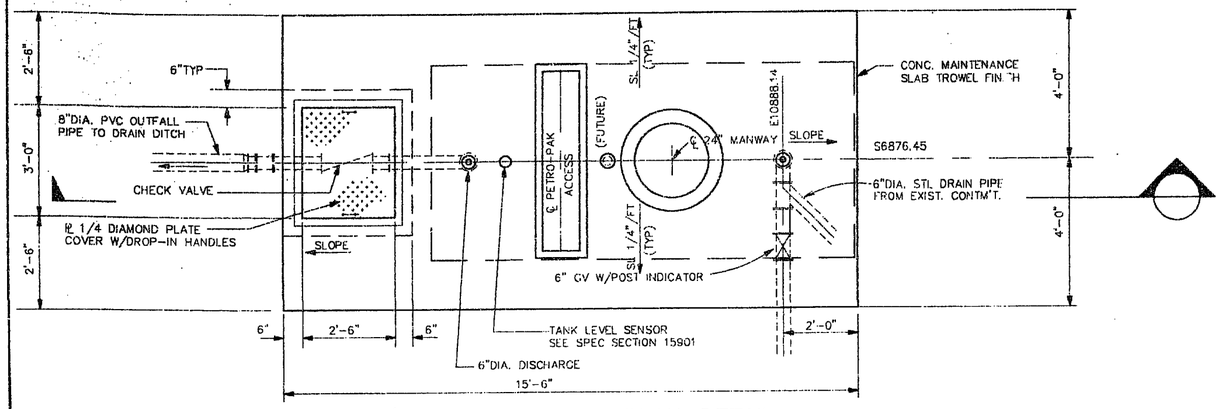
BULK FUEL STORAGE EXPANSION

DATE 8-11-94 | DWG. NO. C2 | 4/27

K:\JOBS\PROJECTS\1853\DWG\C-2.DWG | Aug 04, 1994 - 07:55:59 STUMBAUGH

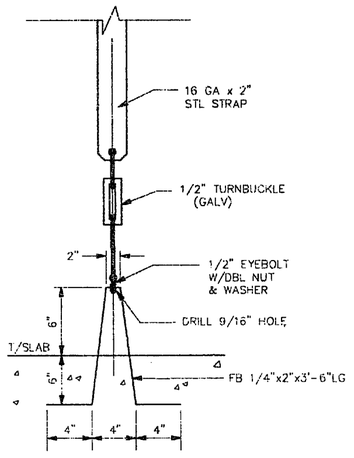
2,000 Gallon OWS

- 94-1014-C6



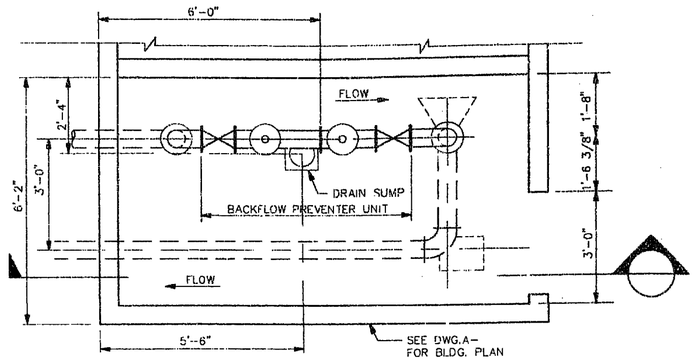
OIL/WATER SEPERATOR PLAN–DETAIL

NOT TO SCALE



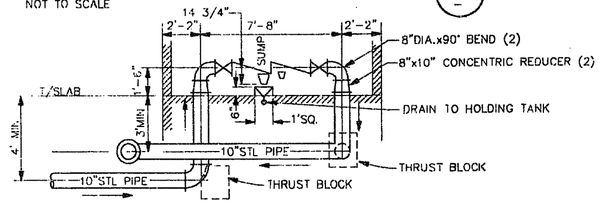
DETAIL

NOT TO SCALE



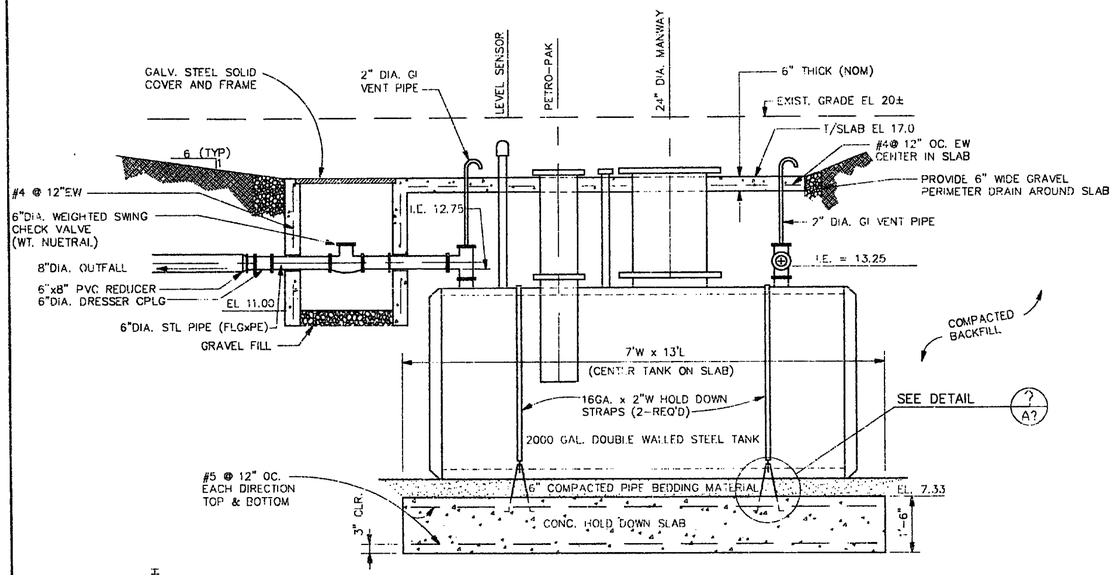
BACKFLOW PREVENTER DETAIL

NOT TO SCALE



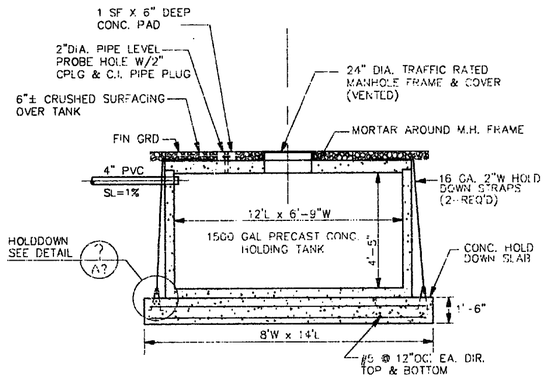
SECTION

NOT TO SCALE



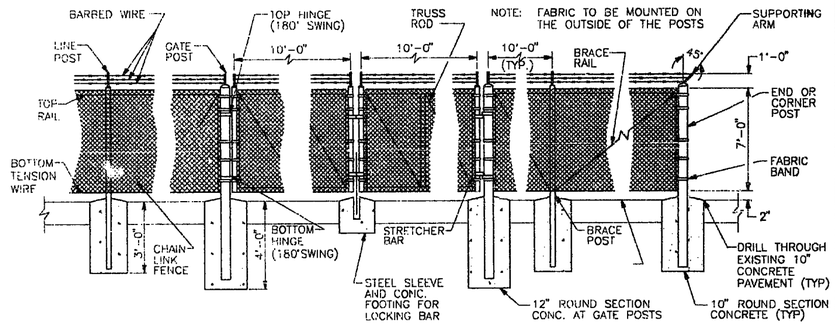
OIL/WATER SEPERATOR SECTION

NOT TO SCALE



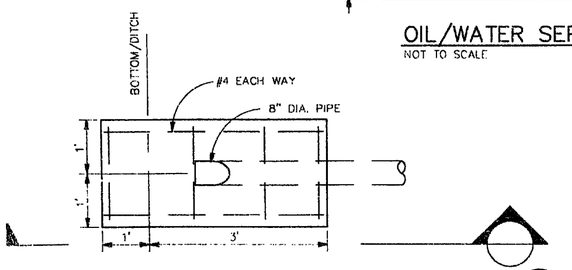
SEWAGE HOLDING TANK–DETAIL

NOT TO SCALE



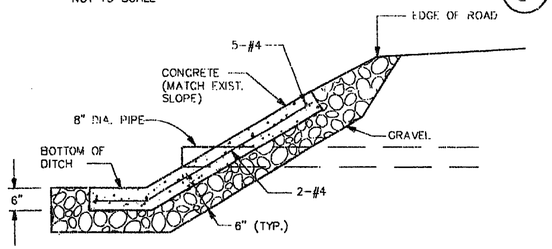
SWING GATE AND CHAIN LINK FENCE

NOT TO SCALE



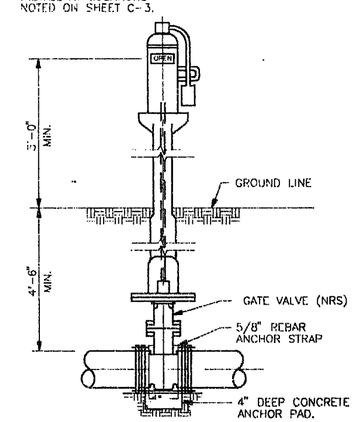
OUTFALL HEADWALL PLAN–DETAIL

NOT TO SCALE



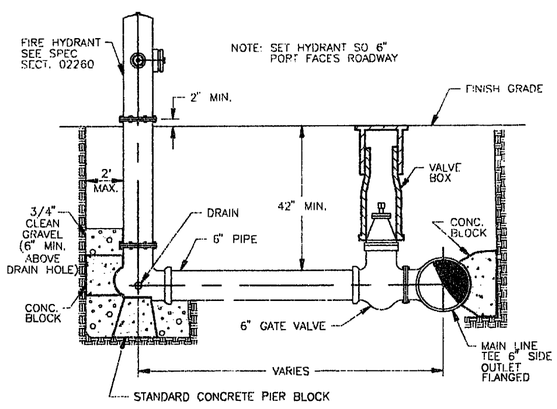
SECTION

NOT TO SCALE



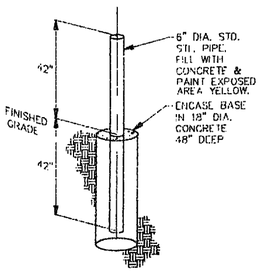
POST INDICATOR

NOT TO SCALE C-3



FIRE HYDRANT DETAIL

NOT TO SCALE



BOLLARD DETAIL

NOT TO SCALE

95 % SUBMITTAL
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AUGUST 11, 1994

NO.	REVISION	DATE	BY

BOVAY ENGINEERS, INC.

PFFC PORTLAND FUELING FACILITIES CORPORATION
PORTLAND INTERNATIONAL AIRPORT

OIL/WATER SEPERATOR & MISC. DETAILS

DESIGN:
CHECK:
REVIEW:

BULK FUEL STORAGE EXPANSION

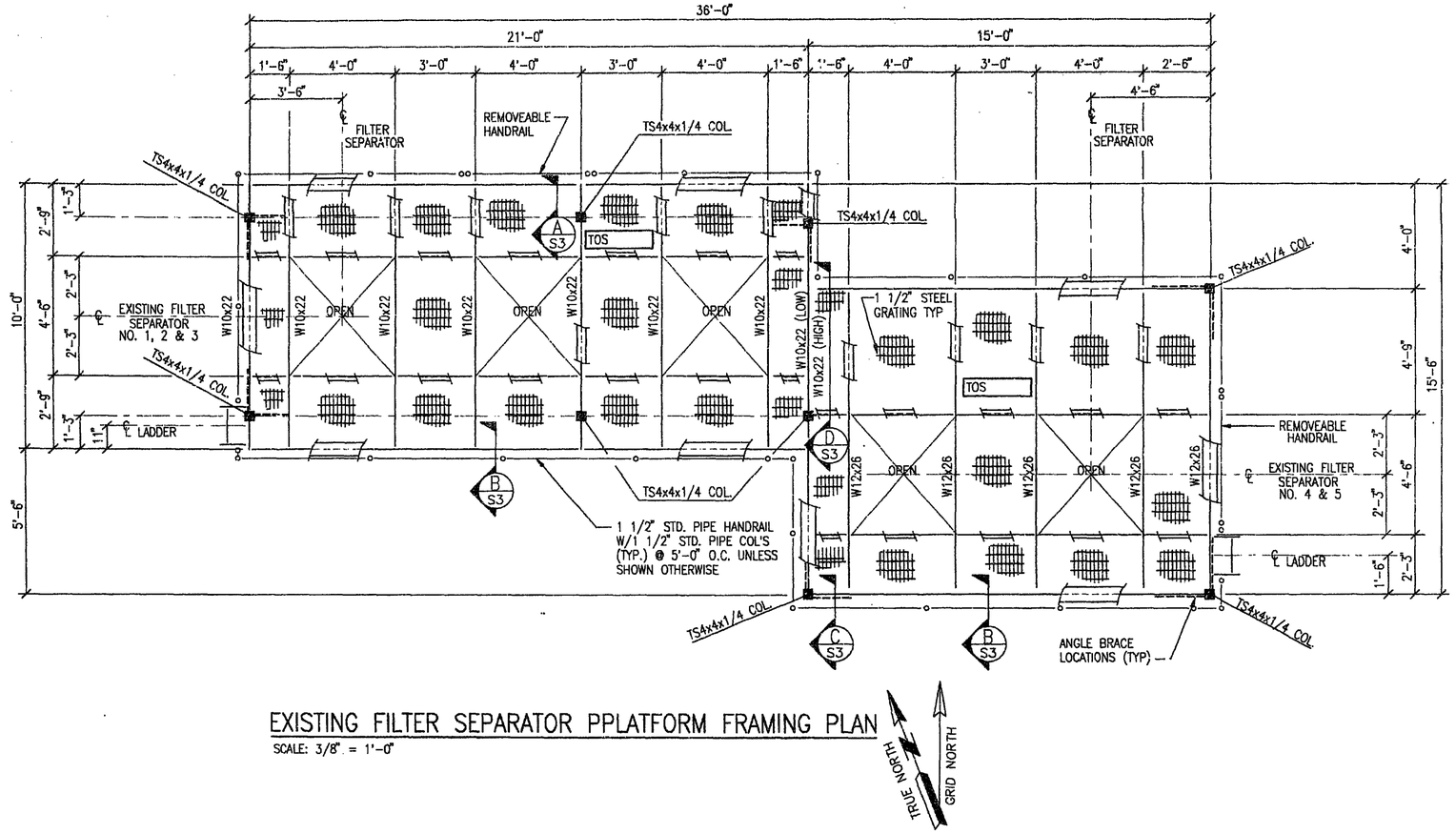
DATE: 6-30-94
DWG. NO. C6
SHT. 5 OF 27

PDX 94-1014 7/26

K:\JOBS\PROJECTS\1993\PDX\C-SLDWG | Aug 04, 1994 - 08:15:47 HOUSTON

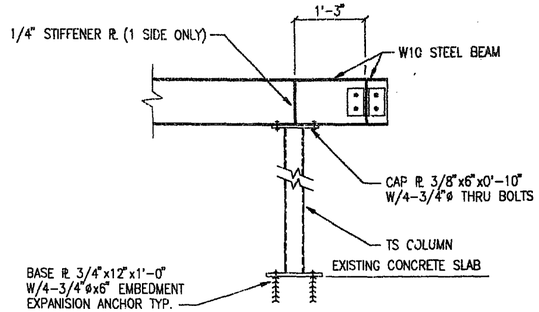
Hydrant Pump Pad Platform

- 94-1014-S-3



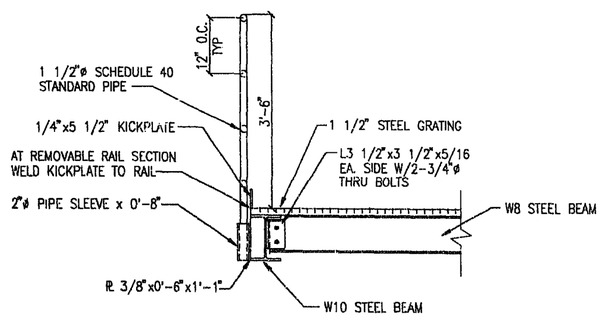
EXISTING FILTER SEPARATOR PPLATFORM FRAMING PLAN

SCALE: 3/8" = 1'-0"



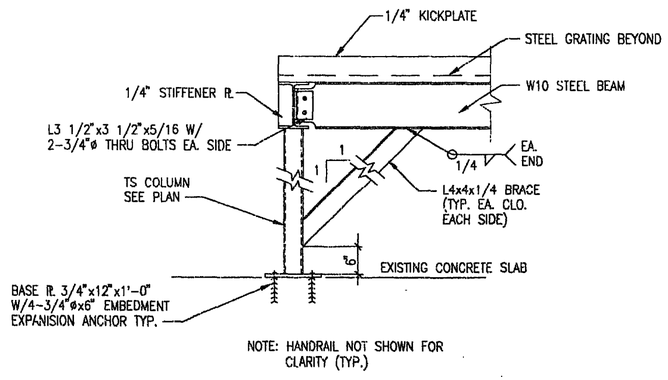
FRAMING DETAIL A S3

SCALE: 3/4" = 1'-0"



FRAMING DETAIL B S3

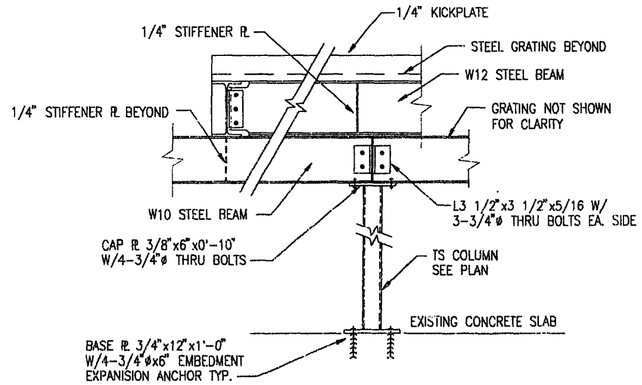
SCALE: 3/4" = 1'-0"



NOTE: HANDRAIL NOT SHOWN FOR CLARITY (TYP.)

FRAMING DETAIL C S3

SCALE: 3/4" = 1'-0"



FRAMING DETAIL D S3

SCALE: 3/4" = 1'-0"

GRAPHIC SCALE

3/8" = 1'-0" 2' 1' 6" 0' 1' 2' 3' 4'

3/4" = 1'-0" 1' 6" 0' 1' 2' 3'

95 % SUBMITTAL

RELEASED FOR REVIEW PURPOSES ONLY

AUGUST 2, 1994

NO.	REVISION	DATE	BY

PFFC PORTLAND FUELING FACILITIES CORPORATION
PORTLAND INTERNATIONAL AIRPORT

DESIGN:
CHECK:
REVISOR:
APPROV:

PLATFORM & DETAILS

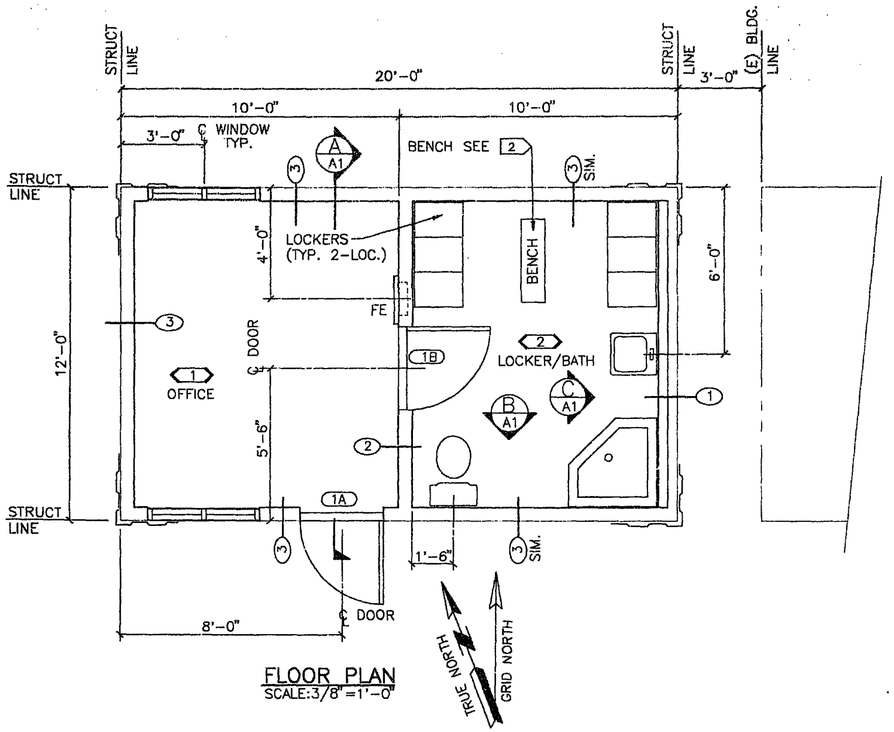
BULK FUEL STORAGE EXPANSION

DATE: 08-02-94 DWG. NO. S-3

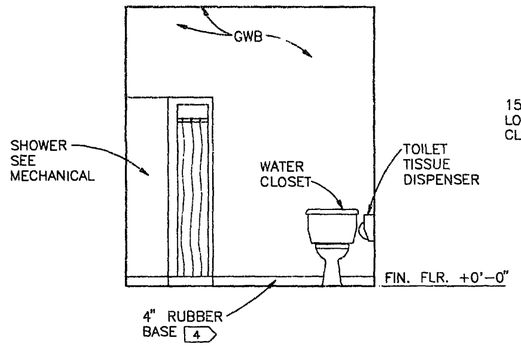
PDX 94-1014 11/26

Service Building / Lab

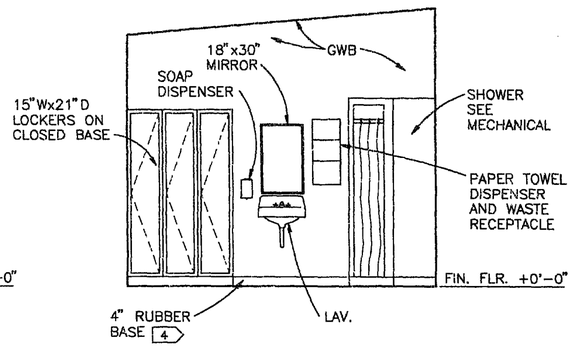
- Drawing - 94-1014-A1
- Drawing - 94-1014-S-2



FLOOR PLAN
SCALE:3/8"=1'-0"



INTERIOR ELEVATION B/A1
SCALE:3/8"=1'-0"



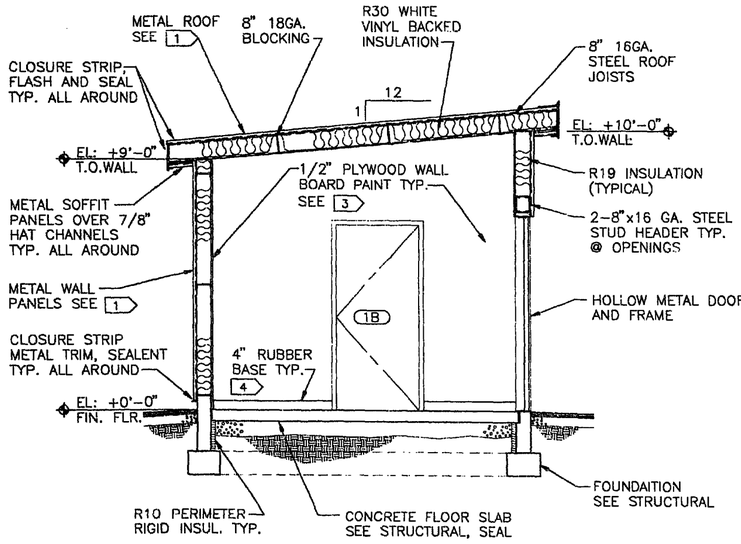
INTERIOR ELEVATION C/A1
SCALE:3/8"=1'-0"

GENERAL NOTES

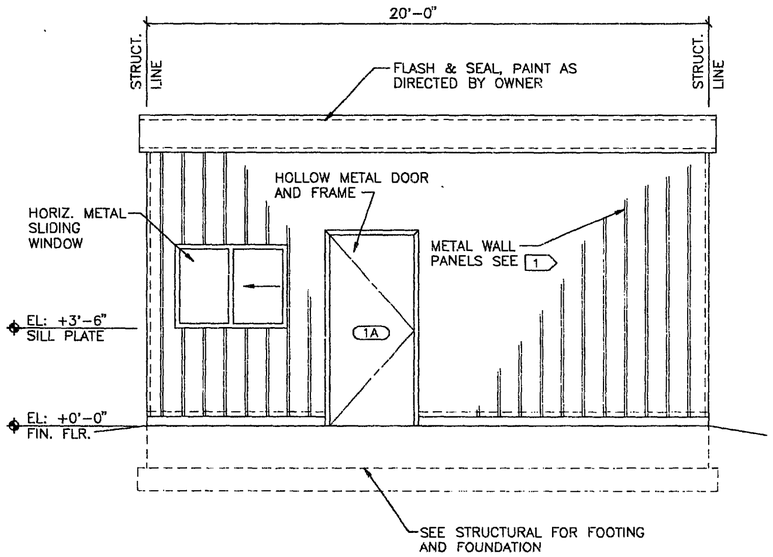
1. METAL ROOF AND WALL PANELS SHALL BE 26 GA. MIN., G-90 ZINC COATED STEEL CONFORMING TO ASTM A446 AND ASTM A525. METAL PANEL COLOR AND PROFILE SHALL EMULATE THOSE OF SURROUNDING EXISTING STRUCTURES. ACCESSORIES INCLUDING ALL TRIM, FLASHING, CLOSURE STRIPS AND SIMILAR METAL ACCESSORIES SHALL BE PROVIDED FOR A WEATHER TIGHT INSTALLATION.
2. SEE SPECIFICATION SECTION 10500 FOR LOCKER ROOM BENCH.
3. ALL 1/2" PLYWOOD SHALL BE APA RATED AC SHEATHING. INSTALL PERPENDICULAR TO WALL FRAMING, SANDED SIDE EXPOSED. FASTEN PER UBC REQUIREMENTS.
4. RUBBER BASE SHALL MEET THE REQUIREMENTS OF FEDERAL SPECIFICATION SS-W-40, TYPE 1. COLOR TO BE CHOSEN BY OWNER. INSTALL PER MANUFACTURERS DIRECTIONS.

STANDARD ABBREVIATIONS

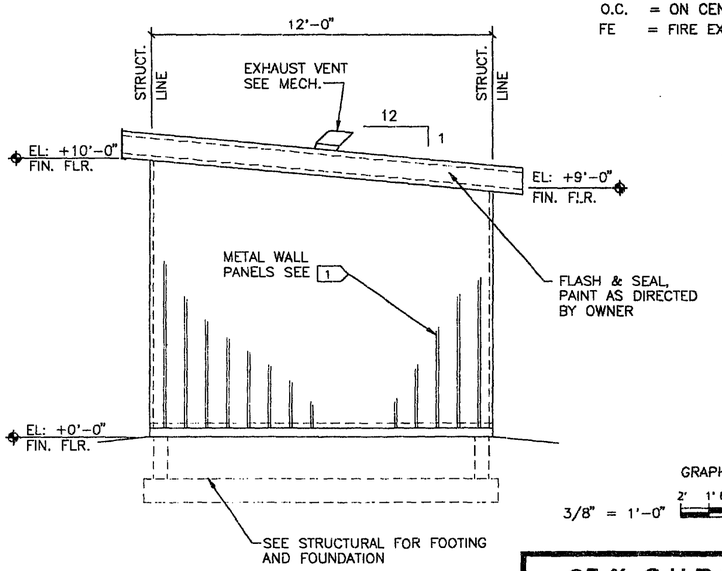
(E)	=	EXISTING
F.O.S.	=	FACE OF STUDS
SIM.	=	SIMILAR
LOC.	=	LOCATIONS
T.O.	=	TOP OF
INSUL.	=	INSULATION
GA.	=	GUAGE
REQ'D	=	REQUIRED
PLYWD	=	PLYWOOD
GWB	=	GYPSUM WALLBOARD
H.M.	=	HOLLOW METAL
℄	=	CENTERLINE
O.C.	=	ON CENTER
FE	=	FIRE EXTINGUISHER



TYPICAL BUILDING SECTION A/A1
SCALE:3/8"=1'-0"

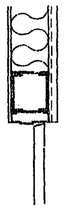


SOUTH ELEVATION-NORTH ELEVATION SIM.
SCALE:3/8"=1'-0"



EAST ELEVATION-WEST ELEV. SIM.
SCALE:3/8"=1'-0"

GRAPHIC SCALE
3/8" = 1'-0"
2' 1' 6" 0' 1' 2' 3' 4'



HEAD
SCALE: 1" = 1'-0" A/A1

95 % SUBMITTAL
RELEASED FOR REVIEW PURPOSES ONLY
AUGUST 2, 1994

NO.	REVISION	DATE	BY

BOVAY

PFFC PORTLAND FUELING FACILITIES CORPORATION
PORTLAND INTERNATIONAL AIRPORT

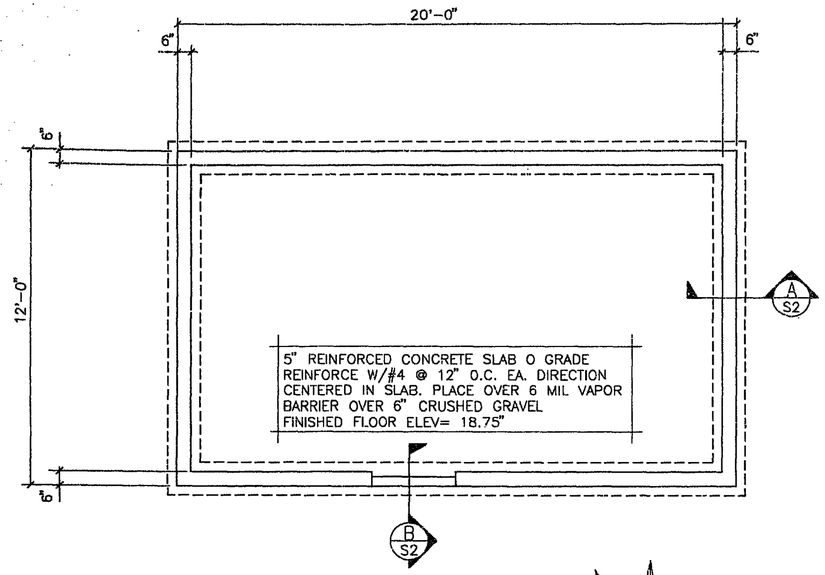
OFFICE BUILDING

FLOOR PLAN, ELEVATIONS & DETAILS

BULK FUEL STORAGE EXPANSION

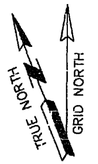
DESIGN
CHECKED
REVIEW
APPROVAL
DATE: 08./02/94
DWG. NO. A1
9/25

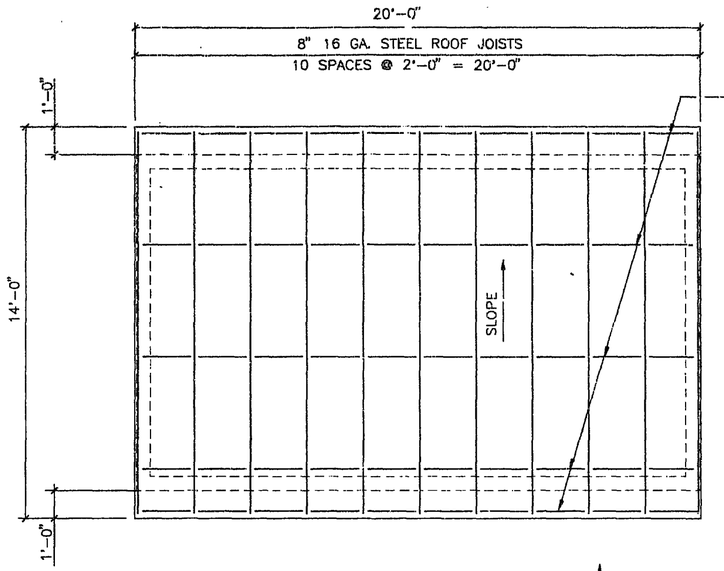
PDX 94-1014 8/26



FOUNDATION PLAN

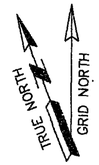
SCALE: 3/8" = 1'-0"

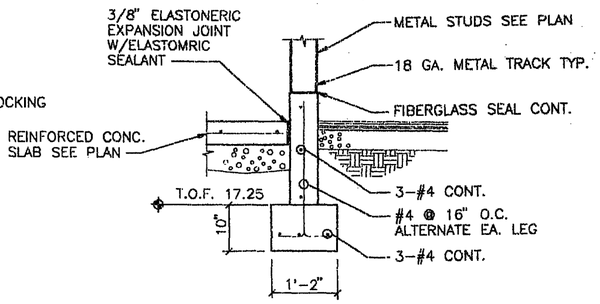




ROOF FRAMIING PLAN

SCALE: 3/8" = 1'-0"

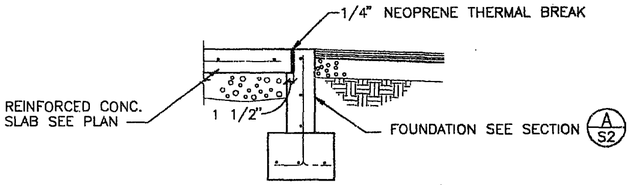




TYPICAL FOUNDATION WALL

SCALE: 3/4" = 1'-0"

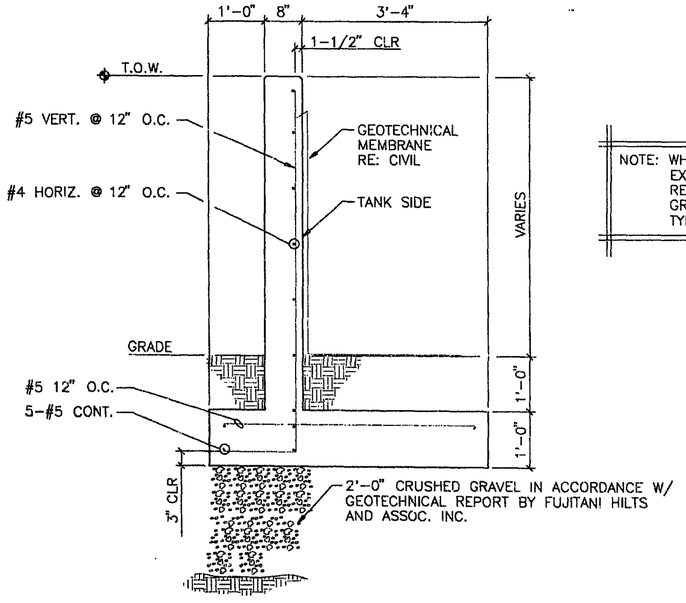
A
S2



TYPICAL FOUNDATION WALL AT DOORWAY

SCALE: 3/4" = 1'-0"

B
S2

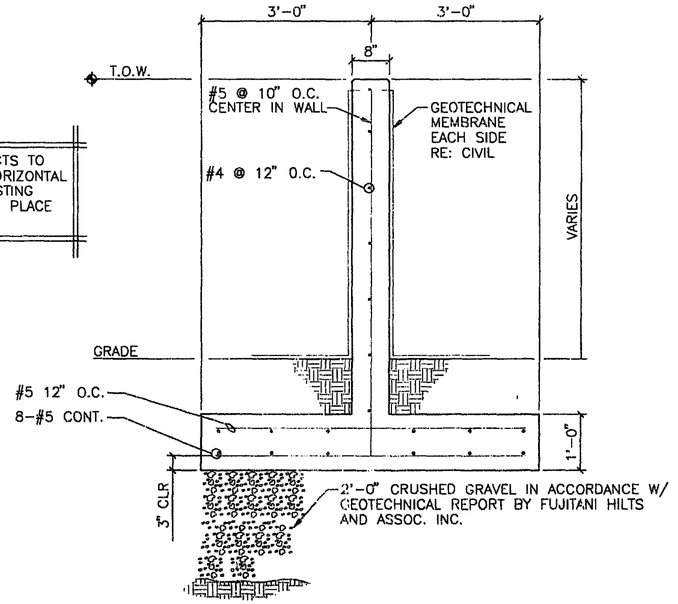


NOTE: WHERE NEW WALL CONNECTS TO EXISTING WALL EXTEND HORIZONTAL REINFORCING 8" INTO EXISTING GROUTED CELLS EPOXY IN PLACE TYPICAL.

CONTAINMENT DIKE (1 SIDE ONLY)

SCALE: 3/4" = 1'-0"

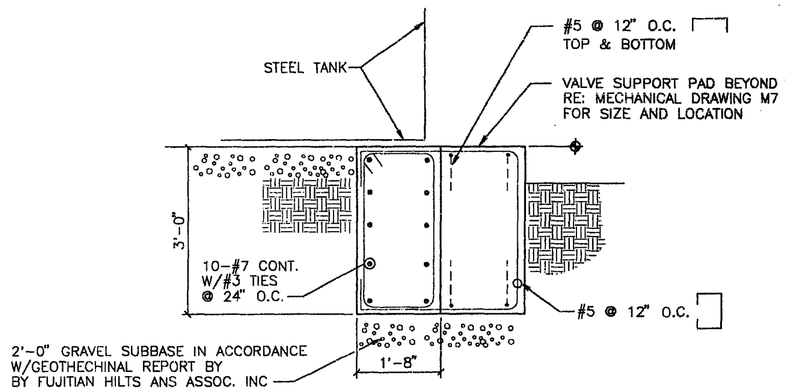
C
C2



CONTAINMENT DIKE (BOTH SIDES)

SCALE: 3/4" = 1'-0"

D
C2



TYPICAL RING WALL FOUNDATION

SCALE: 3/4" = 1'-0"

F
C2

GRAPHIC SCALE

3/8" = 1'-0" (2' 1' 6" 0' 1' 2' 3' 4')

3/4" = 1'-0" (1' 6" 0' 1' 2' 3')

95 % SUBMITTAL

RELEASED FOR REVIEW PURPOSES ONLY

AUGUST 2, 1994

PDX 94-1014 10/26

NO.	REVISION	DATE	BY

BOVAY ENGINEERING

PFFC — PORTLAND FUELING FACILITIES CORPORATION, PORTLAND INTERNATIONAL AIRPORT

OFFICE BUILDING

FOUNDATION PLAN, SECTIONS & DETAILS

PORTLAND FUEL FARM

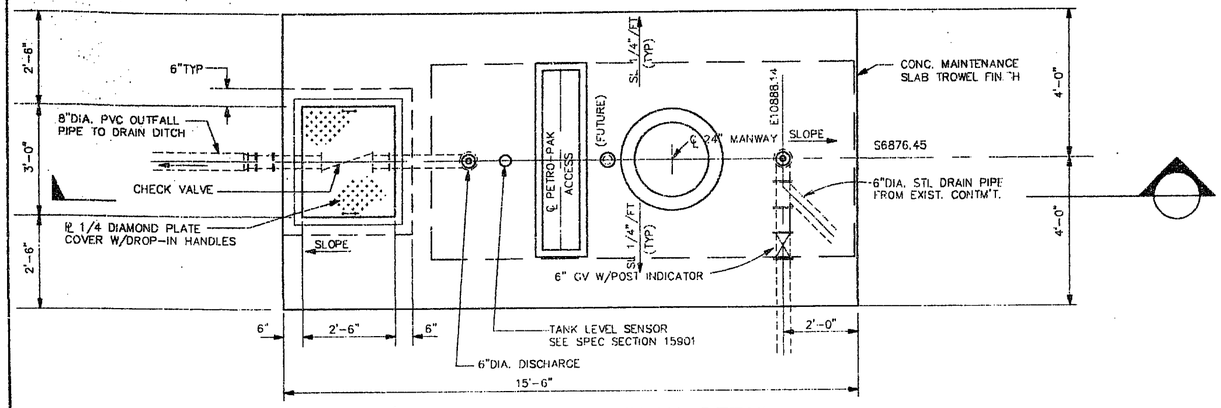
DESIGN: CHECKED: REVIEWED: APPROVED:

DATE: 08-02-94 DWG. NO. S-2

11/28

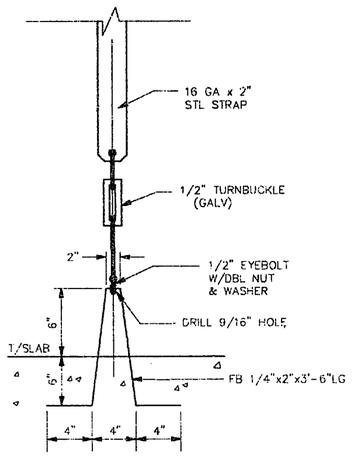
Sewage Holding Tank

- Drawing - 94-1014-C6



OIL/WATER SEPERATOR PLAN–DETAIL

NOT TO SCALE



DETAIL

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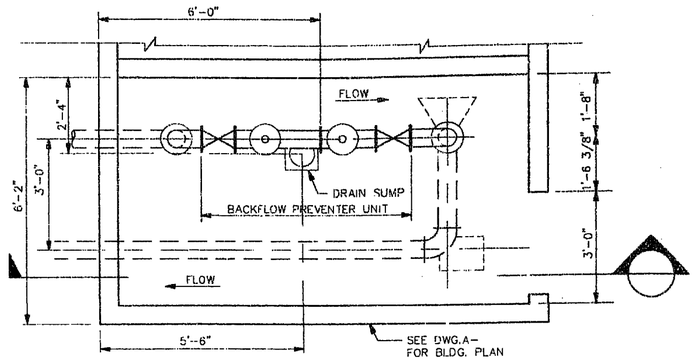
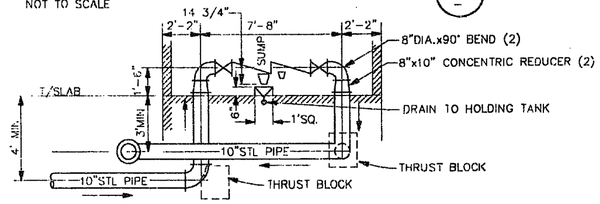


BACKFLOW PREVENTER DETAIL

NOT TO SCALE



SECTION

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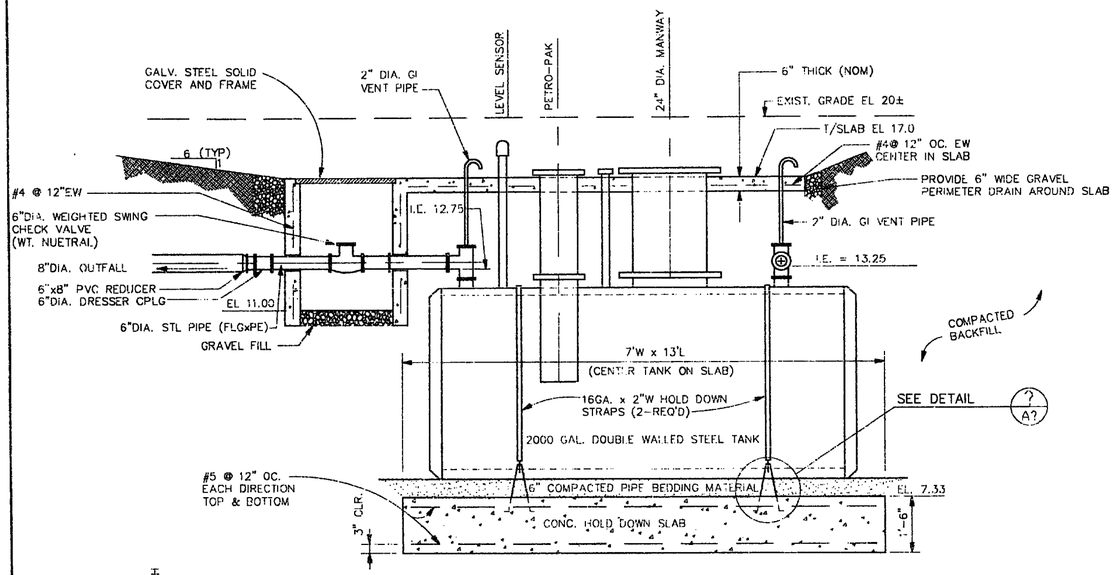
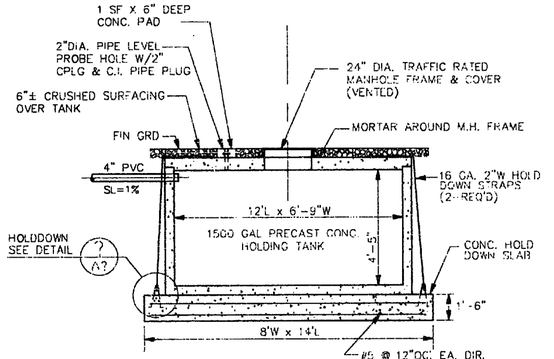


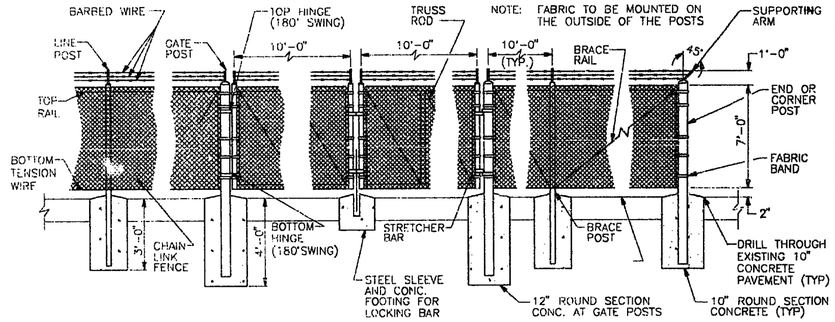
OIL/WATER SEPERATOR SECTION

NOT TO SCALE



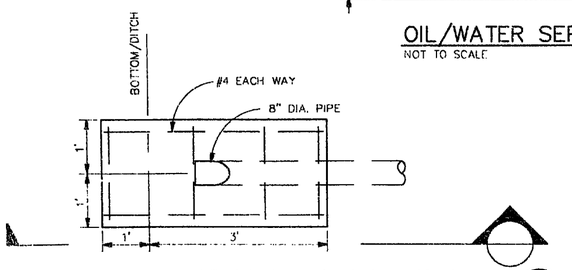
SEWAGE HOLDING TANK–DETAIL

NOT TO SCALE



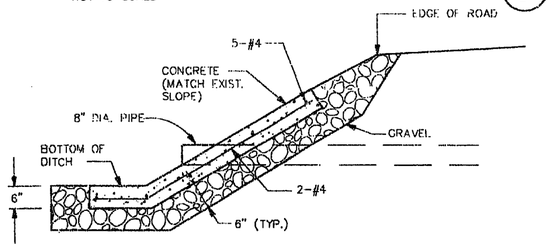
SWING GATE AND CHAIN LINK FENCE

NOT TO SCALE



OUTFALL HEADWALL PLAN–DETAIL

NOT TO SCALE



SECTION

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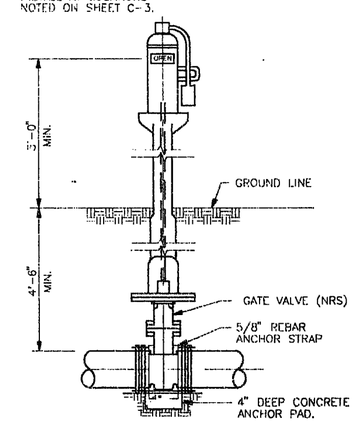
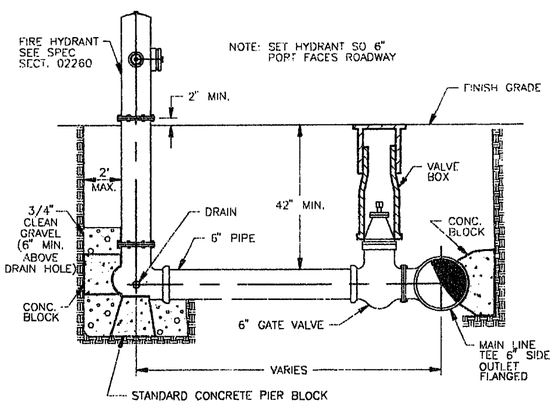


POST INDICATOR

NOT TO SCALE C-3



FIRE HYDRANT DETAIL

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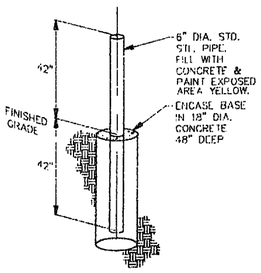

BOLLARD DETAIL

NOT TO SCALE

95 % SUBMITTAL
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AUGUST 11, 1994

NO.	REVISION	DATE	BY

BOVAY ENGINEERS, INC.

PFFC PORTLAND FUELING FACILITIES CORPORATION
PORTLAND INTERNATIONAL AIRPORT

OIL/WATER SEPERATOR & MISC. DETAILS

BULK FUEL STORAGE EXPANSION

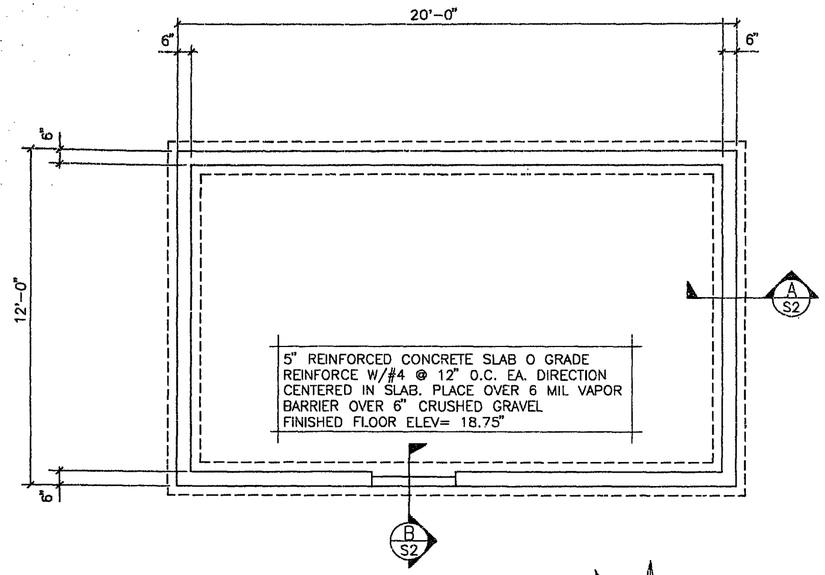
DESIGN:
CHECK:
REVIEW:
DATE: 6-30-94
DWG. NO. C6
SHT. 27

PDX 94-1014 7/26

K:\JOBS\PDX\94101\ENGR\DWG\C-ELEV.1 Aug 04, 1994 - 08:15:47 HOUSTON

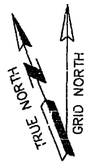
Tank 3

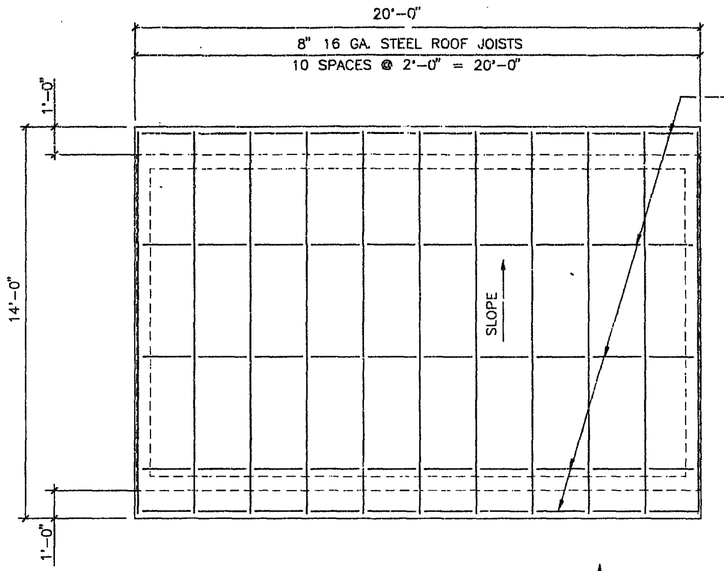
- Drawing - 94-1014-S-2
- Drawing - 94-1014-M2



FOUNDATION PLAN

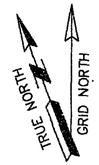
SCALE: 3/8" = 1'-0"

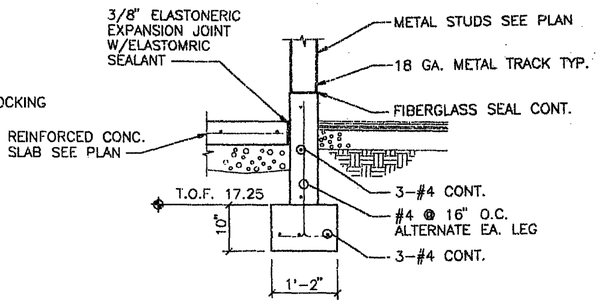




ROOF FRAMIING PLAN

SCALE: 3/8" = 1'-0"

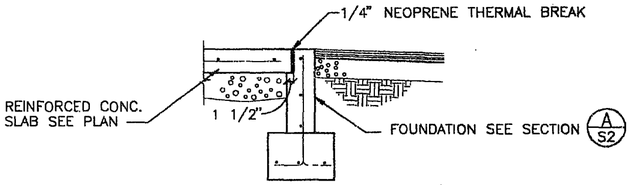




TYPICAL FOUNDATION WALL

SCALE: 3/4" = 1'-0"

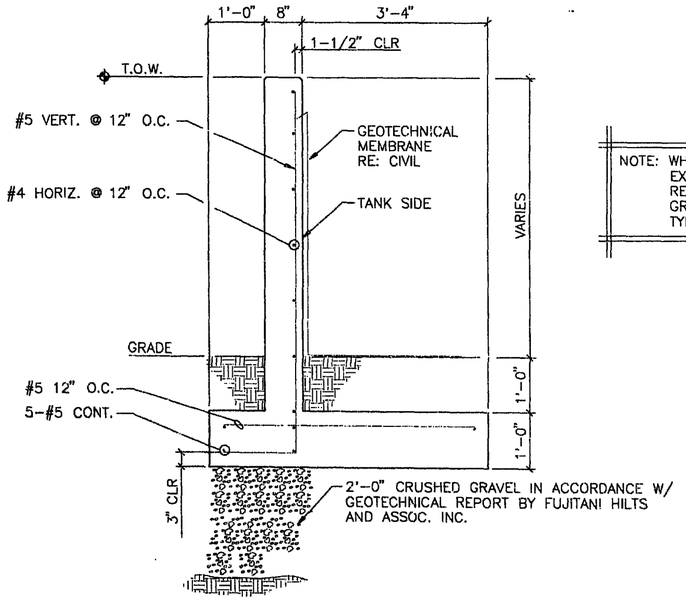
A S2



TYPICAL FOUNDATION WALL AT DOORWAY

SCALE: 3/4" = 1'-0"

B S2

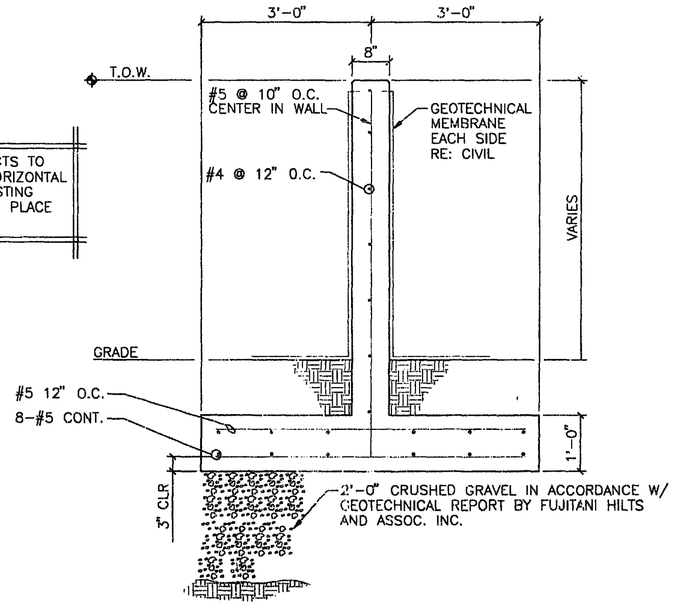


NOTE: WHERE NEW WALL CONNECTS TO EXISTING WALL EXTEND HORIZONTAL REINFORCING 8" INTO EXISTING GROUTED CELLS EPOXY IN PLACE TYPICAL.

CONTAINMENT DIKE (1 SIDE ONLY)

SCALE: 3/4" = 1'-0"

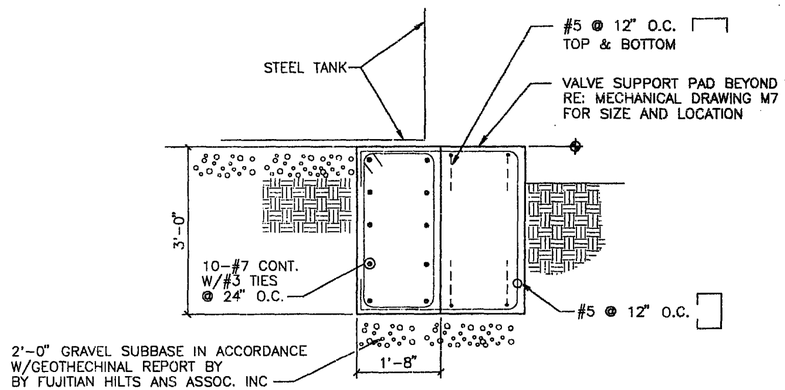
C C2



CONTAINMENT DIKE (BOTH SIDES)

SCALE: 3/4" = 1'-0"

D C2



TYPICAL RING WALL FOUNDATION

SCALE: 3/4" = 1'-0"

F C2

GRAPHIC SCALE

3/8" = 1'-0" 2' 1' 6" 0' 1' 2' 3' 4'

3/4" = 1'-0" 1' 6" 0' 1' 2' 3'

95 % SUBMITTAL
RELEASED FOR REVIEW PURPOSES ONLY
AUGUST 2, 1994

PDX 94-1014 10/26

NO.	REVISION	DATE	BY

BOVAY ENGINEERING

PFFC — PORTLAND FUELING FACILITIES CORPORATION, PORTLAND INTERNATIONAL AIRPORT

OFFICE BUILDING

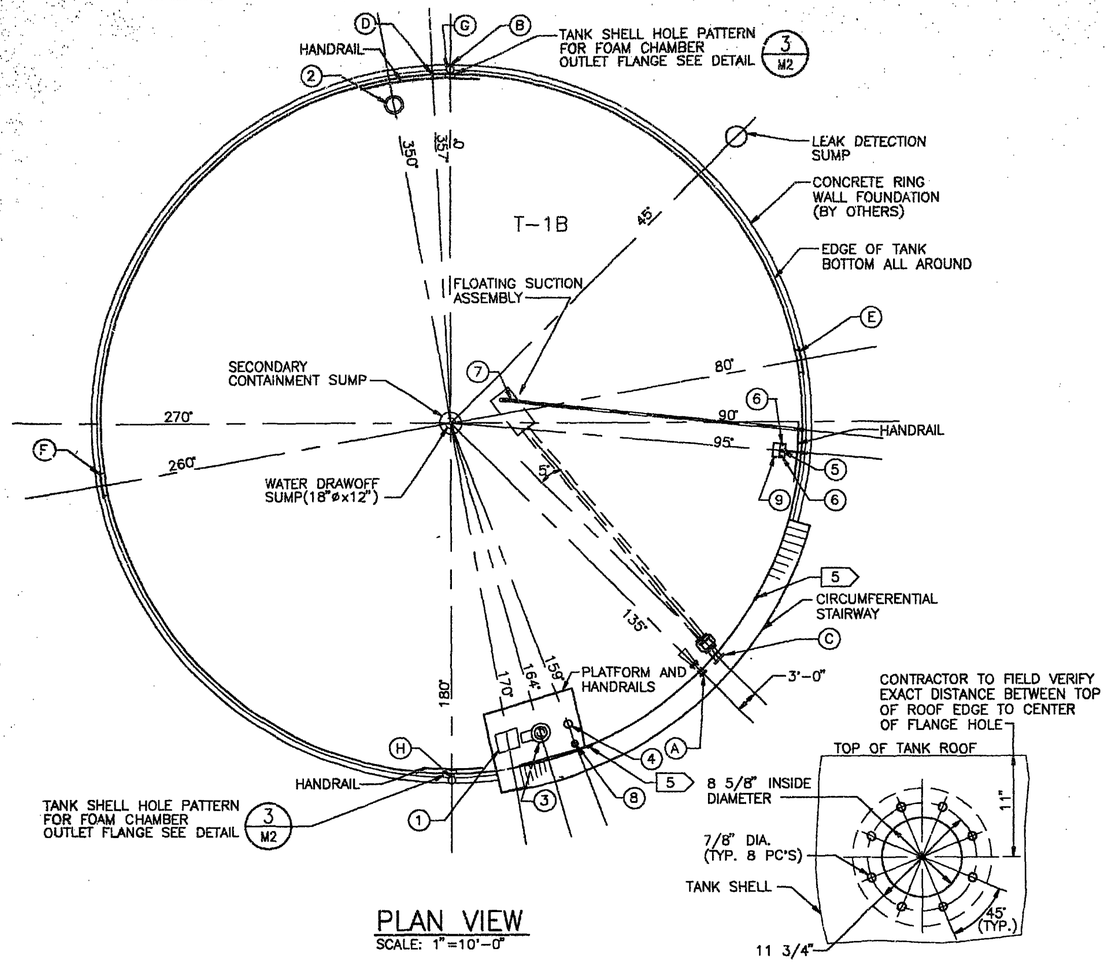
FOUNDATION PLAN, SECTIONS & DETAILS

PORTLAND FUEL FARM

DESIGN: CHECKED: REVIEWED: APPROVED:

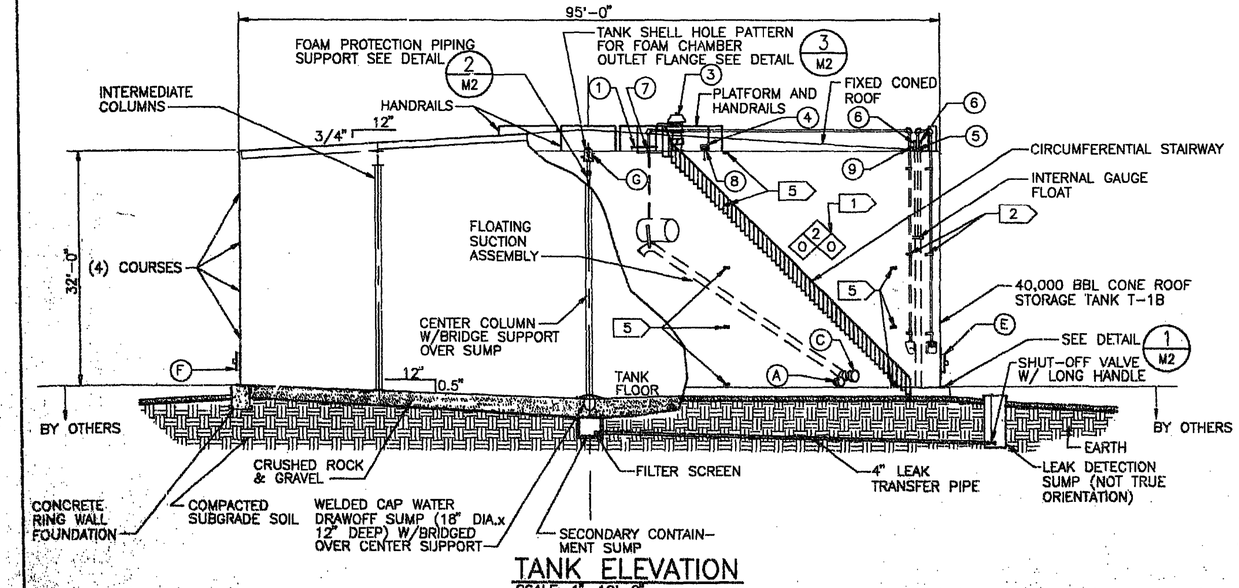
DATE: 08-02-94 DWG. NO. S-2

11/28



PLAN VIEW
SCALE: 1"=10'-0"

TANK SHELL HOLE PATTERN FOR FOAM CHAMBER FLANGE 3/M2
SCALE: 1 1/2"=1'-0"



TANK ELEVATION
SCALE: 1"=10'-0"

SHELL NOZZLE APPURTENANCE SCHEDULE

SYMBOL ○	DESCRIPTION	DESCRIPTION	SIZE	FLANGED	TANK ORIENTATION	HEIGHT FROM BOTTOM OF TANK TO CENTER OF NOZZLE
A	FILL NOZZLE	150lb. RAISED FACE DOUBLE FLANGED CONNECTION WITH REINFORCING PLATE CONNECTED TO FLANGED INTERNAL DIFFUSER	8"	150lb.	135°	9 1/2"
B	RECIRCULATION SHELL NOZZLE/SUMP DRAIN	150lb. DOUBLE FLANGED CONNECTION WITH REINFORCING PLATE TO INTERNAL PIPE CONNECTION, SCHEDULE 40, CARBON STEEL SUPPORTED PIPE TO RUN PARALLEL TO TANK BOTTOM, INTO CENTER SUMP.	4"	150lb.	0°	6"
C	OUTLET NOZZLE	150lb. DOUBLE FLANGED CONNECTION, PLAT FACED INTERNAL RAISED FACE EXTERNAL WITH REINFORCING PLATE, CONNECTED TO SUPPORTED CENTRAL TYPE SWING JOINT AND FLOATING SUCTION WITH ANTIVOR-EX BAFFLE.	16"	150lb.	132°	1'-6 3/4"
D	WATER DRAWOFF	SOCKET WELD 3000lb COUPLING. SCHEDULE 40 CARBON STEEL SUPPORTED PIPE TO RUN PARALLEL TO TANK BOTTOM, INTO CENTER SUMP.	1"		357°	3 1/2"
E	MANHOLE	PROVIDE FLANGED REINFORCED MANHOLE, API 650 DESIGN, WITH DAVITS. CENTER 1/2" SEALED HOLE FOR TEMPERATURE INDICATOR.	38 1/2"	150lb.	80°	3'-2 3/8"
F	MANHOLE	PROVIDE FLANGED REINFORCED MANHOLE, API 650 DESIGN, WITH DAVITS	36"	150lb.	260°	3'-2 3/8"
G	HOLE PATTERN FOAM CHAMBER FLANGE	150lb. FLANGED HOLE PATTERN CONNECTION (SEE DETAIL 3 THIS SHEET), LOCATION TO BE ABOVE HIGH-HIGH EMERGENCY LEVEL SWITCH AND AUTOMATIC TANK GAUGE.	8 5/8"		0°	3 31'-0"
H	HOLE PATTERN FOAM CHAMBER FLANGE	150lb. FLANGED HOLE PATTERN CONNECTION (SEE DETAIL 3 THIS SHEET), LOCATION TO BE ABOVE HIGH-HIGH EMERGENCY LEVEL SWITCH AND AUTOMATIC TANK GAUGE.	8 5/8"		180°	3 31'-0"

ROOF NOZZLE APPURTENANCE SCHEDULE

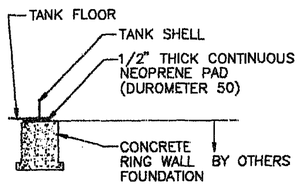
SYMBOL ○	DESCRIPTION	DESCRIPTION	SIZE	FLANGED	TANK ORIENTATION	DISTANCE FROM EDGE
1	ROOF SCUTTLE	PROVIDE FLANGED CONNECTION PER MANUFACTURER'S RECOMMENDATION TO CONNECT TO HATCH COVER.	3'x2'-6"			2'-6" TO EDGE
2	MANWAY	PROVIDE API 650 STANDARD FLANGE MANHOLE CONNECTION WITH REINFORCED PLATES. COVER WITH EMERGENCY RELIEF MANHOLE COVER AND ACCESS LADDER. LOCATE NEXT TO GUARDRAIL.	24"	150lb.	350°	2'-6" TO EDGE
3	PRESSURE/VACUUM RELIEF VENT	ROOF NOZZLE TRIMMED FLUSH WITH ROOFLINE AND RAISED FACE FLANGED CONNECTION FOR PRESSURE/VACUUM RELIEF VALVE FLANGE CONNECTION AND FLAME ARRESTOR.	12"	150lb.	164°	2'-6" TO EDGE
4	SAMPLING AND GAUGING HATCH	PROVIDE FLAT FACE FLANGED CONNECTION PER ANSI CLASS 125 DIMENSIONS FOR SAMPLING AND GAUGING HATCH COVER CONNECTION. SCHEDULE 40 PIPE TO RUN TO TANK FLOOR.	8"	125lb.	159°	2'-6" TO EDGE
5	AUTOMATIC TANK GAUGE	PROVIDE NOZZLE QTLG. AND COORDINATE LOCATION OF ANCHORS WITH GAUGE MFG'S. RECOMMENDATIONS. PROVIDE BRACKETS FOR PIPE SUPPORTS FROM ROOF TO GAUGE HEAD. CONNECTS TO LEVEL SWITCHES.	1 1/2"		95°	1'-5" TO EDGE
6	TOP ANCHORS	EXACT LOCATIONS OF ANCHORS TO BE DETERMINED PER MANUFACTURER'S RECOM-MENDATIONS FOR AUTOMATIC TANK GAUGE. (2 REQUIRED BY MANUFACTURES)				4
7	FLOATING SUCTION INDICATOR	PROVIDE NOZZLE COUPLING ABOVE FLOAT ON FLOATING SUCTION PER MANU-FACTURER'S RECOMMENDATIONS. PROVIDE SUPPORTS ALONG THE TOP AND SIDES OF TANK FOR PIPE CONTAINING CABLE TO POSITION INDICATOR.	1 1/2"			COORDINATE W/DIMENSIONS OF FLOATING SUCTION
8	HIGH-HIGH LEVEL EMERGENCY SWITCH	PROVIDE 150lb. FLANGED CONNECTION, 3" HIGH FROM TOP OF FLANGE TO TANK ROOF.	6"	150lb.	159°	6" TO CENTER
9	LEVEL GAUGE INSPECTION COVER & MOUNTING BASE	ROOF CUTOUT SHALL BE 15"x18 3/4" AND INSPECTION COVER SHALL BE 9 3/4"x 15 3/4". WELD BASEPLATE TO TANK ROOF & COORDINATE EXACT LOCATION WITH AUTOMATIC LEVEL GAUGE.	15x18 3/4"		95°	4

INSTRUMENTS/EQUIPMENT TO BE PROVIDED BY CONTRACTOR

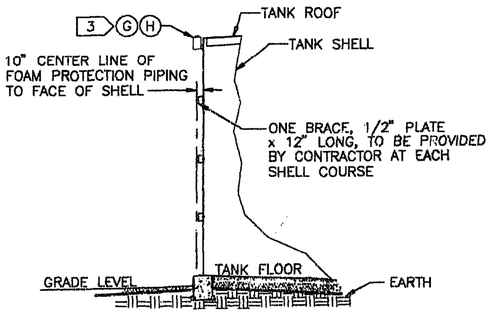
ITEM	MANUFACTURER	MODEL #	QUANTITY
PRESSURE/VACUUM RELIEF VALVE	SHAND & JURS	SJ94020	1
FLAME ARRESTOR	SHAND & JURS	94306	1
SAMPLING AND GAUGING HATCH COVER	VAREC	42-6-312	1
AUTOMATIC TANK GAUGE	VAREC	2500-01-01	1
AUTOMATIC TANK GAUGE INSPECTOR COVER	VAREC	FIG. #2513	1
HIGH-HIGH LEVEL EMERGENCY SWITCH	MAGNETROL	T20-1 K3CAKV	1
EMERGENCY MANHOLE COVERS	SHAND & JURS	98200-12-03	1
TEMPERATURE INDICATOR	REOTEMP	B	1
SWING JOINT	STAY TITE	16"	1
FLOATING SUCTION	GAMMON TECHNICAL	16" DIA.	1
FLOATING SUCTION POSITION INDICATOR	GAMMON TECHNICAL	ATTACHES TO FREE END OF F.S. ARM	1
DIFFUSER	OPW	OPW 464	1
ROOF SCUTTLE	BILCO	S-20	1
LEVEL SWITCHES	VAREC	2557-A-B	1

GENERAL NOTES:

1. TANK SHALL BE LABELED FOR HEALTH, HAZARD AND FLAMMABILITY, MATCH EXISTING TANK LABELS
2. CONTRACTOR TO PROVIDE AND INSTALL BRACKET SUPPORTS PER MANUFACTURER'S RECOMMENDATIONS FOR THE TANK GAUGE AND FLOATING SUCTION INDICATOR PIPING ROUTED ALONG OUTER SHELL OF TANK.
3. FIELD VERIFY FOAM CHAMBER LOCATION IS ABOVE HIGH HIGH LEVEL EMERGENCY SWITCH
4. COORDINATE EXACT LOCATION WITH AUTOMATIC LEVEL GAUGE MANUFACTURER.
5. PROVIDE 2"x8" UNISTRUT. UNISTRUT SHALL BE WELDED TO TANK AT A MINIMUM SPACING OF 10 FEET. BOTTOM UNISTRUT SHALL BE MOUNTED 1 FOOT ABOVE TANK BOTTOM.



TANK PAD DETAIL 1/M2



FOAM PROTECTION PIPING SUPPORT DETAIL 2/M2
SCALE: 1"=10'-0"
(TYPICAL 2 PLACES)

GRAPHIC SCALE
1" = 10'-0"
1' 3' 5' 10' 20' 30'

NO.	REVISION	DATE	BY

PFFC PORTLAND FUELING FACILITIES CORPORATION
PORTLAND INTERNATIONAL AIRPORT

NEW JET FUEL STORAGE TANK

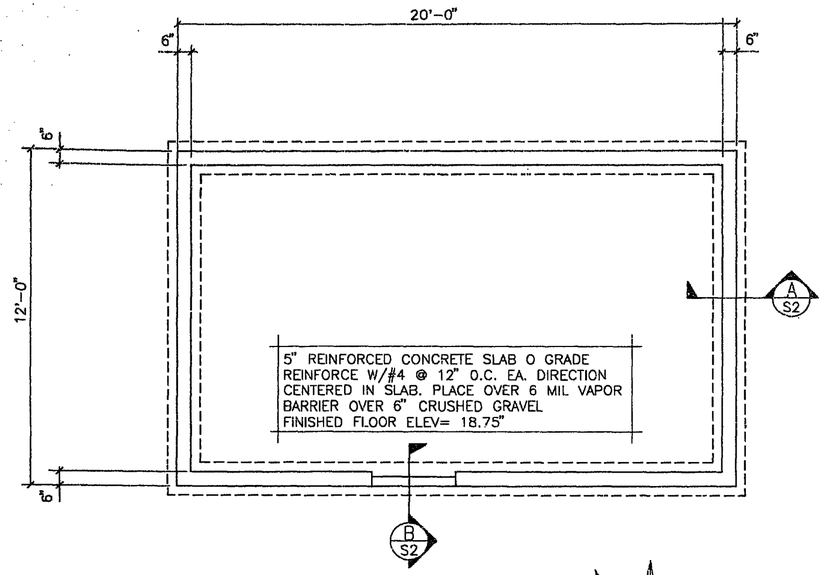
BULK FUEL STORAGE EXPANSION

DATE: 6-30-94 DWG. NO. M2

PDX 94-1013 4/4

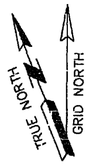
Tank 3 Dike Walls

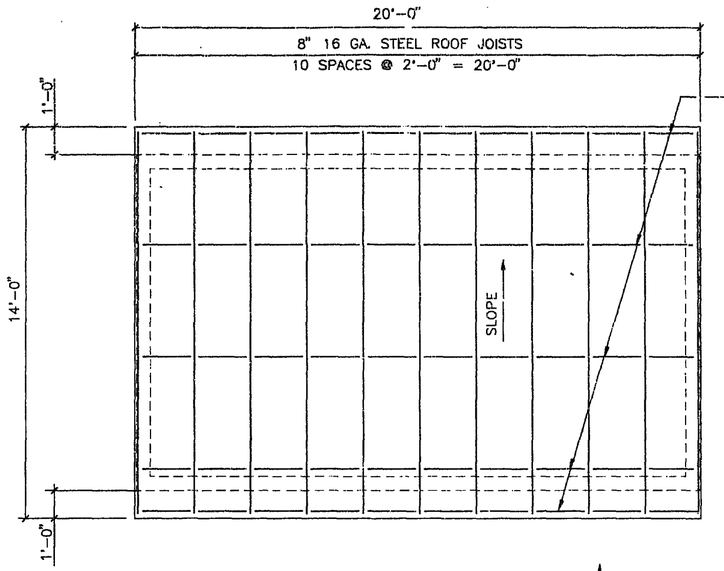
- Drawing - 94-1014-S-2



FOUNDATION PLAN

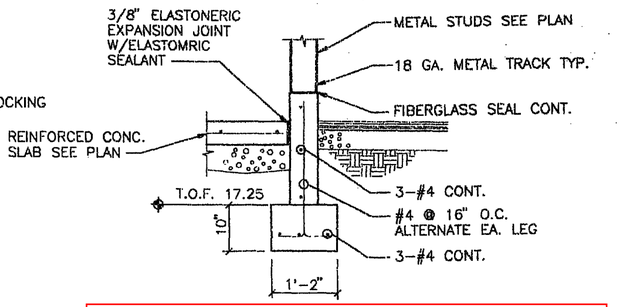
SCALE: 3/8" = 1'-0"





ROOF FRAMIING PLAN

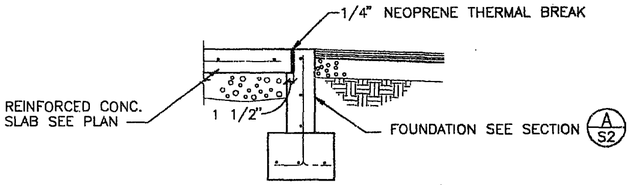
SCALE: 3/8" = 1'-0"



TYPICAL FOUNDATION WALL

SCALE: 3/4" = 1'-0"

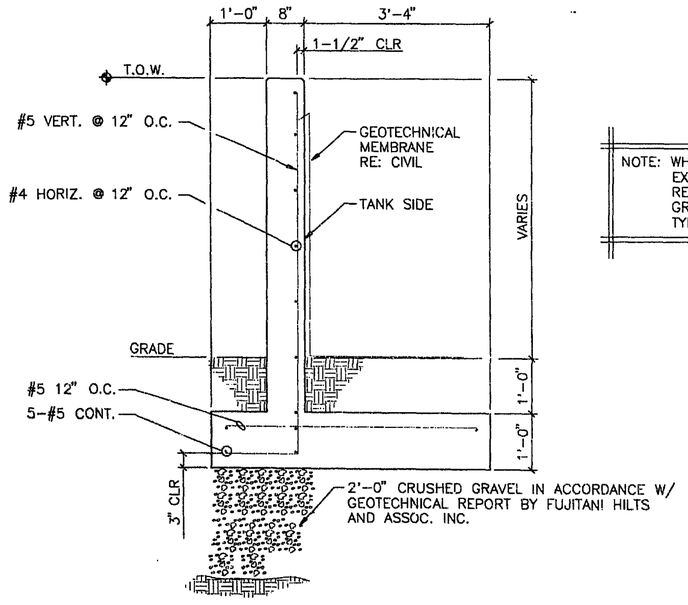
A
S2



TYPICAL FOUNDATION WALL AT DOORWAY

SCALE: 3/4" = 1'-0"

B
S2

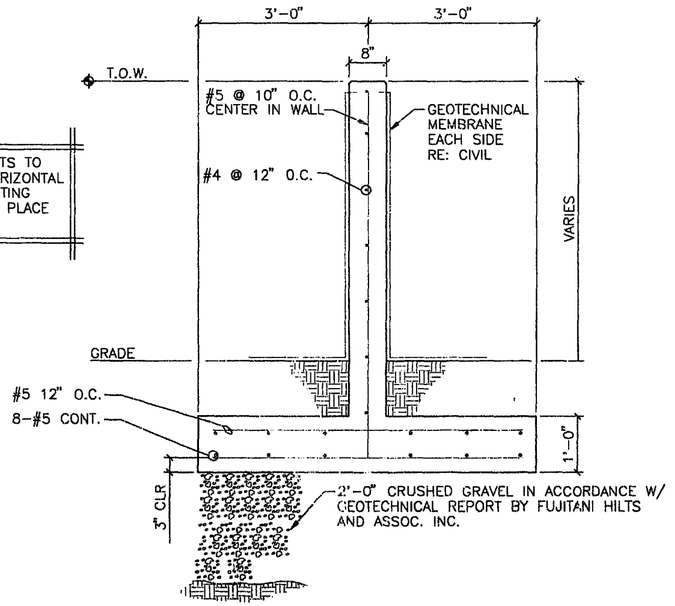


NOTE: WHERE NEW WALL CONNECTS TO EXISTING WALL EXTEND HORIZONTAL REINFORCING 8" INTO EXISTING GROUTED CELLS EPOXY IN PLACE TYPICAL.

CONTAINMENT DIKE (1 SIDE ONLY)

SCALE: 3/4" = 1'-0"

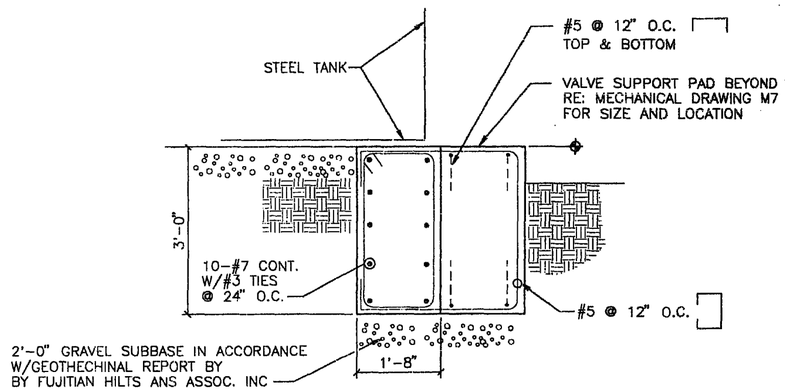
C
C2



CONTAINMENT DIKE (BOTH SIDES)

SCALE: 3/4" = 1'-0"

D
C2



TYPICAL RING WALL FOUNDATION

SCALE: 3/4" = 1'-0"

F
C2

GRAPHIC SCALE

3/8" = 1'-0" 2' 1' 6" 0' 1' 2' 3' 4'

3/4" = 1'-0" 1' 6" 0' 1' 2' 3'

95 % SUBMITTAL

RELEASED FOR REVIEW PURPOSES ONLY

AUGUST 2, 1994

PDX 94-1014 10/26

NO.	REVISION	DATE	BY

BOVAY COMPANY

PFFC

PORTLAND FUELING FACILITIES CORPORATION, PORTLAND INTERNATIONAL AIRPORT

OFFICE BUILDING

DESIGN:

CHECKED:

REVIEWED:

APPROVED:

FOUNDATION PLAN, SECTIONS & DETAILS

PORTLAND FUEL FARM

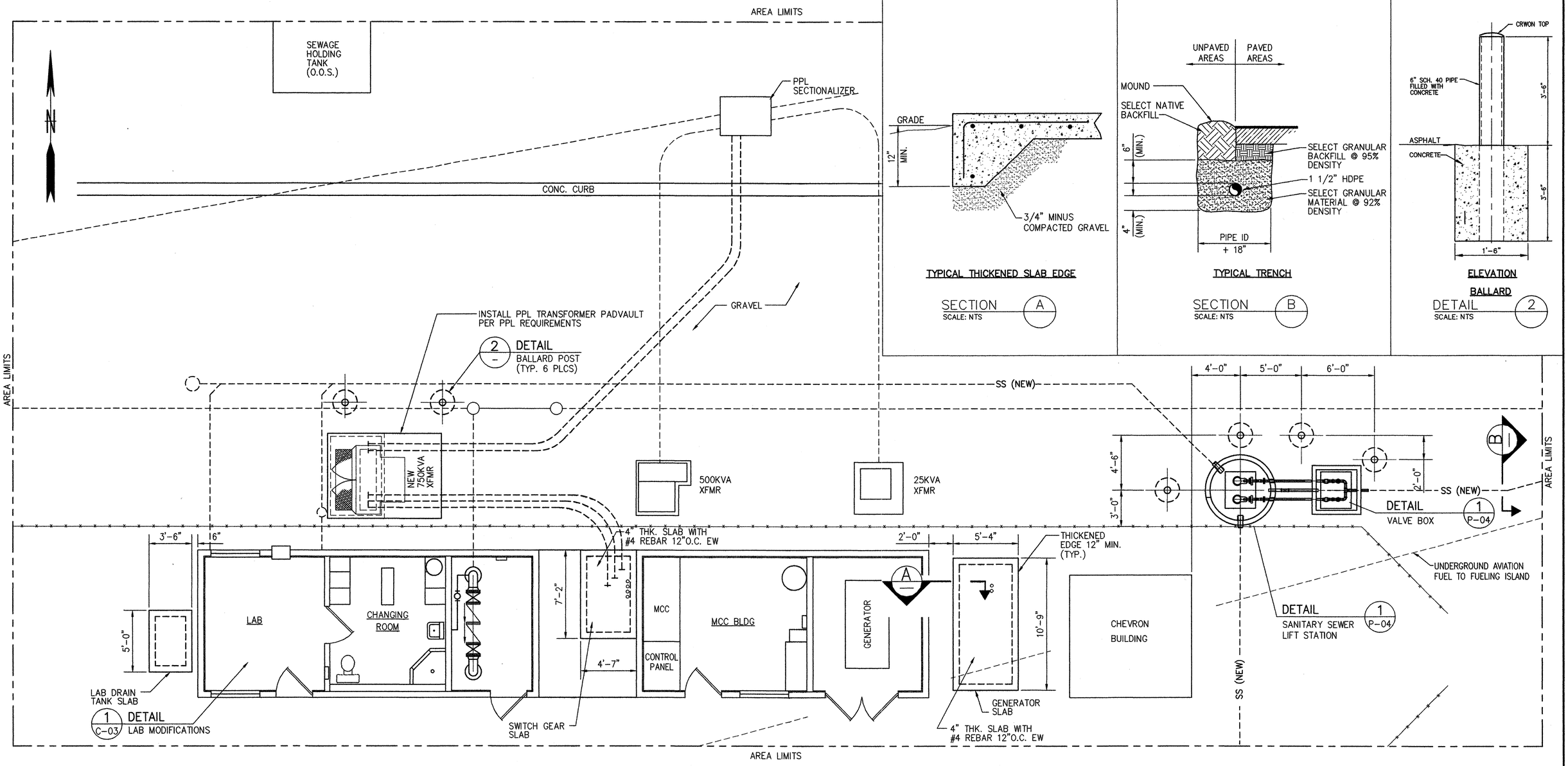
DATE: 08-02-94

DWG. NO. S-2

11/28

Diesel Tank & Foundation

- Drawing - 2003-1023-3405-C-02



PLAN

2' 0' 2' 4' 6' 8' 10' 12'

SCALE: 1/4"=1'-0" (22x34)
SCALE: 1/8"=1'-0" (11x17)

TYPICAL THICKENED SLAB EDGE

SECTION A
SCALE: NTS

TYPICAL TRENCH

SECTION B
SCALE: NTS

ELEVATION
BALLARD

DETAIL 2
SCALE: NTS

NOTES:

1. SEE DWG. 3406-P-02 FOR UTILITY PIPING.

DRAWING NO.	REFERENCE DRAWINGS	REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
3405-C-03	LAB FLOOR PLAN & SECTIONS	0	1/28/04	ISSUE FOR CONSTRUCTION	BDC	WHB					
		1	10/08/04	RECORD DRAWING	QKB	DAB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER 3406

SCALE: 1/4"=1'		DATE
DRAWN BY	QKB	5/07/01
DESIGNED BY	REK	5/07/01
CHECKED BY		
WORK ORDER	34-06	22x34
DATE		
11/2/00		

PDX BULK FUELING FACILITY
PORTLAND, OREGON
LAB AND OFFICE ADDITION
VAULT AND SLAB LOCATION PLAN

DRAWING NO.	SHEET	REV.
3405-C-02	1 OF 1	1

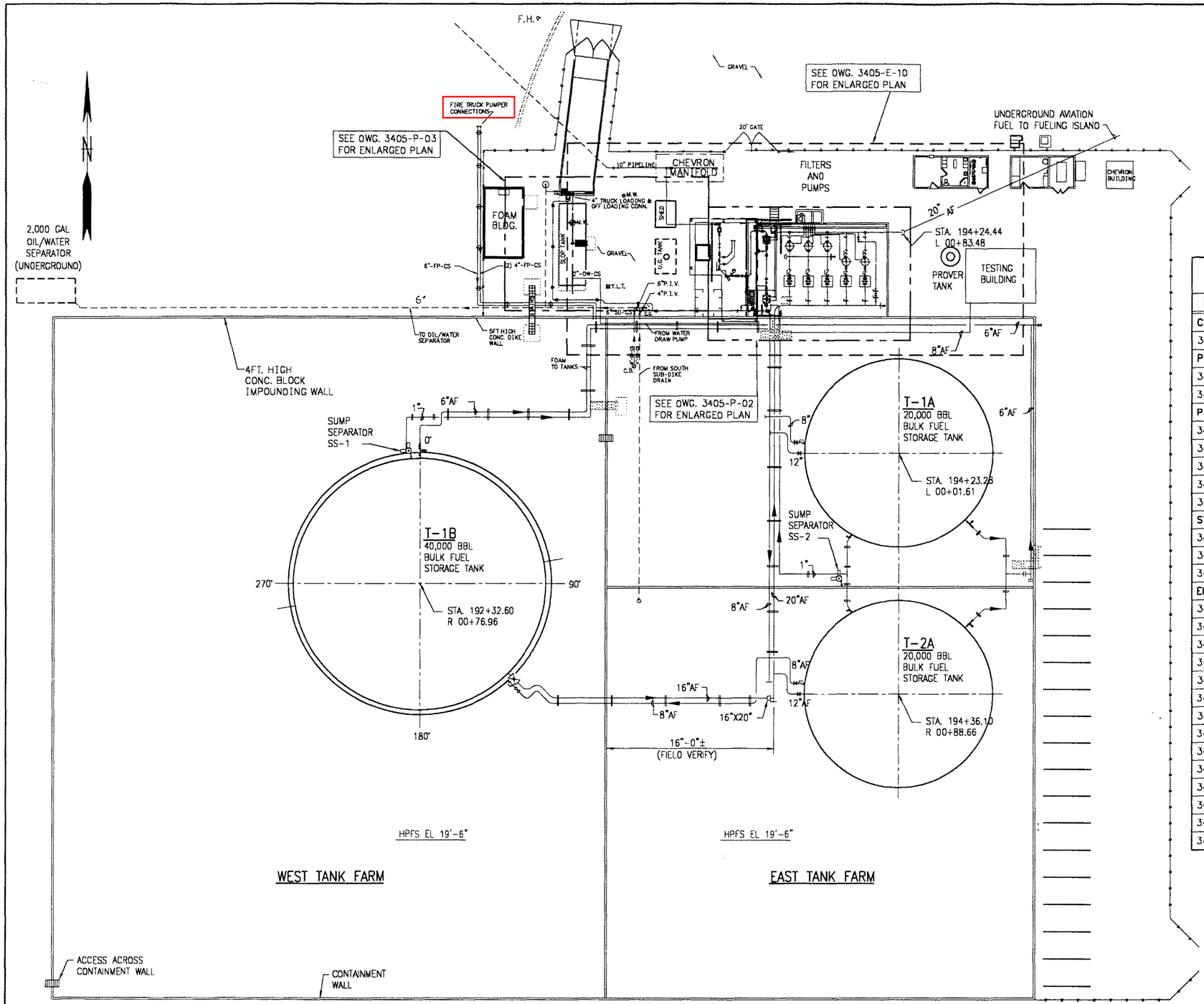
<CPD: 10/05/04 [TIME: 08:54 AM] >
<021.dwg,DWG

Fire Suppression Piping

- Drawing - 3405-A-01
- Drawing - 3405-P-02
- Drawing - 3405-P-04

POP
Permit # PDX 02-57

PIPELINE FILTER/SEPARATOR REPLACEMENT



FACILITY SITE PLAN

DRAWING LIST

DWG NO.	SHEET NO.	REV.	DATE	TITLE
CIVIL				
3405-A-01	1 OF 1	3	9/03/03	BULK STORAGE FACILITY SITE PLAN AND DRAWING LIST
PIPING AND INSTRUMENTATION DIAGRAM				
3405-0-01	1 OF 1	0	09/03/03	P&ID SYMBOLS AND LEGEND SHEET
3405-0-02	1 OF 1	3	09/03/03	P&ID PIPELINE FILTER / SEPARATOR SYSTEM
PIPING				
3405-P-01	1 OF 1	1	09/03/03	PUMP, FILTER & PIPELINE AREA DEMO PLAN
3405-P-02	1 OF 1	2	09/03/03	PUMP, FILTER & PIPELINE AREA PIPING PLAN
3405-P-03	1 OF 1	1	09/03/03	SLOP TANK AREA PIPING PLAN
3405-P-04	1 OF 1	2	09/03/03	SLOP TANK AREA PIPING ELEVATIONS
3405-P-05	1 OF 1	1	09/03/03	OPT & SAMPLE TUBING ISOMETRIC
STRUCTURAL				
3405-S-01	1 OF 1	3	09/03/03	PLATFORM PLAN
3405-S-02	1 OF 1	2	09/03/03	PLATFORM SECTIONS AND DETAILS
3405-S-03	1 OF 1	0	09/03/03	SAMPLING STATION SECTIONS AND DETAILS
ELECTRICAL				
3405-E-02	1 OF 1	0	09/03/03	SYMBOLS AND LEGENDS SHEET
3405-E-03	1 OF 1	2	09/03/03	CONTROL SYSTEM ARCHITECTURE
3405-E-04	1 OF 1	1	09/03/03	ONE-LINE DIAGRAM
3405-E-05	1 OF 3	2	09/03/03	CONTROL POWER DISTRIBUTION
3405-E-05	2 OF 3	2	09/03/03	CONTROL POWER DISTRIBUTION
3405-E-05	3 OF 3	0	09/03/03	MAIN TERMINAL ESD CIRCUIT LOCATED IN RM T1228
3405-E-06	1 OF 1	2	09/03/02	PLC SCHEMATICS SLOT 0 & 1
3405-E-07	1 OF 1	2	09/03/02	PLC SCHEMATICS SLOT 2 & 3
3405-E-08	1 OF 1	2	09/03/02	PLC SCHEMATICS SLOT 4 & 5
3405-E-09	1 OF 1	1	09/03/02	PLC SCHEMATICS SLOT 6 & 7
3405-E-10	1 OF 1	2	09/03/02	CONDUIT LAYOUT AND SCHEDULE
3405-E-11	1 OF 1	2	09/03/02	GROUND HOG SYSTEM & INTERCONNECT DIAGRAM
3405-E-12	1 OF 1	1	09/03/02	AREA CLASSIFICATION FACILITY SITE PLAN
3405-E-13	1 OF 1	1	09/03/02	AREA CLASSIFICATION DETAILS

20' 0' 20' 40'
SCALE: 1"=20' (22x34)
SCALE: 1"=40' (11x17)

DRAWING NO.	REFERENCE DRAWINGS	REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
		0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
		1	06/24/01	UPDATED REVISION STATUS	DAB	WHB					
		2	09/27/02	UPDATED REVISION STATUS & ADDED ELECTRICAL DRAWINGS	QKB	BDC					
		3	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE., PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

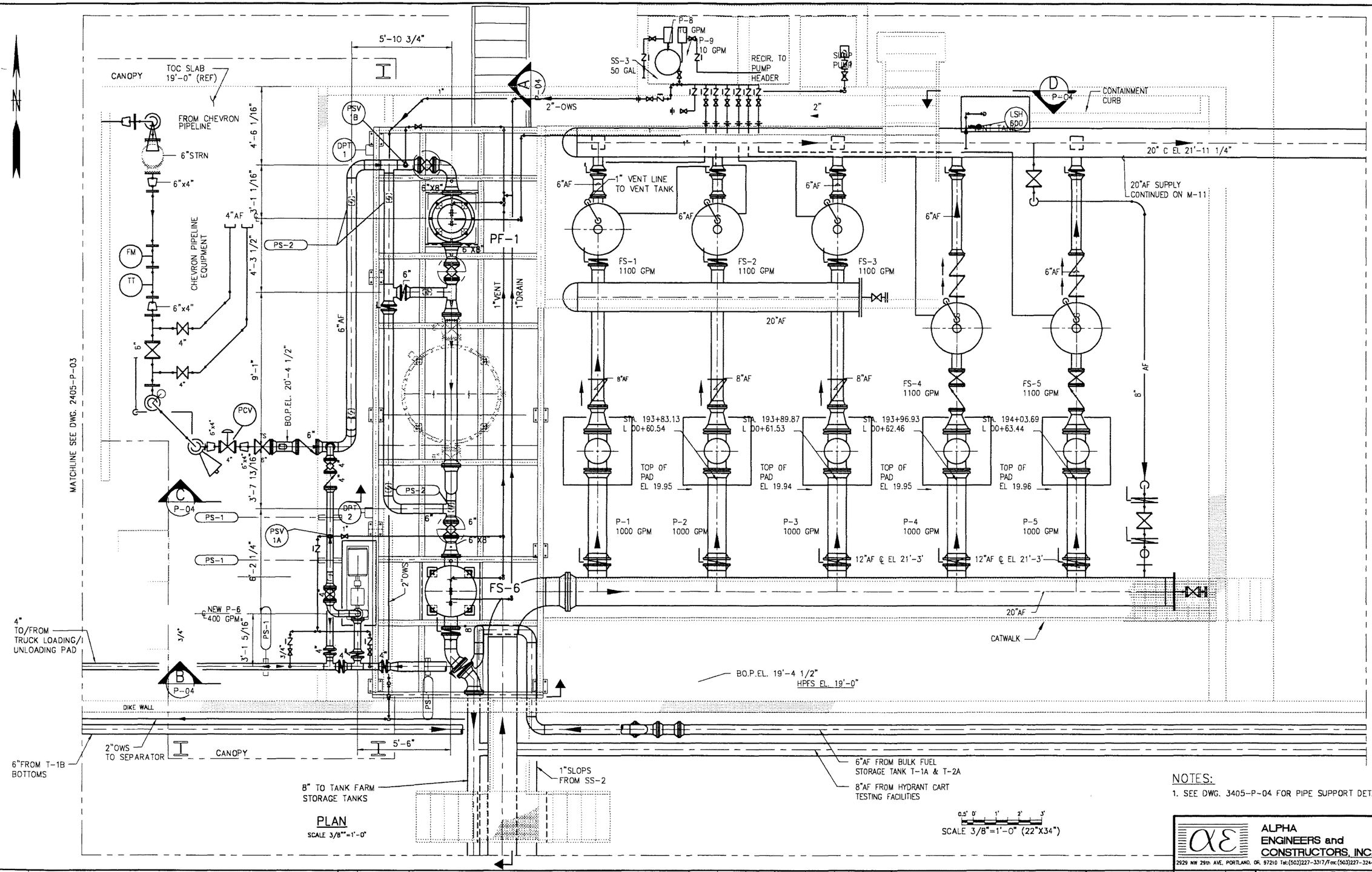
AECI PROJECT NUMBER: 34-05

SCALE: AS NOTED		DATE
DRAWN BY	DAB	12/03/99
DESIGNED BY	DAB	12/03/99
CHECKED BY	WHB	01/16/01
WORK ORDER	34-05	22X34
DATE		12/03/99

PDX BULK FUELING FACILITY
PORTLAND, OREGON
PIPELINE FILTER/SEPARATOR REPLACEMENT
BULK STORAGE FACILITY SITE PLAN & DRAWING LIST

DRAWING NO.	SHEET	REV.
3405-A-01	1 OF 1	3

3405d013.DWG <CPD: 10/02/03 [TIME: 08:54 AM] >



PLAN

SCALE 3/8"=1'-0"

NOTES:

1. SEE DWG. 3405-P-04 FOR PIPE SUPPORT DETAILS.

SCALE 3/8"=1'-0" (22"X34")

DRAWING NO.	REFERENCE DRAWINGS
3405-P-03	SLOP TANK AREA PIPING PLAN
3405-P-04	SECTIONS AND DETAILS

REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
1	06/24/02	REVISED FILTER DIMENSIONS, ADD LSH600	DAB	WHB					
2	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE., PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER: 3405

PDX BULK FUELING FACILITY
PORTLAND, OREGON
PIPELINE FILTRATION MODIFICATIONS
FILTER & PIPELINE AREA
PIPING PLAN

SCALE: AS NOTED		DATE
DRAWN BY	DAB	09/09/00
DESIGNED BY	DAB	09/09/00
CHECKED BY	WHB	09/13/00
WORK ORDER	34-05	22X34

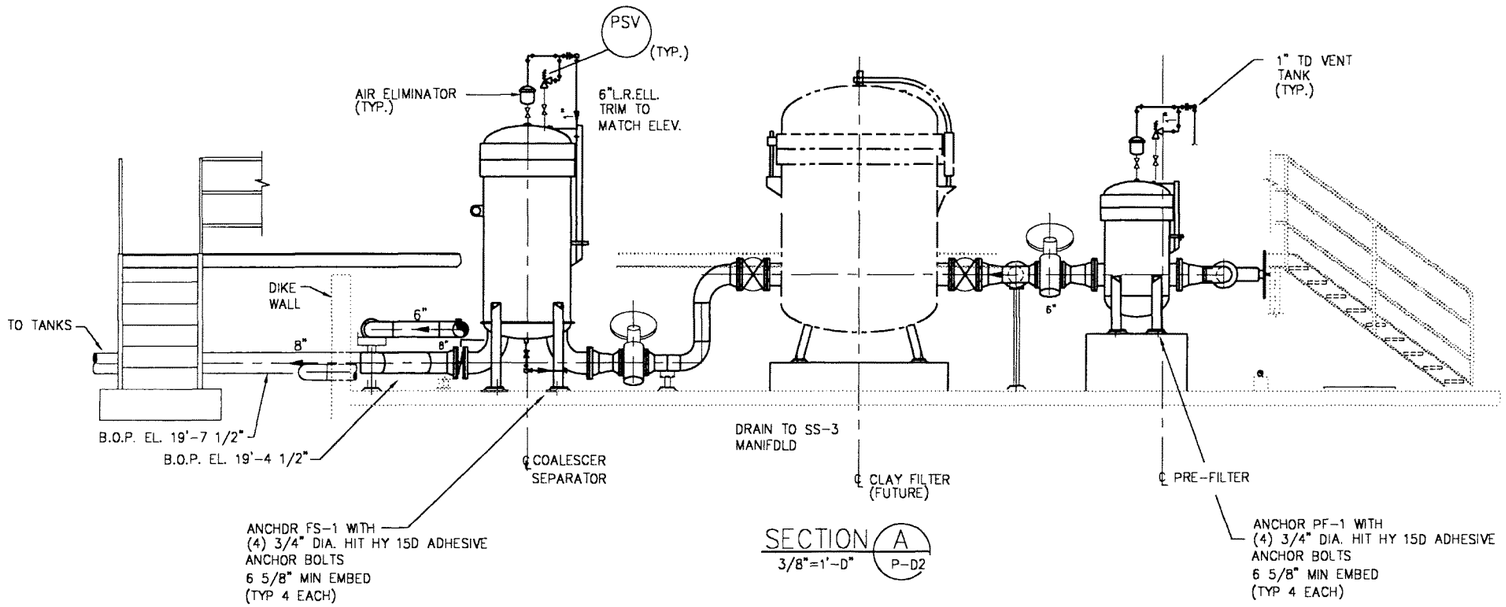
DATE: 09/06/00

DRAWING NO.: 3405-P-02

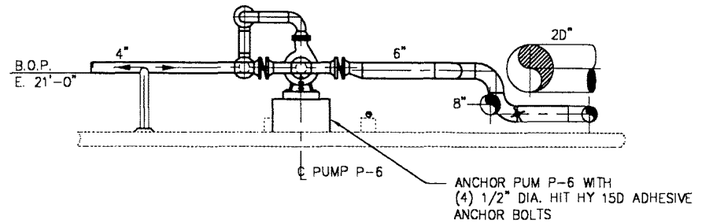
SHEET: 1 OF 1

REV.: 2

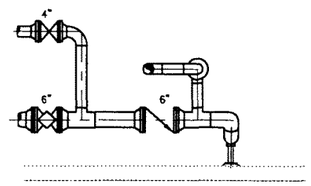
3405p022.DWG <PPD: 09/22/03 [TIME: 08:21 AM] >



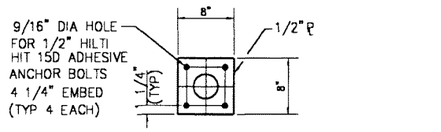
SECTION A
3/8"=1'-0" P-D2



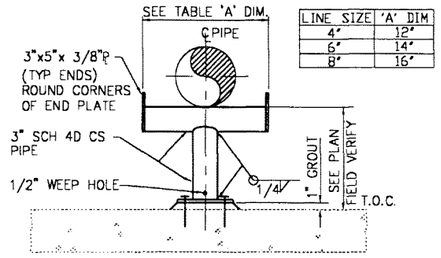
SECTION B
3/8"=1'-0" P-D2



SECTION C
3/8"=1'-0" P-D2

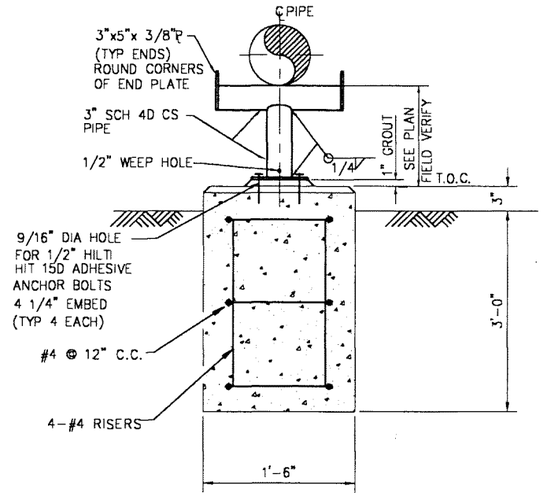


BASE PLATE

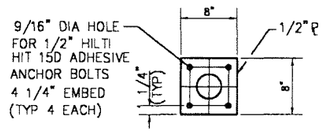


LINE SIZE	'A' DIM
4"	12"
6"	14"
8"	16"

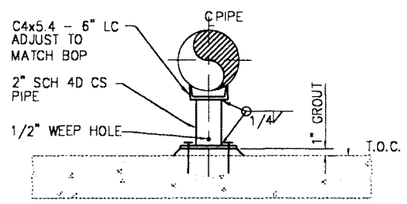
PIPE SUPPORT
PS-1



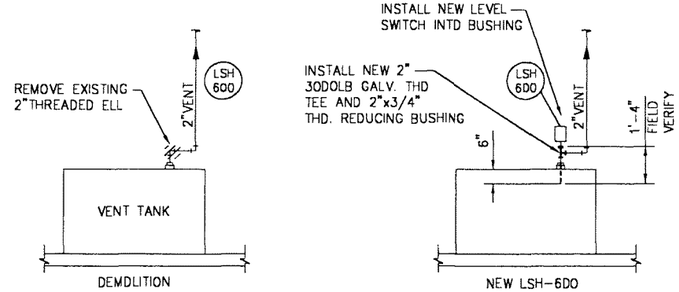
PIPE SUPPORT
MODIFIED
PS-1



BASE PLATE



PIPE SUPPORT
PS-2



SECTION D
3/8"=1'-0" P-D2

NOTES:
1. NEW WORK SHOWN BOLD.

SCALE 3/8"=1'-0" (22"X34")

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER 3405

DRAWING NO.	REFERENCE DRAWINGS

REV.	DATE	REVISED	DRAWN	CKD.	CIV/STR.	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
1	06/24/02	CHANGED FILTER DIMENSIONS ADD LSH-600	DAB	WHB					
2	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

SCALE: AS NOTED		DATE
DRAWN BY	DAB	01/12/01
DESIGNED BY	DAB	01/12/01
CHECKED BY	WHB	01/12/01
WORK ORDER	34-05	22X34
DATE		11/1/00

PDX BULK FUELING FACILITY
PORTLAND, OREGON
FILTRATION MODIFICATIONS
FILTER, & PIPELINE AREA
PIPING ELEVATIONS

DRAWING NO.	SHEET	REV.
3405-P-04	1 OF 1	2

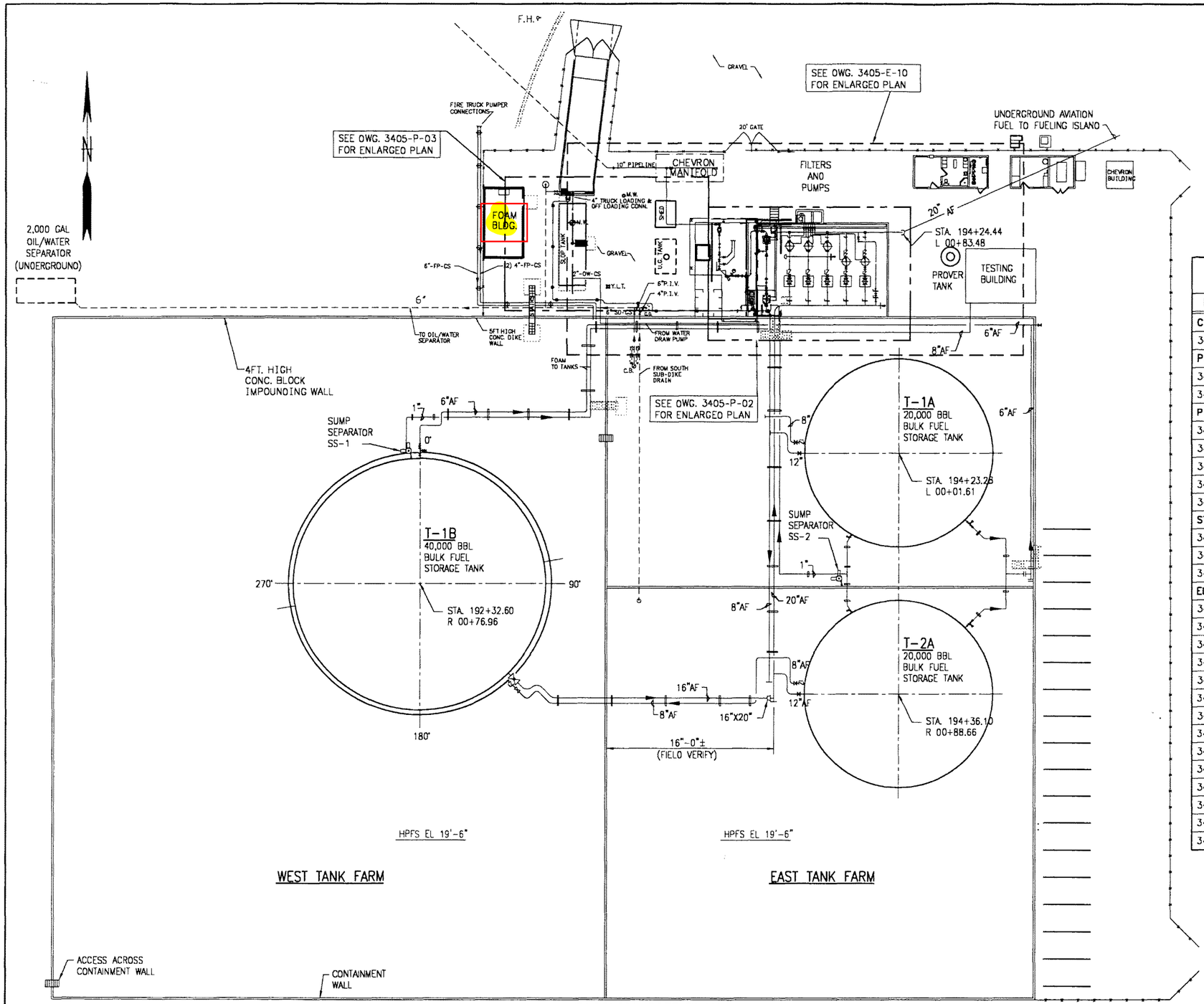
3405p042.DWG <PD: 09/22/03 [TIME: 09:33 AM] >

Foam Building

- Drawing - 3405-A-01

POP
Permit # PDX 02-57

PIPELINE FILTER/SEPARATOR REPLACEMENT



FACILITY SITE PLAN

DRAWING LIST

DWG NO.	SHEET NO.	REV.	DATE	TITLE
CIVIL				
3405-A-01	1 OF 1	3	9/03/03	BULK STORAGE FACILITY SITE PLAN AND DRAWING LIST
PIPING AND INSTRUMENTATION DIAGRAM				
3405-0-01	1 OF 1	0	09/03/03	P&ID SYMBOLS AND LEGEND SHEET
3405-0-02	1 OF 1	3	09/03/03	P&ID PIPELINE FILTER / SEPARATOR SYSTEM
PIPING				
3405-P-01	1 OF 1	1	09/03/03	PUMP, FILTER & PIPELINE AREA DEMO PLAN
3405-P-02	1 OF 1	2	09/03/03	PUMP, FILTER & PIPELINE AREA PIPING PLAN
3405-P-03	1 OF 1	1	09/03/03	SLOP TANK AREA PIPING PLAN
3405-P-04	1 OF 1	2	09/03/03	SLOP TANK AREA PIPING ELEVATIONS
3405-P-05	1 OF 1	1	09/03/03	OPT & SAMPLE TUBING ISOMETRIC
STRUCTURAL				
3405-S-01	1 OF 1	3	09/03/03	PLATFORM PLAN
3405-S-02	1 OF 1	2	09/03/03	PLATFORM SECTIONS AND DETAILS
3405-S-03	1 OF 1	0	09/03/03	SAMPLING STATION SECTIONS AND DETAILS
ELECTRICAL				
3405-E-02	1 OF 1	0	09/03/03	SYMBOLS AND LEGENDS SHEET
3405-E-03	1 OF 1	2	09/03/03	CONTROL SYSTEM ARCHITECTURE
3405-E-04	1 OF 1	1	09/03/03	ONE-LINE DIAGRAM
3405-E-05	1 OF 3	2	09/03/03	CONTROL POWER DISTRIBUTION
3405-E-05	2 OF 3	2	09/03/03	CONTROL POWER DISTRIBUTION
3405-E-05	3 OF 3	0	09/03/03	MAIN TERMINAL ESD CIRCUIT LOCATED IN RM T1228
3405-E-06	1 OF 1	2	09/03/02	PLC SCHEMATICS SLOT 0 & 1
3405-E-07	1 OF 1	2	09/03/02	PLC SCHEMATICS SLOT 2 & 3
3405-E-08	1 OF 1	2	09/03/02	PLC SCHEMATICS SLOT 4 & 5
3405-E-09	1 OF 1	1	09/03/02	PLC SCHEMATICS SLOT 6 & 7
3405-E-10	1 OF 1	2	09/03/02	CONDUIT LAYOUT AND SCHEDULE
3405-E-11	1 OF 1	2	09/03/02	GROUND HOG SYSTEM & INTERCONNECT DIAGRAM
3405-E-12	1 OF 1	1	09/03/02	AREA CLASSIFICATION FACILITY SITE PLAN
3405-E-13	1 OF 1	1	09/03/02	AREA CLASSIFICATION DETAILS

20' 0' 20' 40'
SCALE: 1"=20' (22x34)
SCALE: 1"=40' (11x17)

DRAWING NO.	REFERENCE DRAWINGS	REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
		0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
		1	06/24/01	UPDATED REVISION STATUS	DAB	WHB					
		2	09/27/02	UPDATED REVISION STATUS & ADDED ELECTRICAL DRAWINGS	QKB	BDC					
		3	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE., PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER 34-05

SCALE: AS NOTED		DATE
DRAWN BY	DAB	12/03/99
DESIGNED BY	DAB	12/03/99
CHECKED BY	WHB	01/16/01
WORK ORDER	34-05	22X34
DATE		12/03/99

PDX BULK FUELING FACILITY
PORTLAND, OREGON
PIPELINE FILTER/SEPARATOR REPLACEMENT
BULK STORAGE FACILITY SITE PLAN & DRAWING LIST

DRAWING NO.	SHEET	REV.
3405-A-01	1 OF 1	3

3405d013.DWG <CPD: 10/02/03 [TIME: 08:54 AM] >

Operations Building

- Drawing - 2004-KM-04 (1-6)

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3	LH	4/19/04	CUST.	2,6,11,11M
4	LH	4/27/04	DD	6,9,19
5	LH	4/29/04	CUST.	6,7,8,11
6	LH	4/30/04	JM	6

24' x 64' MODULAR OFFICE

ALPHA ENGINEERS

PORTLAND, OREGON

COVER SHEET

REGISTERED PROFESSIONAL ENGINEER 13.431 OREGON SEPT. 18, 1986 KENNETH A. RASMUSSEN
EXPIRES: 12/31/04

SHEET 1

2004-KM-04

GENERAL NOTES

1. THE TERM U.B.C. SHALL APPLY TO THE CURRENT EDITION OF THE O.S.S.C. FOR PROJECTS IN THE STATE OF OREGON AND SHALL APPLY TO THE CURRENT EDITION OF THE AMENDED UNIFORM BUILDING CODE FOR PROJECTS IN THE STATE OF WASHINGTON. FOR PROJECTS IN ALL OTHER STATES IT SHALL APPLY TO THE CURRENT EDITION OF THE UNAMENEDED UNIFORM BUILDING CODE.
2. ALL CONTROLS AND HARDWARE SHALL BE ACCESSIBLE TO PERSONS WITH DISABILITIES (1109.3)
3. LOCAL JURISDICTION TO DETERMINE COMPLIANCE WITH UBC CHAPTER 29, SECTION 2902 AND TABLE 29A WITH REGARD TO ADJACENT FACILITIES.

DESIGN CRITERIA

GENERAL:	CONSTRUCTION TYPE	5-N (NON-SPRINKLERED)
	OCCUPANCY GROUP	B
	OCCUPANCY LOAD (T-10A)	13
	DISTANCE TO PROPERTY LINE OR ASSUMED PROPERTY LINE	FRONT: 20' MIN. REAR: 20' MIN. LEFT: 20' MIN. RIGHT: 20' MIN.
PLUMBING:	PLUMBING OCCUPANCY LOAD (T-29A)	8
	QUANTITY OF PLUMBING FIXTURES	8
ELECTRICAL:	ELECTRIC SERVICE LOAD	125 AMP 3 PH.
MECHANICAL:	VENTILATION OCCUPANCY LOAD	12
	CLIMATE ZONE	ZONE 1
	HEATING	FAE/HP
	AIR-CONDITIONING	YES
STRUCTURAL:	ROOF LIVE LOAD	25 PSF
	FLOOR LIVE LOAD	50 PSF
	WIND LOAD	80 MPH - EXP. C
	SEISMIC ZONE	ZONE 3
OREGON PLAN APPROVAL NO.		PENDING

JOB NAME:
ALPHA ENGINEERS

JOB SITE ADDRESS:
8133 N.E. AIR TRANS WAY
PORTLAND, OREGON 97218

OWNER NAME:
ALPHA ENGINEERS & CONSTRUCTORS INC.

COUNTY:
MULTNOMAH

SHEET INDEX

NO.	TITLE
1	COVER SHEET
2	FOUNDATION PLAN
3	FOUNDATION DETAILS
4	FOUNDATION DETAILS
5	FOUNDATION DETAILS
6	FLOOR PLAN
7	SCHEDULES
8	NOTES AND CALCULATIONS
9	INTERIOR ELEVATIONS
10	EXTERIOR ELEVATIONS
11	REFLECTED CEILING / ELECTRICAL PLAN
11M	MECHANICAL PLAN
12	ELECTRICAL / MECHANICAL NOTES AND SCHEDULES
13	ELECTRICAL PANEL AND LOAD CALCULATION
14	DETAILS
15	DETAILS
16	DETAILS
17	DETAILS
18	DETAILS
19	PLUMBING DIAGRAMS
20	PLUMBING NOTES
21	RAMP AND LANDING DETAILS
22	RAMP AND LANDING DETAILS
23	RAMP AND LANDING DETAILS
24	RAMP AND LANDING DETAILS
25	RAMP AND LANDING DETAILS

MF

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5	LH	4/29/04	CUST.	6,7,8,11
6	LH	4/30/04	JM	6

24' x 64' MODULAR OFFICE

ALPHA ENGINEERS

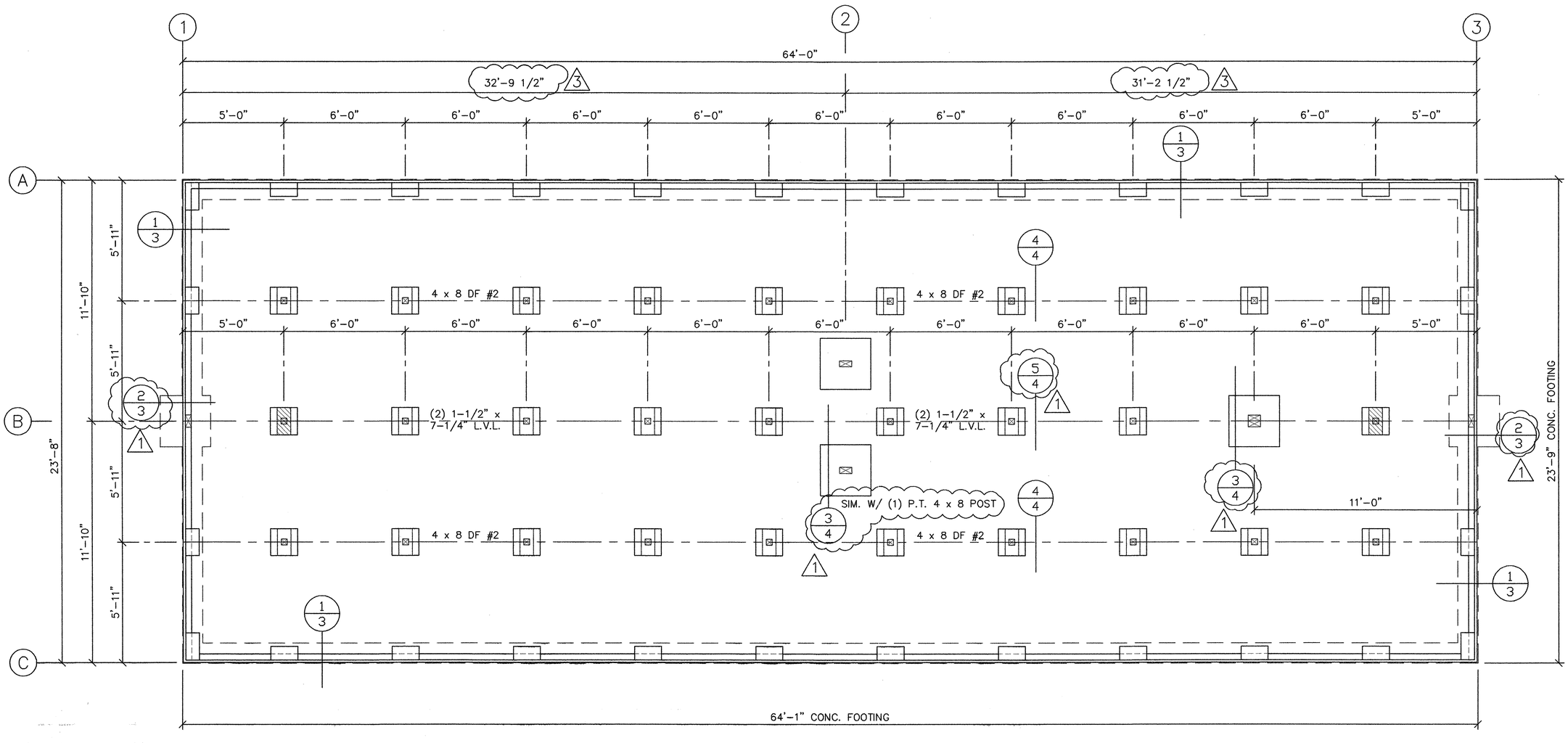
PORTLAND, OREGON

FOUNDATION PLAN

REGISTERED PROFESSIONAL ENGINEER
13.431
OREGON
SEPT. 18, 1986
KENNETH A. RASMUSSEN
EXPIRES: 12/31/04

SHEET 2

2004-KM-04



FOUNDATION PLAN

SCALE: 3/16" = 1'-0"

NOTE:
FOR DETAIL 6/5 REFER TO FLOOR PLAN (SHEET 6) FOR HOLDOWN LOCATIONS

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6	LH	4/30/04	JM	6

24' x 64' MODULAR OFFICE

ALPHA ENGINEERS

PORTLAND, OREGON

FOUNDATION NOTES AND DETAILS

REGISTERED PROFESSIONAL ENGINEER 13.431 OREGON SEPT. 18, 1986 KENNETH A. RASMUSSEN
EXPIRES: 12/31/04

SHEET 3

2004-KM-04

FOUNDATION NOTES

1. GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS. THIS STRUCTURE SHALL BE ADEQUATELY BRACED FOR WIND OR EARTHQUAKE FORCES AND TEMPORARY FORCES DURING SETTING AND ERECTION UNTIL ALL UNITS HAVE BEEN PERMANENTLY ATTACHED THERETO.

2. DESIGN LOADS:

ROOF DEAD LOAD	12 PSF
ROOF SNOW LOAD	25 PSF
FLOOR DEAD LOAD	10 PSF
FLOOR LIVE LOAD	50 PSF

WIND LOAD = 80 MPH EXP. C
SEISMIC ZONE 3

3. EXCEPT AS NOTED, DIMENSION LUMBER FOR FOUNDATIONS SHALL BE HEM-FIR, NO. 2 & BETTER.

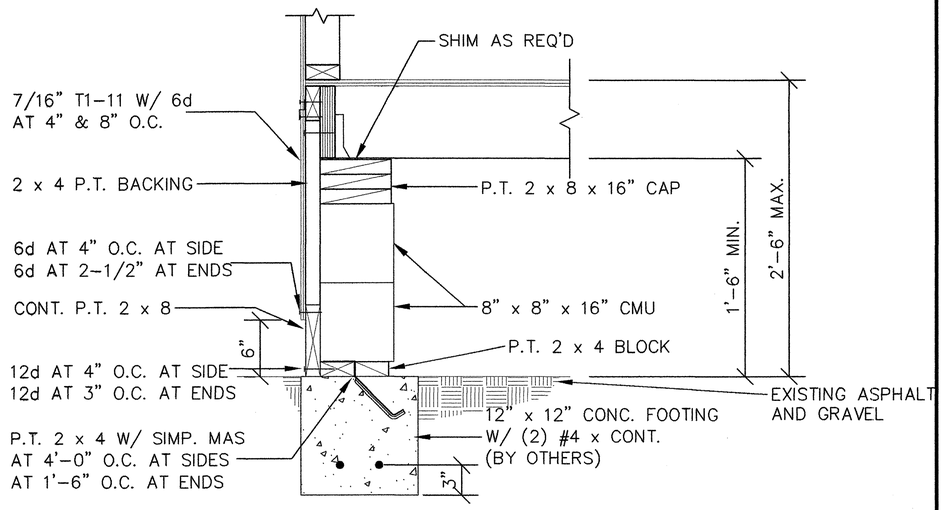
   TREATED LUMBER SHALL BE PRESSURE TREATED IN ACCORDANCE WITH AWPS STANDARD C-2 TO A MINIMUM RETENTION OF .40 PCT. AT PIECES IN CONTACT WITH GROUND, SAWN END GRAIN SHALL BE FIELD TREATED WITH 2% MIN. CONCENTRATION COPPER NAPHTHENATE. TREATED PLATE STOCK SHALL BE GOOD QUALITY AND SHALL NOT CONTAIN CONTAIN EXCESSIVE SPLITS, CHECKS OR WANE.

   2 x 4 FRAMING SHALL BE HEM-FIR, STANDARD OR BETTER, TREATED 2 x 4 FRAMING SHALL MEET THE REQUIREMENTS SPECIFIED ABOVE.

4. ALL NAILS TO BE GALVANIZED.

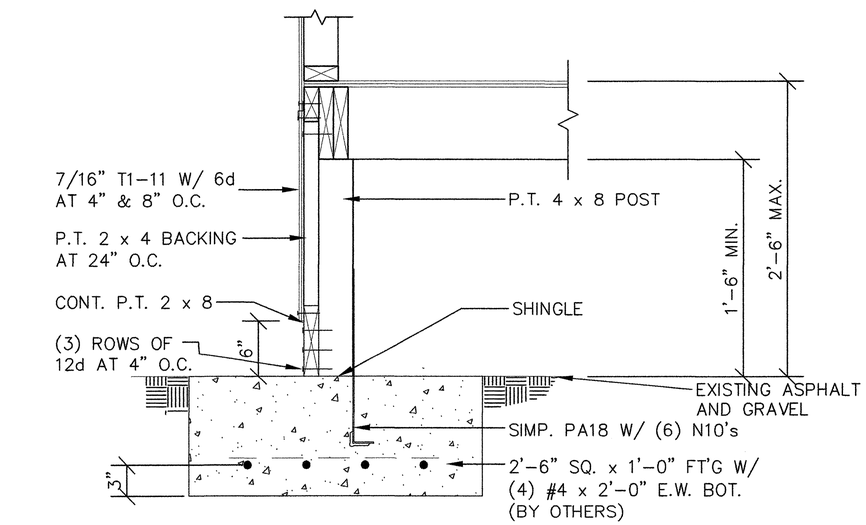
5. VENT CRAWL SPACE 1 SQ. FT. PER 150 SQ. FT. OF FLOOR AREA OR AS SHOWN. INSTALL 6 MIL. VAPOR BARRIER.

6. CONNECT STORM WATER FROM ROOF GUTTERS AND DOWNSPOUTS AND DIRECT AWAY FROM BUILDING PAD TO AN APPROVED DRAINAGE SYSTEM.



1/3 (831) PERIMETER FOOTING

SCALE: 3/4" = 1'-0"



2/3 (832) ENDWALL COLUMN FOOTING

SCALE: 3/4" = 1'-0"

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5	LH	4/29/04	CUST.	6,7,8,11
6	LH	4/30/04	JM	6

24' x 64' MODULAR OFFICE

ALPHA ENGINEERS

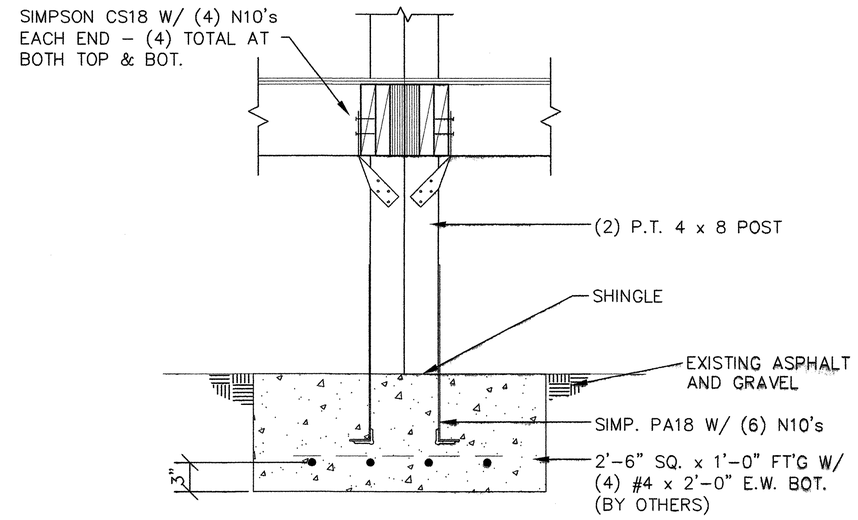
PORTLAND, OREGON

FOUNDATION DETAILS

REGISTERED PROFESSIONAL ENGINEER 13.431 OREGON SEPT. 18, 1986 KENNETH A. RASMUSSEN
EXPIRES: 12/31/04

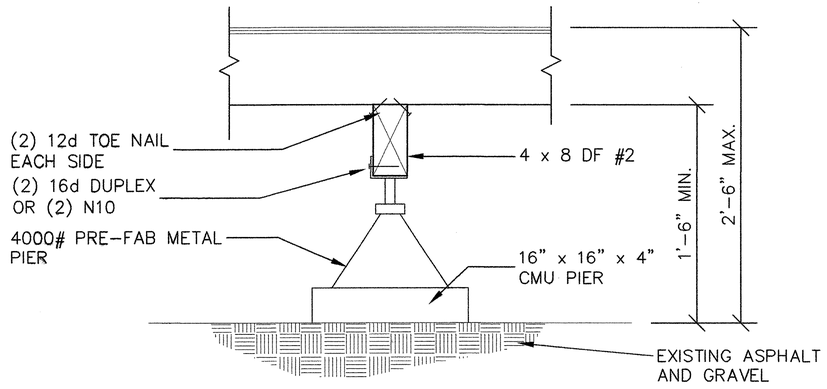
SHEET 4

2004-KM-04



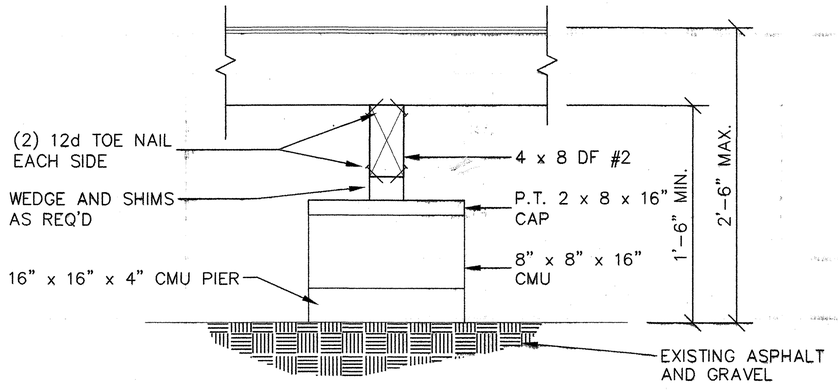
833 3/4 COLUMN FOOTING

SCALE: 3/4" = 1'-0"



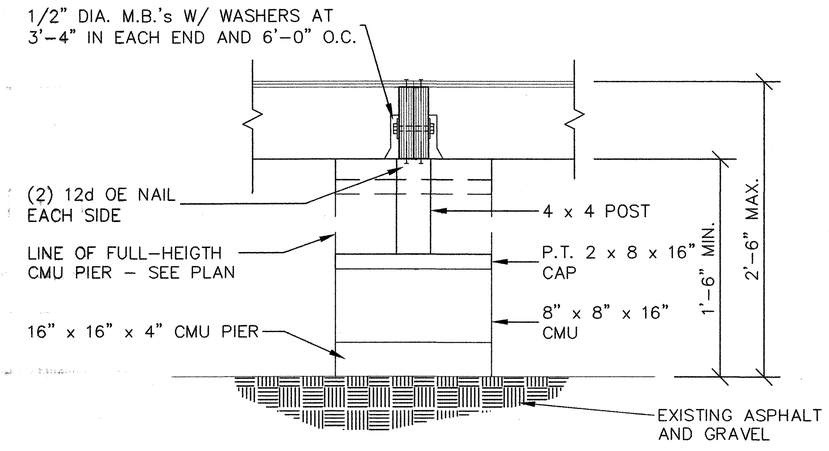
844 4A/4 ALTERNATE MID-SPAN FOOTING

SCALE: 3/4" = 1'-0"



834 4/4 MID-SPAN FOOTING

SCALE: 3/4" = 1'-0"



835 5/4 MARRIAGE LINE FOOTING

SCALE: 3/4" = 1'-0"

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5	LH	4/29/04	CUST.	6,7,8,11
6	LH	4/30/04	JM	6

24' x 64' MODULAR OFFICE

ALPHA ENGINEERS

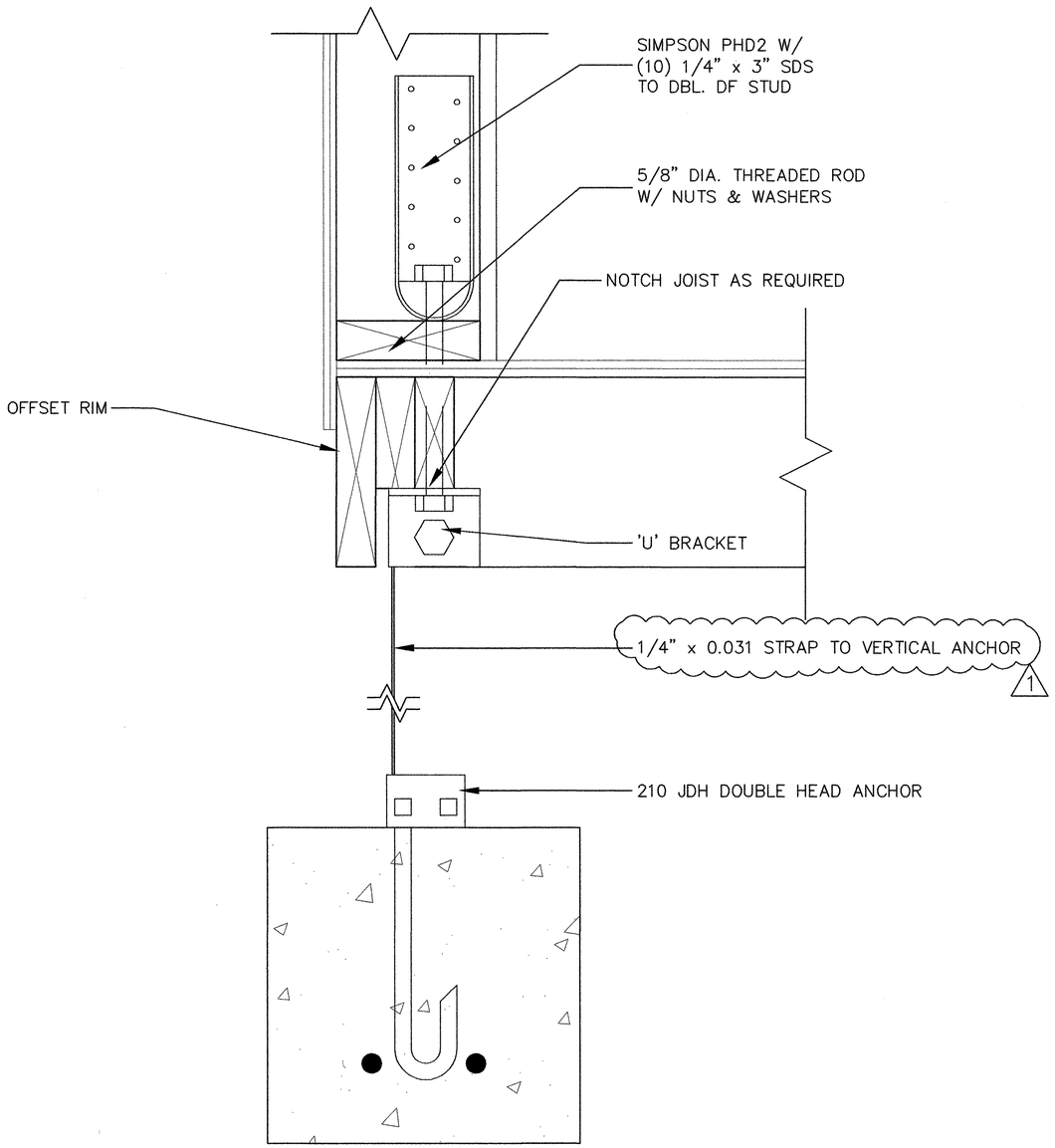
PORTLAND, OREGON

FOUNDATION DETAILS

REGISTERED PROFESSIONAL ENGINEER
13.431
OREGON
SEPT. 18, 1986
KENNETH A. RASMUSSEN
EXPIRES: 12/31/04

SHEET 5

2004-KM-04



6/5 VERTICAL HOLDOWN AT ENDWALL

SCALE: 1-1/2" = 1'-0"

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6	LH	4/30/04	JM	6

24' x 64' MODULAR OFFICE

ALPHA ENGINEERS

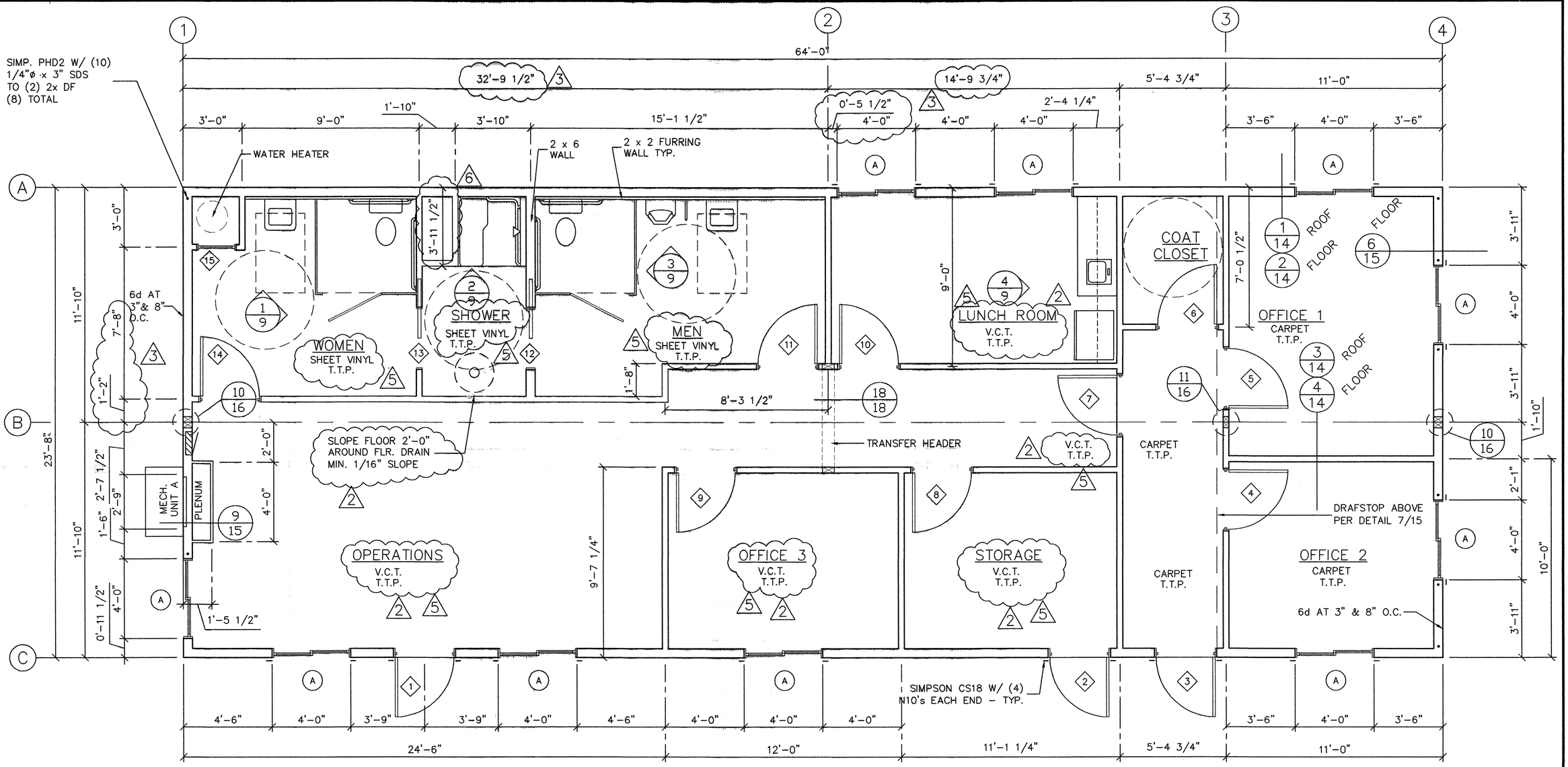
PORTLAND, OREGON

FLOOR PLAN

REGISTERED PROFESSIONAL ENGINEER 13.431 OREGON SEPT. 18, 1986 KENNETH A. RASMUSSEN
EXPIRES: 12/31/04

SHEET 6

2004-KM-04

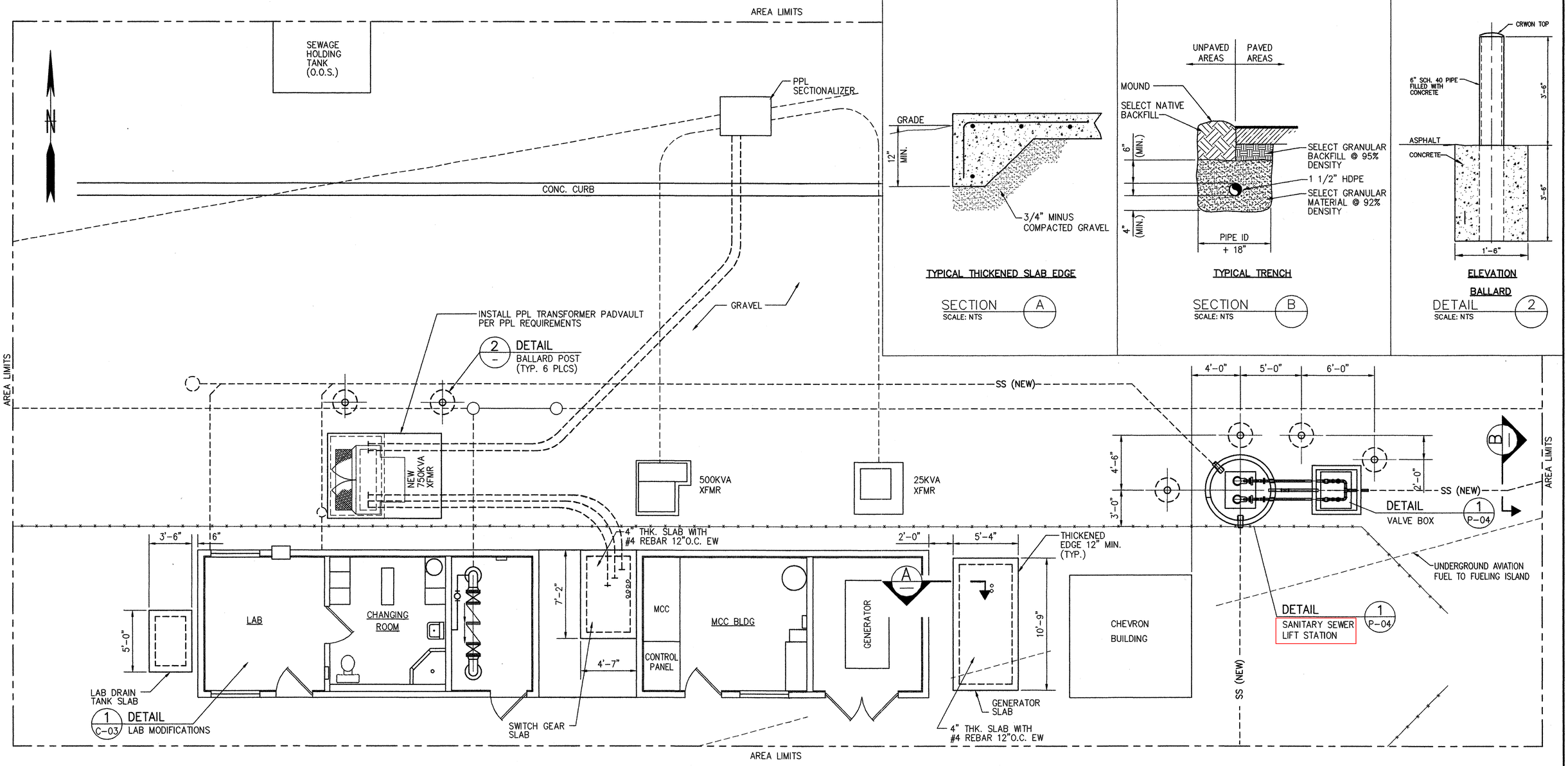


FLOOR PLAN

SCALE: 3/16" = 1'-0"

Sanitary Sewer Lift Station

- Drawing - 3405-C-02
- Drawing - 3406-P-04



TYPICAL THICKENED SLAB EDGE

SECTION A
SCALE: NTS

TYPICAL TRENCH

SECTION B
SCALE: NTS

ELEVATION
BALLARD

DETAIL 2
SCALE: NTS

PLAN

2' 0' 2' 4' 6' 8' 10' 12'

SCALE: 1/4"=1'-0" (22x34)
SCALE: 1/8"=1'-0" (11x17)

NOTES:

1. SEE DWG. 3406-P-02 FOR UTILITY PIPING.

DRAWING NO.	REFERENCE DRAWINGS
3405-C-03	LAB FLOOR PLAN & SECTIONS

REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	1/28/04	ISSUE FOR CONSTRUCTION	BDC	WHB					
1	10/08/04	RECORD DRAWING	QKB	DAB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

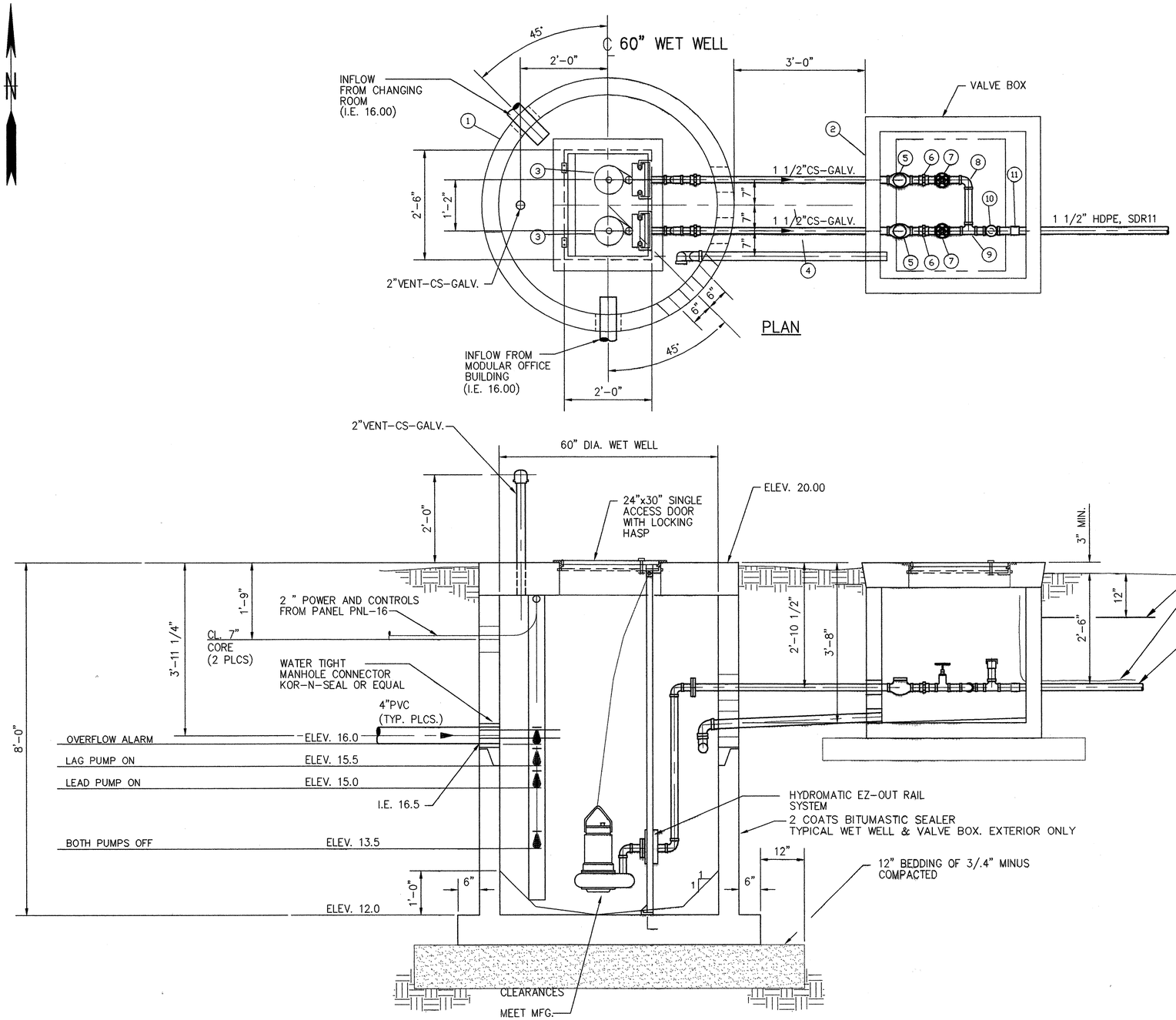
AECI PROJECT NUMBER: 3406

SCALE: 1/4"=1'		DATE
DRAWN BY	QKB	5/07/01
DESIGNED BY	REK	5/07/01
CHECKED BY		
WORK ORDER	34-06	22x34
DATE		
11/2/00		

PDX BULK FUELING FACILITY
PORTLAND, OREGON
LAB AND OFFICE ADDITION
VAULT AND SLAB LOCATION PLAN

DRAWING NO.	SHEET	REV.
3405-C-02	1 OF 1	1

©021.dwg,DWG <CPD: 10/05/04 [TIME: 08:54 AM] >



PLAN

WET WELL LEGEND:

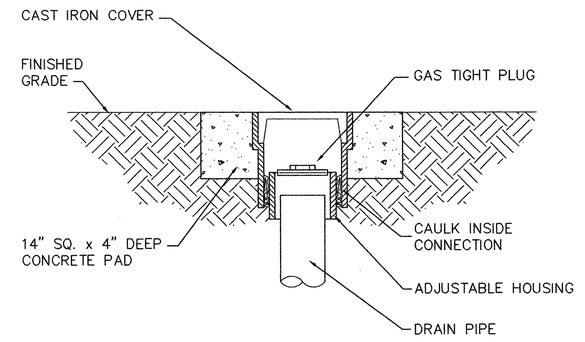
1	WET WELL, RCP CLASS III
2	VALVE BOX, UTILITY VAULT NO.444-LA W/COVER 44-332P
3	PUMP, SUBMERSIBLE GRINDER PUMP, WITH EZ-LIFT RAIL SYSTEM
4	2" PVC DRAIN WITH FLAP VALVE AND P-TRAP
5	1 1/2" BALL CHECK (
6	1 1/2" UNION
7	1 1/2" GATE VALVE
8	1 1/2" 90 DEG. ELBOW
9	1 1/2" TEE
10	1 1/2" TEE WITH 2" KAMLOCK HOSE CONNECTOR
11	1 1/2" TRANSITION CPLG, STEEL X HDPE

PUMP DATA:

PUMP TYPE:	2 EXPOSION-PROOF SUBMERSIBLE SEWAGE GRINDER PUMPS EQUAL TO HYDROMATIC MODEL HPG1X200 2HP, 3500 RPM, 3PH, 460V.
PUMP CAPACITY:	25 GPM AT 60 FT TDH

SECTION

DETAIL 1 / P-02
60" DIA.WET WELL



CLEANOUT TO GRADE — NO SCALE
(REQD. SPACING 400LF)

NOTES:

1. NEW WORK SHOWN BOLD.

2' 1' 0' 2' 4'

SCALE 3/4"=1'-0"

DRAWING NO.	REFERENCE DRAWINGS

REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	01/28/04	ISSUE FOR CONSTRUCTION	DAB	WHB					
1	10/08/04	RECORD DRAWING	QKB	DAB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER: 3406

SCALE:1/2"=1'-0"		DATE
DRAWN BY	DAB	08/27/03
DESIGNED BY	DAB	08/27/03
CHECKED BY	WHB	09/12/03
WORK ORDER	34-06	22X34
DATE		08/27/03

PDX BULK FUELING FACILITY
PORTLAND, OREGON
LAB AND OFFICE
WET WELL
PIPING PLAN

DRAWING NO.	SHEET	REV.
3406-P-04	1 OF 1	1

<CPD: 10/05/04 [TIME: 11:36 AM] > 3406p041.dwg

PDX 2003-1023 13/55

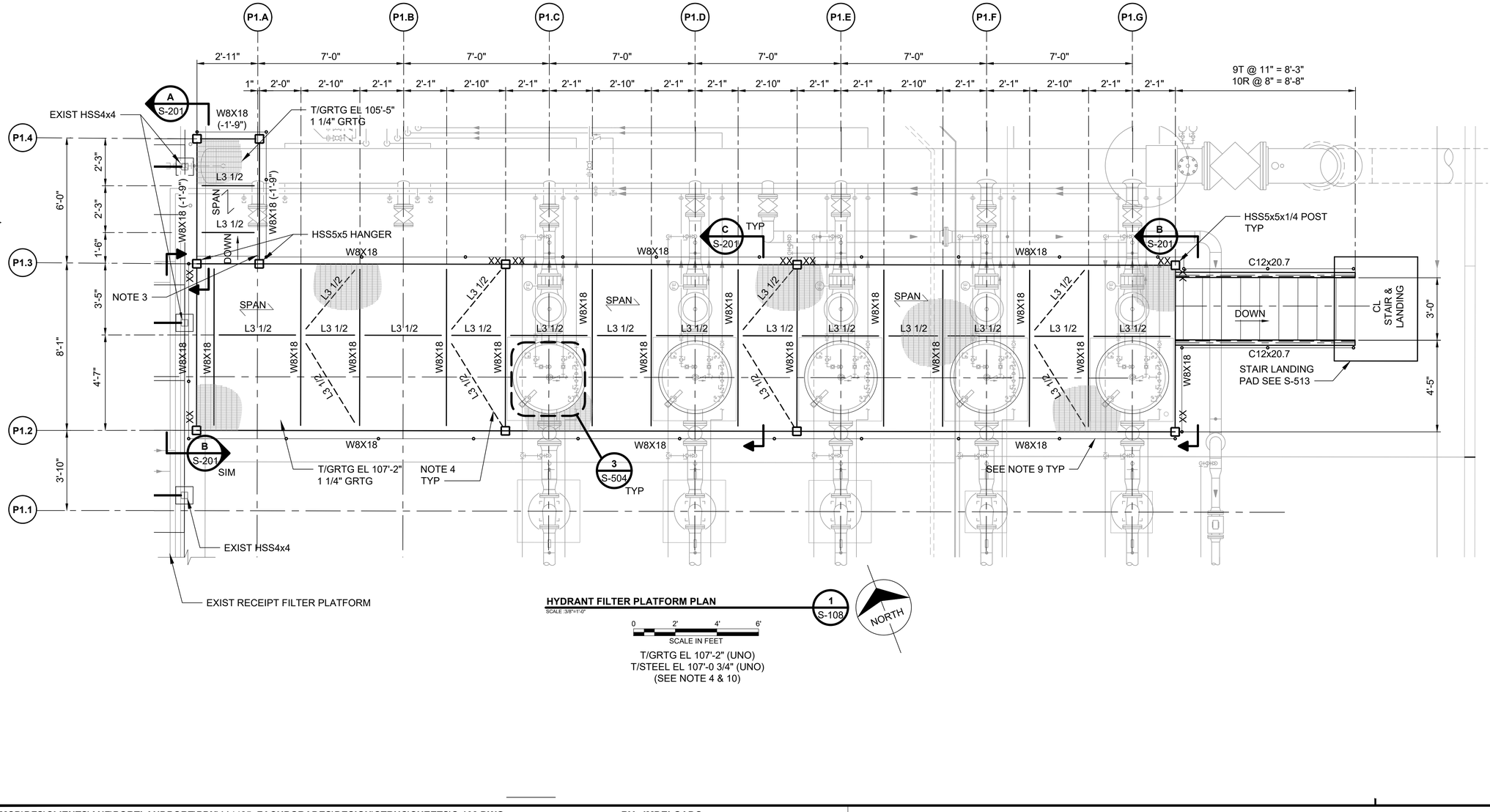
MF

Hydrant Filter Platform

- Drawing - S-108

NOTES:

1. SEE S-001 FOR STRUCTURAL GENERAL NOTES.
2. SEE S-101 FOR PUMP PAD NOTES.
3. STAIRCASE STRINGERS MEMBERS SHALL BE C12x20.7.
4. WHERE L3 1/2 IS INDICATED, PROVIDE L3 1/2x3 1/2x1/4 HORIZONTAL BRACING AT 4" BELOW TOP OF STEEL WHERE SHOWN. SEE DETAILS ON S-506.
5. XX INDICATES KNEE BRACE, SEE DETAIL 1/S-506.
6. SEE S-543 FOR STAIR AND HANDRAIL DETAILS.
7. SEE S-506 FOR PLATFORM CONNECTION DETAILS.
8. SEE S-201 FOR PLATFORM ELEVATIONS.
9. INSTALL GUARDRAIL AND KICKPLATE PER DETAIL 5/S-504.
10. TOP OF CONCRETE ELEVATION 100'-0" CORRESPONDS TO CIVIL DRAWING ELEVATIONS.
11. GRATING SHALL BE W-19-14 (1 1/4 x 3/16) GALVANIZED SERRATED.



HYDRANT FILTER PLATFORM PLAN 1/S-108
SCALE: 3/8"=1'-0"

0 2' 4' 6'
SCALE IN FEET

NORTH

T/GRTG EL 107'-2" (UNO)
T/STEEL EL 107'-0 3/4" (UNO)
(SEE NOTE 4 & 10)

no.	date	by	ckd	description
0	11/13/20	AJK	BBB	ISSUED FOR CONSTRUCTION

BURNS McDONNELL

date	detailed
06/10/2019	M. PATEL
designed	checked
A. KRAL	B. BRETTMANN

PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DR.
PORTLAND, OREGON 97218

HYDRANT FILTER PLATFORM PLAN

project | contract

drawing **S-108** rev. **0**

file **S-108.DWG**

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\\BMCD\DFS\CLIENTS\ANF\PORTLANDPORT\PDX\114425_FACUPGRADES\DESIGN\STRUC\SHEETS\S-108.DWG BY: JMDELGADO

Power Distribution Center / HVAC

- Drawing - PDC PEMB

PDC BUILDING

PORTLAND INTERNATIONAL AIRPORT

5000 NE MARINE DRIVE
PORTLAND, OREGON 97218

City Of Portland

REVIEWED FOR CODE COMPLIANCE

Date: 04/08/21

Permit #: 20-160323-000-00-CO

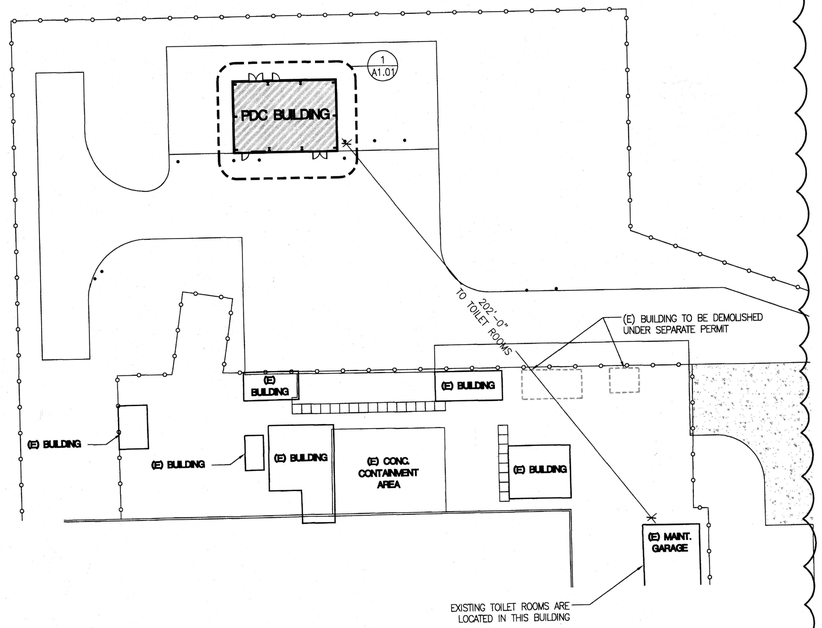
SHEET LIST

RELEASES			06/12/2020 PERMIT SET	07/23/2020 CITY COMMENTS
SHEET NUMBER	SHEET TITLE			
ARCHITECTURAL				
T1.01	TITLE SHEET	0	1	
A1.01	CODE PLAN & FLOOR PLAN	0		
A2.01	ELEVATIONS	0		
A3.01	SECTIONS AND DETAILS	0		
STRUCTURAL				
S0.01	STRUCTURAL GENERAL NOTES AND DETAILS	0		
S0.02	STRUCTURAL SPECIAL INSPECTIONS	0		
S1.01	FOUNDATION PLAN AND DETAILS	0		

SHEET LIST

RELEASES			6/22/2020 PERMIT SET
SHEET NUMBER	SHEET TITLE		
MECHANICAL			
M201	MECHANICAL FLOOR PLAN	0	
M601	MECHANICAL SCHEDULES	0	
M602	MECHANICAL DETAILS	0	
M603	MECHANICAL SPECIFICATIONS	0	
M604	MECHANICAL SPECIFICATIONS	0	

NORTH 1 T1.01 **VICINITY MAP**
1" = 20'-0"



TRUE NORTH NORTH 2 T1.01 **SITE PLAN**
1" = 30'-0"

JH KELLY — GENERAL CONTRACTOR

CONTACT: DEREK KOISTINEN
200 GRAND BOULEVARD
VANCOUVER, WA 98661
PHONE: (360)905-1373
dkoistin@jhkelly.com

LIVERMORE ARCHITECTURE & ENGINEERING — ARCHITECTURE / STRUCTURAL ENGINEERING

ARCHITECTURE: GEOFF GRUMMON, RA, LEED AP BD+C
geoffg@livermoreae.com

STRUCTURAL ENGINEERING: GARY LIVERMORE, P.E.
garyl@livermoreae.com

1500 SW FIRST AVE, SUITE 240
PORTLAND, OREGON 97201
PHONE: (503) 892-3002

MFIA, INC. CONSULTING ENGINEERS — MECHANICAL, ELECTRICAL, & PLUMBING ENGINEERING

CONTACT: MECHANICAL AND FIRE PROTECTION ENGINEER: JIM TORMEY, PE
james.tormey@mfia-eng.com

2007 SE ASH STREET
PORTLAND, OREGON 97214
PHONE: (503) 234-0548

SCOPE OF WORK

NEW PRE-ENGINEERED STORAGE BUILDING LOCATED AT PORTLAND INTERNATIONAL AIRPORT. BUILDING WILL BE USED TO ENCLOSE UPGRADED HYDRANT SYSTEM AS WELL AS GENERAL STORAGE.

GENERAL NOTES

- THE CONTRACTOR SHALL HAVE A FULL SET OF THE CURRENT APPROVED CONSTRUCTION DOCUMENTS INCLUDING ADDENDA ON THE PROJECT SITE AT ALL TIMES
- THE CONTRACTOR SHALL COMPLY WITH LOCAL UTILITY PROVIDERS REQUIRING NOTIFICATION OF INTENDED EXCAVATION.
- ALL WORK SHALL COMPLY WITH THE LOCAL JURISDICTION REQUIREMENTS AND THE PROJECT SPECIFICATIONS.
- THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS SHOWN OR IMPLIED WHICH MAY AFFECT THE WORK PRIOR TO THE START OF CONSTRUCTION AND NOTIFY THE ENGINEER OF RECORD OF ANY DISCREPANCIES.
- SITE PLAN SHOWN FOR REFERENCE ONLY
- SEE CIVIL DRAWINGS FOR MORE INFORMATION ON PROPOSED SITE IMPROVEMENTS
- EROSION CONTROL TO BE PROVIDED BY CITY OF PORTLAND SIMPLE SITE EROSION CONTROL FORM
- STREET TREE ACTIVITY IS NOT APPROVES AS A PART OF THIS PERMIT. SEE TH0894 FOR RIGHT OF WAY IMPROVEMENTS

GENERAL SITE INFORMATION

PROPERTY ID	R316871
ZONING	1G2-hlkx

GENERAL BUILDING INFORMATION

PROPOSED BUILDING FOOT PRINT	1,322 SF
PROPOSED BUILDING FLOOR AREA	1,322 SF

LEGEND

(E) EXISTING

EXISTING BUILDING

PROPOSED BUILDING

FEMA SPECIAL FLOOD HAZARD ZONE

#	DATE	DESC.
0	06/12/20	PERMIT SET
1	07/23/20	CITY COMMENTS
2	11/18/20	CITY COMMENTS

REGISTERED ARCHITECT GARY LIVERMORE PORTLAND, OR 5844 STATE OF OREGON

LIVERMORE ARCHITECTURE & ENGINEERING, INC.
1500 SW First Ave. Suite 240
Portland, Oregon 97201
Phone: 503-892-3002
www.livermoreae.com

Livermore
JOB NO: 219067.00

PDC BUILDING
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OR 97218

DRAWING TITLE:
TITLE SHEET

DRAWN BY: KG
CHECKED BY: GML

T1.01

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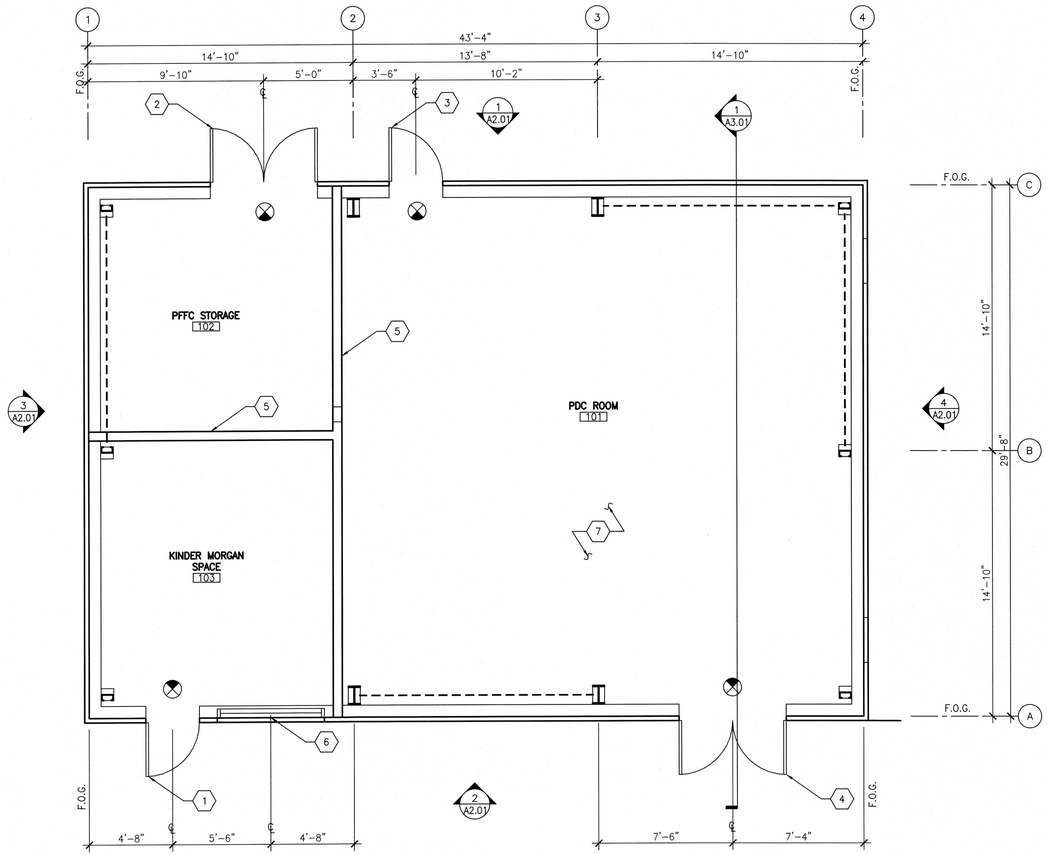

PROJECT NORTH

1 A1.01 **FLOOR PLAN**

1/4 = 1'-0"

FLOOR PLAN GENERAL NOTES

- APPLICABLE CODES: ALL WORK SHALL BE IN CONFORMANCE WITH ALL FEDERAL, STATE, AND LOCAL CODES. SPECIFICATIONS AND STANDARDS SHALL MEAN, AND ARE REFERENCED TO, THE LATEST EDITION, AMENDMENT OR REVISION OF SUCH REFERENCED STANDARDS IN EFFECT AT THE DATE OF THE CONTRACT DOCUMENTS.
- CONTRACTOR TO VERIFY EXISTING CONDITIONS AND DIMENSIONS SHOWN OR IMPLIED PRIOR TO START OF CONSTRUCTION AND NOTIFY A/E OF ANY DISCREPANCIES.
- CONTRACTOR SHALL PROVIDE ALL NECESSARY TESTING AND COORDINATE REQUIRED INSPECTIONS.
- GLASS USED IN DOORS AND WINDOWS LOCATED WITHIN A 24" ARC OF THE NEAREST VERTICAL EDGE OF A DOOR OR IN AREAS SUBJECT TO HUMAN IMPACT OTHERWISE NOTED SHALL BE TEMPERED OR OF AN APPROVED SAFETY GLAZING MATERIAL PER SECTION 2406 OF THE INTERNATIONAL BUILDING CODE (IBC).
- VENTILATION AND LIGHT SHALL BE PROVIDED AS PER SECTIONS 1203 AND 1205 OF THE IBC.
- ALL INSULATION INDICATED ON THE PLANS SHALL COMPLY WITH OR EXCEED THE REQUIREMENTS IN SECTION 719 OF THE IBC FOR SMOKE DENSITY AND FLAME SPREAD.
- PROVIDE CLASS ABC FIRE EXTINGUISHERS AT EACH EXIT DOOR AND SUCH THAT THE MAXIMUM TRAVEL DISTANCE DOES NOT EXCEED 75 FEET. COORDINATE FINAL LOCATIONS OF EACH WITH FIRE MARSHALL.
- PROVIDE EGRESS IDENTIFICATION PER SECTION 1011 OF THE IBC. VERIFY EXACT LOCATION OF SIGNS WITH FIRE MARSHAL AT TIME OF CONSTRUCTION.
- PROVIDE EGRESS ILLUMINATION PER SECTION 1006 OF THE IBC BY SEPARATE PERMIT.
- ALL DOOR HARDWARE SHALL COMPLY WITH REQUIREMENTS OF LOC L ACCESSIBILITY CODES AND THE ADA.
- ALL NEW DOORS AND WINDOWS SHALL COMPLY WITH APPLICABLE I ERGY CODES.
- PROVIDE 18" MIN. CLEAR OPPOSITE DOOR LEVER ON PULL SIDE C DOOR AND 12" MIN. CLEAR OPPOSITE DOOR LEVER ON PUSH SIDE PER ADA GUIDELINES.
- GRID LINES ARE TO CENTERLINE OF COLUMNS UNLESS NOTED OTHERWISE.
- DIMENSIONS ARE TO GRID LINE OR FACE OF GIRT/STUD OR CENTERLINE OF OPENING UNLESS NOTED OTHERWISE.

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit#:
20-160323-000-00-

LEGEND

ROOM 101	ROOM NAME ROOM ###
####A	DOOR NUMBER -- SEE DOOR SCHEDULE
W#	WALL TYPE -- SEE WALL TYPE SCHEDULE
1	WINDOW TYPE, INDICATED ON EXTERIOR ELEVETIONS
F.O.G.	FACE OF GIRT
℄	CENTERLINE
	EXTERIOR WALL
	INTERIOR WALL
	STRUCTURAL BRACE
O D.S.	DOWNSPOUT
	EXIT SIGN

FLOOR PLAN KEYNOTES

1. 3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR WITH MAX U-0.370 VALUE. PROVIDE LEVER HANDLE LOCKSET (ENTRANCE FUNCTION) WITH CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP
2. (2)3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR PAIR WITH MAX U-0.370 VALUE. PROVIDE LEVER HANDLE LOCKSET (ENTRANCE FUNCTION) WITH MANUAL FLUSH BOLT, CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP.
3. 3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR WITH MAX U-0.370 VALUE. PROVIDE EXIT DEVICE (ENTRANCE FUNCTION) WITH CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP
4. (2)3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR PAIR WITH REMOVABLE TRANSOM WITH MAX U-0.370 VALUE. PROVIDE EXIT DEVICE (ENTRANCE FUNCTION) WITH MANUAL FLUSH BOLT, CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP.
5. INTERIOR WALL – 5/8" GYP. WALL BOARD (BOTH SIDES) ON 6" METAL STUDS @ 16" O.C. -- EXTEND TO STRUCTURE.
6. 6'-0" X 4'-0" ALUMINUM WINDOW WITH MAX U-0.36 VALUE
7. CONCRETE MAT FOUNDATION -- SEE STRUCTURAL FOR THICKNESS AND REINFORCING

CODE ANALYSIS

APPLICABLE CODES

BUILDING CODE	2019 OREGON STRUCTURAL SPECIALTY CODE (OSSC)
ELECTRICAL CODE	2017 OREGON ELECTRICAL SPECIALTY CODE (OESC)
ENERGY CODE	2019 OREGON ZERO ENERGY READY COMMERCIAL CODE
MECHANICAL CODE	2019 OREGON MECHANICAL SPECIALTY CODE (OMSC)
PLUMBING CODE	2017 OREGON PLUMBING SPECIALTY CODE (OPSC)
FIRE CODE	2019 PORTLAND FIRE CODE
JURISDICTION	CITY OF PORTLAND

OCCUPANCY CLASSIFICATION

OCCUPANCY GROUPS	CH. 3	S-1 (STORAGE)
OCCUPANCY SEPARATION	508	N/A

CONSTRUCTION TYPE

CONSTRUCTION TYPE	602	IIB

FIRE PROTECTION SYSTEMS

AUTOMATIC SPRINKLER SYSTEM	903	NOT REQUIRED -- NOT PROVIDED
FIRE ALARM	907	NOT REQUIRED -- NOT PROVIDED

BUILDING HEIGHT AND AREA

ALLOWABLE AREA

ALLOWABLE AREA IS DEFINED AS (506.1):	AA=AT+[ATxIF]+[ATxIS]		
BUILDING PERIMETER THAT FRONTS PUBLIC WAY OR OPEN SPACE 20' WIDE MIN	F	148	Ft
PERIMETER OF ENTIRE BUILDING	P	148	Ft
WIDTH OF PUBLIC WAY OR OPEN SPACE	W	30	Ft
TABULAR AREA PER STORY FROM (TABLE 506.2)	AT	17500	SF
AREA INCREASE FOR FRONTAGE IF=[F/P-0.25]W/30	IF	0.75	
ALLOWABLE AREA PER STORY (506.2.1)	AA	30,625	SF
ACTUAL AREA (LARGEST FLOOR)		1322	SF

BUILDING HEIGHT

BASIC ALLOWABLE HEIGHT (TABLE 504.3)	55	FT
ACTUAL HEIGHT	18	FT

NUMBER OF STORIES

BASIC ALLOWABLE (TABLE 504.4)	2	
ACTUAL NUMBER OF STORIES	1	

EXITS

EXITS REQUIRED PER STORY	1021.2	1
MAXIMUM TRAVEL DISTANCE	1016.1	75 FEET (S-1 OCCUPANCY, NO SPRINKLER SYSTEM)
COMMON PATH OF EGRESS TRAVEL	1006.2.1	100 FEET (S-1 OCCUPANCY, NO SPRINKLER SYSTEM)

OCCUPANT LOAD

ROOM #	ROOM NAME	OCCUPANCY	AREA	SF/OCC	OCCUPANTS
FIRST FLOOR					
101	PDC ROOM	S-1	807	300	3
102	PFFC STORAGE	S-1	169	300	1
103	KINDER MORGAN SPACE	S-1	193	300	1
FIRST FLOOR TOTAL					5

ENERGY CODE REQUIREMENTS

CLIMATE ZONE	4C			
BUILDING ENVELOPE REQUIREMENTS				
		REQUIRED	PROVIDED	COMMENTS
ROOFS	TABLE 5.5-4	R-19 + R-11	R-19 + R-11	WITH MIN R-3 THERMAL BLOCKS
WALLS	TABLE 5.5-4	U-0.060	U-0.060	
SLAB ON GRADE	TABLE 5.5-4	R-15 FOR 24"	R-16 (U-0.06) FOR 24"	
OPAQUE SWINGING DOORS	TABLE 5.5-4	U-0.370	U-0.370	
FENESTRATION FIXED	TABLE 5.5-4	U-0.36	U-0.36	
FENESTRATION SHCG	TABLE 5.5-4	0.36	0.36	

#	DATE	DESC.
0	06/12/20	PERMIT SET

REGISTERED ARCHITECT
GARY LIVERMORE
PORTLAND, OR 5844
STATE OF OREGON

LIVERMORE ARCHITECTURE & ENGINEERING, INC.
1500 SW First Ave. Suite 240
Portland, Oregon 97201
Phone: 503.892.3002
www.livermore.com

Livermore
JOB NO: 219067.00

PDC BUILDING
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OR 97218

DRAWING TITLE:
FLOOR PLAN AND CODE PLAN
DRAWN BY: CSN
CHECKED BY: GML

A1.01

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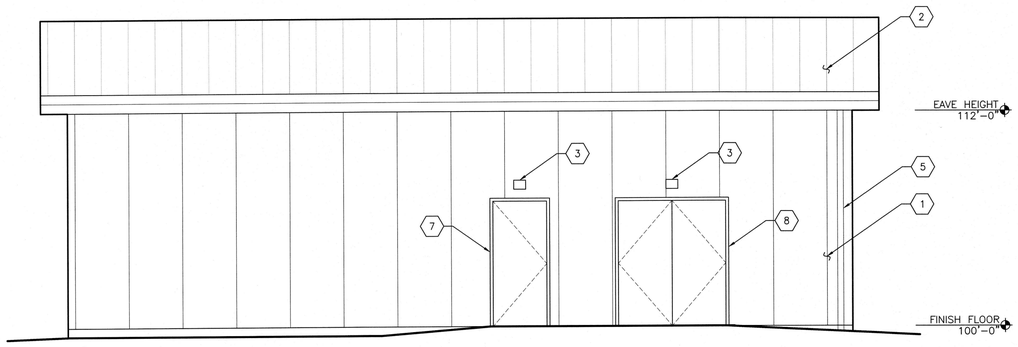
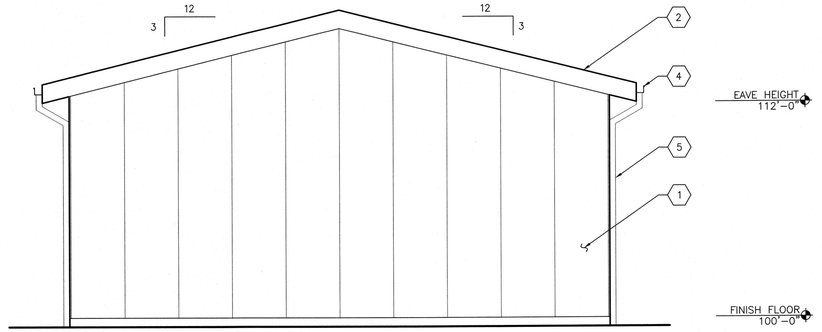


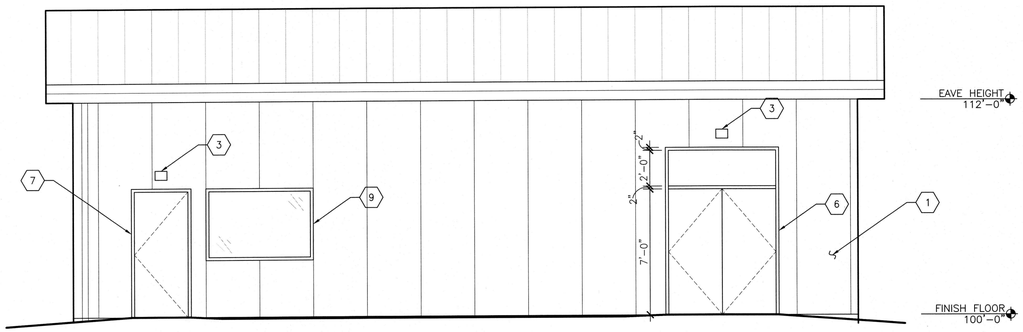
1 A2.01 NORTH ELEVATION

1/4" = 1'-0"



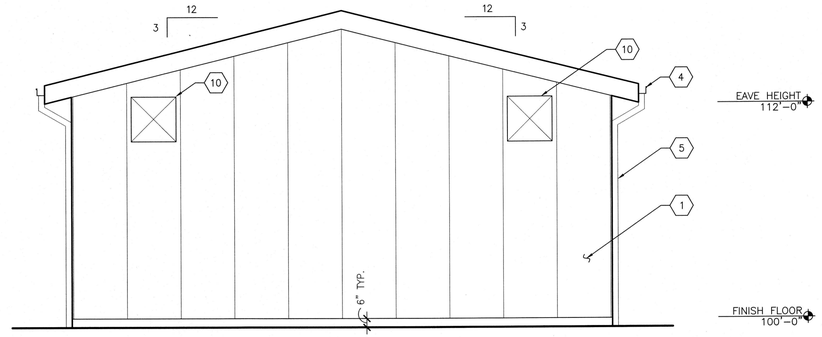
3 A2.01 WEST ELEVATION

1/4" = 1'-0"



2 A2.01 SOUTH ELEVATION

1/4" = 1'-0"



4 A2.01 EAST ELEVATION

1/4" = 1'-0"

ELEVATION GENERAL NOTES

- CONTRACTOR TO VERIFY EXISTING CONDITIONS AND DIMENSIONS SHOWN OR IMPLIED PRIOR TO THE START OF CONSTRUCTION AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES.
- PENETRATIONS ARE DIAGRAMATIC AND MAY NOT DEPICIT THE ACTUAL NUMBER, SIZE OR LOCATION. SEE MECHANICAL/PLUMBING/EQUIPMENT DRAWINGS FOR INFORMATION REGARDIGN DUCT, PIPING, LOUVER, ETC... PENETRATIONS.

ELEVATION KEYNOTES

1. INSULATED METAL PANELS -- CENTRIA FORMAWALL DIMENSION FLAT PANEL, 2.5" THICK, 36" WIDE, VERTICAL ORIENTATION, U-0.060. COLOR TO MATCH ADJACENT BUILDINGS
2. STANDING SEAM METAL ROOF BY PRE-ENGINEERED METAL BUILDING MANUFACTURER
3. BUILDING MOUNTED LIGHTING --SEE ELECTRICAL DRAWINGS
4. GUTTER -- BY PRE-ENGINEERED METAL BUILDING MANUFACTURER
5. DOWNSPOUT -- TO TERMINATE ON SPLASH BLOCKS
6. (2)3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR PAIR WITH REMOVABLE TRANSOM WITH MAX U-0.370 VALUE. PROVIDE LEVER HANDLE LOCKSET (ENTRANCE FUNCTION) WITH MANUAL FLUSH BOLT, CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP.
7. 3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR WITH MAX U-0.370 VALUE. PROVIDE LEVER HANDLE LOCKSET (ENTRANCE FUNCTION) WITH CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP.
8. (2)3'-0" x 7'-0" INSULATED HOLLOW METAL DOOR PAIR WITH MAX U-0.370 VALUE. PROVIDE LEVER HANDLE LOCKSET (ENTRANCE FUNCTION) WITH MANUAL FLUSH BOLT, CLOSER, THRESHOLD, WEATHERSTRIPPING, AND SWEEP.
9. 6'-0" X 4'-0" ALUMINUM WINDOW WITH MAX U-0.36 VALUE
10. OPENING FOR DUCT -- SEE MECHANICAL

City Of Portland

REVIEWED FOR CODE COMPLIANCE

Date: 04/08/21

Permit #: 20-160323-000-00-CO

#	DATE	DESC.
0	06/12/20	PERMIT SET

REGISTERED ARCHITECT
GARY LIVERMORE
PORTLAND, OR 5844
STATE OF OREGON

LIVERMORE
ARCHITECTURE & ENGINEERING, INC.
1500 SW First Ave. Suite 240
Portland, Oregon 97201
Phone: 503-892-3002
www.livermorae.com

Livermore
JOB NO: 219067.00

PDC BUILDING
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OR 97218

DRAWING TITLE:
ELEVATIONS

DRAWN BY: GGB
CHECKED BY: GML

A2.01

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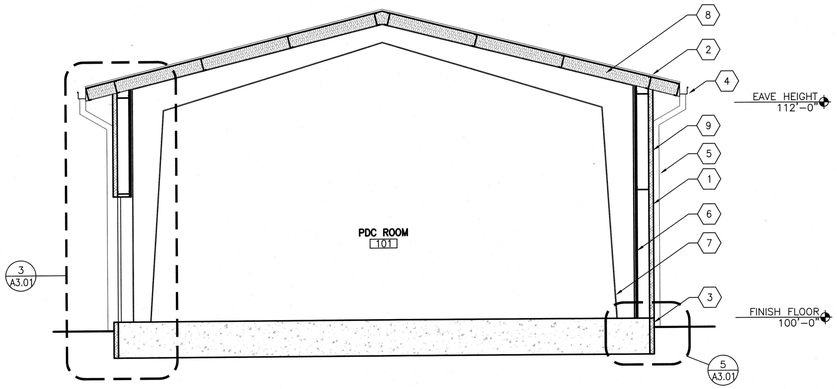


1 A3.01 BUILDING SECTION
1/4" = 1'-0"

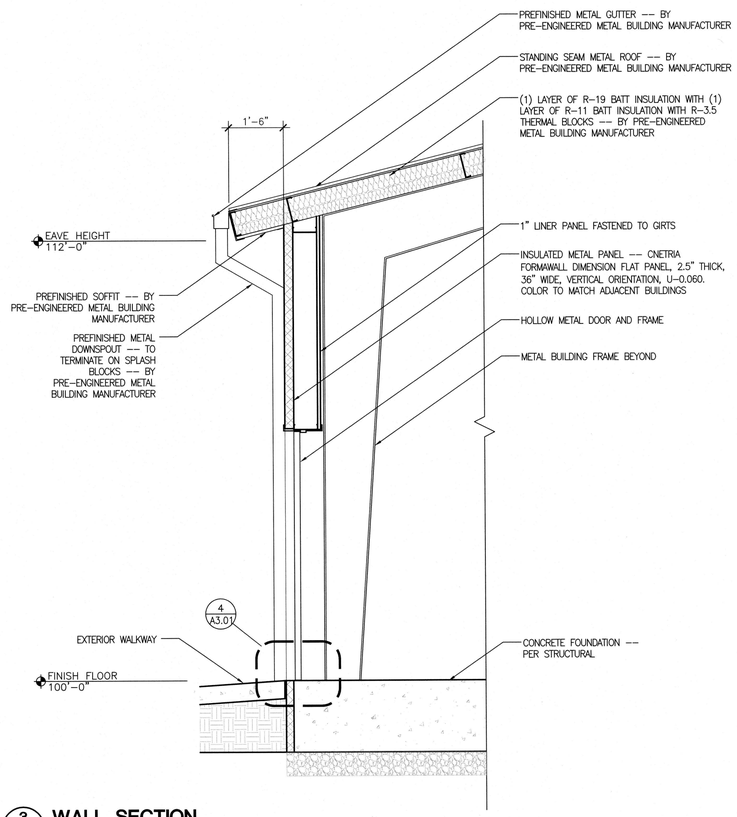
SECTION GENERAL NOTES

- APPLICABLE CODES: ALL WORK SHALL BE IN CONFORMANCE WITH ALL FEDERAL, STATE, AND LOCAL CODES. SPECIFICATIONS AND STANDARDS SHALL MEAN, AND ARE INTENDED TO BE, THE LATEST EDITION, AMENDMENT OR REVISION OF SUCH REFERENCE STANDARDS IN EFFECT ON THE DATE OF THE CONTRACT DOCUMENTS.
- CONTRACTOR SHALL PROVIDE ALL NECESSARY TESTING AND COORDINATE ALL REQUIRED INSPECTIONS.
- ALL INSULATION INDICATED ON THE PLANS SHALL COMPLY WITH OR EXCEED THE REQUIREMENTS IN SECTION 719 OF THE IBC FOR SMOKE DENSITY AND FLAME SPREAD.
- GRID LINES ARE TO CENTERLINE OF COLUMNS UNLESS NOTED OTHERWISE.
- DIMENSIONS ARE TO GRID LINE OR FACE OF GIRT/STUD OR CENTERLINE OF OPENING UNLESS NOTED OTHERWISE.

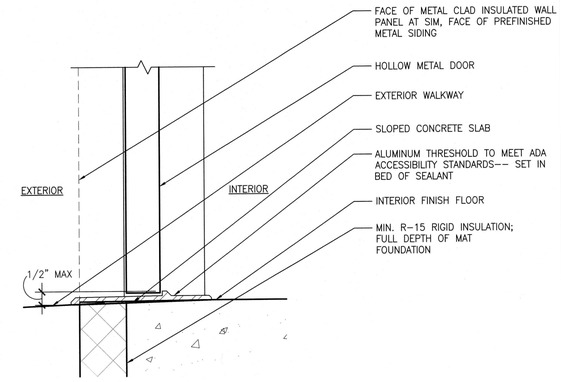
City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit #: 20-160323-000-00-CO

SECTION KEYNOTES

1. INSULATED METAL PANELS -- CENTRIA FORMAWALL DIMENSION FLAT PANEL, 2.5" THICK, 36" WIDE, VERTICAL ORIENTATION, U-0.060. COLOR TO MATCH ADJACENT BUILDINGS
2. STANDING SEAM METAL ROOF BY PRE-ENGINEERED METAL BUILDING MANUFACTURER
3. CONCRETE FOUNDATION -- SEE STRUCTURAL
4. GUTTER -- BY PRE-ENGINEERED METAL BUILDING MANUFACTURER
5. DOWNSPOUT -- TO TERMINATE ON SPLASH BLOCKS
6. 1" METAL LINER PANEL FASTENED TO GIRTS
7. METAL BUILDING FRAME BEYOND
8. (1) LAYER OF R-19 BATT INSULATION WITH (1) LAYER OF R-11 BA INSULATION WITH MIN R-3 THERMAL BLOCKS -- BY PRE-ENGINEERED METAL BUILDING MANUFACTURER
9. CONTINUOUS MIN. R-15 RIGID INSULATION, FULL DEPTH OF MAT FOUNDATION

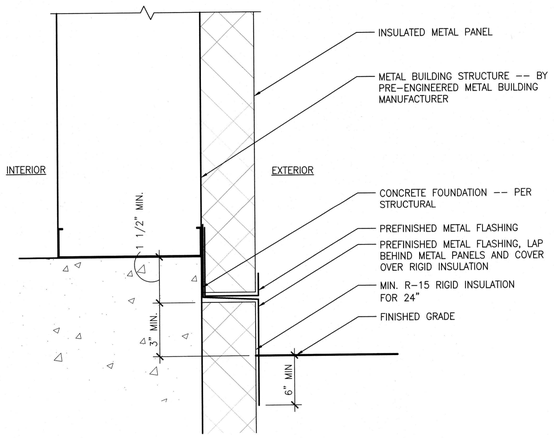


3 A3.01 WALL SECTION
1/2" = 1'-0"

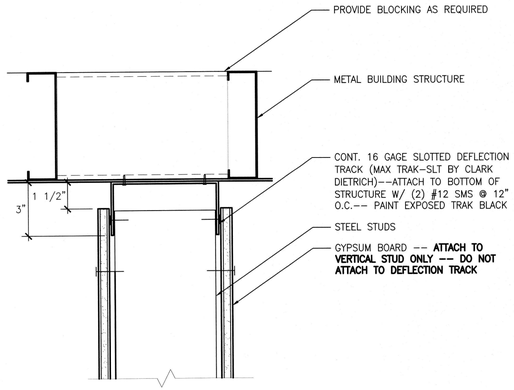


4 A3.01 HOLLOW METAL DOOR @ THRESHOLD
3" = 1'-0"

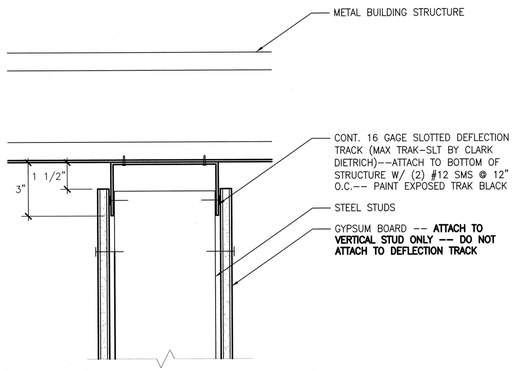
2 A3.01 NOT USED
3" = 1'-0"



5 A3.01 EXTERIOR WALL AT GRADE
3" = 1'-0"



6 A3.01 DEFLECTION CONNECT. PARALLEL TO STRUCTURE
3" = 1'-0"



7 A3.01 DEFLECTION CONNECT. PERP. TO STRUCTURE
3" = 1'-0"

#	DATE	DESC.
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CODE

2019 OREGON STRUCTURAL SPECIALTY CODE (BASED ON INTERNATIONAL BUILDING CODE 2018)

GENERAL STRUCTURAL NOTES

1. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE, THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE AND IS RESPONSIBLE FOR ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE DURING CONSTRUCTION. SUCH MEASURES MAY INCLUDE BUT ARE NOT LIMITED TO; ERECTION MEANS METHODS AND SEQUENCING, BRACING, TEMPORARY SHORING, FORMWORK, JOB SITE SAFETY, AND/OR LOAD EFFECTS DUE TO CONSTRUCTION EQUIPMENT.
   - 1.1. CONSTRUCTION MATERIAL ON STRUCTURES SHALL BE SPREAD OUT IN A MANNER AS TO NOT EXCEED THE DESIGN LIVE LOAD PER SQUARE FOOT.
   - 1.2. VISITS TO THE SITE BY THE ENGINEER OF RECORD SHALL NOT INCLUDE INSPECTION OF THE ABOVE ITEMS.
2. THE CONTRACTOR SHALL REVIEW AND REPORT ANY DISCREPANCIES FOUND AMONG THE CONSTRUCTION DRAWINGS, SPECIFICATIONS AND THE EXISTING SITE CONDITIONS PRIOR TO START OF CONSTRUCTION AND REPORT ANY DISCREPANCY TO THE ENGINEER OF RECORD WHO SHALL CORRECT SUCH DISCREPANCIES IN WITTING.
   - 2.1. ANY WORK PREFORMED BY THE CONTRACTOR AFTER DISCOVERY OF SUCH DISCREPANCIES, BUT BEFORE A WRITTEN CORRECTION IS PROVIDED, SHALL BE AT THE CONTRACTOR'S RISK
   - 2.2. WHERE ANY DISCREPANCIES OCCUR BETWEEN PLANS, DETAILS, GENERAL STRUCTURAL NOTES OR SPECIFICATIONS, THE GREATER REQUIREMENTS SHALL GOVERN.
3. THE CONTRACTOR AND SUBCONTRACTORS SHALL BE RESPONSIBLE TO COORDINATE BETWEEN DISCIPLINES INCLUDING BUT NOT LIMITED TO:
   - 3.1. VERIFICATION OF ALL DIMENSIONS INDICATED ON THE ARCHITECTURAL AND STRUCTURAL DRAWINGS
   - 3.2. VERIFICATION OF ALL ELEVATIONS INDICATED ON THE ARCHITECTURAL AND STRUCTURAL DRAWINGS
   - 3.3. VERIFICATION OF ALL MECHANICAL, ELECTRICAL, AND/OR PROCESS EQUIPMENT LOCATION AND WEIGHT
   - 3.4. VERIFICATION OF LOCATION AND SIZE OF ALL MECHANICAL, ELECTRICAL AND PLUMBING PENETRATIONS THROUGH WALLS, FLOORS AND/OR ROOFS
4. OPTION ARE PROVIDED FOR CONTRACTOR'S CONVENIENCE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY AND ALL CHANGES NECESSARY, AND SHALL COORDINATE ALL DETAILS.
5. ANY ENGINEERING DESIGN PROVIDED BY OTHERS AND SUBMITTED FOR REVIEW SHALL BEAR THE SEAL OF AN ENGINEER REGISTERED IN THE SAME STATE IN WHICH THE PROJECT IS LOCATED.
6. ALL DETAIL CUTS SHOULD BE CONSIDERED TYPICAL AT LIKE CONDITIONS.
7. WHERE REFERENCE IS MADE TO VARIOUS TEST STANDARDS FOR MATERIALS, SUCH STANDARDS SHALL BE THE LATEST EDITION AND/OR ADDENDUM.

FLOOR AND ROOF DESIGN LOADING

LOCATION	DEAD	LIVE		COMMENTS
		UNIFORM	CONC.	
ROOF	BY OTHERS	25 PSF	--	1, 2
FLOOR		250 PSF	2000 LB	

COMMENTS:
1. LIVE LOADING SHOWN IS NOT REDUCED AND INCLUDES 5 PSF RAIN SURCHARGE
2. METAL BUILDING SUPPLIER TO INCLUDE A 3 PSF COLLATERAL LOAD WITH DEAD.

DESIGN LOAD CRITERIA

SNOW LOADING INFORMATION
- GROUND SNOW LOAD, (P_g) — 11 PSF
- FLAT-ROOF SNOW LOAD, (Pf) — 25 PSF

SOIL PARAMETERS — PROVIDED BY HART CROWSER, INC IN A GEOTECHNICAL REPORT DATED AUGUST 17, 2020
- SITE CLASS — E
- BEARING PRESSURE — 1,500 PSF

EARTHQUAKE DESIGN DATA
- RISK CATEGORY — II
- SEISMIC IMPORTANCE FACTOR, (Ie) — 1.0
- MAPPED SPECT. RESPONSE PARAMETERS — S_{MS}=.847, S_{M1}=.376, F_a=1.3 & F_v=2.496
- DESIGN SPECT. RESPONSE PARAMETERS — S_{DS}=.734, S_{D1}=.626

WIND DESIGN DATA
- ULTIMATE DESIGN WIND SPEED (V_{ULT}) — 135 MPH
- RISK CATEGORY — II
- WIND EXPOSURE — D
- INTERNAL PRESSURE COEFFICIENT — +/-0.18

FOUNDATIONS

1. PREPARATION OF SUBGRADE SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT RECOMMENDATIONS INCLUDING COMPACTION REQUIREMENTS AND VAPOR BARRIER RECOMMENDATIONS
   - 1.1. FOOTINGS TO BEAR ON NATURAL UNDISTURBED SOIL FREE OF ORGANIC MATTER, OR ON ENGINEERED FILL IN ACCORDANCE WITH THE GEOTECHNICAL REPORT RECOMMENDATIONS
   - 1.2. PROVIDE DRAINAGE AS NECESSARY TO AVOID A WATER SOFTENED SUBGRADE
2. BOTTOM OF FOOTINGS TO BE A MINIMUM OF **18"** BELOW FINISHED GRADE

CONCRETE

1. TWENTY-EIGHT DAY COMPRESSIVE STRENGTH SHALL BE AS FOLLOWS:
   MAT FOUNDATIONS 4000 PSI (EXPOSURE CLASS **F0**)
2. CONCRETE TO HAVE A MAXIMUM WATER/CEMENT RATIOS PER ACI 318 TABLE 4.3.1 (PROPORTIONING ON THE BASIS OF FIELD EXPERIENCE AND/OR TRIAL MIXTURES). THESE MAXIMUMS MAY BE EXCEEDED IF TEST RECORDS, PER SECTION 5.3 OF ACI 318, ARE SUBMITTED TO AND APPROVED BY THE ENGINEER.
3. MAXIMUM SLUMP 3" PLUS OR MINUS 1".
4. CONCRETE AND REINFORCING TO HAVE SPECIAL INSPECTION IN ACCORDANCE WITH IBC CHAPTER 17.
5. MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED, EXCEPT THAT SLABS ON GRADE MAY BE VIBRATED ONLY AROUND UNDER-FLOOR DUCTS, ETC..
6. CAST CLOSURE POUR AROUND COLUMNS AFTER COLUMN DEAD LOAD IS APPLIED.
7. UNLESS NOTED OTHERWISE ON DRAWINGS ALL CONCRETE SLABS ON GRADE SHALL BE BOUND BY CONTROL OR CONSTRUCTION JOINTS SUCH THAT THE ENCLOSED AREA DOES NOT EXCEED 400 SQUARE FEET AND THE ENCLOSED AREA'S LENGTH TO WIDTH RATIO IS LESS THAN 2:1.
   - 7.1. SAWCUT CONTROL JOINTS 1/4 SLAB DEPTH.

REINFORCING

1. DEFORMED BARS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A615, GRADE 60. WELDED BARS ASTM A706, GRADE 60. WELDED WIRE FABRIC PER ASTM A185, AND WIRE PER ASTM A82.
2. UNLESS NOTED OTHERWISE, LAP SPLICES SHALL BE CLASS 'B' TENSION LAP SPLICES IN ACCORDANCE WITH ACI 318, CHAPTER 12. LAP SPLICES IN COLUMNS SHALL BE STANDARD COMPRESSION LAP SPLICES PER LATEST EDITION OF ACI 318. STAGGER ALTERNATE SPLICES A MINIMUM OF ONE LAP LENGTH. LAPS IN WELDED WIRE FABRIC SHALL BE MADE SO THAT THE OVERLAP MEASURED BETWEEN OUTERMOST CROSS WIRES OF EACH FABRIC SHEET IS NOT LESS THAN THE SPACING OF CROSS WIRES PLUS 2".
3. PROVIDE BENT CORNER BARS TO MATCH AND LAP WITH HORIZONTAL BARS AT CORNERS AND INTERSECTIONS OF FOOTING AND WALLS. REINFORCING BAR SPACING GIVEN ARE MAXIMUM ON CENTERS. ALL BARS PER CRSI SPECIFICATIONS AND HANDBOOK. DOWEL ALL VERTICAL REINFORCING TO FOUNDATION. SECURELY TIE ALL BARS IN LOCATION BEFORE PLACING CONCRETE. CONCRETE COLUMN DOWEL EMBEDMENTS SHALL BE A STANDARD COMPRESSION DOWEL EMBEDMENT LENGTH ACCORDING TO THE LATEST EDITION OF ACI 318.
4. CLEAR CONCRETE COVERAGE AS FOLLOWS FOR CAST-IN-PLACE
   - CAST AGAINST & PERMANENTLY EXPOSED TO EARTH: 3"
   - EXPOSED TO EARTH OR WEATHER & #6 OR LARGER: 2"
   - EXPOSED TO EARTH OR WEATHER & #5 OR SMALLER: 1 1/2"
   - COLUMNS (TO TIES): 1 1/2"
   - BEAMS (TO STIRRUPS): 1 1/2"

ALL OTHERS PER LATEST EDITION OF ACI 318.

METALS

1. MISCELLANEOUS STRUCTURAL STEEL TO BE ASTM A36, FY = 36 KSI, UNLESS NOTED OTHERWISE.
2. STRUCTURAL STEEL BEAMS AND WIDE FLANGE COLUMNS TO BE ASTM A992 FY=50 KSI, UNLESS NOTED OTHERWISE.
3. TUBES TO BE ASTM A500 Gr. B, FY = 46 KSI.
4. PIPES TO BE ASTM A53 Gr. B, FY = 36 KSI.
5. BOLTS TO BE ASTM A307 Gr. A, UNLESS NOTED OTHERWISE.
6. WELDING TO BE BY CERTIFIED WELDERS USING E70XX ELECTRODES IN ACCORDANCE WITH AWS STANDARDS.
7. ALL STEEL TO HAVE A SHOP COAT.
8. STEEL FABRICATOR TO SUBMIT SHOP DRAWINGS TO A/E FOR REVIEW PRIOR TO FABRICATION.
9. STEEL WASHERS TO BE USED AT ALL BOLTED CONDITIONS.
10. BRACING RODS TO BE INSTALLED TAUT, ONE STANDARD TURNBUCKLE PER ROD MAY BE USED.
11. LATEST AISC, SJI AND AWS CODES APPLY. ALL CONSTRUCTION PER LATEST AISC HANDBOOK.
12. ALL EXPANSION ANCHORS SHALL BE SIMPSON STRONG BOLT.
13. ALL ADHESIVE ANCHORS TO BE SIMPSON SET-XP ADHESIVE ANCHORS.
14. ALL REFERENCE TO HEADED STUDS (HWS) SHALL INDICATE AUTOMATIC WELDED HEADED STUDS (NELSON OR EQUIVALENT).
15. ALL REFERENCE TO POWDER DRIVEN ANCHORS (PDA'S) SHALL BE SIMPSON 0.145" DIA. x 3" LONG PDP OR EQUIVALENT.

PREFABRICATED STEEL BUILDINGS

1. PREFABRICATED STEEL BUILDING SHALL BE DESIGNED TO SUPPORT THEIR OWN WEIGHT PLUS SUPERIMPOSED DEAD, LIVE, WIND OR SEISMIC LOADING, WHICHEVER COMBINATION PRODUCES THE MOST SEVERE CONDITION, IN ACCORDANCE WITH THE LATEST RECOMMENDATIONS OF THE METAL BUILDING MANUFACTURER'S ASSOCIATION AND IBC CODE. SUPPLIERS SHALL BE RESPONSIBLE FOR CONNECTIONS AND DETAILS AS NOTED ON THE DRAWINGS.
2. BOTH THE SHOP DRAWINGS AND THE CALCULATIONS MUST BE SEALED BY A PROFESSIONAL ENGINEER. IT IS THE INTENT THAT THE SHOP DRAWINGS AND CALCULATIONS WILL BE PREPARED UNDER THE DIRECT SUPERVISION OF THE PRODUCT MANUFACTURER'S IN-HOUSE PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF OREGON. THE ENGINEER MUST HAVE REVIEWED ALL APPLICABLE CONSTRUCTION DOCUMENTS FOR CONFORMITY, DESIGN AND INSTALLATION OF THE PREFABRICATED STEEL BUILDING.
3. IT IS THE RESPONSIBILITY OF THE PREFABRICATED STEEL BUILDING'S IN-HOUSE REGISTERED PROFESSIONAL ENGINEER TO CONTACT AND VERIFY SNOW, ROOF LIVE LOAD, WIND AND SEISMIC LOADS WITH THE LOCAL PERMITTING JURISDICTION PRIOR TO SUBMITTING SHOP DRAWINGS AND CALCULATION TO ENGINEER OF RECORD FOR REVIEW AND APPROVAL.

MIN. REINF. BAR SPLICE LENGTHS IN CONCRETE

ESTABLISHED PER ACI 318 SECTION 12.2 & 12.3.

		TENSION BARS						COMP. BARS	
		f'c = 3000 psi		f'c = 4000 psi		f'c = 5000 psi		f'c	
		REGULAR	TOP	REGULAR	TOP	REGULAR	TOP	OPEN	ENCLOSED WITH TIES
		CLASS	CLASS	CLASS	CLASS	CLASS	CLASS		
BAR	GRADE	B	B	B	B	B	B		
#3	60	22"	28"	19"	24"	17"	22"	12"	12"
#4	60	29"	37"	25"	33"	23"	29"	15"	13"
#5	60	36"	47"	31"	40"	28"	36"	19"	16"
#6	60	43"	56"	37"	48"	34"	43"	23"	19"
#7	60	63"	81"	54"	71"	49"	63"	27"	22"
#8	60	71"	93"	62"	81"	56"	72"	30"	25"
#9	60	81"	105"	70"	91"	63"	81"	34"	29"

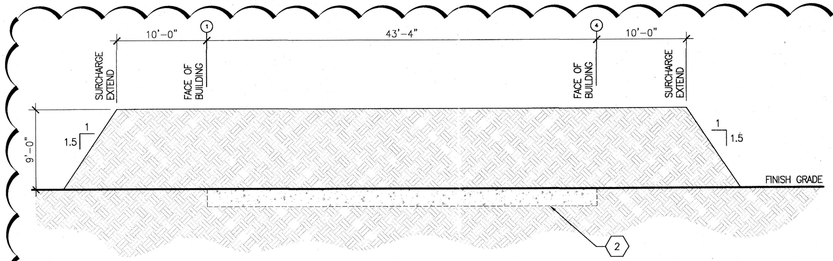
NOTES:
1. TOP BARS ARE ANY HORIZONTAL BARS PLACED SO THAT MORE THAN 12" OF FRESH CONCRETE IS CAST ON THE MEMBER BELOW THE REINFORCEMENT.
2. UNLESS NOTED OTHERWISE, LAP SPLICES IN CONCRETE BEAMS, SLABS AND WALLS SHALL BE CLASS 'B' TENSION LAP SPLICES AND LAP SPLICES IN CONCRETE COLUMNS SHALL BE COMPRESSION LAP SPLICES.
3. ALL REINFORCING SHALL BE UNCOATED.
4. VALUES SHOWN ABOVE ARE FOR CLEAR COVER OF 1 BAR DIAMETER MINIMUM AND CLEAR BAR SPACING OF 2 BAR DIAMETERS MINIMUM. WHERE COVER OF BAR SPACING IS LESS THAT THIS INCREASE LAP LENGTH BY 50%.
5. NO BUNDLE BARS.
6. ALL CONCRETE SHALL BE NORMAL WEIGHT AGGREGATE.

DEFERRED SUBMITTAL/SHOP DRAWINGS

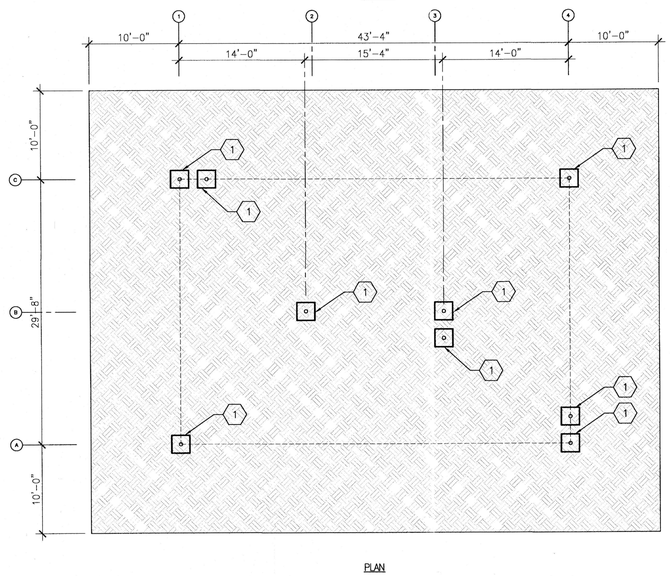
PURSUANT TO THE IBC, SUBMITTAL DOCUMENTS FOR DEFERRED ITEMS SHALL BE PROVIDE TO THE ARCHITECT/ENGINEER OF RECORD FOR REVIEW AND APPROVAL.

ITEM	SUBMIT ITEM TO:		NOTE
	A/E OF RECORD	BUILDING OFFICIAL	
STRUCTURAL STEEL SHOP DRAWINGS	X		2, 4
CONCRETE MIX DESIGN	X		
STRUCTURAL STEEL MILL CERT.	X		
REINF. STEEL SHOP DRAWINGS	X		2, 4
PREFABRICATED STEEL BUILDINGS	X	X	1, 3, 4

NOTE:
1. PROVIDE DRAWINGS AND CALCULATIONS BEARING THE SEAL OF A CIVIL OR STRUCTURAL ENGINEER REGISTERED IN THE STATE OF OREGON.
2. CONSTRUCTION DOCUMENTS BY LIVERMORE ARCHITECTURE & ENGINEERING INC. ARE THE SOLE PROPERTY OF LIVERMORE ARCHITECTURE & ENGINEERING INC. AND SHALL NOT BE DUPLICATED FOR THE USE IN SHOP DRAWING SUBMITTALS.
3. DEFERRED SUBMITTALS MUST BE APPROVED BY THE ENGINEER OF RECORD AND SUBMITTED/APPROVED BY THE LOCAL JURISDICTION PRIOR TO CONSTRUCTION PER IBC SECTION 107.3.4.2.
4. ANY SHOP DRAWING DETAILING REVISED FROM LIVERMORE ARCHITECTURE & ENGINEERING INC. CONSTRUCTION DOCUMENTS SHALL BE CLOUDED AND SPECIFICALLY APPROVED BY THE ENGINEER OF RECORD.



SECTION



PLAN

NORTH

1 / S0.01 SURCHARGE PLAN AND SECTION

1/8" = 1'-0"

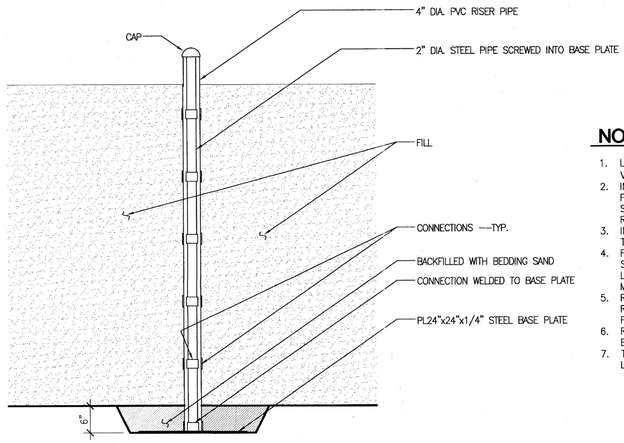
SURCHARGE GENERAL NOTES:

1. AT LEAST ONE SETTLEMENT PLATE AND ROD SHOULD BE INSTALLED NEAR THE CENTER OF EACH STOCKPILE OR AT THE POINT OF THICKEST FILLS PRIOR TO THE PLACEMENT OF ANY FILLS OR SURCHARGE MATERIALS. ADDITIONAL PLATES MAY BE REQUIRED DEPENDING UPON THE LAYOUT OF THE BUILDINGS AND STOCKPILES.
2. THE SETTLEMENT PLATE(S) AND ADJACENT GROUND SHOULD BE SURVEYED AT THE FOLLOWING INTERVALS:
   - IMMEDIATELY UPON INSTALLATION
   - DAILY DURING ALL EARTHWORK ACTIVITIES
   - THREE TIMES WEEKLY FOR A PERIOD OF 2 WEEKS AFTER THE COMPLETION OF EARTHWORK ACTIVITIES
   - ONCE WEEKLY AFTER THE 2-WEEK PERIOD.
3. THE SURVEY EQUIPMENT SHOULD HAVE A MINIMUM ACCURACY OF AT LEAST 1/100TH OF A FOOT AND BE REFERENCED TO A STATIONARY DATUM AT LEAST 100 FEET FROM THE EDGE OF ACTIVE WORK AREAS.
4. THE DATA SHOULD BE PROVIDED TO THE GEOTECHNICAL ENGINEER EACH DAY COLLECTED, AND THE MONITORING SHOULD CONTINUE UNTIL THE DATA SHOW THAT SETTLEMENT IS SUBSTANTIALLY COMPLETED, AS DETERMINED BY THE GEOTECHNICAL ENGINEER.
5. THE AVERAGE FINAL UNIT WEIGH OF PRE-LOAD SOILS SHALL BE 100 PCF. THIS ASSUMES THAT ON-SITE SOILS WILL BE USED AS PRE-LOAD SURCHARGE.

SURCHARGE KEYNOTES:

1. SETTLEMENT PLATE -- SEE 2/S0.01

NOTE:
SURCHARGE PLAN SHALL BE APPROVED BY THE PROJECT GEOTECH PRIOR TO CONSTRUCTION.



NOTES

1. LOCATIONS OF SETTLEMENT PLATES SHALL BE CLEARLY MARKED AND READILY VISIBLE (RED FLAGGED) TO EQUIPMENT OPERATORS.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE OR EXTENSION RESULTING FROM EQUIPMENT OPERATING WITHIN PRESCRIBED CLEARANCE AREA, CONTRACTOR SHALL IMMEDIATELY NOTIFY SOILS ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. INSTALL PLATES ON FIRM GROUND OR ON SAND PADS IF NEEDED FOR STABILITY. TAKE INITIAL READING ON TOP OF PIPE PRIOR TO PLACEMENT OF FILL.
4. FOR EASE IN HANDLING, ROD AND CASING ARE USUALLY INSTALLED IN 5-FOOT SECTIONS. AS FILL PROGRESSES, COUPLINGS ARE USED TO INSTALL ADDITIONAL LENGTHS. CONTINUITY IS MAINTAINED BY READING THE TOP OF THE MEASUREMENT ROD. BOTH READINGS ARE RECORDED.
5. RECORD THE ELEVATION OF THE TOP OF THE MEASUREMENT ROD AT THE RECOMMENDED TIME INTERVALS. EACH TIME, NOTE ELEVATION OF THE ADJACENT FILL SURFACE.
6. READ THE MEASUREMENT ROD TO THE NEAREST 0.005 FOOT NOTE THE FILL ELEVATION TO THE NEAREST 0.1 FOOT.
7. THE ELEVATIONS SHOULD BE REFERENCED TO A TEMPORARY BENCHMARK LOCATED ON STABLE GROUND AT LEAST 200 FEET FROM EMBANKMENT.

2 / S0.01 TYPICAL SETTLEMENT PLATE DETAIL

3/4" = 1'-0"

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit #: 20-160323-000-00-CO

#	DATE	DESC.
0	06/12/20	PERMIT SET
1	12/09/20	CITY COMMENTS 2

EXPIRES: 12/31/20

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DRAWING TITLE:
STRUCTURAL NOTES

DRAWN BY: MGV
CHECKED BY: GML

S0.01

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STATEMENT OF SPECIAL INSPECTION

ITEM	SPECIAL INSPECTION	STRUCTURAL OBSERVATION	IBC SECTION
SOILS	X		1705.6
CONCRETE CONSTRUCTION	X	X	1705.3
STRUCTURAL STEEL	X		1705.2.1
SEISMIC RESISTANCE	X		1705.11

COMMENTS:
ITEMS INDICATE WITH AN "X" ABOVE INDICATE THE REQUIREMENT FOR SPECIAL INSPECTION AND/OR STRUCTURAL OBSERVATIONS SEE GENERAL NOTES ON INSPECTIONS BELOW FOR ADDITIONAL INFORMATION.

GENERAL NOTES ON INSPECTIONS

1. INSPECTION, OBSERVATION AND TESTING REQUIREMENTS HAVE BEEN ESTABLISHED PER 2012 INTERNATIONAL BUILDING CODE (IBC)
   - 1.1. REFERENCE PROJECT DRAWINGS, SPECIFICATIONS, AND IBC SECTION 110 AND 17 FOR REQUIREMENTS
   - 1.2. ABBREVIATIONS USED
     - EOR ENGINEER OF RECORD
     - AHJ AUTHORITY HAVING JURISDICTION
     - NDT NON DESTRUCTIVE TESTING
     - SDC SEISMIC DESIGN CATEGORY, SEE S0.01 FOR ADDITIONAL INFORMATION
     - SFRS SEISMIC FORCE RESISTING SYSTEM, SEE S0.01 FOR ADDITIONAL INFORMATION
2. REQUIRED INSPECTIONS BY THE BUILDING OFFICIAL (IBC SECTION 110)
   - 2.1. FOOTING AND FOUNDATION INSPECTION
   - 2.2. CONCRETE SLAB AND UNDER FLOOR INSPECTION
   - 2.3. FRAME INSPECTION
   - 2.4. GYPSUM BOARD INSPECTION
   - 2.5. FIRE AND SMOKE RESISTANCE PENETRATION INSPECTION
   - 2.6. ENERGY EFFICIENT INSPECTIONS
   - 2.7. IN ADDITION TO THE ABOVE REQUIRED INSPECTIONS, THE BUILDING OFFICIAL IS AUTHORIZED TO MAKE OR AUTHORIZE ANY ADDITIONAL INSPECTIONS AS NECESSARY TO ENSURE COMPLIANCE WITH BUILDING CODE OR ANY OTHER LAWS ENFORCED BY THE BUILDING DEPARTMENT
3. SPECIAL INSPECTIONS AND STRUCTURAL TESTING (IBC SECTION 1705)
   - 3.1. THE OWNER, OR OWNER'S REPRESENTATIVE, SHALL EMPLOY AN APPROVED AGENCY TO PERFORM SPECIAL INSPECTIONS
     - 3.1.1. SPECIAL INSPECTION SHALL BE ACCOMPLISHED BY A CERTIFIED SPECIAL INSPECTOR FROM AN ESTABLISHED TESTING AGENCY CURRENTLY CERTIFIED AND APPROVED BY THE BUILDING OFFICIAL
   - 3.2. THE SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED FOR CONFORMANCE WITH THE APPROVED DESIGN DRAWINGS AND SPECIFICATIONS
     - 3.2.1. CONTINUOUS SPECIAL INSPECTION REQUIRES THE SPECIAL INSPECTOR TO BE ON THE SITE AT ALL TIMES OBSERVING THE WORK REQUIRING SPECIAL INSPECTION, INSPECTIONS MUST BE PREFORMED BEFORE FINAL ACCEPTANCE OF THE ITEM.
     - 3.2.2. PERIODIC SPECIAL INSPECTION REQUIRES THE SPECIAL INSPECTOR TO BE ON SITE AT TIME INTERVALS NECESSARY TO CONFIRM THAT ALL WORK REQUIRING SPECIAL INSPECTION IS IN COMPLIANCE, OPERATIONS NEED NOT BE DELAYED PENDING INSPECTIONS
     - 3.2.3. SPECIAL INSPECTION IS NOT REQUIRED FOR WORK PERFORMED ON THE PREMISES OF AN APPROVED FABRICATOR PER IBC SECTION 1704.2.5.2
   - 3.3. THE SPECIAL INSPECTOR SHALL FURNISH INSPECTION REPORTS TO THE BUILDING OFFICIAL, THE ENGINEER OF RECORD, ARCHITECT OF RECORD AND OTHER DESIGNATED PERSONNEL.
     - 3.3.1. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE GENERAL CONTRACTOR FOR POSSIBLE CORRECTIVE ACTIONS, THEN IF STILL NOT IN CONFORMANCE REPORTED TO THE EOR AND THE BUILDING OFFICIAL
     - 3.3.2. THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL REPORT STATING THAT THE WORK REQUIRING SPECIAL INSPECTION WAS COMPLETED IN CONFORMANCE WITH THE APPROVED PLANS AND SPECIFICATIONS. ANY INSPECTIONS OR TESTING WHICH IS NOT IN ACCORDANCE SHALL BE CLEARLY INDICATED
   - 3.4. SPECIAL INSPECTION AND TESTING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF IBC SECTION 17 AND ANY ADDITIONAL REQUIREMENTS OF THE BUILDING OFFICIAL. OMISSION FROM THE LISTED REQUIREMENTS DOES NOT RELIEVE THE CONTRACTOR FROM PROVIDING INSPECTION AND TESTING REQUIRED BY THE IBC, SPECIFICATIONS, OR THE BUILDING OFFICIAL
4. STRUCTURAL OBSERVATIONS (IBC 1704.5)
   - 4.1. STRUCTURAL OBSERVATIONS SHALL BE PREFORMED BY THE EOR OR OTHER REGISTERED DESIGN PROFESSIONAL DURING CONSTRUCTION IN A MANNER TO BECOME GENERALLY FAMILIAR WITH THE IN PLACE CONSTRUCTION CONDITION
     - 4.1.1. GENERAL CONTRACTOR TO COORDINATE STRUCTURAL OBSERVATIONS AND NOTIFY THE ENGINEER IN ADVANCE (MINIMUM 1 WEEK PRIOR) TO FACILITATE THE OBSERVATION BEFORE THE ITEM UNDER OBSERVATION IS COVERED OR RENDERED INACCESSIBLE
   - 4.2. THE STRUCTURAL OBSERVER SHALL SUBMIT A REPORT TO THE BUILDING OFFICIAL INDICATING THAT THE SITE VISITS HAVE BEEN MADE AND IDENTIFY ANY DEFICIENCIES OBSERVED.
     - 4.2.1. STRUCTURAL OBSERVATION REPORTS SHALL NOT CONSTITUTE A WARRANTY OR AS A GUARANTEE BY THE STRUCTURAL ENGINEER AND DO NOT CONSTITUTE A SPECIAL INSPECTION
5. CONTRACTOR RESPONSIBILITY (IBC 1704.4)
   - 5.1. CONTRACTOR SHALL CONVENE A PRE-CONSTRUCTION MEETING WITH THE EOR, AHJ, AND SPECIAL INSPECTOR WHERE THE REQUIREMENTS FOR SPECIAL INSPECTION, TESTING AND STRUCTURAL OBSERVATIONS AND INSPECTION SCHEDULE ARE DISCUSSED. MEETING MINUTES SHALL BE PROVIDED TO THE AHJ AND MAINTAINED ON-SITE AT ALL TIMES
   - 5.2. AS REQUIRED PER IBC, IF SEISMIC OR WIND RESISTANCE IS INDICATED IN THE STATEMENT OF SPECIAL INSPECTION, THE CONTRACTOR RESPONSIBLE FOR ITS CONSTRUCTION SHALL SUBMIT A LETTER CONTAINING ACKNOWLEDGEMENT OF THE SPECIAL INSPECTION REQUIREMENTS TO THE AHJ AND THE OWNER

SOILS (IBC TABLE 1705.6)

VERIFICATION AND INSPECTION TASK	INSPECTION: CONTINUOUS	PERIODIC	COMMENTS
VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING STRENGTH		X	1, 2
VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL		X	1, 2
PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS		X	1, 2
VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESS DURING PLACEMENT AND COMPACTION OF COMPACTED FILL	X		1, 2
PRIOR TO PLACEMENT OF COMPACTED FILL, OBSERVE SUBGRADE AND VERIFY THAT THE SITE HAS BEEN PREPARED PROPERLY		X	1, 2
SURCHARGE INSTALLATION, SETTLEMENT MONITORING AND DURATION		X	1, 2

COMMENTS:
1. THE APPROVED DESIGN DRAWINGS AND/OR THE APPROVED GEOTECHNICAL REPORT SHALL BE USED TO DETERMINE COMPLIANCE
2. THE SPECIAL INSPECTION SHALL BE ACCOMPLISHED BY THE SAME GEOTECHNICAL ENGINEER WHO HAS CREATED THE GEOTECHNICAL REPORT RECOMMENDATIONS.

CONCRETE CONSTRUCTION (IBC TABLE 1705.3)

VERIFICATION AND INSPECTION TASK	INSPECTION: CONTINUOUS	PERIODIC	COMMENTS
INSPECTION OF REINFORCING STEEL, INCLUDING PRESTRESSING TENDONS, AND PLACEMENT		X	
INSPECTION OF ANCHOR RODS AND OTHER EMBEDDED ITEMS PRIOR TO AND DURING CONCRETE PLACEMENT FOR BOLT GRADE, DIAMETER, STAND-OFF HEIGHT, EMBEDMENT DEPTH AND EDGE DISTANCES	X		
INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS IN HORIZONTALLY OR UPWARDS INCLINED ORIENTATION RESISTING SUSTAINED LOADS	X		1
INSPECTION OF ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS IN CONDITIONS NOT DESCRIBED ABOVE		X	1
VERIFY USE OF REQUIRED DESIGN MIX		X	
AT TIME FRESH CONCRETE IS SAMPLED; FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE	X		2
INSPECTION OF THE CONCRETE AND/OR SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES	X		
INSPECTION FOR MAINTENANCE OF SPECIFIED CURING TEMPERATURES AND TECHNIQUES		X	
VERIFICATION OF IN-SITU CONCRETE STRENGTH, PRIOR TO STRESSING OF TENDONS IN POST-TENSIONED CONCRETE AND PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAMS AND STRUCTURAL SLABS		X	
INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED		X	
INSPECTION OF CONCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES		X	
VERIFY REINFORCING STEEL WELDING PER "STEEL CONSTRUCTION OTHER THAN STRUCTURAL STEEL" (IBC TABLE 1705.2.2)			3

COMMENTS:
1. SPECIFIC REQUIREMENTS FOR SPECIAL INSPECTION SHALL BE DESCRIBED IN THE RESEARCH REPORT FOR THE ANCHOR ISSUED BY AN APPROVED SOURCE (ICC, IAPMO, ECT.) PER ACI 355.2
2. FOR PROJECT WHERE MORE THAN 50 CUBIC YARDS OF A CLASS OF CONCRETE WILL BE USED, A SAMPLE OF STRENGTH TESTS FOR EACH CLASS OF CONCRETE SHALL BE TAKEN ONCE EACH SHIFT BUT NOT LESS THEN ONE SAMPLE FOR EACH 150 CUBIC YARDS OR 5000 SQUARE FEET OF WALL OR SLAB, WITH A PROJECT MINIMUM OF FIVE SAMPLES TAKEN IN ACCORDANCE WITH ASTM C172
3. SEE ADDITIONAL REQUIREMENTS ON THIS SHEET

STRUCTURAL STEEL CONSTRUCTION (IBC 1705.2/AISC 360 CHAPTER N)

VERIFICATION AND INSPECTION TASK	INSPECTION: CONTINUOUS	PERIODIC	COMMENTS
VERIFY COMPLIANCE WITH THE DETAILS SHOWN ON THE CONSTRUCTION DOCUMENTS SUCH AS BRACES, STIFFENERS, MEMBER LOCATIONS AND PROPER APPLICATION OF JOINT DETAIL AT EACH CONNECTION		X	
PERFORM INSPECTIONS PER "STRUCTURAL STEEL ELEMENTS OF COMPOSITE CONSTRUCTION", IF APPLICABLE			1
PERFORM INSPECTIONS PER "STRUCTURAL STEEL CONSTRUCTION: WELDING" REQUIREMENTS AND TESTING PER "NDT OF WELDED JOINTS", IF APPLICABLE			1
PERFORM INSPECTIONS PER "STRUCTURAL STEEL CONSTRUCTION: BOLTING" REQUIREMENTS AND TESTING PER "NDT OF BOLTED JOINTS", IF APPLICABLE			1

COMMENTS:
1. SEE ADDITIONAL REQUIREMENTS ON THIS SHEET

STRUCTURAL STEEL CONSTRUCTION: WELDING (AISC 360 CHAPTER N)

VERIFICATION AND INSPECTION TASK	INSPECTION: CONTINUOUS	PERIODIC	COMMENTS
INSPECTION TASKS PRIOR TO WELDING (AISC 360 TABLE N5.4-1)			
WELDING PROCEDURE SPECIFICATIONS (WPSs) AVAILABLE	X		
MANUFACTURE CERTIFICATIONS FOR WELDING CONSUMABLES AVAILABLE	X		
MATERIAL IDENTIFICATION (TYPE/GRADE)		X	
WELDER IDENTIFICATION SYSTEM		X	
FIT-UP OF GROOVE WELDS (INCLUDING JOINT GEOMETRY) • JOINT PREPARATION • DIMENSIONS (ALIGNMENT, ROOT OPENING, ROOT FACE, BEVEL) • CLEANLINESS (CONDITION OF STEEL SURFACES) • TACKING (TACK WELD QUALITY AND LOCATION) • BACKING TYPE AND FIT (IF APPLICABLE)		X	
CONFIGURATION AND FINISH OF ACCESS HOLES		X	
FIT-UP OF FILLET WELDS • DIMENSIONS (ALIGNMENT, GAPS AT ROOT) • CLEANLINESS (CONDITION OF STEEL SURFACES) • TACKING (TACK WELD QUALITY AND LOCATION)		X	
INSPECTION TASKS DURING WELDING (AISC 360 TABLE N5.4-2)			
USE OF QUALIFIED WELDERS		X	
CONTROL AND HANDLING OF WELDING CONSUMABLES • PACKING • EXPOSURE CONTROL		X	
NO WELDING OVER CRACKED TACK WELDS		X	
ENVIRONMENTAL CONDITIONS • WIND SPEED WITHIN LIMITS • PRECIPITATION AND TEMPERATURE		X	
WPS FOLLOWED • SETTINGS ON WELDING EQUIPMENT AND TRAVEL SPEED • SELECTED WELDING MATERIALS AND SHIELDING GAS TYPE/FLOW RATE • PREHEAT APPLIED AND INTERPASS TEMPERATURE MAINTAINED (MIN./MAX.) • PROPER POSITION (F, V, H, OH)		X	
WELDING TECHNIQUES • INTERPASS AND FINAL CLEANING • EACH PASS WITHIN PROFILE LIMITS AND MEETS QUALITY REQUIREMENTS		X	
INSPECTION TASKS AFTER WELDING (AISC 360 TABLE N5.4-3)			
WELDS CLEANED		X	
SIZE, LENGTH AND LOCATION OF WELDS	X		
WELDS MEET VISUAL ACCEPTANCE CRITERIA • CRACK PROHIBITION AND WELD/BASE-METAL FUSION • CRATER CROSS SECTION • WELD PROFILE AND WELD SIZE • UNDERCUT AND POROSITY	X		1
ARC STRIKES	X		
K-AREA	X		2
BACKING AND WELD TABS REMOVED (IF REQUIRED)	X		1
PLACEMENT OF REINFORCING OR CONTOURING FILLET WELDS (IF REQUIRED)	X		1
REPAIR ACTIVITIES	X		1

COMMENTS:
1. IF MEMBERS ARE IDENTIFIED AS PART OF THE SFRS AND/OR WELDS ARE IDENTIFIED AS DEMAND CRITICAL, DOCUMENTATION BY THE SPECIAL INSPECTOR SHALL BE PREPARED INDICATING THE WORK HAS BEEN PREFORMED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
2. IF WELDS HAVE BEEN PREFORMED IN THE K-AREA, VISUALLY INSPECT THE WEB K-AREA FOR CRACKS WITHIN 3" OF THE WELD.

NDT OF WELDED JOINTS

1. VISUAL INSPECTION SHALL BE THE PRIMARY METHOD OF NDT. WHERE REQUIRED, ULTRASONIC TESTING (UT), MAGNETIC PARTICLE TESTING (MT), PENETRATE TESTING (PT) AND RADIOGRAPH TESTING (RT) SHALL BE PREFORMED IN ACCORDANCE WITH AWS D1.1/D1.1M
2. COMPLETE JOINT PENETRATION (CJP) GROOVE WELD NDT
   - 2.1. UT TESTING SHALL BE PREFORMED ON 10% OF COMPLETE JOINT PENETRATION (CJP) WELDS
     - 2.1.1. CJP WELDS IN MATERIAL 5/16" OR LESS ARE EXEMPTED FROM NDT TESTING
3. ACCESS HOLE NDT
   - 3.1. THERMALLY CUT SURFACES OF ACCESS HOLES SHALL BE TESTED USING MT OR PT WHEN FLANGE OR WEB THICKNESS EXCEEDS 2", ANY CRACKING SHALL BE DEEMED UNACCEPTABLE
4. RATE OF UT TESTING
   - 4.1. THE RATE OF UT TESTING MAY BE INCREASED OR DECREASED BY THE EOR AND AHJ IN ACCORDANCE WITH AISC 360 SECTION N5e AND N5f
5. DOCUMENTATION OF NDT
   - 5.1. ALL NDT PREFORMED SHALL BE DOCUMENTED AND IDENTIFY THE TESTED WELD BY THE MEMBER PIECE MARK AND LOCATION IN THE PIECE
   - 5.2. WHEN A WELD IS REJECTED ON THE BASIS OF NDT, THE DOCUMENTATION SHALL INDICATE THE LOCATION OF THE DEFECT AND THE BASIS OF REJECTION

SEISMIC RESISTANCE (IBC 1705.11)

VERIFICATION AND INSPECTION TASK	INSPECTION: CONTINUOUS	PERIODIC	COMMENTS
STRUCTURAL STEEL (AISC 341 CHAPTER J)			
WELDING OF THE SFRS HAS BEEN ACCOMPLISHED IN ACCORDANCE WITH "STRUCTURAL STEEL CONSTRUCTION: WELDING" (AISC 360 CHAPTER N) AND TESTING HAS BEEN ACCOMPLISHED PER "NDT OF WELDED JOINTS IN SFRS" IN SDC C, D, E, OR F		X	1, 8
BOLTING OF THE SFRS HAS BEEN ACCOMPLISHED IN ACCORDANCE WITH "STRUCTURAL STEEL CONSTRUCTION: BOLTING" (AISC 360 CHAPTER N) AND TESTING HAS BEEN ACCOMPLISHED PER "NDT OF BOLTED JOINTS IN SFRS" IN SDC C, D, E, OR F		X	1, 8
VERIFY THE CONTOUR AND FINISH AND DIMENSIONAL TOLERANCES OF REDUCED BEAM SECTIONS (RBS), IF APPLICABLE		X	1
NO HOLES OR UNAPPROVED ATTACHMENTS HAVE BEEN MADE TO THE PROTECTED ZONE OF THE SFRS, IF APPLICABLE		X	1
DESIGNATED SEISMIC SYSTEM (IBC 1705.11.4)			
VERIFY LABELING, ANCHORAGE OR MOUNTING CONFORMS TO THE CERTIFICATE OF COMPLIANCE		X	0
ARCHITECTURAL COMPONENTS (IBC 1705.11.5)			
VERIFY TYPE, ATTACHMENT AND CONNECTIONS OF; EXTERIOR CLADDING, INTERIOR AND EXTERIOR NON-BEARING WALLS AND INTERIOR AND EXTERIOR VENEER IN SDC D, E, OR F		X	4, 7
ACCESS FLOORS ANCHORAGE IN SDC D, E, OR F		X	
MECHANICAL AND ELECTRICAL COMPONENTS (IBC 1705.11.6)			
ANCHORAGE OF ELECTRICAL EQUIPMENT FOR EMERGENCY AND STANDBY POWER IN SDC C, D, E, OR F		X	7
ANCHORAGE OF ELECTRICAL EQUIPMENT, NOT FOR EMERGENCY AND STANDBY POWER, IN STRUCTURES ASSIGNED TO SDC D, E OR F		X	5, 7
INSTALLATION AND ANCHORAGE OF PIPING SYSTEMS OR DUCTWORK DESIGNED TO CARRY HAZARDOUS MATERIAL AND ASSOCIATED MECHANICAL EQUIPMENT IN SDC C, D, E, OR F		X	6, 7
INSTALLATION AND ANCHORAGE OF PIPING SYSTEMS OR DUCTWORK NOT CARRYING HAZARDOUS MATERIAL AND ASSOCIATED MECHANICAL EQUIPMENT IN SDC D, E, OR F		X	5, 6, 7
INSTALLATION AND ANCHORAGE OF VIBRATION ISOLATING SYSTEMS WHERE A NOMINAL CLEARANCE OF 1/4" OR LESS BETWEEN THE EQUIPMENT AND THE SUPPORT FRAME IS SPECIFIED IN SDC C, D, E, OR F		X	7

COMMENTS:
1. DOCUMENTATION BY THE SPECIAL INSPECTOR SHALL BE PREPARED INDICATING THE WORK HAS BEEN PREFORMED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS
2. NOT REQUIRED FOR ANY COMPONENTS OF THE SFRS WHERE THE FASTENER SPACING IS GREATER THAN 4" O.C.
3. NOT REQUIRED FOR ANY COMPONENTS OF THE SFRS SYSTEM WHERE THE SHEATHING IS GYPSUM OR FIBERBOARD OR WHERE THE SHEATHING IS WOOD AND THE FASTENER SPACING IS GREATER THAN 4" O.C.
4. SPECIAL INSPECTION IS NOT REQUIRED FOR WALLS 30'-0" TALL OR LESS, OR CLADDING/VENEER WEIGHING 5 PSF OR LESS, OR FOR NONBEARING WALLS WEIGHING 15 PSF OR LESS
5. SPECIAL INSPECTION IS NOT REQUIRED IF THE COMPONENT IS POSITIVELY ATTACHED TO THE STRUCTURE, WEIGHS LESS THAN 400 LBS WITH A CENTER OF MASS LESS THAN 4'-0" FROM THE ADJACENT FLOOR (OR WEIGHS LESS THAN 20 LBS) AND FLEXIBLE CONNECTIONS ARE PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING OR CONDUIT (ASCE 7-10 13.1.4)
6. HAZARDOUS MATERIALS ARE TOXIC, HIGHLY TOXIC, OR EXPLOSIVE AND ARE SUFFICIENT TO POSE A THREAT TO THE PUBIC IF RELEASED AND OCCUR IN A QUANTITY EXCEEDING A THRESHOLD SET BY THE AHJ OR OCCUR IN A HAZARDOUS OCCUPANCY (ASCE 7-10 13.1.3)
7. THE MANUFACTURER OF ARCHITECTURAL, ELECTRICAL OR MECHANICAL COMPONENT(S) SHALL SUBMIT A MANUFACTURER'S CERTIFICATION DEMONSTRATING COMPLIANCE WITH ASCE 07-10 13.2 FOR REVIEW AND APPROVAL BY THE REGISTERED DESIGN PROFESSIONAL AND AHJ
8. SEE ADDITIONAL REQUIREMENTS ON THIS SHEET

NDT OF WELDED JOINTS IN SFRS

1. IN ADDITION TO THE NDT REQUIREMENTS OF WELDED JOINTS ON THIS SHEET, WELDS OF WELDED JOINTS IN SFRS SHALL BE IN ACCORDANCE WITH AWS D1.8/D1.8M AND AS FOLLOWS:
2. K-AREA NDT
   - 2.1. WELDING PREFORMED IN THE K-AREA SHALL BE TESTED FOR CRACKS USING MT IN THE K-AREA AND WITHIN 3" OF THE WELD NO SOONER THAN 48 HOURS AFTER WELDING
3. COMPLETE JOINT PENETRATION (CJP) GROOVE WELD NDT
   - 3.1. UT TESTING SHALL BE PREFORMED ON 100% OF COMPLETE JOINT PENETRATION (CJP) WELDS
     - 3.1.1. CJP WELDS IN MATERIAL 5/16" OR LESS ARE EXEMPTED FROM NDT TESTING
   - 3.2. MT SHALL BE PREFORMED ON 25% OF BEAM TO COLUMN CJP GROOVE WELDS
   - 3.3. FOR ORDINARY MOMENT FRAMES, UT AND MT OF CJP GROOVE WELDS ARE REQUIRED FOR DEMAND CRITICAL WELDS ONLY
   - 3.4. AT THE ENDS OF WELDS WHERE THE WELD TABS HAVE BEEN REMOVED, MT SHALL BE PREFORMED ON THE SAME BEAM TO COLUMN JOINT RECEIVING UT AS REQUIRED ABOVE
     - 3.4.1. MT OF CONTINUITY PLATE WELD TABS REMOVAL SITES IS NOT REQUIRED
4. BASE METAL NDT FOR LAMELLAR TEARING AND LAMINATION
   - 4.1. AFTER CJP, BASE METAL THICKER THAN 1 1/2" AND WHERE THE CONNECTED MATERIAL IS GREATER THAN 3/4" SHALL BE UT BEHIND AND ADJACENT TO THE FUSION LINE
     - 4.1.1. ANY BASE METAL DISCONTINUITIES FOUND WITH IN t/4 OF THE STEEL SURFACE SHALL BE ACCEPTED OR REJECTED ON THE BASES OF AWS D1.1/D1.1M TABLE 6.2 WHERE t IS THE THICKNESS OF THE PART SUBJECTED TO THE THROUGH-THICKNESS STRAIN
5. ACCESS HOLE AND BEAM COPE NDT
   - 5.1. AT WELDED SPLICES AND CONNECTIONS, THERMALLY CUT SURFACES OF BEAM COPES AND ACCESS HOLES SHALL BE TESTED USING MT OR PT WHEN FLANGE OR WEB THICKNESS EXCEEDS 1 1/2", ANY CRACKING SHALL BE DEEMED
6. REDUCED BEAM SECTION REPAIR NDT
   - 6.1. ANY WELDING OR GRINDING OPERATIONS IN THE VICINITY OF THE REDUCED BEAM SECTION SHALL BE VERIFIED WITH MT
7. RATE OF UT TESTING
   - 7.1. THE RATE OF UT TESTING MAY BE INCREASED OR DECREASED BY THE EOR AND AHJ IN ACCORDANCE WITH AISC 341 SECTION J6.2g AND J6.2h
8. DOCUMENTATION OF NDT
   - 8.1. ALL NDT PREFORMED SHALL BE DOCUMENTED AND IDENTIFY THE TESTED WELD BY THE MEMBER PIECE MARK AND LOCATION IN THE PIECE.
   - 8.2. WHEN A WELD IS REJECTED ON THE BASIS OF NDT, THE DOCUMENTATION SHALL INDICATE THE LOCATION OF THE DEFECT AND THE BASIS OF REJECTION

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
21-183223-000-00-FC

#	DATE	DESC.
0	06/12/20	PERMIT SET
1	12/09/20	CITY COMMENTS 2

REGISTERED PROFESSIONAL ENGINEER
19071
OREGON
MICHAEL L. MINNIS
EXPIRES: 12/31/20

LIVERMORE ARCHITECTURE & ENGINEERING, INC.
1500 SW First Ave. Suite 240
Portland, Oregon 97201
Phone: 503-892-3002
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Livermore
JOB NO: 219067.00

PDC BUILDING
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OR 97218

DRAWING TITLE:
SPECIAL INSPECTIONS

DRAWN BY: MGV
CHECKED BY: GML

S0.02

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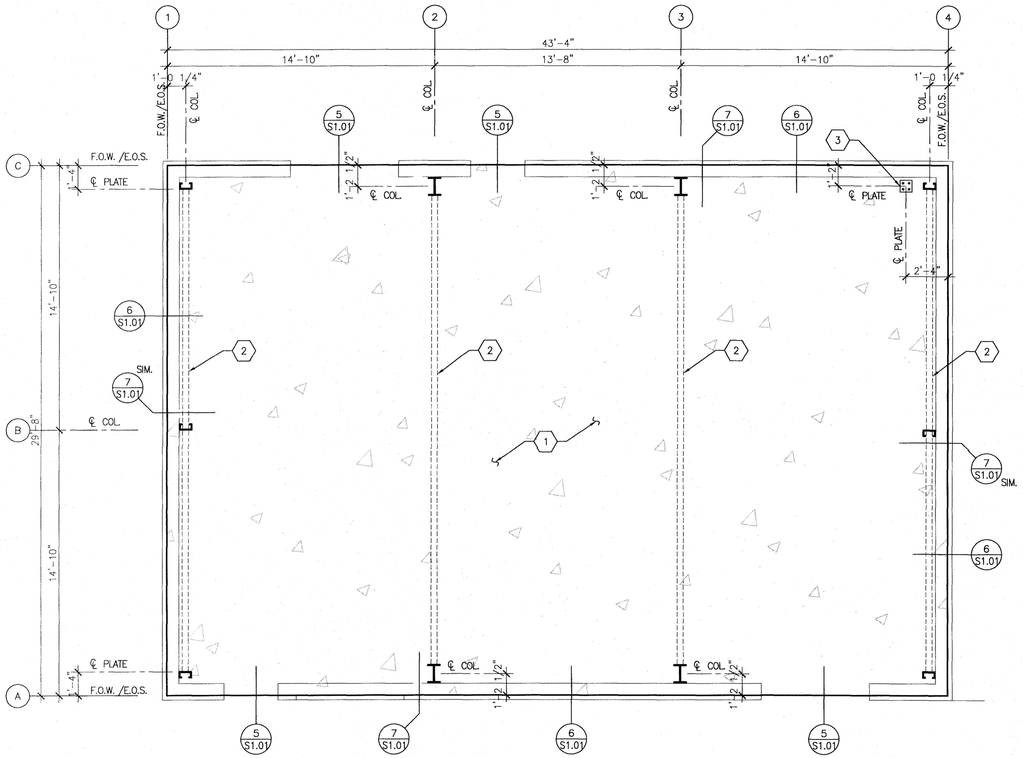


NOTE:
PRE-LOAD EXISTING SITE AREA FOR 600 PSF FUTURE LOADING AND AS PER REQUIREMENTS OF GEOTECHNICAL REPORT --SEE 1/S0.01.
AN INTERIM SOIL SPECIAL INSPECTION MEMORANDUM BY THE PROJECT GEOTECHNICAL ENGINEER REGARDING SATISFACTORY COMPLETION OF THE SURCHARGE WILL BE REQUIRED PRIOR TO CITY INSPECTOR APPROVAL OF THE FOUNDATION.

NORTH

1 S1.01 FOUNDATION PLAN

1/4" = 1'-0"

FOUNDATION NOTES

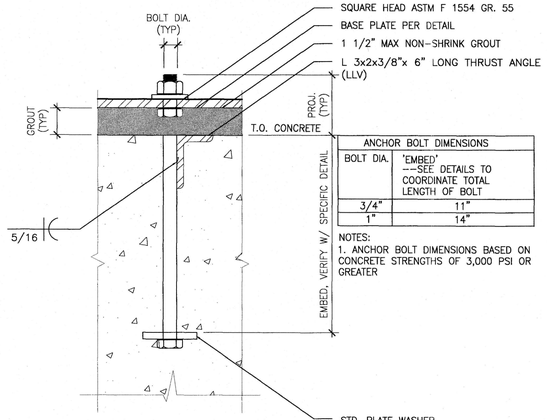
- SEE ARCHITECTURAL/MECHANICAL DRAWINGS FOR DRAINS, SLOPES, AND OTHER FLOOR DEPRESSIONS NOT SHOWN.
- SEE ARCHITECTURAL DRAWINGS FOR DIMENSIONS, ELEVATIONS AND WALLS NOT SHOWN.
- SEE SOILS REPORT FOR ALL FOUNDATION AND SLAB SUPPORT REQUIREMENTS. THIS IS TO INCLUDE ALL EXCAVATION & FILL REPLACEMENT REQUIREMENTS.
- ALL DETAIL CUTS TO BE CONSDERED SIIMILAR AT LIKE CONDITIONS, TYPICAL.
- SEE ARCHITECTURAL DRAWINGS FOR BOLLARD LOCATION AND ADDITIONAL INFORMATION

LEGEND

℄	CENTERLINE	═══	EXTERIOR P.E.M.B. WALL
F.F.	FINISH FLOOR	- - - - -	BRACE PER PRE-ENGINEERED METAL BUILDING MANUFACTURER
E.O.S.	EDGE OF SLAB		
F.O.W.	FACE OF WALL		

KEYNOTES

1. 24" CONCRETE MAT FOUNDATION ON 24" MEDIUM DENSE GRANULAR MATERIAL CONSISTING OF ON-SITE GRANULAR FILL OVERLYING THE SOFT OVERBANK DEPOSITS, IMPORTED STRUCTURAL FILL OR A COMBINATION THEREOF --SEE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS FOR SITE PREPARATION --SEE 8/S1.01 FOR SITE PRELOADING/SURCHARGE DETAIL PRIOR TO PLACEMENT OF NEW STRUCTURE
   --REINFORCE WITH #6 @ 10" O.C. TOP & BOTTOM, EACH WAY
2. (4) #5 CONTINUOUS IN SLAB TIES AT ALL PRE-ENGINEERED METAL BUILDING FRAME LINES -- SEE 3/S1.01
3. WINDBENT BASE PLATE WITH 1" DIA. ANCHOR BOLTS PER P.E.M.B. --SEE 2/S1.01

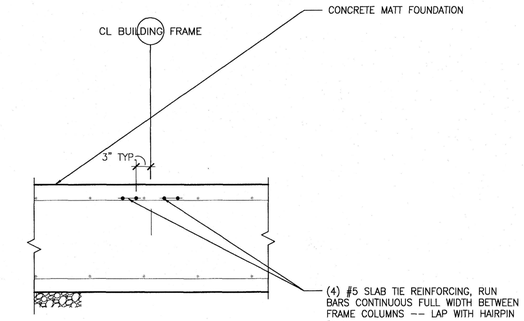


ANCHOR BOLT DIMENSIONS	
BOLT DIA.	'EMBED' --SEE DETAILS TO COORDINATE TOTAL LENGTH OF BOLT
3/4"	11"
1"	14"

NOTES:
1. ANCHOR BOLT DIMENSIONS BASED ON CONCRETE STRENGTHS OF 3,000 PSI OR GREATER

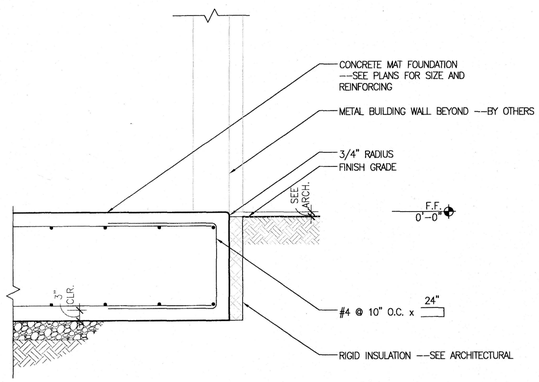
2 S1.01 ANCHOR BOLT DETAIL

3" = 1'-0"



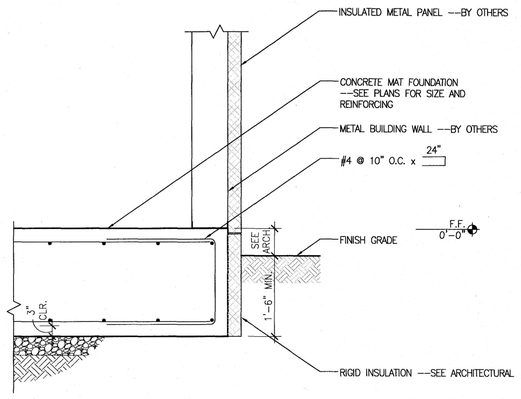
3 S1.01 SLAB TIE DETAIL

3/4" = 1'-0"



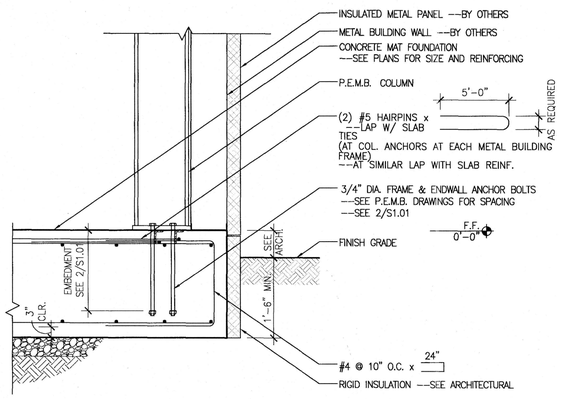
5 S1.01 PERIMETER BUILDING AT PERSONNEL DOOR

3/4" = 1'-0"



6 S1.01 PERIMETER BUILDING WALL

3/4" = 1'-0"



7 S1.01 PERIMETER COLUMN

3/4" = 1'-0"

City Of Portland

REVIEWED FOR CODE COMPLIANCE

Date: 04/08/21

Permit #: 20-160323-000-00-CO

#	DATE	DESC.
0	06/12/20	PERMIT SET
1	11/18/20	CITY COMMENTS
2	12/09/20	CITY COMMENTS 2

OREGON REGISTERED PROFESSIONAL ENGINEER 12/31/20 MICHAEL LIVERMORE

EXPIRES: 12/31/20

LIVERMORE ARCHITECTURE & ENGINEERING, INC.
1500 SW First Ave. Suite 240
Portland, Oregon 97201
Phone: 503-892-3002
www.livermorea.com

Livermore
JOB NO: 219067.00

PDC BUILDING
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OR 97218

DRAWING TITLE:
FOUNDATION PLAN AND DETAILS

DRAWN BY: MGV
CHECKED BY: GML

S1.01

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City Of Portland

REVIEWED FOR CODE COMPLIANCE

Date: 04/08/21

Permit #: 20-160323-000-00-CO

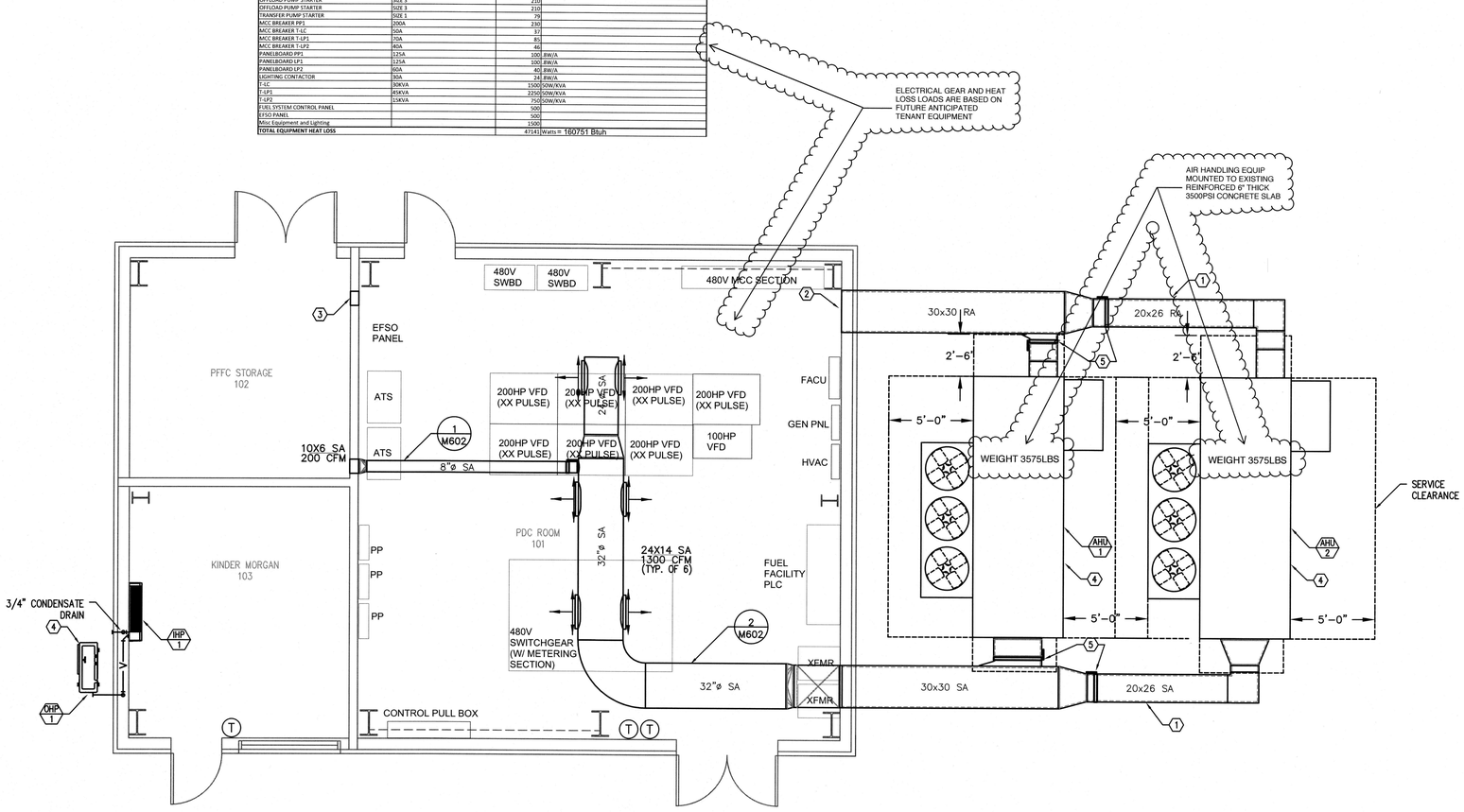
GENERAL NOTES

1. WORK SHALL COMPLY WITH CURRENT CODES AND STANDARDS.
2. COORDINATE INSTALLATION WITH OTHER TRADES.
3. VERIFY ALL EQUIPMENT LOCATIONS BEFORE BEGINNING WORK.
4. ALL DUCTWORK SHALL BE RIGID SHEET METAL.
5. ANGLE ALL SPIRAL DUCT MOUNTED DIFFUSERS AT 22.5°
6. PROVIDE BALANCING DAMPERS ON ALL SUPPLY OUTLETS.

KEY NOTES

1. PROVIDE EXTERNALLY INSULATED SA AND RA DUCT WITH R8 INSULATION AND WEATHERPROOF METAL JACKET
2. PROVIDE 30X30 RETURN AIR GRILLE 12" AFF
3. PROVIDE 10X6 TRANSFER GRILLE
4. ANCHOR EQUIPMENT TO CONCRETE PAD PER MANUFACTURERS RECOMMENDATION
5. PROVIDE MOTORIZED SUPPLY AND RETURN DAMPERS INTERLOCKED WITH UNITS SUPPLY FAN

Description	Size/Rating	HEAT LOSS Watts	NOTES
	(3) - 1200A		
Switchgear SW-1	(1) - 2000A	1980	
ATS-1	1200A	100	
ATS-2	1200A	100	
SWBD-1	1200A	350	
SWBD-2	1200A	350	
VFD-P1	18 PULSE DRIVE	5730	
VFD-P2	18 PULSE DRIVE	5730	
VFD-P3	18 PULSE DRIVE	5730	
VFD-P4	18 PULSE DRIVE	5730	
VFD-P5	18 PULSE DRIVE	5730	
VFD-P6	18 PULSE DRIVE	5730	
VFD-P7	18 PULSE DRIVE	0	MAXIMUM 6 PUMPS RUNNING
MCC			
MCC MAIN BREAKER 1	800A	650	
MCC MAIN BREAKER 2	800A	650	
HYDRANT CART TEST STARTER	SIZE 4	420	
OFFLOAD PUMP STARTER	SIZE 3	210	
OFFLOAD PUMP STARTER	SIZE 3	210	
TRANSFER PUMP STARTER	SIZE 1	79	
MCC BREAKER PP1	200A	230	
MCC BREAKER T-LC	50A	37	
MCC BREAKER T-LP1	70A	85	
MCC BREAKER T-LP2	40A	46	
PANELBOARD PP1	125A	100	.8W/A
PANELBOARD LP1	125A	100	.8W/A
PANELBOARD LP2	60A	40	.8W/A
LIGHTING CONTACTOR	30A	24	.8W/A
T-LC	30KVA	1500	50W/KVA
T-LP1	45KVA	2250	50W/KVA
T-LP2	15KVA	750	50W/KVA
FUEL SYSTEM CONTROL PANEL		500	
EFSO PANEL		500	
Misc Equipment and Lighting		1500	
TOTAL EQUIPMENT HEAT LOSS		47141	Watts = 160751 Btuh



1 M201 MECHANICAL FLOOR PLAN
SCALE: 1/4" = 1'-0"

6-22-2020
REGISTERED PROFESSIONAL ENGINEER
14,509
JULY 26, 1985
JAMES L. TORMEY JR.
EXPIRES: 30JUN22

JHK REV	8-20-20	SHOW HEAT LOAD	

Date: 6-22-2020
Proj No: 9891
Drawn By: BKG
Chkd By: JLT
DSGN By: BKG
Acad File: 9891

PDX PDC
JH KELLY
5000 NE MARINE DR
PORTLAND OREGON

MECHANICAL FLOOR PLAN

MFIA INC.
Consulting Engineers
2007 S.E. Ash St.
Portland, OR 97214
PHN: (503) 234-0548
FAX: (503) 234-0677
WWW.MFIA-ENG.COM

SHEET
M201
OF ●●●●

NUCOR BUILDING SYSTEMS
A DIVISION OF NUCOR CORPORATION

PROJECT NUMBER: U19H0787A
PROJECT NAME: PDX PDC Bldg
PROJECT LOCATION: Portal, OR
CUSTOMER: JH Kelly

MBMA MEMBER | CSSBI | CWB CERTIFIED CSA W47.1 | IAS ACCREDITED Metal Building Systems AC 472 | CWB CERTIFIED CSA A660

Notes and Specifications

Building Erection Notes

1) The general contractor and/or erector is responsible to safely and properly erect the metal building system in conformance with these drawings, OSHA requirements and metal building system in conformance with these drawings. OSHA requirements and either MBMA or CSA S16 standards pertaining to proper erection. This includes, but is not limited to, the correct use of temporary guys and bracing where needed for squaring, plumbing, and securing the structural and secondary framing. Secondary wall framing members (girts or bar joists) are not designed to function as a work platform or provide safety tie-off attachment in accordance with OSHA requirements. Secondary roof framing members (purlins or bar joists) are not designed to provide safety tie-off attachment in accordance with OSHA requirements.
2) A325 & A490 Bolt tightening requirements:
It is the responsibility of the erector to ensure proper bolt tightness in accordance with applicable regulations. See the RCSC Specification for Structural Joints Using A325 or A490 Bolts for more information.

The following criteria may be used to determine the bolt tightness (i.e., "snug-tight" or "fully-pretensioned"), unless required otherwise by local jurisdiction or contract requirements:
A) All A490 bolts shall be "fully-pretensioned".
B) All A325 bolts in primary framing (rigid frames and bracing) may be "snug-tight", except as follows:
"Fully-pretension" A325 bolts if:
a) Building supports a crane system with a capacity greater than 5 tons,
b) Building supports machinery that creates vibration, impact or stress-reversals on the connections. The Engineer-of-Record for the project should be consulted to evaluate for this condition,
c) The project site is located in a high seismic area. For IBC-based codes, "High Seismic Area" is defined as "Seismic Design Category" of "D", "E", or "F". See the "Building Loads" section of this page for the defined seismic design category for this project,
d) Any connection designated in these drawings as "A325-SC". "Slip-Critical (SC)" connections must be free of paint, oil, or other materials that reduce friction at contact surfaces. Galvanized or lightly rusted surfaces are acceptable.
C) In Canada, all A325 and A490 bolts shall be "fully pre-tensioned", except for secondary members (purlins, girts, opening framing, etc.) and flange braces.
D) Secondary members (purlins, girts, opening framing, etc.) and flange brace connections may always be "snug-tight", unless indicated otherwise in these drawings.
3) The metal building supplier shall be notified prior to any field modifications. Modifications shall be approved by the metal building supplier before work is undertaken.
4) Common Abbreviations:
a) TYP UNO - Typical Unless Noted Otherwise
b) SLV - Short Leg Vertical
c) LLV - Long Leg Vertical
d) NS & FS - Near Side and Far Side
e) O.A.L. - Overall Length
f) SIM - Similar
g) NIC - Not In Contract
h) SL - Steel Line
i) N/A - Not Applicable
j) MBS - Metal Building Supplier
5) Construction loads shall not be placed on any structural steel framework unless such framework is safely bolted, welded, or otherwise adequately secured.
6) Purlins and girts shall not be used as an anchorage point for a fall arrest system unless written approval is obtained from the metal building supplier.
7) Purlins may only be used as a walking/working surface when installing safety systems, after all permanent bridging has been installed and fall protection is provided.
8) Construction loads may be placed only within a zone that is within 8 feet of the center line of the primary support member. CFR bundles should be placed directly over the rigid frames.
9) All lifting devices must meet OSHA or MSHA standards and in no case is it acceptable to use structural members supplied by the MBS as a spreader bar or lifting device.

General Design Notes

1) All structural steel sections and welded plate members are designed in accordance with ANSI/AISC 360 "Specifications for Structural Steel Buildings" or the CAN/CSA S16 "Limit States Design of Steel Structures", as required by the specified building code.
2) All welding of structural steel is based on either AWS D1.1 "Structural Welding Code - Steel" or CAN/CSA W59 "Welded Steel Construction (Metal Arc Welding)", as required by the specified building code.
3) All cold formed members are designed in accordance with ANSI/AISI S100 or CAN/CSA S136 "Specifications for the Design of Cold Formed Steel Structural Members", as required by the specified building code.
4) All welding of cold formed steel is based on AWS D1.3 "Structural Welding Code - Sheet Steel" or CAN/CSA W59 "Welded Steel Construction (Metal Arc Welding)", as required by the specified building code.
5) This Metal Building Supplier facility is IAS AC-472 Accredited and CAN/CSA A660 and W47.1 Certified (if applicable) for the design and manufacturing of Metal Building Systems.
6) If joists are included with this project, they are supplied as a part of the systems engineered metal building and are fabricated in accordance with the requirements of Section 1926.758 of the OSHA safety standards for steel erection, dated January 18, 2001.

Material Specifications

Plate and Flange Material:	
5" - 12" Wide, to 1 1/4" Th.	A529 Grade 55
Others	A572 Grade 50
Built-Up Structural Web	A1011 SS (or HSLAS Class 1) Grade 55
Hot-Rolled Structural	A36 or A572 Grade 50 or A992 Grade 50
Structural Tube	A500 Grade B (46 KSI)
Structural Pipe	A500 Grade B (42 KSI)
Cold-Formed Structural	A1011 or A1039 SS (or HSLAS Class 1) or A653 Grade 55
Thru-Fastened Roof Panel	A792 Grade 80
Standing Seam Roof Panel	A792 Grade 50, Class 1
All Wall Panel Profiles	A653 Grade 80, Class 1 or A792 Grade 80, Class 1
Rod Bracing	A529 Grade 50
Welds	AWS D1.1/D1.3 or CSA W59 per Building Code
High-Strength Bolts	A325 Type 1 or A490 Type 1 Heavy Hex
Machine Bolts	A307 Grade A Hex

	YES	NO
PRIMARY AND SECONDARY STEEL PRIMER COLOR: GRAY		☐
ROOF SHEETING, TYPE: SS 24 GAUGE, FINISH: Polar White SP		
ROOF PANEL CLIP TYPE: Toll Fixed		
THERMAL BLOCKS: Yes EPS FOAM SPACER: No		
COMPOSITE CFR DECK, TYPE: N/A GAUGE, FINISH:		
ROOF LINE TRIM, PAINTED: Undefined color B		
EXTERIOR WALL SHEETING, TYPE: BY OTHERS GAUGE, FINISH:		
EXTERIOR WALL CORNER TRIM FINISH: BY OTHERS		
EXTERIOR BASE TRIM, PAINTED: BY OTHERS		
FRAMED OPENING TRIM, PAINTED: BY OTHERS		☐
WALL FRAMED OPENING, SIZES: FSW (1) 6'-0" x 4'-0", sill at 3'-0"; (1) 6'-4" x 9'-2"		
BSW none		
LEW none		
REW none		☐
INTERIOR WALL SHEETING, TYPE: CL 26 GAUGE, FINISH: Undefined color H		
INTERIOR CEILING LINER, TYPE: none GAUGE, FINISH:		
INTERIOR WALL TRIM, PAINTED: Undefined color I		
DOWNSPOUTS PAINTED: Undefined color G GUTTERS PAINTED: Undefined color B	☒	☐
WALKDOORS, QUANTITY: (2) 3070; (1) 6070 PAINTED: WHITE	☒	☐
WINDOWS: PAINTED:	☐	☒
INSULATION (NOT BY MBS), ROOF: 6 INCH WALLS: INCH	☒	☐
CRANES (SEE CRANE PLAN FOR ADDITIONAL CRANE INFORMATION)	☐	☒
MEZZANINE (SEE MEZZANINE PLAN FOR ADDITIONAL MEZZANINE INFO)	☐	☒
WALL TRANSLUCENT PANELS:	☐	☒
ROOF TRANSLUCENT PANELS:	☐	☒
INSULATED PANELS YES ☐ NO ☐		
PIPE JACKS, SIZE: QUANTITY:	☐	☒
ROOF FRAMED OPENINGS, SEE ROOF FRAMING PLAN FOR SIZES	☐	☒
RIDGE VENTS, 10'-0" LONG X 9" THROAT. QUANTITY:	☐	☒

	YES	NO
FASCIA, PROJECTION: TOP OF FASCIA HEIGHT:	☐	☒
FACE PANEL, TYPE: GAUGE, FINISH:		
BACK PANEL, TYPE: GAUGE, FINISH:		
CAP TRIM PAINTED: BASE TRIM PAINTED:		
CLOSED SYSTEM, CLEAR UNDER SOFFIT TRIM:	☐	
SOFFIT PANEL, TYPE: GAUGE, FINISH:		
SOFFIT TRIM AT BUILDING LINE PAINTED:		
OPEN SYSTEM, (NO SOFFIT PANEL PROVIDED)	☐	
CLEAR UNDER FASCIA:		
PARAPET SYSTEM	☒	
STRUCTURAL PARAPET ☐ NON-STRUCTURAL PARAPET	☐	
TOP OF PARAPET HEIGHT:		
BACKER PANEL, TYPE: GAUGE, FINISH:		
CANOPY, PROJECTION:	☒	
AT EAVE LINE ☐ BELOW EAVE ☐		
ROOF PANEL, TYPE: GAUGE, FINISH:		
SOFFIT PANEL, TYPE: GAUGE, FINISH:		
SOFFIT TRIM AT BUILDING LINE PAINTED:		
CLEAR UNDER CANOPY BEAM:		
EAVE EXTENSION, PROJECTION:	☒	
SOFFIT PANEL, TYPE: GAUGE, FINISH:		
SOFFIT TRIM AT BUILDING LINE PAINTED:		
RAKE EXTENSION, PROJECTION:	☒	
SOFFIT PANEL, TYPE: GAUGE, FINISH:		
SOFFIT TRIM AT BUILDING LINE PAINTED:		
PARTITION WALL SHEETING	☒	
PANEL TYPE: GAUGE, FINISH:		
PARTITION WALL TRIM COLOR:		
WAINSCOT	☒	
WALL PANEL, TYPE: GAUGE, FINISH:		
BASE TRIM PAINTED: JAMB TRIM PAINTED:		
TRANSITION TRIM PAINTED:		

FOR OCCUPANCY (RISK) CATEGORY I OR II, IBC PROVISIONS INDICATE THAT SINGLE-STORY BUILDINGS SHALL HAVE "NO DRIFT LIMIT" PROVIDED THAT INTERIOR WALLS, PARTITIONS, CEILINGS, AND EXTERIOR WALL SYSTEMS HAVE BEEN DESIGNED TO ACCOMMODATE THE SEISMIC STORY DRIFTS. INTERIOR WALLS, PARTITIONS, CEILINGS, OR EXTERIOR WALL SYSTEMS NOT PROVIDED BY THE METAL BUILDING MANUFACTURER SHALL BE DESIGNED AND DETAILED BY OTHERS TO ACCOMMODATE THE SEISMIC STORY DRIFTS. SEISMIC DRIFT VALUES MAY BE OBTAINED FROM THE METAL BUILDING MANUFACTURER.

THIS BUILDING SYSTEM DESIGN IS BASED ON UNIFORMLY APPLYING THE CONTRACT-SPECIFIED LIVE LOAD AND ROOF SNOW LOAD. IN ADDITION, THE DESIGN IS BASED ON APPLYING A CODE-DEFINED LIVE LOAD (INCLUDING APPLICABLE REDUCTIONS) AND A CODE-DEFINED SNOW LOAD (BASED ON CONTRACT-SPECIFIED GROUND SNOW) FOR ALL PARTIAL LOADING AND UNBALANCED SNOW LOAD CONDITIONS.

THE WALL SYSTEM BY OTHERS MUST WEIGH NO MORE THAN 3 PSF.

THE PROJECT "ENGINEER OF RECORD" (EOR), NOT THE METAL BUILDING MANUFACTURER, IS RESPONSIBLE FOR ASSURING THAT THE WALL SHEETING NOT PROVIDED BY THE METAL BUILDING MANUFACTURER IS DESIGNED TO SAFELY WITHSTAND ALL CODE REQUIRED LOADINGS ASSOCIATED WITH THE GIRT SPACING PROVIDED. ALL TRIM AND FLASHING FOR THE WALLS NOT PROVIDED BY THE METAL BUILDING MANUFACTURER ARE TO BE PROVIDED BY OTHERS.

2 UPDATE SEISMIC VALUES. REVIEW DRAWINGS IN FULL FOR CHANGES.

ERECTOR NOTE:
ALTERNATE FASTENERS HAVE BEEN SUBSTITUTED ON THIS BUILDING. 1 1/2" ROOF FASTENERS HAVE BEEN SUPPLIED FOR ROOF PANEL TO PURLIN ATTACHMENT. WHERE DRAWINGS INDICATE AN H103D STRUCTURAL FASTENER, H1D35 FASTENERS HAVE BEEN SUPPLIED.

BUILDING LOADS

DESIGN CODE: OSSC 19
ROOF LIVE LOAD: 20.00 PSF MBMA OCC. CLASS: III
LIVE LOAD REDUCIBLE Yes
GROUND SNOW LOAD: 11.0 PSF SNOW EXP. FACTOR, Ce: 1.0000
SNOW IMPORTANCE FACTOR, Is: 1.10
100 YEAR RAINFALL INTENSITY (IN/HR): 1.500
WIND: 135 / 105 MPH (Vult) / (Vasd)
C & C PRESSURES (PSF): 40 / -53
EXPOSURE: C
UL 90 NO
Classic Roof-Const. No.161 ; Classic Roof w/ Translucent Panel-Const. No.167 CFR Roof-Const. No.552 ; CFR Roof w/ Translucent Panel-Const. No.590 ; Composite CFR Roof-Const. No.552A ; VR16 II Roof-Const. No.332 .
SEISMIC INFORMATION Ss: 0.847 S1: 0.376
Design Sds/Sd1: 0.734 / 0.626 Site Class: E
Seismic Imp. Factor: 1.25 Seismic Design Category: D
Analysis Procedure: Equivalent Lateral Force Method
Basic SFRS: Ordinary Steel Moment Frames & Ordinary Steel Conc. - Braced Frames

NOTES:
1) COLLATERAL DEAD LOADS, UNLESS OTHERWISE NOTED, ARE ASSUMED TO BE UNIFORMLY DISTRIBUTED. WHEN SUSPENDED SPRINKLER SYSTEMS, LIGHTING, HVAC EQUIPMENT, CEILINGS, ETC., ARE SUSPENDED FROM ROOF MEMBERS, CONSULT THE M.B.S. IF THESE CONCENTRATED LOADS EXCEED 500 POUNDS (USING THE WEB MOUNT DETAIL) OR 200 POUNDS (USING THE FLANGE MOUNT DETAIL), OR IF INDIVIDUAL MEMBERS ARE LOADED SIGNIFICANTLY MORE THAN OTHERS.
2) THE DESIGN OF STRUCTURAL MEMBERS SUPPORTING GRAVITY LOADS IS CONTROLLED BY THE MORE CRITICAL EFFECT OF ROOF LIVE LOAD OR ROOF SNOW LOAD, AS DETERMINED BY THE APPLICABLE CODE.
3) Pm IS BASED ON THE MINIMUM ROOF SNOW LOAD CALCULATED PER BUILDING CODE OR THE CONTRACT SPECIFIED SNOW LOAD, WHICHEVER IS GREATER. THIS VALUE, Pm, IS ONLY APPLIED IN COMBINATION WITH THE DEAD AND COLLATERAL LOADS. ROOF SNOW IN OTHER LOADING CONDITIONS IS DETERMINED PER THE SPECIFIED BUILDING CODE.

	BUILDING
ROOF DEAD (PSF):	3.75
PRI. COL. (PSF):	3.00
SEC. COL. (PSF):	3.00
SNOW Ct:	1.00
SNOW Cs:	1.00
ROOF SNOW Ps (PSF):	8.47
ROOF SNOW Pm (PSF):	25.00
WIND ENCLOSURE:	Closed
GCp:	+/-0.18
SEISMIC R:	3.25
SEISMIC Cs:	0.234
BASE SHEAR (KIPS):	5.06

ERECTION MANUALS REQUIRED

(ERECTION MANUALS ARE SHIPPED WITH THE BUILDING IN A WAREHOUSE PACKING CRATE)

☒ CFR ROOF	☒ H970D OR ☐ H8260	☐ SINGLE CURB (H985D)
☐ CLASSIC ROOF	☐ H942D OR ☐ H8201	☐ DOUBLE CURB (H9800)
☐ WALL SHEETING	☐ H943D OR ☐ H8300	☐ VR16 II (H9925)

DRAWING INDEX

COVERSHEET C1, C2, C3
ANCHOR BOLT DRAWINGS F1, F2
COLUMN BASE REACTIONS F2
STRUCTURAL/SHEETING DRAWINGS E1, E2, E3, E4, E5, E6, E7, E8, E9
DETAILS D1, D2, D3, D4, D5, D6, D7, D8, D9, D10

For Building Dept. Review	MBS	KJM	DSC	CLE	05/19/19	
Approval Drawings	MBS	KJM	DSC	CLE	05/19/19	
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	06/26/20	
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	06/29/20	
Plan Check Review	MBS	COB	KDB	CLE	01/19/21	
Rev. 2 Anchor Bolt Plan	MBS	COB	KDB	CLE	03/19/21	
Rev. 2 Building Dept. Review	MBS	COB	KDB	CLE	03/23/21	

NUCOR BUILDING SYSTEMS
300 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1000, 200 WESTSTONE RD, SPARTA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 PLAYA DEL TORO, TORRELL, TX 75160
PHONE: (972) 807-7000 FAX: 75160
1050 WATERY LANE, BRIGHAM CITY, UT, 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: PDX PDC BLDG
2000 NE AIRPORT WAY, PORTAL, OR
CUSTOMER NAME: JH KELLY
CITY: TROUTDALE/GRESHAM/TROUTDALE, WA
JOB NUMBER: U19H0787A
SHEET TITLE:

03/26/2021
OREGON SEPT 11, 2018 CURTIS L EAR
EXPIRATION DATE: 12-31-2021

It is a set of papers only to the materials listed and is supplied by Nucor Corporation. This drawing is for the use of the client named herein and for the specific building listed herein. It should not be used on any other building. The sale or use of this drawing in any form without the permission of Nucor Corporation, expressed or implied, to anyone other than the client named herein is prohibited. Nucor Corporation will retain all common law, statutory and other reserved rights, including the copyright thereto.

SHEET C1 of 3

CITY INFORMATION AND DIRECTIVES

Soil Special Inspection is Required

For the Following:

☐ Grading & Site Preparation	☑ Fill Placement & Compaction
☑ Shallow Foundation Subgrade Preparation	☐ Deep Foundations
☐ Soil Anchors	☐ Mech. Stabilized Earth Walls
☐ Rockery Retaining Walls	☐ Temporary Cut Slopes
☐ Settlement / Movement Monitoring	☐ Private St. Subgrade, Base, and Asphaltic Concrete
☐ FEMA Elevation Certificate	☐ Ground Improvement (Rammed Aggregate Piers)

☑ Other: Surcharge installation, settlement, and duration

Soil Special Inspection by the Geotechnical Engineer is required during construction in accordance with Portland City Code (PCC) Title 24.20 and OSSC 1705.6.

PCC 24.20.030 General Duties of the Special Inspector.

(Amended by Ordinance No. 188647, effective November 17, 2017.)

A. The Special Inspector shall observe the work assigned for conformance with the approved construction documents.

B. The Special Inspector shall keep records of inspections and shall furnish inspection reports to the Director, the Registered Design Professional, as that term is defined in Chapter 2 of the Oregon Structural Code. All discrepancies shall be brought to the immediate attention of the contractor for correction, then, if uncorrected, to the Director.

C. The Special Inspector/Inspection Agency shall submit a final signed summary report stating whether the work requiring special inspection was, to the best of their knowledge, in conformance with the approved plans and specifications and the applicable workmanship provisions in the State Building Code.

#	DATE	DESC.

PDC BUILDING
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OR 97218

DRAWING TITLE:

DRAWN BY:
CHECKED BY:

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NUCOR BUILDING SYSTEMS
A DIVISION OF NUCOR CORPORATION

PROJECT NUMBER: U19H0787A
PROJECT NAME: PDX PDC Bldg
PROJECT LOCATION: Portal, OR
CUSTOMER: JH Kelly

MBMA MEMBER
IAS ACCREDITED Metal Building Systems AC 472
CSSBI
CWB CERTIFIED CSA W47.1
CWB CERTIFIED CSA A660

For Building Dept. Review	MBS	KJM	DSC	CLE	09/19/19
Approval Drawings	MBS	KJM	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	06/29/20
Plan Check Review	MBS	COB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	COB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	COB	KDB	CLE	03/23/21

STRUCTURAL TESTS AND INSPECTION:

1) THE SPECIAL INSPECTOR'S DUTIES ARE AS DESCRIBED IN SPECIAL INSPECTION. THE SPECIAL INSPECTOR'S DUTIES ARE AS DESCRIBED IN IBC 1704.3 AND IBC 1705
2) ALL TESTS AND INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT TESTING AND INSPECTION AGENCY EMPLOYED BY THE OWNER OR ARCHITECT.
3) THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE TEST AND INSPECTION FIRM WITH A SCHEDULE TO FACILITATE THE PROPER COORDINATION OF WORK.
4) PORTIONS OF WORK REQUIRING SPECIAL INSPECTION:

AGENCY RESPONSIBLE FOR INSPECTION AND TESTING TO BE NAMED BY OWNER LATER.

	YES	NO	N/A
A. STRUCTURAL STEEL:			
1. MILL REPORTS AND IDENTIFICATION OF STEEL (AFFIDAVIT OF COMPLIANCE)	☐	■	☐
2. SAMPLING AND TESTING OF SPECIMENS	☐	■	☐
B. WELDING:			
1. ALL STRUCTURAL WELDING (INCLUDES DECKING AND WELDED STUDS), EXCEPT WELDING IN APPROVED SHOPS PER IBC 1704.2.2	■	☐	☐
2. ULTRASONIC TESTING OF FULL PENETRATION WELD CONNECTIONS AT MOMENT FRAMES, BRACED FRAMES, BEAM SPLICES, AND FIELD WELDS.	☐	■	☐
3. STRUCTURAL LIGHT GAGE METAL FRAME WELDING	☐	■	☐
C. BOLTING:			
1. HIGH STRENGTH BOLT A325SC AND A490SC (PRETENSION VERIFICATION)	■	☐	☐
2. HIGH STRENGTH BOLT A325N AND A490X (PER COVER SHEET NOTES)	■	☐	☐
3. EXPANSION/ADHESIVE ANCHORS IN CONCRETE OR MASONRY	■	☐	☐

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1000 WESTAR LANE, CORPUS CHRISTI, TX 78407
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR
CUSTOMER NAME: KELLY
DNGVIEW, WA
NUMBER: 9H0787A
SHEET TITLE

[redacted]

03/26/2021
OREGON SEPT 11, 2018 CURTIS L. FAIR
EXPIRATION DATE: 12-31-2021

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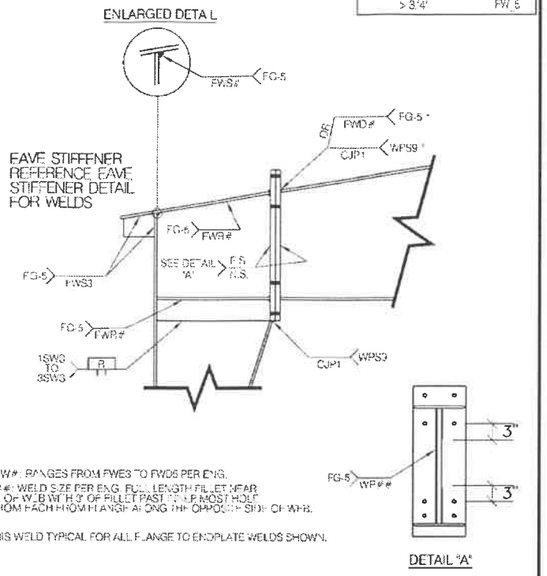
SHEET C2 of 3

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/09/21
Permit #: 20-[redacted]-CO

STANDARD WELDS AND LEGEND

Thickest Mat. Joined	Weld
≤ 1/2"	FW_3
< 3/4"	FW_4
> 3/4"	FW_5



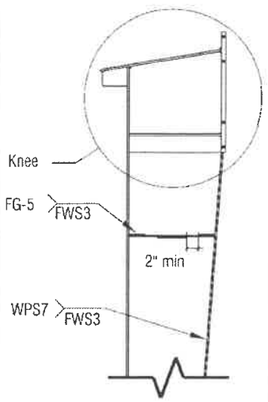
W##: RANGES FROM FWE3 "TO FW06 PER ENG.
WP## WELD SIZE PER E.G. FULL LENGTH FILLET NEAR SIDE OF W.B WITH TOE OF FILLET PAST THE NEAREST HOLE IN FROM EACH FLANGE ALONG THE OPPOSITE SIDE OF WEB.

* THIS WELD TYPICAL FOR ALL FLANGE TO ENDPLATE WELDS SHOWN.

Perpendicular Knee Column

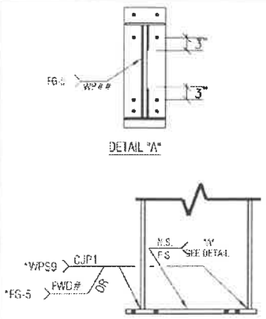
See Weld Standard sheet for WPS description

Thickest Mat. Joined	Weld
≤ 1/2"	FW_3
< 3/4"	FW_4
>3/4"	FW_5



Typical Column

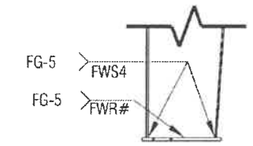
See Weld Standard sheet for WPS description



TYP. FIXED BASE DETAIL

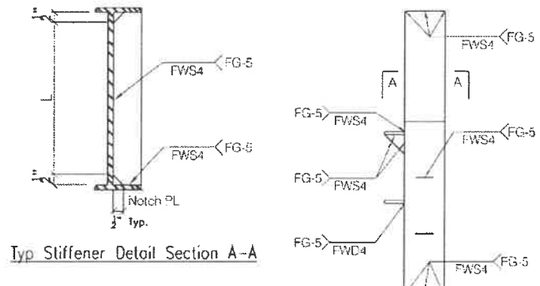
See Weld Standard sheet for WPS description

Base plate extension and anchor bolt locations may vary.



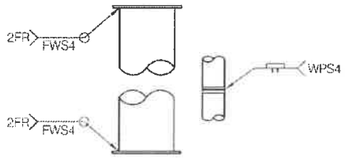
TYP. PINNED BASE DETAIL

See Weld Standard sheet for WPS description

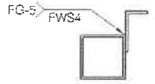


Typ Stiffener Detail Section A-A

Structural Column



Pipe or Tube Column



Tube Bracket

Structural Details

See Weld Standard sheet for WPS description

FWS$ - FILLET WELD, ONE SIDE

$	FILLET LEG
3	3/16"
4	1/4"
5	5/16"

NEAR SIDE WELD: FWS# $

"A" SIDE WELD: FWS2 $

FWD$ - FILLET WELD, BOTH SIDES

$	FILLET LEG
3	3/16"
4	1/4"
5	5/16"

FWD$ OR FWD# $ $

FWR - Full length fillet on near side with 1"(Max. D/5 or 3") fillet return at both ends on opposite side of plate

$	FILLET LEG
3	3/16"
4	1/4"
5	5/16"

FWR$ OR FWR# $ $ 1"(Max.D/5 or 3")

WP1$ - Full length fillet on near side of web with 3" of fillet past inner mast hole in from each flange along the opposite side of web.

$	FILLET LEG
3	3/16"
4	1/4"
5	5/16"

WP1$ OR WP1# $ $ 3" FROM INNER MAST HOLE TO END OF FILLET WELD

CJP1 - COMPLETE JOINT PENETRATION, SINGLE BEVEL WELD

NEAR SIDE WELD: CJP1, BACK GOUGE, 45°

FAR SIDE WELD: CJP1, BACK GOUGE, 45°

CJP1 OR CJP2 BEVEL SIDE

PURLIN / GIRT / CHANNEL

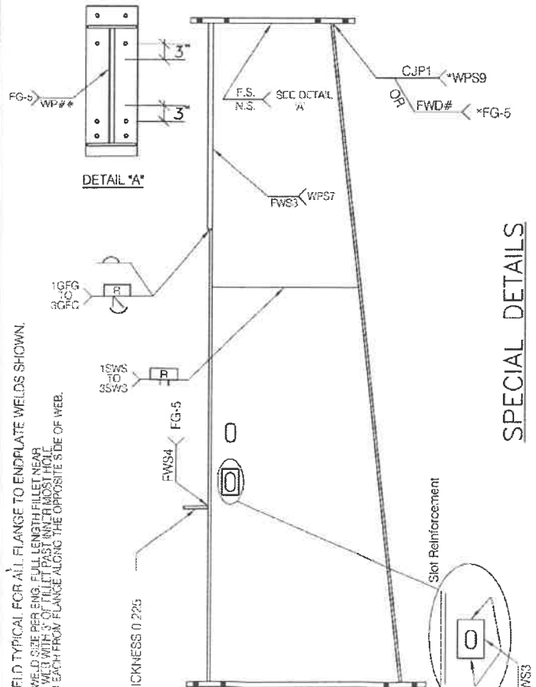
QTY — (2) 08C060 — SHAPE

SIZE — THICKNESS X 1000

EAVE STRUT

QTY — (2) 8E2075 — SHAPE SLOPE

SIZE — THICKNESS X 1000

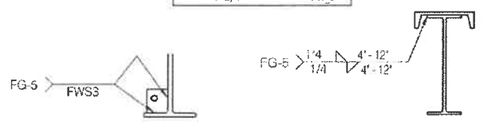


* THIS WELD TYPICAL FOR ALL FLANGE TO ENDPLATE WELDS SHOWN.
W## = WELD SIZE PER ENG. FULL LENGTH FILLET NEAR SIDE OF W.B WITH TOE OF FILLET PAST THE NEAREST HOLE IN FROM EACH FLANGE ALONG THE OPPOSITE SIDE OF WEB.

SPECIAL DETAILS

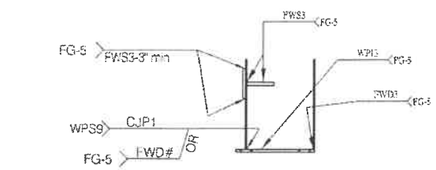
See Weld Standard sheet for WPS description

Thickest Mat. Joined	Weld
≤ 1/2"	FW_3
< 3/4"	FW_4
> 3/4"	FW_5

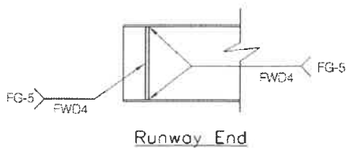


Typ. Flange Brace Clip

Runway Beam



Interior Wide Flange Fixed Base Plate Crane Stop



Runway End

SPECIAL DETAILS

See Weld Standard sheet for WPS description

WPS #	Description	Weld Code	Process	Preq	Position	Limitation	Plant Location UT	IN	SC	TX
FG-4	⅜" & 7/16" multi-pass fillet weld	AWS D1.1:10	GMAW (P) multi-pass fillet weld	PQR	1G	⅜" - 7/16"	X	X	X	X
FG-5	⅜" & 7/16" single-pass fillet weld	AWS D1.1:10	GMAW (P) single-pass fillet weld	PQR	2F	⅜" - 1-½"	X	X	X	X
1GFG	¾" through 1" flange splice	AWS D1.1:10	GMAW (P) 1" flange splice	PQR	1G	¾" - 1"	X	X	X	X
2GFG	¾" flange splice	AWS D1.1:10	GMAW (P) ¾" flange splice	PQR	1G	¾" - 7/16"	X	X	X	X
3GFG	¾" to 1" flange splice	AWS D1.1:10	GMAW (P) ¾" to 1" flange splice	PQR	1G-2F	Groove 1/2" Fillet 5/8"	X	X	X	X
2036	¾" to 1" flange splice	AWS D1.1:10	GMAW (P) ¾" to 1" flange splice	PQR	1G-2F	Groove 3/16" Fillet 5/8"	X	X	X	X
5GFG	1" flange splice	AWS D1.1:10	GMAW (P) 1" flange splice	PQR	1G-2F	Groove 1"	X	X	X	X
1SWS	web splice for 0.225" through 0.313" thick	AWS D1.1:10	SAW (P) 0.225-0.313" Web splice	PQR	1G	0.225 - 0.313	X	X	X	X
2SWS	web splice for 0.156" through 0.150" thick	AWS D1.1:10	SAW (P) 0.156-0.150" Web splice	PQR	1G	0.156 - 0.150	X	X	X	X
3SWS	web splice for 0.175" through 0.250" thick	AWS D1.1:10	SAW (P) 0.175-0.250" Web splice	PQR	1G	0.175 - 0.250	X	X	X	X
2038	web splice for 0.375" through 0.500" thick	AWS D1.1:10	SAW (P) 0.375-0.500" Web splice	PQR	1G	0.375 - 0.500	X	X	X	X
2FR	plate to endplate weld	AWS D1.1:10	GMAW (P) plate to endplate weld	PQR	2F ROTATED	6" thru 1"	X	X	X	X
FBG-1	Rod to plate/angle weld	AWS D1.1:10	GMAW (P) Rod to Plate Weld	PQR	1G	Diameter 1-¼" & ¾" - 1-½"	X	X	X	X
WPS4	pipe splice for 0.134 through 0.375" thick	AWS D1.1:10	GMAW (P) Pipe Splice 0.134" - 0.375"	YES	1G ROTATED	Diameter 6-10"	X	X	X	X
WPS5	pipe splice for 0.375" through 0.500" thick	AWS D1.1:10	GMAW (P) Pipe Splice 0.375" - 0.500"	YES	1G ROTATED	Diameter 8-10"	X	X	X	X
WPS6	weld - flange beam splice, all sizes	AWS D1.1:10	GMAW (P) Flange Splice Weld	YES	1G	0.313 - .50	X	X	X	X
WPS7	flange to web weld made by allowable to 0.062" @ fillet/node	AWS D1.1:10	SAW (P) Allowable Weld	YES	2F	0.125 - .00	X	X	X	X
WPS8	flange to web weld made by allowable using 0.062" @ fillet/node	AWS D1.1:10	SAW (P) Allowable Weld	YES	2F	0.175 - .00	X	X	X	X
WPS9	complete penetration groove weld for tee connection ¾" thick	AWS D1.1:10	GMAW (P) flange to web weld	YES	1G	0.375 - .00	X	X	X	X
WPS11	vertical tack-fillets	AWS D1.1:10	GMAW (P) tack fillet welds	YES	2F	0.125 - Unlimited	X	X	X	X
WPS-1	Cold-Form seam stitch weld	AWS D1.3:08	Gas/Air (CF) seam weld	PQR	FLAT	0.0329 - 0.210	X	X	X	X
WPS-1a	Cold-Form seam stitch weld (galvanized)	AWS D1.3:08	GMAW (CF) seam weld galvanized	PQR	FLAT	0.0329 - 0.210	X	X	X	X
WPS-2	Cold-Form seam weld (galvanized)	AWS D1.3:08	GMAW (CF) seam weld	PQR	HORIZ.	t1=0.0329" - 0.210"	X	X	X	X
WPS-2a	Cold-Form seam weld to support steel ≤ 0.313" thick (galvanized)	AWS D1.3:08	GMAW (CF) seam weld to support steel	PQR	HORIZ.	t1=0.06-.5 - 0.313"	X	X	X	X
WPS-3	cold-formed seam weld to support steel ≤ 0.313" thick (galvanized)	AWS D1.3:08	GMAW (CF) seam weld to support steel	PQR	HORIZ.	t1=0.0329" - 0.313" t2 ≥ 0.0329"	X	X	X	X
WPS-3a	cold-formed seam weld to support steel ≤ 0.313" thick (galvanized)	AWS D1.3:08	GMAW (CF) seam weld to support steel (galvanized)	PQR	HORIZ.	t1=0.0329" - 0.313" p ≥ 0.375"	X	X	X	X
WPS-4	cold-formed tee connection fillet weld	AWS D1.3:08	GMAW (CF) tee fillet welds	PQR	HORIZ.	t1=0.0329" - 0.313"	X	X	X	X
WPS-4a	cold-formed tee connection fillet weld (galvanized)	AWS D1.3:08	GMAW (CF) tee fillet welds galvanized	PQR	HORIZ.	t1=0.0329" - 0.313"	X	X	X	X
WPS-5	cold-formed tee connection fillet weld to support steel ≤ 0.313" thick	AWS D1.3:08	GMAW (CF) tee fillet to support steel	PQR	HORIZ.	t1=0.0329" - 0.313" t2 ≥ 0.0329"	X	X	X	X
WPS-5a	cold-formed tee connection fillet weld to support steel ≤ 0.313" thick (galvanized)	AWS D1.3:08	GMAW (CF) tee fillet to support steel (galvanized)	PQR	HORIZ.	t1=0.0329" - 0.313" t2 ≥ 0.0329"	X	X	X	X
WPS-6	cold-formed lap fillet weld	AWS D1.3:08	GMAW (CF) lap fillet welds	PQR	HORIZ.	t1=0.0329" - 0.313"	X	X	X	X
WPS-6a	cold-formed lap fillet weld (galvanized)	AWS D1.3:08	GMAW (CF) lap fillet welds galvanized	PQR	HORIZ.	t1=0.0329" - 0.313"	X	X	X	X
WPS-7	cold-formed lap fillet weld to support steel ≤ 0.313" thick	AWS D1.3:08	GMAW (CF) lap fillet to support steel	PQR	HORIZ.	t1=0.0329" - 0.313" t2 ≥ 0.0329"	X	X	X	X
WPS-7a	cold-formed lap fillet weld to support steel ≤ 0.313" thick (galvanized)	AWS D1.3:08	GMAW (CF) lap fillet to support steel (galvanized)	PQR	HORIZ.	t1=0.0329" - 0.313" t2 ≥ 0.0329"	X	X	X	X

Rev	By	Chk	Date
For Building Dept. Review	MBS	KJM	05/19/19
Approval Drawings	MBS	KJM	05/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	06/29/20
Plan Check Review	MBS	COB	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	COB	03/19/21
Rev. 2 Building Dept. Review	MBS	COB	03/23/21

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PROJECT NAME: X PDC BLDG
000 NE AIRPORT WAY, PORTAL, OR
OWNER NAME: KELLY
DNGVIEW, WA
NUMBER: 9H0787A
SHEET TITLE:

03/26/2021
SEPT. 11, 2018
CURTIS L. EAS
EXPIRATION DATE: 12-31-2021

SHEET: C3 of 3

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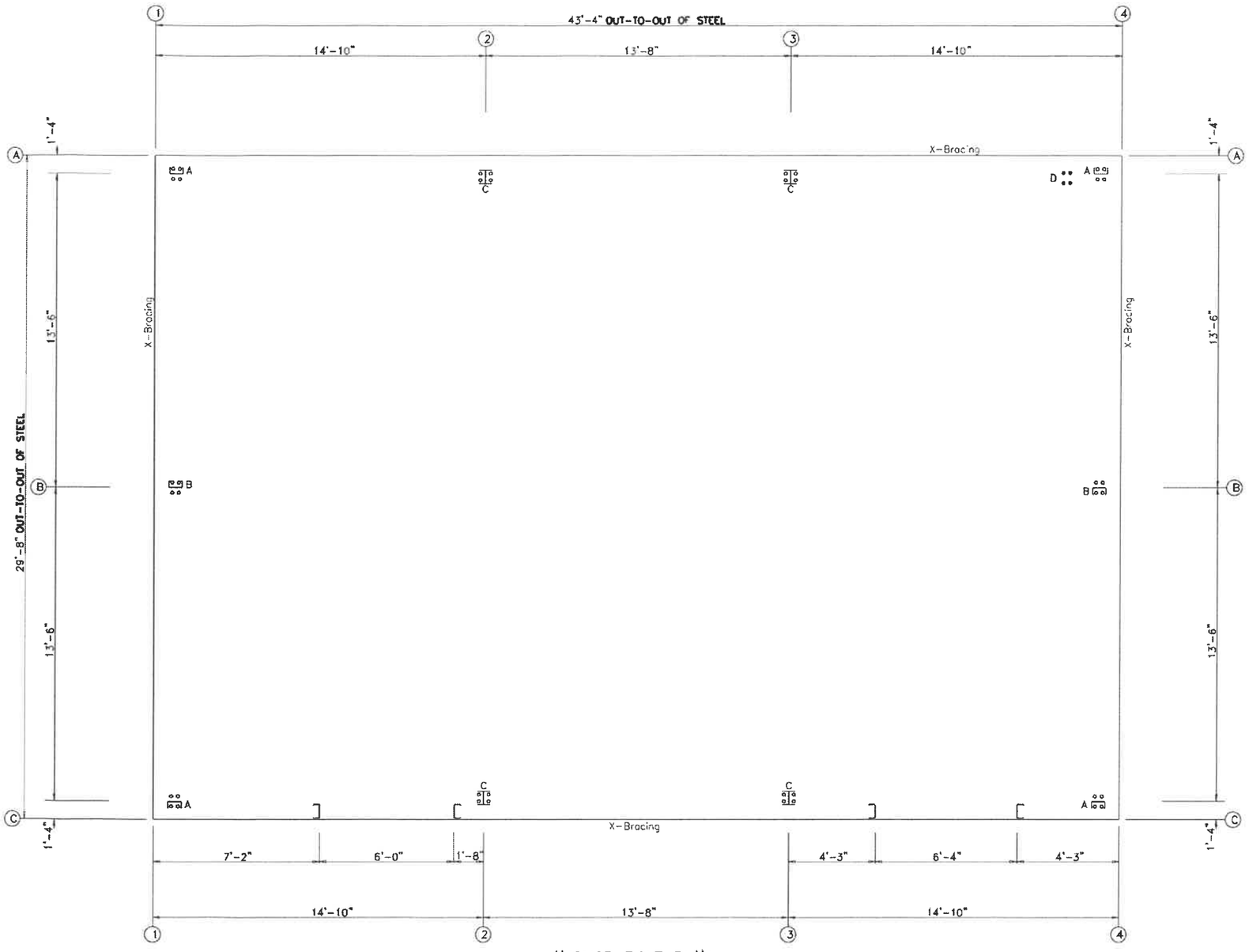

ANCHOR BOLT PLAN
NOTE: All Base Plates @ 100'-0" (U.N.O.)

○ Dia= 3/4"
⊗ Dia= 1"

ANCHOR BOLT SUMMARY

	Qty	Locale	Dia (in)	Type	Proj (in)
○	24	Endwall	3/4"	F1554	3.00
○	16	Frame	3/4"	F1554	3.00
⊗	4	WindBent	1"	F1554	3.00

ANCHOR BOLT PLAN

GENERAL NOTES

1. THE SPECIFIED ANCHOR ROD DIAMETER ASSUMES F1554 GRADE 55 UNLESS NOTED OTHERWISE. ANCHOR ROD MATERIAL OF EQUAL DIAMETER MEETING OR EXCEEDING THE STRENGTH REQUIREMENTS SET FORTH ON THESE DRAWINGS MAY BE UTILIZED AT THE DISCRETION OF THE FOUNDATION DESIGN ENGINEER. ANCHOR ROD EMBEDMENT LENGTH SHALL BE DETERMINED BY THE FOUNDATION DESIGN ENGINEER.
2. METAL BUILDING MANUFACTURER IS NOT RESPONSIBLE FOR PROJECT FOUNDATION DESIGN. THE FOUNDATION DESIGN IS THE RESPONSIBILITY OF A REGISTERED PROFESSIONAL ENGINEER, FAMILIAR WITH LOCAL SITE CONDITIONS.
3. ALL ANCHOR RODS, FLAT WASHERS FOR ANCHOR RODS, EXPANSION BOLTS, AS WELL AS ALL CONCRETE/MASONRY EMBEDMENT PLATES ARE NOT BY METAL BUILDING MANUFACTURER.
4. THIS DRAWING IS NOT TO SCALE.
5. FINISHED FLOOR ELEVATION = 100'-0" UNLESS NOTED OTHERWISE.
6. "SINGLE" CEE COLUMNS SHALL BE ORIENTED WITH THE "TOES" TOWARD THE LOW EAVE UNLESS NOTED OTHERWISE.
7. ANCHOR RODS ARE REQUIRED ONLY IN THE QUANTITIES SPECIFIED. BASEPLATES MAY BE FABRICATED WITH MORE HOLES THAN NEEDED FOR THIS PROJECT.
8. THE ANCHOR BOLT LOCATIONS PROVIDED BY METAL BUILDING MANUFACTURER SATISFY PERTINENT REQUIREMENTS FOR THE DESIGN OF THE MATERIALS SUPPLIED BY THE METAL BUILDING MANUFACTURER. PLEASE NOTE THAT THESE REQUIREMENTS MAY NOT SATISFY ALL ANCHOR BOLT CONCRETE EDGE DISTANCE REQUIREMENTS DEPENDING ON THE DETAILS OF THE FOUNDATION DESIGN. BECAUSE FOUNDATION DESIGN IS NOT WITHIN THE METAL BUILDING MANUFACTURER'S SCOPE OF WORK, IT IS THE RESPONSIBILITY OF THE QUALIFIED PROFESSIONAL DESIGNING THE FOUNDATION TO MAKE CERTAIN THAT SUFFICIENT CONCRETE EDGE DISTANCE IS PROVIDED FOR THE ANCHOR BOLTS IN THE DETAILS OF THE FOUNDATION DESIGN.

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	KJM	09/19/19
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Rev. 1 Building Dept. Review	MBS	KJM	06/29/20
Plan Check Review	MBS	COB	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	COB	03/19/21
Rev. 2 Building Dept. Review	MBS	COB	03/23/21

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UNDULE C NAME: X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR
MER NAME: KELLY
DNGVIEW, WA
NUMBER: H07787A
SHEET TITLE

03/26/2021
OREGON
SEPT 11, 2018
CURTIS L. EARL
EXPIRATION DATE: 12-31-2021

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit # 20180201-000-00-CO

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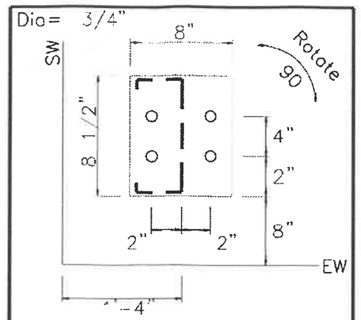
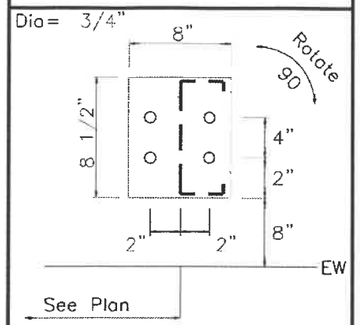
SHEET
F1 of 2



DETAIL A



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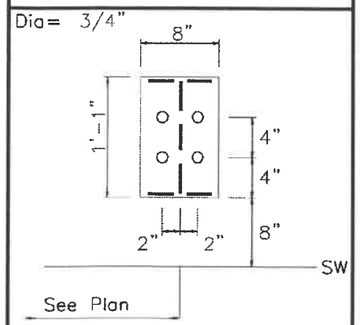

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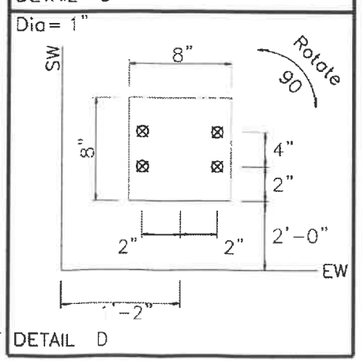
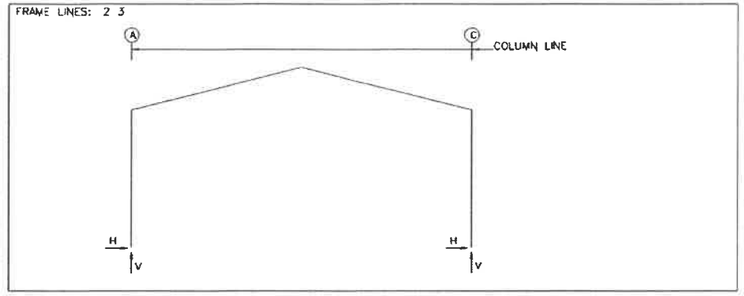


DETAIL D



RIGID FRAME: ANCHOR BOLTS & BASE PLATES

Frm Line	Col Line	Anc. Bolt Qty	Anc. Bolt Dia	Base Plate (in) Width	Base Plate (in) Length	Base Plate (in) Thick	Elev. (in)
2*	A	4	0.750	6.000	13.00	0.375	0.0
2*	C	4	0.750	6.000	13.00	0.375	0.0

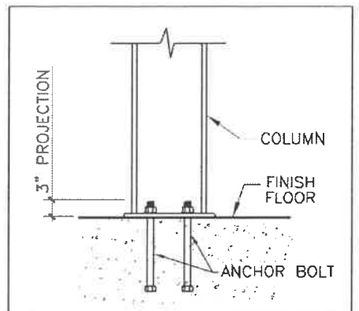
2* Frome lines: 2 3

ENDWALL COLUMN: ANCHOR BOLTS & BASE PLATES

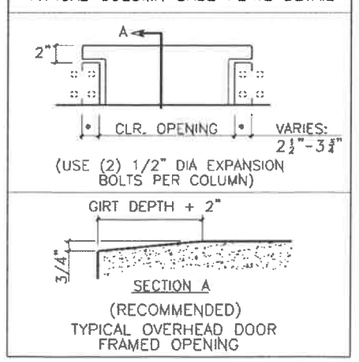
Frm Line	Col Line	Anc. Bolt Qty	Anc. Bolt Dia	Base Plate (in) Width	Base Plate (in) Length	Base Plate (in) Thick	Elev. (in)
1	A	4	0.750	6.000	8.500	0.375	0.0
1	B	4	0.750	6.000	8.500	0.375	0.0
1	C	4	0.750	6.000	8.500	0.375	0.0
4	C	4	0.750	6.000	8.500	0.375	0.0
4	B	4	0.750	6.000	8.500	0.375	0.0
4	A	4	0.750	6.000	8.500	0.375	0.0

BUILDING BRACING REACTIONS

Wall Loc	Wall Line	Col Line	± Reactions(k) Wind Horz	Wind Vert	Seismic Horz	Seismic Vert	Panel Shear (lb/ft) Wind	Seis
L_EW	1	A,B	1.5	1.5	1.2	1.2		
F_SW	C	2,3	2.7	2.0	2.7	1.9		
R_EW	4	B,A	1.5	1.5	1.2	1.2		
B_SW	A	4,3	2.7	1.8	2.7	1.8		



TYPICAL COLUMN BASE PLATE DETAIL



RIGID FRAME: BASIC COLUMN REACTIONS (k)

Frome Line	Column Line	Dead Horiz	Dead Vert	Collateral Horiz	Collateral Vert	Live Horiz	Live Vert	Snow Horiz	Snow Vert	Wind_Left1 Horiz	Wind_Left1 Vert	Wind_Right1 Horiz	Wind_Right1 Vert
2*	A	0.3	1.2	0.2	0.7	1.0	3.4	0.5	1.9	-3.5	-7.0	1.2	-4.1
2*	C	-0.3	1.2	-0.2	0.7	-1.0	3.4	-0.5	1.9	-1.2	-4.1	3.5	-7.0

Frome Line	Column Line	Wind_Left2 Horiz	Wind_Left2 Vert	Wind_Right2 Horiz	Wind_Right2 Vert	Wind_Long1 Horiz	Wind_Long1 Vert	Wind_Long2 Horiz	Wind_Long2 Vert	Seismic_Left Horiz	Seismic_Left Vert	Seismic_Right Horiz	Seismic_Right Vert
2*	A	-3.8	-4.3	0.8	-1.4	0.7	-5.7	0.1	-5.0	-1.0	-0.8	1.0	0.8
2*	C	-0.8	-1.4	3.8	-4.3	-0.1	-5.0	-0.7	-5.7	-1.0	0.8	1.0	-0.8

Frome Line	Column Line	MIN_SNOW Horiz	MIN_SNOW Vert	F1UNB_SL_L Horiz	F1UNB_SL_L Vert	F1UNB_SL_R Horiz	F1UNB_SL_R Vert
2*	A	1.6	5.5	0.5	2.0	0.5	1.2
2*	C	-1.6	5.5	-0.5	1.2	-0.5	2.0

2* Frome lines: 2 3

ENDWALL COLUMN: BASIC COLUMN REACTIONS (k)

Frm Line	Col Line	Dead Vert	Collat Vert	Live Vert	Snow Vert	Wind Left1 Vert	Wind Right1 Vert	Wind Left2 Vert	Wind Right2 Horz	Wind Press Horz	Wind Suct Horz	Wind Long1 Vert	Wind Long2 Vert
1	A	0.3	0.2	1.3	0.5	-2.4	-1.6	-1.4	-0.6	-1.1	1.2	-2.7	-1.8
1	B	0.6	0.4	2.4	1.0	-3.4	-3.8	-2.3	-2.7	-4.3	4.7	-2.9	-2.8
1	C	0.3	0.2	1.3	0.5	-2.0	-2.4	-1.0	-1.4	-1.1	1.2	-1.8	-2.8

Frm Line	Col Line	Seis Left Vert	Seis Right Vert	MIN_SNOW Horz	MIN_SNOW Vert	E1UNB_SL_L Horz	E1UNB_SL_L Vert	E1UNB_SL_R Horz	E1UNB_SL_R Vert
1	A	0.1	0.3	0.0	1.6	0.0	0.6	0.0	0.2
1	B	0.0	-0.4	0.0	3.0	0.0	1.0	0.0	1.0
1	C	-0.1	0.1	0.0	1.6	0.0	0.2	0.0	0.6

Frm Line	Col Line	Dead Vert	Collat Vert	Live Vert	Snow Vert	Wind Left1 Vert	Wind Right1 Vert	Wind Left2 Vert	Wind Right2 Vert	Wind Press Horz	Wind Suct Horz	Wind Long1 Vert	Wind Long2 Vert
4	C	0.3	0.2	1.3	0.5	-2.4	-2.0	-1.4	-1.0	-1.1	1.2	-2.8	-1.8
4	B	0.6	0.4	2.4	1.0	-3.8	-3.4	-2.7	-2.3	-4.3	4.7	-2.8	-2.9
4	A	0.3	0.2	1.3	0.5	-1.6	-2.4	-0.6	-1.4	-1.1	1.2	-1.8	-2.7

Frm Line	Col Line	Seis Left Vert	Seis Right Vert	MIN_SNOW Horz	MIN_SNOW Vert	E2UNB_SL_L Horz	E2UNB_SL_L Vert	E2UNB_SL_R Horz	E2UNB_SL_R Vert
4	C	0.1	-0.1	0.0	1.6	0.0	0.6	0.0	0.2
4	B	-0.4	0.0	0.0	3.0	0.0	1.0	0.0	1.0
4	A	0.3	0.1	0.0	1.6	0.0	0.2	0.0	0.6

GENERAL NOTES

1. ALL LOADING CONDITIONS ARE EXAMINED. THE MAXIMUM AND MINIMUM HORIZONTAL (H) AND VERTICAL (V) REACTIONS AND THE CORRESPONDING VERTICAL (V) OR HORIZONTAL (H) REACTIONS ARE REPORTED.
2. REACTIONS ARE PROVIDED BY LOAD CASE IN ORDER TO AID THE FOUNDATION ENGINEER IN DETERMINING THE APPROPRIATE LOAD FACTORS AND COMBINATIONS TO BE USED WITH EITHER WORKING STRESS OR ULTIMATE STRENGTH DESIGN METHODS. WIND LOAD CASES ARE GIVEN FOR EACH PRIMARY WIND DIRECTION.
3. FOR ASCE7-10 AND LATER BASED BUILDING CODES, THE UNFACTORED LOAD CASE REACTIONS DUE TO WIND ARE GENERATED USING THE ULTIMATE DESIGN WIND SPEED (Vult).
4. POSITIVE (+) REACTIONS ARE AS SHOWN ABOVE. FOUNDATION LOADS ARE IN OPPOSITE DIRECTIONS.
5. BRACING REACTIONS ARE IN THE PLANE OF THE BRACE WITH THE HORIZONTAL REACTION (H) ACTING AWAY FROM THE BRACED BAY AND THE VERTICAL REACTION (V) ACTING DOWNWARD.

****** RIGID FRAME LOAD CASE ABBREVIATIONS: ******
Wind_L1/Wind_R1: LATERAL WIND FROM THE LEFT/RIGHT, CASE 1
Wind_L2/Wind_R2: LATERAL WIND FROM THE LEFT/RIGHT, CASE 2
Wind_Ln1/Wind_Ln2: LONGITUDINAL WIND, CASE 1/2
Seismic_L/Seismic_R: LATERAL SEISMIC LOAD FROM LEFT/RIGHT
LWIND#_L#E/LWIND#_R#E: LONGITUDINAL WIND EDGE ZONES
F#UNB_SL_L/F#UNB_SL_R: UNBALANCED ROOF SNOW WITH WIND FROM LEFT/RIGHT
F#PAT_LL #/F#PAT_SL #: PARTIAL LIVE/SNOW LOADING FOR CONTINUOUS BEAM SYSTEMS

****** ENDWALL COLUMN LOAD CASE ABBREVIATIONS: ******
Collat: COLLATERAL LOAD
Rafter Wind_L/Rafter Wind_R: LATERAL WIND FROM THE LEFT/RIGHT
Brace Wind_L/Brace Wind_R: LATERAL WIND FROM THE LEFT/RIGHT
Wind_P/Wind_S: LONGITUDINAL WIND PRESSURE/SUCTION ON COLUMNS
Wind_Ln: LONGITUDINAL WIND SUCTION ON ROOF
Seis_L/Seis_R: LATERAL SEISMIC LOAD FROM LEFT/RIGHT
E#UNB_SL_L/E#UNB_SL_R: UNBALANCED ROOF SNOW WITH WIND FROM LEFT/RIGHT
E#PAT_LL #/E#PAT_SL #: PARTIAL LIVE/SNOW LOADING FOR CONTINUOUS BEAM SYSTEMS

FOUNDATION DESIGN NOTES:

1. THE ORIENTATION OF THE ANCHOR BOLT DETAILS SHOWN ON THIS PAGE MAY NOT COINCIDE WITH THE ACTUAL COLUMN ORIENTATION SHOWN ON THE ANCHOR BOLT DRAWING. PLEASE REFERENCE THE SIDEWALL (SW) AND ENDWALL (EW) STEEL LINES SHOWN ON THE ANCHOR BOLT DETAILS WITH THE ANCHOR BOLT PLAN DURING LAYOUT OF COLUMN AND ANCHOR BOLT LOCATIONS.
2. COLUMN BASE PLATES MAY HAVE MORE HOLES THAN ARE REQUIRED DUE TO PRODUCTION LIMITATIONS. PLEASE FOLLOW ANCHOR BOLT DETAILS FOR QUANTITY OF ANCHOR BOLTS REQUIRED. EXTRA BASE PLATE HOLES DO NOT NEED INFILLED PER THE MBS DESIGN SPECIFICATIONS.

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit # 20-160000-CO/HO/CO

For Building Dept. Review	MBS	KJM	DSC	CLE	09/19/19
Approval Drawings	MBS	KJM	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	06/29/20
Plan Check Review	MBS	COB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	COB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	COB	KDB	CLE	03/23/21

NUCOR BUILDING SYSTEMS
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1600 WALNUT ST, TROY, TX 76579
PHONE: (972) 219-7000 FAX: (972) 219-7017
1080 WATERY LANE, BIRCHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: [redacted] X PDC BLDG
200 NE AIRPORT WAY, PORTAL, OR
OWNER NAME: KELLY
LONGVIEW, WA
NUMBER: BH0787A
SHEET TITLE

03/26/2021
OREGON SEPT 11, 2018 CURTIS L. EAR
EXPIRATION DATE: 12-31-2021

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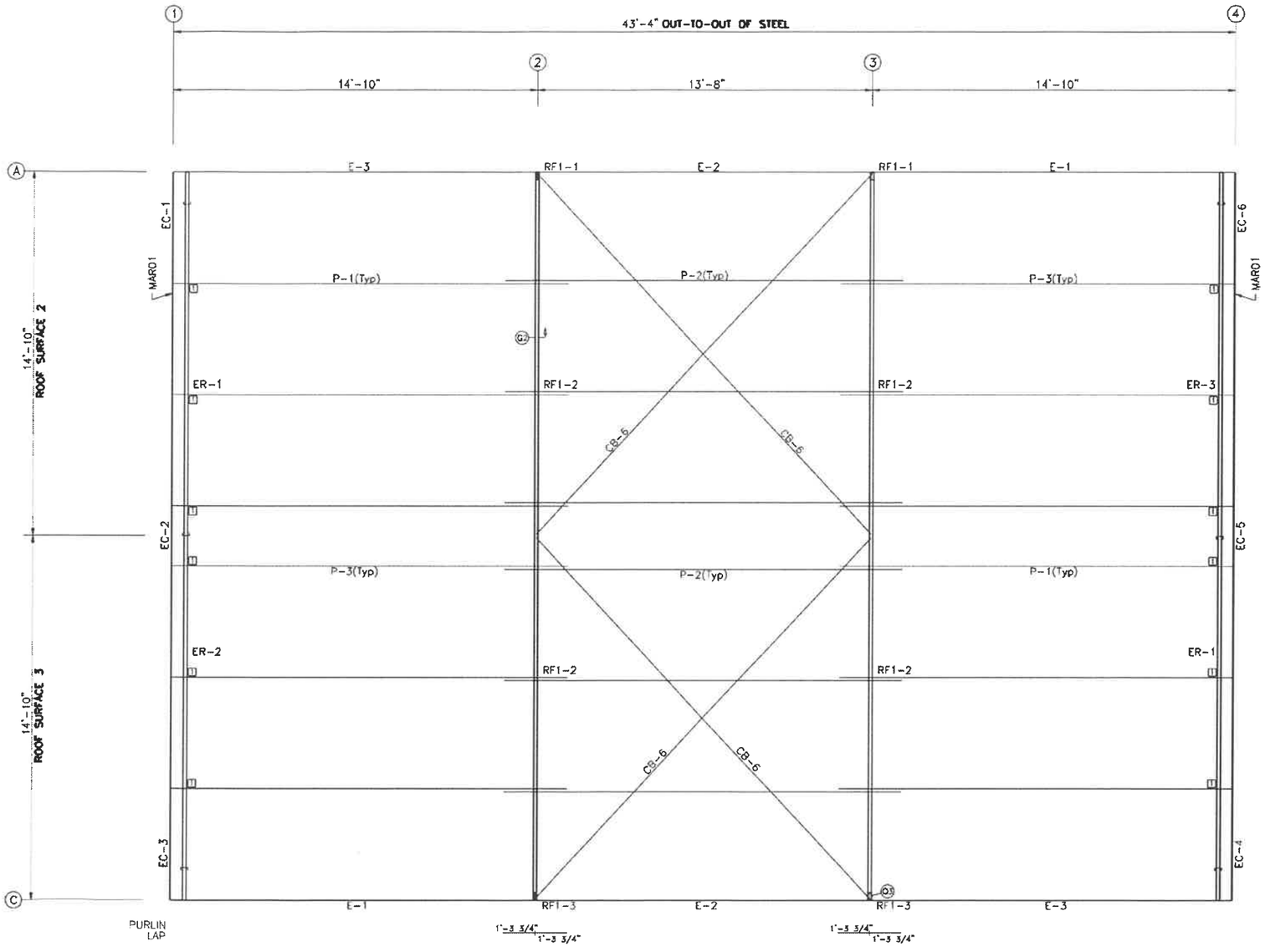
SHEET F2 of 2

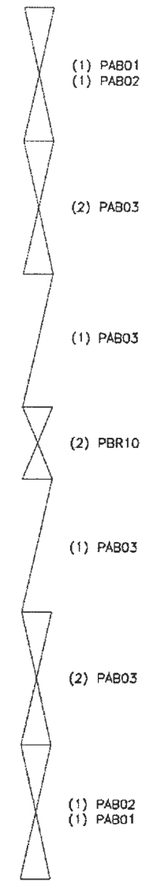
MEMBER TABLE ROOF PLAN		
MARK	PART	LENGTH
P-1	08Z060	193.500
P-2	08Z060	195.500
P-3	08Z060	193.500
E-1	08E3060	177.500
E-2	08E3060	163.500
E-3	08E3060	177.500
CB-6	RDB-	230.000

CONNECTION PLATES ROOF PLAN	
ID	MARK/PART
1	PCC01



ROOF FRAMING PLAN

PURLIN BRACING REQUIRED, TWO ROWS PER BAY, SEE DETAIL ON SHEET D3



ROOF FRAMING PLAN

GENERAL NOTES

1. PLACE TAGGED END OF RAFTERS TOWARDS THE LOW EAVE.
2. STD. ROD/CABLE SIZES PER PART PREFIX ARE:

ROD		CABLE	
RDB-	= 5/8" ROD	CAA-	= 1/4" CABLE
RDC-	= 3/4" ROD	CAB-	= 3/8" CABLE
RDD-	= 7/8" ROD	CAC-	= 1/2" CABLE
RDE-	= 1" ROD		
RDF-	= 1 1/8" ROD		
RDG-	= 1 1/4" ROD		

3. PURLIN AND EAVE STRUT CONNECTIONS UTILIZE BOTH A307 AND A325 BOLTS. REFER TO THE DETAILS FOR SPECIFIC USAGE REQUIREMENTS.
4. THIS DRAWING IS NOT TO SCALE.

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	DSC	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	05/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	05/29/20
Plan Check Review	MBS	COB	KOB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	COB	KOB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	COB	KOB	CLE	03/23/21

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1000 ALLEGHENY AVE, BOPTRAIL, OR 97015
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME
X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR

OWNER NAME
KELLY
DNGVIEW, WA

NUMBER
9H0787A

SHEET TITLE

03/26/2021

OREGON
SEPT 11, 2018
CURTIS L. EAR

EXPIRATION DATE: 12-31-2021

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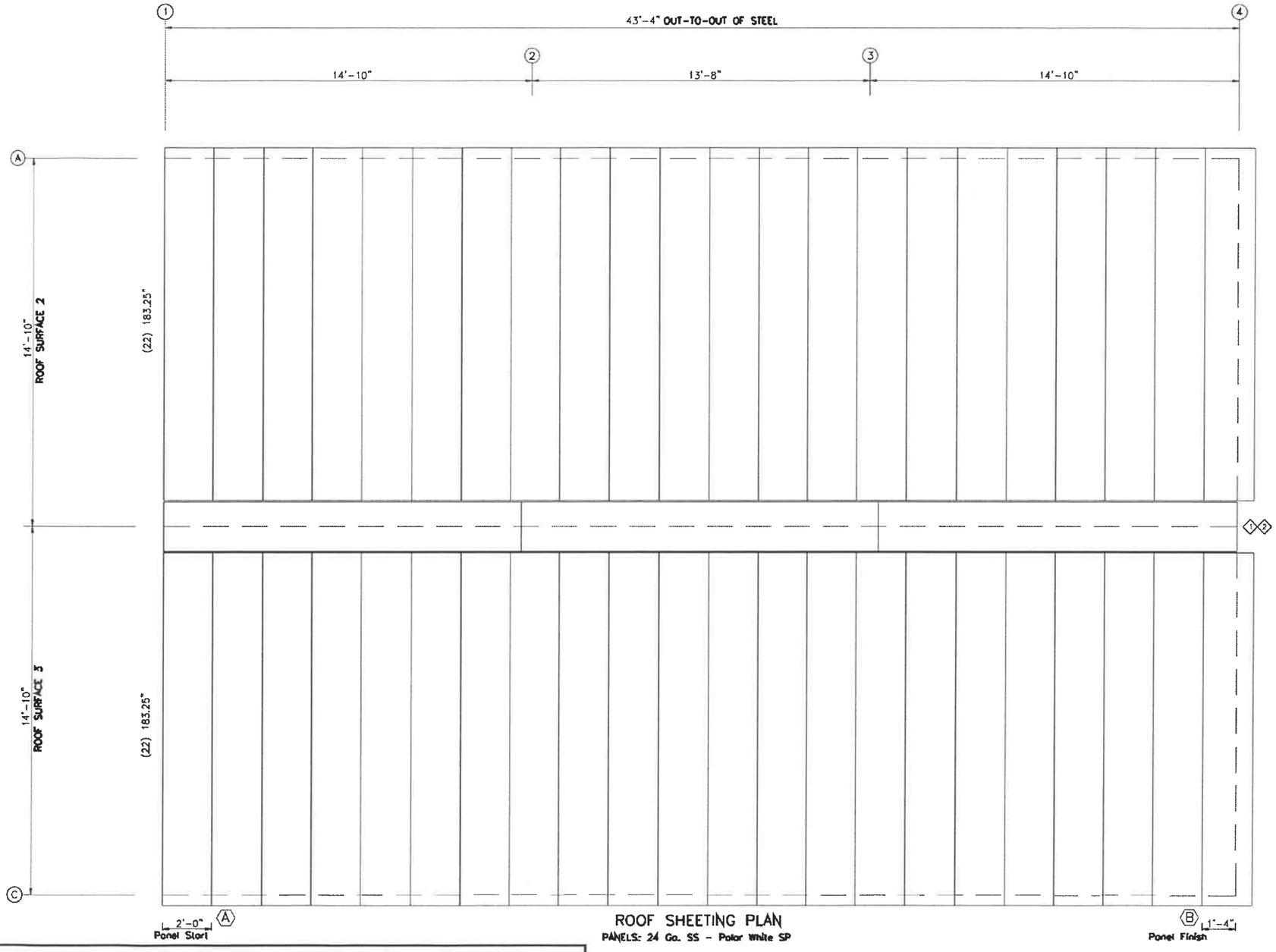
SHEET
E1 of 9

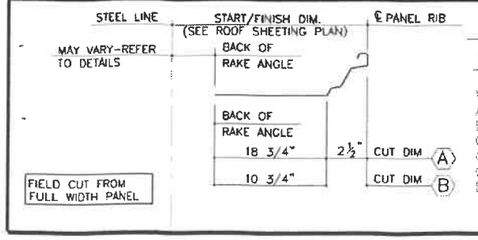
RELEASED FOR CODE COMPLIANCE
Date: 04/08/21
Permit # 20190702000-00-00

TRIM TABLE ROOF PLAN			
◇ID	PART	LENGTH	DETAIL
1	RGD01	121.000	TRIM_953
2	RGD02	242.000	TRIM_953



ROOF SHEETING PLAN

PANELS: 24 Ga. SS - Polar White SP



START PANEL WIDTH DETAIL (FIELD CUT)

NOTE: THE FINISH PANEL ALSO NEEDS TO BE CUT TO THE REQUIRED WIDTH FROM A FULL SHEET

WHEN FIELD CUTTING OR MITERING OFF ROOF PANELS, NO ABRASIVE CUTTING TOOLS SUCH AS NIBBLERS OR TIN-SNIPS SHALL BE USED. ABRASIVE CUTTING TOOLS SUCH AS MECHANICAL GRINDERS, SAWS, SHEARS, OR SCISSORS CAN DAMAGE THE QA VALUVE FINISH AND CREATE EXCESS METAL SHAVINGS THAT CAN CORRODE THE PANELS. THE USE OF NON-APPROVED CUTTING DEVICES MAY VOID YOUR FACTORY WARRANTY.

City Of Portland

REVIEWED FOR CODE COMPLIANCE

Date: 04/08/21

Permit # 20[redacted]-03/00/00-CO

For Building Dept. Review	WBS	KJW	DSC	CLE	09/19/19
Approval Drawings	WBS	KJW	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	WBS	KJW	STK	CLE	05/26/20
Rev. 1 Building Dept. Review	WBS	KJW	STK	CLE	05/29/20
Plan Check Review	WBS	CDB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	WBS	CDB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	WBS	CDB	KDB	CLE	03/23/21

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600 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 551-4600 FAX: (972) 551-4417
1000 WATERY LANE, BIRCHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: X PDC BLDG

00 NE AIRPORT WAY, PORTAL, OR

CUSTOMER NAME: KELLY

DNGVIEW, WA

JOB NUMBER: 9H0787A

[redacted]

03/26/2021

OREGON SEPT 11, 2018 CURTIS L. FAIR

EXPIRATION DATE: 12-31-2021

SHEET TITLE

SHEET: E2 of 9

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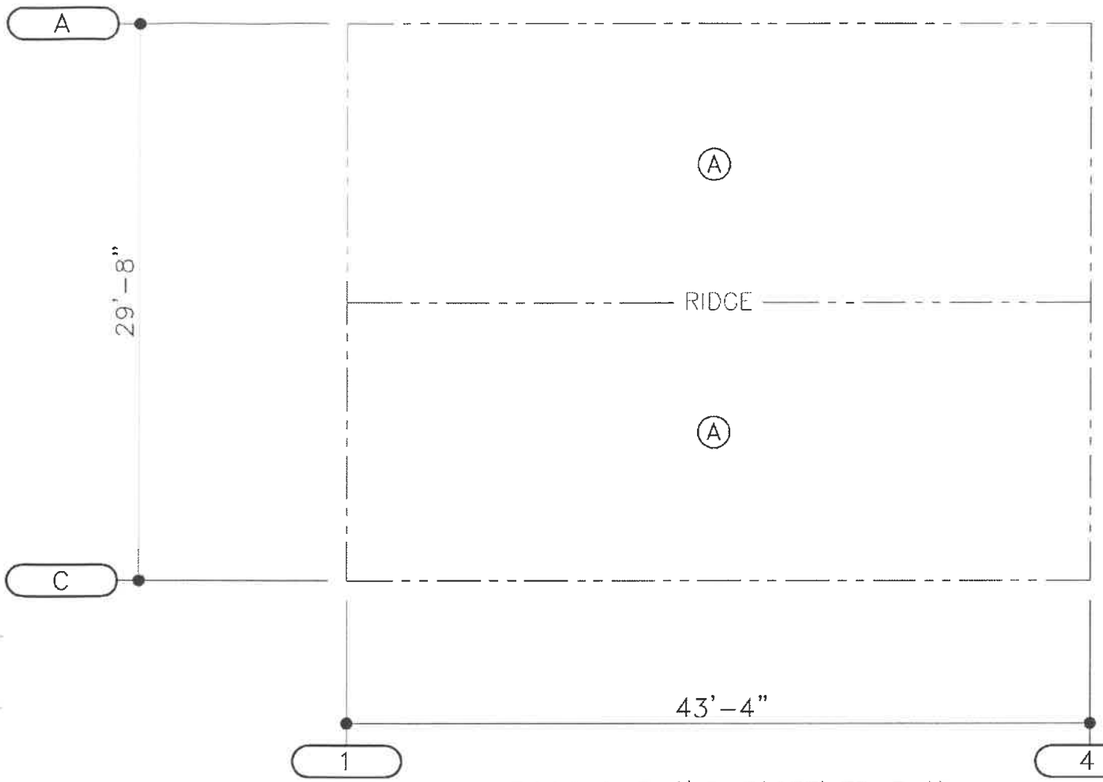
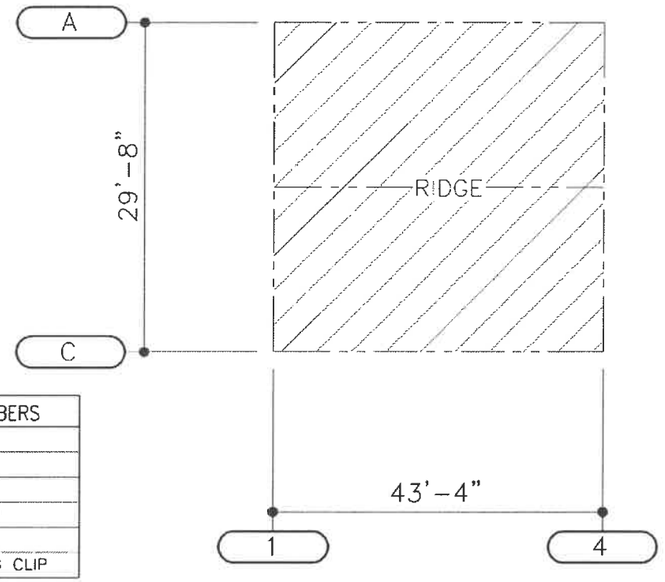
ERECTOR NOTE:

THIS BUILDING HAS SPECIFIC ROOF CLIP AND FASTENER REQUIREMENTS. PLEASE REVIEW THIS DETAIL PRIOR TO ERECTING THE ROOF PANEL. FAILURE TO FOLLOW THESE SPECIFIC REQUIREMENTS COULD RESULT IN LOSS OF ROOF PANEL(S).



ROOF CLIP AND FASTENER PLAN



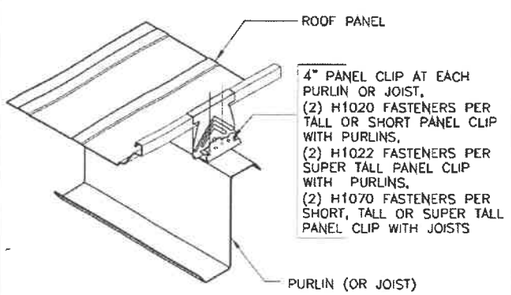
ROOF SEAMING PLAN

1) ☐ NUCOR ROLL LOCK™ U.N.O.
2) ▨ INDICATES NUCOR VISE LOCK®.
3) ▩ INDICATES NUCOR VISE LOCK 360®.

STD 4" CFR CLIP PART NUMBERS	
MARK #	PART DESCRIPTION
H2500	SHORT FIXED CLIP
H2510	TALL FIXED CLIP
H2520	SHORT SLIDING CLIP
H2530	TALL SLIDING CLIP
H2540	SUPER TALL SLIDING CLIP

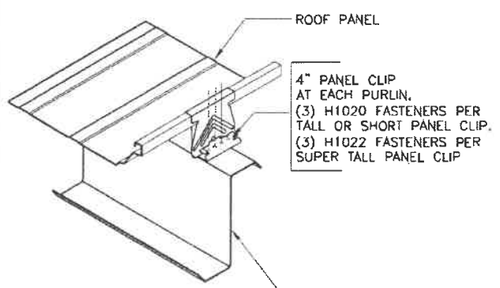
CFR PERIMETER CLIP PART NUMBERS	
MARK #	PART DESCRIPTION
H2720	SHORT SLIDING 8" CLIP
H2730	TALL SLIDING 8" CLIP
H2740	SHORT SLIDING 12" CLIP
H2750	TALL SLIDING 12" CLIP
H2760	SHORT SLIDING 16" CLIP
H2770	TALL SLIDING 16" CLIP

STD. 4" PANEL CLIP ATTACHMENT DETAIL
SEE CFR ROOF ERECTION NOTES FOR PANEL CLIP MARK NUMBER



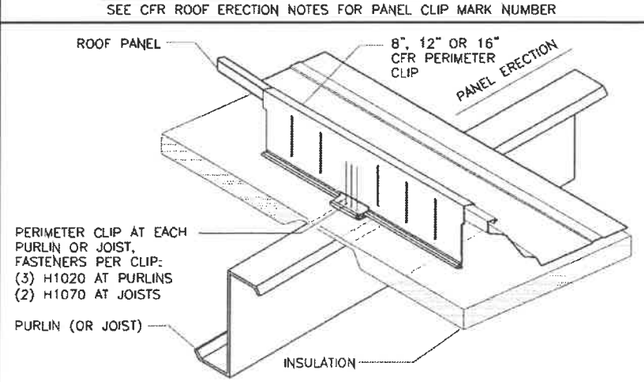
(2) FASTENERS PER CLIP AT PURLIN/JOIST — A

STD. 4" PANEL CLIP ATTACHMENT DETAIL
SEE CFR ROOF ERECTION NOTES FOR PANEL CLIP MARK NUMBER



(3) FASTENERS PER CLIP AT PURLIN — B

PERIMETER PANEL CLIP ATTACHMENT DETAIL
SEE CFR ROOF ERECTION NOTES FOR PANEL CLIP MARK NUMBER



(3) FASTENERS PER CLIP AT PURLIN
(2) FASTENERS PER CLIP AT JOIST — C

CRITICAL SEAMER ORDERING INFORMATION

ROOF TYPE	CFR	
PANEL GAUGE	24 GA.	
SQUARE FOOTAGE (ENTIRE ROOF)	1,286 SQ. FT	
ROOF PITCH	3:12	
SEAM HEIGHT	☒ 3"	☐ 2"
ENDLAPS	☐ YES	☒ NO
GALVALUME OR PAINTED ROOF	☐ GALVALUME	☒ PAINTED
PERIMETER CLIPS REQUIRED	☐ YES	☒ NO

NOTE SEAM HEIGHT: CFR = 3", VR16-II & SR2 = 2"

PLEASE NOTE THAT ALL SEAMER ORDERS WILL TAKE APPROXIMATELY 5-7 WORKING DAYS FOR DELIVERY TO JOB SITE FROM DATE OF ORDER. VISE LOCK & VISE LOCK 360 CFR ROOFS REQUIRE (5) STATION SEAMERS.

NUCOR.DIROOFSEAMERS.COM PHONE (888) 343-0456

For Building Dept. Review	WBS	KJM	DSC	CLE	09/19/19
Approval Drawings	WBS	KJM	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	WBS	KJM	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	WBS	KJM	STK	CLE	06/29/20
Plan Check Review	WBS	COB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	WBS	COB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	WBS	COB	KDB	CLE	03/23/21

NUCOR BUILDING SYSTEMS
300 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1000, 200 WESTSIDE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APPLE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-4400 FAX: (972) 524-4417
1050 WATERY LANE, BRIGHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: PDC BLDG
200 NE AIRPORT WAY, PORTAL, OR
CUSTOMER NAME: KELLY
VANCOUVER, WA
JOB NUMBER: 9H0787A
SHEET TITLE:

03/26/2021
OREGON SEPT. 11, 2018 CURTIS L. EAR
EXPIRATION DATE: 12-31-2021

The seal pertains only to the materials designed and supplied by Nucor Building Systems as reflected in the Nucor Building Systems drawings listed hereon. The Nucor Building Systems drawings listed hereon were prepared in accordance with the applicable design loads noted on these drawings by employees of Nucor Building Systems who are registered as professional engineers. Nucor Building Systems is employed by the owner or the owner's representative as an independent contractor and is not employed as a consultant to the owner or project engineer of record and shall not be construed as such.

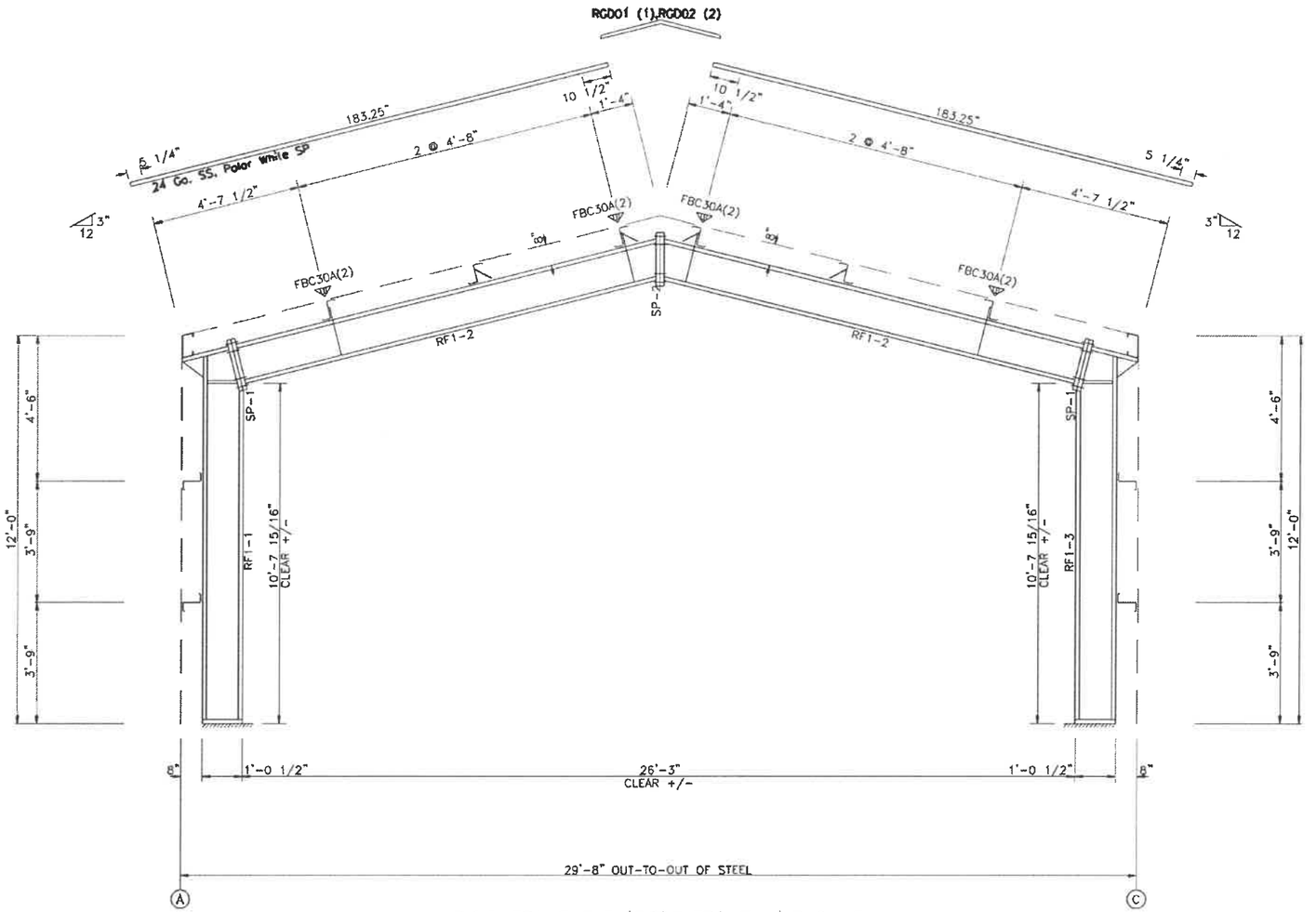
SHEET E3 of 9

EA6027

SPLICE PLATE & BOLT TABLE									
Mark	Qty Top	Bot	Int	Type	Dia	Length	Width	Thick	Length
SP-1	4	4	0	A325	0.625	2.25	6"	3/8"	1'-6 1/2"
SP-2	4	4	0	A325	0.625	2.25	6"	3/8"	1'-6 7/8"

MEMBER TABLE					
Mark	Web Depth Start/End	Web Plate Thick	Web Plate Length	Outside Flange W x Thk x Length	Inside Flange W x Thk x Length
RF1-1	12.0/12.0	0.135	139.3	5 x 1/4" x 137.1 5 x 1/4" x 16.7	5 x 1/4" x 124.5
RF1-2	12.0/12.0	0.135	165.3	5 x 1/4" x 165.3	5 x 1/4" x 162.2
RF1-3	12.0/12.0	0.135	139.3	5 x 1/4" x 16.7 5 x 1/4" x 137.1	5 x 1/4" x 124.5

CONNECTION PLATES	
☐ ID	Mark/Part
1	FBL&N01



RIGID FRAME ELEVATION: FRAME LINE 2 3

GENERAL NOTES

1. ▽ INDICATES FLANGE BRACING LOCATIONS. (1) = ONE SIDE; (2) = TWO SIDES.
2. IF FLANGE BRACING IS REQUIRED ON BOTH SIDES OF AN EXPANDABLE RIGID FRAME, THE OPPOSITE SIDE FLANGE BRACES WILL HAVE TO BE INSTALLED AT THE TIME OF FUTURE EXPANSION. THESE FLANGE BRACES HAVE BEEN PROVIDED, AS REQUIRED, FOR THIS FUTURE CONDITION.
3. RIGID FRAMES SHALL HAVE 50% OF THEIR BOLTS INSTALLED AND TIGHTENED ON BOTH SIDES OF THE WEB ADJACENT TO EACH FLANGE BEFORE THE HOISTING EQUIPMENT IS RELEASED.
4. INTERIOR COLUMN METAL TAG IS ORIENTED TOWARD THE LOW EAVE OF THE BUILDING.

REVIEWED FOR CODE COMPLIANCE
Date: 04/05/21
Permit # 20-197052-000-00-DS

For Building Dept. Review	MBS	DSC	09/19/19
Approval Drawings	MBS	DSC	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	STK	06/26/20
Rev. 1 Building Dept. Review	MBS	STK	06/29/20
Plan Check Review	MBS	KDB	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	KDB	03/19/21
Rev. 2 Building Dept. Review	MBS	KDB	03/23/21

NUCOR BUILDING SYSTEMS
205 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WHETSTONE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 551-6433 FAX: (972) 551-6417
1000 WATERY LANE, BIRMINGHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR
OWNER NAME: KELLY
DNGVIEW, WA
NUMBER: 9H0787A
SHEET TITLE:

[redacted]

03/26/2021

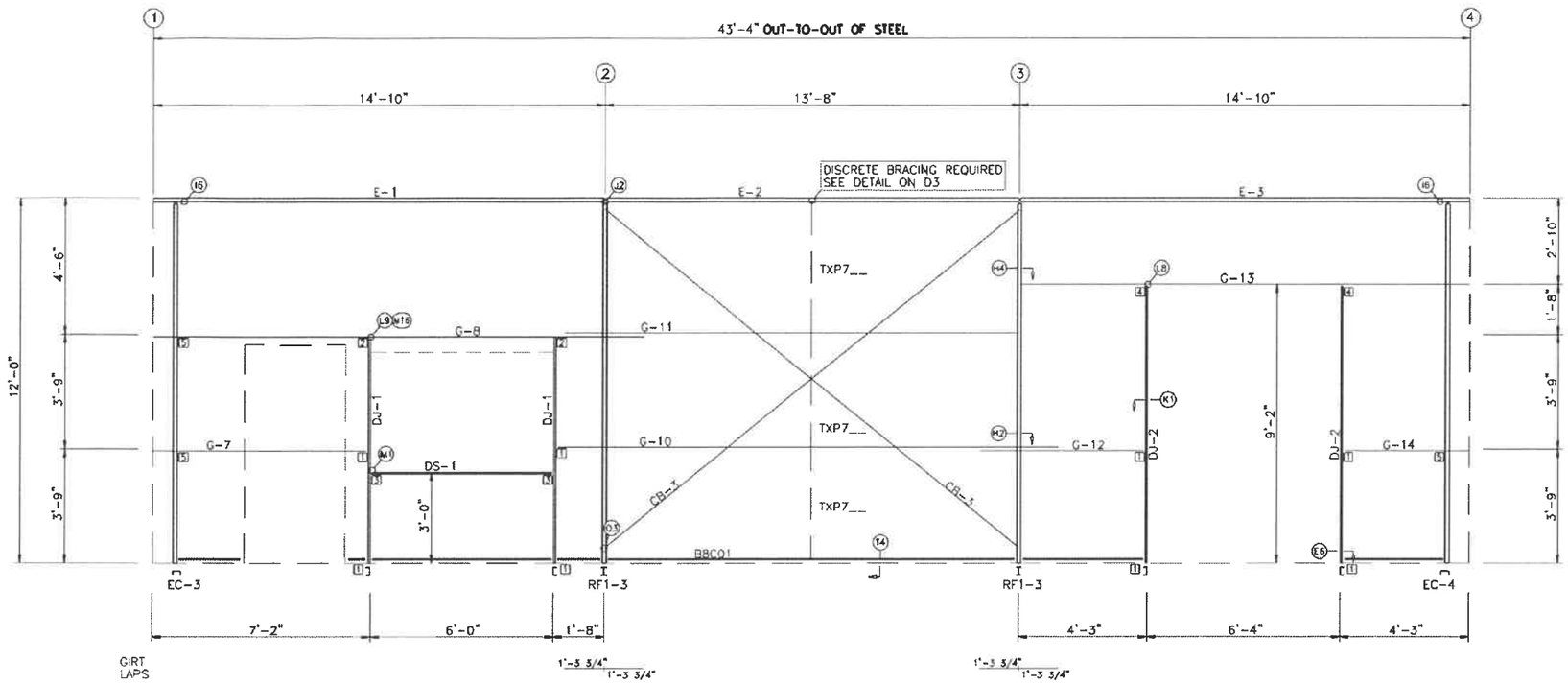
OREGON
SEPT 11, 2018
CURTIS L. EARL

EXPIRATION DATE: 12-31-2021

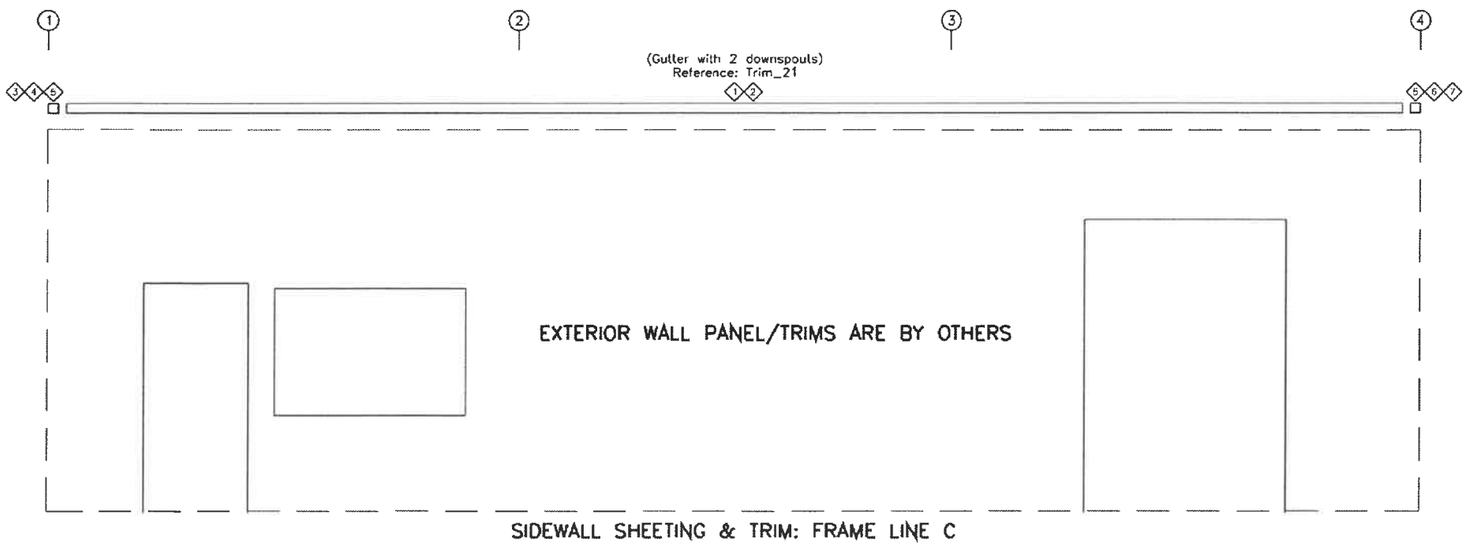
It is assumed that this set of plans is only to the materials designed and supplied by Nucor Building Systems, a division of Nucor Corporation. The drawings and the details in buildings which may represent the work of Nucor Building Systems. The regular professional engineer must also approve any Nucor Building System drawings prior to seeking approval as an engineer of record for the project. Any proposed engineer of record shall not be considered as such.

SHEET: E4 of 9

ROD BRACING IS 6.38" ABOVE FINISHED FLOOR AND 6.00" BELOW THE EAVE STRUT.



SIDEWALL FRAMING: FRAME LINE C



SIDEWALL SHEETING & TRIM: FRAME LINE C

TRIM TABLE FRAME LINE C			
◇ID	PART	LENGTH	DETAIL
1	GTA01	121.000	TRIM_958
2	GTA02	242.000	TRIM_958
3	H4000	5.000	
4	RCA01	9.250	
5	GRA01	8.000	
6	H4000	5.000	
7	RCA02	9.250	

MEMBER TABLE FRAME LINE C		
MARK	PART	LENGTH
DJ-1	F08C060	85.750
DJ-2	F08C060	110.000
DS-1	F08C060	72.000
E-1	08E3060	177.500
E-2	08E3060	163.500
E-3	08E3060	177.500
G-7	08Z054	75.250
G-8	08Z054	193.500
G-10	08Z054	196.500
G-11	08Z054	182.000
G-12	08Z054	63.500
G-13	08C060	177.000
G-14	08Z054	47.500
CB-3	RDB-	214.000

CONNECTION PLATES FRAME LINE C	
□ID	MARK/PART
1	JCA&P02
2	JCT01
3	HCJ01
4	JCT13
5	GCC03

SIDEWALL FRAMING PLAN

GENERAL NOTES

1. STD. ROD/CABLE SIZES PER PART PREFIX ARE:

ROD		CABLE	
RDB-	= 5/8" ROD	CAA-	= 1/4" CABLE
RDC-	= 3/4" ROD	CAB-	= 3/8" CABLE
RDD-	= 7/8" ROD	CAC-	= 1/2" CABLE
RDE-	= 1" ROD		
RDF-	= 1 1/8" ROD		
RDG-	= 1 1/4" ROD		

2. ROD/CABLE BRACING THAT OCCURS IN FLUSH OR INSET GIRT CONDITIONS WILL REQUIRE FIELD SLOTTING OF GIRT WEBS TO ALLOW FOR BRACING.
3. FRAMED OPENINGS WHICH ARE FIELD LOCATED WILL REQUIRE FIELD CUTTING OF GIRTS AND SHEETING.
4. THIS DRAWING IS NOT TO SCALE.

City of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/09/21
Permit #: 20-197854-000-00-DD

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	DSC	CLE 09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK 06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK CLE 06/29/20
Plan Check Review	MBS	CDB	KDB CLE 01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KDB CLE 03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KDB CLE 03/23/21

NUCOR BUILDING SYSTEMS
505 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WESTSIDE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 BRUTON PKWY, TERRELL, TX 75160
PHONE: (972) 524-6417 FAX: (972) 524-6417
1000 WATERY LANE, BIRCHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

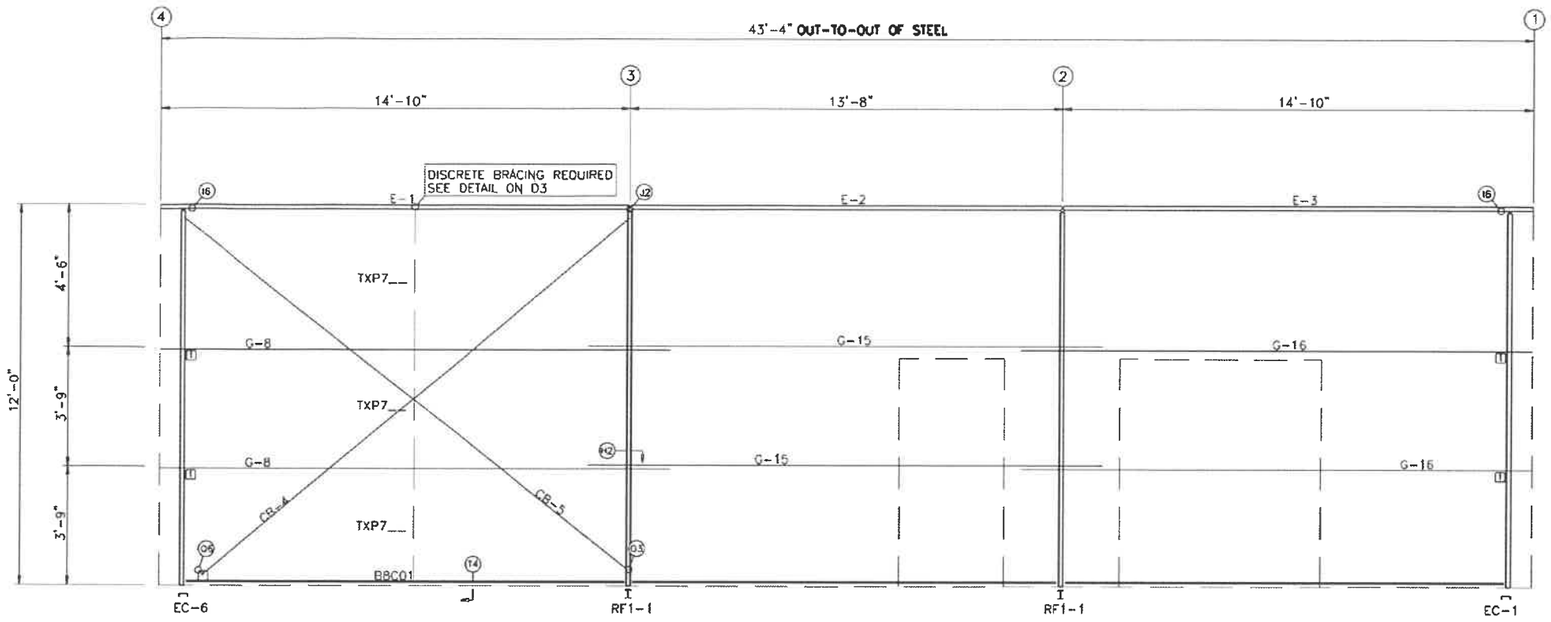
PROJECT NAME: X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR
OWNER NAME: KELLY
ONGVIEW, WA
NUMBER: 0H0787A
SHEET TITLE:

03/26/2021
OREGON
SEPT 11, 2018
CURTIS L. FAIR
EXPIRATION DATE: 12-31-2021

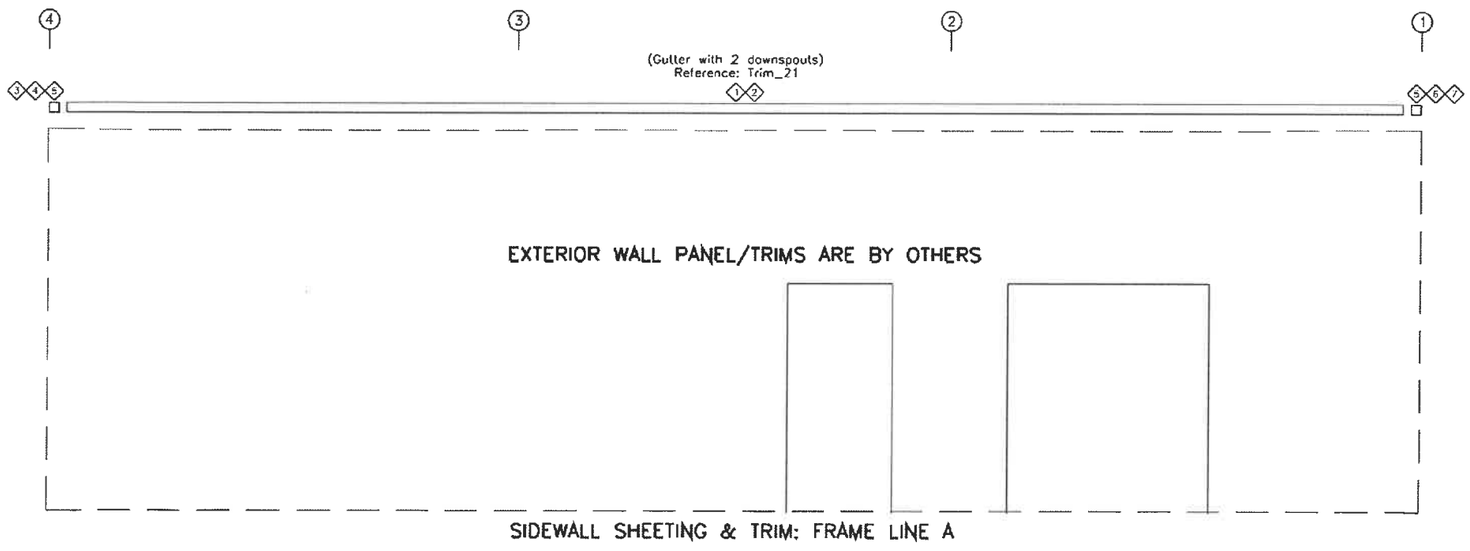
This seal pertains only to the materials designed and supplied by Nucor Corporation, Building Systems and the metal buildings which they represent. It does not pertain to any other buildings, components or materials supplied by Nucor Buildings Systems or others. Any reproduction of these drawings without the engineer-of-record's written consent is prohibited and any use of these drawings for projects other than as originally intended will render them void.

SHEET E5 of 9

ROD BRACING IS 6.38" ABOVE FINISHED FLOOR AND 6.00" BELOW THE EAVE STRUT.



SIDEWALL FRAMING: FRAME LINE A



SIDEWALL SHEETING & TRIM: FRAME LINE A

TRIM TABLE FRAME LINE A			
◇ID	PART	LENGTH	DETAIL
1	GTA01	121.000	TRIM_958
2	GTA02	242.000	TRIM_958
3	H4000	5.000	
4	RCA01	9.250	
5	GRA01	8.000	
6	H4000	5.000	
7	RCA02	9.250	

MEMBER TABLE FRAME LINE A		
MARK	PART	LENGTH
E-1	08E3060	177.500
E-2	08E3060	163.500
E-3	08E3060	177.500
G-8	08Z054	193.500
G-15	08Z054	195.500
G-16	08Z054	193.500
CB-4	RDB-	176.000
CB-5	RDB-	218.000

CONNECTION PLATES FRAME LINE A	
□ID	MARK/PART
1	GCC03

SIDEWALL FRAMING PLAN

GENERAL NOTES

1. STD. ROD/CABLE SIZES PER PART PREFIX ARE:

ROD		CABLE	
RDB-	= 5/8" ROD	CAA-	= 1/4" CABLE
RDC-	= 3/4" ROD	CAB-	= 3/8" CABLE
RDD-	= 7/8" ROD	CAC-	= 1/2" CABLE
RDE-	= 1" ROD		
RDF-	= 1 1/8" ROD		
RDG-	= 1 1/4" ROD		

2. ROD/CABLE BRACING THAT OCCURS IN FLUSH OR INSET GIRT CONDITIONS WILL REQUIRE FIELD SLOTTING OF GIRT WEBS TO ALLOW FOR BRACING.
3. FRAMED OPENINGS WHICH ARE FIELD LOCATED WILL REQUIRE FIELD CUTTING OF GIRTS AND SHEETING.
4. THIS DRAWING IS NOT TO SCALE.

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit #: 20-

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	KJM	DSC 09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	CLE 06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK CLE 06/29/20
Plan Check Review	MBS	CDB	KOB CLE 01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KOB CLE 03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KOB CLE 03/23/21

NUCOR BUILDING SYSTEMS
500 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7586
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PHONE: (803) 568-2100 FAX: (803) 568-2121
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PHONE: (972) 524-5407 FAX: (972) 524-5417
1000 WESTERN AVE, BOWLING GREEN, KY 42102
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: [redacted] PDC BLDG
000 NE AIRPORT WAY, PORTAL, OR
JOB NAME: KELLY
ONGVIEW, WA
NUMBER: PH0787A
SHEET TITLE

03/26/2021

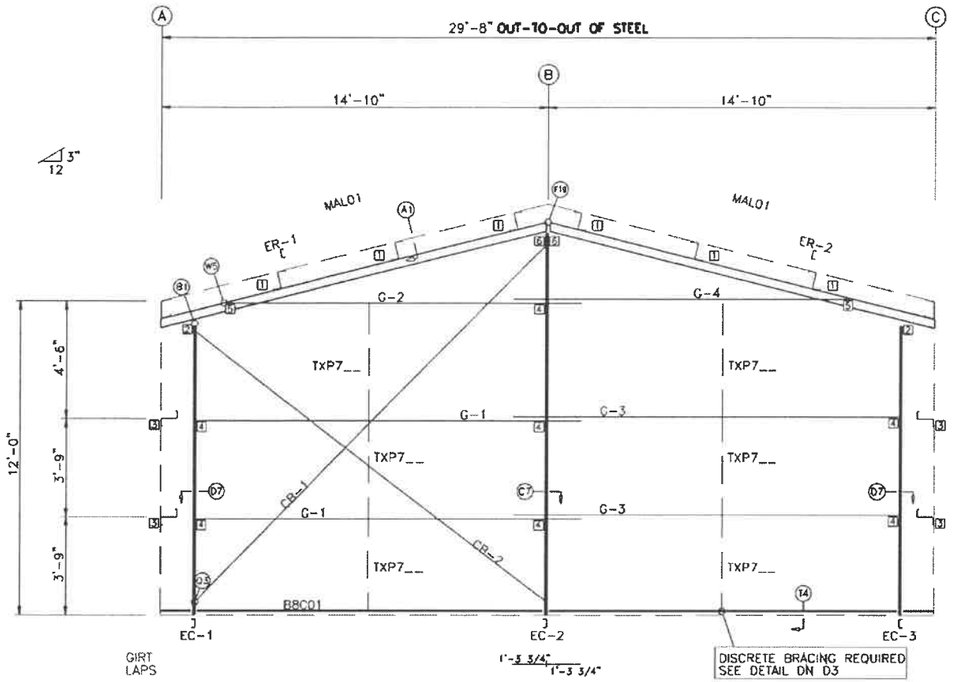
OREGON
SEPT 11, 2018
CURTIS L. FAA

EXPIRATION DATE: 12-31-2021

This seal pertains only to the materials designed and supplied by Nucor Building Systems, a division of Nucor Corporation. The drawings and the installation of the materials they represent are to be performed by Nucor Building Systems. The register professional engineer whose seal appears on these drawings is employed by Nucor Building Systems and is responsible only for the design as it appears on the drawings and as it represents the project engineer of record and shall not be construed as any

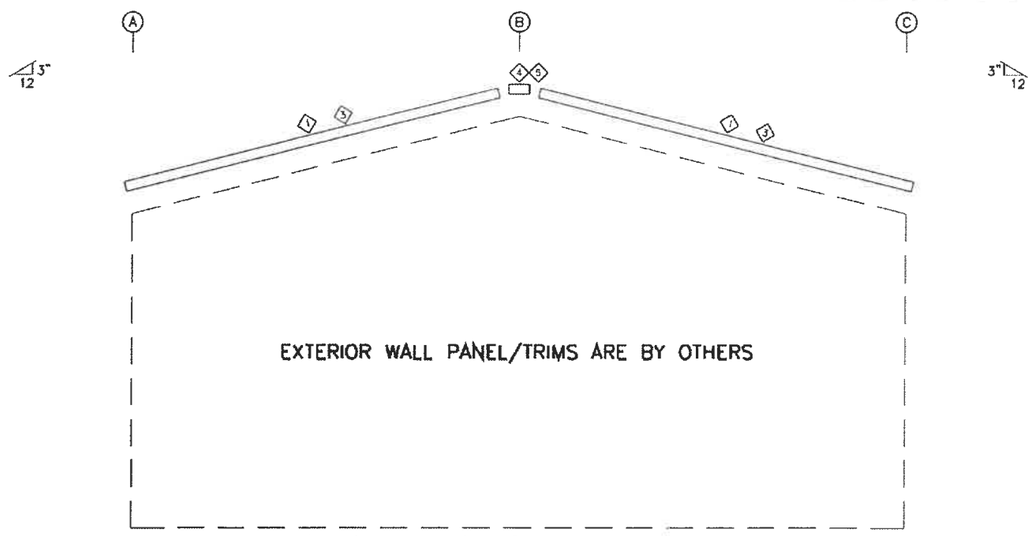
SHEET

E6 of 9



ENDWALL FRAMING: FRAME LINE 1

ROD BRACING IS 6.38" ABOVE FINISHED FLOOR AND 6.00" BELOW THE RAFTER.



ENDWALL SHEETING & TRIM: FRAME LINE 1

BOLT TABLE FRAME LINE 1				
LOCATION	QUAN	TYPE	DIA	LENGTH
ER-1/ER-2	4	A325	1/2"	2"
Columns/Rof	6	A325	1/2"	2"

TRIM TABLE FRAME LINE 1			
◇ID	PART	LENGTH	DETAIL
1	RTA02	242.000	TRIM_902
3	RRA01	121.000	TRIM_902
4	M0103	26.440	
5	MPP03	14.380	

MEMBER TABLE FRAME LINE 1		
MARK	PART	LENGTH
EC-1	W08S075	131.500
EC-2	W08S099	172.000
EC-3	W08S075	131.500
ER-1	W08S089	180.938
ER-2	W08S089	180.938
G-1	08Z054	185.250
G-2	08Z054	160.750
G-3	08Z054	185.250
G-4	08Z054	160.750
CB-1	RDB-	233.000
CB-2	RDB-	207.000

CONNECTION PLATES FRAME LINE 1	
□ID	MARK/PART
1	PCC01
2	EWA01
3	GCC03
4	GCW08gcb
5	GCC12
6	GCB03

ENDWALL FRAMING PLAN

GENERAL NOTES

1. STD. ROD/CABLE SIZES PER PART PREFIX ARE:

ROD		CABLE	
RDB-	= 5/8" ROD	CAA-	= 1/4" CABLE
RDC-	= 3/4" ROD	CAB-	= 3/8" CABLE
RDD-	= 7/8" ROD	CAC-	= 1/2" CABLE
RDE-	= 1" ROD		
RDF-	= 1 1/8" ROD		
RDG-	= 1 1/4" ROD		

2. ROD/CABLE BRACING THAT OCCURS IN FLUSH OR INSET GIRT CONDITIONS WILL REQUIRE FIELD SLOTTING OF GIRT WEBS TO ALLOW FOR BRACING.
3. FRAMED OPENINGS WHICH ARE FIELD LOCATED WILL REQUIRE FIELD CUTTING OF GIRTS AND SHEETING.
4. THIS DRAWING IS NOT TO SCALE.

REVISED FOR CODE COMPLIANCE
Date 04/08/21
Permit # 20-0902-000-00DO

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	DSC	CLE 09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	CLE 06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK CLE 06/29/20
Plan Check Review	MBS	CDB	KDB CLE 01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KDB CLE 03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KDB CLE 03/23/21

NUCOR BUILDING SYSTEMS
300 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WHETSTONE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APAC-KE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-5407 FAX: (972) 524-5417
1005 MAIN AVE, SPOKANE, WA 99202
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: [redacted] X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR
OMER NAME: KELLY
NGVIEW, WA
OMBER: 9H0787A

03/26/2021

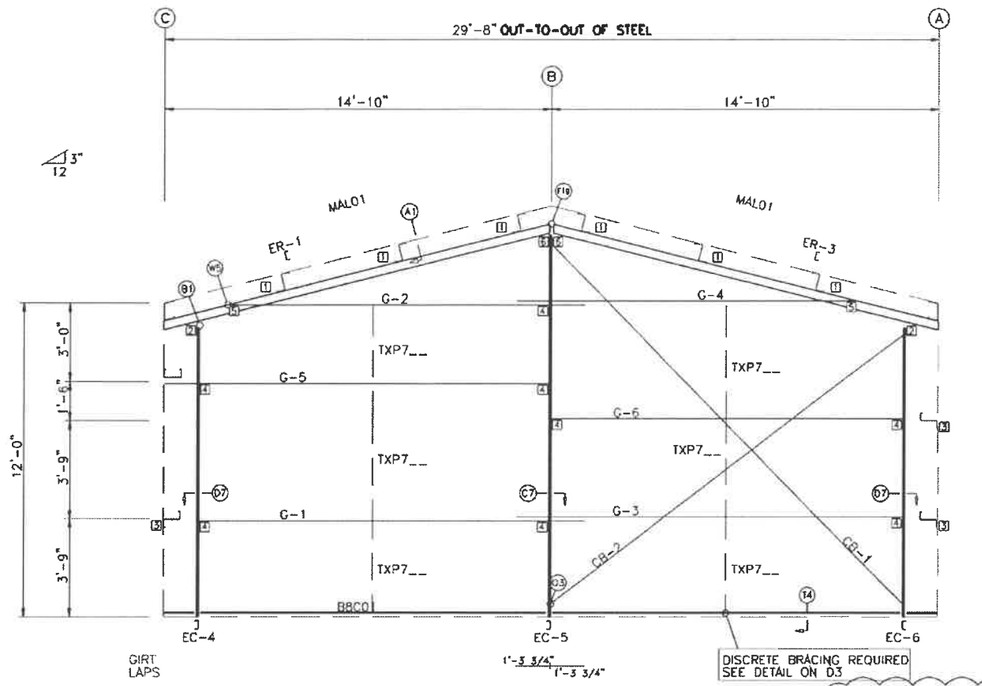
OREGON
SEPT 11, 2019
CURTIS L EAR

EXPIRATION DATE: 12-31-2021

This seal pertains only to the materials detailed and supplied by Nucor Corporation, Buildings Group. The design of the building system in which they may be incorporated is the responsibility of others. Nucor Buildings Group shall not be responsible for any errors or omissions which may appear in these drawings as a result of inaccurate or incomplete information supplied by others. Nucor Buildings Group shall not be responsible for any deviation from these drawings not authorized by Nucor Buildings Group. Nucor Buildings Group's responsibility is limited to the drawings as interpreted by its detailers and does not extend to any modifications made in the field or to erection procedures. Nucor Buildings Group's responsibility does not include the design of or responsibility for temporary bracing, shoring, guying, or the erection sequence, all of which are the responsibility of others. Approval of these drawings must be obtained before any fabrication will be performed. Any deviation from the approved drawings, specifications, and/or erection procedures will render this seal and all liability assumed by Nucor Buildings Group null and void.

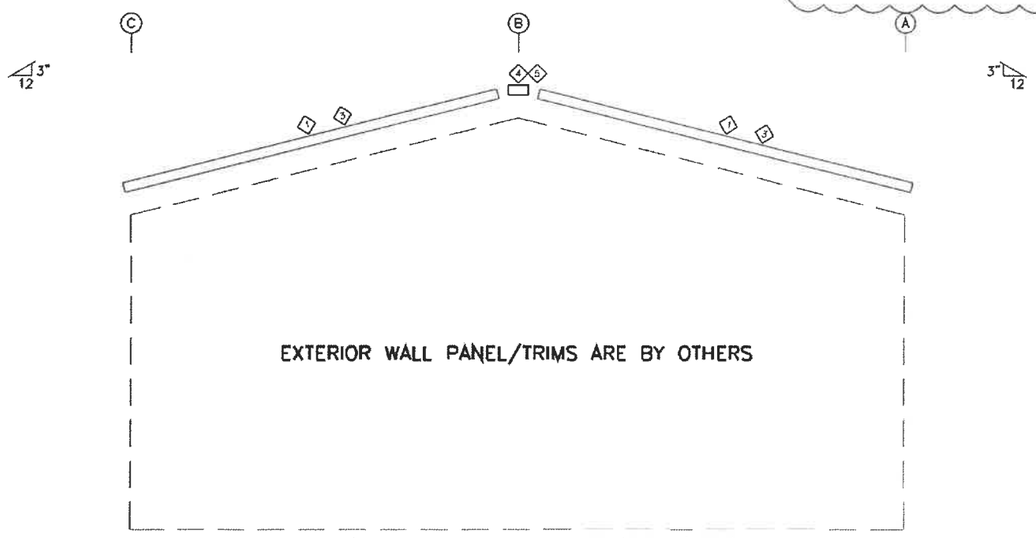
SHEET TITLE

SHEET E7 of 9



ENDWALL FRAMING: FRAME LINE 4

ROD BRACING IS 6.38" ABOVE FINISHED FLOOR AND 6.00" BELOW THE RAFTER.



ENDWALL SHEETING & TRIM: FRAME LINE 4

BOLT TABLE FRAME LINE 4				
LOCATION	QUAN	TYPE	DIA	LENGTH
ER-1/ER-3	4	A325	1/2"	2"
Columns/Raf	6	A325	1/2"	2"

TRIM TABLE FRAME LINE 4			
◇ID	PART	LENGTH	DETAIL
1	RTA02	242.000	TRIM_902
3	RRA01	121.000	TRIM_902
4	M0103	26.440	
5	MPP03	14.380	

MEMBER TABLE FRAME LINE 4		
MARK	PART	LENGTH
EC-4	W08S075	131.500
EC-5	W08S099	172.000
EC-6	W08S075	131.500
ER-1	W08S089	180.938
ER-3	W08S089	180.938
G-1	08Z054	185.250
G-2	08Z054	160.750
G-3	08Z054	185.250
G-4	08Z054	160.750
G-5	08Z054	177.000
G-6	08Z054	171.750
CB-1	RDB-	233.000
CB-2	RDB-	207.000

CONNECTION PLATES FRAME LINE 4	
□ID	MARK/PART
1	PCC01
2	EWA01
3	GCC03
4	GCW08gcb
5	GCC12
6	GCB03

ENDWALL FRAMING PLAN

GENERAL NOTES

1. STD. ROD/CABLE SIZES PER PART PREFIX ARE:

ROD		CABLE	
RDB-	= 5/8" ROD	CAA-	= 1/4" CABLE
RDC-	= 3/4" ROD	CAB-	= 3/8" CABLE
RDD-	= 7/8" ROD	CAC-	= 1/2" CABLE
RDE-	= 1" ROD		
RDF-	= 1 1/8" ROD		
RDG-	= 1 1/4" ROD		

2. ROD/CABLE BRACING THAT OCCURS IN FLUSH OR INSET GIRT CONDITIONS WILL REQUIRE FIELD SLOTTING OF GIRT WEBS TO ALLOW FOR BRACING.
3. FRAMED OPENINGS WHICH ARE FIELD LOCATED WILL REQUIRE FIELD CUTTING OF GIRTS AND SHEETING.
4. THIS DRAWING IS NOT TO SCALE.

ISSUE			
For Building Dept. Review	WBS	K.M	09/19/19
Approval Drawings	WBS	DSC	09/19/19
Rev. 1 Anchor Bolt Plan	WBS	K.M	06/26/20
Rev. 1 Building Dept. Review	WBS	STK	06/29/20
Plan Check Review	WBS	COB	01/19/21
Rev. 2 Anchor Bolt Plan	WBS	COB	03/19/21
Rev. 2 Building Dept. Review	WBS	COB	03/23/21

NUCOR BUILDING SYSTEMS
500 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WESTSIDE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-0117 FAX: (972) 524-0417
1060 WATERY LANE, BRIGHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: X PDC BLDG
000 NE AIRPORT WAY, PORTAL, OR
OWNER NAME: KELLY
ONGVIEW, WA
JMBER: 9H0787A
SHEET TITLE

[redacted]

03/26/2021

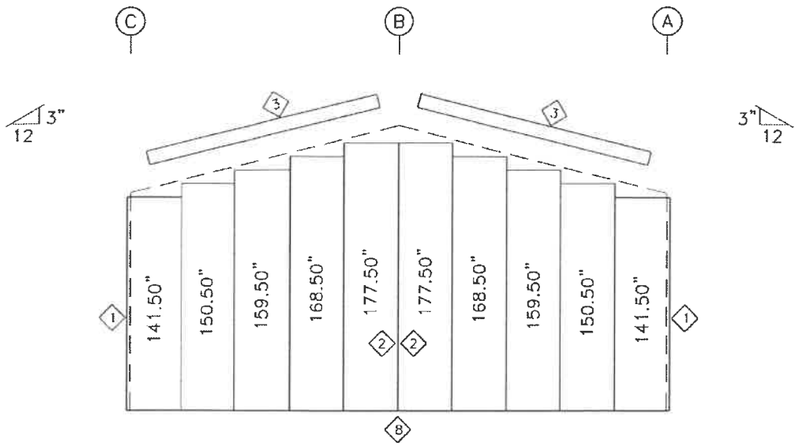
OREGON
SEPT 11, 2018
CURTIS L. EAR

EXPIRATION DATE: 12-31-2021

This seal pertains only to the materials shown hereon designed by Nucor Building Systems, a division of Nucor Corporation. The drawings and the metal buildings which they represent were prepared by Nucor Building Systems. The engineer understands Nucor Building Systems' practices and has exercised reasonable care in review of the information supplied by Nucor Building Systems and has relied upon it as to accuracy in preparing the engineer's drawings and calculations as noted.

NOT APPROVED FOR CODE COMPLIANCE
Date: 04/09/21
Permit #: 23-V0034-0000-000

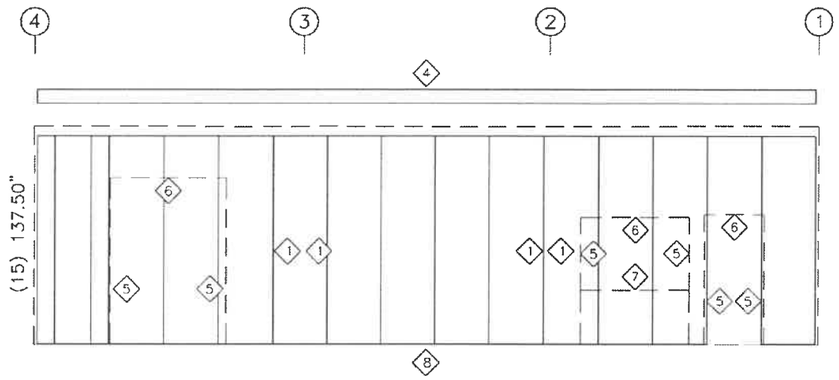
SHEET E8 of 9



ENDWALL LINER SHEETING & TRIM: FRAME LINE 1

PANELS: 26 Ga. CL – Undefined color H

(As Viewed From Inside Of Building)

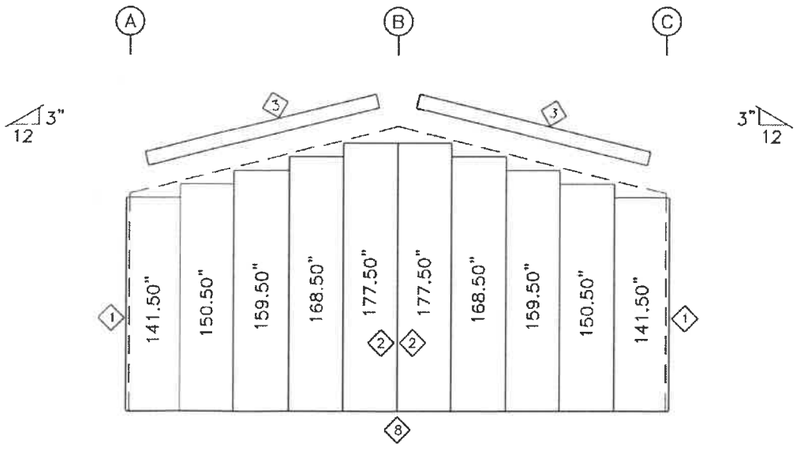


SIDEWALL LINER SHEETING & TRIM: FRAME LINE C

PANELS: 26 Ga. CL – Undefined color H

(As Viewed From Inside Of Building)

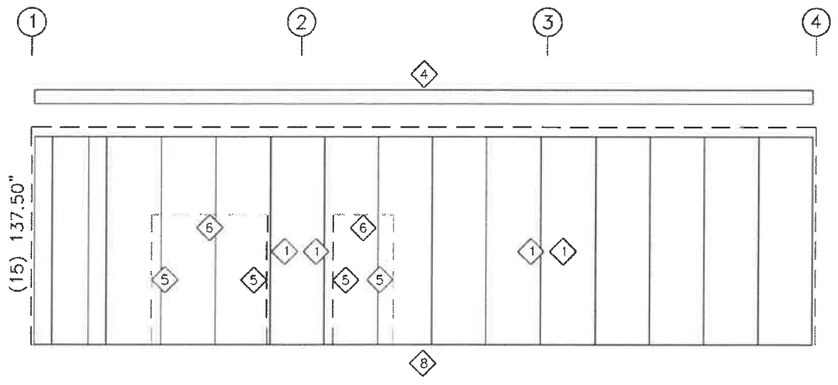
TRIM TABLE FRAME LINE 1 C 4 A			
◇ID	PART	LENGTH	DETAIL
1	HTD146	146.000	TRIM_32
2	HTD194	194.000	TRIM_32
3	CTA02	121.000	TRIM_41
4	HTD121	121.000	TRIM_46
5	HTD096	96.000	TRIM_23
6	HTD096	96.000	TRIM_27
7	HTD096	96.000	TRIM_28
8	NO_TRIM		TRIM_38



ENDWALL LINER SHEETING & TRIM: FRAME LINE 4

PANELS: 26 Ga. CL – Undefined color H

(As Viewed From Inside Of Building)



SIDEWALL LINER SHEETING & TRIM: FRAME LINE A

PANELS: 26 Ga. CL – Undefined color H

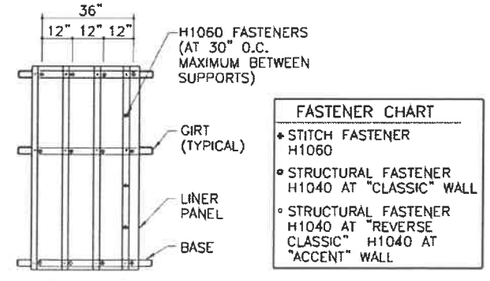
(As Viewed From Inside Of Building)

GENERAL NOTES:

1. FIELD WORK OF THE LINER PANELS AT THE FLANGE BRACE LOCATIONS MAY BE REQUIRED.

ERECTOR NOTE:

THE ERECTION OF THE LINER PANEL MUST BE COORDINATED PROPERLY WITH THE BRACING AND BRACE STRUTS TO ENSURE PROPER FIT-UP. IT IS THE ERECTOR'S RESPONSIBILITY TO ENSURE THAT THE STRUCTURE IS ADEQUATELY BRACED DURING THE ERECTION PROCESS. TEMPORARY REMOVAL OF BRACING AND BRACE STRUTS IS ACCEPTABLE FOR LINER PANEL ERECTION, PROVIDED ADEQUATE TEMPORARY BRACING IS USED.



NBS LINER PANEL ERECTION NOTES

(PANELS 36" NET LAY)

For Building Dept. Review	MBS	KJW	DSC	CLE	09/19/19
Approval Drawings	MBS	KJW	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJW	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	MBS	KJW	STK	CLE	06/29/20
Plan Check Review	MBS	CDB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KDB	CLE	03/23/21

NUCOR BUILDING SYSTEMS
505 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WESTSTONE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-4477 FAX: (972) 524-4417
1050 WATERY LANE, BRIGHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: X PDC BLDG

00 NE AIRPORT WAY, PORTAL, OR

MER NAME: KELLY

DNGVIEW, WA

SHEET TITLE

JMBER: 0H0787A

[redacted]

03/26/2021

OREGON SEPT 11, 2018 CURTIS L. FAH

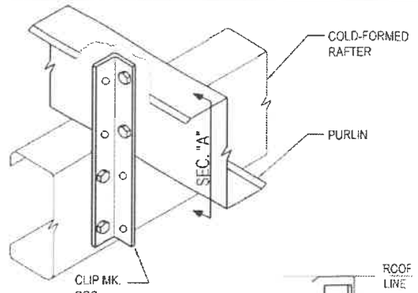
EXPIRATION DATE: 12-31-2021

This detail pertains only to the materials designed and supplied by Nucor Corporation, Buildings Systems. Nucor Corporation shall not be responsible for any modifications made to this detail by any party other than Nucor Buildings Systems. The erector professional engineer shall review and approve all erection procedures and temporary bracing. Our single source responsibility does not apply to any work not performed by Nucor Buildings Systems or its agents and shall not be considered as such.

SHEET

E9 of 9

REVIEWED FOR CODE COMPLIANCE
Date: 04/03/21



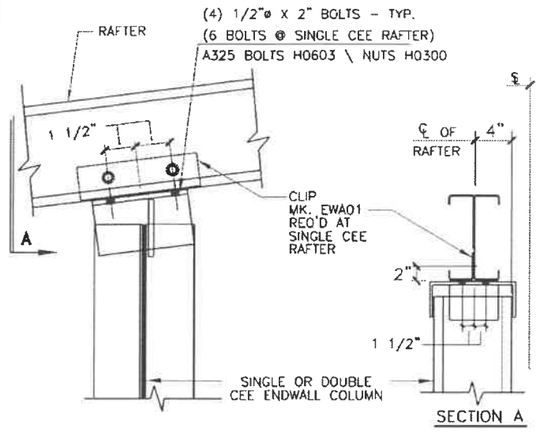
RAFTER DEPTH	PUR. IN DEPTH	8"	9.5"	10"	12"
	8"	PCC01	PCC13	PCC03	PCC02
	12"	PCC02	PCC14	PCC04	PCC05

SECTION A

EW PURLIN AT SINGLE CEE RAFTER

USE (4) 1/2" x 1 1/4" A307 BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

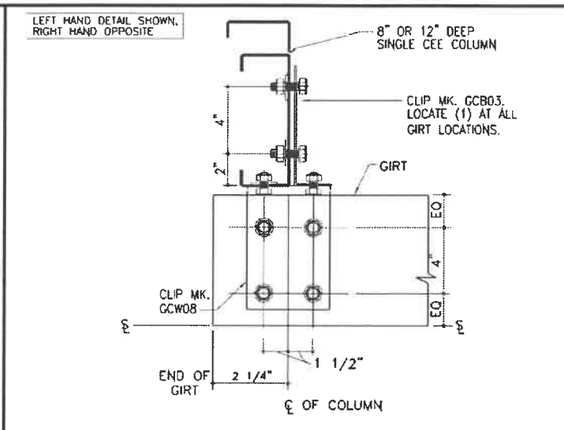
BB0071 — A1



ENDWALL COLUMN TO RAFTER

COLD-FORMED COLUMN TO COLD-FORMED RAFTER
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

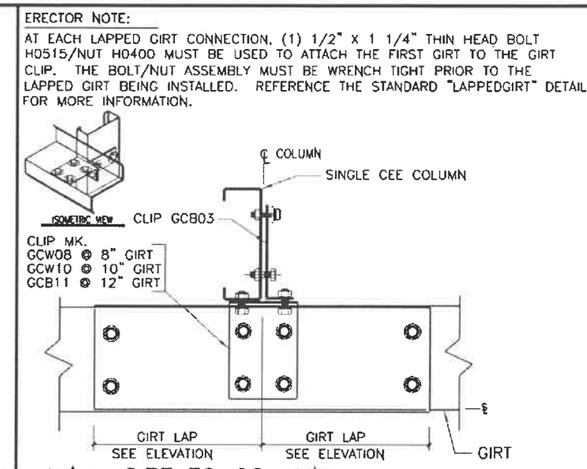
AB0090 — B1



GIRT TERMINATION, BYPASS ENDWALL

NOTE: USE (8) 1/2" x 1 1/2" A307 BOLTS H0500/NUTS H0400
SEE ERECTOR NOTE FOR TYP. WASHER REQUIREMENTS

C3



WALL GIRT TO COLUMN

USE (11) 1/2" x 1 1/4" A307
BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

C7

For Building Dept. Review	MBS	DSC	CLE	09/19/19
Approval Drawings	MBS	KJM	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	05/29/20
Plan Check Review	MBS	CDB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KDB	CLE	03/23/21

NUCOR BUILDING SYSTEMS
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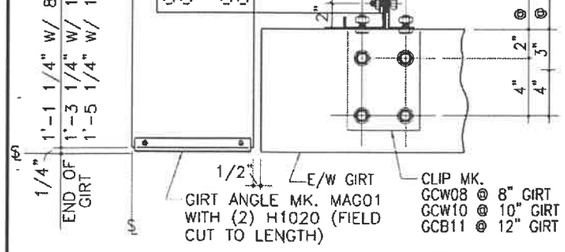
PHONE: (435) 919-3100 FAX: (435) 919-3101

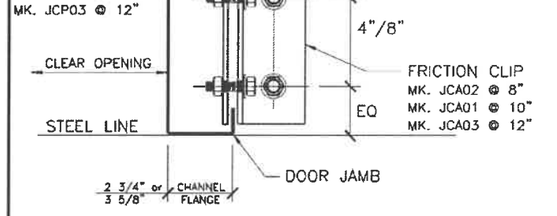
PROJECT NAME: X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR
DRAWN BY: KELLY
ONGVIEW, WA
JMBER: 9H0787A
SHEET TITLE:



BYPASS ENDWALL GIRT AT CORNER

USE (7) 1/2" x 1 1/4" A307
BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

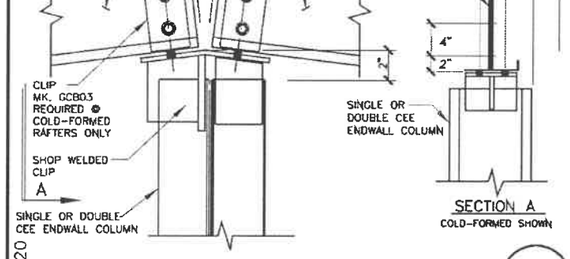
CF0010 — D7



JAMB TO FINISHED FLOOR

USE (2) 1/2" x 1 1/4" A307
BOLTS H0500 / NUTS H0400
ATTACHMENT TO SLAB BY OTHERS
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

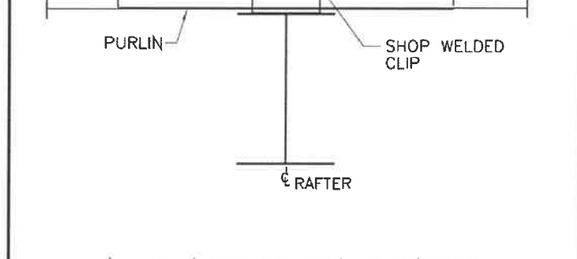
CG0030 — E6



EW CEE COL TO RIDGE RAFTER CONN

BOLT COL. TO RAF. FLANGE W/ (4) 1/2" X 2" A325 BOLTS H0603/NUTS H0300
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

AB0120 — F19

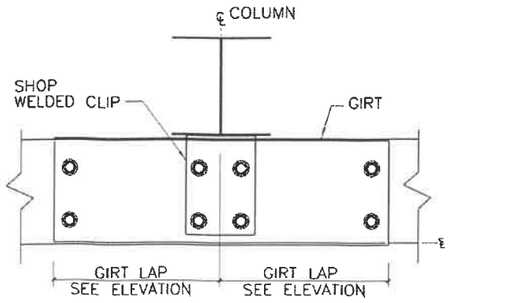


PURLIN TO INTERIOR FRAME RAFTER

USE (8) 1/2" x 1 1/4" A307
BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

BB0050 — G2

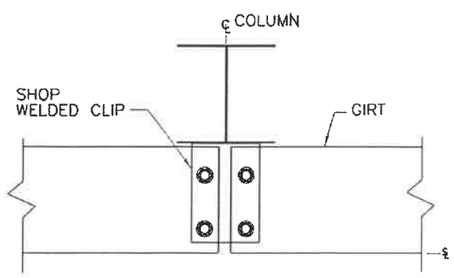
ERECTOR NOTE:
AT EACH LAPPED GIRT CONNECTION, (1) 1/2" x 1 1/4" THIN HEAD BOLT H0515/NUT H0400 MUST BE USED TO ATTACH THE FIRST GIRT TO THE GIRT CLIP. THE BOLT/NUT ASSEMBLY MUST BE WRENCH TIGHT PRIOR TO THE LAPPED GIRT BEING INSTALLED. REFERENCE THE STANDARD "LAPPED GIRT DETAIL" FOR MORE INFORMATION.



GIRT TO COLUMN

USE (7) 1/2" x 1 1/4" A307
BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

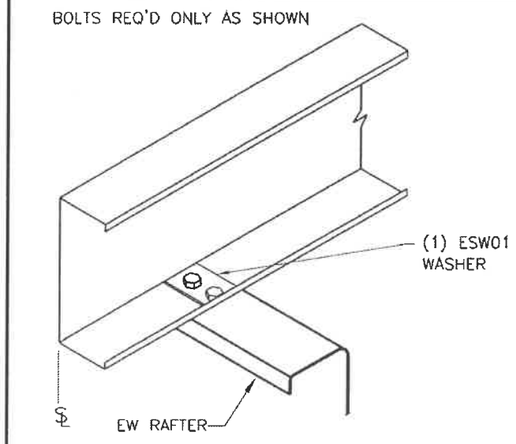
CI0020 — H2



SIMPLE SPAN GIRT TO COLUMN

USE (4) 1/2" x 1 1/4" A307
BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

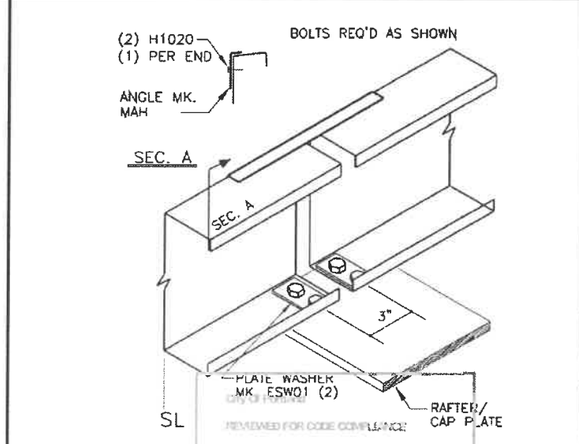
H4



EAVE STRUT TO ENDWALL RAFTER

USE (2) 1/2" x 2" A325 BOLTS H0603 / NUTS H0300
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

BA0050 — I6



LOW EAVE EAVE STRUT AT BYPASS GIRTS

USE (4) 1/2" x 2" A325 BOLTS H0603 / NUTS H0300
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

BA0020 — J2

03/26/2021
OREGON SEPT 11, 2018 CURTIS L. LAIR
EXPIRATION DATE: 12-31-2021

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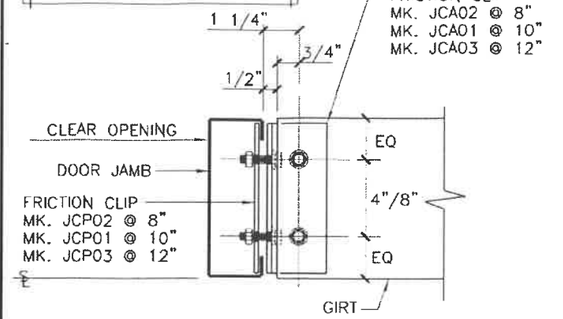
SHEET: D1 of 10

NOTE:
INSTALL CLIPS ON JAMB BEFORE STANDING JAMB. USE LEVEL TO ALIGN GIRTS ADJUST CLIP AS REQUIRED.



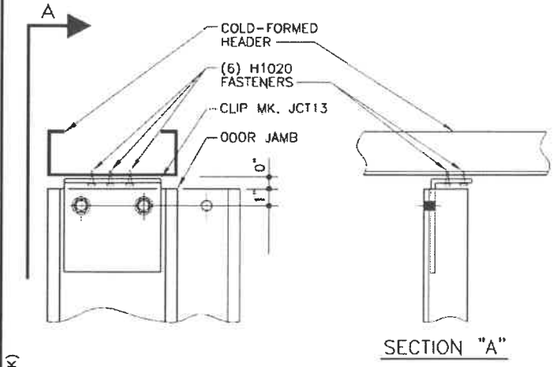
GIRT TO JAMB

USE (4) 1/2" x 1 1/4" A307 BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

K1

CG0060

LEFT HAND DETAIL SHOWN, RIGHT HAND OPPOSITE



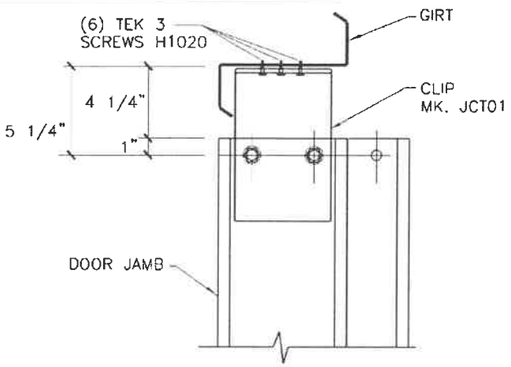
DOOR JAMB TO HEADER CONN

USE (4) 1/2" x 1 1/4" A307 THIN HEAD BOLTS H0515/NUTS H0400
REFERENCE STANDARD WASHER DETAIL FOR TYPICAL WASHER REQUIREMENTS

L8

CG0062(K)

ERECTOR NOTE:
PRE-DRILL HOLES @ NESTED ZEE GIRTS & DOUBLE CEE GIRTS IF REQUIRED.

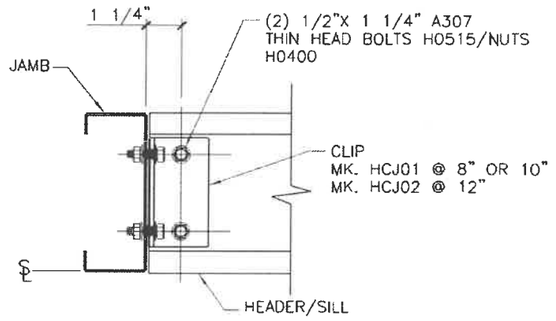


DOOR JAMB TO GIRT CONNECTION

USE (2) 1/2" X 1 1/2" A307 BOLTS H0500/NUTS H0400
SEE ERECTOR NOTE FOR TYP. WASHER REQUIREMENTS

L9

CG0070



HEADER/SILL TO JAMB

USE (2) 1/2" x 1 1/4" A307 BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

M1

GC0050

For Building Dept. Review	MBS	KJM	DSC	CLE	09/19/19
Approval Drawings	MBS	KJM	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	06/29/20
Plan Check Review	MBS	CDB	KDB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KDB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KDB	CLE	03/23/21

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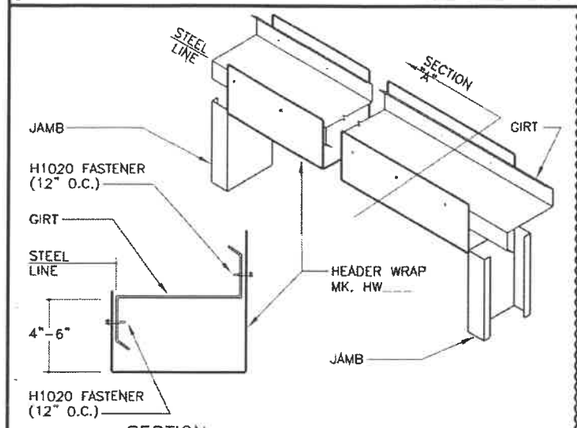
900 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-3411 FAX: (972) 524-3417
1050 MARTIN LANE, BEECH GROVE, IN 46107
PHONE: (438) 818-3100 FAX: (438) 919-3101



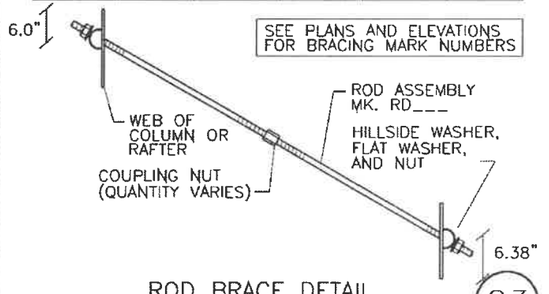
HEADER WRAP DETAIL

M16

CG0025

ROD DIAMETER	MARK NUMBER	HILLSIDE WASHERS	FLAT WASHERS	A307/A325 NUTS	COUPLING NUTS
5/8" ø	RDB ___	(2) H0930	(2) H0210	(2) H0310	H0810
3/4" ø	RDC ___	(2) H0930	(2) H0220	(2) H0320	H0820
7/8" ø	RDD ___	(2) H0930	(2) H0230	(2) H0325	H0830
1" ø	RDE ___	(2) H0960	(2) H0240	(2) H0330	H0840
1 1/8" ø	RDF ___	(2) H0960	(2) H0250	(2) H0450	H0850
1 1/4" ø	RDG ___	(2) H0960	(2) H0260	(2) H0340	H0860

SEE PLANS AND ELEVATIONS FOR BRACING MARK NUMBERS



ROD BRACE DETAIL
(WEB TO WEB)

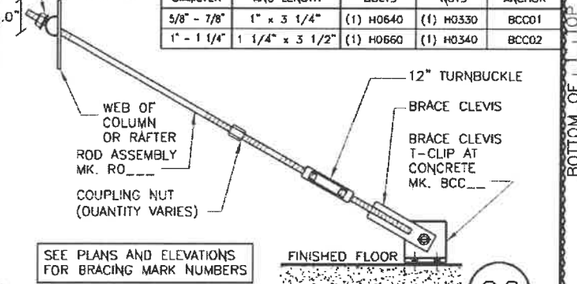
Q3

AF0010

ROD DIAMETERS	MARK NUMBERS	HILLSIDE WASHERS	FLAT WASHERS	A307/A325 NUTS	BRACE CLEVISES	TURN-BUCKLES	COUPLING NUTS
5/8" ø	RDB ___	(1) H0930	(1) H0210	(1) H0310	(1) BCS02	(1) H0710	(1) H0810
3/4" ø	RDC ___	(1) H0930	(1) H0220	(1) H0320	(1) BCS03	(1) H0720	(1) H0820
7/8" ø	RDD ___	(1) H0930	(1) H0230	(1) H0325	(1) BCS04	(1) H0730	(1) H0830
1" ø	RDE ___	(1) H0960	(1) H0240	(1) H0330	(1) BCL05	(1) H0740	(1) H0840
1 1/8" ø	RDF ___	(1) H0960	(1) H0250	(1) H0450	(1) BCL01	(1) H0750	(1) H0850
1 1/4" ø	RDG ___	(1) H0960	(1) H0260	(1) H0340	(1) BCL02	(1) H0760	(1) H0860

BRACE CLEVIS BOLT AND NUT PART NUMBERS

ROD DIAMETER	BOLT DIAMETER AND LENGTH	A325 BOLTS	A325 NUTS	FLOOR ANCHOR
5/8" - 7/8"	1" x 3 1/4"	(1) H0640	(1) H0330	BCC01
1" - 1 1/4"	1 1/4" x 3 1/2"	(1) H0660	(1) H0340	BCC02

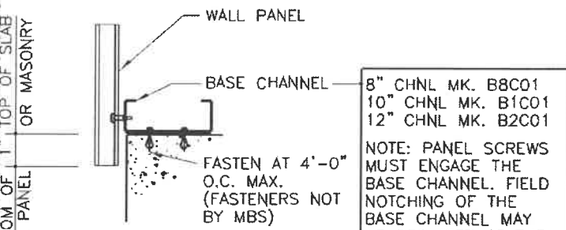


SEE PLANS AND ELEVATIONS FOR BRACING MARK NUMBERS

ROD BRACE DETAIL
(WEB TO FLOOR)

Q6

AF0040

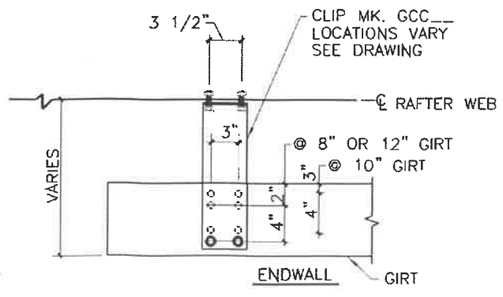


8" CHNL MK. B8C01
10" CHNL MK. B1C01
12" CHNL MK. B2C01

NOTE: PANEL SCREWS MUST ENGAGE THE BASE CHANNEL. FIELD NOTCHING OF THE BASE CHANNEL MAY BE REQUIRED AT THE COL'S AND CORNERS.

BASE CHANNEL (NO TRIM)
SEE WALL SHEETING ERECTION NOTES FOR WALL PANEL FASTENER LOCATIONS

T4



BYPASS GIRT to CEE RAFTER WEB

USE (4) 1/2" x 1 1/4" A307 BOLTS H0500 / NUTS H0400
REFERENCE ERECTOR NOTE FOR TYPICAL WASHER REQUIREMENTS

W5

TYPICAL FLANGE BRACE MARK NUMBERS

ACTUAL FLANGE BRACES DO NOT HAVE MARK NUMBERS ON THEM

FBC___
INDICATES LENGTH OF FLANGE BRACE IN INCHES
LENGTH

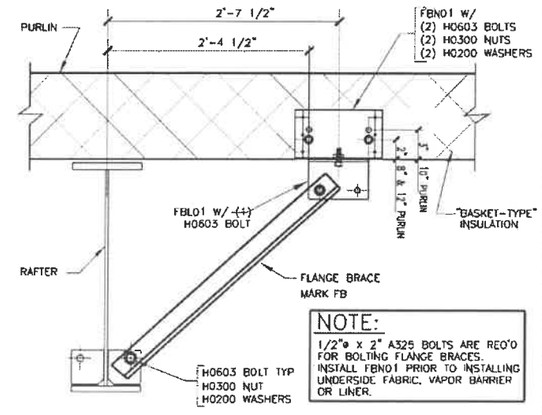
FBD___
INDICATES LENGTH OF FLANGE BRACE IN INCHES
LENGTH

FBE___
COUNTER - SEE CHART

COUNTER	LENGTH
01	35 7/8"
02	37 1/8"
03	49 1/2"
04	50 1/4"

LENGTH

AG0003



NOTE:
1/2"ø x 2" A325 BOLTS ARE REQ'D FOR BOLTING FLANGE BRACES. INSTALL FBN01 PRIOR TO INSTALLING UNDERSIDE FABRIC, VAPOR BARRIER OR LINER.

TYP FLANGE BRACE @ PURLIN & RAFTER

WITH THE USE OF "BASKET-TYPE" INSULATION
NOTES: SEE PLANS AND ELEVATIONS FOR FLANGE BRACE PART MARKS

AG0110

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/08/21
Permit # 20-162270-(RS-FD-CO)

PROJECT NAME: X PDC BLDG
000 NE AIRPORT WAY, PORTAL, OR
OWNER NAME: KELLY
DNGVIEW, WA
UMBER: BH0787A
SHEET TITLE:

03/26/2021
OREGON
SEPT 11, 2018
CURTIS L. EAR
EXPIRATION DATE: 12-31-2021

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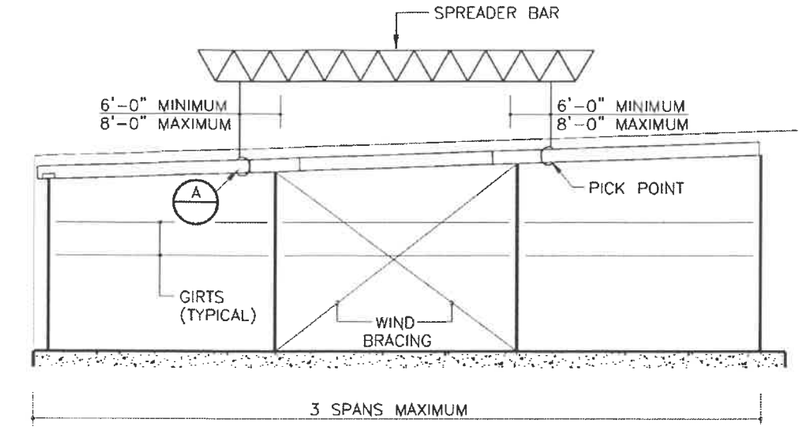
SHEE
D2 of 10



SECTION A

COLD FORMED ENDWALL ERECTOR DETAIL

1) GIRTS, CLIPS, RAFTERS AND COLUMNS MUST BE SECURELY AND TIGHTLY BOLTED TOGETHER PRIOR TO STANDING UP THE ENDWALL SECTION. (NOTE: THE GIRTS PROVIDE STABILITY TO THE ENDWALL SYSTEM DURING THE ERECTION PROCESS)

2) BUILT-UP COLUMNS/RAFTERS MUST BE ERECTED INDIVIDUALLY WHEN USED WITH COLD FORMED ENDWALL PARTS

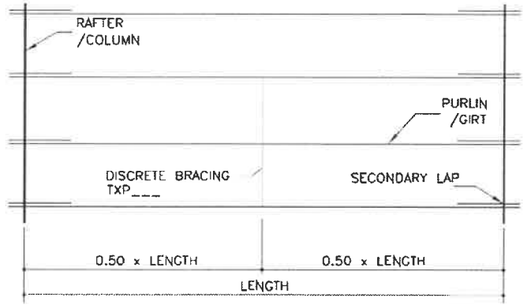
3) THIS DETAIL IS SUGGESTED IN ORDER TO MAINTAIN STRUCTURAL INTEGRITY OF ENDWALL PARTS AFTER ERECTION. SOUND JUDGEMENT BASED ON ERECTION KNOWLEDGE AND EXPERIENCE SHOULD BE APPLIED REGARDING SAFETY AND PRACTICALITY OF INDIVIDUAL SITUATIONS.

4) REGULATIONS SET FORTH BY THE OCCUPATIONAL SAFETY AND HEALTH ACT, LOCAL, STATE, AND/OR FEDERAL AGENCIES SHOULD BE ADHERED TO AT ALL TIMES. THE METAL BUILDING MANUFACTURER IS NOT RESPONSIBLE FOR INJURY, DAMAGE, OR FAILURE WHICH MAY RESULT FROM FAILING TO MEET ANY OF THESE REGULATIONS.

AA0005

PLAN VIEW OF DISCRETE BRACING LOCATIONS PER BAY

1) THE SAG BRACING IS SPACED AS SHOWN IN THE DETAIL BELOW

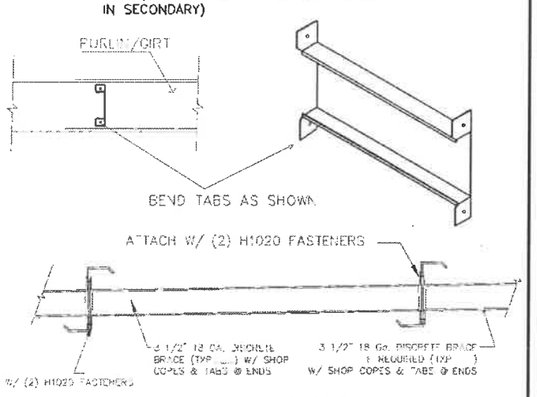


NOTE: THE DISCRETE BRACING ATTACHMENT METHOD IS THE SAME REGARDLESS OF THE SECONDARY MEMBER TYPE (ZEE, CEE, EAVE STRUT, BEAM, ETC.)

ATTACHMENT AT FINISHED FLOOR IS BY OTHERS

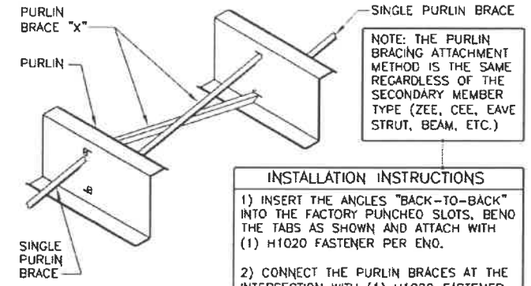
INSTALLATION INSTRUCTIONS

1)BEND THE TABS AS SHOWN AND ATTACH WITH (1) H1020 FASTENER PER TAB. (BE CAREFUL TO MISS ANY HOLES IN SECONDARY)



DISCRETE BRACING DETAIL

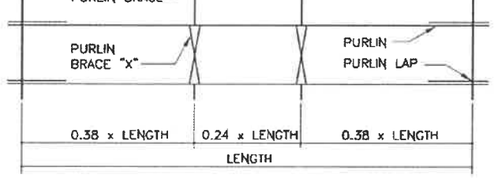
SEE ROOF & WALL FRAMING PLANS FOR BRACING QUANTITIES AND LOCATIONS



PLAN VIEW OF PURLIN BRACING LOCATIONS PER BAY

1) THERE ARE ALWAYS (2) ROWS OF PURLIN BRACING REQUIRED REGARDLESS OF THE BAY LENGTH.

2) THE PURLIN BRACING IS ALWAYS SPACED AS SHOWN IN THE DETAIL BELOW.



PURLIN BRACING ATTACHMENT ≥2:12 SLOPE

SEE ROOF FRAMING PLAN(S) FOR PURLIN BRACING MARK NUMBERS, QUANTITIES, AND LOCATIONS

RB0002

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	KJM	DSC CLE 09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK CLE 06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK CLE 06/29/20
Plan Check Review	MBS	CDB	KDB CLE 01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KDB CLE 03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KDB CLE 03/23/21

NUCOR BUILDING SYSTEMS
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PHONE: (972) 524-4417 FAX: (972) 524-4417
1050 WATERY LANE, BRIGHAM CITY, UT 84302
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME
[redacted]
X PDC BLDG
00 NE AIRPORT WAY, PORTAL, OR

CUSTOMER NAME
KELLY
DNGVIEW, WA

JOB NUMBER
BH0787A

SHEET TITLE

03/26/2021

OREGON
SEPT 11, 2018
CURTIS L. EARL
EXPIRATION DATE: 12-31-2021

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SHEET D3 of 10

City Of Portland
REVIEWED FOR CODE COMPLIANCE
Date: 04/03/21
Permit # 20160220MX0000

COLLATERAL DEAD LOADS. UNLESS OTHERWISE NOTED, ARE ASSUMED TO BE UNIFORMLY DISTRIBUTED. WHEN SUSPENDED SPRINKLER SYSTEMS, LIGHTING, HVAC EQUIPMENT, CEILINGS, ETC. ARE SUSPENDED FROM ROOF MEMBERS, CONSULT ENGINEER OF RECORD IF THESE CONCENTRATED LOADS EXCEED 500 POUNDS (USING THE WEB MOUNT DETAIL) OR 200 POUNDS (USING THE FLANGE MOUNT DETAIL), OR IF INDIVIDUAL MEMBERS ARE LOADED SIGNIFICANTLY MORE THAN OTHERS.

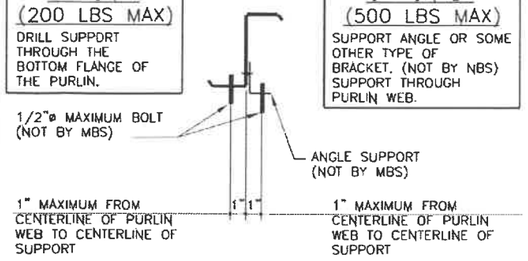
GENERAL RESTRICTION:

UNDER NO CIRCUMSTANCES CAN THE PURLIN STIFFENING LIP BE FIELD MODIFIED FROM THE FACTORY SUPPLIED CONDITION. ALSO DO NOT HANG ANYTHING FROM PURLIN STIFFENING LIP.

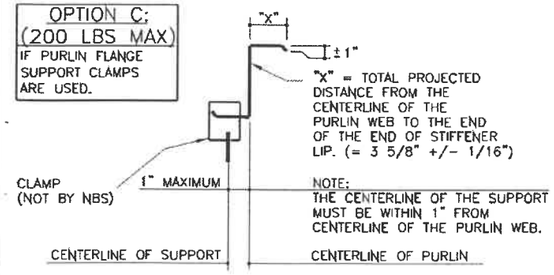
OPTIONS FOR SUPPORT ATTACHMENTS

OPTION A (200 LBS MAX)
DRILL SUPPORT THROUGH THE BOTTOM FLANGE OF THE PURLIN.

OPTION B (500 LBS MAX)
SUPPORT ANGLE OR SOME OTHER TYPE OF BRACKET. (NOT BY NBS) SUPPORT THROUGH PURLIN WEB.



OPTION C: (200 LBS MAX)
IF PURLIN FLANGE SUPPORT CLAMPS ARE USED.



B00010

PURLIN SUPPORT METHODS

TYPICAL FIELD WELD REQUIREMENTS ERECTOR NOTE:

(UNLESS NOTED OTHERWISE ON DRAWINGS)

ALL FIELD WELDING MUST BE PERFORMED BY AWS/CWB CERTIFIED WELDERS WHO ARE QUALIFIED FOR THE WELDING PROCESSES AND POSITIONS INDICATED.

ALL WORK MUST BE COMPLETED AND INSPECTED IN ACCORDANCE WITH THE APPLICABLE AWS/CWB SPECIFICATIONS.

WELD ELECTRODES USED FOR THE SMAW (OR STICK) WELD PROCESS MUST BE 70 KSI/483 MPa MATERIAL AND LOW HYDROGEN CONTENT.

GALVANIZED STEEL FIELD WELDING RECOMMENDATIONS

PREPARATION OF WELD AREA

AWS D-19.0, WELDING ZINC COATED STEEL, CALLS FOR WELDS TO BE MADE ON STEEL THAT IS FREE OF ZINC IN THE AREA TO BE WELDED. FOR GALVANIZED STRUCTURAL COMPONENTS, THE ZINC COATING SHOULD BE REMOVED AT LEAST ONE TO FOUR INCHES (2.5-10 cm) FROM EITHER SIDE OF THE INTENDED WELD ZONE AND ON BOTH SIDES OF THE WORKPIECE. GRINDING BACK THE ZINC COATING IS THE PREFERRED AND MOST COMMON METHOD; BURNING THE ZINC AWAY OR PUSHING BACK THE MOLTEN ZINC FROM THE WELD AREA ARE ALSO EFFECTIVE.

TOUCH-UP OF WELD AREA

WELDING ON GALVANIZED SURFACES DESTROYS THE ZINC COATING ON AND AROUND THE WELD AREA. RESTORATION OF THE AREA WILL BE PERFORMED IN ACCORDANCE WITH ASTM A 780, STANDARD PRACTICE FOR REPAIR OF DAMAGED AND UNCOATED AREAS OF HOT-DIP GALVANIZED COATINGS, WHICH SPECIFIES THE USE OF PAINTS CONTAINING ZINC DUST, ZINC-BASED SOLDERS OR SPRAYED ZINC. ALL TOUCHUP AND REPAIR METHODS ARE CAPABLE OF BUILDING A PROTECTIVE LAYER TO THE THICKNESS REQUIRED BY ASTM A 780.

SAFETY & HEALTH

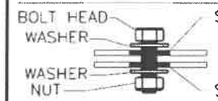
WHEN WELDING DIRECTLY ON GALVANIZED STEEL IS UNAVOIDABLE, OSHA PERMISSIBLE EXPOSURE LIMITS (PELS) MAY BE EXCEEDED AND EVERY PRECAUTION, INCLUDING HIGH-VELOCITY CIRCULATING FANS WITH FILTERS, AIR RESPIRATORS AND FUME-EXTRACTION SYSTEMS SUGGESTED BY AWS, SHOULD BE EMPLOYED. FUMES FROM WELDING GALVANIZED STEEL CAN CONTAIN ZINC, IRON, AND LEAD. FUME COMPOSITION TYPICALLY DEPENDS ON THE COMPOSITION OF THE MATERIALS USED, AS WELL AS THE HEAT APPLIED BY THE PARTICULAR WELDING PROCESS. IN ANY EVENT, GOOD VENTILATION MINIMIZES THE AMOUNT OF EXPOSURE TO FUMES.

PRIOR TO WELDING ON ANY METAL, CONSULT ANSI/ASC Z-49.1, SAFETY IN WELDING, CUTTING AND ALLIED PROCESSES, WHICH CONTAINS INFORMATION ON THE PROTECTION OF PERSONNEL AND THE GENERAL AREA, VENTILATION AND FIRE PREVENTION.

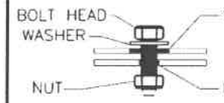
INFORMATION COURTESY OF AMERICAN GALVANIZERS ASSOCIATION

TYPICAL WASHER REQUIREMENTS ERECTOR NOTE

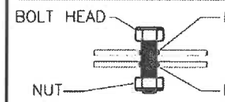
(UNLESS NOTED OTHERWISE ON DRAWINGS)



SLOT TO SLOT CONNECTIONS
WASHERS ARE REQUIRED ON BOTH SIDES OF MATERIAL IF SLOTS ARE USED ON BOTH SIDES (NOTE LAPPED ZEE MEMBER EXCEPTION).



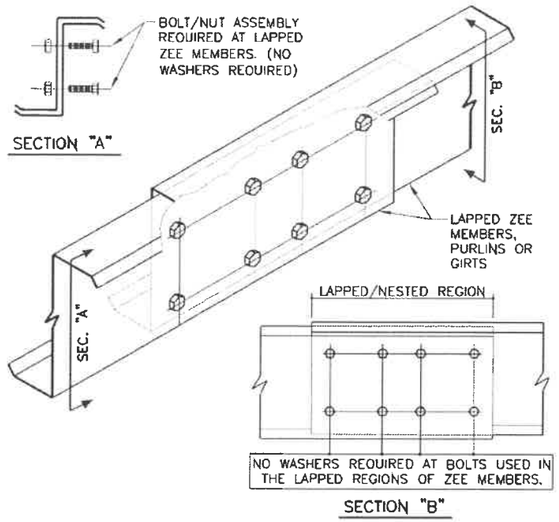
SLOT TO HOLE CONNECTIONS
ONE WASHER REQUIRED ON SLOTTED SIDE ONLY.



HOLE TO HOLE CONNECTIONS
NO WASHERS ARE REQUIRED WHEN SLOTS ARE NOT USED.

WASHER PART NUMBERS

H0200 - 1/2" FLAT WASHER	H0240 - 1" FLAT WASHER
H0210 - 5/8" FLAT WASHER	H0250 - 1 1/8" FLAT WASHER
H0220 - 3/4" FLAT WASHER	H0260 - 1 1/4" FLAT WASHER
H0230 - 7/8" FLAT WASHER	



IMPORTANT ERECTOR NOTE:

PLEASE REFER TO THE SHEETING ERECTION MANUALS FOR FURTHER ASSEMBLY INSTRUCTIONS

ONLINE VIDEO AND MANUALS ARE ALSO AVAILABLE:

PRIOR TO STARTING THE SHEETING PLEASE VISIT:
https://www.nucorbuildingsystems.com/resources/manuals/

INSTALLATION INSTRUCTIONS

CFR Standing Seam Installation

CFR Installation Videos

Video de Instalacion de cubierta tipo

Classic Roof Installation

VR16 II Vertical Rib Installation

HR3 Insulated Roof Installation

SR2 Insulated Standing Seam

Insulated Wall Sheeting

Single Curb Installation

Double Curb Installation

SEAMING MANUALS

CFR Standing Seam

SR2 Insulated Standing Seam

VR16 II Vertical Rib

SPECS & OTHER GUIDES

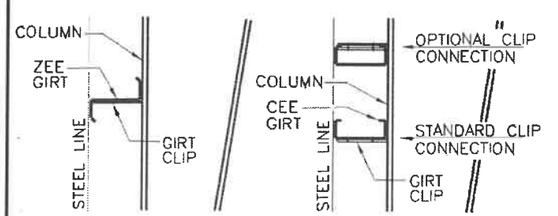
Master Spec 13 34 19

NBS Specification Guide

Preventative Maintenance Manual

ERECTOR NOTE: UNLESS SPECIFICALLY NOTED OTHERWISE, STANDARD ZEE GIRT ORIENTATION IS TO HAVE THE GIRT TOED DOWN AT THE STEEL LINE AS SHOWN IN THE DETAIL BELOW.

UNLESS SPECIFICALLY NOTED OTHERWISE, STANDARD CEE GIRT ORIENTATION IS TO HAVE THE GIRT TOED UP AS SHOWN IN THE DETAIL BELOW. STANDARD CLIP ATTACHMENT IS BELOW THE GIRT, HOWEVER SOME DETAILS REQUIRE THAT THE CLIP BE ABOVE THE GIRT. (REFER TO THE GIRT DETAILS ON THE ERECTION DRAWINGS FOR REQUIREMENTS) BOTH CLIP ATTACHMENTS ARE SHOWN IN THE DETAIL BELOW.

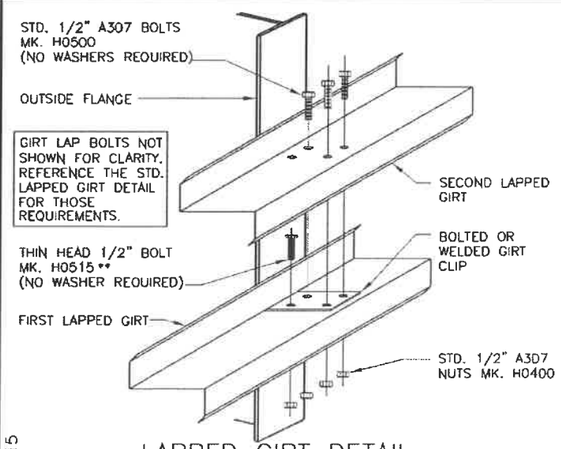


ZEE GIRT ORIENTATION CEE GIRT ORIENTATION

STANDARD GIRT ORIENTATION DETAIL

NOTE: BYPASS GIRT CONDITION IS SHOWN FOR REFERENCE ONLY. YOUR PROJECT MAY HAVE FLUSH OR INSET GIRTS.

CC0005



LAPPED GIRT DETAIL

LAPPED GIRTS @ INTERIOR BAY COLUMNS

** THE THIN HEAD 1/2" A307 BOLT MUST BE INSTALLED INTO THE FIRST GIRT AND CLIP OF A LAPPED CONDITION. THE BOLT/NUT ASSEMBLY MUST BE WRENCH TIGHT PRIOR TO THE SECOND LAPPED GIRT BEING INSTALLED.

CC0015

EMNOTE

For Building Dept. Review	MBS	KJM	DSC	09/19/19
Approval Drawings	MBS	KJM	DSC	CLE	09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	STK	CLE	06/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK	CLE	06/29/20
Plan Check Review	MBS	COB	KOB	CLE	01/19/21
Rev. 2 Anchor Bolt Plan	MBS	COB	KOB	CLE	03/19/21
Rev. 2 Building Dept. Review	MBS	COB	KOB	CLE	03/23/21

NUCOR BUILDING SYSTEMS
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PROJECT NAME: [redacted] PDC BLDG
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03/26/2021
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Date: 04/08/21

SHEET D4 of 10

CFR HAND CRIMPING INSTRUCTIONS

IMPORTANT NOTE: THE INSTRUCTIONS ON THE PAGE ONLY ADDRESS THE USE OF THE HAND CRIMPING TOOLS. THE INSTRUCTIONS FOR MECHANICAL SEAMING, IF REQUIRED, ARE OUTLINED IN THE CFR SEAMING MANUAL, WHICH IS INCLUDED WITH THE MECHANICAL SEAMER KIT.

SPECIALIZED SEAMING AND HAND CRIMPING TOOLS
The finished seam of the CFR roof panels requires special seaming tools that are available only through NBS.
CAUTION: The use of other seaming/crimping equipment will result in faulty and/or damaged seams and shall invalidate the roof . system's material and weathertightness warranties.

SEAMING TOOL SOURCE
The seaming tools are provided by NBS in accordance with the terms and conditions of the NBS contract documents. Contact the NBS Quality Service Representive to arrange scheduling, delivery and return of the seaming tools OR to purchase other roof accessory tools (crimpers, modularity tools and clamps.)

IMPORTANT: It shall be the erector's responsibility to apply the Nucor Roll Lock™ hand crimping method in such a way as to ensure that the panels have been adequately secured until mechanical seaming can occur.

CFR CRIMPING/SEAMING REQUIREMENTS

THE DESIGN OF THIS STRUCTURE REQUIRES THAT THE FOLLOWING SEAMING METHOD BE UTILIZED:

1) ☐ NUCOR ROLL LOCK™ SEAM (SEE NOTE 1 AND 2 BELOW)
2) ☐ MODIFIED NUCOR ROLL LOCK™ SEAM (SEE DETAIL ON FOLLOWING SHEET)
3) ☒ NUCOR VISE LOCK® SEAM (SEE NOTE 1, 2 AND 3 BELOW)
4) ☐ NUCOR VISE LOCK 360® SEAM (SEE NOTE 2 AND 3 BELOW)

NOTE 1: ADDITIONAL SEAMING MAY BE NECESSARY AS SPECIFIED BY THE BUILDER.

NOTE 2: MULTIPLE SEAMING TYPES MAY BE REQUIRED. REVIEW THE ROOF SEAMING PLAN CAREFULLY FOR SEAMING REQUIREMENTS.

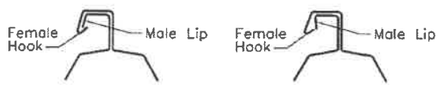
NOTE 3: NOT ALL ROOF SYSTEMS REQUIRE MECHANICAL SEAMING. THE BUYER, OWNER, OR ARCHITECT MAY ELECT TO SPECIFY A MECHANICALLY SEAMED PANEL. OFTEN, FACTORY MUTUAL RATINGS ALSO REQUIRE A VL360 MECHANICAL SEAMER.
SEE THE CFR SEAMING MANUAL FOR IMPORTANT ERECTOR INFO ABOUT VISE LOCK 360 SEAMER REQUIREMENTS.

WHEN TO CRIMP/SEAM
As work progress's, it shall be the erector's responsibility to apply the Nucor Roll Lock™ hand crimping method in such a way as to ensure that the panels have been adequately secured until mechanical seaming can occur.

Whenever possible, the installed roof panels should be mechanically seamed as work progress's OR at the completion of each day's work. If high winds or rain/snow conditions are imminenet, the installed roof panels must be seamed before such conditions occur.

Refer to the project erection drawing Roof Seaming Plan and/or Detail pages to determine what seaming option is required. The above detail conveys the MINIMUM seaming requirements based upon the design of the project. Additional seaming may be necessary as specified by the builder. NOTE: multiple seaming types may be required on a project, review the Roof Seaming Plan and details carefully.

CHECK PANEL ASSEMBLY



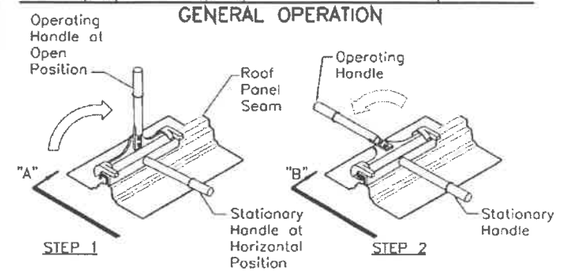
SIDE LAP FIT-UP
Before seaming and/or crimping, inspect the full length of each roof panel side lap. Check that the lip at the panel's male edge is enclosed by the hook of the adjacent panel's female edge, as shown in the detail above. Any conditions where the male lip is not positioned inside of the female hook must be corrected before attempting to seam/crimp the roof panels.
CAUTION: False seaming may occur where the female lip does not hook the roof panel's male edge. False seamed roof panels cannot provide their designed wind load and weather resistance.

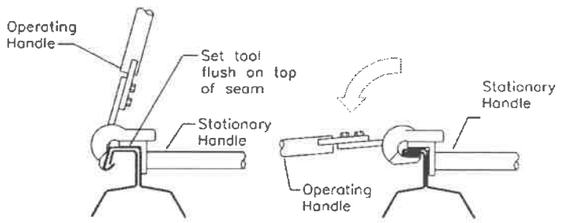
CLIP ALIGNMENT
Before seaming and or crimping, check that each roof panel clip is properly seated in the roof side lap assembly. Any displaced clips must be corrected before attempting to seam the roof panels.
CAUTION: Panel clips that are not properly aligned can cause faulty seaming/crimping and objectionable seam appearance.

SEAM DAMAGE
Before seaming, check that the male and female edges do not have kinks or other distortions. Any such distortions must be corrected before attempting to seam the roof panels.

EA6010

MANUAL CRIMPING TOOL OPERATION
GENERAL OPERATION





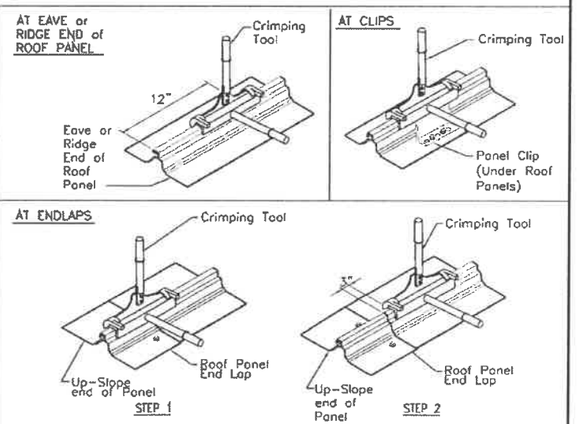
NOMENCLATURE
The detail above identifies the operational parts of the Roll Lock/Vise Lock Crimping Tool. This crimping tool is shown for the manually producing the Roll Lock Seam.

TOOL ORIENTATION & FORMING THE SEAM
Orient the tool to fit correctly onto the roof panel seam as shown in Sec A above.

When the tool is correctly positioned on the panel, push the stationary blade solidly against the top of the seam. While holding the stationary handle in the horizontal position, rotate the operating handle down to the horizontal position.

NOTE: The detail shows a short handled crimping tool, the tool you receive may be the stand-up type crimper, with either tool the orientation on the seam is the same.

MANUAL CRIMPING AT EAVE, ENDLAP, RIDGE AND AT EACH CLIP



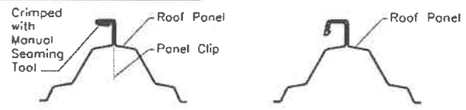
TOOL POSITION AT THE END OF THE ROOF PANEL When hand crimping at the eave or ridge end of the roof panel, crimp panel a full 12" up from the eave and down from the ridge.
TOOL POSITION AT PANEL CLIPS When crimping at a panel clip location, center the tool over the panel clip and crimp that area, as shown in Detail above.

TOOL POSITION AT AN END LAP When crimping at an end lap, the crimping must be done in two steps.
STEP 1 Center the end of the crimping tool over the end lap and seam that area.
STEP 2 Position the end of the crimping tool 3" from the edge of the end lap and seam that area to ensure that the panel clip at this location is also crimped.

CFR SEAM TYPES

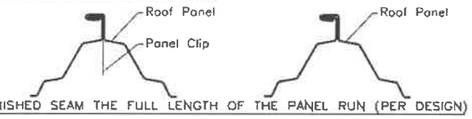
The NBS CFR roof system has three seam type options. The project design and performance requirements govern which seam type is required. Different seam types may be required on specific areas of the roof. In all cases, refer to the Roof Seaming Plan in erection drawings set to determine the required seam type and locations.

NUCOR ROLL LOCK™ SEAM



The "Roll Lock" Seam requires the roof panels be crimped with the hand crimping tool at the panel clips, the eave, the high side of the roof panels, and the end laps. The Motorized Seaming Machine is not required for this seam type.

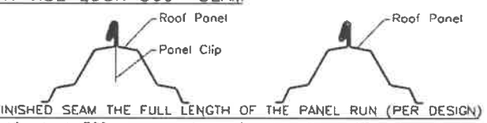
NUCOR VISE LOCK® SEAM



The Vise Lock seam can be achieved by two different methods:
1. Continually hand crimping the seam with the Vise Lock Hand Crimper.
2. Mechanically seaming with a Vise Lock Seaming Machine.

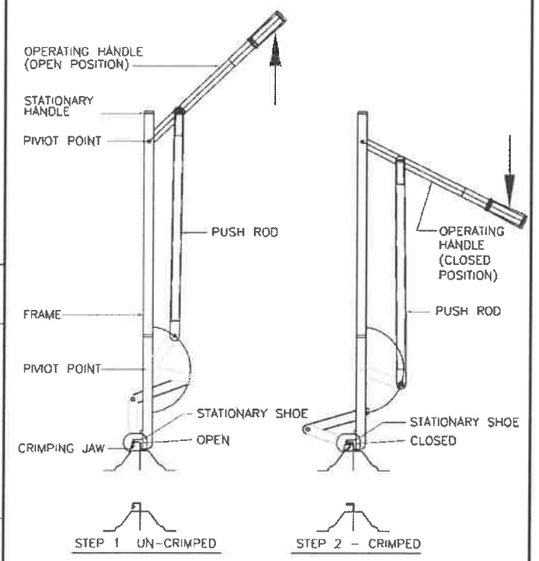
Refer to the CFR SEAMING MANUAL for specific motorized seaming instructions. This manual is included in the Motorized Seamer Kit.

NUCOR VISE LOCK 360® SEAM



The Vise Lock 360 seam can be achieved by three different methods:
1. Continually hand crimping the seam with the Vise Lock 360 Hand Crimper. Seam needs to be hand crimped or seamed into a Vise Lock Seam *prior* to using the Vise Lock 360 crimper. This crimper is a buy-out tool and is used to hand crimp small edge and corner zones.
2. Utilizing a two pass (separate seamers) seamer method. Meaning the first pass seamer would be a Vise Lock Seamer and the second seamer would be a Vise Lock 360 Seamer.
3. Utilizing a Single directional Vise Lock 360 Seamer.

Refer to the CFR SEAMING MANUAL for specific motorized seaming instructions. This manual is included in the Motorized Seamer Kit.



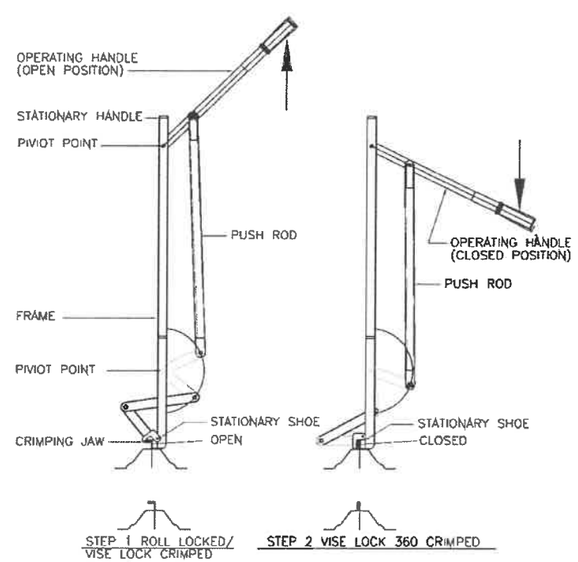
MANUAL CRIMPING WITH THE STAND-UP VISE LOCK CRIMPER

The Manual Crimping procedure for this stand-up Vise Lock crimper is the same procedure as the small Vise Lock hand crimper. This crimper could be used in conjunction with the stand-up Vise Lock 360 crimper. Continually crimping with this crimper will result in a Vise Lock Seam.

TOOL OPERATION

STEP 1 With the handle in the upword position, place the VL crimper on panel rib. Make sure the crimper head is completely down on the top of the panel rib before crimping. Improper placement of crimper on the panel may result in panel and/or crimper damage.

STEP 2 Push down on the handle until it stops. Release and move the crimper approximently 4" and repeat step #1 (as needed).



MANUAL CRIMPING WITH THE STAND-UP VISE LOCK 360 CRIMPER

The Manual Crimping procedure for the stand-up Vise Lock 360 crimper is the same procedure as the small Vise Lock 360 hand crimper. This crimper is designed to be used in conjunction with the stand-up Vise Lock crimper OR seamer. Continually crimping with this crimper will result in a Vise Lock 360 Seam.

TOOL OPERATION

Step 1 After the area has been completely seamed or crimped to form the VISE LOCK SEAM, place the VISE LOCK 360 crimper over the area with the handle in the upword position.

Step 2 Push the handle down until it stops. Release handle and move the crimper approximently 4", repeat step #1.

IMPORTANT: If the 360 tool does not form the VISE LOCK 360 seam correctly, then stop and check the seam to see if you have a good continuous VISE LOCK SEAM. If not, then re-crimp/seam the area with the proper VISE LOCK tool.

NOTE: DO NOT USE THE VISE LOCK 360 CRIMPER FOR TEMPORARY CRIMPING

For Building Dept. Review	MBS	KJM	09/19/19
Approval Drawings	MBS	DSC	CLE 09/19/19
Rev. 1 Anchor Bolt Plan	MBS	KJM	DSC CLE 05/26/20
Rev. 1 Building Dept. Review	MBS	KJM	STK CLE 05/29/20
Plan Check Review	MBS	CDB	KOB CLE 01/19/21
Rev. 2 Anchor Bolt Plan	MBS	CDB	KOB CLE 03/19/21
Rev. 2 Building Dept. Review	MBS	CDB	KOB CLE 03/23/21

NUCOR BUILDING SYSTEMS
500 INDUSTRIAL PARKWAY, WATERLOO, IN 46793
PHONE: (260) 837-7891 FAX: (260) 837-7384
PO BOX 1006, 200 WHETSTONE RD, SWANSEA, SC 29160
PHONE: (803) 568-2100 FAX: (803) 568-2121
600 APACHE TRAIL, TERRELL, TX 75160
PHONE: (972) 524-3441 FAX: (972) 524-3447
1000 WATERY LANE, BIRMINGHAM, UT 84045
PHONE: (435) 919-3100 FAX: (435) 919-3101

PROJECT NAME: [redacted] PDC BLDG
[redacted] 00 NE AIRPORT WAY, PORTAL, OR
CUSTOMER NAME: KELLY
[redacted] ONGVIEW, WA
JOB NUMBER: [redacted] 9H0787A
SHEET TITLE:

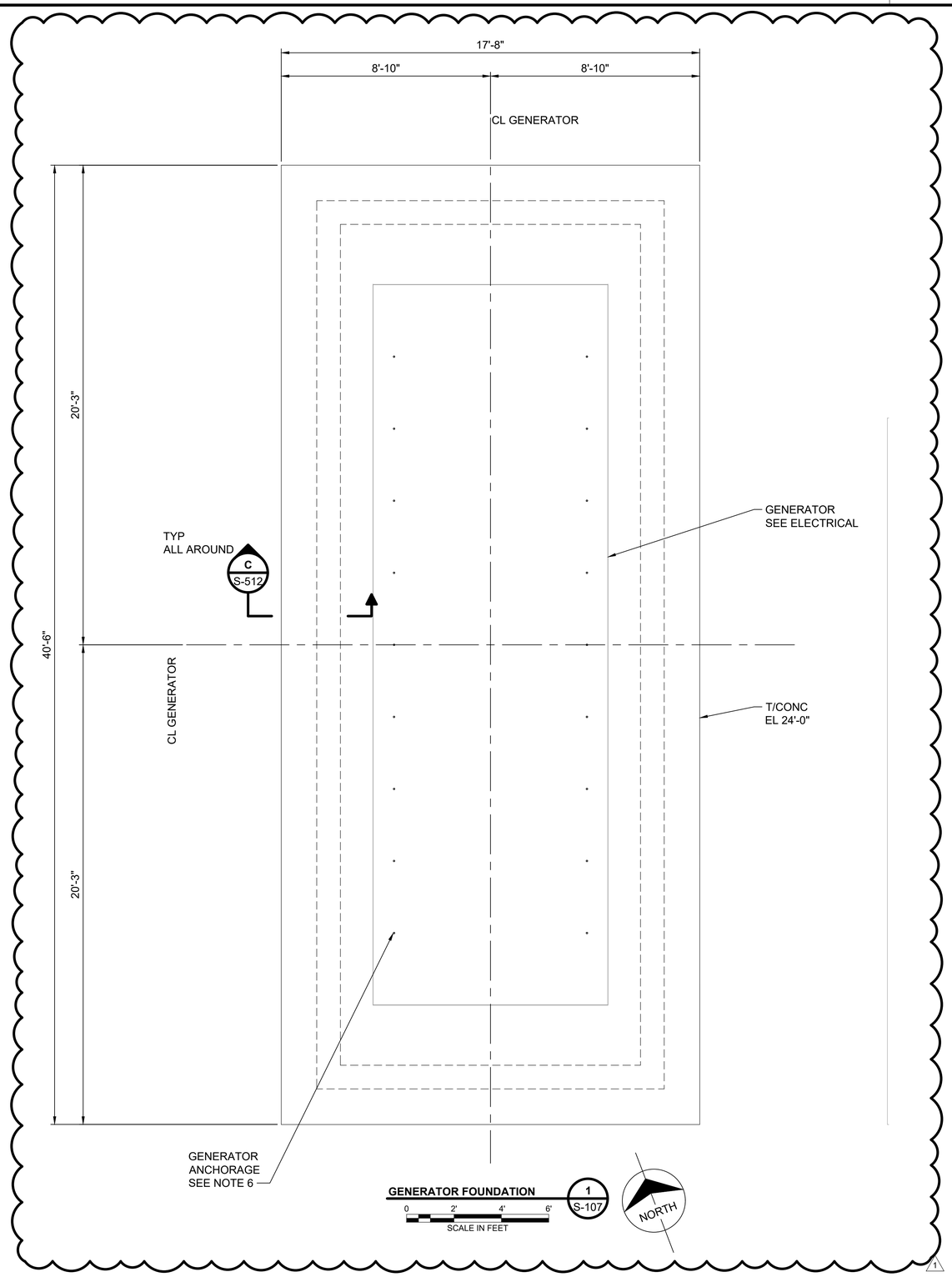
03/26/2021
OREGON SEPT 11, 2018 CURTIS L. EARL
EXPIRATION DATE: 12-31-2021

It is said persons or/ to the materials design and supplied by Nucor Building Systems, a division of Nucor Corporation. The drawings and the instructions, designs and plans contained herein, along which they represent, are and shall remain the property of Nucor Building Systems. The recipient professional engineer whose seal appears on these documents is employed by Nucor Bldg. Sys. and as such is not acting as an independent professional engineer and is not responsible for the design of the building. Any use of these documents by any party other than Nucor Bldg. Sys. and as an independent professional engineer of record for the project for which they were prepared is prohibited and any such use shall be considered illegal.

SHEET D5 of 10

Stand-by Generator

- Drawing - S-107



NOTES:

1. SEE SHEET S-001 FOR STRUCTURAL GENERAL NOTES.
2. SEE CIVIL DRAWINGS FOR EXACT FACILITY LOCATION AND ORIENTATION.
3. ELEVATION INDICATED FOR THIS FACILITY EQUALS THE DATUM ELEVATION SHOWN ON THE CIVIL DRAWINGS.
4. SUBCONTRACTOR SHALL PROVIDE BROOMED FINISH FOR THE TOP SURFACES OF THE FUELING ISLAND AND DRIVE SLABS AND CURBS.
5. SUBCONTRACTOR SHALL COORDINATE ELECTRICAL CONDUIT PENETRATIONS. REFERENCE ELECTRICAL DRAWINGS AND GENERATOR CUT-SHEETS FOR LOCATIONS.
6. INSTALL (18) HAS B-105 WITH 7 INCH MINIMUM EMBEDMENT UTILIZING HIT-HY200 EPOXY ADHESIVE AS INDICATED ON KOHLER CO. ADV-8870.

1

no.	date	by	ckd	description
0	11/13/20	AJK	BBB	ISSUED FOR CONSTRUCTION
1	11/11/22	AJK	BBB	RFI #20

BURNS McDONNELL

date	detailed
06/10/2019	M. PATEL
designed	checked
A. KRAL	B. BRETTMANN

PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DR.
PORTLAND, OREGON 97218

GENERATOR FOUNDATION

project	contract

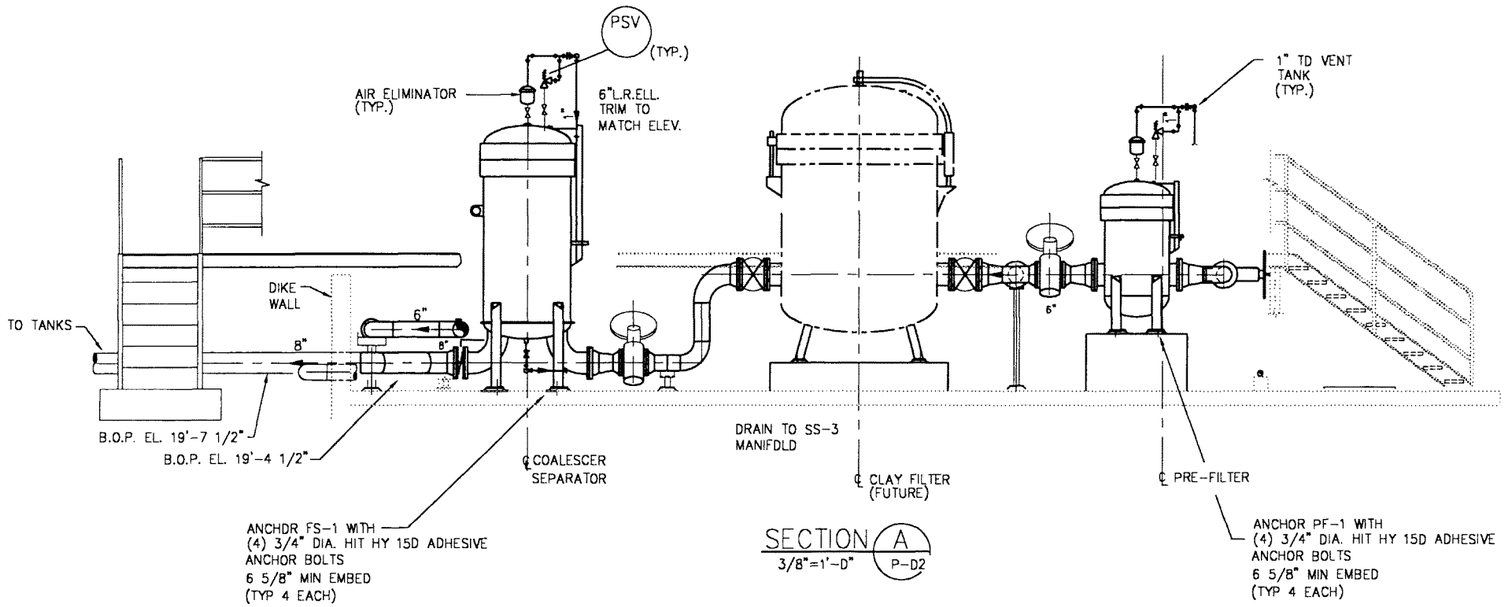
drawing **S-107** – rev. **1**

file **S-107.DWG**

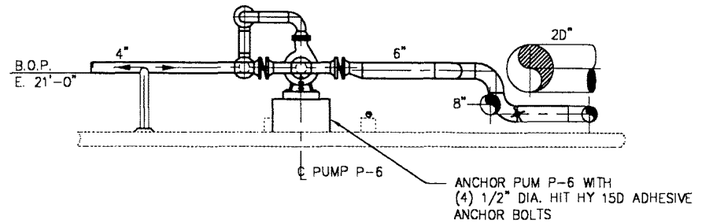
Scale For Microfilming
Millimeters
Inches

Jet Fuel Pipe Supports

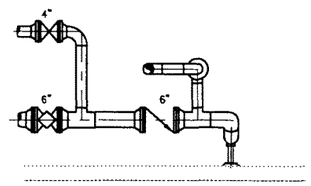
- Drawing - 3405-P-04



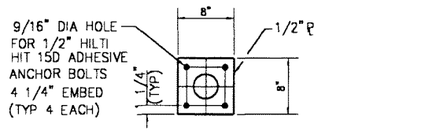
SECTION A
3/8"=1'-0" P-D2



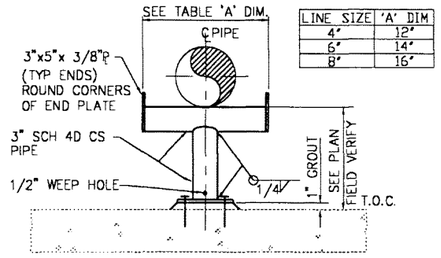
SECTION B
3/8"=1'-0" P-D2



SECTION C
3/8"=1'-0" P-D2

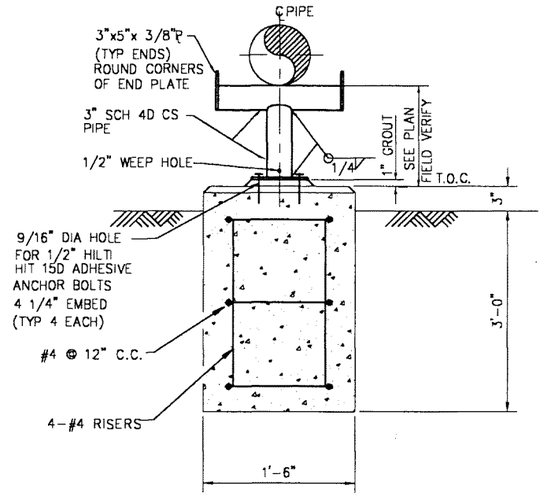


BASE PLATE

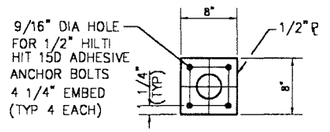


LINE SIZE	'A' DIM
4"	12"
6"	14"
8"	16"

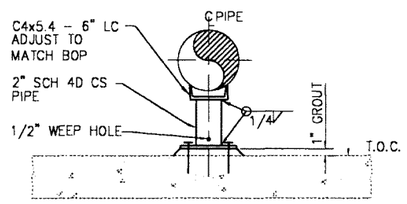
PIPE SUPPORT
PS-1



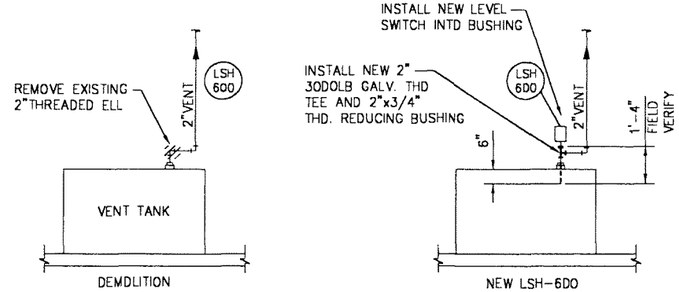
PIPE SUPPORT
MODIFIED
PS-1



BASE PLATE



PIPE SUPPORT
PS-2



SECTION D
3/8"=1'-0" P-D2

NOTES:
1. NEW WORK SHOWN BOLD.

SCALE 3/8"=1'-0" (22"X34")

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER 3405

DRAWING NO.	REFERENCE DRAWINGS

REV.	DATE	REVISED	DRAWN	CKD.	CIV/STR.	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
1	06/24/02	CHANGED FILTER DIMENSIONS ADD LSH-600	DAB	WHB					
2	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

SCALE: AS NOTED		DATE
DRAWN BY	DAB	01/12/01
DESIGNED BY	DAB	01/12/01
CHECKED BY	WHB	01/12/01
WORK ORDER	34-05	22X34
DATE		11/1/00

PDX BULK FUELING FACILITY
PORTLAND, OREGON
FILTRATION MODIFICATIONS
FILTER, & PIPELINE AREA
PIPING ELEVATIONS

DRAWING NO.	SHEET	REV.
3405-P-04	1 OF 1	2

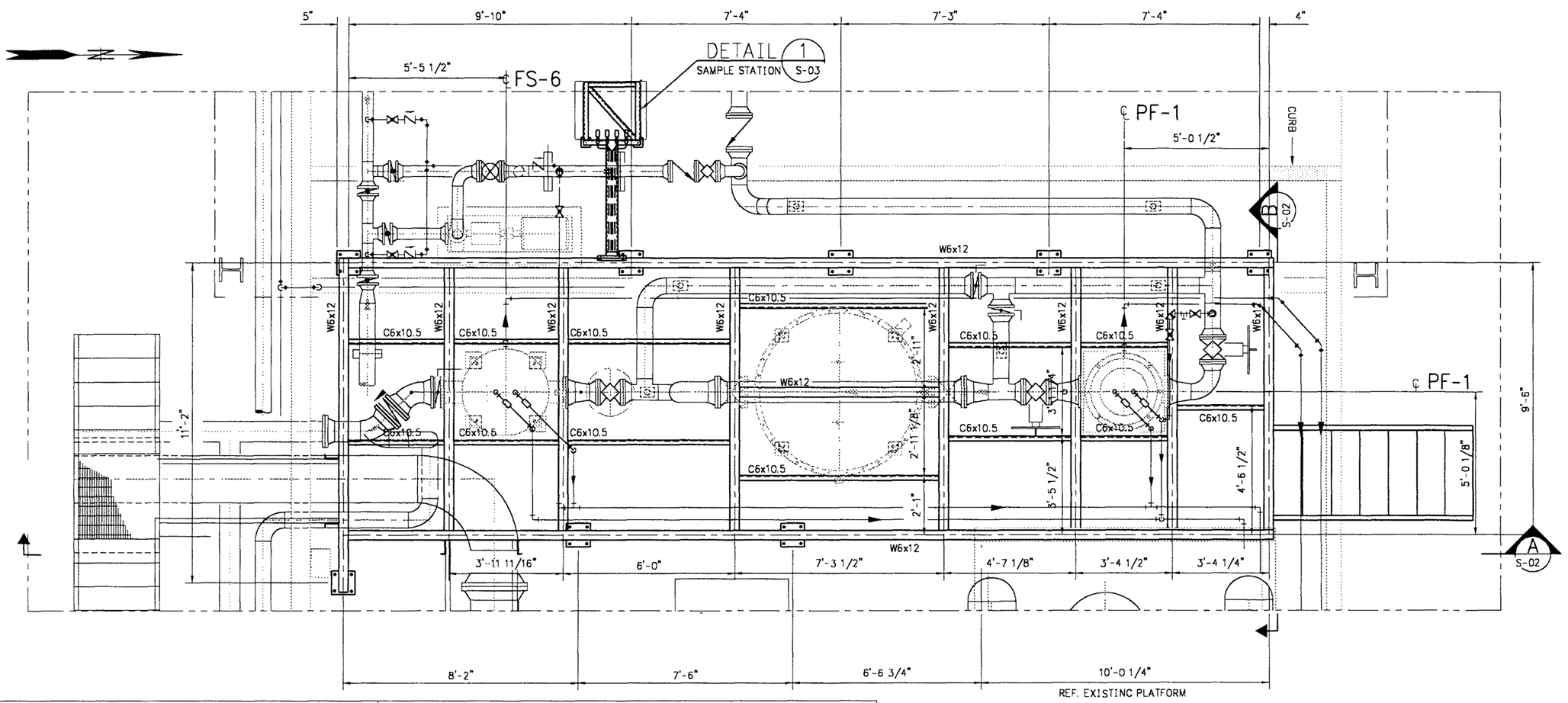
3405p042.DWG <PD: 09/22/03 [TIME: 09:33 AM] >

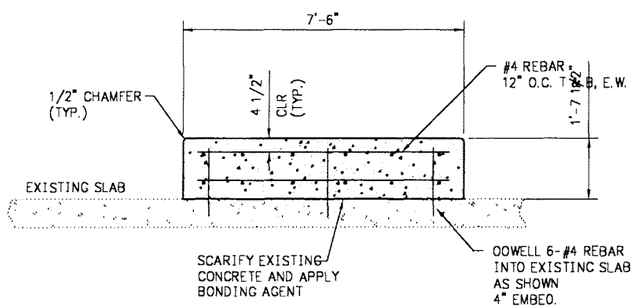
Crossover Stairs

- Drawing - PDX Aerial

Filter Separator Platform

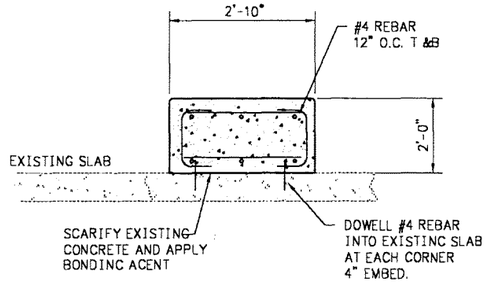
- Drawing - 3405-S-01
- Drawing - 3405-S-02
- Drawing - S-101
- Drawing - S-544





PUMP P-6 FOUNDATION

DETAIL 1 / S-01
3/4"=1'-0"



PF-1 FOUNDATION

DETAIL 2 / S-01
3/4"=1'-0"

FILTER PLATFORM PLAN

SCALE 1/2"=1'-0"

NOTES:

1. NEW WORK SHOWN BOLD.
2. CONTRACTOR TO FIELD VERIFY DIMENSIONS PRIOR TO FABRICATION

DRAWING NO.	REFERENCE DRAWINGS
3405-S-02	SECTION AND DETAILS

REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
1	06/24/01	GENERAL REVISION	DAB	WHB					
2	04/11/03	REVISED PLATFORM TO FIT AS-BUILT PIPING	DAB	WHB					
3	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

CLIENT APPROVALS		
REV	BY	DATE

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE. PORTLAND, OR. 97210 Tel: (503)227-3317/Fax: (503)227-3244

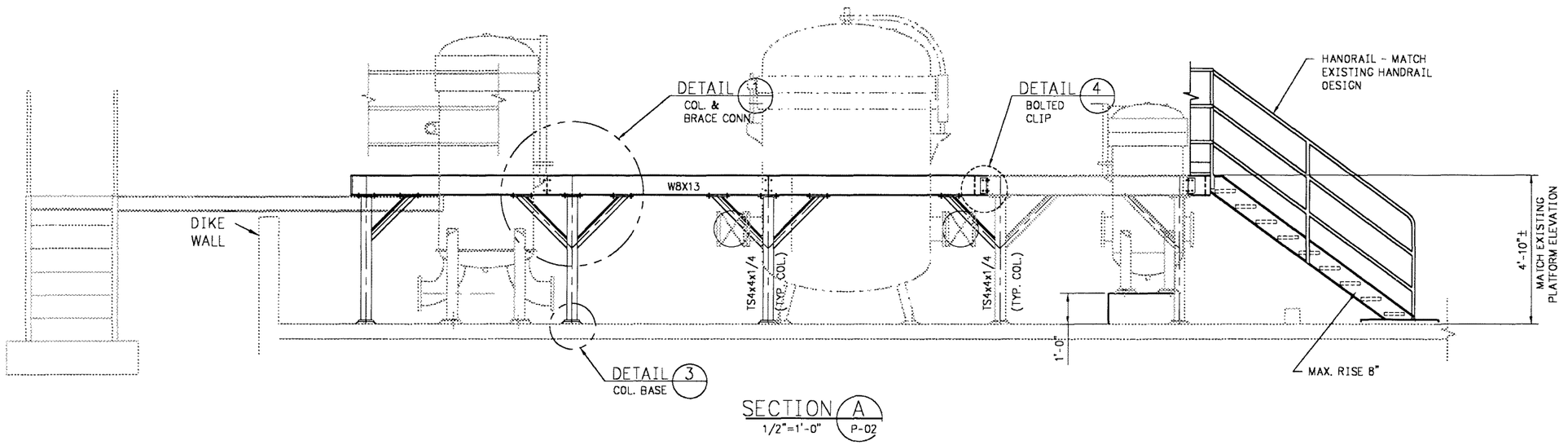
AECI PROJECT NUMBER: 3405

SCALE: AS NOTED		DATE
DRAWN BY	DAB	01/12/01
DESIGNED BY	DAB	01/12/01
CHECKED BY	WHB	01/12/01
WORK ORDER	34-05	22X34
DATE		01/12/01

PDX BULK FUELING FACILITY
PORTLAND, OREGON
PIPELINE FILTRATION MODIFICATIONS
FILTER & PIPELINE AREA
PLATFORM PLAN

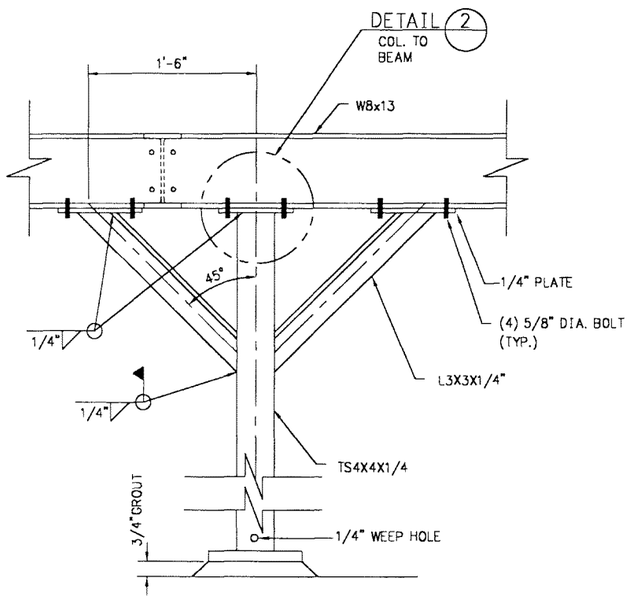
DRAWING NO.	SHEET	REV.
3405-S-01	1 OF 1	3

3405S013.DWG <CPD: 09/22/03 [TIME: 09:37 AM] >



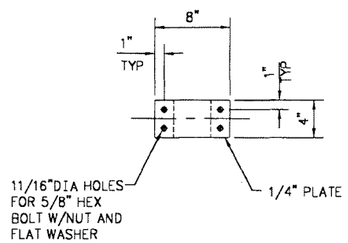
SECTION A

1/2"=1'-0" P-02



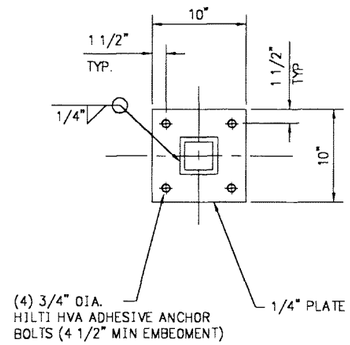
COLUMN & BRACE CONNECTION

DETAIL 1 — 1/2"=1'-0" S-02



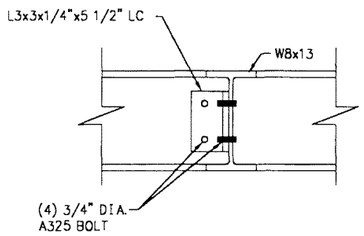
COLUMN TOP PLATE

DETAIL 2 — 1 1/2"=1'-0" S-02



COLUMN BASE PLATE

DETAIL 3 — 1 1/2"=1'-0" S-02



TYPICAL BOLTED CLIP

DETAIL 4 — 1 1/2"=1'-0" S-02

NOTES:

1. NEW WORK SHOWN BOLD.

ALPHA ENGINEERS and CONSTRUCTORS, INC.
2929 NW 29th AVE, PORTLAND, OR. 97210 Tel:(503)227-3317/Fax:(503)227-3244

AECI PROJECT NUMBER 3405

DRAWING NO.	REFERENCE DRAWINGS	REV.	DATE	REVISED	DRAWN	CKD.	CIV/STRL	MECH/PIPING	ELEC/INST	SAFETY	P.E.
3405-S-02	SECTION AND DETAILS	0	06/20/01	ISSUE FOR CONSTRUCTION	DAB	WHB					
		1	06/24/01	GENERAL REVISION	DAB	WHB					
		2	09/03/03	RECORD DRAWING	DAB	WHB					

ASIG
AIRCRAFT SERVICE INTERNATIONAL GROUP
PORTLAND, OREGON

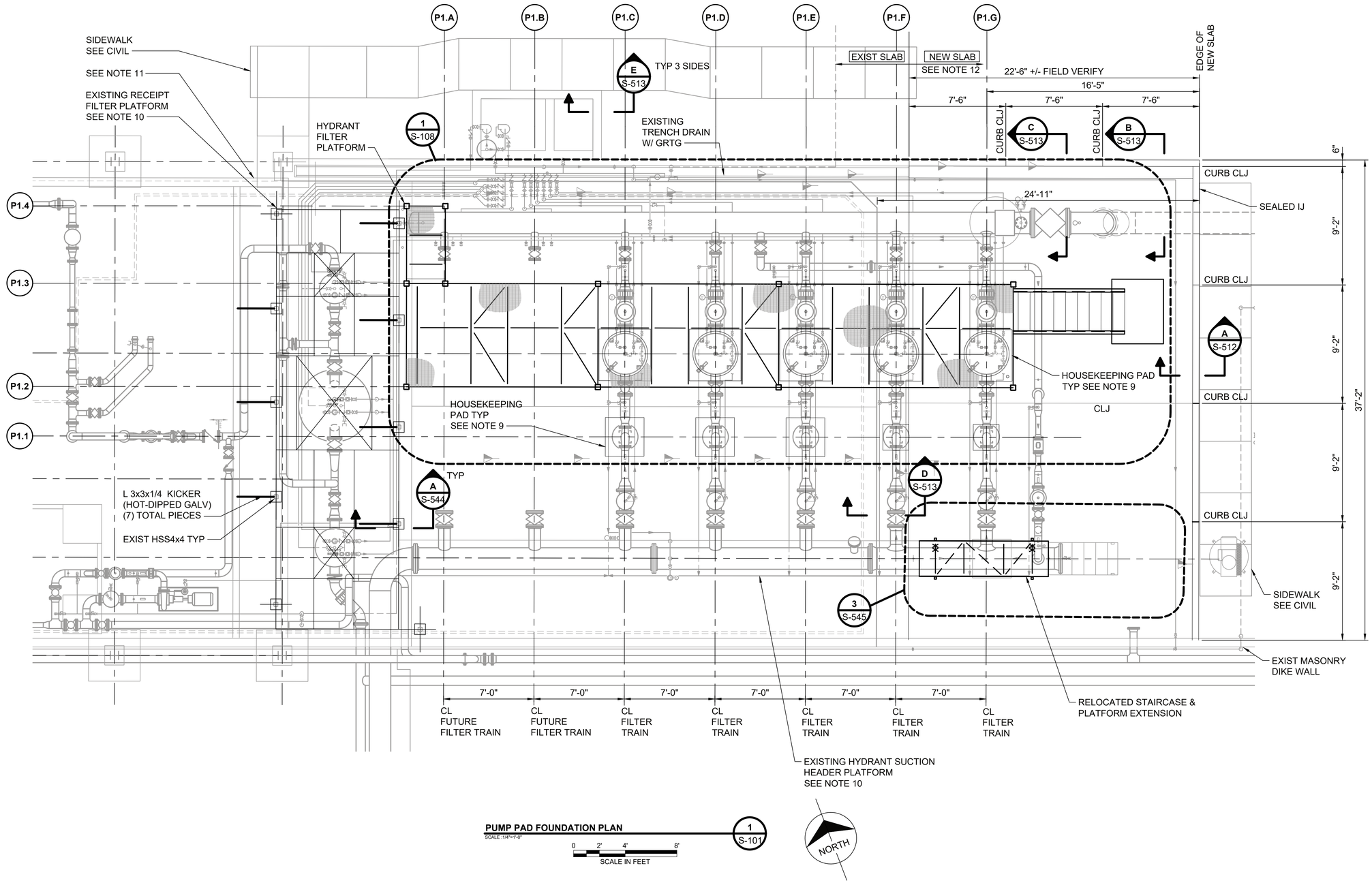
CLIENT APPROVALS		
REV	BY	DATE

SCALE: AS NOTED		DATE
DRAWN BY	DAB	01/12/01
DESIGNED BY	DAB	01/12/01
CHECKED BY	WHB	01/12/01
WORK ORDER	34-05	22X34
DATE		
01/12/01		

PDX BULK FUELING FACILITY
PORTLAND, OREGON
PIPELINE FILTRATION MODIFICATIONS
FILTER & PIPELINE AREA
PLATFORM
SECTIONS AND DETAILS

DRAWING NO.	SHEET	REV
3405-S-02	1 OF 1	2

3405S022.DWG <CPD: 09/22/03 [TIME: 09:38 AM] >



PUMP PAD FOUNDATION PLAN
SCALE :1/4"=1'-0"

1
S-101

0 2' 4' 8'
SCALE IN FEET

NOTES:

1. SEE S-001 FOR STRUCTURAL GENERAL NOTES.
2. SEE CIVIL DRAWINGS FOR EXACT FACILITY LOCATION AND ORIENTATION.
3. ELEVATION INDICATED FOR THIS FACILITY EQUALS THE DATUM ELEVATION SHOWN ON THE CIVIL DRAWINGS.
4. SUBCONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS ON EXISTING PUMP PAD AND ASSOCIATED PLATFORM MODIFICATIONS. INFORM ENGINEER / CONTRACTOR IF CONFLICTS EXIST.
5. SEE DRAWING SD-101 AND SD-102 FOR DEMO DRAWINGS ASSOCIATED WITH THE PUMP PAD.
6. CONSTRUCTION JOINT (CJ), CONTROL JOINT (CLJ), AND ISOLATION JOINT (IJ) DETAILS, SEE S-502. ALL JOINTS SHALL BE SEALED WITH FUEL RESISTANT SEALANT.
7. SUBCONTRACTOR SHALL PROVIDE BROOMED FINISH FOR THE TOP SURFACES OF THE NEW PUMP PAD SLAB.
8. SUBCONTRACTOR SHALL COAT ALL EXPOSED CONCRETE SURFACES WITH PENETRATING SEALER/HARDENER. REMOVE AND REPAIR ALL EXISTING PUMP PAD CONCRETE JOINT SEALANT. APPLY PENETRATING SEALER/HARDENER.
9. SUBCONTRACTOR SHALL COORDINATE HOUSEKEEPING PAD REQUIREMENTS WITH MECHANICAL DRAWINGS AND EQUIPMENT PURCHASED. SEE S-501 FOR TYPICAL HOUSEKEEPING PAD DETAIL. SUBMIT TO CONTRACTOR FOR FINAL APPROVAL.
10. SUBCONTRACTOR SHALL REPAIR DAMAGED GALVANIZED OR PAINTED SURFACES OF EXISTING STEEL THAT IS TO REMAIN PER SPECIFICATION.
11. SUBCONTRACTOR SHALL REPAIR AND REPLACE ALL EXISTING JOINT MATERIAL AT PUMP PAD. PER S-502 AND CONTRACT SPECIFICATIONS.
12. PROVIDE 8" THICK SLAB WITH #5 @ 12" EACH WAY TOP WITH 2" CLEAR COVER AT TOP.

STRUCTURAL
REGISTERED PROFESSIONAL ENGINEER
76819PE
OREGON
MAY 10, 2005
BARIE BRETTMANN
EXPIRES: 12-31-2021

no.	date	by	ckd	description
0	11/13/20	AJK	BBB	ISSUED FOR CONSTRUCTION

BURNS McDONNELL

date	detailed
06/10/2019	M. PATEL
designed	checked
A. KRAL	B. BRETTMANN

PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DR.
PORTLAND, OREGON 97218

PUMP PAD FOUNDATION

project	contract

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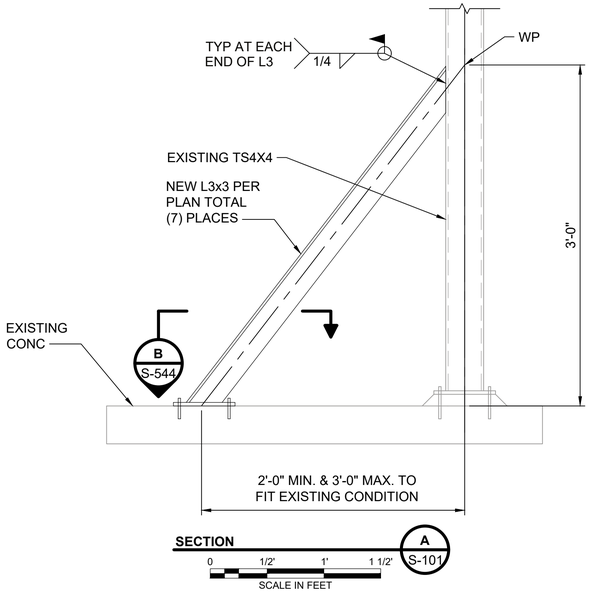

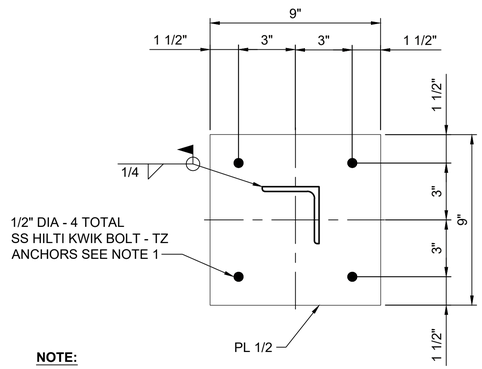

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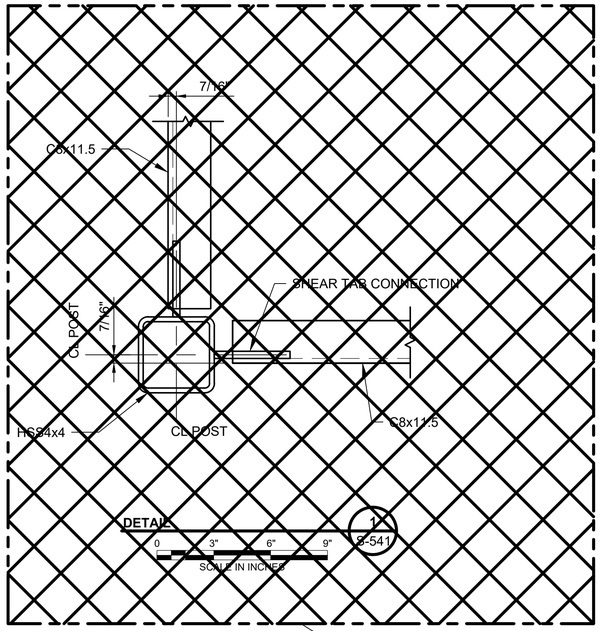

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STAIRS AND PLATFORMS
SECTIONS AND DETAILS - SHEET 2

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APPENDIX B

ENHANCED SEISMIC DESIGN CONSIDERATIONS

HALEY ALDRICH

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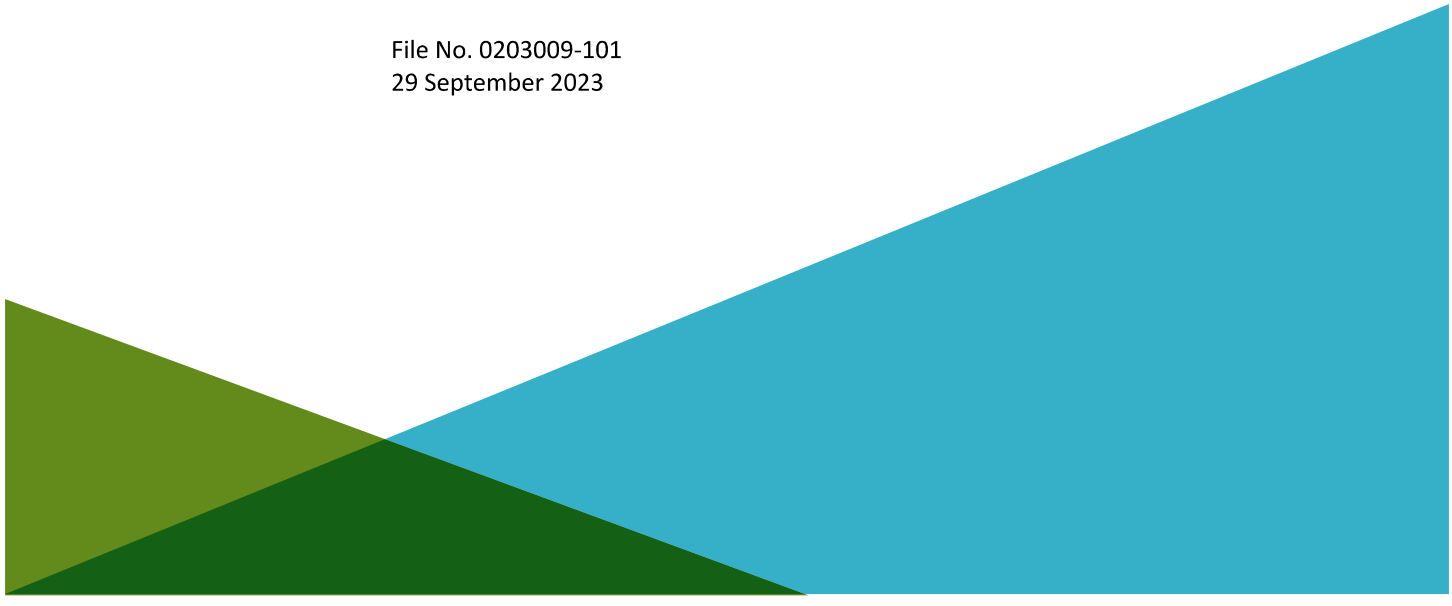
REPORT ON

ENHANCED SEISMIC DESIGN CONSIDERATIONS
PDX FUEL TANK PROJECT
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON

by
Haley & Aldrich, Inc.
Portland, Oregon

for
Burns & McDonnell
Bloomington, Minnesota

File No. 0203009-101
29 September 2023



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ENHANCED SEISMIC DESIGN CONSIDERATIONS
PDX FUEL TANK PROJECT
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON

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1. Introduction

This report provides a comprehensive overview of our enhanced seismic design analyses, performed to support the geotechnical seismic vulnerability assessment (SVA) and design for the proposed new fuel tanks at Portland International Airport (PDX) in Portland, Oregon (Project Site). The geotechnical seismic analyses documented within this report are also intended to apply to the existing tanks at the site. The report has been prepared exclusively for Burns & McDonnell (B&M), based on the current project conceptualization and discussions with B&M. Our understanding of the subsurface soil conditions is based on explorations at discrete locations at the site. Soil properties inferred from the field and laboratory tests formed the basis for developing the geotechnical recommendations contained in this report. Soil conditions may vary in the areas between the explorations, and the nature and extent of the variations may not be evident until construction. If variations appear, it may be necessary to reevaluate the recommendations in this report.

We understand, based on review of the draft Oregon Department of Environmental Quality (DEQ) 2023 for Fuel Tank Seismic Stability (dated 31 May 2023 for public comment), that the current Oregon Structural Specialty Code (OSSC, 2022) represents the general basis of design for evaluation and design of the new and existing fuel tanks described in this report. The current building code references American Society of Civil Engineers (ASCE) 7-16 for seismic design considerations. Considering this, the seismic hazard and ground motion time history analyses documented within this report were developed in general accordance with the requirements of ASCE 7-16.

The report is structured into the following sections:

1. Introduction
2. Purpose, Scope, and Use of This Report
3. Site and Project Understanding
4. Subsurface Conditions
5. Engineering Analysis & Seismic Vulnerability Evaluation
6. Limitations
7. Closure
8. References

Tables and figures are included or referenced throughout the report to illustrate the project area, exploration locations, and seismic vulnerability assessment results. The appendices provide detailed information, including the logs of deep boring explorations (Appendix A), the summary of subsurface engineering properties interpreted from Cone Penetrometer Testing (CPT) tests (Appendix B), constant rate of strain (CRS) consolidation and cyclic and monotonic direct simple shear (DSS) performed by Haley & Aldrich, Inc. (Haley & Aldrich) (Appendix C), probabilistic and deterministic seismic hazard analysis and design ground motion characterization (Appendix D), advanced two-dimensional (2D) nonlinear deformation analysis using FLAC (Appendix E), and a summary of the geophysical survey (Appendix F).

2. Purpose, Scope, and Use of This Report

Our primary objective is to provide B&M with a sitewide geotechnical seismic hazard evaluation to support the SVA and eventual design and construction of the proposed fuel tank facilities at the PDX Project Site. Figure 1 shows the vicinity map of the Project Site.

The scope of our services encompasses the following tasks:

1. ***In situ* geotechnical explorations**

   We conducted various field tests, including borings, CPTs with seismic and pore pressure measurement, and a geophysical survey. These explorations aimed to characterize the subsurface conditions and soil engineering properties at the Project Site. Full documentation of these geotechnical explorations is presented in the project geotechnical data report (Haley & Aldrich, 2023).

2. **Advanced laboratory testing**

   To further understand the dynamic strength and cyclic behavior of the Project Site, we performed advanced laboratory tests including index testing, constant rate of strain consolidation testing (CRS), and cyclic and monotonic direct simple shear testing (CDSS and DSS).

3. **Geotechnical engineering analyses, evaluations, and recommendations**

   Our work involved conducting several analyses to inform the design and construction process, including:

   - Seismic hazard analysis and design ground motion characterization: This analysis estimated the ground motion parameters at the Project Site for an MCE_R (approximately 2475-year return period) hazard level.
   - 2D nonlinear deformation analysis (NDA): This analysis estimated the amount of permanent lateral and vertical displacement expected during an MCE_R level earthquake event.
   - One-dimensional (1D) nonlinear site response analysis (SRA): This analysis estimated the site-specific Design MCE_R (Maximum Considered Earthquake Response) spectrum.
   - Production of this enhanced seismic design report.

It is important to note that, while our study includes the levee zone located north of the project site on NE Marine Drive, a detailed analysis of the existing levee is beyond the scope of this study. Due to the limited availability of geotechnical information related to the levee, reasonable geotechnical properties were assumed, as discussed in Section 5 of this report. The geometry of the levee was modeled using publicly available topography and bathymetry data depicted in Figure 2.

This report is intended exclusively for the use of B&M. Our work was conducted in accordance with generally accepted geotechnical engineering practices applicable to projects of similar nature and locality at the time the services were performed. No other warranty, expressed or implied, is made. Our scope of services does not cover any environmental aspects related to the project.

3. Site and Project Understanding

The existing fuel facility is located near the northwest end of the PDX property. The current facility is roughly rectangular and encompasses approximately 3.3 acres with three aboveground fuel storage tanks and surrounding support equipment. The proposed development will include portions of the existing property and will extend to the north and east of the existing storage tank area. The site is relatively flat, with a slight gradient of less than 2 feet across the project area. Elevations range from approximately 20 to 22 feet above mean sea level (MSL). The gradient increases gradually toward the Columbia River (north of the existing facility) where the slope ranges from approximately 0.5 to 1.0 percent.

We previously performed work at the site and provided a geotechnical report (dated 17 September 2020) with design and construction recommendations for prior facility improvements including a new electrical building, upgrades to the existing substation, addition of a buried bulk spill containment unit, a new fueling canopy, and installation of light poles at various points across the site.

We understand the proposed improvements include two new 120-foot-diameter by 32-foot-high aboveground fuel storage tanks and a new operations and fire protection building. Other ancillary improvements will include new light poles and pavements for access roads. One of the three existing fuel tanks as well as much of the ancillary infrastructure will remain in service.

Based on our previous work, the upper soil layer (e.g., fill and alluvium) are susceptible to consolidation settlement due to building and tank loads, and to post-seismic settlement and strength reduction in the event of an earthquake. The site is also expected to be susceptible to lateral spreading due to the site's proximity (within 1500 feet away) to the Columbia River. These conditions are likely to prevent the use of a conventional spread-footing foundation system for most improvements without ground improvements. Based on our previous work and the provided information, the current anticipated foundation types are shallow drilled or formed shafts for light poles, either interlocking spread footings or deep foundations for the operations and fire protection building, and deep foundations (piles or drilled shafts) for the fuel tanks. Ground improvement may also be considered.

Specific to the scope of services included within this report, we understand that new regulatory rules will require seismic evaluation and potential stabilization of existing fuel tanks at the site. The new tanks will potentially require greater than normal seismic stabilization measures. As seismic evaluation of the existing tanks was not required previously, our 2020 geotechnical report for the site only included simplified assessments of various seismic considerations (e.g., liquefaction susceptibility, liquefaction-induced settlement, lateral spreading concerns, etc.) and did not include recommendations for mitigation of these concerns. The scope of services included within this report was developed to include advanced laboratory testing results and site-specific seismic modeling that will be used to produce better estimates of the seismic hazards important to the existing and new fuel tanks at the site. Potential mitigation strategies and foundation recommendations will be included in a new geotechnical report for the site and the seismic mitigation plan developed to meet the new DEQ requirements for the new structures.

3.1 SEISMICALLY INDUCED GEOTECHNICAL HAZARDS

Based on our evaluation, the major potential seismically induced geotechnical hazards at the project sites include lateral spreading (possibly flow failure), liquefaction-induced ground failure, and ejecta-induced settlement. Our review of these hazards is based on the soils encountered in explorations at the site, regional experience, and our knowledge of local seismicity.

3.1.1 Lateral Spreading

Lateral spreading commonly occurs on mildly sloping ground and involves lateral displacement caused by the accumulation of cyclic shear strain during earthquake. As the soil undergoes cyclic loading, excess pore pressure builds up, reducing the effective stress and gradually leading to a reduction in shear strength. This accumulation of shear strain ultimately results in permanent lateral deformation. Excessive lateral displacement resulting from lateral spreading can impact the fuel tank facility area by increasing the lateral force and displacement exerted on the tank foundation. Given the proximity of the project site to the Columbia River and the presence of liquefiable soil, we conducted an evaluation of the potential geotechnical impact on fuel tank facilities due to lateral deformation caused by liquefaction-induced lateral spreading during a design-level event. However, it is possible that the upslope geometry from the project site toward the levee may help reduce lateral displacement.

3.1.2 Flow failure

Flow failure typically occurs at sites with sloping ground (>2.0 percent) and/or a significant free-face condition nearby, underlain by very loose, contractive soil deposits (e.g., loose granular soil or non-plastic fine-grained soil). In such cases, the soil experiences a more significant reduction in shear strength caused by soil liquefaction within or beneath the slope. If the post-earthquake shear strength is lower than the gravitational forces acting along a critical failure surface, flow failure instability can be initiated. Moreover, once the earthquake shaking ceases, the presence of a low-permeability soil layer on top of a liquefied, high-permeability clean sand layer may produce a water-film layer that becomes a critical failure surface (i.e., described as void redistribution mechanisms by Idriss & Boulanger, 2008). To assess this condition (and the potential for flow failure affecting our site), we performed limit equilibrium slope stability analyses utilizing liquefied strengths for soils expected to be susceptible to liquefaction. These liquefied strengths were developed considering void redistribution effects. This analysis is documented in Section 5.5.1 of this report and indicates that flow failure is unlikely to impact the structures at our site.

3.1.3 Liquefaction-Induced Free Field Settlement and Ground Failure

Liquefaction is caused by rapid increase of excess pore water pressure that reduces the effective stress between soil particles to a low value, loosening the frictional contact of soil particles, resulting in sudden loss of shear strength and stiffness of the soil. In general, loose, saturated sandy soils with low silt and clay content are most susceptible to experience strength loss. Silty soils with low plasticity are also susceptible. For any soil type, the soil must be saturated for liquefaction to occur. The consequences of soil liquefaction may include excessive ground settlement and lateral deformation. Post-liquefaction (or reconsolidation) settlement occurs because liquefiable soils tend to get redistributed and become denser after the earthquake and after excess porewater pressure dissipates. Ground surface settlement is not typically uniform across the area and can result in significant differential settlement.

To preliminarily evaluate the extent of liquefaction triggering on the clean sand deposit at the project site, we performed a CPT-based liquefaction triggering simplified analysis using the procedure proposed by Boulanger & Idriss (2016) up to a depth of 150 feet. The preliminary CPT-based liquefaction analysis considered an earthquake magnitude (M_w) of 9.0 and a surface peak horizontal ground acceleration (PGA_M) of 0.55 g. The PGA_M of 0.55g is consistent with the ASCE 7-16 with a 2 percent probability of exceedance in 50 years and Site Class E. Based on our analysis, the CPT-based simplified procedure estimates that liquefaction is triggered within a depth range of 40 feet to 150 feet. The estimated post-liquefaction reconsolidation vertical settlement from the CPT-based simplified method (with depth correction factor) using the same M_w and PGA_M values ranges from 15 to 25 inches. Although the simplified procedure is useful for performing a preliminary assessment and estimating the resulting effect, it can sometimes introduce unnecessary conservatism. The simplified procedure is derived from empirical case histories collected from soil samples above 50 feet, which might be inappropriate for estimating liquefaction triggering of soils deeper than that threshold. The SVA study presented in this report performed a more advanced 2D nonlinear deformation analysis using advanced soil constitutive models created to simulate the behavior of sands and silts under seismic loading. This approach offers the advantage of simulating the dynamic response of the site and using a more mechanistically defensible methodology to estimate the extent of liquefaction triggering.

3.1.4 Ejecta-induced Settlement and Ground Failure

During earthquake shaking, excess pore water pressure is generated and, if it reaches a sufficient pressure, it can trigger high-gradient upward seepage during the earthquake or even after the shaking stops. The resulting effects from the dissipation process of excess pore water pressure could be significant for lightweight structures below the groundwater table in shallow ground such as manholes, pipelines, etc. We used the recent methodology proposed by Hutabarat & Bray (2022) to evaluate the severity of liquefaction-induced ground failure caused by upward seepage pressure and sediment ejecta. This method considers the dynamic response of the site and the counterbalancing forces between upward seepage pressure (liquefaction demand, L_D) and the crust material (crust resistance factor, C_R).

The thickness of low-permeability layers of soil and the non-liquefiable crust layer at the project site ranging from 40 to 60 feet thick contributes to a high crust resistance factor. From the liquefaction demand side, the liquefiable layer at depth >50 feet is unlikely to produce sufficient artesian pressure to produce sand ejecta (sand boil) at the ground surface. Based on our analysis using the design-level earthquake and available CPT data of the project site, we anticipated the ejecta-induced ground failure severity falls in the “None” category of the Hutabarat & Bray (2022) L_D-C_R chart. Therefore, the estimated ejecta-induced settlement is negligible.

4. Subsurface Conditions

4.1 PROJECT GEOTECHNICAL EXPLORATION

We developed our conceptual geotechnical recommendations based on our interpretations on subsurface information obtained from *in situ* and laboratory testing presented in this report. We completed:

- one onshore geotechnical boring in 2019,
- two onshore geotechnical borings in 2023,
- two CPTs with pore pressure dissipation testing in 2019,
- one seismic CPT (SCPTu) with pore pressure dissipation testing in 2019, and
- three SCPTu soundings with pore pressure dissipation testing in 2023.

The deepest geotechnical borings were advanced to a depth of 151.5 feet (see Appendix A for boring log). The CPT soundings were advanced to a depth 150.2 feet (see Appendix B) to complement the boring log interpretation and to determine engineering properties of soil in our analysis. The locations of geotechnical borings and CPTs are shown in Figure 2.

4.2 SUBSURFACE SOIL CONDITIONS

Our understanding of the subsurface conditions is based on our review of available geotechnical data, including our borings (Appendix A) and CPT sounding data (Appendix B). A cross-section across the fuel tanks immediate vicinity is shown on Figure 3. An additional cross-section profile of generalized subsurface conditions (for 2D modeling purpose) from the fuel tank perimeter to Columbia River is shown in Figure 4. As shown in Figure 3 and Figure 4, we classified the project site into three engineering soil units (ESUs), as interpreted from existing borings and CPTs, as discussed below:

ESU-1 (Top Soil / Fill) – This ESU consists of silty, poorly graded sand (SM to SP-SM) sand to a depth of approximately 7 to 15 feet below ground surface (bgs). The soils appeared to be brown, fine to medium grained, and poorly graded sand with a variable amount of silt. This unit is unsaturated most of the time as the ground water table fluctuations are rarely expected to rise above the base of this ESU.

ESU-2 (Overbank Deposit) – This ESU underlies the ESU-1 layer. This ESU consists of interbedded low plasticity clay (CL), silt (ML), and sandy silt to silty sand (SM) extended to depths varying between approximately 40 and 50 feet bgs. We performed soil index testing from undisturbed soil samples taken between depths of 15 feet to 42 feet. The plasticity index (PI) of this ESU ranges from 12 to 23 with an average value of 16 and a standard deviation of 4. The water content (w_c) ranges from 33 to 60 percent with an average value of 46 percent and standard deviation of 10 percent. The liquid limit (LL) of the soil samples ranges from 33 to 55 (average value of 46) resulting w_c/LL value from 0.7 to 1.3 (average value 1.0). According to the Bray & Sancio (2006) criteria, 50 percent of the tested soil sample is classified as moderately susceptible to strength loss during cyclic loading and the other 50 percent of the tested soil sample is classified as non-susceptible. Figure B-1 of Appendix B showed more detail of engineering properties of this ESU. The advanced laboratory testing results, performed on samples taken from this ESU, are summarized in Appendix C of this report.

ESU-3 (Columbia River Sand) – Underlying ESU-2, this ESU consists of fully saturated, poorly graded, loose to medium-dense, micaceous, clean-sand with traces of silt (SP to SP-SM) with fines content ranging from 5 to 13 percent. Based on the normalized penetration resistance value (q_{c1N}) the clean-sand deposit is liquefiable (q_{c1N} <150) from a depth of 40 feet to a depth of 135 feet bgs. We estimate the *in situ* relative density (D_R) of this ESU ranges from 40 to 58 percent (loose to medium dense sand). For modeling purposes, we distinguish this ESU into three subgroups namely ESU-3a (40 to 60 feet bgs), ESU-3b (60 to 120 feet bgs), and ESU-3c (120 to 160 feet bgs) to account for increasing relative density with depth. Figure B-2 of Appendix B shows more details related to the engineering properties of this ESU.

4.3 GROUNDWATER CONDITIONS

Based on the interpretation of the boring log explorations (Appendix A) and pore pressure measurements from six CPTs (Appendix B), the groundwater table within the fuel tank perimeter is estimated to be approximately 12 to 17 feet bgs. For modeling purposes, the groundwater table was taken at a depth of approximately 15 feet bgs, as shown in Figure 3. In Figure 4, the phreatic line (groundwater table) is depicted, which decreases from 15 feet bgs (El. +7.0) at the fuel tank area to El. +0.0, matching the groundwater elevation of the Columbia River. Soil elements below the groundwater table shown in Figure 4 are assumed to be fully saturated.

5. Engineering Analyses and Seismic Vulnerability Evaluation

5.1 SEISMIC SETTING

Oregon is located near the contact between two large crustal tectonic plates. The Juan de Fuca Plate constitutes the floor of the Pacific Ocean off the northwestern coast of the United States and moves northeastward from its spreading ridge boundary with the Pacific Plate at an average rate of approximately 1.5 inches per year. As the Juan de Fuca Plate converges with continental North America, it subducts or dips below the North American Plate, forming a shallow, eastward-dipping contact interface. This boundary is referred to as the Cascadia Subduction Zone (CSZ) and is responsible for seismic activity in the western regions of Washington and Oregon. The CSZ gives rise to earthquakes associated with three types of source zones: subduction interface, subduction intraslab, and shallow crustal earthquakes.

Figure 5 illustrates that the seismicity of the Pacific Northwest (PNW) region is predominantly influenced by the Cascadia Subduction Zone. In this zone, the offshore Juan de Fuca Plate subducts beneath the continental North American Plate. Subduction zones typically exhibit three main types of earthquakes: crustal earthquakes, interface subduction earthquakes, and intraslab subduction earthquakes.

Intraslab and Interface Sources. A subduction zone is characterized by the interaction of a down-going oceanic plate, such as the Juan de Fuca Plate, and an overriding continental plate, such as the North American Plate. The displacement caused by the subduction of the Juan de Fuca Plate below the North American Plate does not generally manifest as slip between the two plates; rather, it is absorbed by compression of the North American Plate at the interface at relatively shallow depths. When the magnitude of the compression becomes large enough to overcome the stresses locking the plates together, the plates will suddenly rupture, causing an interface earthquake. Based on geologic and historical evidence, this compression is released about every 350 to 600 years on average in the form of magnitude 8.0 to 9.0 earthquakes. The most recent CSZ interface event is thought to have occurred around 9 p.m. local time on 26 January 1700, based on paleoseismic evidence and historical records of an orphan tsunami along the Japanese coast (Atwater et al. 2005). Interface earthquakes (such as the 2011 magnitude 9.0 Tohoku earthquake in northern Japan) are some of the largest magnitude earthquakes on record. Characteristics of this type of earthquake may include very large ground accelerations, shaking durations in excess of 3 minutes, and particularly strong long-period ground motions, which may affect tall or long-period structures.

Intraslab earthquakes originate from a deeper zone of seismicity that is associated with bending and breaking of the subducting Juan de Fuca Plate. Intraslab earthquakes (such as the 2001 magnitude 7.0 Nisqually earthquake in west central Washington) occur at depths of 40 to 70 kilometers (km) (130,000 to 230,000 feet) and can produce earthquakes with magnitudes greater than magnitude 7.0. Deep intraslab earthquakes tend to be felt over larger areas than shallower crustal events, and generally lack significant aftershocks.

Crustal Sources. Shallow crustal faults are caused by cracking of the continental crust resulting from the stress that builds as the subduction zone plates remain locked together. Few surficial geologic traces exist of the shallow crustal faults in the Portland, Oregon area. The nearest series of known shallow crustal faults, including the Portland Hills Fault, East Bank Fault, Oatfield Fault, Lacamas Lake, and the Beaverton Fault Zone, have had their surface traces either eroded away or buried by ancient flood

deposits, but have been mapped by seismic reflection and refraction studies and other geophysical methods. Therefore, less information is known about these faults than faults with distinct surface traces.

Crustal seismicity from known faults near the project site is generally dominated by the Portland Hills Fault, located approximately 6 miles from the project site. The Portland Hills, Oatfield, and East Bank faults run in a generally northwest-southeast direction through downtown Portland, and the Portland Hills Fault is generally believed to be capable of producing earthquake events with magnitude 7.0 or greater with a return period from 10,000 years to 20,000 years (Petersen et. al., 2014). No estimates for the maximum expected earthquake magnitudes are available for the Beaverton Fault Zone and the Oatfield Fault (Peterson et. al., 2014); however, the East Bank Fault has a lower estimated slip rate and an expected maximum earthquake magnitude of 6.2. These faults and other crustal sources contribute significantly to the seismic hazard at all periods.

5.2 SITE CLASS FOR SEISMIC DESIGN

We determined the soil site class based on the foundation soil information following the guidelines of ASCE 7-16, as referenced by the current OSSC. The soil site class is determined by considering the soil characteristics and measured shear wave velocity data at the site up to a depth of 100 feet bgs. Table 1 provides a summary of the measured shear wave velocity data obtained from SCPTu soundings, refraction microtremor (ReMi) tests and multichannel analysis of surface waves (MASW) testing. Based on our calculations, the site is classified as seismic Site Class E, without accounting for the presence of liquefiable soils at the Project Site. **As a liquefaction hazard is determined to be present at the site, the site is classified as Site Class F and a site response analysis is required to determine the site-specific response spectrum.**

Table 1. Summary of Geophysical Measurement Results and Site Class

Measurement	Elevation (feet) NAVD88	Latitude	Longitude	V_{S30} (ft/s)[a]
ReMi-1	23.1	45.597666	–122.614894	607 (Site D)
ReMi-2	24.0	45.598167	–122.614895	608 (Site D)
ReMi-3	24.5	45.598619	–122.614903	614 (Site D)
ReMi-4	36.0	45.600218	–122.613956	531 (Site E)
SCPT-1	22.5	45.59739	–122.61306	650 (Site D)
SCPT-4	23.0	45.597566	–122.614008	602 (Site D)
SCPT-5	20.4	45.596392	–122.613845	517 (Site E)
SCPT-6	22.4	45.597485	–122.612872	583 (Site E)

Notes:
a. feet per second = ft/s; Site Classifications are based on ASCE 7-16

5.3 SITE-SPECIFIC GROUND MOTION HAZARD ANALYSIS

Site-specific probabilistic seismic hazard analysis (PSHA) and deterministic seismic hazard analysis (DSHA) were performed to obtain a target MCE_R response spectrum for the project. This MCE_R spectrum is used as the target response spectrum for selection of ground motion time histories for use in our 1D nonlinear site response analyses (SRA) and 2D nonlinear deformation analyses (NDA). The PSHA/DSHA framework and results are presented in the following sections.

The overall procedure involved the following steps:

1. Development of a probabilistic, risk-adjusted MCE_R response spectrum for the site considering elastic half-space conditions. This spectrum is based on a comprehensive evaluation of the probabilistic seismic hazard.
2. Development of a deterministic MCE_R response spectrum for the site. This spectrum is derived from a deterministic analysis that considers specific earthquake scenarios and corresponding ground motions.
3. Calculation of the recommended target MCE_R response spectrum, which is determined as the lesser of the probabilistic and deterministic spectra. This ensures a conservative approach in selecting the design response spectrum.
4. Verification that the recommended target MCE_R spectrum meets or exceeds the minimum requirements defined by the ASCE 7-16 code for seismic design. This step ensures compliance with the relevant design standards and regulations.

5.3.1 Half-Space V_{S30} and Site Period

Seismic CPT (SCPTu) soundings were conducted at the site, measuring shear wave velocity (Vs) at 1-meter intervals to a maximum depth of approximately 150 feet bgs. In addition, four 1D ReMi tests and one 2D MASW test were performed to provide information about the deep Vs profile at the project site. These tests used arrays spanning up to about 600 to 650 feet in length (see Appendix F). Both active and passive measurements were taken, and 1D Vs profiles were obtained down to a maximum depth of 200 feet. The geophysical measurement report along with their corresponding locations are included in Appendix F.

Figure 6 displays the V_s data measured at the Project Site, reaching a depth of 180 feet bgs. The SCPTu data shows good agreement with the ReMi data in the upper 60 feet of the site. Below 60 feet, the SCPTu data is relied upon more heavily to determine the baseline Vs value. The baseline Vs profile, incorporating all the measurements, is depicted in Figure 6. Using this baseline Vs profile, the fundamental period of the soil profile is calculated to be approximately 1.2 seconds.

Figure 6 also reveals a significant impedance contrast at a depth of 180 feet bgs, as indicated by the ReMi 4 measurement. This measurement, being the only one available at that depth, estimates a shear wave velocity (V_s) of 1,271 feet per second (fps). It is worth noting that this impedance contrast exists below the deepest boring, introducing uncertainty regarding a notable geologic contact.

For the purposes of this study, we consider it reasonable to assume a half-space condition at 180 feet bgs, with a V_{S30} of 1,271 fps, corresponding to a Site Class C (rock outcrop) classification. Based on this assumption, an MCE_R spectrum for "rock outcrop" conditions will be developed, which will be thoroughly discussed in the following section. The developed MCE_R spectrum will serve as the target spectrum for selecting and scaling input ground motion time histories used in our analyses.

5.3.2 Site-Specific Probabilistic Seismic Hazard Analysis (PSHA)

A site-specific PSHA was performed for the site to obtain the probabilistic response spectra for the maximum considered earthquake (MCE) hazard level at half-space condition. The PSHA framework and results are presented in the following sections.

5.3.2.1 Seismic Source Characterization

Our site-specific PSHA was performed using the HAZ45 software. The seismic source characterization (SSC) contains seismic source geometries and recurrence models developed based on the 2014 United States Geological Survey (USGS) National Seismic Hazard Model (NSHM), as documented in USGS Open-File report 2014-1091 and further clarified in correspondence with USGS. Inputs to the PSHA include the earthquake source file, site properties, and ground motion model (GMM) weights.

The earthquake source file used for the analyses includes source models for known faults (such as the Portland Hills Fault), gridded crustal seismicity, and the CSZ. Our HAZ45 earthquake source model was validated against the USGS 2014 National Hazard Maps for grid points in the PNW, including Portland. This validation study was previously presented to a geotechnical peer reviewer on a past peer-reviewed project.

Based on review of the 2018 update to the 2014 NSHM (Petersen et. al., 2020) and communications with the expert consultant who developed the HAZ45 implementation of our seismic source model, we understand the PNW portion of the source model did not change in the 2018 update to the 2014 NSHM. We understand the USGS did look at updating the seismicity catalog extending into 2018, which could slightly impact seismic source rates for the crustal background source as well as the slab sources, which are based on the seismicity catalog. Upon review of this updated seismicity catalog, no new events with a magnitude greater than 4.0 were identified, which is the cut-off magnitude used by the USGS for their gridded calculations. Following this examination, we consider our current PNW seismic source model to be generally consistent with the latest widely accepted and implemented science.

5.3.2.2 Ground Motion Models

The GMM weighting scheme used to compute probabilistic ground motions for each source type are presented below in Tables 2 through 4. The selected GMMs and their associated weights generally represent the practicing state-of-the-art in ground motion hazard evaluation in the PNW, in our opinion.

The Next-Generation Attenuation - West 2 (NGA-West2) crustal GMMs were developed in 2014 and are the latest and most comprehensive GMMs published for crustal sources. Additional epistemic uncertainty per Atik and Youngs (2014) is included with the NGA-West2 crustal GMMs to capture an appropriate level of epistemic uncertainty about the median and sigma models.

The NGA-Subduction GMMs (Parker et al., 2022 [PSHAB], Kuehn et. al., 2020 [KBCG], and Abrahamson and Gulerce, 2020 [AG]) were released to the public for use in 2020 and are applicable to both subduction interface and subduction intraslab source-types. They are based on a more comprehensive and up-to-date subduction zone ground motion database than preceding GMMs. Each of these GMMs includes regionalized terms specifically for use with the Cascadia region. As each of these GMMs represents an equally modern, independently developed model, we assigned equal weights to each of these three GMMs.

Each of the three NGA-Subduction GMMs includes a global version of the model in addition to the Cascadia regionalized version, and each GMM modeling team made different modeling decisions when developing their Cascadia regionalized GMM. These modeling differences are especially noticeable as they relate to each GMMs predictions of subduction interface ground motions due to the lack of large recorded CSZ interface events. We understand that PSHAB chose to anchor their CSZ interface model

quite tightly to the global model, KBCG allowed for significant differences between the two, and the AG with adjustments model represents a compromise between these two approaches. We understand that the model authors recommend use of the Cascadia regionalized versions of each GMM at CSZ sites due to differences in the distance and V_{S30} scaling models (among other regional modeling differences).

In our opinion, these differences in modeling decisions between the three Cascadia regionalized models represent an appropriate range of epistemic uncertainty for application to this project.

Other GMMs that were considered for this study, but were not used, include:

1. **Idriss (2014) NGA-West2 GMM**. The Idriss GMM includes significantly fewer input parameters and is less sophisticated than the other NGA-West2 GMMs. The USGS gave this GMM only a 12 percent weight compared to 22 percent to the other NGA-West2 equations in the 2014 NSHM. We omitted the Idriss model from our logic tree weighting scheme.
2. **Atkinson and Macias (2009) GMM.** This equation was derived entirely from earthquake simulations rather than from observed ground motions and lacks a term corresponding to the site-specific V_{S30}. This GMM is also noted to have a potentially unrealistic flatter spectral decay at long periods when compared to recorded ground motions and other subduction interface GMMs.
3. **BCHydro (2018) GMM**. Prior to release of the NGA-Subduction expressions, the 2018 BCHydro GMM (Abrahamson et al., 2018) was considered the state-of-the-art subduction GMM. As the AG model contains borrowed terms from the BCHydro GMM and represents a regionalized version of the 2018 model, the 2018 BCHydro GMM was excluded from our PSHA in favor of the AG model.

Table 2. GMMs and Relative Weights for Crustal Sources

Ground Motion Model (GMM)	GMM Abbreviation	GMM Weights
Abrahamson et al. NGA-West2 (2014)	ASK	0.25
Boore et al. NGA-West2 (2014)	BSSA	0.25
Campbell and Bozorgnia NGA-West2 (2014)	CB	0.25
Chiou and Youngs NGA-West2 (2014)	CY	0.25

Table 3.GMMs and Relative Weights for Subduction Intraslab Sources

Ground Motion Model (GMM)	GMM Abbreviation	GMM Weights
Parker et al. (2022) [a]	PSHAB	0.3333
Kuehn et al. (2020) [b]	KBCG	0.3333
Abrahamson and Gulerce (2020) [c]	AG	0.3334

Notes:

a. *Cascadia, outside Basin with $Z_{2.5}$.*
b. *Cascadia, Non-Seattle Basin.*
c. *Cascadia with adjustments.*

Table 4. GMMs and Relative Weights for Subduction Interface Sources		
Ground Motion Model (GMM)	**GMM Abbreviation**	**GMM Weights**
Parker et al. (2022) [a]	PSHAB	0.3333
Kuehn et al. (2020)[b]	KBCG	0.3333
Abrahamson and Gulerce (2020) [c]	AG	0.3334
Notes: a. *Cascadia, outside Basin with $Z_{2.5}$.* b. *Cascadia, Non-Seattle Basin.* c. *Cascadia with adjustments.*		

5.3.2.3 Site Properties

Basin depth terms ($Z_{1.0}$ and $Z_{2.5}$) are required to compute ground motion intensity for all of the above-selected shallow crustal and subduction GMMs. $Z_{1.0}$ is defined as the depth a V_S horizon of 1,000 meters per second while $Z_{2.5}$ represents the depth to a V_S horizon of 2,500 meters per second.

CB, AG, KBCG, and PSHAB rely upon the $Z_{2.5}$ depth parameter for their basin response term. We used a site-specific $Z_{2.5}$ value of 1.85 kilometers within our PSHA. This site-specific value was calculated from the $Z_{2.5}$ iso-surface extracted from the Stephenson et. al., (2017) velocity model using an inverse-distance weighted average of the $Z_{2.5}$ values taken from the four closest grid points surrounding the site.

ASK, BSSA, and CY rely upon the $Z_{1.0}$ term instead of $Z_{2.5}$. For these three NGA-West2 models, we used a $Z_{1.0,eff}$ value of 0.405 kilometers, consistent with the site-specific $Z_{2.5}$ value. This $Z_{1.0,eff}$ value was determined using an equal weight average of the empirical correlation models described in Petersen et. al. (2020), as shown in the following equations ($Z_{1.0}$ and $Z_{2.5}$ are depths in kilometers).

$$Z_{1.0,eff} = 0.1146\ Z_{2.5} + 0.2826$$

$$Z_{1.0,eff} = 0.0933\ Z_{2.5} + 0.1444$$

This approach is consistent with the USGS approach for basin adjustments in the Seattle region used in the 2018 National Seismic Hazard Maps and can be reasonably adopted for the Portland region as well, in our opinion. As the Portland basin is relatively shallow, the effects of these basin adjustments are generally minor.

5.3.2.4 Haley & Aldrich Site-Specific PSHA Results

Using the framework described in this section, the site-specific PSHA results included probabilistic MCE uniform hazard spectrum (UHS) at half-space conditions, total mean hazard curves, source-specific hazard curves, and disaggregation hazard contribution results. Table 5 (attached) summarizes the Haley & Aldrich site-specific MCE UHS at half-space condition. More detailed results produced from PSHA results are presented in Appendix D of this report.

5.3.3 Site-Specific Deterministic Seismic Hazard Analysis (DSHA)

The 84th percentile deterministic (MCE_R) seismic hazard was computed per ASCE 7-16 Section 21.2.2. RotD50, deterministic response spectra were computed for the Portland Hills Fault, CSZ intraslab, and

the CSZ interface sources using the same suite of GMMs and epistemic weights documented in Tables 2 through 4, utilizing the best-estimate design V_{S30}.

Table 6 summarizes the primary input parameters selected for each of the deterministic scenarios. Distance metrics were selected to be consistent with the modeled source geometry and location of the site. Characteristic magnitudes were selected considering existing literature related to each source type and disaggregation results for the site.

Table 6. Deterministic Scenario Input Parameters

Parameter	Portland Hills	CSZ Intraslab	CSZ Interface
M_W	7.1	7.2	9.0
R_{Rup} (km)	10.4	75	94
R_{JB} (km)	10.4	N/A	N/A
Z_{TOR} (km)	0	50	5
Hypocentral Depth (km)	N/A	65	N/A
Note: *V_{S30} = 388 m/s, $Z_{1.0}$ = 0.405 km, $Z_{2.5}$ = 1.85 km*			

The calculated deterministic response spectrum is summarized in Table 5 (attached). The calculated 84th percentile deterministic response spectrum is taken as the envelope of the three source-specific deterministic spectra and is presented in Figure 7. More detailed results including the development of the deterministic response spectra for the three source types summarized in Table 6 are presented in Appendix D. As presented in Appendix D, the intraslab subduction spectrum is highest at very short periods with the Portland Hills Fault and interface subduction spectra controlling at longer periods.

5.3.4 Probabilistic Response Spectrum Modification for Targeted Risk

The probabilistic MCE hazard is risk-adjusted to achieve a 1 percent probability of collapse in 50 years. We calculated the risk coefficients using Method 2 in ASCE 7-16, Section 21.2.1.2, by using an iterative integration procedure that combines the probability of exceedance of a given spectral acceleration with a lognormal probability density function representing the probability of collapse for that spectral acceleration (also known as a fragility curve).

The risk coefficients were calculated using a MATLAB script obtained from USGS and were determined using a lognormal standard deviation of 0.6. The input to the MATLAB script consisted of seismic hazard curves at each period (i.e., annual exceedance frequency versus spectral acceleration), which were obtained from the PSHA. The primary outputs of the code are the MCE_R and 2 percent in 50-year UHS spectra. The risk coefficients, which the MATLAB script also computes, are simply the ratio of these two response spectra. The computed risk coefficients are listed in Table 5 (attached).

5.3.5 MCE_R Response Spectrum Modification for Maximum Component

The results of the PSHA and DSHA are RotD50 response spectra. However, the maximum spectral acceleration over all orientations (known as the maximum component or RotD100 accelerations) is a potentially more significant parameter for structural design (BSSC, 2009). To develop the maximum component spectrum, the RotD50 response spectrum obtained from the PSHA and DSHA was adjusted by period-dependent factors that relate maximum component to RotD50 spectral accelerations. We

used the scale factors from Shahi and Baker (2014) to develop the MCE_R. These factors are shown in Table 5 (attached).

5.3.6 Target Half-Space MCE_R Response Spectrum

Per ASCE 7-16 Section 21.2.3, the site-specific MCE_R response spectrum is taken as the lesser of the probabilistic and deterministic MCE_R response spectra. Figure 7 presents a comparison of the probabilistic and deterministic MCE_R response spectra, and it is observed that the deterministic spectrum is higher at all periods. As such, the probabilistic MCE_R spectrum is adopted as the recommended MCE_R spectrum.

The recommended site-specific MCE_R response spectra, shown in Figure 7, is also tabulated in the last column of Table 5. Table 5 compares the calculated MCE_R response spectrum with the Site Class C code-based spectrum. As shown in Figure 7, the target half-space MCE_R response spectrum meets the requirement to be greater than or equal to the minimum allowable spectrum (80 percent code-based Site Class C) for all spectral periods.

5.4 INPUT GROUND MOTION SELECTION

This section describes the framework used to select and scale input ground motion time histories for use in as inputs to our seismic analyses (2D NDA and 1D SRA).

5.4.1 Spectral Periods of Interest

Based on email discussions with B&M in late May to early June of 2023, we understand that the impulsive period of the proposed fuel tank is 0.202 seconds and the natural period of the first mode of sloshing (convective period) is 7.5 seconds. To deal with these different fundamental periods in a reasonable manner, two suites of five input ground motions (10 total) are developed: One suite developed relative to the impulsive period (T = 0.2 seconds) and a second suite developed relative to the sloshing period (T = 7.5 seconds). As an additional consideration, the estimated fundamental site period (as discussed in Section 5.3.1) is approximately 1.2 seconds. The identified period ranges of interest for each suite of ground motions are summarized as follows:

- For the impulsive period (T = 0.2 seconds) scenario, the spectral period range interest for selection and scaling of the selected ground motions will be taken from 0.04 seconds (0.2 times the structure impulsive period) to 1.6 seconds (1.3 times the fundamental site period, representative of a degraded site period).
- For the convective period (T = 7.5 seconds) scenario, spectral period range interest for selection and scaling of the selected ground motions will be taken from 3.75 seconds (0.5 times the structure convective period) to 10 seconds.

5.4.2 Disaggregated Hazard Contributions

The recommended ground motion source distributions for each suite of five ground motions were derived based on the disaggregation results at spectral periods of 0.2 seconds and 7.5 seconds, respectively. Table 7 summarizes the results of disaggregation results for each period and earthquake source, as well as the identified number or ground motions to be selected for each source type.

Table 7. Seismic Hazard Contributions at 2,475-year Return Period										
Source	T = 0.2 seconds (Impulsive)					T = 7.5 seconds (Convective)				
	Percent Contribution	ε	M_w	R_{rup} (km)	# of Motion	Percent Contribution	ε	M_w	R_{rup} (km)	# of Motion
Interface Subduction	20	1.52	9.0	93	1	76	0.88	8.9	112	4
Intraslab Subduction	30	1.22	6.9	81	2	< 0.5	2.91	7.2	75	0
Crustal	50	1.12	6.3	13.6	2	24	0.99	7.1	31	1
Note: The tabulated ε, M_w, and R_{rup} are the mean disaggregated values calculated from disaggregation analysis.										

5.4.3 Ground Motion Selection

Table 7 served as the basis for performing ground motion suite selection for each scenario. We selected 5, 1-component ground motion time histories for both impulsive and convective period suites, resulting in 10 selected input motions total. Five motions for each suite were selected to be consistent with the site response analysis requirements in Section 21.1.1 of ASCE 7-16. We chose the processed ground motion records published by the Pacific Earthquake Engineering Research (PEER) center for both crustal earthquakes (NGA West2) and subduction earthquakes (NGA Sub). An amplitude scaling approach was selected for use rather than a spectral matching approach to minimize modification of potentially important characteristics of the earthquake recordings. The ground motion suites were selected based primarily on the following criteria:

1. Multiply original ground motion records by scaling factors ranging from 0.5 to 3.0 (amplitude scaling method)
2. Spectral shape fit, with respect to the target spectrum within the spectral period of interest for either the Impulsive or Convective period;
3. Appropriate source mechanism (i.e., shallow crustal, subduction interface, subduction intraslab);
4. Moment magnitude and source-to-site distance.
5. Earthquake duration using significant duration metric ($D_{5\text{-}95}$) estimated using Bahrampouri et. al. (2021).
6. Cumulative absolute velocity (CAV) estimated using and M_w and R_{rup} from disaggregation result in Table 7 using Macedo et. al. (2020) and Liu & Macedo (2022) for crustal and subduction source conditional ground motion models, respectively.

Tables 8 and 9 (attached) summarize the metadata and information for selected ground motion for impulsive and convective period suite, respectively. Figure 8 presents the selected input motion spectra for each suite and the target MCE_R half-space spectrum. Figure 8 shows that the average amplitude-scaled ground motion response spectra matches the level of the MCE_R target spectrum well across all periods, meeting the intent of ASCE 7-16 Chapter 21.1.1 ground motion selection criteria. Detailed plots of acceleration, displacement, velocity time histories, and ground motion parameters for each selected ground motion are presented in Appendix D.

5.5 2D EFFECTIVE-STRESS NONLINEAR DEFORMATION ANALYSES

5.5.1 Limit-Equilibrium Flow Failure Evaluation

Limit-equilibrium flow failure analysis was performed to evaluate the potential for a flow failure that affects our site, assuming liquefaction of the full ESU-3 layer occurs. Figure E-1 in Appendix E summarizes the results of limit-equilibrium stability analysis using the software program SLIDE. We assigned post-liquefied residual shear strength ratio (S_r/σ'_{vo}) to ESU-3a, ESU-3b, and ESU-3c of 0.08, 0.1, and 0.12, respectively. We compared the value recommended by Idriss & Boulanger (2008) and Robertson (2021) where all values are interpreted from CPT data. We found that the assigned values are relatively conservative assuming the q_{c1Ncs} values of 90, 110, and 120 for ESU-3a, ESU-3b, and ESU-3c, respectively (see Figure B-2).

As shown in Figure E-1, flow failure appears unlikely to occur and the failure planes with the lowest factors of safety (> 1.0) do not extend to the existing fuel tank facilities.

5.5.2 2D Numerical Model

A free field 2D model was used to predict the behavior of the site under seismic loading. The resulting deformations represent the conditions accordingly, and do not account for additional deformation, which would be imposed by shallow foundations and the associated structural loading as we understand that the new tanks will be founded on deep foundation elements or ground improvement.

5.5.2.1 2D FLAC Element Mesh

The cross-section B-B' shown in Figure 4 was used to derive a 2D model for nonlinear deformation analyses (NDA) using the finite difference program FLAC 8.1. The user defined PM4Sand (V3.1) and PM4Silt (V1.0) constitutive models were used to model ESUs reasonably likely to be susceptible to liquefaction or cyclic softening at the project site. The left boundary of the model was located 200 feet away from the left edge (southern perimeter) of the existing fuel tanks (near boring B-2 in Figure 2), and the model extends 2,850 feet northwards from the existing facilities toward the Columbia River. The full plane strain model is shown in Figure E2 in Appendix E.

As shown on the available topography and bathymetry data, the model captures a ground surface sloping slightly up approximately 0.5 to 1.0 percent from the existing facilities toward the levee, and then sloping down from the levee toward the river. In the vertical axis, the mesh was modeled from the ground surface (NAVD88 El. +22 feet at the existing facilities and approximately El. +45 feet at the crest of the levee) to the bottom of the model at El. –160 feet. To simplify the calculation, the geometry of the Columbia Riverbed was simplified as shown in Figure 4. The deepest elevation of the riverbed modeled in our analysis was at NAVD88 El. –34 feet.

The full model mesh is approximately 2,850 feet wide and 180 feet tall, comprising about 20,864 elements. The elements are typically 8 to 10 feet long and 3 feet tall, with an aspect ratio ranging from 2.7 to 3.3. This grid mesh resolutions were considered sufficiently fine to capture important aspects of wave propagation in a nonlinear time-domain dynamic simulation. By assuming 10 elements is sufficient to propagate a single wavelength, the average element height of 3 feet with shear wave velocity profile shown in Figure 6 are capable for propagating input motion with a maximum frequency of at least 25 hertz (Hz). Even if stiffness degradation during shaking is considered, this mesh resolution can still propagate motion with a frequency of at least 10 Hz.

5.5.2.2 Boundary Condition

The dynamic simulation used a compliant (quiet) model base, with the outcrop input motion (presented in Figure 8 and Appendix D) applied as a horizontal stress-time history at the bottom of the model (j = 1). The half-space layer from El. –130 to El. –160 feet was modeled as an elastic material. The dashpot coefficient factor was calibrated to ensure that the nodal velocity time history at the base of the 2D model (j = 1) matched the outcrop input motion velocity time history (FLAC 8.1 Technical Manual, Itasca 2019). This was done to avoid over- or underestimation of the input motion, as the dashpot coefficient factor is influenced by the model geometry and impedance contrast of the elastic half-space velocity and the nonlinear soil continuum above it. The 30-foot elastic half-space layer at the base of the model was modeled as an elastic material with a shear wave velocity of 1,271 feet per second (ft/s) and a Poisson's ratio of 0.33.

The left and right boundaries were modeled using radiating absorbent boundaries, also known as "free-field" side boundaries, and all columns within 10 feet of the boundaries were considered elastic to adequately confine all interior zones. The elastic column was set to have a 30-percent reduction in small-strain shear moduli to accommodate cyclic degradation during the simulation. We also performed a sensitivity analysis by extending the left boundary to evaluate the results and found that it produced only small differences, which will be discussed in the following section.

For all simulations, the nodal pore pressure boundary conditions were set to be impermeable at the left, right, and bottom of the model. For the top of the model (surface to riverbed), the nodal pore pressure was set to allow flow outside the model (i.e., permeable).

5.5.2.3 Initial State & Analysis Settings

The simulations were performed in several analysis stages. In the first stage, the model was solved for static equilibrium by assigning Mohr-Coulomb elastoplastic material to all elements, assuming dry conditions, using the drained friction angle, and small-strain shear modulus (derived from the shear wave velocity profile shown in Figure 6). The coefficient of earth pressure at rest (Ko) for all soil elements was calculated to be between 0.45 and 0.5. The water table was initialized by setting a static phreatic surface, as shown in cross-section B-B' in Figure 4. The initial state of stress of the model is presented in Figure E-2.

In the second stage, the pore-pressure conditions were solved for, and then the PM4Sand and PM4Silts materials were assigned to ESU3 and ESU2, respectively. The model was solved once again for static equilibrium using the updated parameters.

The last stage is the dynamic simulation stage, where the analysis is divided into several parts to run different time duration partitions. Rayleigh damping of 0.5 percent centered at a frequency of 1 Hz was applied during shaking, as it has been found to be sufficient by other researchers (Boulanger & Ziotopoulou, 2017). During the shaking simulation, the groundwater flow equation was also solved over the duration of the ground shaking. The simulation solved both for mechanical and flow (fully-coupled) at each time step.

5.5.2.4 *Monitored Engineering Demand Parameter (EDP)*

For this Seismic Vulnerability Assessment (SVA) study, we determined several Engineering Demand Parameters (EDPs) to evaluate the extent of liquefaction triggering and the deformation pattern of the 2D model. These EDPs include induced shear strain, nodal lateral deformation, and excess pore pressure ratios. These outputs were extracted for all elements at the end of the input motion for all motions. The contour maps presenting these outputs are shown in Appendix E (Figure E3 – E8).

Additionally, we also monitored several element responses, such as nodal displacement, velocity, and acceleration time history at the surface within the fuel tank facilities. We also monitored the profile of depth versus lateral displacement (Figure 9), shear strain increment (Figure E9, Appendix E), and excess pore pressure ratio (Figure E10, Appendix E) at the left edge (southern), middle, and right edge (northern) perimeter of the fuel tank facilities.

5.5.2.5 *Input Motion*

Selected, scaled, and processed ground motions for each impulsive and convective period were used as input motions. With a total of 10 input motions, we produced 10 simulation results as the baseline case. To eliminate numerical noise caused by the high-frequency components of each input motion, a 6th order Butterworth filter was applied to all motions with a cutoff frequency of approximately 20 to 25 Hz. The filtering process was monitored to ensure that the Arias Intensity of the filtered input motions were not less than 95 percent of the original Arias Intensity.

5.5.3 Calibration of Constitutive Soil Model

5.5.3.1 *ESU-1*

This section discusses the soil constitutive models assigned to each ESU, as presented in Figure E2 in Appendix E. During the dynamic simulation, ESU1 was changed from a Mohr-Coulomb material to an elastic material with hysteretic damping (Sigmoidal3) in FLAC. ESU1 was calibrated to match the Darendeli (2001) modulus reduction curve of clay with a plasticity index (PI) of 20. Table 10 provides a summary of the baseline soil parameters used for our 2D NDA.

5.5.3.2 *ESU-2 (Overbank Deposit)*

As shown in Figure 4, the lack of subsurface information in the northern part of the existing fuel tank facilities led us to project CPT-18 data from the Geotechnical Resources, Inc (GRI) report. This data indicates that ESU2 was observed only up to NAVD88 El. 0.0 feet. However, this assumption should be confirmed through more detailed subsurface investigation. The presence of a thicker and softer ESU2 layer toward the Columbia River may potentially impact the overall results presented in this report.

Based on laboratory testing (index testing, CRS, DSS, and CDSS results) and interpretation of CPTs (see Figure B1 in Appendix B), we believe ESU2 is not susceptible (Figure C-6) to experiencing zero effective stress (i.e., $R_{u\text{-}max} < 0.8 – 0.9$ from CDSS test), but it can still experience strength degradation and accumulate shear strain during cyclic loading (see Figure C2 – C5). The DSS test (Figure C1) indicates that ESU2 is composed of non-sensitive (S = 1.2) fine-grained material. Softening behavior (approximately 15 to 20 percent degradation) was observed at shear strain levels exceeding 30 percent. We expect the strength of ESU2 to experience 5 to 10 percent strength degradation during an earthquake event.

To capture the cyclic behavior, strength degradation, and shear strain accumulation of ESU2, we used the PM4Silt V1.0 constitutive model. We employed a conservative assumption of a baseline value of S_u/σ'_{vo} of 0.3. The shear modulus coefficient (G_o) was calibrated using the measured V_s values, which are presented in Figure B1. We set all secondary parameters to the recommended default values as discussed in Boulanger & Ziotopoulou (2018). Additionally, we checked the damping behavior to match the Darendeli (2001) modulus reduction curve for a material with an overconsolidation ratio (OCR) of 2 and a plasticity index (PI) of 16. Using the CDSS results presented in Appendix C, we calibrated the contraction rate parameter (h_{po}) to match the CRR vs $N_{c\text{-}liq}$ line under single-element undrained CDSS simulations up to 3 percent single amplitude shear strain. We found that h_{po} = 25 produced a reasonable agreement. The hydraulic conductivity of this ESU was estimated using the correlations by Robertson & Cabal (2015), and we set the horizontal to vertical hydraulic conductivity ratio to be 5.0.

Table 10. Summary of Soil Constitutive Model Parameters Used in 2D FLAC Simulation

Model Parameter	ESU-1 (Above GWL)	ESU-2 (Overbank Deposit)	ESU-3 (Columbia River Sand)	Elastic Half-Space
Top Elevation (feet)	23	3	–38	–160
Bot. Elevation (feet)	3	–38	–160	–180
Constitutive Model	***Elastic Hysteretic (Sig3)***	***PM4Silt***[a]	***PM4Sand***[a]	***Elastic***
Plasticity Index	15 - 20	16	Non-Plastic	N/A
MRD Curves	Darendeli (2001)	Darendeli (2001)	n.a	n.a
Unit Weight (pcf)	115	115	120	130
Mass Density (slugs/feet^3)	3.573	3.573	3.728	4.039
Shear Wave Velocity (ft/s)[b]	375	472	613 - 816	1271
Mohr-Coulomb Cohesion (psf)	500	n.a.	n.a.	n.a.
Mohr-Coulomb Friction Angle (°)	30	n.a.	n.a.	n.a.
Undrained Shear Strength Ratio[c] (S_u/σ'_{vo})	n.a.	**0.3** (0.17 - 0.86)	n.a.	n.a.
Relative Density, D_R (%)[c]	n.a.	n.a.	ESU-3a: **40%** ESU-3b: **50%** ESU-3c: **58%**	n.a.
Clean-sand equivalent CPT tip resistance[d], q_{c1Ncs}	n.a.	n.a.	ESU-3a: **90** ESU-3b: **110** ESU-3c: **120**	n.a.
Vertical Hydraulic Conductivity, k_v (ft/s)	6.5E-8	6.5E-8	ESU-3a: **2.0E-6** ESU-3b: **1.0E-5** ESU-3c: **1.0E-5**	1.0E-5
Horizontal Hydraulic Conductivity, k_h (ft/s)	5.0 k_v	5.0 k_v	2.0 k_v	2.0 k_v
h_{po}[e]	n.a.	25	ESU-3a: **1.8** ESU-3b: **1.9** ESU-3c: **2.0**	n.a.

Table 10. Summary of Soil Constitutive Model Parameters Used in 2D FLAC Simulation				
Model Parameter	**ESU-1 (Above GWL)**	**ESU-2 (Overbank Deposit)**	**ESU-3 (Columbia River Sand)**	**Elastic Half-Space**
G_o	n.a.	425 - 546	ESU-3a: **628 - 687** ESU-3b: **587 - 782** ESU-3c: **681 - 743**	n.a.
Notes: *a. All secondary parameters are set to default unless specified.* *b. Baseline value from field geophysical measurement* *c. Mean value from estimated values, see Appendix-A.* *d. Based on Boulanger & Idriss (2016)* *e. Calibration parameters to match cyclic resistance curves.*				

5.5.3.3 ESU-3 (Columbia River Sand)

We relied on the interpretation of CPTs shown in Figure B-2 to determine the engineering properties of ESU-3. Based on the tabulated data in Table 10 and Figure B-2, we discretized this ESU into three sub-layers with different relative densities ranging from 40 to 58 percent. The shear modulus coefficient (G_o) was calibrated using the measured V_s values, which are presented in Figure B2.

To estimate the cyclic resistance ratio (CRR), we utilized the liquefaction triggering line [CRR = f(q_{c1Ncs})] from Boulanger & Idriss (2016), along with their Magnitude Scale Factor (MSF) relationship, to estimate the relationship between CRR and Nc-liq. Subsequently, we performed single-element undrained CDSS simulations until 3 percent single amplitude shear strain to match the target CRR vs Nc-liq relationship. We calibrated the contraction rate parameter (h_{po}) to match the CRR vs Nc-liq, assuming a probability of liquefaction of 15 percent.

The hydraulic conductivity of this ESU was estimated using the correlations by Robertson & Cabal (2015). We set the horizontal to vertical hydraulic conductivity ratio to be 2.0.

5.5.4 Analysis Results

5.5.4.1 Lateral Deformation

The purpose of our simulation is to evaluate the extent of liquefaction triggering by evaluating the maximum induced shear strain during shaking, the generation of excess pore water pressure ratio ($R_{u\ max}$), and the lateral displacement pattern. We ran the selected 10 input ground motions described in Section 5.4.3 and 5.5.1.5 and produced contour maps of the monitored parameters, as presented in Appendix E. Our evaluation focuses on two parts of the model: the levee area and the existing fuel tank perimeter.

In general, based on the analysis of the 2D plane-strain model, the levee toe region experienced significant lateral deformation (more than 10 feet) due to high shear strain accumulation within the toe region, as shown in Figures E2 to E5. A wide extent of soil liquefaction (i.e., $R_{u\text{-}max} \approx 1.0$ and maximum shear strain, γ_{max} >10 percent) occurred within the levee area, reaching a depth of 80 feet bgs. Figure E6 to E7 display the $R_{u\text{-}max}$ contour map, illustrating the extent of liquefaction. Out of the 10 motions we analyzed, one long-duration input motion (NGASubRSN6001811_MET-EW) from a subduction interface source caused progressive failure that propagated toward the existing fuel tank facilities. The estimated lateral deformation within the levee area shaken by this motion exceeded 13 feet. This long-duration

motion is observed to have the largest CAV of all the input motions, as well as a response spectrum that generally matches or exceeds the target MCE_R spectrum at most periods.

Within the existing fuel tank facilities area, the presence of a 0.5 to 1.0 percent upsloping ground helps to mitigate deformation toward the Columbia River direction. However, our simulations, based on the 10 motions we ran, showed that the existing fuel tank facilities area experienced lateral displacement toward the south direction, reaching a maximum displacement of 6 feet due to the modeled surficial topography for 9 of the motions, except the previously discussed NGASubRSN6001811_MET-EW motion. Figure 9 provides a summary of the lateral displacement profiles calculated from the 10 motions. Tables 8 and 9 (attached) showed that the NGASubRSN6001811_MET-EW motion represents the most intense earthquake event in terms of highest CAV and longest duration. This motion resulted in progressive failure propagating from the levee area to the middle of the fuel tank facility area. The maximum lateral deformation calculated due to the NGASubRSN6001811_MET-EW input motion was also 6 feet toward the north direction.

As shown in Figure 9, significant shear strain was observed within the depth range of 40 to 50 feet bgs. Based on our estimation, this depth range corresponds to the location of the failure sliding plane. Considering a 2,475-year hazard level, we estimated that the existing fuel tank facilities area will experience lateral displacement, either toward the north or south direction, of up to 6 feet. The cyclic shear strain accumulation within the depth range of 40 to 50 feet contributes the most to the resulting permanent deformation.

5.5.4.2 Post-Liquefaction Reconsolidation Settlement Calculation

The estimation of post-liquefaction reconsolidation settlement was performed by combining the maximum shear strain profile results calculated from the 2D FLAC NDA and laboratory-based volumetric strain–max shear strain models (ε_{vol}–γ_{max}). Figure E8 illustrates the maximum cyclic shear strain profiles induced by all 10 motions. By employing the laboratory-based ε_{vol}–γ_{max} models for Columbia River silty soil (Stuedlein et. al., 2022) and typical clean sand soil (Bray & Olaya, 2023), we were able to estimate the post-shaking settlement, as summarized in Figure 10.

The average calculated settlement from all 10 motions was approximately 11 inches at the left edge (southern), 9 inches at the middle, and 7 inches at the right edge (northern) perimeter of the fuel tank facilities.

We estimated that the soil within the depth range of 0 to 60 feet bgs contributes to more than 75 percent of the resulting post-shaking settlement. Notably, we observed higher settlement along the left edge perimeter, which may lead to significant differential settlement for the fuel tank facilities.

5.5.4.3 Summary of Primary 2D Modeling Results

As described earlier in this report, we selected two suites of 5 ground motions to capture the convective and impulsive periods of the tank, resulting in 10 total motions. For consistency with the intent of ASCE 7-16 Section 16.2.2 we have counted the ground motion with the largest deformation twice to take the average of eleven total ground motions. The resulting averages are provided in Tables 11 and 12.

Table 11. Summary of Total Settlement and Lateral Displacement		
Analysis Profile	**Average Vertical Settlement (inches)**	**Average Lateral Surface Displacement (inches)**
North (right)	8.1	18
Middle	10.2	20
South (left)	12.2	32
Notes: Distance between north edge to south edge is 440 feet		

Table 12. Summary of Differential Settlement and Lateral Displacement		
Analysis Profile	**Average Differential Settlement (inches/50 feet)**	**Average Differential Lateral Surface Displacement (inches/50 feet)**
Between North and South Profiles	0.5	1.6
Notes: Distance between north edge to south edge is 440 feet		

Note that for the tabulated average lateral surface displacements in Tables 11 and 12, we utilized the absolute value of all surface displacements. To calculate the average differential settlements/lateral displacements, we took the difference of the values at the north and south ends of the tank site, divided that value by the distance between them, and then normalized this difference to reflect a distance of 50 feet.

5.5.4.4 Other Modeling Considerations

We conducted additional analyses to assess the impact of two factors: the distance of the existing fuel tank facilities to the left boundary and the ground motion polarity. Our findings indicate that extending the left boundary to a distance of 700 feet away from the existing facilities still resulted in a similar magnitude of southward deformation, showing that the tendency to deform in that direction is primarily a function of the topography rather than edge effects of the model.

Furthermore, we evaluated the influence of ground motion polarity by multiplying –1.0 to the input time history. For this particular 2D model and ground motion, we observed that the ground motion polarity has a negligible effect, as it produced a very similar deformation pattern and magnitude compared to the baseline results.

5.6 SITE-SPECIFIC SITE RESPONSE ANALYSIS

The site-specific 1D site response analysis (SRA) conducted in this report serves two main purposes: first, to determine a recommended response spectrum at the ground surface, and second, to provide additional support and analysis to complement the results obtained from the 2D NDA (Numerical Dynamic Analysis).

Comparing the induced shear strain and displacement profiles calculated by the 2D NDA and 1D SRA is valuable for assessing the consistency and reliability of the results. To carry out the 1D SRA, the DEEPSOIL V7.0 computer program was employed. By conducting both the 2D NDA and 1D SRA analyses, a more comprehensive understanding of the site response is obtained.

5.6.1 One-Dimensional Model

A representative 1D soil profile was developed for the purpose of conducting ground response analysis, utilizing available subsurface information such as boring logs, CPT data, and geophysical measurements. The depth of the groundwater table was specified at 15 feet depth, as discussed earlier in this report. The soil profile and stratification for the ground response analysis is depicted in Figure 6 and Figure B1. This profile was developed to represent a generalized depiction of the subsurface conditions at the site suitable for development of a site-specific response spectrum for the site.

To explore the effects of variability in shear wave velocity, multiple V_S profiles were used for the ground response analyses. These profiles involved increasing and decreasing the baseline Vs profiles by 20 percent to assess the sensitivity of the results to changes in the Vs distribution.

To capture the response of each soil layer accurately, the thickness of each layer was set to 3 feet. This configuration ensures that each layer is capable of propagating harmonic motion with maximum frequencies of at least 25 Hz, allowing for a detailed analysis of the ground response. The specifics of the 1D ground response analysis can be found in Appendix E, where the results and interpretations are presented in detail.

5.6.2 Nonlinear Soil Properties

Nonlinear soil behavior, as described by nonlinear shear modulus reduction (G/G_{max}) and damping curves, was assigned to the analysis profile based on soil type and *in situ* effective stress. Empirical correlations for curves of soil G/G_{max} and damping with shear strain were used to generate the total stress nonlinear soil behavior for model layers, which were then fit to a hyperbolic soil model.

5.6.2.1 Soil Models and Empirical Modulus Reduction and Damping (MRD) Curves

The General Quadratic/Hyperbolic (GQ/H) soil model, developed by Groholski et. al. (2016), was selected for use in our analysis. This model incorporates the Modulus Reduction Factor (MRDF) concept proposed by Phillips and Hashash (2009). The GQ/H model is a strength-controlled soil model that ensures the shear strength of the soil never exceeds an asymptotic limit.

The GQ/H model's parameters are calibrated to fit the small-strain region of the G/G_{max} curve, capturing the initial onset of nonlinearity with shear strain in the soil. The large-strain behavior is controlled by a specified soil strength. The MRDF component of the model modifies the size of unload-reload hysteretic loops, deviating from the Masing behavior. The MRDF parameters are adjusted to match the hysteretic damping across all strain ranges.

Table 13 provides a summary of the selected MRD (Modulus Reduction-Damping) curves used in the analysis. The small-strain damping, D_{min}, is estimated empirically using the proposed MRD models. To obtain a more realistic surface spectrum, we multiply D_{min} by a factor of 3.0, following the

recommendation by Tao & Rathje (2019). The profiles plot in Appendix E illustrates the selected D_{min} values, implied shear strength, and implied friction angle for each sublayer.

The GQ/H model is fit to the modulus reduction (G/G_{max}) and damping curves. By using shear strength as an input parameter, the GQ/H model corrects the empirical G/G_{max} curve to match the site's implied shear strength at higher shear strain values. This strength-corrected procedure ensures a more realistic stress-strain behavior at higher strains, which is crucial for producing accurate nonlinear ground response analyses.

Table 13. Nonlinear Curve Soil Index Properties

Depth Range in feet	Empirical MRD Curves	Unit Weight in pcf[a]	Friction Angle in degrees	Undrained Shear Strength Ratio	Additional Model Parameters
0 to 15	Darendeli (2001) Clay PI = 20	115	n.a.	0.5	$K_0 = 0.45\ (OCR)^{0.5}$
15 to 40	Darendeli (2001) Clay PI = 16	115	n.a.	0.3	$K_0 = 0.45\ (OCR)^{0.5}$
40 to 180	Darendeli (2001) Sand	120	29 to 32	0	$K_0 = 1 - \sin \phi$
> 180	Elastic Half-space	130	n.a.	n.a.	n.a.

Notes:

a. pcf = pounds per cubic foot

5.7 SURFACE RESPONSE SPECTRUM

The interpretation of 1D SRA results and development of the recommended spectrum are detailed in the following sections.

5.7.1 Results of 1D Site Response Analysis

In our analysis, we conducted 1D, nonlinear, time domain site-specific site response analyses on the representative soil profile described in Table 13 and Figure 6. We applied the five selected input ground motions from the impulsive period scenario to the base of the soil column and propagated them upward. For the 1D GRA, we excluded the convective period scenario input ground motion as the convective period (7.5 seconds) is much greater than the natural period of the 1D modeled profile (1.2 seconds). Stewart, Afshari, and Hashash (2014) note that at periods beyond the site period, SRA results have been found deficient in their ability to predict site response and a recommendation to use semi-empirical models at these periods is suggested instead.

The results of the analysis, including the propagation of peak acceleration through the soil profile, the maximum resulting strain in the soil profile, peak cyclic shear stress ratio, and peak displacement, are presented in Appendix E.

To measure the response of the soil column, we consider the spectral acceleration at the ground surface, which accounts for any amplification or deamplification of the input outcropping motions by the soil column, as shown in Figure 11.

The site effect, which represents the amplification or deamplification by the soil column, is typically characterized by amplification factors (see Figure 11). These factors are defined as the ratio between the surface and base response spectra. In our analysis, we computed linearly averaged amplification factors for each defined soil profile using all five ground motions. These amplification factors were then used to generate a surface spectrum by multiplying the amplification factor at each period by the base response spectrum at that period. The results of the amplified spectrum for all profile analyzed in this study is presented on Figure 11. This resulting surface spectrum is referred to as the amplified outcrop response spectrum and is consistent with the requirements for site response analyses outlined in ASCE 7-16.

5.7.2 Recommended Design MCE_R Spectrum

The recommended surface response spectrum has been developed based primarily on the results of the site response analysis. The spectrum is presented in Figure 11 and is observed to be generally equal to or larger than the full ASCE 7-16 Chapter 21 code-based spectrum in the impulsive period range of interest. At periods significantly beyond the estimated site period, a choice was made to set the recommended site-specific MCE_R response spectrum equal to the ASCE 7-22 Site Class DE response spectrum. This choice was made to avoid potential underestimation of the surface response spectrum at periods beyond where we trust the results of our SRA.

This recommended surface response spectrum satisfies the minimum bound requirement of ASCE 7-16, which states that the surface spectrum should not be lower than 80 percent of the Class E code-based spectrum. The site class E spectrum depicted on Figure 11 includes modifications performed in accordance with OSSC (2019) Section 1613.4.13.

To facilitate design, the design earthquake (DE) spectrum is determined as 2/3 of the MCE_R spectrum. Tabular values for both the MCE_R and DE spectra are provided in Table 14. Additionally, the design acceleration parameters, S_{D1} and S_{DS}, are computed from the recommended design spectrum in accordance with Section 21.4 of ASCE 7-16. These design acceleration parameters are included in the notes section of Table 14 and Figure 11 for reference.

By utilizing the recommended design spectrum, along with the calculated design acceleration parameters, designers can appropriately incorporate the seismic loading considerations into the structural design process in accordance with ASCE 7-16 guidelines.

Table 14. Recommended Surface Response Spectra		
Period (seconds)	**Recommended MCE_R Surface Response Spectrum (g)**	**Recommended Design Surface Response Spectrum (2/3 MCE_R) (g)**
0.01	0.34	0.23
0.03	0.40	0.27
0.05	0.45	0.30
0.10	0.58	0.39
0.20	0.89	0.59
1.20	0.89	0.59
1.50	0.74	0.49
1.70	0.65	0.43
2.00	0.52	0.35
3.00	0.36	0.24
4.00	0.27	0.18
5.00	0.21	0.14
7.50	0.13	0.09
10.00	0.10	0.07
Note: *S_{DS} = 0.59g, S_{D1} = 0.74g*		

6. Limitations

The recommendations presented in this report should be subject to review and modification as necessary during the final design stages of the project. As further details and information become available, it is essential to reassess and refine the recommendations to ensure their alignment with the specific project requirements and conditions.

6.1 ANALYSIS LIMITATIONS

While this SVA study involved advanced and high-level numerical analysis, it is important to acknowledge that there are limitations due to the limited subsurface information available for the project site. These limitations include:

1. **Limited subsurface explorations within the levee area:** The lack of detailed subsurface explorations in the levee area has resulted in a simplified 2D model derived from cross-section B-B'. The model geometry and interpreted soil layering are important factors that impact the calculated results. The extension of ESU-2 toward the levee area or the presence of thicker ESU-3a in that region may have an impact on the outcomes presented in this report.
2. **Assumptions on soil properties for the Levee structure:** Reasonable assumptions have been made regarding the soil properties of the Levee structure. It is worth noting, however, that, while not a major factor, the properties of the levee soil can influence the calculated lateral deformation at the existing facilities.
3. **Free-Field Analysis:** The numerical model evaluated free-field conditions for the site to estimate the ground deformations at the planned tank location. The values presented do not account for additional deformations induced by structures on shallow foundations on unmitigated soil conditions, or the effects of liquefaction mitigation measures. Additionally, it does not account for structure-soil-structure interaction that has been documented showing that structures founded on mitigated soils may significantly increase the rotation and seismic demand on adjacent structures over unmitigated soils (Hwang et. al., 2021, 2023).

Acknowledging these limitations is important to ensure a comprehensive understanding of the analysis results. It is recommended to address these limitations through additional investigations, explorations, and characterization of the subsurface conditions to improve the accuracy and reliability of the assessments and recommendations.

7. Closure

The recommendations provided in this report are formulated based on our current understanding of the project. It is important to note that these recommendations should be revisited and reassessed if there are any changes to the design that significantly impact the fundamental period of the structure.

This seismic design report presents data obtained from field explorations, advanced laboratory testing, and geophysical surveys conducted at the fuel tank facilities using the procedures outlined in this report. All analyses and calculations presented herein are based on the information provided in this report and the associated geotechnical data report. It is important to acknowledge that the subsurface conditions interpreted from the data presented in this report should not be considered as a guarantee of those interpreted conditions.

We assume the subsurface conditions encountered during the explorations are representative of the overall subsurface conditions throughout the project site. However, it is crucial to recognize that unanticipated soil conditions are commonly encountered during construction projects and cannot be fully determined solely by evaluating soil samples from a single boring. Therefore, continuous monitoring and assessment of the subsurface conditions during construction are necessary to address any unexpected variations or challenges that may arise.

8. References

1. Abrahamson, N. A., and Gulerce, Z. 2020. Regionalized ground-motion models for subduction earthquakes based on the NGA-SUB database. Report No. 2020/25, Berkeley, CA: Pacific Earthquake Engineering Research Center, University of California, Berkeley.

2. Abrahamson, N. A., et al. 2018. Update of the BC Hydro Subduction Ground-Motion Model using the NGA-Subduction Dataset. PEER Report No. 2018/02.

3. Abrahamson, N.A., W.J Silva, and R. Kamai 2014. Summary of the ASK14 ground-motion relation for active crustal regions; Earthquake Spectra, Vol. 30, No. 3, August 2014.

4. American Society of Civil Engineers 2017. Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE/SEI 7-16.

5. American Society of Civil Engineers 2022. Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE/SEI 7-22.

6. Atik, L. A., & Youngs, R. R. 2014. Epistemic Uncertainty for NGA-West2 Models. Earthquake Spectra, 30(3), 1301–1318. https://doi.org/10.1193/062813EQS173M.

7. Atkinson G. M., Macias M., 2009. Predicted ground motions for great interface earthquakes in the Cascadia Subduction Zone. Bulletin of the Seismological Society of America, Vol. 99, No. 3, 1552–1578

8. Atwater, B.F., S. Musumi-Rokkaku, K. Satake, T. Yoshinobu, K. Ueda, D. Yamaguchi, 2005. “The orphan tsunami of 1700,” U.S. Geological Survey Professional Paper 1707.

9. Bahrampouri, M., Rodriguez-Marek, A. and Green, R.A., 2021. Ground motion prediction equations for significant duration using the KiK-net database. *Earthquake Spectra*, *37*(2), pp.903-920.

10. Boore, D.M, J.P. Stewart, Emel Seyhan, and G.A. Atkinson 2014. NGA-West2 equations for predicting PGA, PGV, and 5% damped PSA for shallow crustal earthquakes. Earthquake Spectra Vol. 30, No. 3, August 2014.

11. Boulanger, Ross W., and I. M. Idriss. "CPT-based liquefaction triggering procedure." Journal of Geotechnical and Geoenvironmental Engineering 142.2 (2016): 04015065.

12. Boulanger, R.W., and Ziotopoulou, K. (2017). “PM4Sand (version 3.1): A sand plasticity model for earthquake engineering applications.” Report No. UCD/CGM-17/01, Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California, Davis, CA, March, 112 pp.

13. Boulanger, R. W., and Ziotopoulou, K. (2018). “PM4Silt (Version 1): A silt plasticity model for earthquake engineering applications.” Report No. UCD/CGM-18/01, Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California, Davis, CA.

14. Bray, J.B., Olaya, F. (2023). 2022 H. Bolton Seed Memorial Lecture: Evaluating Liquefaction Effects. ASCE Journal of Geotechnical & Geoenviornmental Engineering. https://ascelibrary.org/doi/10.1061/JGGEFK.GTENG-11242.

15. Bray, J.B., Sancio, R.B. (2006). Assessment of the Liquefaction Susceptibility of Fine-Grained Soils. ASCE JGGE. https://doi.org/10.1061/(ASCE)1090-0241(2006)132:9(116

16. Building Seismic Safety Council (BSSC), 2009. NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, FEMA P-749, Federal Emergency Management Agency, Washington, D.C.

17. Campbell, K.W. and Y. Bozorgnia 2014. NGA-West2 Ground motion model for the average horizontal components of PGA, PGV, and 5% damped linear acceleration response spectra; Earthquake Spectra, Vol. 30, No. 3, August 2014.

18. Chiou, B.S.J. and R.R. Youngs, 2014. Update of the Chiou and Youngs NGA model for the average horizontal component of peak ground motion and response spectra; Earthquake Spectra, Vol. 30, No. 3, August 2014.

19. Darendeli, M. B. 2001. Development of a New Family of Normalized Modulus Reduction and Material Damping Curves, Department of Civil, Architectural and Environmental Engineering, The University of Texas, Austin, Texas.

20. Groholski, D., Hashash, Y., Kim, B., Musgrove, M., Harmon, J., and Stewart, J., 2016. “Simplified Model for Small-Strain Nonlinearity and Strength in 1D Seismic Site Response Analysis.” J. Geotech. Geoenviron. Eng., 10.1061/(ASCE)GT.1943-5606.0001496, 04016042.

21. Hashash, Y.M.A., Musgrove, M.I., Harmon, J.A., Ilhan, O., Xing, G., Numanoglu, O., Groholski, D.R., Phillips, C.A., and Park, D. (2020) “DEEPSOIL 7.0, User Manual”. Urbana, IL, Board of Trustees of University of Illinois at Urbana-Champaign.

22. Haley & Aldrich 2023. Geotechnical Data Report. PDX Fuel Tank Project, Portland International Airport. 17 July 2023.

23. Hutabarat, D., and Bray, J.D. 2022. Estimating the Severity of Liquefaction Ejecta Using the Cone Penetration Test. ASCE Journal of Geotechnical & Geoenvironmental Engineering, Vol. 148-3-2022.

24. Hwang, Y.W., Ramirez, J., Dashti, S., Kirkwood, P., Liel, A.B., Camata, G., Petracca, M. (2021). “Seismic Interaction of Adjacent Structures on Liquefiable Soils: Insight from Centrifuge and Numerical Modeling,” ASCE JGGE.

25. Hwang, Y.W., Dashti, S. (2023). “Seismic Interactions Among Multiple Structures Founded on Liquefiable Soils in a City Block,” ASCE JGGE.

26. Idriss, I.M. and Boulanger, R.W. (2008) Soil Liquefaction during Earthquake. EERI Publication, Monograph MNO-12, Earthquake Engineering Research Institute, Oakland.

27. Idriss I. M., 2014. An NGA-West2 empirical model for estimating the horizontal spectral values generated by shallow crustal earthquakes, Earthquake Spectra, Vol. 30, No. 3, August 2014.

28. International Code Council 2022. Oregon Structural Specialty Code (OSSC) 2022.

29. Itasca Consulting Group, Inc. (2019) FLAC — Fast Lagrangian Analysis of Continua, Ver. 8.1. Minneapolis: Itasca.

30. Kuehn N., Bozorgnia Y., Campbell K. W., and Gregor N. (2020). Partially nonergodic ground-motion model for subduction regions using NGA-Subduction database, PEER Report No. 2020/04, Pacific Earthquake Engineering Research Center, University of California, Berkeley, CA.

31. Liu C, Macedo J. New conditional, scenario-based, and non-conditional cumulative absolute velocity models for subduction tectonic settings. Earthquake Spectra. 2022;38(1):615-647. doi:10.1177/87552930211043897

32. Macedo J, Abrahamson N, Liu C (2021) New scenario-based cumulative absolute velocity models for shallow crustal tectonic settings. Bulletin of the Seismological Society of America 111(1): 157–172.

33. Parker GA, Stewart JP, Boore DM, Atkinson GM, Hassani B. NGA-subduction global ground motion models with regional adjustment factors. Earthquake Spectra. 2022; 38(1):456-493. doi:10.1177/87552930211034889.

34. Petersen, M.D., et al. (2014). Documentation for the 2014 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2014-1091.

35. Petersen, M.D., Shumway, A.M., Powers, P.M., et al. (2020) The 2018 update of the US National Seismic Hazard Model: Overview of model and implications. Earthquake Spectra.;36(1):5-41. doi:10.1177/8755293019878199.

36. Phillips, C. and Y. M. A. Hashash, 2009. Damping formulation for non-linear 1D site response analyses. Soil Dynamics and Earthquake Engineering, 29(7): Pages 1143-1158.

37. Robertson, P.K., Cabal, K. (2015). Guide to Cone Penetration Testing 7th Edition. Gregg Drilling LLC.

38. Robertson, P.K.(2021). Evaluation of flow liquefaction and liquefied strength using the cone penetration test: an update. Canadian Geotechnical Journal. https://cdnsciencepub.com/doi/10.1139/cgj-2020-0657.

39. Rocscience Slide2, Version 9.028. Accessed 13 July 2023.

40. Shahi, Shrey K. and Jack W. Baker 2014. NGA-West2 Models for Ground-Motion Directionality, Earthquake Spectra: August 2014. Vol. 30, No. 3, pp. 1285-1300.

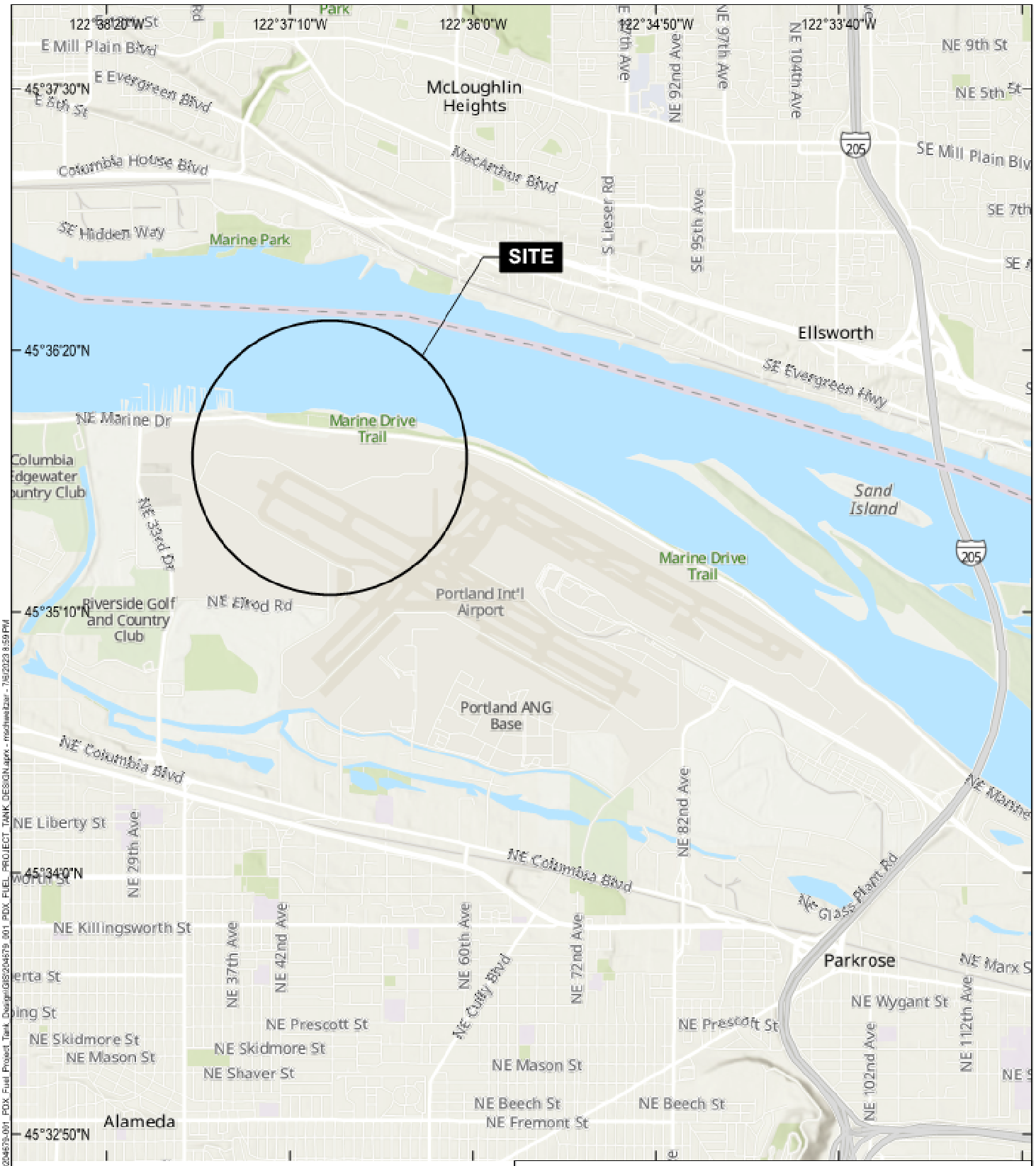
41. Stephenson, W. J., Reitman, N. G., and Angster, S. J. (2017). P- and S-wave velocity models incorporating the Cascadia subduction zone for 3D earthquake ground motion simulations—Update for Open-File Report 2007-1348, Version 1.6: U.S. Geological Survey Open-File Report 2017-1152.

42. Stuedlein, A.W., Dadashiderej, A., Jana, A., Evans. M.T. (2022). Liquefaction Susceptibility and Cyclic Response of Intact Nonplastic and Plastic Silts. ASCE Journal of Geotechnical & Geoenvironmental Engineering. https://ascelibrary.org/doi/10.1061/%28ASCE%29GT.1943-5606.0002935.

43. Stewart, J.P., Afshari, K., Hashash, Y.M.A. Guidelines for performing hazard-consistent one-dimensional ground response analysis for ground motion prediction. PEER Report 2014/16, October 2014.

44. Tao, Y. and Rathje, E.M. (2019). Insights into Modeling Small-Strain Site Response Derived from Downhole Array Data. ASCE JGGE. https://ascelibrary.org/doi/10.1061/%28ASCE%29GT.1943-5606.0002048.

FIGURES



HALEY ALDRICH

PDX FUEL TANKS – SEISMIC VULNERABILITY ASSESSMENT
PORTLAND, OREGON 97218

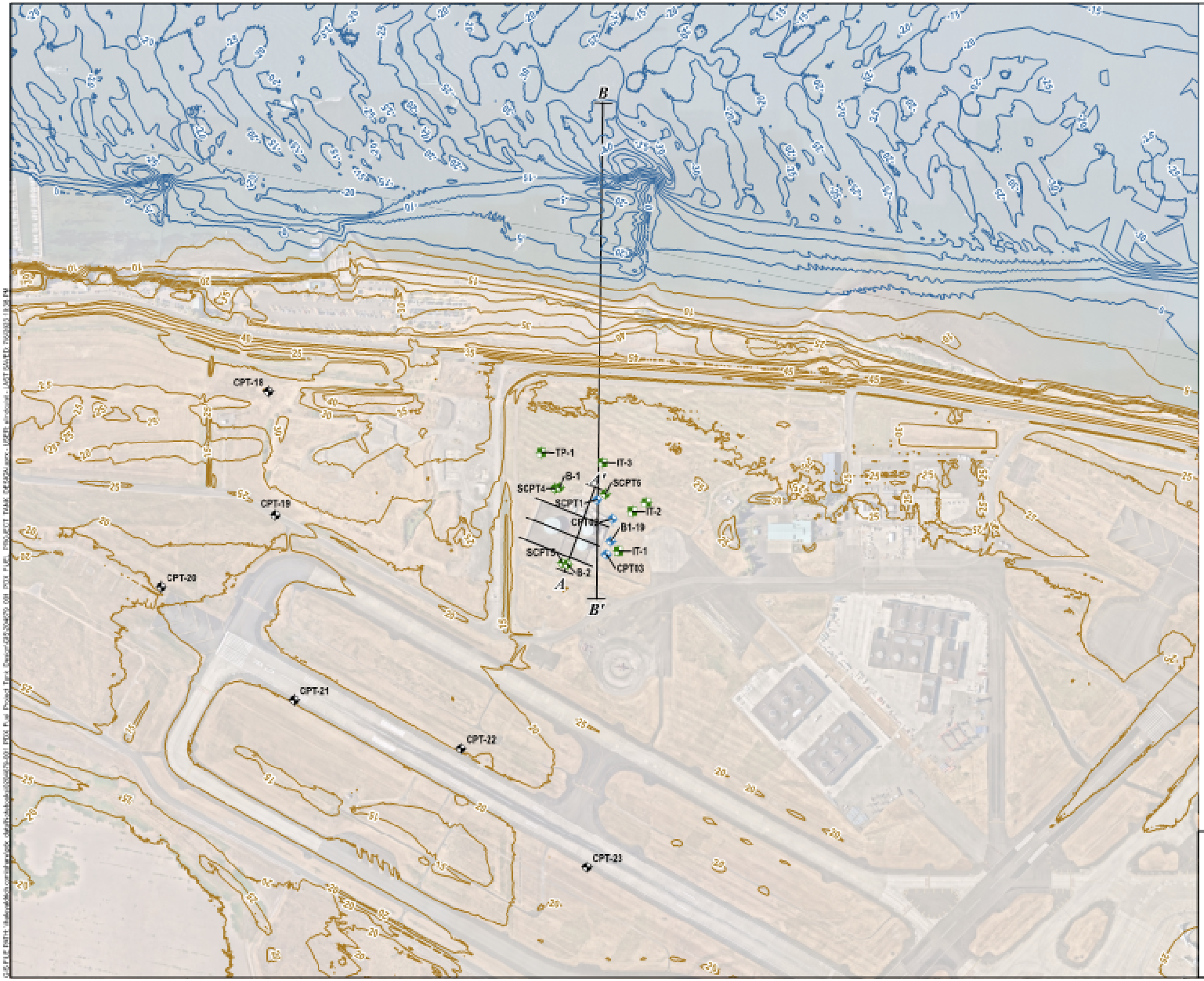
VICINITY MAP

MAP SOURCE: ESRI
SITE COORDINATES: 45°35'06"N, 122°35'39"W

APPROXIMATE SCALE: 1 IN = 1 MILE
JULY 2023

FIGURE 1

GIS: \\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\0204679_001_PDX_FUEL_PROJECT_TANK_DESIGN.aprx - mschwalbe - 7/6/2023 3:59 PM



LEGEND

- CURRENT EXPLORATION (H&A, 2023)
- PREVIOUS EXPLORATION (GRI, 2017)
- PREVIOUS EXPLORATION (H&A, 2019)
- TEST PITS CURRENT EXPLORATION (H&A, 2023)
- CROSS SECTION
- BATHYMETRIC ELEVATION CONTOUR, 5-FT INTERVAL (NAVD 88)
- TOPOGRAPHIC ELEVATION CONTOUR, 5-FT INTERVAL (NAVD 88)
- NORTHERN, MIDDLE, AND SOUTHERN PERIMETER OF FUEL TANK FACILITY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. TOPOGRAPHY/BATHYMETRY SOURCE: US ARMY CORPS OF ENGINEERS, 2010.
3. AERIAL IMAGERY SOURCE: NEARMAP, 14 AUGUST 2022.
4. NORTH AMERICAN VCERTICAL DATUM OF 1988 (NAVD88)

N

0 800 1,600
SCALE IN FEET

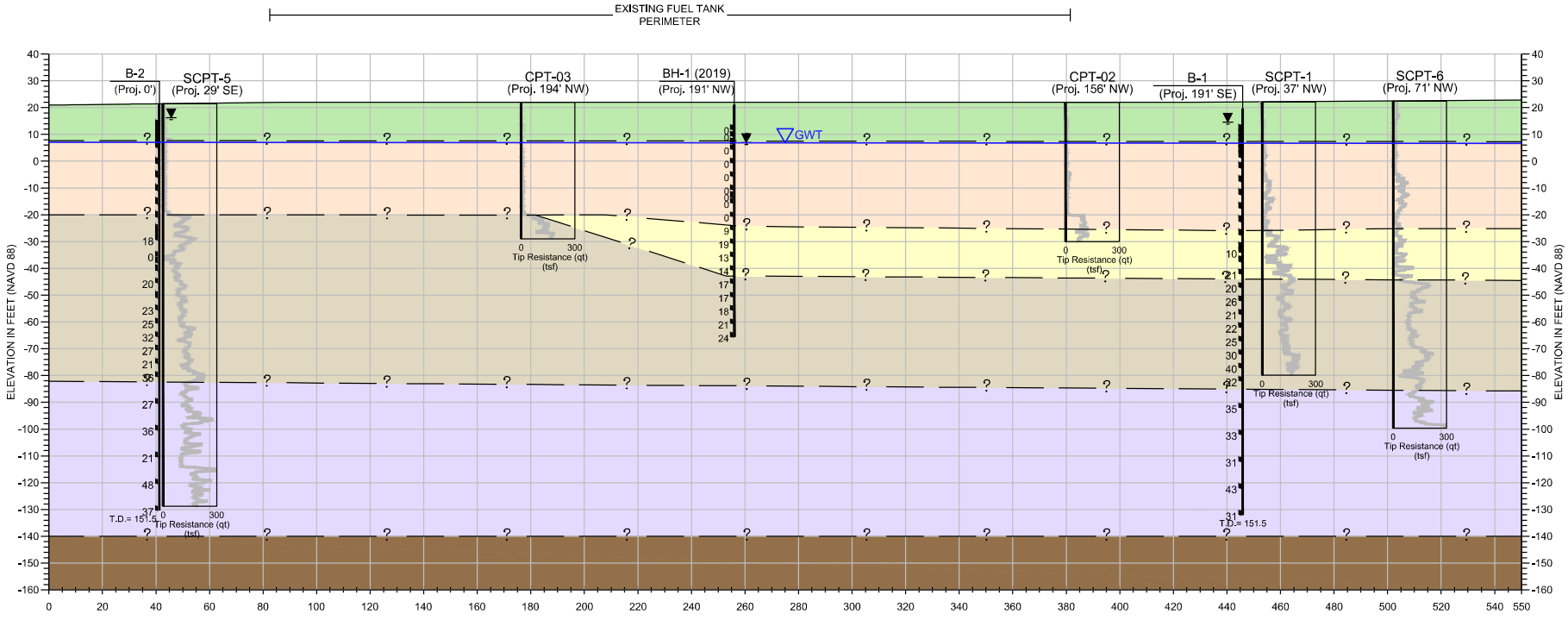
HALEY ALDRICH

PDX FUEL TANKS – SEISMIC VULNERABILITY ASSESSMENT
PORTLAND, OREGON 97218

SITE PLAN

JULY 2023

FIGURE 2



LEGEND

EXPLORATION

B-1
(Proj. 221' E)

STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT — 10 / 21 SP / 20

WATER LEVEL

USCS CLASSIFICATION

T.D.= 151.5

EXPLORATION DEPTH IN FEET

CPT EXPLORATION

CPT-18
(Proj. 1905' E)

0 300
Tip Resistance (qt) (tsf)

ESU-1 - FILL & OVERBANK DEPOSIT (ABOVE G.W.T)

ESU-2 - OVERBANK DEPOSIT

ESU-3A - COLUMBIA RIVER SAND (DR =40%)

ESU-3B - COLUMBIA RIVER SAND (SP)(DR = 50%)

ESU-3C - COLUMBIA RIVER SAND (SP)(DR = 58%)

VERY DENSE SANDY GRAVEL (ELASTIC HALFSPACE VS = 1271 FT/SEC)

NOTES

1. CONTACTS BETWEEN SOIL UNITS ARE BASED UPON INTERPOLATION BETWEEN BORINGS AND REPRESENT OUR INTERPRETATION OF SUBSURFACE CONDITIONS BASED ON CURRENTLY AVAILABLE DATA.
2. PROFILE SURFACE CREATED FROM A DIGITAL ELEVATION MODEL (DEM) CREATED BY THE LOWER COLUMBIA ESTUARY PARTNERSHIP.

0 40 80
SCALE IN FEET

HALEY ALDRICH

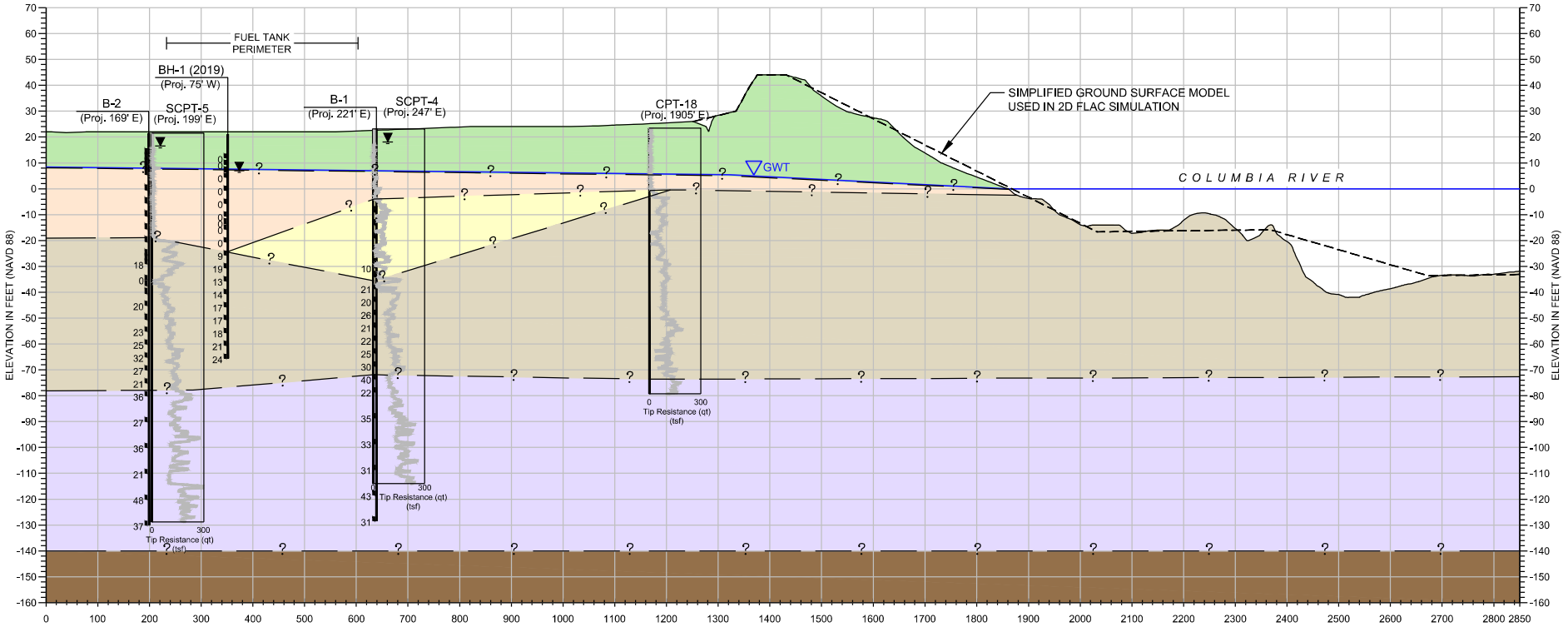
PDX FUEL TANK - SEISMIC VULNERABILITY ASSESSMENT
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OREGON 97218

SUBSURFACE CROSS SECTION A-A'

JULY 2023

FIGURE 3

Saved by: ELINDQUIST Printed: 7/10/2023 10:56 AM Sheet: HA-SEC-A
\\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\CAD\C3D\204679_001_CROSS_SECTION.DWG



LEGEND

EXPLORATION

B-1
(Proj. 221' E)

STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT — WATER LEVEL — USCS CLASSIFICATION — EXPLORATION DEPTH IN FEET

T.D.= 151.5

CPT EXPLORATION

CPT-18
(Proj. 1905' E)

Tip Resistance (qt) (tsf)

- **ESU-1 -** FILL & OVERBANK DEPOSIT (ABOVE G.W.T)
- **ESU-2** - OVERBANK DEPOSIT
- **ESU-3A** - COLUMBIA RIVER SAND (DR =40%)
- **ESU-3B -** COLUMBIA RIVER SAND (SP)(DR = 50%)
- **ESU-3C -** COLUMBIA RIVER SAND (SP)(DR = 58%)
- VERY DENSE SANDY GRAVEL (ELASTIC HALFSPACE VS = 1271 FT/SEC)

NOTES

1. CONTACTS BETWEEN SOIL UNITS ARE BASED UPON INTERPOLATION BETWEEN BORINGS AND REPRESENT OUR INTERPRETATION OF SUBSURFACE CONDITIONS BASED ON CURRENTLY AVAILABLE DATA.
2. PROFILE SURFACE CREATED FROM A DIGITAL ELEVATION MODEL (DEM) CREATED BY THE LOWER COLUMBIA ESTUARY PARTNERSHIP.

HORIZ. 0 200 400
VERT. 0 40 80
SCALE IN FEET

HALEY ALDRICH

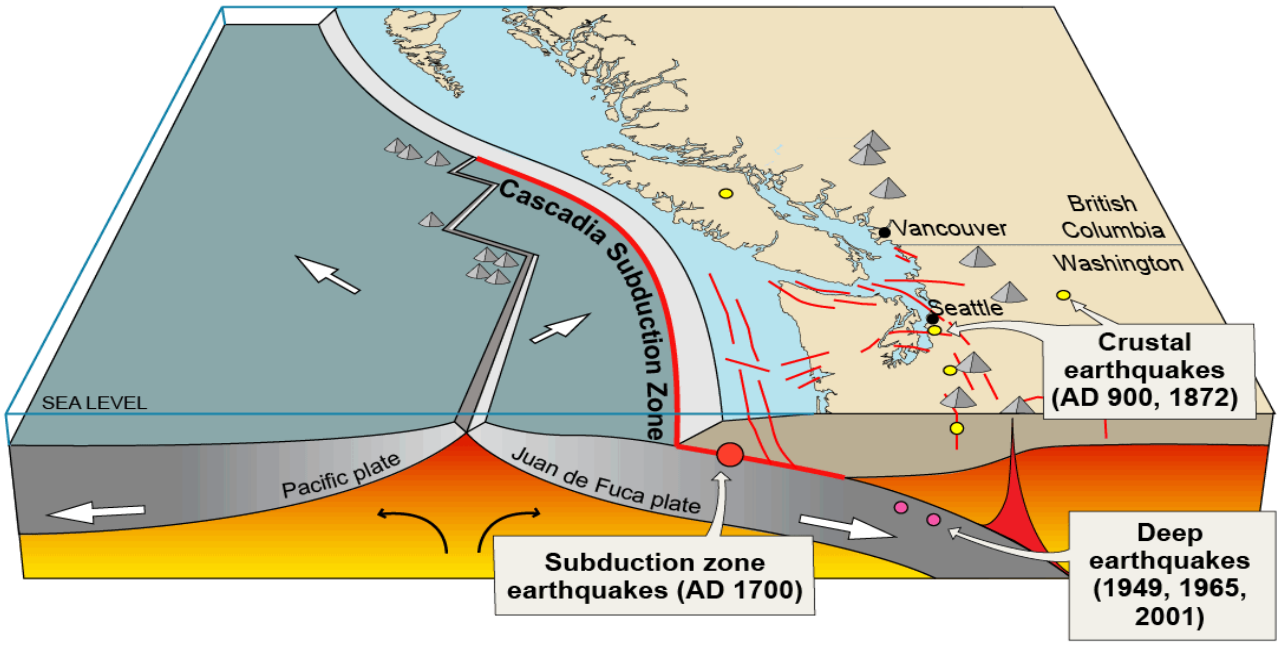
PDX FUEL TANK - SEISMIC VULNERABILITY ASSESSMENT
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OREGON 97218

SUBSURFACE CROSS SECTION B-B'

JULY 2023

FIGURE 4

Saved by: ELINDQUIST Printed: 7/7/2023 12:53 PM Sheet: HA-SEC-B
\\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001 PDX_FUEL_PROJECT_TANK_DESIGN\CAD\C3D\204679_001_CROSS_SECTION.DWG



Source	Max. Size	Recurrence
Subduction zone	M 9+	200–600 years
Deep Juan de Fuca plate	M 7+	30–50 years
Crustal faults	M 7+	Hundreds of years?

Volcano

Active crustal fault

Active plate boundary fault

Source: https://www.dnr.wa.gov/pictures/ger/ger_hazards_eq_wa_faults_1140.png

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Seismotectonic Characteristic of The Pacific Northwest

0204679-001 July 2023

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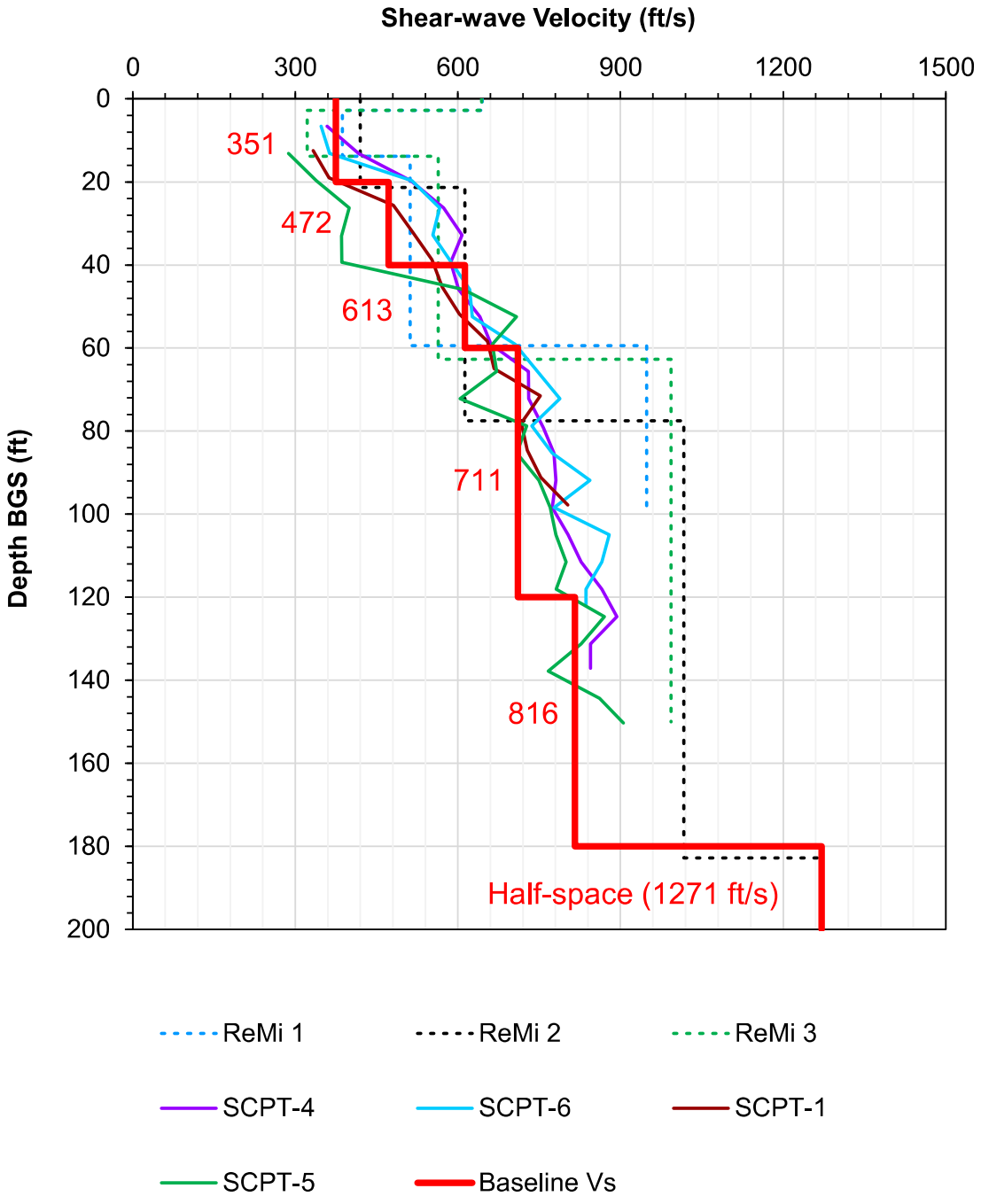
Fig. 5



Notes:
1. Half-space Vs = 1271 ft/s

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Measured Shear Wave Velocity Profile at Fuel Tank Facilities Area

0204679-001 July 2023

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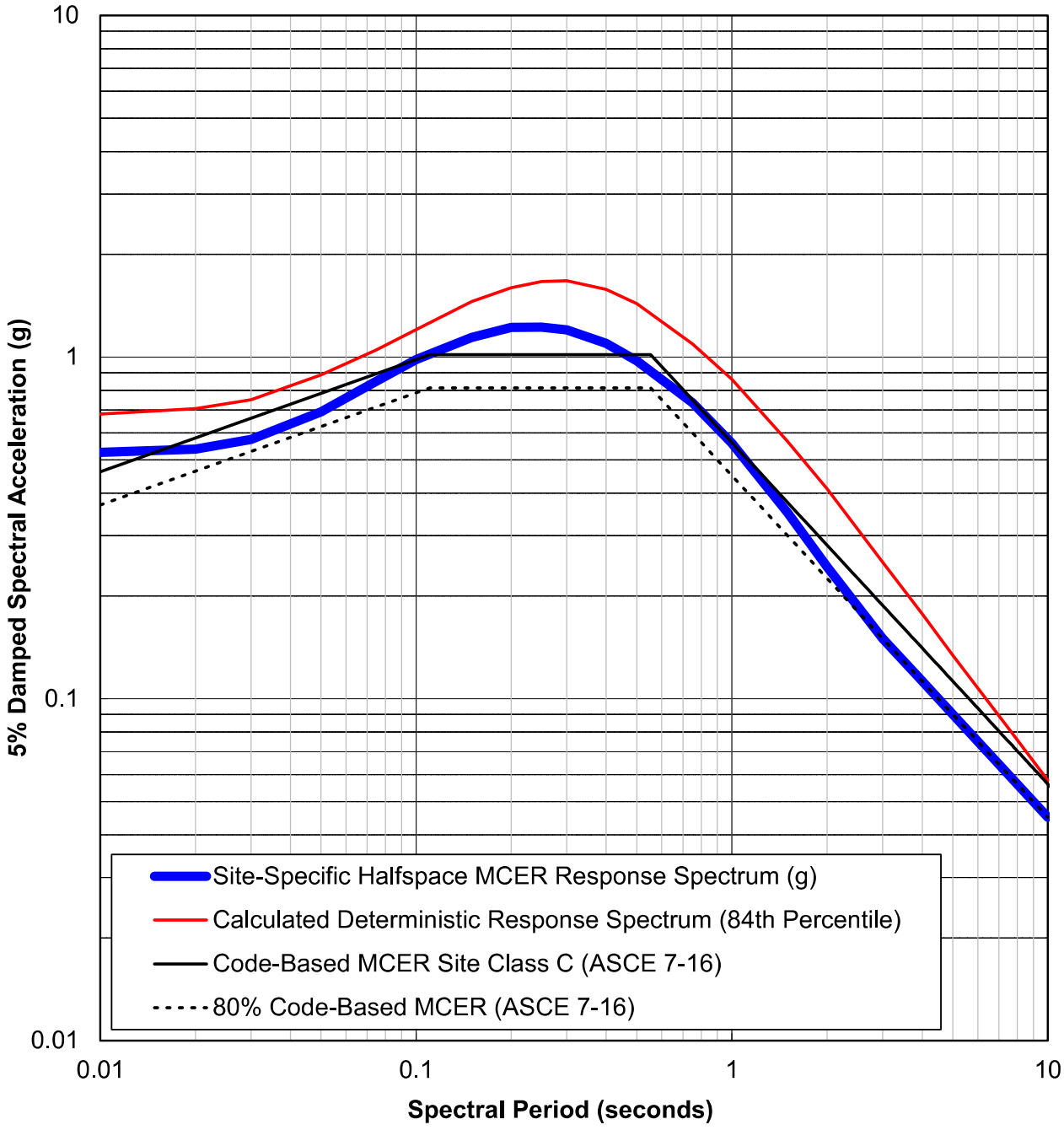
Fig. 6



Notes:
1. Half-space Vs = 1271 ft/s

2. This response spectrum was used as the target spectrum for selection of ground motion time histories. It is not intended for use in design

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Site-Specific (Half-space) MCE_R Target Response Spectrum

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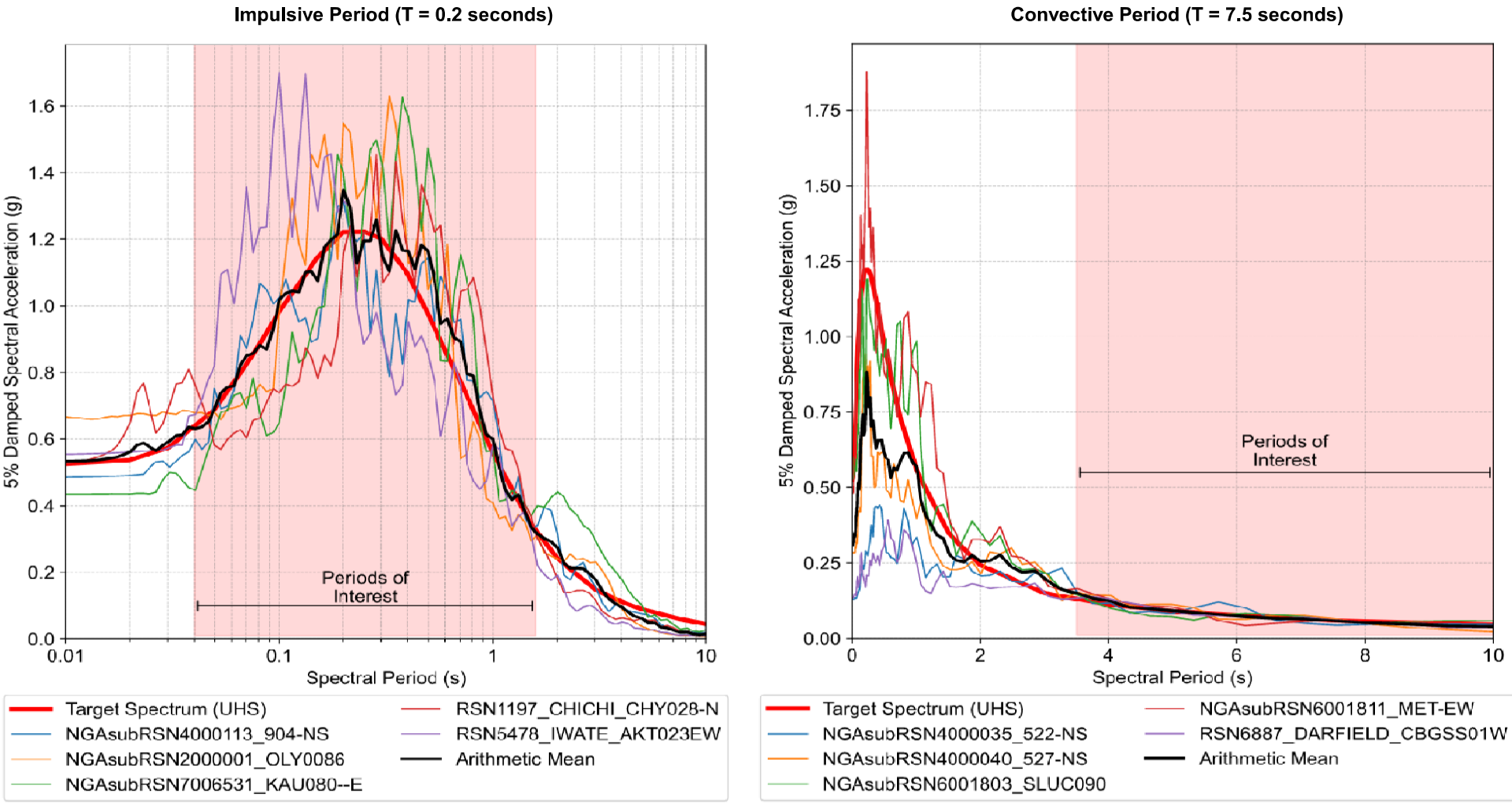
Fig. 7



Notes:
1. Half-space condition with Vs = 1271 ft/sec
2. Amplitude-scaled one component ground motion

PDX Fuel Tanks SVA
Portland, Oregon

Selected Amplitude-Scaled Ground Motion for Impulsive and Convective Period

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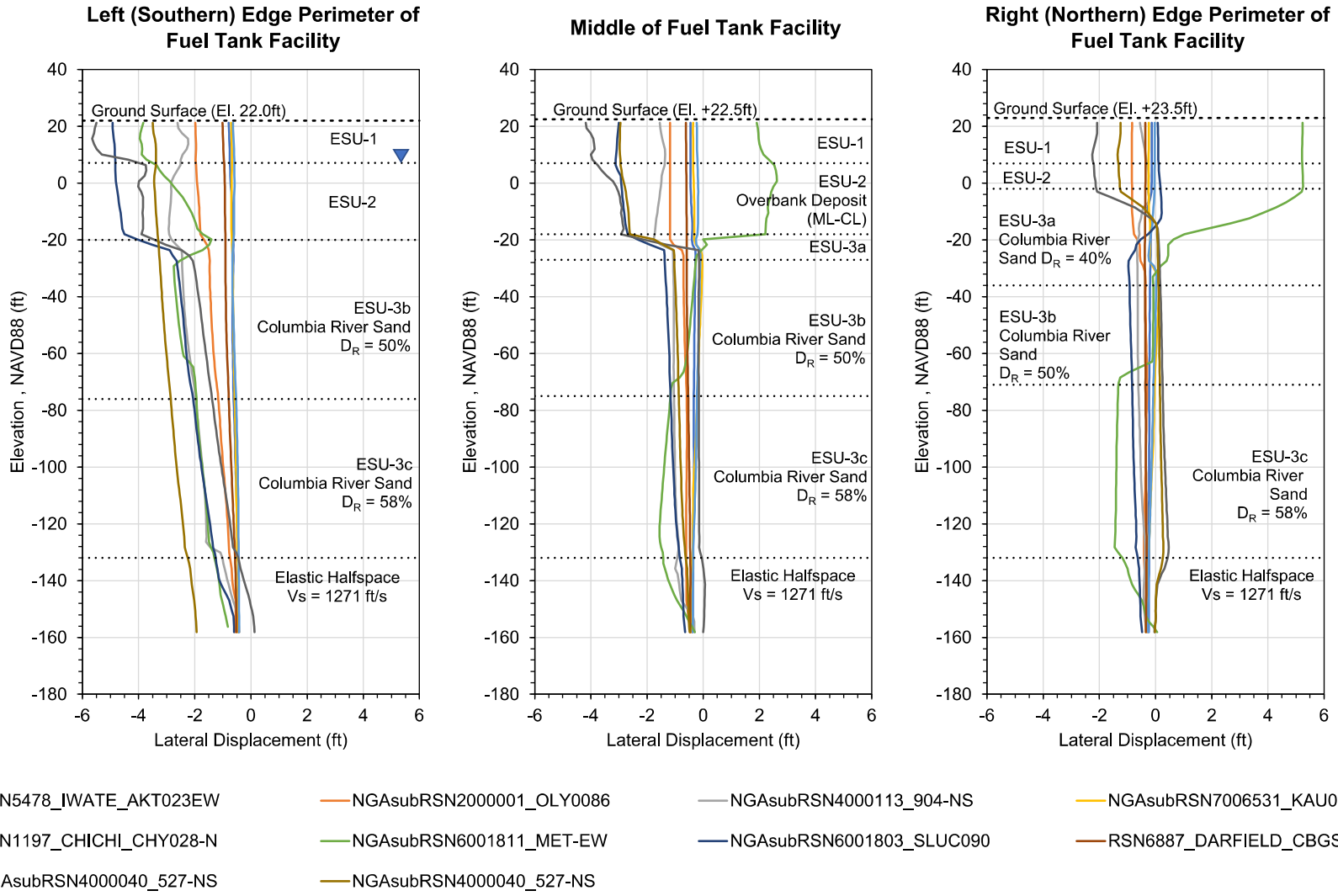
Figure 8



Notes:
1. The displacement profile show results at the end of the FLAC 2D Nonlinear Deformation Analysis (NDA) for each motions
2. The depth of contact for every ESU are consistent with the FLAC 2D NDA model

PDX Fuel Tanks SVA
Portland, Oregon

Calculated Lateral Displacement Profile: FLAC 2D NDA

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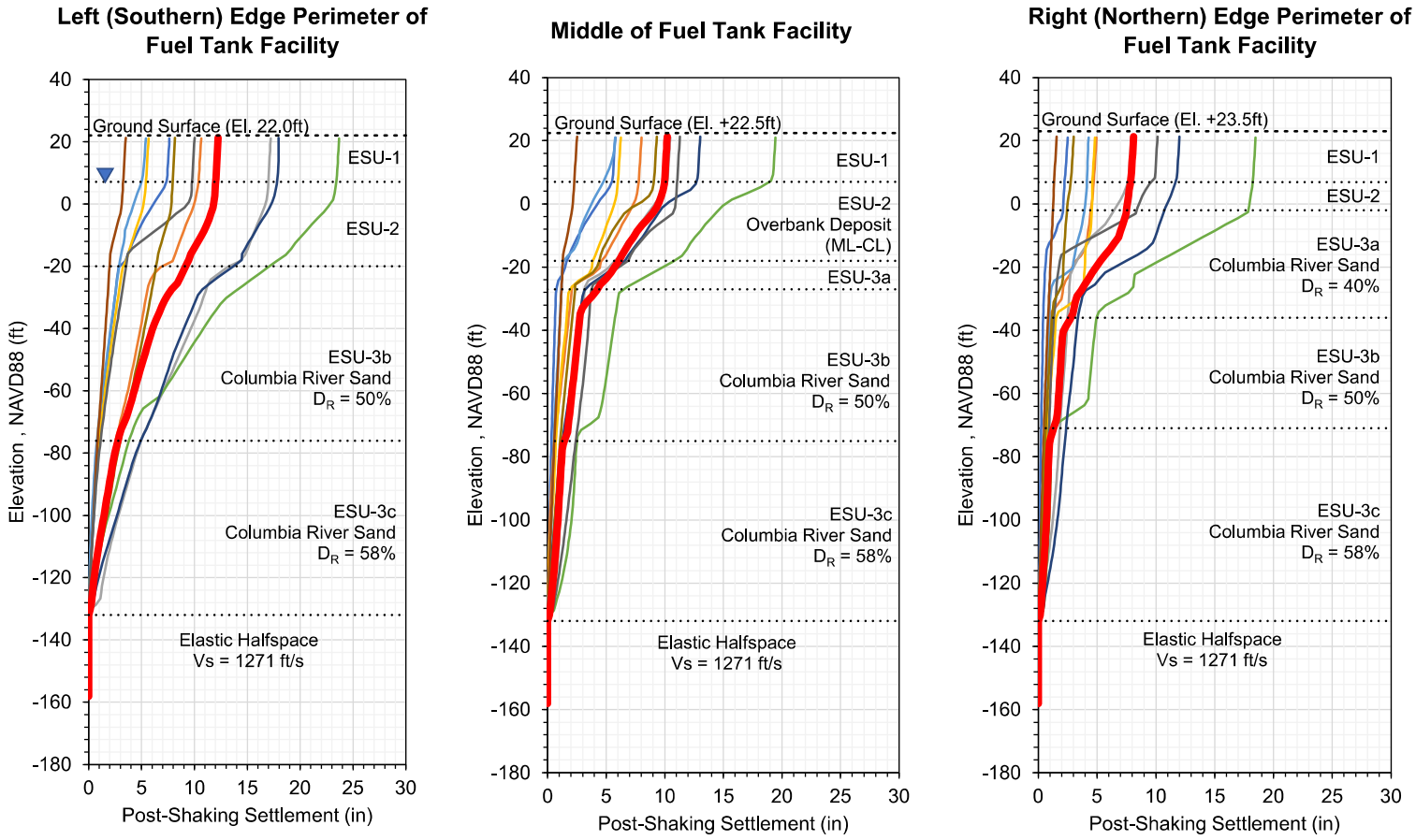
Figure 9



Notes:

1. Post-Liquefaction Volumetric Strain for ESU-2 (Overbank Deposit) is estimated using Stuedlein et al. (2022) ε_{vol} (%) = 0.139 EXP(0.04$r_{u\text{-}max}$)
2. Post-Liquefaction Volumetric Strain for ESU-3a,3b,3c (Columbia River Sand) is estimated using Bray & Olaya (2023) ε_{vol} (%) = 1.14 EXP(-2.0 D_R) (MIN(γ_{max},8%))
3. $S_e(inch) = \sum_{i=1}^{n} \varepsilon_{vol_i} \Delta H_i$,where ΔH = thickness of sub layer i, and n = number of layers
4. $r_{u\text{-}max}$ and γ_{max} were the maximum pore pressure ratio and shear strain value calculated from FLAC 2D NDA simulation
5. The calculated settlement does not include the primary and secondary consolidation settlement of ESU-2 layer

PDX Fuel Tanks SVA
Portland, Oregon

Estimated Post Liquefaction Reconsolidation Settlement Profile

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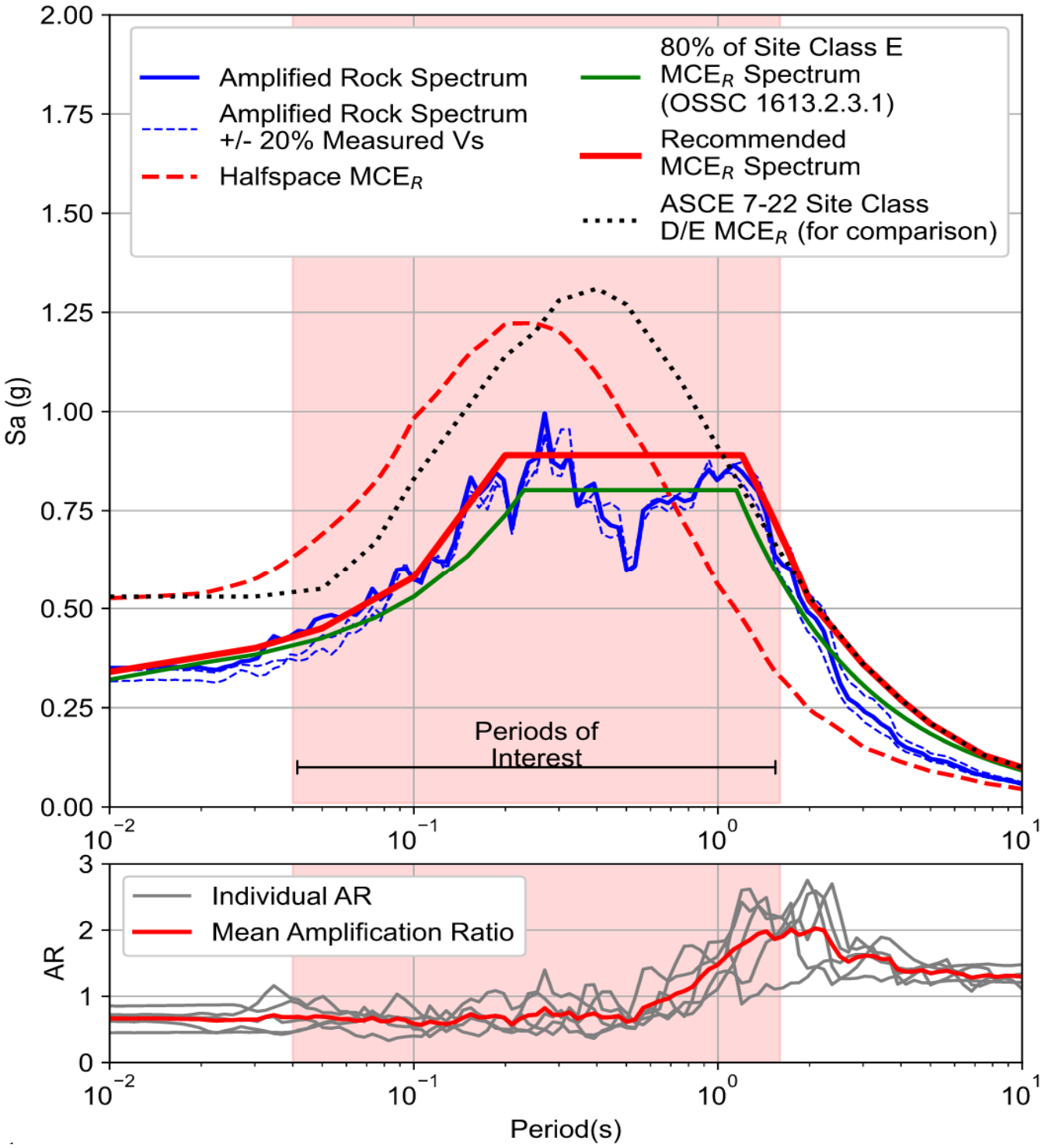
Figure 10



Notes:

1. Amplified Rock Spectrum = Halfspace MCER x Mean Amplification Ratio
2. Site-specfic Design Parameters are S_{DS} = 0.59g, S_{D1} = 0.74 g

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Recommended Surface MCE$_R$ Spectrum From 1D Site Response Analysis

0204679-001 July 2023

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Fig. 11

TABLES

Table 5 - Development of Site-Specific Halfspace MCE_R Response Spectrum

Period (s)	Haley & Aldrich PSHA Site-Specific (V_{S30} = 1271 ft/s) 2,475-year Response Spectrum (g)[1] (RotD50)	Risk Coefficients (ASCE 7-16 Method 2)[2]	Maximum Component Factor (Shahi and Baker, 2014)	Calculated MCE_R Response Spectrum (g)	ASCE 7-16 Code-Based MCE_R Response Spectrum for Site Class C (g)	Ratio of Calculated MCE_R Response Spectrum to Code-Based MCE_R Spectrum	Calculated Deterministic Response Spectrum (84th Percentile)	**Site-Specific Halfspace MCE_R Response Spectrum (g)**
0.01	0.50	0.89	1.19	0.53	0.46	1.14	0.68	**0.53**
0.02	0.51	0.89	1.19	0.54	0.52	1.04	0.71	**0.54**
0.03	0.54	0.90	1.19	0.57	0.57	1.00	0.75	**0.57**
0.05	0.65	0.89	1.19	0.69	0.68	1.01	0.89	**0.69**
0.075	0.79	0.90	1.19	0.85	0.82	1.04	1.05	**0.85**
0.1	0.92	0.90	1.19	0.98	0.96	1.03	1.20	**0.98**
0.15	1.08	0.89	1.19	1.14	1.02	1.12	1.46	**1.14**
0.2	1.13	0.89	1.21	1.22	1.02	1.20	1.60	**1.22**
0.25	1.14	0.89	1.21	1.22	1.02	1.20	1.66	**1.22**
0.3	1.11	0.89	1.22	1.20	1.02	1.18	1.67	**1.20**
0.4	1.00	0.89	1.23	1.10	1.02	1.08	1.58	**1.10**
0.5	0.89	0.89	1.23	0.97	1.02	0.96	1.43	**0.97**
0.75	0.67	0.88	1.24	0.73	0.75	0.98	1.09	**0.73**
1	0.51	0.89	1.24	0.56	0.56	0.99	0.86	**0.56**
1.5	0.32	0.88	1.24	0.35	0.38	0.93	0.57	**0.35**
2	0.22	0.88	1.24	0.24	0.28	0.86	0.41	**0.24**
3	0.13	0.88	1.25	0.14	0.19	0.75	0.25	**0.15**
4	0.087	0.88	1.26	0.097	0.141	0.69	0.18	**0.113**
5	0.064	0.88	1.26	0.071	0.113	0.63	0.13	**0.090**
7.5	0.038	0.87	1.28	0.042	0.075	0.56	0.08	**0.060**
10	0.026	0.87	1.29	0.030	0.056	0.53	0.06	**0.045**

Notes:

1. Values were obtained from Haley & Aldrich's PSHA using site-specific basin depth terms ($Z_{1.0}$ = 0.405 km and $Z_{2.5}$ = 1.85 km), as described in the report.
2. Risk coefficients based were obtained at each period using a Matlab routine provided to us by USGS.

Table 8 - Metadata of Selected Input Ground Motion for Impulsive Period (T = 0.2 sec)

Record ID	Earthquake	Recording Station	Magnitude	Distances (km)		V_{S30} (m/s)	Max. Useable Period[a,b] (s)	Fault Mechanism	Pulse-Like? (Period of Pulse in Seconds)	Component ID	Data Source & PEER ID Number	Scale Factor	Hanging Wall Indicators	D_{5-95} (seconds)[c]		CAV (ft/s)[d]		Sources
				R_{rup}	R_{JB}									Estimated	Selected	Estimated	Selected	
1–1	Tohoku_Japan 2011	42308	9.1	91.8	78.8	411	66.0	Subduction - Interface	n.a.	NGAsubRSN4000113_904-NS.AT2	PEER NGA-Sub	2.22	n.a.	34 / 51 / 76	61	133 / 175 / 231	175	Cascadia Interface
1–2	Olympia_WA 1949	OLY0	6.7	47.6	0.8	399	2.7	Subduction - Intraslab	n.a.	NGAsubRSN2000001_OLY0086.AT2	PEER NGA-Sub	2.20	n.a.	12 / 19 / 30	17.2	50 / 68 / 93	85	Juan De-Fuca Intraslab
1–3	Pingtung.Doublet2 Taiwan 2006	KAU080	6.9	34.7	23.4	400	10.5	Subduction - Intraslab	n.a.	NGAsubRSN7006531_KAU080--E.AT2	PEER NGA-Sub	2.21	n.a.	12 / 19 / 30	10.2	50 / 68 / 93	58	Juan De-Fuca Intraslab
1–4	Chi-Chi_ Taiwan 1999	1197	7.6	3.1	3.1	543	6.7	Reverse Oblique (Dip 33°)	No	RSN1197_CHICHI_CHY028-N.AT2	PEER NGA-West2	0.68	FW	6 / 9 / 14	8.7	21 / 28 / 38	40	Portland Hills
1–5	Iwate_ Japan 2008	5478	6.9	17.0	11.7	556	8.0	Reverse (40° Dip)	No	RSN5478_IWATE_AKT023EW.AT2	PEER NGA-West2	1.51	HW	6 / 9 / 14	10.1	21 / 28 / 38	54	Gridded Seismicity Background

Notes:

a. Interface records were downloaded as corrected accelerograms from a preliminary subset of the NGA-Sub database. The maximum usable periods are documented by PEER.

b. Crustal records were downloaded as corrected accelerograms from the NGA-West2 database. The maximum usable periods are documented by PEER.

c. D_{5-95} in column Model is the estimated (-1 Std.Dev / Mean / +1 Std. Dev) value using Bahrampouri et al. (2020) ground motion model and disaggreagtion resuls, D_{5-95} in column Selected is the actual D_{5-95} of the motion

d. CAV in column Estimated is the estimated (-1 Std.Dev / Mean / +1 Std. Dev) value using disaggregation results and Liu et al (2022) and Macedo et al. (2020) conditional ground motion for subduction and crustal sources, respectively. CAV in column Selected is the actual CAV of the motion

Table 9 - Metadata of Selected Input Ground Motion for Convective Period (T = 7.5 sec)

Record ID	Earthquake	Recording Station	Magnitude	Distances (km)		V_{S30} (m/s)	Max. Useable Period[a,b] (s)	Fault Mechanism	Pulse-Like? (Period of Pulse in Seconds)	Component ID	Data Source & PEER ID Number	Scale Factor	Hanging Wall Indicators	D_{5-95} (seconds)[c]		CAV (ft/s)[d]		Sources
				R_{rup}	R_{JB}									Estimated	Selected	Estimated	Selected	
1–1	Tohoku_Japan 2011	41314	9.1	107.8	96.9	257	127.5	Subduction - Interface	n.a.	NGAsubRSN4000035_522-NS.AT2	PEER NGA-Sub	2.03	n.a.	33 / 50 / 74	141	127 / 168 / 222	114	Cascadia Interface
1–2	Tohoku_Japan 2011	41319	9.1	124.5	115.2	270	52.1	Subduction - Interface	n.a.	NGAsubRSN4000040_527-NS.AT2	PEER NGA-Sub	2.44	n.a.	33 / 50 / 74	95.1	127 / 168 / 222	159	Cascadia Interface
1–3	2010 Chile	STL	8.8	123.7	113.1	1411	23.3	Subduction - Interface	n.a.	NGAsubRSN6001803_SLUC090.AT2	PEER NGA-Sub	1.56	n.a.	33 / 50 / 74	37.7	127 / 168 / 222	136	Cascadia Interface
1–4	2010 Chile	MET	8.8	121.9	111.1	598	40.4	Subduction - Interface	n.a.	NGAsubRSN6001811_MET-EW.AT2	PEER NGA-Sub	2.89	n.a.	33 / 50 / 74	41.7	127 / 168 / 222	207	Cascadia Interface
1–5	Darfield_NZ 2010	CBGS	7.0	18.0	18.0	187	20.0	Strike-Slip	Yes (12.621)	RSN6887_DARFIELD_CBGSS01W.AT2	PEER NGA-West2	0.71	n.a.	6 / 9.7 / 16	28.5	30 / 41 / 56	26	Gridded Seismicity Background

Notes:

a. Interface records were downloaded as corrected accelerograms from a preliminary subset of the NGA-Sub database. The maximum usable periods are documented by PEER.

b. Crustal records were downloaded as corrected accelerograms from the NGA-West2 database. The maximum usable periods are documented by PEER.

c. D_{5-95} in column Estimated is the estimated (-1 Std.Dev / Mean / +1 Std. Dev) value using Bahrampouri et al. (2020) ground motion model and disaggreagtion resuls, D_{5-95} in column Selected is the actual D_{5-95} of the motion

d. CAV in column Estimated is the estimated (-1 Std.Dev / Mean / +1 Std. Dev) value using Liu et al (2022) and Macedo et al. (2020) conditional ground motion for subduction and crustal sources, respectively. CAV in column Selected is the actual CAV of the motion

APPENDIX A
Boring Logs

Sample Description

Identification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. ASTM D 2488 visual-manual identification methods were used as a guide. Where laboratory testing confirmed visual-manual identifications, then ASTM D 2487 was used to classify the soils.

Relative Density/Consistency

Soil density/consistency in borings is related primarily to the standard penetration resistance (N). Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

SAND or GRAVEL Relative Density	N (Blows/Foot)	SILT or CLAY Consistency	N (Blows/Foot)
Very loose	0 to 4	Very soft	0 to 1
Loose	5 to 10	Soft	2 to 4
Medium dense	11 to 30	Medium stiff	5 to 8
Dense	31 to 50	Stiff	9 to 15
Very dense	>50	Very stiff	16 to 30
		Hard	>30

Moisture

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

USCS Soil Classification Chart (ASTM D 2487)

Major Divisions			Symbols: Graph	Symbols: USCS	Typical Descriptions
Coarse Grained Soils: More than 50% of Material Retained on No. 200 Sieve	Gravel and Gravelly Soils: More than 50% of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels (<5% fines)		GW	Well-Graded Gravel; Well-Graded Gravel with Sand
				GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Gravels (5-12% fines)		GW-GM	Well-Graded Gravel with Silt; Well-Graded Gravel with Silt and Sand
				GW-GC	Well-Graded Gravel with Clay; Well-Graded Gravel with Clay and Sand
				GP-GM	Poorly Graded Gravel with Silt; Poorly Graded Gravel with Silt and Sand
				GP-GC	Poorly Graded Gravel with Clay; Poorly Graded Gravel with Clay and Sand
		Gravels with Fines (>12% fines)		GM	Silty Gravel; Silty Gravel with Sand
				GC	Clayey Gravel; Clayey Gravel with Sand
	Sand and Sandy Soils: More than 50% of Coarse Fraction Passing No. 4 Sieve	Sands with few Fines (<5% fines)		SW	Well-Graded Sand; Well-Graded Sand with Gravel
				SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Sands (5-12% fines)		SW-SM	Well-Graded Sand with Silt Well-Graded Sand with Silt and Gravel
				SW-SC	Well-Graded Sand with Clay; Well-Graded Sand with Clay and Gravel
				SP-SM	Poorly Graded Sand with Silt; Poorly Graded Sand with Silt and Gravel
				SP-SC	Poorly Graded Sand with Clay; Poorly Graded Sand with Clay and Gravel
		Sands with Fines (>12% fines)		SM	Silty Sand; Silty Sand with Gravel
				SC	Clayey Sand; Clayey Sand with Gravel
Fine Grained Soils: More than 50% of Material Passing No. 200 Sieve	Silts			ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
				MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
	Silty Clay (based on Atterberg Limits)			CL-ML	Silty Clay; Silty Clay with Sand or Gravel; Gravelly or Sandy Silty Clay
	Clays			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
				CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
	Organics			OL/OH	Organic Soil; Organic Soil with Sand or Gravel; Sandy or Gravelly Organic Soil
Highly Organic (>50% organic material)				PT	Peat - Decomposing Vegetation - Fibrous to Amorphous Texture

Minor Constituents

	Estimated Percentage
Sand, Gravel	
Trace	<5
Few	5 - 15
Cobbles, Boulders	
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45

Soil Test Symbols

%F	Percent Passing No. 200 Sieve
AL	Atterberg Limits (%)
	Liquid Limit (LL)
	Water Content (WC)
	Plastic Limit (PL)
CA	Chemical Analysis
CAUC	Consolidated Anisotropic Undrained Compression
CAUE	Consolidated Anisotropic Undrained Extension
CBR	California Bearing Ratio
CIDC	Consolidated Drained Isotropic Triaxial Compression
CIUC	Consolidated Isotropic Undrained Compression
CK0DC	Consolidated Drained k0 Triaxial Compression
CK0DSS	Consolidated k0 Undrained Direct Simple Shear
CK0UC	Consolidated k0 Undrained Compression
CK0UE	Consolidated k0 Undrained Extension
CRSCN	Constant Rate of Strain Consolidation
DSS	Direct Simple Shear
DT	In Situ Density
GS	Grain Size Classification
HYD	Hydrometer
ILCN	Incremental Load Consolidation
K0CN	k0 Consolidation
kc	Constant Head Permeability
kf	Falling Head Permeability
MD	Moisture Density Relationship
OC	Organic Content
OT	Tests by Others
P	Pressuremeter
PID	Photoionization Detector Reading
PP	Pocket Penetrometer
SG	Specific Gravity
TRS	Torsional Ring Shear
TV	Torvane
UC	Unconfined Compression
UUC	Unconsolidated Undrained Triaxial Compression
VS	Vane Shear
WC	Water Content (%)

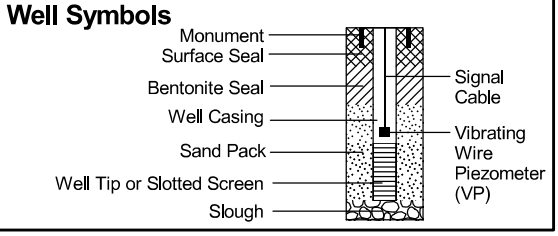
Groundwater Indicators

- Groundwater Level on Date or At Time of Drilling (ATD)
- Groundwater Level on Date Measured in Piezometer
- Groundwater Seepage (Test Pits)

Sample Symbols

- 1.5" I.D. Split Spoon
- 3.25" O.D. Split Spoon
- Modified California Sampler
- Rock Core Run
- Sonic Core
- Shelby Tube/Push Probe/GeoProbe®
- Grab
- Cuttings

Well Symbols



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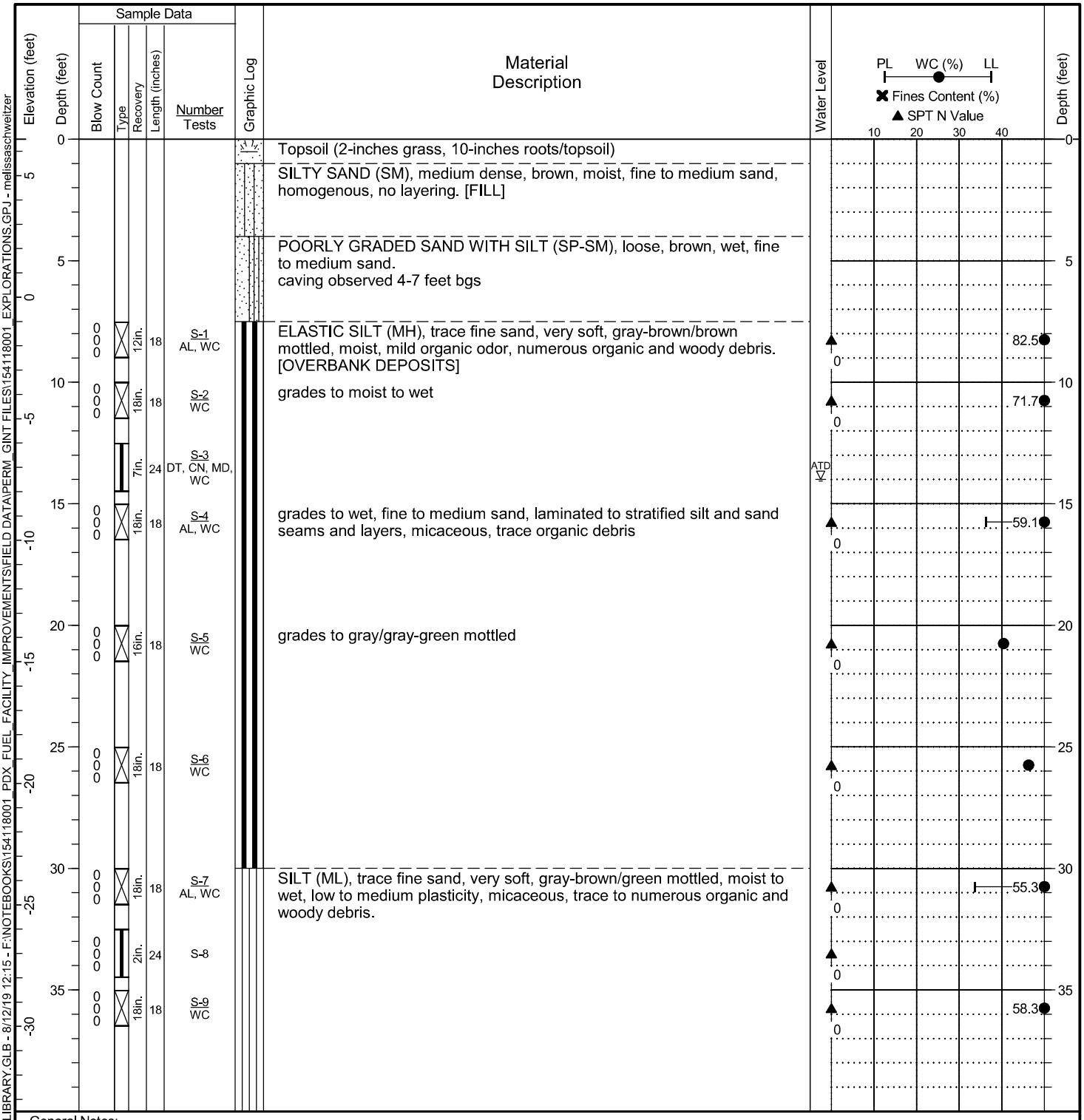
Date Started: 6/27/19	Date Completed: 6/27/19	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Lucas	
Logged by: D. Knapp	Checked by: T. Anderson	Drilling Method: Mud Rotary/Hollow Stem Auger	
Location: Lat: 45.596739 Long: -122.612754		Rig Model/Type: GeoProbe® 7822DT / Track-mounted push-probe rig	
Ground Surface Elevation: 6.5 feet		Hammer Type: Auto-hammer	
Horizontal Datum: WGS 84		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
Vertical Datum: NAVD 88		Measured Hammer Efficiency (%): 91	
Comments: Location and ground surface elevations are approximate.		Hole Diameter:	Casing Diameter: NA
		Total Depth: 86.5 feet	Depth to Groundwater: 14 feet



General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material descriptions and stratum lines are interpretive and actual changes may be gradual. Solid stratum lines indicate distinct contact between material strata or geologic units. Dashed stratum lines indicate gradual or approximate change between material strata or geologic units.
3. USCS designations are based on visual-manual identification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

HARTCROWSER

Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Boring Log
B-1

Figure **A-2**
Sheet **1 of 3**

HC BORING LOG - F:\GINT\HC_LIBRARY.GLB - 8/12/19 12:15 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Date Started: 6/27/19	Date Completed: 6/27/19	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Lucas	
Logged by: D. Knapp	Checked by: T. Anderson	Drilling Method: Mud Rotary/Hollow Stem Auger	
Location: Lat: 45.596739 Long: -122.612754		Rig Model/Type: GeoProbe® 7822DT / Track-mounted push-probe rig	
Ground Surface Elevation: 6.5 feet		Hammer Type: Auto-hammer	
Horizontal Datum: WGS 84		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
Vertical Datum: NAVD 88		Measured Hammer Efficiency (%): 91	
Comments: Location and ground surface elevations are approximate.		Hole Diameter:	Casing Diameter: NA
		Total Depth: 86.5 feet	Depth to Groundwater: 14 feet

Elevation (feet)	Depth (feet)	Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10 20 30 40)	Depth (feet)
-35	40	0 0 0		18in.	18	S-10 WC		SILT (ML), trace fine sand, very soft, gray-brown/green mottled, moist to wet, low to medium plasticity, micaceous, trace to numerous organic and woody debris. *(continued)* numerous fine to coarse sand lenses and layers, blocky, trace clay		▲ 0	40
-40	45	5 5 4		12in.	18	S-11 WC		POORLY GRADED SAND WITH SILT (SP-SM), loose, gray, wet, fine to medium sand, rapid dilatancy, micaceous, quartz-rich. [COLUMBIA RIVER SAND AQUIFER]		▲ 9	45
-45	50	8 9 10		11in.	18	S-12 GS, WC		grades to medium dense		✖ 6 ▲ 19 ●	50
-50	55	4 6 7		10in.	18	S-13 WC				▲ 13 ●	55
-55	60	5 6 8		12in.	18	S-14 WC				▲ 14 ●	60
-60	65	6 8 9		9in.	18	S-15 WC				▲ 17 ●	65
-65	70	5 8 9		10in.	18	S-16 WC				▲ 17 ●	70
-70	75	8 7 11		12in.	18	S-17 WC		increase in silt content		▲ 18 ●	75

General Notes:
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3. USCS designations are based on visual-manual identification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

HARTCROWSER

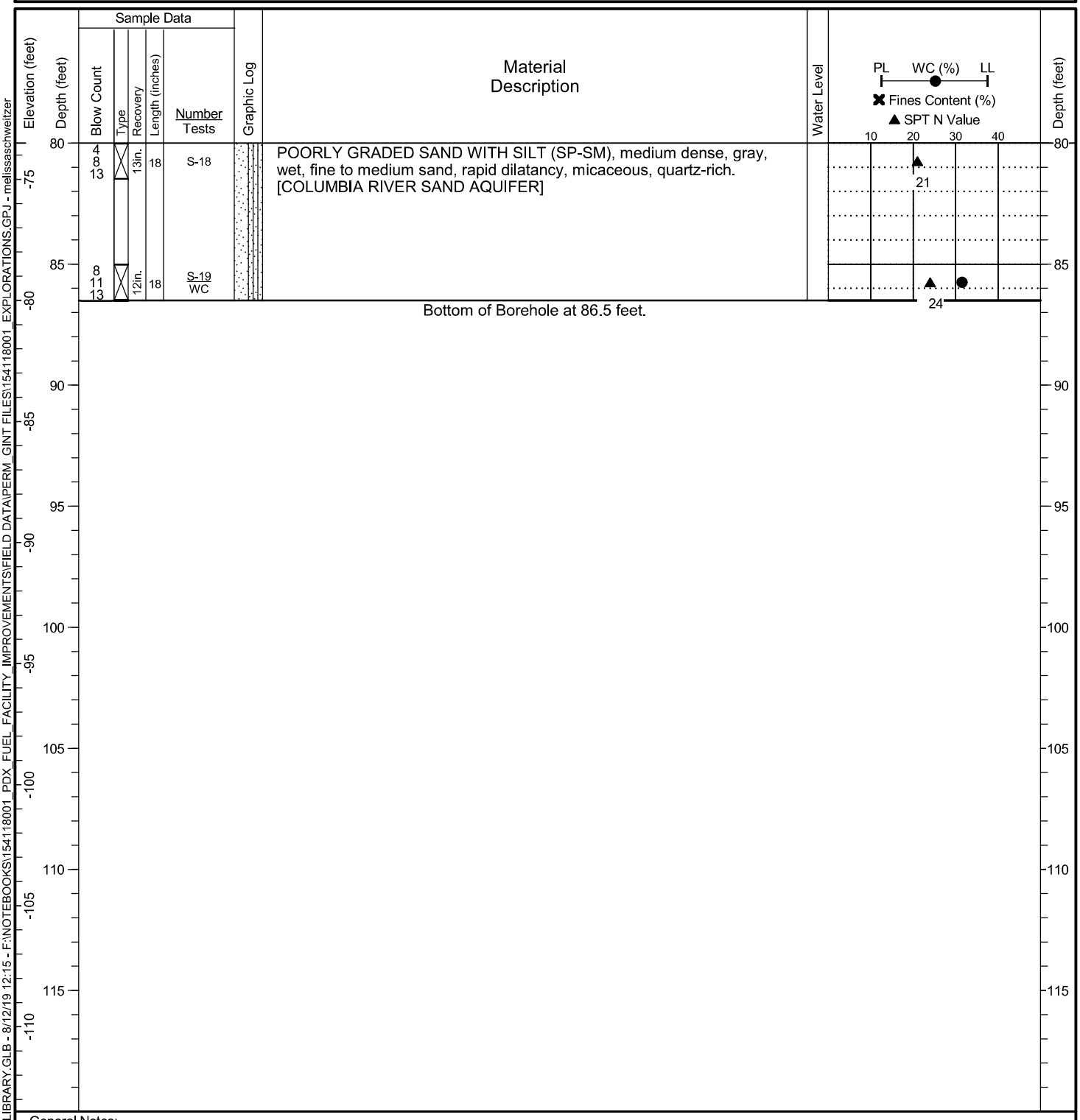
Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Boring Log **B-1**

Figure **A-2**
Sheet **2 of 3**

HC BORING LOG - F:\GINT\HC_LIBRARY.GLB - 8/12/19 12:15 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Date Started: 6/27/19	Date Completed: 6/27/19	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Lucas	
Logged by: D. Knapp	Checked by: T. Anderson	Drilling Method: Mud Rotary/Hollow Stem Auger	
Location: Lat: 45.596739 Long: -122.612754		Rig Model/Type: GeoProbe® 7822DT / Track-mounted push-probe rig	
Ground Surface Elevation: 6.5 feet		Hammer Type: Auto-hammer	
Horizontal Datum: WGS 84		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
Vertical Datum: NAVD 88		Measured Hammer Efficiency (%): 91	
Comments: Location and ground surface elevations are approximate.		Hole Diameter:	Casing Diameter: NA
		Total Depth: 86.5 feet	Depth to Groundwater: 14 feet



General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
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4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

HARTCROWSER	Project: PDX Fueling Facility Improvements Location: Portland, Oregon Project No.: 154-118-001	Boring Log **B-1**	Figure **A-2** Sheet **3 of 3**

HC BORING LOG - F:\GINT\HC_LIBRARY.GLB - 8/12/19 12:15 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level
19.5	0							topsoil (3-inch thick)	
								vacuum excavated to 6 ft. bgs.	
15	5								▽ 2/28/2023
				19.5in.	24	U-1 PP, TV		SILT (ML), very soft, wet, gray, micaceous. (PP = 0.0 tsf, TV = 0.175 tsf)	
				20in.	24	U-2 PP, TV		grades to mottled with gray-brown and iron-oxide staining (PP = 0.0 tsf, TV = 0.2 tsf)	
10	10			21.5in.	24	U-3 PP, TV		grades to soft (PP = 0.5 tsf, TV = 0.325 tsf)	
				22.5in.	24	U-4 PP, TV		grades to no iron-oxide staining (PP = 0.5 tsf, TV = 0.25 tsf)	
5	15			24in.	24	U-5 PP, TV		grades to medium stiff (PP = 0.75 tsf, TV = 0.25 tsf)	
				23in.	24	U-6 PP, TV		(PP = 0.5 tsf, TV = 0.225 tsf)	
0	20			15in.	24	U-7			
-5	25			19.5in.	24	U-8 PP		(PP = 0.5 tsf)	
-10	30			18in.	24	U-9		POORLY GRADED SAND (SP), loose to medium dense, wet, gray, mostly fine sand, micaceous.	
-15	35			22.5in.	24	U-10 GS, WC			
-20									

PL WC (%) LL
✖ Fines Content (%)
▲ SPT N Value
10 20 30 40

47

General Notes:
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4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Push Probe Log
B-1

Figure **A**
Sheet **1 of 4**

HA BORING LOG - I:\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HAC_LIBRARY.GLB - 1/6/23 12:59 - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\RBM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - Hobel

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10 20 30 40)	Depth (feet)
-20	40							POORLY GRADED SAND (SP), loose to medium dense, wet, gray, mostly fine sand, micaceous. *(continued)*			40
				14in.	24	U-11 PP, TV		(PP = 0.75 tsf, TV = 0.15 tsf) layer of silt observed at 41.2 ft (0.079-inch thick), material is likely interbedded			
-25	45			17in.	24	U-12 AL, GS, WC		flowing water observed in sand in hole		95 / 53.7	45
-30	50			8in.	24	U-13 PP		(PP = 1.5 tsf)			50
		2 4 6		13in.	18	S-1 GS, WC		frequent silt lamination througout sample, trace coarse sand		23 / 10	
-35	55			2.5in.	24	U-14		grades to medium dense			55
-40	60	7 10 11		12in.	18	S-2		grades to no silt lamination, coarse sand		21	60
-45	65	6 9 11		10in.	18	S-3				20	65
-50	70	6 11 15		10in.	18	S-4 WC				26	70
-55	75	6 9 12		11in.	18	S-5				21	75
-60											

General Notes:
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4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Push Probe Log **B-1**	Figure **A** Sheet **2 of 4**

HA BORING LOG - I:\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HAC_LIBRARY.GLB - 16/5/23 12:59 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_2\ANL_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - Hobel

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10–40)	Depth (feet)
	80	7 10 12		10in.	18	S-6a S-6b WC		POORLY GRADED SAND (SP), loose to medium dense, wet, gray, mostly fine sand, micaceous. *(continued)* layer of silty sand observed (approximately 3-inch thick)		▲ 22	80
-65	85	9 11 14		12in.	18	S-7				▲ 25	85
-70	90	9 14 16		12in.	18	S-8 WC				● ▲ 30	90
-75	95	14 20 20		13in.	18	S-9		grades to dense		▲ 40	95
-80	100	7 9 13		8in.	18	S-10		grades to medium dense		▲ 22	100
-85	105										105
-90	110	9 16 19		11in.	18	S-11 WC		grades to dense		● ▲ 35	110
-95	115										115
-100											

General Notes:
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5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Push Probe Log **B-1**	Figure **A** Sheet **3 of 4**

HA BORING LOG - I:\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HAC_LIBRARY.GLB - 16/5/23 12:59 - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\REBM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - Hubel

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10–40)	Depth (feet)
120	120	10 15 18		9in.	18	S-12		POORLY GRADED SAND (SP), loose to medium dense, wet, gray, mostly fine sand, micaceous. *(continued)* occasional laminations of medium white sand		▲ 33	120
-105	125										125
-110	130	10 14 17		10in.	18	S-13 WC				● ▲ 31	130
-115	135										135
-120	140	13 20 23		15in.	18	S-14				▲ 43	140
-125	145										145
-130	150	11 14 17		9in.	18	S-15				▲ 31	150
-135	155							Bottom of Borehole at 151.5 feet.			155
-140											

General Notes:
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4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Push Probe Log **B-1**	Figure **A** Sheet **4 of 4**

HA BORING LOG - I:\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HAC_LIBRARY.GLB - 16/5/23 12:59 - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\RBM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - Hubel

Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	WC (%) ● / Fines Content (%) ✖ / SPT N Value ▲ (10 20 30 40)	Depth (feet)
20	0							topsoil (3-inch thick)			0
								vacuum excavated to 6 ft. bgs.			
									▽ 2/28/2023		
15	5							SILT (ML), soft, moist to wet, gray.			5
				0in.	24	U-1		(PP = 0.75 tsf, TV = 0.15 tsf)			
				24in.	24	U-2 PP, TV					
10	10							wood observed in cuttings from 10 to 12 ft.			10
				24in.	24	U-3 PP, TV		(PP = 0.35 tsf, TV = 0.75 tsf)			
				0in.	24	U-4					
5	15							(PP = 0.2 tsf, TV = 0.5 tsf)			15
				24in.	24	U-5 PP, TV					
0	20							(PP = 0.35 tsf, TV = 0.75 tsf)			20
				22.5in.	24	U-6 PP, TV					
-5	25							layer of SAND WITH SILT (0.079-inch thick), material is likely interbedded			25
				20in.	24	U-7 PP, TV		(PP = 1.0 tsf, TV = 0.15 tsf)			
-10	30							(PP = 1.5 tsf, TV = 0.3 tsf)			30
				23.5in.	24	U-8 PP, TV		grades to mottled with gray and brown iron-oxide staining			
-15	35							grades to no iron-oxide staining			35
				24in.	24	U-9 PP, TV		(PP = 0.75 tsf, TV = 0.15 tsf)			

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Push Probe Log **B-2**	Figure **A** Sheet **1 of 4**

HA BORING LOG - I:\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HAC_LIBRARY.GLB - 16/5/23 12:59 - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PBRM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - Model

Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description
	40							SILT (ML), soft, moist to wet, gray. *(continued)*
-20				24in.	24	U-10 GS, WC		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, fine sand, micaceous.
	45							
-25				0in.	24	U-11		
					24	U-12		
		1		5in.				
	50	6		15in.	18	S-1 GS, WC		
-30		12						
	55	0			18	S-2		SILT (ML), soft, moist to wet, gray.
-35		0		9in.				
		0						POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, fine sand, micaceous.
	60			12in.	24	U-13		
-40								
				7in.	24	U-14		
	65	5			18	S-3 WC		
-45		9		8in.				
		11						wood observed in cuttings from 69 to 70 ft.
	70							
-50				8in.	24	U-15		
	75	7			18	S-4		
-55		11		8in.				
		12						

Water Level: 0

WC (%) ● ✖ Fines Content (%) ▲ SPT N Value

Depth (feet)	WC (%)	Fines Content (%)	SPT N Value
50		6	18
55		13	
65			20
75			23

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Push Probe Log **B-2**	Figure **A** Sheet **2 of 4**

HA BORING LOG - I:\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 16/5/23 12:59 - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - Hubel

Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	WC (%) ● ✖ Fines Content (%) ▲ SPT N Value (10–40)	Depth (feet)
	80	8 12 13		9in.	18	S-5 WC		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, fine sand, micaceous. *(continued)*		▲● 25	80
-60	85	8 15 17		9in.	18	S-6		grades to dense		▲ 32	85
-65	90	7 11 16		9in.	18	S-7 GS, WC		grades to medium dense		✖ 6 ▲● 27	90
-70	95	11 12 9		9in.	18	S-8				▲ 21	95
-75	100	9 17 19		9in.	18	S-9 WC		grades to dense		● ▲ 36	100
-80	105										105
-85	110	8 11 16		9in.	18	S-10		grades to medium dense		▲ 27	110
-90	115										115
-95											

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Push Probe Log
B-2

Figure **A**
Sheet **3 of 4**

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Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by:	Drilling Method: Mud Rotary/ Push Probe	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): Not Available	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	WC (%) ● / Fines Content (%) ✖ / SPT N Value ▲ (10 20 30 40)	Depth (feet)
-100	120	13 15 21		9in.	18	S-11 WC		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, fine sand, micaceous. *(continued)* grades to dense		▲ 36	120
-105	125										125
-110	130	8 9 12		9in.	18	S-12		grades to medium dense		▲ 21	130
-115	135										135
-120	140	19 23 25		9in.	18	S-13 WC		grades to dense		● ▲ 48	140
-125	145										145
-130	150	16 19 18		10in.	18	S-14				▲ 37	150
-135	155							Bottom of Borehole at 151.5 feet.			155

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Push Probe Log **B-2**	Figure **A** Sheet **4 of 4**

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Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew:

Logged by: Checked by: Rig Model/Type: Backhoe

Location: Lat: 45.596585 Long: -122.612579 (WGS 84) Total Depth: 3.5 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 20.97 feet (NAVD 88)

Comments: Single ring falling head infiltration test conducted from 1050 to 1200.

Elevation (feet)	Depth (feet)	Sample Data: Type	Sample Data: Length (inches)	Sample Data: Number / Tests	Graphic Log	Material Description
20	0					topsoil (2-inch thick)
						SILTY SAND (SM), (medium dense), moist, gray-brown. [NATIVE]
				G-1		POORLY GRADED SAND WITH SILT (SP), (medium dense), moist, gray, mostly fine to medium sand.
						Bottom of Test Pit at 3.5 feet.
15	5					
10	10					
5	15					
0	20					
-5	25					
-10	30					
-15	35					

General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Test Pit Log
IT-1

Figure **A**
Sheet **1 of 1**

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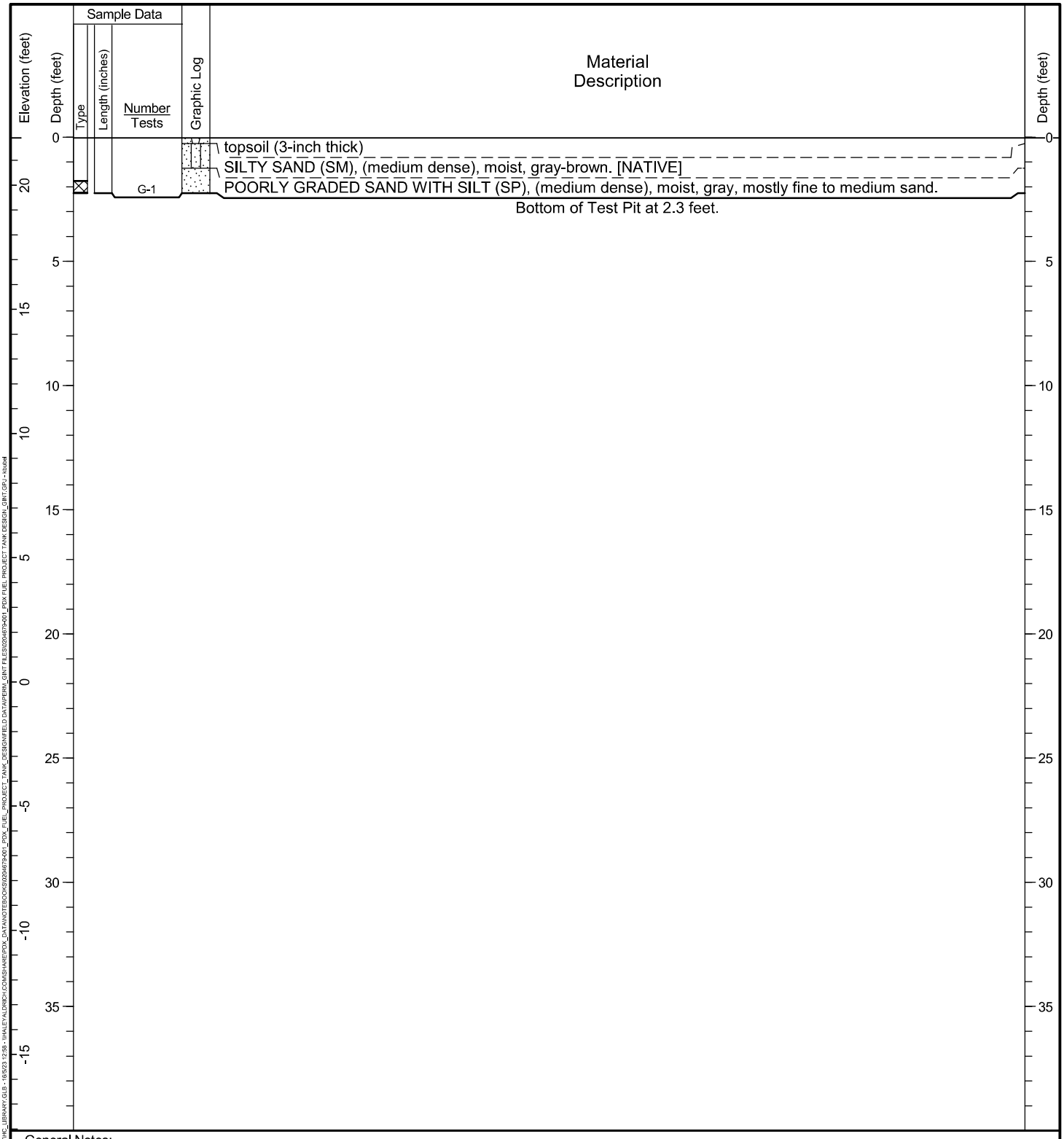
Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew:

Logged by: Checked by: Rig Model/Type: Backhoe

Location: Lat: 45.597209 Long: -122.612269 (WGS 84) Total Depth: 2.25 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 21.93 feet (NAVD 88)

Comments: Double ring falling head infiltration test conducted from 1050 to 1200.



General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Test Pit Log **IT-2**	Figure **A** Sheet **1 of 1**

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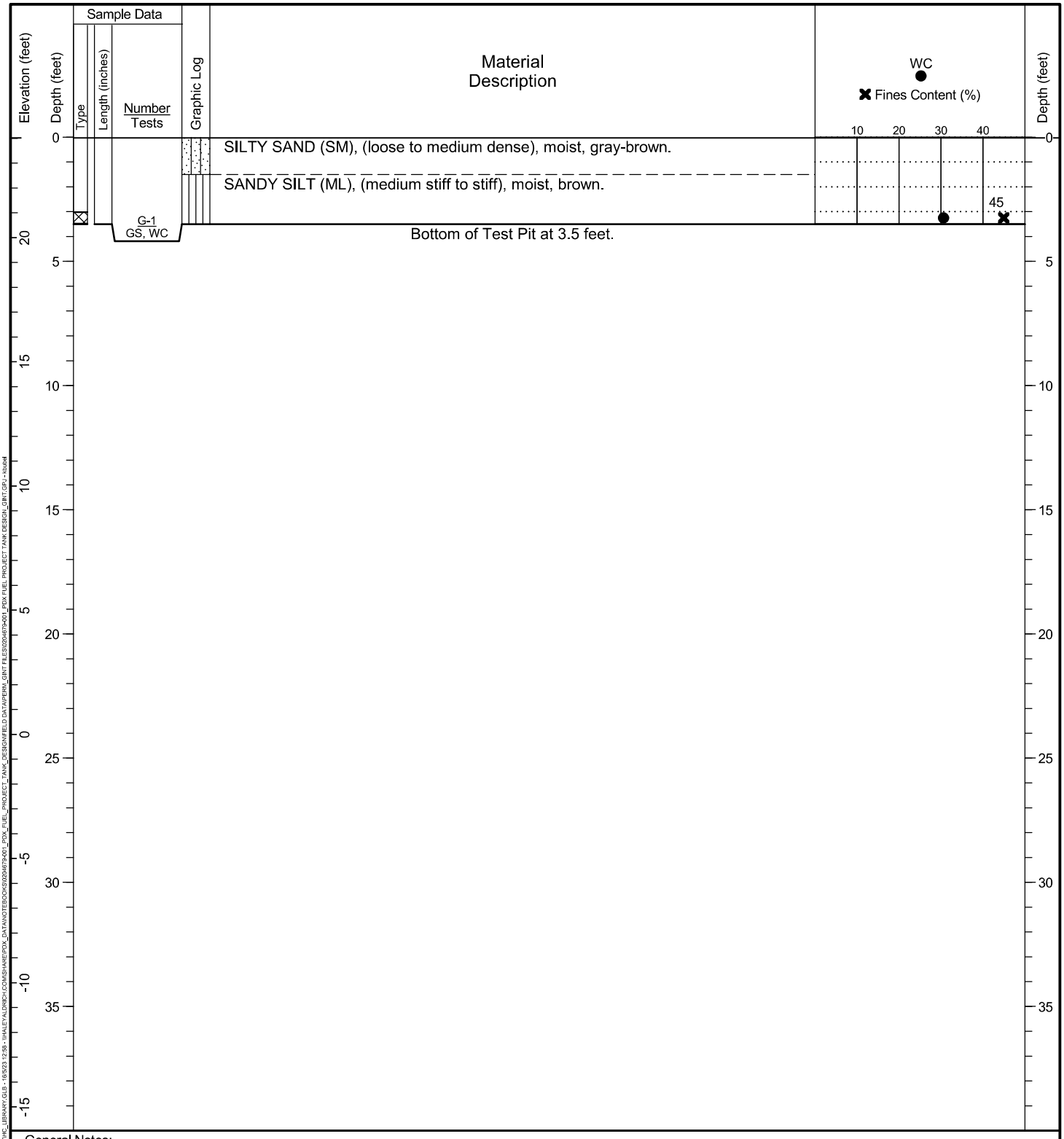
Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew:

Logged by: Checked by: Rig Model/Type: Backhoe

Location: Lat: 45.597973 Long: -122.612933 (WGS 84) Total Depth: 3.5 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 24.05 feet (NAVD 88)

Comments: Single ring falling head infiltration test conducted from 1215 to 1430.



General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Test Pit Log **IT-3**	Figure **A** Sheet **1 of 1**

HA_TEST PIT - I:\HALEYALDRICH.COM\SHARESEA_DATA\GINT\HC_LIBRARY.GLB - 6/6/23 12:58 - \\HALEYALDRICH.COM\SHARESEA_DATA\GINT\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuttl

Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew:

Logged by: Checked by: Rig Model/Type: Backhoe

Location: Lat: 45.598133 Long: -122.614312 (WGS 84) Total Depth: 10 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 24.28 feet (NAVD 88)

Comments:

Elevation (feet)	Depth (feet)	Sample Data: Type	Sample Data: Length (inches)	Sample Data: Number / Tests	Graphic Log	Material Description	Depth (feet)
20	0					topsoil (3-inch thick)	0
		☒		G-1		SILTY SAND (SM), trace fine and coarse gravel, (loose to medium dense), moist, trace organics.	
						grades to no organics, increase in sand content	
15	5					SANDY SILT (ML), (soft to medium stiff), moist, dark gray-brown to brown.	5
						increase in moisture	
10	10					grades to dark gray-brown	
						water begins to seep into test pit at 10 ft.	10
5	15					Bottom of Test Pit at 10.0 feet.	15
0	20						20
-5	25						25
-10	30						30
-15	35						35

General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Test Pit Log
TP-1

Figure **A**
Sheet **1 of 1**

HA_TEST PIT - I:\HALEYALDRICH.COM\SHARESEA_DATA\GINT\HC_LIBRARY.GLB - 6/5/23 12:58 - I:\HALEYALDRICH.COM\SHARESEA_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - kludvi

Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew:

Logged by: Checked by: Rig Model/Type: Backhoe

Location: Lat: 45.597348 Long: -122.611951 (WGS 84) Total Depth: 5.5 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 23.00 feet (NAVD 88)

Comments:

Elevation (feet)	Depth (feet)	Sample Data: Type	Sample Data: Length (inches)	Sample Data: Number / Tests	Graphic Log	Material Description
23	0					POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), trace cobbles, (loose to medium dense), moist to wet, gray-brown. [FILL]
				G-1		SANDY SILT (ML), (medium dense), moist, brown mottled with gray-brown.
20				G-2		SILTY SAND (SM), (medium dense), moist, brown.
						grades to gray
						POORLY GRADED SAND (SP), few silt, (loose), moist.
18	5			G-3		water begins to seep into test pit
						Bottom of Test Pit at 5.5 feet.

General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Test Pit Log
TP-2

Figure **A**
Sheet **1 of 1**

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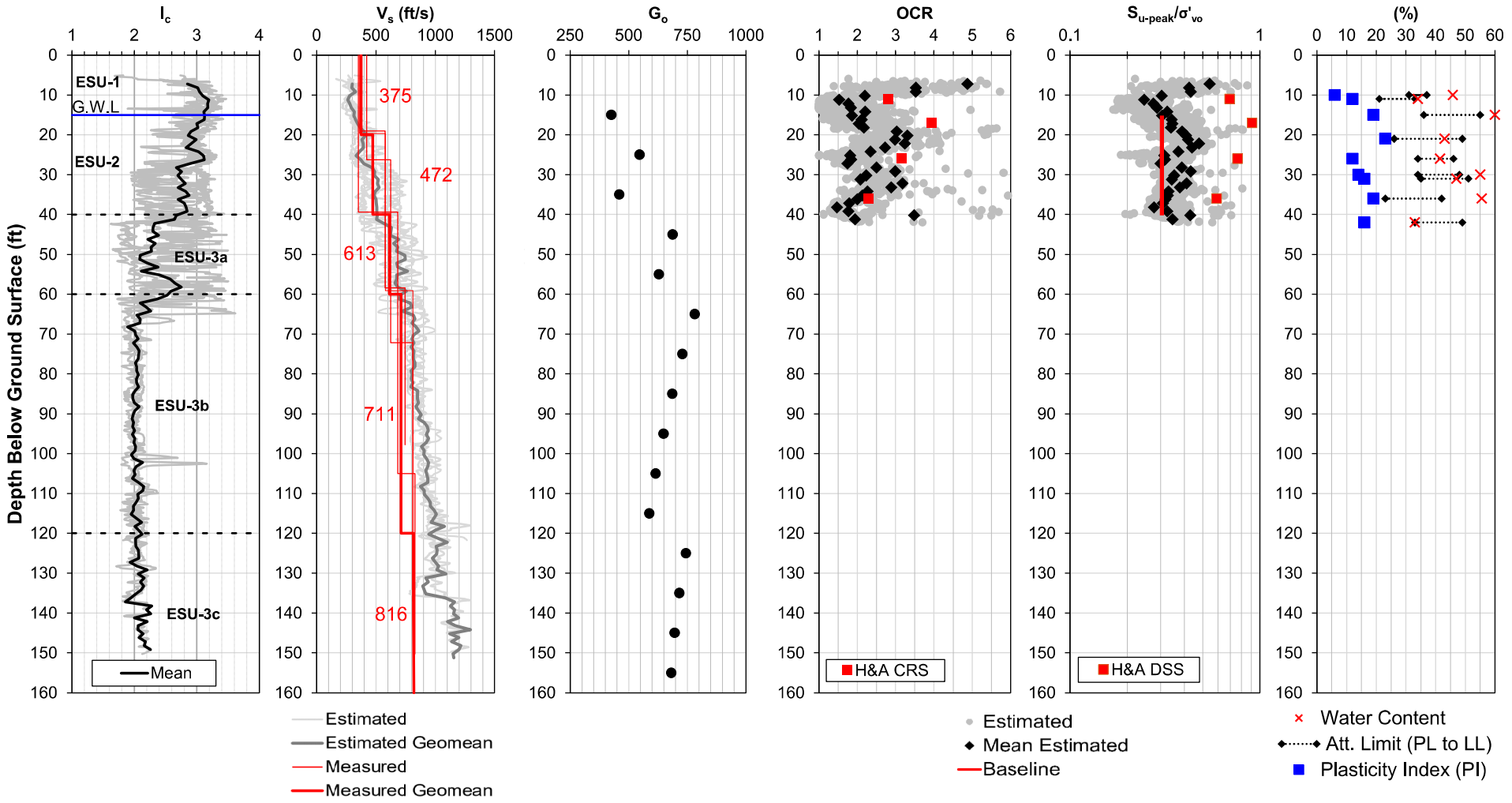
APPENDIX B
Summary of Subsurface Engineering Properties Derived from CPT Interpretation

Soil Constitutive Model Parameters for ESU-2: PM4Silt Version 1 (Boulanger & Ziotopoulou 2018)



Notes:

1. Estimated Vs values are computed using Robertson 2009 CPT-Vs correlation
2. Measured Vs values are based on Seismic CPT data
3. G_o values for PM4Silt parameters are calibrated to "Measured Geomean" Vs value for every 10 ft elevation ($G_o = (G_{max}/p_{atm}) / (p'/p_{atm})^{0.75}$
4. Estimated OCR values are computed using procedure proposed by Agaiby & Mayne (2019)
5. Peak undrained shear strength is $S_{u\text{-}peak}/\sigma_{vo} = 0.5 \sin(\phi'_{NTH})\ OCR^{0.8}$, where ϕ'_{NTH} is estimated using Ouyang & Mayne (2019)
6. H&A CRS and DSS were the laboratory Constant Rate Strain consolidation and Direct Simple Shear test results performed by Haley & Aldrich, Inc

PDX Fuel Tank SVA
Portland, OR

Estimated Engineering Soil Properties for ESU-2: Overbank Deposit (ML / CL)

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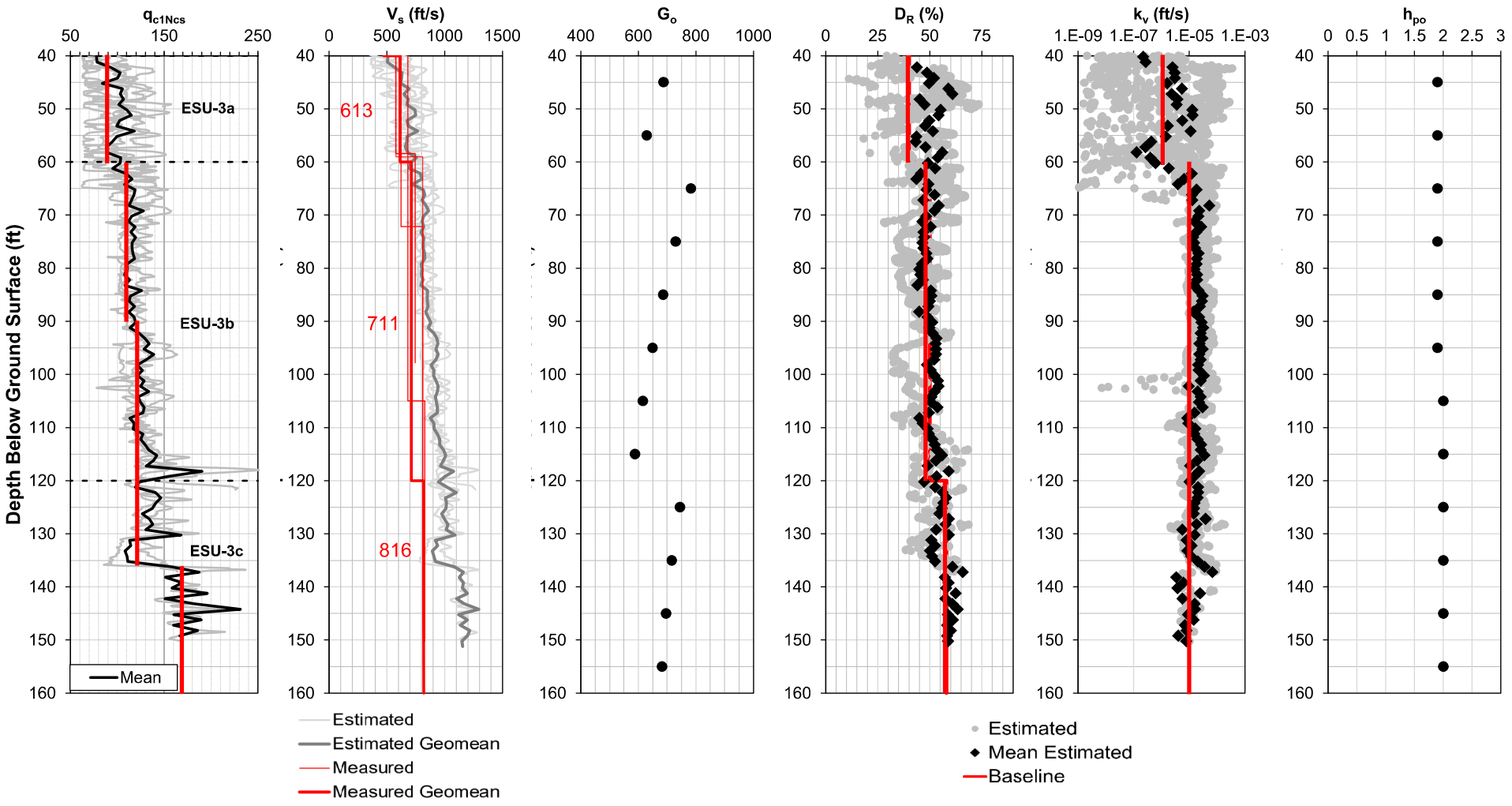
Fig. **B-1**

Soil Constitutive Model Parameters for ESU-3: PM4Sand Version 3.1 (Boulanger & Ziotopoulou 2017)



Notes:

1. q_{c1Ncs} values is computed following Idriss & Boulanger (2016)
2. Estimated Vs values are computed using Robertson (2009), Measured Vs values are based on Seismic CPT data
3. G_o values for PM4Sand parameters are calibrated to Measured Geomean value and every 10 ft elevation ($G_o = (G_{max}/p_{atm}) / (p'/p_{atm})^{0.5}$
4. Relative density (DR) values are estimated using Idriss & Boulanger (2008), Jamiolkowski et al. (2001), and Kulhawy & Mayne (1991) with weighting factor of 0.4, 0.3, 0.3, respectively
5. Hydraulic conductivity value are estimated using Robertson & Cabal (2015) CPT correlations
6. h_{po} value is calibrated to match Boulanger & Idriss (2016) CRR-N_c within P_{Liq} of 15 to 85%

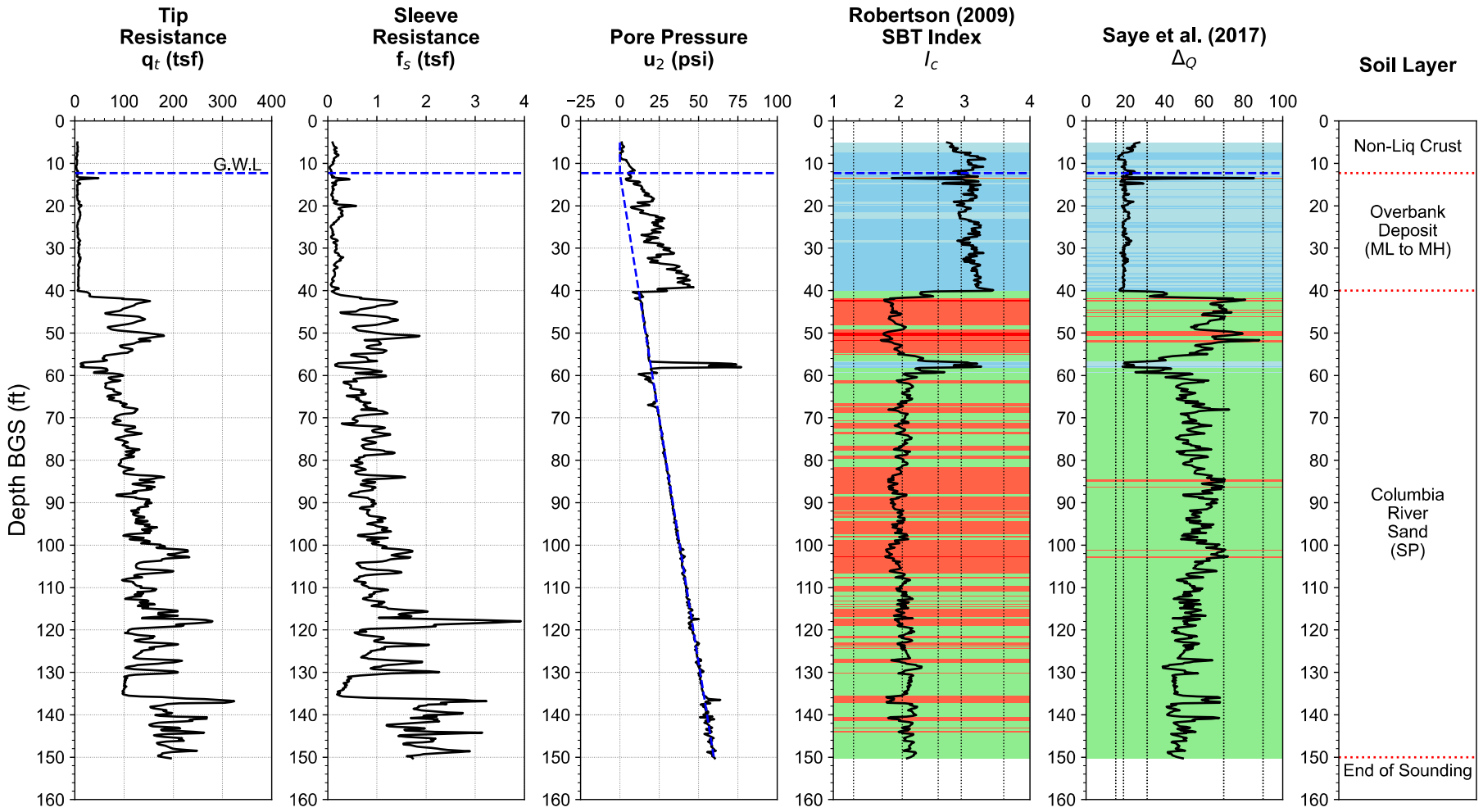
PDX Fuel Tanks SVA
Portland, OR

Estimated Engineering Soil Properties for ESU-3: Columbia River Sand (SP)

0204679-001 07 - 2023

HALEY ALDRICH

Fig. **B-2**



Robertson (2009) SBTn Zone:

- Gravelly Sands (I_c < 1.31)
- Clean sands (1.31 ≤ I_c < 1.8)
- Silty Sands (1.8 ≤ I_c < 2.05)
- Sand mixture: Sandy silt (2.05 ≤ I_c < 2.6)
- Silt mixture: Clayey silt to silty clay (2.6 ≤ I_c < 2.95)
- Clays (2.95 ≤ I_c ≤ 3.6)
- Organic Soils (I_c > 3.6)

Saye et al. (2017) Δ_Q Zone (Typical USCS):

- SP, SW (FC ≤ 5%, Δ_Q > 90)
- SP-SM, SP-SC (FC ≈ 5-12%, 70 ≤ Δ_Q < 90)
- SM, SC, GM, GC (FC ≈ 12-50%, 31 ≤ Δ_Q < 70)
- ML, CL (FC > 50%, D_{50} = 75μm, 19 ≤ Δ_Q < 31)
- MH, CH (Liquid Limit, w_L > 50, 15 ≤ Δ_Q < 19)
- OL, OH, Pt (Highly Organic Soil, Δ_Q < 15)

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Basic Measurement
SCPT-5 : (45.597485 , -122.612872)

0204679-001 July 2023

HALEY ALDRICH

Figure
B-3

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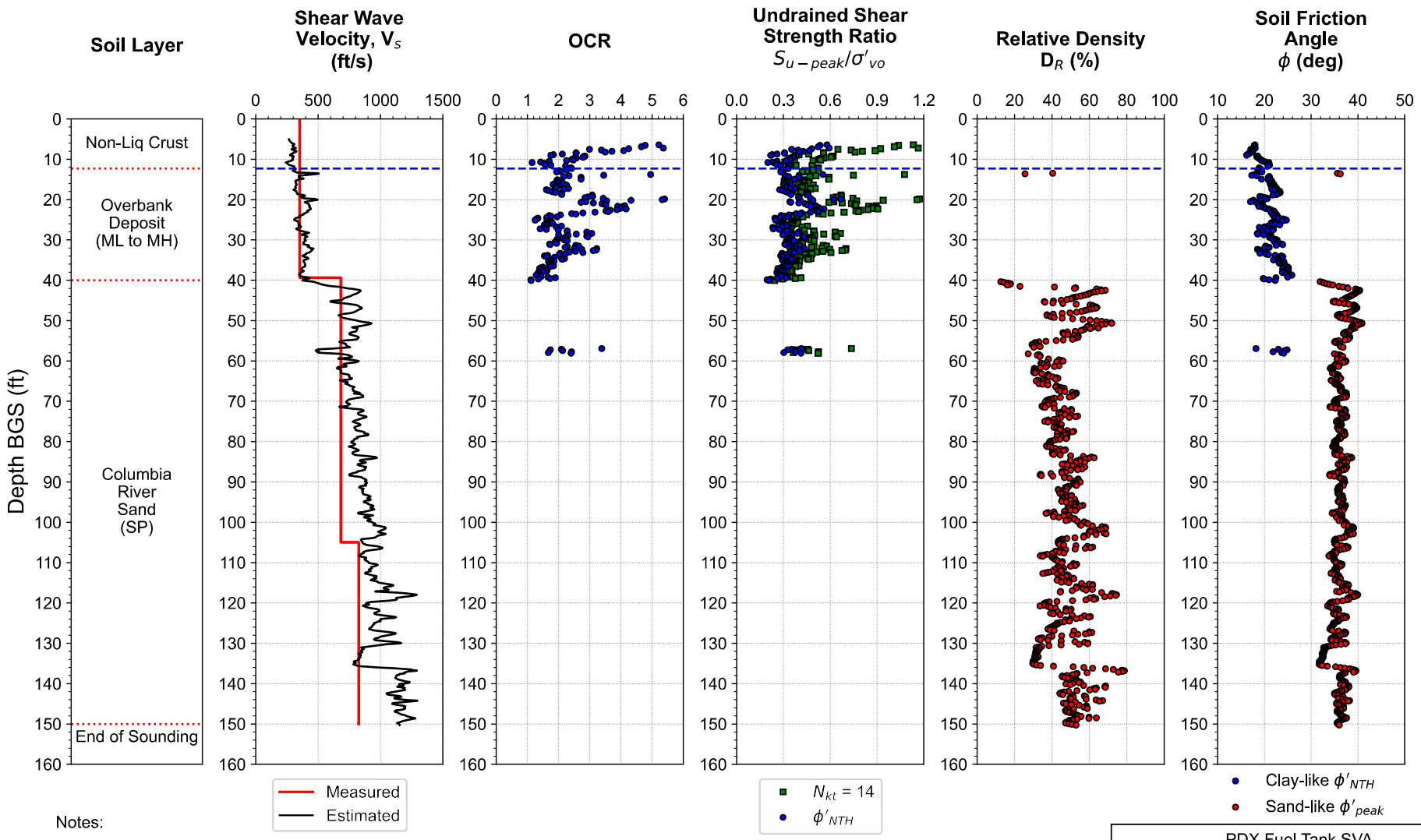

Notes:

1a. V_s is estimated using Robertson (2009) CPT-V_s Correlation
1b. Measured V_s is calculated using Slope method
2. OCR is determined using Agaiby & Mayne (2019) procedure
3a. S_{u-peak}/σ'_{vo} = $(q_t - \sigma_{vo})$ / $(N_{kt}\sigma'_{vo})$ and S_{u-peak}/σ'_{vo} = 0.5 $\sin(\phi'_{NTH})$ OCR $^{0.8}$
3b. N_{kt} = 14 ; ϕ_{NTH} = Effective friction angles calculated using modified NTH method (Ouyang & Mayne 2019)
4. Relative Density is estimated using Idriss & Boulanger 2008, Jamiolkowski et al. 2001, and Kulhawy & Mayne 1991 with weighting average factor 0.4, 0.3, 0.3, respectively
5. ϕ_{peak} = Peak friction angle calculated using Robertson (2010) equation for sandy soils, assuming ϕ'_{cv} = 33°

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Engineering Properties
SCPT-5 : (45.597485 , -122.612872)

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Figure
B-4

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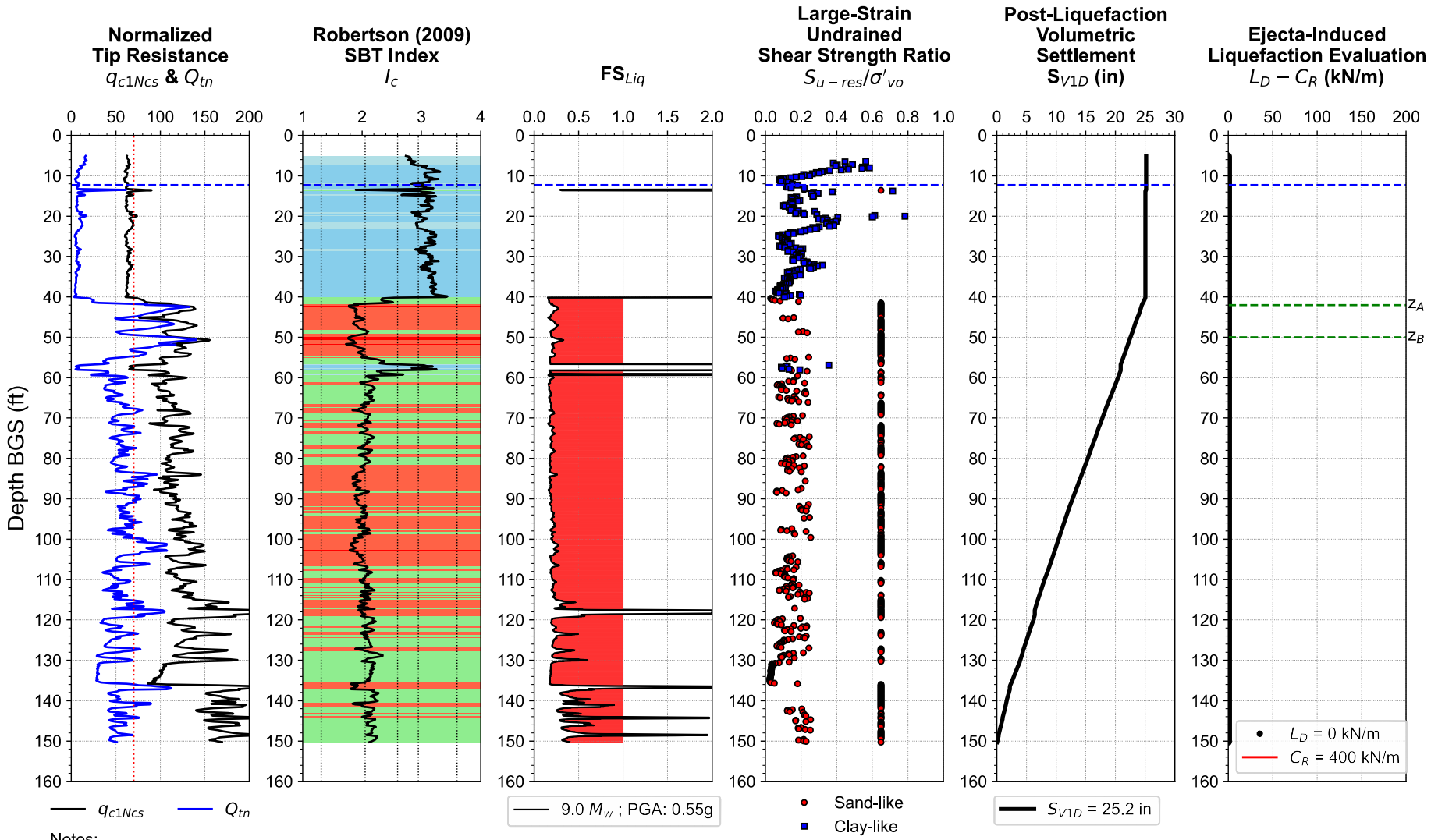

Notes:

1a. q_{c1Ncs}: Equivalent clean sand tip resistance following Boulanger & Idriss (2016) to estimate cyclic resistance ratio
1b. Q_{tn}: Normalized tip resistance following Robertson 2020 to estimate large-strain undrained shear strength ratio
2. FS_{Liq} is calculated using Boulanger & Idriss (2016) with P_{Liq} = 0.15 ; I_{c-cut} = 2.6 ; C_{FC} = 0.0
3. Large-strain undrained shear strength ratio is estimated using Robertson (2020) for clay-like and sand-like soil:
   Sand-like: Post-liquefied strength ratio (S_{u-liq}/σ'_{vo}) = tan (ϕ'_{cv}) for Q_{tn} > 70, where ϕ'_{cv} is assumed to be 33°
   Clay-like: S_{u-res} is the same as remolded strength S_{u-rem}
4. Post-Liquefaction volumetric settlement is calculated using Zhang et al. (2002) procedure
5. Ejecta-induced settlement & severity are calculated based on Hutabarat & Bray (2022)

PDX Fuel Tank SVA
Portland, OR

CPT-based Liquefaction Evaluation
2475-yrs Hazard Level
SCPT-5 : (45.597485 , -122.612872)

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Figure
B-5

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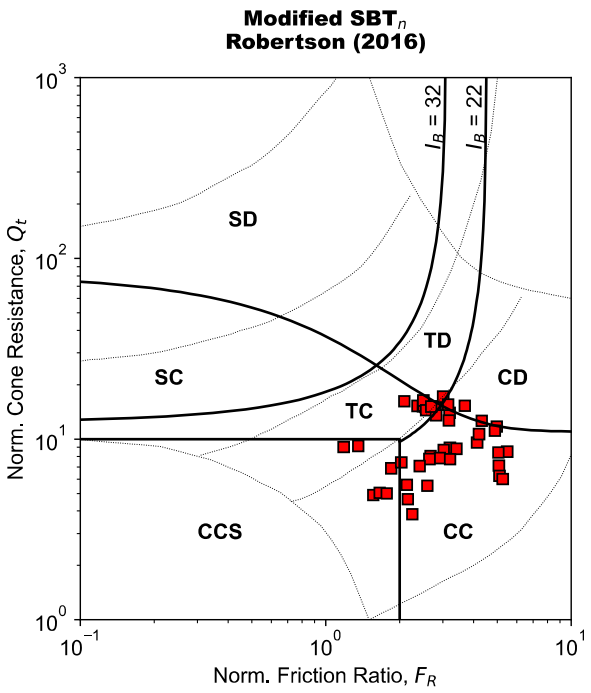

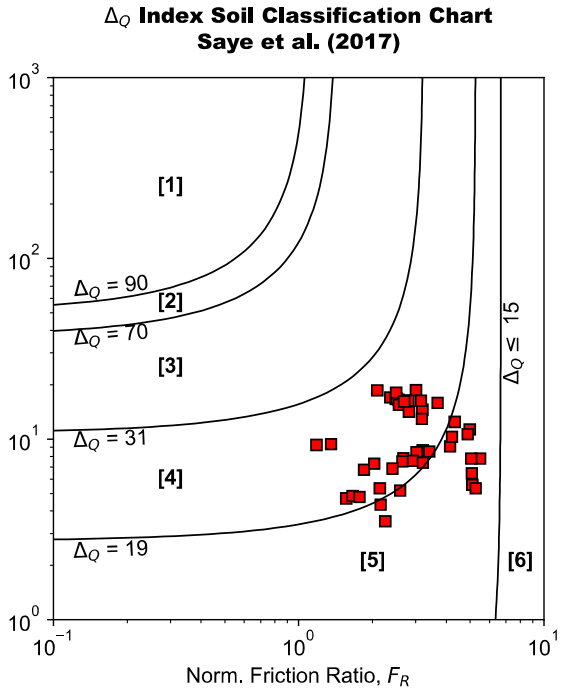

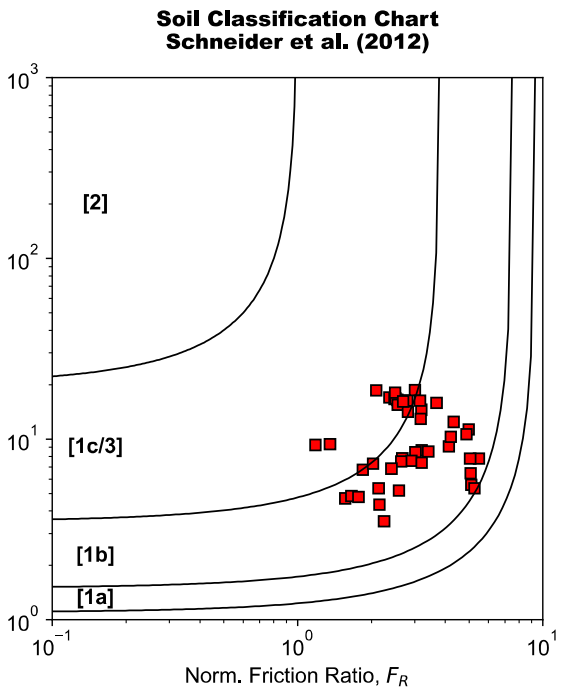

Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-1: 5 ft to 12 ft
SCPT-5 : (45.597485 , -122.612872)

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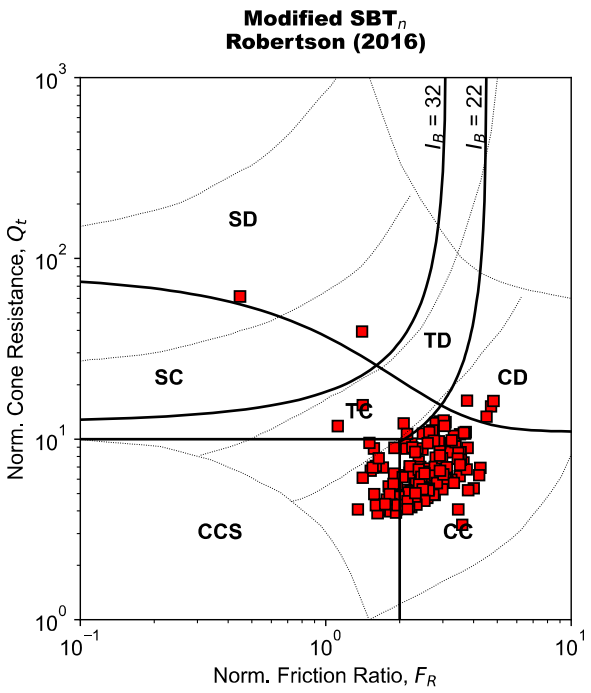
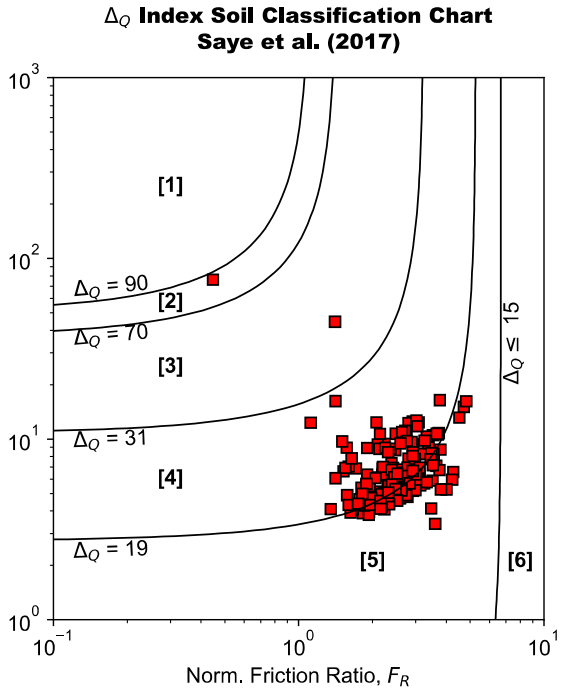
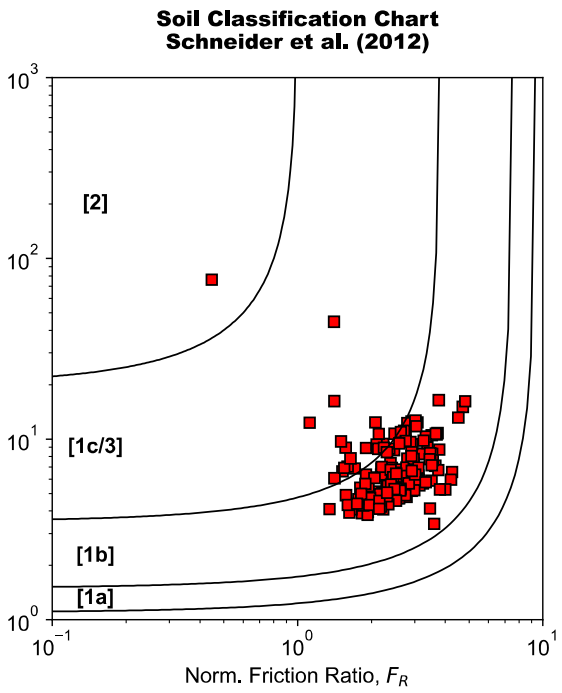
Figure
B-6







Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-2: 12 ft to 40 ft
SCPT-5 : (45.597485 , -122.612872)

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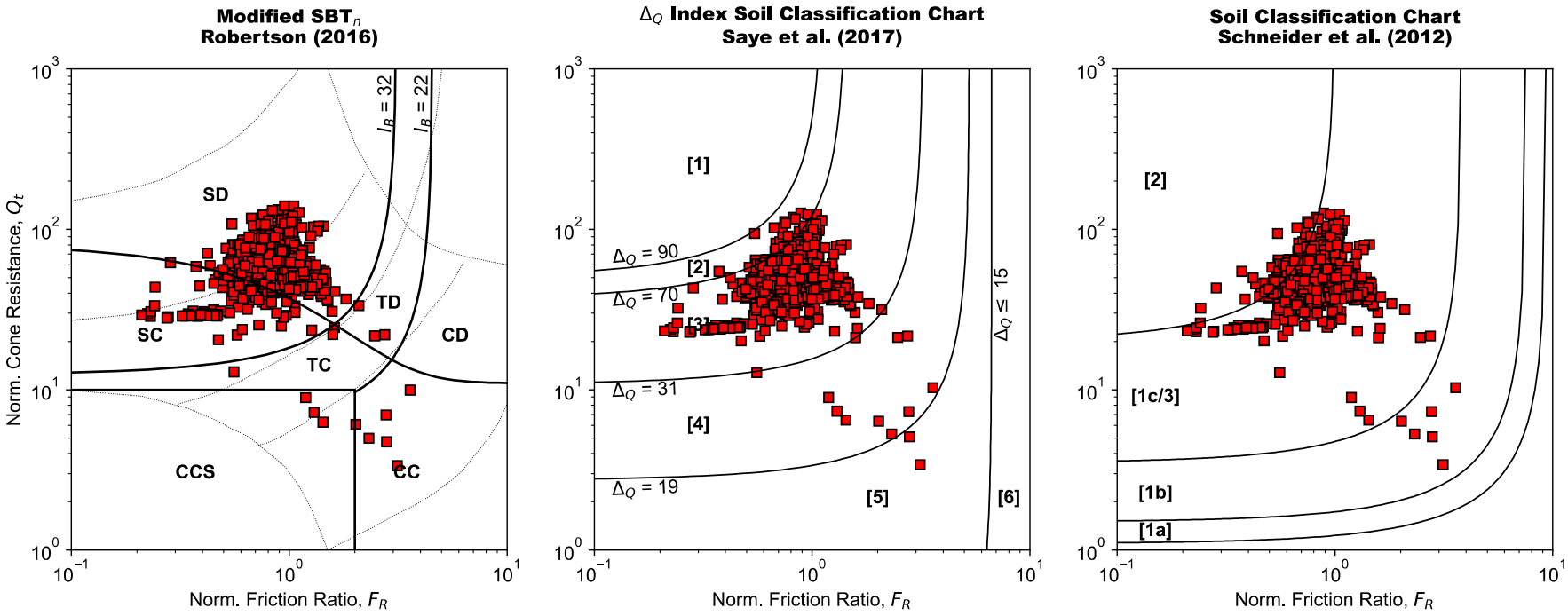
Figure
B-7



Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-3: 40 ft to 150 ft
SCPT-5 : (45.597485 , -122.612872)

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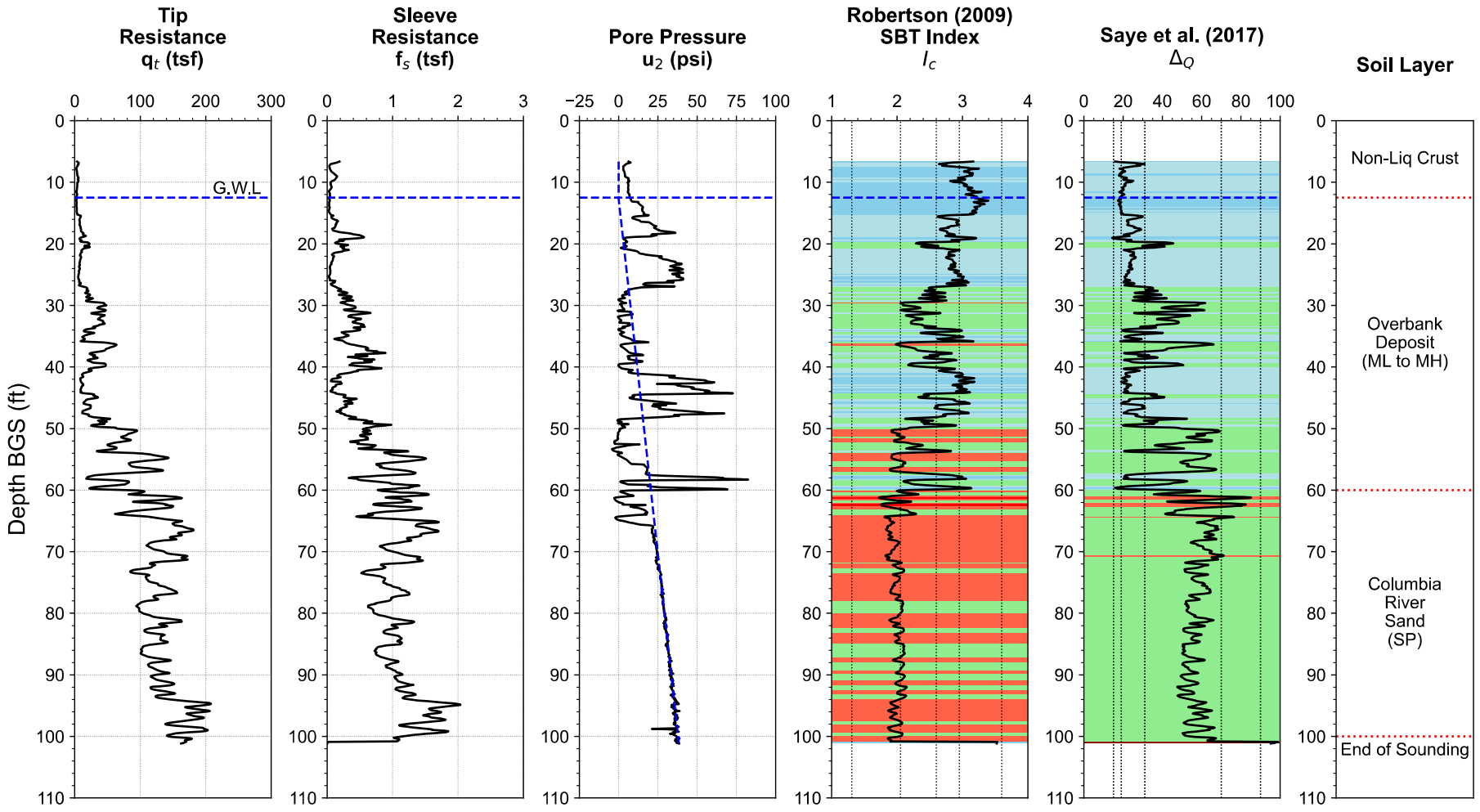
Figure
B-8



Robertson (2009) SBTn Zone:

- Gravelly Sands (I_c < 1.31)
- Clean sands (1.31 ≤ I_c < 1.8)
- Silty Sands (1.8 ≤ I_c < 2.05)
- Sand mixture: Sandy silt (2.05 ≤ I_c < 2.6)
- Silt mixture: Clayey silt to silty clay (2.6 ≤ I_c < 2.95)
- Clays (2.95 ≤ I_c ≤ 3.6)
- Organic Soils (I_c > 3.6)

Saye et al. (2017) Δ_Q Zone (Typical USCS):

- SP, SW (FC ≤ 5%, Δ_Q > 90)
- SP-SM, SP-SC (FC ≈ 5-12%, 70 ≤ Δ_Q < 90)
- SM, SC, GM, GC (FC ≈ 12-50%, 31 ≤ Δ_Q < 70)
- ML, CL (FC > 50%, D_{50} = 75μm, 19 ≤ Δ_Q < 31)
- MH, CH (Liquid Limit, w_L > 50, 15 ≤ Δ_Q < 19)
- OL, OH, Pt (Highly Organic Soil, Δ_Q < 15)

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Basic Measurement
SCPT-1 : (45.59739 , -122.61306)

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Figure
B-9

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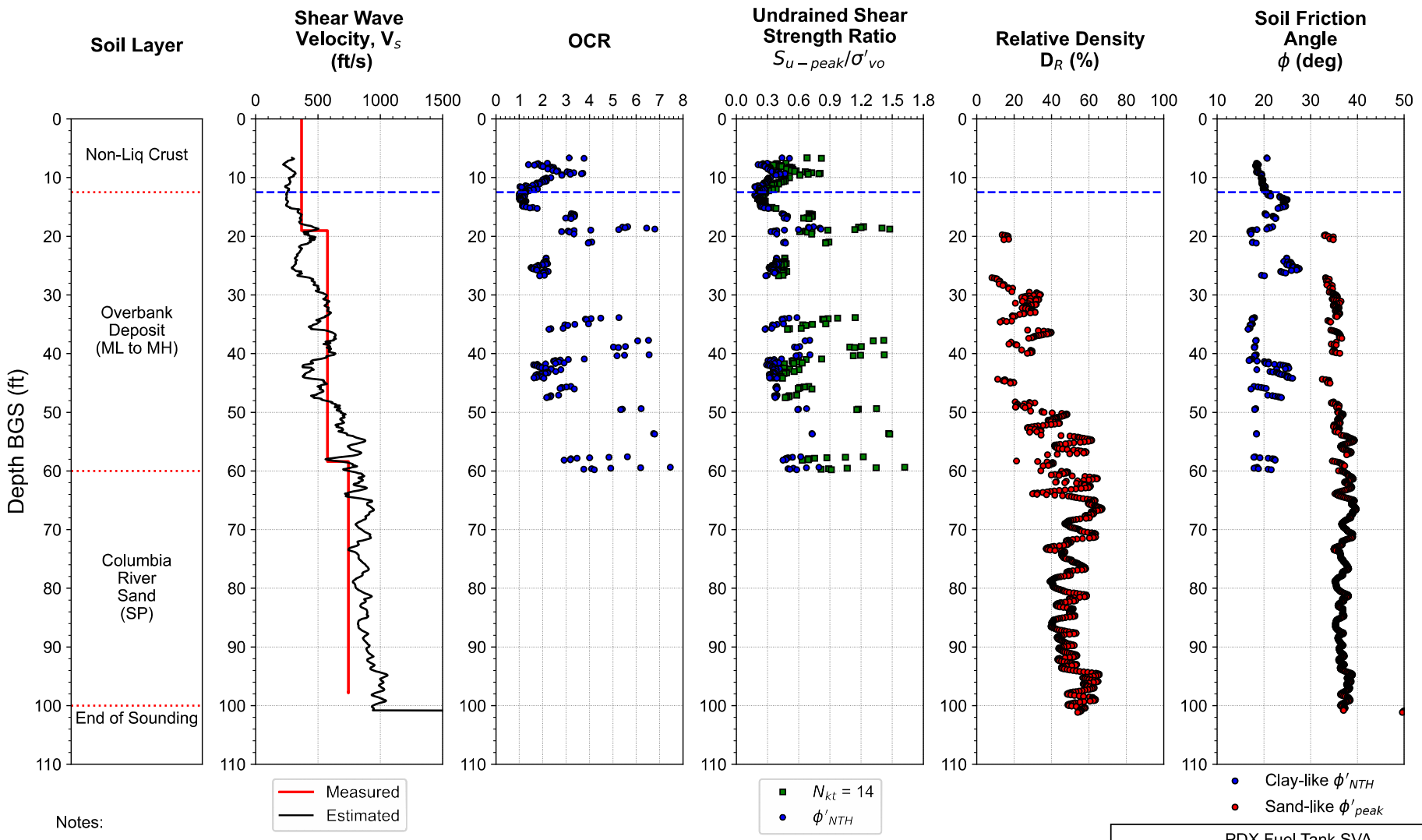

Notes:

1a. V_s is estimated using Robertson (2009) CPT-V_s Correlation
1b. Measured V_s is calculated using Slope method
2. OCR is determined using Agaiby & Mayne (2019) procedure
3a. $S_{u-peak}/\sigma'_{vo} = (q_t - \sigma_{vo}) / (N_{kt}\sigma'_{vo})$ and $S_{u-peak}/\sigma'_{vo} = 0.5 \sin(\phi'_{NTH})$ OCR $^{0.8}$
3b. N_{kt} = 14 ; ϕ_{NTH} = Effective friction angles calculated using modified NTH method (Ouyang & Mayne 2019)
4. Relative Density is estimated using Idriss & Boulanger 2008, Jamiolkowski et al. 2001, and Kulhawy & Mayne 1991 with weighting average factor 0.4, 0.3, 0.3, respectively
5. ϕ_{peak} = Peak friction angle calculated using Robertson (2010) equation for sandy soils, assuming $\phi'_{cv} = 33^o$

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Engineering Properties
SCPT-1 : (45.59739 , -122.61306)

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Figure
B-10

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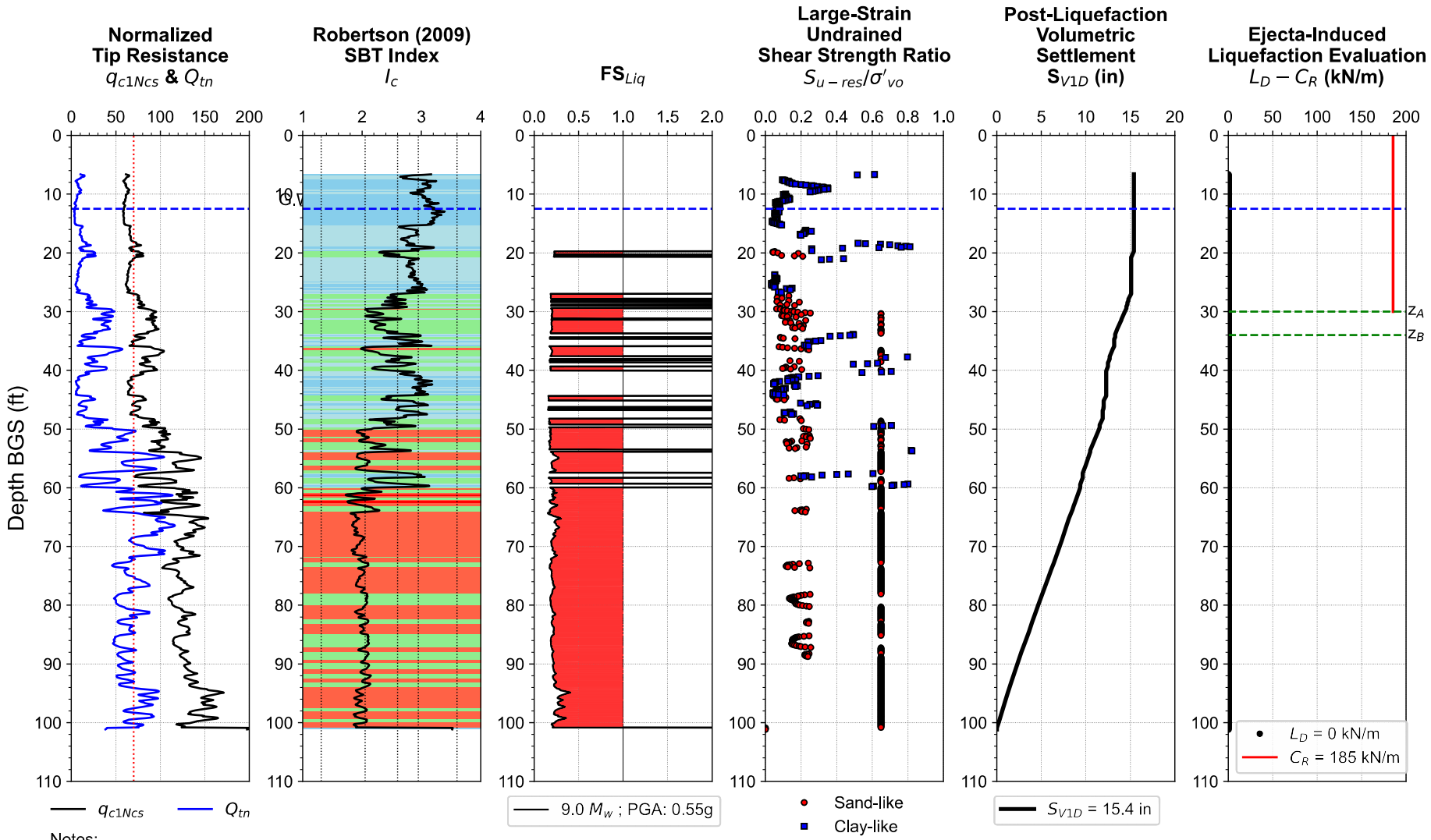

Notes:

1a. q_{c1Ncs}: Equivalent clean sand tip resistance following Boulanger & Idriss (2016) to estimate cyclic resistance ratio
1b. Q_{tn}: Normalized tip resistance following Robertson 2020 to estimate large-strain undrained shear strength ratio
2. FS_{Liq} is calculated using Boulanger & Idriss (2016) with P_{Liq} = 0.15 ; I_{c-cut} = 2.6 ; C_{FC} = 0.0
3. Large-strain undrained shear strength ratio is estimated using Robertson (2020) for clay-like and sand-like soil:
   Sand-like: Post-liquefied strength ratio (S_{u-liq}/σ'_{vo}) = tan (ϕ'_{cv}) for Q_{tn} > 70, where ϕ'_{cv} is assumed to be 33°
   Clay-like: S_{u-res} is the same as remolded strength S_{u-rem}
4. Post-Liquefaction volumetric settlement is calculated using Zhang et al. (2002) procedure
5. Ejecta-induced settlement & severity are calculated based on Hutabarat & Bray (2022)

PDX Fuel Tank SVA
Portland, OR

CPT-based Liquefaction Evaluation
2475-yrs Hazard Level
SCPT-1 : (45.59739 , -122.61306)

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Figure
B-11

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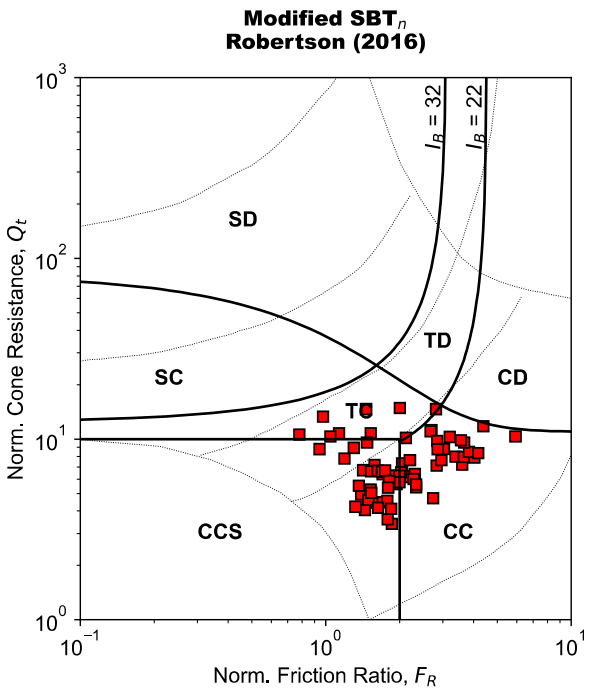

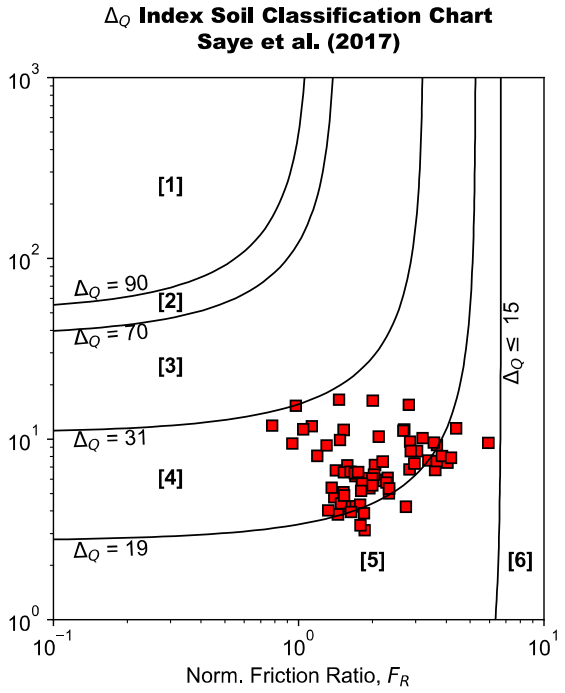

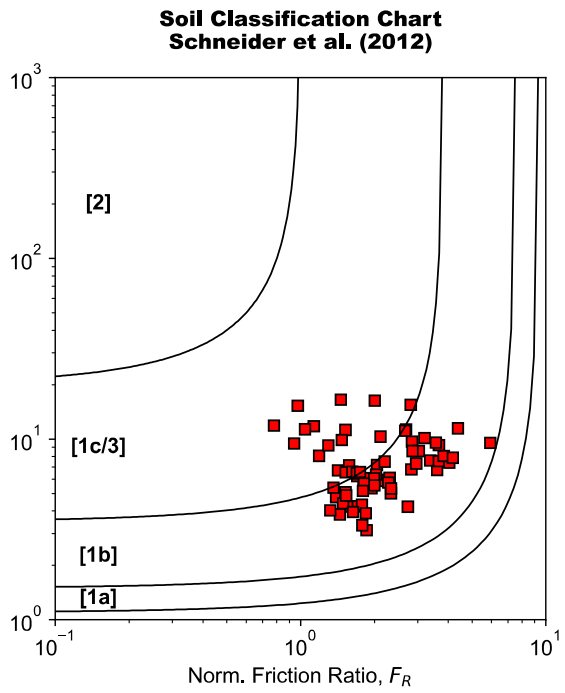

Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-1: 7 ft to 12 ft
SCPT-1 : (45.59739 , -122.61306)

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Figure
B-12

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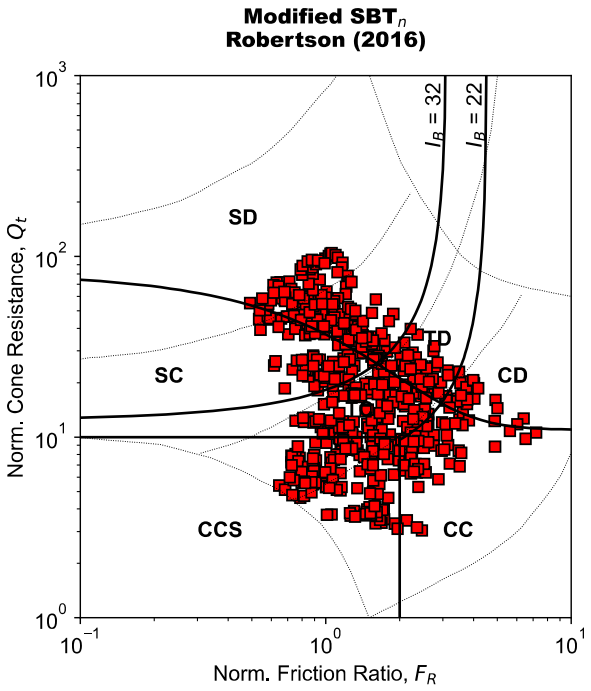

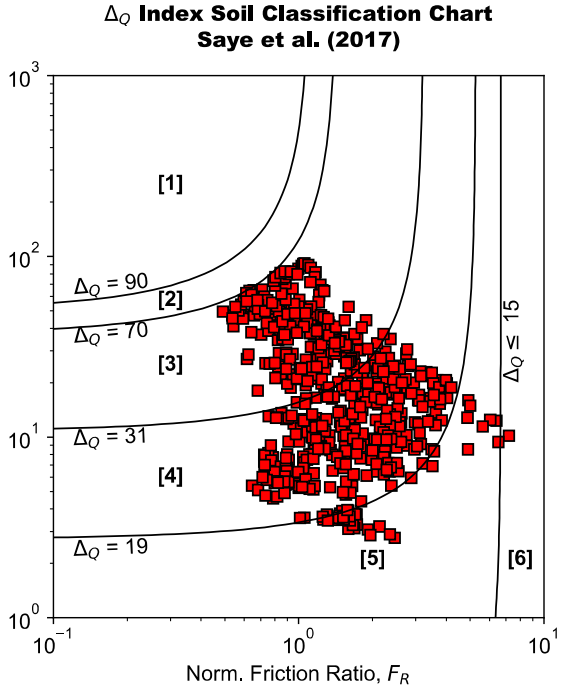

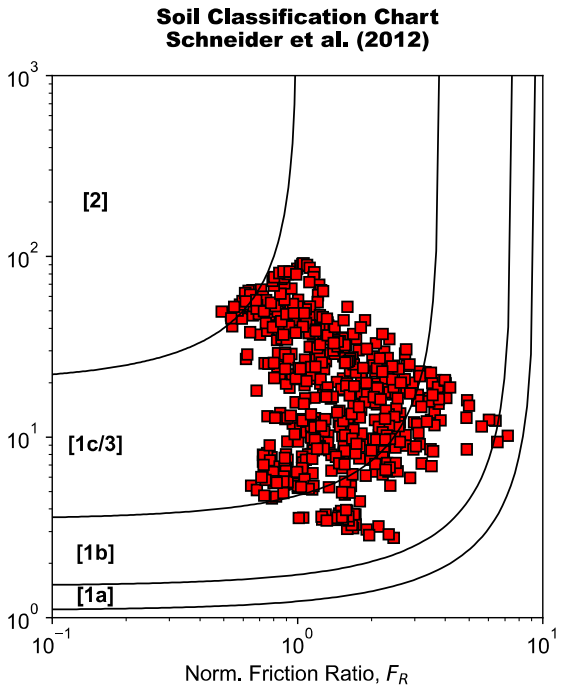

Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-2: 12 ft to 60 ft
SCPT-1 : (45.59739 , -122.61306)

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Figure
B-13

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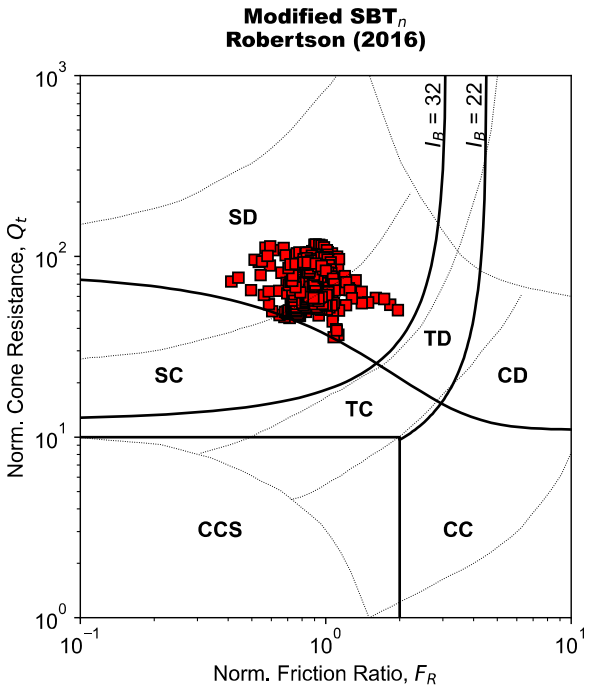

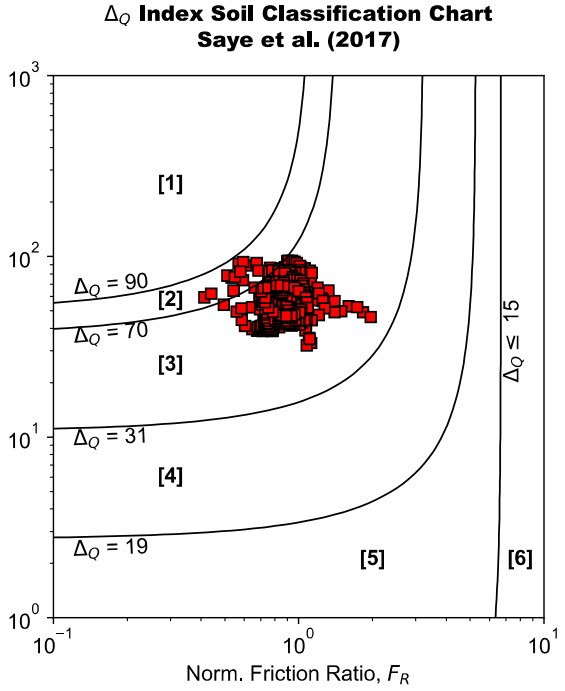

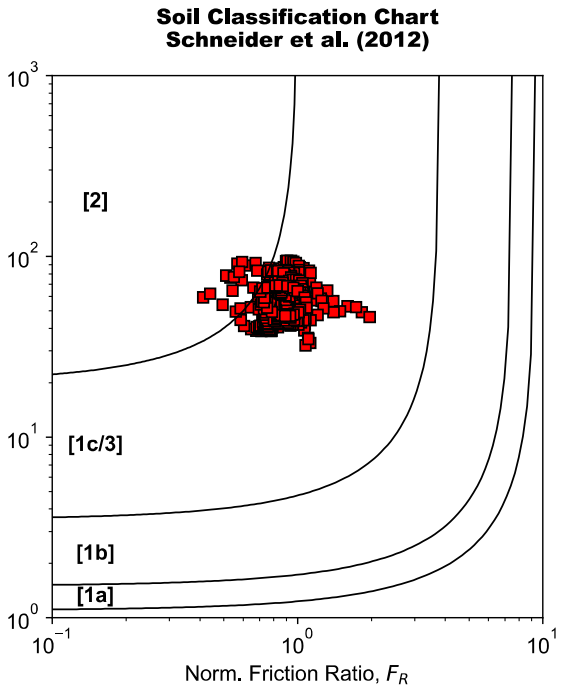

Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-3: 60 ft to 100 ft
SCPT-1 : (45.59739 , -122.61306)

0204679-001 July 2023

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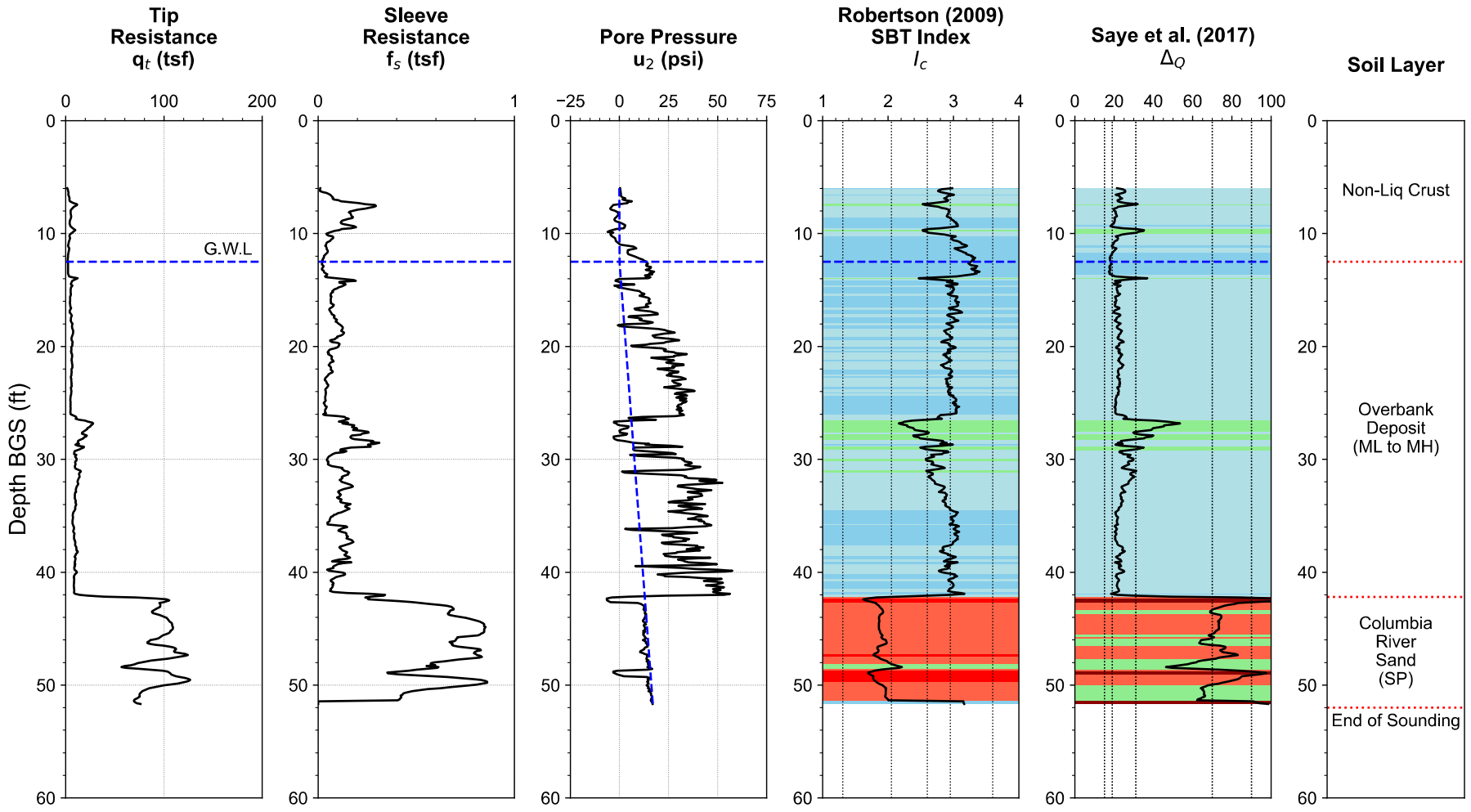
Figure
B-14



Robertson (2009) SBTn Zone:

- Gravelly Sands (I_c < 1.31)
- Clean sands (1.31 ≤ I_c < 1.8)
- Silty Sands (1.8 ≤ I_c < 2.05)
- Sand mixture: Sandy silt (2.05 ≤ I_c < 2.6)
- Silt mixture: Clayey silt to silty clay (2.6 ≤ I_c < 2.95)
- Clays (2.95 ≤ I_c ≤ 3.6)
- Organic Soils (I_c > 3.6)

Saye et al. (2017) Δ_Q Zone (Typical USCS):

- SP, SW (FC ≤ 5%, Δ_Q > 90)
- SP-SM, SP-SC (FC ≈ 5-12%, 70 ≤ Δ_Q < 90)
- SM, SC, GM, GC (FC ≈ 12-50%, 31 ≤ Δ_Q < 70)
- ML, CL (FC > 50%, D_{50} = 75μm, 19 ≤ Δ_Q < 31)
- MH, CH (Liquid Limit, w_L > 50, 15 ≤ Δ_Q < 19)
- OL, OH, Pt (Highly Organic Soil, Δ_Q < 15)

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Basic Measurement
CPT-2 : (45.59709 , -122.61272)

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Figure
B-15

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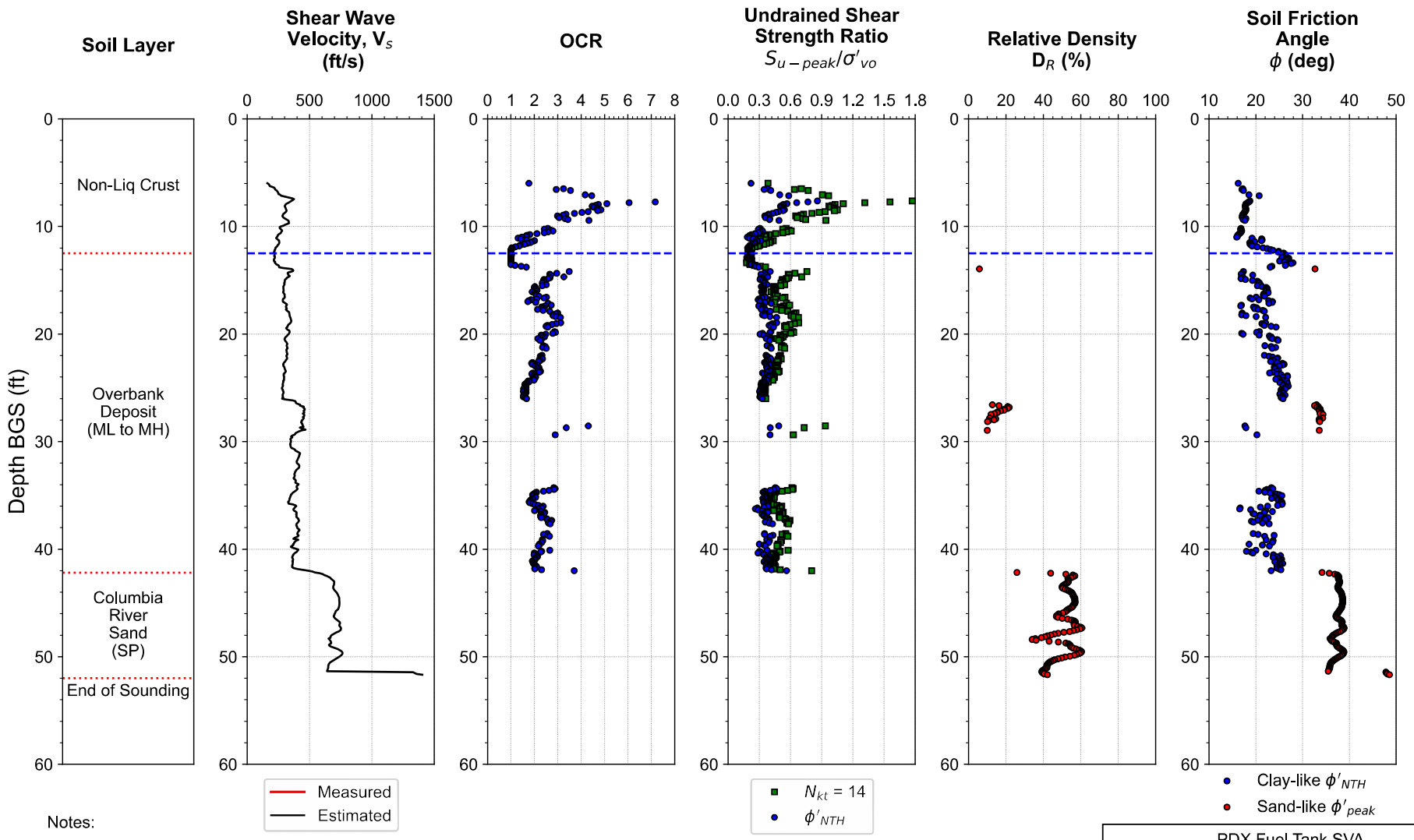

Notes:

1a. V_s is estimated using Robertson (2009) CPT-V_s Correlation
1b. Measured V_s is calculated using Slope method
2. OCR is determined using Agaiby & Mayne (2019) procedure
3a. S_{u-peak}/σ'_{vo} = $(q_t - \sigma_{vo})$ / $(N_{kt}\sigma'_{vo})$ and S_{u-peak}/σ'_{vo} = 0.5 $\sin(\phi'_{NTH})$ OCR $^{0.8}$
3b. N_{kt} = 14 ; ϕ_{NTH} = Effective friction angles calculated using modified NTH method (Ouyang & Mayne 2019)
4. Relative Density is estimated using Idriss & Boulanger 2008, Jamiolkowski et al. 2001, and Kulhawy & Mayne 1991 with weighting average factor 0.4, 0.3, 0.3, respectively
5. ϕ_{peak} = Peak friction angle calculated using Robertson (2010) equation for sandy soils, assuming ϕ'_{cv} = 33°

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Engineering Properties
CPT-2 : (45.59709 , -122.61272)

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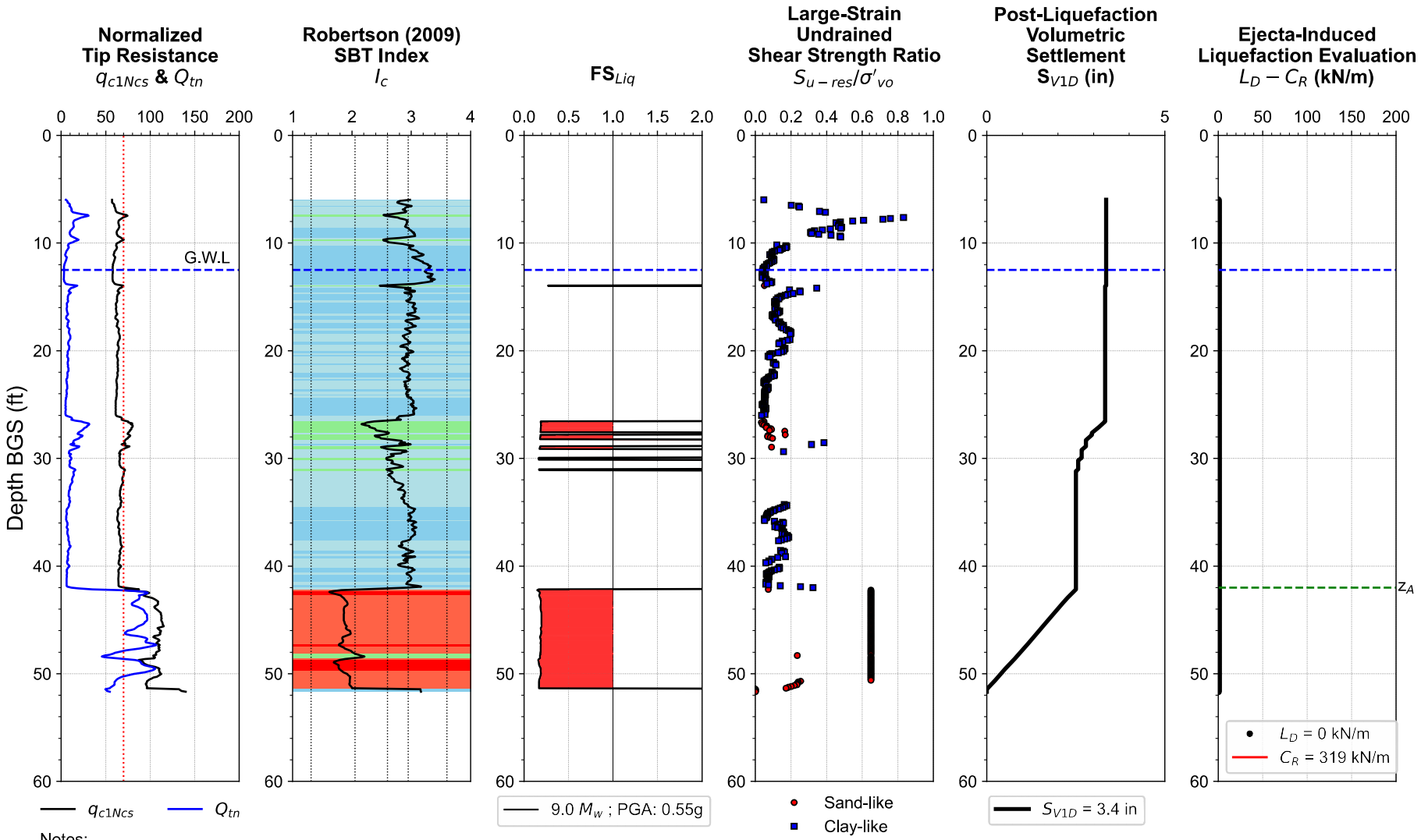
Figure
B-16



Notes:

1a. q_{c1Ncs}: Equivalent clean sand tip resistance following Boulanger & Idriss (2016) to estimate cyclic resistance ratio
1b. Q_{tn}: Normalized tip resistance following Robertson 2020 to estimate large-strain undrained shear strength ratio
2. FS_{Liq} is calculated using Boulanger & Idriss (2016) with P_{Liq} = 0.15 ; I_{c-cut} = 2.6 ; C_{FC} = 0.0
3. Large-strain undrained shear strength ratio is estimated using Robertson (2020) for clay-like and sand-like soil:
   Sand-like: Post-liquefied strength ratio (S_{u-liq}/σ'_{vo}) = tan (ϕ'_{cv}) for Q_{tn} > 70, where ϕ'_{cv} is assumed to be 33°
   Clay-like: S_{u-res} is the same as remolded strength S_{u-rem}
4. Post-Liquefaction volumetric settlement is calculated using Zhang et al. (2002) procedure
5. Ejecta-induced settlement & severity are calculated based on Hutabarat & Bray (2022)

PDX Fuel Tank SVA
Portland, OR

CPT-based Liquefaction Evaluation
2475-yrs Hazard Level
CPT-2 : (45.59709 , -122.61272)

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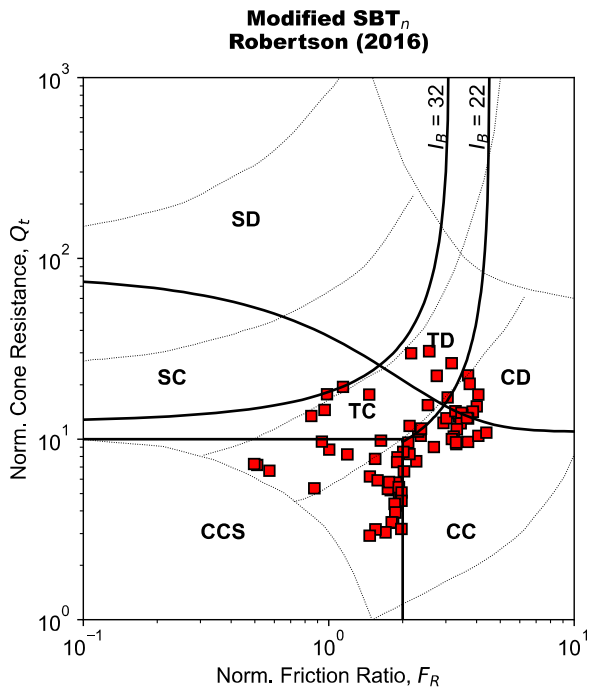
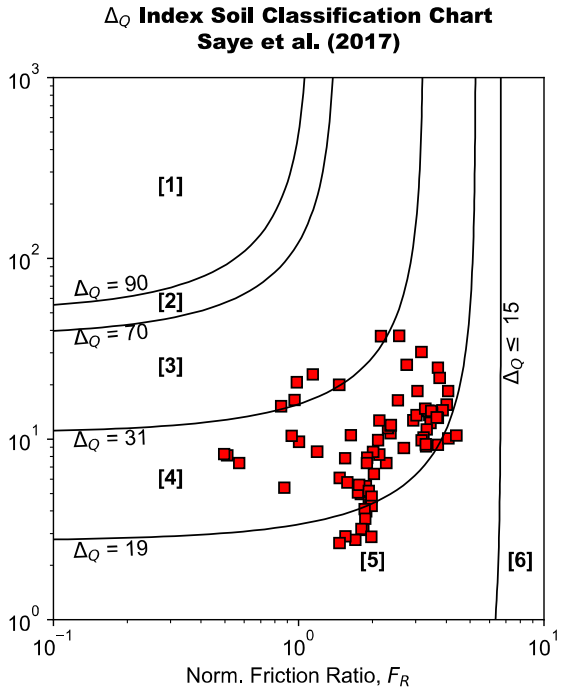
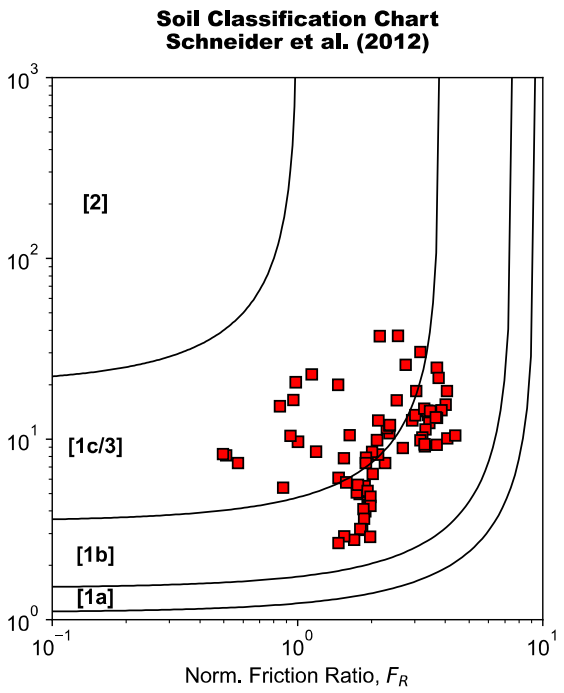
Figure
B-17







Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
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[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-1: 6 ft to 12 ft
CPT-2 : (45.59709 , -122.61272)

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Figure
B-18

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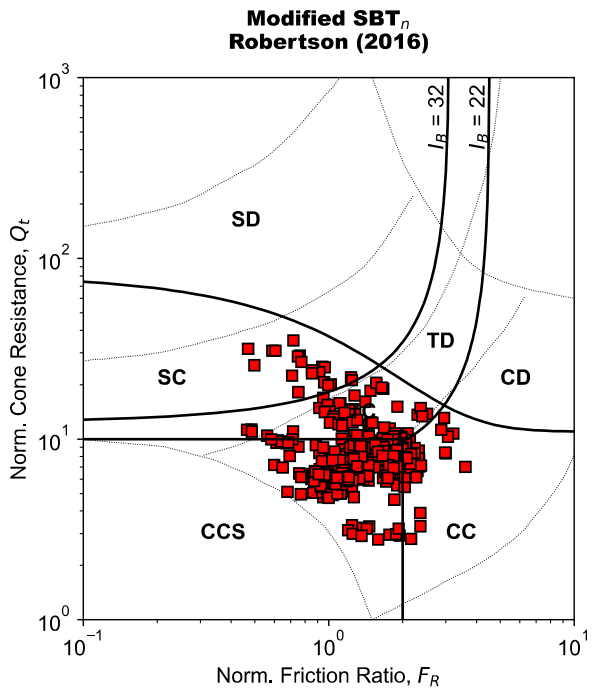

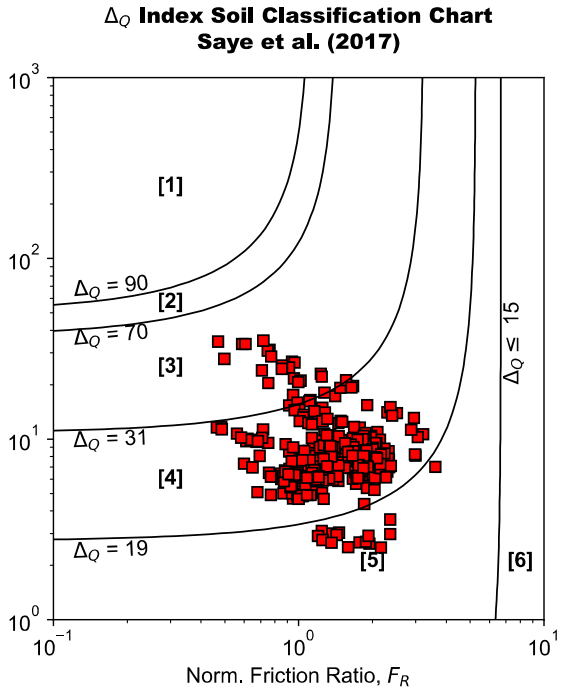

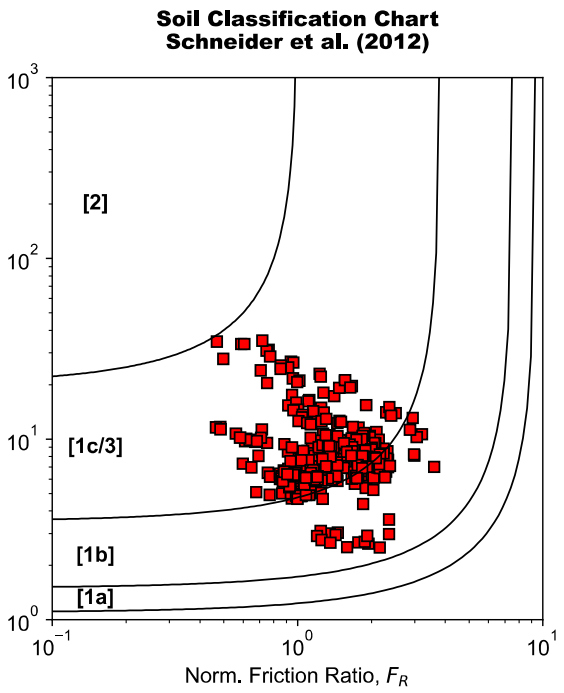

Robertson (2016) SBTn Zone:
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SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
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Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-2: 12 ft to 42 ft
CPT-2 : (45.59709 , -122.61272)

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Figure
B-19

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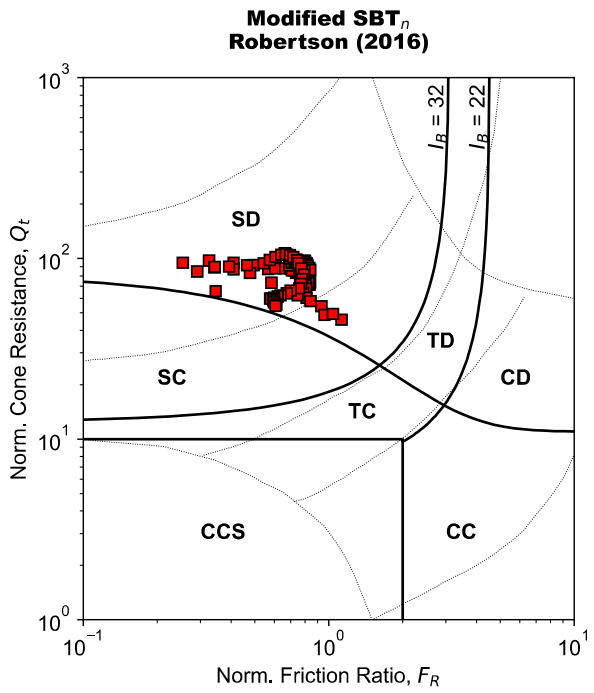

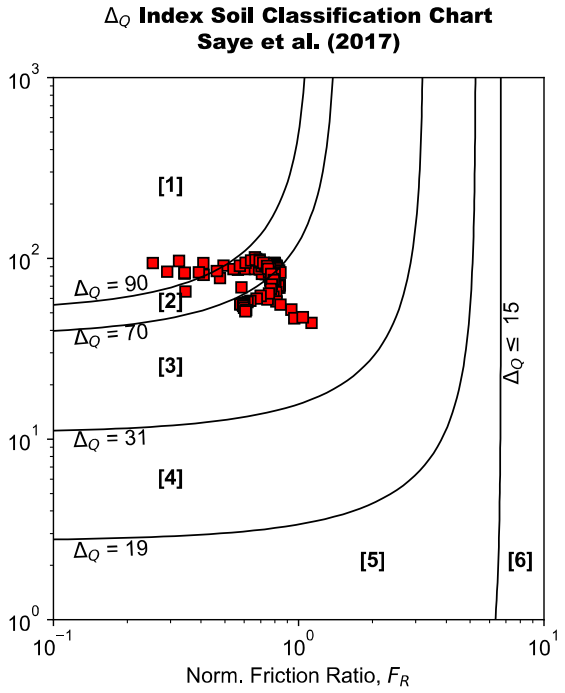

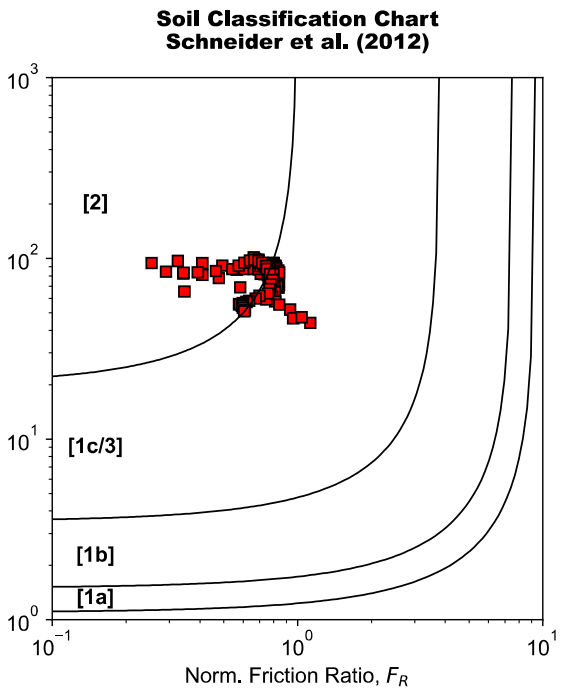

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CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
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Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-3: 42 ft to 52 ft
CPT-2 : (45.59709 , -122.61272)

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Figure
B-20

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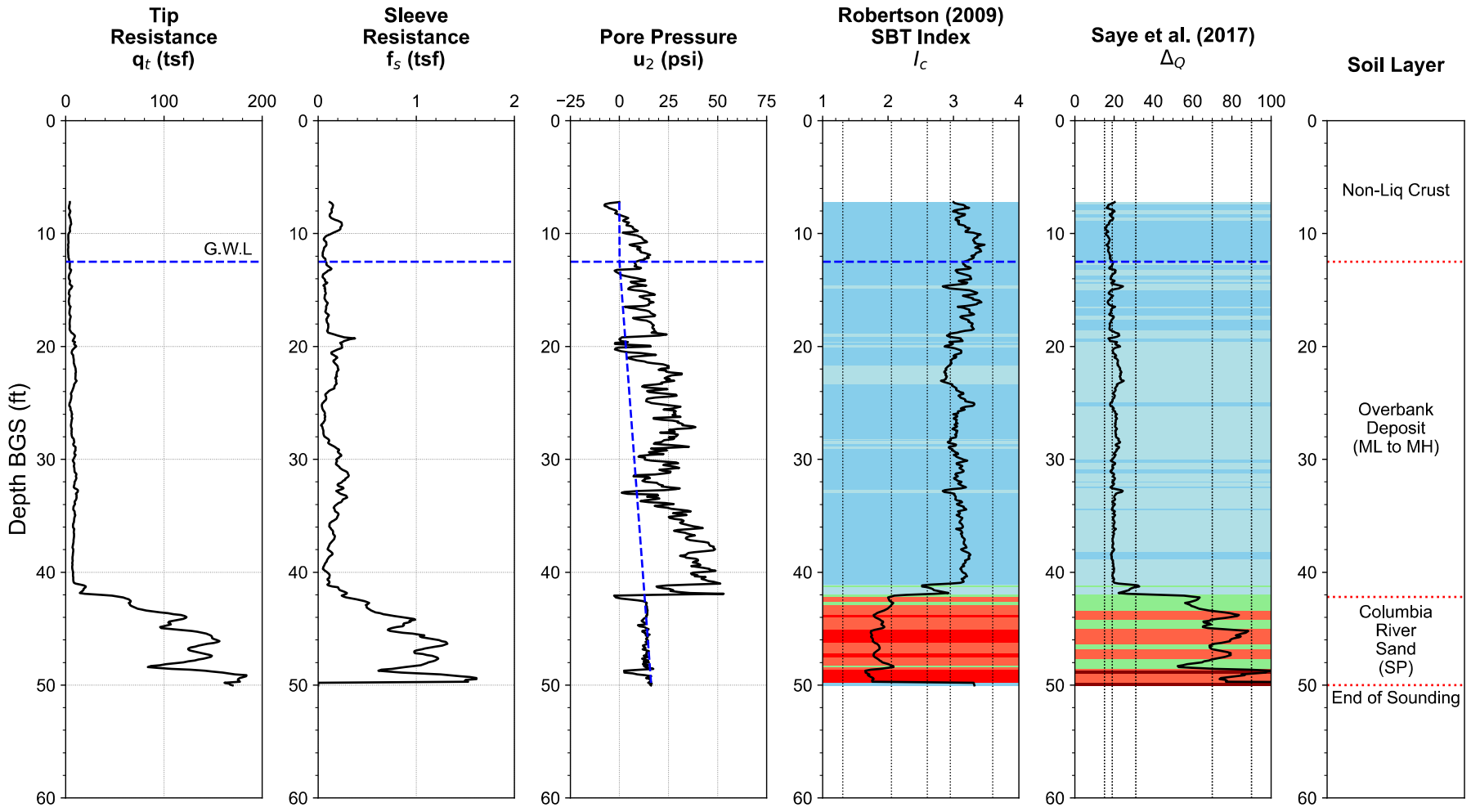

Robertson (2009) SBTn Zone:

- Gravelly Sands (I_c < 1.31)
- Clean sands (1.31 ≤ I_c < 1.8)
- Silty Sands (1.8 ≤ I_c < 2.05)
- Sand mixture: Sandy silt (2.05 ≤ I_c < 2.6)
- Silt mixture: Clayey silt to silty clay (2.6 ≤ I_c < 2.95)
- Clays (2.95 ≤ I_c ≤ 3.6)
- Organic Soils (I_c > 3.6)

Saye et al. (2017) Δ_Q Zone (Typical USCS):

- SP, SW (FC ≤ 5%, Δ_Q > 90)
- SP-SM, SP-SC (FC ≈ 5-12%, 70 ≤ Δ_Q < 90)
- SM, SC, GM, GC (FC ≈ 12-50%, 31 ≤ Δ_Q < 70)
- ML, CL (FC > 50%, D_{50} = 75μm, 19 ≤ Δ_Q < 31)
- MH, CH (Liquid Limit, w_L > 50, 15 ≤ Δ_Q < 19)
- OL, OH, Pt (Highly Organic Soil, Δ_Q < 15)

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Basic Measurement
CPT-3 : (45.59653 , -122.61285)

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Figure
B-21

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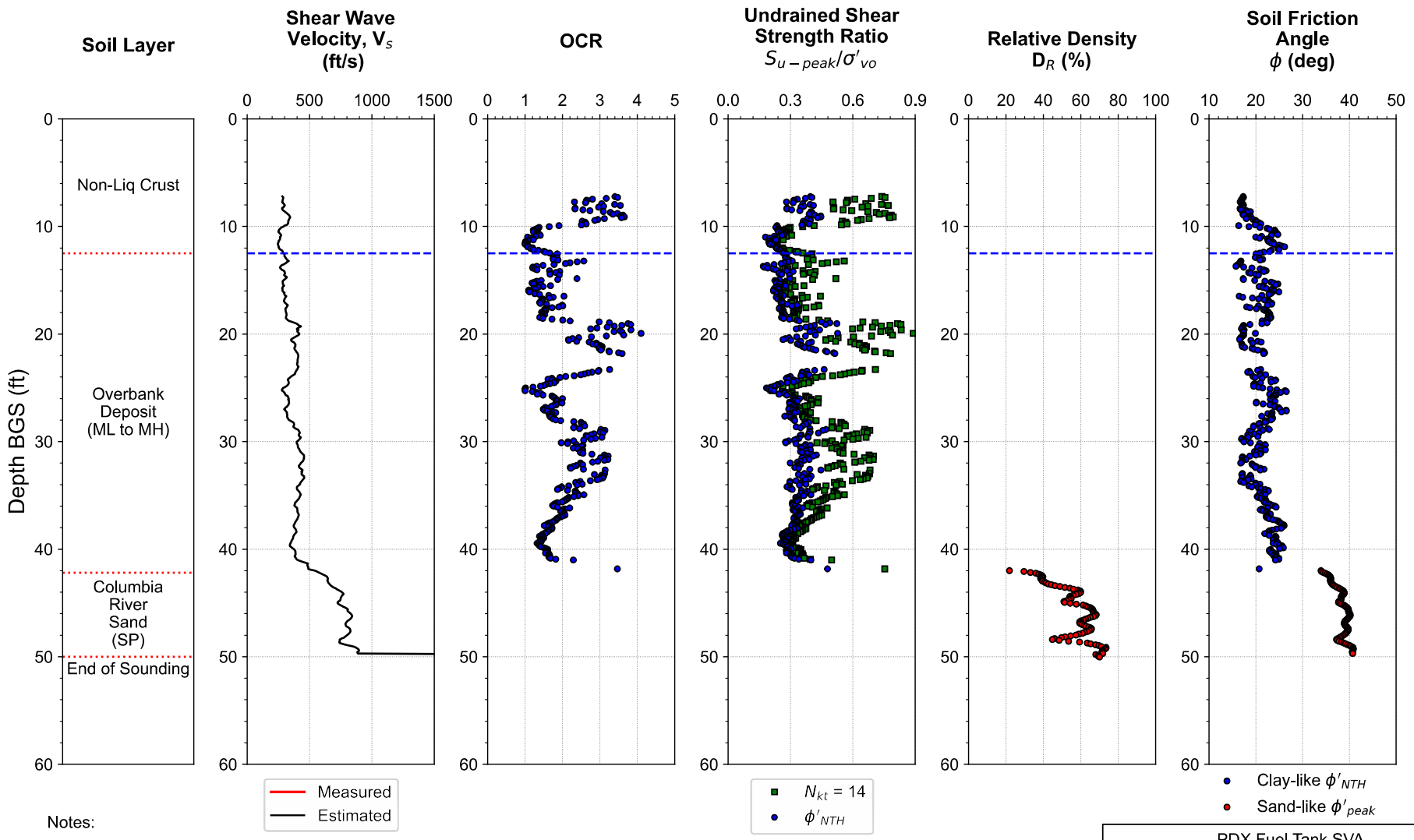

Notes:

1a. V_s is estimated using Robertson (2009) CPT-V_s Correlation
1b. Measured V_s is calculated using Slope method
2. OCR is determined using Agaiby & Mayne (2019) procedure
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3b. N_{kt} = 14 ; ϕ_{NTH} = Effective friction angles calculated using modified NTH method (Ouyang & Mayne 2019)
4. Relative Density is estimated using Idriss & Boulanger 2008, Jamiolkowski et al. 2001, and Kulhawy & Mayne 1991 with weighting average factor 0.4, 0.3, 0.3, respectively
5. ϕ_{peak} = Peak friction angle calculated using Robertson (2010) equation for sandy soils, assuming $\phi'_{cv} = 33^o$

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Engineering Properties
CPT-3 : (45.59653 , -122.61285)

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Figure
B-22

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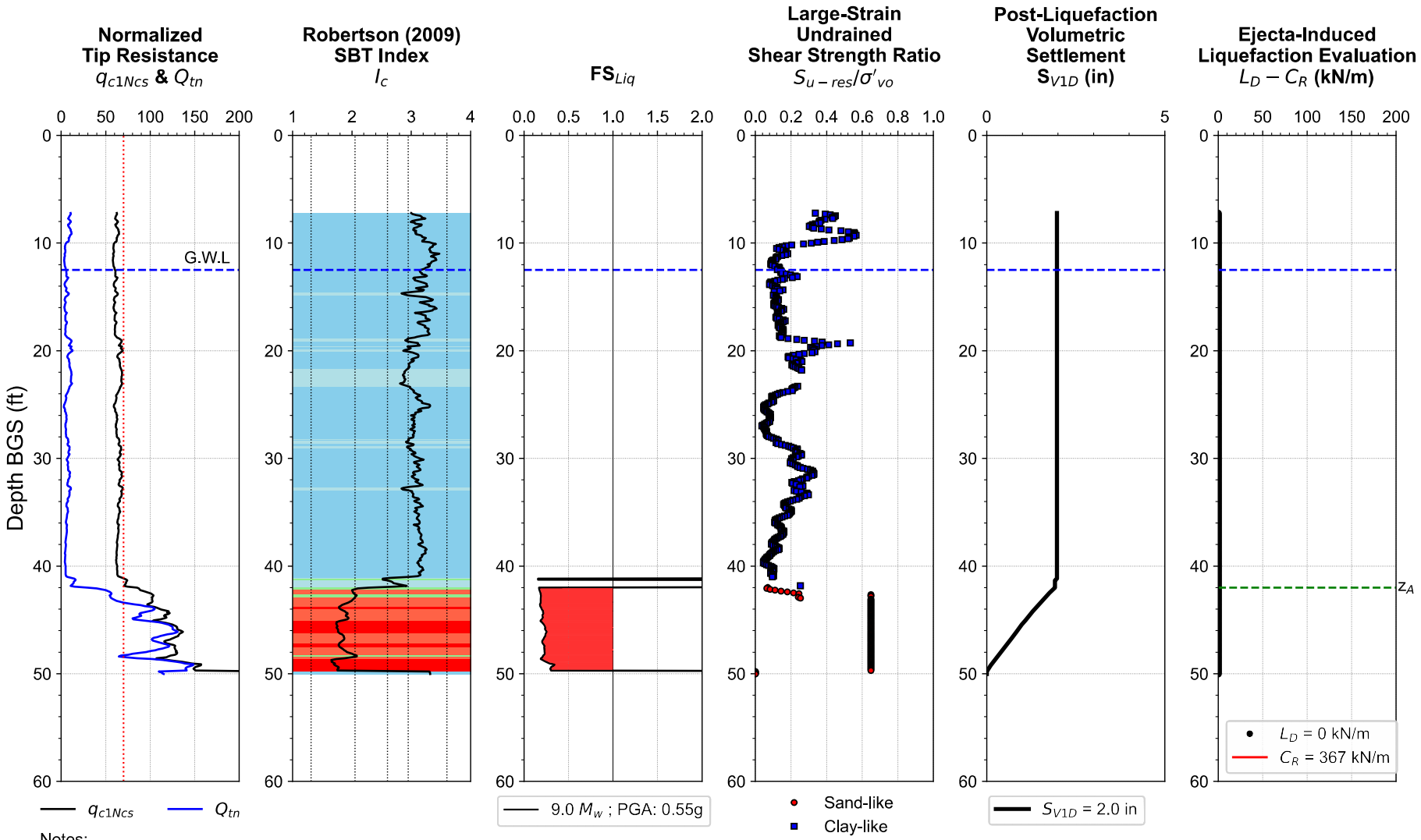

Notes:

1a. q_{c1Ncs}: Equivalent clean sand tip resistance following Boulanger & Idriss (2016) to estimate cyclic resistance ratio
1b. Q_{tn}: Normalized tip resistance following Robertson 2020 to estimate large-strain undrained shear strength ratio
2. FS$_{Liq}$ is calculated using Boulanger & Idriss (2016) with P_{Liq} = 0.15 ; I_{c-cut} = 2.6 ; C_{FC} = 0.0
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   Sand-like: Post-liquefied strength ratio (S_{u-liq}/σ'_{vo}) = tan (ϕ'_{cv}) for Q_{tn} > 70, where ϕ'_{cv} is assumed to be 33^o
   Clay-like: S_{u-res} is the same as remolded strength S_{u-rem}
4. Post-Liquefaction volumetric settlement is calculated using Zhang et al. (2002) procedure
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PDX Fuel Tank SVA
Portland, OR

CPT-based Liquefaction Evaluation
2475-yrs Hazard Level
CPT-3 : (45.59653 , -122.61285)

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Figure
B-23

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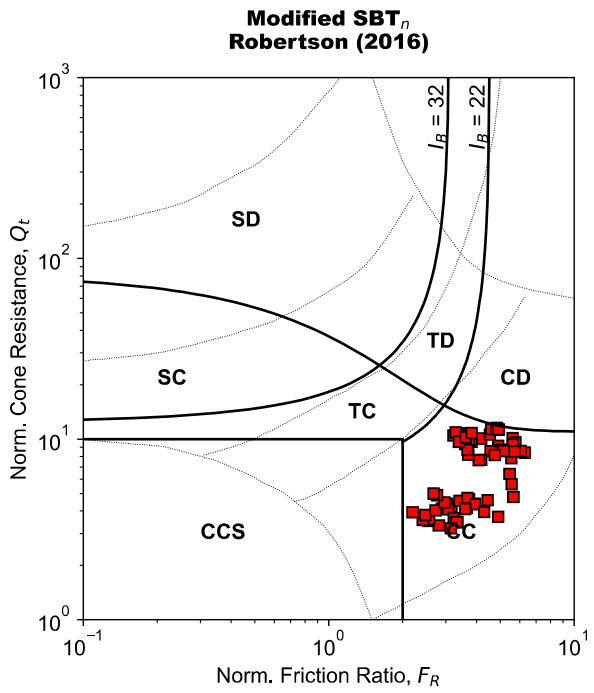

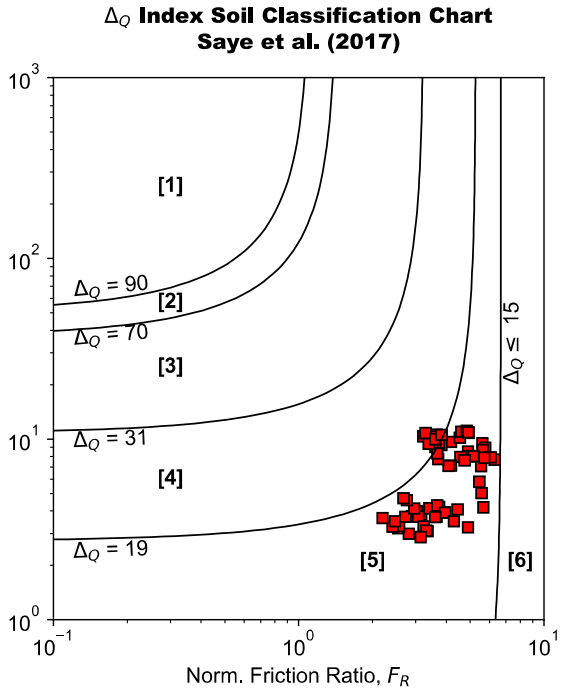

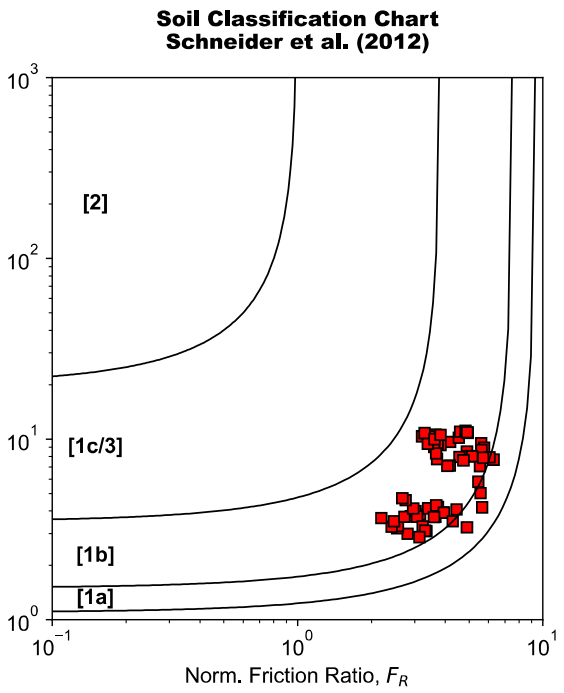

Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
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[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
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[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-1: 7 ft to 12 ft
CPT-3 : (45.59653 , -122.61285)

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Figure
B-24

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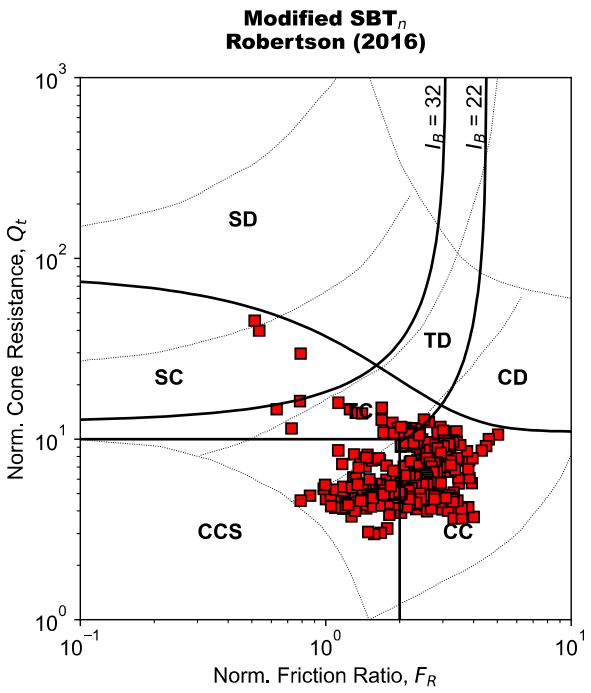

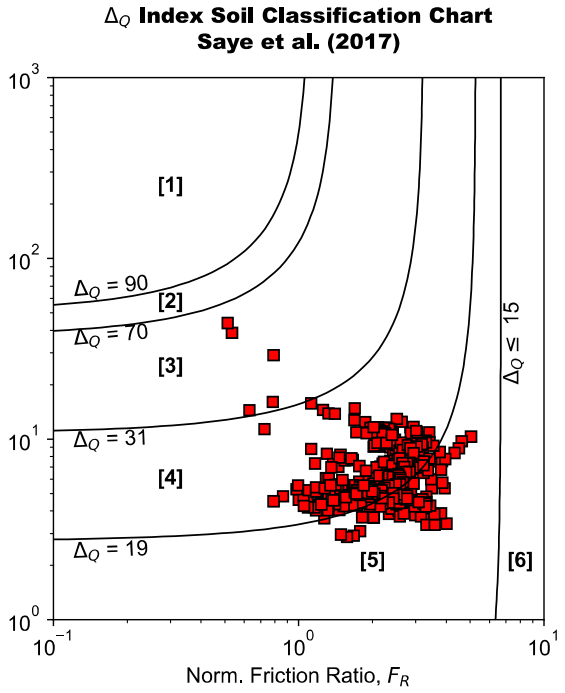

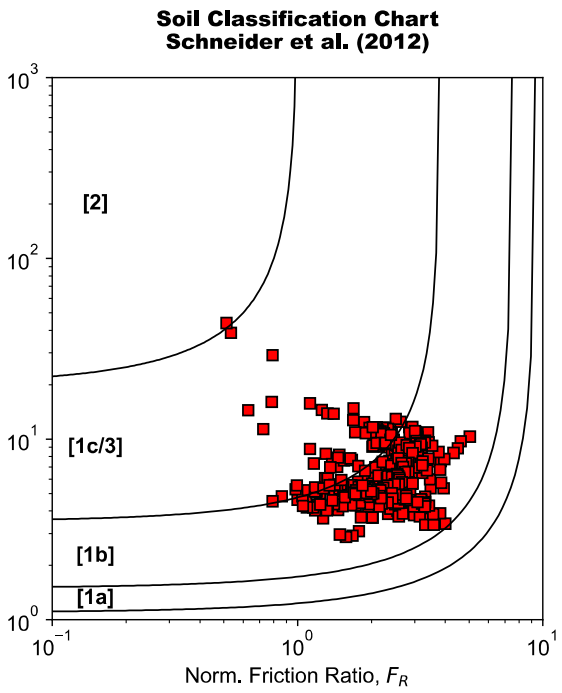

Robertson (2016) SBTn Zone:
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TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

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Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-2: 12 ft to 42 ft
CPT-3 : (45.59653 , -122.61285)

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Figure
B-25

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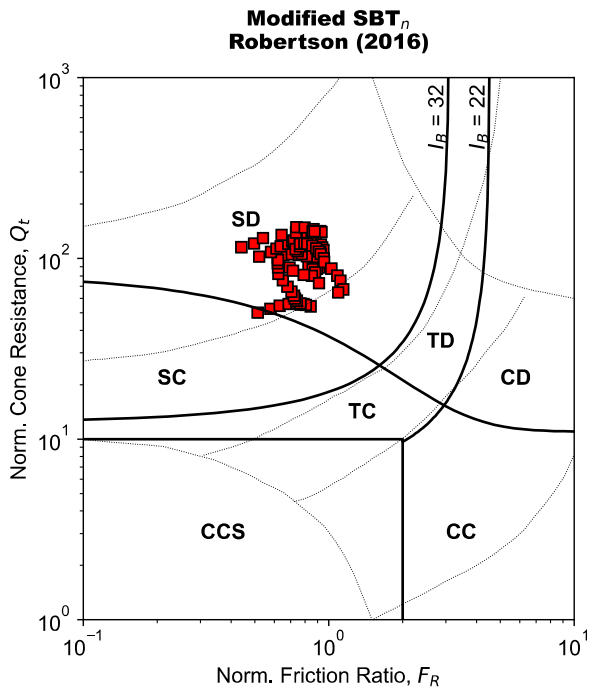

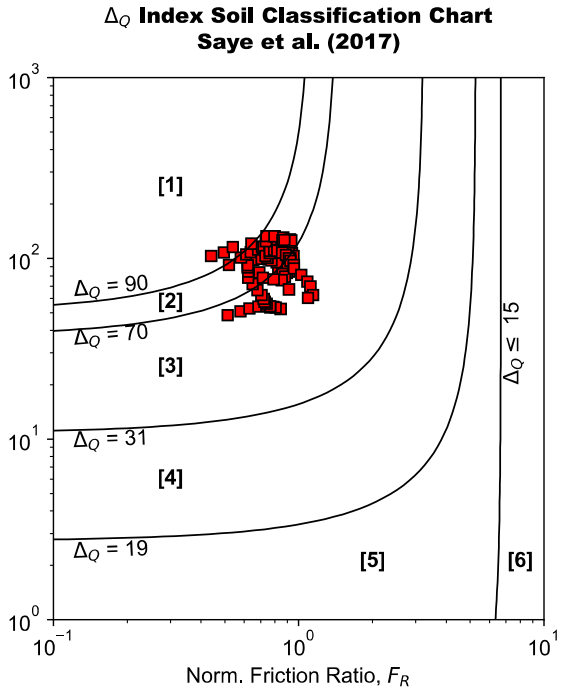

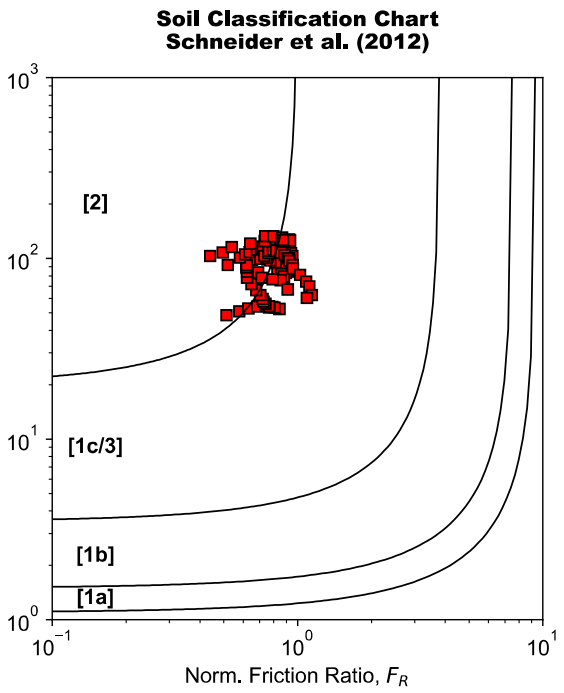

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PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-3: 42 ft to 50 ft
CPT-3 : (45.59653 , -122.61285)

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Figure
B-26

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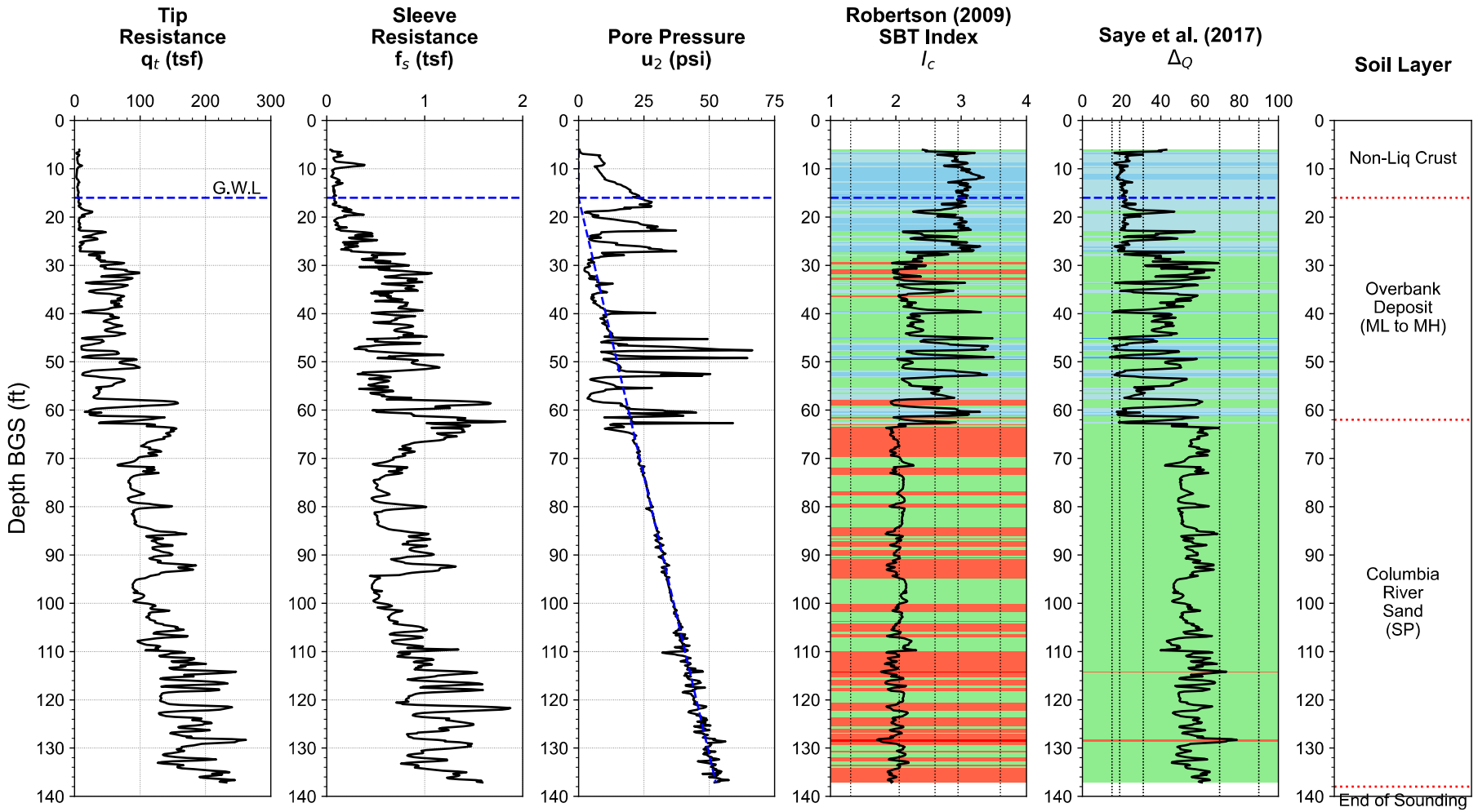

Robertson (2009) SBTn Zone:

- Gravelly Sands ($I_c < 1.31$)
- Clean sands ($1.31 \leq I_c < 1.8$)
- Silty Sands ($1.8 \leq I_c < 2.05$)
- Sand mixture: Sandy silt ($2.05 \leq I_c < 2.6$)
- Silt mixture: Clayey silt to silty clay ($2.6 \leq I_c < 2.95$)
- Clays ($2.95 \leq I_c \leq 3.6$)
- Organic Soils ($I_c > 3.6$)

Saye et al. (2017) Δ_Q Zone (Typical USCS):

- SP, SW (FC ≤ 5%, $\Delta_Q > 90$)
- SP-SM, SP-SC (FC ≈ 5-12%, $70 \leq \Delta_Q < 90$)
- SM, SC, GM, GC (FC ≈ 12-50%, $31 \leq \Delta_Q < 70$)
- ML, CL (FC > 50%, $D_{50} = 75\mu m$, $19 \leq \Delta_Q < 31$)
- MH, CH (Liquid Limit, $w_L > 50$, $15 \leq \Delta_Q < 19$)
- OL, OH, Pt (Highly Organic Soil, $\Delta_Q < 15$)

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Basic Measurement
SCPT-4 : (45.597566 , -122.614008)

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Figure
B-27

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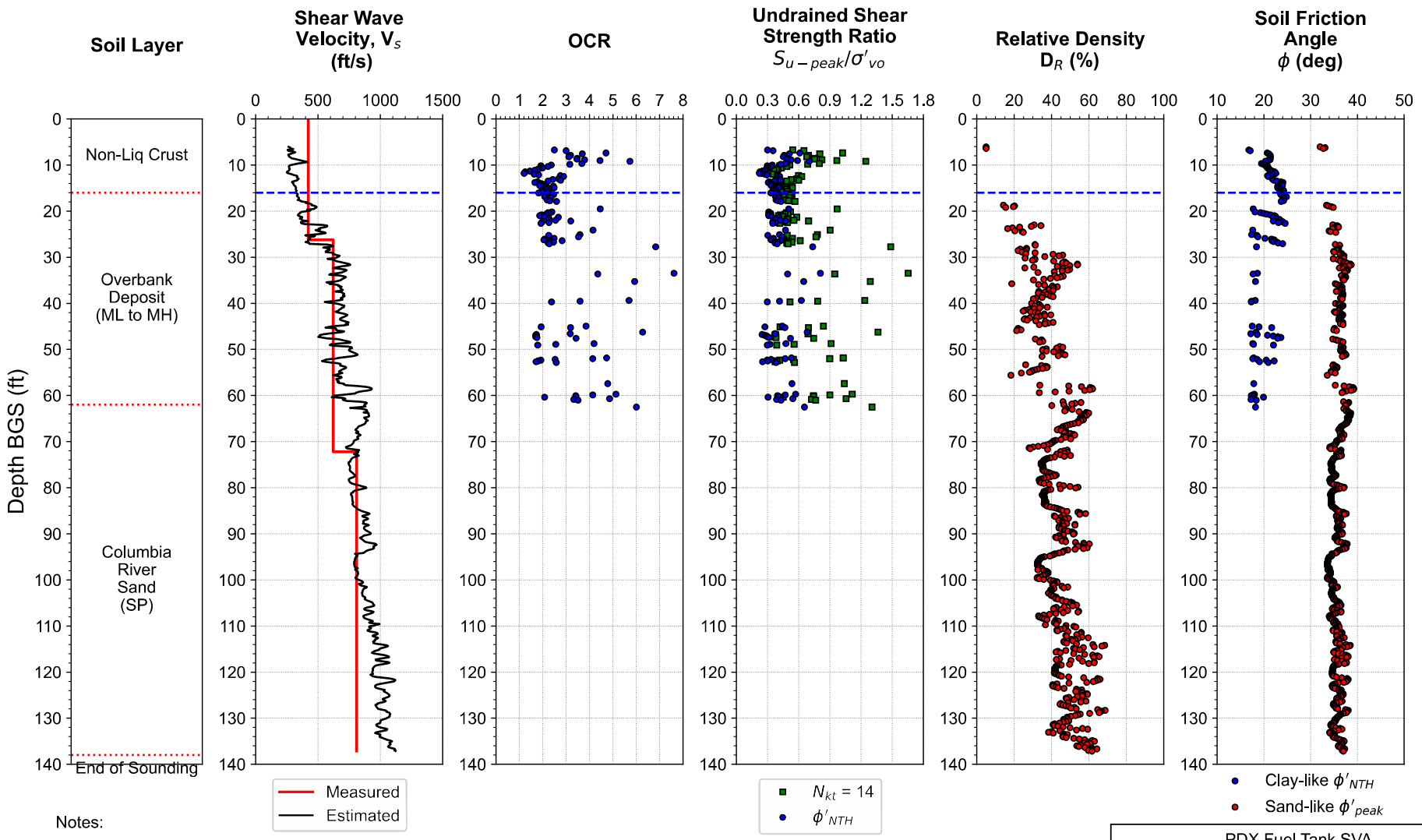

Notes:

1a. V_s is estimated using Robertson (2009) CPT-V_s Correlation
1b. Measured V_s is calculated using Slope method
2. OCR is determined using Agaiby & Mayne (2019) procedure
3a. S_{u-peak}/σ'_{vo} = ($q_t - \sigma_{vo}$) / ($N_{kt}\sigma'_{vo}$) and S_{u-peak}/σ'_{vo} = 0.5 sin(ϕ'_{NTH}) OCR $^{0.8}$
3b. N_{kt} = 14 ; ϕ_{NTH} = Effective friction angles calculated using modified NTH method (Ouyang & Mayne 2019)
4. Relative Density is estimated using Idriss & Boulanger 2008, Jamiolkowski et al. 2001, and Kulhawy & Mayne 1991 with weighting average factor 0.4, 0.3, 0.3, respectively
5. ϕ_{peak} = Peak friction angle calculated using Robertson (2010) equation for sandy soils, assuming ϕ'_{cv} = 33°

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Engineering Properties
SCPT-4 : (45.597566 , -122.614008)

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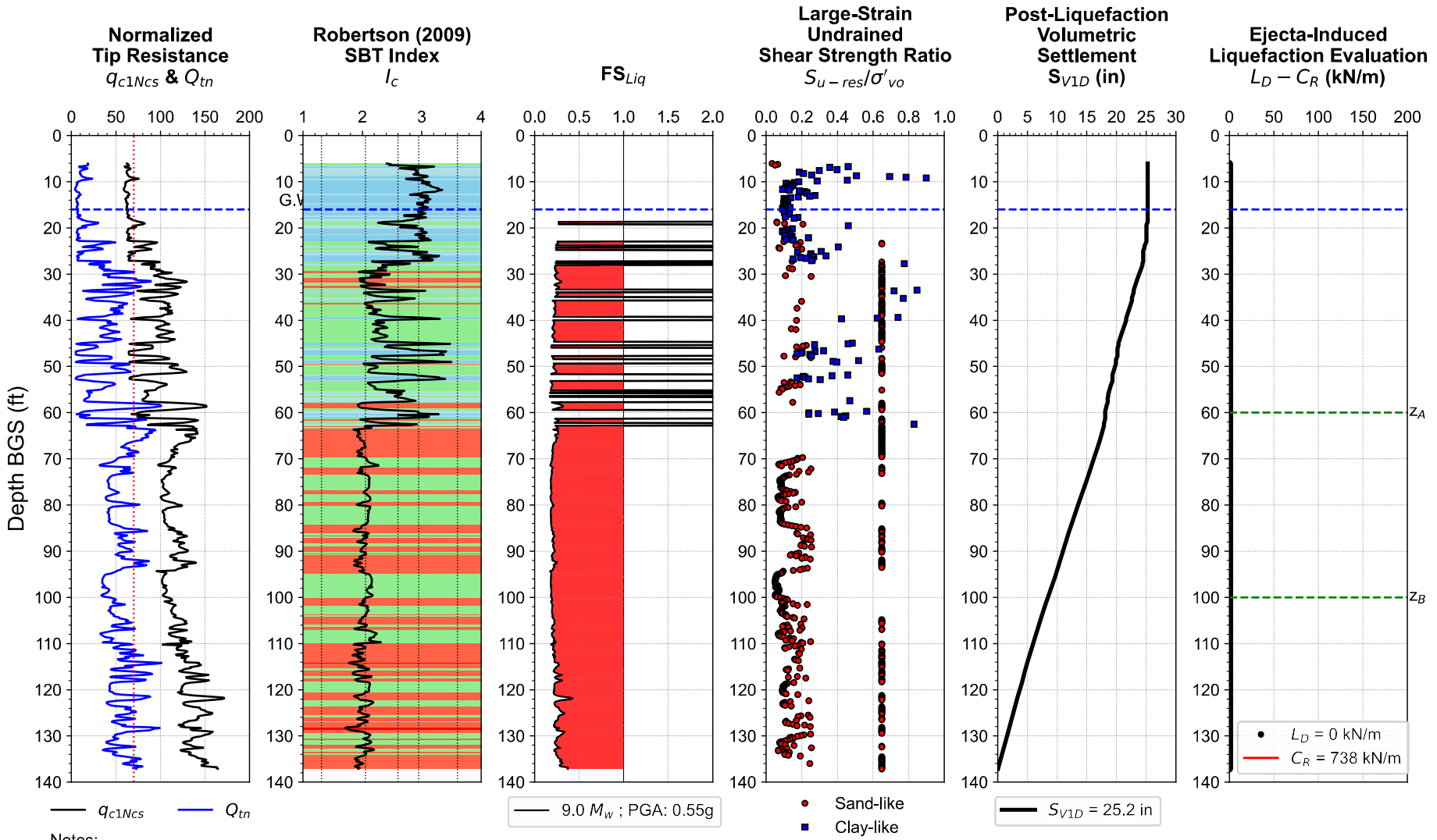
Figure
B-28



Notes:

1a. q_{c1Ncs}: Equivalent clean sand tip resistance following Boulanger & Idriss (2016) to estimate cyclic resistance ratio
1b. Q_{tn}: Normalized tip resistance following Robertson 2020 to estimate large-strain undrained shear strength ratio
2. FS_{Liq} is calculated using Boulanger & Idriss (2016) with P_{Liq} = 0.15 ; I_{c-cut} = 2.6 ; C_{FC} = 0.0
3. Large-strain undrained shear strength ratio is estimated using Robertson (2020) for clay-like and sand-like soil:
   Sand-like: Post-liquefied strength ratio (S_{u-liq}/σ'_{vo}) = tan (ϕ'_{cv}) for Q_{tn} > 70, where ϕ'_{cv} is assumed to be 33°
   Clay-like: S_{u-res} is the same as remolded strength S_{u-rem}
4. Post-Liquefaction volumetric settlement is calculated using Zhang et al. (2002) procedure
5. Ejecta-induced settlement & severity are calculated based on Hutabarat & Bray (2022)

PDX Fuel Tank SVA
Portland, OR

CPT-based Liquefaction Evaluation
2475-yrs Hazard Level
SCPT-4 : (45.597566 , -122.614008)

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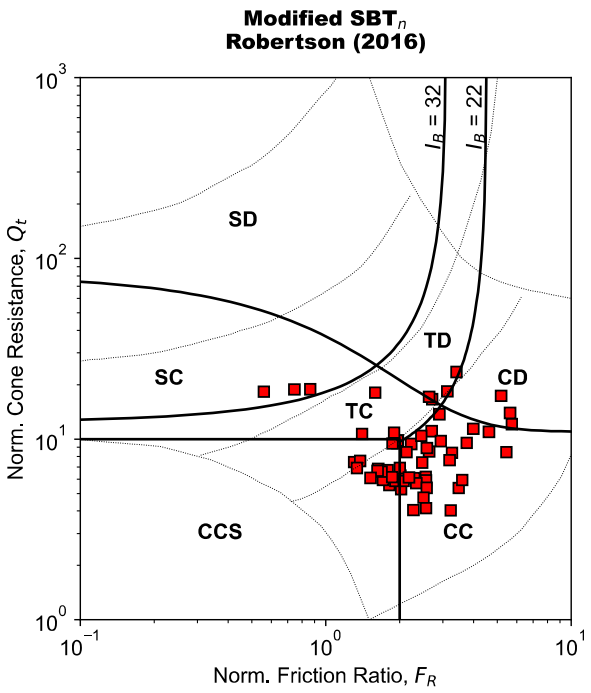
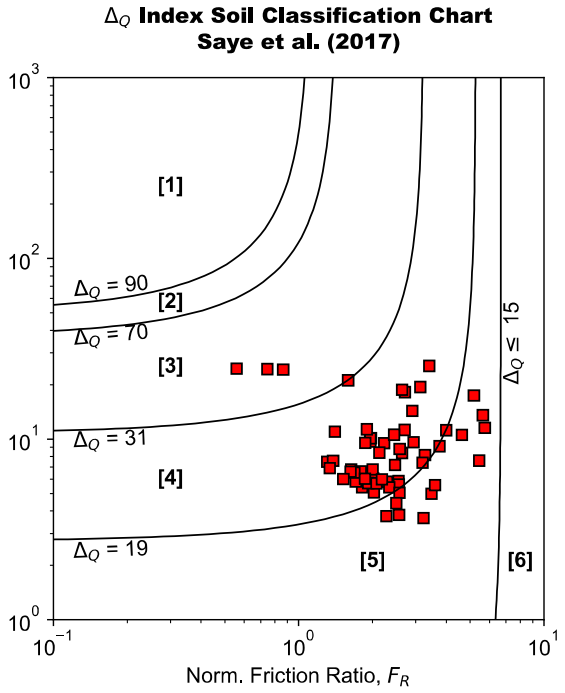
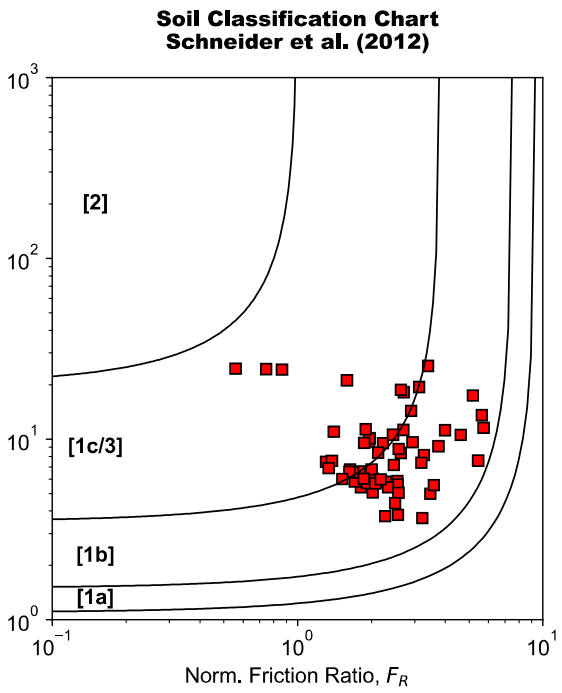
Figure
B-29







Robertson (2016) SBTn Zone:
SD = Sand-like - Dilative
SC = Sand-like - Contractive
TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-1: 6 ft to 16 ft
SCPT-4 : (45.597566 , -122.614008)

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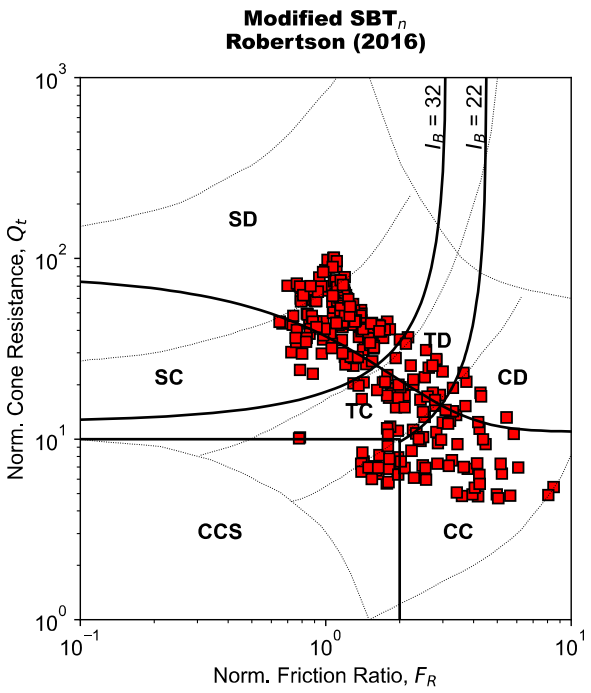
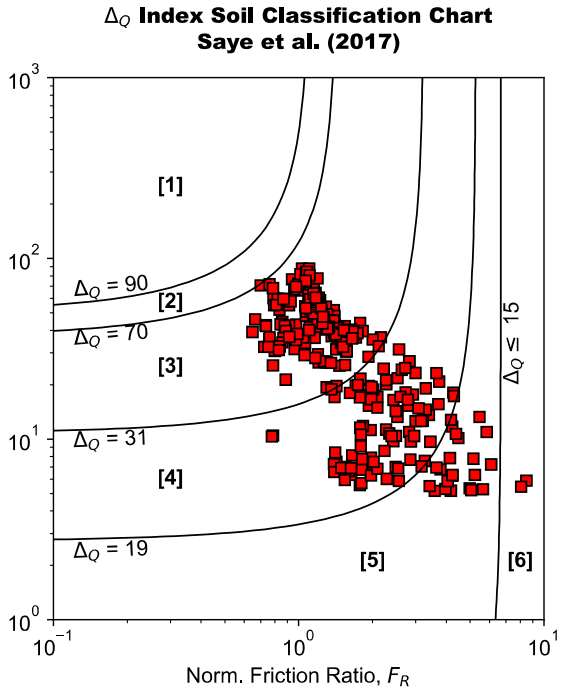
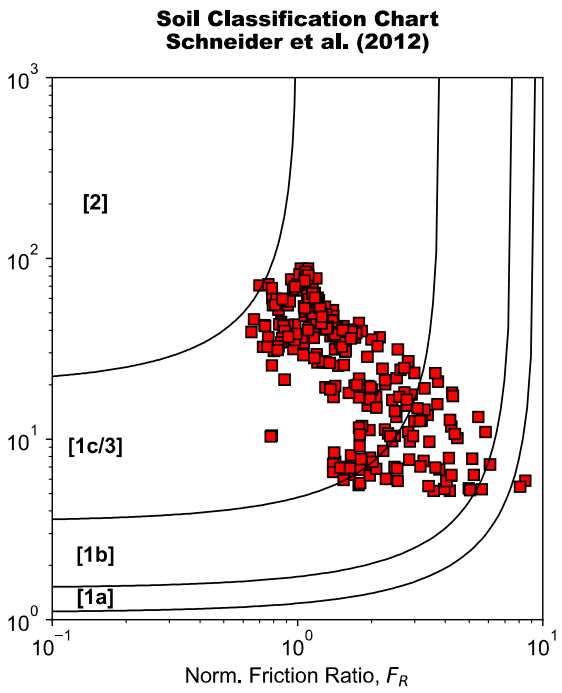
Figure
B-30







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PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-2: 16 ft to 62 ft
SCPT-4 : (45.597566 , -122.614008)

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Figure
B-31

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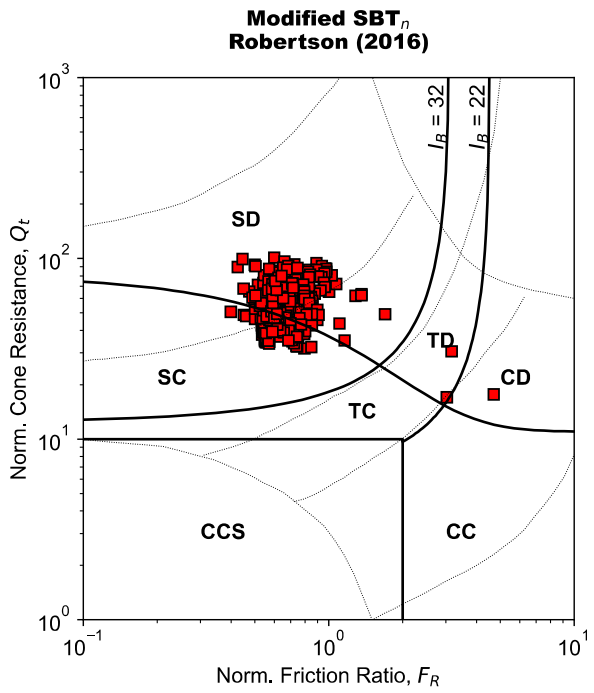

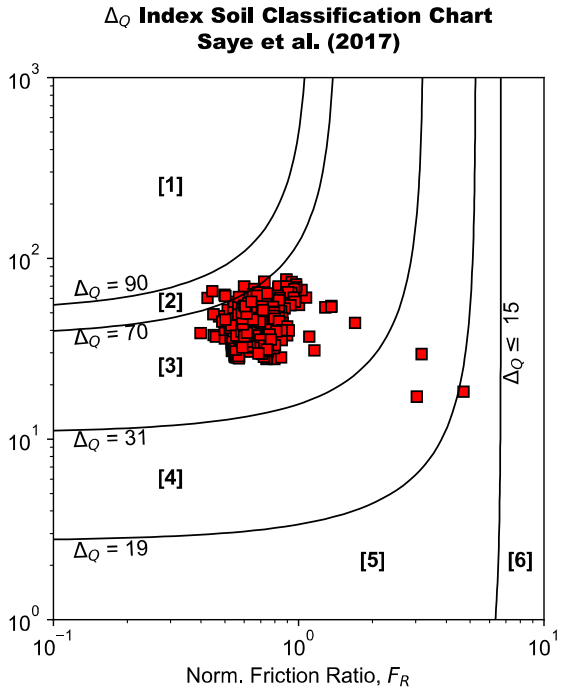

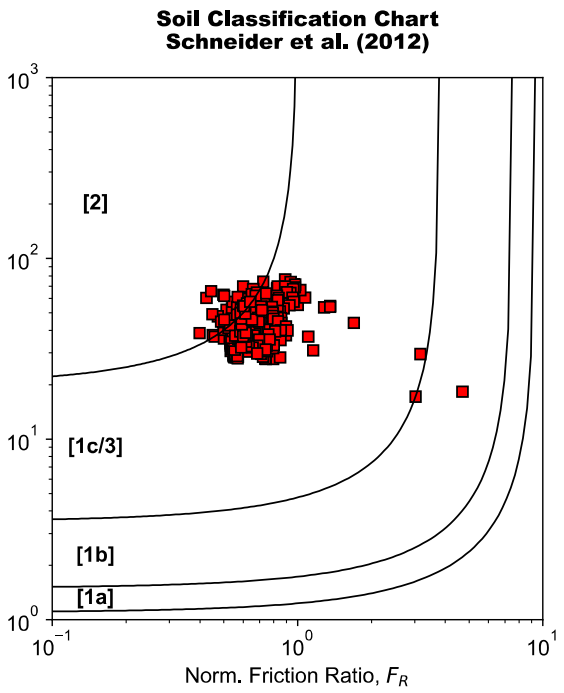

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TC = Transitional - Contractive
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Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-3: 62 ft to 137 ft
SCPT-4 : (45.597566 , -122.614008)

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Figure
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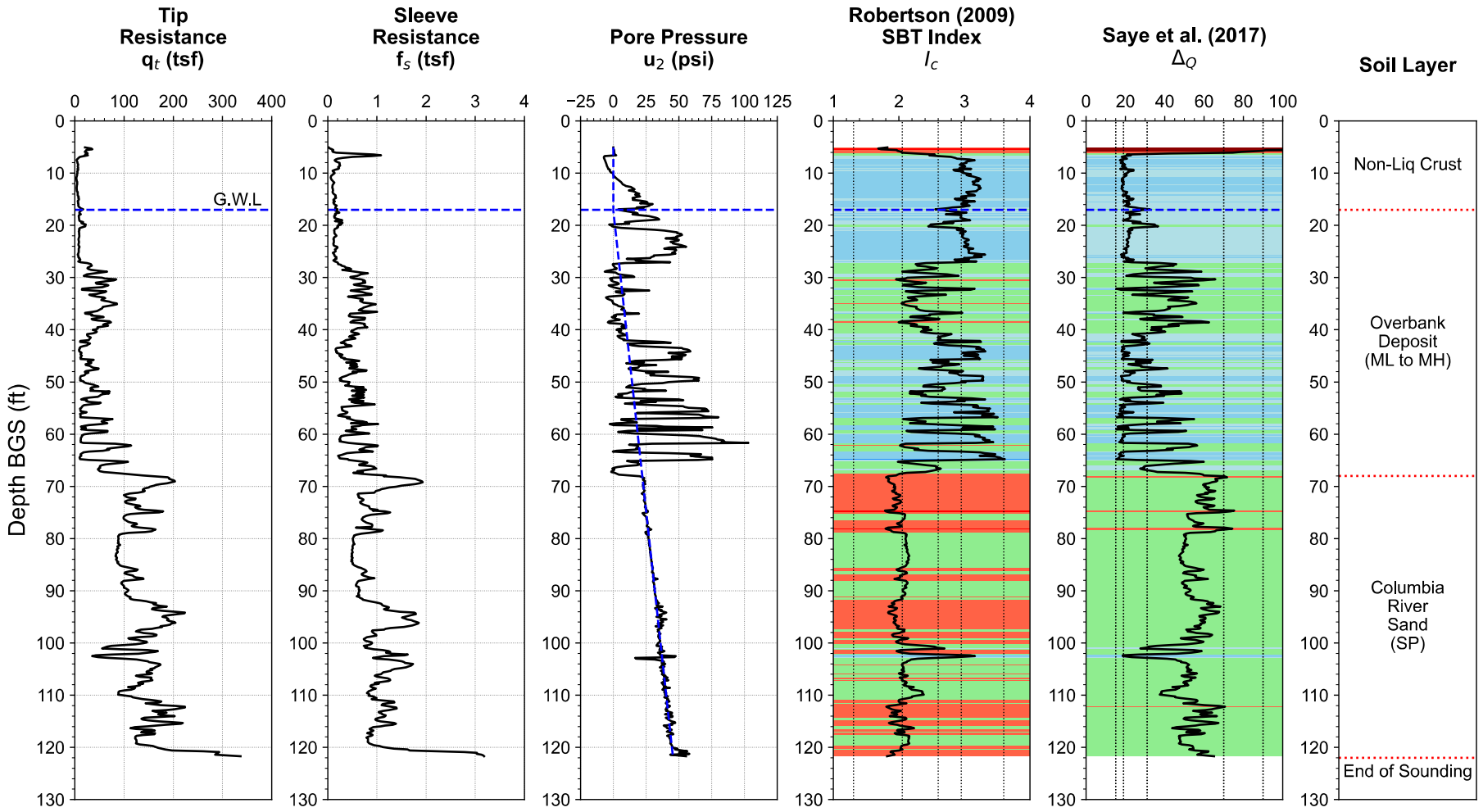

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- Clays (2.95 ≤ I_c ≤ 3.6)
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- MH, CH (Liquid Limit, w_L > 50, 15 ≤ Δ_Q < 19)
- OL, OH, Pt (Highly Organic Soil, Δ_Q < 15)

PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Basic Measurement
SCPT-6 : (45.597485 , -122.612872)

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Figure
B-33

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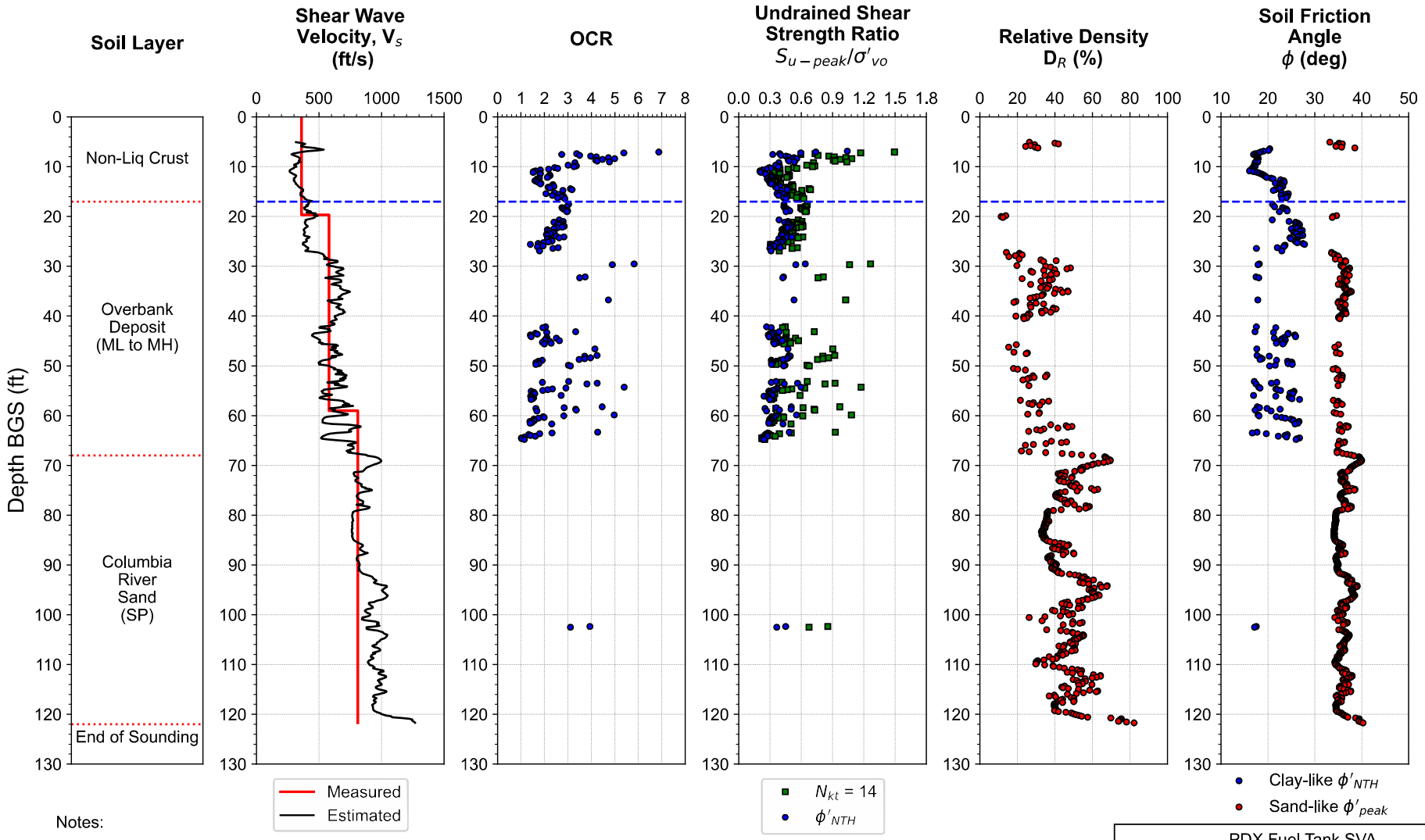

Notes:

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1b. Measured V_s is calculated using Slope method
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PDX Fuel Tank SVA
Portland, OR

CPT-Based Interpretation Summary
Engineering Properties
SCPT-6 : (45.597485 , -122.612872)

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Figure
B-34

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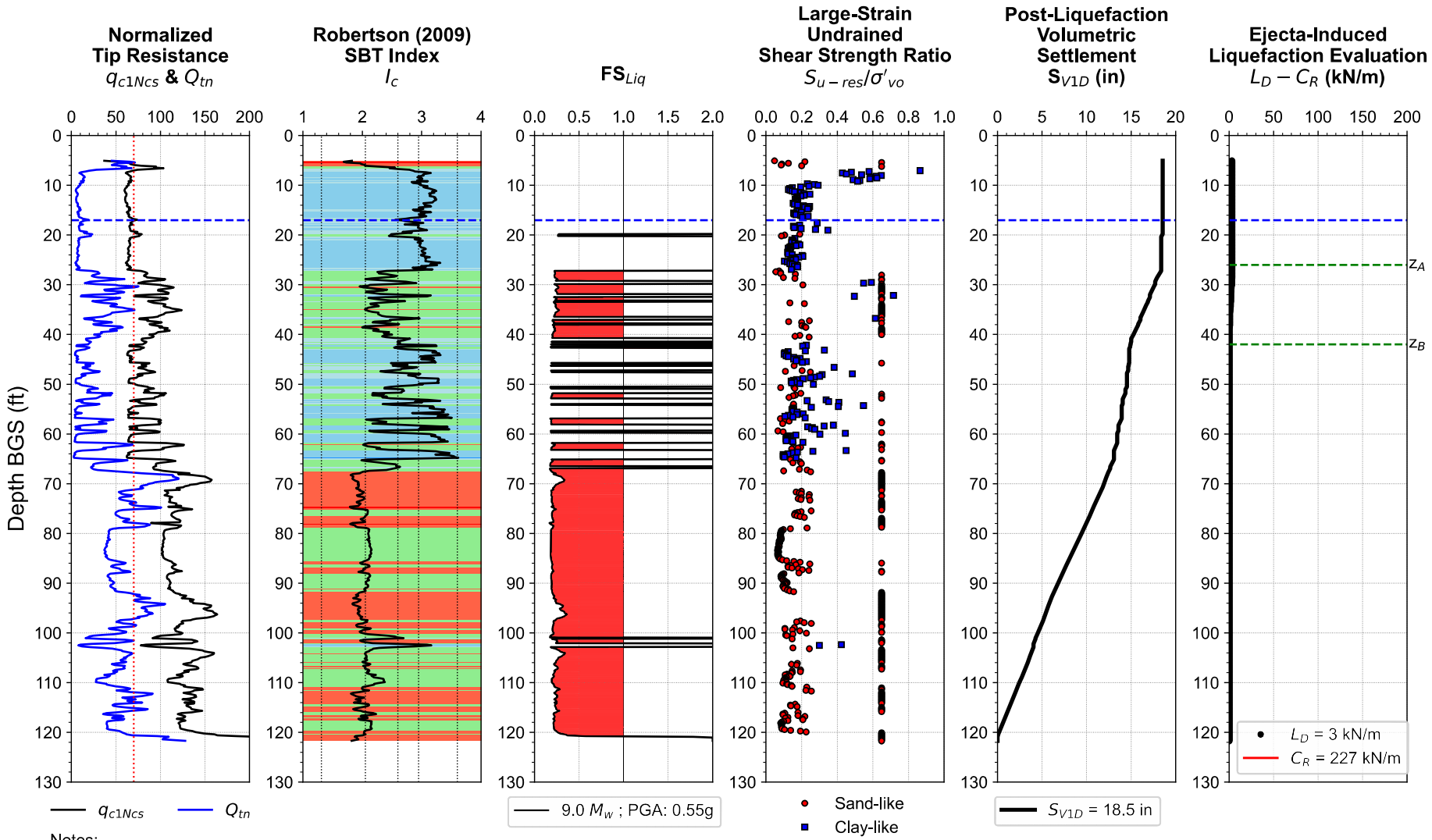

Notes:

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PDX Fuel Tank SVA
Portland, OR

CPT-based Liquefaction Evaluation
2475-yrs Hazard Level
SCPT-6 : (45.597485 , -122.612872)

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Figure
B-35

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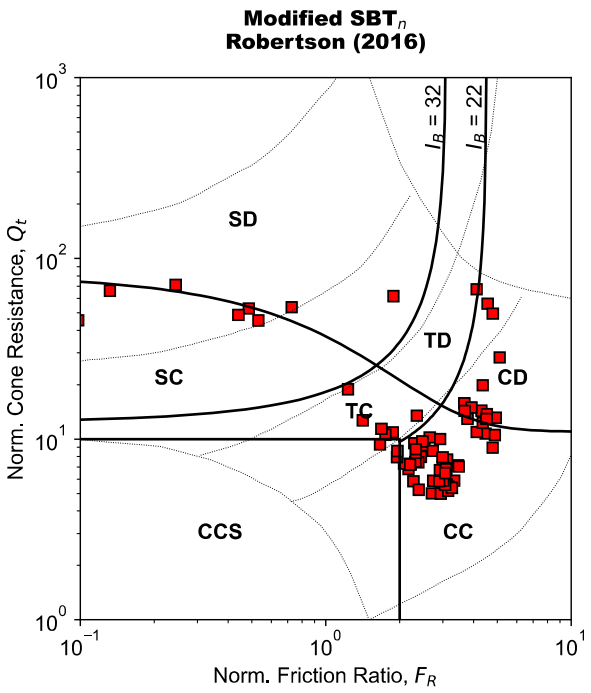

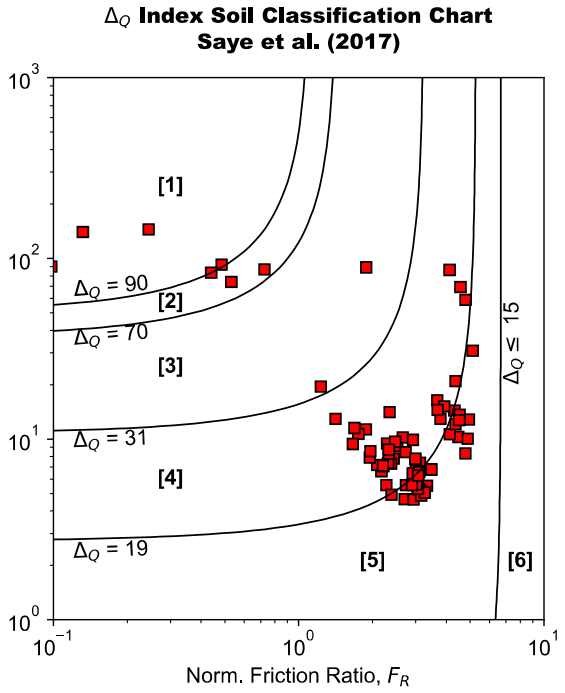

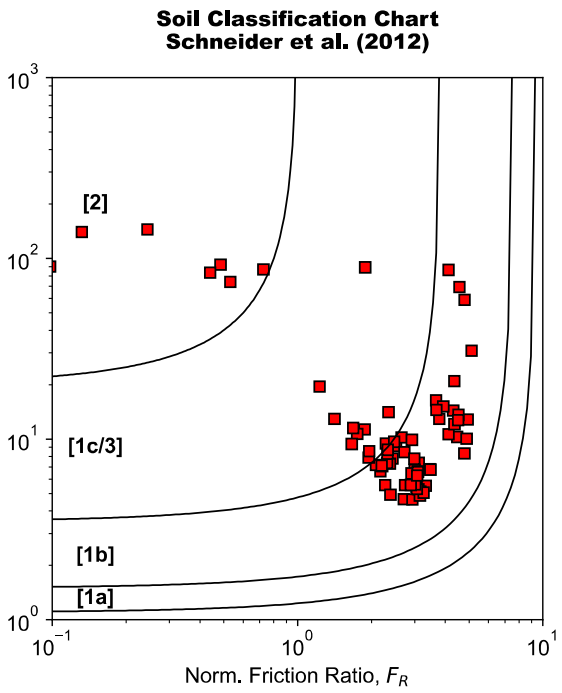

Robertson (2016) SBTn Zone:
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TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
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[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
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[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
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[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-1: 5 ft to 17 ft
SCPT-6 : (45.597485 , -122.612872)

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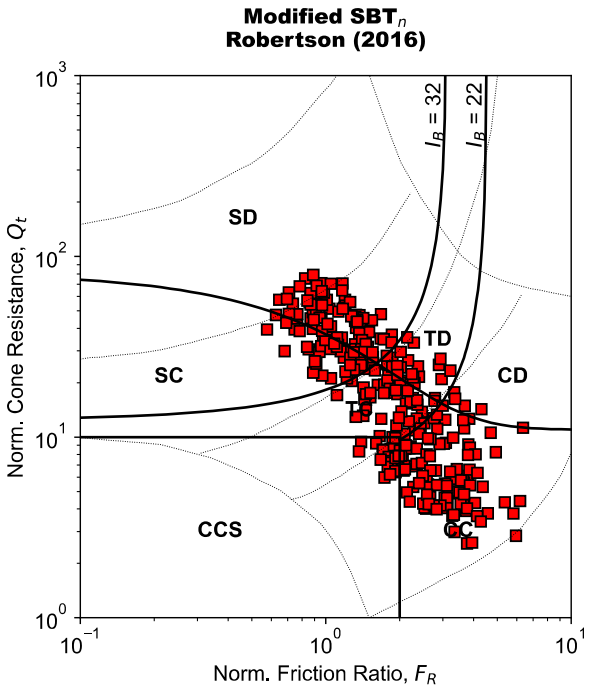
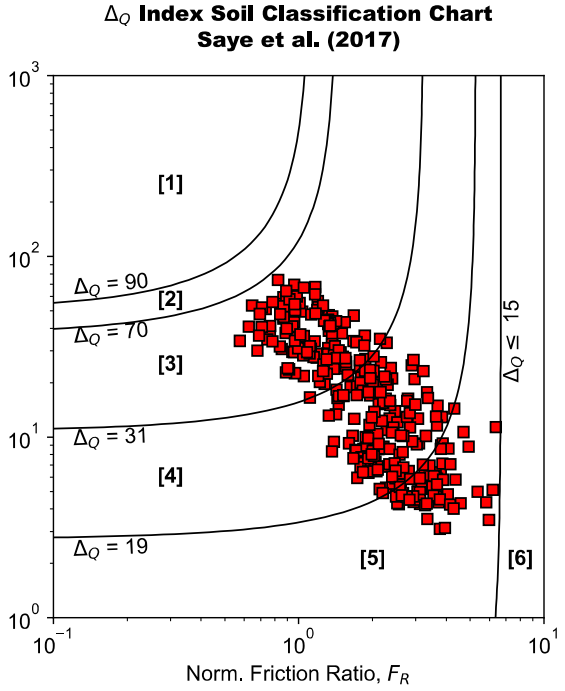
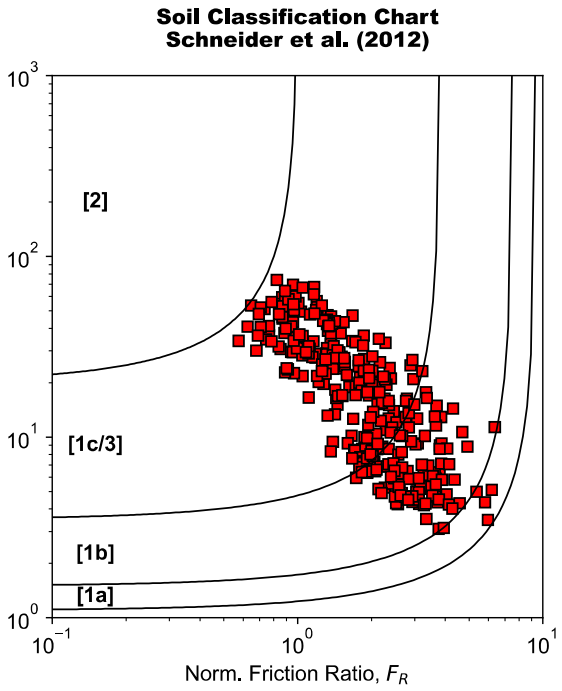
Figure
B-36







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TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
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PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-2: 17 ft to 68 ft
SCPT-6 : (45.597485 , -122.612872)

0204679-001 July 2023

HALEY ALDRICH

Figure
B-37

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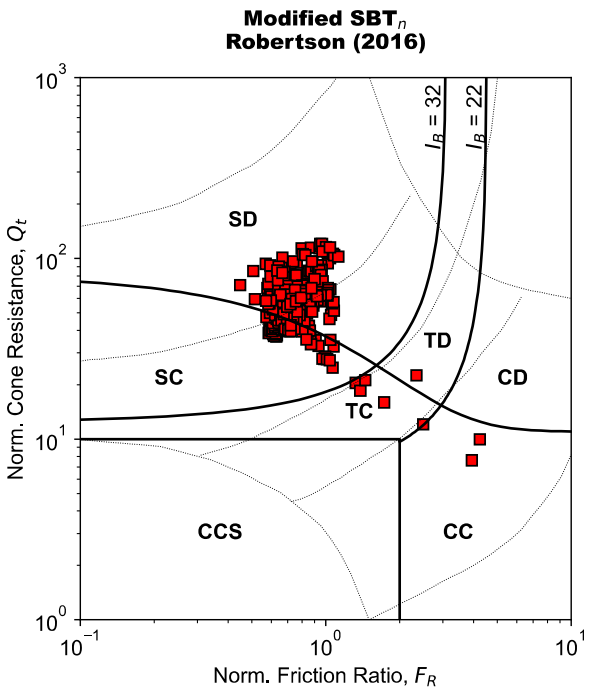

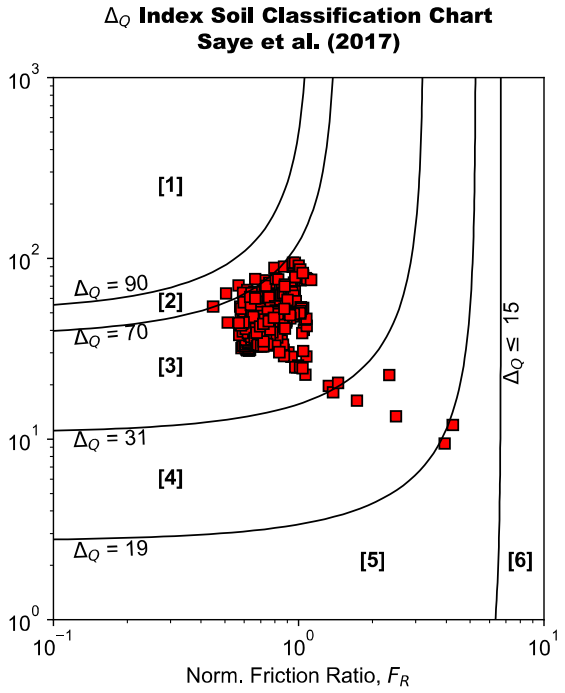

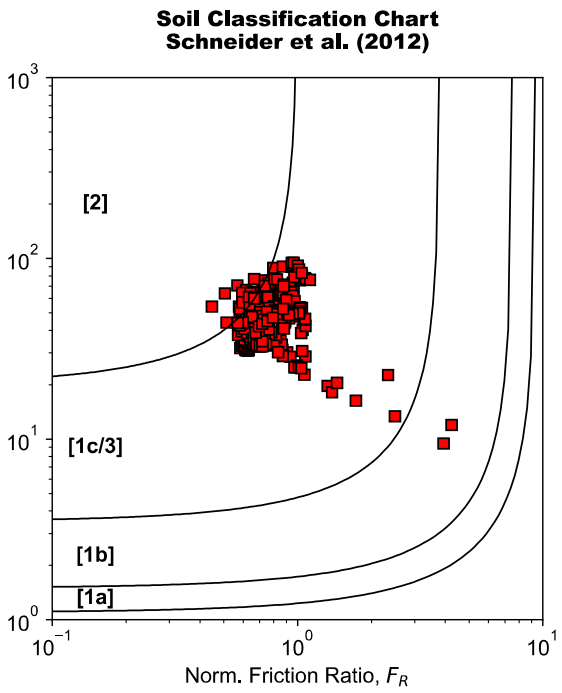

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TD = Transitional - Dilative
TC = Transitional - Contractive
CD = Clay-like - Dilative
CC = Clay-like - Contractive
CCS = Clay-like Contractive Sensitive

Typical USCS (Saye et al. 2017):
[1] $\Delta_Q > 90$ = SP, SW (FC $\leq$ 5%)
[2] $70 \leq \Delta_Q < 90$ = SP-SM, SP-SC (FC $\approx$ 5-12%)
[3] $31 \leq \Delta_Q < 70$ = SM, SC, GM, GC (FC $\approx$ 12-50%)
[4] $19 \leq \Delta_Q < 31$ = ML, CL (FC > 50%, $D_{50} = 75\mu$m)
[5] $15 \leq \Delta_Q < 19$ = MH, CH (Liquid Limit, $w_L > 50$)
[6] $\Delta_Q < 15$ = OL, OH, Pt (Highly Organic Soil)

Classification Zone Schneider et al. 2012:
Zone-[1a] = Low-I_R clays (I_R = G/S_u)
Zone-[1b] = Clays
Zone-[1c] = Sensitive clays
Zone-[3] = Silts and transitional soils
Zone-[2] = Essentially drained sands

PDX Fuel Tank SVA
Portland, OR

Soil Classification Chart
Layer-3: 68 ft to 122 ft
SCPT-6 : (45.597485 , -122.612872)

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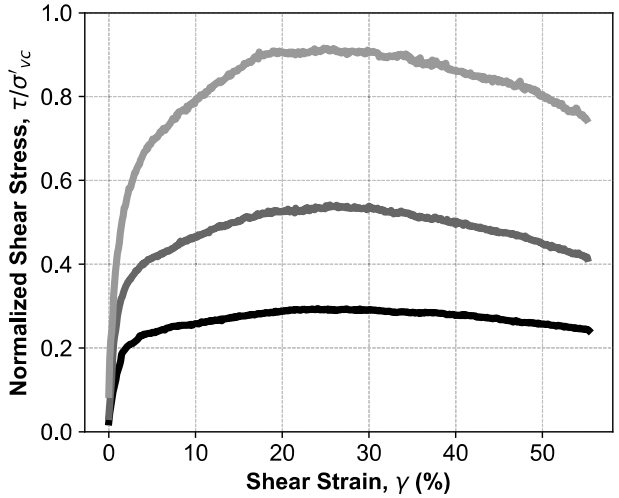
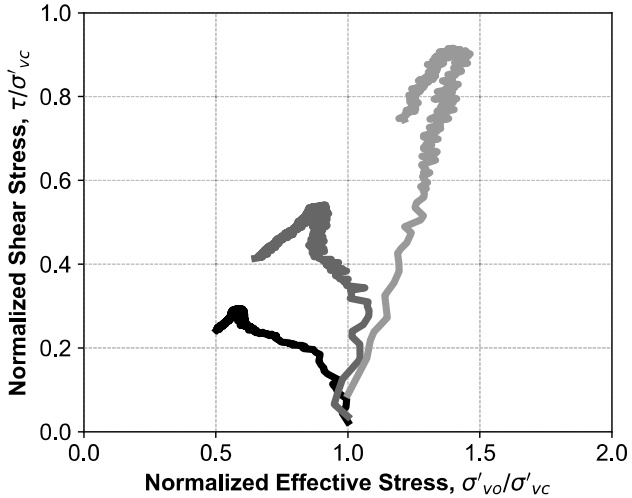
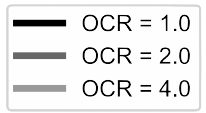
Figure
B-38

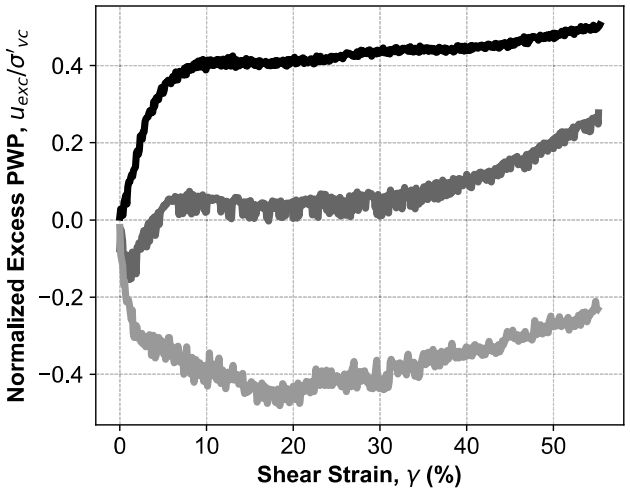
APPENDIX C
Summary of Interpreted Laboratory Testing Results

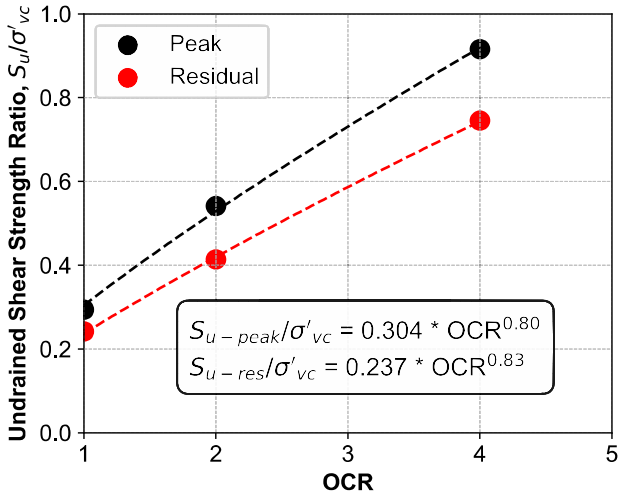
A. Constant Rate Strain Consolidation Results
B. Direct Simple Shear Test Results
C. Cyclic Direct Simple Shear Test Results
D. Index Testing











Test Date = 5/12/2023

Depth = 30 feet
σ'_{vc-1} = 5957 psf
σ'_{vc-2} = 3243 psf
σ'_{vc-3} = 1534 psf
$\sigma'_{vo-field}$ = 2100 psf
σ'_{pc} = 4500 - 5200 psf
Plasticity Index = TBD

Notes:

1. Specimen-1 was consolidated up to 6000 psf (OCR = 1), then shearing was performed
2. Specimen-2 was consolidated up to 6500 psf, unload to 3250 psf (OCR = 2), then shearing was performed
3. Specimen-3 was consolidated up to 6000 psf, unload to 1500 psf (OCR = 4), then shearing was performed
4. Based on ASTM D6528-17 Standard Test Metod for Consolidated Undrained DSS Testing
5. The normalized undrained shear strength vs OCR is determined using power-law regression

PDX Fuel Tank SVA
Portland, OR

Summary of Test Results
Monotonic Direct Simple Shear
Sample B2-U8 (Depth : 30 ft)

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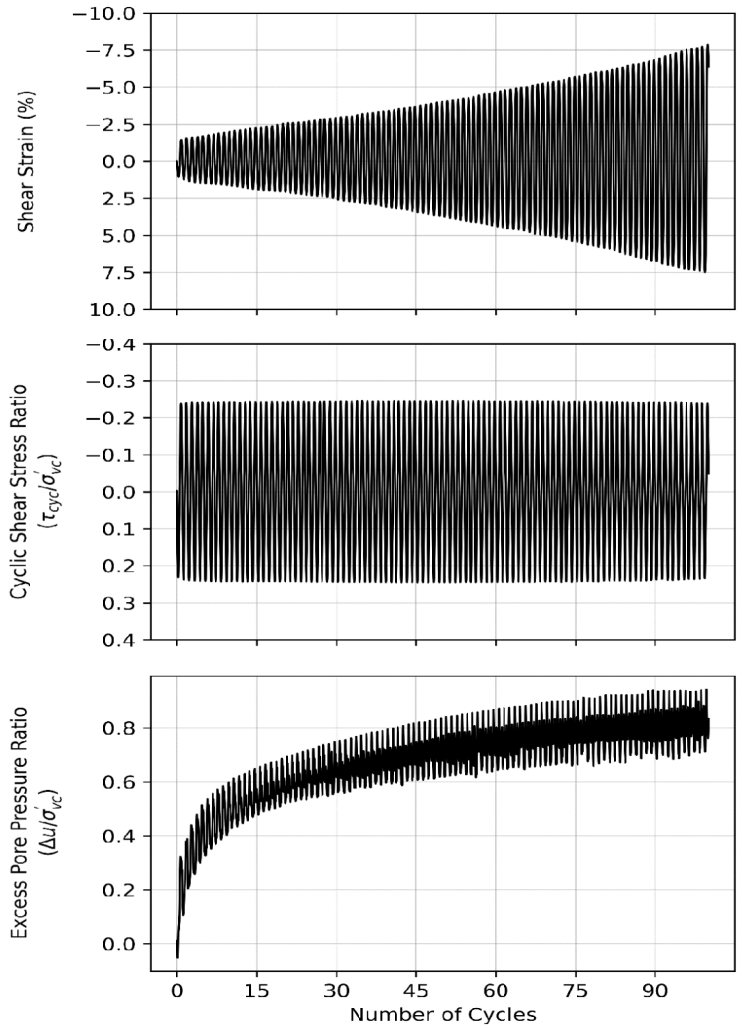
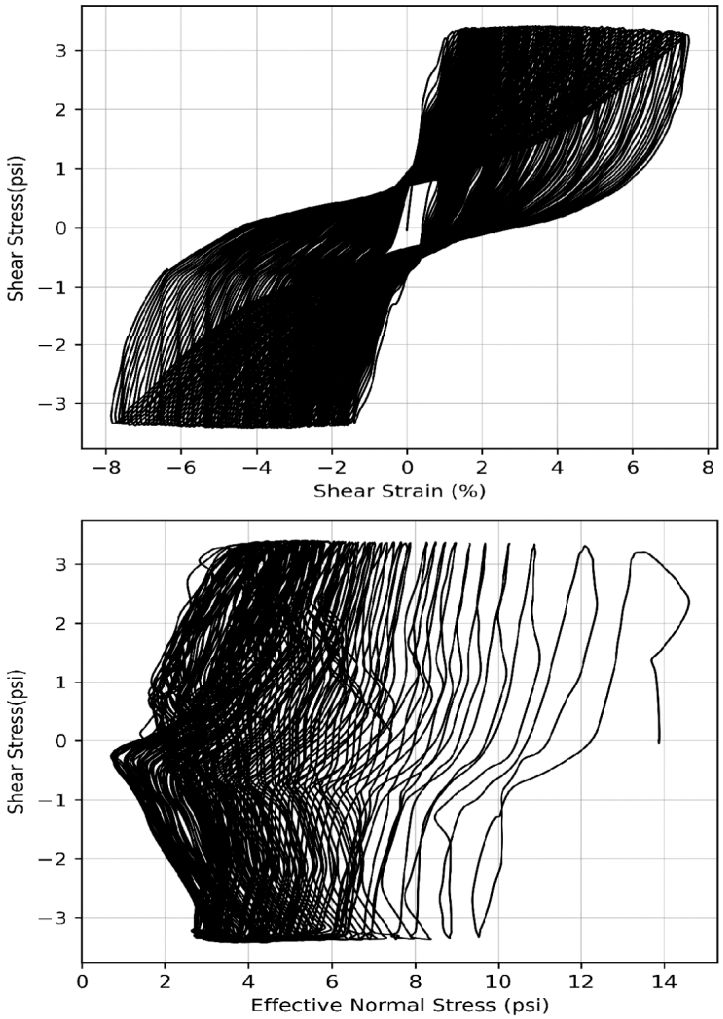
Figure
C-1

C:\Alyson Pyrch\DSS Form\B2-U8.pdf





Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
31.6	48	47	51	35	16	ELASTIC SILT	MH

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	1.2	98.8

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.78
Total Unit Weight (pcf)	105.57
Degree of Saturation (%)	96.31
Void Ratio (e_0)	1.315

PDX Fuel Tanks SVA
Portland, OR

Summary of Cyclic Direct Simple Shear Test: Sample B2-U8 (CSR = 0.25)

0204679-001 07 - 2023

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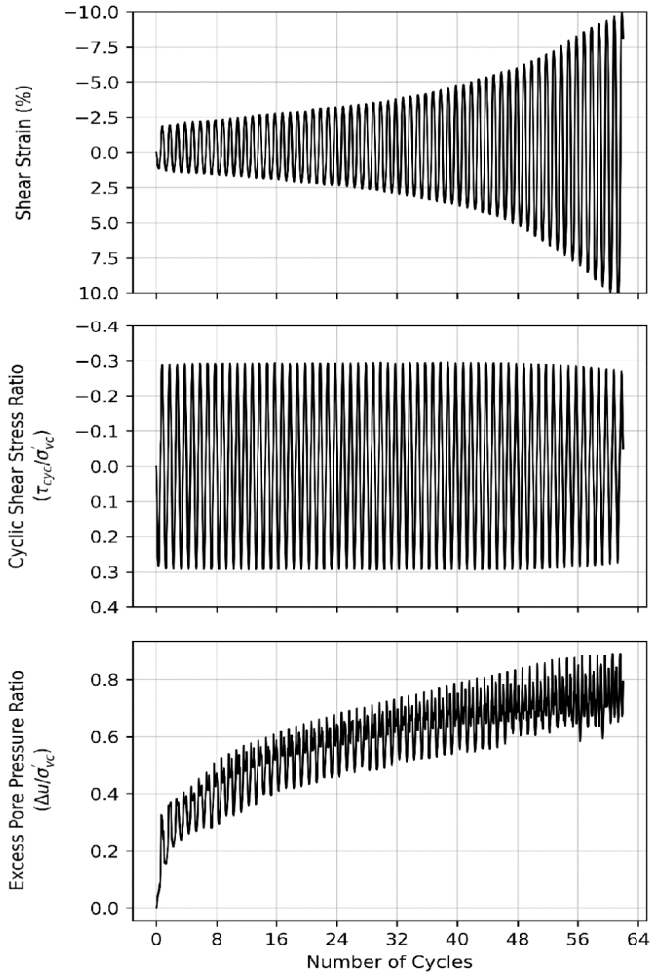
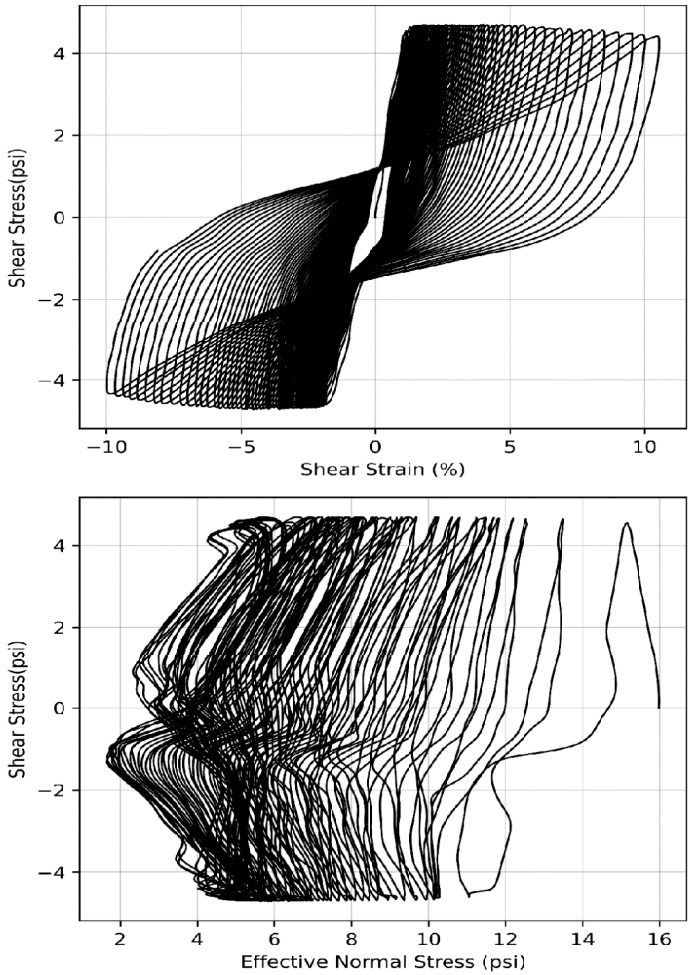
Fig. **C-2**





Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
36.1	49	51	42	23	19	LEAN CLAY	CL

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	0.25	99.75

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.84
Total Unit Weight (pcf)	106.72
Degree of Saturation (%)	99.24
Void Ratio (e_0)	1.309

PDX Fuel Tanks SVA
Portland, OR

Summary of Cyclic Direct Simple Shear Test: Sample B2-U9 (CSR = 0,3)

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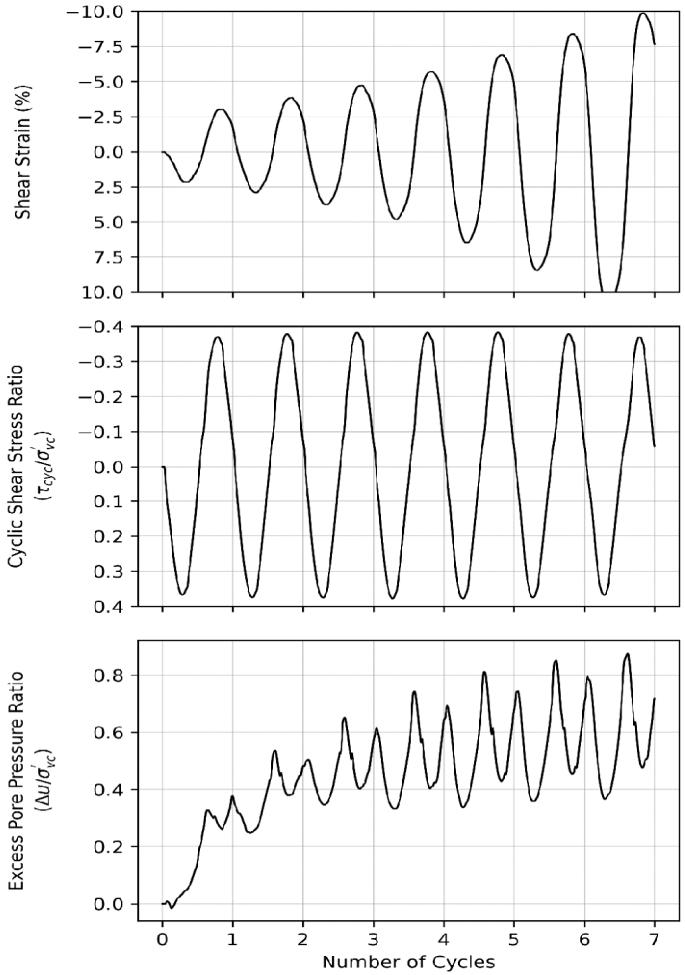
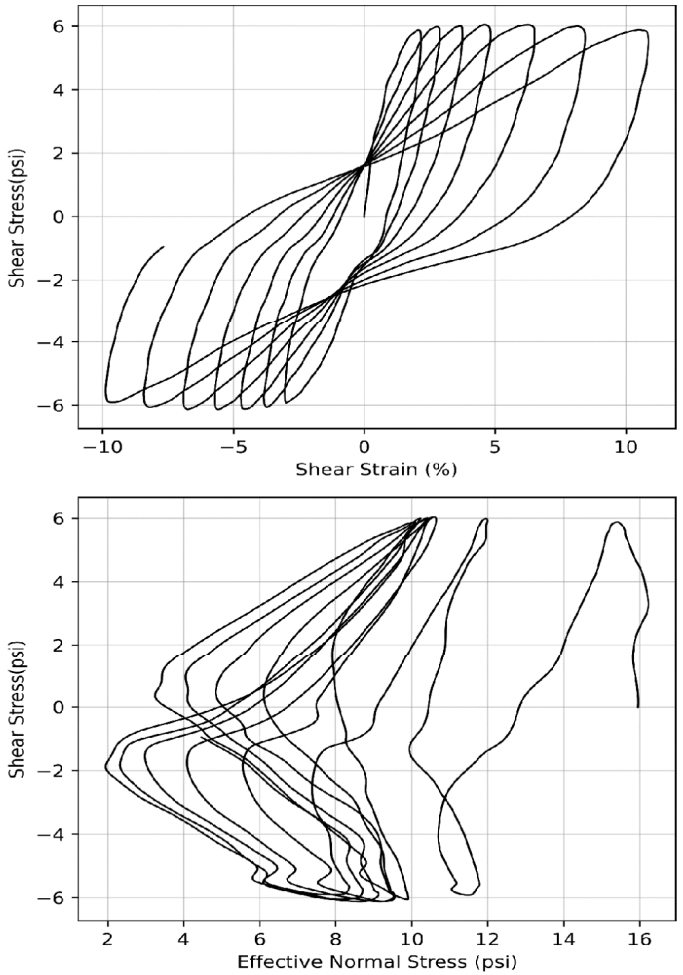
Fig. C-3





Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
36.1	49	51	42	23	19	LEAN CLAY	CL

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	0.25	99.75

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.84
Total Unit Weight (pcf)	106.72
Degree of Saturation (%)	99.24
Void Ratio (e_0)	1.309

PDX Fuel Tanks SVA
Portland, OR

Summary of Cyclic Direct Simple Shear Test: Sample B2-U9 (CSR = 0.35)

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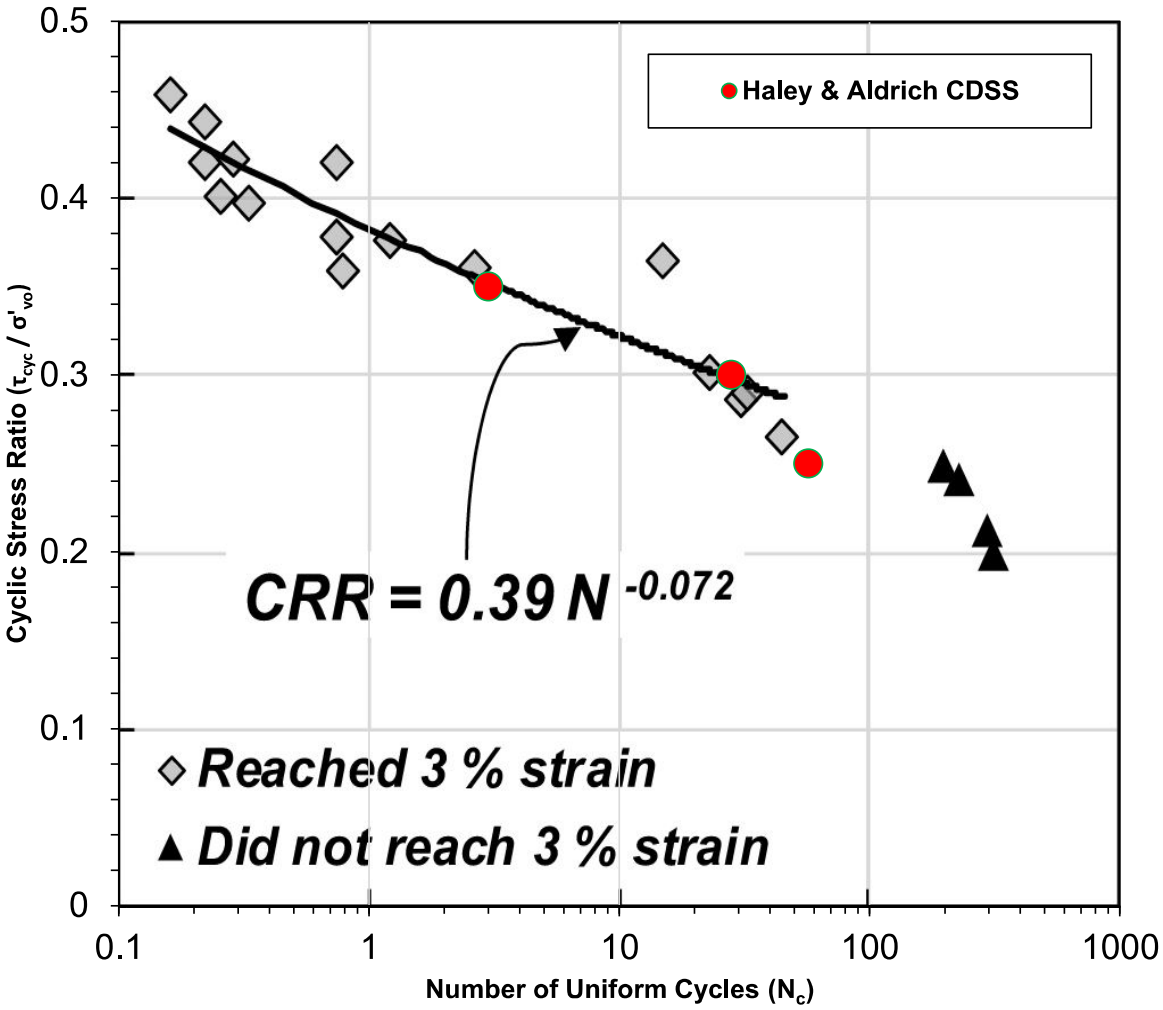
Fig. C-4



Notes:

1. Background figure was taken from Figure 2.17 of *Stuedlein & Jana (2020). Evaluation of Deep, Insitu, Blast-Induced Dynamic Response of Natural Silt and Sand: Dynamic Response of Soils at the Port of Portlan. Cascadia Lifeline Program (CLiP). OSU*

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Comparison of CSR vs N_c Results with Oregon State University Laboratory Testing Results

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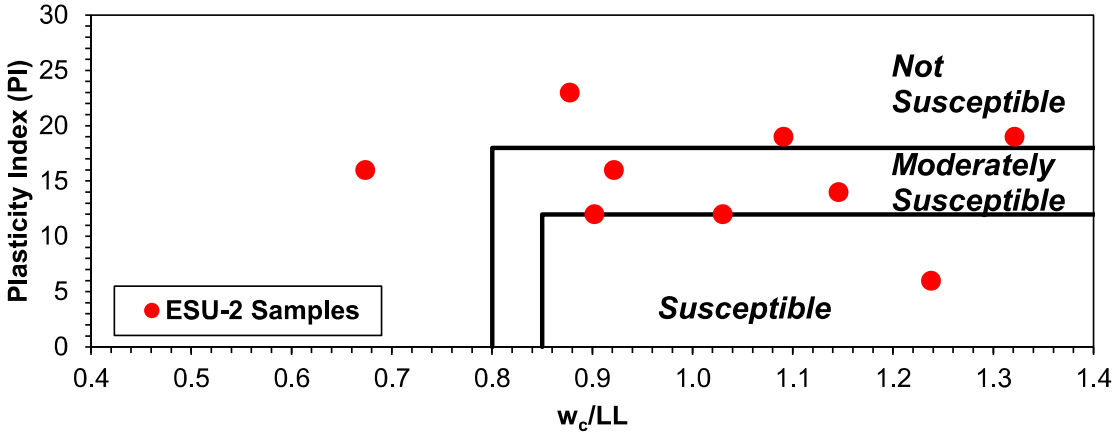
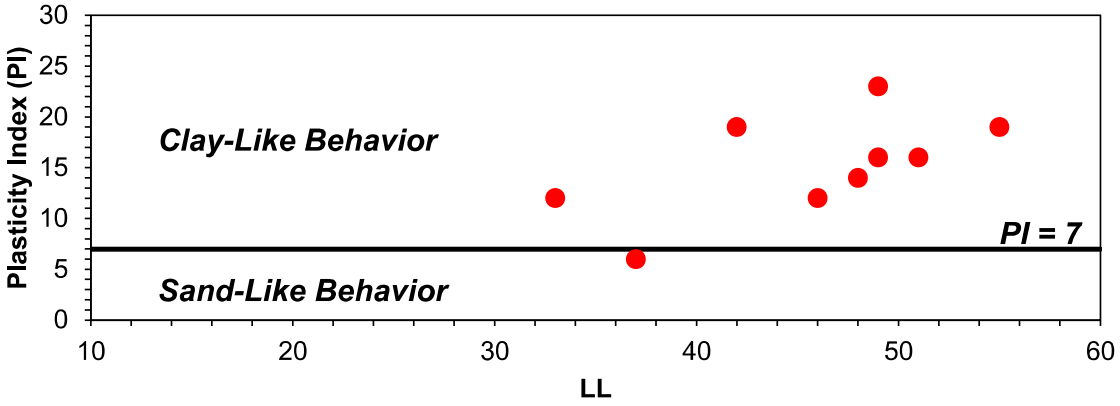
Fig. C-5

C:\Script\HAGTL_CPT_LevelGround\Validation\[Engineering Properties.xlsx]Fig C-5

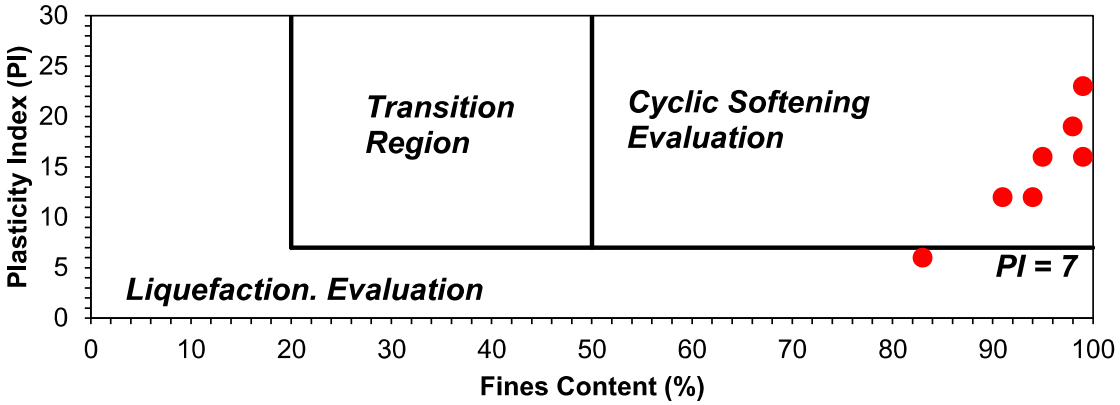
Bray & Sancio (2006)



Boulanger & Idriss (2006)



Armstrong & Malvick (2014)



Notes:

1. All criteria were developed for different classification purposes and are complementary to each other.

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Liquefaction Susceptibility Assessment for ESU-2 (ML-CL)

0204679-001 July 2023

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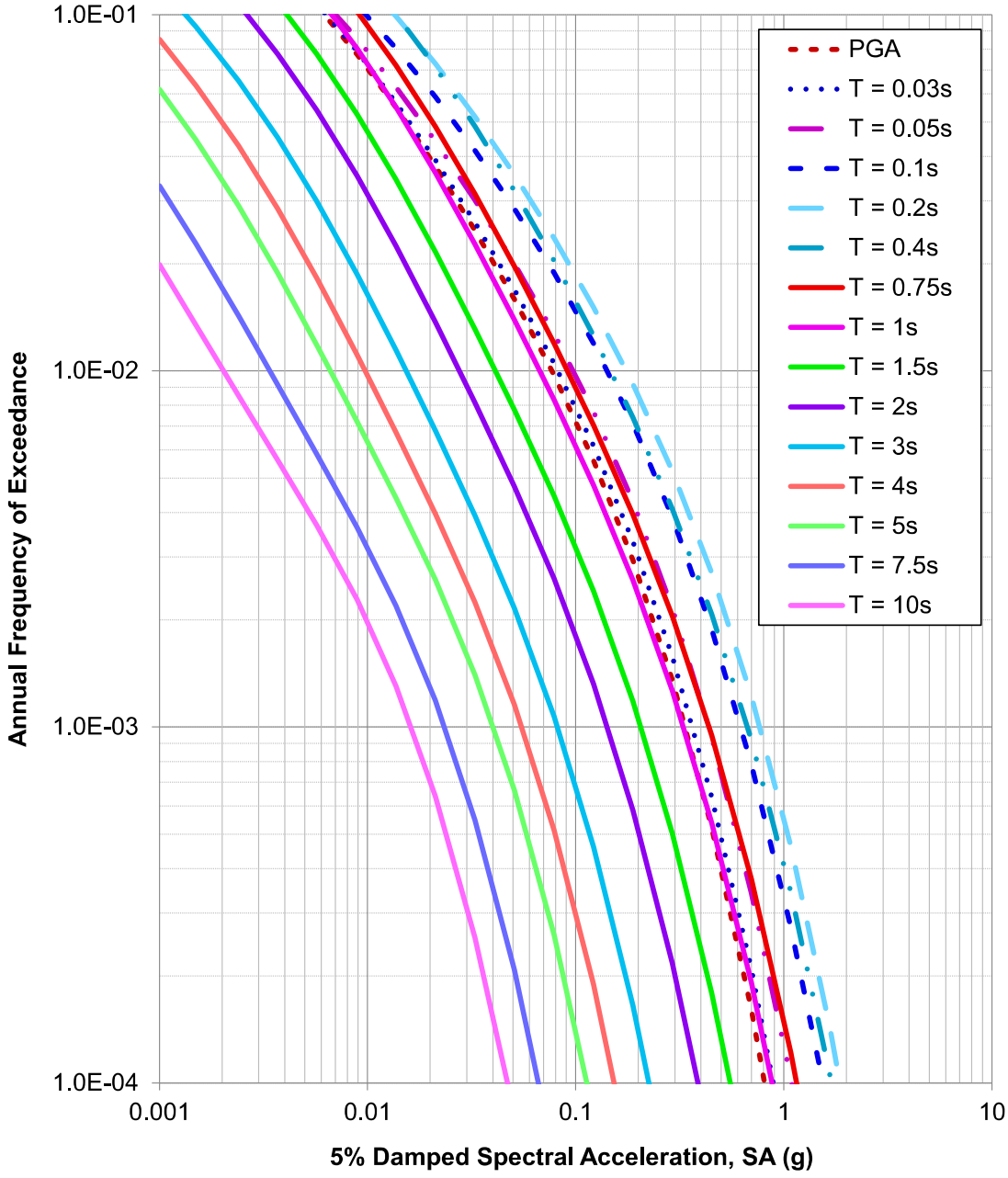
Fig. C-6

C:\Script\HAGTL_CPT_LevelGround\Validation\[Engineering Properties.xlsx]Fig C-5

APPENDIX D
Probabilistic and Deterministic Seismic Hazard Analysis and Design Ground Motion Characterization

A. Total Mean Seismic Hazard Curve
B. Source Specific Hazard Curves:
Impulsive Period (0.2 seconds) and Convective Period (7.5 seconds)
C. Disaggregation Results:
Impulsive Period (0.2 seconds) and Convective g Period (7.5 seconds)
D. 84^{th}-Percentiles Deterministic Spectrum Results:
Portland Hills Fault, CSZ Intraslab, and CSZ Interface
E. Deterministic Spectrum: All sources
F. Input Motions: Impulsive Period Suite
G. Input Motions: Convective Period Suite



PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Total Mean Seismic Hazard Curves

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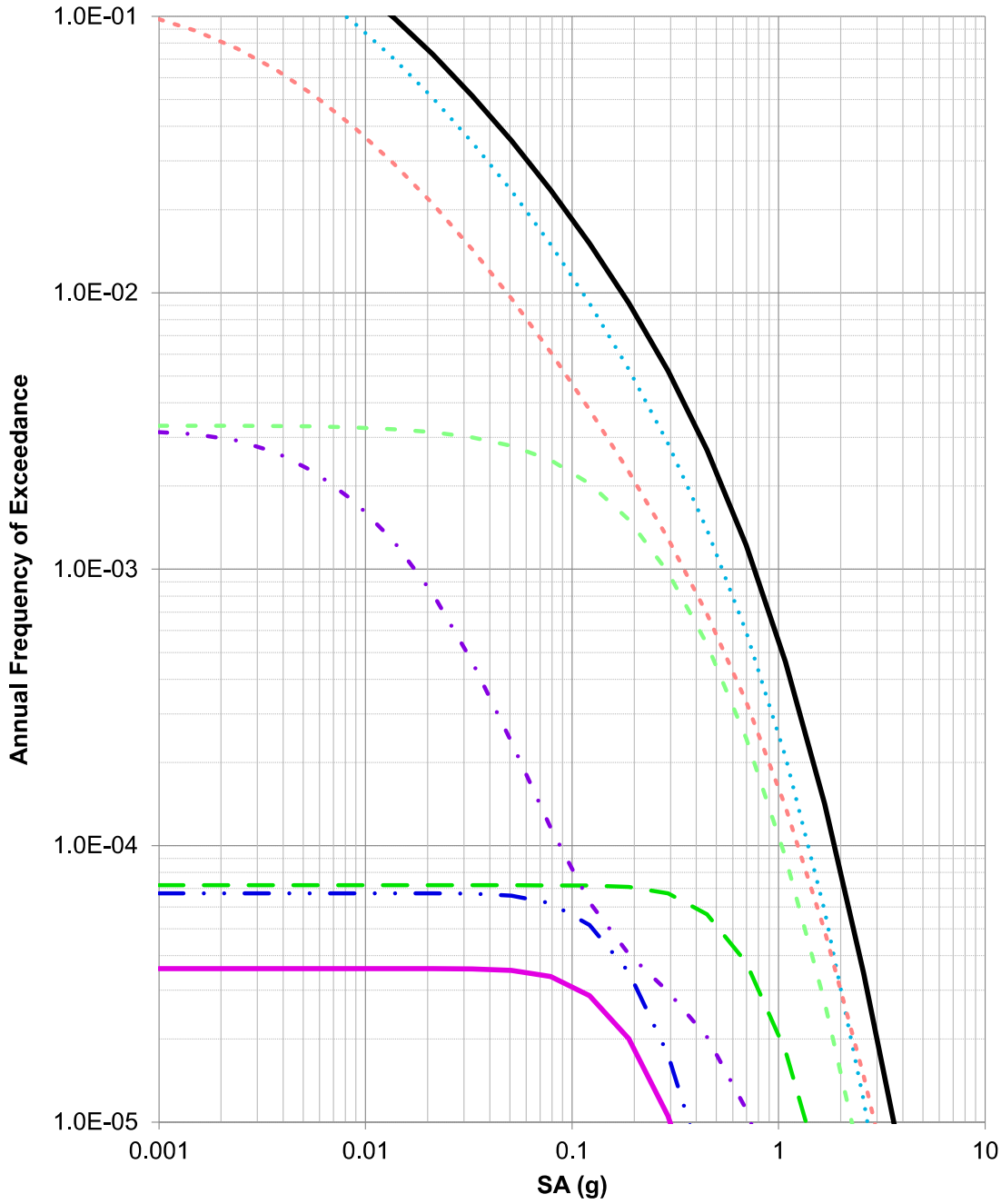
Fig. D-1

\\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\Analysis and Calcs\4 Seismic Hazard & Ground Motions\MCER Development\[Development of MCER - PDXFuelTanl

Impulsive Period (T = 0.2s)



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Seismic Vulnerability Assessment
Portland, Oregon

Impulsive Period (T = 0.2 sec)
Source Specific Seismic Hazard Curves

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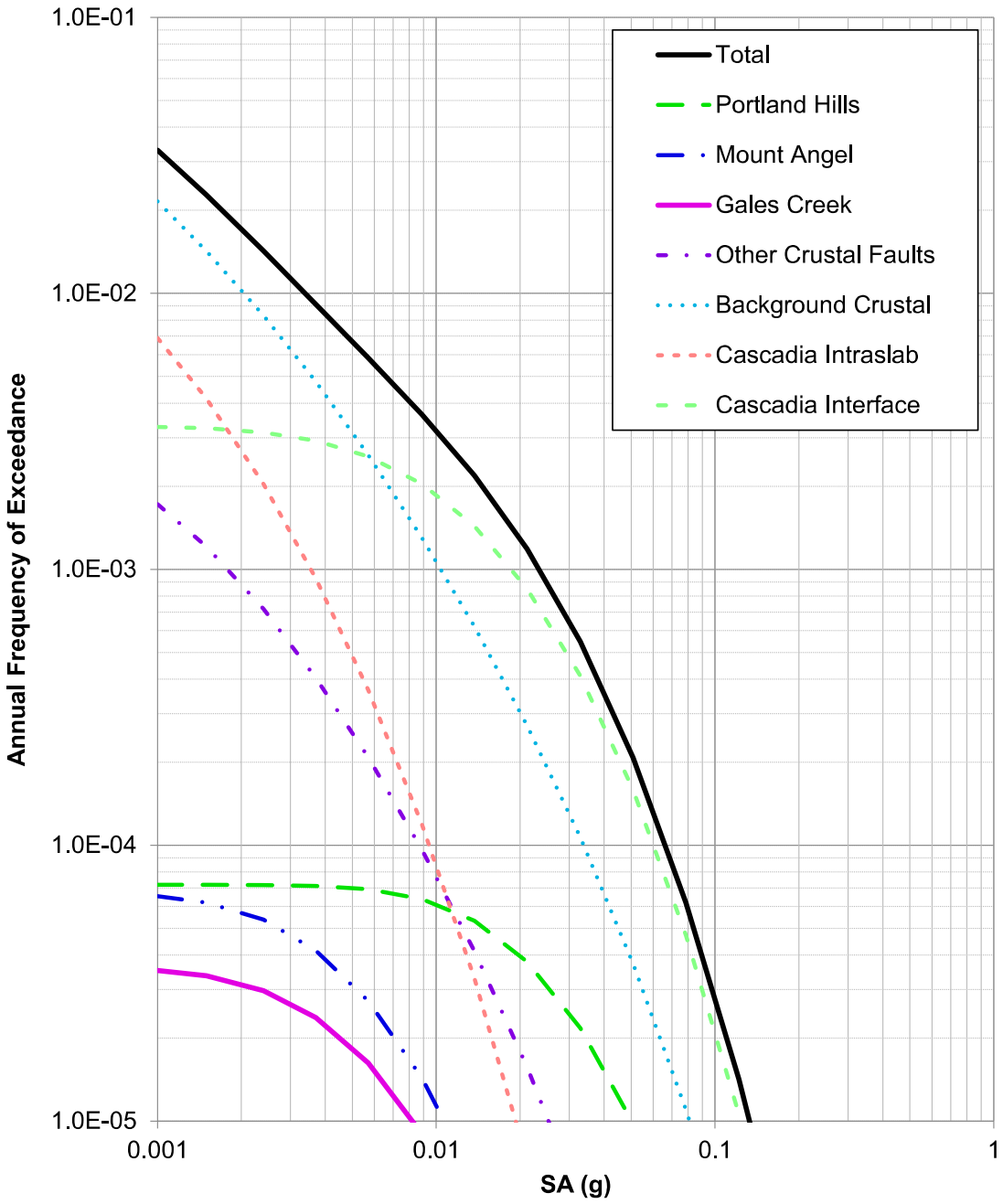
Fig. D-2

\\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\Analysis and Calcs\4 Seismic Hazard & Ground Motions\MCER Development\[Development of MCER - PDXFuelTanl



PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Convective Period (T = 7.5 sec)
Source Specific Seismic Hazard Curves

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Fig. D-3

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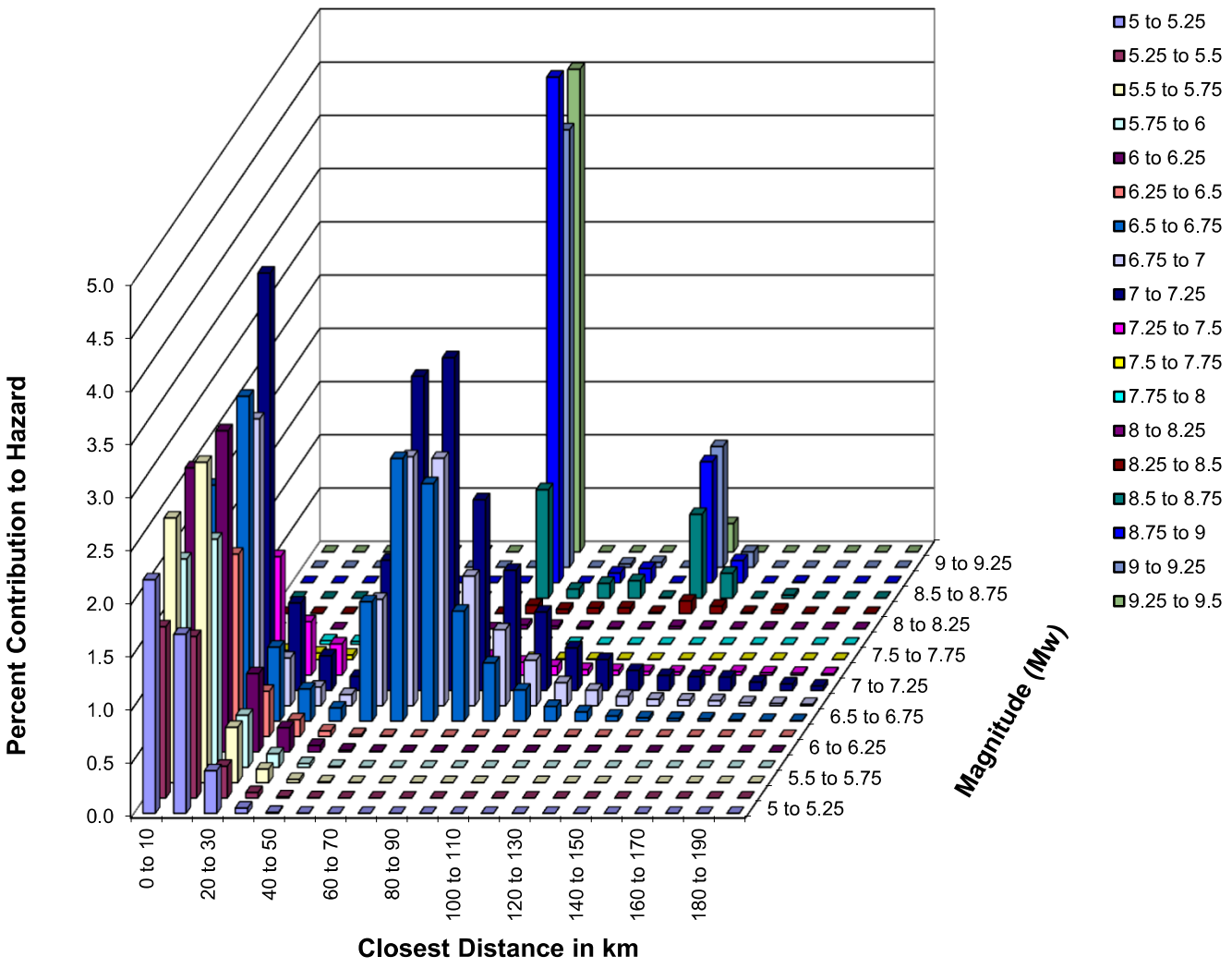

Source	Percent Contribution
Cascadia Interface	19.6%
Portland Hills	4.0%
Other Fault Sources	1.0%
Gridded Crustal Seismicity	45.0%
Deep Intraslab	30.4%

Site and Hazard Information	
Latitude	45.597485
Longitude	-122.6129
Return Period	2,475 years
V_{S30}	1,271 ft/sec
Sa Period	0.2 s
Amplitude	1.13 g

Summary Over All Sources		
Parameter	**Mean**	**Modal**
Magnitude	7.0	8.75 to 9
Distance (km)	50.0	80 to 90
Epsilon	1.22	-

Mean Parameters for Each Source Type		
Source Type	**Mw**	**Rrup**
Interface	9.0	93.8
Intraslab	6.9	81.1
Crustal	6.3	13.6

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

2,475 Years Disaggregated Results at T = 0.2 sec (Impulsive Periods)

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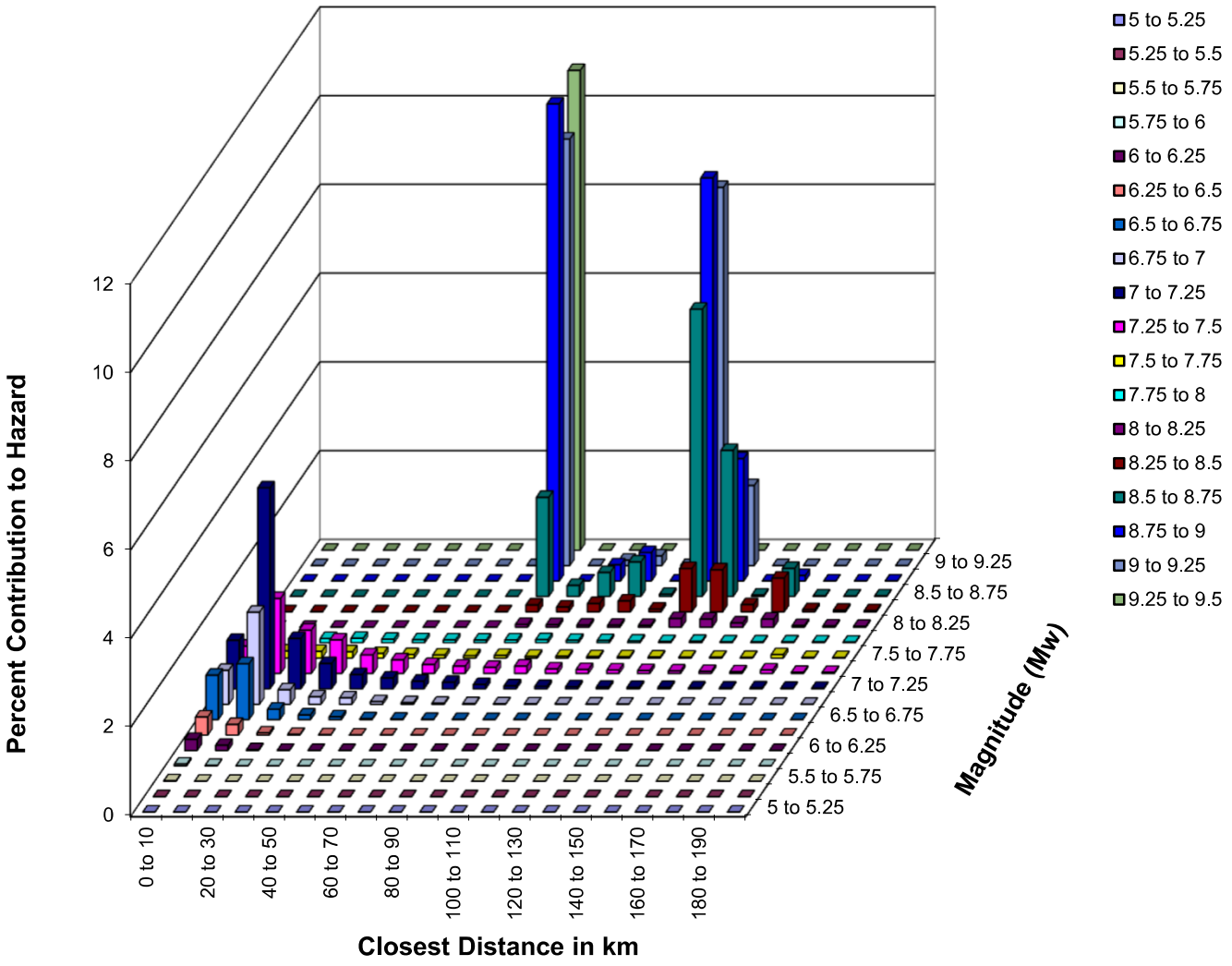
Fig. D-4



Source	Percent Contribution
Cascadia Interface	75.8%
Portland Hills	4.2%
Other Crustal sources	0.8%
Gridded Crustal Seismicity	18.9%
Deep Intraslab	0.2%

Site and Hazard Information	
Latitude	45.597485
Longitude	-122.6129
Return Period	2,475 years
Vs30	1,271 ft/sec
Sa Period	7.5
Amplitude	0.04 g

Summary Over All Sources		
Parameter	Mean	Modal
Magnitude	8.5	9.25 to 9.5
Distance (km)	93.4	80 to 90
Epsilon	0.89	-

Mean Parameters for Each Source Type		
Source Type	Mw	Rrup
Interface	8.9	112.5
Intraslab	7.2	75.6
Crustal	7.1	31.7

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

2,475 Years Disaggregated Results at T = 7.5 sec (Convective Periods)

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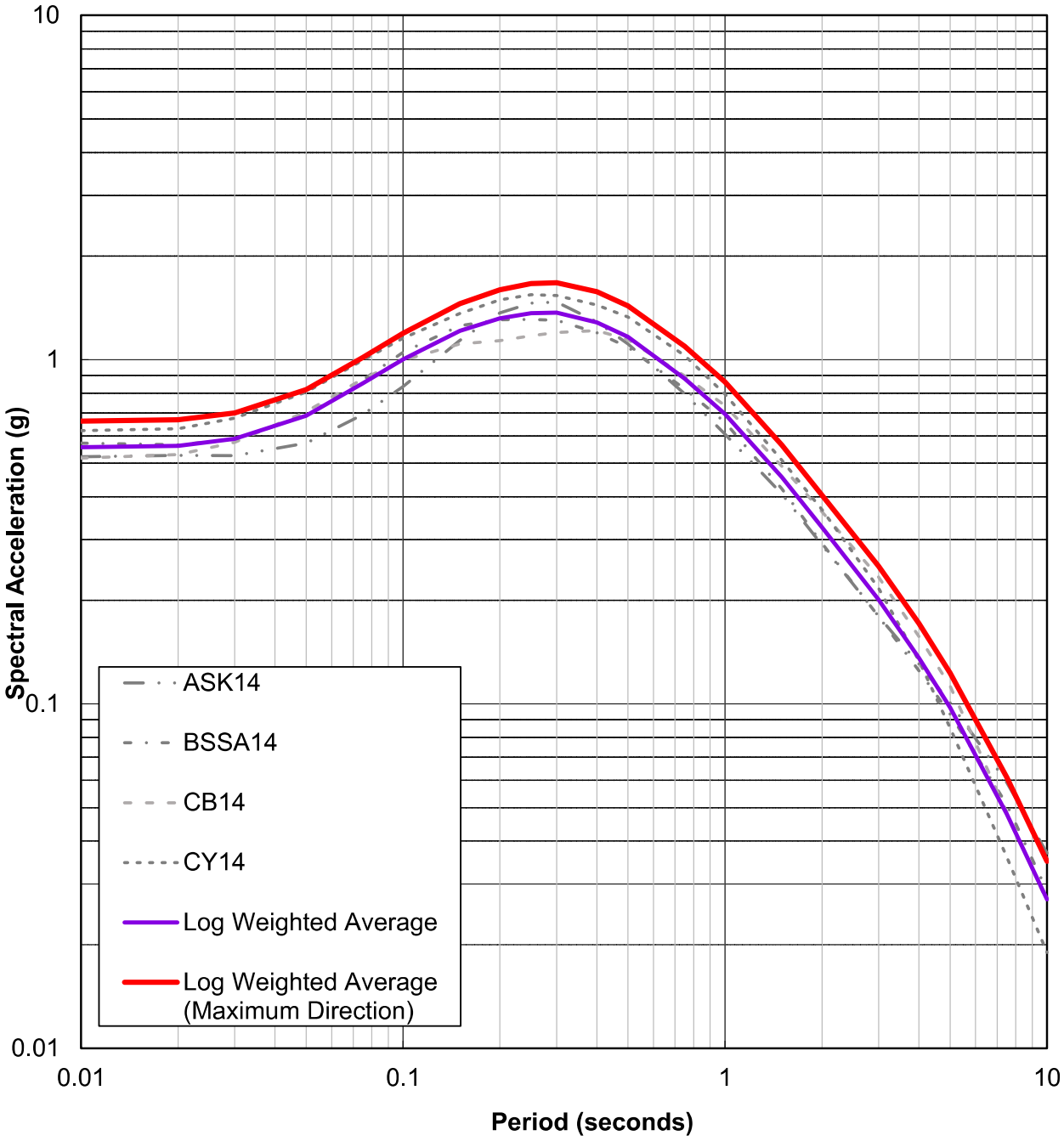
Fig. D-5



Notes:

1. Mw = 7.1, R_{rup} = 10.4 km, V_{S30} = 388 m/s
   Z_{TOR} = 0 km, $Z_{1.0}$ = 0.45 km, $Z_{2.5}$ = 1.8 km
   F_{RV} = 1, F_{HW} = 0, Dip = 70°
   Measured V_{S30}
   Region Global
   Others Parameter set to Default
   Calculated using NGAW2 GMPE Spreadsheet
2. Maximum Direction Factor
   (Shahi & Baker, 2014)

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Portland Hills (Crustal)
Deterministic 84-th Percentile
Response Spectrum

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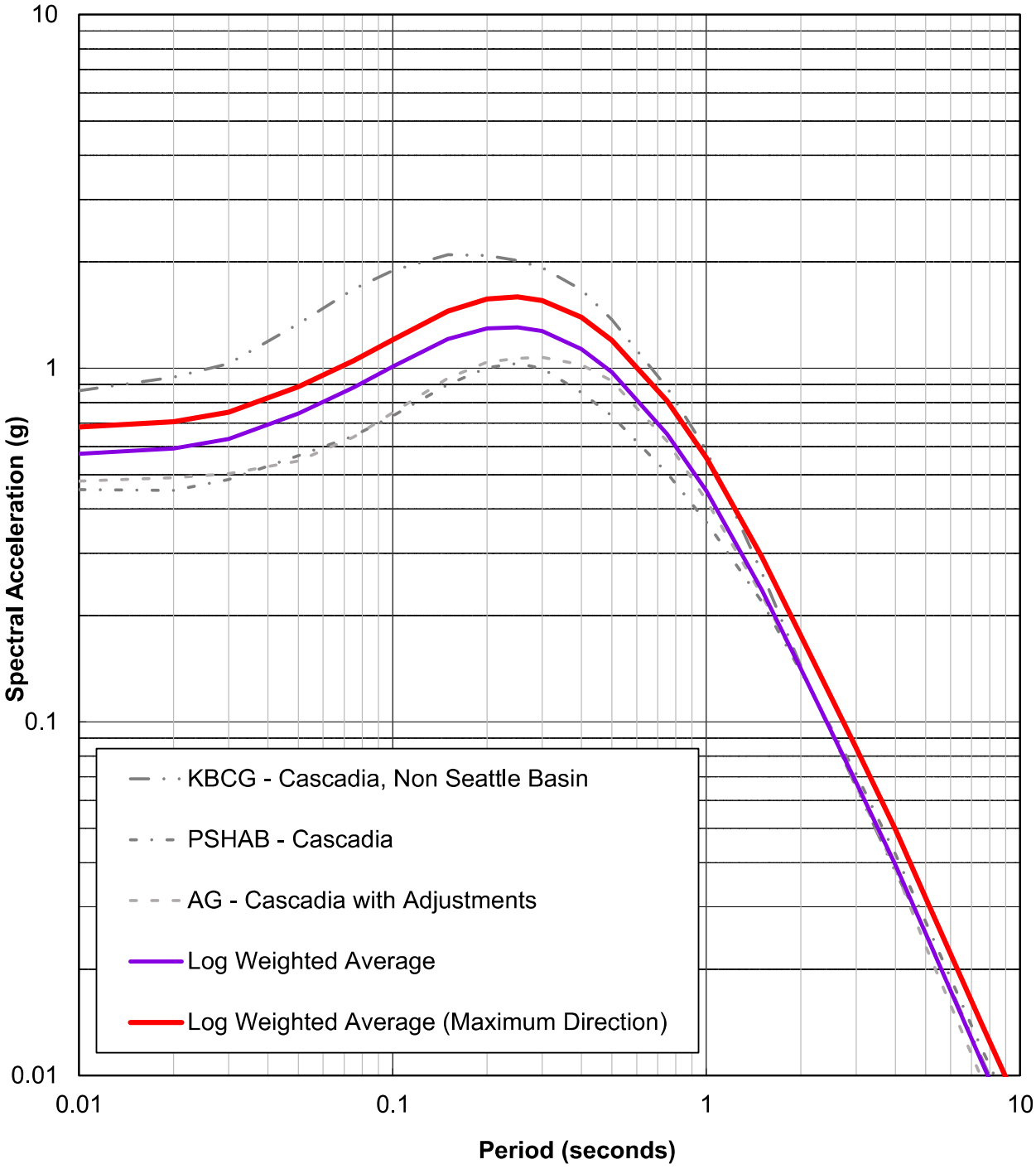
Fig. D-6



Notes:

1. Mw = 7.2, R_{rup} = 75 km, V_{S30} = 388 m/s
   Z_{TOR} = 50 km, Hypocentral Depth = 65 km
   $Z_{1.0}$ = 0.405 km, $Z_{2.5}$ = 1.8 km

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

CSZ Intraslab Deterministic 84-th Percentile Response Spectrum

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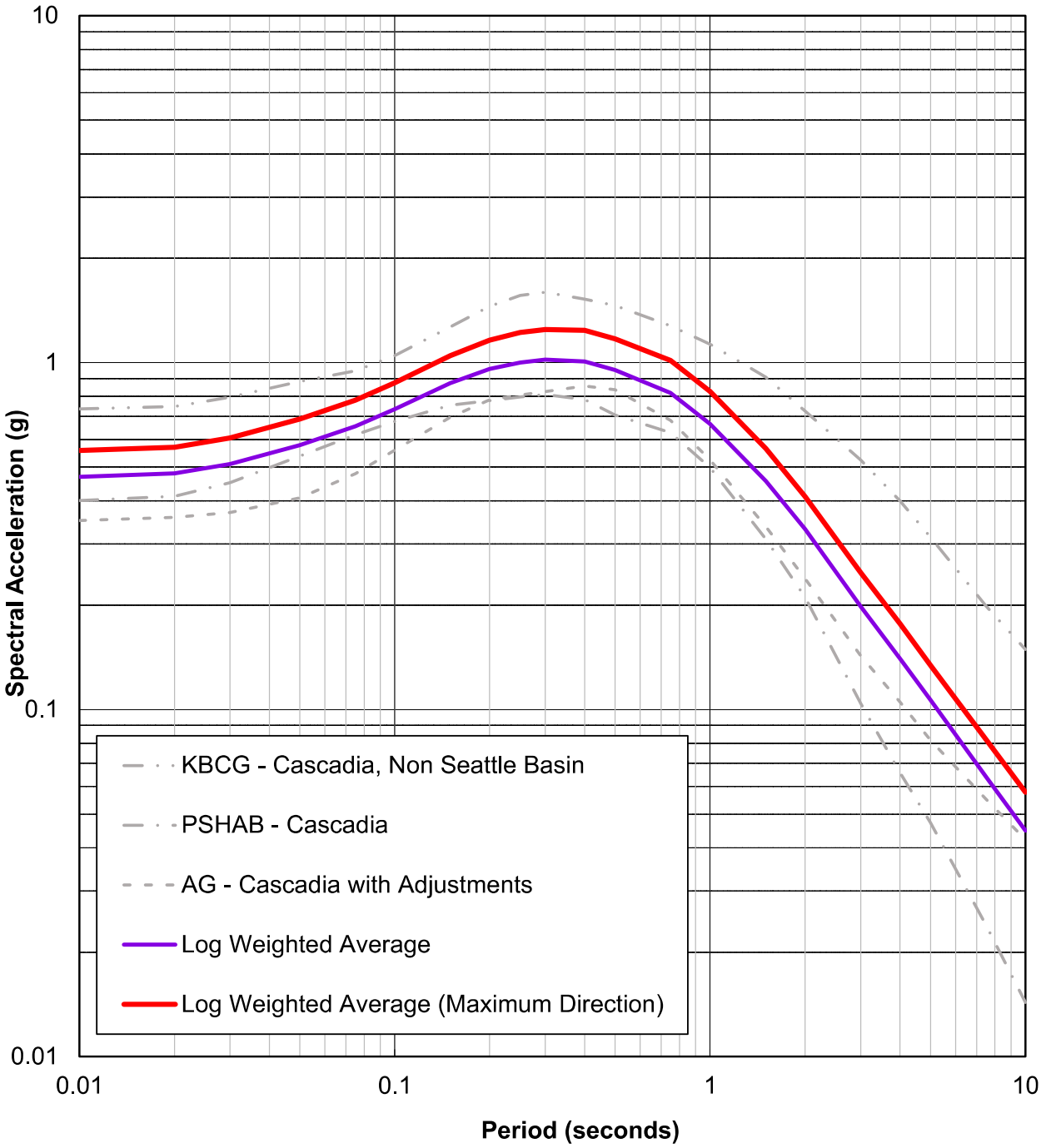
Fig. D-7



Notes:

1. M_w = 9.0, R_{rup} = 94 km, V_{S30} = 388 m/s

   Z_{TOR} = 5 km, $Z_{1.0}$ = 0.405 km, $Z_{2.5}$ = 1.8 km

PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

CSZ Interface Deterministic 84-th Percentile Response Spectrum

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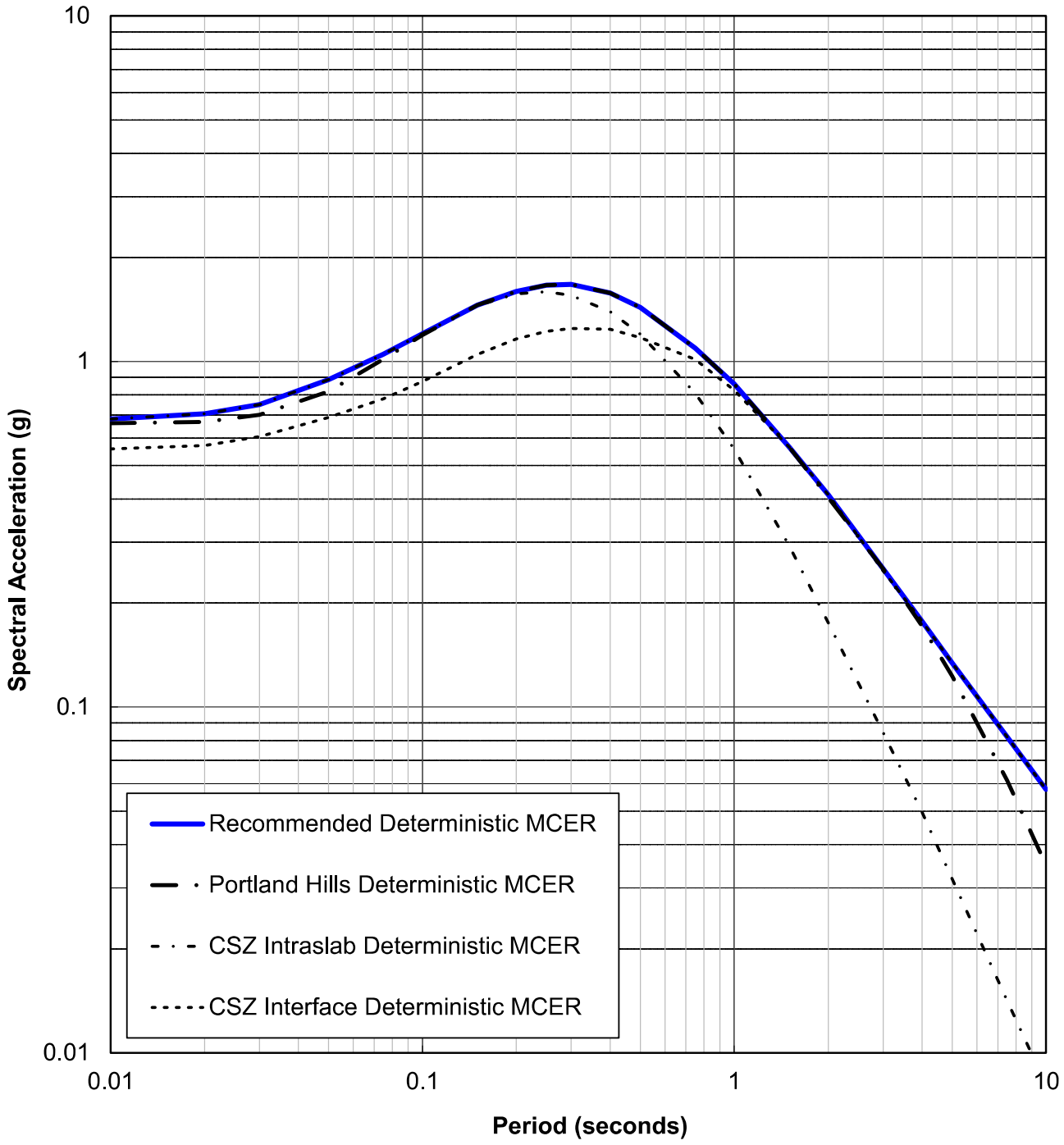
Fig. D-8



PDX Fuel Tank
Seismic Vulnerability Assessment
Portland, Oregon

Calculated Response Spectrum
Deterministic MCE_R: All Sources

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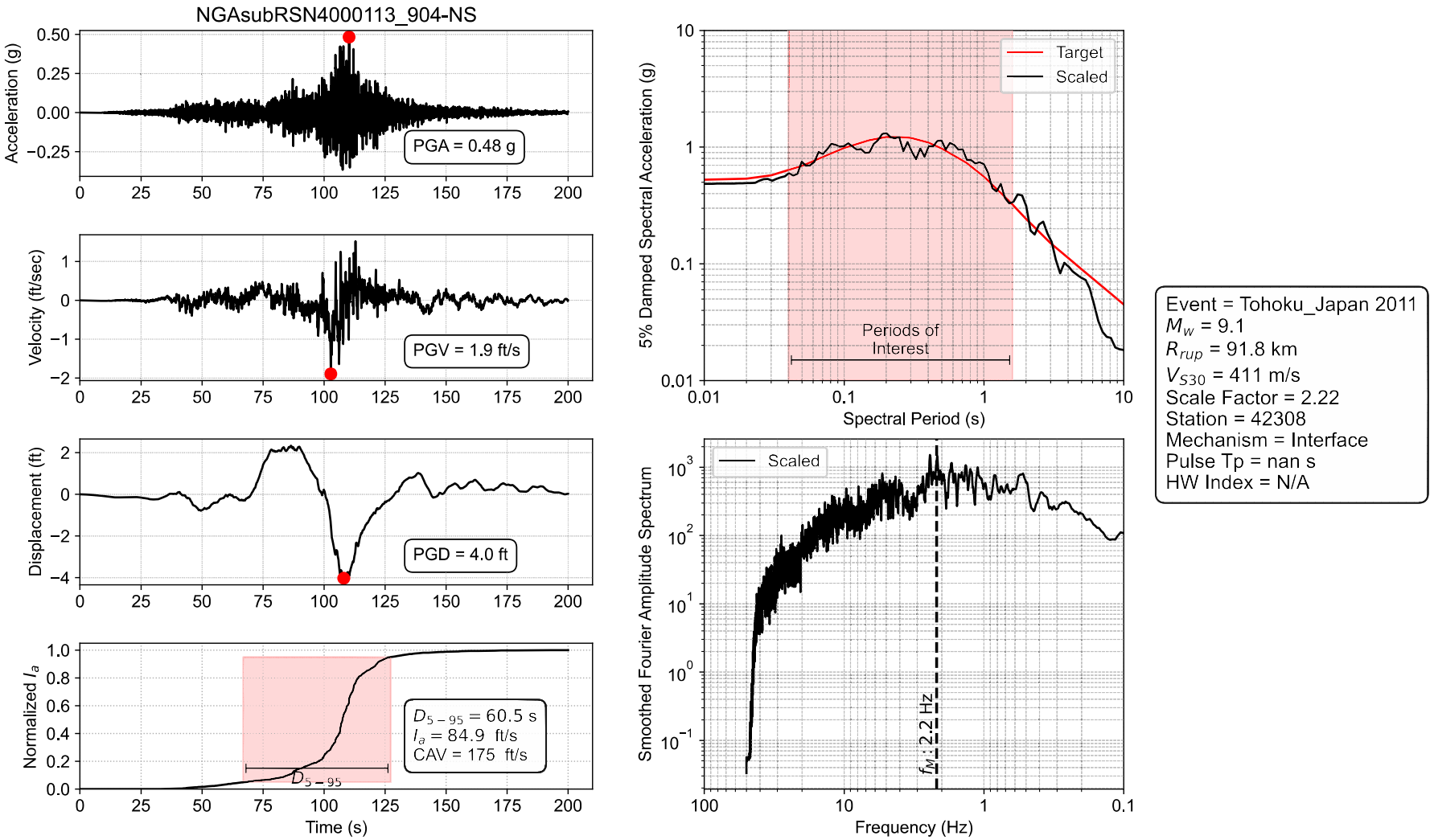
Fig. D-9



Event = Tohoku_Japan 2011
M_w = 9.1
R_{rup} = 91.8 km
V_{S30} = 411 m/s
Scale Factor = 2.22
Station = 42308
Mechanism = Interface
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN4000113_904-NS

0204679-001 July 2023

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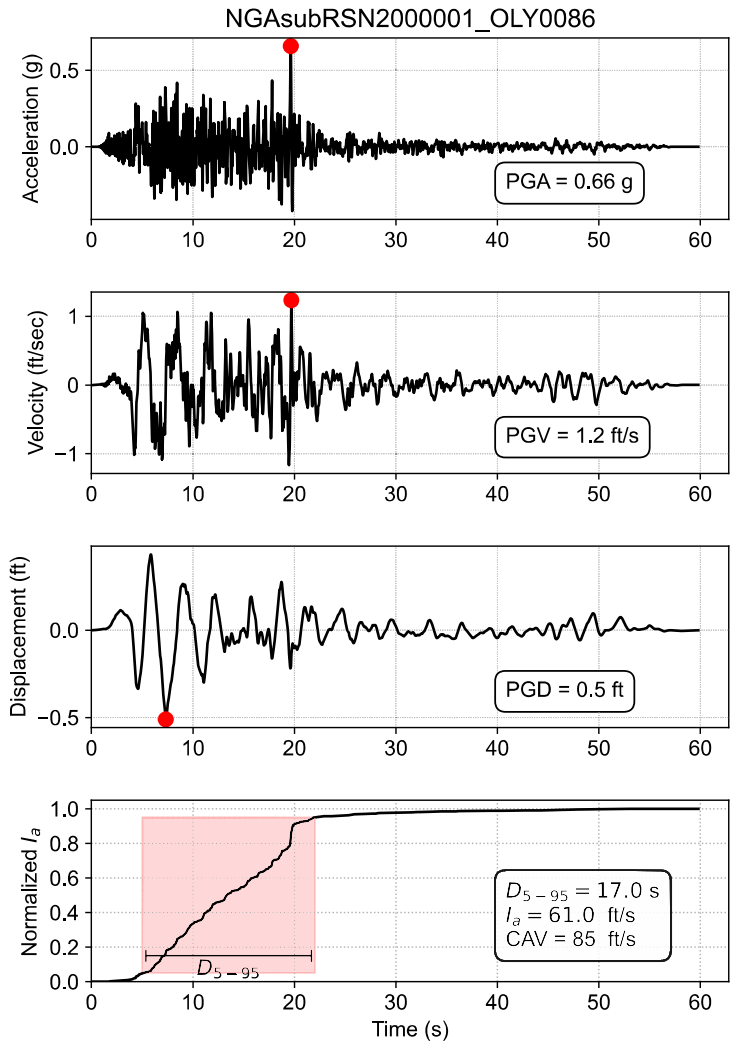
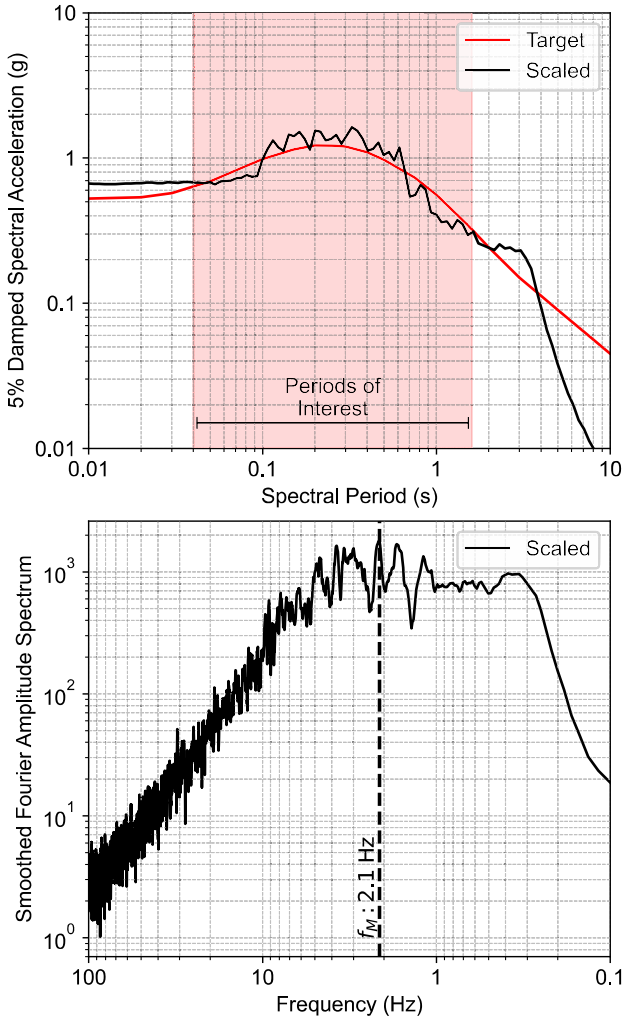
Figure D-10

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Short Period (0.2s)\5Selected Motion\Scaled Input Motion\Results.pdf





Event = Olympia_WA 1949
M_w = 6.7
R_{rup} = 47.6 km
V_{S30} = 399 m/s
Scale Factor = 2.20
Station = OLY0
Mechanism = Intraslab
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

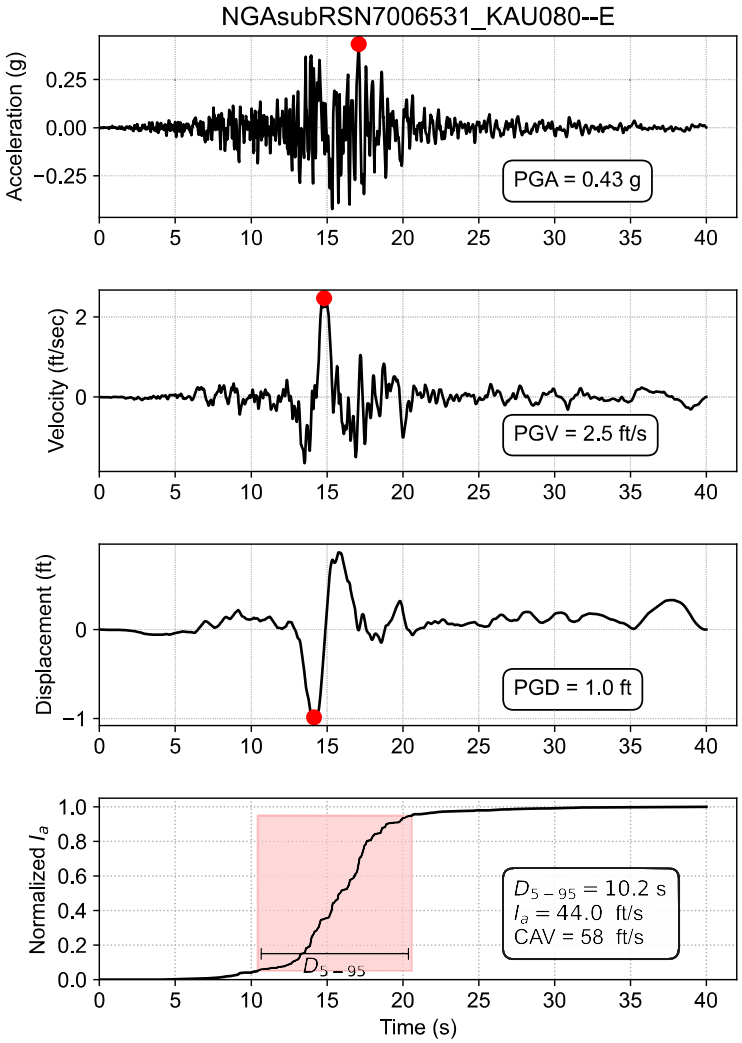
PDX Fuel Tank SVA
Portland, OR

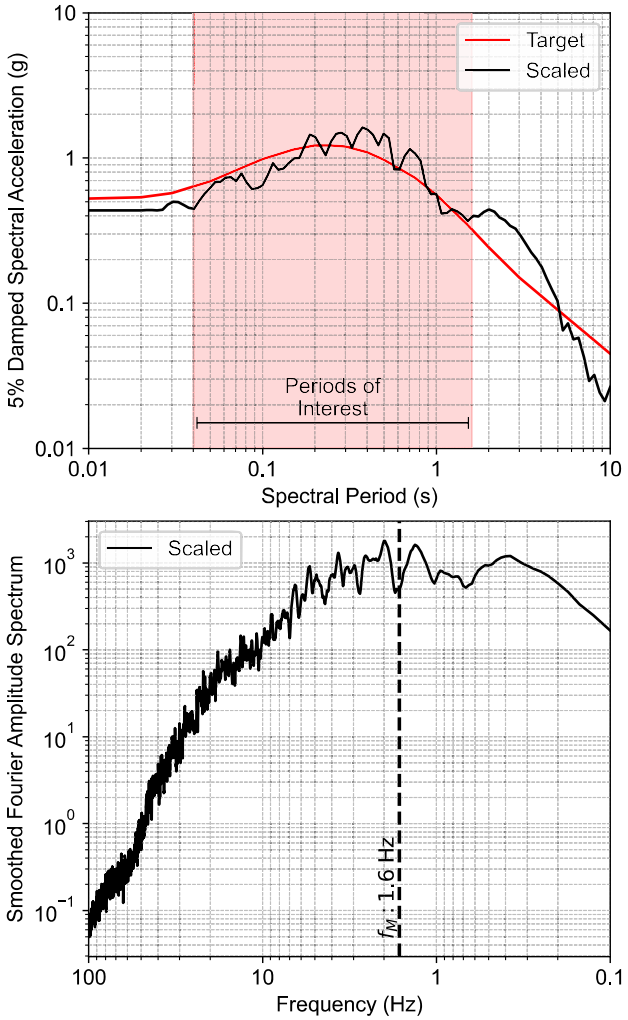
Amplitude Scaled, One-Component Ground Motion Parameters RSN2000001_OLY0086

0204679-001 July 2023

HALEY ALDRICH

Figure D-11





Event = Pingtung_Taiwan 2006
M_w = 6.94
R_{rup} = 34.7 km
V_{S30} = 400 m/s
Scale Factor = 2.21
Station = KAU080
Mechanism = Intraslab
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN7006531_KAU080--E

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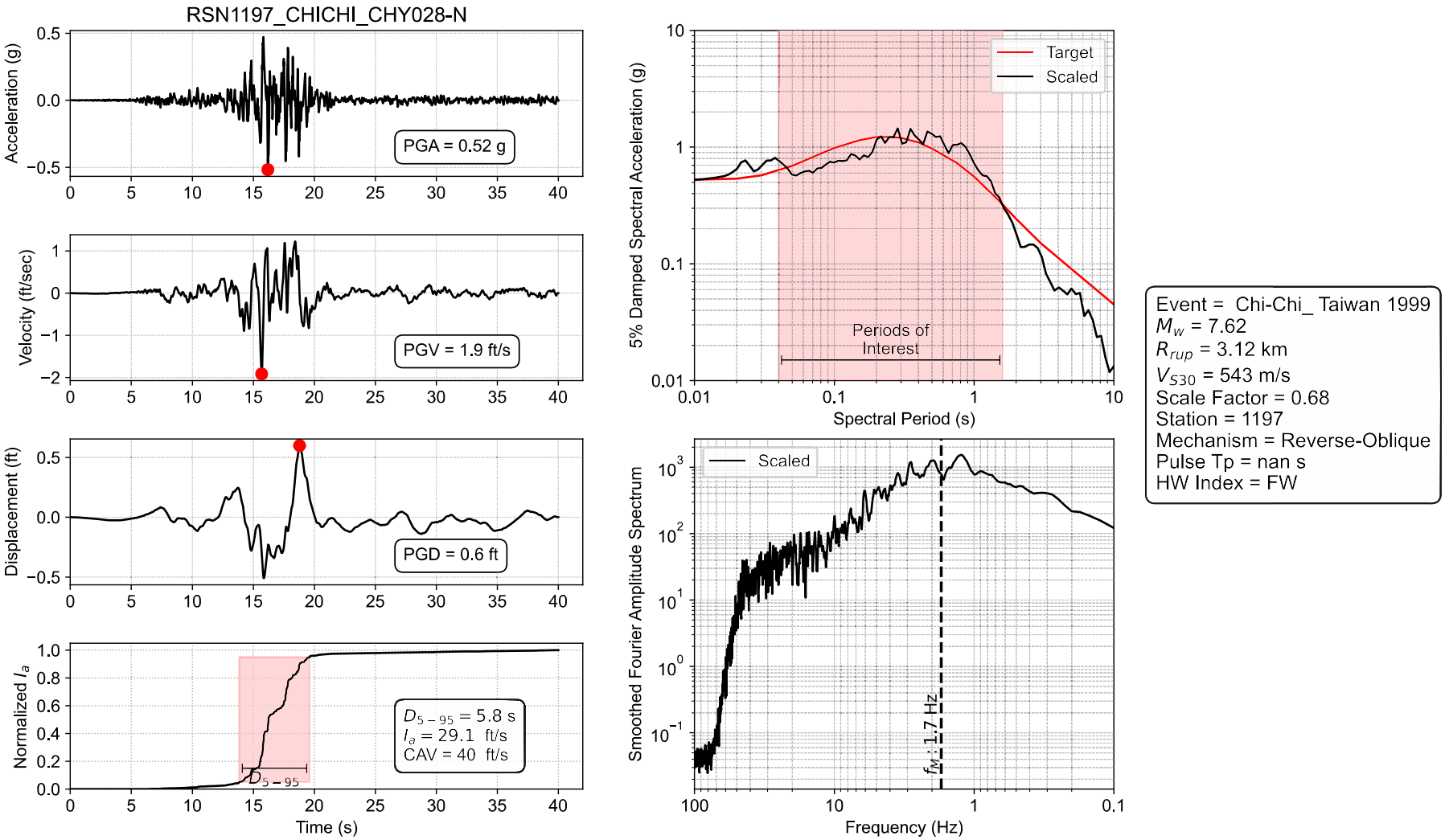
Figure D-12



Event = Chi-Chi_ Taiwan 1999
M_w = 7.62
R_{rup} = 3.12 km
V_{S30} = 543 m/s
Scale Factor = 0.68
Station = 1197
Mechanism = Reverse-Oblique
Pulse Tp = nan s
HW Index = FW

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN1197_CHICHI_CHY028-N

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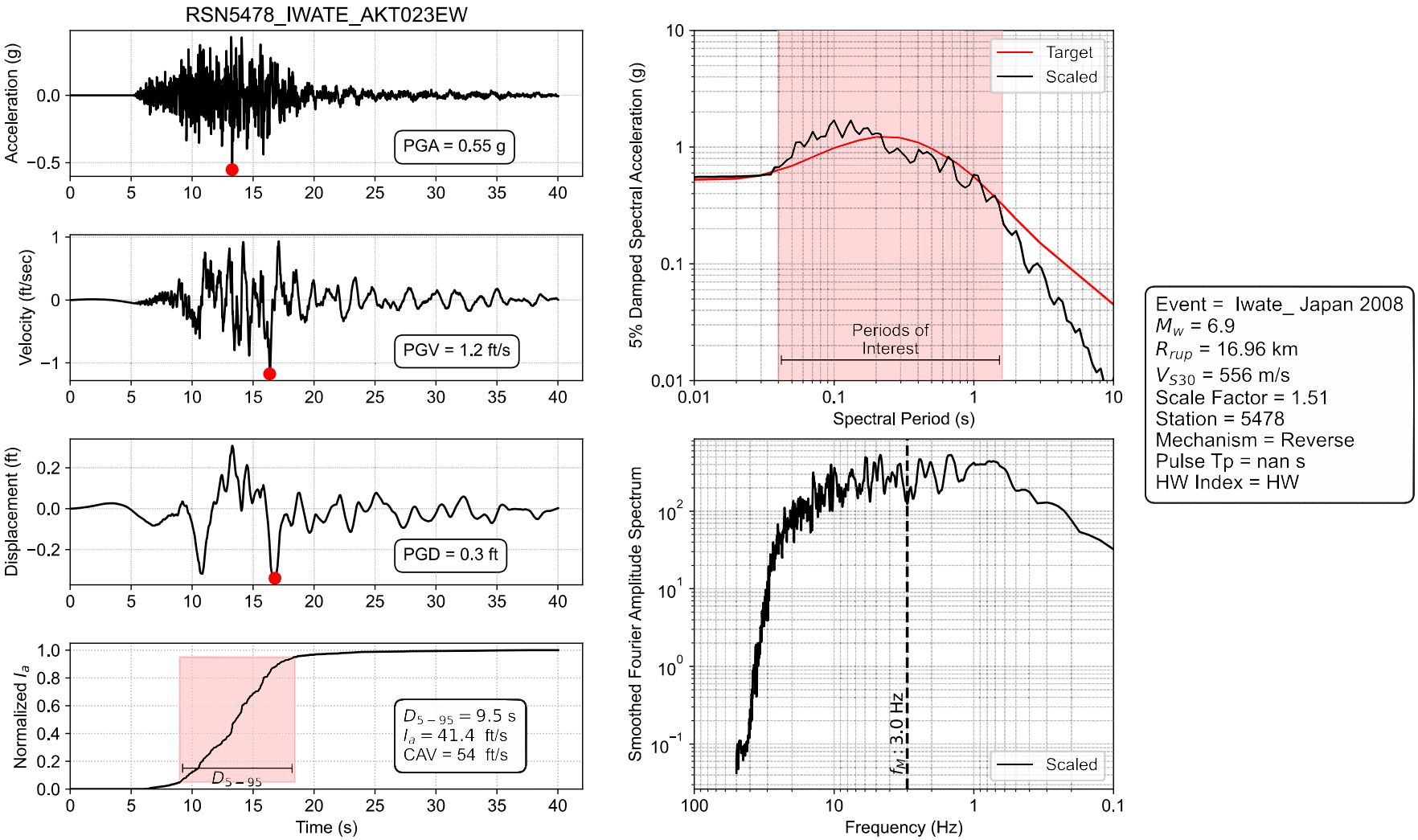
Figure D-13

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Short Period (0.2s)\5Selected Motion\Scaled Input Motion\Results.pdf



Event = Iwate_ Japan 2008
M_w = 6.9
R_{rup} = 16.96 km
V_{S30} = 556 m/s
Scale Factor = 1.51
Station = 5478
Mechanism = Reverse
Pulse Tp = nan s
HW Index = HW

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN5478_IWATE_AKT023EW

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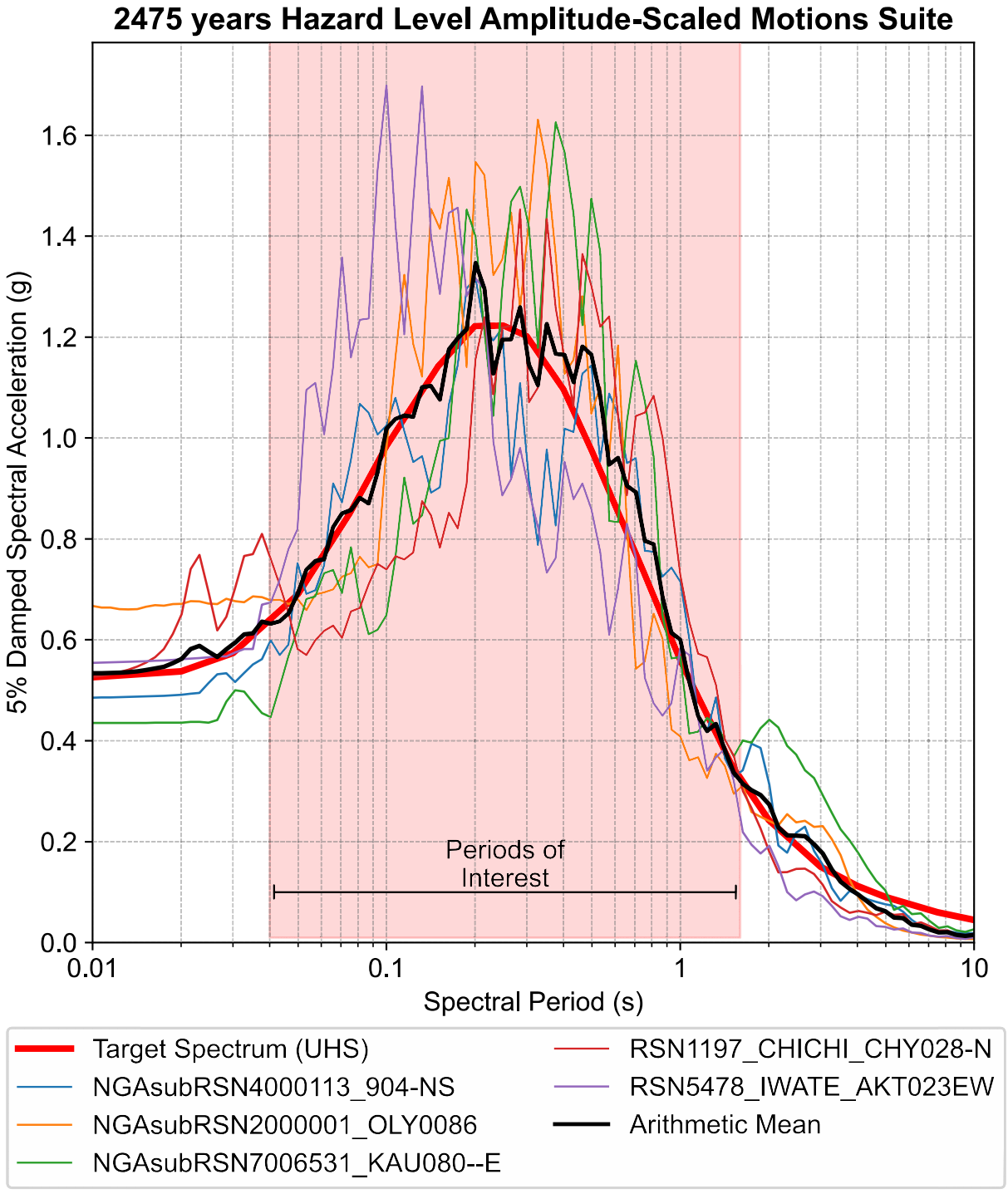
Figure D-14

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Short Period (0.2s)\5Selected Motion\Scaled Input Motion\Results.pdf



Notes:

1. Target spectrum is at halfspace elevation (1271 ft/s) and based on MCER per ASCE 7-16

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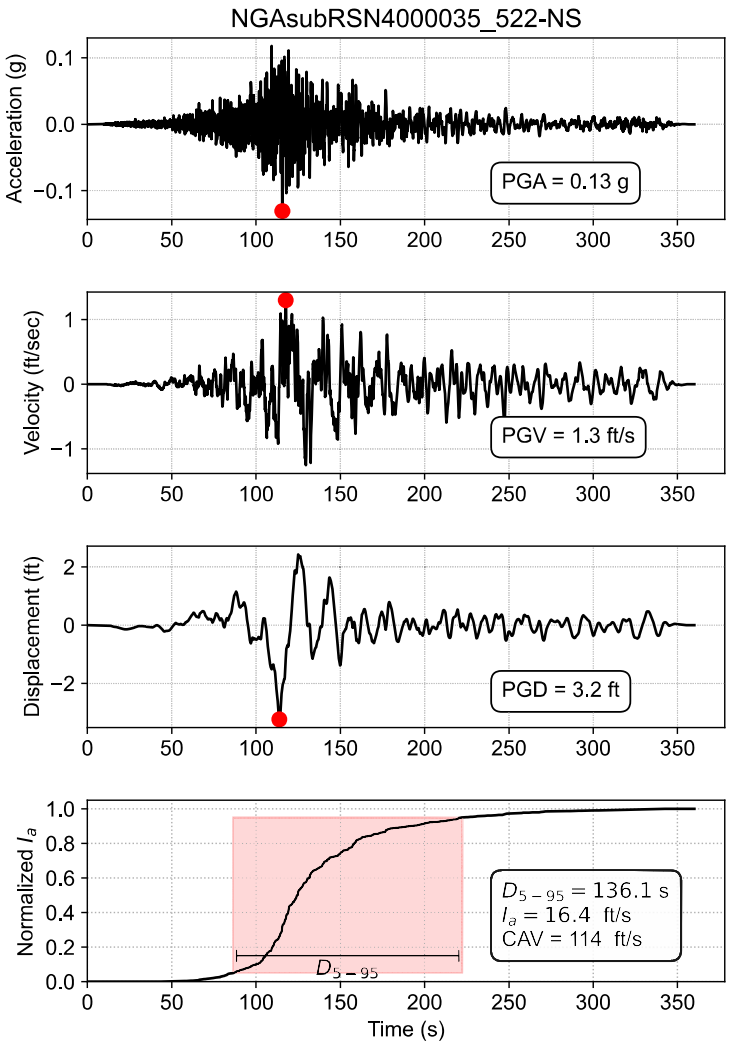
PDX Fuel Tank SVA
Portland, OR

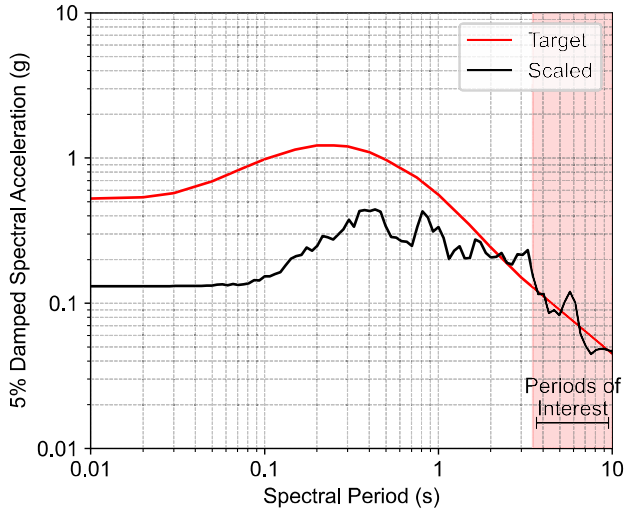
Amplitude-Scaled Response Spectra Summary Impulsive Period (T = 0.2 sec)

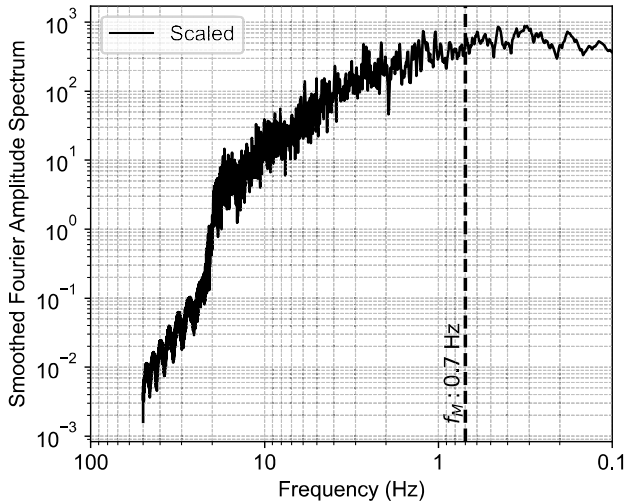
July 2023

0204679-001 | **FIG. D-15**

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Short Period (0.2s)\5Selected Motion\Scaled Input Motion\Results.pdf







Event = Tohoku_Japan 2011
M_w = 9.12
R_{rup} = 107.7902495 km
V_{S30} = 257 m/s
Scale Factor = 2.03
Station = 41314
Mechanism = Interface
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN4000035_522-NS

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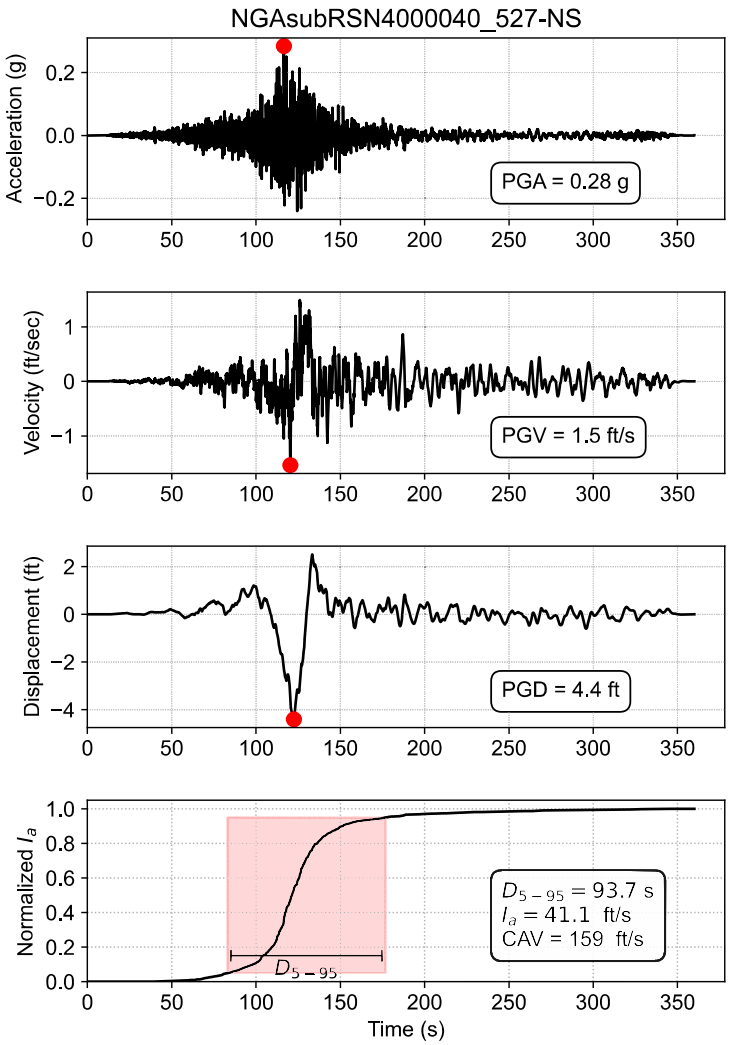
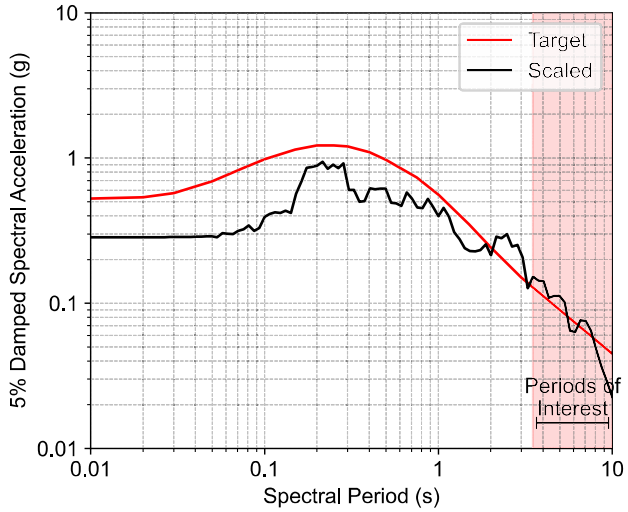
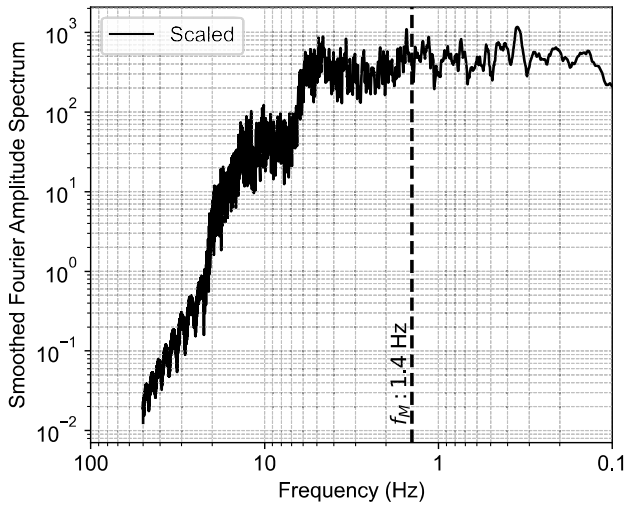
Figure D-16

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Long Period (7.5s)\5Selected Motion\Scaled Input Motion\Results.pdf







Event = Tohoku_Japan 2011
M_w = 9.12
R_{rup} = 124.5198836 km
V_{S30} = 270 m/s
Scale Factor = 2.44
Station = 41319
Mechanism = Interface
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN4000040_527-NS

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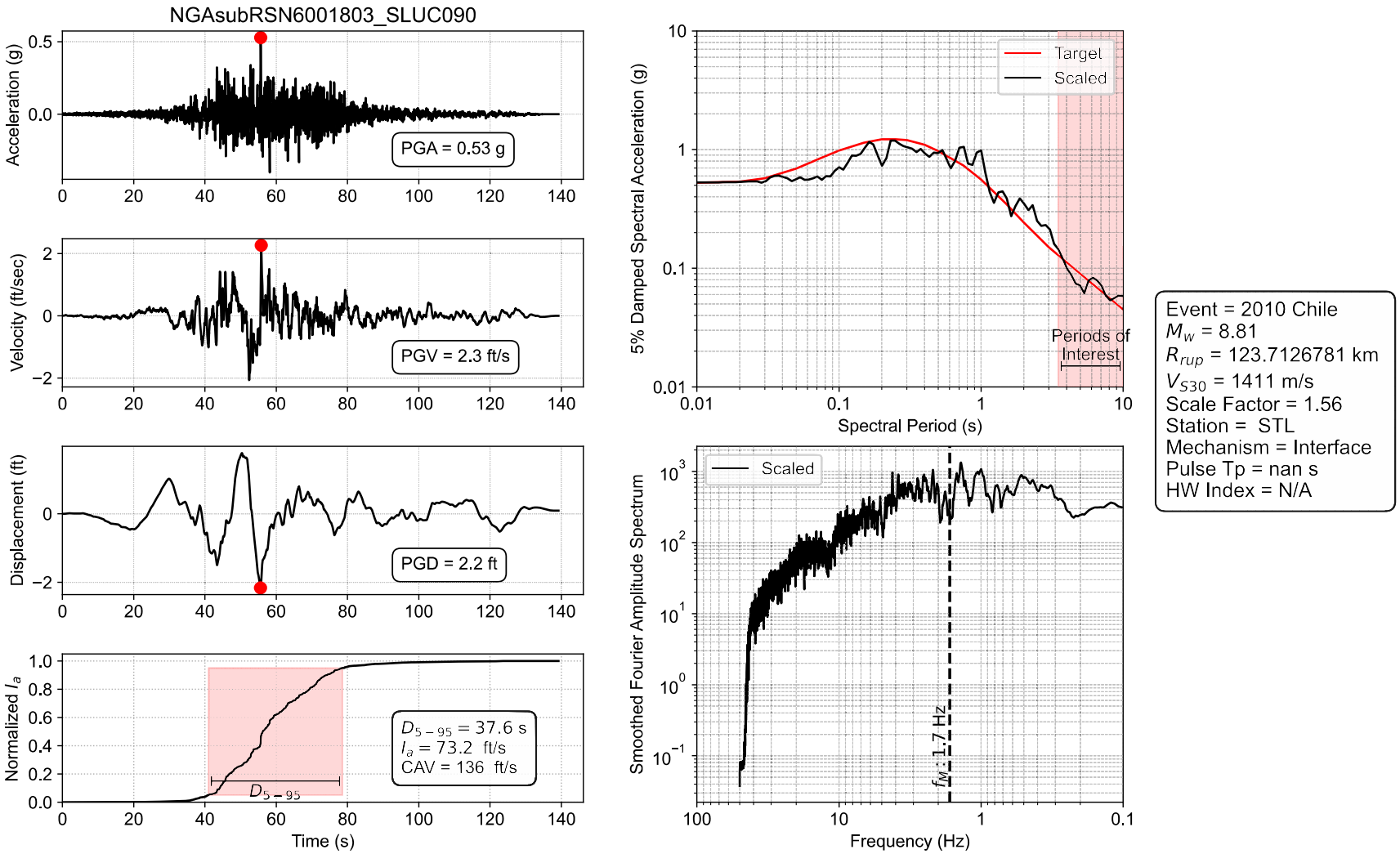
HALEY ALDRICH

Figure D-17

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Long Period (7.5s)\5Selected Motion\Scaled Input Motion\Results.pdf



Event = 2010 Chile
M_w = 8.81
R_{rup} = 123.7126781 km
V_{S30} = 1411 m/s
Scale Factor = 1.56
Station = STL
Mechanism = Interface
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN6001803_SLUC090

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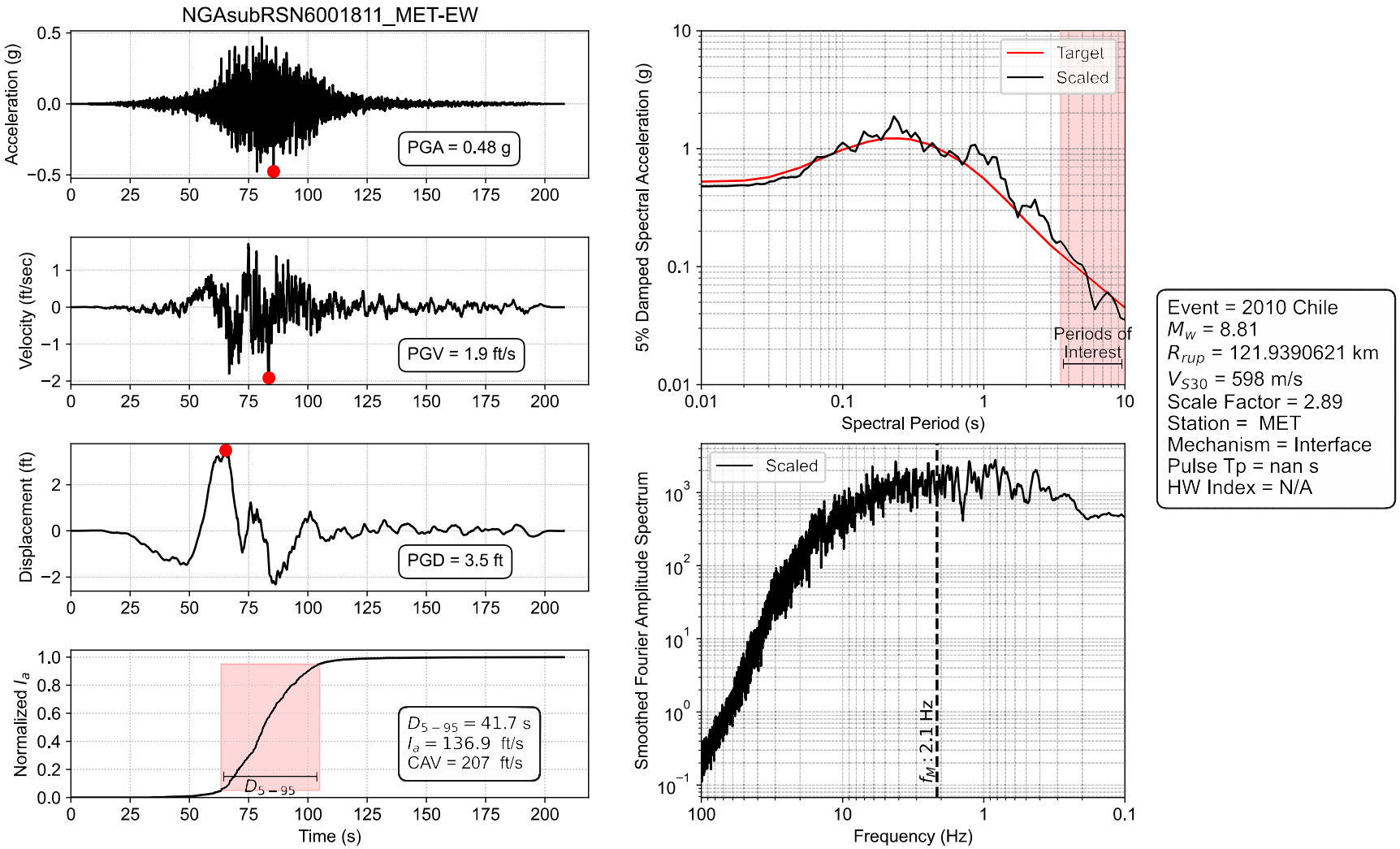
Figure D-18

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Long Period (7.5s)\5Selected Motion\Scaled Input Motion\Results.pdf



Event = 2010 Chile
M_w = 8.81
R_{rup} = 121.9390621 km
V_{S30} = 598 m/s
Scale Factor = 2.89
Station = MET
Mechanism = Interface
Pulse Tp = nan s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters RSN6001811_MET-EW

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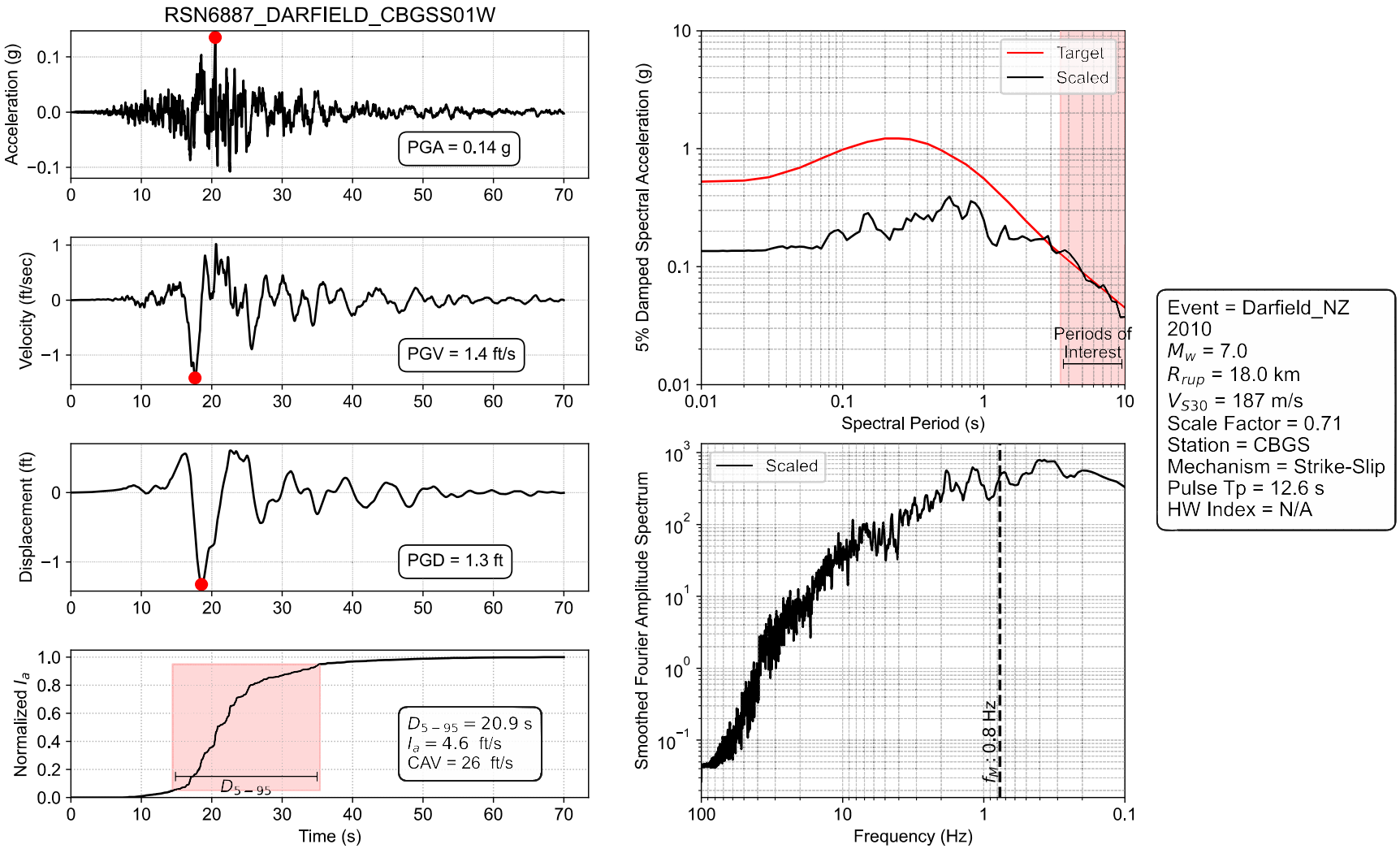
HALEY ALDRICH

Figure D-19

C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Long Period (7.5s)\5Selected Motion\Scaled Input Motion\Results.pdf



Event = Darfield_NZ 2010
M_w = 7.0
R_{rup} = 18.0 km
V_{S30} = 187 m/s
Scale Factor = 0.71
Station = CBGS
Mechanism = Strike-Slip
Pulse Tp = 12.6 s
HW Index = N/A

Notes:

1. PGA, PGV, PGD = Peak Ground Acceleration, Velocity, Displacement
2. The quiet motion (head and tail) of original recording are truncated & baseline corrected
3. D_{5-95} = Significant duration from 5% to 95% Normalized Arias Intensity
4. I_a = Arias Intensity
5. CAV = Cumulative Absolute Velocity
6. f_M = Mean frequency based on Rathje et al. (1998)
7. Pulse Tp = Period of Pulse (seconds), if nan, not classified as a pulse-like record
8. HW Index = Hanging wall index, HW: Hanging Wall, FW: Foot Wall, NU: Neutral, N/A: not applicable

PDX Fuel Tank SVA
Portland, OR

Amplitude Scaled, One-Component Ground Motion Parameters
RSN6887_DARFIELD_CBGSS01W

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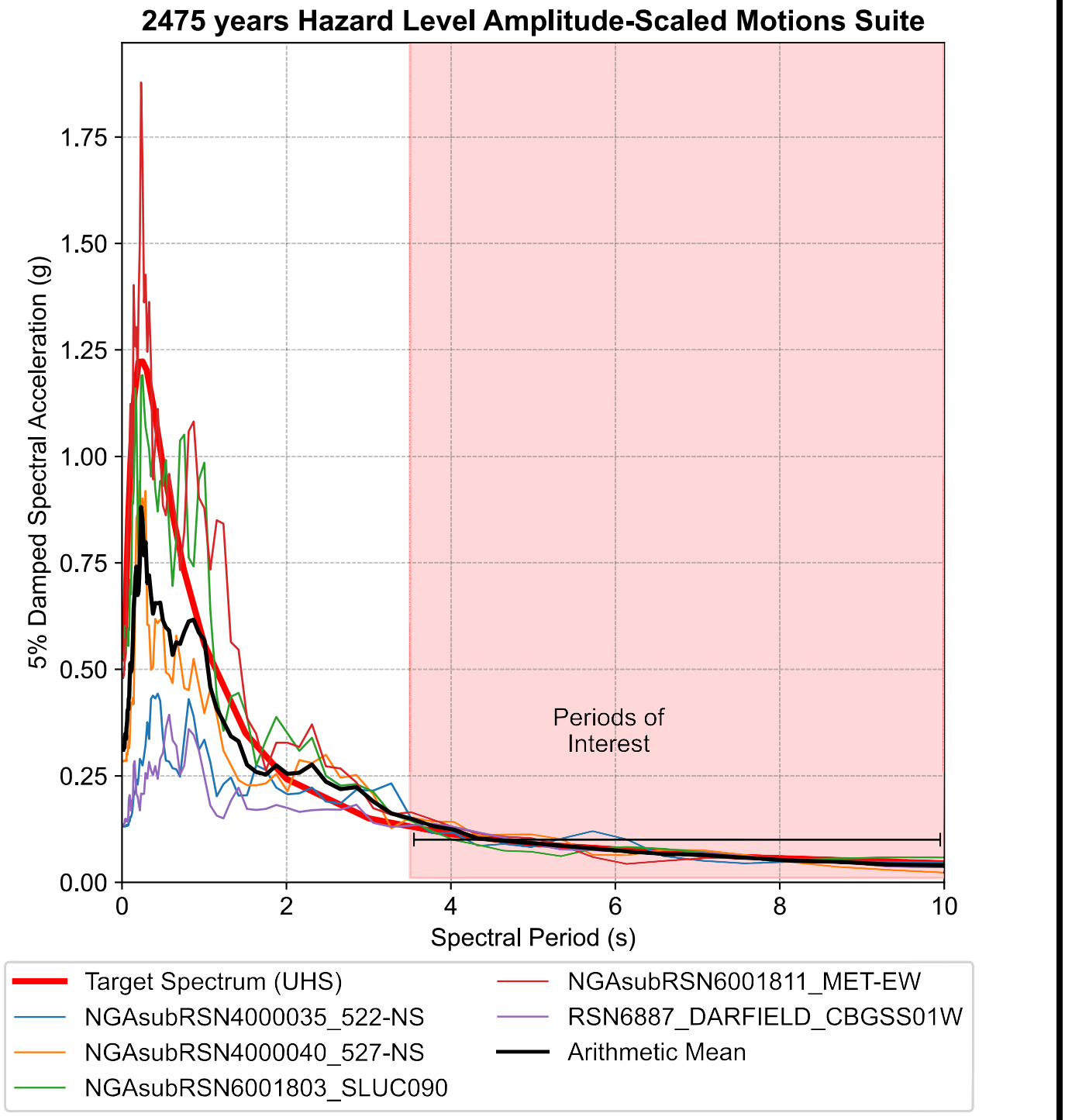
Figure D-20



Notes:

1. Target spectrum is at halfspace elevation (1271 ft/s) and based on MCER per ASCE 7-16

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PDX Fuel Tank SVA
Portland, OR

Amplitude-Scaled Response Spectra Summary Convective Period (T=7.5 sec)

July 2023

0204679-001 | **FIG. D-21**

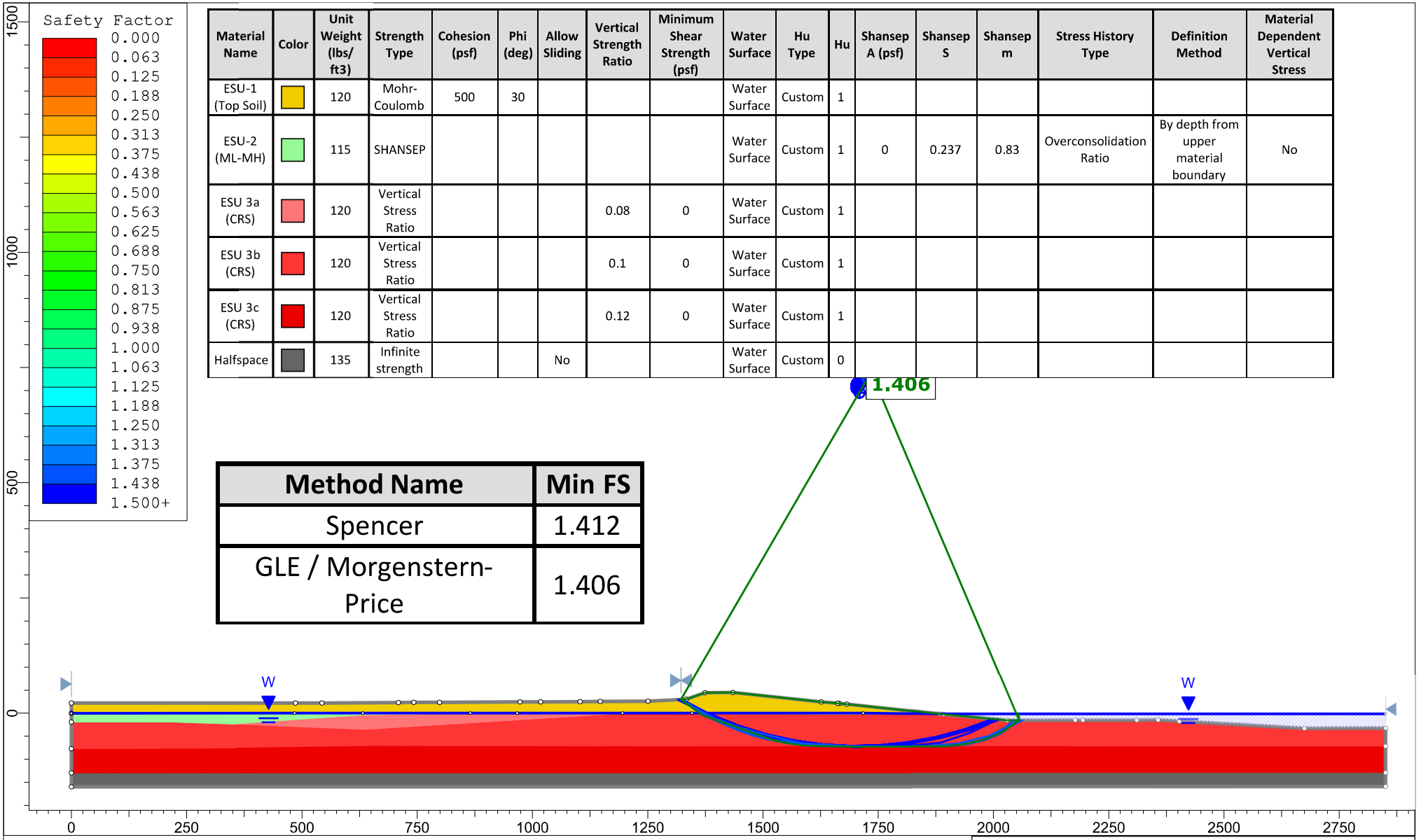
C:\Alyson Pyrch\Task 1 PDX Fuel Tanks\Ground Motion\Long Period (7.5s)\5Selected Motion\Scaled Input Motion\Results.pdf

APPENDIX E
2D-NDA (FLAC) and 1D-SRA (DEEPSOIL) Calculation Results

A. Model Geometry
B. Lateral Displacement Contour Map
C. Shear Strain Increment Contour Map
D. Excess Pore-Pressure Ratio (Ru) Contour Map
E. Maximum Shear Strain Profile (Left, Middle, Right)
F. Maximum Excess Pore Pressure Ratio Profile (Left, Middle, Right)
G. 1D-SRA Results: Profiles of Calculated Response

Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu	Shansep A (psf)	Shansep S	Shansep m	Stress History Type	Definition Method	Material Dependent Vertical Stress
ESU-1 (Top Soil)		120	Mohr-Coulomb	500	30				Water Surface	Custom	1						
ESU-2 (ML-MH)		115	SHANSEP						Water Surface	Custom	1	0	0.237	0.83	Overconsolidation Ratio	By depth from upper material boundary	No
ESU 3a (CRS)		120	Vertical Stress Ratio				0.08	0	Water Surface	Custom	1						
ESU 3b (CRS)		120	Vertical Stress Ratio				0.1	0	Water Surface	Custom	1						
ESU 3c (CRS)		120	Vertical Stress Ratio				0.12	0	Water Surface	Custom	1						
Halfspace		135	Infinite strength			No			Water Surface	Custom	0						

Method Name	Min FS
Spencer	1.412
GLE / Morgenstern-Price	1.406



PDX Fuel Tank SVA
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Post-Liquefied Stability Analysis Considering Void-Redistribution Mechanism

0204679-001 Scale 1:3500 7/14/2023

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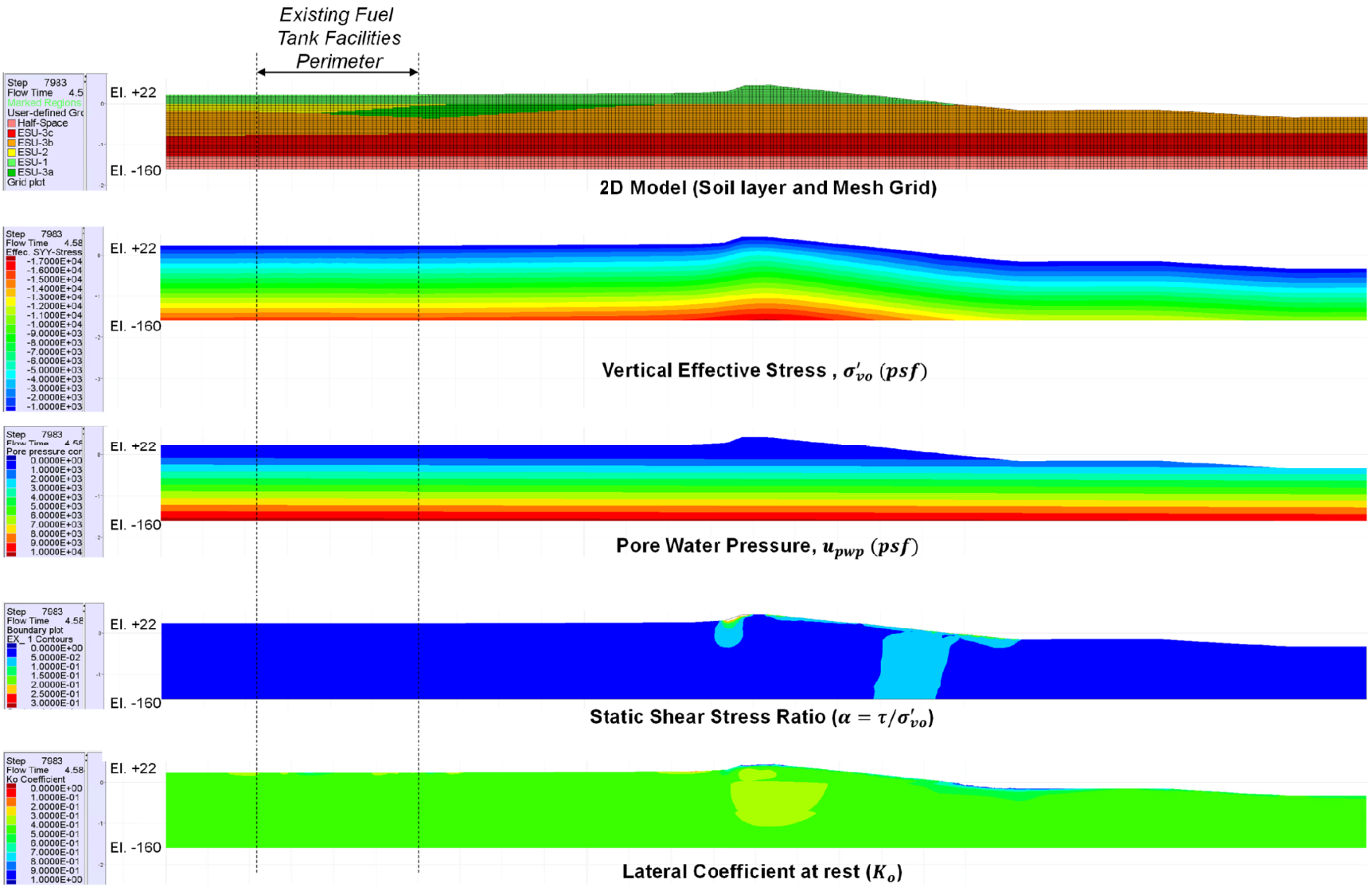
Figure
E-1



Notes:
1. The figure vertical and horizontal scale are 1V : 1H
2. The left boundary is at 0 feet and the right boundary is 2,850 feet

PDX Fuel Tanks SVA
Portland, OR

2D FLAC Numerical Model (Section B-B'): Initial State

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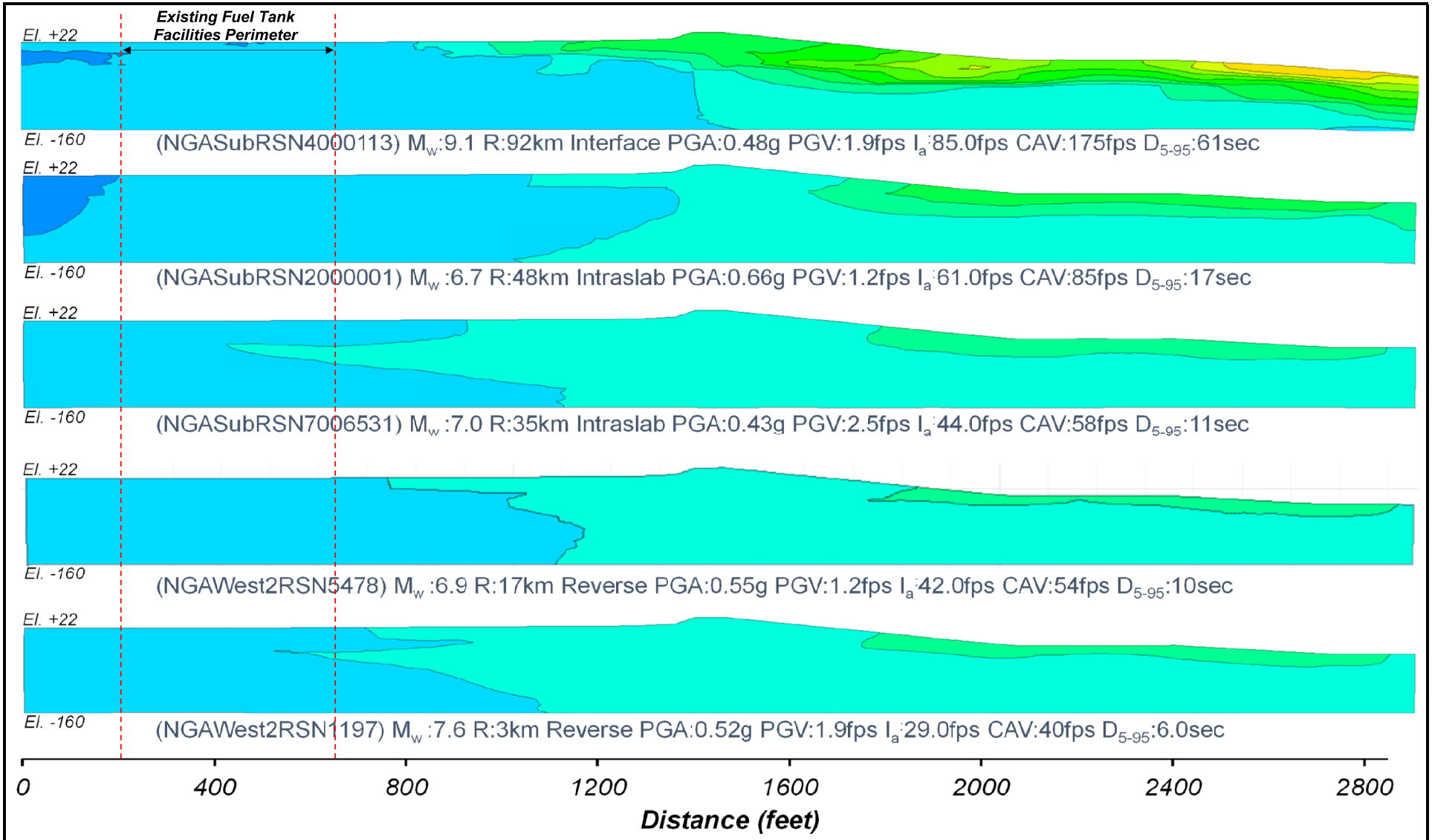
Fig. **E-2**



PDX Fuel Tanks SVA
Portland, OR

Lateral Displacement Contour Plot
(FLAC 2D NDA)
Impulsive Period (T = 0.2 sec)

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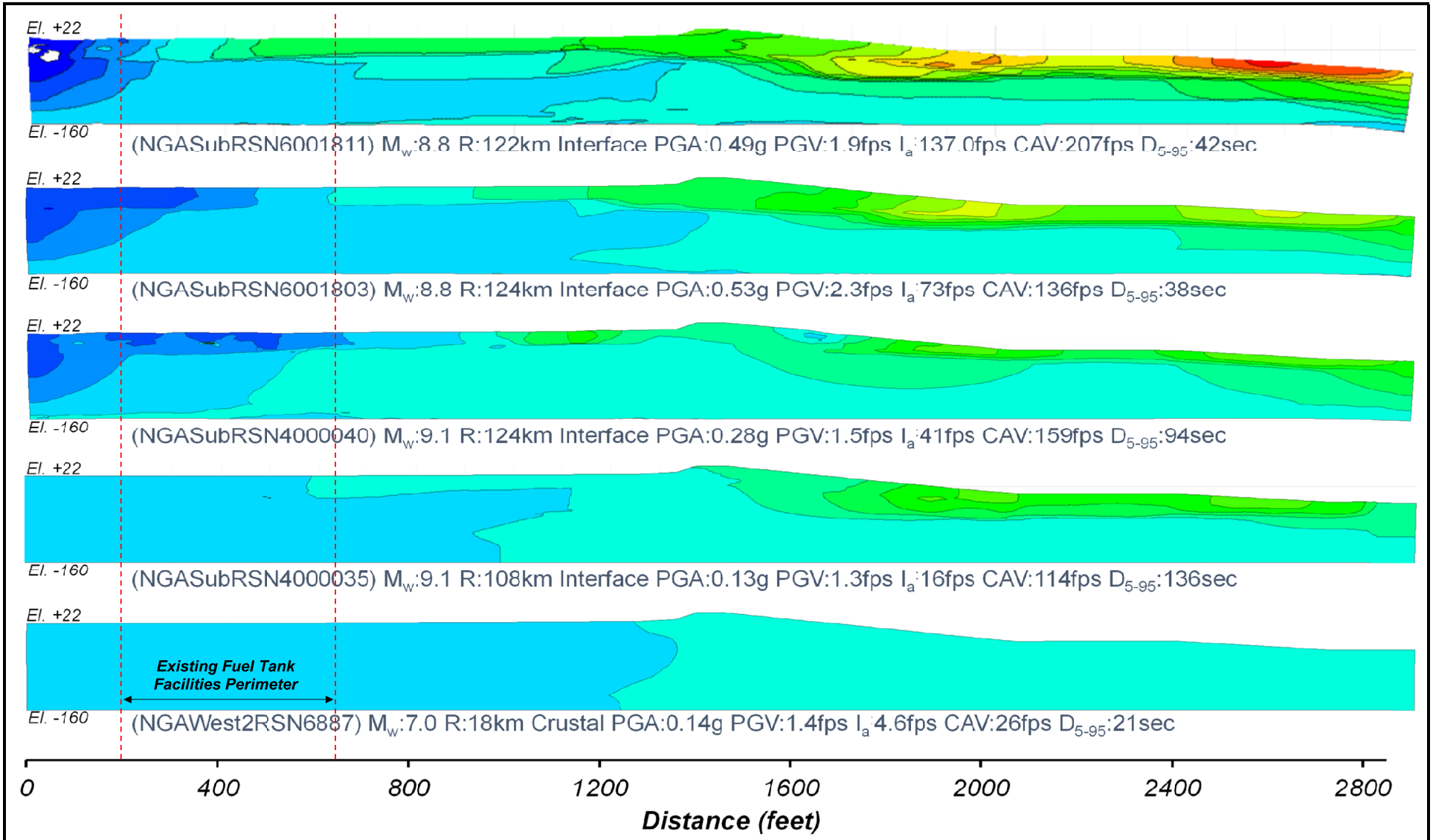
Fig. **E-3**



PDX Fuel Tanks SVA
Portland, OR

Lateral Displacement Contour Plot
(FLAC 2D NDA)
Convective Period (T = 7.5 sec)

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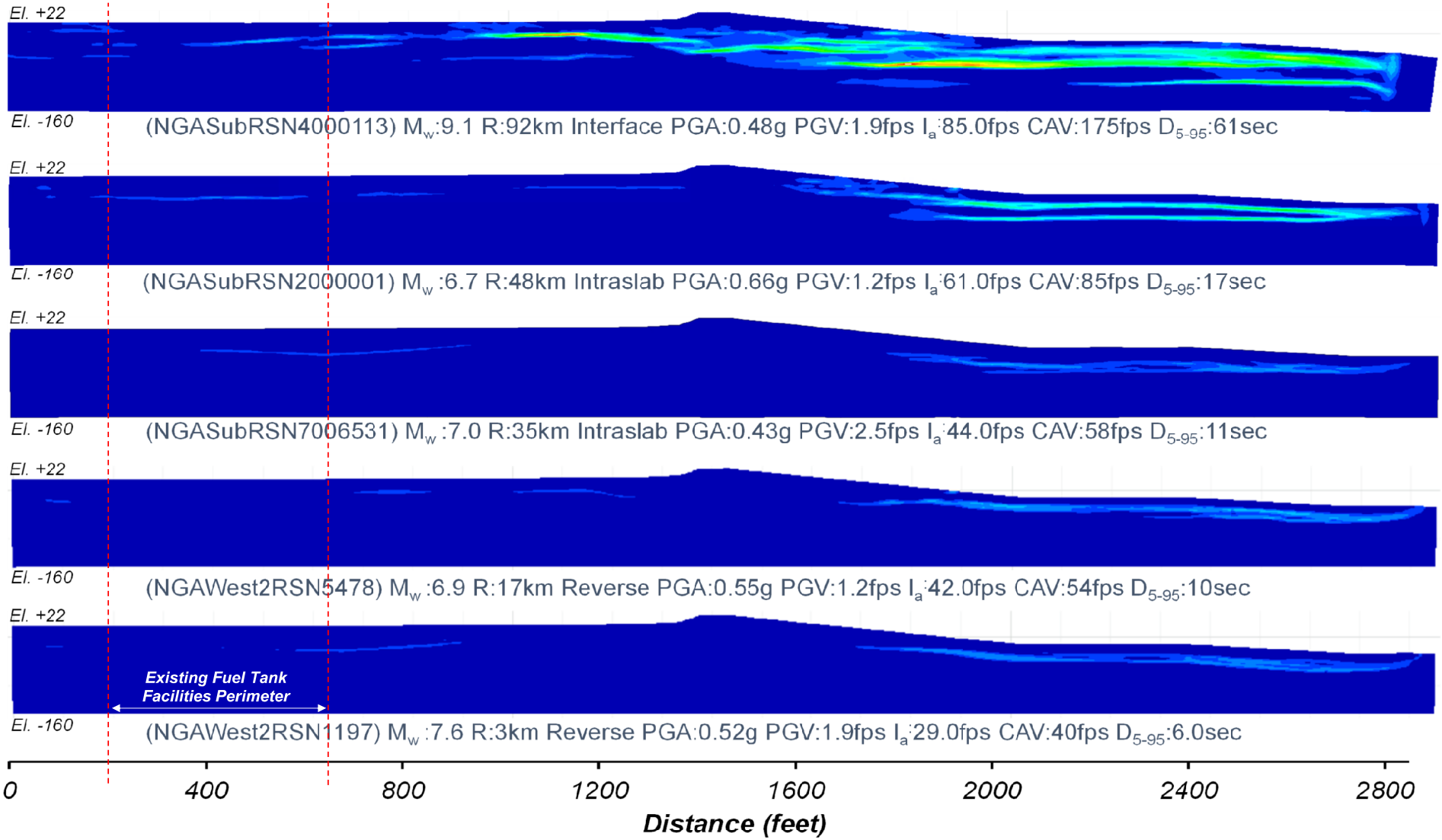
Fig. **E-4**



Notes:

1. Maximum (engineering) shear strain is approximately twice of shear strain increment plotted in this figure

PDX Fuel Tanks SVA
Portland, OR

Shear Strain Increment Contour Plot
(FLAC 2D NDA)
Impulsive Period (T = 0.2 sec)

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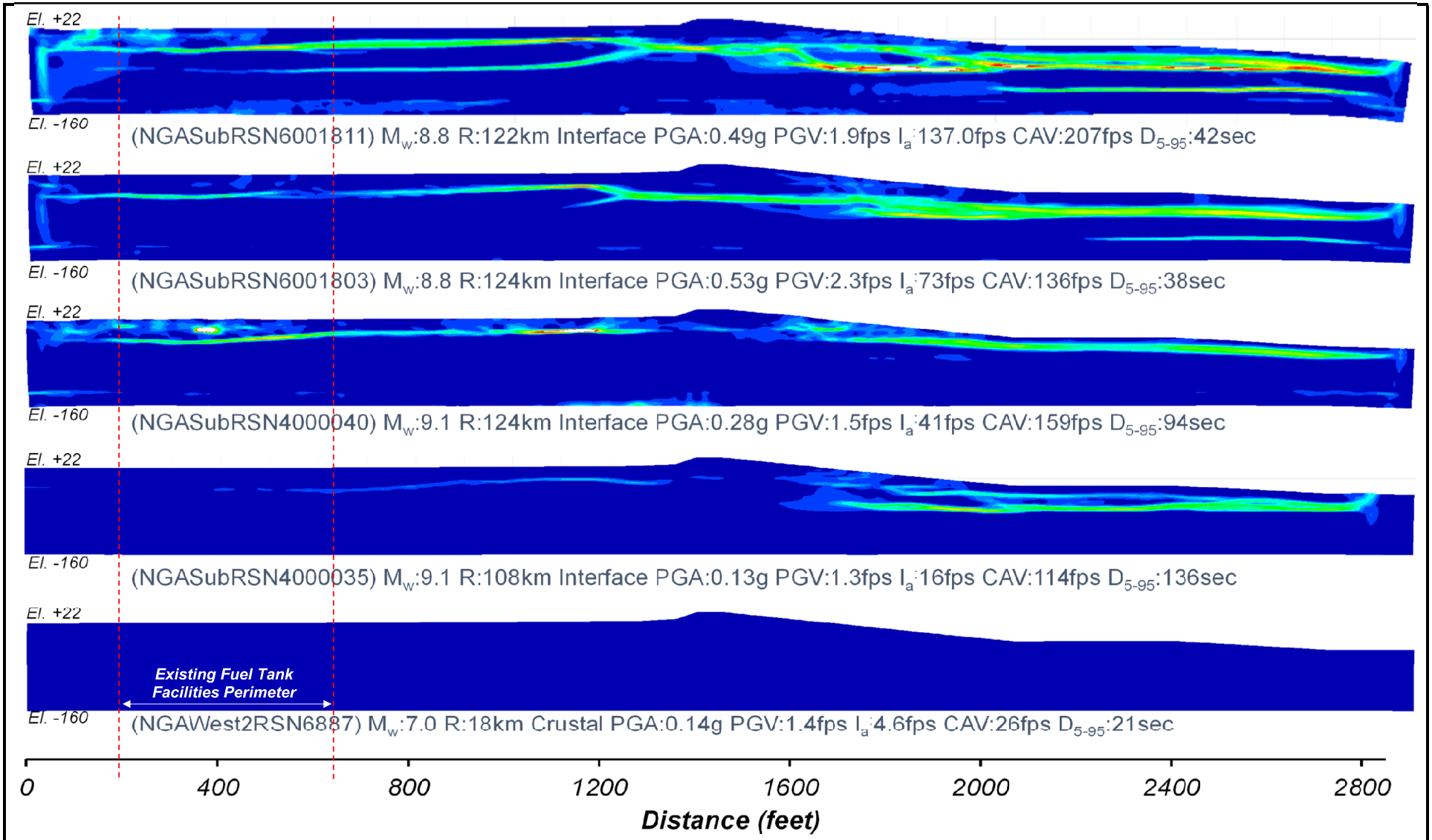
Fig. E-5



Notes:

1. Maximum (engineering) shear strain is approximately twice of shear strain increment plotted in this figure
2. Horizontal : Vertical Scale = 1 : 1

PDX Fuel Tanks SVA
Portland, OR

Shear Strain Increment Contour Plot
(FLAC 2D NDA)
Convective Period (T = 7.5 sec)

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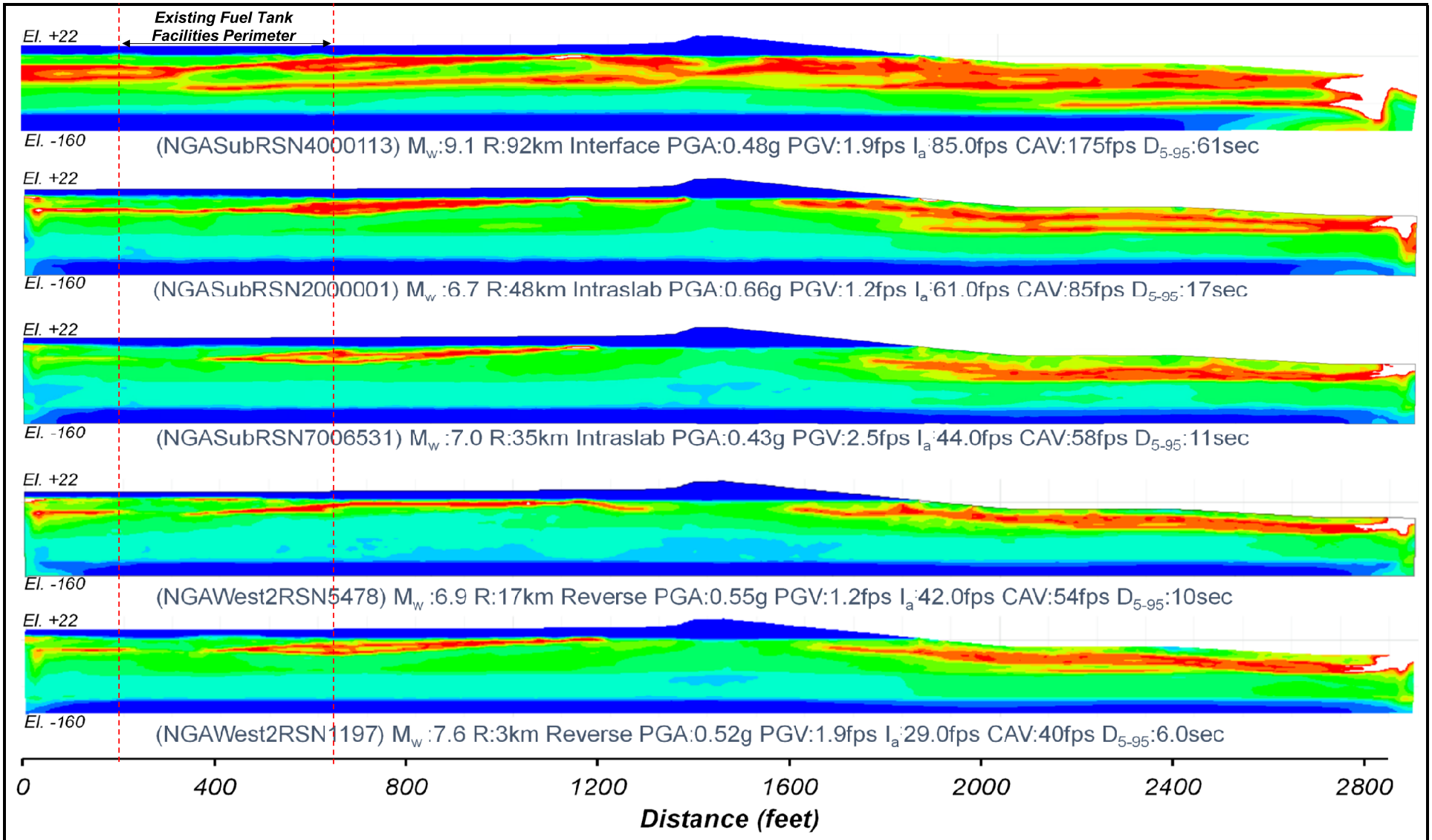
Fig. **E-6**



PDX Fuel Tanks SVA
Portland, OR

$R_{u\text{-}max}$ Contour Plot (FLAC 2D NDA)
Impulsive Period (T = 0.2 sec)

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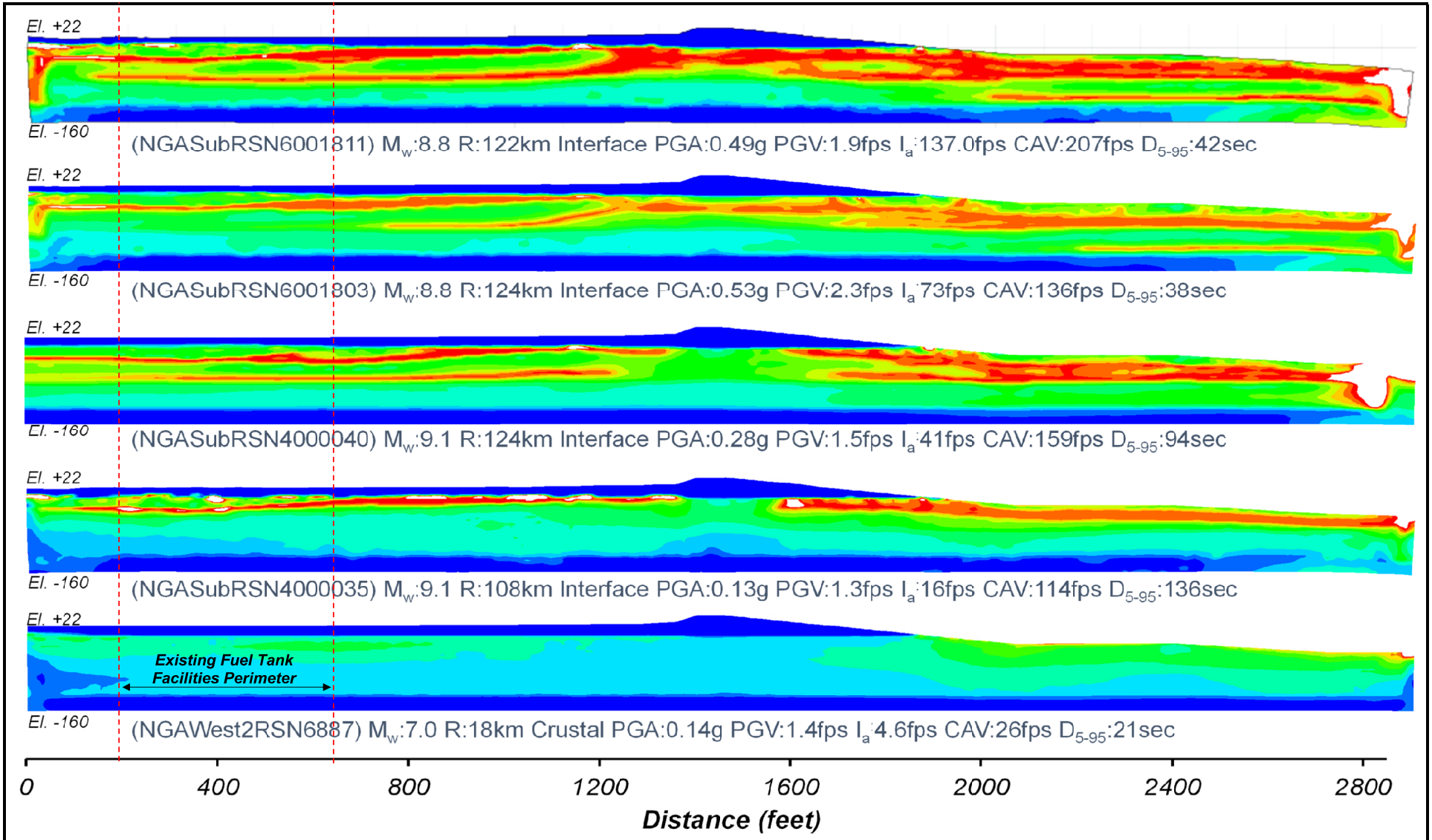
Fig. E-7



PDX Fuel Tanks SVA
Portland, OR

$R_{u\text{-}max}$ Contour Plot (FLAC 2D NDA)
Convective Period (T = 7.5 sec)

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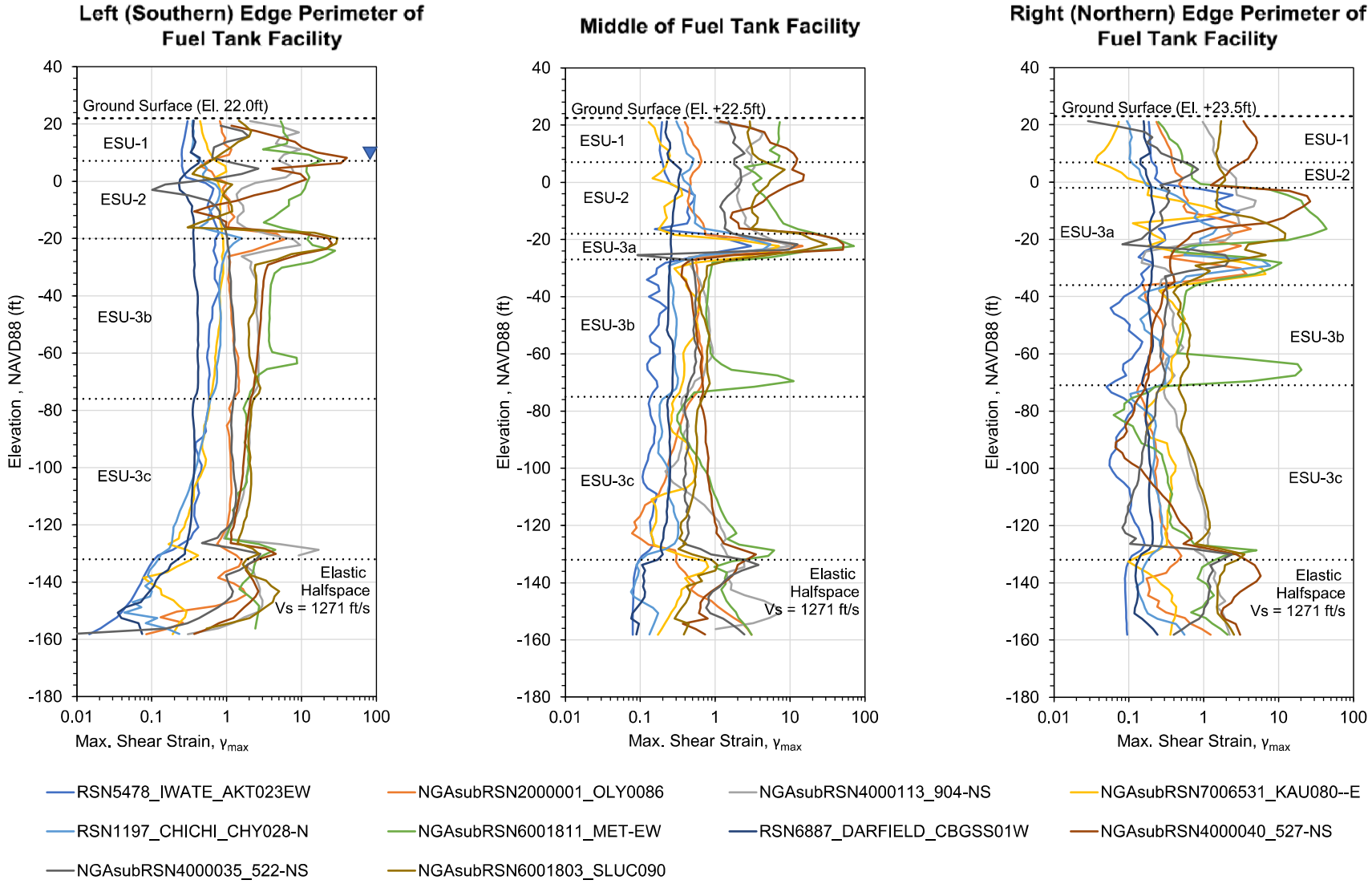
Fig. **E-8**



PDX Fuel Tanks SVA
Portland, OR

Max Shear Strain Profile
(FLAC 2D NDA Results)

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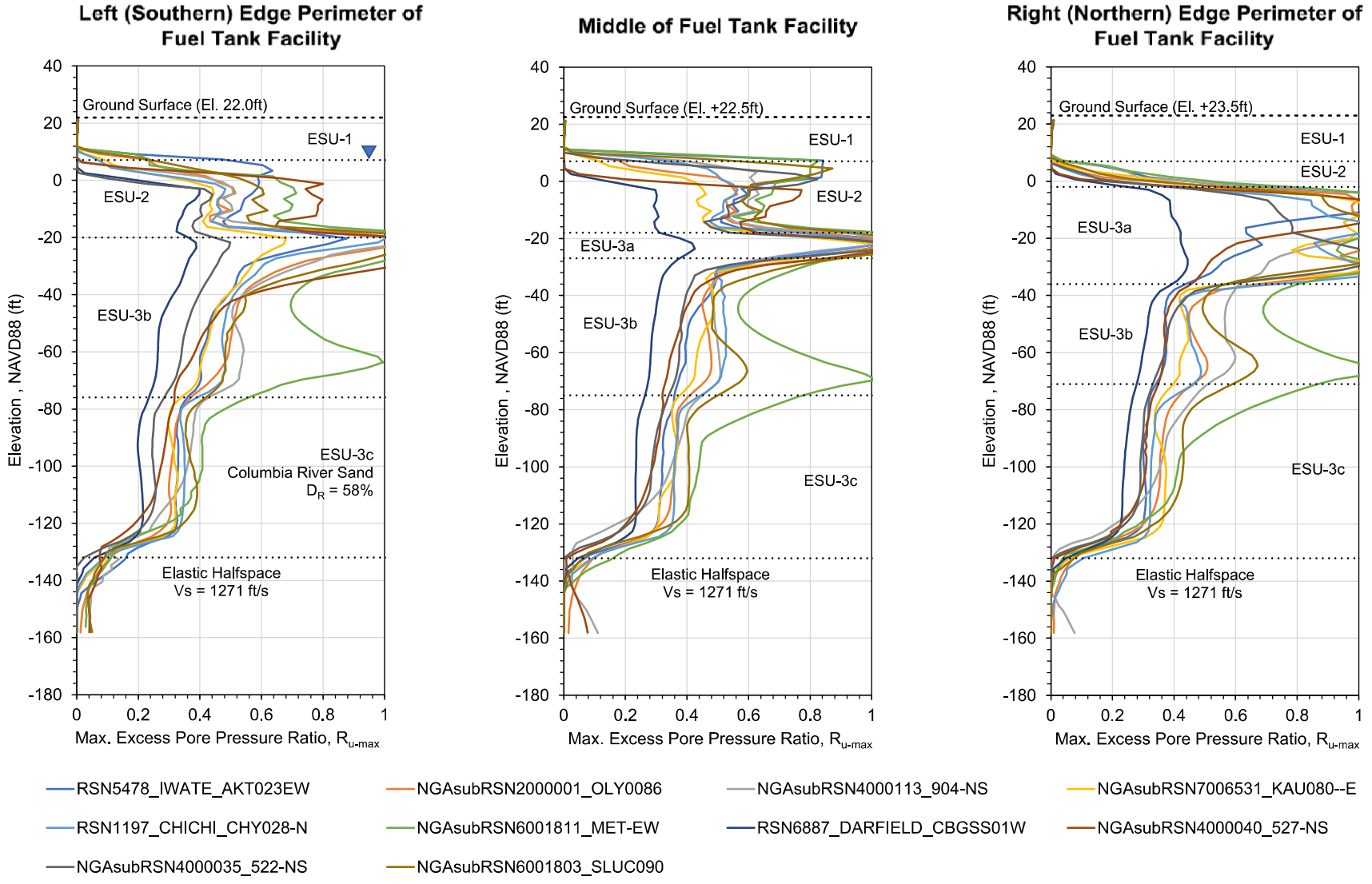
Fig. **E-9**



Notes:

1. The $R_{u\text{-}max}$ value of ESU-2 layer were used to estimate the post-liquefaction settlement presented in Figure 10.

PDX Fuel Tanks SVA
Portland, OR

$R_{u\text{-}max}$ Profile (FLAC 2D NDA Results)

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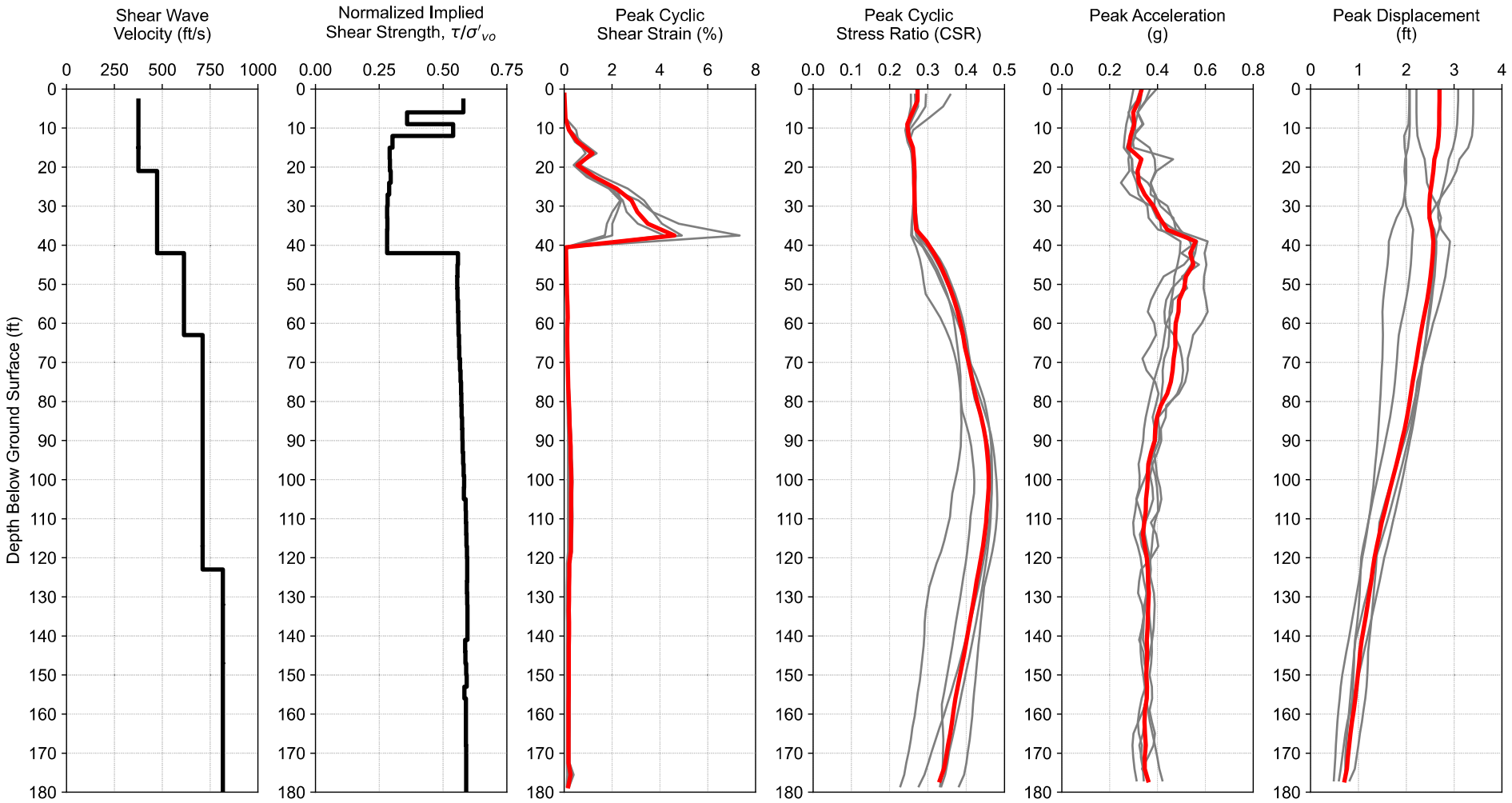
Fig. **E-10**



Notes:

1. Calculated using Deepsoil 7.0 - Time-Domain Nonlinear Total Stress Analysis
2. Soil layers are discretized to propagate maximum frequency of 25 Hz
3. Soil model: General Quadratic/Hyperbolic Model (GQ/H)
4. Hysteretic Re/Unloading Formulation: Non-Masing Rule

PDX Fuel Tanks SVA
Portland, OR

Calculated Site Response
1D Profiles Summary
Short Period (0.2 sec)

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Figure
E-11

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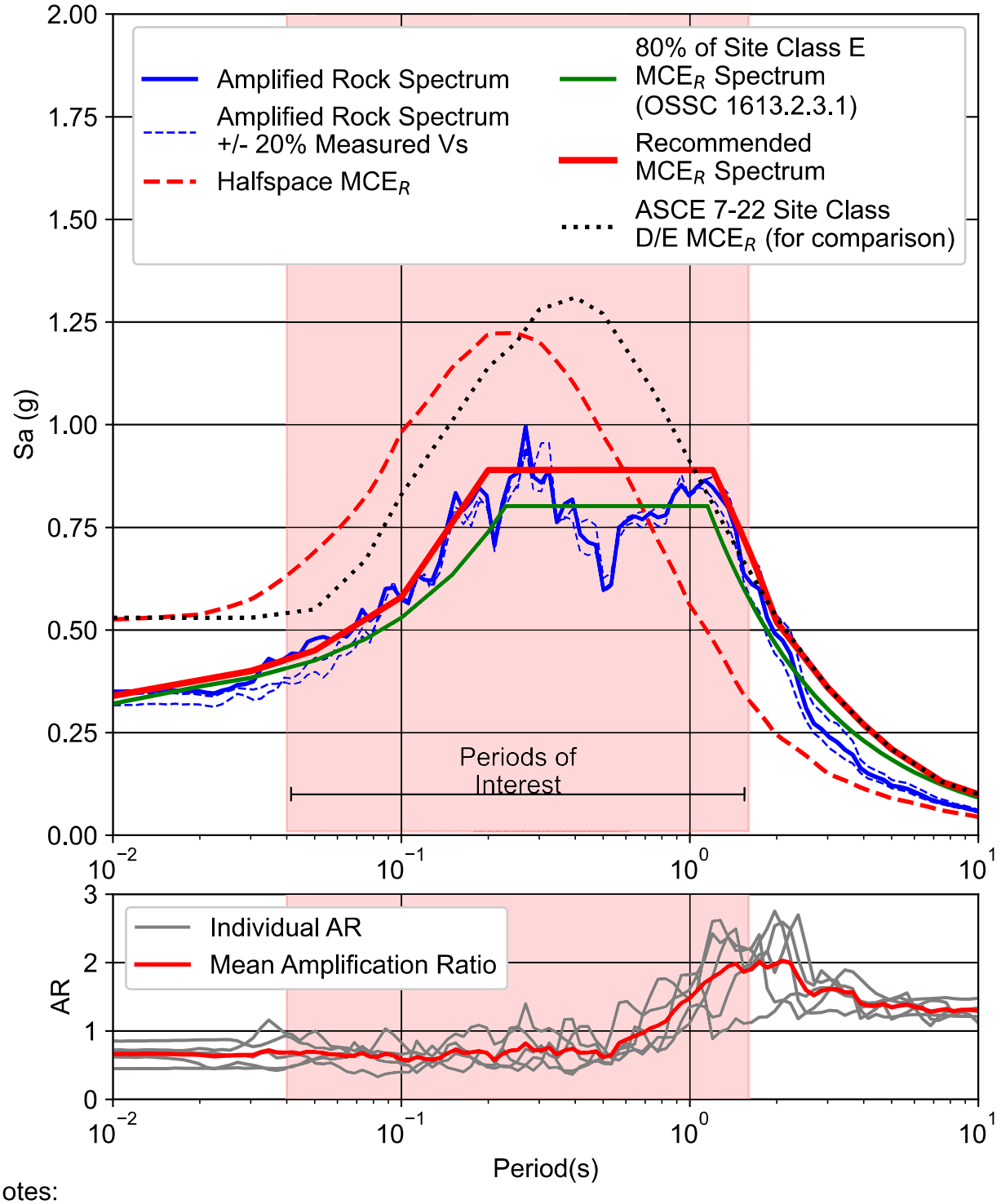

Notes:
1. Amplified Rock Spectrum = Halfspace MCE$_R$ x Mean Amplification Ratio
2. Site-specific Design Parameters are S_{DS} = 0.59g, S_{D1} = 0.74g
3. Half-space Vs = 1271 ft/s

HALEY ALDRICH

PDX Fuel Tanks SVA
Portland, OR

Calculated Surface MCE$_R$ Spectrum From 1D Site Response Analysis
July 2023

0204679-002 | **FIG. E-12**

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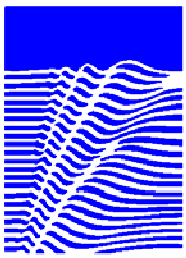
APPENDIX F
Geophysical Survey Report

Report on Seismic Velocity Study
PDX Fuel Facility
Portland, Oregon

Report Date: May 16, 2023

Prepared for:

Haley & Aldrich, Inc
6420 S. Macadam Ave.
Portland, OR 97239



Prepared by:

EARTH DYNAMICS LLC
2284 N.W. Thurman St.
Portland, OR 97210
(503) 227-7659
Project No. 23212

1.0 INTRODUCTION

Haley & Aldrich, Inc. engaged Earth Dynamics LLC to conduct geophysical explorations near the Portland International Airport (PDX) Fuel Facility in Portland, Oregon. The geophysical field work was completed under the supervision of Mr. Daniel Lauer of Earth Dynamics LLC on April 28, 2023. This report describes the methodology and results of the geophysical investigation.

2.0 SCOPE OF WORK

The purpose of this study is to characterize the subsurface shear wave and compressional wave velocities at the site. These data are needed to help determine the seismic response of the site to earthquake loading. The exploration methods consist of passive source refraction micro-tremor (ReMi), and active source Multichannel Analysis of Surface Waves (MASW). ReMi and active source MASW are used to help determine the shear-wave velocities of the underlying soil. ReMi provides average shear wave velocity for the site and MASW can be used to develop a 2-Dimensional profile of the shear wave velocity with depth. Data were acquired at four ReMi arrays and one MASW array. The locations of the arrays are shown in Figure 2-1.

The 2D MASW array was acquired using a 24-channel geophone array deployed on a seismic "land streamer" with a geophone spacing of 10 feet. MASW data were acquired along a 630-foot-long North/South profile within the PDX property. Three ReMi profiles were acquired using various geophone spacings and distances along the same profile. Data for a fourth ReMi array were acquired north of the site between Marine Drive and the Columbia River. The configuration details of the ReMi arrays are summarized in Table 2-1.

Table 2-1. Summary of ReMi Array Configuration.

ReMi Array	Geophone Spacing (ft)	Number of Geophones	Total Array Length (ft)
ReMi Array 1	10	24	230
ReMi Array 2	30	24	690
ReMi Array 3	15	24	345
ReMi Array 4	15	24	345

Figure 2-1. Site layout showing locations of geophysical arrays.

3.0 METHOD

3.1 Passive source ReMi

The ReMi technique provides a simplified characterization of relatively large volumes of the subsurface. The method can be used to estimate one-dimensional shear wave velocity profiles and provide site-specific soil classification data as described in ASCE/SEI 7-16 (2017). In a ReMi survey, geophones are deployed at designated intervals along a linear array. The resolution and depth of investigation depends upon the geophone cut-off frequency, spacing of the geophones, the total array length and the frequency characteristics of the Rayleigh waves at the site. For "rule of thumb" survey planning, the nominal depth of investigation is assumed to be approximately one-third of the geophone array length.

The theoretical basis of the ReMi method is the same as Spectral Analysis of Surface Waves (SASW) and Multi-channel Analysis of Surface Waves (MASW) as first described to the earthquake engineering community by Nazarian and Stokoe (1984). However, ReMi does not require a frequency-controlled source and the field equipment is much more compact and economical. A complete description of the theoretical basis for ReMi is described by Louie (2001). In ReMi analysis all interpretation is done in the frequency domain, and the method assumes that the most energetic arrivals recorded are Rayleigh waves. By applying a time-domain velocity analysis, Rayleigh waves can be separated from body waves, air waves, and other coherent noise. Transforming the time-domain velocity results into the frequency domain allows combination of many arrivals over a long time period, and yields easy recognition of dispersive surface waves.

Data reduction is completed in two steps. First, the time versus amplitude seismic records are transformed into spectral energy shear wave frequency versus shear wave velocity (or slowness). The data are graphically presented in what is commonly termed a p-f plot. The interpreter determines a dispersion curve from the p-f plot by selecting the lower bound of the spectral energy shear wave velocity versus frequency trend. The second phase of the analysis consists of fitting the measured dispersion curve with a theoretical dispersion curve that is based upon a model of multiple layers with various shear wave velocities. The model velocities and layer thicknesses are adjusted until a 'best fit' to the measured data is obtained. This type of interpretation does not provide a unique model. Interpreter experience and knowledge of the existing geology is important to provide a realistic solution. The data are presented as one-dimensional velocity profiles that represent the average shear wave velocities of the subsurface layers over the length of the geophone array.

For this project, data were acquired using a Seismic Source 24 channel DaqLink 4 seismograph equipped with twenty-four 4.5 Hz vertical geophones mounted on the

ground surface. ReMi Array 1 was deployed with a ten-foot geophone spacing for a total array length of 230 feet. Array 2 was deployed with a 30-foot geophone spacing for a total array length of 690 feet. Arrays 3 and 4 were deployed using a 15-foot geophone spacing for an array length of 345 feet. Many 30-second-long seismic records of ambient seismic noise were recorded for each array. Data were also acquired when vehicles, airplanes, and people were moving on and near the site.

3.2 Active source MASW

Active source data were acquired over a 630 foot long profile. The geophone land streamer was configured with a 10 foot geophone spacing and data gathers were acquired with a shot point situated 50 feet south of the last geophone in the array. The entire array was moved 10 feet south for each data gather. Data were acquired at fourty-one locations for the Array. A 20-pound sledgehammer was used as a seismic energy source. The MASW data were analyzed using ParkSeis Software. The software allows for analysis of each shot to develop a fundamental mode dispersion curve. The dispersion curves from each shotpoint are combined to create a 2-D shear wave profile for the array.

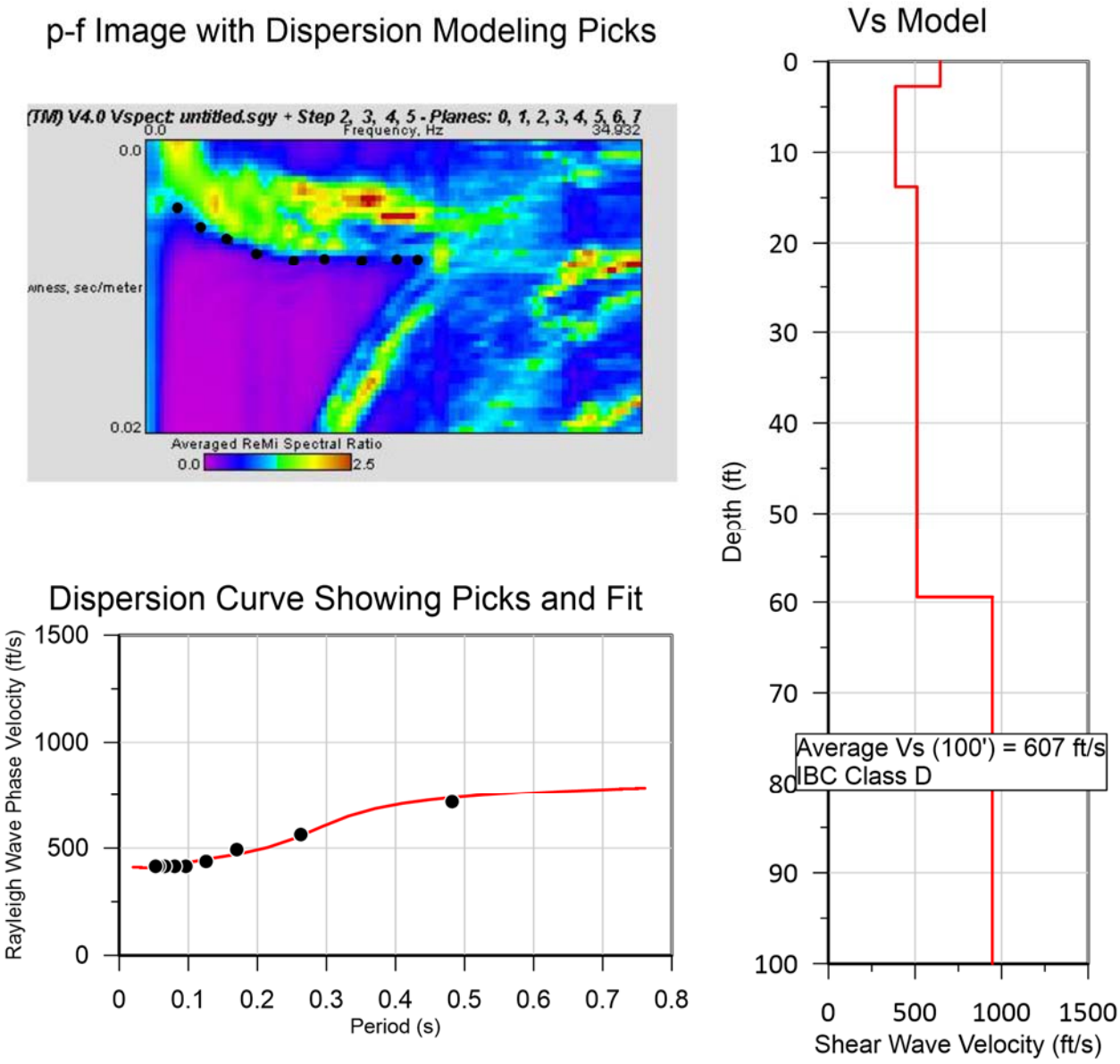
4.0 RESULTS

The approximate locations of the geophysical arrays are shown on the Google Earth image contained in Figure 2-1. The ReMi analysis and results for ReMi Arrays 1 through 4 are contained in Figures 4-1 through 4-4 respectively. Figures 4-1 through 4-4 contain the p-f plot, the dispersion curve, the derived velocity versus depth model that best fits the geology of the site and a table containing the shear wave velocity with depth for the array.

The active source 2-D MASW analysis results are contained in Figure 4-5. Figure 4-5 contains the modelled two-dimensional shear wave velocity cross section and a map showing the estimated confidence levels of the shear wave velocity profile.

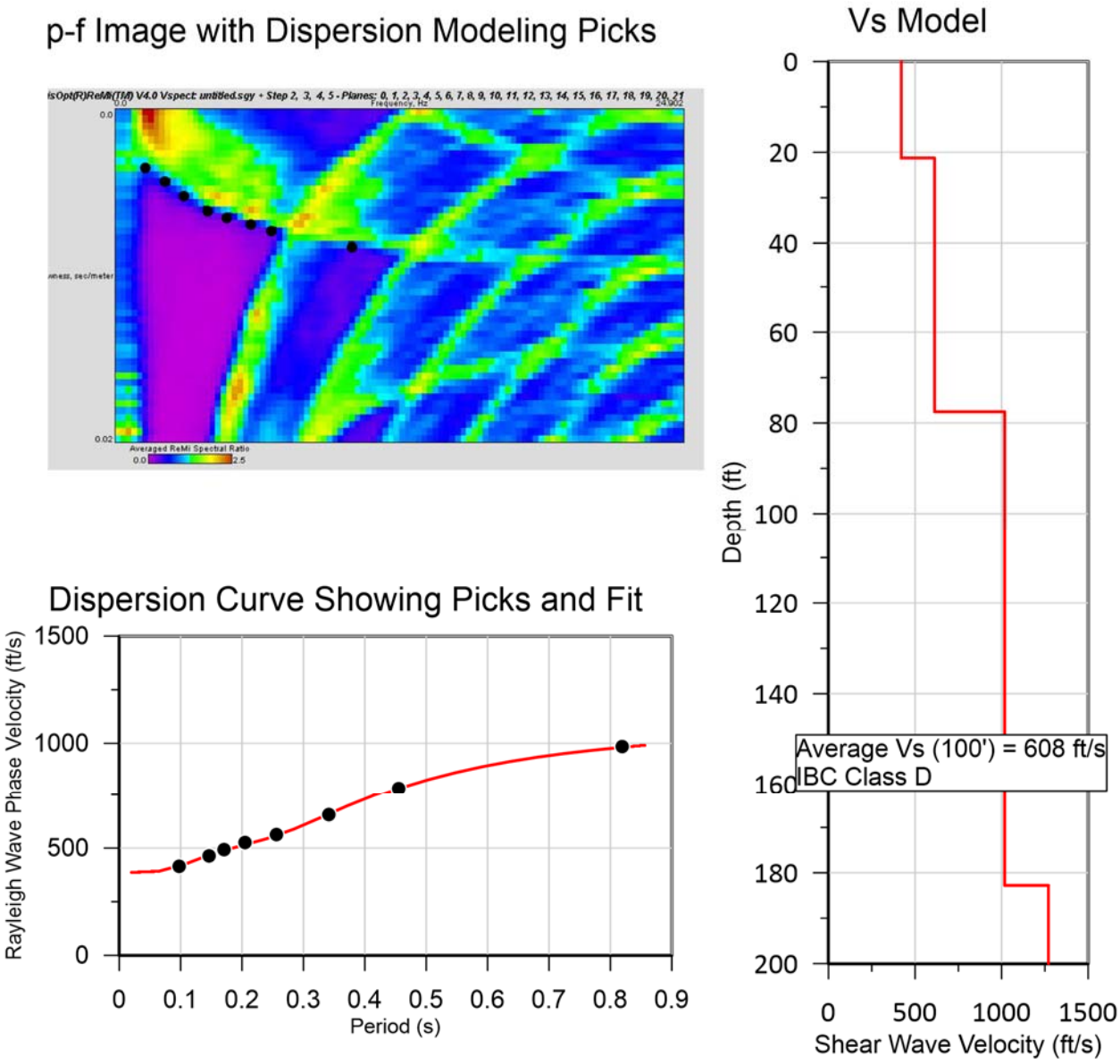
The ReMi dispersion curve data quality is good for all ReMi arrays acquired during this study. The model fit to the data for each array appears to be good to very good. The RMS error of the model fit for these data is less than 20 ft/s.

The MASW data correlate moderately well with the ReMi data. However the confidence level for the 2D MASW profile is very low deeper than approximately fifty feet below the ground surface (bgs). This low confidence level is most likely related to insufficient transmission of low frequency energy from the active source. The long data gathers of the ReMi method produce dispersion curves that are coherent into lower frequencies.



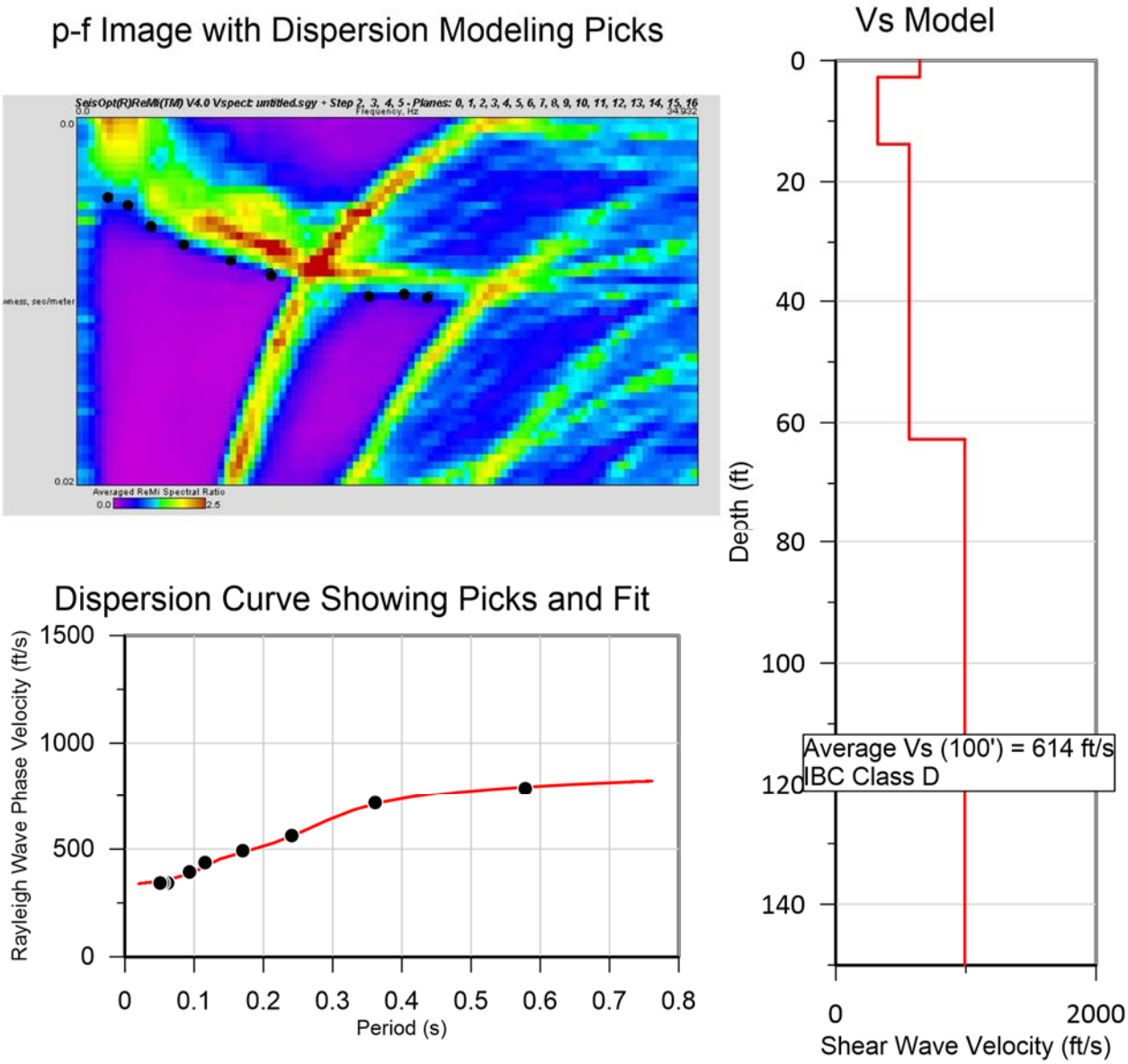
Depth Interval (ft)	Shear-wave velocity (ft/s)
0 – 2.75	645
2.75 – 13.8	387
13.8 –59.4	512
59.4 - 100	948

Figure 4-1. Array 1 ReMi Results



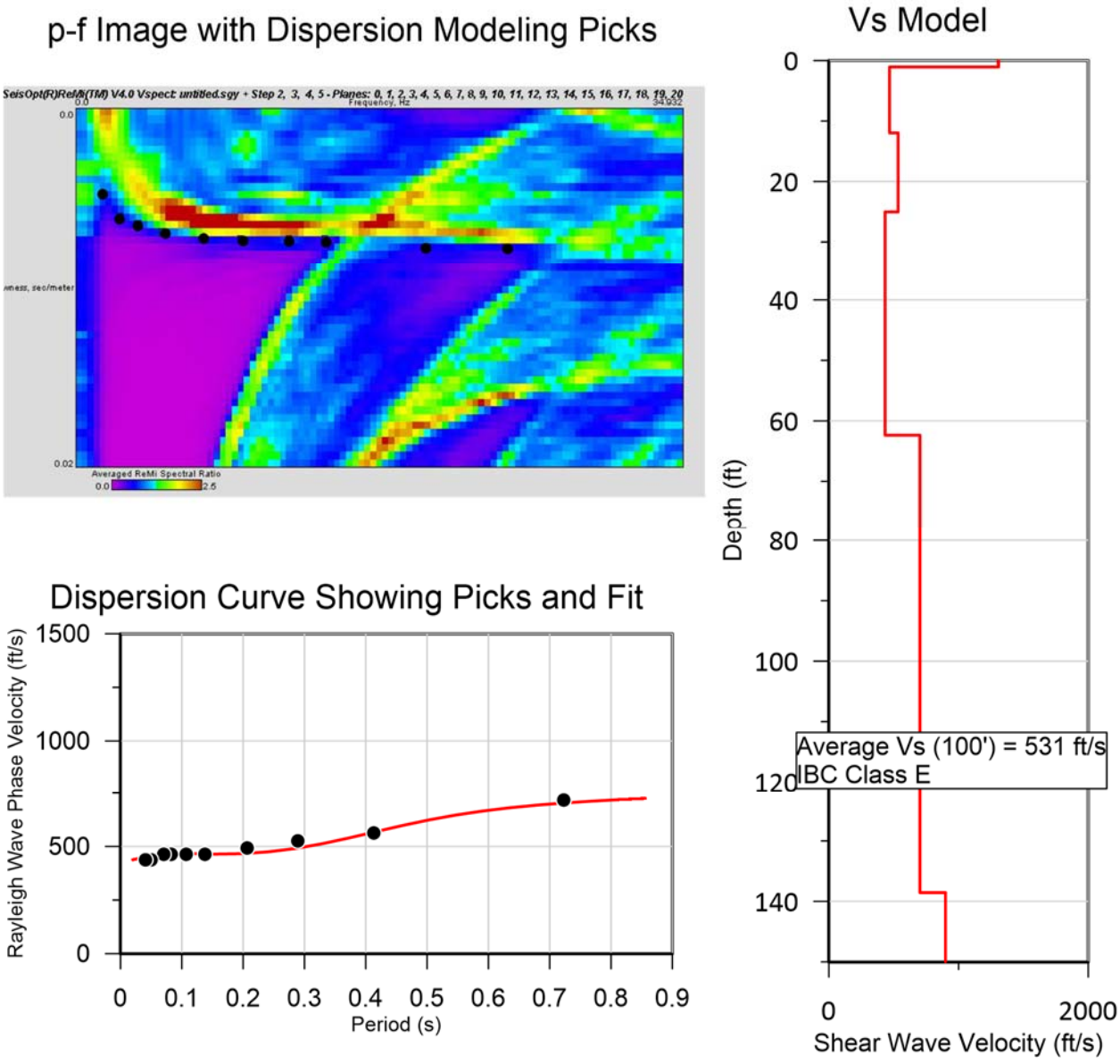
Depth Interval (ft)	Shear-wave velocity (ft/s)
0 – 21.3	420
21.3 – 77.5	613
77.5 – 182.8	1,017
182.8 – 200	1,271

Figure 4-2. Array 2 ReMi Results



Depth Interval (ft)	Shear-wave velocity (ft/s)
0 – 2.75	644
2.75 – 13.8	322
13.8 – 62.7	564
62.7 - 150	993

Figure 4-3. Array 3 ReMi Results



Depth Interval (ft)	Shear-wave velocity (ft/s)
0 – 1.1	1,307
1.1 – 11.9	468
11.9 – 25.0	534
25.0 – 62.4	434
62.4 – 138.6	702
138.6 – 150	900

Figure 4-4. Array 4 ReMi Results

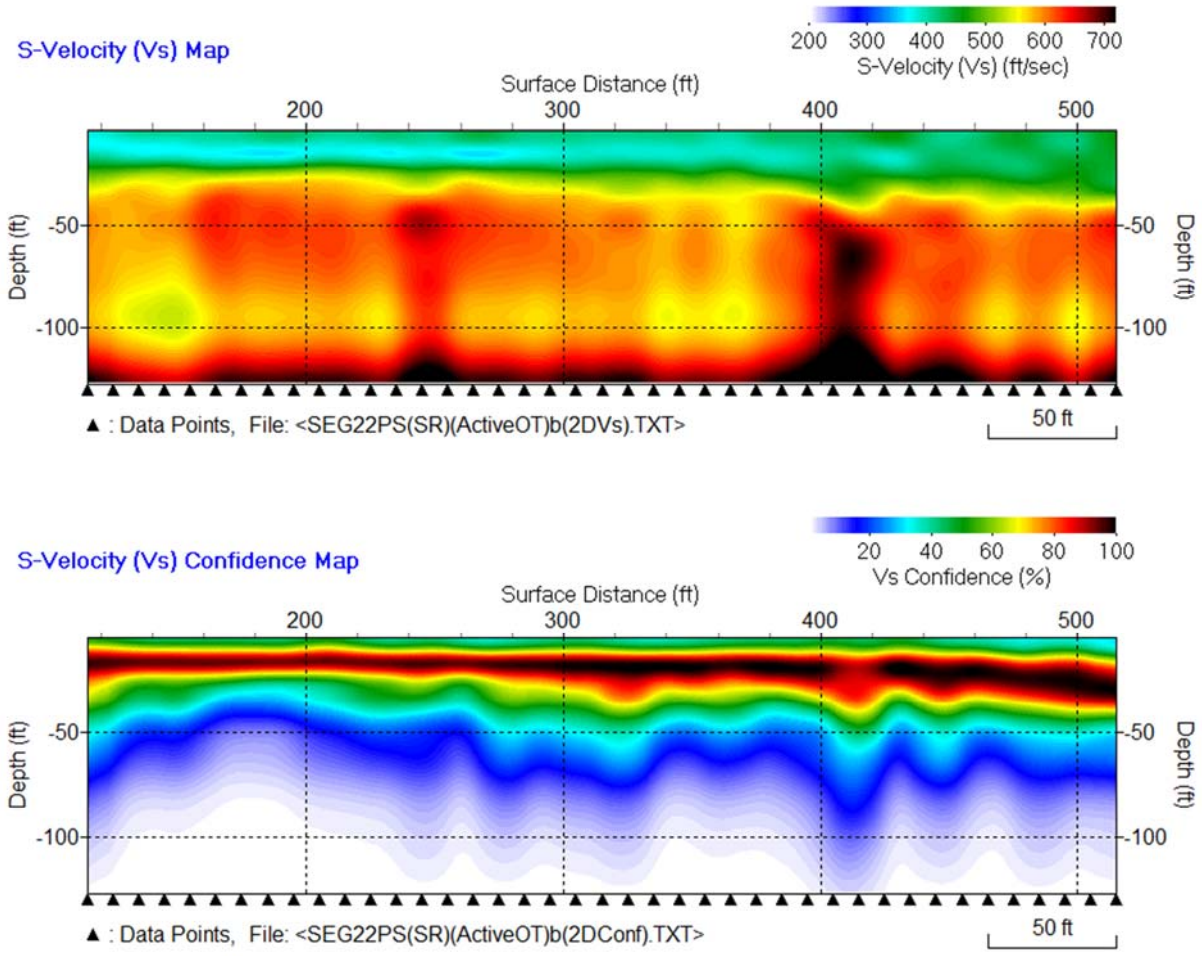


Figure 4-5. 2-D (top) Vs models and Confidence plot (bottom) from active source MASW Array.

5.0 DISCUSSION

There is good correlation of modeled velocity values for both methods. Generally the shear wave velocities at the site are laterally homogeneous with slightly increasing velocity towards the south.

ASCE/SEI 7-16 (2017) defines five site classes based upon the average shear-wave velocity of the soil to a depth of 30 Meters (100 feet). The ASCE classification is summarized in Table 5-1. The classifications in Table 5-1 are incorporated into the International Building Code (IBC 2018) Earthquake shaking is expected to be stronger where shear-wave velocity is lower. Average shear wave velocity to a depth of 100 ft (V_{s100}) is calculated using Equation 5-1.

$$Vs(100) = \frac{100}{\sum_{i=1}^{i=n}\left(\frac{d_i}{Vs_i}\right)} \qquad \text{Equation 5-1}$$

Where:

n = the number of intervals
i = the interval number
d_i = the thickness of the i^{th} interval in feet
Vs_i = the velocity of the i^{th} interval

Using Equation 5-1 and the data in Figures 4-1 through 4-4, the average shear wave velocity to a depth of 100 ft for ReMi Arrays 1 through 3 is slightly greater than 600 ft/s. These velocities are near the lower boundary of Site Class D. However, given the 20 ft/s uncertainty in the modeled results it is recommended that Site Class E be assigned to these models. The average shear wave velocity to a depth of 100 ft of ReMi Array 4 is calculated to be 531 ft/s. This velocity corresponds to Site ClassE. In summary, it is recommended that future seismic design for this site comply with requirements for Site Class E.

Table 5-1. Summary of ASCE soil classification.

Class	Average S-wave Velocity (ft/sec)	Description
A	> 5,000	Hard rock
B	2,500 – 5,000	Rock
C	1,200 – 2,500	Very dense soil and soft rock
D	600 – 1,200	Stiff soil
E	<600	Soil

6.0 LIMITATIONS

The geophysical methods used in this study involve the inversion of measured data. Theoretically, the inversion process yields an infinite number of models which will fit the data. Further, many geologic materials have the same seismic velocity. We have presented models and interpretations which we believe to be the best fit given the geology and known conditions at the site. However, no warranty is made or intended

by this report or by oral or written presentation of this work. Earth Dynamics accepts no responsibility for damages because of decisions made or actions taken based upon this report.

7.0 REFERENCES

ASCE/SEI 7-16 (2017), Minimum Design Loads for Buildings and other Structures, American Society of Civil Engineers, Structural Engineering Institute, Reston, VA.

Louie, J.N. (2001). "Faster, better: shear-wave velocity to 100 meters depth from refraction microtremor arrays", Bull. Seism. Soc. Am., 91, 347-364.

Nazarian, S., and Stokoe II, K.H., (1984), "In situ shear-wave velocities from spectral analysis of surface waves", Proceedings for the World Conference on Earthquake Engineering Vol. 8, San Francisco, Calif., July 21-28, v.3, 31-38.

PARK ??

IBC (2012) 2012 International Building Code , International Code Council, Washington D.C.

RESPECTFULLY SUBMITTED
EARTH DYNAMICS LLC

Daniel Lauer
Partner - Senior Geophysicist

APPENDIX C

GEOTECHNICAL DATA REPORT ON PDX FUEL PROJECT TANK DESIGN

HALEY ALDRICH

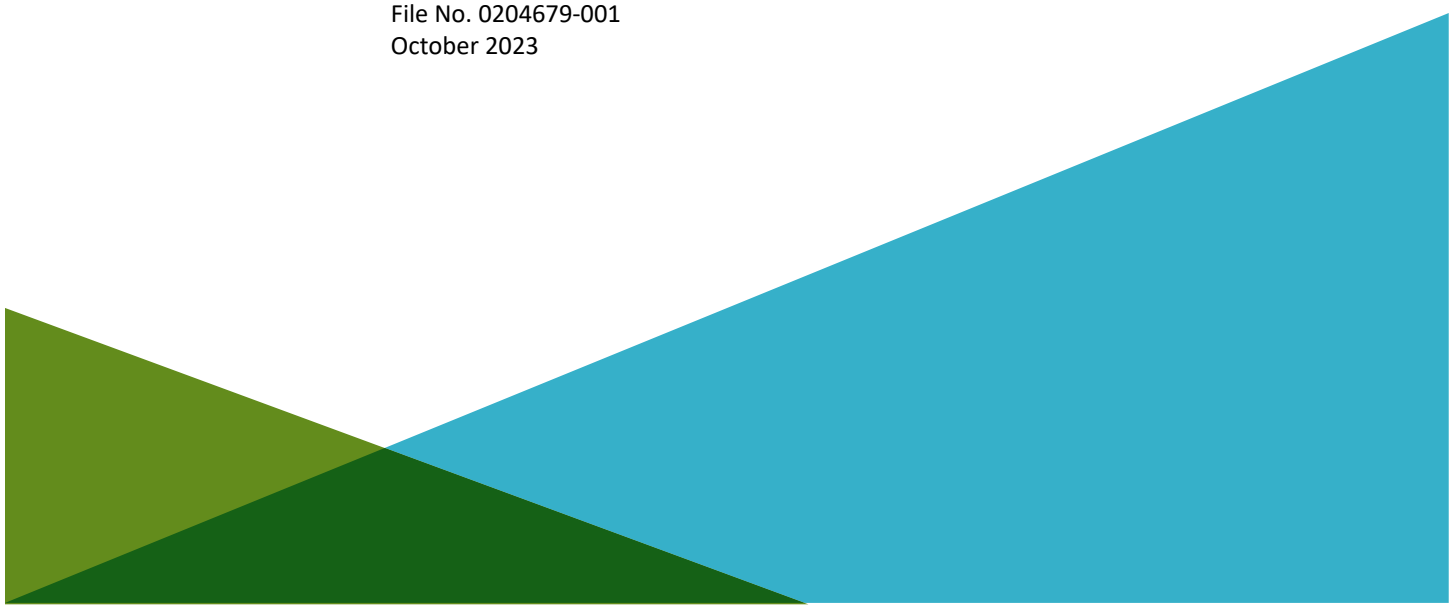
www.haleyaldrich.com

GEOTECHNICAL DATA REPORT ON
PDX FUEL PROJECT TANK DESIGN
PORTLAND INTERNATIONAL AIRPORT
PORTLAND, OREGON

by
Haley & Aldrich, Inc.
Portland, Oregon

for
JH Kelly, LLC
Longview, Washington

File No. 0204679-001
October 2023



HALEY & ALDRICH, INC.
6420 S. Macadam Avenue
Suite 100
Portland, OR 97239-3517
503.620.7284

30 October 2023
File No. 0204679-001

JH Kelly, LLC
821 Third Avenue
Longview, Washington 98632

Attention: Derek Koistinen Project Manager

Subject: Geotechnical Data Report
PDX Fuel Project Tank Design
Portland International Airport
Portland, Oregon

Dear Derek Koistinen:

Haley & Aldrich, Inc. (Haley & Aldrich) is pleased to present the enclosed geotechnical data report for the PDX Fuel Project Tank Design (Project) in Portland, Oregon. The Project site is located within the Portland International Airport (PDX) facility boundaries in Portland, Oregon along the Columbia River.

We understand the Project includes the design and construction of a new fuel truck offload facility, two new large fuel storage tanks, an operations and fire protection building, associated pipelines and utilities, and ancillary light poles, plus the demolition of two existing smaller fuel storage tanks.

This report presents the results of our background research and data generated from our subsurface explorations and laboratory testing.

We appreciate the opportunity to provide our services to you on this Project. If you have any questions, please contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Micah D. Hintz, PE, GE
Geotechnical Engineer

Allison M. Pyrch, PE, GE
Principal Geotechnical Engineer

Enclosures

\\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\Deliverables\Reports\Geotechnical_Data_Report\Final\2023_1030_PDX_GDR_F.docx

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A	Exploration Logs
B	Laboratory Test Results
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1. Introduction

1.1 GENERAL

Haley & Aldrich, Inc. (Haley & Aldrich) is pleased to submit this geotechnical data report to JH Kelly, LLC (JH Kelly) summarizing geotechnical data collected in support of the PDX Fuel Project Tank Design (Project) at 4300 NE Marine Drive, located within the boundaries of Portland International Airport (PDX) in Portland, Oregon. The location of the project site is shown on *Figure 1 Vicinity Map.*

1.2 SCOPE OF SERVICES

The purpose of our services summarized in this report was to collect geotechnical data to support evaluation, design, and construction of the subject project elements. We completed the following tasks in general accordance with our proposal for Geotechnical Services dated 22 February 2023 and includes the following:

- Prepared a site-specific health and safety plan (HASP) for our on-site exploration activities.
- Reviewed previous work at or near the site completed by Haley & Aldrich and others.
- Coordinated clearance of existing site utilities via the "One-Call" Service for public utility locates, engaged the services of a private utility locator to help find on-site utilities, and employed vacuum truck "soft-dig" techniques to clear explorations to a minimum of 6 feet below ground surface (bgs).
- Advanced four cone penetration test (CPT) soundings to depths ranging from 42 to 150 feet bgs. The CPT soundings included the additional items:
  - Collecting pore pressure dissipation test readings in two of the three soundings.
  - Collecting seismic shear wave velocity readings at 3- to 6-foot increments in each sounding.
- Drilled two mud rotary borings to depths of approximately 150 feet bgs.
  - Collected standard penetration test (SPT) and Shelby Tube samples at 2- to 10-foot intervals for characterization and laboratory testing.
  - Maintained logs of the soils encountered in the borings.
- Performed laboratory testing on select soil samples collected during our exploration including *in situ* moisture content, Atterberg limits, grain size distribution, constant rate of strain consolidation testing, direct simple shear testing, and cyclic direct simple shear testing.
- Installed a vibrating wire piezometer with data logger into an existing groundwater monitoring well.
- Prepared this geotechnical data report outlining our findings regarding subsurface conditions.
- Provided project management and support services, including coordinating staff and subcontractors, and conducting telephone consultations and email communications with you and the design team.

2. Site Description

2.1 SURFACE CONDITIONS

The project site is located within PDX boundaries, west of the Port of Portland Fire Department building, and north of the taxiway for the South Runway, as shown on Figure 1. The site is an approximately 1.4-acre parcel of a Port of Portland (Port) property (tax lot R316873). The site currently includes three large (up to 41,000 BBL volume), above-grade storage tanks, a small substation, and several outbuildings, as well as asphalt surfacing to support traffic around the tanks. The site is relatively flat, with a slight gradient of less than 2 feet across the project area. Elevations range from approximately 20 to 22 feet above mean sea level (MSL). The Columbia River is about 1,200 feet north of the site. The gradient increases gradually toward the Columbia River at a slope ranging from approximately 0.5 to 1.0 percent, before encountering an approximately 20-foot-tall dike about 850 feet north of the site. The slope descends from the dike towards the Columbia River at an average grade of 7 percent.

3. Subsurface Explorations

3.1 CURRENT EXPLORATION

We explored subsurface soil and groundwater conditions at the site between February and April 2023 by drilling two borings using mud-rotary drilling method, advancing four CPTs, excavating two test pits, and performing three infiltration tests. Details surrounding these explorations are provided in the following sections.

3.1.1 Borings

Two borings were advanced to depths of approximately 151 feet bgs between 28 February and 3 March 2023 using mud-rotary drilling methods. Drilling was performed with a track mounted CME-75 drill rig operated by Western States Soil Conservation of Hubbard, Oregon. The borings used a 4.875-inch-diameter drill bit. After completion, the boreholes were backfilled with a cement-bentonite grout in accordance with the Oregon Water Resources Department regulations.

Vacuum-excavation was performed within the upper 6 feet of each boring to reduce potential for a utility encounter during drilling.

The borings were coordinated by our staff, who classified the various soil units encountered, obtained representative soil samples for geotechnical testing, observed and recorded groundwater conditions, and maintained detailed logs of the borings.

The exploration logs presented in Appendix A show our interpretation of the drilling, sampling, and testing data. They indicate the depth where the soils change. Note that the changes may be gradual. In the field, we classified the samples taken from the explorations according to the methods presented on Figure A-1 *Key to Exploration Logs* in Appendix A. The key also provides a legend explaining the symbols and abbreviations used in the log.

Materials encountered in the exploration were classified in the field in general accordance with ASTM Standard Practice D2488 “Standard Practice for the Classification of Soils (Visual Manual Procedure).” Soil classifications and sampling intervals are shown in the exploration logs in this appendix.

Soil samples were obtained from each boring using the following methods.

- Sampling using a Standard Penetration Test (SPT) sampler was completed in general conformance with ASTM Test Method D1586 "Standard Method for Penetration Test and Split-Barrel Sampling of Soils." The sampler was driven with a 140-pound auto-trip hammer falling 30 inches. The N value, or number of blows required to drive the sampler 1 foot or as otherwise indicated into the soils, is shown adjacent to the sample symbols on the boring logs. Disturbed samples were obtained from the sampler for subsequent classification and testing.
- Relatively undisturbed samples were obtained using a thin-walled Shelby tube sampler in general conformance with ASTM Test Method D1587 "Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes." The sampler is driven using the hydraulic down-pressure of the drill rig mast.

3.1.2 CPT

A total of four CPT soundings were advanced by Oregon Geotechnical Explorations to evaluate subsurface conditions at the site. Three CPT soundings designated SCPT-4 through SCPT-6 were advanced to depths of 42 to 137 feet bgs on 28 February 2023. A fourth CPT sounding designated SCPT-5a was advanced to a depth of 150 feet bgs on 18 April 2023, to compensate for the early refusal condition encountered at SCPT-5.

The soundings were completed in general conformance with ASTM D5778 using a seismic electronic cone penetrometer. The CPT soundings are *in situ* tests that aid in characterizing subsurface stratigraphy and groundwater levels. The tests include advancing a 35.6-mm-diameter cone equipped with a load cell, friction sleeve, strain gages, porous stone, and geophone through the soil profile. The cone is advanced at a rate of approximately 2 centimeters per second. Tip resistance, sleeve friction, and pore pressure are typically recorded at 0.1-meter intervals.

The logs of the CPT soundings are presented in Appendix A.

3.1.3 Test Pits

Five test pits designated TP-1 and TP-2 and IT-1 through IT-3 were excavated by JH Kelly on 9 March 2023. The excavations were advanced to depths of 2.3 feet and 10 feet bgs to evaluate the conditions of near-surface soils, and in the cases of locations IT-1 through IT-3, to prepare subgrade for *in situ* infiltration testing. Materials exposed along the sides and bottoms of the test pits were documented, and test pit logs are presented in Appendix A.

3.1.4 Infiltration Testing

Three infiltration tests designated IT-1, IT-2, and IT-3 were conducted at the locations shown on Figure 2. Testing was performed in general accordance with the City of Portland's 2020 Stormwater Management Manual (SWMM) Section 2.3.2. Tests at IT-1 and IT-3 were encased falling head tests, while the test at IT-2 was a double-ring infiltrometer test.

3.2 HISTORICAL EXPLORATIONS

Two sets of historical subsurface explorations relevant to the subject project were reviewed in preparation of this geotechnical data report, namely:

- GRI, 2017. Preliminary Seismic Considerations, PDX Runway Seismic Evaluation, Portland International Airport (PDX), Portland, Oregon, dated 28 August 2017; and
- Hart Crowser, 2020. Revised Report of Geotechnical Engineering Services, PDX Fuel Facility Improvements, Portland, Oregon, dated 17 August 2020.

Details pertaining to these historical explorations are presented in the following sections and logs are included in Appendix C.

3.2.1 2017 GRI Explorations

GRI explored subsurface conditions throughout the Airport property between 11 and 27 April 2017 by advancing 31 CPT probes at the site. Six of these CPT locations, designated CPT-18 through CPT-23, are

in the vicinity of the subject improvements and were utilized during the course of this study. The locations of these explorations are presented on Figure 2. CPT logs for these explorations are included in Appendix C.

3.2.2 2019 Hart Crowser Explorations

Hart Crowser (incorporated into Haley & Aldrich in 2021) previously evaluated subsurface conditions at the fuel tank site by completing one boring and three CPT explorations in 2019. The locations of these explorations are presented on Figure 2. Laboratory testing was completed on select samples from the borings. Boring and CPT logs and results of the laboratory testing are included in Appendix C. Details surrounding the 2019 exploration are presented in the following sections.

3.2.2.1 Borings

Hart Crowser completed one drilled boring at the site on 27 June 2019, using hollow stem auger methods in the top 16.5 feet bgs to observe groundwater levels and then advanced the boring to 86.5 feet bgs using mud rotary drilling methods. The boring was advanced using a truck-mounted drill rig operated by Western States Soil Conservation of Hubbard, Oregon. The mud-rotary boring created a hole approximately 5 inches in diameter. Upon completion, the hole was backfilled with hydrated bentonite chips topped with site soils, which had been reserved during drilling.

Materials encountered in the boring were classified in the field in general accordance with ASTM Test Method D2488 “Standard Practice for the Classification of Soils (Visual Manual Procedure).” Soil classifications and sampling intervals are shown on the exploration logs included in this appendix.

Soil samples were obtained from the boring using the following methods.

- Samples were obtained from the boring using 1-1/2-inch inner-diameter split-spoon sampler (SPT sampler) in general accordance with guidelines presented in ASTM D1586. The split-barrel sampler was driven into the soil with a 140-pound hammer free falling 30 inches. The sampler was driven a total distance of 18 inches or until refusal criteria was met (greater than 50 blows per 6 inches). The number of blows required to drive the samplers the final 12 inches (the N-value) is recorded on the exploration log, unless otherwise noted. All soil samples were placed into watertight bags and delivered to Hart Crowser's laboratory.
- Relatively undisturbed samples were collected at selected depths using thin-walled sampling methods, such as Shelby tubes.

3.2.2.2 CPT Soundings

Hart Crowser completed three CPT soundings on 9 July 2019, in general accordance with ASTM D5778 and using a seismic electronic cone penetrometer. The CPT services were provided by Conetec Investigations of Auburn, Washington. A CPT sounding is an *in situ* test that provides assistance in characterizing subsurface stratigraphy. The test includes advancing a 35.6-mm-diameter cone equipped with a load cell, friction sleeve, strain gages, porous stone, and geophone through the soil profile. The cone is advanced at a rate of approximately 2 centimeters per second. Tip resistance, sleeve friction, and pore pressure are typically recorded at 0.1-meter intervals. For seismic shear wave testing, the cone penetration is stopped at prescribed depth intervals (typically every 1 to 2 meters), and seismic profile readings are obtained at intervals of 5 seconds.

3.2.2.3 Laboratory Testing

Hart Crowser completed geotechnical laboratory testing on select samples retrieved from boring B-1. Laboratory testing included *in situ* density and moisture contents, Atterberg Limits, grain size distribution, one-dimensional consolidation, organic content, and corrosion testing. The results of these tests and descriptions of methods used to perform the testing are presented in Appendix C.

4. Geotechnical Laboratory Testing

Soil samples obtained from the borings and test pits completed as part of the current study were transported to our in-house laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering properties of the soils encountered. Representative samples were selected for laboratory testing. The specific tests conducted are outlined below. The test results are included in Appendix B, and where noted, included on the exploration logs in Appendix A.

4.1 VISUAL CLASSIFICATIONS

Soil samples obtained from the explorations were visually classified in the field and in our geotechnical laboratory based on the Unified Soil Classification System (USCS) and ASTM classification methods. ASTM Test Method D2488 "Standard Practice for the Classification of Soils (Visual-Manual Procedure)" was used to classify soils using visual and manual methods. ASTM Test Method D2487 "Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)" was used to classify soils based on laboratory test results.

4.2 MOISTURE CONTENT

Moisture contents of samples were obtained in general accordance with ASTM Test Method D2216. The results of the moisture content tests are presented on the exploration logs included in Appendix A and on Figure B-1 in Appendix B.

4.3 ATTERBERG LIMITS TESTING

Atterberg limits (liquid limit, plastic limit and plasticity index) of fine-grained soil samples were obtained in general accordance with ASTM Test Method D4318-02. The results of the Atterberg limits tests completed on samples from the explorations are presented on the exploration logs included in Appendix A and Appendix B.

4.4 GRAIN SIZE DISTRIBUTION

Sieve analysis tests were performed to determine the quantitative distribution of particle sizes in the sample. The tests were performed in general accordance with ASTM D6913. The fines contents determined from this test are presented on the exploration logs included in Appendix A and the full test results are presented in Appendix B.

4.5 CONSTANT RATE OF STRAIN CONSOLIDATION TESTING

One-dimensional constant rate of strain (CRS) consolidation tests were performed to determine the compressibility and apparent stress history of the tested sample. The CRS testing was done in general accordance with ASTM D4186. After the sample was extracted, a relatively undisturbed, fine-grained sample was carefully trimmed and fit into a rigid steel ring with porous stones placed on the top and bottom of the sample to allow drainage. Vertical strain was then applied continuously to the sample in a way that allowed the sample to partially consolidate under the given strain rate. Measurements were made of the compression of the sample over time, the total load placed on the sample, and the excess pore pressure at the base of the sample throughout the test. Rebound was measured during the unloading phase. In general, an excess pore pressure ratio of 3 percent is targeted during loading, with

an allowance of up to 15 percent without significant concerns about strain rate effects. The test results are plotted in Appendix B in terms of axial strain and coefficient of consolidation versus applied load (stress). The specific gravity of the samples was also determined by ASTM D854.

Sample quality was estimated using methods by both Lunne et al. (2006) and Terzaghi et al. (1996) as described in Tables 1 and 2. As needed for sample quality designation (SQD), the preconsolidation stress was estimated using the Casagrande and strain energy methods. *In situ* vertical effective stress as estimated based on the provided soil profile information.

Though we make every effort to refine our estimates, the user of these data should apply their own interpretation and engineering judgment to the consolidation test results. Our interpretations are intended solely for the purpose of SQD. SQD approaches are most applicable to low to medium plasticity clays with overconsolidation ratios (OCR) ranging between about 1 and 4.

Table 1. Sample Quality by Lunne et al. (2006)

OCR	$\Delta e/e_0$ at σ'_{v0}			
1 to 2	< 0.04	0.04 – 0.07	0.07 – 0.14	> 0.14
2 to 4	< 0.03	0.03 – 0.05	0.05 – 0.10	> 0.10
Quality	1	2	3	4

Note:
1 = very good to excellent, 2 = fair to good, 3 = poor, 4 = very poor

Table 2. Sample Quality by Terzaghi et al. (1996)

ε_v at σ'_{v0}	<1	1 – 2	2 – 4	4 - 8	< 8
Quality	A	B	C	D	E

Note:
A (best) to E (worst)

4.6 DIRECT SIMPLE SHEAR TESTING

A direct simple shear test (DSS) was completed to estimate the static strength of the soil. The test was completed in general accordance with ASTM D6528. A relatively undisturbed fine-grained sample was trimmed to a length of about 6 inches, encased in a rubber membrane, and placed in the triaxial cell. With the sample in the test cell, an all-around pressure was applied hydraulically. The sample was allowed to consolidate under the applied pressure with drainage occurring through porous stones through slotted filter paper placed around the sample. When consolidation was completed, the sample was sheared at a constant strain rate under constant volume conditions. The test results are shown in Appendix B.

4.7 STRESS-CONTROLLED CYCLIC DIRECT SIMPLE SHEAR TESTING

Stress-controlled cyclic direct simple shear (CDSS) tests with pore pressure measurements were completed on multiple samples to provide data for evaluating the liquefaction susceptibility of the soils and their post cyclic soil strength. The CDSS testing was done in general accordance with ASTM D8296-19. After the sample was extracted from the Shelby tube, a relatively undisturbed fine-grained sample was carefully trimmed to a height of about 1 inch and a diameter of 2.5 inches, encased in a rubber membrane, and placed in the test cell. With the sample in the test cell, an all-around pressure was applied hydraulically. The sample was allowed to consolidate under the applied pressure with

drainage occurring through porous stones through slotted filter paper placed around the sample. After the consolidation process completed, cyclic horizontal shear stresses (τ_{cyc}) were applied sinusoidally at an amplitude of the prescribed stress ratio. The τ_{cyc} was applied under constant volume conditions in one or two steps with specified frequency: (1) first step (if any) was to run two 0.2-Hz cycles to allow the machine to adjust; (2) second step was to run at a specified period as shown in Table C-3 until the maximum number of cycles or the maximum peak-to-peak strain, or the maximum excess pore water pressure ratio (Ru) is reached, whichever occurs first. The input parameters for each CDSS test are summarized in Table 3.

Once the cyclic loading process completed without allowing any dissipation of the final excess pore pressure, the sample was even statically sheared at a constant strain rate in accordance with the general procedure described in ASTM D6528. The sample information and results for each test are in Appendix B.

Table 3. CDSS Test Input Parameters

Boring	Sample No.	Effective Vertical Stress[a], σ'vc, psf	Cyclic Stress Ratio	Frequency, Hz	Maximum Number of Cycles	Maximum Ru Ratio	Maximum Peak-to-Peak Strain (percent)
BH-2	U-8.1	2,000	0.25	0.1	100	0.921	20
BH-2	U-9.2	2,300	0.30	0.1	100	0.887	20
BH-2	U-9.3	2,300	0.35	0.1	100	0.875	20

Note:
a. The effective vertical stress refers to end of consolidation.

5. Subsurface Conditions

5.1 GEOLOGIC AND SOIL MAPPING

The geology of the site is mapped as Quaternary Alluvium of Holocene age in Ma et al. 2002 at the 1:63,360 scale by the Oregon Department of Geology and Mineral Industries. The alluvium generally consists of unconsolidated deposits of silt, clay, and sand accumulated by overbank deposition during inundation of the historic floodplain before construction of dams and floodplain dikes on the Columbia River (O'Connor and Evarts 2008). The thickness of this unit is greatest at the river and thins to zero at the edges of the historic floodplain. This unit overlies the Columbia River Sand Aquifer, a filled paleochannel of the Columbia River, which extends as deep as 300 feet and is thickest near the Columbia River (Hartford and McFarland 1989).

Soils at the site are mapped by the U.S. Department of Agriculture (USDA) as found on the Web Soil Survey website (USDA 2023). The near-surface soils at the site consist of Pilchuck-Urban Land Complex, 0 to 3 percent slopes. Pilchuck soils are described as alluvium derived from flood plains and consist of sandy materials to a depth greater than 60 inches bgs. This soil type is considered somewhat excessively drained with a generally high hydraulic conductivity of approximately 6 to 20 inches per hour. Urban land refers to existing fill on the site.

5.2 GEOLOGIC HAZARD MAPPING

Geologic hazards mapped at the site include a low landslide hazard, very strong severe earthquake shaking, and high liquefaction hazard (Oregon HazVu 2023). The site is located at an approximate elevation of 22 feet above mean sea level (MSL) and is not in a mapped tsunami inundation zone (Oregon HazVu 2023). The project site is not located within any previously mapped historic or prehistoric landslide deposits (SLIDO 2021).

5.3 SOIL AND GROUNDWATER CONDITIONS

Subsurface soil and groundwater conditions interpreted from historical explorations and explorations advanced at the site as part of our current study, in conjunction with soil properties inferred from field and laboratory tests, formed the basis for interpretations presented in this report.

Generally, explorations encountered up to 7 feet of dredge sand fill overlying overbank deposits of Columbia River Sand Alluvium up to 50 feet bgs, which then overlies sand of the Columbia River Sand Aquifer to the bases of the explorations. All boring and CPT explorations performed as part of the current study terminated in the latter unit. We interpret that the encountered soils can be distinctly divided into three units, namely Fill Sand, Columbia River Overbank Deposits, and sands of the Columbia River Aquifer. General descriptions of these materials are provided in the following sections.

5.3.1 Fill Sand

Our explorations encountered fill sand to depths of approximately 5 to 7 feet bgs. The sand consists of dredged fill that was placed starting in 1936 as part of a Works Progress Administration grant in order to make the land usable for construction of the Airport (Oregon Encyclopedia 2018).

Fill sand encountered in our explorations generally appeared to be brown, fine to medium grained, and poorly graded with a variable amount of silt. Fill materials were observed primarily during test pit excavations and soft-digging (vacuum clearing) of boring and CPT locations at shallow depths; therefore, SPT blow counts and CPT resistance data from this unit are not available. However, based on observations taken during test pit excavation, fill sand generally appeared to have a loose to medium dense relative density and appeared saturated at depths greater than approximately 4 to 5 feet bgs.

5.3.2 Columbia River Overbank Deposits

Underneath the fill lies an approximately 25- to 40-foot-thick layer of very soft, fine-grained silt alluvium, interpreted to be Columbia River Overbank Deposits. The materials attributed to this unit were derived from slow moving waters during periodic flooding of the adjacent Columbia River. The overbank deposits were observed as extending to a depth of approximately 30 feet bgs at boring B-1, 41 feet bgs at boring B-2, 27 feet bgs at SCPT-4 and SCPT-6, and 42 feet bgs at SCPT-5 during the current investigation; during the 2019 subsurface exploration, overbank deposits were observed to depths as great as 45 feet bgs at boring B-1 (2019).

SPT blow counts (N-values) in these deposits were consistently recorded as zero blows per foot (bpf), as the SPT sampler was driven using only weight of rods and hammer at each sampling location. Field-collected pocket penetrometer (PP) data on SPT samples from this unit ranged from 0 to 0.75 tons per square foot (tsf).

Moisture contents ranged from 41 to 83 percent, and a minor amount of organic material was observed in these deposits, with organic content measured by loss on ignition ranging from 2 to 6 percent of the soil unit by mass. The alluvium was moderately to highly plastic with plasticity indexes ranging from 14 to 52 percent and liquid limits ranging from 48 to 103 percent.

This unit is considered to be relatively weak and compressible, and susceptible to cyclic strength loss where saturated below the groundwater table.

5.3.3 Columbia River Aquifer

Explorations encountered medium dense to dense, poorly graded sand with varying amounts of silt and silty sand below the Overbank Deposits; these soils appear similar to those described as the Columbia River Sand Aquifer, which fills a paleochannel of the Columbia River to approximately 330 feet bgs (Hartford and McFarland 1989). Explorations performed during the current and 2019 exploration programs Boring B-1 (2019) encountered this unit beginning at roughly 45 feet bgs, B-1 (2023) at approximately 30 feet bgs, and B-2 (2023) at approximately 41 feet bgs until each of their ultimate depths ranging from 86 to 151 feet bgs. CPT-1 through CPT-3 and SCPT-4 through SCPT-6 encountered this unit from approximately 30 to 50 feet bgs until their termination.

SPT blow counts (N-values) in this material covered a wide range from 10 to 95 bpf, with one reported zero blow count soft silt interbed. Moisture contents ranged from 26 to 39 percent, and fines contents of this material ranged from 6 to 23 percent.

5.4 GROUNDWATER

Groundwater was encountered at depths ranging from approximately 5 to 14 feet bgs during our current and previous site explorations. Shallower measurements on the order of 5 to 7 feet bgs appear to represent a perched groundwater table within fill materials overlying the more fine-grained overbank deposits. Deeper groundwater level readings appear to be more indicative of the regional groundwater table. CPT pore pressure dissipation data collected during our current and previous site explorations indicates a regional groundwater level between approximately 10½ to 14½ feet bgs, as measured in June 2019 and February 2023.

We anticipate that groundwater elevations will likely fluctuate over time based on the water level of the adjacent Columbia River. Fluctuations in groundwater levels may also occur due to variations in rainfall, temperature, seasons, and other factors. It is important that the contractor provide contingencies for addressing groundwater during construction on this project.

5.5 INFILTRATION CHARACTERISICS

The test in IT-1 was conducted in the near-surface sand soils at approximately 3.5 feet bgs and showed an infiltration rate of approximately 10 inches/hour. The test in IT-3 was conducted in sandy silt at approximately 4 feet bgs and showed nearly no drop in water head over time, indicating no practical infiltration capacity. A double-ring infiltrometer test was run at IT-2 in sand at approximately 2.25 feet bgs and showed an infiltration rate of approximately 20 inches/hour.

6. Limitations

The data provided in this report represents conditions at discrete locations across the project site and actual conditions in other areas could vary. Furthermore, the nature and extent of any variations may not become evident until additional explorations are performed or until construction begins. If significant variations are observed at that time, the data presented in this report may require augmentation to reflect actual site conditions.

References

1. Hartford, S.V., and W.D. McFarland, 1989. *Lithology, Thickness, and Extent of Hydrogeologic Units Underlying the East Portland Area, Oregon.* U.S. Geological Survey Water-Resources Investigations Report 88-4110.

2. Lunne T, Berre T, Andresen K, Strandvik S, Sjursen M. 2006. Effects of sample disturbance and consolidation procedures on measured shear strength of soft marine Norwegian clays. Canadian Geotechnical Journal 43 (7): 726-750.

3. O'Connor, J.E. and R.C. Evarts 2008. Geologic Map of the Camas Quadrangle, Clark County, Washington, and Multnomah County, Oregon: U.S. Geological Survey Scientific Investigations Map 3357, scale 1:24,000.

4. Oregon Encyclopedia (Last Update: March 17, 2018). Portland International Airport. Website: https://oregonencyclopedia.org/articles/portland_international_airport/#.XWghl-hKiUk.

5. Oregon HazVu: 2023. Statewide Geohazards Viewer, Oregon Department of Geology and Mineral Industries (DOGAMI), <http://www.oregongeology.org/sub/hazvu/index.htm>.

6. SLIDO: 2021. Statewide Landslide Information Layer for Oregon, Oregon Department of Geology and Mineral Industries (DOGAMI), http://www.oregongeology.org/sub/slido/

7. Terzaghi, K., Peck, R.B. and Mesri, G. (1996) Soil Mechanics in Engineering Practice. 3rd Edition, John Wiley and Sons, Inc., New York.

8. U.S. Department of Agriculture (USDA) 2023. Web Soil Survey, http://websoilsurvey.sc.egov.usda.gov/

9. U.S. Geologic Survey (USGS) 2023. Earthquake Hazards Program – Unified Hazard Tool website: https://earthquake.usgs.gov/hazards/interactive/

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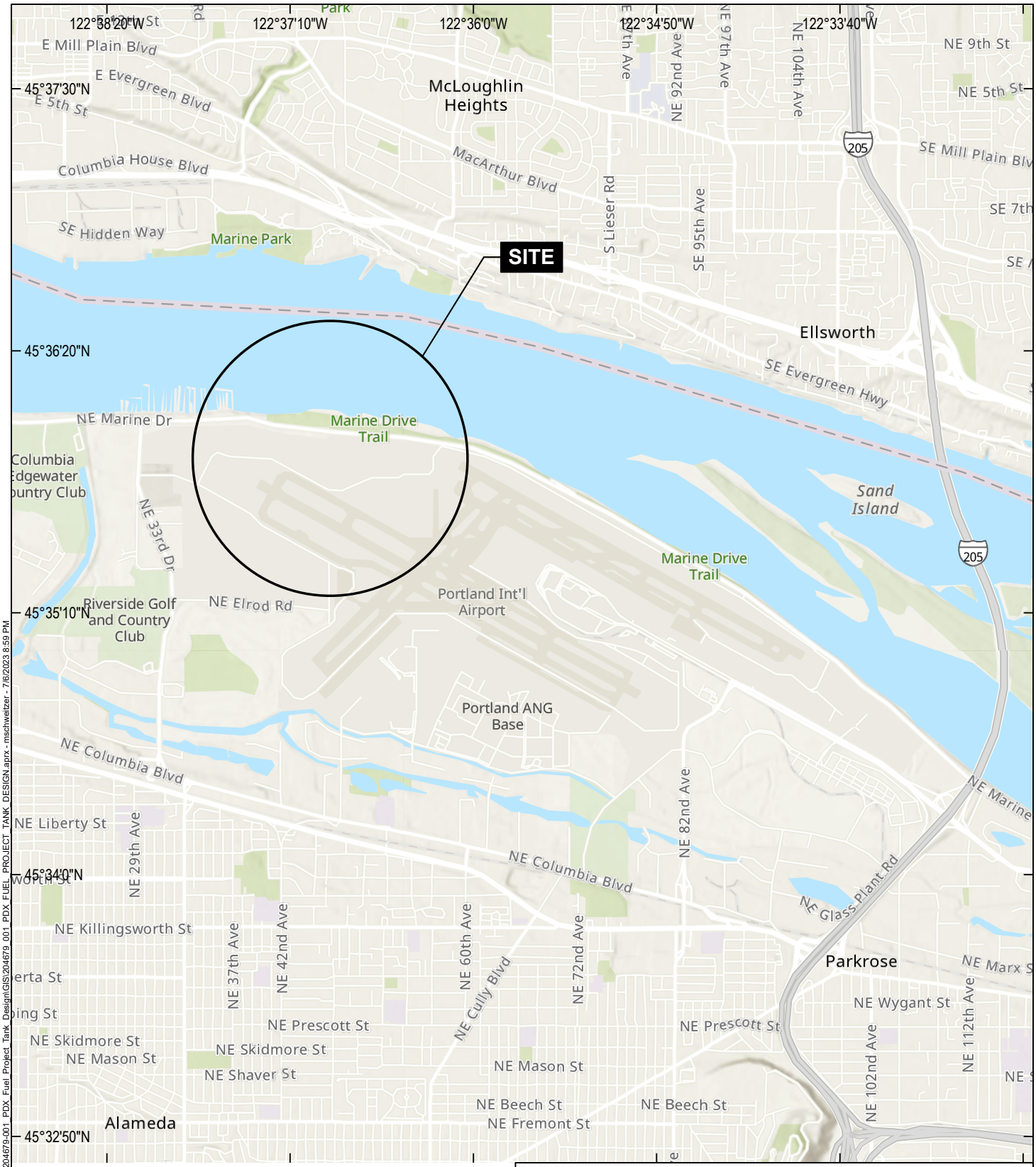
FIGURES



PDX FUEL PROJECT TANK DESIGN
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OREGON

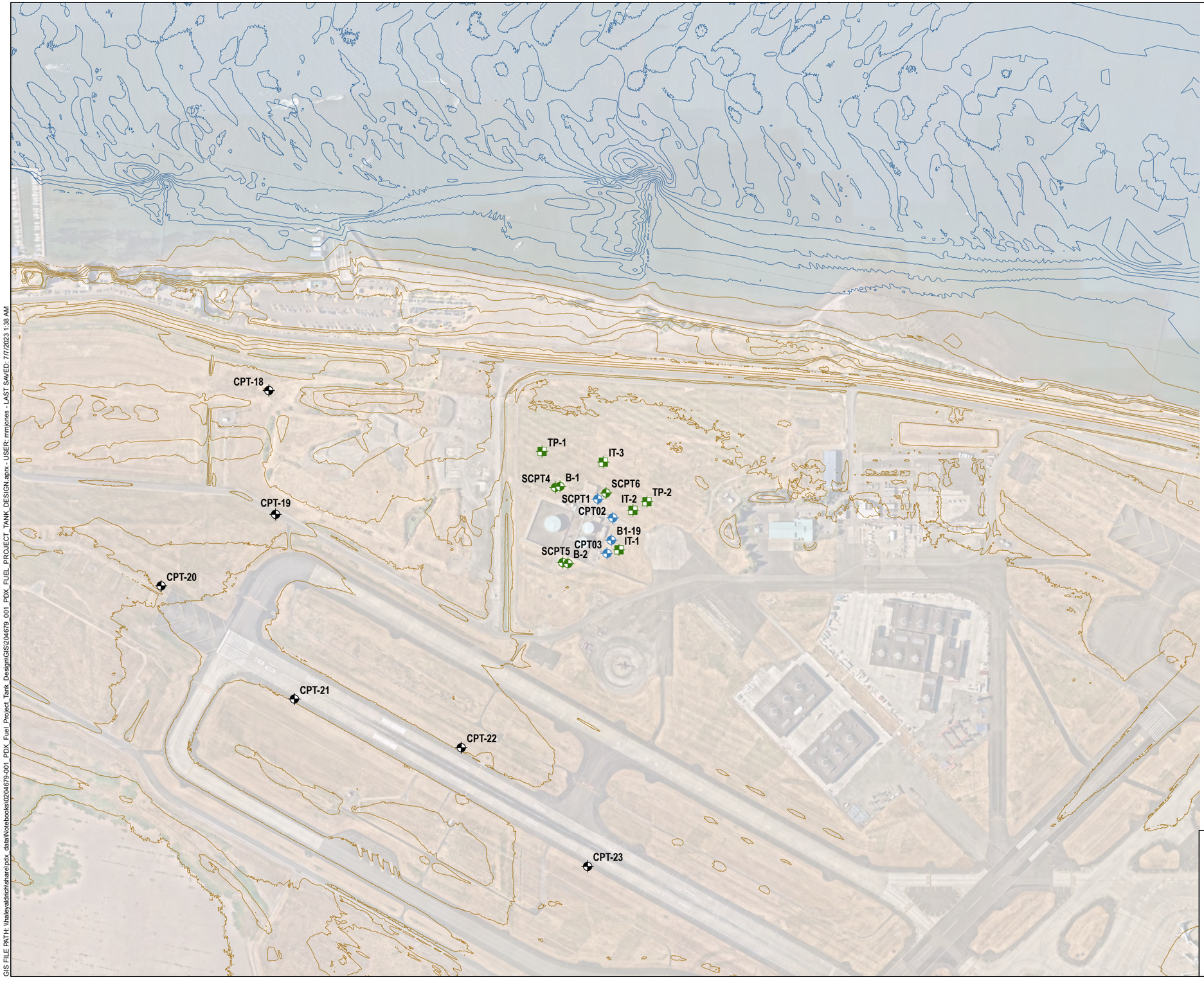
VICINITY MAP

MAP SOURCE: ESRI
SITE COORDINATES: 45°35'06"N, 122°35'39"W

APPROXIMATE SCALE: 1 IN = 1 MILE
JULY 2023

FIGURE 1

GIS: \\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\GIS\204679_001_PDX_FUEL_PROJECT_TANK_DESIGN.aprx - mschweitzer - 7/6/2023 8:59 PM



LEGEND

- BORING OR CPT EXPLORATION (CURRENT STUDY)
- PREVIOUS EXPLORATION (GRI, 2017)
- PREVIOUS EXPLORATION (H&A, 2019)
- TEST PITS (CURRENT STUDY)
- BATHYMETRIC ELEVATION CONTOUR, 5-FT INTERVAL (NAVD 88)
- TOPOGRAPHIC ELEVATION CONTOUR, 5-FT INTERVAL (NAVD 88)

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. TOPOGRAPHY/BATHYMETRY SOURCE: US ARMY CORPS OF ENGINEERS, 2010.
3. AERIAL IMAGERY SOURCE: NEARMAP, 14 AUGUST 2022.
4. NORTH AMERICAN VCERTICAL DATUM OF 1988 (NAVD88)

N

0 800 1,600
SCALE IN FEET

HALEY ALDRICH

PDX FUEL PROJECT TANK DESIGN
PORTLAND INTERNATIONAL AIRPORT
5000 NE MARINE DRIVE
PORTLAND, OREGON

SITE PLAN

JULY 2023

FIGURE 2

GIS FILE PATH: \\haleyaldrich\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\GIS\204679_001_PDX_FUEL_PROJECT_TANK_DESIGN.aprx - USER: mmjones - LAST SAVED: 7/7/2023 1:38 AM

APPENDIX A
Exploration Logs

Sample Description

Identification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. ASTM D 2488 visual-manual identification methods were used as a guide. Where laboratory testing confirmed visual-manual identifications, then ASTM D 2487 was used to classify the soils.

Relative Density/Consistency

Soil density/consistency in borings is related primarily to the standard penetration resistance (N). Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

SAND or GRAVEL Relative Density	N (Blows/Foot)	SILT or CLAY Consistency	N (Blows/Foot)
Very loose	0 to 4	Very soft	0 to 1
Loose	5 to 10	Soft	2 to 4
Medium dense	11 to 30	Medium stiff	5 to 8
Dense	31 to 50	Stiff	9 to 15
Very dense	>50	Very stiff	16 to 30
		Hard	>30

Moisture

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

USCS Soil Classification Chart (ASTM D 2487)

Major Divisions			Symbols: Graph	Symbols: USCS	Typical Descriptions
Coarse Grained Soils: More than 50% of Material Retained on No. 200 Sieve	Gravel and Gravelly Soils: More than 50% of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels (<5% fines)		GW	Well-Graded Gravel; Well-Graded Gravel with Sand
				GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Gravels (5-12% fines)		GW-GM	Well-Graded Gravel with Silt; Well-Graded Gravel with Silt and Sand
				GW-GC	Well-Graded Gravel with Clay; Well-Graded Gravel with Clay and Sand
				GP-GM	Poorly Graded Gravel with Silt; Poorly Graded Gravel with Silt and Sand
				GP-GC	Poorly Graded Gravel with Clay; Poorly Graded Gravel with Clay and Sand
		Gravels with Fines (>12% fines)		GM	Silty Gravel; Silty Gravel with Sand
				GC	Clayey Gravel; Clayey Gravel with Sand
	Sand and Sandy Soils: More than 50% of Coarse Fraction Passing No. 4 Sieve	Sands with few Fines (<5% fines)		SW	Well-Graded Sand; Well-Graded Sand with Gravel
				SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Sands (5-12% fines)		SW-SM	Well-Graded Sand with Silt Well-Graded Sand with Silt and Gravel
				SW-SC	Well-Graded Sand with Clay; Well-Graded Sand with Clay and Gravel
				SP-SM	Poorly Graded Sand with Silt; Poorly Graded Sand with Silt and Gravel
				SP-SC	Poorly Graded Sand with Clay; Poorly Graded Sand with Clay and Gravel
		Sands with Fines (>12% fines)		SM	Silty Sand; Silty Sand with Gravel
				SC	Clayey Sand; Clayey Sand with Gravel
Fine Grained Soils: More than 50% of Material Passing No. 200 Sieve	Silts			ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
				MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
	Silty Clay (based on Atterberg Limits)			CL-ML	Silty Clay; Silty Clay with Sand or Gravel; Gravelly or Sandy Silty Clay
	Clays			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
				CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
	Organics			OL/OH	Organic Soil; Organic Soil with Sand or Gravel; Sandy or Gravelly Organic Soil
Highly Organic (>50% organic material)				PT	Peat - Decomposing Vegetation - Fibrous to Amorphous Texture

Minor Constituents

	Estimated Percentage
Sand, Gravel	
Trace	<5
Few	5 - 15
Cobbles, Boulders	
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45

Soil Test Symbols

%F	Percent Passing No. 200 Sieve
AL	Atterberg Limits (%)
	Liquid Limit (LL)
	Water Content (WC)
	Plastic Limit (PL)
CA	Chemical Analysis
CAUC	Consolidated Anisotropic Undrained Compression
CAUE	Consolidated Anisotropic Undrained Extension
CBR	California Bearing Ratio
CIDC	Consolidated Drained Isotropic Triaxial Compression
CIUC	Consolidated Isotropic Undrained Compression
CK0DC	Consolidated Drained k0 Triaxial Compression
CK0DSS	Consolidated k0 Undrained Direct Simple Shear
CK0UC	Consolidated k0 Undrained Compression
CK0UE	Consolidated k0 Undrained Extension
CRSCN	Constant Rate of Strain Consolidation
DS	Direct Shear
DSS	Direct Simple Shear
DT	In Situ Density
GS	Grain Size Classification
HYD	Hydrometer
ILCN	Incremental Load Consolidation
K0CN	k0 Consolidation
kc	Constant Head Permeability
kf	Falling Head Permeability
MD	Moisture Density Relationship
OC	Organic Content
OT	Tests by Others
P	Pressuremeter
PID	Photoionization Detector Reading
PP	Pocket Penetrometer
SG	Specific Gravity
TRS	Torsional Ring Shear
TV	Torvane
UC	Unconfined Compression
UUC	Unconsolidated Undrained Triaxial Compression
VS	Vane Shear
WC	Water Content (%)

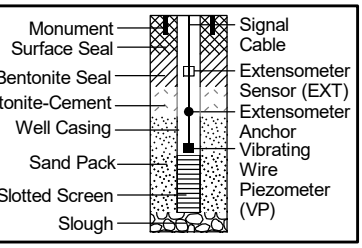
Groundwater Indicators

- Groundwater Level on Date or At Time of Drilling (ATD)
- Groundwater Level on Date Measured in Piezometer
- Groundwater Seepage (Test Pits)

Sample Symbols

- 1.5" I.D. Split Spoon
- 3.0" I.D. Split Spoon
- Modified California Sampler
- Rock Core Run
- Sonic Core
- Thin-walled Sampler
- Grab
- Cuttings
- Push Probe

Well Symbols



HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	**Key to Exploration Logs**	Figure **A-1** Sheet **1 of 1**

HA KEY TO EXP LOGS (SOIL ONLY) - \\HALEYALDRICH.COM\SHARES\EA_DATA\GINT\HC_LIBRARY\GLB - 21\7\23 10:10 - \\HALEYALDRICH.COM\SHARES\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - bturbe

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level
15	0							topsoil (3-inch thick)	
								Vacuum excavated to 6 ft. bgs. Primarily sand with some silty layers [FILL].	
5									▽ 2/28/2023
	5			19.5in.	24	U-1 PP, TV		SILT (ML), very soft, wet, gray, with mica. [OVERBANK DEPOSITS] (PP = 0.0 tsf, TV = 0.175 tsf)	
				20in.	24	U-2 PP, TV		grades to mottled with gray-brown and iron-oxide staining (PP = 0.0 tsf, TV = 0.2 tsf)	
10	10			21.5in.	24	U-3 AL, GS, PP, TV, WC		LEAN CLAY (CL), soft, wet, gray, iron oxide staining, with mica. (PP = 0.5 tsf, TV = 0.325 tsf)	
				22.5in.	24	U-4 PP, TV		grades to no iron-oxide staining (PP = 0.5 tsf, TV = 0.25 tsf)	
5	15			24in.	24	U-5 PP, TV		grades to medium stiff (PP = 0.75 tsf, TV = 0.25 tsf)	
				23in.	24	U-6 AL, GS, PP, TV, WC		SANDY SILT (ML), soft, wet, gray, with mica. (PP = 0.5 tsf, TV = 0.225 tsf)	
0	20			15in.	24	U-7			
-5	25			19.5in.	24	U-8 AL, GS, PP, WC		SILT (ML), soft, wet, gray, with mica. (PP = 0.5 tsf)	
-10	30			18in.	24	U-9		SILTY SAND (SM), loose to medium dense, wet, gray, mostly fine sand, with mica. [COLUMBIA RIVER SAND AQUIFER]	
-15	35			22.5in.	24	U-10 GS, WC			
-20									

PL WC (%) LL
✖ Fines Content (%)
▲ SPT N Value
10 20 30 40

94 (Fines Content, 10 ft)
72 (Fines Content, 15 ft)
91 (Fines Content, 25 ft)
47 (Fines Content, 35 ft)

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

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-1

Figure **A-2**
Sheet **1 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 21/7/23 10:23 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOK\SI\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - kbuhl

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; Fines Content (%); SPT N Value	Depth (feet)
	40			14in.	24	U-11		SILTY SAND (SM), loose to medium dense, wet, gray, mostly fine sand, with mica. [COLUMBIA RIVER SAND AQUIFER] *(continued)* layer of silt observed at 41.2 ft (0.75-inch thick), material is likely interbedded			40
-25	45			17in.	24	U-12 AL, GS, PP, TV, WC		SILT (ML), medium stiff, wet, gray, mostly fine sand, with mica, flowing water observed in sand in hole. (PP = .75 tsf, TV = 0.15 tsf)		95 / 53.7	45
-30	50			8in.	24	U-13 PP		grades to very stiff (PP = 1.5 tsf)			50
		2 4 6		13in.	18	S-1 GS, WC		SILTY SAND (SM), loose, wet, gray, mostly fine sand, trace coarse sand, frequent silt lamination throughout sample, with mica.		23 / 10	
-35	55			2.5in.	24	U-14		grades to medium dense			55
-40	60	7 10 11		12in.	18	S-2		grades to no silt lamination, coarse sand		21	60
-45	65	6 9 11		10in.	18	S-3				20	65
-50	70	6 11 15		10in.	18	S-4 WC		POORLY GRADED SAND (SP), medium dense, wet, gray, with mica.		26	70
-55	75	6 9 12		11in.	18	S-5				21	75
-60											

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-1

Figure **A-2**
Sheet **2 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\DATA\HC LIBRARY\GLB - 21\7\23 10:23 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOK\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - kbuhl

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10–40)	Depth (feet)
-60	80	7 10 12		10in.	18	S-6a S-6b WC		POORLY GRADED SAND (SP), medium dense, wet, gray, with mica. *(continued)* layer of silty sand observed (approximately 3-inch thick)		▲ 22	80
-65	85	9 11 14		12in.	18	S-7				▲ 25	85
-70	90	9 14 16		12in.	18	S-8 WC				● ▲ 30	90
-75	95	14 20 20		13in.	18	S-9		grades to dense		▲ 40	95
-80	100	7 9 13		8in.	18	S-10		grades to medium dense		▲ 22	100
-85	105										105
-90	110	9 16 19		11in.	18	S-11 WC		grades to dense		● ▲ 35	110
-95	115										115
-100											

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
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3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-1

Figure **A-2**
Sheet **3 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:23 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOK\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuhn

Date Started: 03/02/2023	Date Completed: 03/03/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.597583 Long: -122.613906 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 19.53 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10–40)	Depth (feet)
120	0	10 15 18		9in.	18	S-12		POORLY GRADED SAND (SP), dense, wet, gray, with mica. occasional laminations of medium white sand		▲ 33	120
-105	125										125
-110	130	10 14 17		10in.	18	S-13 WC				● ▲ 31	130
-115	135										135
-120	140	13 20 23		15in.	18	S-14				▲ 43	140
-125	145										145
-130	150	11 14 17		9in.	18	S-15				▲ 31	150
-135	155							Bottom of Borehole at 151.5 feet.			155
-140											

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-1

Figure **A-2**
Sheet **4 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:23 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOK\SI\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PSRM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuhn

Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level
20	0							topsoil (3-inch thick)	
								Vacuum excavated to 6 ft. bgs. Primarily sand with some silty layers [FILL].	
15	5			0in.	24	U-1		SILT (ML), soft, moist to wet, gray.	
				24in.	24	U-2 PP, TV		[OVERBANK DEPOSITS] (PP = 0.75 tsf, TV = 0.15 tsf)	
10	10			24in.	24	U-3 AL, GS, PP, TV, WC		SILT WITH SAND (ML), soft, wet, gray, wood observed in cuttings from 10 to 12 ft. (PP = 0.35 tsf, TV = 0.75 tsf)	
				0in.	24	U-4			
5	15			24in.	24	U-5 PP, TV		(PP = 0.2 tsf, TV = 0.5 tsf)	
0	20			22.5in.	24	U-6 AL, GS, PP, TV, WC		LEAN CLAY (CL), soft, wet, gray. (PP = 0.35 tsf, TV = 0.75 tsf)	
-5	25			20in.	24	U-7 PP, TV		grades to stiff, layer of SAND WITH SILT (approximately 0.75-inches thick), material is likely interbedded (PP = 1.0 tsf, TV = 0.15 tsf)	
-10	30			23.5in.	24	U-8 AL, GS, PP, TV, WC		ELASTIC SILT (MH), trace sand, stiff, wet, gray mottled with brown iron oxide staining. (PP = 1.5 tsf, TV = 0.3 tsf)	
-15	35			24in.	24	U-9 AL, GS, PP, TV, WC		LEAN CLAY (CL), trace sand, medium stiff, wet, gray. (PP = 0.75 tsf, TV = 0.15 tsf)	

Water Level: ▽ 2/28/2023

PL WC (%) LL
✖ Fines Content (%)
▲ SPT N Value
10 20 30 40

83 (10 ft.) 100 (20 ft.) 99 (30 ft.) 100 (35 ft.)

Depth (feet) 0 5 10 15 20 25 30 35

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-2

Figure **A-3**
Sheet **1 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:24 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PBRM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - kbubel

Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10 20 30 40)	Depth (feet)
-20	40			24in.	24	U-10 GS, WC		SILTY SAND (SM), medium dense, wet, gray, fine sand, with mica. [COLUMBIA RIVER SAND AQUIFER]		13	40
-25	45			0in.	24	U-11					45
				5in.	24	U-12					
-30	50	1 6 12		15in.	18	S-1 GS, WC		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, with mica.		6 ▲ 18	50
-35	55	0 0 0		9in.	18	S-2		SILT (ML), soft, moist to wet, gray.		▲ 0	55
				12in.	24	U-13		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, fine sand, with mica.			
-40	60			7in.	24	U-14					60
-45	65	5 9 11		8in.	18	S-3 WC				▲ 20	65
								wood observed in cuttings from 69 to 70 ft.			
-50	70			8in.	24	U-15					70
-55	75	7 11 12		8in.	18	S-4				▲ 23	75

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

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Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10–40)	Depth (feet)
-60	80	8 12 13		9in.	18	S-5 WC		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, wet, gray, fine sand, with mica. *(continued)*		▲ 25	80
-65	85	8 15 17		9in.	18	S-6		grades to dense		▲ 32	85
-70	90	7 11 16		9in.	18	S-7 GS, WC		grades to medium dense		✖ 6 ▲ 27	90
-75	95	11 12 9		9in.	18	S-8				▲ 21	95
-80	100	9 17 19		9in.	18	S-9 WC		grades to dense		▲ 36	100
-85	105										105
-90	110	8 11 16		9in.	18	S-10		grades to medium dense		▲ 27	110
-95	115										115

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-2

Figure **A-3**
Sheet **3 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:24 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuttel

Date Started: 02/28/2023	Date Completed: 03/02/2023	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Shane, Alfredo, Chaz	
Logged by: DCH	Checked by: KLA	Drilling Method: Mud Rotary	
Location: Lat: 45.596374 Long: -122.613728 (WGS 84)		Rig Model/Type: CME-55 / Track-mounted drill rig	
Ground Surface Elevation: 21.21 feet (NAVD 88)		Hammer Type: Auto-hammer	
Comments:		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
		Measured Hammer Efficiency (%): 75.1	
		Hole Diameter: 4.875 inches	Well Casing Diameter: NA
		Total Depth: 151.5 feet	Depth to Groundwater: 5 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10–40)	Depth (feet)
120	0	13 15 21		9in.	18	S-11 WC		POORLY GRADED SAND WITH SILT (SP-SM), dense, wet, gray, with mica.		▲ 36	120
125	5										125
130	10	8 9 12		9in.	18	S-12		grades to medium dense		▲ 21	130
135	15										135
140	20	19 23 25		9in.	18	S-13 WC		grades to dense		▲ 48	140
145	25										145
150	30	16 19 18		10in.	18	S-14				▲ 37	150
155	35							Bottom of Borehole at 151.5 feet.			155

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Boring Log
B-2

Figure **A-3**
Sheet **4 of 4**

HA BORING LOG - \\HALEYALDRICH.COM\SHARE\SEA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:24 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuttel

Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew: Bella Terra / DM

Logged by: KLA Checked by: DLK Rig Model/Type: Backhoe

Location: Lat: 45.596585 Long: -122.612579 (WGS 84) Total Depth: 3.5 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 20.97 feet (NAVD 88)

Comments: Single ring falling head infiltration test conducted at bottom of test pit from 1050 to 1200

Elevation (feet)	Depth (feet)	Sample Data: Type	Sample Data: Length (inches)	Sample Data: Number Tests	Graphic Log	Material Description
20	0					topsoil (2-inch thick)
						SILTY SAND (SM), (medium dense), moist, gray-brown. [FILL]
				G-1		POORLY GRADED SAND WITH SILT (SP), (medium dense), moist, gray, mostly fine to medium sand.
15	5					Bottom of Test Pit at 3.5 feet.
10	10					
5	15					
0	20					
-5	25					
-10	30					
-15	35					

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

General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Test Pit Log
IT-1

Figure **A-4**
Sheet **1 of 1**

HA TEST PIT - \\HALEYALDRICH.COM\SHARESEA_DATA\GINTHC_LIBRARY.GLB - 2/17/23 10:10 - \\HALEYALDRICH.COM\SHARESEA_DATA\GINTHC_LIBRARY.GLB - 2/17/23 10:10 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuber

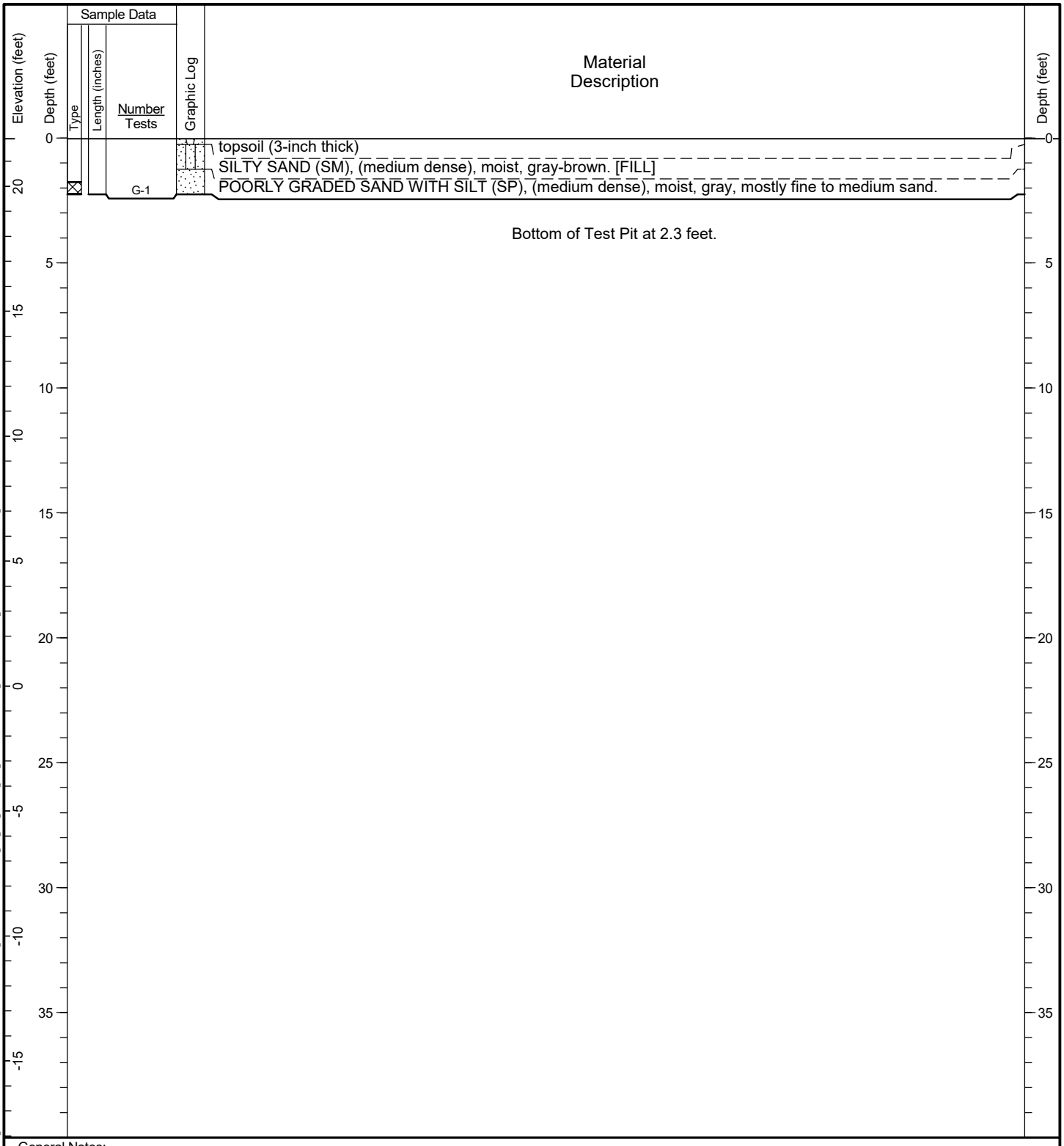
Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew: Bella Terra / DM

Logged by: KLA Checked by: DLK Rig Model/Type: Backhoe

Location: Lat: 45.597209 Long: -122.612269 (WGS 84) Total Depth: 2.25 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 21.93 feet (NAVD 88)

Comments: Double ring falling head infiltration test conducted at bottom of test pit from 1050 to 1200



General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	Test Pit Log **IT-2**	Figure **A-5** Sheet **1 of 1**

HA TEST PIT - \\HALEYALDRICH.COM\SHARE$\EA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:10 - \\HALEYALDRICH.COM\SHARE$\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuber

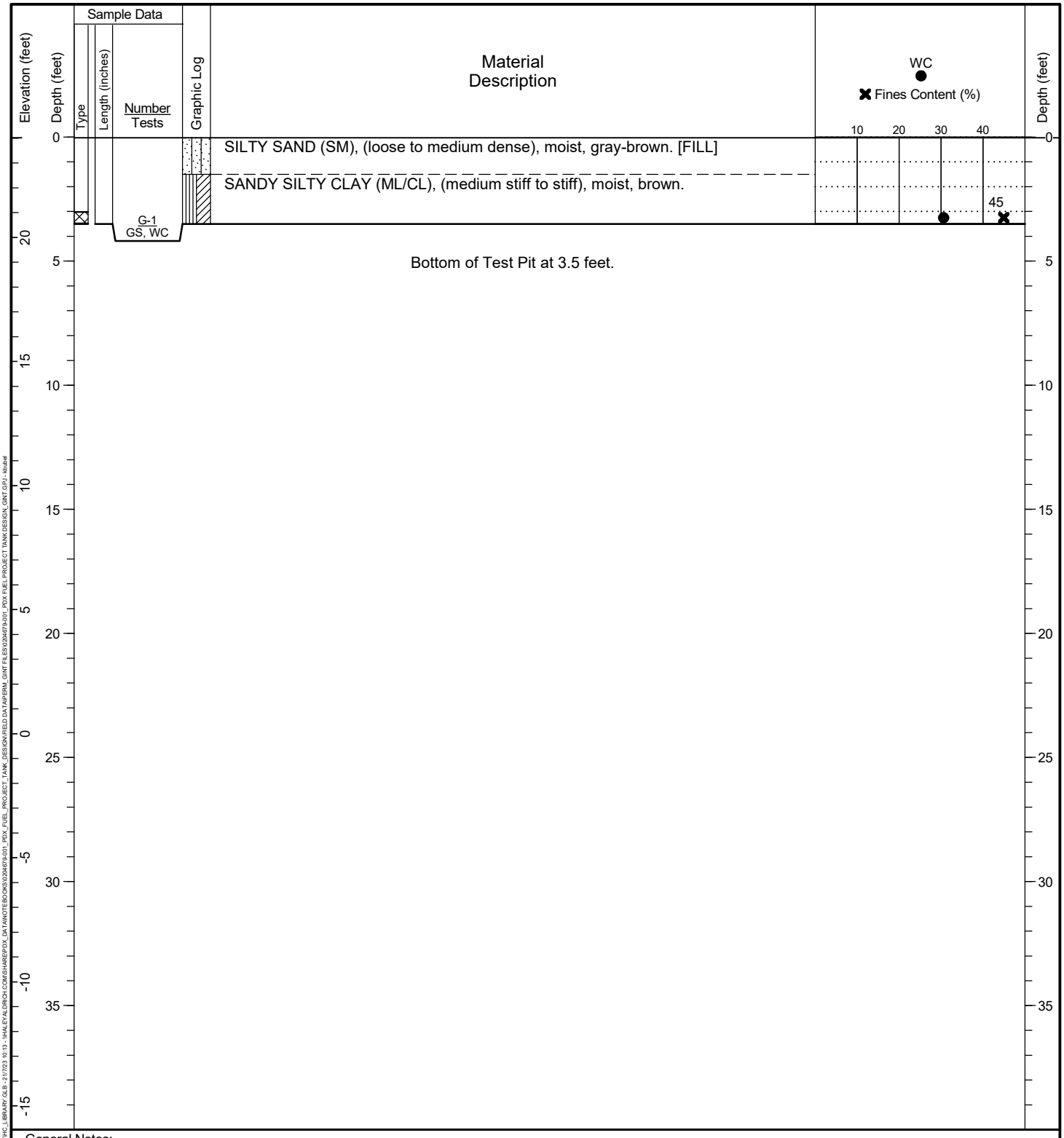
Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew: Bella Terra / DM

Logged by: KLA Checked by: DLK Rig Model/Type: Backhoe

Location: Lat: 45.597973 Long: -122.612933 (WGS 84) Total Depth: 3.5 feet Depth to Seepage: Not Encountered

Ground Surface Elevation: 24.05 feet (NAVD 88)

Comments: Single ring falling head infiltration test conducted at bottom of test pit from 1215 to 1430



General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Test Pit Log
IT-3

Figure **A-6**
Sheet **1 of 1**

HA TEST PIT - \\HALEYALDRICH.COM\SHARESEA_DATA\GINTWC_LIBRARY_GLB - 2/17/23 10:13 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khubel

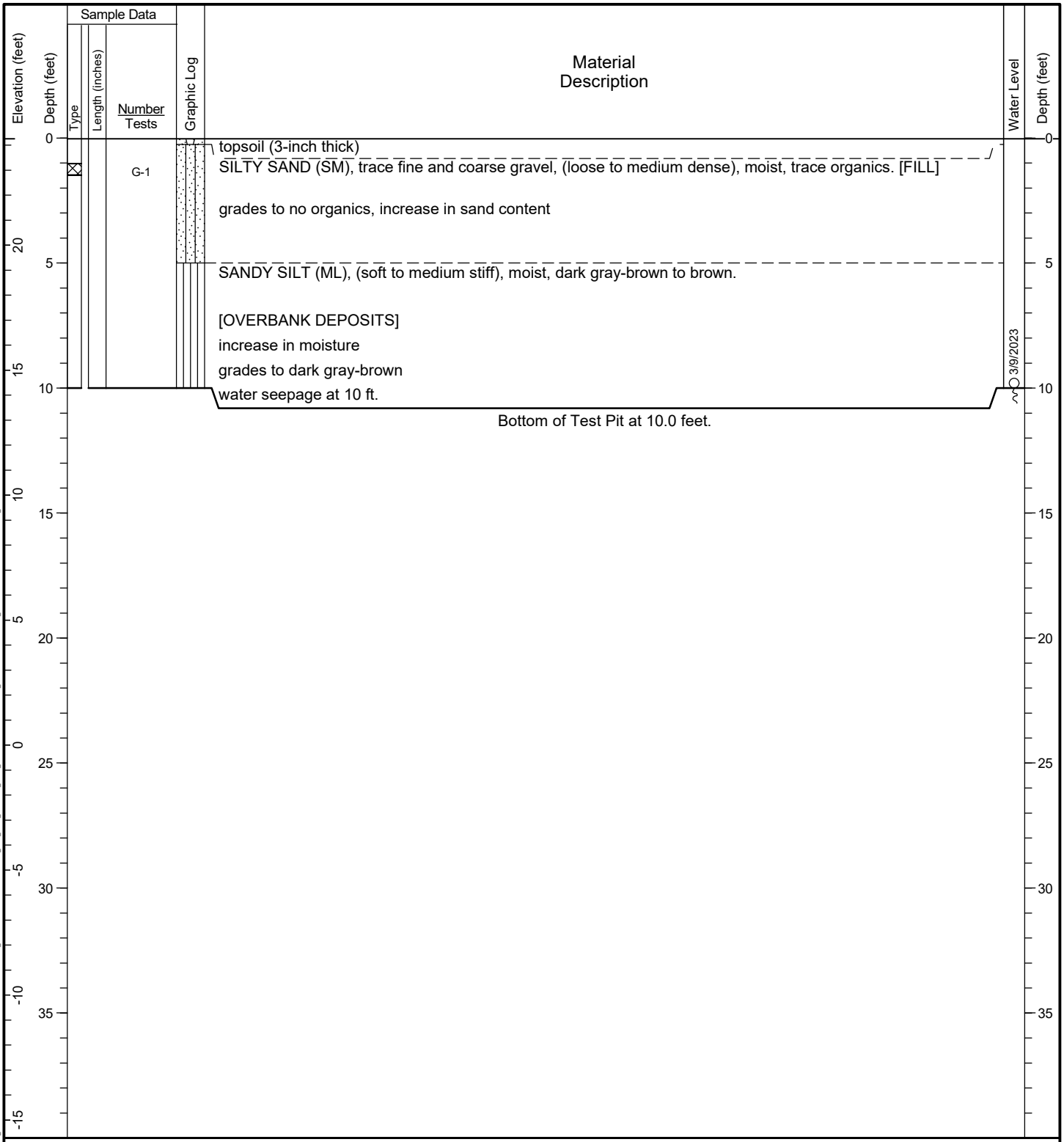
Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew: Bella Terra / DM

Logged by: KLA Checked by: DLK Rig Model/Type: Backhoe

Location: Lat: 45.598133 Long: -122.614312 (WGS 84) Total Depth: 10 feet Depth to Seepage: 10 feet

Ground Surface Elevation: 24.28 feet (NAVD 88)

Comments:



General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Test Pit Log
TP-1

Figure **A-7**
Sheet **1 of 1**

HA TEST PIT - \\HALEYALDRICH.COM\SHARESEA_DATA\GINT\HC_LIBRARY.GLB - 2/17/23 10:10 - \\HALEYALDRICH.COM\SHARESEA_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - khuber

Date Started: 03/09/2023 Date Completed: 03/09/2023 Contractor/Crew: Bella Terra / DM

Logged by: KLA Checked by: DLK Rig Model/Type: Backhoe

Location: Lat: 45.597348 Long: -122.611951 (WGS 84) Total Depth: 5.5 feet Depth to Seepage: 5 feet

Ground Surface Elevation: 23.00 feet (NAVD 88)

Comments:

Elevation (feet)	Depth (feet)	Sample Data: Type	Sample Data: Length (inches)	Sample Data: Number Tests	Graphic Log	Material Description	Water Level	Depth (feet)
23	0					POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), trace cobbles, (loose to medium dense), moist to wet, gray-brown. [FILL]		0
				G-1		SANDY SILT (ML), (medium dense), moist, brown mottled with gray-brown.		
20				G-2		SILTY SAND (SM), (medium dense), moist, brown. grades to gray		
						POORLY GRADED SAND (SP), few silt, (loose), moist.	3/9/2023	
18	5			G-3		water seepage at 5 ft.		5
						Bottom of Test Pit at 5.5 feet.		

General Notes:

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material stratum lines are interpretive and actual changes may be gradual. Solid lines indicate distinct contacts and dashed lines indicate gradual or approximate contacts.
3. USCS designations are based on visual-manual identification (ASTM D 2488), unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.
5. Location and ground surface elevations are approximate.

HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

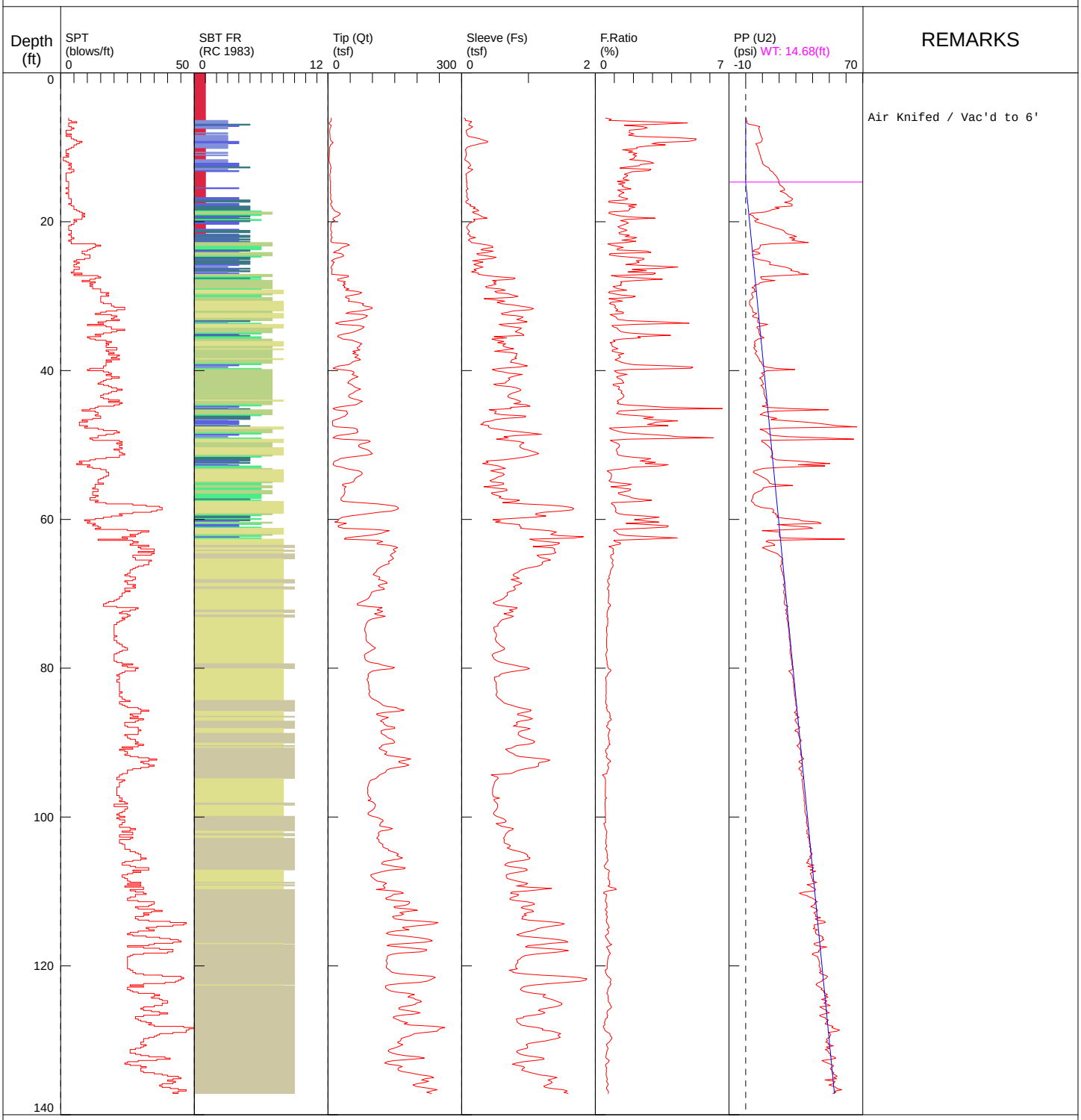
Test Pit Log
TP-2

Figure **A-8**
Sheet **1 of 1**

HA TEST PIT - \\HALEYALDRICH.COM\SHARESEA_DATA\GINTHC_LIBRARY_GLB - 2/17/23 10:10 - \\HALEYALDRICH.COM\SHARESEA_DATA\GINTHC_LIBRARY_GLB - 2/17/23 10:10 - \\HALEYALDRICH.COM\SHARESEA_DATA\GINTWO\BOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - kbutler

Haley & Aldrich / SCPT-4 / 4580 NE Marine Dr Portland

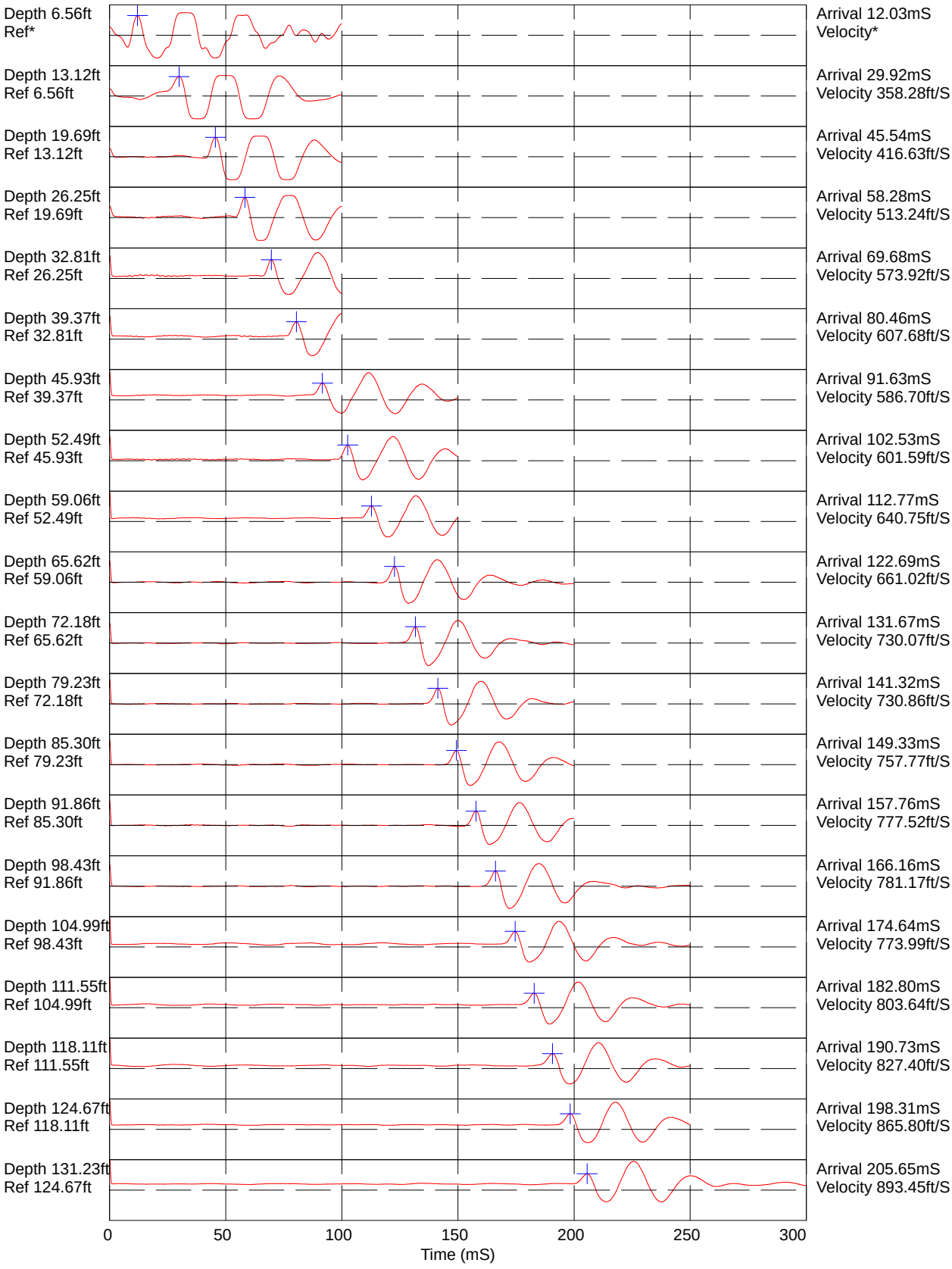
OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 12:58:45 PM
TOTAL DEPTH: 137.139 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

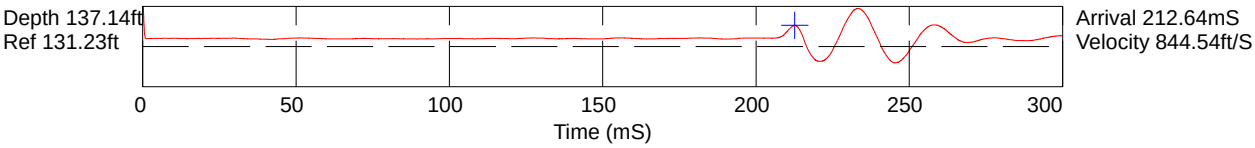
*SBT/SPT CORRELATION: UBC-1983

COMMENT: Haley & Aldrich / SCPT-4 / 4580 NE Marine Dr Portland



Hammer to Rod String Distance (ft): 2.04
* = Not Determined

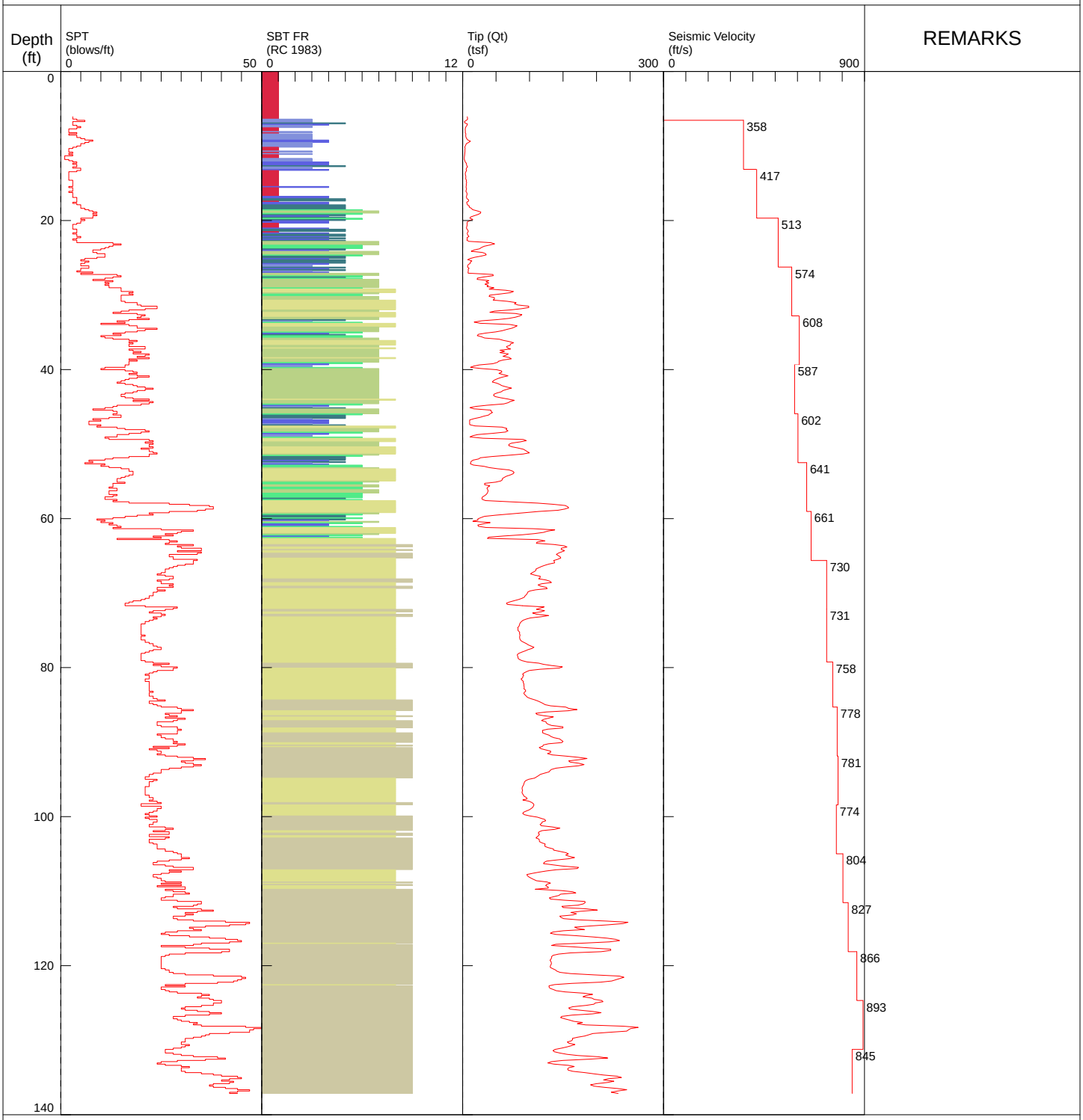
COMMENT: Haley & Aldrich / SCPT-4 / 4580 NE Marine Dr Portland



Hammer to Rod String Distance (ft): 2.04
* = Not Determined

Haley & Aldrich / SCPT-4 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 12:58:45 PM
TOTAL DEPTH: 137.139 ft



1 sensitive fine grained
2 organic material
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4 silty clay to clay
5 clayey silt to silty clay
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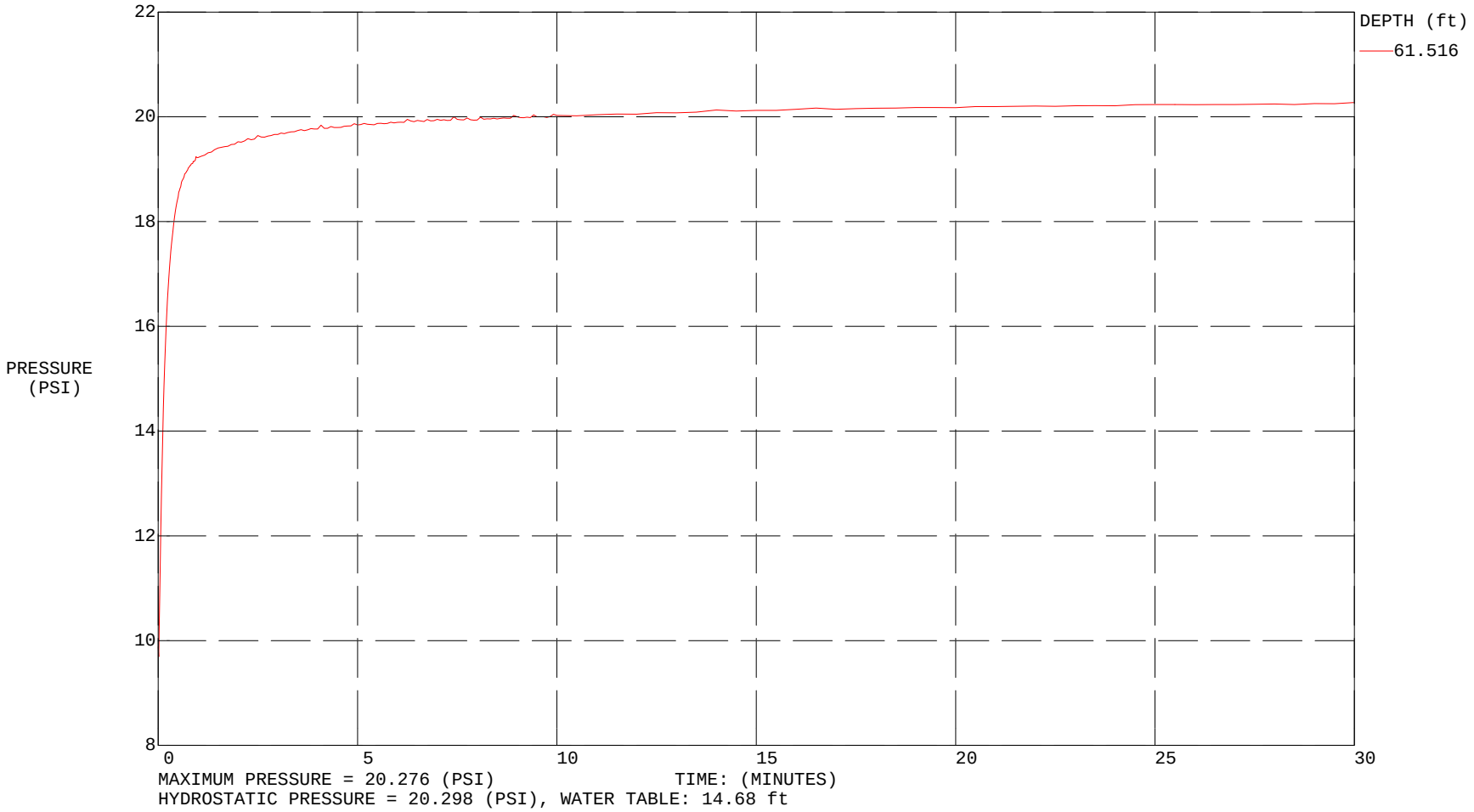
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Haley & Aldrich / SCPT-4 / 4580 NE Marine Dr Portland

CONE ID: DDG1296
TEST DATE: 2/28/2023 12:58:45 PM



MAXIMUM PRESSURE = 20.276 (PSI)
HYDROSTATIC PRESSURE = 20.298 (PSI), WATER TABLE: 14.68 ft

Haley & Aldrich / SCPT-4 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 12:58:45 PM
TOTAL DEPTH: 137.139 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
6.070	7.06	0.0379	0.537	0.323	3	1	sensitive fine grained
6.234	7.18	0.0596	0.831	0.401	3	1	sensitive fine grained
6.398	7.41	0.0530	0.715	0.568	4	1	sensitive fine grained
6.562	5.76	0.1480	2.571	0.677	6	3	clay
6.726	2.65	0.1275	4.820	0.864	3	3	clay
6.890	3.20	0.1082	3.386	1.655	3	3	clay
7.054	7.18	0.1090	1.519	5.352	3	5	clayey silt to silty clay
7.218	6.57	0.1644	2.502	8.336	4	4	silty clay to clay
7.382	5.22	0.1416	2.712	7.815	5	3	clay
7.546	4.27	0.1059	2.478	7.826	4	3	clay
7.710	3.97	0.0711	1.790	8.080	2	1	sensitive fine grained
7.874	3.90	0.0692	1.775	8.361	2	1	sensitive fine grained
8.038	4.12	0.0735	1.783	8.592	2	1	sensitive fine grained
8.202	3.98	0.0802	2.014	8.701	4	3	clay
8.366	4.78	0.0833	1.743	8.991	2	1	sensitive fine grained
8.530	4.58	0.1025	2.239	9.253	4	3	clay
8.694	4.66	0.1968	4.219	9.565	4	3	clay
8.858	5.17	0.2727	5.275	10.024	5	3	clay
9.022	6.13	0.3216	5.246	9.804	6	3	clay
9.186	7.93	0.3884	4.896	9.470	8	3	clay
9.350	11.59	0.3796	3.275	8.815	7	4	silty clay to clay
9.514	9.14	0.2720	2.975	6.088	6	4	silty clay to clay
9.678	5.56	0.2036	3.663	6.475	5	3	clay
9.843	4.93	0.1313	2.661	7.096	5	3	clay
10.007	3.87	0.0839	2.168	7.127	4	3	clay
10.171	3.29	0.0717	2.178	7.386	3	3	clay
10.335	3.79	0.0540	1.425	7.634	2	1	sensitive fine grained
10.499	3.37	0.0658	1.951	7.807	2	1	sensitive fine grained
10.663	3.55	0.0614	1.730	8.038	2	1	sensitive fine grained
10.827	3.37	0.0732	2.172	8.250	3	3	clay
10.991	3.32	0.0655	1.969	8.517	2	1	sensitive fine grained
11.155	3.18	0.0684	2.149	8.776	3	3	clay
11.319	2.89	0.0589	2.036	8.879	1	1	sensitive fine grained
11.483	2.60	0.0528	2.034	9.163	1	1	sensitive fine grained
11.647	2.60	0.0467	1.800	9.423	1	1	sensitive fine grained
11.811	2.59	0.0656	2.528	9.670	2	3	clay
11.975	3.37	0.0976	2.899	10.133	3	3	clay
12.139	3.75	0.1142	3.047	9.921	4	3	clay
12.303	5.44	0.1281	2.354	10.690	3	4	silty clay to clay
12.467	5.77	0.1337	2.316	11.473	4	4	silty clay to clay
12.631	6.28	0.1062	1.692	12.735	4	4	silty clay to clay
12.795	7.25	0.0934	1.289	13.925	3	5	clayey silt to silty clay
12.959	5.61	0.1634	2.914	14.279	5	3	clay
13.123	5.21	0.1466	2.813	14.599	5	3	clay
13.287	5.92	0.1128	1.905	16.076	4	4	silty clay to clay
13.451	4.96	0.0866	1.744	16.580	2	1	sensitive fine grained

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
13.615	4.13	0.0632	1.528	17.104	2	1	sensitive fine grained
13.780	3.96	0.0670	1.691	17.906	2	1	sensitive fine grained
13.944	4.43	0.0724	1.635	18.419	2	1	sensitive fine grained
14.108	4.70	0.0692	1.472	18.803	2	1	sensitive fine grained
14.272	4.60	0.0671	1.460	19.285	2	1	sensitive fine grained
14.436	4.57	0.0807	1.765	19.868	2	1	sensitive fine grained
14.600	5.86	0.0675	1.152	19.709	3	1	sensitive fine grained
14.764	5.33	0.0828	1.553	19.592	3	1	sensitive fine grained
14.928	6.06	0.0739	1.220	20.324	3	1	sensitive fine grained
15.092	5.37	0.0785	1.461	20.497	3	1	sensitive fine grained
15.256	5.49	0.0775	1.412	21.835	3	1	sensitive fine grained
15.420	5.14	0.0821	1.595	22.397	2	1	sensitive fine grained
15.584	5.16	0.0965	1.872	23.144	3	4	silty clay to clay
15.748	5.89	0.0689	1.171	23.269	3	1	sensitive fine grained
15.912	5.29	0.0690	1.304	20.648	3	1	sensitive fine grained
16.076	4.98	0.0748	1.501	22.746	2	1	sensitive fine grained
16.240	6.12	0.0829	1.355	23.966	3	1	sensitive fine grained
16.404	6.51	0.0817	1.256	24.930	3	1	sensitive fine grained
16.568	6.38	0.0780	1.223	25.445	3	1	sensitive fine grained
16.732	5.67	0.0798	1.408	26.758	3	1	sensitive fine grained
16.896	5.72	0.0966	1.689	28.034	4	4	silty clay to clay
17.060	6.35	0.1005	1.583	27.710	4	4	silty clay to clay
17.224	8.97	0.0640	0.714	26.632	4	5	clayey silt to silty clay
17.388	8.90	0.0628	0.705	23.275	4	5	clayey silt to silty clay
17.552	6.05	0.0836	1.382	26.315	3	1	sensitive fine grained
17.717	6.37	0.1373	2.155	27.889	4	4	silty clay to clay
17.881	7.08	0.1229	1.737	27.618	5	4	silty clay to clay
18.045	9.82	0.2033	2.070	17.497	5	5	clayey silt to silty clay
18.209	9.80	0.1755	1.790	19.923	5	5	clayey silt to silty clay
18.373	13.12	0.2364	1.802	15.856	6	5	clayey silt to silty clay
18.537	14.85	0.2529	1.703	14.181	7	5	clayey silt to silty clay
18.701	21.52	0.1620	0.753	11.429	8	6	sandy silt to clayey silt
18.865	27.16	0.1899	0.699	3.444	9	7	silty sand to sandy silt
19.029	26.62	0.2476	0.930	2.285	8	7	silty sand to sandy silt
19.193	22.78	0.2827	1.241	4.380	9	6	sandy silt to clayey silt
19.357	17.14	0.3142	1.833	4.689	8	5	clayey silt to silty clay
19.521	12.16	0.3807	3.131	5.480	8	4	silty clay to clay
19.685	10.74	0.1793	1.670	7.665	5	5	clayey silt to silty clay
19.849	15.21	0.1997	1.313	5.355	6	6	sandy silt to clayey silt
20.013	10.64	0.1722	1.618	5.890	5	5	clayey silt to silty clay
20.177	7.09	0.1226	1.730	8.163	5	4	silty clay to clay
20.341	6.69	0.1031	1.542	11.122	4	4	silty clay to clay
20.505	6.88	0.0942	1.369	13.476	3	1	sensitive fine grained
20.669	6.57	0.0778	1.185	15.365	3	1	sensitive fine grained
20.833	6.06	0.0779	1.285	17.502	3	1	sensitive fine grained
20.997	5.88	0.0877	1.491	20.249	3	1	sensitive fine grained
21.161	6.41	0.1063	1.658	22.603	4	4	silty clay to clay
21.325	8.02	0.1155	1.440	23.194	4	5	clayey silt to silty clay
21.490	8.32	0.1027	1.234	23.751	4	5	clayey silt to silty clay
21.654	7.04	0.0896	1.273	24.938	3	1	sensitive fine grained
21.818	7.00	0.1245	1.778	28.028	4	4	silty clay to clay
21.982	7.82	0.1226	1.567	30.326	4	5	clayey silt to silty clay
22.146	9.59	0.2071	2.159	26.237	5	5	clayey silt to silty clay
22.310	6.37	0.1211	1.900	29.396	4	4	silty clay to clay
22.474	7.17	0.0995	1.387	27.563	3	5	clayey silt to silty clay
22.638	6.28	0.1328	2.116	31.644	4	4	silty clay to clay
22.802	9.21	0.1451	1.575	37.353	4	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
22.966	42.07	0.2723	0.647	15.195	13	7	silty sand to sandy silt
23.130	47.78	0.3900	0.816	8.704	15	7	silty sand to sandy silt
23.294	40.15	0.4559	1.135	8.701	13	7	silty sand to sandy silt
23.458	32.12	0.4673	1.455	8.411	12	6	sandy silt to clayey silt
23.622	27.90	0.3202	1.147	7.929	11	6	sandy silt to clayey silt
23.786	25.36	0.2915	1.150	5.213	10	6	sandy silt to clayey silt
23.950	17.32	0.4714	2.722	4.274	8	5	clayey silt to silty clay
24.114	12.79	0.3724	2.912	7.701	8	4	silty clay to clay
24.278	29.55	0.2269	0.768	8.609	9	7	silty sand to sandy silt
24.442	34.23	0.2505	0.732	4.015	11	7	silty sand to sandy silt
24.606	35.07	0.3938	1.123	4.151	11	7	silty sand to sandy silt
24.770	27.93	0.5148	1.843	4.672	11	6	sandy silt to clayey silt
24.934	18.26	0.4648	2.546	5.720	9	5	clayey silt to silty clay
25.098	11.54	0.2909	2.522	7.782	6	5	clayey silt to silty clay
25.262	7.74	0.1656	2.139	11.952	5	4	silty clay to clay
25.427	13.86	0.3187	2.300	14.802	7	5	clayey silt to silty clay
25.591	11.50	0.2396	2.084	14.334	6	5	clayey silt to silty clay
25.755	11.41	0.1818	1.594	14.301	5	5	clayey silt to silty clay
25.919	8.54	0.2372	2.779	18.798	5	4	silty clay to clay
26.083	7.40	0.3197	4.321	23.375	7	3	clay
26.247	7.34	0.2556	3.485	25.916	7	3	clay
26.411	9.65	0.1867	1.936	27.504	5	5	clayey silt to silty clay
26.575	8.19	0.2182	2.663	26.955	5	4	silty clay to clay
26.739	8.64	0.1480	1.713	31.842	4	5	clayey silt to silty clay
26.903	7.98	0.2519	3.156	31.778	8	3	clay
27.067	8.18	0.2496	3.052	37.417	5	4	silty clay to clay
27.231	45.33	0.3770	0.832	20.511	14	7	silty sand to sandy silt
27.395	45.75	0.5526	1.208	8.904	15	7	silty sand to sandy silt
27.559	32.64	0.8017	2.457	9.317	13	6	sandy silt to clayey silt
27.723	22.21	0.7791	3.509	9.673	11	5	clayey silt to silty clay
27.887	21.64	0.4608	2.129	17.460	8	6	sandy silt to clayey silt
28.051	39.17	0.5163	1.318	11.289	13	7	silty sand to sandy silt
28.215	34.80	0.4808	1.382	8.403	11	7	silty sand to sandy silt
28.379	39.16	0.5151	1.316	7.782	12	7	silty sand to sandy silt
28.543	33.54	0.4561	1.360	5.048	11	7	silty sand to sandy silt
28.707	38.21	0.3586	0.938	5.235	12	7	silty sand to sandy silt
28.871	36.48	0.3715	1.018	3.728	12	7	silty sand to sandy silt
29.035	46.67	0.5748	1.231	5.280	15	7	silty sand to sandy silt
29.199	39.41	0.6502	1.650	5.090	15	6	sandy silt to clayey silt
29.364	64.48	0.4971	0.771	6.051	15	8	sand to silty sand
29.528	75.78	0.5195	0.686	3.792	18	8	sand to silty sand
29.692	71.52	0.6949	0.972	3.558	17	8	sand to silty sand
29.856	56.19	0.7618	1.356	3.739	18	7	silty sand to sandy silt
30.020	40.39	0.8411	2.082	4.168	15	6	sandy silt to clayey silt
30.184	39.42	0.7593	1.926	4.461	15	6	sandy silt to clayey silt
30.348	47.28	0.3354	0.709	3.811	15	7	silty sand to sandy silt
30.512	47.42	0.5170	1.090	2.541	15	7	silty sand to sandy silt
30.676	45.54	0.6446	1.415	2.290	15	7	silty sand to sandy silt
30.840	66.46	0.5326	0.801	2.351	16	8	sand to silty sand
31.004	79.80	0.5953	0.746	2.262	19	8	sand to silty sand
31.168	77.49	0.7660	0.989	2.351	19	8	sand to silty sand
31.332	82.64	0.8744	1.058	2.859	20	8	sand to silty sand
31.496	98.54	1.0004	1.015	3.583	24	8	sand to silty sand
31.660	98.91	1.0734	1.085	3.875	24	8	sand to silty sand
31.824	87.88	1.0289	1.171	4.040	21	8	sand to silty sand
31.988	71.68	0.7666	1.069	4.148	17	8	sand to silty sand
32.152	47.72	0.6990	1.465	4.291	15	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
32.316	40.48	0.5940	1.468	6.547	13	7	silty sand to sandy silt
32.480	79.04	0.6079	0.769	5.578	19	8	sand to silty sand
32.644	88.50	0.8171	0.923	4.034	21	8	sand to silty sand
32.808	85.63	0.9194	1.074	4.346	20	8	sand to silty sand
32.972	78.79	0.8873	1.126	7.464	19	8	sand to silty sand
33.136	69.25	0.8250	1.191	7.333	22	7	silty sand to sandy silt
33.301	52.30	0.9002	1.721	7.141	17	7	silty sand to sandy silt
33.465	28.55	0.9777	3.424	7.110	14	5	clayey silt to silty clay
33.629	17.14	0.8414	4.909	7.929	16	3	clay
33.793	26.46	0.5621	2.124	13.111	10	6	sandy silt to clayey silt
33.957	70.76	0.6168	0.872	10.746	17	8	sand to silty sand
34.121	81.22	0.7619	0.938	6.695	19	8	sand to silty sand
34.285	77.86	0.8932	1.147	6.756	19	8	sand to silty sand
34.449	73.74	0.8690	1.179	7.979	24	7	silty sand to sandy silt
34.613	66.16	0.8318	1.257	7.843	21	7	silty sand to sandy silt
34.777	59.17	0.8022	1.356	7.938	19	7	silty sand to sandy silt
34.941	49.30	0.8671	1.759	7.974	16	7	silty sand to sandy silt
35.105	34.25	0.9157	2.674	8.208	13	6	sandy silt to clayey silt
35.269	23.64	0.9312	3.940	8.495	15	4	silty clay to clay
35.433	21.76	0.4849	2.228	9.866	10	5	clayey silt to silty clay
35.597	28.29	0.6699	2.368	10.896	11	6	sandy silt to clayey silt
35.761	32.93	0.4549	1.382	7.258	13	6	sandy silt to clayey silt
35.925	54.67	0.5161	0.944	6.453	17	7	silty sand to sandy silt
36.089	60.95	0.6322	1.037	5.241	19	7	silty sand to sandy silt
36.253	69.83	0.5389	0.772	5.229	17	8	sand to silty sand
36.417	75.90	0.6574	0.866	5.750	18	8	sand to silty sand
36.581	71.37	0.6163	0.863	4.926	17	8	sand to silty sand
36.745	70.96	0.6249	0.881	5.929	17	8	sand to silty sand
36.909	65.54	0.6848	1.045	4.786	21	7	silty sand to sandy silt
37.073	66.34	0.7777	1.172	5.202	21	7	silty sand to sandy silt
37.238	71.46	0.6350	0.889	5.750	17	8	sand to silty sand
37.402	55.95	0.4933	0.882	6.650	18	7	silty sand to sandy silt
37.566	62.41	0.7254	1.162	5.920	20	7	silty sand to sandy silt
37.730	55.74	0.8292	1.488	5.633	18	7	silty sand to sandy silt
37.894	68.03	0.8176	1.202	6.427	22	7	silty sand to sandy silt
38.058	64.99	0.8221	1.265	6.957	21	7	silty sand to sandy silt
38.222	60.41	0.7947	1.315	7.249	19	7	silty sand to sandy silt
38.386	69.50	0.8177	1.176	7.893	22	7	silty sand to sandy silt
38.550	72.58	0.7502	1.034	8.188	17	8	sand to silty sand
38.714	60.25	0.7409	1.230	8.361	19	7	silty sand to sandy silt
38.878	54.04	0.7319	1.354	9.403	17	7	silty sand to sandy silt
39.042	51.74	0.8335	1.611	9.643	17	7	silty sand to sandy silt
39.206	45.06	0.9118	2.023	9.985	17	6	sandy silt to clayey silt
39.370	24.94	0.9830	3.942	10.403	16	4	silty clay to clay
39.534	16.59	0.8479	5.110	12.515	16	3	clay
39.698	11.69	0.5855	5.010	17.641	11	3	clay
39.862	26.91	0.4594	1.707	29.360	10	6	sandy silt to clayey silt
40.026	50.83	0.5082	1.000	12.429	16	7	silty sand to sandy silt
40.190	57.92	0.6192	1.069	11.253	18	7	silty sand to sandy silt
40.354	58.60	0.7018	1.198	9.428	19	7	silty sand to sandy silt
40.518	54.24	0.9052	1.669	10.317	17	7	silty sand to sandy silt
40.682	60.45	0.8154	1.349	10.568	19	7	silty sand to sandy silt
40.846	67.68	0.7510	1.110	9.684	22	7	silty sand to sandy silt
41.011	59.25	0.6986	1.179	8.300	19	7	silty sand to sandy silt
41.175	53.60	0.7197	1.343	9.283	17	7	silty sand to sandy silt
41.339	49.18	0.7001	1.424	9.793	16	7	silty sand to sandy silt
41.503	45.94	0.6641	1.446	9.949	15	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
41.667	44.33	0.6584	1.485	10.361	14	7	silty sand to sandy silt
41.831	51.17	0.4783	0.935	10.726	16	7	silty sand to sandy silt
41.995	55.39	0.5249	0.948	9.060	18	7	silty sand to sandy silt
42.159	58.53	0.7296	1.246	9.843	19	7	silty sand to sandy silt
42.323	65.32	0.8200	1.255	10.258	21	7	silty sand to sandy silt
42.487	72.93	0.8751	1.200	10.899	23	7	silty sand to sandy silt
42.651	66.05	0.8839	1.338	10.894	21	7	silty sand to sandy silt
42.815	60.42	0.8431	1.395	10.835	19	7	silty sand to sandy silt
42.979	57.46	0.7740	1.347	11.072	18	7	silty sand to sandy silt
43.143	51.03	0.7274	1.425	10.919	16	7	silty sand to sandy silt
43.307	46.87	0.7000	1.494	11.356	15	7	silty sand to sandy silt
43.471	46.14	0.6880	1.491	11.415	15	7	silty sand to sandy silt
43.635	48.86	0.7058	1.445	11.715	16	7	silty sand to sandy silt
43.799	57.22	0.7788	1.361	12.170	18	7	silty sand to sandy silt
43.963	67.59	0.8264	1.223	12.223	22	7	silty sand to sandy silt
44.127	77.19	0.8807	1.141	12.900	18	8	sand to silty sand
44.291	71.15	0.8689	1.221	11.919	23	7	silty sand to sandy silt
44.455	67.82	0.7816	1.153	12.373	22	7	silty sand to sandy silt
44.619	61.50	0.9690	1.576	13.139	20	7	silty sand to sandy silt
44.783	36.54	1.0221	2.797	9.924	14	6	sandy silt to clayey silt
44.948	19.67	0.7314	3.718	12.874	13	4	silty clay to clay
45.112	11.10	0.7382	6.649	26.443	11	3	clay
45.276	16.80	0.4127	2.456	49.419	8	5	clayey silt to silty clay
45.440	42.10	0.5168	1.228	17.441	13	7	silty sand to sandy silt
45.604	42.64	0.5082	1.192	11.275	14	7	silty sand to sandy silt
45.768	44.53	0.4926	1.106	9.849	14	7	silty sand to sandy silt
45.932	41.04	0.5965	1.454	8.620	13	7	silty sand to sandy silt
46.096	38.87	0.9578	2.464	12.549	15	6	sandy silt to clayey silt
46.260	31.29	0.9501	3.037	14.844	15	5	clayey silt to silty clay
46.424	25.61	0.6473	2.527	18.614	12	5	clayey silt to silty clay
46.588	17.15	0.5051	2.946	15.148	8	5	clayey silt to silty clay
46.752	10.51	0.4527	4.309	25.501	10	3	clay
46.916	10.39	0.3295	3.172	35.687	7	4	silty clay to clay
47.080	10.60	0.3209	3.029	43.011	7	4	silty clay to clay
47.244	10.44	0.2844	2.726	49.049	7	4	silty clay to clay
47.408	10.72	0.4084	3.809	54.198	10	3	clay
47.572	18.58	0.4000	2.153	66.465	9	5	clayey silt to silty clay
47.736	58.95	0.4293	0.728	19.486	14	8	sand to silty sand
47.900	65.90	0.5587	0.848	8.595	16	8	sand to silty sand
48.064	64.93	0.6880	1.060	10.746	21	7	silty sand to sandy silt
48.228	67.69	0.8650	1.278	12.209	22	7	silty sand to sandy silt
48.392	64.07	1.0219	1.595	13.078	20	7	silty sand to sandy silt
48.556	44.84	1.1926	2.660	14.028	17	6	sandy silt to clayey silt
48.720	22.67	0.8390	3.701	15.981	14	4	silty clay to clay
48.885	14.88	0.6329	4.253	25.086	14	3	clay
49.049	11.22	0.6944	6.188	45.745	11	3	clay
49.213	30.37	0.5193	1.710	64.579	12	6	sandy silt to clayey silt
49.377	90.42	0.7110	0.786	9.604	22	8	sand to silty sand
49.541	94.93	0.8566	0.902	9.540	23	8	sand to silty sand
49.705	86.30	0.9314	1.079	11.066	21	8	sand to silty sand
49.869	72.91	0.8931	1.225	11.958	23	7	silty sand to sandy silt
50.033	69.09	0.8744	1.266	13.003	22	7	silty sand to sandy silt
50.197	68.74	0.8665	1.261	13.563	22	7	silty sand to sandy silt
50.361	73.42	0.8846	1.205	14.535	23	7	silty sand to sandy silt
50.525	83.02	0.9247	1.114	14.906	20	8	sand to silty sand
50.689	90.79	1.0004	1.102	15.410	22	8	sand to silty sand
50.853	93.73	1.0565	1.127	15.831	22	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
51.017	96.66	1.1220	1.161	15.780	23	8	sand to silty sand
51.181	99.81	1.1516	1.154	16.198	24	8	sand to silty sand
51.345	90.05	1.0779	1.197	15.828	22	8	sand to silty sand
51.509	68.88	1.0107	1.467	15.271	22	7	silty sand to sandy silt
51.673	43.45	0.9027	2.078	15.059	17	6	sandy silt to clayey silt
51.837	26.71	0.7721	2.891	16.928	13	5	clayey silt to silty clay
52.001	23.76	0.6283	2.644	18.221	11	5	clayey silt to silty clay
52.165	15.64	0.3660	2.340	30.792	7	5	clayey silt to silty clay
52.329	12.61	0.3966	3.144	40.108	8	4	silty clay to clay
52.493	12.03	0.3149	2.619	50.378	6	5	clayey silt to silty clay
52.657	11.60	0.4426	3.815	31.499	11	3	clay
52.822	16.06	0.5468	3.404	47.391	10	4	silty clay to clay
52.986	32.14	0.5996	1.866	22.812	12	6	sandy silt to clayey silt
53.150	39.52	0.6536	1.654	10.423	15	6	sandy silt to clayey silt
53.314	52.45	0.5242	0.999	7.729	17	7	silty sand to sandy silt
53.478	69.55	0.4322	0.621	5.185	17	8	sand to silty sand
53.642	74.97	0.5312	0.708	4.469	18	8	sand to silty sand
53.806	76.78	0.6232	0.812	5.413	18	8	sand to silty sand
53.970	75.62	0.6371	0.842	7.007	18	8	sand to silty sand
54.134	71.20	0.6043	0.849	8.511	17	8	sand to silty sand
54.298	65.51	0.5416	0.827	9.907	16	8	sand to silty sand
54.462	62.23	0.5090	0.818	11.306	15	8	sand to silty sand
54.626	59.39	0.4721	0.795	12.443	14	8	sand to silty sand
54.790	59.22	0.4239	0.716	13.390	14	8	sand to silty sand
54.954	57.04	0.4491	0.787	13.961	14	8	sand to silty sand
55.118	49.15	0.6244	1.270	14.072	16	7	silty sand to sandy silt
55.282	32.97	0.6278	1.904	16.003	13	6	sandy silt to clayey silt
55.446	32.80	0.5299	1.616	28.151	13	6	sandy silt to clayey silt
55.610	40.51	0.3321	0.820	14.042	13	7	silty sand to sandy silt
55.774	37.65	0.4939	1.312	10.311	12	7	silty sand to sandy silt
55.938	36.32	0.6704	1.846	10.233	14	6	sandy silt to clayey silt
56.102	37.42	0.6812	1.820	9.403	14	6	sandy silt to clayey silt
56.266	38.16	0.6000	1.572	7.662	12	7	silty sand to sandy silt
56.430	37.45	0.4466	1.193	6.007	12	7	silty sand to sandy silt
56.594	36.71	0.4575	1.246	4.931	12	7	silty sand to sandy silt
56.759	35.30	0.5217	1.478	4.472	14	6	sandy silt to clayey silt
56.923	32.88	0.5887	1.791	4.190	13	6	sandy silt to clayey silt
57.087	29.87	0.5612	1.879	4.360	11	6	sandy silt to clayey silt
57.251	28.77	0.6392	2.222	3.875	11	6	sandy silt to clayey silt
57.415	29.38	0.8656	2.946	3.491	14	5	clayey silt to silty clay
57.579	34.15	0.8064	2.361	3.380	13	6	sandy silt to clayey silt
57.743	70.00	0.6124	0.875	4.647	17	8	sand to silty sand
57.907	111.58	0.9406	0.843	5.040	27	8	sand to silty sand
58.071	135.10	1.3145	0.973	5.522	32	8	sand to silty sand
58.235	152.89	1.5226	0.996	7.433	37	8	sand to silty sand
58.399	156.89	1.6471	1.050	9.431	38	8	sand to silty sand
58.563	158.26	1.6747	1.058	15.817	38	8	sand to silty sand
58.727	152.36	1.6528	1.085	16.599	36	8	sand to silty sand
58.891	142.28	1.4838	1.043	16.711	34	8	sand to silty sand
59.055	113.49	1.2258	1.080	16.009	27	8	sand to silty sand
59.219	91.58	1.1098	1.212	18.059	22	8	sand to silty sand
59.383	70.53	1.1117	1.576	17.953	23	7	silty sand to sandy silt
59.547	49.54	1.2601	2.543	19.553	19	6	sandy silt to clayey silt
59.711	32.52	1.0862	3.340	18.430	16	5	clayey silt to silty clay
59.875	26.94	0.7471	2.774	23.957	13	5	clayey silt to silty clay
60.039	22.82	0.4679	2.050	32.174	9	6	sandy silt to clayey silt
60.203	22.92	0.5803	2.532	33.394	11	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
60.367	15.25	0.5070	3.326	43.432	10	4	silty clay to clay
60.532	41.11	0.6598	1.605	44.956	13	7	silty sand to sandy silt
60.696	31.42	0.8661	2.757	18.881	12	6	sandy silt to clayey silt
60.860	22.60	0.8640	3.823	26.465	14	4	silty clay to clay
61.024	23.72	0.8925	3.762	37.509	15	4	silty clay to clay
61.188	35.01	0.8828	2.521	40.128	13	6	sandy silt to clayey silt
61.352	105.19	1.0878	1.034	28.006	25	8	sand to silty sand
61.516	137.64	1.3096	0.951	9.813	33	8	sand to silty sand
61.680	126.60	1.4168	1.119	20.294	30	8	sand to silty sand
61.844	120.56	1.3767	1.142	20.216	29	8	sand to silty sand
62.008	107.30	1.3334	1.243	20.110	26	8	sand to silty sand
62.172	88.78	1.4479	1.631	20.113	28	7	silty sand to sandy silt
62.336	60.98	1.8234	2.990	20.280	23	6	sandy silt to clayey silt
62.500	39.15	1.6798	4.291	21.481	25	4	silty clay to clay
62.664	37.07	1.0188	2.748	59.140	14	6	sandy silt to clayey silt
62.828	111.89	1.0872	0.972	13.312	27	8	sand to silty sand
62.992	122.81	1.2796	1.042	12.122	29	8	sand to silty sand
63.156	111.20	1.4641	1.317	15.340	27	8	sand to silty sand
63.320	110.09	1.4477	1.315	16.666	26	8	sand to silty sand
63.484	136.06	1.3618	1.001	17.410	33	8	sand to silty sand
63.648	151.21	1.0698	0.707	11.696	29	9	sand
63.812	155.91	1.3576	0.871	10.019	30	9	sand
63.976	147.61	1.3945	0.945	11.897	35	8	sand to silty sand
64.140	147.15	1.3857	0.942	13.432	35	8	sand to silty sand
64.304	152.18	1.3926	0.915	15.368	29	9	sand
64.469	147.81	1.4095	0.954	17.382	35	8	sand to silty sand
64.633	143.08	1.3625	0.952	19.015	34	8	sand to silty sand
64.797	139.93	1.1266	0.805	19.932	27	9	sand
64.961	142.73	1.1480	0.804	20.578	27	9	sand
65.125	145.64	1.1781	0.809	21.637	28	9	sand
65.289	146.50	1.2711	0.868	22.071	28	9	sand
65.453	141.90	1.3275	0.936	21.553	34	8	sand to silty sand
65.617	135.91	1.2356	0.909	21.350	33	8	sand to silty sand
65.781	137.00	1.2018	0.877	21.400	33	8	sand to silty sand
65.945	137.28	1.2094	0.881	21.600	33	8	sand to silty sand
66.109	128.67	1.1923	0.927	21.227	31	8	sand to silty sand
66.273	122.64	1.1460	0.934	20.692	29	8	sand to silty sand
66.437	117.72	1.0559	0.897	21.043	28	8	sand to silty sand
66.601	113.70	0.9648	0.849	21.138	27	8	sand to silty sand
66.765	109.63	0.8970	0.818	21.311	26	8	sand to silty sand
66.929	109.51	0.8655	0.790	21.380	26	8	sand to silty sand
67.093	107.51	0.8469	0.788	22.082	26	8	sand to silty sand
67.257	104.07	0.8003	0.769	21.974	25	8	sand to silty sand
67.421	101.36	0.7715	0.761	22.166	24	8	sand to silty sand
67.585	107.68	0.7757	0.720	22.642	26	8	sand to silty sand
67.749	115.96	0.8200	0.707	22.877	28	8	sand to silty sand
67.913	115.49	0.8590	0.744	22.740	28	8	sand to silty sand
68.077	113.65	0.7403	0.651	22.798	27	8	sand to silty sand
68.241	124.61	0.8002	0.642	23.005	24	9	sand
68.406	130.13	0.8506	0.654	23.292	25	9	sand
68.570	132.69	0.8999	0.678	23.551	25	9	sand
68.734	118.03	0.8663	0.734	22.339	28	8	sand to silty sand
68.898	112.76	0.8036	0.713	22.684	27	8	sand to silty sand
69.062	116.22	0.7752	0.667	22.893	28	8	sand to silty sand
69.226	125.01	0.7988	0.639	23.392	24	9	sand
69.390	126.11	0.8032	0.637	23.395	24	9	sand
69.554	108.96	0.7714	0.708	22.757	26	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
69.718	100.15	0.7113	0.710	22.796	24	8	sand to silty sand
69.882	97.10	0.6787	0.699	22.662	23	8	sand to silty sand
70.046	96.54	0.6834	0.708	23.141	23	8	sand to silty sand
70.210	95.31	0.6841	0.718	23.487	23	8	sand to silty sand
70.374	93.26	0.6577	0.705	23.425	22	8	sand to silty sand
70.538	92.09	0.6374	0.692	23.498	22	8	sand to silty sand
70.702	88.51	0.6126	0.692	23.423	21	8	sand to silty sand
70.866	83.74	0.5734	0.685	23.292	20	8	sand to silty sand
71.030	76.34	0.5166	0.677	23.055	18	8	sand to silty sand
71.194	69.88	0.4693	0.672	22.932	17	8	sand to silty sand
71.358	65.39	0.4887	0.747	23.172	16	8	sand to silty sand
71.522	66.75	0.5326	0.798	23.478	16	8	sand to silty sand
71.686	89.55	0.6798	0.759	25.200	21	8	sand to silty sand
71.850	121.60	0.8259	0.679	24.816	29	8	sand to silty sand
72.014	115.90	0.8166	0.705	24.713	28	8	sand to silty sand
72.178	110.28	0.7155	0.649	23.776	26	8	sand to silty sand
72.343	122.38	0.7696	0.629	24.749	23	9	sand
72.507	117.16	0.7298	0.623	24.247	22	9	sand
72.671	104.55	0.6324	0.605	23.991	25	8	sand to silty sand
72.835	110.52	0.6897	0.624	24.774	26	8	sand to silty sand
72.999	128.40	0.7717	0.601	25.172	25	9	sand
73.163	117.54	0.7375	0.627	24.565	23	9	sand
73.327	101.14	0.6672	0.660	24.551	24	8	sand to silty sand
73.491	94.75	0.6028	0.636	24.740	23	8	sand to silty sand
73.655	90.02	0.5859	0.651	24.969	22	8	sand to silty sand
73.819	88.05	0.5683	0.645	25.105	21	8	sand to silty sand
73.983	86.27	0.5559	0.644	25.298	21	8	sand to silty sand
74.147	85.13	0.5428	0.638	25.445	20	8	sand to silty sand
74.311	84.69	0.5457	0.644	25.406	20	8	sand to silty sand
74.475	83.90	0.4838	0.577	25.554	20	8	sand to silty sand
74.639	82.24	0.4790	0.582	25.498	20	8	sand to silty sand
74.803	82.97	0.4897	0.590	25.855	20	8	sand to silty sand
74.967	82.27	0.4850	0.590	25.810	20	8	sand to silty sand
75.131	84.00	0.4960	0.591	25.899	20	8	sand to silty sand
75.295	85.24	0.5134	0.602	25.924	20	8	sand to silty sand
75.459	84.86	0.5203	0.613	25.930	20	8	sand to silty sand
75.623	85.83	0.5211	0.607	26.097	21	8	sand to silty sand
75.787	85.38	0.5159	0.604	25.872	20	8	sand to silty sand
75.951	85.06	0.5065	0.595	26.075	20	8	sand to silty sand
76.115	85.46	0.5014	0.587	26.223	20	8	sand to silty sand
76.280	86.01	0.5124	0.596	26.326	21	8	sand to silty sand
76.444	88.06	0.5185	0.589	26.345	21	8	sand to silty sand
76.608	91.31	0.5417	0.593	26.604	22	8	sand to silty sand
76.772	95.29	0.5631	0.591	26.518	23	8	sand to silty sand
76.936	97.90	0.5784	0.591	26.476	23	8	sand to silty sand
77.100	102.06	0.6072	0.595	26.799	24	8	sand to silty sand
77.264	106.48	0.6364	0.598	26.888	25	8	sand to silty sand
77.428	103.66	0.6431	0.620	26.601	25	8	sand to silty sand
77.592	97.87	0.6119	0.625	26.432	23	8	sand to silty sand
77.756	93.61	0.5653	0.604	26.585	22	8	sand to silty sand
77.920	88.23	0.5041	0.571	26.515	21	8	sand to silty sand
78.084	84.04	0.4703	0.560	26.585	20	8	sand to silty sand
78.248	81.56	0.4558	0.559	27.100	20	8	sand to silty sand
78.412	81.89	0.4636	0.566	27.086	20	8	sand to silty sand
78.576	82.79	0.4777	0.577	27.103	20	8	sand to silty sand
78.740	82.78	0.4845	0.585	27.164	20	8	sand to silty sand
78.904	84.73	0.5095	0.601	27.382	20	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
79.068	88.65	0.5411	0.610	27.546	21	8	sand to silty sand
79.232	96.40	0.5993	0.622	27.719	23	8	sand to silty sand
79.396	113.61	0.6875	0.605	27.577	27	8	sand to silty sand
79.560	120.81	0.7776	0.644	27.635	23	9	sand
79.724	132.99	0.8541	0.642	27.981	25	9	sand
79.888	148.93	0.9775	0.656	27.858	29	9	sand
80.052	144.37	1.0155	0.703	28.463	28	9	sand
80.217	115.95	0.9449	0.815	27.557	28	8	sand to silty sand
80.381	99.86	0.8092	0.810	25.805	24	8	sand to silty sand
80.545	94.92	0.6877	0.724	26.568	23	8	sand to silty sand
80.709	91.73	0.6069	0.662	27.153	22	8	sand to silty sand
80.873	89.49	0.5716	0.639	27.738	21	8	sand to silty sand
81.037	91.09	0.5656	0.621	27.986	22	8	sand to silty sand
81.201	89.91	0.4897	0.545	28.123	22	8	sand to silty sand
81.365	89.83	0.4928	0.549	28.184	22	8	sand to silty sand
81.529	87.29	0.4884	0.559	28.577	21	8	sand to silty sand
81.693	88.67	0.5002	0.564	28.521	21	8	sand to silty sand
81.857	90.84	0.5159	0.568	28.432	22	8	sand to silty sand
82.021	90.31	0.5180	0.574	28.546	22	8	sand to silty sand
82.185	91.48	0.5137	0.562	28.811	22	8	sand to silty sand
82.349	91.50	0.5178	0.566	28.624	22	8	sand to silty sand
82.513	91.78	0.5188	0.565	28.825	22	8	sand to silty sand
82.677	92.08	0.5166	0.561	28.992	22	8	sand to silty sand
82.841	91.43	0.5198	0.569	28.931	22	8	sand to silty sand
83.005	93.79	0.5277	0.563	29.048	22	8	sand to silty sand
83.169	94.06	0.5327	0.566	29.089	23	8	sand to silty sand
83.333	91.93	0.5271	0.573	29.062	22	8	sand to silty sand
83.497	91.52	0.5142	0.562	29.154	22	8	sand to silty sand
83.661	93.39	0.5171	0.554	29.293	22	8	sand to silty sand
83.825	94.93	0.5330	0.561	29.482	23	8	sand to silty sand
83.990	96.89	0.5454	0.563	29.535	23	8	sand to silty sand
84.154	101.22	0.5721	0.565	29.661	24	8	sand to silty sand
84.318	107.79	0.5937	0.551	29.805	26	8	sand to silty sand
84.482	112.59	0.6105	0.542	30.062	22	9	sand
84.646	116.63	0.6325	0.542	29.939	22	9	sand
84.810	120.08	0.6786	0.565	30.042	23	9	sand
84.974	123.11	0.7491	0.608	29.903	24	9	sand
85.138	131.48	0.8006	0.609	30.432	25	9	sand
85.302	153.80	0.8620	0.560	30.786	29	9	sand
85.466	158.26	0.9632	0.609	30.340	30	9	sand
85.630	170.78	1.0395	0.609	30.287	33	9	sand
85.794	157.71	1.0217	0.648	30.118	30	9	sand
85.958	125.21	0.9202	0.735	29.006	30	8	sand to silty sand
86.122	109.34	0.8376	0.766	30.605	26	8	sand to silty sand
86.286	111.06	0.8421	0.758	29.842	27	8	sand to silty sand
86.450	120.53	0.9469	0.786	31.121	29	8	sand to silty sand
86.614	135.43	1.0043	0.742	31.937	26	9	sand
86.778	128.49	1.0593	0.824	30.076	31	8	sand to silty sand
86.942	121.11	0.9988	0.825	29.410	29	8	sand to silty sand
87.106	117.70	0.8798	0.748	29.722	28	8	sand to silty sand
87.270	124.35	0.8185	0.658	30.360	24	9	sand
87.434	125.08	0.8312	0.665	30.761	24	9	sand
87.598	127.77	0.8278	0.648	31.371	24	9	sand
87.762	132.76	0.7738	0.583	31.304	25	9	sand
87.927	149.79	0.9173	0.612	32.514	29	9	sand
88.091	149.77	1.0233	0.683	31.906	29	9	sand
88.255	126.98	0.9798	0.772	30.037	30	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
88.419	119.12	0.8878	0.745	29.399	29	8	sand to silty sand
88.583	119.40	0.8555	0.717	31.441	29	8	sand to silty sand
88.747	119.41	0.8457	0.708	31.238	29	8	sand to silty sand
88.911	123.57	0.8452	0.684	31.694	24	9	sand
89.075	129.07	0.8661	0.671	31.616	25	9	sand
89.239	131.90	0.9040	0.685	32.218	25	9	sand
89.403	136.26	0.9577	0.703	32.098	26	9	sand
89.567	144.67	1.0099	0.698	32.728	28	9	sand
89.731	147.05	1.0725	0.729	33.308	28	9	sand
89.895	149.87	1.0926	0.729	32.580	29	9	sand
90.059	148.11	1.0676	0.721	31.934	28	9	sand
90.223	128.39	0.9912	0.772	31.809	31	8	sand to silty sand
90.387	120.37	0.8257	0.686	30.608	29	8	sand to silty sand
90.551	119.55	0.7823	0.654	31.374	23	9	sand
90.715	114.36	0.7475	0.654	32.018	27	8	sand to silty sand
90.879	116.89	0.6568	0.562	32.385	22	9	sand
91.043	123.93	0.6806	0.549	32.770	24	9	sand
91.207	131.46	0.7039	0.535	33.043	25	9	sand
91.371	131.29	0.7433	0.566	32.826	25	9	sand
91.535	126.90	0.7862	0.620	32.709	24	9	sand
91.699	133.84	0.8012	0.599	33.029	26	9	sand
91.864	153.90	0.8754	0.569	33.664	29	9	sand
92.028	172.37	1.0430	0.605	34.085	33	9	sand
92.192	185.81	1.2422	0.669	34.748	36	9	sand
92.356	174.00	1.3185	0.758	33.361	33	9	sand
92.520	158.50	1.2723	0.803	31.845	30	9	sand
92.684	160.26	1.1625	0.725	32.098	31	9	sand
92.848	173.54	1.1486	0.662	33.689	33	9	sand
93.012	181.40	1.1531	0.636	33.517	35	9	sand
93.176	173.06	1.1445	0.661	33.678	33	9	sand
93.340	154.42	1.0796	0.699	32.383	30	9	sand
93.504	139.30	0.9603	0.689	31.681	27	9	sand
93.668	132.34	0.8738	0.660	32.422	25	9	sand
93.832	130.38	0.8156	0.626	33.475	25	9	sand
93.996	128.95	0.7826	0.607	33.530	25	9	sand
94.160	122.52	0.7392	0.603	33.018	23	9	sand
94.324	115.92	0.4408	0.380	33.283	22	9	sand
94.488	113.43	0.4872	0.430	33.575	22	9	sand
94.652	110.59	0.5411	0.489	34.773	21	9	sand
94.816	107.42	0.5460	0.508	34.152	21	9	sand
94.980	98.52	0.5210	0.529	33.583	24	8	sand to silty sand
95.144	94.57	0.5063	0.535	33.787	23	8	sand to silty sand
95.308	92.62	0.4926	0.532	33.926	22	8	sand to silty sand
95.472	91.88	0.4886	0.532	34.068	22	8	sand to silty sand
95.636	91.22	0.4830	0.529	34.063	22	8	sand to silty sand
95.801	90.53	0.4770	0.527	34.241	22	8	sand to silty sand
95.965	89.42	0.4709	0.527	34.194	21	8	sand to silty sand
96.129	88.76	0.4655	0.524	34.341	21	8	sand to silty sand
96.293	88.88	0.4631	0.521	34.397	21	8	sand to silty sand
96.457	89.52	0.4632	0.517	34.492	21	8	sand to silty sand
96.621	88.99	0.4644	0.522	34.536	21	8	sand to silty sand
96.785	88.64	0.4604	0.519	34.578	21	8	sand to silty sand
96.949	89.70	0.4629	0.516	34.834	21	8	sand to silty sand
97.113	90.77	0.4680	0.516	34.862	22	8	sand to silty sand
97.277	91.93	0.4746	0.516	34.854	22	8	sand to silty sand
97.441	95.46	0.5660	0.593	35.057	23	8	sand to silty sand
97.605	96.29	0.4848	0.503	34.996	23	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
97.769	90.00	0.4833	0.537	34.806	22	8	sand to silty sand
97.933	99.03	0.5031	0.508	35.400	24	8	sand to silty sand
98.097	103.30	0.5220	0.505	35.255	25	8	sand to silty sand
98.261	105.61	0.5364	0.508	35.344	20	9	sand
98.425	106.40	0.5372	0.505	35.216	20	9	sand
98.589	105.52	0.5399	0.512	35.392	25	8	sand to silty sand
98.753	104.45	0.5337	0.511	35.322	25	8	sand to silty sand
98.917	102.32	0.5256	0.514	35.472	24	8	sand to silty sand
99.081	99.49	0.5123	0.515	35.431	24	8	sand to silty sand
99.245	94.63	0.4930	0.521	35.369	23	8	sand to silty sand
99.409	90.77	0.4794	0.528	35.550	22	8	sand to silty sand
99.573	89.65	0.4792	0.535	35.818	21	8	sand to silty sand
99.738	92.42	0.4928	0.533	36.044	22	8	sand to silty sand
99.902	100.06	0.5233	0.523	36.303	24	8	sand to silty sand
100.066	111.32	0.5746	0.516	36.498	21	9	sand
100.230	117.02	0.6258	0.535	36.528	22	9	sand
100.394	122.76	0.6493	0.529	36.422	24	9	sand
100.558	123.96	0.6671	0.538	36.562	24	9	sand
100.722	118.66	0.6433	0.542	36.161	23	9	sand
100.886	118.13	0.5171	0.438	36.562	23	9	sand
101.050	115.71	0.5506	0.476	36.690	22	9	sand
101.214	117.38	0.5900	0.503	36.729	22	9	sand
101.378	133.24	0.6750	0.507	37.431	26	9	sand
101.542	145.07	0.7738	0.533	37.615	28	9	sand
101.706	136.86	0.7604	0.556	36.921	26	9	sand
101.870	118.61	0.7045	0.594	36.481	23	9	sand
102.034	114.18	0.6886	0.603	36.899	27	8	sand to silty sand
102.198	112.90	0.6670	0.591	36.545	27	8	sand to silty sand
102.362	114.84	0.6584	0.573	37.428	22	9	sand
102.526	113.45	0.6456	0.569	37.960	22	9	sand
102.690	111.31	0.6415	0.576	37.083	27	8	sand to silty sand
102.854	109.54	0.6252	0.571	37.868	26	8	sand to silty sand
103.018	114.22	0.6388	0.559	37.941	22	9	sand
103.182	114.50	0.6362	0.556	38.033	22	9	sand
103.347	114.73	0.6349	0.553	38.077	22	9	sand
103.511	118.39	0.6449	0.545	38.036	23	9	sand
103.675	123.35	0.6924	0.561	38.509	24	9	sand
103.839	122.80	0.7269	0.592	38.465	24	9	sand
104.003	123.00	0.7185	0.584	38.066	24	9	sand
104.167	127.64	0.6820	0.534	38.866	24	9	sand
104.331	135.55	0.7265	0.536	39.064	26	9	sand
104.495	135.92	0.7910	0.582	38.562	26	9	sand
104.659	144.59	0.8725	0.603	38.674	28	9	sand
104.823	153.94	0.9373	0.609	39.526	29	9	sand
104.987	157.83	0.9680	0.613	39.838	30	9	sand
105.151	154.05	0.9892	0.642	38.894	30	9	sand
105.315	158.77	0.9826	0.619	38.206	30	9	sand
105.479	166.98	1.0240	0.613	39.197	32	9	sand
105.643	158.34	1.0118	0.639	37.790	30	9	sand
105.807	140.97	0.9306	0.660	37.133	27	9	sand
105.971	125.37	0.7911	0.631	37.434	24	9	sand
106.135	121.57	0.6918	0.569	36.266	23	9	sand
106.299	120.71	0.6589	0.546	38.153	23	9	sand
106.463	134.73	0.6433	0.477	40.808	26	9	sand
106.627	148.69	0.7089	0.477	37.097	28	9	sand
106.791	173.03	0.8580	0.496	40.624	33	9	sand
106.955	171.19	0.9657	0.564	40.125	33	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
107.119	139.69	0.9831	0.704	38.604	27	9	sand
107.284	125.36	0.9314	0.743	41.741	30	8	sand to silty sand
107.448	114.14	0.8178	0.717	39.560	27	8	sand to silty sand
107.612	104.34	0.7202	0.690	38.621	25	8	sand to silty sand
107.776	96.08	0.6684	0.696	39.000	23	8	sand to silty sand
107.940	96.57	0.6675	0.691	39.331	23	8	sand to silty sand
108.104	99.12	0.6714	0.677	39.523	24	8	sand to silty sand
108.268	102.50	0.6834	0.667	39.621	25	8	sand to silty sand
108.432	105.95	0.7489	0.707	40.390	25	8	sand to silty sand
108.596	110.22	0.8266	0.750	39.813	26	8	sand to silty sand
108.760	125.63	0.9175	0.730	42.530	30	8	sand to silty sand
108.924	131.13	0.9854	0.751	40.830	25	9	sand
109.088	125.69	0.9545	0.759	36.804	30	8	sand to silty sand
109.252	123.96	0.8210	0.662	38.771	24	9	sand
109.416	127.62	0.9898	0.776	39.417	31	8	sand to silty sand
109.580	127.94	1.3449	1.051	41.209	31	8	sand to silty sand
109.744	108.32	1.1828	1.092	41.763	26	8	sand to silty sand
109.908	147.26	0.9999	0.679	41.357	28	9	sand
110.072	164.44	0.7490	0.455	35.007	31	9	sand
110.236	169.03	0.7316	0.433	32.034	32	9	sand
110.400	146.40	0.8506	0.581	33.834	28	9	sand
110.564	143.71	0.8382	0.583	36.704	28	9	sand
110.728	136.37	0.7745	0.568	37.821	26	9	sand
110.892	129.48	0.7260	0.561	39.866	25	9	sand
111.056	131.11	0.7206	0.550	40.997	25	9	sand
111.221	152.55	0.8047	0.528	41.713	29	9	sand
111.385	182.54	0.9708	0.532	42.900	35	9	sand
111.549	182.95	1.0720	0.586	41.228	35	9	sand
111.713	179.87	1.0905	0.606	41.474	34	9	sand
111.877	172.23	1.0252	0.595	40.217	33	9	sand
112.041	148.16	0.9138	0.617	38.986	28	9	sand
112.205	150.24	0.8896	0.592	40.905	29	9	sand
112.369	185.12	0.9667	0.522	42.613	35	9	sand
112.533	200.93	1.0578	0.526	42.939	38	9	sand
112.697	176.16	1.0754	0.610	42.365	34	9	sand
112.861	161.60	0.9828	0.608	40.674	31	9	sand
113.025	169.79	0.9345	0.550	41.671	33	9	sand
113.189	164.46	0.9681	0.589	41.774	31	9	sand
113.353	144.95	0.9087	0.627	41.763	28	9	sand
113.517	146.60	0.9140	0.623	44.736	28	9	sand
113.681	150.93	0.8976	0.595	41.513	29	9	sand
113.845	173.25	1.0005	0.577	42.956	33	9	sand
114.009	214.33	1.2329	0.575	47.274	41	9	sand
114.173	246.90	1.4411	0.584	47.606	47	9	sand
114.337	239.46	1.5364	0.642	43.611	46	9	sand
114.501	218.02	1.4798	0.679	40.872	42	9	sand
114.665	190.51	1.3355	0.701	40.919	36	9	sand
114.829	167.52	1.2239	0.731	41.301	32	9	sand
114.993	171.51	1.1335	0.661	40.429	33	9	sand
115.158	181.95	1.1052	0.607	43.039	35	9	sand
115.322	150.64	1.0389	0.690	41.471	29	9	sand
115.486	134.58	0.9362	0.696	41.805	26	9	sand
115.650	131.07	0.8883	0.678	41.891	25	9	sand
115.814	139.75	0.8258	0.591	42.758	27	9	sand
115.978	168.69	0.8767	0.520	44.956	32	9	sand
116.142	195.01	1.0691	0.548	46.263	37	9	sand
116.306	215.73	1.2837	0.595	45.814	41	9	sand

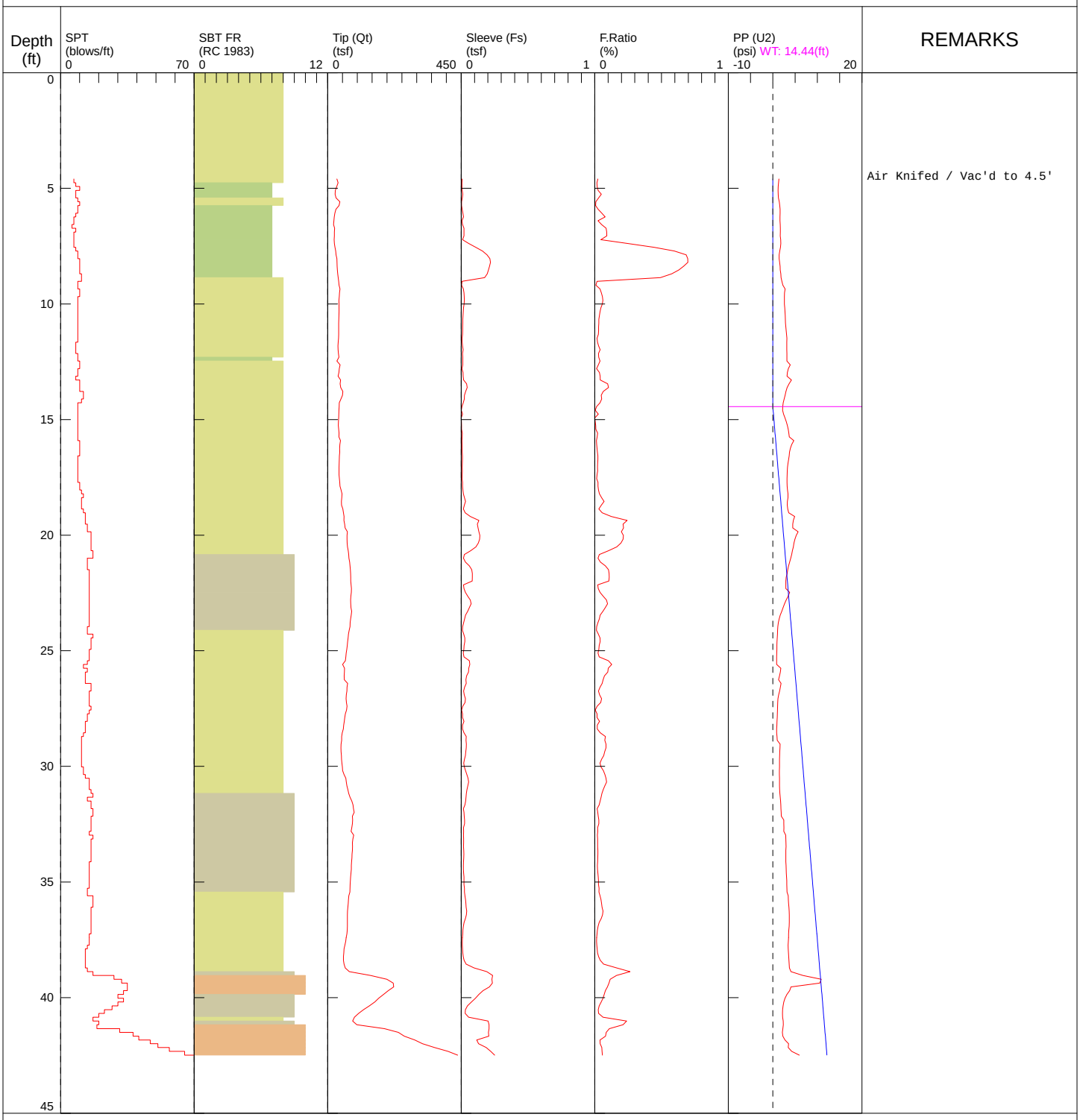
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
116.470	228.71	1.4457	0.632	46.798	44	9	sand
116.634	234.14	1.5537	0.664	45.536	45	9	sand
116.798	219.26	1.5894	0.725	44.349	42	9	sand
116.962	182.08	1.3396	0.736	40.992	35	9	sand
117.126	139.23	1.1884	0.854	41.014	33	8	sand to silty sand
117.290	132.50	0.9880	0.746	42.613	25	9	sand
117.454	163.43	0.9550	0.584	48.442	31	9	sand
117.618	190.96	1.2001	0.628	44.705	37	9	sand
117.782	221.03	1.4751	0.667	44.842	42	9	sand
117.946	221.24	1.5950	0.721	43.630	42	9	sand
118.110	206.84	1.4639	0.708	43.878	40	9	sand
118.274	161.11	1.2688	0.788	40.512	31	9	sand
118.438	143.27	1.0796	0.754	39.763	27	9	sand
118.602	135.24	0.9557	0.707	41.462	26	9	sand
118.766	132.92	0.9097	0.684	43.101	25	9	sand
118.931	132.86	0.8856	0.667	43.282	25	9	sand
119.095	132.19	0.8710	0.659	43.449	25	9	sand
119.259	130.44	0.8357	0.641	43.867	25	9	sand
119.423	131.59	0.8396	0.638	43.956	25	9	sand
119.587	132.39	0.8412	0.635	44.182	25	9	sand
119.751	132.61	0.8193	0.618	44.249	25	9	sand
119.915	131.47	0.8095	0.616	43.828	25	9	sand
120.079	130.69	0.8091	0.619	43.995	25	9	sand
120.243	131.02	0.8089	0.617	44.396	25	9	sand
120.407	134.65	0.8346	0.620	44.792	26	9	sand
120.571	138.68	0.7088	0.511	44.352	27	9	sand
120.735	140.81	0.7635	0.542	45.335	27	9	sand
120.899	145.39	0.7740	0.532	44.098	28	9	sand
121.063	160.85	0.9187	0.571	44.995	31	9	sand
121.227	196.65	1.1778	0.599	47.255	38	9	sand
121.391	234.07	1.5336	0.655	48.887	45	9	sand
121.555	240.87	1.7420	0.723	48.567	46	9	sand
121.719	234.46	1.8739	0.799	47.689	45	9	sand
121.883	228.55	1.8558	0.812	45.789	44	9	sand
122.047	222.53	1.7884	0.804	45.636	43	9	sand
122.211	205.49	1.5606	0.759	43.872	39	9	sand
122.375	162.85	1.3218	0.812	42.449	31	9	sand
122.539	137.40	1.1117	0.809	42.053	26	9	sand
122.703	129.10	0.9768	0.757	42.995	31	8	sand to silty sand
122.868	128.95	0.9136	0.708	44.229	25	9	sand
123.032	130.45	0.8871	0.680	45.678	25	9	sand
123.196	135.21	0.8786	0.650	45.121	26	9	sand
123.360	139.82	0.9077	0.649	46.773	27	9	sand
123.524	152.75	0.9684	0.634	46.569	29	9	sand
123.688	180.74	1.0816	0.598	47.737	35	9	sand
123.852	193.97	1.2524	0.646	48.865	37	9	sand
124.016	183.84	1.2197	0.663	47.249	35	9	sand
124.180	179.68	1.2202	0.679	49.227	34	9	sand
124.344	192.92	1.2820	0.665	47.706	37	9	sand
124.508	196.29	1.3511	0.688	45.366	38	9	sand
124.672	207.62	1.3961	0.672	48.561	40	9	sand
124.836	209.56	1.4467	0.690	48.099	40	9	sand
125.000	198.00	1.4976	0.756	46.820	38	9	sand
125.164	196.11	1.4997	0.765	48.876	38	9	sand
125.328	184.18	1.4663	0.796	50.498	35	9	sand
125.492	164.39	1.3943	0.848	44.240	31	9	sand
125.656	158.57	1.2886	0.813	45.566	30	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
125.820	160.19	1.1764	0.734	46.884	31	9	sand
125.984	176.94	1.1479	0.649	48.539	34	9	sand
126.148	194.71	1.2160	0.625	48.355	37	9	sand
126.312	206.81	1.2464	0.603	50.096	40	9	sand
126.476	193.72	1.1902	0.614	46.742	37	9	sand
126.640	163.63	1.0688	0.653	44.229	31	9	sand
126.805	147.96	0.9280	0.627	45.045	28	9	sand
126.969	146.34	0.9226	0.630	47.664	28	9	sand
127.133	152.37	0.8180	0.537	47.706	29	9	sand
127.297	159.11	0.8242	0.518	49.517	30	9	sand
127.461	165.79	0.8295	0.500	48.341	32	9	sand
127.625	179.02	0.8379	0.468	48.372	34	9	sand
127.789	171.17	0.8690	0.508	47.525	33	9	sand
127.953	183.74	0.8864	0.482	49.489	35	9	sand
128.117	240.37	0.9913	0.412	52.272	46	9	sand
128.281	262.17	1.1327	0.432	51.515	50	9	sand
128.445	250.76	1.2141	0.484	53.398	48	9	sand
128.609	247.50	1.2059	0.487	56.181	47	9	sand
128.773	244.92	1.3551	0.553	54.510	47	9	sand
128.937	218.57	1.4205	0.650	49.431	42	9	sand
129.101	194.41	1.4822	0.762	50.498	37	9	sand
129.265	188.23	1.4411	0.766	50.793	36	9	sand
129.429	182.19	1.4539	0.798	50.283	35	9	sand
129.593	171.74	1.4743	0.858	50.303	33	9	sand
129.757	163.79	1.4222	0.868	48.631	31	9	sand
129.921	164.16	1.3378	0.815	48.458	31	9	sand
130.085	162.39	1.2557	0.773	49.032	31	9	sand
130.249	156.30	1.1309	0.724	47.781	30	9	sand
130.413	158.52	1.0174	0.642	49.631	30	9	sand
130.577	167.72	0.9651	0.575	49.372	32	9	sand
130.742	162.23	0.9810	0.605	52.448	31	9	sand
130.906	155.70	0.9851	0.633	48.238	30	9	sand
131.070	148.04	0.9809	0.663	50.219	28	9	sand
131.234	137.90	0.8949	0.649	47.670	26	9	sand
131.398	134.86	0.8342	0.619	49.010	26	9	sand
131.562	137.28	0.8221	0.599	49.439	26	9	sand
131.726	144.82	0.8468	0.585	49.849	28	9	sand
131.890	155.88	0.8887	0.570	50.863	30	9	sand
132.054	171.79	0.9648	0.562	50.442	33	9	sand
132.218	202.38	1.1034	0.545	52.693	39	9	sand
132.382	216.42	1.2275	0.567	53.841	41	9	sand
132.546	187.59	1.2296	0.655	51.138	36	9	sand
132.710	149.84	1.0953	0.731	45.572	29	9	sand
132.874	132.93	0.9279	0.698	46.968	25	9	sand
133.038	127.12	0.8181	0.644	48.893	24	9	sand
133.202	136.50	0.7590	0.556	50.562	26	9	sand
133.366	157.76	0.8366	0.530	52.509	30	9	sand
133.530	166.68	0.9275	0.556	52.270	32	9	sand
133.694	158.71	0.9400	0.592	51.099	30	9	sand
133.858	156.75	0.9067	0.578	50.562	30	9	sand
134.022	157.64	0.8988	0.570	51.526	30	9	sand
134.186	164.40	0.9634	0.586	51.523	31	9	sand
134.350	182.46	1.0345	0.567	52.743	35	9	sand
134.514	196.12	1.1127	0.567	51.944	38	9	sand
134.679	210.38	1.1876	0.564	53.749	40	9	sand
134.843	230.66	1.3392	0.581	54.691	44	9	sand
135.007	236.96	1.4273	0.602	52.671	45	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
135.171	217.72	1.3597	0.625	54.329	42	9	sand
135.335	210.24	1.2916	0.614	47.361	40	9	sand
135.499	225.82	1.3356	0.591	53.353	43	9	sand
135.663	216.84	1.3542	0.625	53.014	42	9	sand
135.827	200.21	1.3286	0.664	52.635	38	9	sand
135.991	191.07	1.2741	0.667	49.860	37	9	sand
136.155	196.27	1.2278	0.626	52.247	38	9	sand
136.319	211.75	1.2491	0.590	53.888	41	9	sand
136.483	231.45	1.3532	0.585	54.629	44	9	sand
136.647	245.21	1.5234	0.621	57.510	47	9	sand
136.811	230.86	1.5812	0.685	53.337	44	9	sand
136.975	221.85	1.5304	0.690	54.039	42	9	sand
137.139	232.16	1.5904	0.685	52.041	44	9	sand

Haley & Aldrich / SCPT-5 / 4580 NE Marine Dr Portland

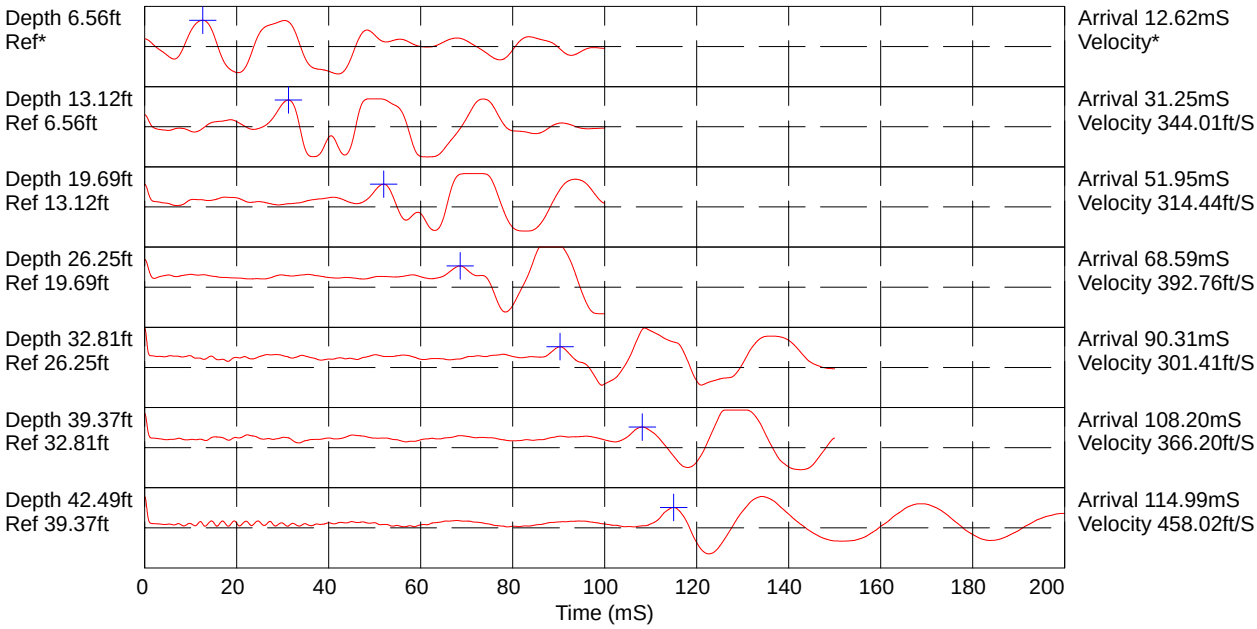
OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 4:25:00 PM
TOTAL DEPTH: 42.487 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Haley & Aldrich / SCPT-5 / 4580 NE Marine Dr Portland

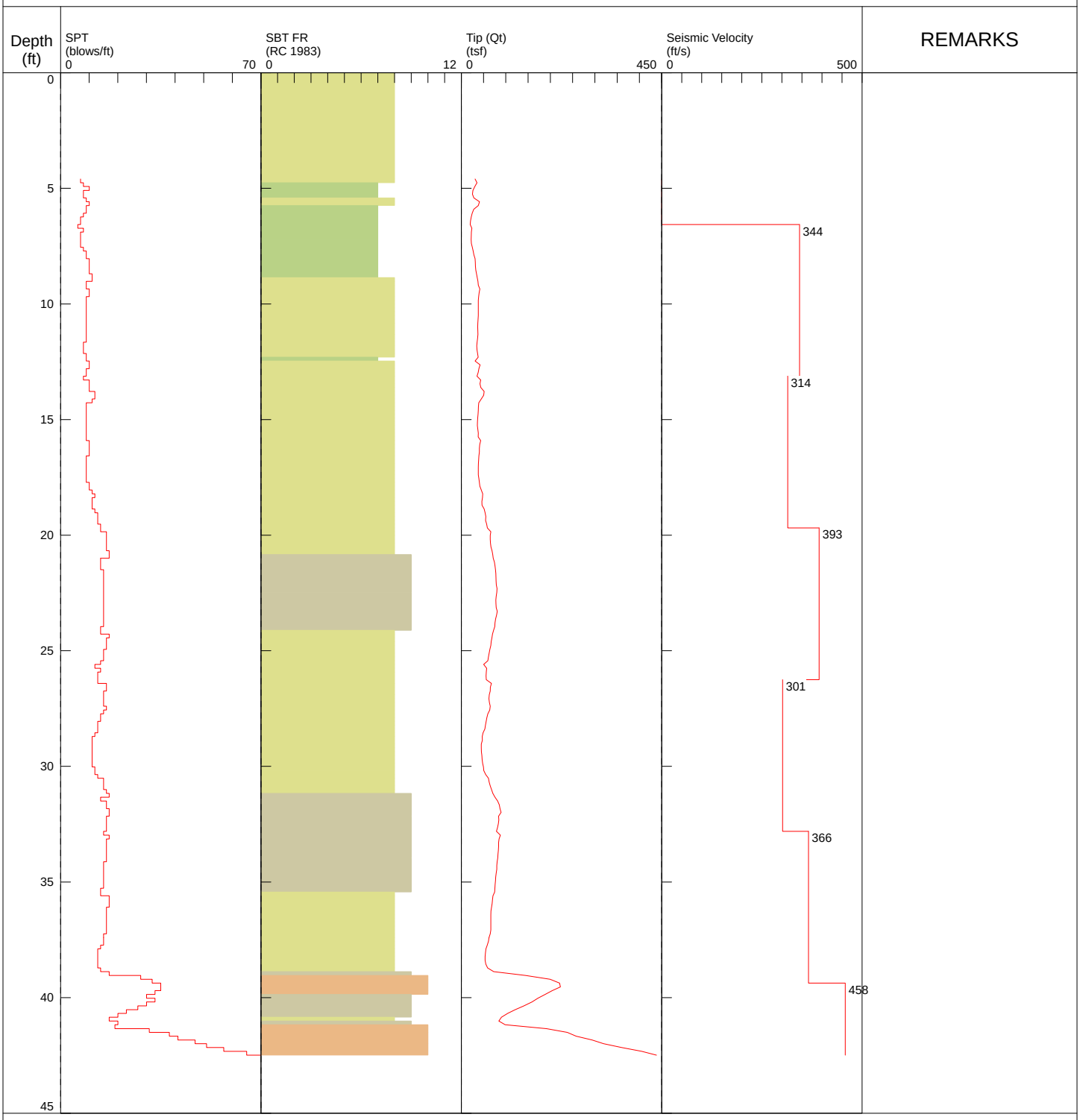


Hammer to Rod String Distance (ft): 2.04

* = Not Determined

Haley & Aldrich / SCPT-5 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 4:25:00 PM
TOTAL DEPTH: 42.487 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Haley & Aldrich / SCPT-5 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 4:25:00 PM
TOTAL DEPTH: 42.487 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
4.593	30.76	0.0072	0.023	1.337	7	8	sand to silty sand
4.757	35.14	0.0054	0.015	1.284	8	8	sand to silty sand
4.921	30.42	0.0055	0.018	1.184	10	7	silty sand to sandy silt
5.085	25.93	0.0064	0.025	1.167	8	7	silty sand to sandy silt
5.249	25.07	0.0123	0.049	1.201	8	7	silty sand to sandy silt
5.413	28.18	0.0080	0.028	1.245	9	7	silty sand to sandy silt
5.577	40.97	0.0031	0.008	1.438	10	8	sand to silty sand
5.741	38.26	0.0023	0.006	1.541	9	8	sand to silty sand
5.906	27.92	0.0069	0.025	1.608	9	7	silty sand to sandy silt
6.070	24.23	0.0127	0.052	1.608	8	7	silty sand to sandy silt
6.234	22.24	0.0172	0.077	1.596	7	7	silty sand to sandy silt
6.398	20.65	0.0049	0.024	1.599	7	7	silty sand to sandy silt
6.562	19.85	0.0100	0.050	1.627	6	7	silty sand to sandy silt
6.726	23.58	0.0200	0.085	1.694	8	7	silty sand to sandy silt
6.890	22.50	0.0200	0.089	1.691	7	7	silty sand to sandy silt
7.054	22.28	0.0200	0.090	1.669	7	7	silty sand to sandy silt
7.218	21.87	0.0100	0.046	1.741	7	7	silty sand to sandy silt
7.382	22.56	0.0558	0.247	1.778	7	7	silty sand to sandy silt
7.546	24.54	0.1091	0.444	1.716	8	7	silty sand to sandy silt
7.710	26.67	0.1589	0.596	1.543	9	7	silty sand to sandy silt
7.874	28.12	0.1925	0.685	1.418	9	7	silty sand to sandy silt
8.038	30.76	0.2142	0.696	1.404	10	7	silty sand to sandy silt
8.202	31.44	0.2191	0.697	1.518	10	7	silty sand to sandy silt
8.366	31.74	0.2112	0.665	1.605	10	7	silty sand to sandy silt
8.530	32.45	0.2041	0.629	1.666	10	7	silty sand to sandy silt
8.694	33.91	0.1954	0.576	1.764	11	7	silty sand to sandy silt
8.858	35.65	0.1752	0.492	1.842	11	7	silty sand to sandy silt
9.022	37.19	0.0063	0.017	2.023	9	8	sand to silty sand
9.186	38.17	0.0029	0.008	2.248	9	8	sand to silty sand
9.350	41.59	0.0162	0.039	2.747	10	8	sand to silty sand
9.514	40.01	0.0197	0.049	2.616	10	8	sand to silty sand
9.678	38.78	0.0222	0.057	2.597	9	8	sand to silty sand
9.843	37.98	0.0230	0.061	2.591	9	8	sand to silty sand
10.007	38.10	0.0214	0.056	2.591	9	8	sand to silty sand
10.171	38.07	0.0173	0.046	2.675	9	8	sand to silty sand
10.335	38.05	0.0151	0.040	2.733	9	8	sand to silty sand
10.499	37.88	0.0131	0.034	2.783	9	8	sand to silty sand
10.663	37.55	0.0116	0.031	2.797	9	8	sand to silty sand
10.827	37.12	0.0113	0.030	2.814	9	8	sand to silty sand
10.991	36.91	0.0104	0.028	2.900	9	8	sand to silty sand
11.155	37.12	0.0104	0.028	2.998	9	8	sand to silty sand
11.319	37.21	0.0100	0.027	3.073	9	8	sand to silty sand
11.483	36.39	0.0059	0.016	3.165	9	8	sand to silty sand
11.647	35.41	0.0072	0.020	3.137	8	8	sand to silty sand
11.811	34.60	0.0097	0.028	3.115	8	8	sand to silty sand
11.975	35.02	0.0140	0.040	3.134	8	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
12.139	36.35	0.0100	0.028	3.151	9	8	sand to silty sand
12.303	37.74	0.0109	0.029	3.165	9	8	sand to silty sand
12.467	30.80	0.0119	0.038	3.165	10	7	silty sand to sandy silt
12.631	41.96	0.0113	0.027	3.903	10	8	sand to silty sand
12.795	39.31	0.0054	0.014	3.471	9	8	sand to silty sand
12.959	37.73	0.0133	0.035	3.243	9	8	sand to silty sand
13.123	35.14	0.0141	0.040	3.176	8	8	sand to silty sand
13.287	43.51	0.0180	0.041	4.154	10	8	sand to silty sand
13.451	41.79	0.0402	0.096	3.636	10	8	sand to silty sand
13.615	43.82	0.0449	0.103	3.193	10	8	sand to silty sand
13.780	51.23	0.0326	0.064	2.942	12	8	sand to silty sand
13.944	50.07	0.0238	0.048	2.764	12	8	sand to silty sand
14.108	44.58	0.0230	0.052	2.521	11	8	sand to silty sand
14.272	39.19	0.0151	0.039	2.301	9	8	sand to silty sand
14.436	38.45	0.0052	0.013	2.226	9	8	sand to silty sand
14.600	37.98	0.0010	0.003	2.204	9	8	sand to silty sand
14.764	37.47	0.0100	0.027	2.388	9	8	sand to silty sand
14.928	36.93	0.0001	0.000	2.728	9	8	sand to silty sand
15.092	36.23	0.0012	0.003	3.034	9	8	sand to silty sand
15.256	35.98	0.0024	0.007	3.279	9	8	sand to silty sand
15.420	37.06	0.0031	0.008	3.446	9	8	sand to silty sand
15.584	38.22	0.0082	0.021	3.591	9	8	sand to silty sand
15.748	37.76	0.0069	0.018	3.694	9	8	sand to silty sand
15.912	43.29	0.0050	0.012	4.692	10	8	sand to silty sand
16.076	41.34	0.0060	0.014	4.226	10	8	sand to silty sand
16.240	40.33	0.0069	0.017	3.920	10	8	sand to silty sand
16.404	40.44	0.0078	0.019	3.733	10	8	sand to silty sand
16.568	39.60	0.0090	0.023	3.639	9	8	sand to silty sand
16.732	38.78	0.0090	0.023	3.527	9	8	sand to silty sand
16.896	38.51	0.0084	0.022	3.385	9	8	sand to silty sand
17.060	38.16	0.0076	0.020	3.293	9	8	sand to silty sand
17.224	38.09	0.0080	0.021	3.215	9	8	sand to silty sand
17.388	38.21	0.0067	0.017	3.193	9	8	sand to silty sand
17.552	39.37	0.0056	0.014	3.187	9	8	sand to silty sand
17.717	40.51	0.0097	0.024	3.187	10	8	sand to silty sand
17.881	41.44	0.0100	0.024	3.207	10	8	sand to silty sand
18.045	44.85	0.0124	0.028	3.293	11	8	sand to silty sand
18.209	48.11	0.0164	0.034	3.410	12	8	sand to silty sand
18.373	47.62	0.0240	0.050	3.391	11	8	sand to silty sand
18.537	46.34	0.0322	0.069	3.276	11	8	sand to silty sand
18.701	46.45	0.0227	0.049	3.232	11	8	sand to silty sand
18.865	51.06	0.0154	0.030	3.327	12	8	sand to silty sand
19.029	53.39	0.0296	0.055	3.561	13	8	sand to silty sand
19.193	54.99	0.0677	0.123	4.892	13	8	sand to silty sand
19.357	54.52	0.1319	0.242	4.578	13	8	sand to silty sand
19.521	56.83	0.1204	0.212	4.486	14	8	sand to silty sand
19.685	58.50	0.1258	0.215	4.447	14	8	sand to silty sand
19.849	66.36	0.1317	0.198	5.661	16	8	sand to silty sand
20.013	64.95	0.1393	0.215	5.235	16	8	sand to silty sand
20.177	65.03	0.1374	0.211	4.934	16	8	sand to silty sand
20.341	65.51	0.1282	0.196	4.745	16	8	sand to silty sand
20.505	66.63	0.1093	0.164	4.591	16	8	sand to silty sand
20.669	68.98	0.0707	0.102	4.394	17	8	sand to silty sand
20.833	70.55	0.0234	0.033	4.238	17	8	sand to silty sand
20.997	71.79	0.0173	0.024	3.995	14	9	sand
21.161	74.21	0.0311	0.042	3.761	14	9	sand
21.325	75.54	0.0603	0.080	3.508	14	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
21.490	76.53	0.0787	0.103	3.335	15	9	sand
21.654	77.54	0.0834	0.108	3.196	15	9	sand
21.818	77.69	0.0836	0.108	3.012	15	9	sand
21.982	77.90	0.0820	0.105	2.914	15	9	sand
22.146	78.72	0.0175	0.022	2.903	15	9	sand
22.310	80.08	0.0205	0.026	2.920	15	9	sand
22.474	79.64	0.0314	0.039	3.767	15	9	sand
22.638	78.05	0.0495	0.063	3.430	15	9	sand
22.802	77.52	0.0678	0.087	2.984	15	9	sand
22.966	77.66	0.0743	0.096	2.619	15	9	sand
23.130	78.47	0.0613	0.078	2.287	15	9	sand
23.294	80.71	0.0484	0.060	1.998	15	9	sand
23.458	79.00	0.0317	0.040	1.655	15	9	sand
23.622	77.02	0.0256	0.033	1.421	15	9	sand
23.786	75.81	0.0178	0.023	1.218	15	9	sand
23.950	74.97	0.0108	0.014	1.103	14	9	sand
24.114	72.32	0.0090	0.012	1.050	14	9	sand
24.278	69.93	0.0185	0.027	1.042	17	8	sand to silty sand
24.442	68.54	0.0266	0.039	0.958	16	8	sand to silty sand
24.606	66.94	0.0271	0.041	0.914	16	8	sand to silty sand
24.770	66.01	0.0216	0.033	0.911	16	8	sand to silty sand
24.934	64.21	0.0191	0.030	0.905	15	8	sand to silty sand
25.098	62.47	0.0151	0.024	0.886	15	8	sand to silty sand
25.262	60.92	0.0200	0.033	0.866	15	8	sand to silty sand
25.427	59.59	0.0609	0.102	0.866	14	8	sand to silty sand
25.591	50.35	0.0637	0.127	0.853	12	8	sand to silty sand
25.755	56.73	0.0569	0.100	1.772	14	8	sand to silty sand
25.919	56.16	0.0545	0.097	1.674	13	8	sand to silty sand
26.083	55.46	0.0400	0.072	1.488	13	8	sand to silty sand
26.247	56.02	0.0351	0.063	1.282	13	8	sand to silty sand
26.411	67.48	0.0372	0.055	1.842	16	8	sand to silty sand
26.575	65.31	0.0251	0.038	1.694	16	8	sand to silty sand
26.739	64.72	0.0180	0.028	1.493	15	8	sand to silty sand
26.903	62.75	0.0224	0.036	1.307	15	8	sand to silty sand
27.067	61.91	0.0312	0.050	1.156	15	8	sand to silty sand
27.231	62.93	0.0283	0.045	1.075	15	8	sand to silty sand
27.395	64.86	0.0115	0.018	1.064	16	8	sand to silty sand
27.559	63.78	0.0024	0.004	1.039	15	8	sand to silty sand
27.723	59.53	0.0100	0.017	1.006	14	8	sand to silty sand
27.887	57.50	0.0100	0.017	0.964	14	8	sand to silty sand
28.051	55.91	0.0200	0.036	0.928	13	8	sand to silty sand
28.215	54.04	0.0100	0.019	0.892	13	8	sand to silty sand
28.379	52.74	0.0100	0.019	0.844	13	8	sand to silty sand
28.543	48.81	0.0200	0.041	0.858	12	8	sand to silty sand
28.707	46.83	0.0370	0.079	0.917	11	8	sand to silty sand
28.871	47.09	0.0356	0.076	0.961	11	8	sand to silty sand
29.035	44.97	0.0378	0.084	1.621	11	8	sand to silty sand
29.199	44.56	0.0371	0.083	1.602	11	8	sand to silty sand
29.364	45.15	0.0332	0.074	1.557	11	8	sand to silty sand
29.528	46.23	0.0310	0.067	1.502	11	8	sand to silty sand
29.692	46.68	0.0237	0.051	1.477	11	8	sand to silty sand
29.856	47.78	0.0190	0.040	1.491	11	8	sand to silty sand
30.020	49.50	0.0230	0.046	1.485	12	8	sand to silty sand
30.184	50.37	0.0324	0.064	1.465	12	8	sand to silty sand
30.348	54.79	0.0415	0.076	1.468	13	8	sand to silty sand
30.512	60.90	0.0509	0.084	1.471	15	8	sand to silty sand
30.676	62.50	0.0548	0.088	1.488	15	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
30.840	64.70	0.0488	0.075	1.491	15	8	sand to silty sand
31.004	67.96	0.0431	0.063	1.499	16	8	sand to silty sand
31.168	70.80	0.0377	0.053	1.569	17	8	sand to silty sand
31.332	75.39	0.0354	0.047	1.649	14	9	sand
31.496	81.43	0.0330	0.041	1.719	16	9	sand
31.660	85.31	0.0279	0.033	1.786	16	9	sand
31.824	86.81	0.0154	0.018	1.817	17	9	sand
31.988	89.41	0.0200	0.022	1.858	17	9	sand
32.152	83.48	0.0220	0.026	1.895	16	9	sand
32.316	84.15	0.0256	0.030	2.441	16	9	sand
32.480	83.18	0.0249	0.030	2.463	16	9	sand
32.644	81.35	0.0173	0.021	2.480	16	9	sand
32.808	78.83	0.0178	0.023	2.463	15	9	sand
32.972	87.74	0.0171	0.020	2.881	17	9	sand
33.136	84.74	0.0182	0.021	2.909	16	9	sand
33.301	83.58	0.0182	0.022	2.942	16	9	sand
33.465	83.62	0.0173	0.021	2.950	16	9	sand
33.629	83.08	0.0189	0.023	2.914	16	9	sand
33.793	82.21	0.0192	0.023	2.917	16	9	sand
33.957	81.82	0.0185	0.023	2.909	16	9	sand
34.121	80.44	0.0171	0.021	2.920	15	9	sand
34.285	79.83	0.0153	0.019	2.962	15	9	sand
34.449	79.64	0.0158	0.020	2.998	15	9	sand
34.613	78.32	0.0179	0.023	3.017	15	9	sand
34.777	77.37	0.0200	0.026	3.059	15	9	sand
34.941	76.56	0.0212	0.028	3.104	15	9	sand
35.105	75.85	0.0210	0.028	3.120	15	9	sand
35.269	75.18	0.0240	0.032	3.151	14	9	sand
35.433	74.89	0.0236	0.032	3.187	14	9	sand
35.597	71.11	0.0273	0.038	3.455	17	8	sand to silty sand
35.761	69.99	0.0323	0.046	3.480	17	8	sand to silty sand
35.925	69.14	0.0349	0.051	3.533	17	8	sand to silty sand
36.089	67.87	0.0366	0.054	3.602	16	8	sand to silty sand
36.253	66.66	0.0408	0.061	3.650	16	8	sand to silty sand
36.417	66.26	0.0387	0.058	3.689	16	8	sand to silty sand
36.581	66.18	0.0315	0.048	3.697	16	8	sand to silty sand
36.745	66.24	0.0219	0.033	3.697	16	8	sand to silty sand
36.909	66.28	0.0165	0.025	3.647	16	8	sand to silty sand
37.073	66.03	0.0126	0.019	3.586	16	8	sand to silty sand
37.238	64.66	0.0109	0.017	3.547	15	8	sand to silty sand
37.402	62.40	0.0089	0.014	3.510	15	8	sand to silty sand
37.566	60.68	0.0083	0.014	3.474	15	8	sand to silty sand
37.730	57.96	0.0085	0.015	3.430	14	8	sand to silty sand
37.894	55.17	0.0097	0.018	3.444	13	8	sand to silty sand
38.058	54.12	0.0111	0.020	3.485	13	8	sand to silty sand
38.222	53.38	0.0151	0.028	3.552	13	8	sand to silty sand
38.386	53.44	0.0218	0.041	3.600	13	8	sand to silty sand
38.550	55.01	0.0363	0.066	3.639	13	8	sand to silty sand
38.714	59.01	0.0969	0.164	3.725	14	8	sand to silty sand
38.878	72.57	0.1913	0.264	4.054	17	8	sand to silty sand
39.042	144.28	0.2346	0.163	6.753	28	9	sand
39.206	199.46	0.2294	0.115	10.855	32	10	gravelly sand to sand
39.370	220.69	0.2328	0.105	10.534	35	10	gravelly sand to sand
39.534	222.40	0.2105	0.095	4.076	35	10	gravelly sand to sand
39.698	204.38	0.1635	0.080	3.770	33	10	gravelly sand to sand
39.862	188.24	0.1324	0.070	3.162	30	10	gravelly sand to sand
40.026	171.70	0.1064	0.062	2.700	33	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
40.190	158.80	0.0764	0.048	2.457	30	9	sand
40.354	140.45	0.0458	0.033	2.279	27	9	sand
40.518	120.71	0.0310	0.026	2.193	23	9	sand
40.682	104.11	0.0291	0.028	2.154	20	9	sand
40.846	89.98	0.0552	0.061	2.179	17	9	sand
41.011	84.22	0.2009	0.239	2.329	20	8	sand to silty sand
41.175	98.24	0.2078	0.212	2.349	19	9	sand
41.339	191.38	0.2085	0.109	2.248	31	10	gravelly sand to sand
41.503	237.89	0.2039	0.086	2.126	38	10	gravelly sand to sand
41.667	257.92	0.2066	0.080	2.251	41	10	gravelly sand to sand
41.831	293.57	0.1162	0.040	2.719	47	10	gravelly sand to sand
41.995	319.40	0.1292	0.040	3.519	51	10	gravelly sand to sand
42.159	359.89	0.1868	0.052	3.446	57	10	gravelly sand to sand
42.323	405.29	0.2200	0.054	4.224	65	10	gravelly sand to sand
42.487	438.07	0.2501	0.057	5.959	70	10	gravelly sand to sand

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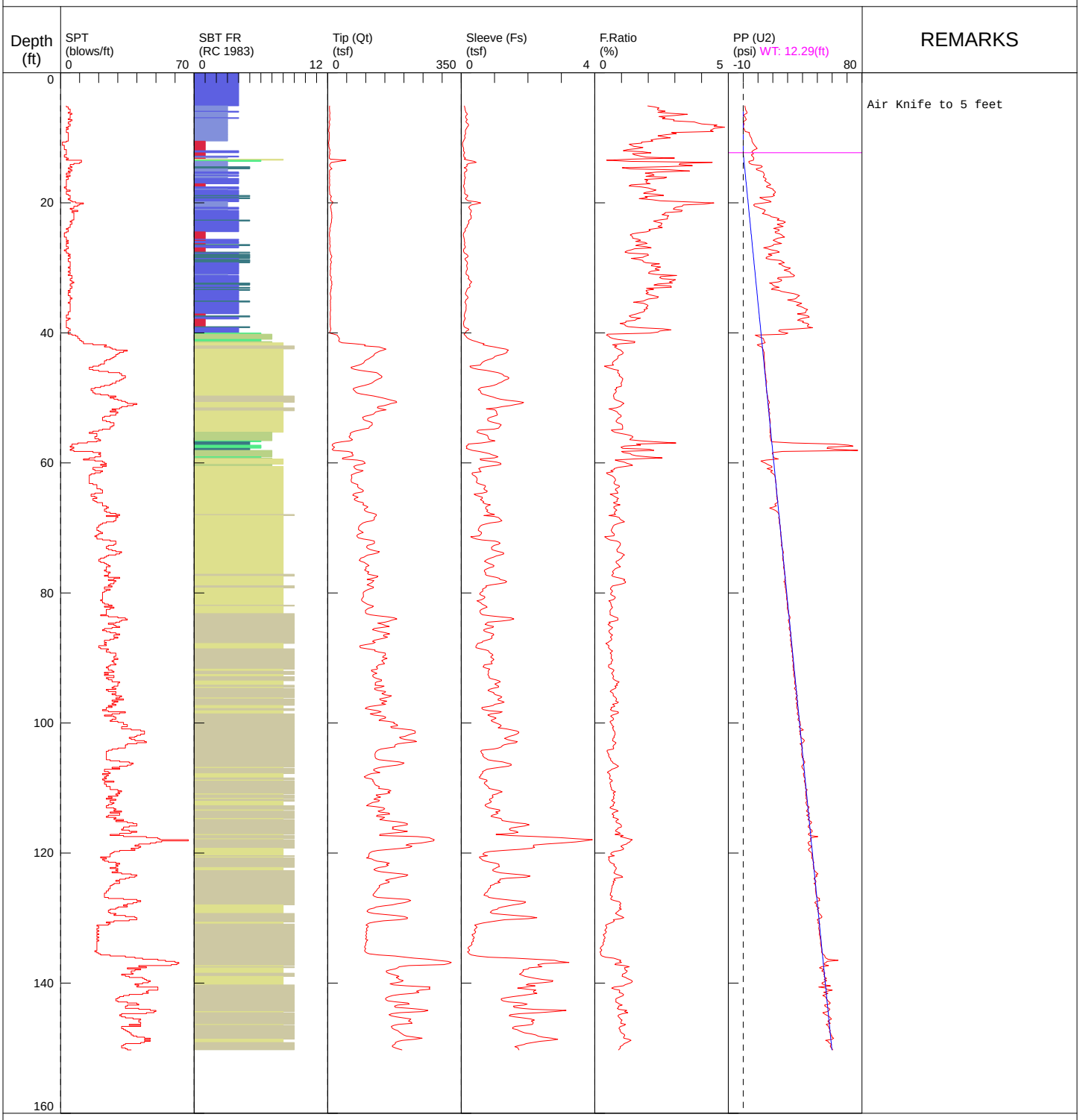
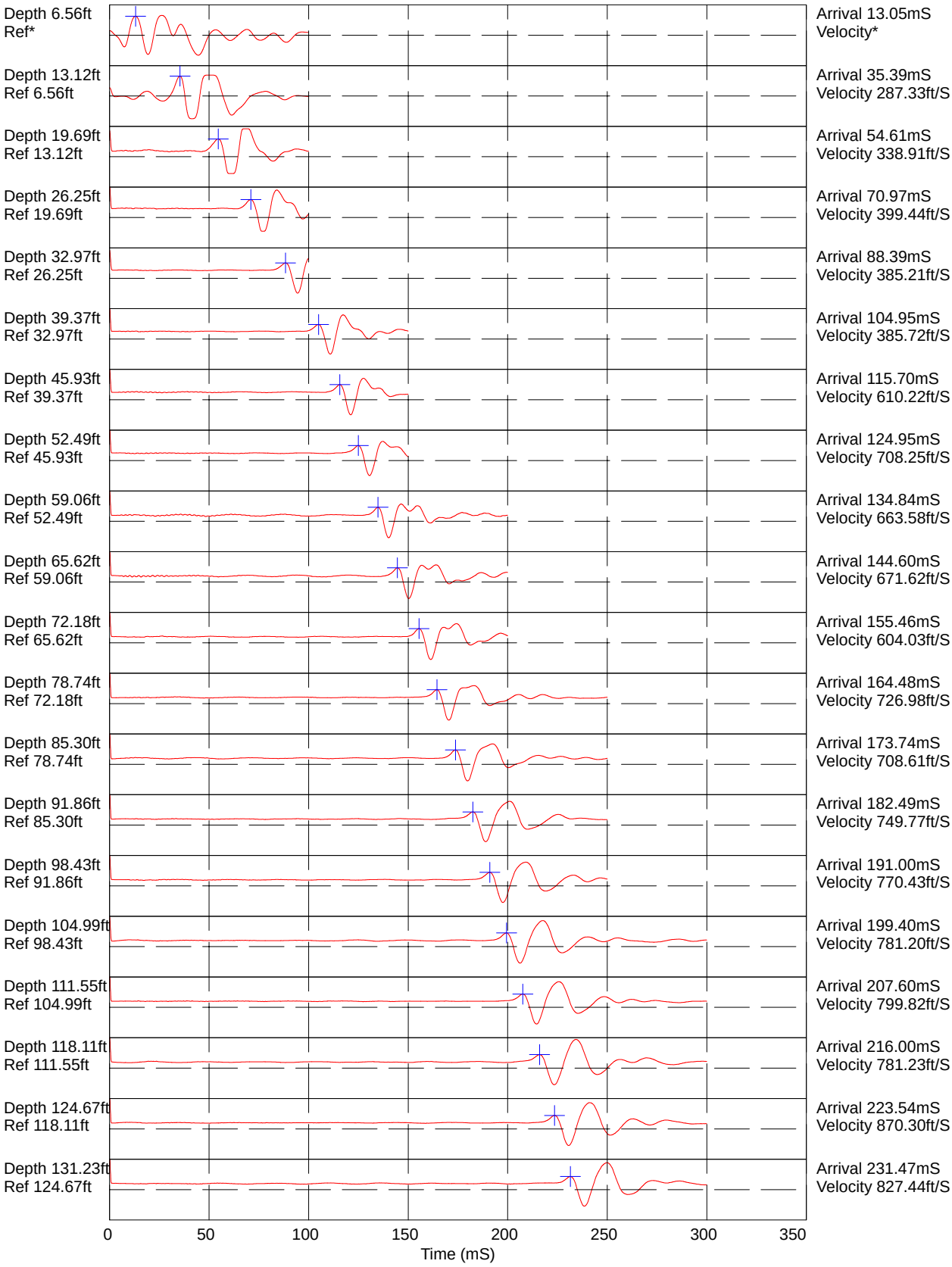
OPERATOR: OGE BAK
CONE ID: DDG1615
TEST DATE: 4/18/2023 10:38:43 AM
TOTAL DEPTH: 150.263 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

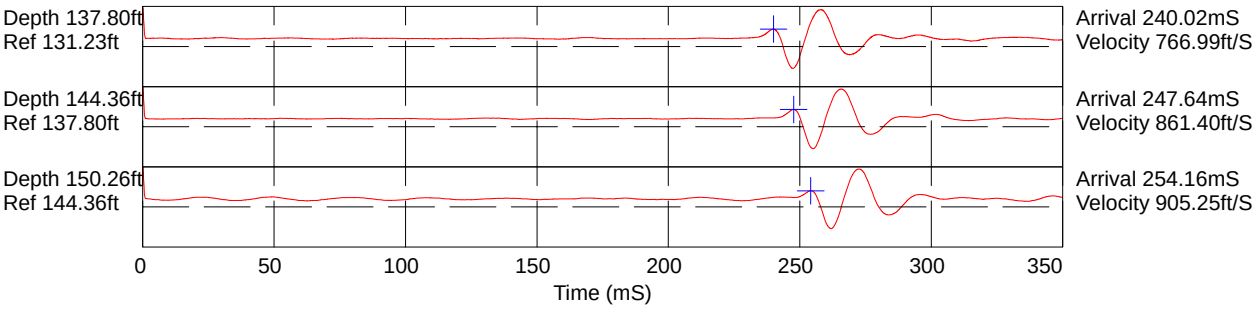
*SBT/SPT CORRELATION: UBC-1983

COMMENT: Haley & Aldrich / CPT-5a / 4580 NE Marine Dr Portland



Hammer to Rod String Distance (ft): 1.97
* = Not Determined

COMMENT: Haley & Aldrich / CPT-5a / 4580 NE Marine Dr Portland



Hammer to Rod String Distance (ft): 1.97

* = Not Determined

Haley & Aldrich / SCPT-5a / 4580 NE Marine Dr Portland

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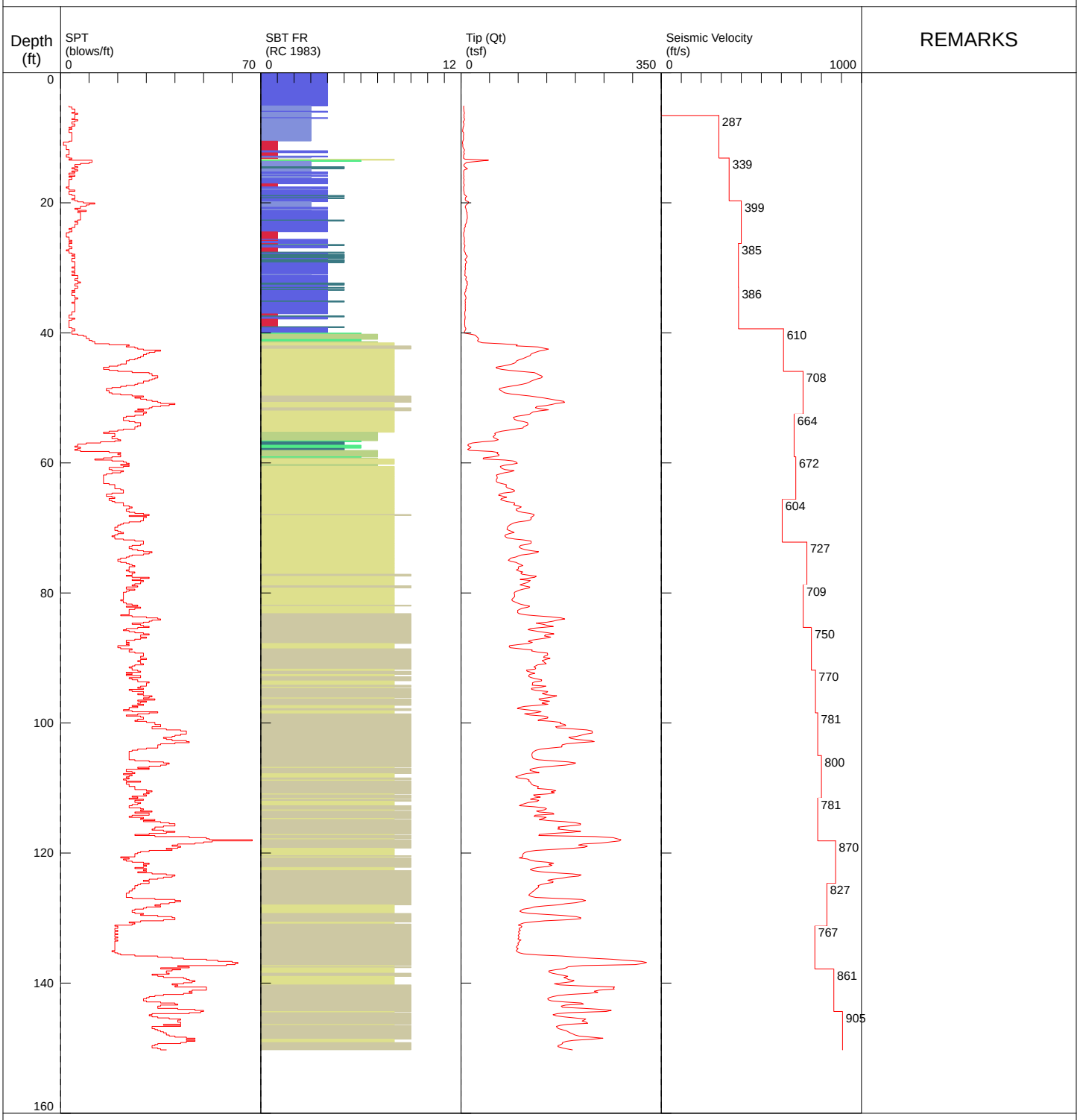

1 sensitive fine grained
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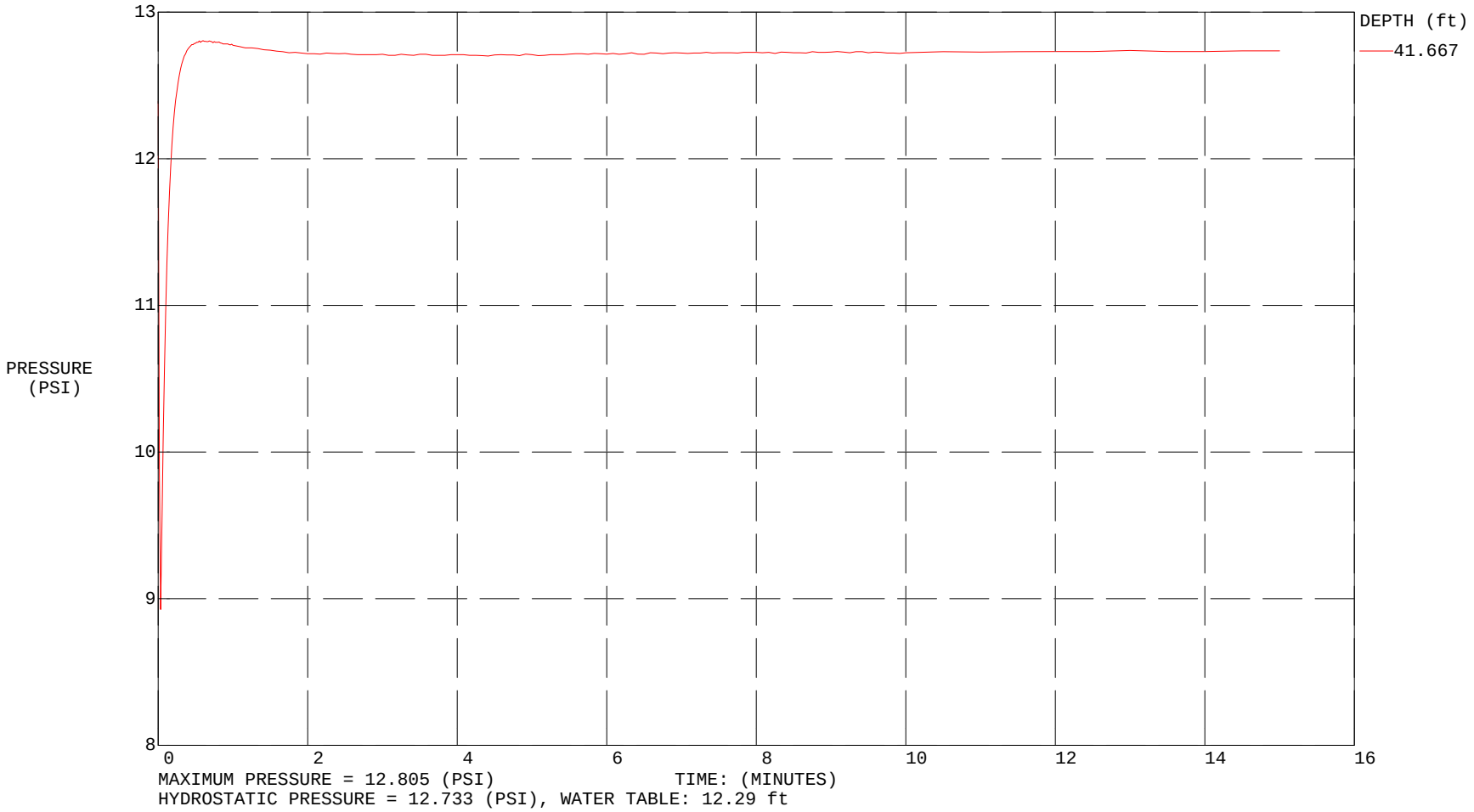


MAXIMUM PRESSURE = 12.805 (PSI)
HYDROSTATIC PRESSURE = 12.733 (PSI), WATER TABLE: 12.29 ft

Haley & Aldrich / SCPT-5a / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1615
TEST DATE: 4/18/2023 10:38:43 AM
TOTAL DEPTH: 150.263 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
5.085	4.83	0.0958	1.984	1.126	3	4	silty clay to clay
5.249	4.58	0.1023	2.233	1.215	4	3	clay
5.413	4.59	0.1104	2.403	1.377	4	3	clay
5.577	4.78	0.1121	2.345	1.542	5	3	clay
5.741	4.96	0.1173	2.366	1.696	5	3	clay
5.906	4.98	0.1314	2.636	2.185	5	3	clay
6.070	5.63	0.1332	2.365	2.626	4	4	silty clay to clay
6.234	5.96	0.1701	2.852	2.423	6	3	clay
6.398	5.26	0.1823	3.467	1.130	5	3	clay
6.562	4.97	0.1485	2.988	-0.058	5	3	clay
6.726	5.40	0.1299	2.403	1.210	5	3	clay
6.890	5.10	0.1341	2.632	1.297	5	3	clay
7.054	5.91	0.1497	2.532	1.840	4	4	silty clay to clay
7.218	6.11	0.1814	2.971	2.027	6	3	clay
7.382	5.03	0.1483	2.947	1.004	5	3	clay
7.546	3.73	0.1390	3.723	0.062	4	3	clay
7.710	4.26	0.1635	3.835	0.329	4	3	clay
7.874	5.19	0.2077	4.006	0.663	5	3	clay
8.038	4.85	0.2218	4.574	0.347	5	3	clay
8.202	4.69	0.2093	4.458	0.113	4	3	clay
8.366	3.62	0.1760	4.860	0.169	3	3	clay
8.530	3.69	0.1652	4.480	0.336	4	3	clay
8.694	3.19	0.1402	4.401	0.886	3	3	clay
8.858	2.87	0.1242	4.331	1.032	3	3	clay
9.022	2.81	0.1245	4.433	1.351	3	3	clay
9.186	4.37	0.1255	2.873	4.230	4	3	clay
9.350	4.38	0.1336	3.052	4.019	4	3	clay
9.514	4.43	0.1198	2.704	4.361	4	3	clay
9.678	4.20	0.0995	2.368	4.613	4	3	clay
9.843	4.15	0.1068	2.572	4.938	4	3	clay
10.007	4.13	0.1167	2.826	5.394	4	3	clay
10.171	4.26	0.0994	2.333	5.732	4	3	clay
10.335	3.99	0.0840	2.104	5.872	4	3	clay
10.499	3.19	0.0693	2.170	5.870	3	3	clay
10.663	2.79	0.0489	1.752	6.230	1	1	sensitive fine grained
10.827	2.39	0.0419	1.755	6.633	1	1	sensitive fine grained
10.991	3.06	0.0394	1.289	7.114	1	1	sensitive fine grained
11.155	3.18	0.0437	1.375	7.612	2	1	sensitive fine grained
11.319	3.19	0.0467	1.465	8.244	2	1	sensitive fine grained
11.483	3.55	0.0640	1.804	8.905	2	1	sensitive fine grained
11.647	4.41	0.0709	1.608	9.461	2	1	sensitive fine grained
11.811	5.97	0.0731	1.225	7.728	3	1	sensitive fine grained
11.975	5.99	0.0639	1.067	6.531	3	1	sensitive fine grained
12.139	4.91	0.0877	1.786	5.810	3	4	silty clay to clay
12.303	5.00	0.1052	2.105	6.455	3	4	silty clay to clay
12.467	6.00	0.0847	1.412	6.936	3	1	sensitive fine grained

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
12.631	4.77	0.0710	1.488	5.478	2	1	sensitive fine grained
12.795	4.34	0.0741	1.707	6.037	2	1	sensitive fine grained
12.959	4.46	0.0855	1.918	6.740	3	4	silty clay to clay
13.123	4.25	0.1268	2.982	7.138	4	3	clay
13.287	6.62	0.0899	1.359	7.012	3	1	sensitive fine grained
13.451	47.86	0.2109	0.441	6.909	11	8	sand to silty sand
13.615	28.45	0.3908	1.374	3.812	11	6	sandy silt to clayey silt
13.780	10.13	0.4458	4.400	3.898	10	3	clay
13.944	7.30	0.2330	3.189	4.315	7	3	clay
14.108	5.20	0.1641	3.158	6.032	5	3	clay
14.272	4.89	0.1786	3.653	12.072	5	3	clay
14.436	6.01	0.1617	2.692	12.897	6	3	clay
14.600	8.64	0.0887	1.026	11.724	4	5	clayey silt to silty clay
14.764	11.21	0.1481	1.321	8.747	5	5	clayey silt to silty clay
14.928	6.11	0.1713	2.803	9.108	6	3	clay
15.092	4.63	0.1641	3.544	11.542	4	3	clay
15.256	4.71	0.1100	2.337	13.404	5	3	clay
15.420	4.92	0.0928	1.887	13.847	3	4	silty clay to clay
15.584	4.76	0.1028	2.161	14.090	3	4	silty clay to clay
15.748	4.75	0.1054	2.218	14.339	5	3	clay
15.912	5.13	0.0981	1.914	13.614	3	4	silty clay to clay
16.076	4.60	0.1237	2.689	13.580	4	3	clay
16.240	4.53	0.1170	2.586	15.187	4	3	clay
16.404	5.45	0.1021	1.874	15.438	3	4	silty clay to clay
16.568	4.97	0.0985	1.982	14.464	3	4	silty clay to clay
16.732	4.85	0.0928	1.914	15.365	3	4	silty clay to clay
16.896	4.76	0.0916	1.926	16.589	3	4	silty clay to clay
17.060	4.87	0.1013	2.079	17.750	3	4	silty clay to clay
17.224	5.71	0.0778	1.362	18.562	3	1	sensitive fine grained
17.388	5.44	0.0699	1.286	15.995	3	1	sensitive fine grained
17.552	4.27	0.0745	1.745	15.647	2	1	sensitive fine grained
17.717	4.43	0.0891	2.012	18.278	3	4	silty clay to clay
17.881	4.79	0.1023	2.135	20.089	3	4	silty clay to clay
18.045	4.74	0.1085	2.291	20.256	5	3	clay
18.209	4.98	0.1071	2.151	21.275	3	4	silty clay to clay
18.373	5.39	0.1036	1.923	21.740	3	4	silty clay to clay
18.537	5.44	0.0993	1.825	21.104	3	4	silty clay to clay
18.701	5.50	0.1286	2.338	20.233	4	4	silty clay to clay
18.865	7.66	0.1975	2.578	21.075	5	4	silty clay to clay
19.029	9.87	0.1855	1.879	19.457	5	5	clayey silt to silty clay
19.193	7.77	0.1525	1.964	11.188	5	4	silty clay to clay
19.357	7.46	0.1238	1.659	12.804	4	5	clayey silt to silty clay
19.521	7.31	0.1573	2.151	14.697	5	4	silty clay to clay
19.685	8.65	0.2116	2.447	17.668	6	4	silty clay to clay
19.849	13.12	0.4571	3.483	18.787	8	4	silty clay to clay
20.013	13.03	0.5804	4.456	13.947	12	3	clay
20.177	10.83	0.4444	4.102	7.770	10	3	clay
20.341	9.10	0.3012	3.311	7.012	9	3	clay
20.505	7.61	0.2493	3.276	7.717	7	3	clay
20.669	7.30	0.2221	3.043	9.777	7	3	clay
20.833	8.25	0.2441	2.957	11.500	5	4	silty clay to clay
20.997	8.93	0.2629	2.944	13.511	6	4	silty clay to clay
21.161	9.19	0.3007	3.273	14.880	9	3	clay
21.325	9.32	0.3021	3.241	14.299	6	4	silty clay to clay
21.490	10.79	0.2835	2.629	13.916	7	4	silty clay to clay
21.654	10.31	0.2708	2.626	12.839	7	4	silty clay to clay
21.818	10.68	0.2691	2.520	15.999	7	4	silty clay to clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
21.982	10.83	0.2999	2.769	18.151	7	4	silty clay to clay
22.146	10.69	0.2907	2.718	18.914	7	4	silty clay to clay
22.310	11.18	0.3045	2.723	22.612	7	4	silty clay to clay
22.474	10.52	0.2863	2.722	24.194	7	4	silty clay to clay
22.638	10.04	0.2423	2.415	22.857	6	4	silty clay to clay
22.802	9.75	0.2142	2.197	26.996	5	5	clayey silt to silty clay
22.966	9.98	0.2332	2.336	28.415	6	4	silty clay to clay
23.130	8.98	0.2258	2.513	27.071	6	4	silty clay to clay
23.294	8.06	0.2011	2.496	22.897	5	4	silty clay to clay
23.458	7.20	0.1792	2.487	24.439	5	4	silty clay to clay
23.622	7.57	0.1792	2.368	26.996	5	4	silty clay to clay
23.786	6.36	0.1607	2.528	22.881	4	4	silty clay to clay
23.950	5.48	0.1251	2.284	20.565	3	4	silty clay to clay
24.114	5.63	0.1142	2.028	24.096	4	4	silty clay to clay
24.278	6.16	0.1279	2.076	24.143	4	4	silty clay to clay
24.442	5.34	0.1038	1.944	21.497	3	4	silty clay to clay
24.606	4.65	0.0765	1.644	21.675	2	1	sensitive fine grained
24.770	4.56	0.0644	1.410	24.553	2	1	sensitive fine grained
24.934	4.52	0.0599	1.324	25.997	2	1	sensitive fine grained
25.098	4.47	0.0622	1.390	26.591	2	1	sensitive fine grained
25.262	5.46	0.0774	1.416	27.921	3	1	sensitive fine grained
25.427	5.85	0.0827	1.414	23.504	3	1	sensitive fine grained
25.591	5.66	0.0916	1.619	21.655	3	1	sensitive fine grained
25.755	5.60	0.0959	1.714	20.242	4	4	silty clay to clay
25.919	6.03	0.0923	1.532	21.871	3	1	sensitive fine grained
26.083	5.68	0.1066	1.879	23.369	4	4	silty clay to clay
26.247	5.38	0.1053	1.957	25.897	3	4	silty clay to clay
26.411	5.62	0.0936	1.665	20.407	3	1	sensitive fine grained
26.575	6.88	0.1057	1.535	20.173	3	5	clayey silt to silty clay
26.739	6.47	0.1254	1.937	17.407	4	4	silty clay to clay
26.903	5.54	0.1168	2.110	13.765	4	4	silty clay to clay
27.067	5.50	0.0821	1.491	16.437	3	1	sensitive fine grained
27.231	5.14	0.0702	1.368	18.718	2	1	sensitive fine grained
27.395	5.70	0.0684	1.198	22.766	3	1	sensitive fine grained
27.559	6.77	0.0764	1.127	24.328	3	1	sensitive fine grained
27.723	7.56	0.0959	1.269	21.175	4	5	clayey silt to silty clay
27.887	7.60	0.1508	1.984	16.962	5	4	silty clay to clay
28.051	9.35	0.1881	2.011	19.441	4	5	clayey silt to silty clay
28.215	11.05	0.2068	1.872	17.452	5	5	clayey silt to silty clay
28.379	9.86	0.1774	1.799	15.503	5	5	clayey silt to silty clay
28.543	8.53	0.1169	1.371	15.412	4	5	clayey silt to silty clay
28.707	6.98	0.1143	1.638	18.436	4	4	silty clay to clay
28.871	7.85	0.1413	1.798	25.142	4	5	clayey silt to silty clay
29.035	9.56	0.1730	1.811	26.459	5	5	clayey silt to silty clay
29.199	9.71	0.1859	1.913	27.694	5	5	clayey silt to silty clay
29.364	7.67	0.1857	2.422	23.936	5	4	silty clay to clay
29.528	7.78	0.1660	2.133	25.905	5	4	silty clay to clay
29.692	7.56	0.1602	2.119	26.584	5	4	silty clay to clay
29.856	7.05	0.1733	2.460	28.516	4	4	silty clay to clay
30.020	7.76	0.1799	2.318	31.822	5	4	silty clay to clay
30.184	8.04	0.1817	2.259	30.701	5	4	silty clay to clay
30.348	7.07	0.1709	2.417	27.610	5	4	silty clay to clay
30.512	6.96	0.1478	2.122	29.937	4	4	silty clay to clay
30.676	7.14	0.1448	2.028	31.904	5	4	silty clay to clay
30.840	7.16	0.1442	2.013	31.951	5	4	silty clay to clay
31.004	6.53	0.1490	2.282	33.487	4	4	silty clay to clay
31.168	6.61	0.2026	3.066	34.588	6	3	clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
31.332	9.06	0.2232	2.465	33.954	6	4	silty clay to clay
31.496	9.38	0.2276	2.426	23.496	6	4	silty clay to clay
31.660	8.32	0.2097	2.520	23.200	5	4	silty clay to clay
31.824	8.15	0.2461	3.019	25.821	5	4	silty clay to clay
31.988	9.07	0.2657	2.928	25.843	6	4	silty clay to clay
32.152	11.24	0.3142	2.794	23.854	7	4	silty clay to clay
32.316	9.85	0.2860	2.905	17.708	6	4	silty clay to clay
32.480	11.28	0.2665	2.362	19.406	5	5	clayey silt to silty clay
32.644	11.03	0.2443	2.214	19.949	5	5	clayey silt to silty clay
32.808	9.36	0.2667	2.849	21.115	6	4	silty clay to clay
32.972	8.81	0.2523	2.866	24.092	6	4	silty clay to clay
33.136	10.15	0.1966	1.937	20.002	5	5	clayey silt to silty clay
33.301	7.97	0.1754	2.202	19.108	5	4	silty clay to clay
33.465	8.50	0.1634	1.922	24.141	4	5	clayey silt to silty clay
33.629	7.91	0.1528	1.931	25.825	5	4	silty clay to clay
33.793	6.80	0.1364	2.006	29.828	4	4	silty clay to clay
33.957	6.50	0.1246	1.917	34.054	4	4	silty clay to clay
34.121	6.71	0.1374	2.049	36.319	4	4	silty clay to clay
34.285	7.55	0.1656	2.194	37.973	5	4	silty clay to clay
34.449	8.27	0.1973	2.387	36.493	5	4	silty clay to clay
34.613	8.62	0.2011	2.334	36.028	6	4	silty clay to clay
34.777	8.41	0.1684	2.002	34.755	5	4	silty clay to clay
34.941	7.36	0.1403	1.905	29.926	5	4	silty clay to clay
35.105	7.11	0.1298	1.825	33.440	5	4	silty clay to clay
35.269	7.67	0.1115	1.453	36.484	4	5	clayey silt to silty clay
35.433	7.13	0.1295	1.817	39.401	5	4	silty clay to clay
35.597	7.42	0.1417	1.910	37.990	5	4	silty clay to clay
35.761	7.40	0.1475	1.993	35.919	5	4	silty clay to clay
35.925	7.36	0.1456	1.978	38.475	5	4	silty clay to clay
36.089	7.44	0.1427	1.918	40.287	5	4	silty clay to clay
36.253	7.34	0.1448	1.972	41.546	5	4	silty clay to clay
36.417	7.81	0.1438	1.841	43.444	5	4	silty clay to clay
36.581	7.49	0.1405	1.875	42.432	5	4	silty clay to clay
36.745	6.74	0.1235	1.832	42.260	4	4	silty clay to clay
36.909	6.53	0.1097	1.680	41.940	4	4	silty clay to clay
37.073	6.43	0.1000	1.555	36.522	4	4	silty clay to clay
37.238	6.54	0.0916	1.399	41.088	3	1	sensitive fine grained
37.402	6.91	0.0892	1.292	43.745	3	1	sensitive fine grained
37.566	7.29	0.0984	1.350	44.459	3	5	clayey silt to silty clay
37.730	7.16	0.1221	1.705	40.434	5	4	silty clay to clay
37.894	6.88	0.1074	1.560	38.264	4	4	silty clay to clay
38.058	6.42	0.0973	1.515	36.651	3	1	sensitive fine grained
38.222	6.48	0.0754	1.163	40.638	3	1	sensitive fine grained
38.386	6.42	0.0747	1.163	40.002	3	1	sensitive fine grained
38.550	6.45	0.0611	0.947	43.442	3	1	sensitive fine grained
38.714	6.27	0.0705	1.124	44.274	3	1	sensitive fine grained
38.878	6.74	0.0768	1.140	43.260	3	1	sensitive fine grained
39.042	6.84	0.0854	1.248	43.389	3	1	sensitive fine grained
39.206	7.60	0.1308	1.721	46.771	4	5	clayey silt to silty clay
39.370	8.43	0.2151	2.551	36.913	5	4	silty clay to clay
39.534	7.89	0.2249	2.851	24.481	5	4	silty clay to clay
39.698	6.63	0.1611	2.431	23.905	4	4	silty clay to clay
39.862	5.83	0.1382	2.370	25.892	4	4	silty clay to clay
40.026	5.86	0.1210	2.066	30.080	4	4	silty clay to clay
40.190	16.53	0.0809	0.489	28.030	6	6	sandy silt to clayey silt
40.354	25.00	0.1086	0.434	8.193	8	7	silty sand to sandy silt
40.518	26.69	0.1420	0.532	9.626	9	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
40.682	28.82	0.1627	0.565	11.762	9	7	silty sand to sandy silt
40.846	30.71	0.2078	0.677	13.554	10	7	silty sand to sandy silt
41.011	30.40	0.2610	0.859	13.836	10	7	silty sand to sandy silt
41.175	28.89	0.3402	1.178	13.927	11	6	sandy silt to clayey silt
41.339	30.10	0.4518	1.501	14.306	12	6	sandy silt to clayey silt
41.503	37.40	0.5555	1.485	14.773	12	7	silty sand to sandy silt
41.667	69.75	0.6841	0.981	12.370	17	8	sand to silty sand
41.831	98.32	0.6560	0.667	9.455	24	8	sand to silty sand
41.995	96.59	0.8007	0.829	10.647	23	8	sand to silty sand
42.159	134.66	0.9908	0.736	12.492	26	9	sand
42.323	143.25	1.1532	0.805	13.006	27	9	sand
42.487	152.83	1.3366	0.875	13.224	29	9	sand
42.651	145.34	1.4153	0.974	13.574	35	8	sand to silty sand
42.815	136.40	1.3730	1.007	13.729	33	8	sand to silty sand
42.979	130.04	1.3726	1.056	14.130	31	8	sand to silty sand
43.143	124.65	1.3179	1.057	14.108	30	8	sand to silty sand
43.307	121.71	1.2256	1.007	14.116	29	8	sand to silty sand
43.471	121.22	1.0909	0.900	14.157	29	8	sand to silty sand
43.635	116.75	1.0043	0.860	14.217	28	8	sand to silty sand
43.799	111.88	0.9748	0.871	14.214	27	8	sand to silty sand
43.963	108.13	0.9186	0.850	14.203	26	8	sand to silty sand
44.127	102.03	0.8076	0.792	14.286	24	8	sand to silty sand
44.291	97.44	0.7159	0.735	14.254	23	8	sand to silty sand
44.455	96.12	0.6537	0.680	14.406	23	8	sand to silty sand
44.619	94.20	0.6205	0.659	14.510	23	8	sand to silty sand
44.783	89.12	0.5925	0.665	14.437	21	8	sand to silty sand
44.948	81.47	0.5717	0.702	14.450	20	8	sand to silty sand
45.112	71.82	0.2595	0.361	14.508	17	8	sand to silty sand
45.276	61.36	0.2803	0.457	14.651	15	8	sand to silty sand
45.440	62.36	0.3643	0.584	14.566	15	8	sand to silty sand
45.604	71.40	0.5092	0.713	14.675	17	8	sand to silty sand
45.768	84.30	0.7458	0.885	14.684	20	8	sand to silty sand
45.932	104.17	0.9055	0.869	14.780	25	8	sand to silty sand
46.096	128.07	1.0957	0.856	14.826	31	8	sand to silty sand
46.260	132.76	1.1922	0.898	14.851	32	8	sand to silty sand
46.424	134.94	1.2545	0.930	15.145	32	8	sand to silty sand
46.588	140.12	1.2677	0.905	15.165	34	8	sand to silty sand
46.752	142.47	1.3812	0.970	15.147	34	8	sand to silty sand
46.916	139.84	1.4309	1.023	15.262	33	8	sand to silty sand
47.080	133.08	1.4037	1.055	15.325	32	8	sand to silty sand
47.244	127.59	1.3139	1.030	15.474	31	8	sand to silty sand
47.408	122.82	1.2566	1.023	15.774	29	8	sand to silty sand
47.572	119.14	1.2035	1.010	15.788	29	8	sand to silty sand
47.736	114.76	1.1211	0.977	15.601	27	8	sand to silty sand
47.900	107.08	1.0649	0.995	15.463	26	8	sand to silty sand
48.064	96.90	0.9713	1.002	15.485	23	8	sand to silty sand
48.228	85.93	0.8500	0.989	15.440	21	8	sand to silty sand
48.392	74.39	0.5983	0.804	15.585	18	8	sand to silty sand
48.556	67.02	0.5480	0.818	15.670	16	8	sand to silty sand
48.720	67.11	0.5066	0.755	15.590	16	8	sand to silty sand
48.885	70.42	0.5627	0.799	15.792	17	8	sand to silty sand
49.049	72.59	0.5838	0.804	15.863	17	8	sand to silty sand
49.213	76.35	0.5886	0.771	15.839	18	8	sand to silty sand
49.377	87.03	0.6261	0.719	16.048	21	8	sand to silty sand
49.541	102.69	0.7266	0.708	16.253	25	8	sand to silty sand
49.705	120.04	0.8356	0.696	16.431	29	8	sand to silty sand
49.869	133.54	0.9588	0.718	16.504	26	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
50.033	146.56	1.0469	0.714	16.629	28	9	sand
50.197	157.18	1.1699	0.744	16.680	30	9	sand
50.361	167.83	1.3836	0.824	16.934	32	9	sand
50.525	179.68	1.6871	0.939	17.403	34	9	sand
50.689	180.97	1.8702	1.033	17.657	35	9	sand
50.853	165.92	1.8063	1.089	17.392	40	8	sand to silty sand
51.017	158.09	1.6137	1.021	16.847	38	8	sand to silty sand
51.181	147.24	1.4593	0.991	17.216	35	8	sand to silty sand
51.345	131.96	1.2321	0.934	17.056	32	8	sand to silty sand
51.509	130.06	1.0550	0.811	17.152	31	8	sand to silty sand
51.673	140.53	0.7507	0.534	17.565	27	9	sand
51.837	153.03	1.0056	0.657	17.599	29	9	sand
52.001	136.79	1.0387	0.759	16.891	26	9	sand
52.165	125.94	1.0590	0.841	17.552	30	8	sand to silty sand
52.329	122.39	1.0576	0.864	17.942	29	8	sand to silty sand
52.493	120.04	1.0824	0.902	17.821	29	8	sand to silty sand
52.657	110.51	1.0762	0.974	17.508	26	8	sand to silty sand
52.822	98.08	0.9730	0.992	17.534	23	8	sand to silty sand
52.986	91.56	0.8667	0.947	17.559	22	8	sand to silty sand
53.150	92.66	0.7998	0.863	17.897	22	8	sand to silty sand
53.314	93.61	0.7902	0.844	18.035	22	8	sand to silty sand
53.478	99.60	0.7984	0.802	18.222	24	8	sand to silty sand
53.642	109.44	0.8740	0.799	18.304	26	8	sand to silty sand
53.806	116.27	0.9912	0.852	18.258	28	8	sand to silty sand
53.970	116.84	1.1344	0.971	18.191	28	8	sand to silty sand
54.134	116.71	1.1976	1.026	18.108	28	8	sand to silty sand
54.298	113.35	1.1722	1.034	18.002	27	8	sand to silty sand
54.462	109.30	1.1430	1.046	18.120	26	8	sand to silty sand
54.626	108.18	1.1234	1.038	18.177	26	8	sand to silty sand
54.790	93.88	0.9797	1.044	18.066	22	8	sand to silty sand
54.954	84.11	0.5229	0.622	17.999	20	8	sand to silty sand
55.118	71.07	0.4767	0.671	18.204	17	8	sand to silty sand
55.282	63.15	0.4767	0.755	17.950	15	8	sand to silty sand
55.446	58.86	0.5706	0.969	18.404	19	7	silty sand to sandy silt
55.610	60.13	0.6996	1.164	18.609	19	7	silty sand to sandy silt
55.774	58.93	0.7844	1.331	18.153	19	7	silty sand to sandy silt
55.938	56.16	0.8002	1.425	18.229	18	7	silty sand to sandy silt
56.102	57.28	0.8109	1.415	18.349	18	7	silty sand to sandy silt
56.266	61.50	0.8198	1.333	18.496	20	7	silty sand to sandy silt
56.430	65.06	0.8519	1.310	18.638	21	7	silty sand to sandy silt
56.594	58.26	1.0068	1.728	18.731	19	7	silty sand to sandy silt
56.759	37.11	0.8419	2.268	19.179	14	6	sandy silt to clayey silt
56.923	19.66	0.5969	3.036	33.393	9	5	clayey silt to silty clay
57.087	13.32	0.2080	1.562	62.031	6	5	clayey silt to silty clay
57.251	11.62	0.1994	1.717	70.994	6	5	clayey silt to silty clay
57.415	13.56	0.1504	1.109	74.058	5	6	sandy silt to clayey silt
57.579	17.61	0.1733	0.984	57.100	7	6	sandy silt to clayey silt
57.743	15.06	0.1562	1.037	56.459	6	6	sandy silt to clayey silt
57.907	11.39	0.2331	2.046	62.127	5	5	clayey silt to silty clay
58.071	15.07	0.3335	2.213	77.180	7	5	clayey silt to silty clay
58.235	53.43	0.5353	1.002	26.466	17	7	silty sand to sandy silt
58.399	64.60	0.6941	1.074	19.871	21	7	silty sand to sandy silt
58.563	63.13	0.8397	1.330	19.539	20	7	silty sand to sandy silt
58.727	66.41	0.9150	1.378	20.093	21	7	silty sand to sandy silt
58.891	66.08	1.0212	1.545	20.167	21	7	silty sand to sandy silt
59.055	55.83	1.1009	1.972	20.380	18	7	silty sand to sandy silt
59.219	39.27	0.9909	2.524	21.030	15	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
59.383	38.61	0.5621	1.456	23.656	12	7	silty sand to sandy silt
59.547	76.99	0.5878	0.764	15.567	18	8	sand to silty sand
59.711	91.62	0.8145	0.889	11.911	22	8	sand to silty sand
59.875	96.29	1.0566	1.097	13.302	23	8	sand to silty sand
60.039	98.24	1.1825	1.204	15.104	24	8	sand to silty sand
60.203	88.64	1.1881	1.340	16.348	21	8	sand to silty sand
60.367	75.37	1.0653	1.413	17.617	24	7	silty sand to sandy silt
60.532	68.54	0.7946	1.159	19.261	22	7	silty sand to sandy silt
60.696	69.55	0.6012	0.864	19.308	17	8	sand to silty sand
60.860	72.20	0.5204	0.721	16.095	17	8	sand to silty sand
61.024	76.87	0.5548	0.722	18.006	18	8	sand to silty sand
61.188	92.73	0.5562	0.600	19.708	22	8	sand to silty sand
61.352	86.42	0.5950	0.688	18.395	21	8	sand to silty sand
61.516	75.40	0.3292	0.437	19.386	18	8	sand to silty sand
61.680	68.46	0.3215	0.470	20.302	16	8	sand to silty sand
61.844	61.78	0.3521	0.570	21.086	15	8	sand to silty sand
62.008	62.54	0.4115	0.658	21.399	15	8	sand to silty sand
62.172	63.24	0.4442	0.702	21.524	15	8	sand to silty sand
62.336	63.36	0.4715	0.744	21.658	15	8	sand to silty sand
62.500	61.88	0.4778	0.772	21.760	15	8	sand to silty sand
62.664	61.62	0.4773	0.775	21.822	15	8	sand to silty sand
62.828	61.73	0.4598	0.745	21.905	15	8	sand to silty sand
62.992	63.33	0.4540	0.717	21.929	15	8	sand to silty sand
63.156	71.06	0.5131	0.722	22.091	17	8	sand to silty sand
63.320	79.15	0.6174	0.780	22.310	19	8	sand to silty sand
63.484	79.07	0.7192	0.910	22.160	19	8	sand to silty sand
63.648	78.54	0.7264	0.925	22.129	19	8	sand to silty sand
63.812	80.71	0.7004	0.868	22.118	19	8	sand to silty sand
63.976	85.88	0.6758	0.787	22.314	21	8	sand to silty sand
64.140	91.84	0.7058	0.768	22.496	22	8	sand to silty sand
64.304	93.82	0.7762	0.827	22.601	22	8	sand to silty sand
64.469	90.14	0.7642	0.848	22.577	22	8	sand to silty sand
64.633	73.45	0.6333	0.862	22.505	18	8	sand to silty sand
64.797	67.31	0.3871	0.575	22.550	16	8	sand to silty sand
64.961	65.69	0.4358	0.664	22.788	16	8	sand to silty sand
65.125	73.92	0.5416	0.733	22.463	18	8	sand to silty sand
65.289	79.79	0.6322	0.792	22.879	19	8	sand to silty sand
65.453	70.79	0.6290	0.889	22.766	17	8	sand to silty sand
65.617	69.31	0.5757	0.831	22.846	17	8	sand to silty sand
65.781	73.59	0.6128	0.833	23.231	18	8	sand to silty sand
65.945	80.63	0.6726	0.834	23.369	19	8	sand to silty sand
66.109	92.93	0.6494	0.699	23.057	22	8	sand to silty sand
66.273	93.83	0.7219	0.769	21.477	22	8	sand to silty sand
66.437	92.15	0.8722	0.946	21.411	22	8	sand to silty sand
66.601	100.03	0.7906	0.790	22.385	24	8	sand to silty sand
66.765	105.20	0.7455	0.709	20.634	25	8	sand to silty sand
66.929	101.50	0.7287	0.718	17.833	24	8	sand to silty sand
67.093	96.40	0.7434	0.771	19.713	23	8	sand to silty sand
67.257	96.54	0.7988	0.827	21.362	23	8	sand to silty sand
67.421	99.80	0.7626	0.764	22.474	24	8	sand to silty sand
67.585	107.09	0.8004	0.747	23.180	26	8	sand to silty sand
67.749	119.95	0.8709	0.726	23.856	29	8	sand to silty sand
67.913	127.41	0.9923	0.779	24.056	31	8	sand to silty sand
68.077	127.39	0.6796	0.534	24.092	24	9	sand
68.241	125.07	0.9926	0.794	24.285	30	8	sand to silty sand
68.406	121.75	1.1153	0.916	23.818	29	8	sand to silty sand
68.570	122.86	1.1533	0.939	24.143	29	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
68.734	121.33	1.1847	0.976	24.481	29	8	sand to silty sand
68.898	115.85	1.2179	1.051	24.330	28	8	sand to silty sand
69.062	101.15	1.1258	1.113	24.350	24	8	sand to silty sand
69.226	92.40	0.8731	0.945	24.288	22	8	sand to silty sand
69.390	88.11	0.7190	0.816	24.608	21	8	sand to silty sand
69.554	84.97	0.6170	0.726	24.871	20	8	sand to silty sand
69.718	82.68	0.5689	0.688	24.962	20	8	sand to silty sand
69.882	81.05	0.5471	0.675	25.031	19	8	sand to silty sand
70.046	80.96	0.5275	0.652	25.080	19	8	sand to silty sand
70.210	80.23	0.5082	0.633	25.107	19	8	sand to silty sand
70.374	83.88	0.5110	0.609	25.180	20	8	sand to silty sand
70.538	89.13	0.5658	0.635	25.269	21	8	sand to silty sand
70.702	92.81	0.6073	0.654	25.340	22	8	sand to silty sand
70.866	84.28	0.6043	0.717	25.160	20	8	sand to silty sand
71.030	78.15	0.5726	0.733	25.267	19	8	sand to silty sand
71.194	76.41	0.5473	0.716	25.396	18	8	sand to silty sand
71.358	77.56	0.2854	0.368	25.447	19	8	sand to silty sand
71.522	80.63	0.3457	0.429	25.569	19	8	sand to silty sand
71.686	93.81	0.4628	0.493	25.523	22	8	sand to silty sand
71.850	110.02	0.6288	0.571	25.725	26	8	sand to silty sand
72.014	122.05	1.0093	0.827	25.794	29	8	sand to silty sand
72.178	122.55	1.1174	0.912	25.819	29	8	sand to silty sand
72.343	122.41	1.1646	0.951	26.150	29	8	sand to silty sand
72.507	116.21	1.1149	0.959	25.832	28	8	sand to silty sand
72.671	104.69	0.9881	0.944	25.643	25	8	sand to silty sand
72.835	102.04	0.9400	0.921	26.014	24	8	sand to silty sand
72.999	102.13	0.9052	0.886	26.255	24	8	sand to silty sand
73.163	105.83	0.9112	0.861	26.379	25	8	sand to silty sand
73.327	112.31	0.9244	0.823	26.520	27	8	sand to silty sand
73.491	122.92	1.0228	0.832	26.809	29	8	sand to silty sand
73.655	135.51	1.1365	0.839	27.029	32	8	sand to silty sand
73.819	131.56	1.2657	0.962	27.120	31	8	sand to silty sand
73.983	120.26	1.2711	1.057	26.778	29	8	sand to silty sand
74.147	105.27	1.1689	1.110	26.515	25	8	sand to silty sand
74.311	100.18	1.0471	1.045	26.575	24	8	sand to silty sand
74.475	95.52	0.9770	1.023	27.018	23	8	sand to silty sand
74.639	87.00	0.8744	1.005	26.531	21	8	sand to silty sand
74.803	84.58	0.7864	0.930	26.738	20	8	sand to silty sand
74.967	82.56	0.7362	0.892	26.727	20	8	sand to silty sand
75.131	87.09	0.6981	0.802	27.051	21	8	sand to silty sand
75.295	96.15	0.7611	0.792	27.247	23	8	sand to silty sand
75.459	99.79	0.8301	0.832	27.189	24	8	sand to silty sand
75.623	104.72	0.9234	0.882	27.330	25	8	sand to silty sand
75.787	108.03	0.9821	0.909	27.648	26	8	sand to silty sand
75.951	100.75	0.9663	0.959	27.189	24	8	sand to silty sand
76.115	100.04	0.8559	0.856	27.180	24	8	sand to silty sand
76.280	100.61	0.7681	0.763	27.456	24	8	sand to silty sand
76.444	96.79	0.7042	0.728	27.601	23	8	sand to silty sand
76.608	100.96	0.6879	0.681	27.792	24	8	sand to silty sand
76.772	107.76	0.7101	0.659	27.910	26	8	sand to silty sand
76.936	104.43	0.7361	0.705	27.779	25	8	sand to silty sand
77.100	106.41	0.7217	0.678	27.886	25	8	sand to silty sand
77.264	119.41	0.7540	0.631	28.053	23	9	sand
77.428	131.55	0.8785	0.668	28.251	25	9	sand
77.592	128.87	1.0423	0.809	28.431	31	8	sand to silty sand
77.756	115.51	1.1473	0.993	28.244	28	8	sand to silty sand
77.920	103.20	1.1581	1.122	27.928	25	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
78.084	120.91	1.3084	1.082	28.309	29	8	sand to silty sand
78.248	118.42	1.3623	1.150	27.305	28	8	sand to silty sand
78.412	115.34	1.3206	1.145	28.164	28	8	sand to silty sand
78.576	108.57	1.1280	1.039	28.022	26	8	sand to silty sand
78.740	103.23	0.8954	0.867	28.104	25	8	sand to silty sand
78.904	110.89	0.7383	0.666	28.596	27	8	sand to silty sand
79.068	120.18	0.7542	0.628	28.211	23	9	sand
79.232	119.04	0.7125	0.599	28.589	23	9	sand
79.396	108.49	0.6352	0.586	28.638	26	8	sand to silty sand
79.560	101.79	0.6466	0.635	28.832	24	8	sand to silty sand
79.724	97.83	0.6475	0.662	28.860	23	8	sand to silty sand
79.888	93.56	0.5934	0.634	28.818	22	8	sand to silty sand
80.052	92.72	0.5570	0.601	28.976	22	8	sand to silty sand
80.217	93.54	0.5603	0.599	29.250	22	8	sand to silty sand
80.381	93.54	0.6145	0.657	29.272	22	8	sand to silty sand
80.545	93.83	0.7003	0.746	29.183	22	8	sand to silty sand
80.709	91.90	0.7047	0.767	29.317	22	8	sand to silty sand
80.873	90.00	0.6662	0.740	29.174	22	8	sand to silty sand
81.037	88.66	0.6026	0.680	29.399	21	8	sand to silty sand
81.201	89.88	0.4715	0.525	29.628	22	8	sand to silty sand
81.365	93.89	0.5386	0.574	29.779	22	8	sand to silty sand
81.529	98.01	0.5854	0.597	29.617	23	8	sand to silty sand
81.693	103.12	0.6232	0.604	29.670	25	8	sand to silty sand
81.857	110.97	0.6851	0.617	29.835	27	8	sand to silty sand
82.021	119.92	0.7476	0.623	29.966	23	9	sand
82.185	117.01	0.7738	0.661	29.819	28	8	sand to silty sand
82.349	107.30	0.6898	0.643	29.657	26	8	sand to silty sand
82.513	102.15	0.6073	0.595	29.906	24	8	sand to silty sand
82.677	98.90	0.5641	0.570	30.115	24	8	sand to silty sand
82.841	99.14	0.5595	0.564	30.354	24	8	sand to silty sand
83.005	98.91	0.5690	0.575	30.318	24	8	sand to silty sand
83.169	101.20	0.5857	0.579	30.456	24	8	sand to silty sand
83.333	111.99	0.6399	0.571	30.852	21	9	sand
83.497	130.87	0.8559	0.654	31.095	25	9	sand
83.661	156.66	1.1649	0.744	31.555	30	9	sand
83.825	174.95	1.5004	0.858	31.546	34	9	sand
83.990	181.34	1.5745	0.868	31.413	35	9	sand
84.154	168.70	1.4607	0.866	30.342	32	9	sand
84.318	161.31	1.1940	0.740	30.554	31	9	sand
84.482	150.21	0.8015	0.534	30.734	29	9	sand
84.646	131.32	0.7637	0.582	30.972	25	9	sand
84.810	143.70	0.7136	0.497	31.299	28	9	sand
84.974	150.99	0.8171	0.541	31.437	29	9	sand
85.138	161.35	0.9683	0.600	31.553	31	9	sand
85.302	142.61	0.9485	0.665	31.019	27	9	sand
85.466	121.78	0.7804	0.641	30.948	23	9	sand
85.630	117.15	0.6752	0.576	31.141	22	9	sand
85.794	126.82	0.6757	0.533	31.626	24	9	sand
85.958	137.77	0.7355	0.534	31.791	26	9	sand
86.122	152.11	0.8505	0.559	32.169	29	9	sand
86.286	162.44	0.9621	0.592	32.154	31	9	sand
86.450	147.06	0.9726	0.661	31.464	28	9	sand
86.614	145.94	0.9102	0.624	31.675	28	9	sand
86.778	156.61	0.9172	0.586	32.256	30	9	sand
86.942	147.68	0.9197	0.623	32.060	28	9	sand
87.106	134.16	0.8555	0.638	31.922	26	9	sand
87.270	121.56	0.7422	0.611	31.795	23	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
87.434	117.65	0.6334	0.538	32.040	23	9	sand
87.598	124.78	0.6277	0.503	32.474	24	9	sand
87.762	118.41	0.4915	0.415	32.418	23	9	sand
87.927	99.84	0.4721	0.473	32.118	24	8	sand to silty sand
88.091	84.82	0.4490	0.529	32.314	20	8	sand to silty sand
88.255	84.07	0.4354	0.518	32.425	20	8	sand to silty sand
88.419	85.93	0.4430	0.516	32.554	21	8	sand to silty sand
88.583	103.35	0.5706	0.552	33.008	25	8	sand to silty sand
88.747	124.42	0.7456	0.599	33.019	24	9	sand
88.911	123.35	0.8224	0.667	32.539	24	9	sand
89.075	133.41	0.8348	0.626	32.904	26	9	sand
89.239	150.99	0.8672	0.574	33.215	29	9	sand
89.403	151.41	0.9307	0.615	33.255	29	9	sand
89.567	151.11	0.9513	0.630	33.186	29	9	sand
89.731	145.17	0.8934	0.615	33.084	28	9	sand
89.895	144.16	0.8849	0.614	33.184	28	9	sand
90.059	155.75	0.9439	0.606	33.598	30	9	sand
90.223	147.74	0.9796	0.663	33.480	28	9	sand
90.387	141.90	0.9404	0.663	33.251	27	9	sand
90.551	144.09	0.8904	0.618	33.533	28	9	sand
90.715	146.66	0.9085	0.619	33.820	28	9	sand
90.879	148.85	0.9285	0.624	33.856	29	9	sand
91.043	133.49	0.6924	0.519	33.651	26	9	sand
91.207	130.29	0.6740	0.517	33.562	25	9	sand
91.371	127.36	0.6537	0.513	33.567	24	9	sand
91.535	130.84	0.7318	0.559	33.912	25	9	sand
91.699	129.80	0.8537	0.658	33.916	25	9	sand
91.864	114.50	0.8242	0.720	33.604	27	8	sand to silty sand
92.028	115.46	0.8077	0.700	34.134	28	8	sand to silty sand
92.192	122.55	0.8185	0.668	34.143	23	9	sand
92.356	129.05	0.8118	0.629	34.230	25	9	sand
92.520	120.16	0.7953	0.662	33.969	23	9	sand
92.684	118.14	0.8153	0.690	34.181	28	8	sand to silty sand
92.848	118.56	0.8355	0.705	34.292	28	8	sand to silty sand
93.012	122.92	0.8335	0.678	34.644	24	9	sand
93.176	129.90	0.8857	0.682	34.839	25	9	sand
93.340	140.92	1.0355	0.735	35.022	27	9	sand
93.504	140.69	1.1316	0.804	34.853	27	9	sand
93.668	129.12	1.1737	0.909	34.646	31	8	sand to silty sand
93.832	124.69	1.0812	0.867	34.757	30	8	sand to silty sand
93.996	125.19	1.0076	0.805	34.753	30	8	sand to silty sand
94.160	124.23	1.0613	0.854	35.300	30	8	sand to silty sand
94.324	148.12	1.1175	0.754	35.863	28	9	sand
94.488	139.50	1.1152	0.799	35.142	27	9	sand
94.652	123.14	0.9538	0.775	34.423	29	8	sand to silty sand
94.816	123.24	0.8443	0.685	35.049	24	9	sand
94.980	131.32	0.8021	0.611	35.487	25	9	sand
95.144	151.58	0.8663	0.571	36.008	29	9	sand
95.308	149.97	0.9737	0.649	35.654	29	9	sand
95.472	142.00	0.9735	0.686	35.442	27	9	sand
95.636	148.93	1.0295	0.691	35.965	29	9	sand
95.801	167.07	1.1504	0.689	36.582	32	9	sand
95.965	161.10	1.2146	0.754	35.712	31	9	sand
96.129	151.10	1.1855	0.785	35.676	29	9	sand
96.293	136.13	1.1076	0.814	35.269	33	8	sand to silty sand
96.457	138.52	1.1018	0.795	35.990	27	9	sand
96.621	154.71	1.2163	0.786	36.829	30	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
96.785	145.94	1.2870	0.882	36.586	28	9	sand
96.949	141.60	1.1875	0.839	35.716	27	9	sand
97.113	151.99	1.0072	0.663	36.181	29	9	sand
97.277	130.05	0.9534	0.733	36.328	25	9	sand
97.441	111.18	0.8279	0.745	36.077	27	8	sand to silty sand
97.605	101.39	0.6189	0.610	36.008	24	8	sand to silty sand
97.769	98.47	0.6163	0.626	36.346	24	8	sand to silty sand
97.933	113.00	0.6623	0.586	36.740	22	9	sand
98.097	130.51	0.8334	0.639	37.016	25	9	sand
98.261	140.20	1.2226	0.872	36.969	34	8	sand to silty sand
98.425	129.11	1.1495	0.890	36.562	31	8	sand to silty sand
98.589	111.20	0.8965	0.806	36.366	27	8	sand to silty sand
98.753	120.61	0.7997	0.663	36.907	23	9	sand
98.917	145.03	0.8604	0.593	37.699	28	9	sand
99.081	152.04	0.9746	0.641	37.534	29	9	sand
99.245	151.27	1.0438	0.690	37.358	29	9	sand
99.409	139.45	0.9813	0.704	36.844	27	9	sand
99.573	134.44	0.8969	0.667	37.120	26	9	sand
99.738	158.50	0.9172	0.579	38.240	30	9	sand
99.902	174.06	1.0013	0.575	38.373	33	9	sand
100.066	173.21	1.0784	0.623	38.404	33	9	sand
100.230	181.77	1.1581	0.637	38.498	35	9	sand
100.394	183.13	1.1973	0.654	38.535	35	9	sand
100.558	165.31	1.1675	0.706	37.554	32	9	sand
100.722	167.70	1.1059	0.659	38.095	32	9	sand
100.886	194.62	1.3451	0.691	39.510	37	9	sand
101.050	219.67	1.5031	0.684	40.549	42	9	sand
101.214	228.98	1.6609	0.725	37.928	44	9	sand
101.378	229.52	1.7265	0.752	38.322	44	9	sand
101.542	229.48	1.7170	0.748	38.564	44	9	sand
101.706	218.01	1.6609	0.762	38.144	42	9	sand
101.870	209.54	1.5636	0.746	38.705	40	9	sand
102.034	202.24	1.4439	0.714	38.847	39	9	sand
102.198	188.51	1.3779	0.731	38.796	36	9	sand
102.362	191.90	1.2971	0.676	39.728	37	9	sand
102.526	202.92	1.3730	0.677	40.707	39	9	sand
102.690	227.13	1.5152	0.667	41.264	44	9	sand
102.854	232.90	1.6793	0.721	40.796	45	9	sand
103.018	206.32	1.6343	0.792	40.280	40	9	sand
103.182	184.62	1.4245	0.772	38.295	35	9	sand
103.347	176.85	1.2780	0.723	39.061	34	9	sand
103.511	176.17	1.2230	0.694	39.650	34	9	sand
103.675	176.29	1.1983	0.680	39.477	34	9	sand
103.839	156.63	1.1106	0.709	40.066	30	9	sand
104.003	140.03	0.9699	0.693	39.430	27	9	sand
104.167	131.49	0.6187	0.471	39.501	25	9	sand
104.331	127.85	0.5806	0.454	39.657	24	9	sand
104.495	125.37	0.6055	0.483	39.564	24	9	sand
104.659	124.61	0.6135	0.492	39.537	24	9	sand
104.823	123.80	0.6589	0.532	39.292	24	9	sand
104.987	124.03	0.6391	0.515	39.523	24	9	sand
105.151	124.42	0.6662	0.535	39.710	24	9	sand
105.315	125.08	0.6868	0.549	39.746	24	9	sand
105.479	127.02	0.7571	0.596	40.703	24	9	sand
105.643	134.74	0.7949	0.590	40.349	26	9	sand
105.807	160.37	0.9779	0.610	41.097	31	9	sand
105.971	187.25	1.2382	0.661	41.562	36	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
106.135	200.24	1.3551	0.677	41.364	38	9	sand
106.299	195.17	1.4871	0.762	40.531	37	9	sand
106.463	182.42	1.5009	0.823	40.126	35	9	sand
106.627	159.54	1.4132	0.886	39.443	31	9	sand
106.791	139.47	1.1637	0.834	39.639	27	9	sand
106.955	127.75	0.9442	0.739	40.017	31	8	sand to silty sand
107.119	120.77	0.7640	0.633	40.520	23	9	sand
107.284	120.73	0.7099	0.588	41.074	23	9	sand
107.448	128.05	0.6374	0.498	41.299	25	9	sand
107.612	136.54	0.6474	0.474	41.459	26	9	sand
107.776	114.59	0.6275	0.548	40.558	22	9	sand
107.940	106.29	0.5867	0.552	40.636	25	8	sand to silty sand
108.104	100.74	0.5898	0.585	40.845	24	8	sand to silty sand
108.268	95.56	0.5404	0.566	40.961	23	8	sand to silty sand
108.432	99.59	0.5454	0.548	41.439	24	8	sand to silty sand
108.596	114.80	0.6428	0.560	41.717	22	9	sand
108.760	119.08	0.7650	0.642	41.531	23	9	sand
108.924	117.98	0.7743	0.656	41.143	28	8	sand to silty sand
109.088	121.36	0.7040	0.580	41.470	23	9	sand
109.252	122.04	0.6900	0.565	41.635	23	9	sand
109.416	123.31	0.7162	0.581	41.875	24	9	sand
109.580	126.81	0.7613	0.600	41.851	24	9	sand
109.744	135.37	0.7982	0.590	42.140	26	9	sand
109.908	134.39	0.8287	0.617	41.976	26	9	sand
110.072	133.67	0.8337	0.624	42.025	26	9	sand
110.236	158.14	0.9855	0.623	43.128	30	9	sand
110.400	165.72	1.1497	0.694	42.797	32	9	sand
110.564	157.55	1.2272	0.779	41.987	30	9	sand
110.728	162.91	1.1246	0.690	42.323	31	9	sand
110.892	152.59	1.0714	0.702	42.162	29	9	sand
111.056	126.81	0.9394	0.741	42.147	30	8	sand to silty sand
111.221	130.35	0.9284	0.712	42.361	25	9	sand
111.385	138.69	0.9588	0.691	42.601	27	9	sand
111.549	126.87	0.9183	0.724	42.263	24	9	sand
111.713	121.46	0.8417	0.693	42.737	29	8	sand to silty sand
111.877	135.86	0.8550	0.629	43.153	26	9	sand
112.041	133.31	0.8983	0.674	42.863	26	9	sand
112.205	117.95	0.8825	0.748	42.247	28	8	sand to silty sand
112.369	111.61	0.8010	0.718	42.443	27	8	sand to silty sand
112.533	106.38	0.7249	0.681	42.656	25	8	sand to silty sand
112.697	101.94	0.7150	0.701	42.990	24	8	sand to silty sand
112.861	127.61	0.7664	0.601	44.350	24	9	sand
113.025	146.48	0.8299	0.567	44.201	28	9	sand
113.189	149.58	0.9651	0.645	43.660	29	9	sand
113.353	145.51	1.1506	0.791	43.297	28	9	sand
113.517	132.07	1.1555	0.875	42.547	32	8	sand to silty sand
113.681	136.75	1.0342	0.756	43.502	26	9	sand
113.845	160.42	1.1040	0.688	44.568	31	9	sand
114.009	162.46	1.0495	0.646	44.490	31	9	sand
114.173	129.70	0.9288	0.716	42.832	25	9	sand
114.337	127.90	0.8907	0.696	43.629	24	9	sand
114.501	148.88	1.0130	0.680	44.719	29	9	sand
114.665	144.03	1.1839	0.822	44.314	28	9	sand
114.829	136.71	1.2143	0.888	43.609	33	8	sand to silty sand
114.993	152.14	1.2223	0.803	44.461	29	9	sand
115.158	181.15	1.4289	0.789	45.807	35	9	sand
115.322	199.32	1.6438	0.825	46.112	38	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
115.486	208.97	1.9261	0.922	45.387	40	9	sand
115.650	208.64	2.0346	0.975	44.697	40	9	sand
115.814	189.21	1.8937	1.001	43.925	36	9	sand
115.978	169.77	1.6811	0.990	43.731	33	9	sand
116.142	172.10	1.4983	0.871	44.804	33	9	sand
116.306	169.04	1.4424	0.853	45.084	32	9	sand
116.470	186.70	1.4661	0.785	46.295	36	9	sand
116.634	209.10	1.6448	0.787	46.586	40	9	sand
116.798	193.62	1.7018	0.879	45.972	37	9	sand
116.962	161.07	1.5420	0.957	44.368	31	9	sand
117.126	136.98	1.0388	0.758	43.854	26	9	sand
117.290	135.98	1.4508	1.067	44.975	33	8	sand to silty sand
117.454	235.07	2.2611	0.962	50.249	45	9	sand
117.618	265.97	2.9678	1.116	46.154	51	9	sand
117.782	272.40	3.4365	1.262	45.318	52	9	sand
117.946	279.48	3.9272	1.405	45.389	67	8	sand to silty sand
118.110	277.41	3.6923	1.331	45.687	53	9	sand
118.274	260.93	3.4275	1.314	44.087	50	9	sand
118.438	244.82	2.9898	1.221	43.631	47	9	sand
118.602	213.73	2.5557	1.196	44.372	41	9	sand
118.766	205.47	2.1734	1.058	44.236	39	9	sand
118.931	220.73	2.1547	0.976	46.188	42	9	sand
119.095	215.70	2.1973	1.019	45.554	41	9	sand
119.259	195.12	2.0994	1.076	44.911	37	9	sand
119.423	163.73	1.7565	1.073	43.936	39	8	sand to silty sand
119.587	131.50	1.2588	0.957	44.125	31	8	sand to silty sand
119.751	117.02	0.8604	0.735	44.922	28	8	sand to silty sand
119.915	111.30	0.7060	0.634	45.845	27	8	sand to silty sand
120.079	108.80	0.6541	0.601	46.375	26	8	sand to silty sand
120.243	108.03	0.6592	0.610	46.250	26	8	sand to silty sand
120.407	107.41	0.7841	0.730	46.368	26	8	sand to silty sand
120.571	107.95	0.5465	0.506	46.424	21	9	sand
120.735	101.73	0.5539	0.544	46.117	24	8	sand to silty sand
120.899	116.02	0.6064	0.523	46.780	22	9	sand
121.063	120.35	0.6285	0.522	46.929	23	9	sand
121.227	129.57	0.7240	0.559	47.049	25	9	sand
121.391	150.85	0.8705	0.577	47.648	29	9	sand
121.555	161.94	1.0269	0.634	47.514	31	9	sand
121.719	153.68	1.1301	0.735	47.038	29	9	sand
121.883	158.75	1.1247	0.708	47.294	30	9	sand
122.047	151.28	1.1446	0.757	47.198	29	9	sand
122.211	134.28	1.0658	0.794	47.429	26	9	sand
122.375	125.37	1.0111	0.806	47.378	30	8	sand to silty sand
122.539	121.05	0.9444	0.780	47.701	29	8	sand to silty sand
122.703	126.44	0.9458	0.748	48.101	30	8	sand to silty sand
122.868	139.83	1.0392	0.743	48.771	27	9	sand
123.032	165.69	1.1820	0.713	49.595	32	9	sand
123.196	194.88	1.5139	0.777	50.367	37	9	sand
123.360	210.01	1.8436	0.878	48.956	40	9	sand
123.524	205.40	2.0617	1.004	49.770	39	9	sand
123.688	186.26	1.9516	1.048	48.547	36	9	sand
123.852	175.70	1.3607	0.774	47.781	34	9	sand
124.016	161.58	1.1528	0.713	47.897	31	9	sand
124.180	151.52	1.1659	0.769	48.604	29	9	sand
124.344	160.97	1.0952	0.680	49.058	31	9	sand
124.508	160.47	1.1613	0.724	48.845	31	9	sand
124.672	148.57	1.0132	0.682	47.703	28	9	sand

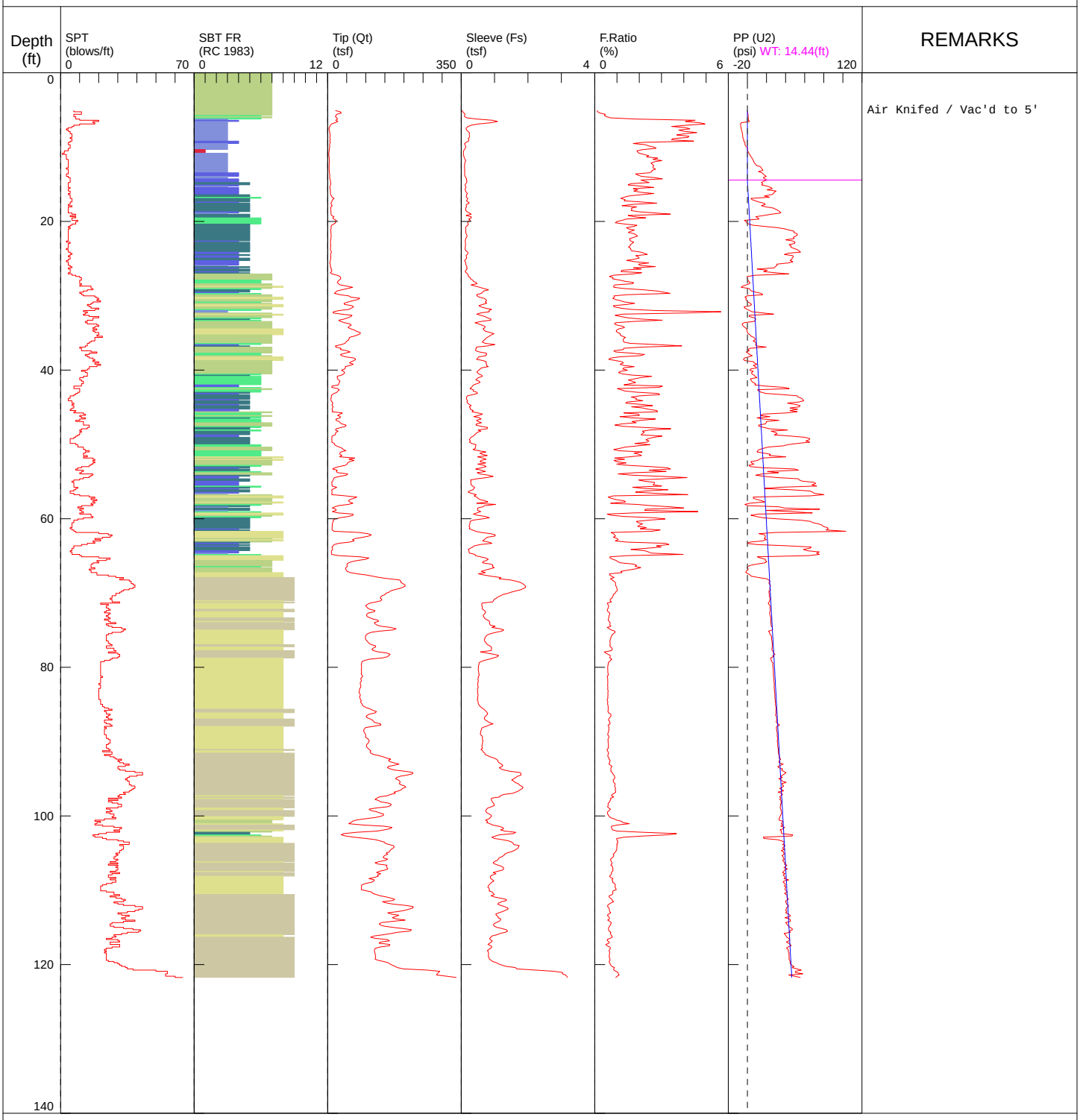
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
124.836	140.37	0.9770	0.696	48.736	27	9	sand
125.000	134.70	0.8729	0.648	48.544	26	9	sand
125.164	135.97	0.8791	0.646	48.911	26	9	sand
125.328	134.48	0.8714	0.648	48.762	26	9	sand
125.492	130.93	0.8211	0.627	48.704	25	9	sand
125.656	129.26	0.8151	0.631	48.798	25	9	sand
125.820	127.04	0.7896	0.622	48.865	24	9	sand
125.984	124.20	0.7743	0.623	48.929	24	9	sand
126.148	122.40	0.7151	0.584	48.945	23	9	sand
126.312	119.69	0.7011	0.586	49.105	23	9	sand
126.476	118.51	0.6803	0.574	49.232	23	9	sand
126.640	122.14	0.8038	0.658	49.563	23	9	sand
126.805	130.53	0.8229	0.630	49.875	25	9	sand
126.969	172.21	1.0312	0.599	51.473	33	9	sand
127.133	210.82	1.2789	0.607	51.214	40	9	sand
127.297	217.69	1.5830	0.727	51.666	42	9	sand
127.461	209.25	1.9200	0.918	48.834	40	9	sand
127.625	200.98	1.9162	0.953	48.157	38	9	sand
127.789	182.40	1.7856	0.979	49.183	35	9	sand
127.953	169.98	1.5706	0.924	49.677	33	9	sand
128.117	146.43	1.4023	0.958	49.170	35	8	sand to silty sand
128.281	127.02	1.2289	0.967	49.902	30	8	sand to silty sand
128.445	121.36	1.1113	0.916	51.194	29	8	sand to silty sand
128.609	109.43	1.0858	0.992	49.911	26	8	sand to silty sand
128.773	105.09	0.9449	0.899	50.703	25	8	sand to silty sand
128.937	102.87	0.9005	0.875	50.393	25	8	sand to silty sand
129.101	106.86	0.8700	0.814	50.692	26	8	sand to silty sand
129.265	120.02	0.9336	0.778	51.150	29	8	sand to silty sand
129.429	146.18	1.2204	0.835	51.869	28	9	sand
129.593	177.05	1.6097	0.909	52.438	34	9	sand
129.757	201.19	2.0635	1.026	53.157	39	9	sand
129.921	209.29	2.2677	1.084	52.799	40	9	sand
130.085	208.74	2.0079	0.962	50.883	40	9	sand
130.249	187.32	1.2988	0.693	49.846	36	9	sand
130.413	146.58	1.0723	0.732	50.498	28	9	sand
130.577	122.74	0.8342	0.680	50.743	24	9	sand
130.742	109.66	0.6560	0.598	50.231	26	8	sand to silty sand
130.906	104.24	0.5149	0.494	51.671	25	8	sand to silty sand
131.070	100.23	0.4050	0.404	51.090	19	9	sand
131.234	106.32	0.4444	0.418	51.157	20	9	sand
131.398	105.58	0.4746	0.450	51.090	20	9	sand
131.562	101.64	0.4417	0.435	50.872	19	9	sand
131.726	101.73	0.4036	0.397	51.092	19	9	sand
131.890	103.79	0.3900	0.376	51.214	20	9	sand
132.054	100.40	0.4318	0.430	51.466	19	9	sand
132.218	100.89	0.4243	0.421	51.361	19	9	sand
132.382	102.40	0.3892	0.380	51.350	20	9	sand
132.546	100.75	0.3205	0.318	51.232	19	9	sand
132.710	99.93	0.3382	0.338	51.615	19	9	sand
132.874	101.82	0.3789	0.372	51.762	20	9	sand
133.038	100.61	0.3900	0.388	51.940	19	9	sand
133.202	99.40	0.3482	0.350	51.955	19	9	sand
133.366	104.92	0.3519	0.335	52.169	20	9	sand
133.530	101.54	0.3684	0.363	52.200	19	9	sand
133.694	101.35	0.3223	0.318	52.160	19	9	sand
133.858	99.24	0.3067	0.309	52.042	19	9	sand
134.022	100.19	0.3248	0.324	52.194	19	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
134.186	99.22	0.2955	0.298	52.360	19	9	sand
134.350	97.07	0.2462	0.254	52.494	19	9	sand
134.514	96.98	0.2058	0.212	52.659	19	9	sand
134.679	99.90	0.2063	0.207	52.868	19	9	sand
134.843	97.92	0.2508	0.256	52.926	19	9	sand
135.007	96.59	0.2441	0.253	52.906	18	9	sand
135.171	98.44	0.1904	0.193	52.854	19	9	sand
135.335	102.59	0.2193	0.214	52.992	20	9	sand
135.499	109.55	0.2450	0.224	53.604	21	9	sand
135.663	133.76	0.3049	0.228	54.434	26	9	sand
135.827	176.44	0.4804	0.272	54.973	34	9	sand
135.991	203.31	0.8228	0.405	55.178	39	9	sand
136.155	226.80	1.6130	0.711	55.812	43	9	sand
136.319	263.80	2.2009	0.834	57.122	51	9	sand
136.483	287.65	2.7969	0.972	63.891	55	9	sand
136.647	315.11	2.9266	0.929	56.577	60	9	sand
136.811	324.04	3.2298	0.997	55.874	62	9	sand
136.975	317.66	2.4841	0.782	54.414	61	9	sand
137.139	304.54	2.3003	0.755	54.639	58	9	sand
137.303	212.86	2.3125	1.086	57.567	41	9	sand
137.467	187.42	2.4187	1.291	52.757	45	8	sand to silty sand
137.631	183.80	2.0315	1.105	51.388	35	9	sand
137.795	176.95	2.0086	1.135	53.444	42	8	sand to silty sand
137.959	163.93	1.8470	1.127	54.165	39	8	sand to silty sand
138.123	153.45	1.8623	1.214	52.899	37	8	sand to silty sand
138.287	154.04	1.8294	1.188	54.421	37	8	sand to silty sand
138.451	159.29	1.8016	1.131	55.040	38	8	sand to silty sand
138.616	167.70	1.7446	1.040	54.132	32	9	sand
138.780	177.23	1.8259	1.030	54.946	34	9	sand
138.944	186.54	1.9048	1.021	54.481	36	9	sand
139.108	179.94	2.0812	1.157	55.264	43	8	sand to silty sand
139.272	184.68	2.2339	1.210	56.114	44	8	sand to silty sand
139.436	187.61	2.4412	1.301	54.510	45	8	sand to silty sand
139.600	197.67	2.7471	1.390	56.201	47	8	sand to silty sand
139.764	193.72	2.7277	1.408	55.113	46	8	sand to silty sand
139.928	178.87	2.4264	1.357	53.199	43	8	sand to silty sand
140.092	163.20	2.0151	1.235	53.153	39	8	sand to silty sand
140.256	172.87	1.9466	1.126	54.944	41	8	sand to silty sand
140.420	206.49	2.2131	1.072	58.813	40	9	sand
140.584	268.25	1.9421	0.724	50.890	51	9	sand
140.748	266.04	1.6850	0.633	55.805	51	9	sand
140.912	267.85	1.9837	0.741	55.981	51	9	sand
141.076	241.27	2.2340	0.926	60.062	46	9	sand
141.240	232.92	2.1655	0.930	56.677	45	9	sand
141.404	239.10	2.1676	0.907	54.272	46	9	sand
141.568	223.55	2.2681	1.015	57.053	43	9	sand
141.732	190.07	2.0482	1.078	55.545	36	9	sand
141.896	170.42	1.8168	1.066	53.647	33	9	sand
142.060	160.79	1.5612	0.971	55.175	31	9	sand
142.224	154.30	1.3492	0.874	55.712	30	9	sand
142.389	151.30	1.2010	0.794	56.125	29	9	sand
142.553	152.75	1.1976	0.784	56.757	29	9	sand
142.717	158.02	1.2509	0.792	57.067	30	9	sand
142.881	180.67	1.4190	0.785	57.963	35	9	sand
143.045	210.34	1.8204	0.865	58.749	40	9	sand
143.209	213.94	1.9767	0.924	58.028	41	9	sand
143.373	183.16	1.8795	1.026	54.882	35	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
143.537	175.08	1.5600	0.891	55.077	34	9	sand
143.701	177.42	1.5803	0.891	56.390	34	9	sand
143.865	215.80	1.8250	0.846	57.921	41	9	sand
144.029	243.53	2.1756	0.893	58.400	47	9	sand
144.193	262.71	3.1428	1.196	57.759	50	9	sand
144.357	253.35	2.8253	1.115	57.133	49	9	sand
144.521	188.37	2.3309	1.237	53.655	45	8	sand to silty sand
144.685	168.46	1.7646	1.047	54.526	32	9	sand
144.849	160.68	1.4668	0.913	55.596	31	9	sand
145.013	166.35	1.4342	0.862	57.002	32	9	sand
145.177	179.73	1.6012	0.891	58.124	34	9	sand
145.341	198.68	1.8554	0.934	58.813	38	9	sand
145.505	218.05	2.0865	0.957	59.588	42	9	sand
145.669	215.22	2.1936	1.019	58.148	41	9	sand
145.833	211.55	2.0974	0.991	56.995	41	9	sand
145.997	218.80	2.1535	0.984	57.472	42	9	sand
146.161	221.29	2.1512	0.972	58.691	42	9	sand
146.326	185.67	2.1297	1.147	55.927	36	9	sand
146.490	173.56	1.9269	1.110	56.666	42	8	sand to silty sand
146.654	166.67	1.6118	0.967	57.483	32	9	sand
146.818	167.76	1.5374	0.916	57.592	32	9	sand
146.982	170.70	1.5415	0.903	58.110	33	9	sand
147.146	176.26	1.6733	0.949	58.257	34	9	sand
147.310	184.00	1.7348	0.943	58.602	35	9	sand
147.474	187.23	1.8089	0.966	58.015	36	9	sand
147.638	190.68	1.8973	0.995	58.553	37	9	sand
147.802	195.24	2.0998	1.076	59.080	37	9	sand
147.966	199.24	2.2354	1.122	59.109	38	9	sand
148.130	206.28	2.2955	1.113	59.817	40	9	sand
148.294	227.41	2.4448	1.075	59.677	44	9	sand
148.458	247.96	2.7075	1.092	60.972	47	9	sand
148.622	227.27	2.8928	1.273	59.982	44	9	sand
148.786	196.37	2.6668	1.358	55.554	47	8	sand to silty sand
148.950	184.42	2.3662	1.283	57.207	44	8	sand to silty sand
149.114	177.39	2.1413	1.207	57.614	42	8	sand to silty sand
149.278	177.28	1.9477	1.099	58.591	34	9	sand
149.442	174.68	1.8728	1.072	59.468	33	9	sand
149.606	169.44	1.7214	1.016	58.771	32	9	sand
149.770	169.49	1.6049	0.947	58.742	32	9	sand
149.934	177.05	1.6994	0.960	59.570	34	9	sand
150.098	184.44	1.7105	0.927	59.991	35	9	sand
150.263	194.65	1.7305	0.889	60.349	37	9	sand

Haley & Aldrich / SCPT-6 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 10:09:48 AM
TOTAL DEPTH: 121.719 ft



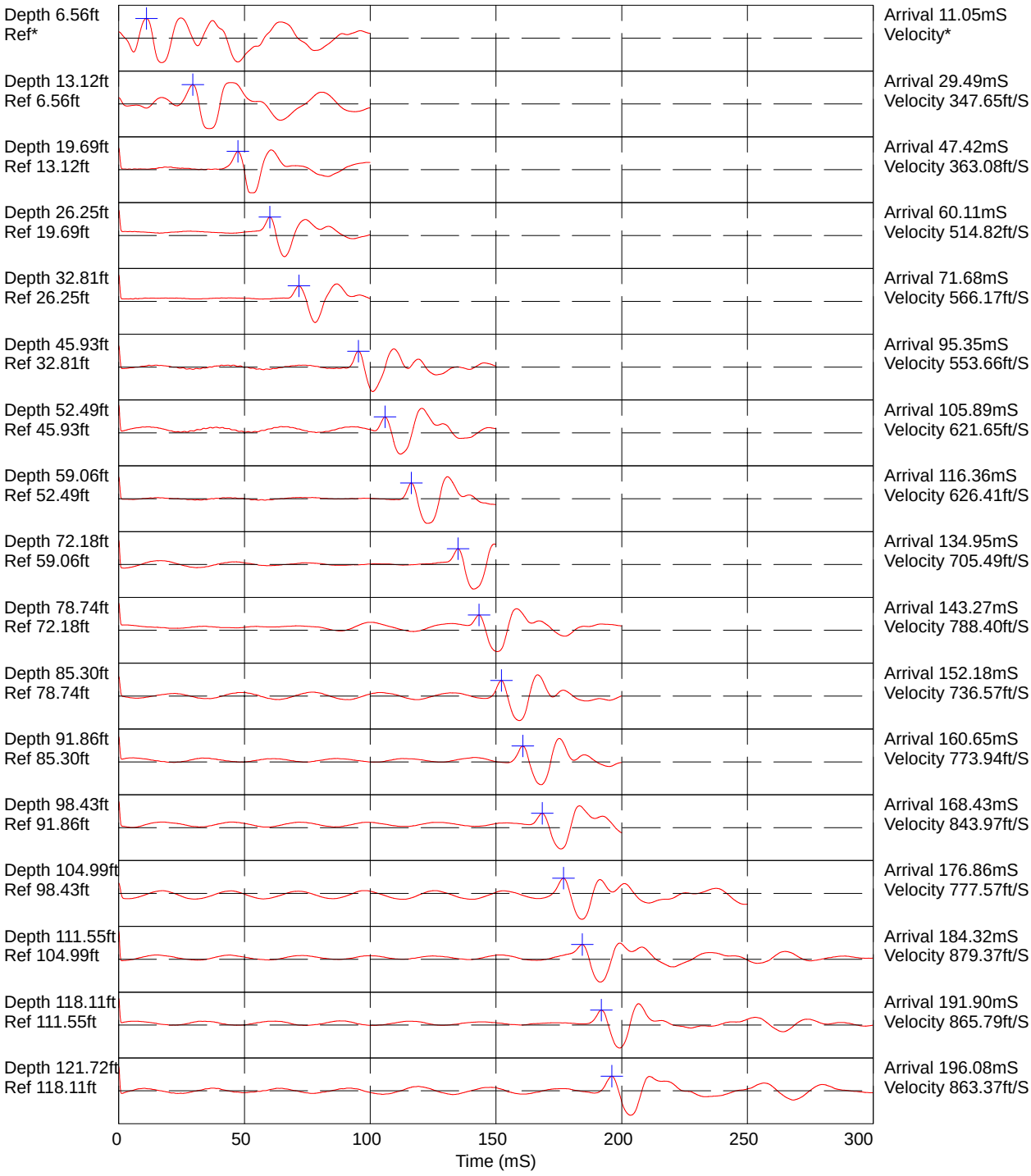
REMARKS

Air Knifed / Vac'd to 5'

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Haley & Aldrich / SCPT-6 / 4580 NE Marine Dr Portland



Hammer to Rod String Distance (ft): 2.04
* = Not Determined

Haley & Aldrich / SCPT-6 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
TEST DATE: 2/28/2023 10:09:48 AM
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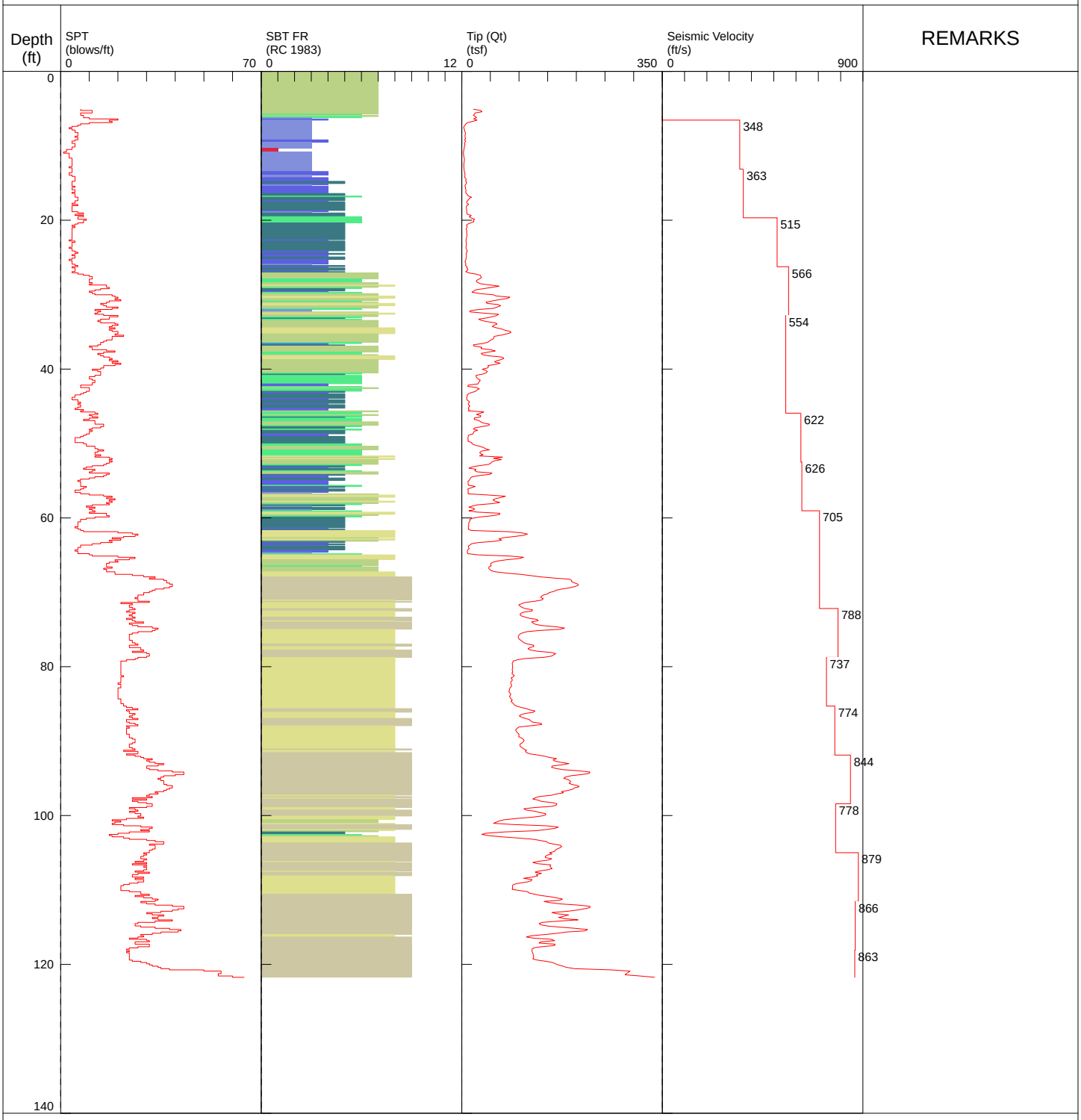

1 sensitive fine grained
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6 sandy silt to clayey silt
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11 very stiff fine grained (*)
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*SBT/SPT CORRELATION: UBC-1983

Haley & Aldrich / SCPT-6 / 4580 NE Marine Dr Portland

OPERATOR: OGE BAK
CONE ID: DDG1296
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TOTAL DEPTH: 121.719 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
5.085	20.63	0.0200	0.097	0.100	7	7	silty sand to sandy silt
5.249	33.05	0.0433	0.131	0.128	11	7	silty sand to sandy silt
5.413	35.34	0.0858	0.243	0.251	11	7	silty sand to sandy silt
5.577	23.39	0.1123	0.480	0.671	7	7	silty sand to sandy silt
5.741	21.85	0.0950	0.435	0.719	7	7	silty sand to sandy silt
5.906	20.10	0.1054	0.524	0.733	8	6	sandy silt to clayey silt
6.070	24.23	0.1739	0.718	0.808	8	7	silty sand to sandy silt
6.234	25.73	0.4797	1.864	0.908	10	6	sandy silt to clayey silt
6.398	20.76	0.9344	4.502	1.087	20	3	clay
6.562	26.59	1.0833	4.074	2.173	17	4	silty clay to clay
6.726	18.82	0.8864	4.710	-6.553	18	3	clay
6.890	10.29	0.5099	4.954	-7.241	10	3	clay
7.054	7.28	0.3026	4.158	-7.202	7	3	clay
7.218	5.92	0.2047	3.457	-6.990	6	3	clay
7.382	3.93	0.1603	4.078	-6.728	4	3	clay
7.546	3.33	0.1422	4.269	-6.439	3	3	clay
7.710	4.25	0.1602	3.765	-6.132	4	3	clay
7.874	4.89	0.1968	4.022	-5.798	5	3	clay
8.038	5.28	0.2417	4.581	-5.522	5	3	clay
8.202	6.01	0.2421	4.028	-5.310	6	3	clay
8.366	6.46	0.2379	3.683	-5.132	6	3	clay
8.530	5.96	0.2515	4.223	-5.001	6	3	clay
8.694	5.71	0.2388	4.181	-4.806	5	3	clay
8.858	5.92	0.2077	3.509	-4.438	6	3	clay
9.022	6.72	0.2313	3.444	-3.976	6	3	clay
9.186	4.88	0.2169	4.439	-3.909	5	3	clay
9.350	6.79	0.1489	2.193	-2.619	4	4	silty clay to clay
9.514	5.63	0.0970	1.723	-2.719	4	4	silty clay to clay
9.678	4.73	0.1074	2.272	-2.460	5	3	clay
9.843	5.32	0.1285	2.416	-1.892	5	3	clay
10.007	5.26	0.1397	2.658	-0.365	5	3	clay
10.171	4.12	0.1133	2.747	-0.184	4	3	clay
10.335	4.39	0.0949	2.159	0.109	4	3	clay
10.499	3.86	0.0729	1.890	0.371	2	1	sensitive fine grained
10.663	3.37	0.0650	1.927	0.853	2	1	sensitive fine grained
10.827	3.09	0.0614	1.987	1.552	1	1	sensitive fine grained
10.991	2.99	0.0666	2.226	2.290	3	3	clay
11.155	3.02	0.0730	2.418	3.065	3	3	clay
11.319	3.57	0.0829	2.323	3.931	3	3	clay
11.483	3.60	0.1015	2.824	4.667	3	3	clay
11.647	4.35	0.1137	2.614	5.581	4	3	clay
11.811	4.44	0.1337	3.013	6.249	4	3	clay
11.975	4.39	0.1181	2.687	6.664	4	3	clay
12.139	4.36	0.1101	2.524	7.219	4	3	clay
12.303	3.81	0.0983	2.584	8.656	4	3	clay
12.467	3.68	0.0975	2.650	9.467	4	3	clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
12.631	3.82	0.0999	2.614	13.521	4	3	clay
12.795	3.61	0.0944	2.613	14.549	3	3	clay
12.959	3.78	0.1030	2.726	15.374	4	3	clay
13.123	3.98	0.1025	2.577	16.173	4	3	clay
13.287	4.23	0.1082	2.561	11.738	4	3	clay
13.451	4.26	0.1046	2.456	15.078	4	3	clay
13.615	5.37	0.0983	1.829	16.638	3	4	silty clay to clay
13.780	5.37	0.1043	1.943	17.692	3	4	silty clay to clay
13.944	5.58	0.1168	2.093	19.745	4	4	silty clay to clay
14.108	5.15	0.1382	2.682	16.569	5	3	clay
14.272	5.36	0.1626	3.032	17.965	5	3	clay
14.436	7.29	0.1512	2.076	20.511	5	4	silty clay to clay
14.600	7.52	0.1686	2.243	17.026	5	4	silty clay to clay
14.764	6.76	0.1649	2.439	14.582	4	4	silty clay to clay
14.928	8.44	0.1351	1.599	16.109	4	5	clayey silt to silty clay
15.092	7.59	0.1140	1.503	14.828	4	5	clayey silt to silty clay
15.256	6.18	0.1260	2.039	20.617	4	4	silty clay to clay
15.420	5.44	0.1441	2.647	24.487	5	3	clay
15.584	6.71	0.1161	1.731	25.924	4	4	silty clay to clay
15.748	6.20	0.1198	1.932	20.439	4	4	silty clay to clay
15.912	7.37	0.1292	1.752	29.939	5	4	silty clay to clay
16.076	7.26	0.1507	2.075	27.958	5	4	silty clay to clay
16.240	6.92	0.1833	2.649	27.568	4	4	silty clay to clay
16.404	7.74	0.1617	2.089	24.896	5	4	silty clay to clay
16.568	10.07	0.1562	1.552	17.739	5	5	clayey silt to silty clay
16.732	11.33	0.1487	1.312	23.007	5	5	clayey silt to silty clay
16.896	16.86	0.1973	1.170	3.761	6	6	sandy silt to clayey silt
17.060	13.33	0.1818	1.364	4.736	6	5	clayey silt to silty clay
17.224	11.94	0.1576	1.320	8.247	6	5	clayey silt to silty clay
17.388	9.98	0.2089	2.093	11.977	5	5	clayey silt to silty clay
17.552	8.58	0.2386	2.782	17.229	5	4	silty clay to clay
17.717	9.29	0.1577	1.698	18.633	4	5	clayey silt to silty clay
17.881	11.99	0.1473	1.228	14.557	6	5	clayey silt to silty clay
18.045	8.50	0.1598	1.881	19.352	4	5	clayey silt to silty clay
18.209	7.99	0.1312	1.642	27.134	4	5	clayey silt to silty clay
18.373	8.18	0.1363	1.665	29.624	4	5	clayey silt to silty clay
18.537	8.27	0.1351	1.633	32.380	4	5	clayey silt to silty clay
18.701	8.52	0.1685	1.977	34.057	4	5	clayey silt to silty clay
18.865	8.79	0.2383	2.712	35.080	6	4	silty clay to clay
19.029	8.74	0.2973	3.400	25.579	8	3	clay
19.193	9.79	0.1468	1.499	17.263	5	5	clayey silt to silty clay
19.357	16.56	0.2907	1.756	8.885	8	5	clayey silt to silty clay
19.521	13.16	0.3008	2.285	10.827	6	5	clayey silt to silty clay
19.685	15.86	0.2264	1.428	12.217	6	6	sandy silt to clayey silt
19.849	22.34	0.2727	1.221	-3.081	9	6	sandy silt to clayey silt
20.013	20.33	0.2030	0.998	-1.410	8	6	sandy silt to clayey silt
20.177	21.15	0.1948	0.921	-0.919	8	6	sandy silt to clayey silt
20.341	15.76	0.2122	1.347	1.463	6	6	sandy silt to clayey silt
20.505	10.38	0.1962	1.890	5.971	5	5	clayey silt to silty clay
20.669	8.25	0.1459	1.769	18.477	4	5	clayey silt to silty clay
20.833	9.40	0.1342	1.427	31.329	5	5	clayey silt to silty clay
20.997	8.77	0.1318	1.502	38.916	4	5	clayey silt to silty clay
21.161	7.72	0.1373	1.779	43.571	4	5	clayey silt to silty clay
21.325	8.22	0.1333	1.622	48.857	4	5	clayey silt to silty clay
21.490	8.81	0.1327	1.507	48.589	4	5	clayey silt to silty clay
21.654	8.38	0.1473	1.758	51.860	4	5	clayey silt to silty clay
21.818	9.01	0.1673	1.856	52.456	4	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
21.982	9.11	0.1756	1.927	50.548	4	5	clayey silt to silty clay
22.146	8.91	0.1564	1.755	48.038	4	5	clayey silt to silty clay
22.310	8.34	0.1304	1.563	48.901	4	5	clayey silt to silty clay
22.474	7.96	0.1248	1.569	39.911	4	5	clayey silt to silty clay
22.638	7.22	0.1166	1.614	47.614	3	5	clayey silt to silty clay
22.802	7.24	0.1267	1.749	50.074	5	4	silty clay to clay
22.966	7.56	0.1265	1.672	49.194	4	5	clayey silt to silty clay
23.130	8.12	0.1294	1.593	43.633	4	5	clayey silt to silty clay
23.294	8.01	0.1266	1.581	45.873	4	5	clayey silt to silty clay
23.458	7.68	0.1164	1.516	45.410	4	5	clayey silt to silty clay
23.622	7.26	0.1172	1.614	48.642	3	5	clayey silt to silty clay
23.786	7.39	0.1193	1.614	52.102	4	5	clayey silt to silty clay
23.950	8.54	0.1412	1.654	54.033	4	5	clayey silt to silty clay
24.114	9.54	0.1962	2.057	55.599	5	5	clayey silt to silty clay
24.278	8.97	0.2000	2.230	42.471	6	4	silty clay to clay
24.442	7.54	0.1777	2.358	38.838	5	4	silty clay to clay
24.606	7.96	0.1469	1.846	47.659	4	5	clayey silt to silty clay
24.770	7.98	0.1560	1.955	48.079	5	4	silty clay to clay
24.934	8.20	0.1633	1.991	46.775	5	4	silty clay to clay
25.098	7.77	0.1370	1.764	46.561	4	5	clayey silt to silty clay
25.262	7.15	0.1023	1.431	44.836	3	5	clayey silt to silty clay
25.427	6.49	0.1188	1.829	47.480	4	4	silty clay to clay
25.591	5.52	0.1330	2.410	42.780	4	4	silty clay to clay
25.755	6.81	0.1337	1.962	30.900	4	4	silty clay to clay
25.919	7.22	0.1471	2.037	31.040	5	4	silty clay to clay
26.083	6.51	0.1763	2.710	29.067	6	3	clay
26.247	9.25	0.1609	1.739	28.167	4	5	clayey silt to silty clay
26.411	8.58	0.1790	2.086	10.225	5	4	silty clay to clay
26.575	10.88	0.1332	1.224	20.887	5	5	clayey silt to silty clay
26.739	9.83	0.1162	1.182	17.081	5	5	clayey silt to silty clay
26.903	6.91	0.1453	2.102	28.591	4	4	silty clay to clay
27.067	11.49	0.1949	1.696	43.335	6	5	clayey silt to silty clay
27.231	24.87	0.2090	0.840	8.798	8	7	silty sand to sandy silt
27.395	32.44	0.2112	0.651	-0.293	10	7	silty sand to sandy silt
27.559	33.25	0.2718	0.817	-0.348	11	7	silty sand to sandy silt
27.723	34.42	0.2768	0.804	0.120	11	7	silty sand to sandy silt
27.887	30.22	0.3413	1.129	0.669	10	7	silty sand to sandy silt
28.051	26.52	0.3626	1.367	1.301	10	6	sandy silt to clayey silt
28.215	25.40	0.4427	1.743	2.599	10	6	sandy silt to clayey silt
28.379	28.03	0.4755	1.696	2.154	11	6	sandy silt to clayey silt
28.543	32.88	0.2960	0.900	-1.337	10	7	silty sand to sandy silt
28.707	49.70	0.4186	0.842	-5.121	16	7	silty sand to sandy silt
28.871	65.08	0.5516	0.848	-6.542	16	8	sand to silty sand
29.035	52.27	0.6733	1.288	1.727	17	7	silty sand to sandy silt
29.199	37.37	0.8195	2.193	2.792	14	6	sandy silt to clayey silt
29.364	24.16	0.6724	2.783	4.087	12	5	clayey silt to silty clay
29.528	20.76	0.6432	3.098	8.776	10	5	clayey silt to silty clay
29.692	17.76	0.5994	3.376	14.387	11	4	silty clay to clay
29.856	31.97	0.4613	1.443	15.992	12	6	sandy silt to clayey silt
30.020	55.04	0.4734	0.860	-0.265	18	7	silty sand to sandy silt
30.184	60.26	0.5320	0.883	-2.644	19	7	silty sand to sandy silt
30.348	83.84	0.6781	0.809	-1.017	20	8	sand to silty sand
30.512	79.30	0.7451	0.940	-1.713	19	8	sand to silty sand
30.676	64.88	0.7576	1.168	-0.708	21	7	silty sand to sandy silt
30.840	53.86	0.7167	1.331	0.552	17	7	silty sand to sandy silt
31.004	42.63	0.7635	1.791	3.143	16	6	sandy silt to clayey silt
31.168	44.10	0.6373	1.445	4.190	14	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
31.332	63.60	0.5320	0.837	2.914	15	8	sand to silty sand
31.496	67.80	0.5893	0.869	-3.499	16	8	sand to silty sand
31.660	61.65	0.7220	1.171	-2.438	20	7	silty sand to sandy silt
31.824	55.74	0.9071	1.627	-0.254	18	7	silty sand to sandy silt
31.988	30.42	0.8323	2.736	2.505	12	6	sandy silt to clayey silt
32.152	14.81	0.8385	5.663	4.747	14	3	clay
32.316	14.05	0.5828	4.149	16.226	13	3	clay
32.480	36.79	0.4674	1.270	27.504	12	7	silty sand to sandy silt
32.644	63.95	0.5864	0.917	1.764	15	8	sand to silty sand
32.808	61.11	0.7073	1.157	1.936	20	7	silty sand to sandy silt
32.972	52.76	0.7871	1.492	7.205	17	7	silty sand to sandy silt
33.136	43.23	0.8909	2.061	8.704	17	6	sandy silt to clayey silt
33.301	29.28	0.8884	3.034	8.041	14	5	clayey silt to silty clay
33.465	33.98	0.6025	1.773	7.046	13	6	sandy silt to clayey silt
33.629	44.08	0.4125	0.936	-3.413	14	7	silty sand to sandy silt
33.793	58.48	0.5173	0.885	-5.539	19	7	silty sand to sandy silt
33.957	61.45	0.6171	1.004	-5.216	20	7	silty sand to sandy silt
34.121	55.82	0.7123	1.276	-4.087	18	7	silty sand to sandy silt
34.285	53.40	0.7133	1.336	-2.404	17	7	silty sand to sandy silt
34.449	60.04	0.6555	1.092	-0.641	19	7	silty sand to sandy silt
34.613	69.36	0.6819	0.983	-0.864	17	8	sand to silty sand
34.777	75.72	0.7264	0.959	-0.220	18	8	sand to silty sand
34.941	84.86	0.8710	1.026	-0.167	20	8	sand to silty sand
35.105	85.58	0.9797	1.145	0.981	20	8	sand to silty sand
35.269	78.63	0.8954	1.139	2.736	19	8	sand to silty sand
35.433	68.62	0.8389	1.223	3.845	22	7	silty sand to sandy silt
35.597	56.80	0.7811	1.375	6.714	18	7	silty sand to sandy silt
35.761	55.93	0.7257	1.298	7.921	18	7	silty sand to sandy silt
35.925	55.27	0.7036	1.273	8.119	18	7	silty sand to sandy silt
36.089	50.95	0.6520	1.280	5.943	16	7	silty sand to sandy silt
36.253	48.07	0.6315	1.314	8.411	15	7	silty sand to sandy silt
36.417	45.29	0.7264	1.604	8.963	14	7	silty sand to sandy silt
36.581	36.10	1.0039	2.781	8.489	14	6	sandy silt to clayey silt
36.745	20.38	0.7955	3.903	9.325	13	4	silty clay to clay
36.909	21.30	0.4578	2.150	19.656	10	5	clayey silt to silty clay
37.073	34.67	0.4505	1.299	2.909	11	7	silty sand to sandy silt
37.238	33.45	0.4299	1.285	0.337	11	7	silty sand to sandy silt
37.402	51.00	0.4341	0.851	1.936	16	7	silty sand to sandy silt
37.566	58.44	0.5413	0.926	-1.220	19	7	silty sand to sandy silt
37.730	45.93	0.7565	1.647	0.532	15	7	silty sand to sandy silt
37.894	33.70	0.7528	2.234	2.201	13	6	sandy silt to clayey silt
38.058	36.22	0.7412	2.046	5.040	14	6	sandy silt to clayey silt
38.222	46.85	0.5215	1.113	1.343	15	7	silty sand to sandy silt
38.386	69.86	0.4979	0.713	-3.190	17	8	sand to silty sand
38.550	73.20	0.4601	0.629	-4.107	18	8	sand to silty sand
38.714	69.32	0.6504	0.938	-2.867	17	8	sand to silty sand
38.878	61.18	0.7515	1.228	6.193	20	7	silty sand to sandy silt
39.042	57.31	0.7381	1.288	7.447	18	7	silty sand to sandy silt
39.206	67.24	0.7637	1.136	9.888	21	7	silty sand to sandy silt
39.370	58.08	0.7529	1.296	6.227	19	7	silty sand to sandy silt
39.534	45.76	0.8088	1.767	8.559	15	7	silty sand to sandy silt
39.698	46.78	0.6117	1.308	9.553	15	7	silty sand to sandy silt
39.862	44.67	0.5610	1.256	3.329	14	7	silty sand to sandy silt
40.026	35.97	0.5279	1.468	2.443	11	7	silty sand to sandy silt
40.190	41.91	0.4814	1.149	6.012	13	7	silty sand to sandy silt
40.354	44.63	0.4762	1.067	4.171	14	7	silty sand to sandy silt
40.518	42.32	0.5252	1.241	4.689	14	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
40.682	36.46	0.6092	1.671	6.868	14	6	sandy silt to clayey silt
40.846	24.93	0.6355	2.549	7.971	12	5	clayey silt to silty clay
41.011	24.96	0.5160	2.067	9.963	10	6	sandy silt to clayey silt
41.175	26.05	0.4674	1.794	3.134	10	6	sandy silt to clayey silt
41.339	28.83	0.4341	1.506	3.747	11	6	sandy silt to clayey silt
41.503	32.25	0.5401	1.675	4.455	12	6	sandy silt to clayey silt
41.667	30.59	0.5607	1.833	5.957	12	6	sandy silt to clayey silt
41.831	29.18	0.4663	1.598	8.592	11	6	sandy silt to clayey silt
41.995	28.25	0.3711	1.314	7.690	11	6	sandy silt to clayey silt
42.159	11.13	0.3377	3.035	19.216	7	4	silty clay to clay
42.323	10.65	0.3082	2.895	38.328	7	4	silty clay to clay
42.487	25.98	0.2636	1.015	43.722	10	6	sandy silt to clayey silt
42.651	30.61	0.3621	1.183	10.573	10	7	silty sand to sandy silt
42.815	26.58	0.3547	1.334	12.000	10	6	sandy silt to clayey silt
42.979	24.29	0.4672	1.923	14.463	9	6	sandy silt to clayey silt
43.143	16.99	0.4860	2.861	19.567	8	5	clayey silt to silty clay
43.307	11.57	0.3364	2.908	37.584	7	4	silty clay to clay
43.471	9.43	0.1901	2.016	52.311	5	5	clayey silt to silty clay
43.635	9.83	0.1611	1.639	53.119	5	5	clayey silt to silty clay
43.799	8.53	0.1596	1.871	56.602	4	5	clayey silt to silty clay
43.963	8.63	0.1594	1.848	58.037	4	5	clayey silt to silty clay
44.127	8.75	0.1889	2.158	58.892	6	4	silty clay to clay
44.291	11.77	0.1726	1.467	54.345	6	5	clayey silt to silty clay
44.455	13.62	0.1886	1.384	42.011	7	5	clayey silt to silty clay
44.619	11.65	0.2394	2.054	49.812	6	5	clayey silt to silty clay
44.783	11.50	0.2982	2.594	55.248	7	4	silty clay to clay
44.948	14.31	0.2369	1.656	54.184	7	5	clayey silt to silty clay
45.112	12.51	0.2706	2.163	44.650	6	5	clayey silt to silty clay
45.276	11.10	0.2672	2.407	52.490	5	5	clayey silt to silty clay
45.440	12.82	0.3562	2.779	44.535	8	4	silty clay to clay
45.604	11.54	0.3252	2.818	52.141	7	4	silty clay to clay
45.768	38.38	0.5009	1.305	40.546	12	7	silty sand to sandy silt
45.932	32.72	0.6399	1.956	16.574	13	6	sandy silt to clayey silt
46.096	25.96	0.5201	2.004	13.655	10	6	sandy silt to clayey silt
46.260	33.13	0.3740	1.129	23.453	11	7	silty sand to sandy silt
46.424	32.91	0.5435	1.652	9.918	13	6	sandy silt to clayey silt
46.588	21.79	0.5930	2.722	16.143	10	5	clayey silt to silty clay
46.752	21.92	0.4573	2.086	32.848	8	6	sandy silt to clayey silt
46.916	30.24	0.5059	1.673	19.709	12	6	sandy silt to clayey silt
47.080	32.58	0.6048	1.856	19.673	12	6	sandy silt to clayey silt
47.244	37.22	0.4524	1.216	18.895	12	7	silty sand to sandy silt
47.408	48.29	0.4380	0.907	11.671	15	7	silty sand to sandy silt
47.572	47.29	0.5893	1.246	12.058	15	7	silty sand to sandy silt
47.736	35.42	0.7895	2.229	17.497	14	6	sandy silt to clayey silt
47.900	22.71	0.7756	3.415	23.214	11	5	clayey silt to silty clay
48.064	20.26	0.5039	2.486	41.975	10	5	clayey silt to silty clay
48.228	27.48	0.5867	2.135	24.857	11	6	sandy silt to clayey silt
48.392	21.57	0.4803	2.227	29.385	10	5	clayey silt to silty clay
48.556	20.43	0.4343	2.126	31.137	10	5	clayey silt to silty clay
48.720	19.35	0.4025	2.080	28.307	9	5	clayey silt to silty clay
48.885	11.80	0.3568	3.024	45.254	8	4	silty clay to clay
49.049	11.06	0.2957	2.673	59.611	7	4	silty clay to clay
49.213	10.95	0.2644	2.414	65.356	5	5	clayey silt to silty clay
49.377	10.56	0.2422	2.294	64.865	5	5	clayey silt to silty clay
49.541	11.22	0.2727	2.429	61.349	5	5	clayey silt to silty clay
49.705	10.60	0.2485	2.345	65.278	5	5	clayey silt to silty clay
49.869	17.43	0.3136	1.799	52.033	8	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
50.033	17.92	0.4436	2.476	42.293	9	5	clayey silt to silty clay
50.197	22.53	0.4333	1.923	37.464	9	6	sandy silt to clayey silt
50.361	30.29	0.4201	1.387	21.784	12	6	sandy silt to clayey silt
50.525	38.09	0.4254	1.117	16.661	12	7	silty sand to sandy silt
50.689	41.34	0.3534	0.855	12.476	13	7	silty sand to sandy silt
50.853	47.97	0.5205	1.085	10.855	15	7	silty sand to sandy silt
51.017	34.62	0.7343	2.121	9.879	13	6	sandy silt to clayey silt
51.181	31.86	0.5613	1.762	17.391	12	6	sandy silt to clayey silt
51.345	31.96	0.6302	1.972	24.222	12	6	sandy silt to clayey silt
51.509	37.14	0.7803	2.101	22.812	14	6	sandy silt to clayey silt
51.673	31.01	0.4875	1.572	40.142	12	6	sandy silt to clayey silt
51.837	70.86	0.6427	0.907	15.613	17	8	sand to silty sand
52.001	55.72	0.7436	1.335	12.752	18	7	silty sand to sandy silt
52.165	69.34	0.5949	0.858	10.556	17	8	sand to silty sand
52.329	57.00	0.5668	0.994	3.555	18	7	silty sand to sandy silt
52.493	52.28	0.7336	1.403	4.332	17	7	silty sand to sandy silt
52.657	50.40	0.4974	0.987	6.801	16	7	silty sand to sandy silt
52.822	46.76	0.6843	1.463	1.613	15	7	silty sand to sandy silt
52.986	29.67	0.7434	2.505	3.020	11	6	sandy silt to clayey silt
53.150	18.47	0.6042	3.272	16.995	9	5	clayey silt to silty clay
53.314	12.73	0.4315	3.389	49.743	8	4	silty clay to clay
53.478	24.89	0.6080	2.443	53.431	12	5	clayey silt to silty clay
53.642	22.65	0.7251	3.201	20.923	11	5	clayey silt to silty clay
53.806	26.50	0.4808	1.814	32.667	10	6	sandy silt to clayey silt
53.970	52.72	0.5526	1.048	15.950	17	7	silty sand to sandy silt
54.134	48.75	0.8134	1.669	8.815	16	7	silty sand to sandy silt
54.298	31.27	0.9540	3.051	18.199	15	5	clayey silt to silty clay
54.462	18.24	0.7556	4.142	31.143	12	4	silty clay to clay
54.626	15.27	0.4757	3.115	53.284	10	4	silty clay to clay
54.790	14.23	0.2807	1.972	54.334	7	5	clayey silt to silty clay
54.954	13.15	0.2906	2.211	57.505	6	5	clayey silt to silty clay
55.118	10.55	0.2832	2.685	70.070	7	4	silty clay to clay
55.282	11.16	0.2982	2.671	71.535	7	4	silty clay to clay
55.446	11.28	0.2951	2.617	67.624	7	4	silty clay to clay
55.610	11.44	0.3435	3.003	72.594	7	4	silty clay to clay
55.774	23.54	0.3992	1.696	34.336	9	6	sandy silt to clayey silt
55.938	17.54	0.3868	2.205	17.820	8	5	clayey silt to silty clay
56.102	10.59	0.3476	3.282	45.449	7	4	silty clay to clay
56.266	10.97	0.2485	2.265	65.261	5	5	clayey silt to silty clay
56.430	11.34	0.2076	1.830	68.267	5	5	clayey silt to silty clay
56.594	11.06	0.3028	2.738	70.134	7	4	silty clay to clay
56.759	10.79	0.4513	4.182	80.261	10	3	clay
56.923	46.04	0.3879	0.843	66.278	15	7	silty sand to sandy silt
57.087	76.32	0.4588	0.601	6.244	18	8	sand to silty sand
57.251	68.74	0.5019	0.730	6.065	16	8	sand to silty sand
57.415	58.88	0.5553	0.943	10.453	19	7	silty sand to sandy silt
57.579	54.34	0.7135	1.313	14.903	17	7	silty sand to sandy silt
57.743	57.72	0.7947	1.377	17.951	18	7	silty sand to sandy silt
57.907	66.01	0.4689	0.710	2.193	16	8	sand to silty sand
58.071	53.91	1.0255	1.902	-2.666	17	7	silty sand to sandy silt
58.235	27.85	0.7019	2.520	0.301	11	6	sandy silt to clayey silt
58.399	18.91	0.6431	3.401	33.113	9	5	clayey silt to silty clay
58.563	12.25	0.4892	3.993	38.671	12	3	clay
58.727	21.73	0.4959	2.282	75.642	10	5	clayey silt to silty clay
58.891	21.94	0.4907	2.237	19.269	11	5	clayey silt to silty clay
59.055	12.58	0.5827	4.634	44.388	12	3	clay
59.219	26.91	0.4714	1.751	68.022	10	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
59.383	66.30	0.3634	0.548	11.395	16	8	sand to silty sand
59.547	66.10	0.4924	0.745	3.686	16	8	sand to silty sand
59.711	54.18	0.7267	1.341	9.325	17	7	silty sand to sandy silt
59.875	31.44	0.8442	2.685	16.151	12	6	sandy silt to clayey silt
60.039	19.28	0.6095	3.161	33.536	9	5	clayey silt to silty clay
60.203	14.32	0.3459	2.416	55.841	7	5	clayey silt to silty clay
60.367	14.56	0.2721	1.869	65.852	7	5	clayey silt to silty clay
60.532	13.21	0.2577	1.950	68.799	6	5	clayey silt to silty clay
60.696	12.10	0.2596	2.145	74.377	6	5	clayey silt to silty clay
60.860	12.09	0.2433	2.012	78.208	6	5	clayey silt to silty clay
61.024	12.26	0.2364	1.929	79.392	6	5	clayey silt to silty clay
61.188	11.23	0.2606	2.320	83.825	5	5	clayey silt to silty clay
61.352	11.82	0.2414	2.042	84.636	6	5	clayey silt to silty clay
61.516	11.34	0.3329	2.936	82.499	7	4	silty clay to clay
61.680	16.71	0.4302	2.575	103.068	8	5	clayey silt to silty clay
61.844	81.91	0.6011	0.734	29.524	20	8	sand to silty sand
62.008	104.63	0.8790	0.840	12.083	25	8	sand to silty sand
62.172	114.51	1.0199	0.891	17.984	27	8	sand to silty sand
62.336	107.97	1.0076	0.933	18.792	26	8	sand to silty sand
62.500	92.40	0.7731	0.837	18.931	22	8	sand to silty sand
62.664	73.45	0.7347	1.000	17.427	18	8	sand to silty sand
62.828	65.16	0.6863	1.053	19.773	21	7	silty sand to sandy silt
62.992	69.70	0.6398	0.918	15.591	17	8	sand to silty sand
63.156	56.62	0.8247	1.457	2.449	18	7	silty sand to sandy silt
63.320	28.76	0.9200	3.199	-0.440	14	5	clayey silt to silty clay
63.484	17.24	0.5739	3.329	9.531	11	4	silty clay to clay
63.648	14.14	0.3921	2.773	42.251	7	5	clayey silt to silty clay
63.812	11.33	0.3381	2.986	66.972	7	4	silty clay to clay
63.976	11.87	0.2802	2.359	65.662	6	5	clayey silt to silty clay
64.140	13.10	0.2124	1.621	58.753	6	5	clayey silt to silty clay
64.304	10.41	0.2328	2.236	62.684	5	5	clayey silt to silty clay
64.469	9.60	0.2308	2.404	75.313	6	4	silty clay to clay
64.633	9.70	0.2457	2.534	72.605	6	4	silty clay to clay
64.797	10.40	0.4127	3.969	75.531	10	3	clay
64.961	28.63	0.4234	1.479	64.425	11	6	sandy silt to clayey silt
65.125	84.70	0.5744	0.678	10.398	20	8	sand to silty sand
65.289	107.82	0.7384	0.685	13.524	26	8	sand to silty sand
65.453	99.63	0.8081	0.811	18.917	24	8	sand to silty sand
65.617	77.74	0.7539	0.970	18.920	19	8	sand to silty sand
65.781	62.89	0.6425	1.022	20.363	20	7	silty sand to sandy silt
65.945	54.53	0.6420	1.177	18.057	17	7	silty sand to sandy silt
66.109	50.67	0.8776	1.732	9.696	16	7	silty sand to sandy silt
66.273	50.62	0.9501	1.877	3.201	16	7	silty sand to sandy silt
66.437	51.37	0.9331	1.816	0.410	16	7	silty sand to sandy silt
66.601	47.66	0.9856	2.068	-0.694	18	6	sandy silt to clayey silt
66.765	46.89	0.8475	1.808	0.855	15	7	silty sand to sandy silt
66.929	48.70	0.7152	1.469	0.323	16	7	silty sand to sandy silt
67.093	51.17	0.5984	1.169	-1.404	16	7	silty sand to sandy silt
67.257	58.89	0.7181	1.219	-1.613	19	7	silty sand to sandy silt
67.421	78.62	0.5171	0.658	1.075	19	8	sand to silty sand
67.585	102.62	0.6875	0.670	2.764	25	8	sand to silty sand
67.749	119.19	0.9052	0.760	4.207	29	8	sand to silty sand
67.913	137.07	1.1859	0.865	11.891	33	8	sand to silty sand
68.077	160.55	1.1366	0.708	20.001	31	9	sand
68.241	188.47	1.4706	0.780	22.208	36	9	sand
68.406	191.74	1.6365	0.853	23.584	37	9	sand
68.570	191.84	1.7761	0.926	22.654	37	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
68.734	196.90	1.8370	0.933	22.668	38	9	sand
68.898	202.54	1.8854	0.931	23.785	39	9	sand
69.062	203.23	1.9235	0.946	24.150	39	9	sand
69.226	196.71	1.9305	0.981	23.545	38	9	sand
69.390	187.56	1.8628	0.993	23.258	36	9	sand
69.554	174.61	1.7792	1.019	24.348	33	9	sand
69.718	164.77	1.6403	0.996	22.378	32	9	sand
69.882	160.69	1.4989	0.933	22.726	31	9	sand
70.046	152.28	1.3926	0.914	22.556	29	9	sand
70.210	150.24	1.2485	0.831	23.526	29	9	sand
70.374	142.55	1.1822	0.829	22.754	27	9	sand
70.538	138.75	1.0938	0.788	23.306	27	9	sand
70.702	137.78	1.0540	0.765	23.612	26	9	sand
70.866	142.15	0.9836	0.692	23.774	27	9	sand
71.030	139.59	0.9642	0.691	23.194	27	9	sand
71.194	127.43	0.9435	0.740	22.941	31	8	sand to silty sand
71.358	111.20	0.6240	0.561	21.667	21	9	sand
71.522	104.53	0.6108	0.584	22.576	25	8	sand to silty sand
71.686	99.44	0.6166	0.620	23.565	24	8	sand to silty sand
71.850	102.03	0.6349	0.622	23.743	24	8	sand to silty sand
72.014	104.52	0.6253	0.598	23.612	25	8	sand to silty sand
72.178	110.24	0.6344	0.575	24.141	26	8	sand to silty sand
72.343	123.51	0.6905	0.559	23.918	24	9	sand
72.507	122.56	0.7286	0.594	23.645	23	9	sand
72.671	107.62	0.7222	0.671	23.172	26	8	sand to silty sand
72.835	103.00	0.6891	0.669	23.448	25	8	sand to silty sand
72.999	101.54	0.6584	0.648	23.640	24	8	sand to silty sand
73.163	104.04	0.6656	0.640	24.130	25	8	sand to silty sand
73.327	110.43	0.6925	0.627	24.495	26	8	sand to silty sand
73.491	118.33	0.7204	0.609	24.481	23	9	sand
73.655	131.49	0.7928	0.603	24.607	25	9	sand
73.819	133.23	0.8463	0.635	24.632	26	9	sand
73.983	122.13	0.8459	0.693	24.111	29	8	sand to silty sand
74.147	124.35	0.8501	0.684	24.958	24	9	sand
74.311	129.07	0.8690	0.673	24.699	25	9	sand
74.475	140.33	1.0154	0.724	25.114	27	9	sand
74.639	165.01	0.9150	0.555	26.061	32	9	sand
74.803	179.20	1.1649	0.650	26.331	34	9	sand
74.967	171.53	1.2727	0.742	26.036	33	9	sand
75.131	135.58	1.2164	0.897	22.135	32	8	sand to silty sand
75.295	113.68	1.0386	0.914	23.069	27	8	sand to silty sand
75.459	105.31	0.8805	0.836	23.211	25	8	sand to silty sand
75.623	101.19	0.7857	0.776	24.320	24	8	sand to silty sand
75.787	99.44	0.7492	0.753	24.974	24	8	sand to silty sand
75.951	98.67	0.7161	0.726	25.468	24	8	sand to silty sand
76.115	98.65	0.7061	0.716	25.206	24	8	sand to silty sand
76.280	99.97	0.6914	0.692	25.312	24	8	sand to silty sand
76.444	102.97	0.7010	0.681	25.774	25	8	sand to silty sand
76.608	105.68	0.7207	0.682	25.810	25	8	sand to silty sand
76.772	108.52	0.7532	0.694	26.039	26	8	sand to silty sand
76.936	114.54	0.7856	0.686	25.844	27	8	sand to silty sand
77.100	125.26	0.8477	0.677	26.150	24	9	sand
77.264	125.87	0.8988	0.714	25.944	24	9	sand
77.428	118.77	0.9101	0.766	25.866	28	8	sand to silty sand
77.592	115.62	0.9016	0.780	25.417	28	8	sand to silty sand
77.756	119.57	0.8952	0.749	26.270	29	8	sand to silty sand
77.920	132.66	0.5749	0.433	27.178	25	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
78.084	156.14	0.7680	0.492	27.259	30	9	sand
78.248	163.72	0.9834	0.601	28.922	31	9	sand
78.412	160.47	1.1208	0.698	26.582	31	9	sand
78.576	156.14	1.0781	0.690	27.005	30	9	sand
78.740	142.56	0.9619	0.675	24.451	27	9	sand
78.904	109.80	0.8408	0.766	24.685	26	8	sand to silty sand
79.068	97.19	0.6889	0.709	24.785	23	8	sand to silty sand
79.232	89.66	0.5849	0.652	25.704	21	8	sand to silty sand
79.396	89.31	0.5335	0.597	26.551	21	8	sand to silty sand
79.560	87.93	0.5352	0.609	26.808	21	8	sand to silty sand
79.724	88.38	0.5218	0.590	26.401	21	8	sand to silty sand
79.888	88.57	0.5146	0.581	26.771	21	8	sand to silty sand
80.052	88.97	0.5109	0.574	26.827	21	8	sand to silty sand
80.217	88.52	0.5134	0.580	27.000	21	8	sand to silty sand
80.381	87.94	0.5114	0.581	27.033	21	8	sand to silty sand
80.545	88.48	0.5180	0.585	27.148	21	8	sand to silty sand
80.709	88.85	0.5257	0.592	27.343	21	8	sand to silty sand
80.873	87.44	0.5252	0.601	27.036	21	8	sand to silty sand
81.037	89.26	0.5433	0.609	27.487	21	8	sand to silty sand
81.201	91.73	0.5142	0.561	27.253	22	8	sand to silty sand
81.365	89.41	0.5092	0.569	27.384	21	8	sand to silty sand
81.529	86.15	0.5017	0.582	27.772	21	8	sand to silty sand
81.693	87.94	0.5053	0.575	27.802	21	8	sand to silty sand
81.857	88.01	0.5102	0.580	27.774	21	8	sand to silty sand
82.021	85.74	0.5029	0.587	27.839	21	8	sand to silty sand
82.185	85.27	0.4947	0.580	28.206	20	8	sand to silty sand
82.349	86.16	0.4973	0.577	28.170	21	8	sand to silty sand
82.513	87.16	0.5015	0.575	28.050	21	8	sand to silty sand
82.677	86.40	0.5105	0.591	27.925	21	8	sand to silty sand
82.841	84.17	0.4860	0.577	28.078	20	8	sand to silty sand
83.005	83.25	0.4855	0.583	28.332	20	8	sand to silty sand
83.169	83.24	0.4977	0.598	28.173	20	8	sand to silty sand
83.333	82.17	0.4875	0.593	28.727	20	8	sand to silty sand
83.497	83.47	0.4841	0.580	28.432	20	8	sand to silty sand
83.661	85.51	0.5071	0.593	28.736	20	8	sand to silty sand
83.825	84.85	0.4999	0.589	28.800	20	8	sand to silty sand
83.990	83.23	0.4843	0.582	28.775	20	8	sand to silty sand
84.154	84.91	0.5012	0.590	28.864	20	8	sand to silty sand
84.318	85.77	0.4742	0.553	29.042	21	8	sand to silty sand
84.482	88.26	0.4968	0.563	29.388	21	8	sand to silty sand
84.646	86.01	0.5077	0.590	29.087	21	8	sand to silty sand
84.810	88.09	0.5042	0.572	29.435	21	8	sand to silty sand
84.974	90.31	0.5203	0.576	29.446	22	8	sand to silty sand
85.138	91.68	0.5399	0.589	29.265	22	8	sand to silty sand
85.302	95.77	0.5771	0.603	29.803	23	8	sand to silty sand
85.466	103.53	0.6211	0.600	29.883	25	8	sand to silty sand
85.630	112.66	0.6785	0.602	30.148	27	8	sand to silty sand
85.794	118.48	0.7112	0.600	29.817	23	9	sand
85.958	127.69	0.7510	0.588	29.831	24	9	sand
86.122	124.92	0.7783	0.623	29.936	24	9	sand
86.286	110.20	0.7933	0.720	29.805	26	8	sand to silty sand
86.450	103.35	0.7530	0.729	29.329	25	8	sand to silty sand
86.614	100.43	0.7172	0.714	30.541	24	8	sand to silty sand
86.778	104.03	0.6877	0.661	30.460	25	8	sand to silty sand
86.942	110.90	0.6952	0.627	30.664	27	8	sand to silty sand
87.106	117.89	0.7294	0.619	30.820	23	9	sand
87.270	119.84	0.7898	0.659	30.126	23	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
87.434	123.92	0.8429	0.680	30.413	24	9	sand
87.598	138.26	0.9520	0.689	31.837	26	9	sand
87.762	139.54	0.8318	0.596	33.751	27	9	sand
87.927	119.24	0.7417	0.622	30.561	23	9	sand
88.091	99.39	0.6370	0.641	30.326	24	8	sand to silty sand
88.255	96.97	0.6086	0.628	30.299	23	8	sand to silty sand
88.419	94.52	0.5987	0.633	30.758	23	8	sand to silty sand
88.583	94.08	0.5857	0.622	30.806	23	8	sand to silty sand
88.747	95.86	0.5805	0.606	31.168	23	8	sand to silty sand
88.911	97.35	0.5722	0.588	31.143	23	8	sand to silty sand
89.075	99.86	0.5771	0.578	31.140	24	8	sand to silty sand
89.239	99.65	0.6246	0.627	31.068	24	8	sand to silty sand
89.403	99.25	0.6341	0.639	31.460	24	8	sand to silty sand
89.567	103.91	0.6341	0.610	31.784	25	8	sand to silty sand
89.731	107.04	0.6322	0.591	31.566	26	8	sand to silty sand
89.895	108.88	0.6516	0.598	31.307	26	8	sand to silty sand
90.059	107.54	0.6415	0.597	31.341	26	8	sand to silty sand
90.223	105.81	0.6358	0.601	31.831	25	8	sand to silty sand
90.387	101.92	0.6269	0.615	31.622	24	8	sand to silty sand
90.551	101.45	0.6229	0.614	31.686	24	8	sand to silty sand
90.715	102.12	0.6238	0.611	31.828	24	8	sand to silty sand
90.879	105.20	0.6415	0.610	32.151	25	8	sand to silty sand
91.043	108.07	0.5893	0.545	32.408	26	8	sand to silty sand
91.207	113.09	0.6398	0.566	32.179	22	9	sand
91.371	111.04	0.6585	0.593	32.388	27	8	sand to silty sand
91.535	112.91	0.7036	0.623	32.327	27	8	sand to silty sand
91.699	119.03	0.7113	0.598	32.706	23	9	sand
91.864	133.95	0.7840	0.585	33.157	26	9	sand
92.028	145.04	0.8612	0.594	33.698	28	9	sand
92.192	153.75	0.9746	0.634	33.065	29	9	sand
92.356	165.22	1.0445	0.632	34.815	32	9	sand
92.520	159.20	1.0974	0.689	33.898	30	9	sand
92.684	162.57	1.0982	0.676	33.051	31	9	sand
92.848	172.14	1.1325	0.658	33.235	33	9	sand
93.012	187.06	1.1976	0.640	37.540	36	9	sand
93.176	175.17	1.2450	0.711	34.968	34	9	sand
93.340	158.40	1.2257	0.774	31.842	30	9	sand
93.504	156.53	1.1406	0.729	32.614	30	9	sand
93.668	163.99	1.1814	0.720	36.773	31	9	sand
93.832	176.51	1.2955	0.734	35.846	34	9	sand
93.996	204.58	1.4680	0.718	37.893	39	9	sand
94.160	223.43	1.7602	0.788	40.342	43	9	sand
94.324	222.33	1.7900	0.805	38.952	43	9	sand
94.488	208.72	1.7915	0.858	37.041	40	9	sand
94.652	190.56	1.6897	0.887	34.623	36	9	sand
94.816	180.62	1.6335	0.904	36.729	35	9	sand
94.980	178.04	1.5769	0.886	32.823	34	9	sand
95.144	184.58	1.5130	0.820	35.528	35	9	sand
95.308	188.81	1.5733	0.833	36.403	36	9	sand
95.472	189.82	1.6111	0.849	40.666	36	9	sand
95.636	187.26	1.7035	0.910	36.005	36	9	sand
95.801	191.85	1.7374	0.906	36.960	37	9	sand
95.965	201.91	1.7924	0.888	37.927	39	9	sand
96.129	204.66	1.8500	0.904	36.556	39	9	sand
96.293	196.07	1.8368	0.937	33.723	38	9	sand
96.457	193.83	1.7729	0.915	35.715	37	9	sand
96.621	186.25	1.7255	0.926	37.991	36	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
96.785	174.08	1.6395	0.942	32.162	33	9	sand
96.949	177.20	1.5454	0.872	35.993	34	9	sand
97.113	164.47	1.2758	0.776	36.754	31	9	sand
97.277	156.59	1.1741	0.750	35.074	30	9	sand
97.441	134.78	1.1504	0.854	33.751	32	8	sand to silty sand
97.605	128.61	0.9077	0.706	34.901	25	9	sand
97.769	123.94	0.8966	0.723	33.912	30	8	sand to silty sand
97.933	133.11	0.9123	0.685	35.305	25	9	sand
98.097	139.26	0.9310	0.669	34.982	27	9	sand
98.261	158.43	0.9610	0.607	36.002	30	9	sand
98.425	166.26	0.9873	0.594	34.324	32	9	sand
98.589	164.80	0.9866	0.599	34.968	32	9	sand
98.753	157.16	0.8981	0.571	34.166	30	9	sand
98.917	127.27	0.7988	0.628	34.472	24	9	sand
99.081	108.39	0.7622	0.703	34.837	26	8	sand to silty sand
99.245	112.46	0.7316	0.651	35.266	27	8	sand to silty sand
99.409	127.56	0.7411	0.581	35.366	24	9	sand
99.573	135.74	0.7679	0.566	35.871	26	9	sand
99.738	146.08	0.8421	0.576	35.553	28	9	sand
99.902	146.57	0.8969	0.612	34.834	28	9	sand
100.066	138.94	0.9048	0.651	34.079	27	9	sand
100.230	123.06	0.8711	0.708	33.809	29	8	sand to silty sand
100.394	96.84	0.8288	0.856	33.093	23	8	sand to silty sand
100.558	74.32	0.7324	0.985	33.076	18	8	sand to silty sand
100.722	65.22	0.7897	1.211	37.177	21	7	silty sand to sandy silt
100.886	60.64	0.7598	1.253	36.659	19	7	silty sand to sandy silt
101.050	55.24	0.8573	1.552	35.333	18	7	silty sand to sandy silt
101.214	92.80	0.9373	1.010	37.191	22	8	sand to silty sand
101.378	147.99	1.1175	0.755	34.993	28	9	sand
101.542	168.51	1.2403	0.736	38.991	32	9	sand
101.706	162.96	1.2696	0.779	37.556	31	9	sand
101.870	147.85	1.1838	0.801	34.074	28	9	sand
102.034	129.33	1.2970	1.003	35.765	31	8	sand to silty sand
102.198	75.33	1.6287	2.162	35.366	24	7	silty sand to sandy silt
102.362	42.61	1.5649	3.673	35.999	20	5	clayey silt to silty clay
102.526	34.89	1.1470	3.287	47.536	17	5	clayey silt to silty clay
102.690	46.99	1.0278	2.187	46.670	18	6	sandy silt to clayey silt
102.854	69.08	0.9166	1.327	16.613	22	7	silty sand to sandy silt
103.018	100.90	0.9929	0.984	17.550	24	8	sand to silty sand
103.182	125.38	1.2371	0.987	31.433	30	8	sand to silty sand
103.347	137.17	1.4161	1.032	36.113	33	8	sand to silty sand
103.511	148.35	1.5091	1.017	38.348	36	8	sand to silty sand
103.675	150.46	1.5535	1.032	38.626	36	8	sand to silty sand
103.839	160.38	1.5691	0.978	36.743	31	9	sand
104.003	172.27	1.7359	1.008	39.537	33	9	sand
104.167	174.24	1.7166	0.985	37.877	33	9	sand
104.331	171.41	1.6980	0.991	36.651	33	9	sand
104.495	166.37	1.6340	0.982	39.044	32	9	sand
104.659	163.05	1.5900	0.975	35.428	31	9	sand
104.823	161.69	1.4874	0.920	37.829	31	9	sand
104.987	153.32	1.3629	0.889	38.055	29	9	sand
105.151	157.34	1.2952	0.823	38.476	30	9	sand
105.315	149.63	1.2804	0.856	36.294	29	9	sand
105.479	145.69	1.2124	0.832	37.545	28	9	sand
105.643	145.96	1.1279	0.773	37.498	28	9	sand
105.807	157.04	1.1084	0.706	38.596	30	9	sand
105.971	151.58	1.0853	0.716	37.035	29	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
106.135	134.23	0.9877	0.736	37.835	26	9	sand
106.299	124.11	0.9544	0.769	39.860	30	8	sand to silty sand
106.463	132.20	1.0079	0.762	38.598	25	9	sand
106.627	155.30	1.1068	0.713	41.437	30	9	sand
106.791	153.97	1.2212	0.793	39.883	29	9	sand
106.955	155.44	1.2657	0.814	38.267	30	9	sand
107.119	157.60	1.2705	0.806	42.039	30	9	sand
107.284	149.98	1.2386	0.826	38.771	29	9	sand
107.448	135.45	1.0857	0.802	38.245	26	9	sand
107.612	128.24	0.9567	0.746	36.807	31	8	sand to silty sand
107.776	138.90	1.0412	0.750	39.417	27	9	sand
107.940	130.27	0.9446	0.725	37.581	25	9	sand
108.104	132.61	0.8793	0.663	38.615	25	9	sand
108.268	123.19	0.8668	0.704	39.752	29	8	sand to silty sand
108.432	108.13	0.8843	0.818	38.501	26	8	sand to silty sand
108.596	122.23	0.9422	0.771	43.156	29	8	sand to silty sand
108.760	120.97	0.9794	0.810	38.203	29	8	sand to silty sand
108.924	114.62	0.9091	0.793	37.503	27	8	sand to silty sand
109.088	99.89	0.8763	0.877	39.337	24	8	sand to silty sand
109.252	90.30	0.8359	0.926	39.821	22	8	sand to silty sand
109.416	88.37	0.8104	0.917	38.818	21	8	sand to silty sand
109.580	88.59	0.7990	0.902	40.468	21	8	sand to silty sand
109.744	88.59	0.8333	0.941	39.476	21	8	sand to silty sand
109.908	87.89	0.8470	0.964	39.367	21	8	sand to silty sand
110.072	101.68	0.8309	0.817	40.738	24	8	sand to silty sand
110.236	115.70	0.9274	0.802	41.666	28	8	sand to silty sand
110.400	116.96	0.9542	0.816	38.857	28	8	sand to silty sand
110.564	127.74	0.9939	0.778	40.685	31	8	sand to silty sand
110.728	137.43	0.8930	0.650	41.769	26	9	sand
110.892	153.53	0.9861	0.642	41.089	29	9	sand
111.056	165.88	1.1708	0.706	42.273	32	9	sand
111.221	175.41	1.3433	0.766	42.903	34	9	sand
111.385	171.11	1.3556	0.792	40.512	33	9	sand
111.549	143.70	1.2087	0.841	40.094	28	9	sand
111.713	155.18	1.1159	0.719	40.766	30	9	sand
111.877	173.42	1.0936	0.631	41.136	33	9	sand
112.041	204.74	1.1836	0.578	43.140	39	9	sand
112.205	223.76	1.2914	0.577	42.911	43	9	sand
112.369	223.52	1.3950	0.624	40.671	43	9	sand
112.533	213.31	1.4039	0.658	40.877	41	9	sand
112.697	201.99	1.3202	0.654	39.835	39	9	sand
112.861	185.04	1.2416	0.671	41.287	35	9	sand
113.025	157.49	1.1260	0.715	40.142	30	9	sand
113.189	165.99	1.0356	0.624	42.766	32	9	sand
113.353	186.27	1.0483	0.563	44.753	36	9	sand
113.517	178.50	1.1028	0.618	44.697	34	9	sand
113.681	169.41	1.1049	0.652	39.370	32	9	sand
113.845	179.40	1.1812	0.658	44.137	34	9	sand
114.009	202.82	1.1712	0.577	45.193	39	9	sand
114.173	171.49	1.1412	0.665	45.017	33	9	sand
114.337	140.76	1.0492	0.745	39.977	27	9	sand
114.501	135.07	0.9797	0.725	41.153	26	9	sand
114.665	137.61	0.9656	0.702	41.883	26	9	sand
114.829	148.43	0.9901	0.667	43.162	28	9	sand
114.993	170.69	1.0711	0.628	44.675	33	9	sand
115.158	197.95	1.2204	0.616	46.951	38	9	sand
115.322	219.24	1.3495	0.616	47.115	42	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
115.486	215.48	1.3901	0.645	43.730	41	9	sand
115.650	183.15	1.3225	0.722	45.006	35	9	sand
115.814	166.88	1.1656	0.698	38.462	32	9	sand
115.978	147.67	1.0773	0.730	39.665	28	9	sand
116.142	121.75	0.9241	0.759	40.696	29	8	sand to silty sand
116.306	112.66	0.8842	0.785	41.045	27	8	sand to silty sand
116.470	124.33	0.8504	0.684	43.279	24	9	sand
116.634	155.99	0.8702	0.558	44.541	30	9	sand
116.798	162.22	0.9290	0.573	43.354	31	9	sand
116.962	138.16	0.8984	0.650	40.771	26	9	sand
117.126	134.83	0.8465	0.628	43.259	26	9	sand
117.290	162.67	0.8017	0.493	44.970	31	9	sand
117.454	161.99	0.8867	0.547	45.770	31	9	sand
117.618	138.59	0.9151	0.660	42.569	27	9	sand
117.782	125.54	0.8846	0.705	40.955	24	9	sand
117.946	122.68	0.8278	0.675	42.485	23	9	sand
118.110	122.77	0.7847	0.639	43.014	24	9	sand
118.274	122.63	0.8158	0.665	42.875	23	9	sand
118.438	123.68	0.8163	0.660	43.767	24	9	sand
118.602	124.78	0.8183	0.656	43.371	24	9	sand
118.766	124.77	0.8173	0.655	43.800	24	9	sand
118.931	125.79	0.8111	0.645	43.527	24	9	sand
119.095	125.02	0.8298	0.664	43.806	24	9	sand
119.259	124.06	0.8438	0.680	43.449	24	9	sand
119.423	131.61	0.8974	0.682	44.299	25	9	sand
119.587	146.53	0.9416	0.643	44.549	28	9	sand
119.751	158.41	1.0546	0.666	44.756	30	9	sand
119.915	163.39	1.1237	0.688	44.859	31	9	sand
120.079	169.36	1.2257	0.724	46.143	32	9	sand
120.243	176.72	1.3468	0.762	48.776	34	9	sand
120.407	182.91	1.6232	0.887	46.976	35	9	sand
120.571	197.58	1.6659	0.843	51.855	38	9	sand
120.735	261.12	2.2297	0.854	56.407	50	9	sand
120.899	293.65	2.7789	0.946	50.328	56	9	sand
121.063	290.57	3.0338	1.044	50.227	56	9	sand
121.227	287.30	3.0300	1.055	57.978	55	9	sand
121.391	285.12	3.1254	1.096	43.388	55	9	sand
121.555	311.20	3.1608	1.016	49.467	60	9	sand
121.719	336.66	3.1808	0.945	55.407	64	9	sand

APPENDIX B
Laboratory Test Results

Exploration	Sample ID	Depth	Gravel (%)	Sand (%)	Fines (%)	Liquid Limit	Plastic Limit	Water Content (%)	USCS Group Symbol	Soil Description
B-1	U-1	6.0								
B-1	U-2	8.0								
B-1	U-3	10.0	0.0	6.2	93.8	33	21	36.0	CL	LEAN CLAY
B-1	U-4	12.0								
B-1	U-5	14.0								
B-1	U-6	16.0	0.0	27.6	72.4	NP	NP	41.4	ML	SANDY SILT
B-1	U-7	20.0								
B-1	U-8	25.0	0.0	9.4	90.6	46	34	48.3	ML	SILT
B-1	U-9	30.0								
B-1	U-10	35.0	0.0	53.0	47.0			40.4	SM	SILTY SAND
B-1	U-11	40.0								
B-1	U-12	45.0	0.0	5.2	94.8	49	33	53.7	ML	SILT
B-1	U-13	50.0								
B-1	S-1	52.0	1.9	75.3	22.8			33.2	SM	SILTY SAND
B-1	U-14	55.0								
B-1	S-2	60.0								
B-1	S-3	65.0								
B-1	S-4	70.0						28.7		
B-1	S-5	75.0								
B-1	S-6a	80.0								
B-1	S-6b	80.3						26.1		
B-1	S-7	85.0								
B-1	S-8	90.0						28.2		
B-1	S-9	95.0								
B-1	S-10	100.0								
B-1	S-11	110.0						25.5		
B-1	S-12	120.0								
B-1	S-13	130.0						26.7		
B-1	S-14	140.0								
B-1	S-15	150.0								
B-2	U-1	6.0								
B-2	U-2	8.0								
B-2	U-3	10.0	0.0	16.8	83.2	37	31	45.8	ML	SILT WITH SAND
B-2	U-4	12.0								
B-2	U-5	14.0								
B-2	U-6	20.0	0.0	0.4	99.6	49	26	41.7	CL	LEAN CLAY
B-2	U-7	25.0								
B-2	U-8	30.0	0.0	1.2	98.8	51	35	48.5	MH	ELASTIC SILT
B-2	U-9	35.0	0.0	0.3	99.7	42	23	37.8	CL	LEAN CLAY
B-2	U-10	40.0	0.0	87.0	13.0			30.1	SM	SILTY SAND
B-2	U-11	45.0								
B-2	U-12	47.0								
B-2	S-1	49.0	0.0	93.7	6.3			31.3	SP-SM	POORLY GRADED SAND WITH SILT
B-2	S-2	55.0								
B-2	U-13	57.0								
B-2	U-14	60.0								
B-2	S-3	65.0						28.2		

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HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Summary of Laboratory Results

Figure **B-1**
Sheet **1 of 2**

Exploration	Sample ID	Depth	Gravel (%)	Sand (%)	Fines (%)	Liquid Limit	Plastic Limit	Water Content (%)	USCS Group Symbol	Soil Description
B-2	U-15	70.0								
B-2	S-4	75.0								
B-2	S-5	80.0						27.3		
B-2	S-6	85.0								
B-2	S-7	90.0	0.0	94.5	5.5			31.3	SP-SM	POORLY GRADED SAND WITH SILT
B-2	S-8	95.0								
B-2	S-9	100.0						26.4		
B-2	S-10	110.0								
B-2	S-11	120.0						27.6		
B-2	S-12	130.0								
B-2	S-13	140.0						26.1		
B-2	S-14	150.0								
IT-1	G-1	2.5								
IT-2	G-1	1.8								
IT-3	G-1	3.0	0.0	55.0	45.0			30.6	ML/CL	SANDY SILT/CLAY
TP-1	G-1	1.0								
TP-2	G-1	1.5								
TP-2	G-2	2.5								
TP-2	G-3	5.0								

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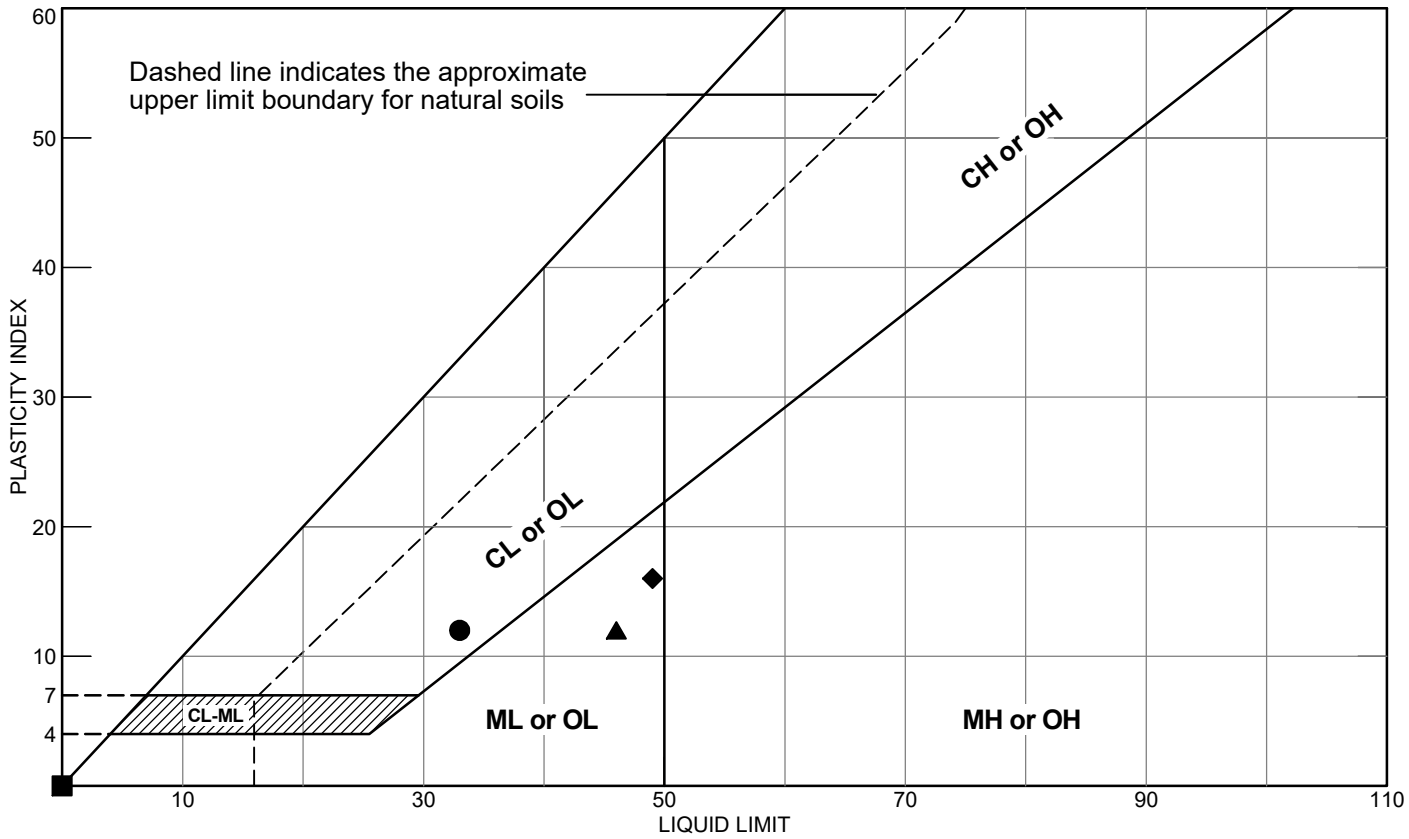

Location and Description	LL	PL	PI	#200	MC%	USCS
● **Source:** B-1 **Sample No.:** U-3 **Depth:** 10.0 to 12.0 LEAN CLAY	33	21	12	94	36	CL
■ **Source:** B-1 **Sample No.:** U-6 **Depth:** 16.0 to 18.0 SANDY SILT	NP	NP	NP	72	41	ML
▲ **Source:** B-1 **Sample No.:** U-8 **Depth:** 25.0 to 27.0 SILT	46	34	12	91	48	ML
◆ **Source:** B-1 **Sample No.:** U-12 **Depth:** 45.0 to 47.0 SILT	49	33	16	95	54	ML

Remarks:

●

■ non-plastic

▲

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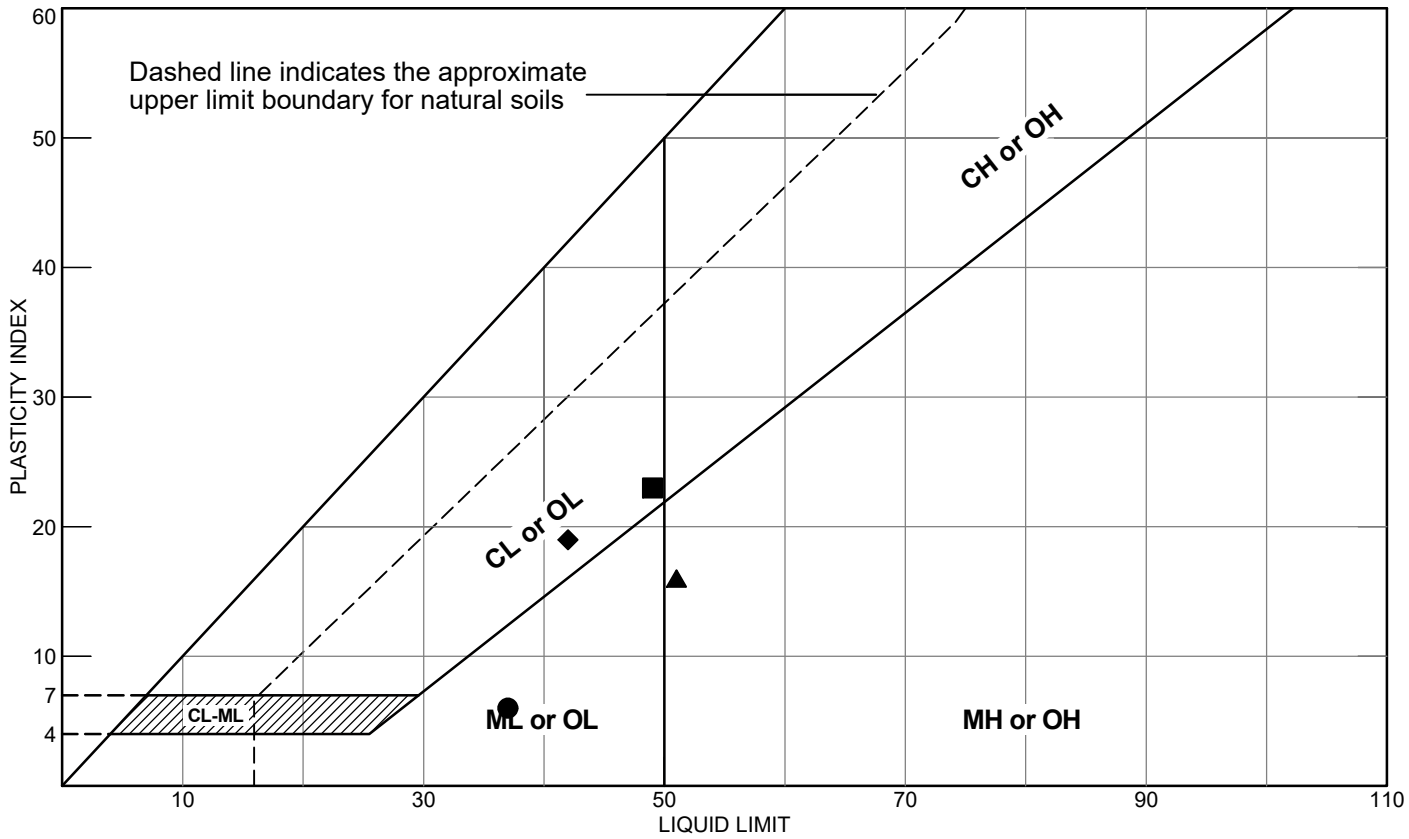
HA ATTERBERG LIMITS

HALEY ALDRICH	Project: PDX Fuel Project Tank Design Location: Portland, Oregon Project No.: 0204679-001	**Liquid Limit, Plastic Limit, and Plasticity Index**	Figure **B-2** Sheet **1 of 2**



Location and Description	LL	PL	PI	-#200	MC%	USCS
● **Source:** B-2 **Sample No.:** U-3 **Depth:** 10.0 to 12.0 SILT WITH SAND	37	31	6	83	46	ML
■ **Source:** B-2 **Sample No.:** U-6 **Depth:** 20.0 to 22.0 LEAN CLAY	49	26	23	100	42	CL
▲ **Source:** B-2 **Sample No.:** U-8 **Depth:** 30.0 to 32.0 ELASTIC SILT	51	35	16	99	49	MH
◆ **Source:** B-2 **Sample No.:** U-9 **Depth:** 35.0 to 37.0 LEAN CLAY	42	23	19	100	38	CL

Remarks:

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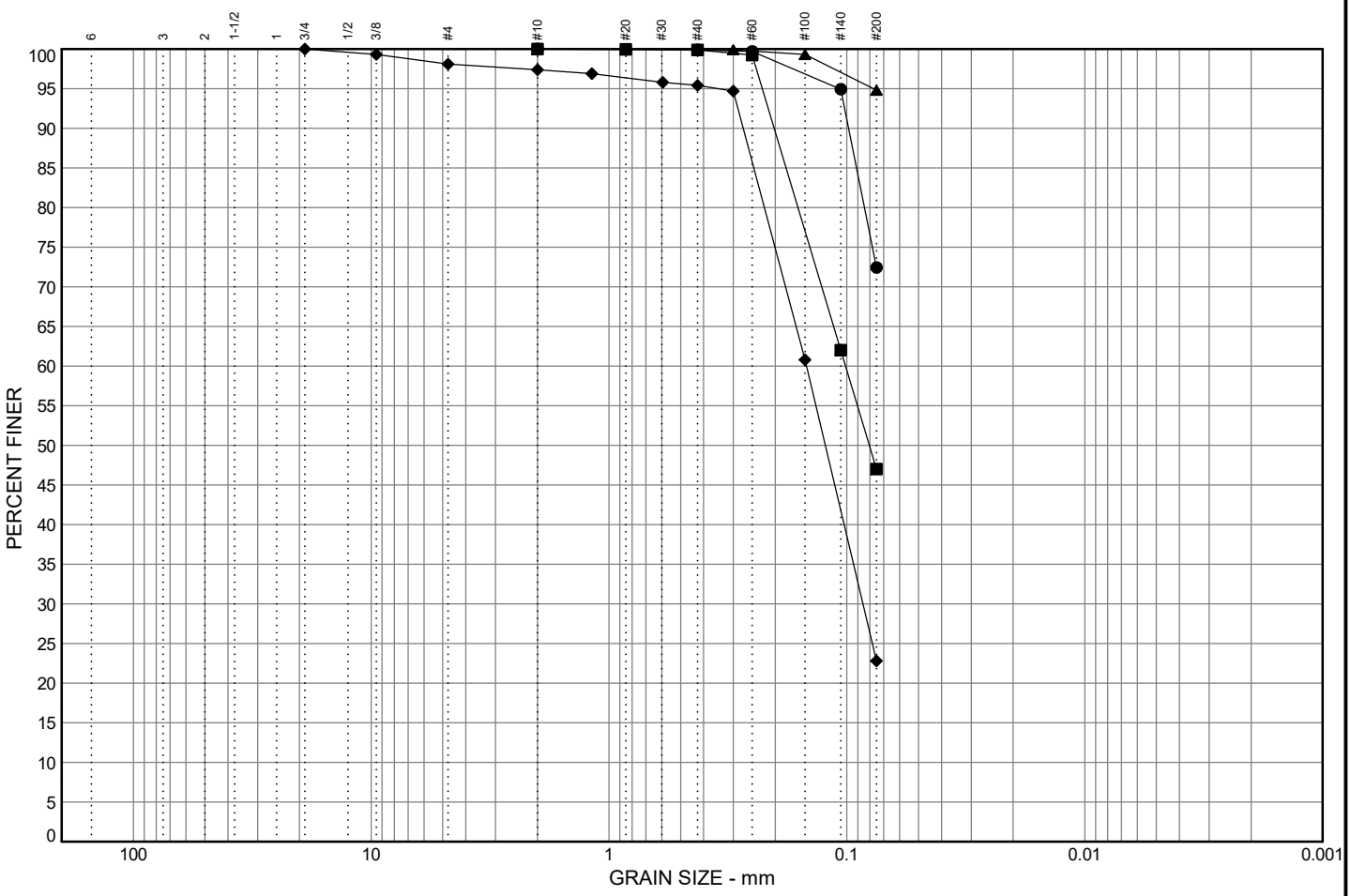
HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Liquid Limit, Plastic Limit, and Plasticity Index

Figure **B-2**
Sheet **2 of 2**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Location and Description	% Cobbles	% Gravel	% Sand	% Silt	% Clay	MC%	USCS
● **Source:** B-1 **Sample No.:** U-6 **Depth:** 16.0 to 18.0 SANDY SILT	0.0	0.0	27.6	72.4		41	ML
■ **Source:** B-1 **Sample No.:** U-10 **Depth:** 35.0 to 37.0 SILTY SAND	0.0	0.0	53.0	47.0		40	SM
▲ **Source:** B-1 **Sample No.:** U-12 **Depth:** 45.0 to 47.0 SILT	0.0	0.0	5.2	94.8		54	ML
◆ **Source:** B-1 **Sample No.:** S-1 **Depth:** 52.0 to 53.5 SILTY SAND	0.0	1.9	75.3	22.8		33	SM

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	NP	NP	0.091							
■			0.180	0.101	0.080					
▲	49	16								
◆			0.246	0.148	0.123	0.086				

Remarks:

● non-plastic

■

▲

◆

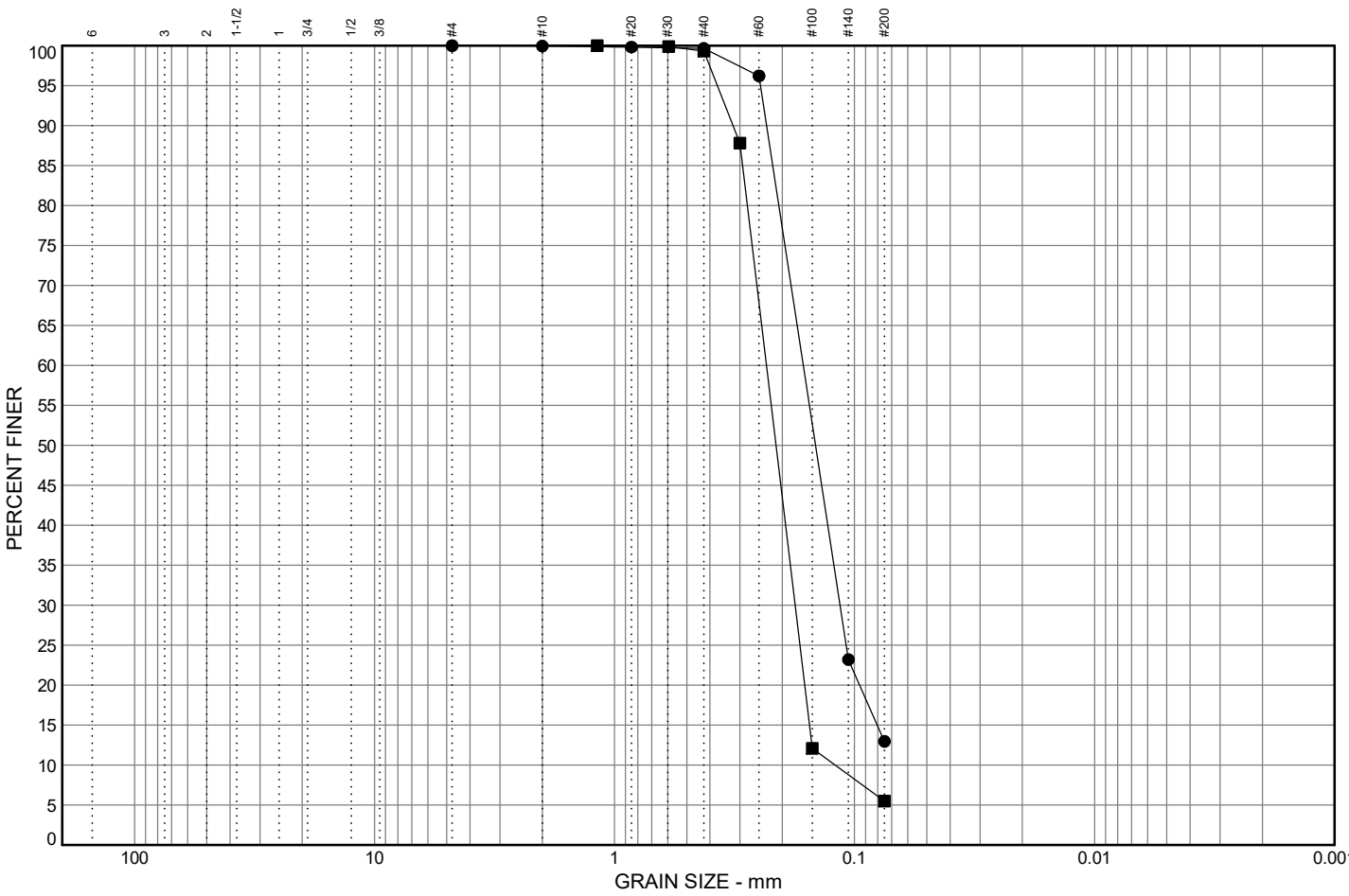
HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Particle-Size Analysis

Figure **B-3**
Sheet **1 of 2**

HA GRAIN SIZE - \\HALEYALDRICH.COM\SHARE\PDX_DATA\GEOMATICS\GINTHC_LIBRARY (GLB - 7/17/23 12:14 - \\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - dlnorp



Location and Description	% Cobbles	% Gravel	% Sand	% Silt	% Clay	MC%	USCS
● **Source:** B-2 **Sample No.:** U-10 **Depth:** 40.0 to 42.0 SILTY SAND	0.0	0.0	87.0	13.0		30	SM
■ **Source:** B-2 **Sample No.:** S-7 **Depth:** 90.0 to 91.5 POORLY GRADED SAND WITH SILT	0.0	0.0	94.5	5.5		31	SP-SM

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.219	0.163	0.145	0.115	0.080			
■			0.292	0.233	0.212	0.177	0.154	0.120	1.12	1.93

Remarks:

●

■

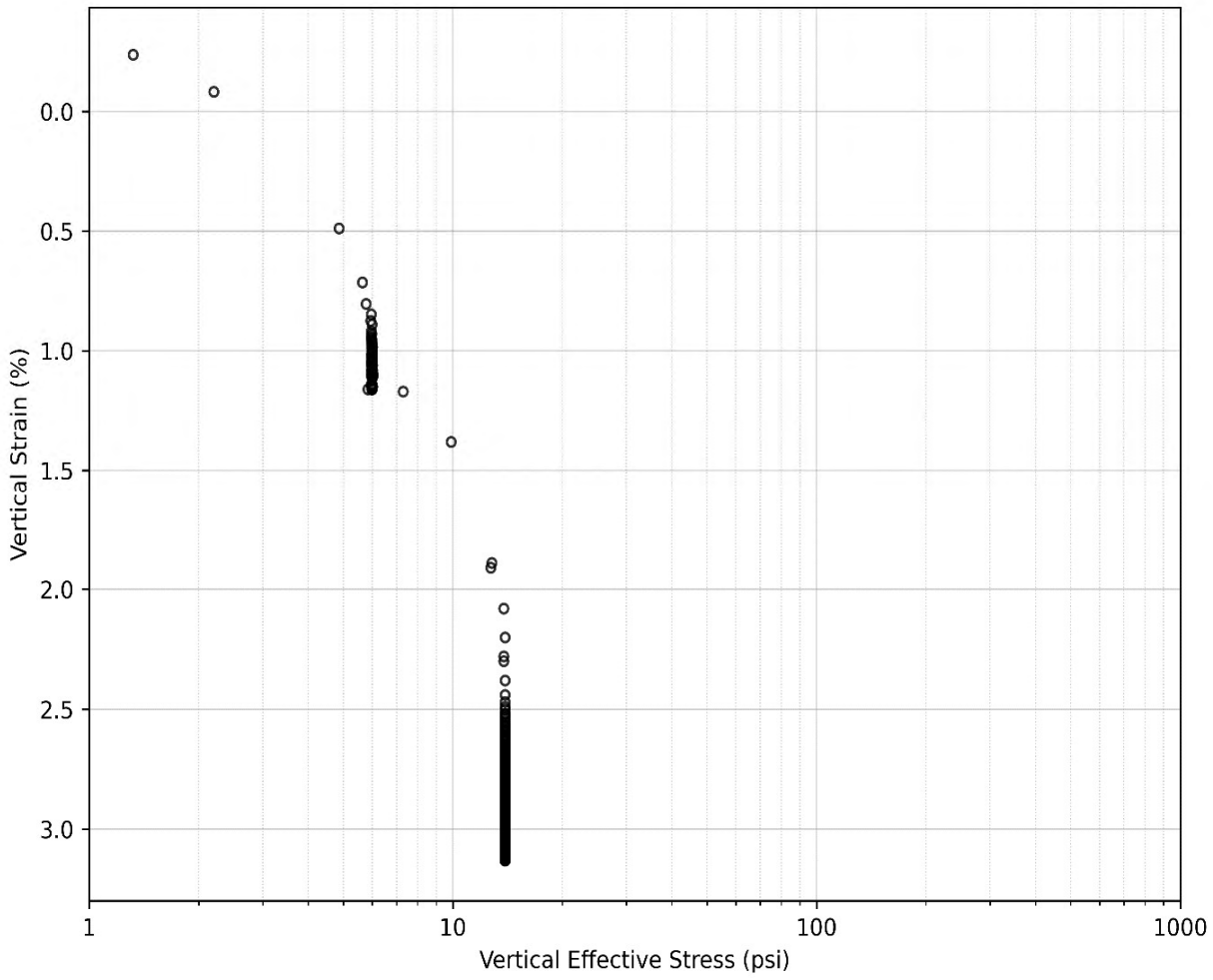
HALEY ALDRICH

Project: PDX Fuel Project Tank Design
Location: Portland, Oregon
Project No.: 0204679-001

Particle-Size Analysis

Figure **B-3**
Sheet **2 of 2**

HA GRAIN SIZE - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\GEOMATICS\GINT\HC_LIBRARY (GLB - 7/17/23 12:14 - I:\HALEYALDRICH.COM\SHARE\PDX_DATA\NOTEBOOKS\0204679-001_PDX_FUEL_PROJECT_TANK_DESIGN\FIELD DATA\PERM_GINT FILES\0204679-001_PDX FUEL PROJECT TANK DESIGN_GINT.GPJ - dlnorp



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
31.6	48	47	51	35	16	ELASTIC SILT	MH

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	1.2	98.8

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.78
Total Unit Weight (pcf)	105.57
Degree of Saturation (%)	96.31
Void Ratio (e_0)	1.315

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Axial Strain Versus Logarithm of Vertical Effective Stress for B-2 U-8 Specimen #1 stress-controlled CDSS Consolidation Phase

Job Number: 0204679-001 06/23

HALEY ALDRICH

Figure
B-4

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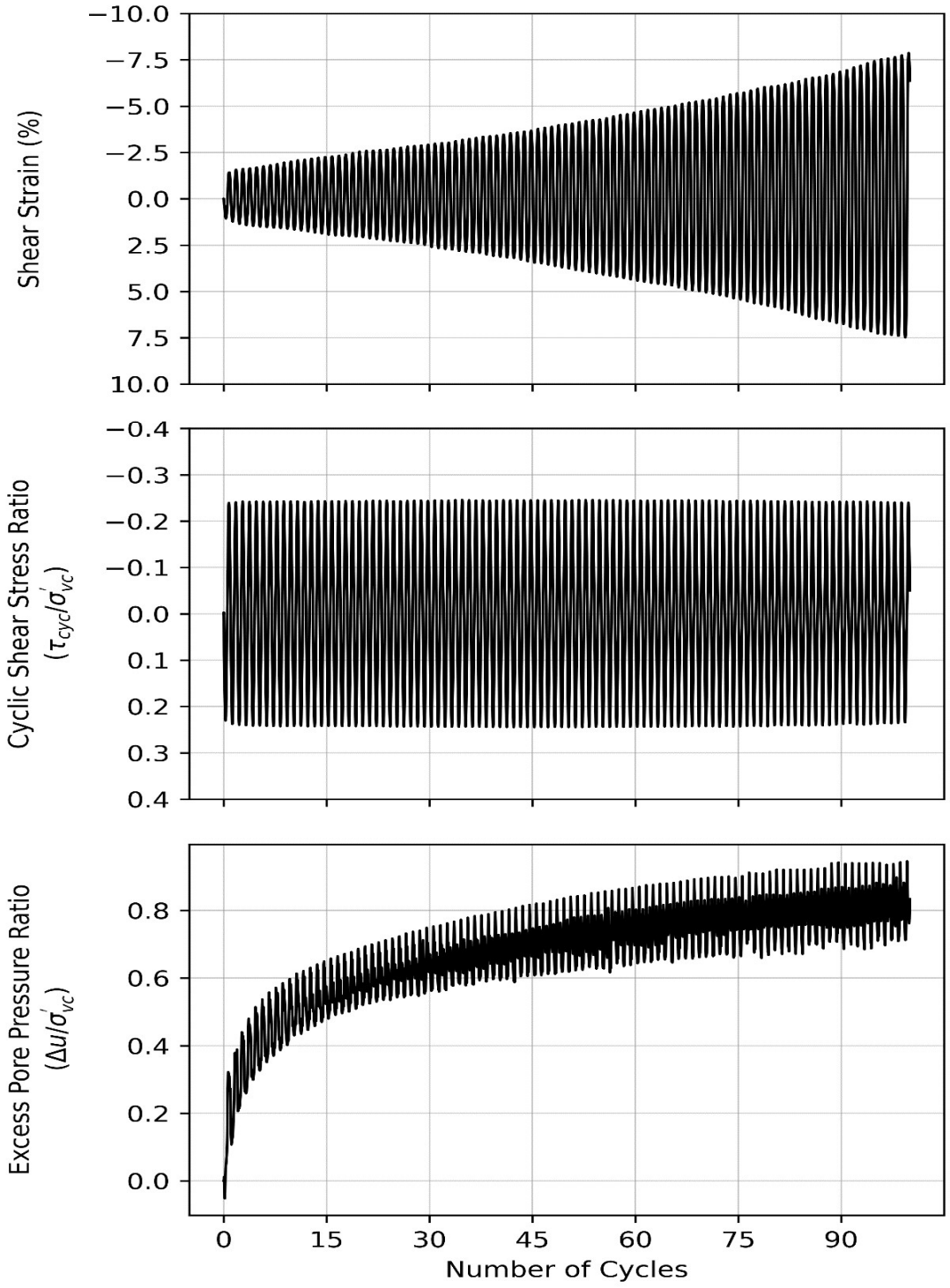

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Cyclic shear phase data for B-2 U-8 Specimen #1 stress-controlled CDSS Cyclic Phase

Job Number: 0204679-001 06/23

HALEY ALDRICH

Figure
B-4

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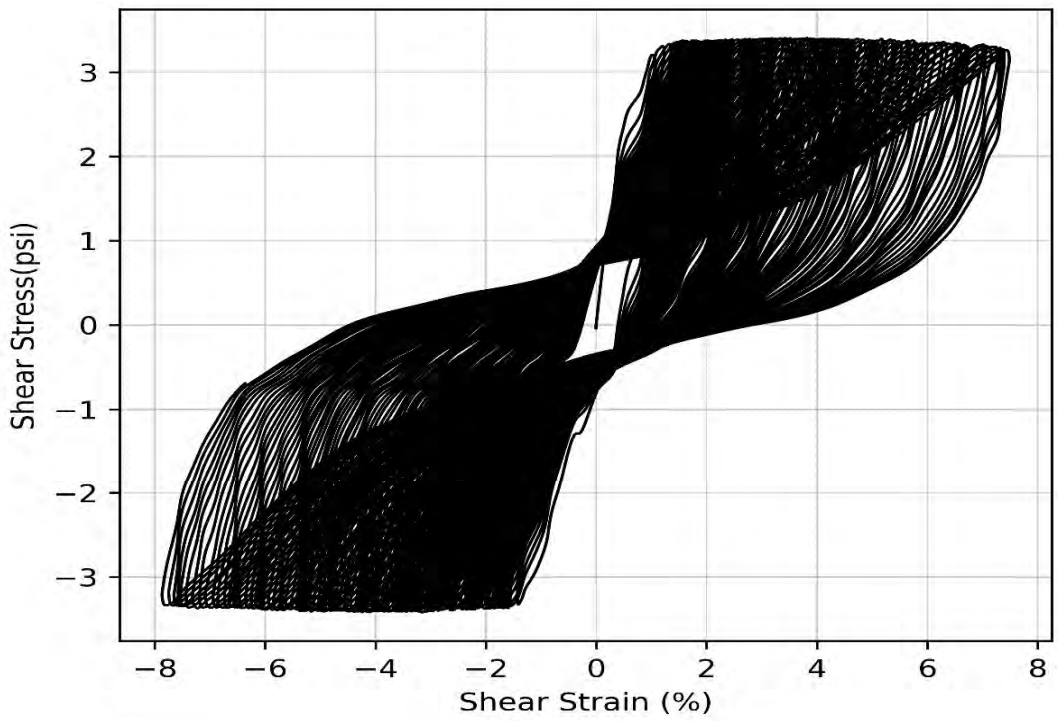
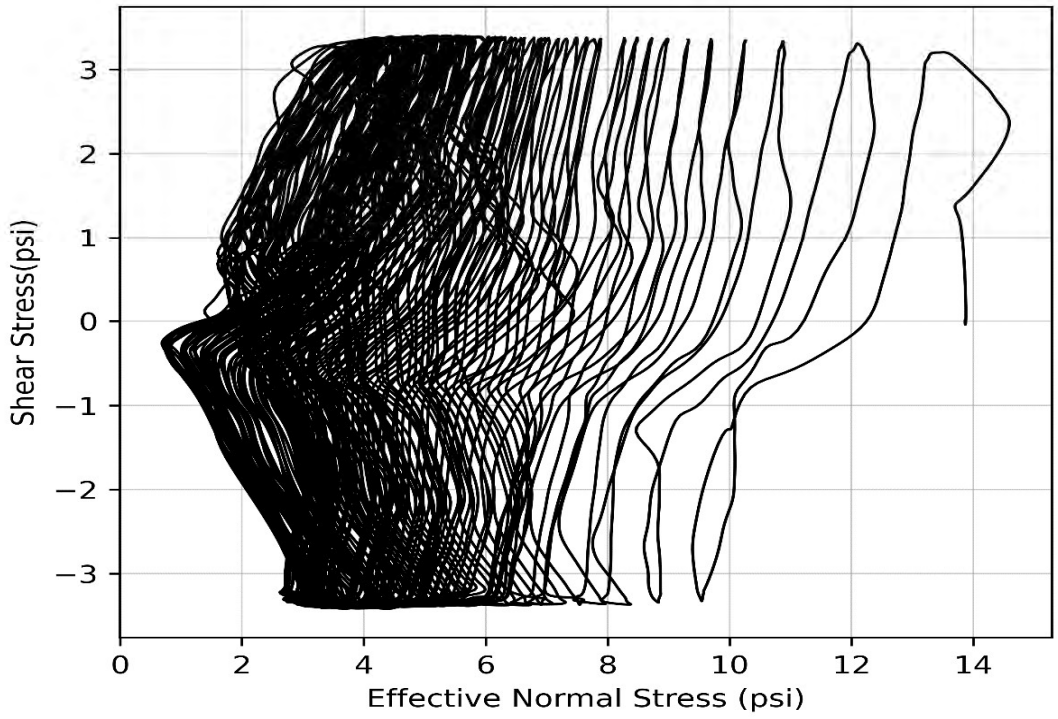




Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

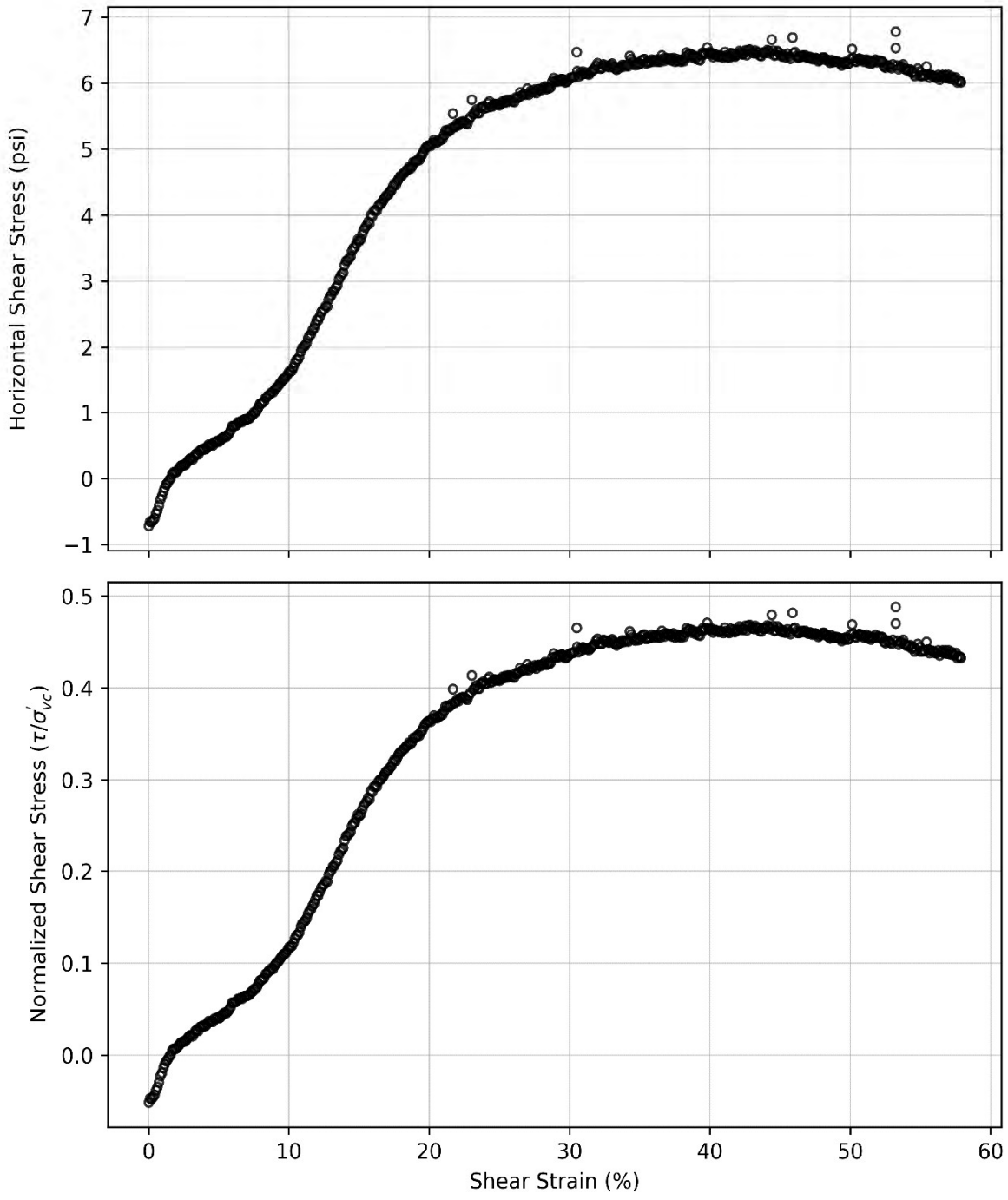
PDX Fuel Project Tank Design
Portland, OR

Cyclic Loop for B-2 U-8 Specimen #1 stress-controlled CDSS Cyclic Phase

Job Number: 0204679-001 06/23

HALEY ALDRICH

Figure
B-4



Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section. Post-cyclic direct simple shear test stress and strain are measured relative to the state of stress of the soil specimen at the end of the cyclic phase

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal Shear Stress and Normalized Shear Stress for B-2 U-8 Specimen #1 stress-controlled CDSS Post-Cyclic Shear Phase

Job Number: 0204679-001 06/23

HALEY ALDRICH

Figure
B-4

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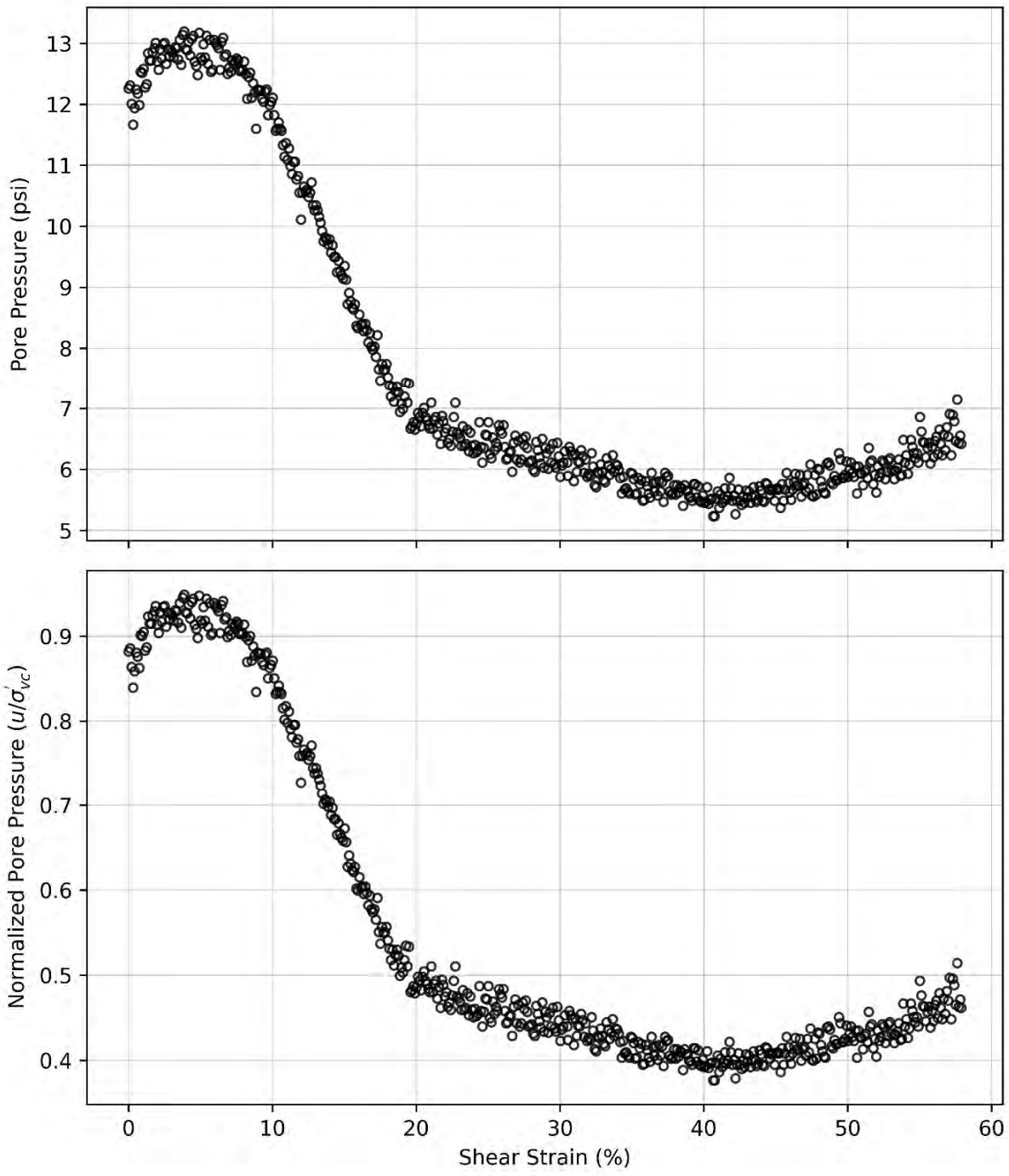

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Pore Pressure and Normalized Pore Pressure Versus Shear Strain for B-2 U-8 Specimen #1 stress-controlled CDSS Post-Cyclic Shear Phase

Job Number: 0204679-001 06/23

HALEY ALDRICH

Figure
B-4

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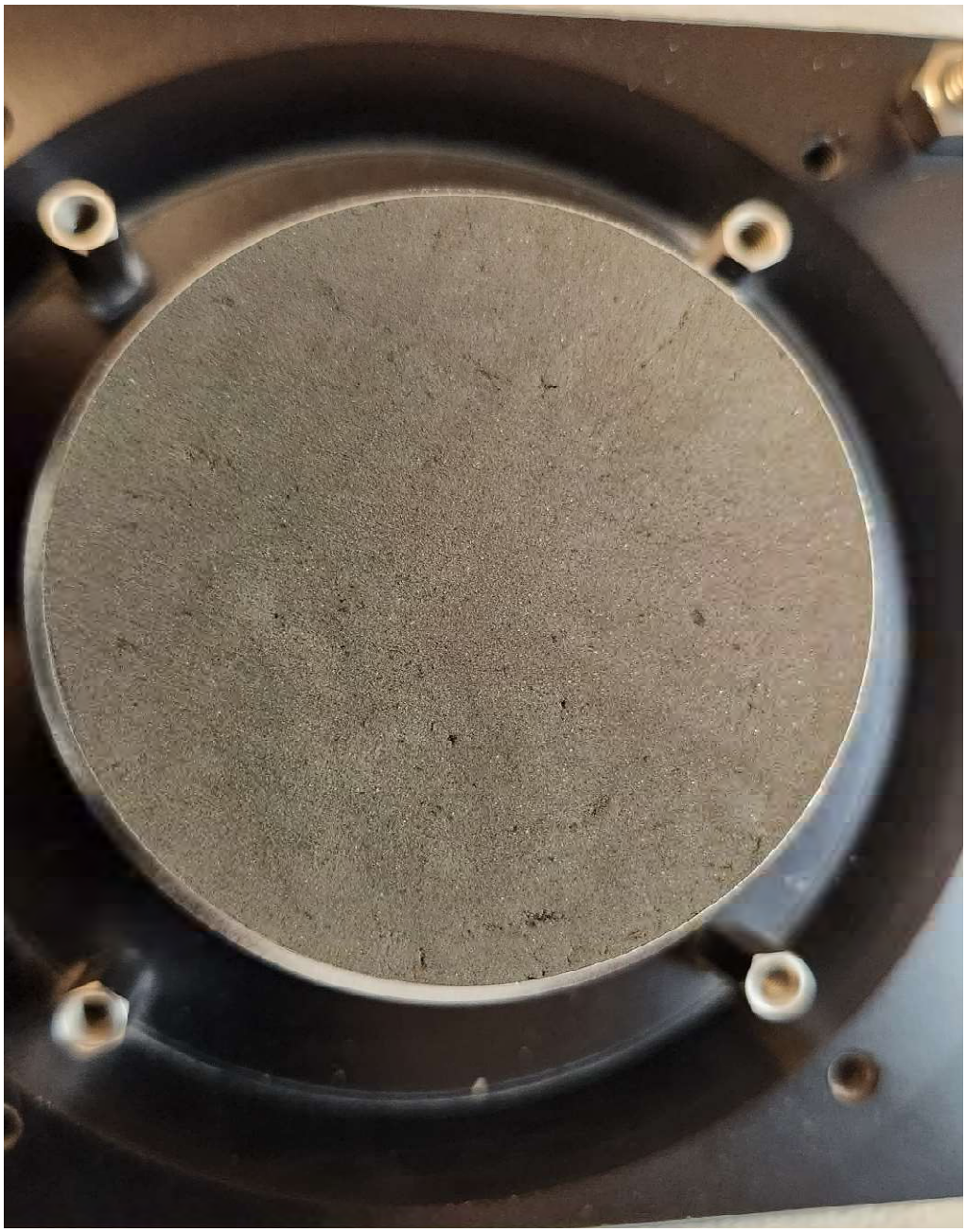


Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

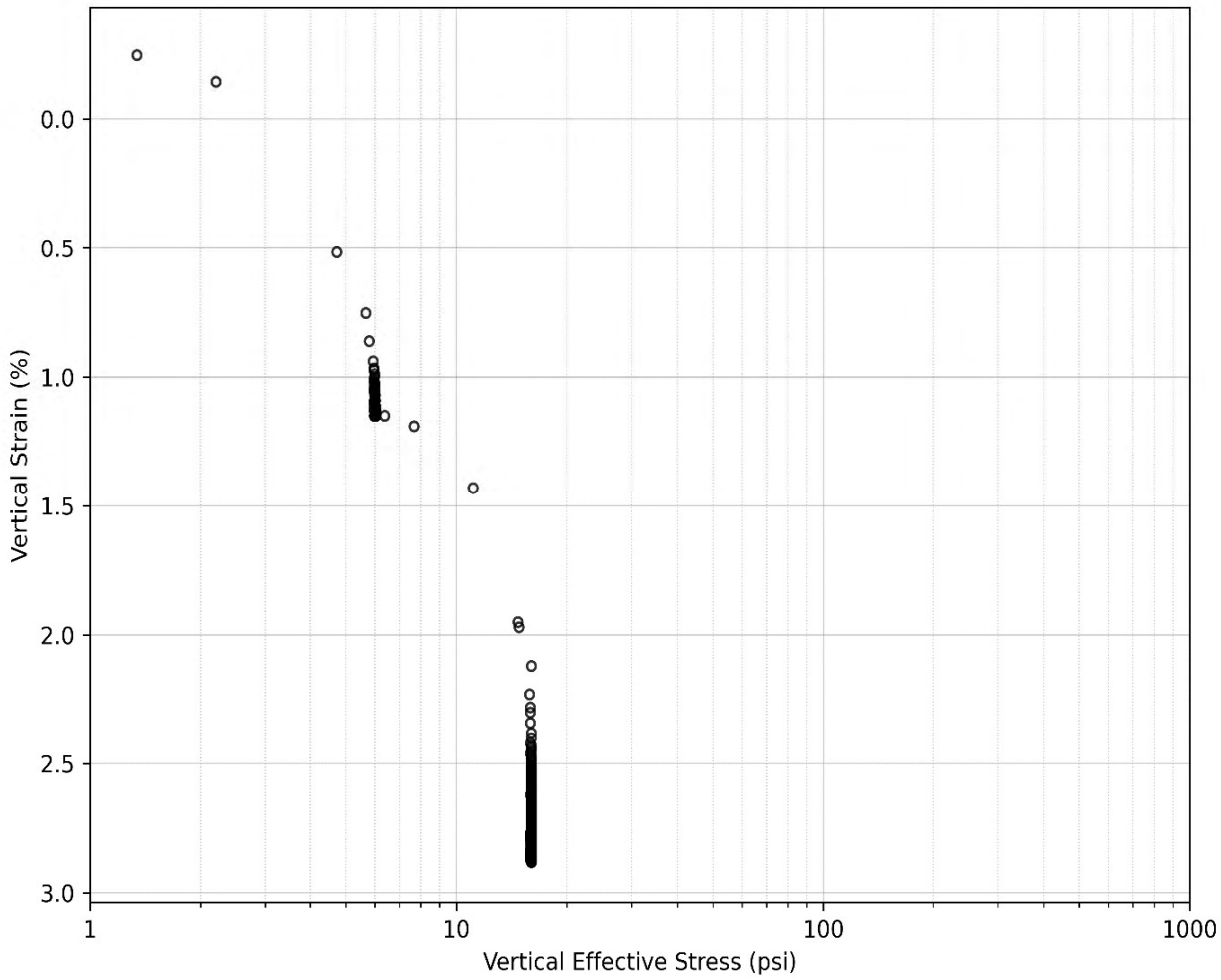
PDX Fuel Project Tank Design
Portland, OR

Pre-Test Photograph of B-2 U-8 Specimen #1 CDSS

Job Number 0204679-001 06/23

HALEY ALDRICH

Figure
B-4



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
36.1	49	51	42	23	19	LEAN CLAY	CL

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	0.25	99.75

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.84
Total Unit Weight (pcf)	106.72
Degree of Saturation (%)	99.24
Void Ratio (e_0)	1.309

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Axial Strain Versus Logarithm of Vertical Effective Stress for B-2 U-9 Specimen #2 stress-controlled CDSS Consolidation Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-5

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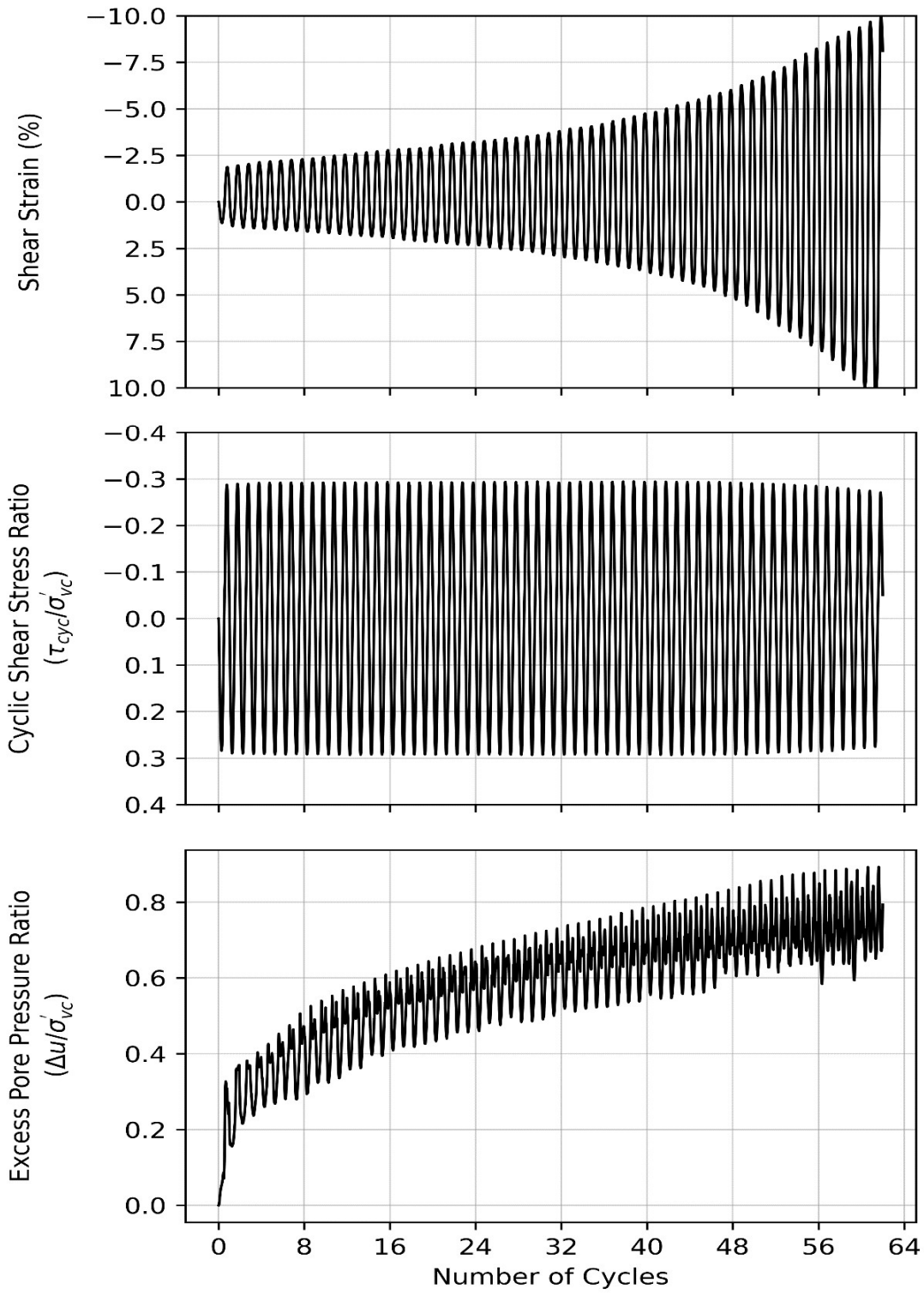

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Cyclic shear phase data for B-2 U-9 Specimen #2 stress-controlled CDSS Cyclic Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-5

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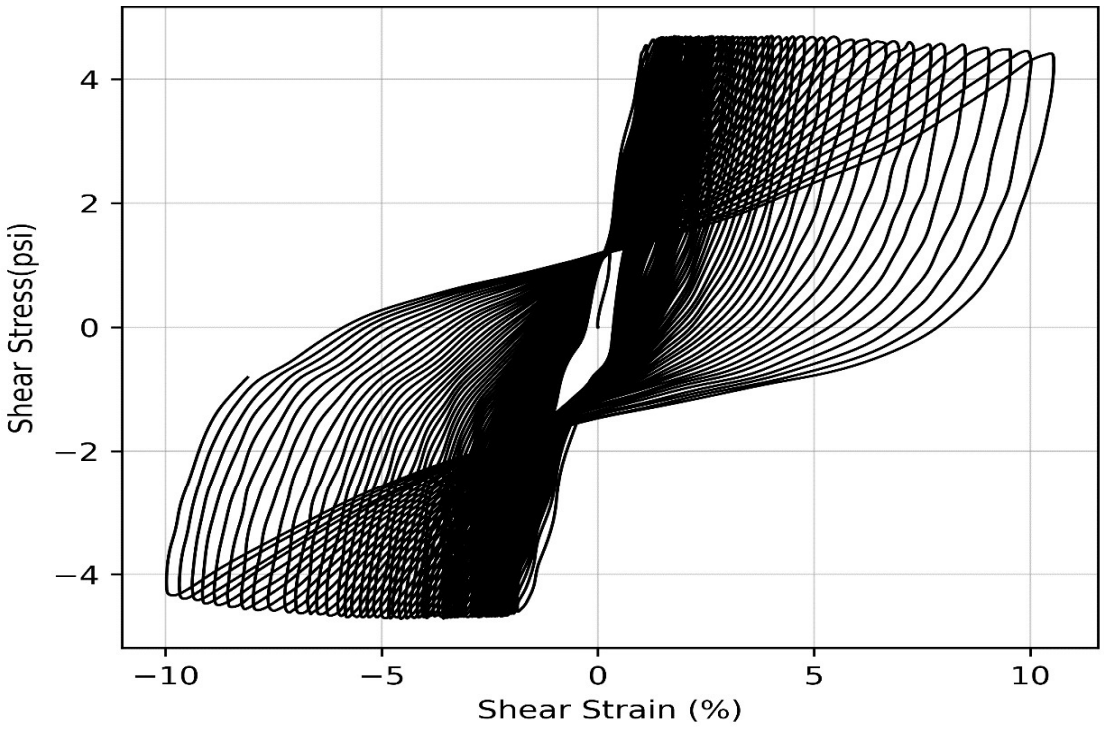
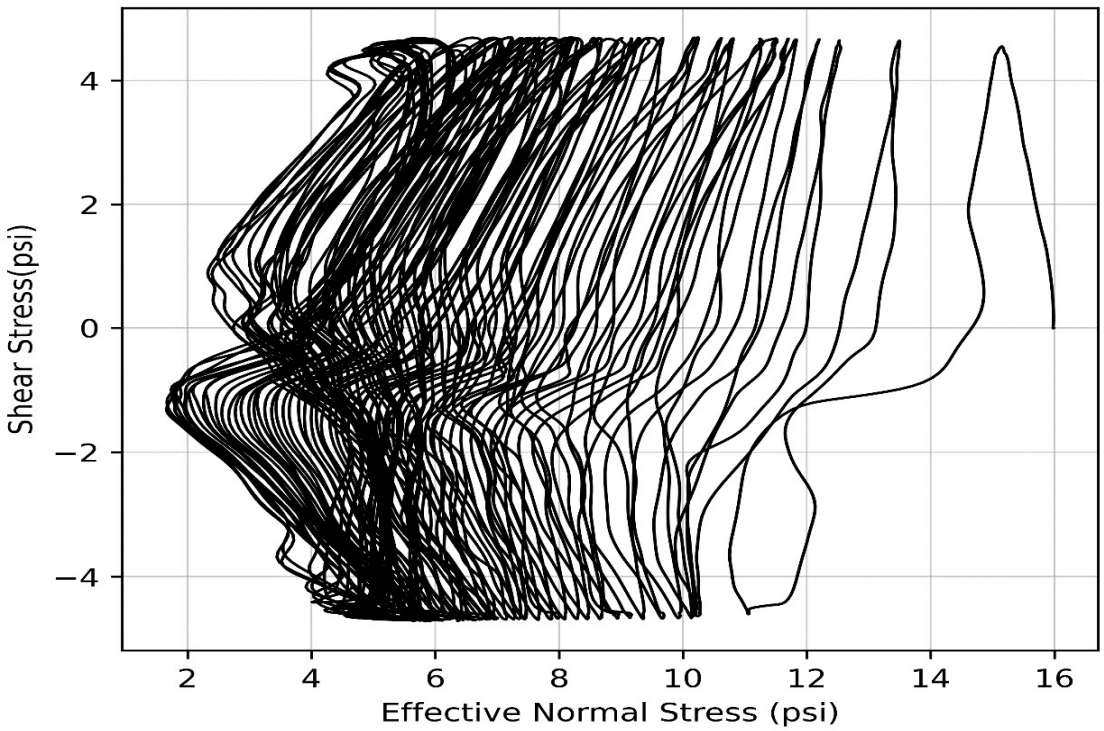




Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

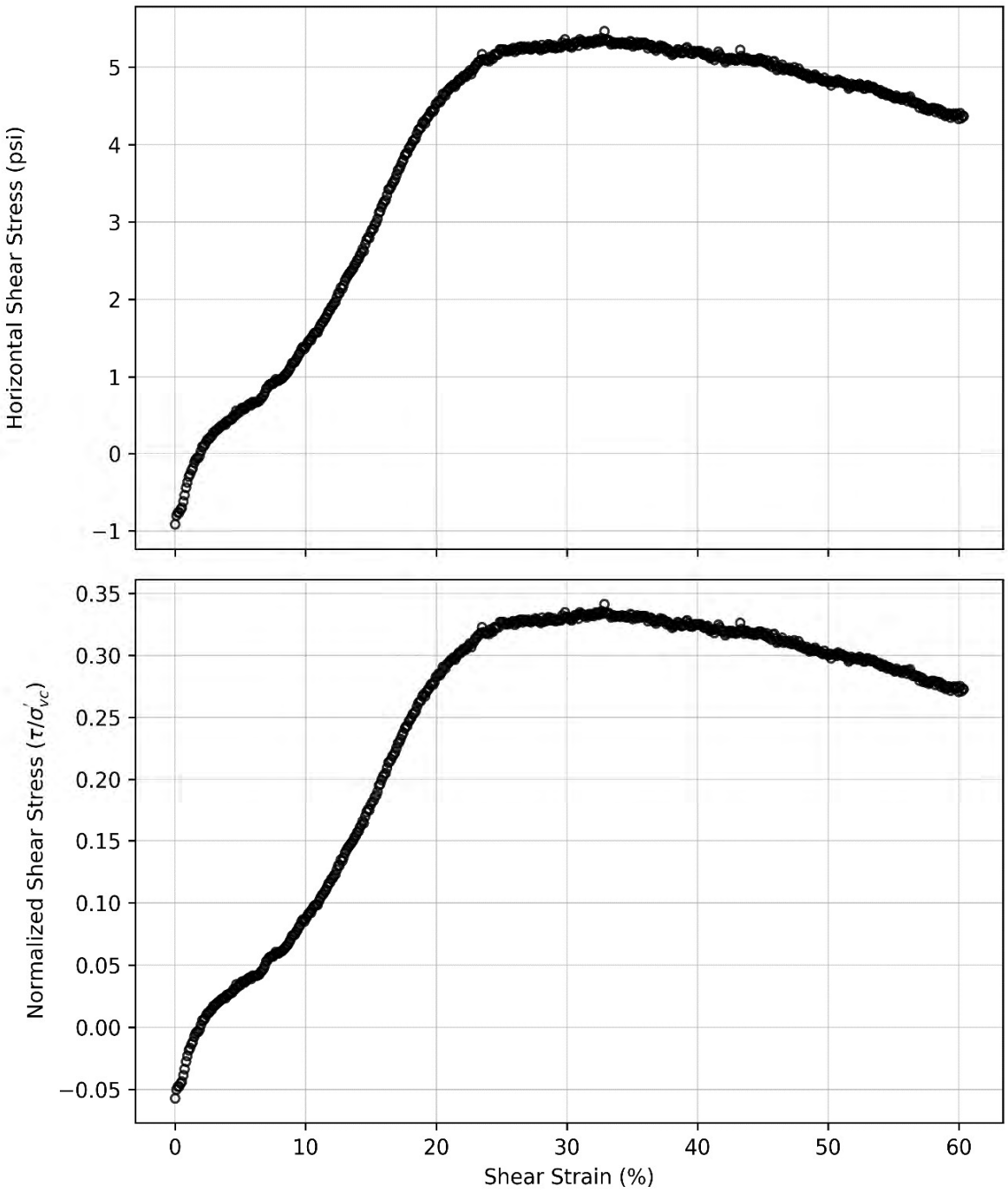
Cyclic Loop for B-2 U-9 Specimen #2 stress-controlled CDSS Cyclic Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-5

0 05/23/2023 \\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\Workspace\Geotechnical_Data_Report\Appendix B\CDSS\0204679-001 B2 U9 CDSS-2 processed 052623 REVISED.xlsx



Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section. Post-cyclic direct simple shear test stress and strain are measured relative to the state of stress of the soil specimen at the end of the cyclic phase

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal Shear Stress and Normalized Shear Stress for B-2 U-9 Specimen #2 stress-controlled CDSS Post-Cyclic Shear Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-5

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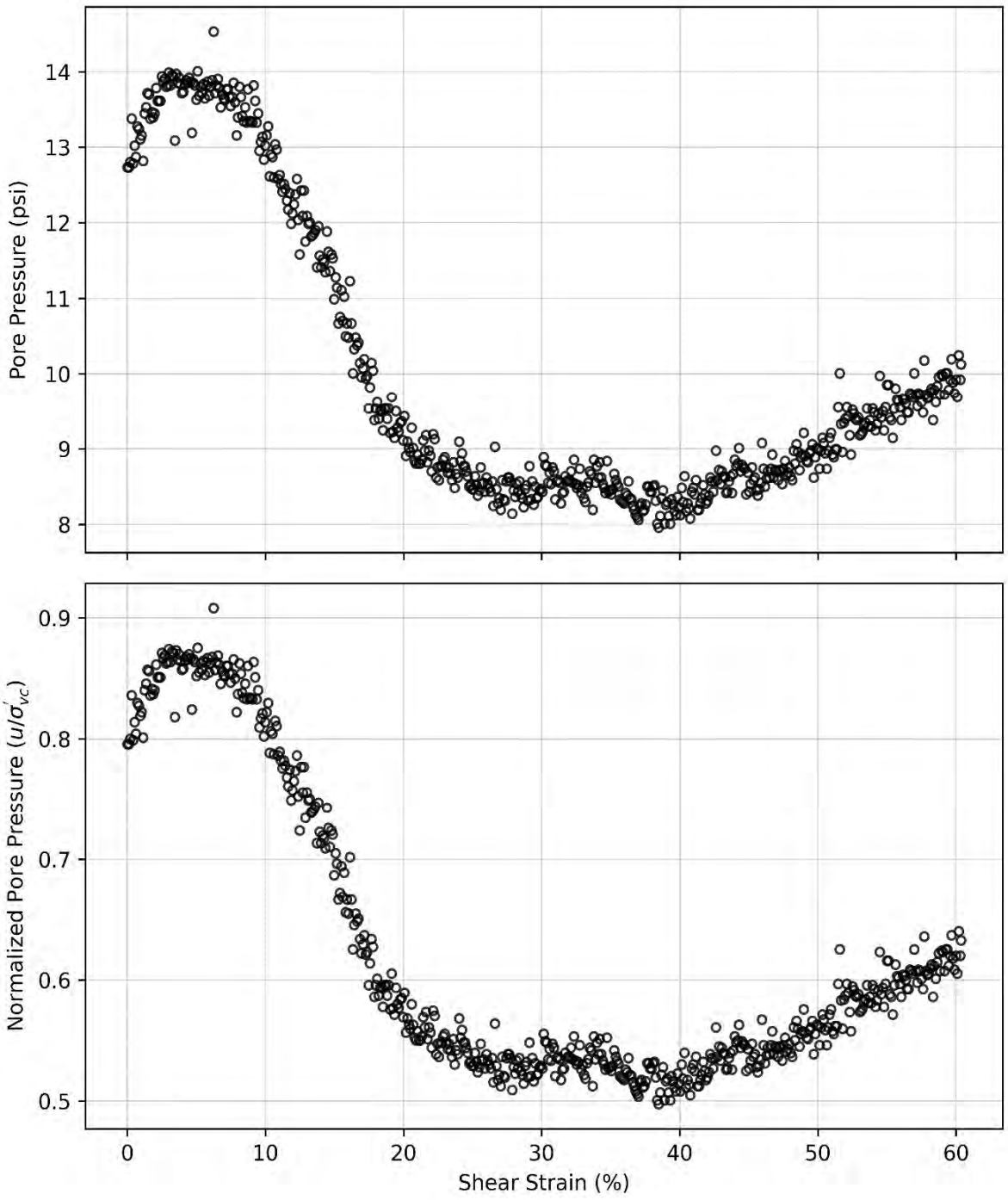

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Pore Pressure and Normalized Pore Pressure Versus Shear Strain for B-2 U-9 Specimen #2 stress-controlled CDSS Post-Cyclic Shear Phase

Job Number: 0204679-001 05/23

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Figure
B-5

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Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

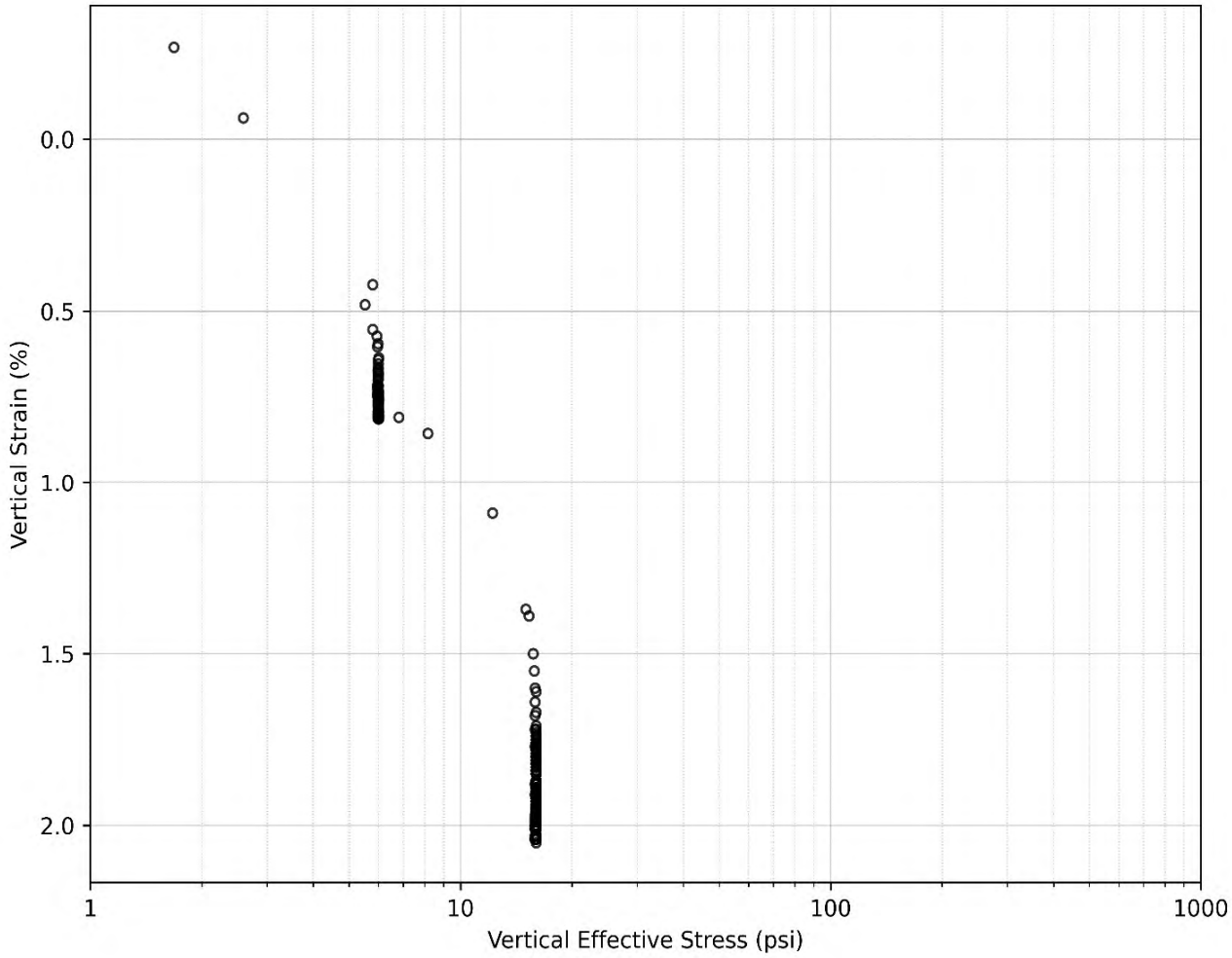
Pre-Test Photograph of B-2 U-9 Specimen #2 CDSS

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure

B-5



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
36.5	41	42	42	23	19	LEAN CLAY	CL

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	0.25	99.75

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.96
Total Unit Weight (pcf)	109.37
Degree of Saturation (%)	95.45
Void Ratio (e_0)	1.124

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Axial Strain Versus Logarithm of Vertical Effective Stress for B-2 U-9 Specimen #3 stress-controlled CDSS Consolidation Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-6

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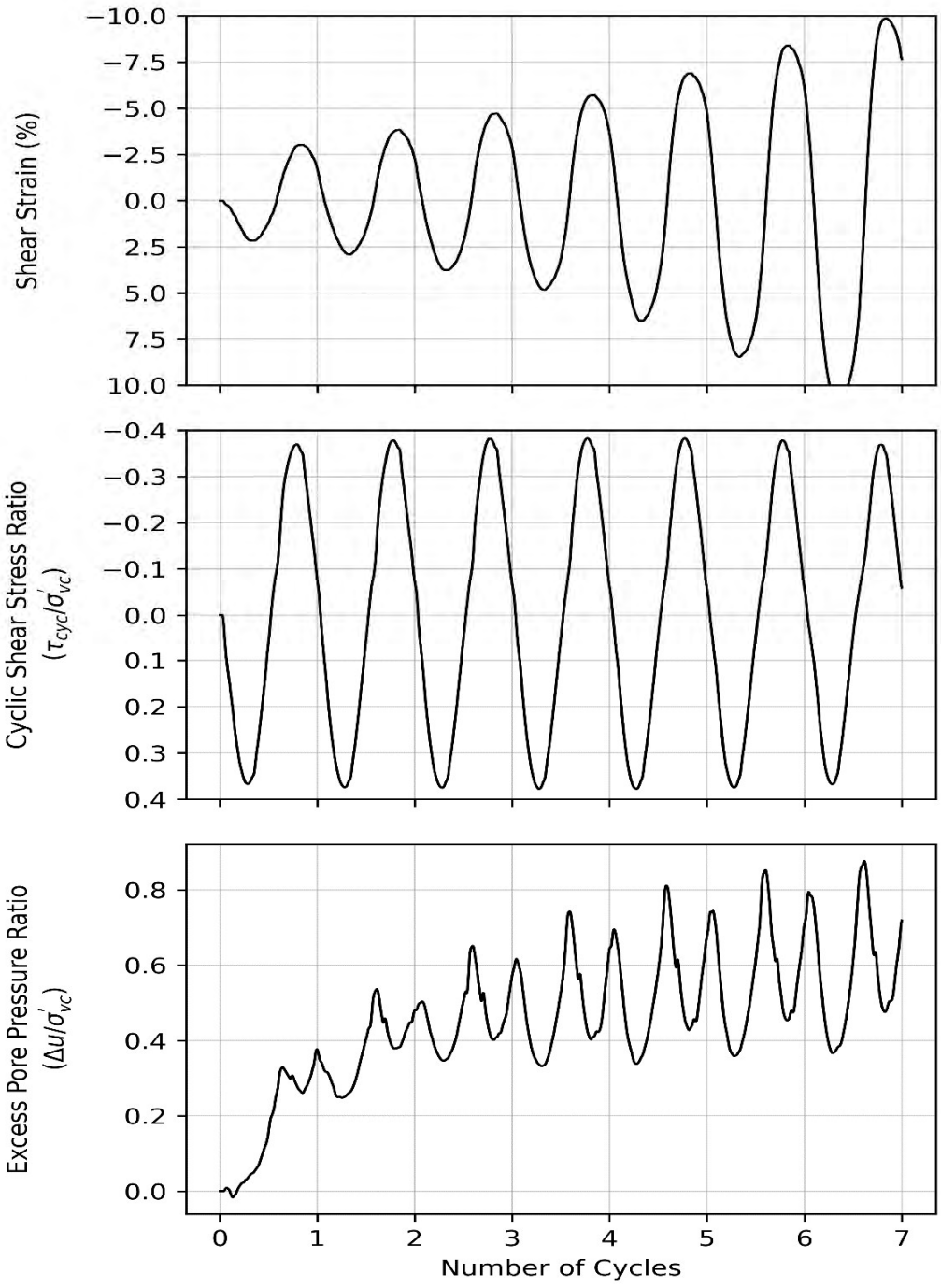


Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

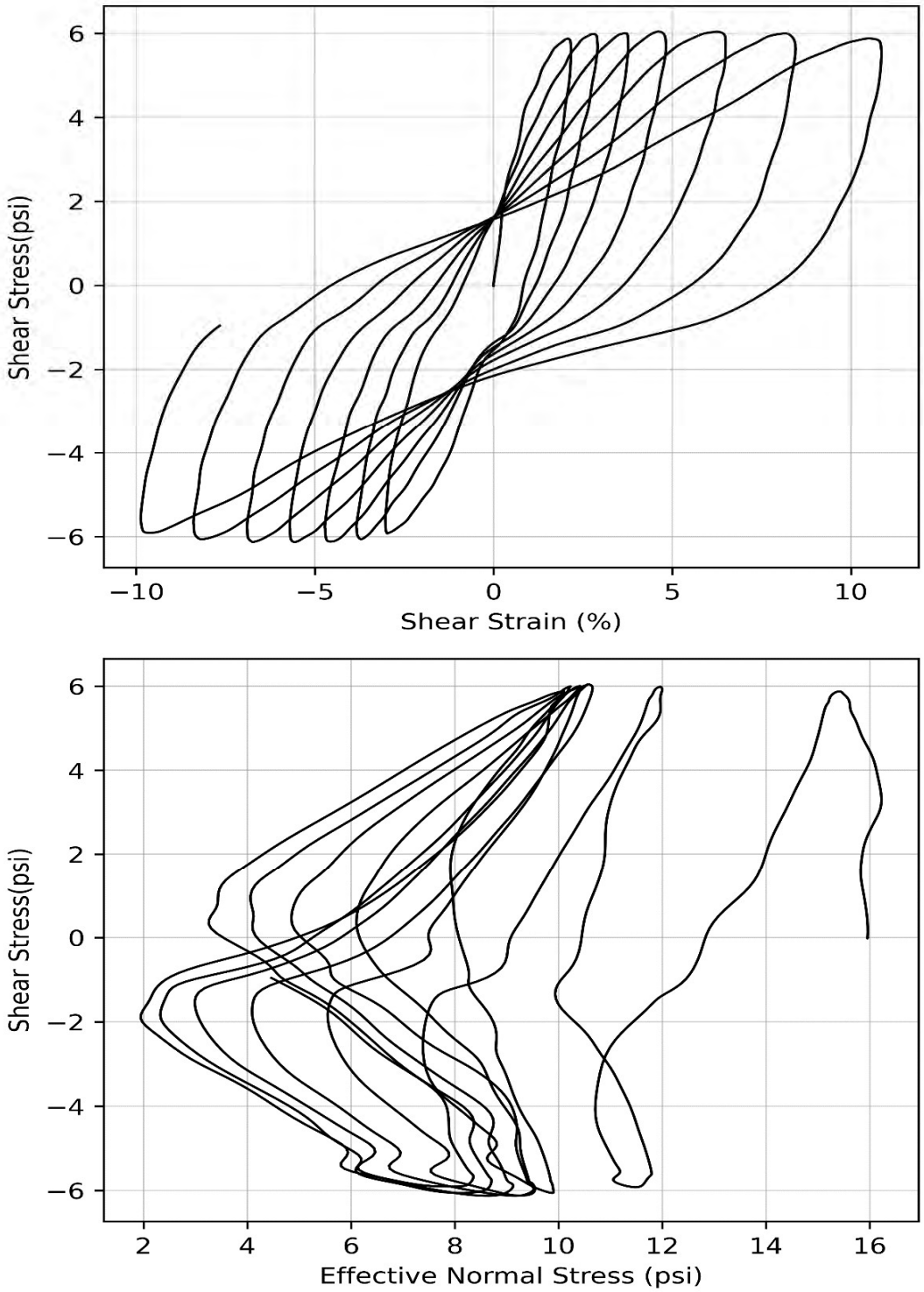
PDX Fuel Project Tank Design
Portland, OR

Cyclic shear phase data for B-2 U-9 Specimen #3 stress-controlled CDSS Cyclic Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-6



Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Cyclic Loop for B-2 U-9 Specimen #3 stress-controlled CDSS Cyclic Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-6

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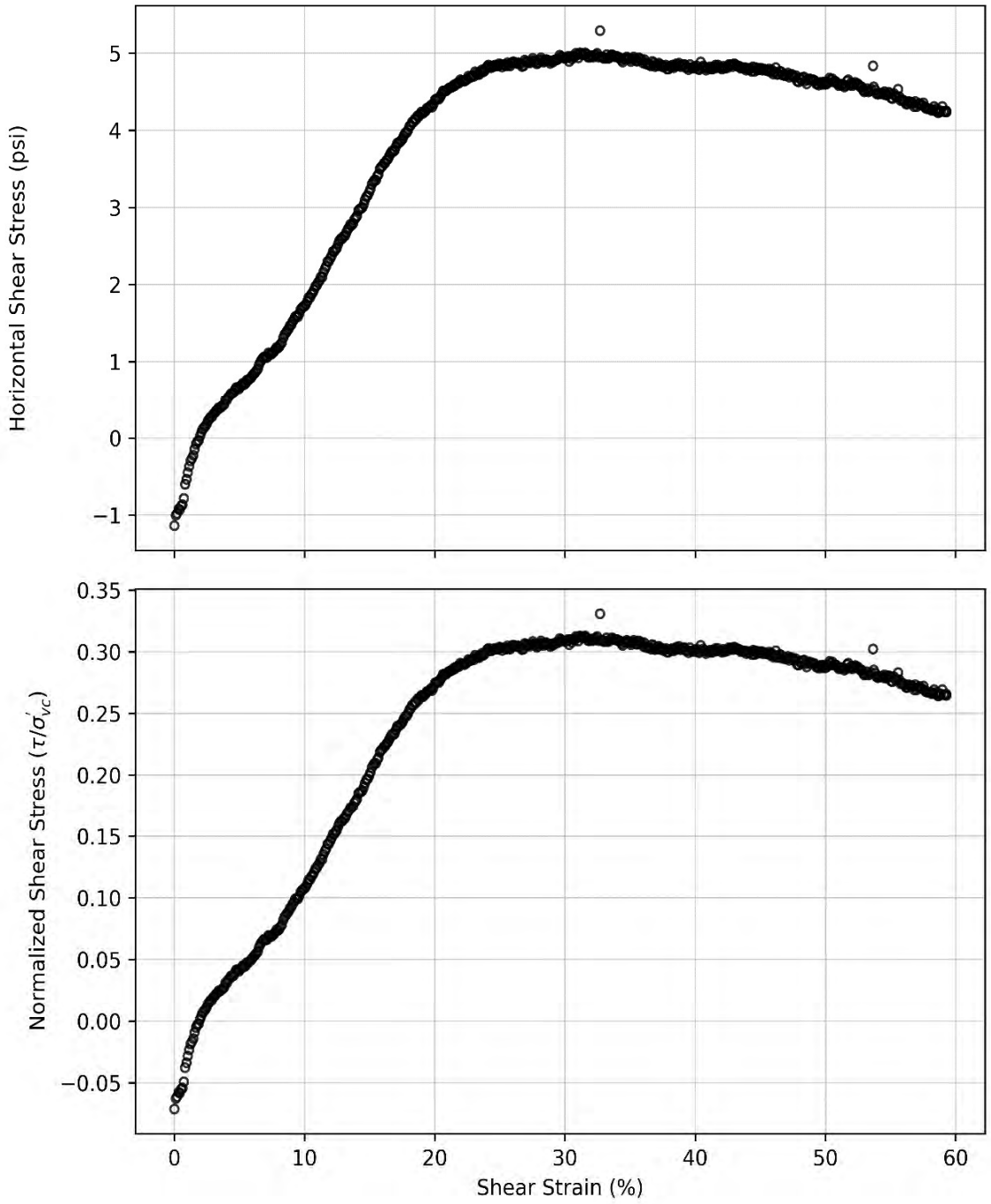

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section. Post-cyclic direct simple shear test stress and strain are measured relative to the state of stress of the soil specimen at the end of the cyclic phase

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal Shear Stress and Normalized Shear Stress for B-2 U-9 Specimen #3 stress-controlled CDSS Post-Cyclic Shear Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-6

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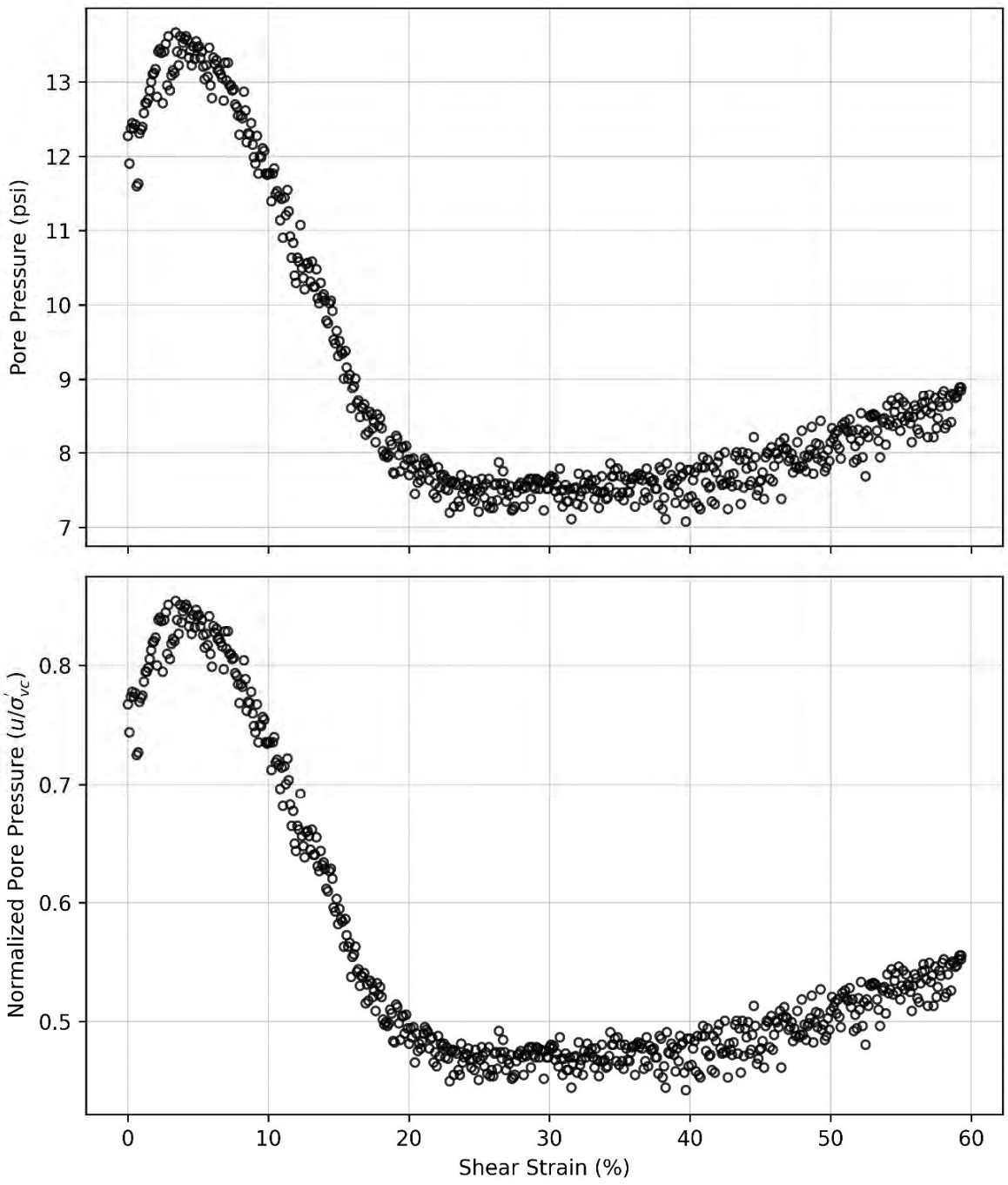

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Pore Pressure and Normalized Pore Pressure Versus Shear Strain for B-2 U-9 Specimen #3 stress-controlled CDSS Post-Cyclic Shear Phase

Job Number: 0204679-001 05/23

HALEY ALDRICH

Figure
B-6

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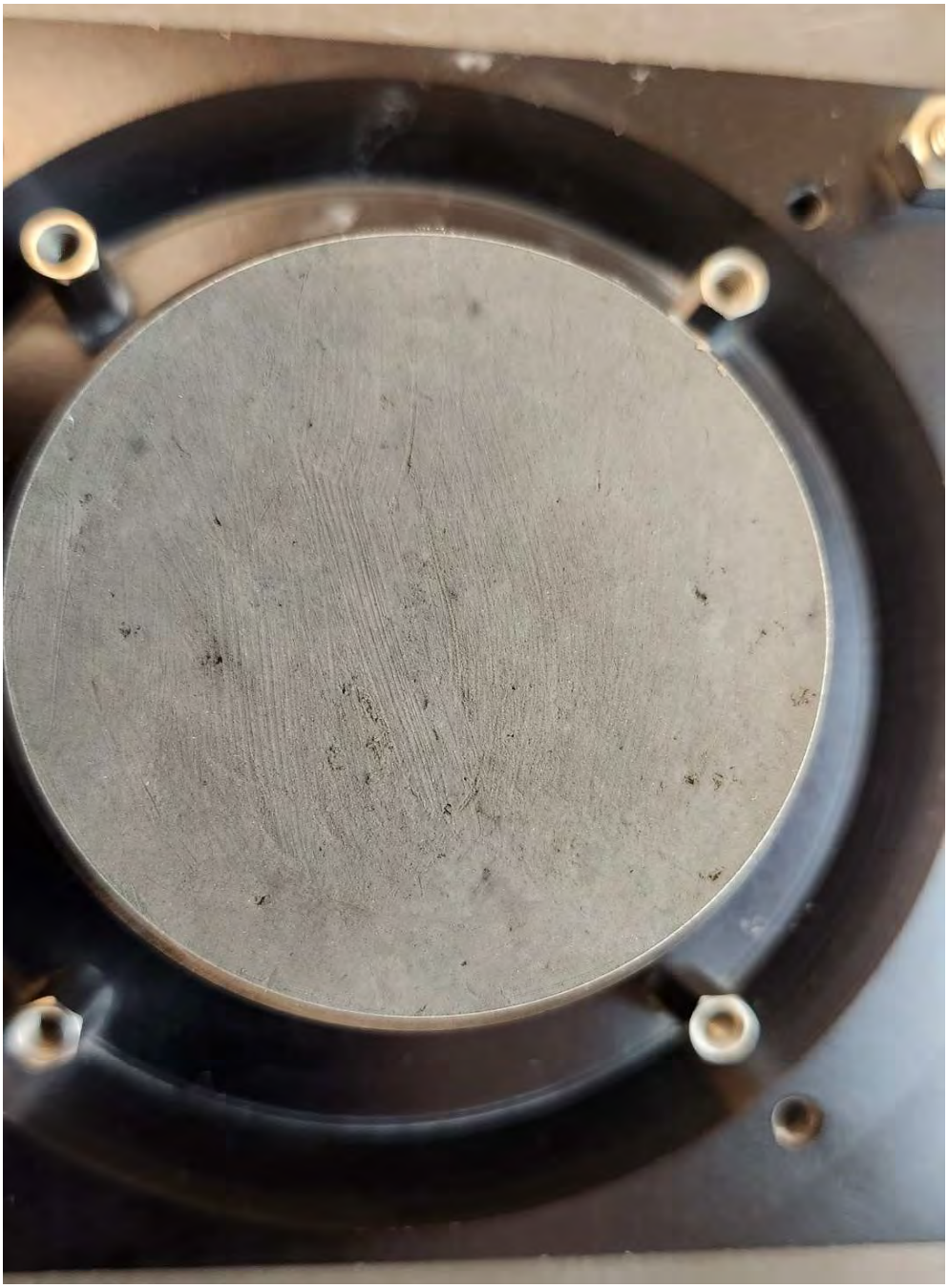


Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

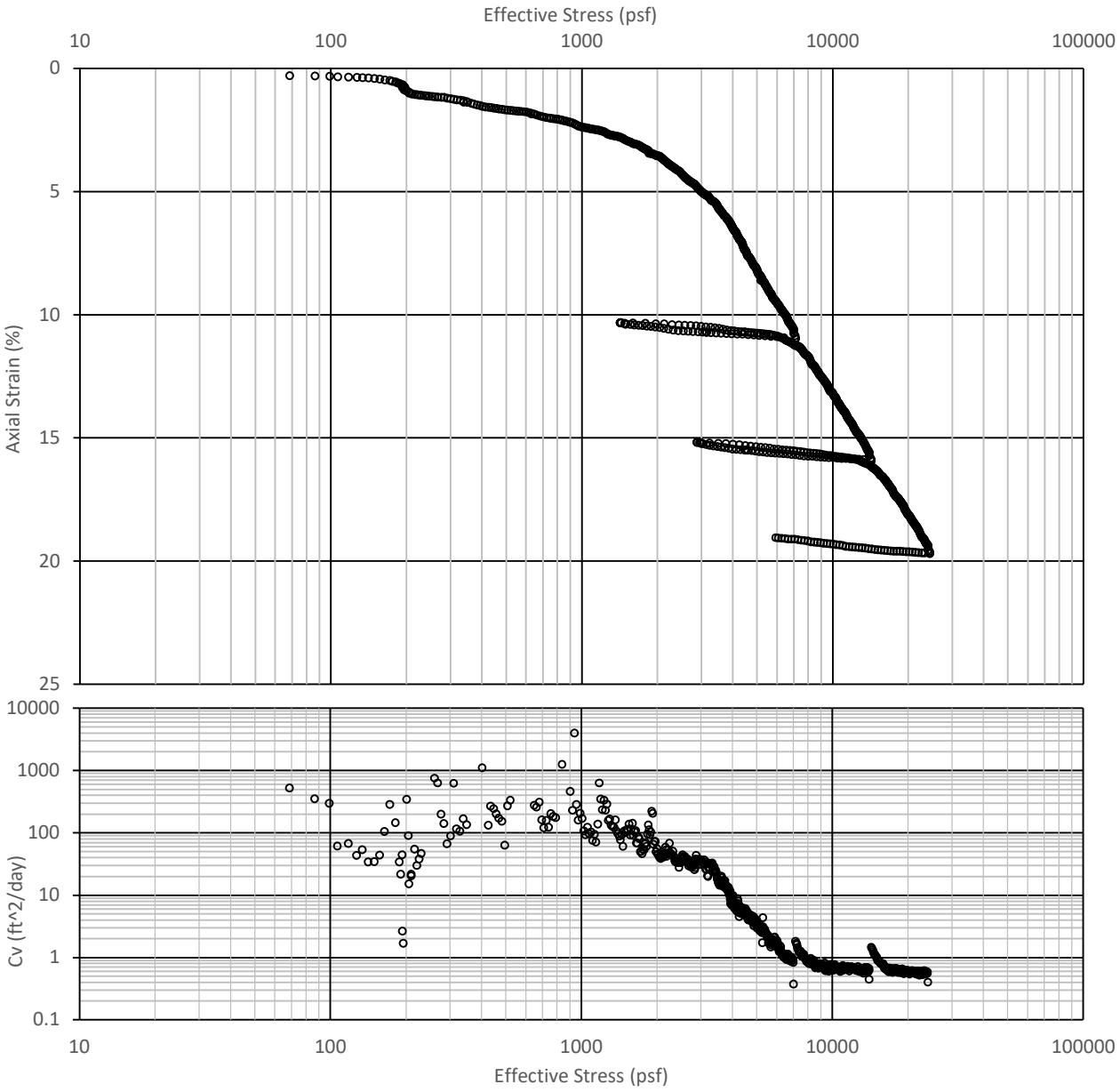
PDX Fuel Project Tank Design
Portland, OR

Pre-Test Photograph of B-2 U-9 Specimen #3 CDSS

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-6



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
11	39	29	33	21	12	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
960	3000	2700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	5.01
Total Unit Weight (pcf)	110.88
Degree of Saturation (%)	95.92
Void Ratio (e0)	1.068

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

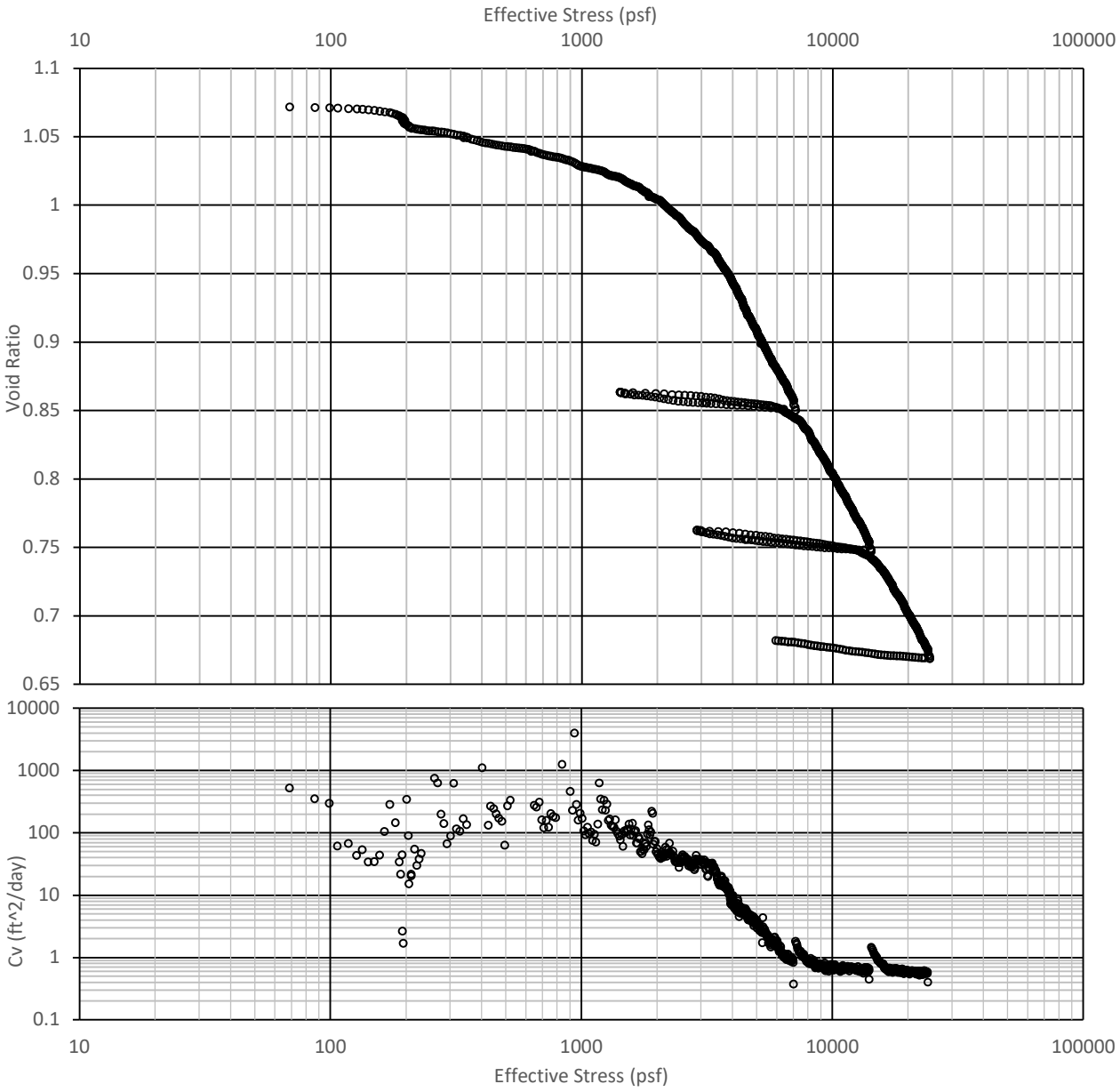
Axial strain and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-3 CRS Consolidation

Job Number: 0204679-001 4/26/2023

HALEY ALDRICH

Figure
B-7

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
11	39	29	33	21	12	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
960	3000	2700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
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Weight (ounces)	5.01
Total Unit Weight (pcf)	110.88
Degree of Saturation (%)	95.92
Void Ratio (e0)	1.068

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

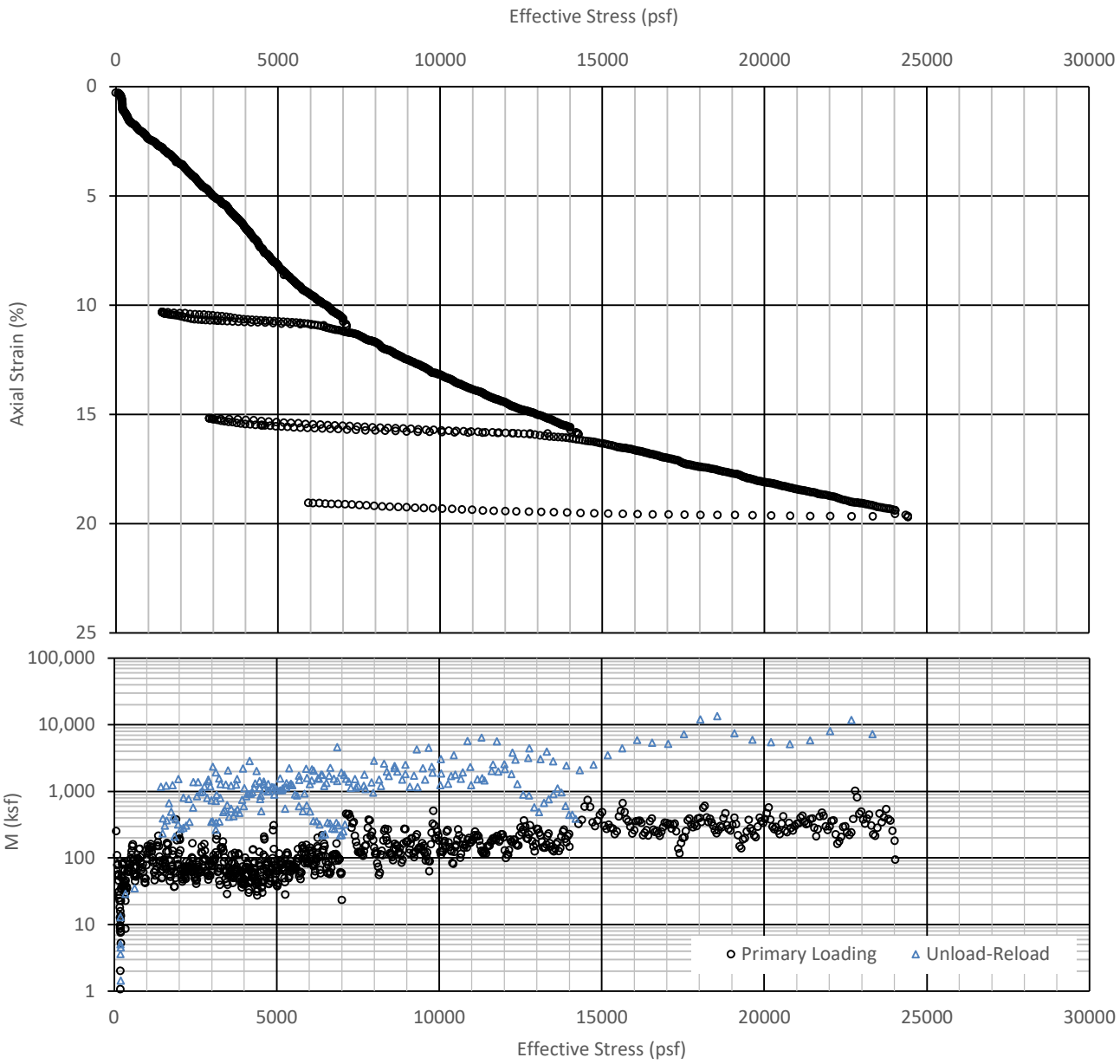
Void ratio and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-3 CRS Consolidation

Job Number: 0204679-001 4/26/2023

HALEY ALDRICH

Figure
B-7

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
11	39	29	33	21	12	LEAN CLAY	CL

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
960	3000	2700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	5.01
Total Unit Weight (pcf)	110.88
Degree of Saturation (%)	95.92
Void Ratio (e0)	1.068

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

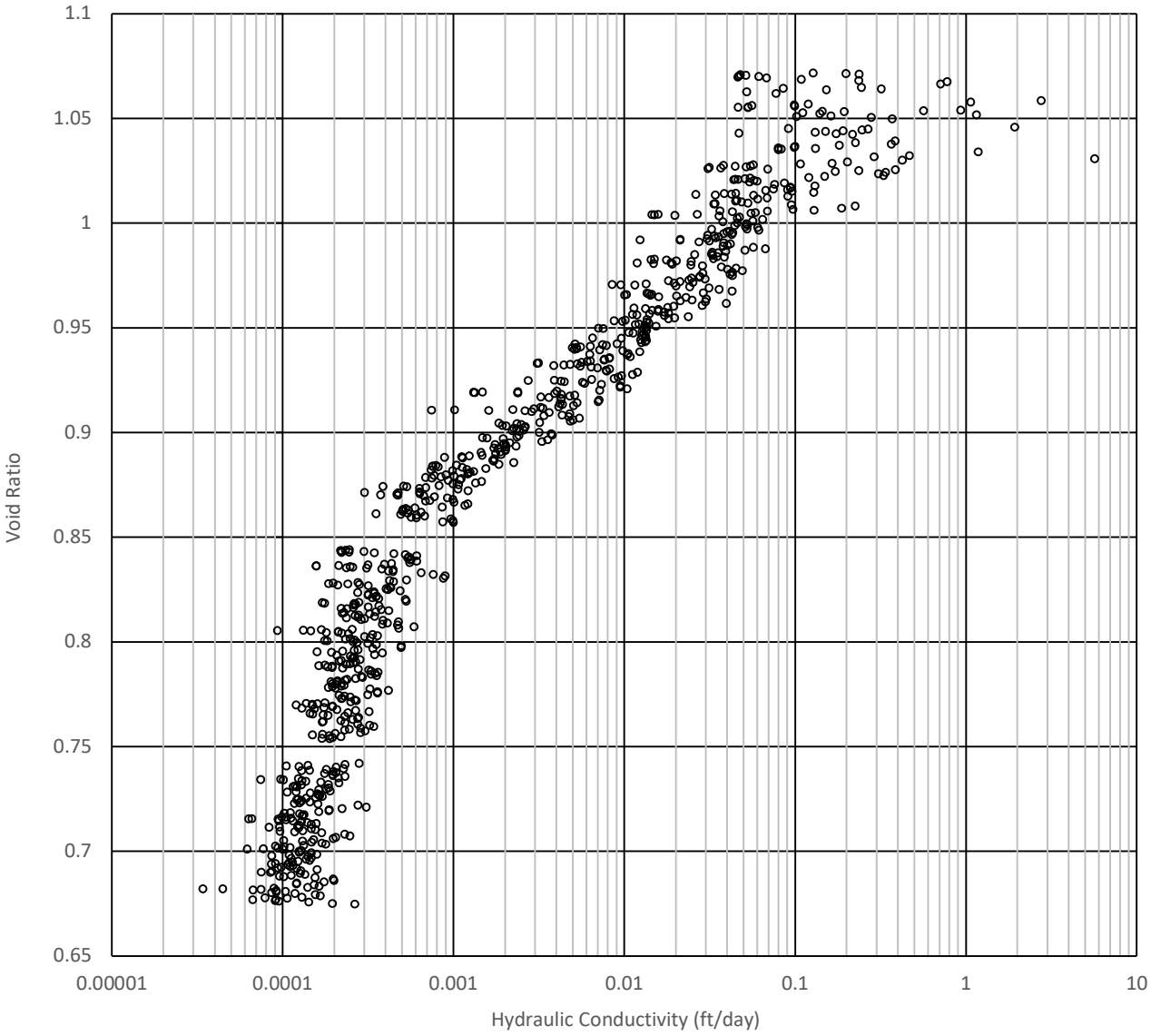
Axial strain versus vertical effective stress for B-1 U-3 CRS Consolidation

Job Number: 0204679-001 4/26/2023

HALEY ALDRICH

Figure
B-7

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
11	39	29	33	21	12	LEAN CLAY	CL

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
960	3000	2700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	5.01
Total Unit Weight (pcf)	110.88
Degree of Saturation (%)	95.92
Void Ratio (e0)	1.068

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

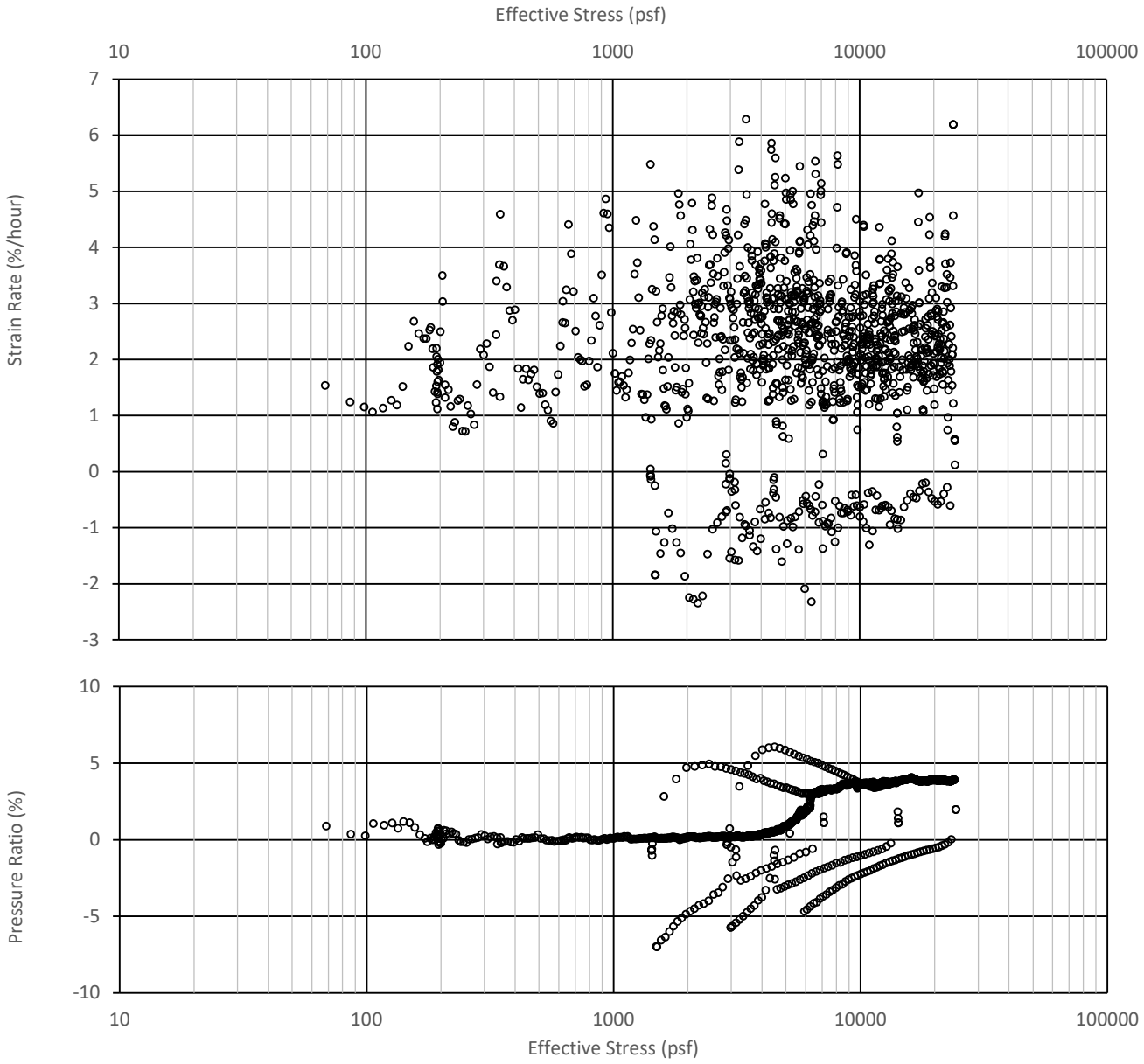
Void ratio versus logarithm of hydraulic conductivity B-1 U-3 CRS Consolidation

Job Number: 0204679-001 4/26/2023

HALEY ALDRICH

Figure
B-7

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
11	39	29	33	21	12	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
960	3000	2700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	5.01
Total Unit Weight (pcf)	110.88
Degree of Saturation (%)	95.92
Void Ratio (e0)	1.068

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

Axial strain, void ratio, and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-3 CRS Consolidation

Job Number: 0204679-001 4/26/2023

HALEY ALDRICH

Figure
B-7

initials MM/DD/YY location\filename.xls

PDX Fuel Project Tank Design
Portland, OR

Pre-Test Photograph

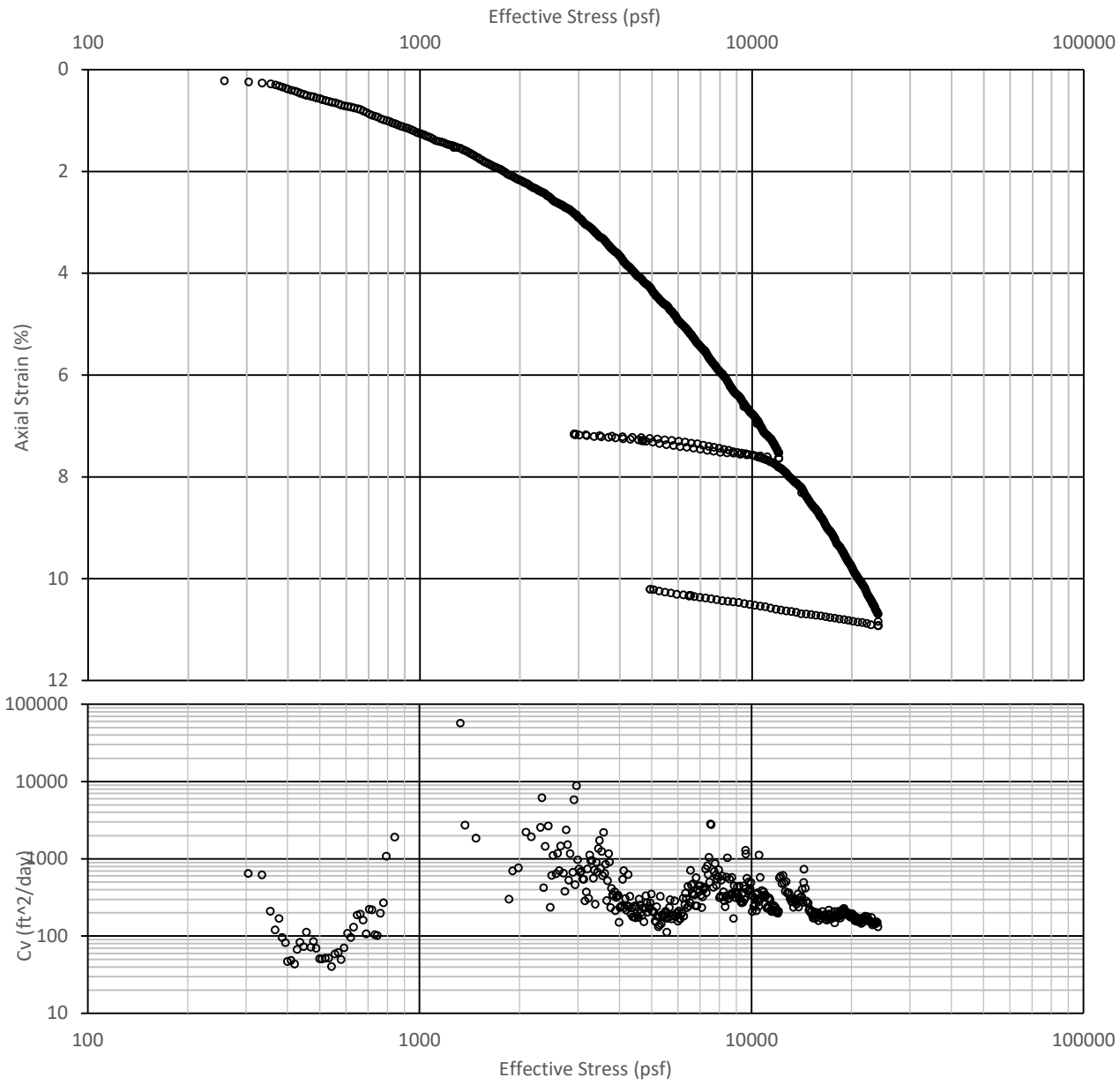
0204679-001 4/26/2023

HALEY ALDRICH

Figure

B-7

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
17	40	34	GNP	GNP	GNP	SANDY SILT	ML

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1440	6500	5700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	Good to fair	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	5.04
Total Unit Weight (pcf)	111.93
Degree of Saturation (%)	99.67
Void Ratio (e0)	1.074

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

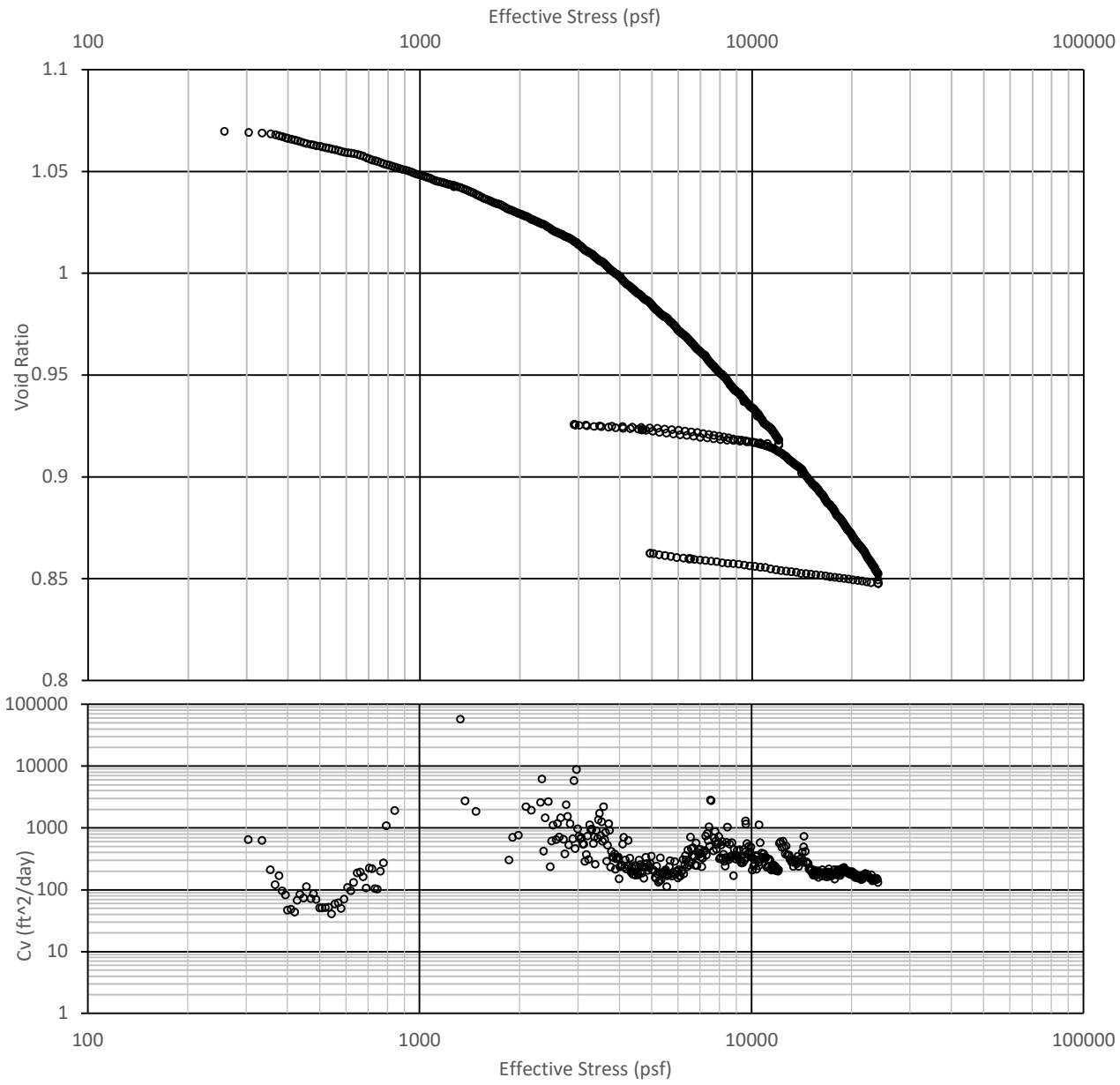
Axial strain and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-6 CRS Consolidation

Job Number: 0204679-001 5/10/2023

HALEY ALDRICH

Figure
B-8

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
17	40	34	GNP	GNP	GNP	SANDY SILT	ML

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1440	6500	5700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	Good to fair	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	5.04
Total Unit Weight (pcf)	111.93
Degree of Saturation (%)	99.67
Void Ratio (e0)	1.074

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

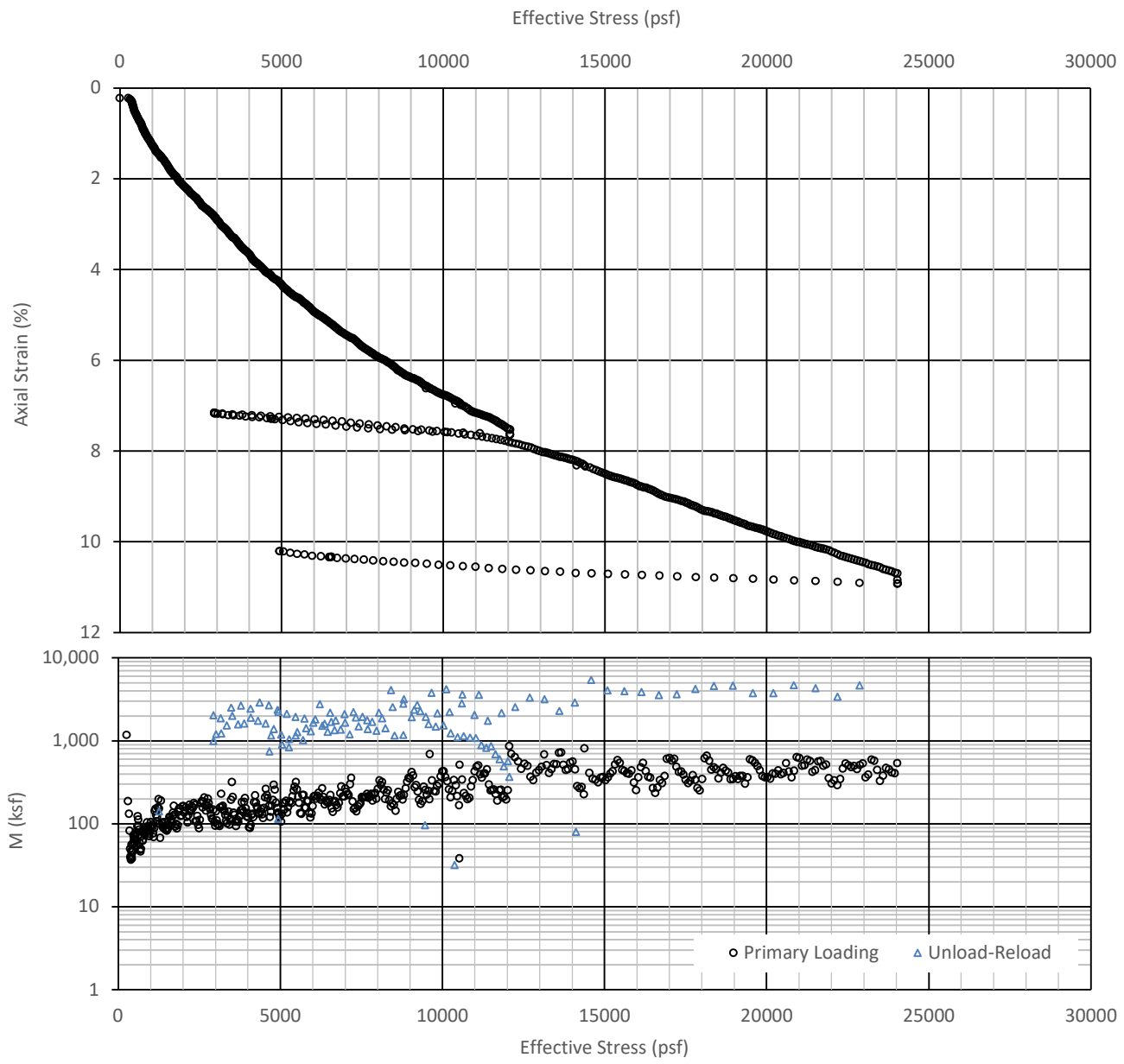
Void ratio and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-6 CRS Consolidation

Job Number: 0204679-001 5/10/2023

HALEY ALDRICH

Figure
B-8

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
17	40	34	GNP	GNP	GNP	SANDY SILT	ML

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1440	6500	5700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	Good to fair	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	5.04
Total Unit Weight (pcf)	111.93
Degree of Saturation (%)	99.67
Void Ratio (e0)	1.074

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

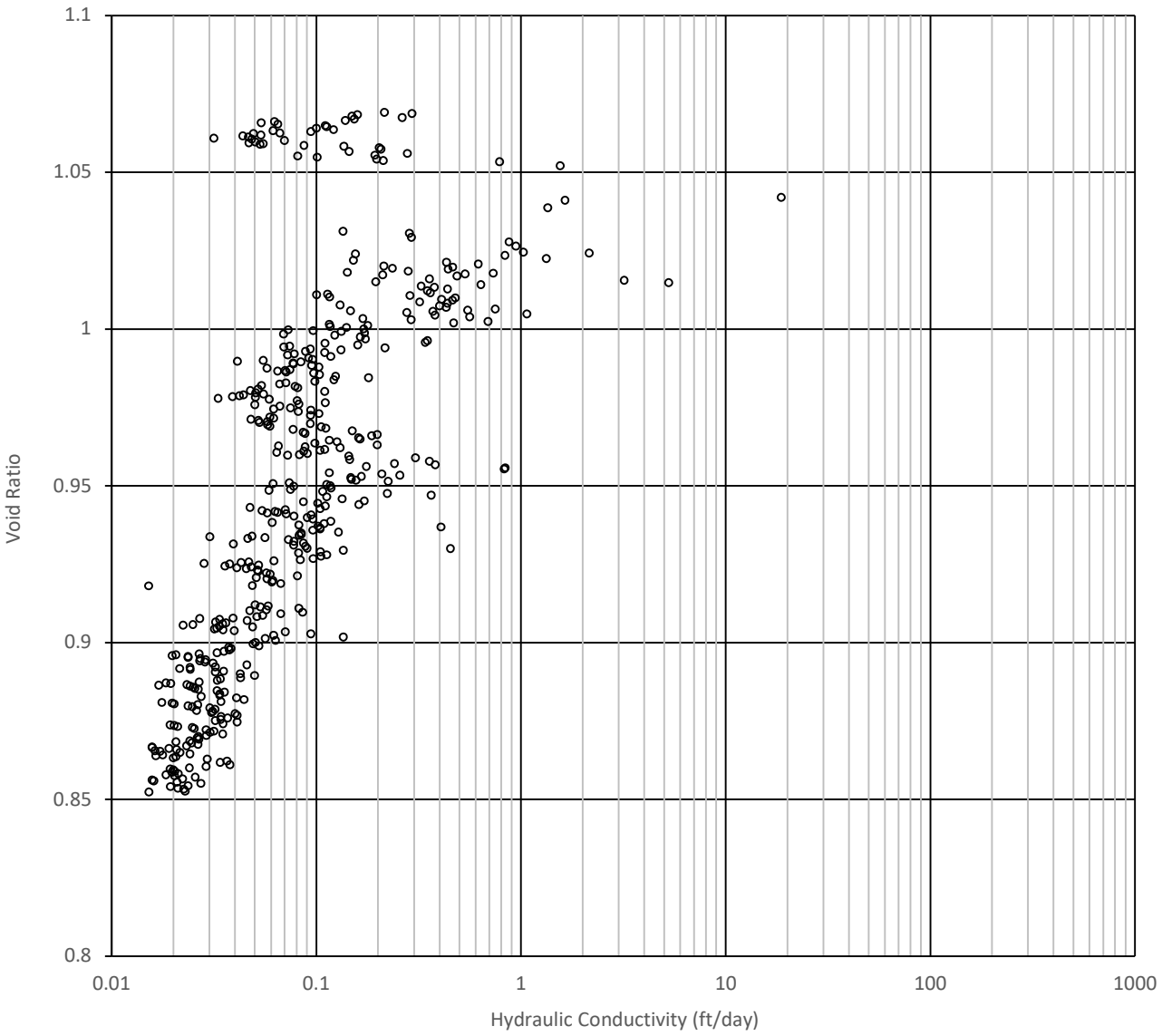
Axial strain versus vertical effective stress for B-1 U-6 CRS Consolidation

Job Number: 0204679-001 5/10/2023

HALEY ALDRICH

Figure
B-8

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
17	40	34	GNP	GNP	GNP	SANDY SILT	ML

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1440	6500	5700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	Good to fair	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	5.04
Total Unit Weight (pcf)	111.93
Degree of Saturation (%)	99.67
Void Ratio (e0)	1.074

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

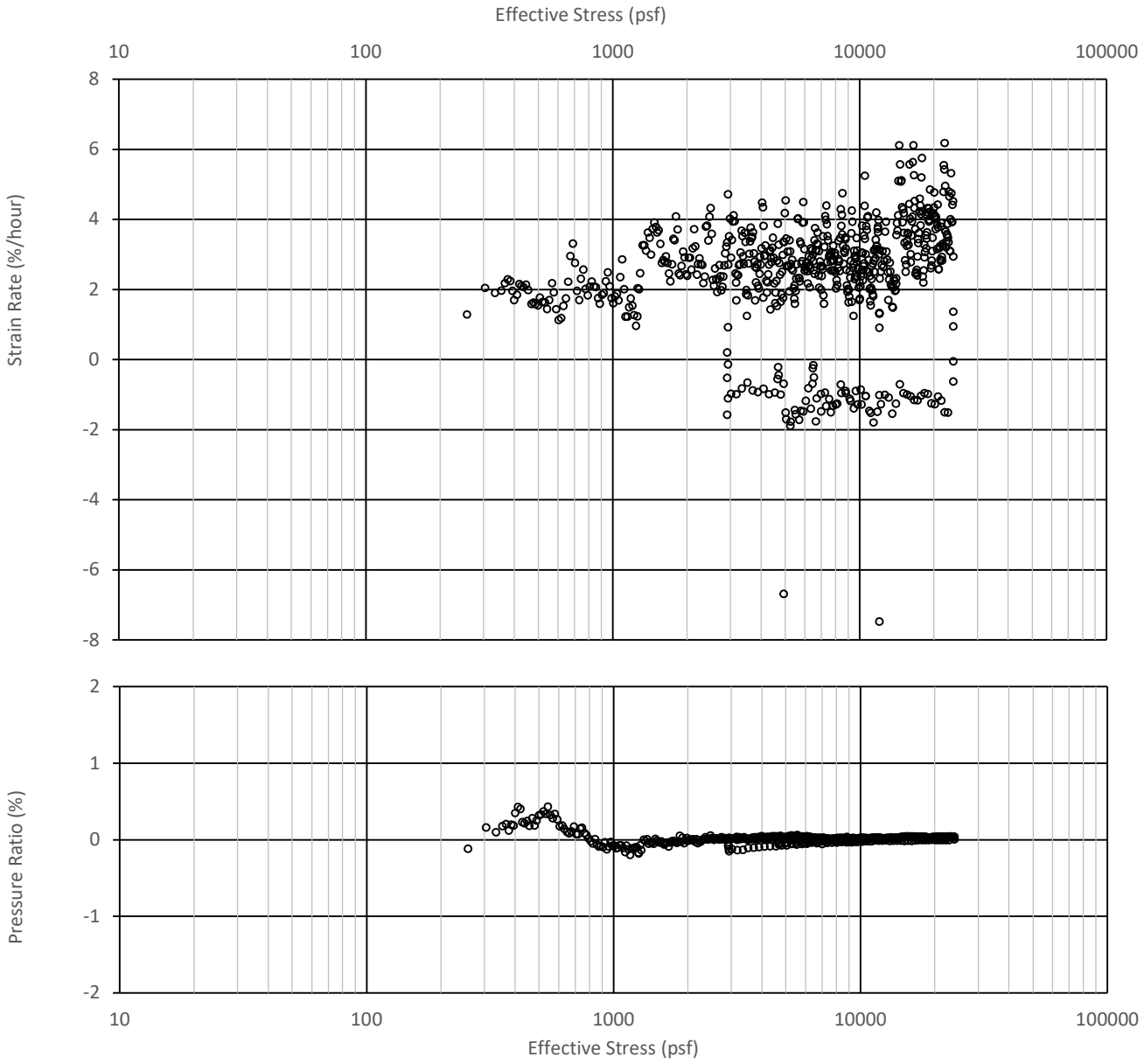
Void ratio versus logarithm of hydraulic conductivity B-1 U-6 CRS Consolidation

Job Number: 0204679-001 5/10/2023

HALEY ALDRICH

Figure
B-8

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
17	40	34	GNP	GNP	GNP	SANDY SILT	ML

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1440	6500	5700
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	Good to fair	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	5.04
Total Unit Weight (pcf)	111.93
Degree of Saturation (%)	99.67
Void Ratio (e0)	1.074

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

Axial strain, void ratio, and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-6 CRS Consolidation

Job Number: 0204679-001 5/10/2023

HALEY ALDRICH

Figure
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initials MM/DD/YY location\filename.xls

PDX Fuel Project Tank Design
Portland, OR

Post-Test Photograph

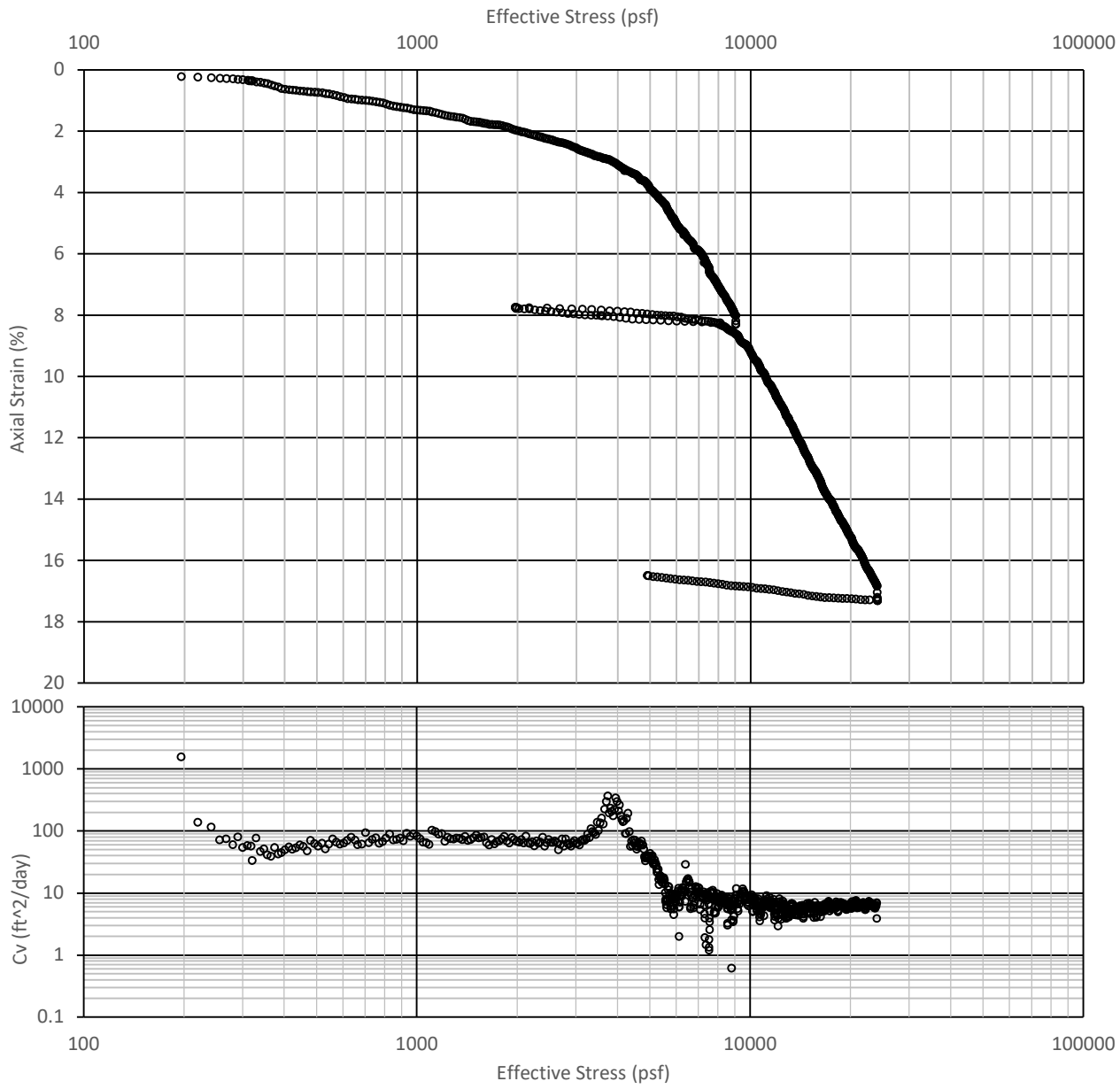
0204679-001 5/10/2023

HALEY ALDRICH

Figure

B-8

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
25.9	46	37	46	34	12	SILT	ML

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1820	5600	5900
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	#N/A	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.83
Total Unit Weight (pcf)	106.37
Degree of Saturation (%)	96.41
Void Ratio (e0)	1.277

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

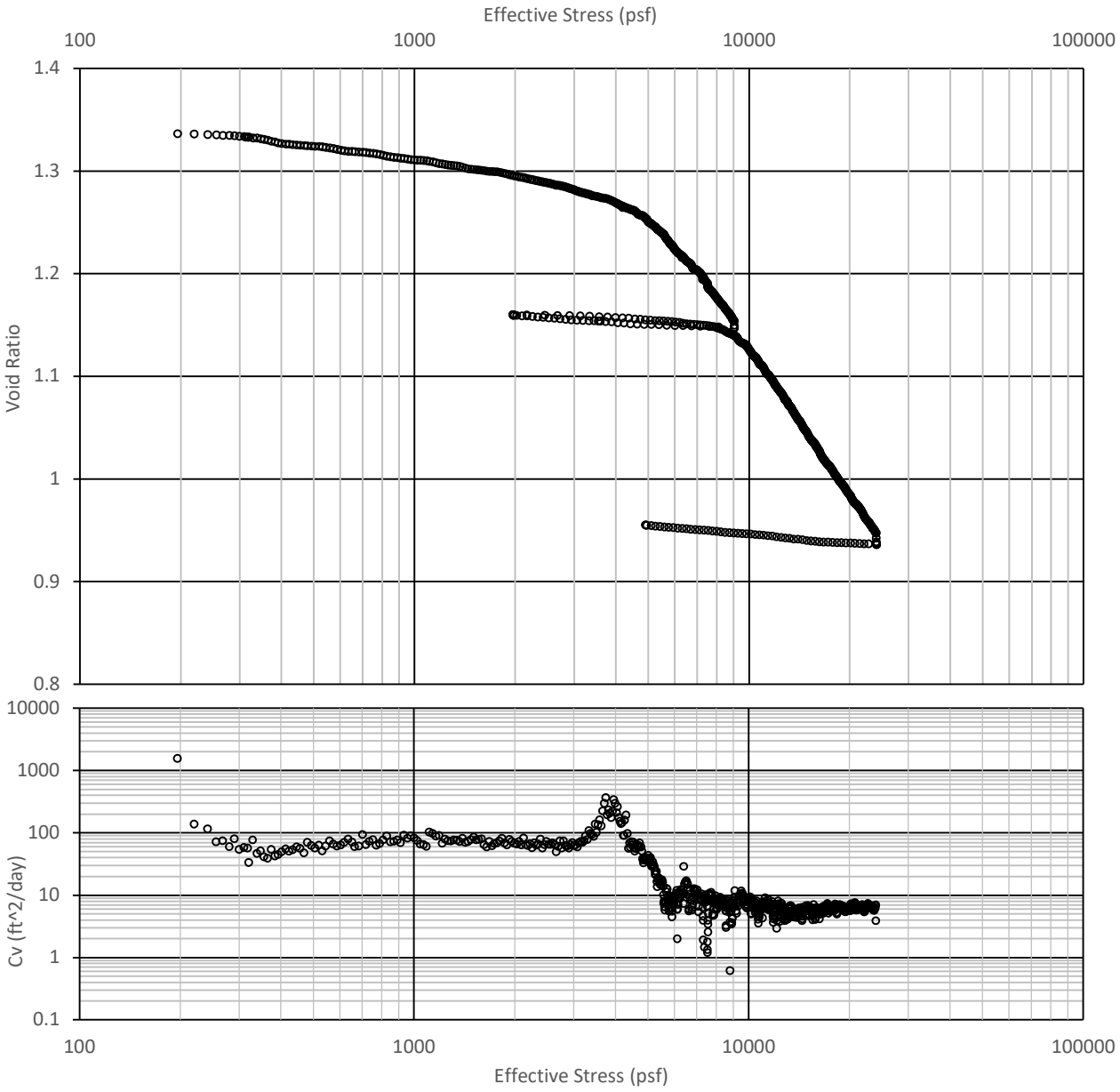
Axial strain and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-8 CRS Consolidation

Job Number: 0204679-001 5/11/2023

HALEY ALDRICH

Figure
B-9

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
25.9	46	37	46	34	12	SILT	ML

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1820	5600	5900
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	#N/A	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.83
Total Unit Weight (pcf)	106.37
Degree of Saturation (%)	96.41
Void Ratio (e0)	1.277

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

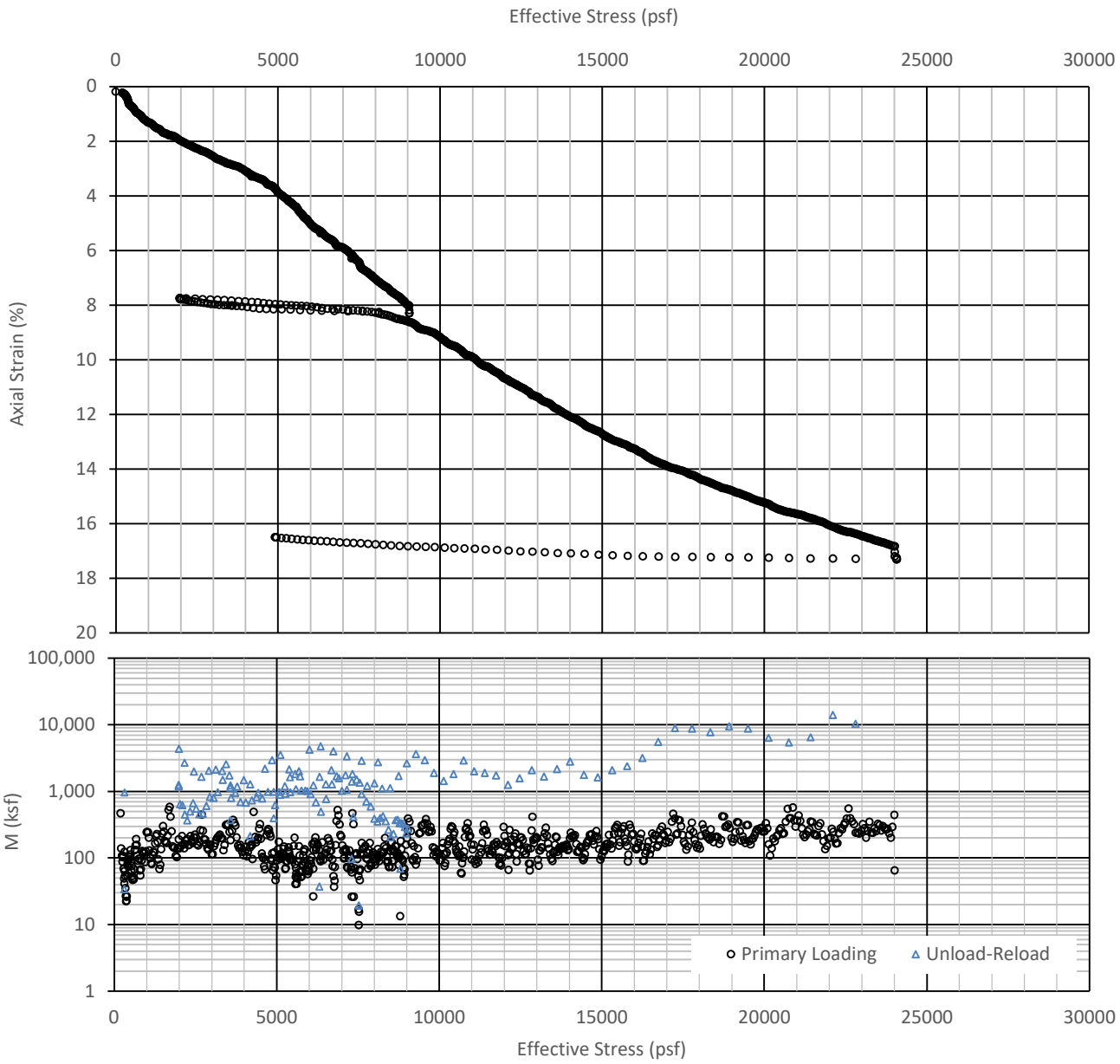
Void ratio and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-8 CRS Consolidation

Job Number: 0204679-001 5/11/2023

HALEY ALDRICH

Figure
B-9

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
25.9	46	37	46	34	12	SILT	ML

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1820	5600	5900
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	#N/A	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.83
Total Unit Weight (pcf)	106.37
Degree of Saturation (%)	96.41
Void Ratio (e0)	1.277

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

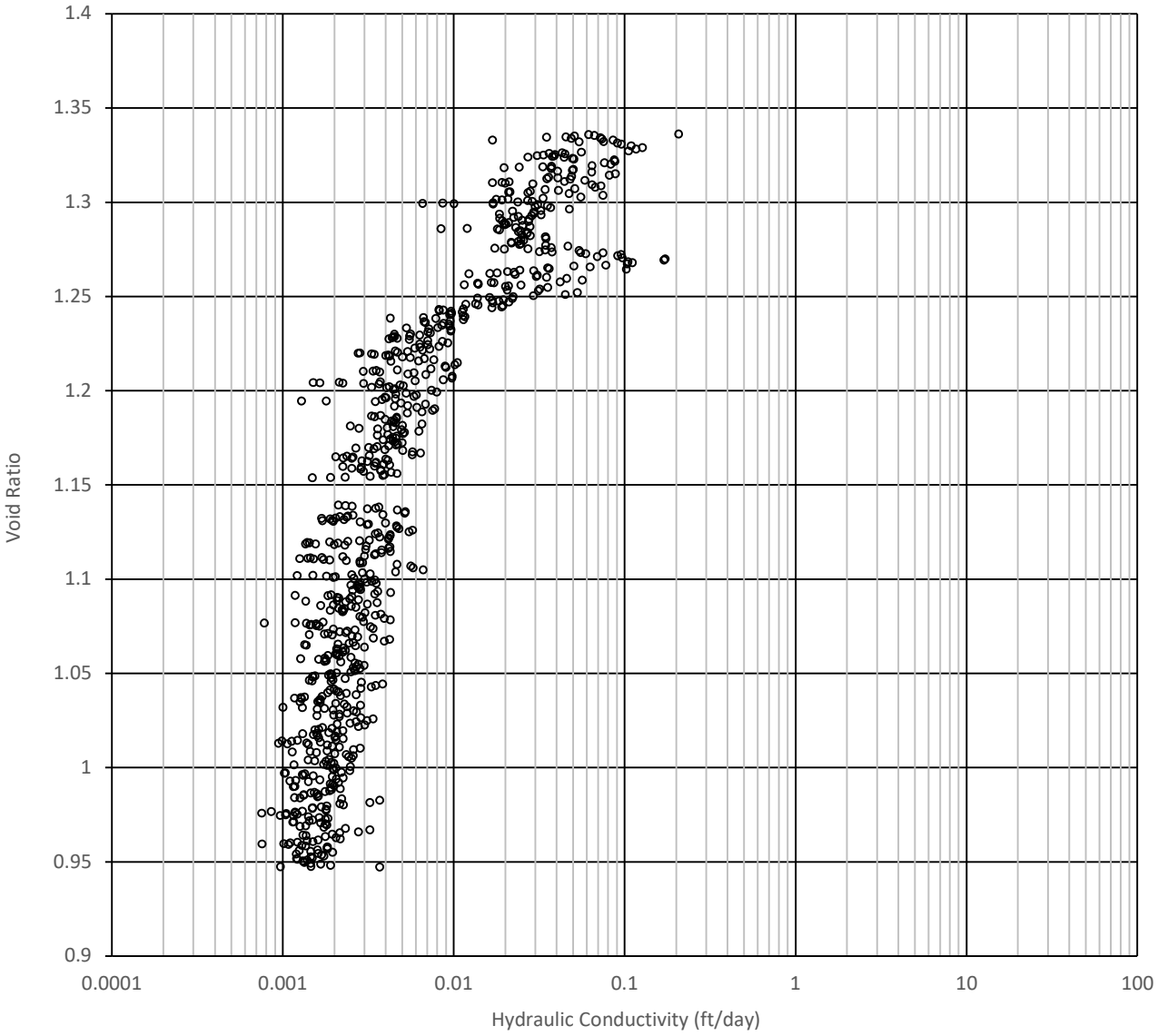
Axial strain versus vertical effective stress for B-1 U-8 CRS Consolidation

Job Number: 0204679-001 5/11/2023

HALEY ALDRICH

Figure
B-9

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
25.9	46	37	46	34	12	SILT	ML

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1820	5600	5900
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	#N/A	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.83
Total Unit Weight (pcf)	106.37
Degree of Saturation (%)	96.41
Void Ratio (e0)	1.277

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

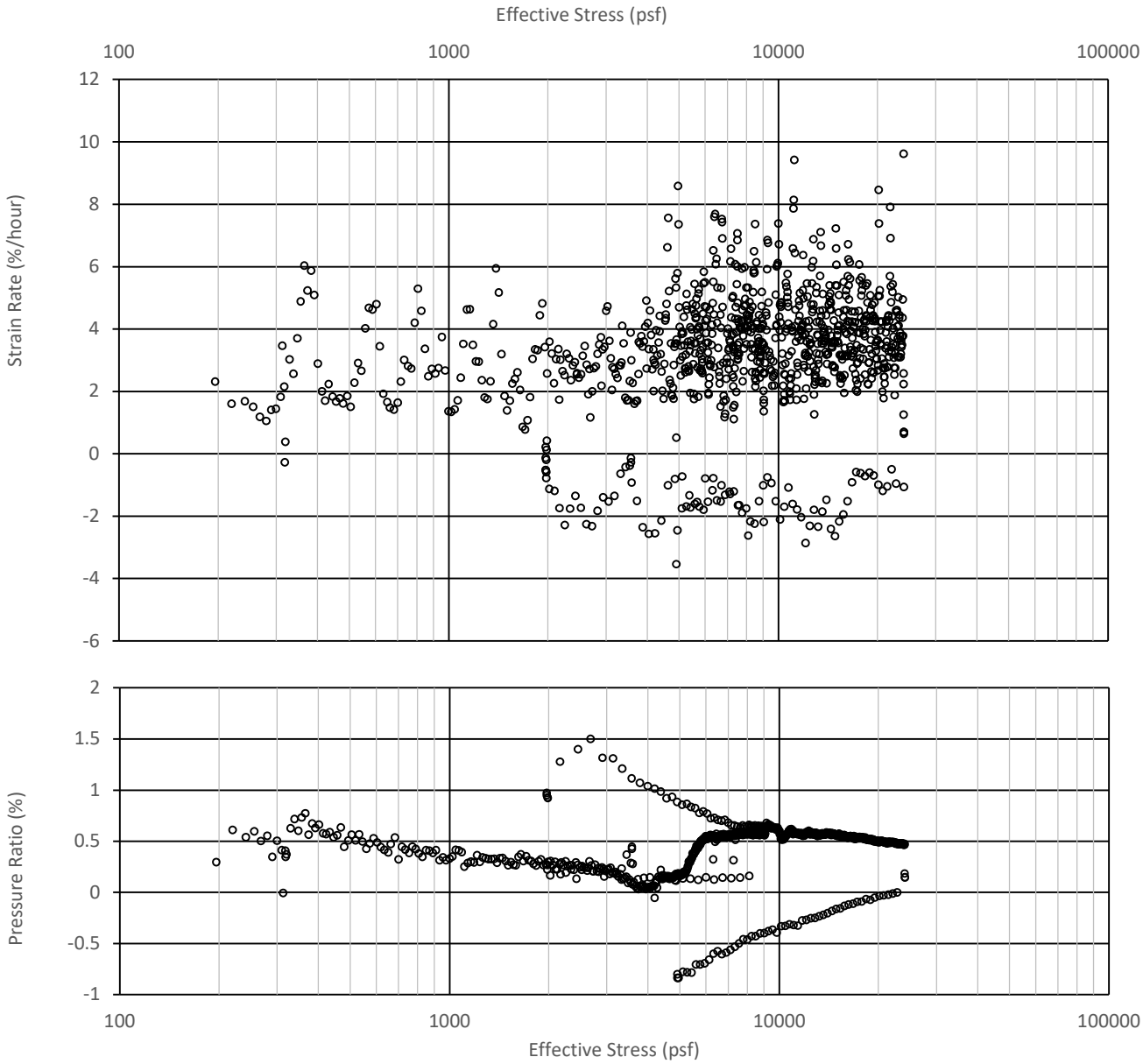
Void ratio versus logarithm of hydraulic conductivity B-1 U-8 CRS Consolidation

Job Number: 0204679-001 5/11/2023

HALEY ALDRICH

Figure
B-9

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
25.9	46	37	46	34	12	SILT	ML

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1820	5600	5900
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
B	#N/A	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.83
Total Unit Weight (pcf)	106.37
Degree of Saturation (%)	96.41
Void Ratio (e0)	1.277

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

Axial strain, void ratio, and coefficient of consolidation versus logarithm of vertical effective stress for B-1 U-8 CRS Consolidation

Job Number: 0204679-001 5/11/2023

HALEY ALDRICH

Figure
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initials MM/DD/YY location\filename.xls

PDX Fuel Project Tank Design
Portland, OR

Pre-Test Photograph

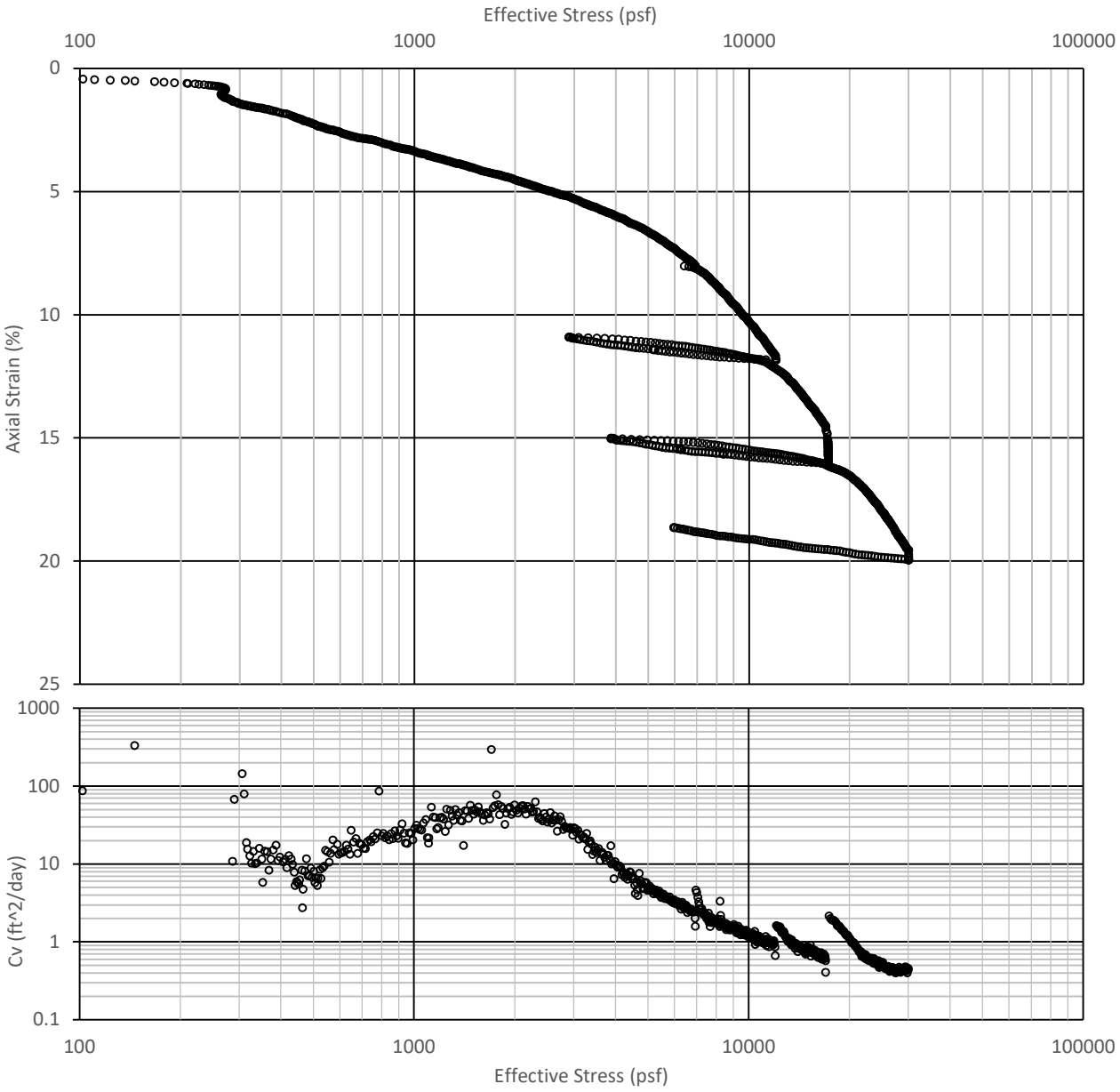
0204679-001 5/11/2023

HALEY ALDRICH

Figure

B-9

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
21	47	39	49	26	23	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1500	7500	7200
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
D	Very poor	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.74
Total Unit Weight (pcf)	105.24
Degree of Saturation (%)	95.13
Void Ratio (e0)	1.310

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, WA

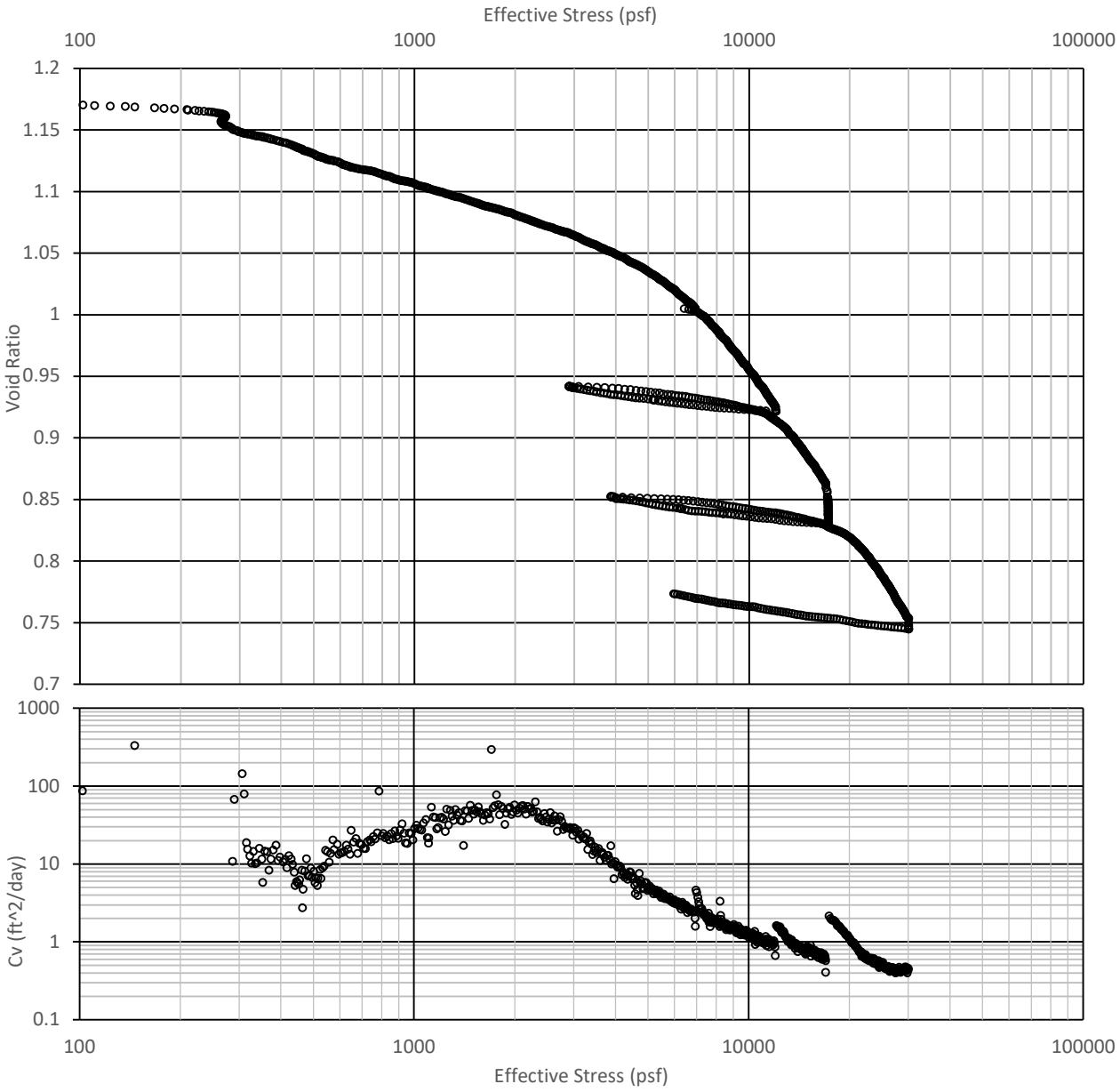
Axial strain and coefficient of consolidation versus logarithm of vertical effective stress for B-2 U-6 CRS Consolidation

Job Number: 0204679-001 4/14/2023

HALEY ALDRICH

Figure
B-10

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
21	47	39	49	26	23	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1500	5000	7200
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
D	Very poor	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.74
Total Unit Weight (pcf)	105.24
Degree of Saturation (%)	95.13
Void Ratio (e0)	1.310

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, WA

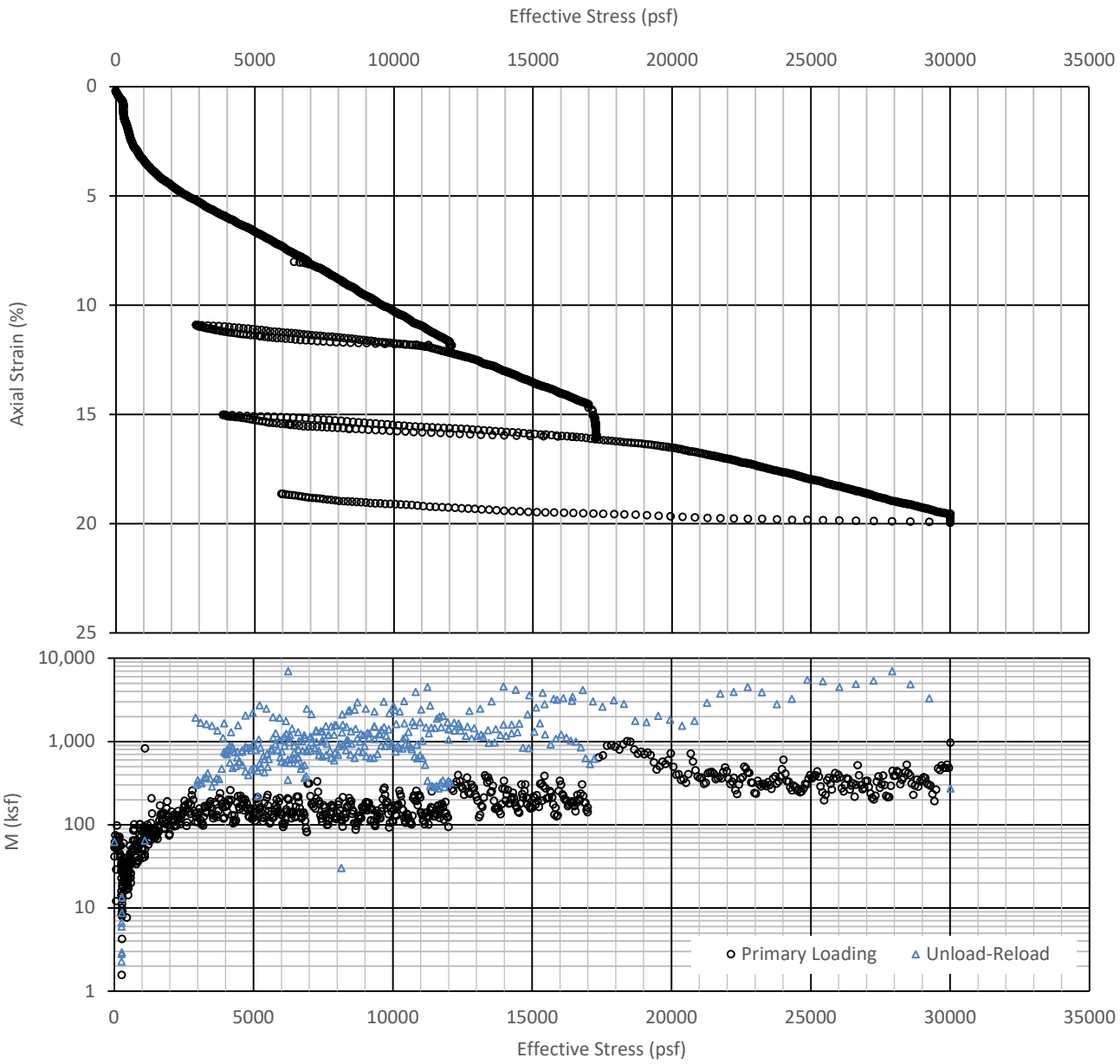
Void ratio and coefficient of consolidation versus logarithm of vertical effective stress for B-2 U-6 CRS Consolidation

Job Number: 0204679-001 4/14/2023

HALEY ALDRICH

Figure
B-10

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
21	47	39	49	26	23	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1500	5000	7200
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
D	Very poor	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.74
Total Unit Weight (pcf)	105.24
Degree of Saturation (%)	95.13
Void Ratio (e0)	1.310

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, WA

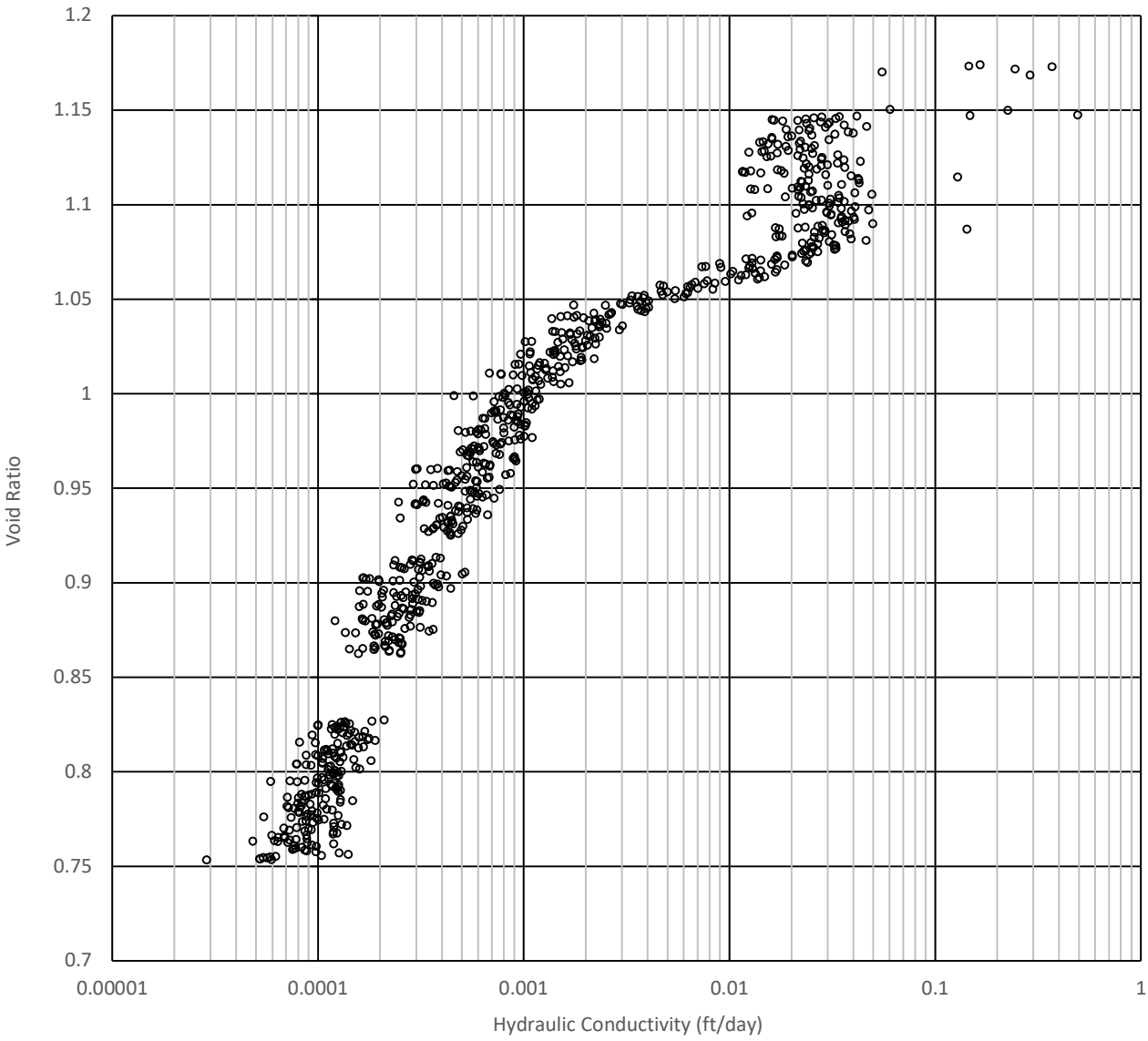
Axial strain versus vertical effective stress for B-2 U-6 CRS Consolidation

Job Number: 0204679-001 4/14/2023

HALEY ALDRICH

Figure
B-10

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
21	47	39	49	26	23	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1500	5000	7200
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
D	Very poor	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.74
Total Unit Weight (pcf)	105.24
Degree of Saturation (%)	95.13
Void Ratio (e0)	1.310

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, WA

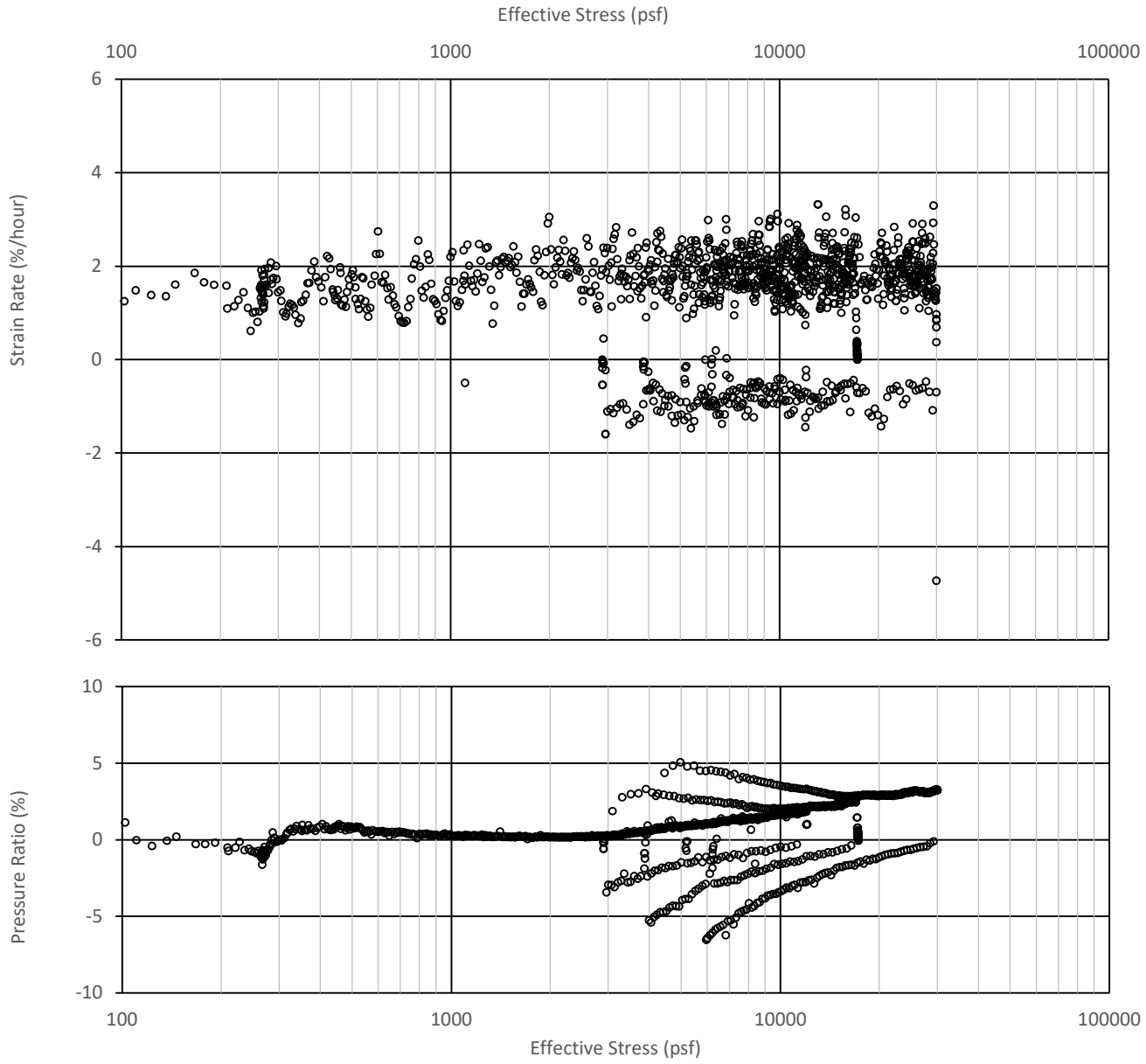
Void ratio versus logarithm of hydraulic conductivity B-2 U-6 CRS Consolidation

Job Number: 0204679-001 4/14/2023

HALEY ALDRICH

Figure
B-10

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
21	47	39	49	26	23	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1500	5000	7200
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
D	Very poor	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.74
Total Unit Weight (pcf)	105.24
Degree of Saturation (%)	95.13
Void Ratio (e0)	1.310

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, WA

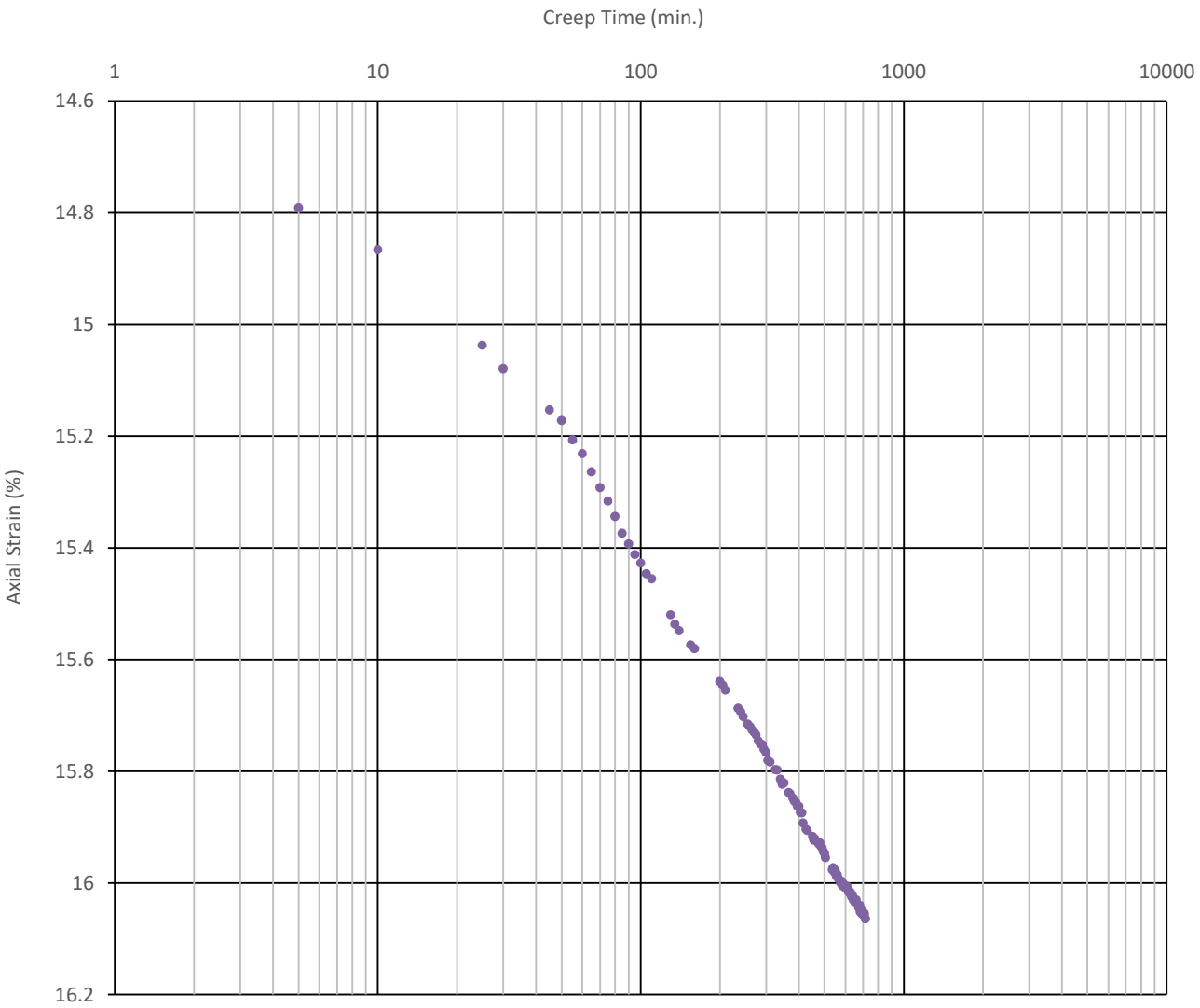
Axial strain, void ratio, and coefficient of consolidation versus logarithm of vertical effective stress for B-2 U-6 CRS Consolidation

Job Number: 0204679-001 4/14/2023

HALEY ALDRICH

Figure
B-10

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
21	47.04	38.51	49	26	23	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
1500	5000	7200
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. 1997	
D	Very poor	

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.74
Total Unit Weight (pcf)	105.24
Degree of Saturation (%)	95.13
Void Ratio (e0)	1.310

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, WA

Axial strain versus creep test logarithm of time for B-2 U-6 CRS Consolidation

Job Number: 0204679-001 4/14/2023

HALEY ALDRICH

Figure
B-10

initials MM/DD/YY location\filename.xls

PDX Fuel Project Tank Design
Portland, WA

Pre-Test Photograph

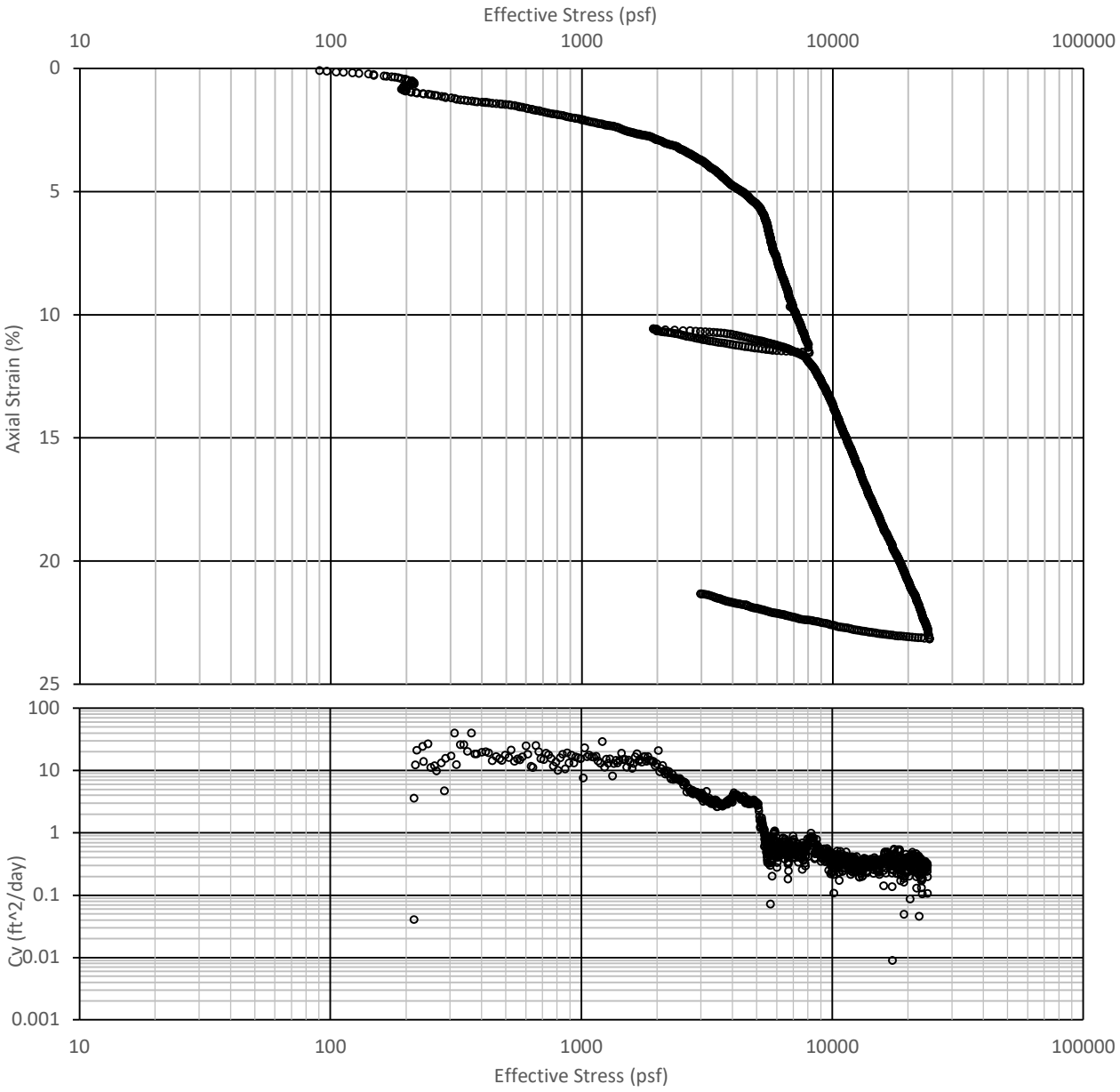
0204679-001 4/14/2023

HALEY ALDRICH

Figure

B-10

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
35.7	63	48	42	23	19	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
2100	5200	4500
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.48
Total Unit Weight (pcf)	98.90
Degree of Saturation (%)	96.87
Void Ratio (e0)	1.729

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

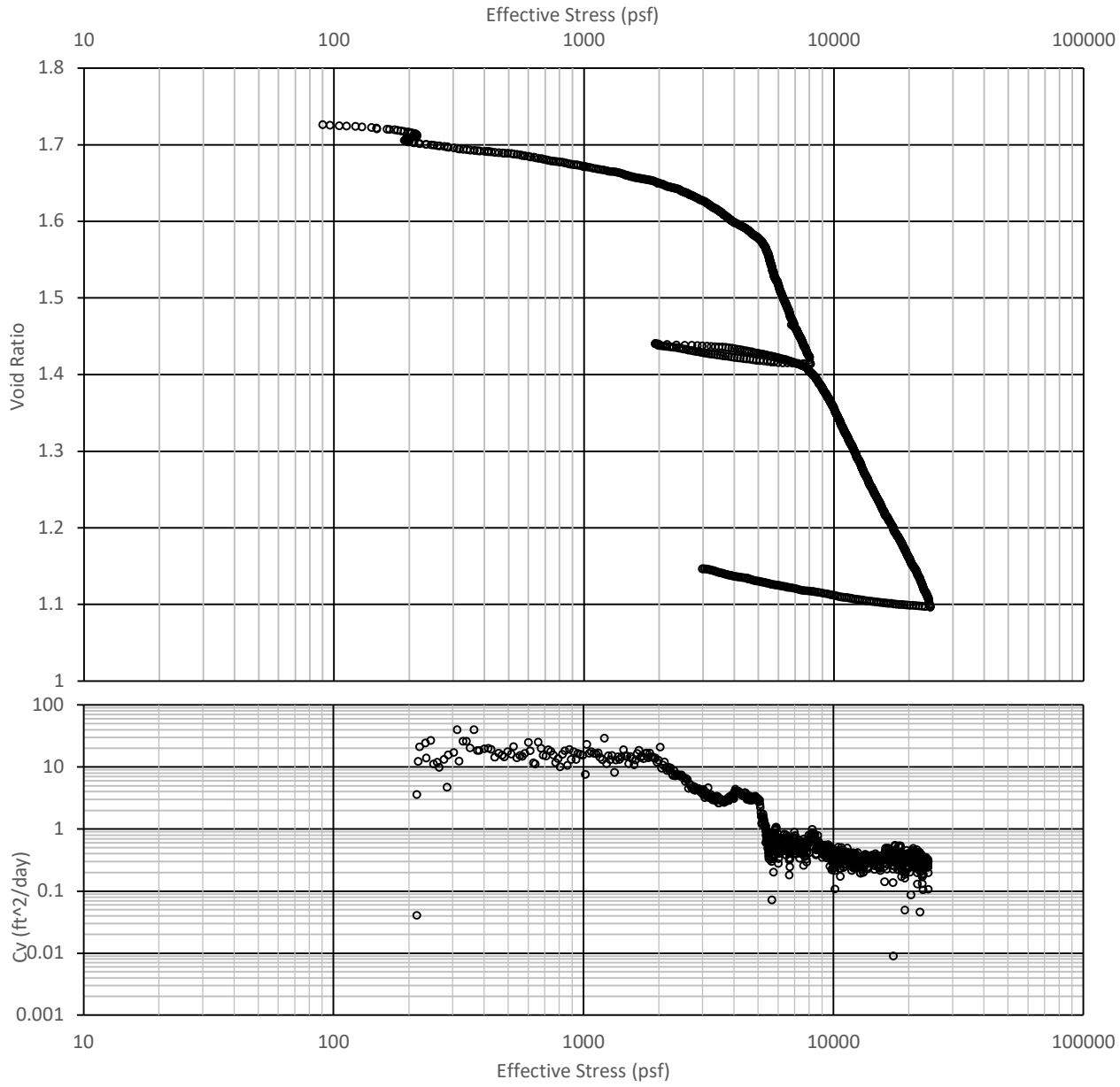
Axial strain and coefficient of consolidation versus logarithm of vertical effective stress for B-2 U-9 CRS Consolidation

Job Number: 0204679-001 4/7/2023

HALEY ALDRICH

Figure
B-11

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
35.7	63	48	42	23	19	LEAN CLAY	CL

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
2100	5200	4500
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.48
Total Unit Weight (pcf)	98.90
Degree of Saturation (%)	96.87
Void Ratio (e0)	1.729

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

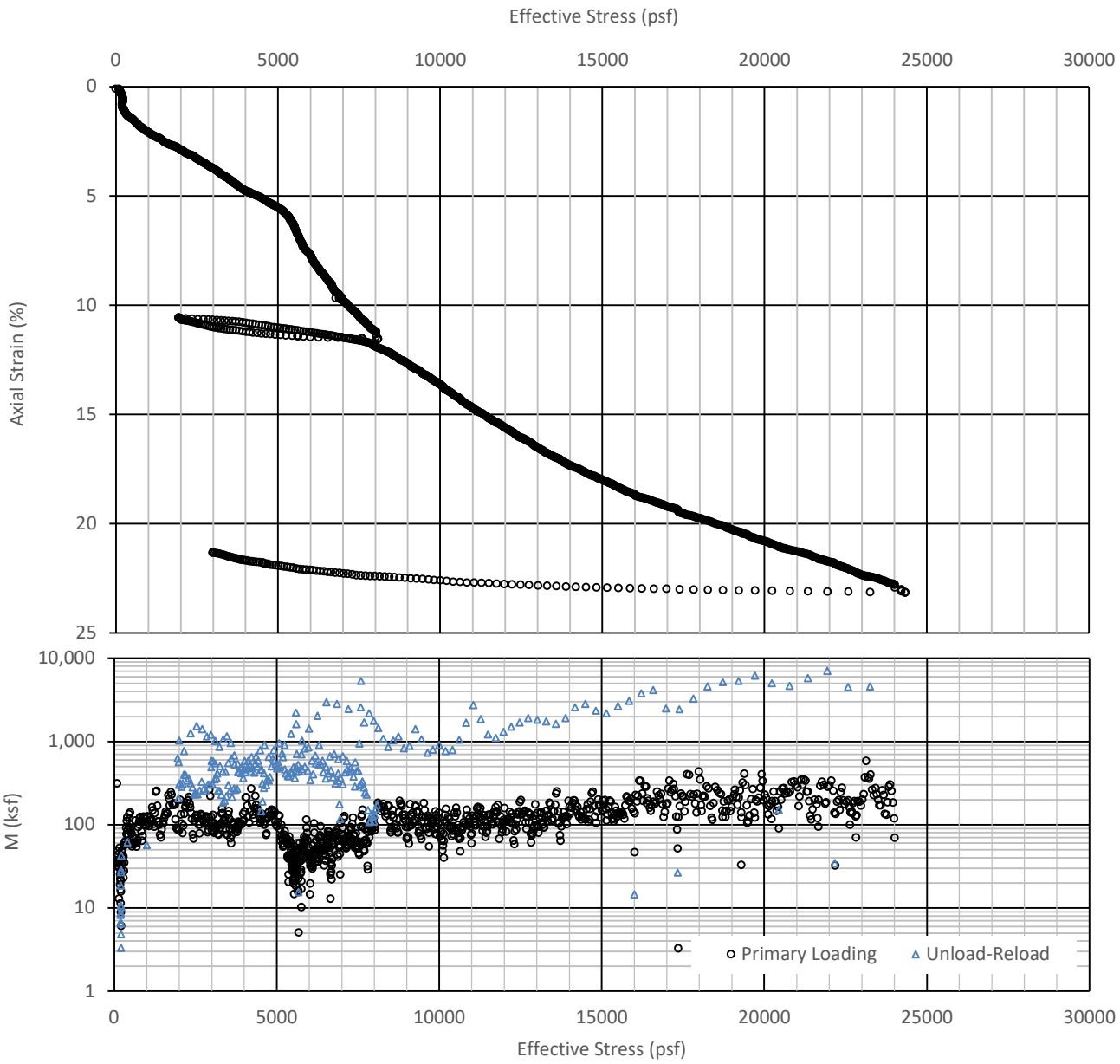
Void ratio and coefficient of consolidation versus logarithm of vertical effective stress for B-2 U-9 CRS Consolidation

Job Number: 0204679-001 4/7/2023

HALEY ALDRICH

Figure
B-11

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
35.7	63	48	42	23	19	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
2100	5200	4500
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.48
Total Unit Weight (pcf)	98.90
Degree of Saturation (%)	96.87
Void Ratio (e0)	1.729

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

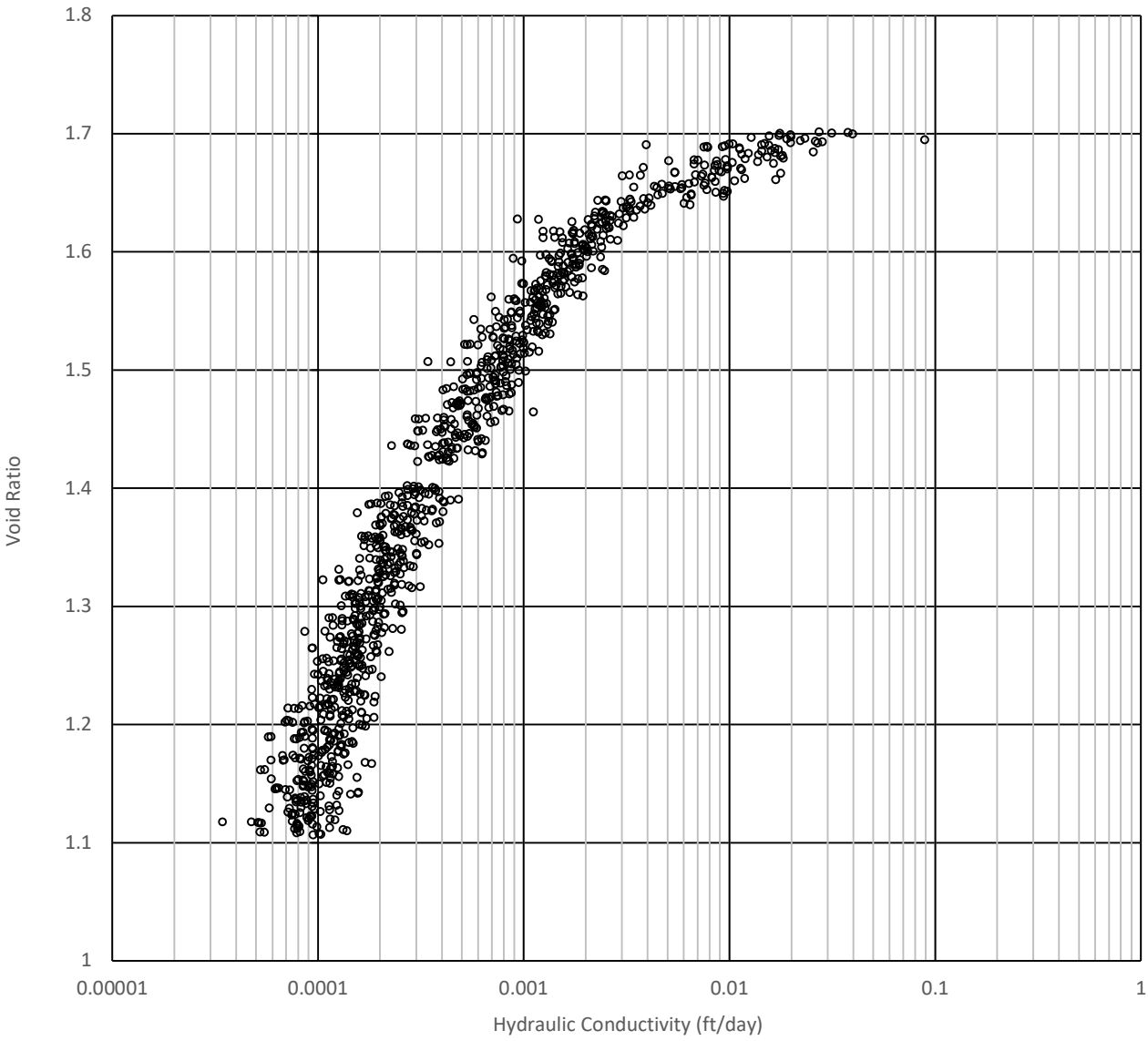
Axial strain versus vertical effective stress for B-2 U-9 CRS Consolidation

Job Number: 0204679-001 4/7/2023

HALEY ALDRICH

Figure
B-11

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
35.7	63	48	42	23	19	LEAN CLAY	CL

$\sigma'v_o$	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
2100	5200	4500
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.48
Total Unit Weight (pcf)	98.90
Degree of Saturation (%)	96.87
Void Ratio (e0)	1.729

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

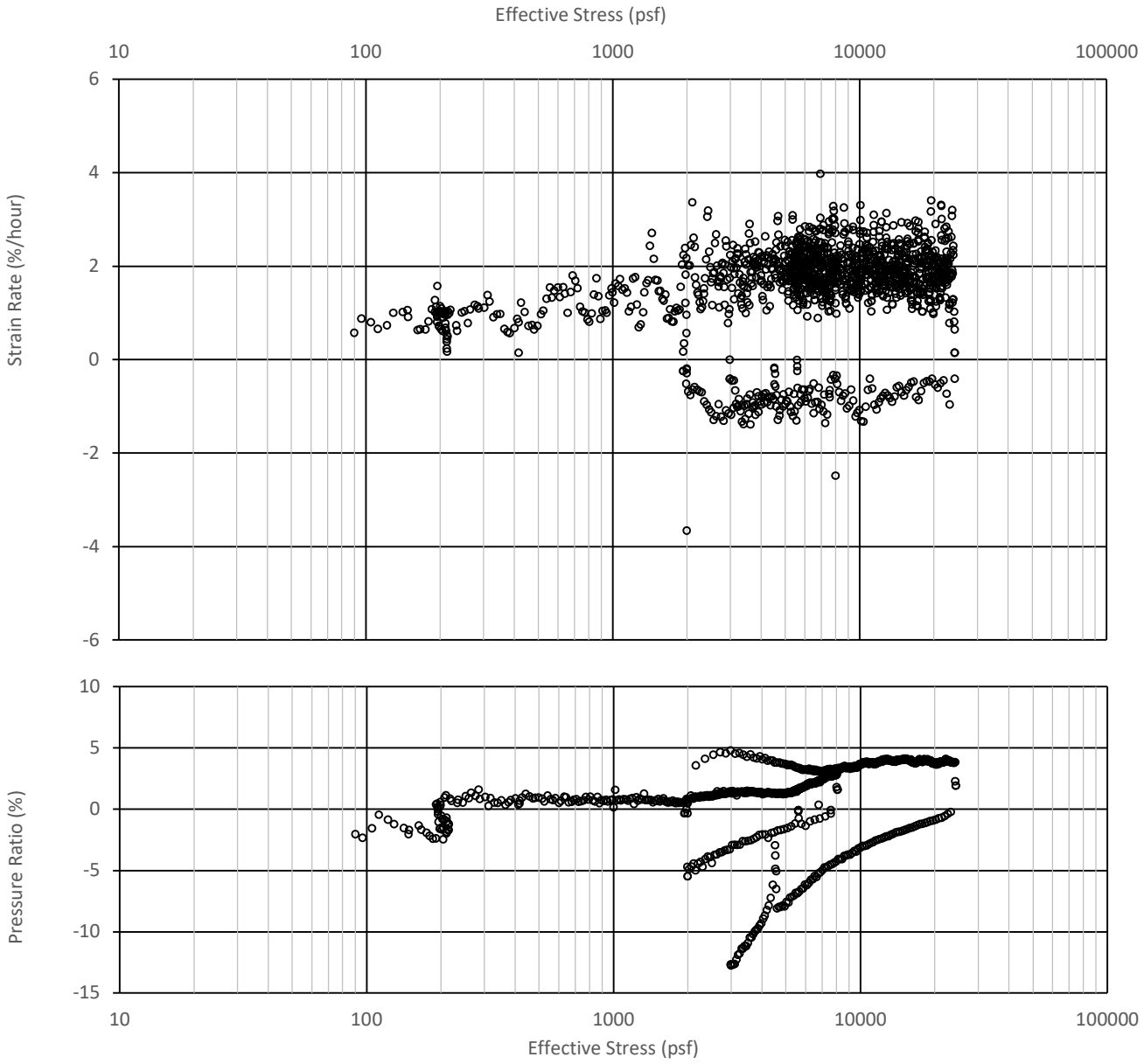
Void ratio versus logarithm of hydraulic conductivity B-2 U-9 CRS Consolidation

Job Number: 0204679-001 4/7/2023

HALEY ALDRICH

Figure
B-11

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
35.7	63	48	42	23	19	LEAN CLAY	CL

σ'_{v_o}	Preconsolidation Pressure (psf)	
(psf)	Strain Energy	Casagrande
2100	5200	4500
Sample Quality Designation		
Terzaghi et al. (1996)	Lunne et al. (1997)	
C	Good to fair	

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.48
Total Unit Weight (pcf)	98.90
Degree of Saturation (%)	96.87
Void Ratio (e0)	1.729

Sample Preparation and Comments:
The specimen test was an intact soil sample which was extracted from the sampling tube by cutting and delaminating a section of the sample tube. The test was run with a room temperature between 71 and 73 degrees Farenheit.

PDX Fuel Project Tank Design
Portland, OR

Axial strain, void ratio, and coefficient of consolidation versus logarithm of vertical effective stress for B-2 U-9 CRS Consolidation

Job Number: 0204679-001 4/7/2023

HALEY ALDRICH

Figure
B-11

initials MM/DD/YY location\filename.xls

PDX Fuel Project Tank Design
Portland, OR

Post-Test Photograph

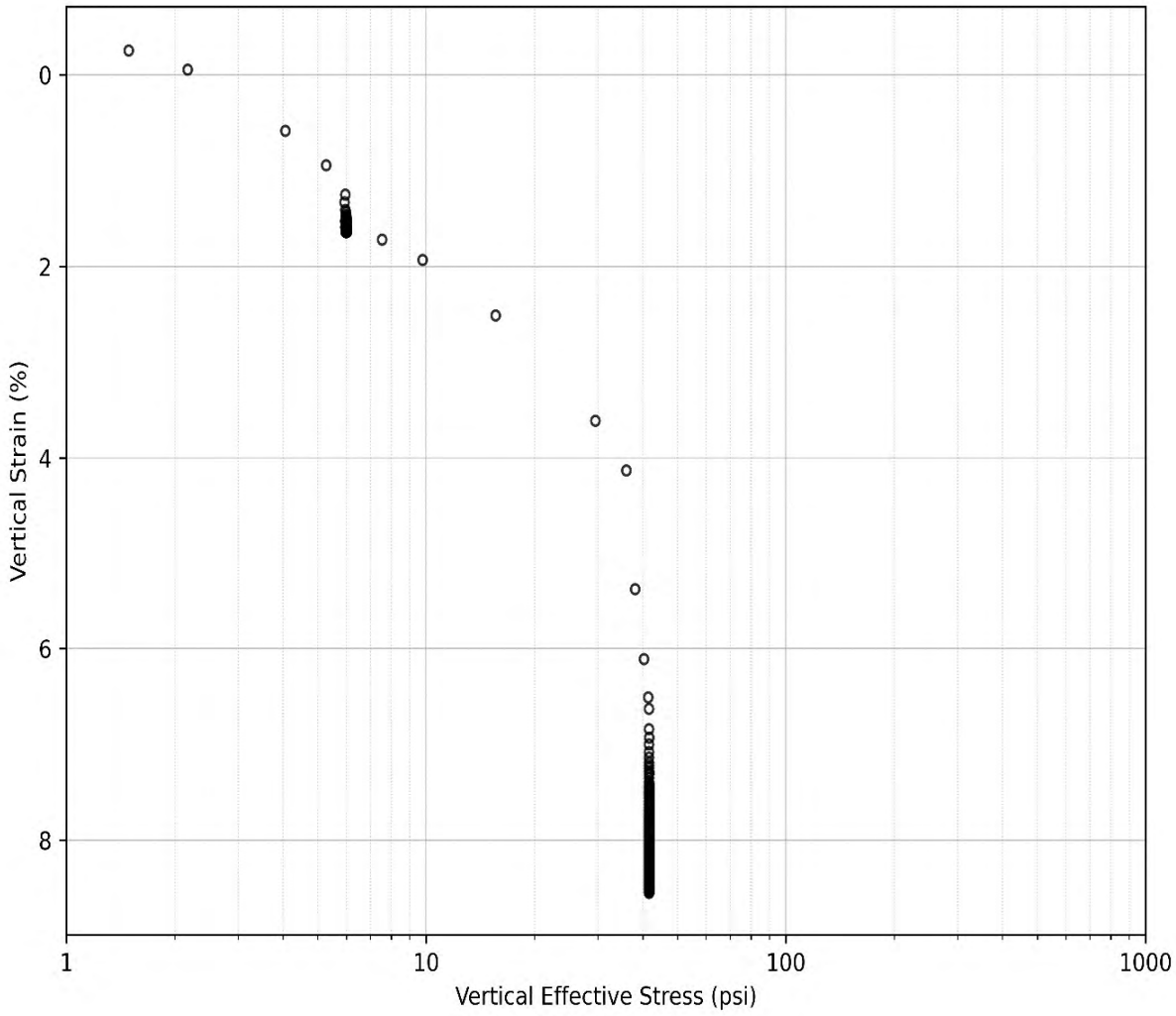
0204679-001 4/7/2023

HALEY ALDRICH

Figure

B-11

initials MM/DD/YY location\filename.xls



Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
31	49	45	51	35	16	ELASTIC SILT	MH

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	1.2	98.8

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.71
Total Unit Weight (pcf)	104.16
Degree of Saturation (%)	95.32
Void Ratio (e_0)	1.370

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Axial Strain Versus Logarithm of Vertical Effective Stress for B-2 U-8 DSS Specimen #1

Job Number 0204679-001 04/23

HALEY ALDRICH

Figure
B-12

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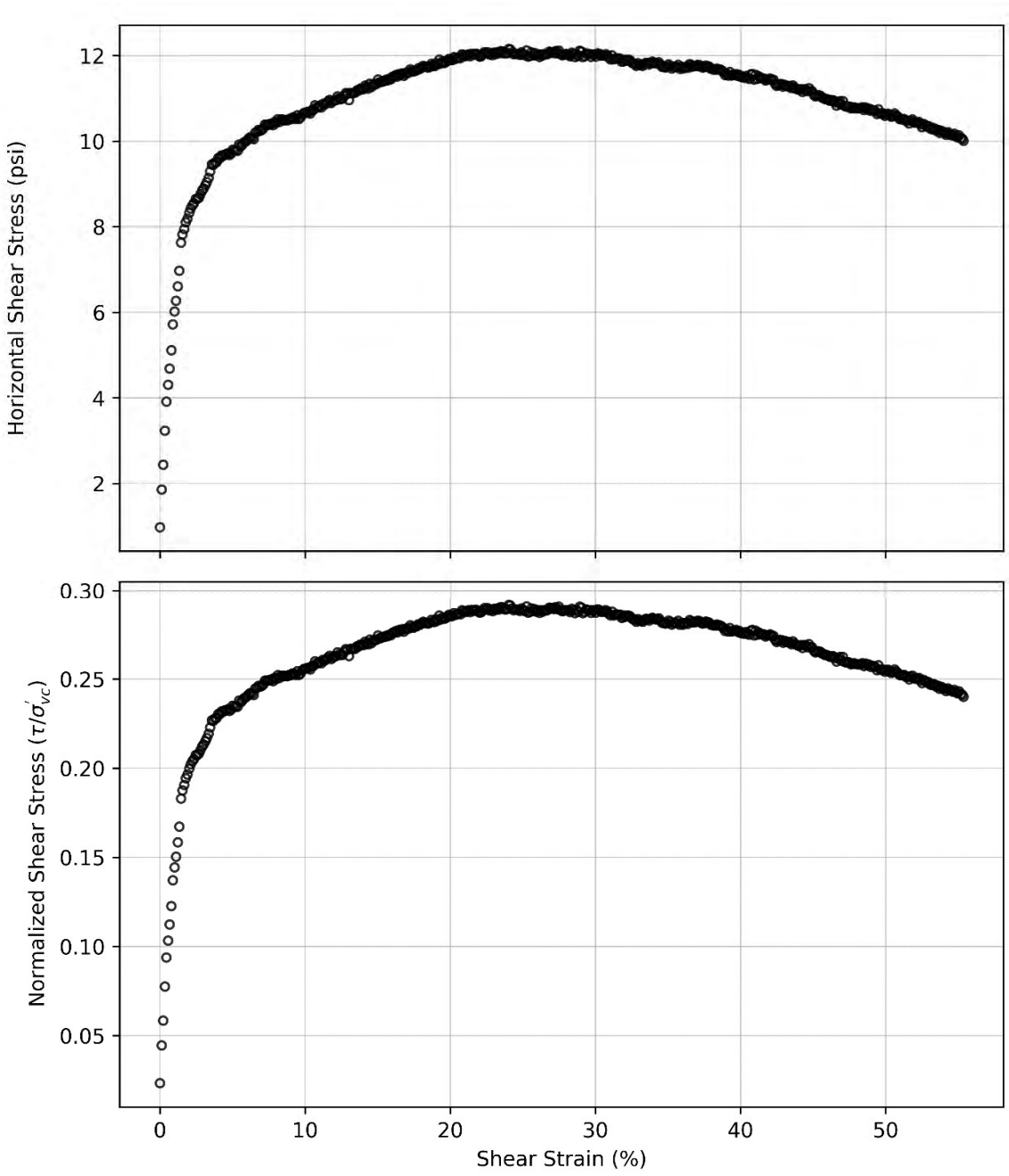

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal Shear Stress and Normalized Shear Stress for B-2 U-8 1 DSS Specimen #1

Job Number 0204679-001 04/23

HALEY ALDRICH

Figure
B-12

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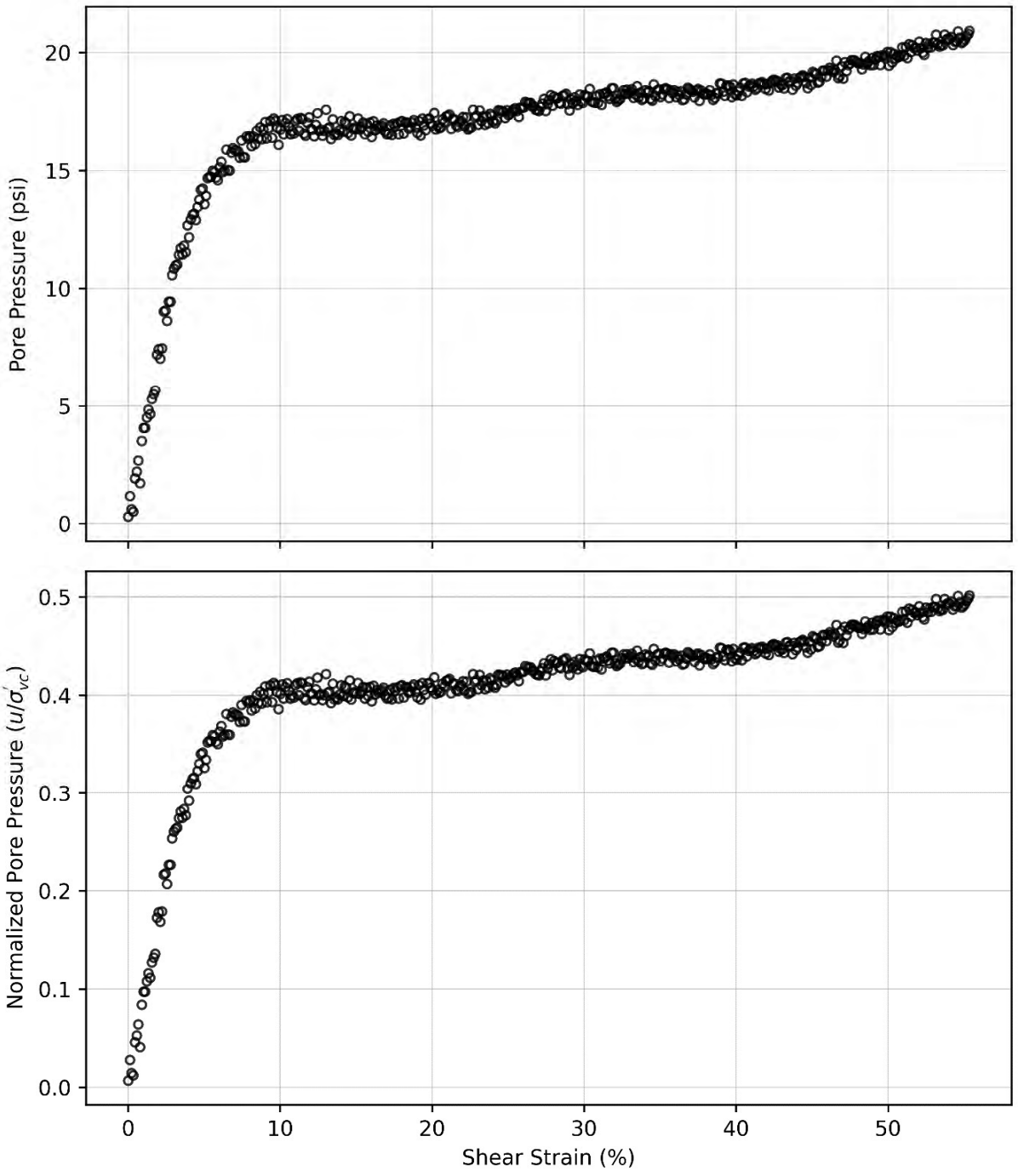

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Pore Pressure and Normalized Pore Pressure Versus Shear Strain for B-2 U-8 1 DSS Specimen #1

Job Number 0204679-001 04/23

HALEY ALDRICH

Figure
B-12

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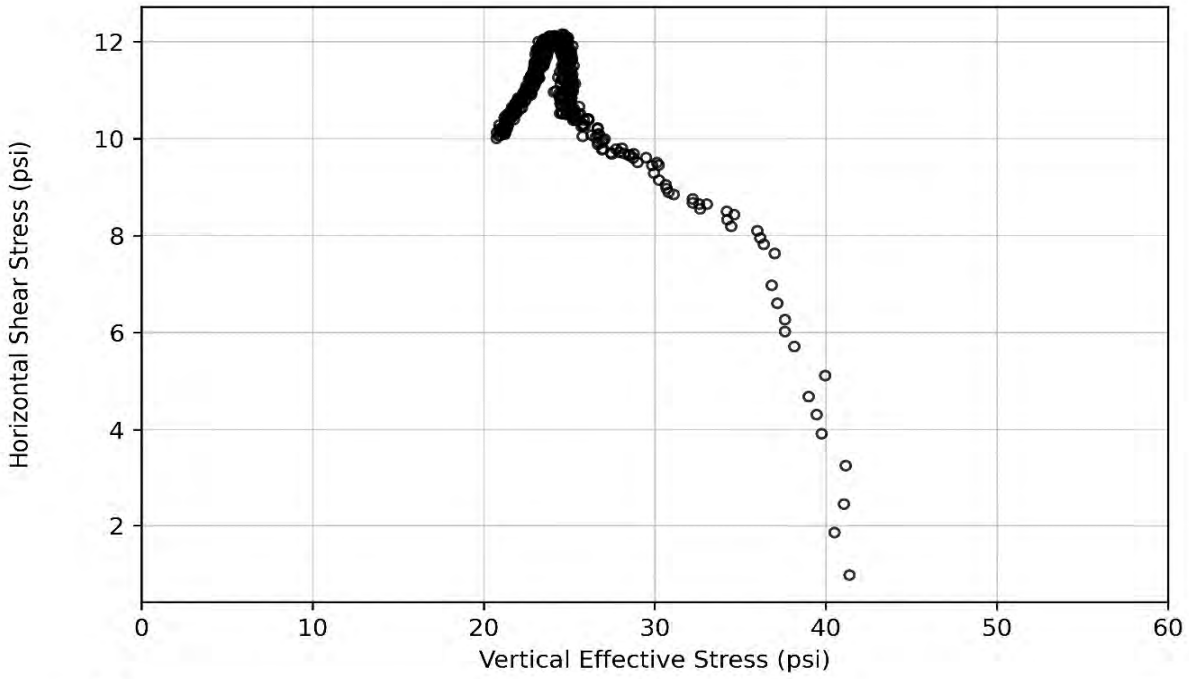

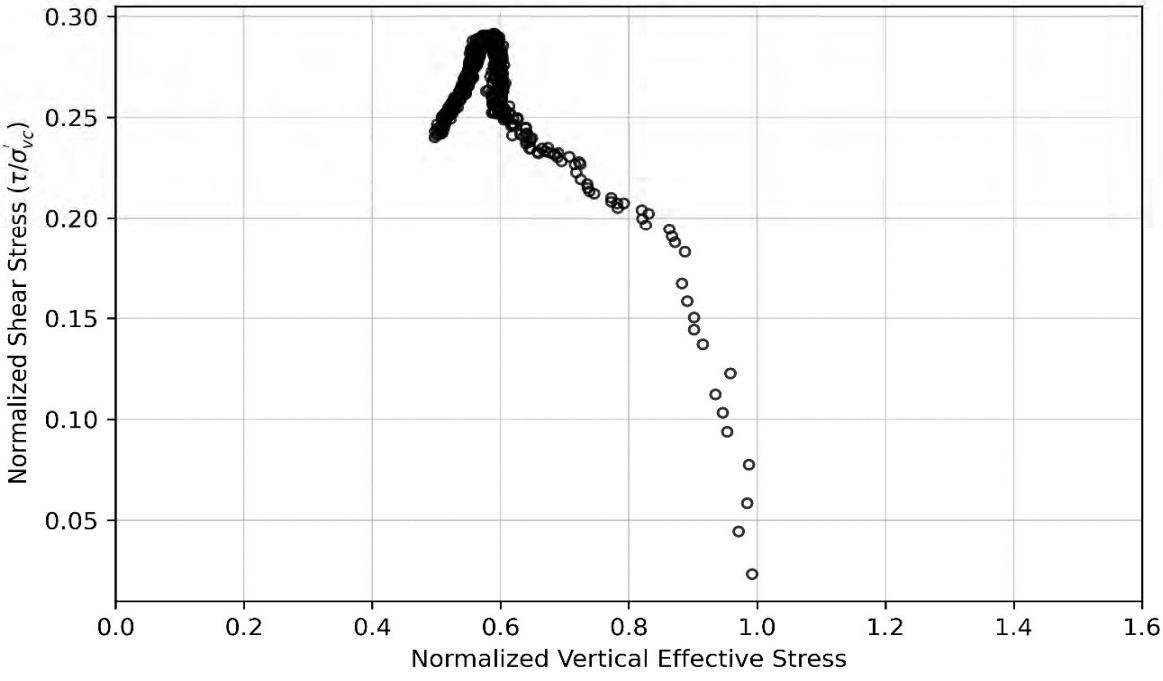

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal and Normalized Shear Stress Versus Vertical and Normalized Vertical Effective Stress for B-2 U-8 1 DSS Specimen #1

Job Number 0204679-001 04/23

HALEY ALDRICH

Figure
B-12

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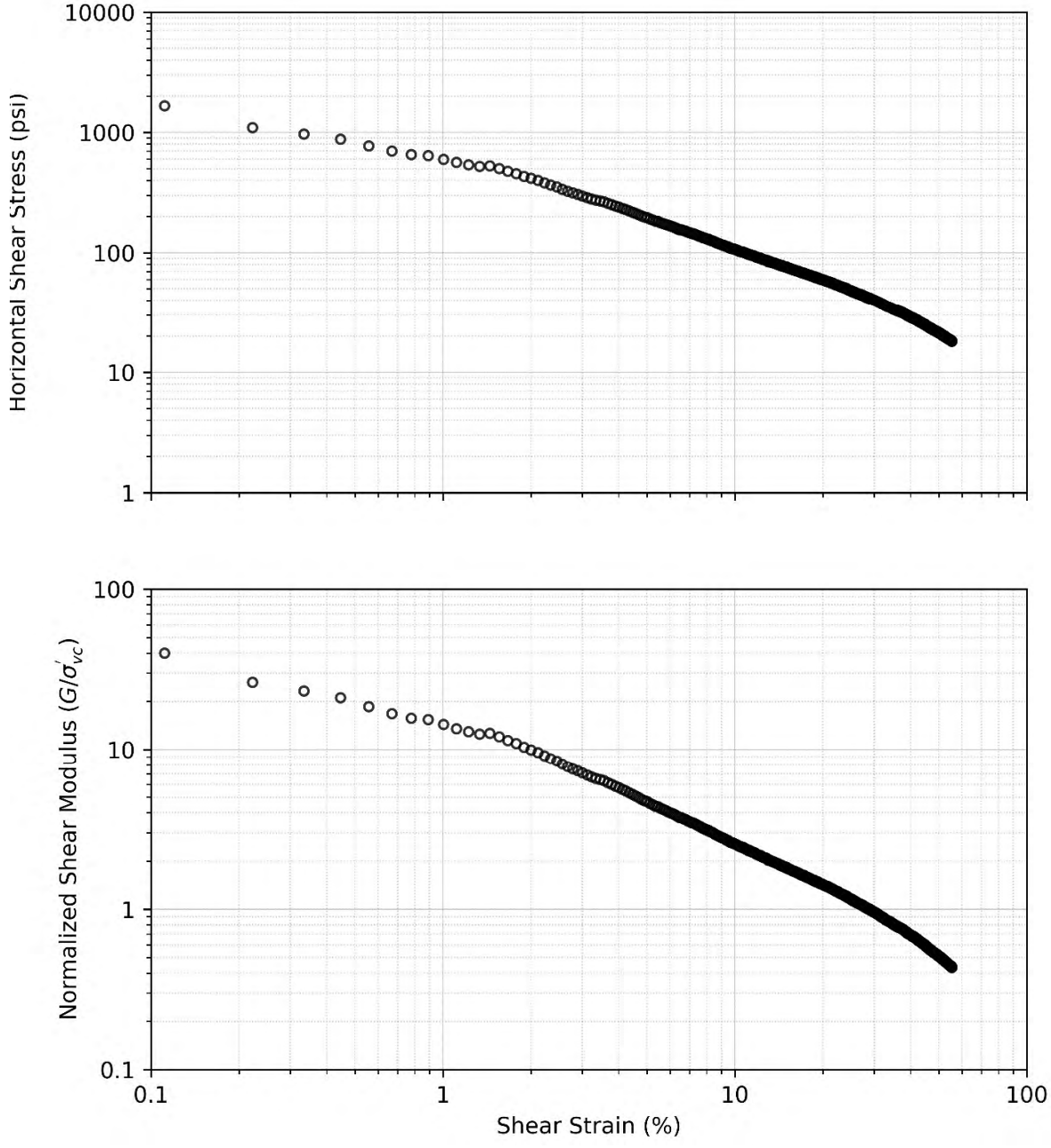

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Shear Modulus and Normalized Shear Modulus Versus Shear Strain for B-2 U-8 1 DSS Specimen #1

Job Number 0204679-001 04/23

HALEY ALDRICH

Figure
B-12

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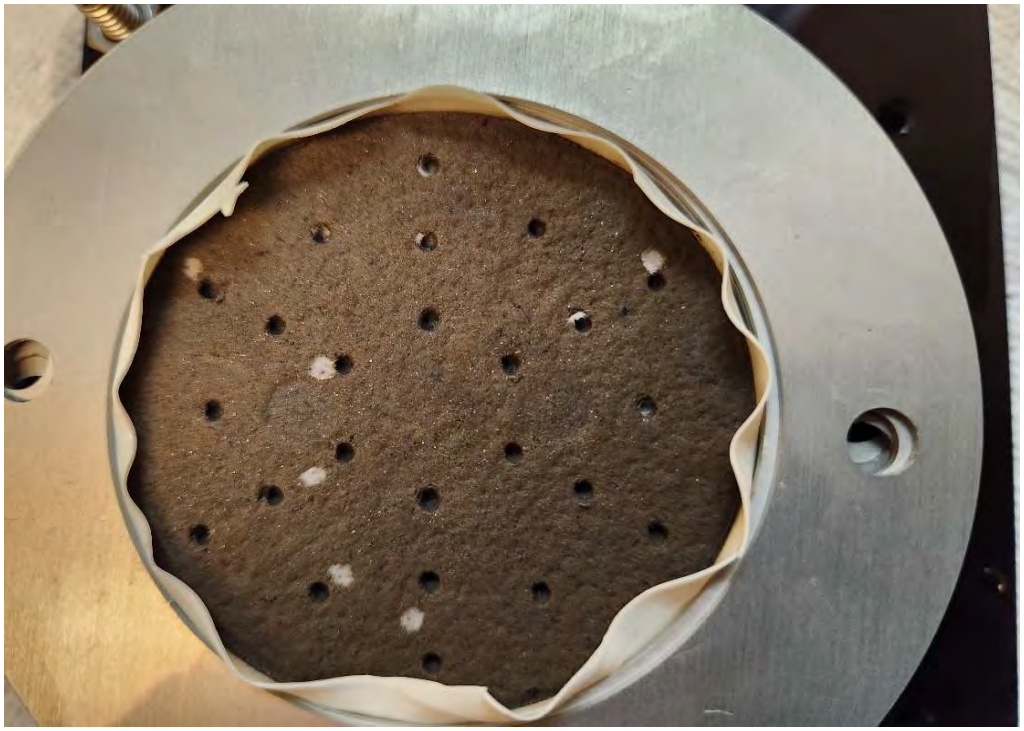

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Post-Test Photographs of B-2 U-8 DSS Specimen #1

Job Number 0204679-001 04/23

HALEY ALDRICH

Figure
B-12

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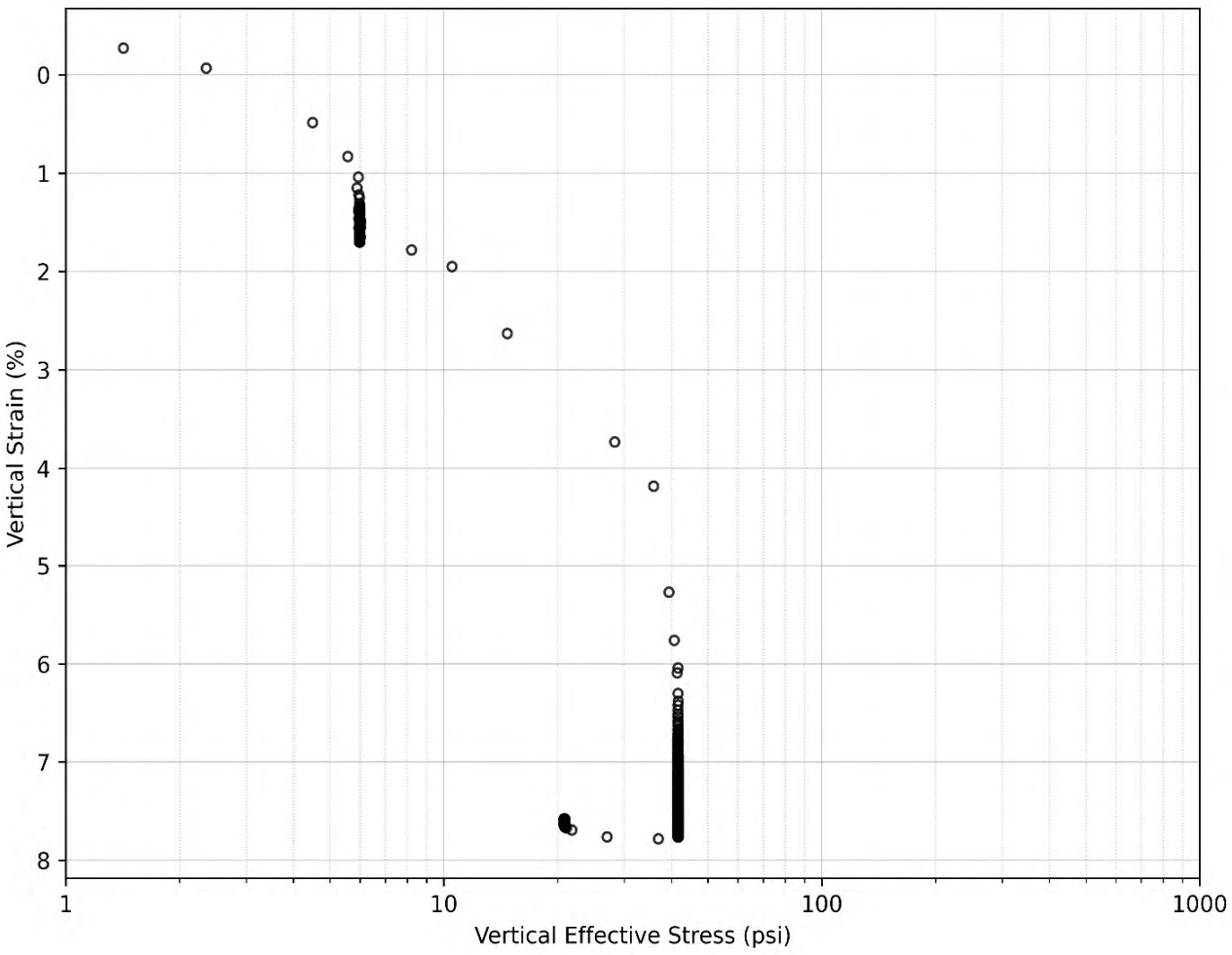

Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
31.2	49	45	51	35	16	ELASTIC SILT	MH

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	1.2	98.8

Initial Specimen Properties	
Height (inches)	0.99
Diameter (inches)	2.50
Weight (ounces)	4.79
Total Unit Weight (pcf)	105.98
Degree of Saturation (%)	97.73
Void Ratio (e_0)	1.320

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Axial Strain Versus Logarithm of Vertical Effective Stress for B-2 U-8 DSS Specimen #2

Job Number 0204679-001 05/23

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Figure
B-13

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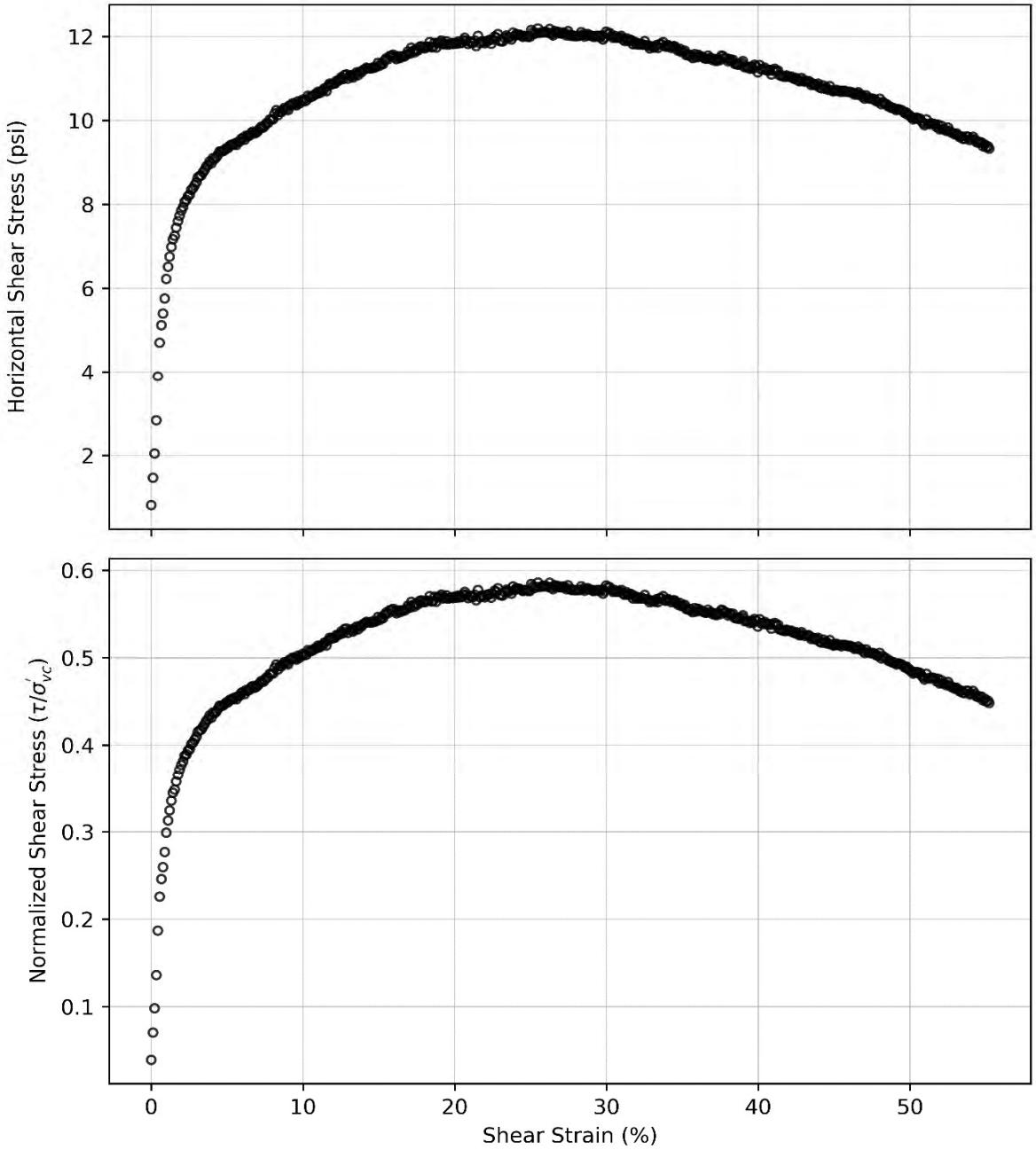

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal Shear Stress and Normalized Shear Stress for B-2 U-8 DSS Specimen #2

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-13

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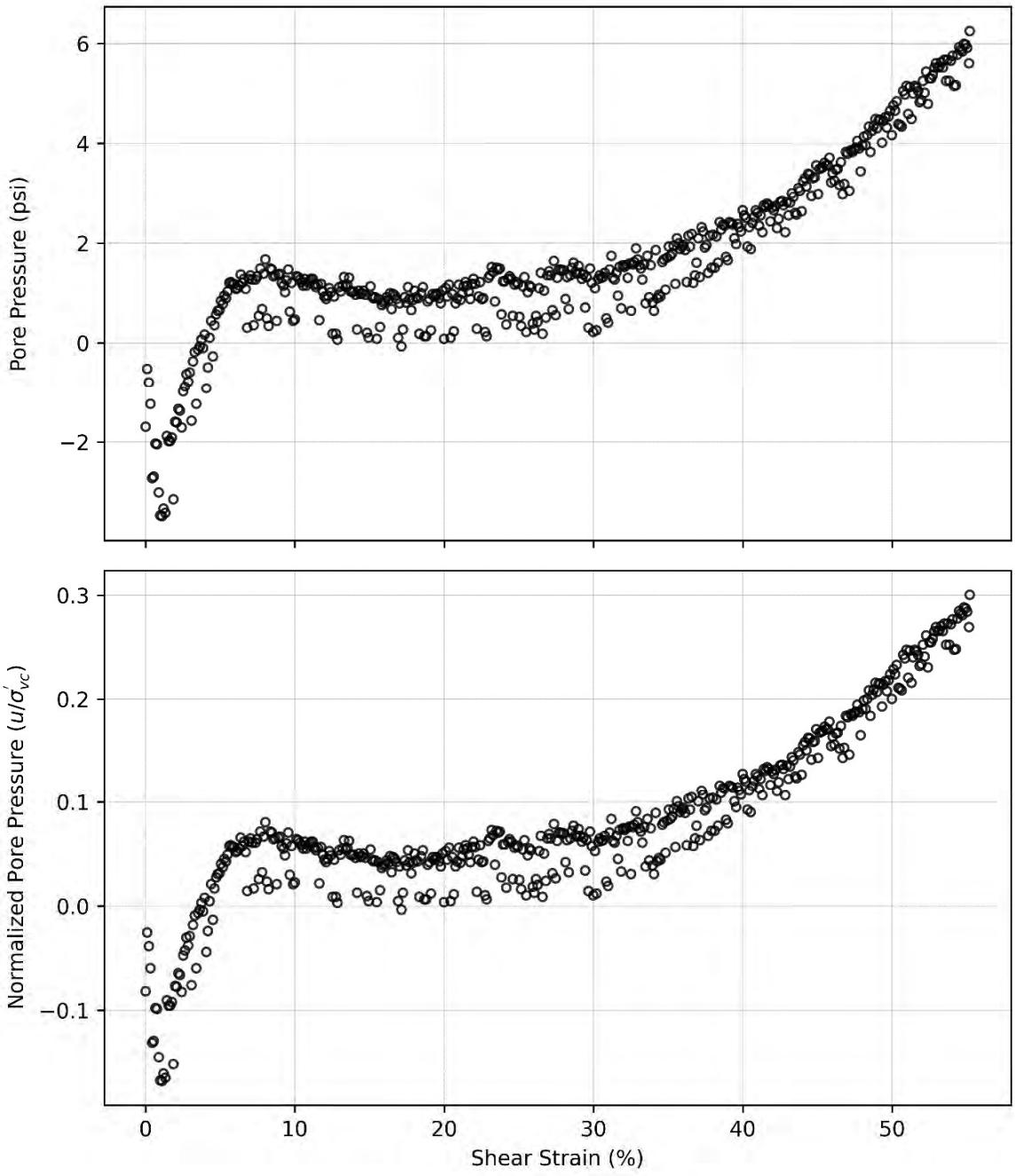

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Pore Pressure and Normalized Pore Pressure Versus Shear Strain for B-2 U-8 DSS Specimen #2

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-13

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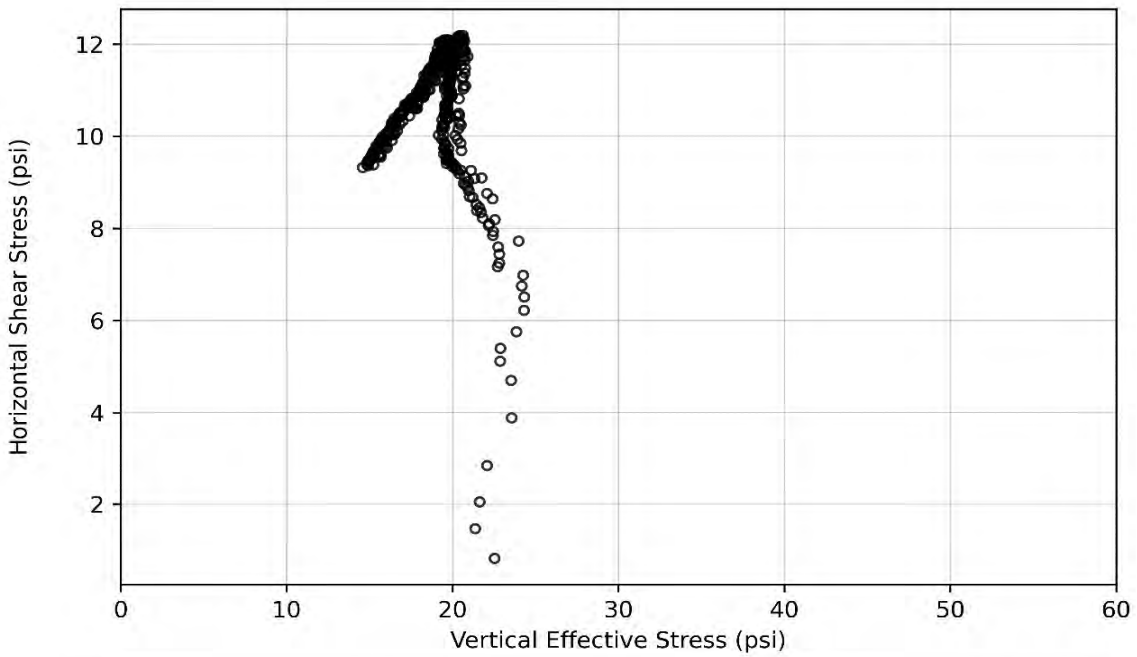
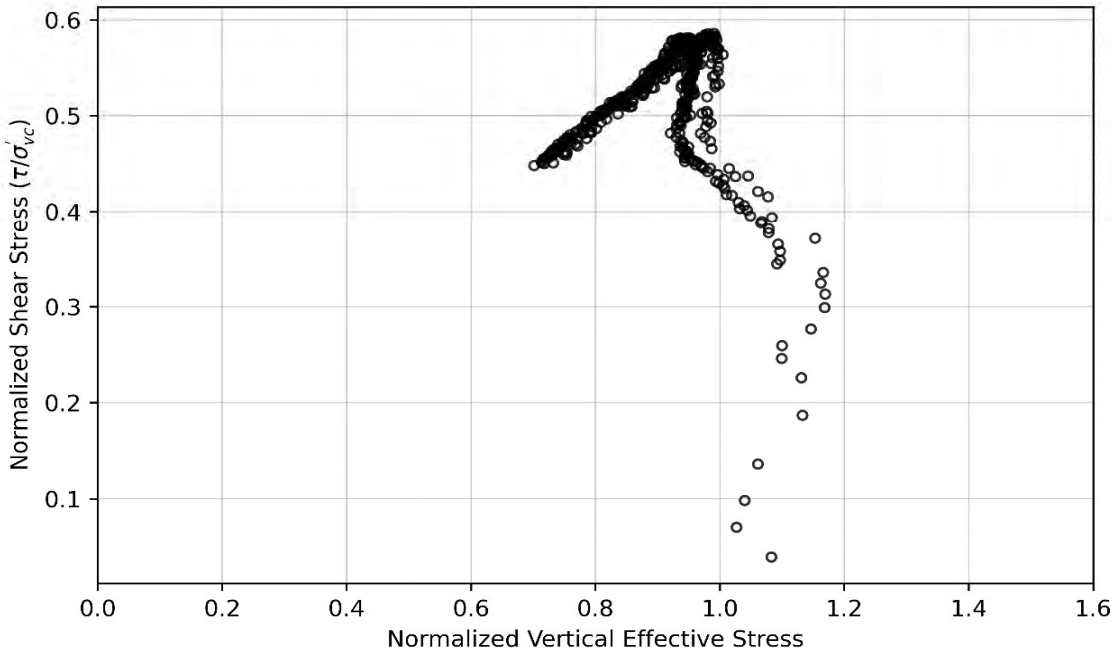




Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

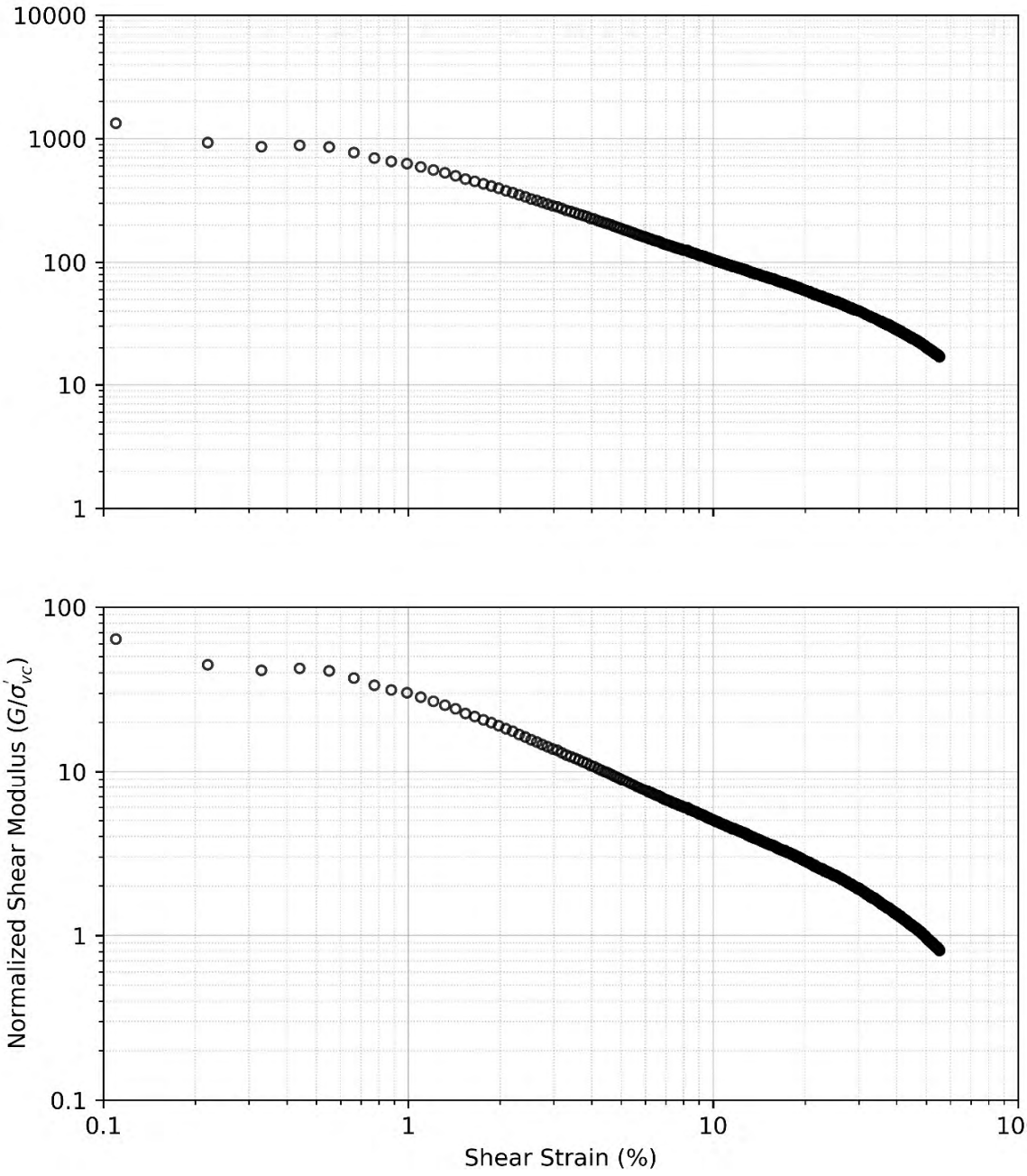
Horizontal and Normalized Shear Stress Versus Vertical and Normalized Vertical Effective Stress for B-2 U-8 DSS Specimen #2

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-13

0 09/15/2022 \\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\Workspace\Geotechnical_Data_Report\Appendix B\DSS\0204679-001 B2 U8 #2 DSS processed 051223.xlsx



Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Shear Modulus and Normalized Shear Modulus Versus Shear Strain for B-2 U-8 DSS Specimen #2

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-13

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Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Post-Test Photographs of B-2 U-8 DSS Specimen #2

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-13

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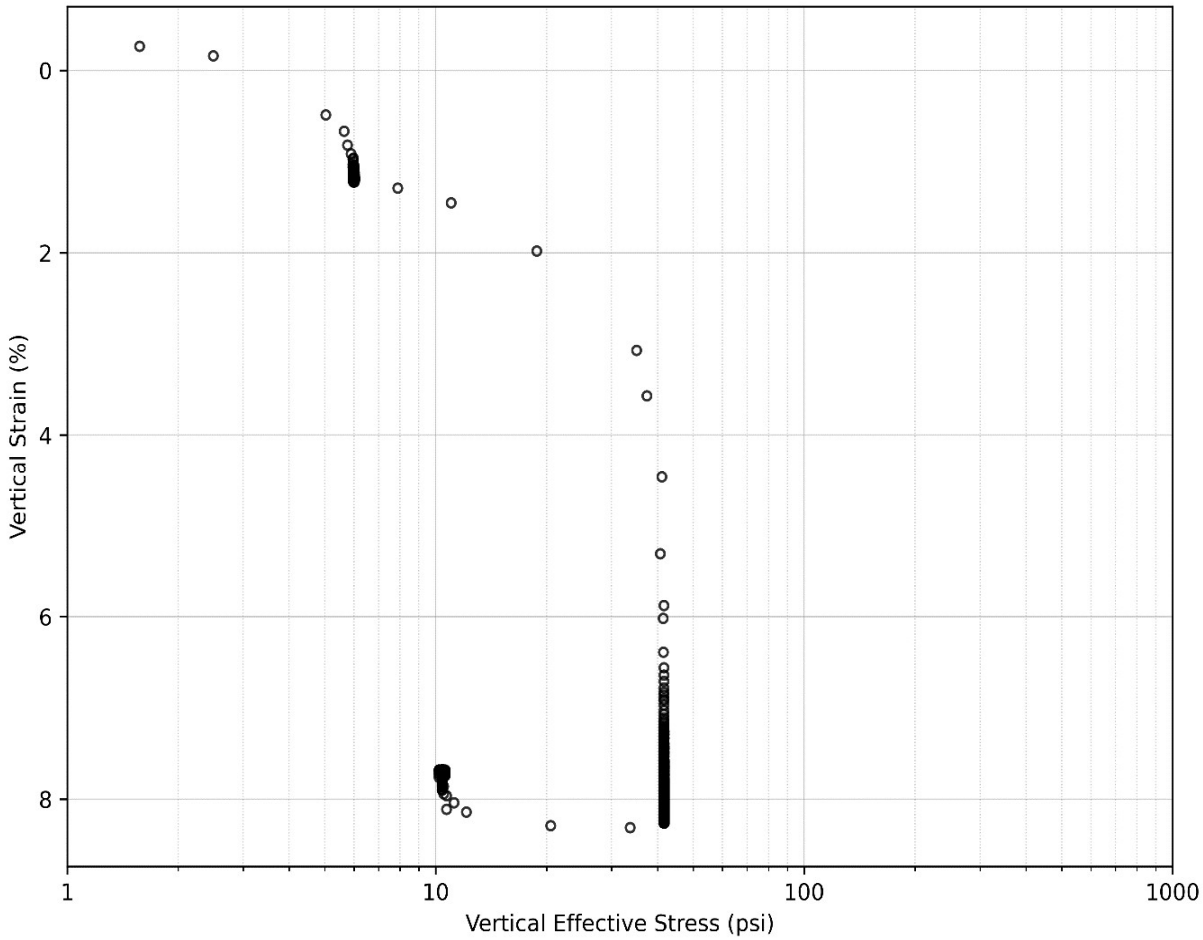


Depth	W.C. (%)		Atterberg Limits			Description	USCS
(ft)	Before	After	LL	PL	PI		
31	52	49	51	35	16	ELASTIC SILT	MH

Partical-size Distribution		
% Gravel	% Sand	% Fines
0	1.2	98.8

Initial Specimen Properties	
Height (inches)	1.00
Diameter (inches)	2.50
Weight (ounces)	4.68
Total Unit Weight (pcf)	103.19
Degree of Saturation (%)	95.62
Void Ratio (e_0)	1.428

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

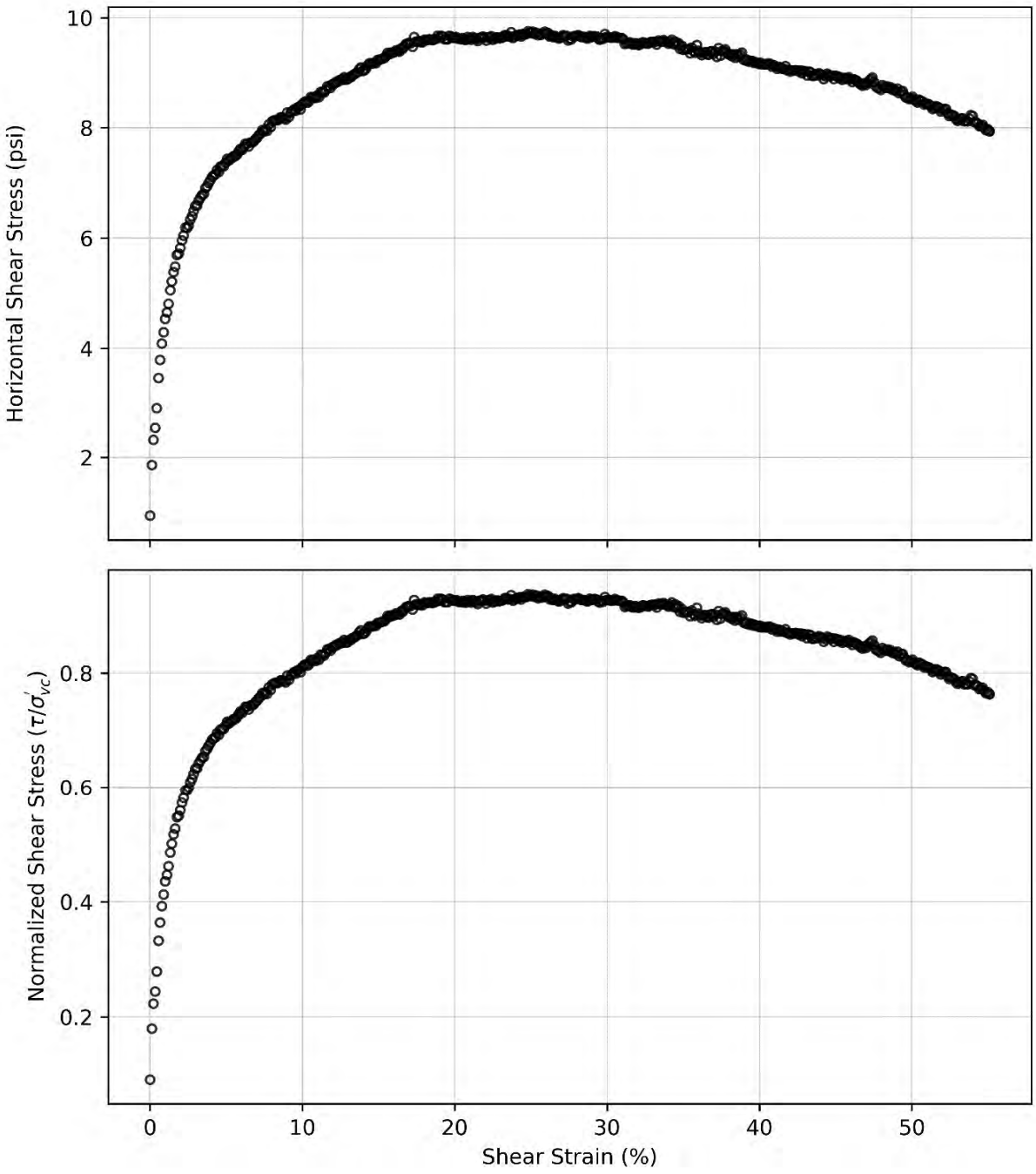
Axial Strain Versus Logarithm of Vertical Effective Stress for B-2 U-8 DSS Specimen #3

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-14

09/15/2022 \\haleyaldrich.com\share\pdx_data\Notebooks\0204679-001_PDX_Fuel_Project_Tank_Design\Workspace\Geotechnical_Data_Report\Appendix B\DSS\0204679-001 B2 U8 #3 DSS processed 051623.xlsx



Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal Shear Stress and Normalized Shear Stress for B-2 U-8 1 DSS Specimen #3

Job Number 0204679-001 05/23

HALEY ALDRICH

Figure
B-14

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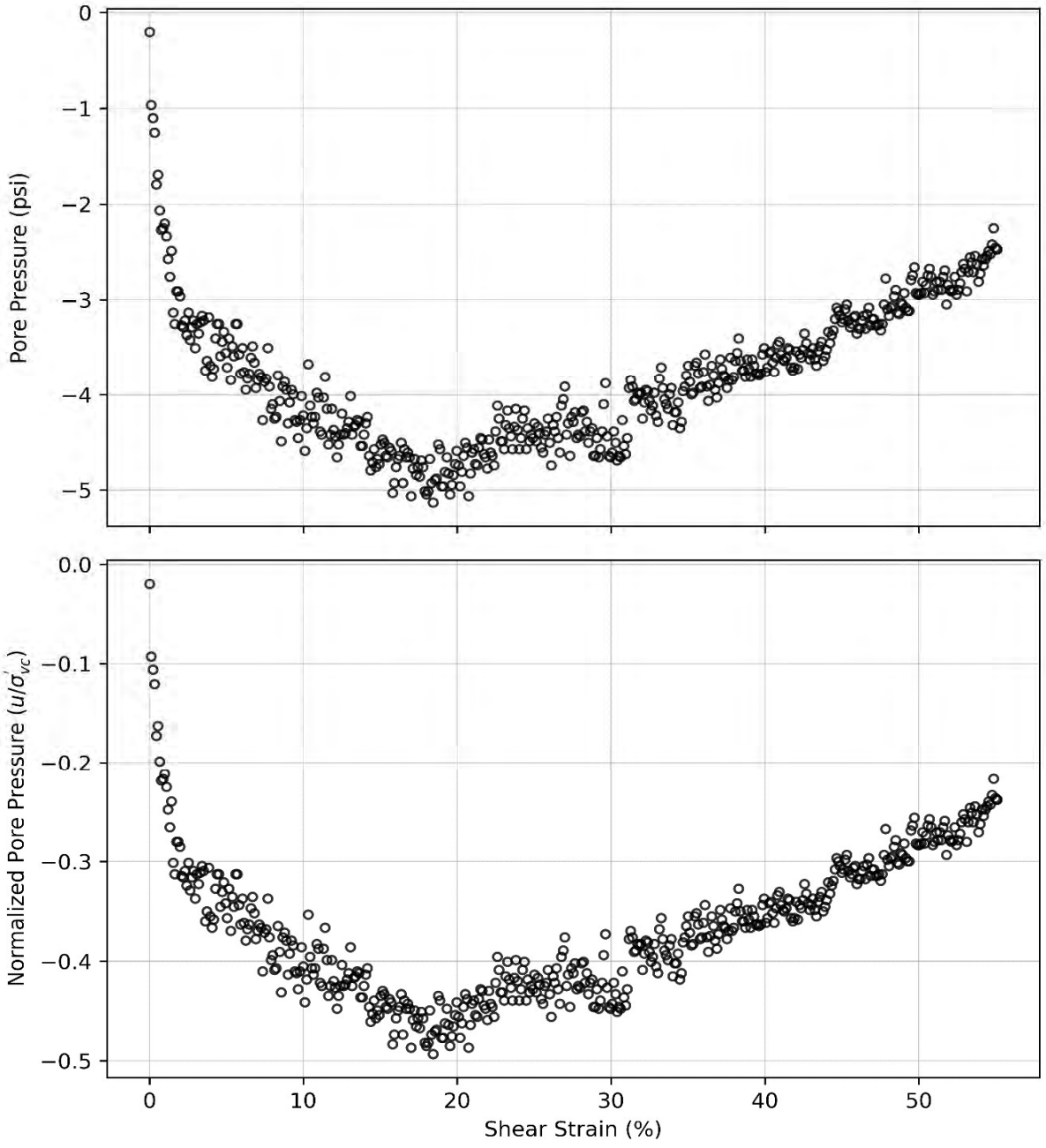

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Pore Pressure and Normalized Pore Pressure Versus Shear Strain for B-2 U-8 1 DSS Specimen #3

Job Number 0204679-001 05/23

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Figure
B-14

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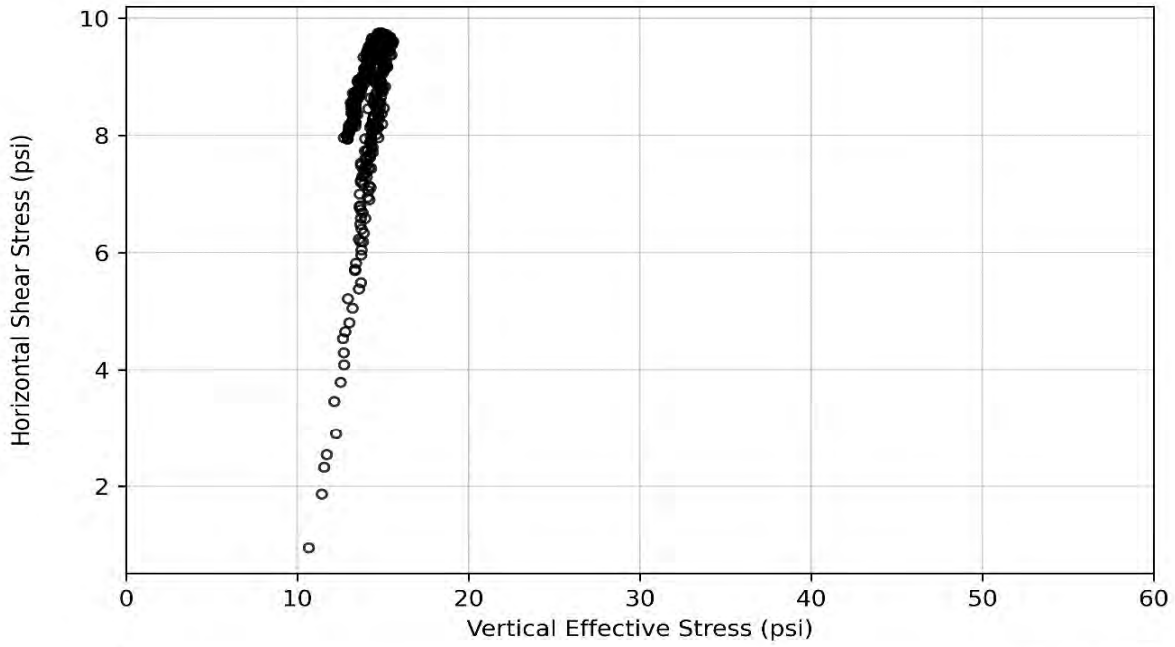

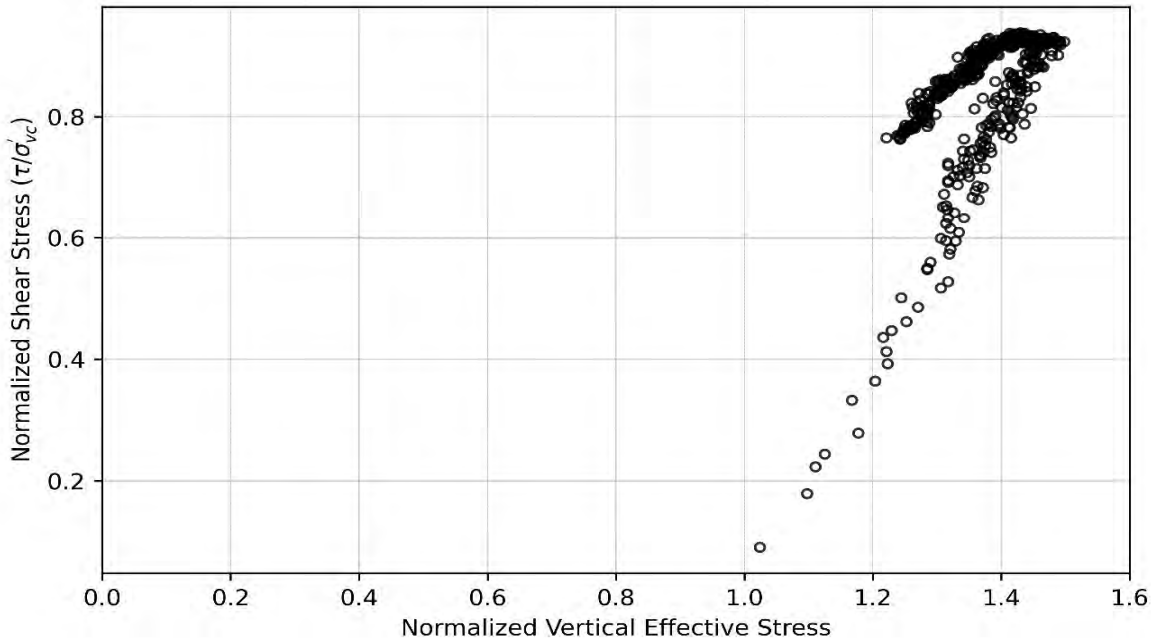

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Horizontal and Normalized Shear Stress Versus Vertical and Normalized Vertical Effective Stress for B-2 U-8 1 DSS Specimen #3

Job Number 0204679-001 05/23

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Figure
B-14

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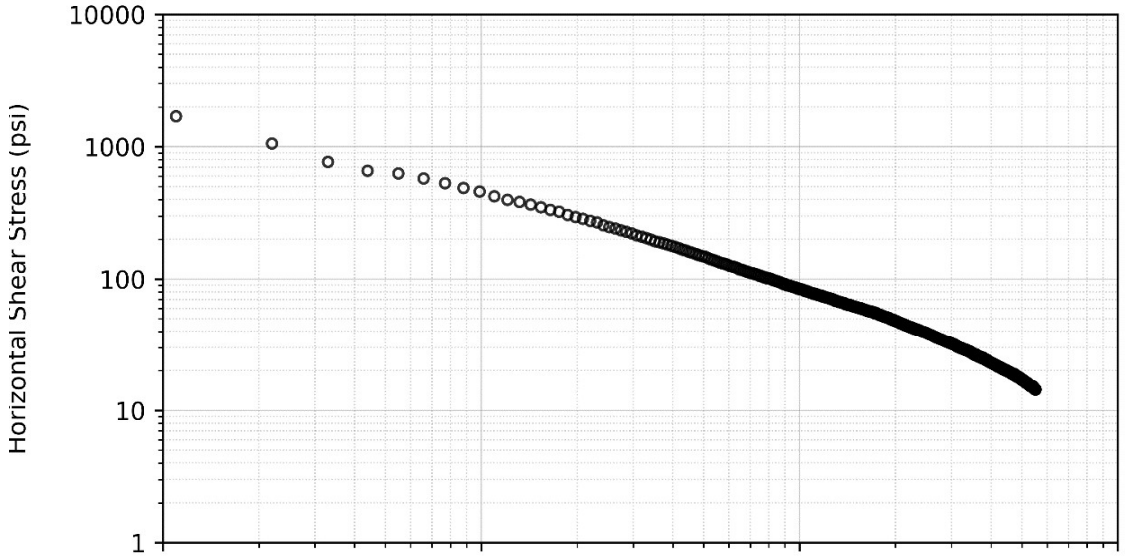

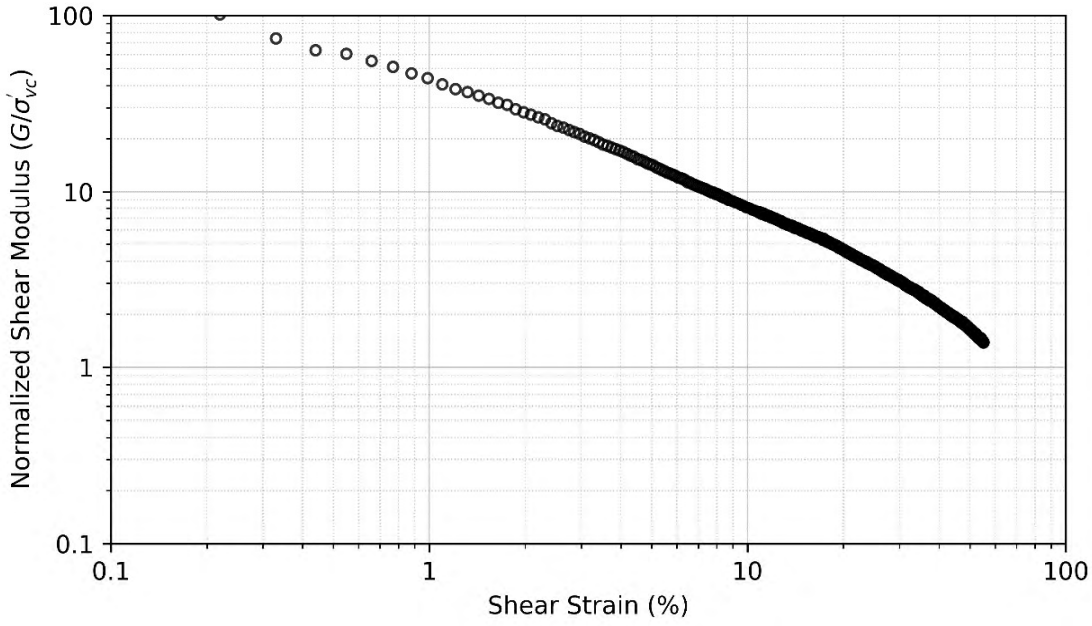

Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

σ'vc = Vertical effective stress at the end of consolidation

PDX Fuel Project Tank Design
Portland, OR

Shear Modulus and Normalized Shear Modulus Versus Shear Strain for B-2 U-8 1 DSS Specimen #3

Job Number 0204679-001 05/23

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Figure
B-14

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Sample preparation and comments: Thin-walled tube specimen cut from section of tube sample; delaminated and pushed to extrude from tube section.

PDX Fuel Project Tank Design
Portland, OR

Pre-Test Photograph of B-2 U-8 DSS Specimen #3

Job Number 0204679-001 05/23

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Figure
B-14

APPENDIX C
Historical Explorations

APPENDIX C

Historical Explorations

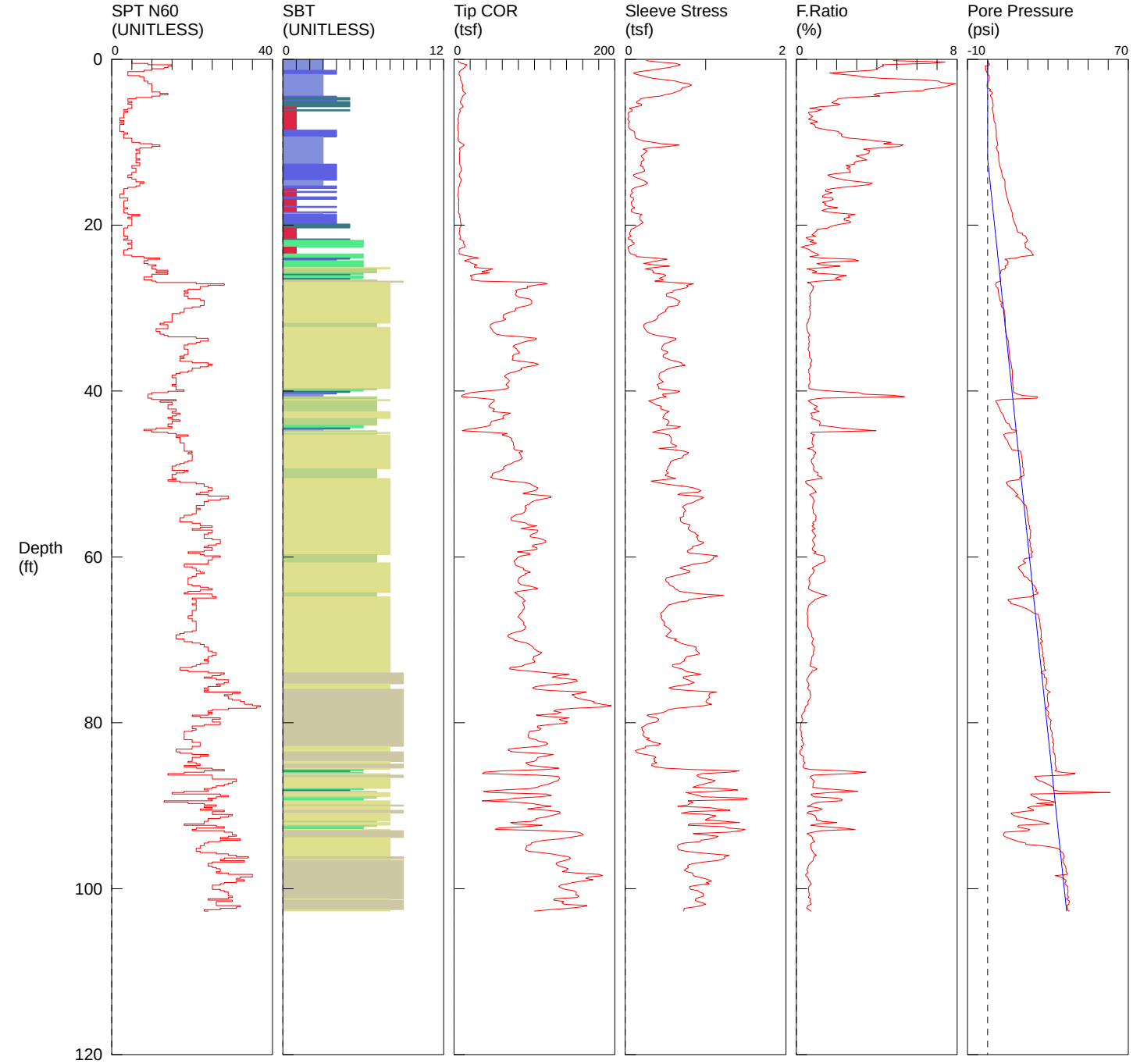
This appendix includes historical exploration data related to the subject project. Six CPT logs (designated CPT-18 through CPT-23) are presented, produced as part of a 2017 GRI exploration program pertaining to a runway evaluation. This appendix also includes a site plan, exploration logs, and laboratory test data from the 2020 Hart Crowser geotechnical report titled, “Revised Report of Geotechnical Engineering Services, PDX Fuel Facility Improvements, Portland Oregon,” dated 17 August 2020.

GRI / CPT-18 / PDX Runway Evaluation

TEST DATE: 4/26/2017 12:35:55 PM
HOLE NUMBER: CPT-18

CUSTOMER: 17058/ GRI / CPT-18/ PDX
OPERATOR: OGE BJB

CONE ID: DPG1386
LOCATION: 17058/ GRI/ CPT-18/ PDX
JOB NUMBER: 17058/ GRI/ CPT-18/ PDX
TEST DATE: 4/26/2017 12:35:55 PM
TOTAL DEPTH: 102.690 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

GRI / CPT-18 / PDX Runway Evaluation

OPERATOR: OGE BJB
TEST DATE: 4/26/2017 12:35:55 PM
COMMENT: GRI / CPT-18 / PDX Runway Evaluation
FILENAME: 17058 CPT-18.cpt
TOTAL DEPTH: 102.690 ft

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
0.164	5.48	0.2638	4.817	0.264	5	3	clay
0.328	5.55	0.4104	7.397	0.273	5	3	clay
0.492	9.46	0.6302	6.660	0.501	9	3	clay
0.656	15.98	0.6820	4.267	0.973	15	3	clay
0.820	14.29	0.6198	4.336	-1.237	14	3	clay
0.984	13.30	0.5470	4.111	-0.995	13	3	clay
1.148	10.79	0.4357	4.037	-0.947	10	3	clay
1.312	8.31	0.3144	3.784	-0.921	8	3	clay
1.476	6.69	0.1739	2.597	-0.539	4	4	silty clay to clay
1.640	6.21	0.1024	1.647	-0.316	4	4	silty clay to clay
1.804	6.03	0.1365	2.262	0.259	4	4	silty clay to clay
1.969	7.05	0.2112	2.994	0.674	7	3	clay
2.133	7.98	0.2653	3.326	0.865	8	3	clay
2.297	8.09	0.3448	4.264	0.791	8	3	clay
2.461	7.86	0.4946	6.296	0.705	8	3	clay
2.625	8.88	0.6292	7.089	0.530	9	3	clay
2.789	9.56	0.6860	7.175	-0.082	9	3	clay
2.953	9.95	0.7878	7.921	-0.259	10	3	clay
3.117	10.79	0.8256	7.649	-0.297	10	3	clay
3.281	10.52	0.7841	7.451	-0.290	10	3	clay
3.445	9.98	0.7098	7.116	-0.257	10	3	clay
3.609	10.92	0.6995	6.406	1.395	10	3	clay
3.773	10.73	0.6768	6.309	0.928	10	3	clay
3.937	12.25	0.6285	5.130	2.045	12	3	clay
4.101	14.49	0.5845	4.035	2.342	14	3	clay
4.265	12.81	0.4927	3.847	1.534	12	3	clay
4.429	10.48	0.4342	4.144	1.395	10	3	clay
4.593	10.17	0.2697	2.652	1.956	6	4	silty clay to clay
4.757	9.37	0.1937	2.066	2.129	4	5	clayey silt to silty clay
4.921	8.86	0.1783	2.013	2.352	4	5	clayey silt to silty clay
5.085	7.79	0.1445	1.855	2.467	5	4	silty clay to clay
5.249	7.90	0.1396	1.766	2.555	4	5	clayey silt to silty clay
5.413	9.44	0.2054	2.175	2.671	5	5	clayey silt to silty clay
5.577	10.53	0.2023	1.922	2.745	5	5	clayey silt to silty clay
5.741	11.25	0.1286	1.143	2.647	5	5	clayey silt to silty clay
5.906	8.28	0.0548	0.661	2.186	4	1	sensitive fine grained
6.070	6.75	0.0846	1.253	2.419	3	1	sensitive fine grained
6.234	7.97	0.0821	1.031	2.591	4	5	clayey silt to silty clay
6.398	6.64	0.0398	0.599	2.668	3	1	sensitive fine grained
6.562	6.15	0.0386	0.629	2.786	3	1	sensitive fine grained
6.726	5.80	0.0405	0.698	2.934	3	1	sensitive fine grained
6.890	5.80	0.0468	0.807	2.939	3	1	sensitive fine grained
7.054	5.22	0.0375	0.719	3.085	2	1	sensitive fine grained
7.218	4.67	0.0280	0.598	3.112	2	1	sensitive fine grained

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
7.382	5.26	0.0467	0.887	3.152	3	1	sensitive fine grained
7.546	5.09	0.0530	1.042	3.246	2	1	sensitive fine grained
7.710	5.80	0.0401	0.690	3.831	3	1	sensitive fine grained
7.874	4.84	0.0433	0.894	3.912	2	1	sensitive fine grained
8.038	4.47	0.0412	0.922	3.975	2	1	sensitive fine grained
8.202	4.38	0.0422	0.965	4.061	2	1	sensitive fine grained
8.366	4.59	0.0561	1.221	4.135	2	1	sensitive fine grained
8.530	4.81	0.0783	1.629	4.188	2	1	sensitive fine grained
8.694	5.30	0.1110	2.095	4.234	3	4	silty clay to clay
8.858	5.53	0.1175	2.126	4.260	4	4	silty clay to clay
9.022	5.24	0.1192	2.276	4.289	3	4	silty clay to clay
9.186	5.41	0.1204	2.227	4.293	3	4	silty clay to clay
9.350	5.36	0.1230	2.293	4.310	3	4	silty clay to clay
9.514	4.93	0.1316	2.667	4.399	5	3	clay
9.678	5.01	0.1745	3.481	4.449	5	3	clay
9.843	5.63	0.2251	3.999	4.574	5	3	clay
10.007	7.45	0.3507	4.710	4.893	7	3	clay
10.171	10.31	0.4478	4.343	4.993	10	3	clay
10.335	12.66	0.6716	5.307	5.130	12	3	clay
10.499	10.60	0.5416	5.109	4.497	10	3	clay
10.663	7.26	0.2995	4.124	4.210	7	3	clay
10.827	6.68	0.2234	3.344	4.569	6	3	clay
10.991	7.35	0.2675	3.640	4.783	7	3	clay
11.155	7.32	0.2650	3.622	5.296	7	3	clay
11.319	6.71	0.2415	3.601	5.346	6	3	clay
11.483	6.61	0.2229	3.372	5.367	6	3	clay
11.647	6.59	0.1961	2.975	5.425	6	3	clay
11.811	6.67	0.2122	3.184	5.502	6	3	clay
11.975	6.79	0.2275	3.350	5.528	7	3	clay
12.139	6.64	0.2327	3.503	5.559	6	3	clay
12.303	6.72	0.2016	3.002	5.610	6	3	clay
12.467	6.87	0.1971	2.868	5.737	7	3	clay
12.631	7.00	0.2026	2.895	5.799	7	3	clay
12.795	7.52	0.1857	2.470	5.924	5	4	silty clay to clay
12.959	8.32	0.2231	2.682	6.223	5	4	silty clay to clay
13.123	8.81	0.2206	2.505	6.441	6	4	silty clay to clay
13.287	8.98	0.2375	2.645	6.698	6	4	silty clay to clay
13.451	9.13	0.2427	2.659	6.835	6	4	silty clay to clay
13.615	7.47	0.2003	2.681	6.933	5	4	silty clay to clay
13.780	7.13	0.1387	1.944	7.081	5	4	silty clay to clay
13.944	6.38	0.1002	1.571	7.177	4	4	silty clay to clay
14.108	6.48	0.1073	1.656	7.297	4	4	silty clay to clay
14.272	7.36	0.1377	1.871	7.537	5	4	silty clay to clay
14.436	8.79	0.1918	2.183	8.321	6	4	silty clay to clay
14.600	8.84	0.2249	2.544	8.520	6	4	silty clay to clay
14.764	8.20	0.2603	3.173	8.616	8	3	clay
14.928	7.38	0.2784	3.770	8.676	7	3	clay
15.092	6.95	0.2521	3.628	8.589	7	3	clay
15.256	6.59	0.2015	3.056	8.585	6	3	clay
15.420	5.67	0.1307	2.303	8.628	4	4	silty clay to clay
15.584	5.48	0.0966	1.764	8.762	3	4	silty clay to clay
15.748	5.27	0.0766	1.453	8.875	3	1	sensitive fine grained
15.912	5.33	0.0772	1.450	8.999	3	1	sensitive fine grained

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.076	5.27	0.0935	1.775	9.136	3	4	silty clay to clay
16.240	5.02	0.0757	1.508	9.253	2	1	sensitive fine grained
16.404	4.56	0.0611	1.342	9.426	2	1	sensitive fine grained
16.568	5.20	0.0668	1.284	9.570	2	1	sensitive fine grained
16.732	5.54	0.0994	1.795	9.735	4	4	silty clay to clay
16.896	5.68	0.1046	1.842	9.997	4	4	silty clay to clay
17.060	5.89	0.0960	1.629	10.169	3	1	sensitive fine grained
17.224	5.65	0.0739	1.307	10.282	3	1	sensitive fine grained
17.388	5.32	0.0769	1.446	10.565	3	1	sensitive fine grained
17.552	5.79	0.0820	1.416	10.785	3	1	sensitive fine grained
17.717	5.65	0.0890	1.576	11.236	3	1	sensitive fine grained
17.881	5.74	0.1175	2.047	11.392	4	4	silty clay to clay
18.045	5.81	0.0872	1.501	11.524	3	1	sensitive fine grained
18.209	5.68	0.0724	1.274	11.857	3	1	sensitive fine grained
18.373	5.49	0.0797	1.453	12.044	3	1	sensitive fine grained
18.537	5.60	0.1169	2.086	12.250	4	4	silty clay to clay
18.701	7.07	0.2068	2.924	12.454	7	3	clay
18.865	7.26	0.1864	2.569	12.269	5	4	silty clay to clay
19.029	6.89	0.1831	2.658	12.458	4	4	silty clay to clay
19.193	7.74	0.1836	2.372	12.679	5	4	silty clay to clay
19.357	7.78	0.1846	2.371	12.818	5	4	silty clay to clay
19.521	7.74	0.2062	2.663	13.065	5	4	silty clay to clay
19.685	8.26	0.2226	2.695	13.341	5	4	silty clay to clay
19.849	8.60	0.1917	2.228	13.621	5	4	silty clay to clay
20.013	8.95	0.1699	1.899	13.983	4	5	clayey silt to silty clay
20.177	8.04	0.1332	1.656	14.069	4	5	clayey silt to silty clay
20.341	7.14	0.1125	1.575	14.278	3	5	clayey silt to silty clay
20.505	6.87	0.0707	1.028	14.513	3	1	sensitive fine grained
20.669	6.83	0.0700	1.025	14.666	3	1	sensitive fine grained
20.833	6.55	0.0600	0.916	14.952	3	1	sensitive fine grained
20.997	6.25	0.0539	0.862	17.385	3	1	sensitive fine grained
21.161	7.25	0.0555	0.765	17.428	3	1	sensitive fine grained
21.325	7.73	0.0735	0.951	18.775	4	1	sensitive fine grained
21.490	8.25	0.0400	0.485	19.226	4	1	sensitive fine grained
21.654	6.74	0.0368	0.547	19.444	3	1	sensitive fine grained
21.818	10.14	0.0873	0.861	19.947	5	5	clayey silt to silty clay
21.982	12.28	0.0819	0.667	19.538	5	6	sandy silt to clayey silt
22.146	11.47	0.1132	0.988	18.401	4	6	sandy silt to clayey silt
22.310	12.63	0.1064	0.842	18.756	5	6	sandy silt to clayey silt
22.474	13.81	0.0613	0.444	18.725	5	6	sandy silt to clayey silt
22.638	12.85	0.0323	0.252	18.754	5	6	sandy silt to clayey silt
22.802	7.63	0.0391	0.512	19.547	4	1	sensitive fine grained
22.966	6.17	0.0409	0.663	20.789	3	1	sensitive fine grained
23.130	6.19	0.0441	0.713	21.376	3	1	sensitive fine grained
23.294	6.23	0.0536	0.860	21.851	3	1	sensitive fine grained
23.458	6.94	0.0727	1.047	22.237	3	1	sensitive fine grained
23.622	12.11	0.1336	1.103	22.786	5	6	sandy silt to clayey silt
23.786	21.12	0.1413	0.669	16.757	8	6	sandy silt to clayey silt
23.950	30.55	0.3763	1.232	14.412	12	6	sandy silt to clayey silt
24.114	18.25	0.5164	2.829	8.606	9	5	clayey silt to silty clay
24.278	13.08	0.4036	3.086	9.877	8	4	silty clay to clay
24.442	19.62	0.3172	1.617	10.184	8	6	sandy silt to clayey silt
24.606	22.37	0.2259	1.010	9.913	9	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
24.770	28.44	0.3545	1.247	9.762	11	6	sandy silt to clayey silt
24.934	25.29	0.5475	2.165	8.546	10	6	sandy silt to clayey silt
25.098	25.44	0.3646	1.433	9.035	10	6	sandy silt to clayey silt
25.262	47.98	0.2519	0.525	8.620	11	8	sand to silty sand
25.427	42.52	0.3397	0.799	6.851	14	7	silty sand to sandy silt
25.591	34.41	0.3485	1.013	6.357	11	7	silty sand to sandy silt
25.755	44.00	0.3471	0.789	6.504	14	7	silty sand to sandy silt
25.919	26.69	0.4788	1.794	6.118	10	6	sandy silt to clayey silt
26.083	20.25	0.5037	2.487	6.012	10	5	clayey silt to silty clay
26.247	22.05	0.4692	2.127	6.266	8	6	sandy silt to clayey silt
26.411	21.80	0.4222	1.937	6.290	8	6	sandy silt to clayey silt
26.575	21.57	0.4773	2.213	6.667	10	5	clayey silt to silty clay
26.739	32.95	0.3686	1.118	6.259	11	7	silty sand to sandy silt
26.903	109.37	0.5978	0.547	4.433	21	9	sand
27.067	115.87	0.8492	0.733	3.965	28	8	sand to silty sand
27.231	100.44	0.7624	0.759	4.020	24	8	sand to silty sand
27.395	90.99	0.7814	0.859	4.166	22	8	sand to silty sand
27.559	91.57	0.7498	0.819	5.080	22	8	sand to silty sand
27.723	80.74	0.6723	0.833	5.202	19	8	sand to silty sand
27.887	76.51	0.5972	0.781	5.274	18	8	sand to silty sand
28.051	77.96	0.5925	0.760	5.343	19	8	sand to silty sand
28.215	76.60	0.5174	0.676	5.471	18	8	sand to silty sand
28.379	76.28	0.5125	0.672	5.492	18	8	sand to silty sand
28.543	77.99	0.5138	0.659	5.669	19	8	sand to silty sand
28.707	81.36	0.5688	0.699	5.809	19	8	sand to silty sand
28.871	93.65	0.6242	0.666	5.943	22	8	sand to silty sand
29.035	96.01	0.6568	0.684	6.137	23	8	sand to silty sand
29.199	96.62	0.6813	0.705	6.377	23	8	sand to silty sand
29.364	96.61	0.6622	0.685	7.443	23	8	sand to silty sand
29.528	95.57	0.6614	0.692	6.590	23	8	sand to silty sand
29.692	91.67	0.6490	0.708	6.729	22	8	sand to silty sand
29.856	82.74	0.5288	0.639	6.878	20	8	sand to silty sand
30.020	76.44	0.5266	0.689	8.033	18	8	sand to silty sand
30.184	76.51	0.5022	0.656	8.179	18	8	sand to silty sand
30.348	75.33	0.5033	0.668	8.287	18	8	sand to silty sand
30.512	69.06	0.4814	0.697	8.311	17	8	sand to silty sand
30.676	64.59	0.4445	0.688	8.338	15	8	sand to silty sand
30.840	61.26	0.4203	0.686	8.575	15	8	sand to silty sand
31.004	60.98	0.4034	0.662	8.635	15	8	sand to silty sand
31.168	61.01	0.4045	0.663	8.685	15	8	sand to silty sand
31.332	64.20	0.3889	0.606	8.743	15	8	sand to silty sand
31.496	61.46	0.3641	0.592	8.795	15	8	sand to silty sand
31.660	52.90	0.3114	0.589	8.752	13	8	sand to silty sand
31.824	48.19	0.2574	0.534	8.700	12	8	sand to silty sand
31.988	45.23	0.2323	0.514	8.685	14	7	silty sand to sandy silt
32.152	44.90	0.2286	0.509	8.748	14	7	silty sand to sandy silt
32.316	45.15	0.2339	0.518	8.779	14	7	silty sand to sandy silt
32.480	46.33	0.2418	0.522	8.853	11	8	sand to silty sand
32.644	47.70	0.2577	0.540	8.932	11	8	sand to silty sand
32.808	48.44	0.2681	0.553	9.035	12	8	sand to silty sand
32.972	50.42	0.2947	0.584	9.136	12	8	sand to silty sand
33.136	52.46	0.3333	0.635	9.217	13	8	sand to silty sand
33.301	60.01	0.4002	0.667	9.349	14	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
33.465	85.65	0.5085	0.594	9.606	21	8	sand to silty sand
33.629	102.32	0.6323	0.618	9.881	24	8	sand to silty sand
33.793	101.52	0.6275	0.618	10.059	24	8	sand to silty sand
33.957	91.76	0.5816	0.634	10.378	22	8	sand to silty sand
34.121	85.64	0.5440	0.635	10.351	21	8	sand to silty sand
34.285	81.04	0.4903	0.605	10.421	19	8	sand to silty sand
34.449	75.40	0.4726	0.627	10.440	18	8	sand to silty sand
34.613	73.28	0.4595	0.627	10.474	18	8	sand to silty sand
34.777	75.95	0.4592	0.605	10.510	18	8	sand to silty sand
34.941	78.08	0.4510	0.578	10.605	19	8	sand to silty sand
35.105	78.37	0.4751	0.606	10.622	19	8	sand to silty sand
35.269	81.26	0.5267	0.648	10.737	19	8	sand to silty sand
35.433	80.74	0.5199	0.644	10.836	19	8	sand to silty sand
35.597	74.68	0.4804	0.643	10.821	18	8	sand to silty sand
35.761	72.61	0.4688	0.646	10.915	17	8	sand to silty sand
35.925	73.55	0.4815	0.655	10.979	18	8	sand to silty sand
36.089	72.85	0.5181	0.711	11.018	17	8	sand to silty sand
36.253	72.18	0.5626	0.779	11.092	17	8	sand to silty sand
36.417	84.31	0.6373	0.756	11.406	20	8	sand to silty sand
36.581	98.79	0.7002	0.709	11.593	24	8	sand to silty sand
36.745	104.76	0.7073	0.675	11.747	25	8	sand to silty sand
36.909	100.58	0.7463	0.742	11.826	24	8	sand to silty sand
37.073	91.32	0.6284	0.688	11.898	22	8	sand to silty sand
37.238	83.21	0.5602	0.673	11.929	20	8	sand to silty sand
37.402	84.12	0.5121	0.609	12.204	20	8	sand to silty sand
37.566	79.14	0.4913	0.621	12.248	19	8	sand to silty sand
37.730	73.07	0.4475	0.613	12.267	17	8	sand to silty sand
37.894	67.89	0.4286	0.631	12.228	16	8	sand to silty sand
38.058	64.10	0.4205	0.656	12.233	15	8	sand to silty sand
38.222	62.87	0.4196	0.667	12.269	15	8	sand to silty sand
38.386	65.14	0.4212	0.647	12.293	16	8	sand to silty sand
38.550	67.07	0.4301	0.641	12.341	16	8	sand to silty sand
38.714	68.59	0.4510	0.658	12.384	16	8	sand to silty sand
38.878	68.26	0.4746	0.695	12.499	16	8	sand to silty sand
39.042	66.42	0.4422	0.666	12.499	16	8	sand to silty sand
39.206	64.35	0.3954	0.614	12.485	15	8	sand to silty sand
39.370	66.40	0.4077	0.614	12.550	16	8	sand to silty sand
39.534	68.02	0.4192	0.616	12.645	16	8	sand to silty sand
39.698	66.57	0.4157	0.625	12.761	16	8	sand to silty sand
39.862	57.11	0.5360	0.939	12.729	18	7	silty sand to sandy silt
40.026	36.55	0.6776	1.854	12.813	14	6	sandy silt to clayey silt
40.190	20.91	0.6445	3.082	13.233	10	5	clayey silt to silty clay
40.354	13.90	0.4650	3.347	14.834	9	4	silty clay to clay
40.518	9.64	0.4691	4.866	17.174	9	3	clay
40.682	9.50	0.5108	5.378	24.812	9	3	clay
40.846	32.25	0.4134	1.282	24.574	10	7	silty sand to sandy silt
41.011	49.76	0.3638	0.731	6.926	16	7	silty sand to sandy silt
41.175	50.15	0.2909	0.580	3.987	12	8	sand to silty sand
41.339	47.98	0.3274	0.682	4.361	15	7	silty sand to sandy silt
41.503	45.92	0.3565	0.776	4.732	15	7	silty sand to sandy silt
41.667	44.70	0.3838	0.858	5.053	14	7	silty sand to sandy silt
41.831	43.13	0.4498	1.043	5.370	14	7	silty sand to sandy silt
41.995	45.02	0.4408	0.979	5.684	14	7	silty sand to sandy silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
42.159	50.24	0.4431	0.882	6.029	16	7	silty sand to sandy silt
42.323	48.69	0.5022	1.031	6.254	16	7	silty sand to sandy silt
42.487	48.22	0.5442	1.129	6.513	15	7	silty sand to sandy silt
42.651	69.89	0.5071	0.726	7.074	17	8	sand to silty sand
42.815	65.51	0.4901	0.748	7.575	16	8	sand to silty sand
42.979	61.15	0.4803	0.786	7.944	15	8	sand to silty sand
43.143	60.53	0.4673	0.772	8.110	14	8	sand to silty sand
43.307	61.60	0.4698	0.763	8.362	15	8	sand to silty sand
43.471	54.50	0.5270	0.967	8.666	17	7	silty sand to sandy silt
43.635	46.75	0.5414	1.158	8.860	15	7	silty sand to sandy silt
43.799	45.76	0.5408	1.182	9.251	15	7	silty sand to sandy silt
43.963	45.03	0.5271	1.171	10.711	14	7	silty sand to sandy silt
44.127	45.36	0.5136	1.132	10.888	14	7	silty sand to sandy silt
44.291	39.63	0.6854	1.730	11.169	15	6	sandy silt to clayey silt
44.455	28.66	0.6453	2.252	11.687	11	6	sandy silt to clayey silt
44.619	16.32	0.4931	3.021	11.900	8	5	clayey silt to silty clay
44.783	10.13	0.4010	3.957	14.506	10	3	clay
44.948	43.31	0.3389	0.782	13.597	14	7	silty sand to sandy silt
45.112	66.23	0.4673	0.706	8.822	16	8	sand to silty sand
45.276	59.83	0.5429	0.907	7.930	19	7	silty sand to sandy silt
45.440	66.05	0.5575	0.844	8.340	16	8	sand to silty sand
45.604	70.09	0.5700	0.813	8.688	17	8	sand to silty sand
45.768	71.98	0.5725	0.795	9.045	17	8	sand to silty sand
45.932	71.23	0.5767	0.810	9.766	17	8	sand to silty sand
46.096	73.08	0.5664	0.775	10.020	17	8	sand to silty sand
46.260	73.69	0.5671	0.770	10.186	18	8	sand to silty sand
46.424	73.72	0.5933	0.805	10.495	18	8	sand to silty sand
46.588	74.24	0.6391	0.861	10.819	18	8	sand to silty sand
46.752	74.87	0.6282	0.839	11.293	18	8	sand to silty sand
46.916	74.08	0.4197	0.567	11.811	18	8	sand to silty sand
47.080	75.33	0.6066	0.805	11.998	18	8	sand to silty sand
47.244	85.49	0.7345	0.859	16.385	20	8	sand to silty sand
47.408	80.84	0.7882	0.975	16.498	19	8	sand to silty sand
47.572	82.36	0.7720	0.937	16.704	20	8	sand to silty sand
47.736	83.10	0.7245	0.872	16.838	20	8	sand to silty sand
47.900	83.28	0.7186	0.863	16.953	20	8	sand to silty sand
48.064	85.00	0.7092	0.834	17.071	20	8	sand to silty sand
48.228	83.17	0.6287	0.756	17.224	20	8	sand to silty sand
48.392	79.54	0.5862	0.737	17.145	19	8	sand to silty sand
48.556	74.25	0.5614	0.756	17.315	18	8	sand to silty sand
48.720	71.36	0.5591	0.784	17.308	17	8	sand to silty sand
48.885	67.09	0.5533	0.825	17.457	16	8	sand to silty sand
49.049	63.07	0.5419	0.859	17.416	15	8	sand to silty sand
49.213	61.29	0.5301	0.865	17.471	15	8	sand to silty sand
49.377	62.09	0.5271	0.849	17.936	15	8	sand to silty sand
49.541	59.02	0.5130	0.869	17.953	19	7	silty sand to sandy silt
49.705	55.34	0.5151	0.931	17.553	18	7	silty sand to sandy silt
49.869	49.74	0.5384	1.082	17.840	16	7	silty sand to sandy silt
50.033	47.39	0.5071	1.070	18.011	15	7	silty sand to sandy silt
50.197	47.72	0.4981	1.044	18.200	15	7	silty sand to sandy silt
50.361	45.48	0.5625	1.237	16.026	15	7	silty sand to sandy silt
50.525	48.67	0.6242	1.283	16.009	16	7	silty sand to sandy silt
50.689	58.26	0.4815	0.826	15.510	14	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
50.853	69.72	0.3227	0.463	10.541	17	8	sand to silty sand
51.017	87.49	0.3988	0.456	9.246	21	8	sand to silty sand
51.181	95.10	0.4889	0.514	9.668	23	8	sand to silty sand
51.345	97.11	0.6095	0.628	9.961	23	8	sand to silty sand
51.509	100.58	0.7588	0.754	10.807	24	8	sand to silty sand
51.673	104.09	0.8469	0.814	11.610	25	8	sand to silty sand
51.837	103.26	0.9004	0.872	12.502	25	8	sand to silty sand
52.001	100.19	0.9419	0.940	13.230	24	8	sand to silty sand
52.165	92.64	0.9098	0.982	13.736	22	8	sand to silty sand
52.329	85.84	0.6900	0.804	14.302	21	8	sand to silty sand
52.493	99.40	0.6523	0.656	15.098	24	8	sand to silty sand
52.657	119.82	0.8973	0.749	13.954	29	8	sand to silty sand
52.822	120.77	0.9757	0.808	15.378	29	8	sand to silty sand
52.986	111.88	0.9468	0.846	15.927	27	8	sand to silty sand
53.150	102.24	0.8960	0.876	16.762	24	8	sand to silty sand
53.314	97.95	0.8637	0.882	17.253	23	8	sand to silty sand
53.478	95.03	0.8294	0.873	17.519	23	8	sand to silty sand
53.642	94.03	0.7659	0.815	18.037	23	8	sand to silty sand
53.806	88.93	0.7350	0.826	19.032	21	8	sand to silty sand
53.970	88.03	0.7117	0.808	19.166	21	8	sand to silty sand
54.134	90.12	0.7298	0.810	19.418	22	8	sand to silty sand
54.298	88.32	0.7425	0.841	19.480	21	8	sand to silty sand
54.462	88.40	0.7512	0.850	19.657	21	8	sand to silty sand
54.626	87.31	0.7291	0.835	19.749	21	8	sand to silty sand
54.790	83.79	0.7264	0.867	19.756	20	8	sand to silty sand
54.954	76.21	0.7307	0.959	19.761	18	8	sand to silty sand
55.118	73.62	0.7216	0.980	19.928	18	8	sand to silty sand
55.282	70.90	0.6786	0.957	19.938	17	8	sand to silty sand
55.446	70.78	0.6874	0.971	20.067	17	8	sand to silty sand
55.610	71.65	0.6865	0.958	19.971	17	8	sand to silty sand
55.774	82.45	0.6960	0.844	20.386	20	8	sand to silty sand
55.938	90.28	0.7259	0.804	20.398	22	8	sand to silty sand
56.102	91.50	0.8046	0.879	20.415	22	8	sand to silty sand
56.266	102.81	0.7994	0.778	20.810	25	8	sand to silty sand
56.430	91.65	0.7856	0.857	20.846	22	8	sand to silty sand
56.594	83.33	0.7815	0.938	20.719	20	8	sand to silty sand
56.759	103.86	0.8009	0.771	21.431	25	8	sand to silty sand
56.923	103.75	0.8265	0.797	21.386	25	8	sand to silty sand
57.087	101.91	0.8691	0.853	21.388	24	8	sand to silty sand
57.251	96.93	0.8767	0.904	21.175	23	8	sand to silty sand
57.415	94.65	0.9108	0.962	21.434	23	8	sand to silty sand
57.579	94.70	0.8843	0.934	21.247	23	8	sand to silty sand
57.743	106.20	0.9003	0.848	21.319	25	8	sand to silty sand
57.907	110.89	0.9024	0.814	20.542	27	8	sand to silty sand
58.071	113.81	0.9171	0.806	20.916	27	8	sand to silty sand
58.235	114.02	0.9760	0.856	21.021	27	8	sand to silty sand
58.399	108.76	0.9615	0.884	21.467	26	8	sand to silty sand
58.563	98.35	0.9122	0.928	21.067	24	8	sand to silty sand
58.727	97.57	0.8360	0.857	21.139	23	8	sand to silty sand
58.891	103.07	0.8390	0.814	21.671	25	8	sand to silty sand
59.055	103.29	0.8123	0.786	21.602	25	8	sand to silty sand
59.219	94.21	0.7773	0.825	21.463	23	8	sand to silty sand
59.383	78.84	0.7712	0.978	22.371	19	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
59.547	93.72	0.8065	0.861	21.736	22	8	sand to silty sand
59.711	94.33	1.0111	1.072	21.690	23	8	sand to silty sand
59.875	83.90	1.1461	1.366	21.980	27	7	silty sand to sandy silt
60.039	79.49	1.0977	1.381	22.187	25	7	silty sand to sandy silt
60.203	77.92	1.0928	1.402	18.521	25	7	silty sand to sandy silt
60.367	76.02	1.0665	1.403	17.934	24	7	silty sand to sandy silt
60.532	74.47	1.0563	1.418	17.756	24	7	silty sand to sandy silt
60.696	75.90	0.9924	1.307	18.842	24	7	silty sand to sandy silt
60.860	75.97	0.8543	1.125	17.850	18	8	sand to silty sand
61.024	76.76	0.7925	1.032	16.493	18	8	sand to silty sand
61.188	82.10	0.7106	0.866	15.273	20	8	sand to silty sand
61.352	86.56	0.6809	0.787	15.304	21	8	sand to silty sand
61.516	86.09	0.7451	0.865	15.865	21	8	sand to silty sand
61.680	90.87	0.8026	0.883	16.519	22	8	sand to silty sand
61.844	94.99	0.8025	0.845	16.922	23	8	sand to silty sand
62.008	88.39	0.7300	0.826	17.687	21	8	sand to silty sand
62.172	88.02	0.6538	0.743	17.677	21	8	sand to silty sand
62.336	83.54	0.5880	0.704	18.188	20	8	sand to silty sand
62.500	80.77	0.5136	0.636	19.854	19	8	sand to silty sand
62.664	80.38	0.5039	0.627	20.175	19	8	sand to silty sand
62.828	79.46	0.5029	0.633	20.894	19	8	sand to silty sand
62.992	79.46	0.5138	0.647	22.047	19	8	sand to silty sand
63.156	80.67	0.5416	0.671	22.047	19	8	sand to silty sand
63.320	83.27	0.5459	0.656	22.522	20	8	sand to silty sand
63.484	92.64	0.5729	0.618	23.244	22	8	sand to silty sand
63.648	99.80	0.6080	0.609	23.716	24	8	sand to silty sand
63.812	104.06	0.6162	0.592	23.970	25	8	sand to silty sand
63.976	93.34	0.6486	0.695	24.404	22	8	sand to silty sand
64.140	79.71	0.6750	0.847	23.793	19	8	sand to silty sand
64.304	75.36	0.7922	1.051	25.118	18	8	sand to silty sand
64.469	78.44	0.9469	1.207	24.603	25	7	silty sand to sandy silt
64.633	79.69	1.2190	1.530	22.347	25	7	silty sand to sandy silt
64.797	82.38	1.0579	1.284	21.937	26	7	silty sand to sandy silt
64.961	85.56	0.9483	1.108	15.249	20	8	sand to silty sand
65.125	86.41	0.7911	0.916	10.104	21	8	sand to silty sand
65.289	88.78	0.7849	0.884	10.370	21	8	sand to silty sand
65.453	85.86	0.6623	0.771	11.408	21	8	sand to silty sand
65.617	85.55	0.6029	0.705	11.478	20	8	sand to silty sand
65.781	86.58	0.5414	0.625	14.194	21	8	sand to silty sand
65.945	87.02	0.5240	0.602	16.349	21	8	sand to silty sand
66.109	87.84	0.5101	0.581	18.109	21	8	sand to silty sand
66.273	87.08	0.4977	0.571	19.597	21	8	sand to silty sand
66.437	85.21	0.4818	0.565	20.832	20	8	sand to silty sand
66.601	84.78	0.4647	0.548	21.911	20	8	sand to silty sand
66.765	83.07	0.4418	0.532	22.973	20	8	sand to silty sand
66.929	81.73	0.4391	0.537	25.231	20	8	sand to silty sand
67.093	80.45	0.4545	0.565	25.344	19	8	sand to silty sand
67.257	79.57	0.4430	0.557	25.435	19	8	sand to silty sand
67.421	81.94	0.4549	0.555	25.488	20	8	sand to silty sand
67.585	83.37	0.4573	0.549	25.993	20	8	sand to silty sand
67.749	85.66	0.4804	0.561	25.821	21	8	sand to silty sand
67.913	86.97	0.4851	0.558	26.084	21	8	sand to silty sand
68.077	86.45	0.4868	0.563	25.996	21	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
68.241	87.26	0.4849	0.556	26.116	21	8	sand to silty sand
68.406	89.39	0.5116	0.572	26.116	21	8	sand to silty sand
68.570	88.22	0.5379	0.610	26.329	21	8	sand to silty sand
68.734	87.82	0.5530	0.630	26.410	21	8	sand to silty sand
68.898	84.03	0.5720	0.681	26.638	20	8	sand to silty sand
69.062	77.10	0.5587	0.725	26.590	18	8	sand to silty sand
69.226	71.71	0.5351	0.746	26.559	17	8	sand to silty sand
69.390	67.55	0.5255	0.778	26.667	16	8	sand to silty sand
69.554	66.83	0.5061	0.757	26.530	16	8	sand to silty sand
69.718	68.55	0.5451	0.795	26.772	16	8	sand to silty sand
69.882	74.12	0.6389	0.862	26.152	18	8	sand to silty sand
70.046	74.74	0.6118	0.819	26.876	18	8	sand to silty sand
70.210	82.47	0.6589	0.799	27.372	20	8	sand to silty sand
70.374	90.15	0.6864	0.761	26.111	22	8	sand to silty sand
70.538	93.99	0.7440	0.792	26.741	23	8	sand to silty sand
70.702	96.31	0.8229	0.854	26.775	23	8	sand to silty sand
70.866	98.22	0.8827	0.899	26.928	24	8	sand to silty sand
71.030	98.94	0.8831	0.893	27.130	24	8	sand to silty sand
71.194	101.78	0.8750	0.860	27.317	24	8	sand to silty sand
71.358	103.94	0.8921	0.858	27.326	25	8	sand to silty sand
71.522	109.13	0.9170	0.840	27.499	26	8	sand to silty sand
71.686	107.22	0.9230	0.861	27.573	26	8	sand to silty sand
71.850	104.11	0.8653	0.831	27.137	25	8	sand to silty sand
72.014	99.15	0.7636	0.770	27.367	24	8	sand to silty sand
72.178	98.96	0.7517	0.760	27.878	24	8	sand to silty sand
72.343	97.78	0.7348	0.752	27.674	23	8	sand to silty sand
72.507	100.02	0.7392	0.739	27.949	24	8	sand to silty sand
72.671	100.64	0.7086	0.704	28.031	24	8	sand to silty sand
72.835	93.91	0.6829	0.727	28.124	22	8	sand to silty sand
72.999	87.63	0.5899	0.673	27.933	21	8	sand to silty sand
73.163	84.53	0.5865	0.694	28.208	20	8	sand to silty sand
73.327	69.56	0.6224	0.895	28.165	17	8	sand to silty sand
73.491	69.01	0.7093	1.028	28.252	17	8	sand to silty sand
73.655	79.64	0.7317	0.919	29.009	19	8	sand to silty sand
73.819	99.73	0.7633	0.765	26.947	24	8	sand to silty sand
73.983	116.91	0.8600	0.736	26.669	28	8	sand to silty sand
74.147	142.94	0.9438	0.660	28.103	27	9	sand
74.311	129.96	0.8155	0.628	28.304	25	9	sand
74.475	122.01	0.7202	0.590	28.141	23	9	sand
74.639	134.60	0.7230	0.537	29.304	26	9	sand
74.803	151.91	0.7817	0.515	29.275	29	9	sand
74.967	153.32	0.8156	0.532	29.266	29	9	sand
75.131	145.99	0.8573	0.587	29.326	28	9	sand
75.295	134.33	0.8072	0.601	29.282	26	9	sand
75.459	114.53	0.7272	0.635	28.779	27	8	sand to silty sand
75.623	102.00	0.6076	0.596	28.913	24	8	sand to silty sand
75.787	97.59	0.5429	0.556	28.803	23	8	sand to silty sand
75.951	101.67	0.5946	0.585	29.174	24	8	sand to silty sand
76.115	121.48	0.8132	0.669	29.990	23	9	sand
76.280	164.48	1.1328	0.689	31.066	32	9	sand
76.444	157.33	1.0518	0.669	29.939	30	9	sand
76.608	146.67	1.0437	0.712	29.819	28	9	sand
76.772	149.77	1.0382	0.693	29.601	29	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
76.936	150.89	1.0511	0.697	29.774	29	9	sand
77.100	157.08	1.0316	0.657	29.704	30	9	sand
77.264	165.46	1.0128	0.612	29.827	32	9	sand
77.428	173.89	1.0015	0.576	29.853	33	9	sand
77.592	174.27	1.0150	0.582	30.160	33	9	sand
77.756	183.62	1.0750	0.585	30.239	35	9	sand
77.920	195.50	0.9833	0.503	30.316	37	9	sand
78.084	185.51	0.8134	0.438	29.903	36	9	sand
78.248	148.95	0.6371	0.428	28.949	29	9	sand
78.412	128.14	0.5381	0.420	29.443	25	9	sand
78.576	123.92	0.5151	0.416	29.901	24	9	sand
78.740	132.90	0.4712	0.355	30.455	25	9	sand
78.904	127.00	0.3929	0.309	30.268	24	9	sand
79.068	102.33	0.2722	0.266	29.963	20	9	sand
79.232	115.18	0.2956	0.257	29.999	22	9	sand
79.396	143.24	0.3860	0.269	30.483	27	9	sand
79.560	130.97	0.4157	0.317	31.090	25	9	sand
79.724	133.11	0.4092	0.307	31.711	25	9	sand
79.888	140.99	0.3797	0.269	31.227	27	9	sand
80.052	138.69	0.3032	0.219	31.440	27	9	sand
80.217	118.89	0.2601	0.219	31.222	23	9	sand
80.381	104.06	0.2386	0.229	30.963	20	9	sand
80.545	103.52	0.2008	0.194	31.270	20	9	sand
80.709	108.32	0.2120	0.196	31.366	21	9	sand
80.873	105.94	0.2099	0.198	31.507	20	9	sand
81.037	93.84	0.2289	0.244	31.811	18	9	sand
81.201	93.25	0.2289	0.245	32.164	18	9	sand
81.365	92.70	0.2211	0.238	32.061	18	9	sand
81.529	92.03	0.2202	0.239	31.948	18	9	sand
81.693	92.19	0.2450	0.266	32.015	18	9	sand
81.857	93.99	0.2993	0.318	32.358	18	9	sand
82.021	102.12	0.2625	0.257	32.588	20	9	sand
82.185	104.48	0.3165	0.303	32.634	20	9	sand
82.349	114.23	0.3574	0.313	32.166	22	9	sand
82.513	116.52	0.4399	0.378	33.029	22	9	sand
82.677	113.26	0.4092	0.361	32.864	22	9	sand
82.841	106.08	0.2522	0.238	32.696	20	9	sand
83.005	83.88	0.2484	0.296	32.425	20	8	sand to silty sand
83.169	67.37	0.1801	0.267	32.737	16	8	sand to silty sand
83.333	67.51	0.1270	0.188	32.766	16	8	sand to silty sand
83.497	73.09	0.1350	0.185	32.545	17	8	sand to silty sand
83.661	103.32	0.1672	0.162	33.173	20	9	sand
83.825	123.20	0.2519	0.205	33.382	24	9	sand
83.990	114.41	0.3517	0.307	33.636	22	9	sand
84.154	104.06	0.3830	0.368	33.569	20	9	sand
84.318	103.17	0.3535	0.343	33.856	20	9	sand
84.482	102.60	0.3683	0.359	33.487	20	9	sand
84.646	99.55	0.3584	0.360	33.782	19	9	sand
84.810	89.42	0.3914	0.438	33.641	21	8	sand to silty sand
84.974	90.70	0.3327	0.367	33.540	22	8	sand to silty sand
85.138	95.25	0.3281	0.344	33.806	18	9	sand
85.302	111.89	0.3754	0.335	33.878	21	9	sand
85.466	130.15	0.4997	0.384	34.053	25	9	sand

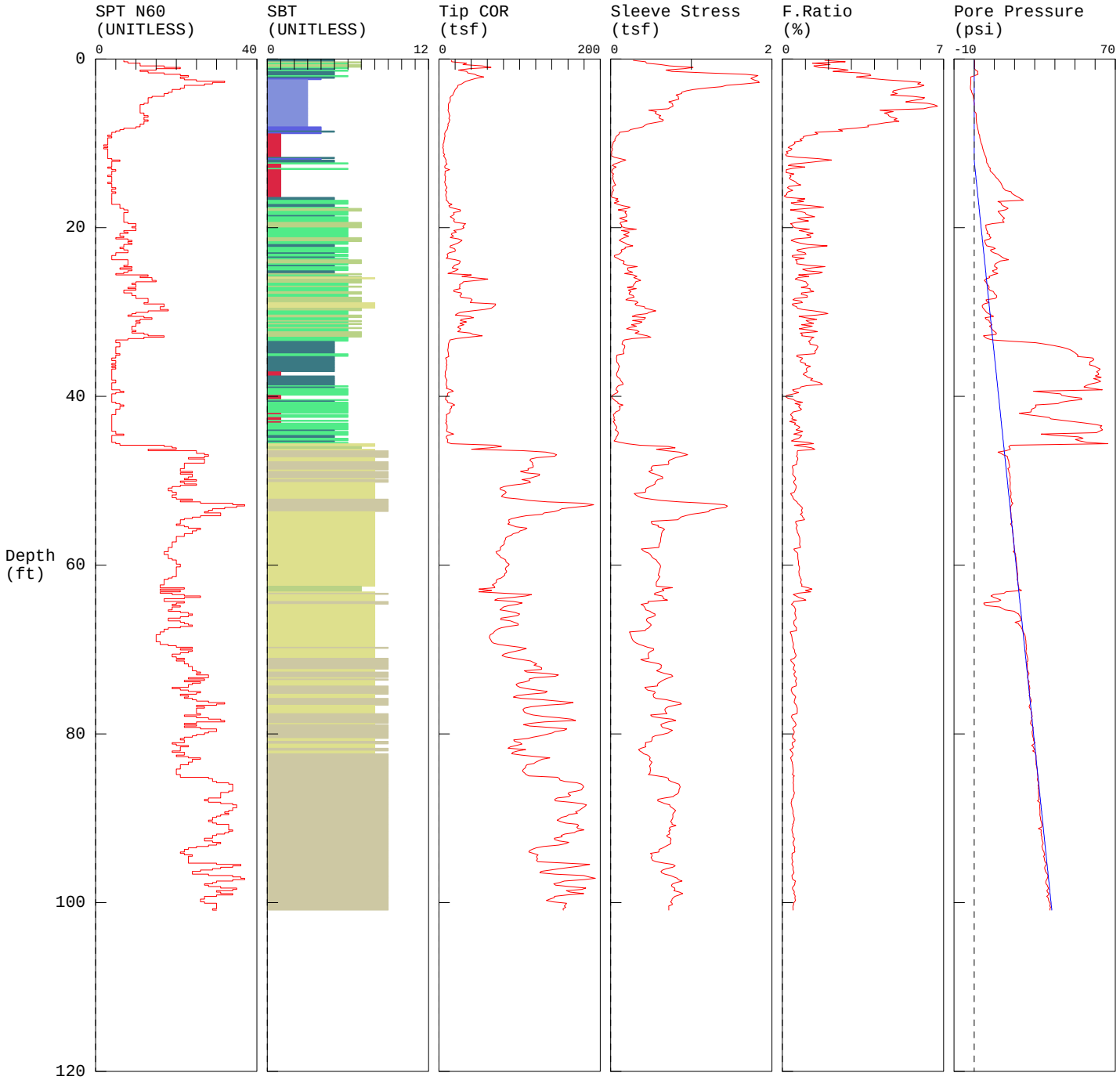
Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
85.630	115.78	0.8150	0.704	34.312	28	8	sand to silty sand
85.794	60.49	1.4176	2.343	33.528	23	6	sandy silt to clayey silt
85.958	37.50	1.2989	3.464	36.481	18	5	clayey silt to silty clay
86.122	35.31	0.9603	2.720	43.584	14	6	sandy silt to clayey silt
86.286	102.96	0.8942	0.869	38.629	25	8	sand to silty sand
86.450	129.26	0.8983	0.695	23.385	25	9	sand
86.614	130.91	0.9431	0.720	24.114	25	9	sand
86.778	130.78	1.0244	0.783	24.284	31	8	sand to silty sand
86.942	129.48	1.1153	0.861	25.389	31	8	sand to silty sand
87.106	124.44	1.0944	0.879	27.360	30	8	sand to silty sand
87.270	120.29	1.0187	0.847	28.928	29	8	sand to silty sand
87.434	116.64	0.9599	0.823	30.093	28	8	sand to silty sand
87.598	107.67	0.8912	0.828	31.385	26	8	sand to silty sand
87.762	103.63	0.8413	0.812	32.432	25	8	sand to silty sand
87.927	94.57	1.2045	1.274	32.722	23	8	sand to silty sand
88.091	62.23	1.3988	2.248	32.895	24	6	sandy silt to clayey silt
88.255	36.65	1.1196	3.055	35.604	18	5	clayey silt to silty clay
88.419	46.27	0.7533	1.628	60.986	15	7	silty sand to sandy silt
88.583	114.72	0.8367	0.729	21.357	27	8	sand to silty sand
88.747	121.02	0.9132	0.755	21.765	29	8	sand to silty sand
88.911	106.99	0.9615	0.899	23.483	26	8	sand to silty sand
89.075	75.13	1.5134	2.014	25.130	24	7	silty sand to sandy silt
89.239	66.24	1.5113	2.281	25.665	25	6	sandy silt to clayey silt
89.403	34.96	0.7816	2.235	31.008	13	6	sandy silt to clayey silt
89.567	78.74	0.8446	1.073	33.911	19	8	sand to silty sand
89.731	97.00	0.8056	0.831	24.404	23	8	sand to silty sand
89.895	107.37	0.7786	0.725	32.538	26	8	sand to silty sand
90.059	120.77	0.6525	0.540	22.112	23	9	sand
90.223	105.22	1.0379	0.986	19.842	25	8	sand to silty sand
90.387	91.82	1.1619	1.265	21.786	22	8	sand to silty sand
90.551	115.86	1.3059	1.127	22.834	28	8	sand to silty sand
90.715	131.09	0.8021	0.612	17.349	25	9	sand
90.879	132.19	0.6991	0.529	11.665	25	9	sand
91.043	127.00	1.0176	0.801	12.034	30	8	sand to silty sand
91.207	119.86	1.1253	0.939	13.432	29	8	sand to silty sand
91.371	112.42	1.0853	0.965	15.884	27	8	sand to silty sand
91.535	102.11	1.0245	1.003	19.149	24	8	sand to silty sand
91.699	101.35	0.9961	0.983	22.592	24	8	sand to silty sand
91.864	96.64	1.2328	1.276	25.818	23	8	sand to silty sand
92.028	70.51	1.4228	2.018	28.654	23	7	silty sand to sandy silt
92.192	75.24	0.8016	1.065	30.833	18	8	sand to silty sand
92.356	109.44	0.7829	0.715	15.421	26	8	sand to silty sand
92.520	88.59	1.2283	1.387	14.916	28	7	silty sand to sandy silt
92.684	55.49	1.2879	2.321	17.450	21	6	sandy silt to clayey silt
92.848	51.08	1.4907	2.918	20.923	20	6	sandy silt to clayey silt
93.012	116.40	1.4431	1.240	20.161	28	8	sand to silty sand
93.176	154.08	1.2874	0.836	8.712	30	9	sand
93.340	158.95	0.8446	0.531	8.177	30	9	sand
93.504	160.74	1.0071	0.627	7.805	31	9	sand
93.668	152.96	1.1549	0.755	8.304	29	9	sand
93.832	142.35	1.1262	0.791	9.687	27	9	sand
93.996	132.27	1.0663	0.806	11.377	32	8	sand to silty sand
94.160	112.36	0.9405	0.837	13.477	27	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
94.324	101.81	0.9313	0.915	15.563	24	8	sand to silty sand
94.488	96.04	0.7375	0.768	18.799	23	8	sand to silty sand
94.652	95.78	0.6714	0.701	19.108	23	8	sand to silty sand
94.816	90.39	0.6517	0.721	26.708	22	8	sand to silty sand
94.980	89.88	0.6506	0.724	31.713	22	8	sand to silty sand
95.144	89.25	0.6556	0.735	34.590	21	8	sand to silty sand
95.308	88.78	0.6664	0.751	35.966	21	8	sand to silty sand
95.472	92.81	0.7569	0.816	36.232	22	8	sand to silty sand
95.636	107.10	0.8914	0.832	37.208	26	8	sand to silty sand
95.801	121.52	1.0761	0.886	37.737	29	8	sand to silty sand
95.965	130.47	1.2938	0.992	37.771	31	8	sand to silty sand
96.129	141.86	1.2322	0.869	38.150	34	8	sand to silty sand
96.293	144.81	1.2380	0.855	37.896	28	9	sand
96.457	143.18	1.2069	0.843	37.320	27	9	sand
96.621	137.15	1.1405	0.832	37.577	33	8	sand to silty sand
96.785	130.03	0.9776	0.752	37.395	25	9	sand
96.949	126.81	0.8640	0.681	37.819	24	9	sand
97.113	127.67	0.7903	0.619	38.325	24	9	sand
97.277	130.99	0.7739	0.591	38.660	25	9	sand
97.441	137.56	0.7888	0.573	38.852	26	9	sand
97.605	141.81	0.7570	0.534	38.996	27	9	sand
97.769	139.65	0.7340	0.526	38.974	27	9	sand
97.933	134.75	0.7659	0.568	38.974	26	9	sand
98.097	151.76	0.8367	0.551	39.643	29	9	sand
98.261	180.33	0.8432	0.468	39.758	35	9	sand
98.425	184.69	0.8455	0.458	33.679	35	9	sand
98.589	167.55	0.9086	0.542	36.371	32	9	sand
98.753	163.85	0.9795	0.598	37.632	31	9	sand
98.917	172.83	1.0325	0.597	38.670	33	9	sand
99.081	159.49	1.0736	0.673	39.164	31	9	sand
99.245	148.11	1.0103	0.682	38.569	28	9	sand
99.409	141.48	1.0451	0.739	38.437	27	9	sand
99.573	132.38	0.9028	0.682	39.001	25	9	sand
99.738	130.22	0.8023	0.616	39.828	25	9	sand
99.902	132.69	0.8023	0.605	39.696	25	9	sand
100.066	138.45	0.8129	0.587	39.816	27	9	sand
100.230	147.89	0.9059	0.613	39.981	28	9	sand
100.394	152.12	0.9215	0.606	39.941	29	9	sand
100.558	152.01	0.9694	0.638	39.816	29	9	sand
100.722	151.66	0.9719	0.641	39.634	29	9	sand
100.886	155.12	0.9752	0.629	39.909	30	9	sand
101.050	153.22	0.9167	0.598	40.362	29	9	sand
101.214	125.38	0.8786	0.701	39.221	24	9	sand
101.378	123.87	0.8690	0.702	39.929	30	8	sand to silty sand
101.542	136.25	0.8995	0.660	40.820	26	9	sand
101.706	134.14	0.9644	0.719	40.470	26	9	sand
101.870	136.82	1.0019	0.732	40.384	26	9	sand
102.034	165.57	0.9432	0.570	39.420	32	9	sand
102.198	159.49	0.8717	0.547	39.758	31	9	sand
102.362	141.95	0.7332	0.517	39.883	27	9	sand
102.526	118.53	0.7302	0.616	39.523	23	9	sand
102.690	99.96	0.7302	0.730	40.655	24	8	sand to silty sand

GRI / CPT-19 / PDX Runway Evaluation

TEST DATE: 4/26/2017 12:14:09 PM
HOLE NUMBER: CPT-19
CUSTOMER: 17058 GRI CPT-19 PDX Runway Evalu
OPERATOR: OGE TAJ

CONE ID: DPG1323
LOCATION: 17058/ GRI / CPT-19 / PDX Runway Evaluation
JOB NUMBER: 17058 / GRI / CPT-19 / PDX Runway Evaluation
TEST DATE: 4/26/2017 12:14:09 PM
TOTAL DEPTH: 100.886 ft

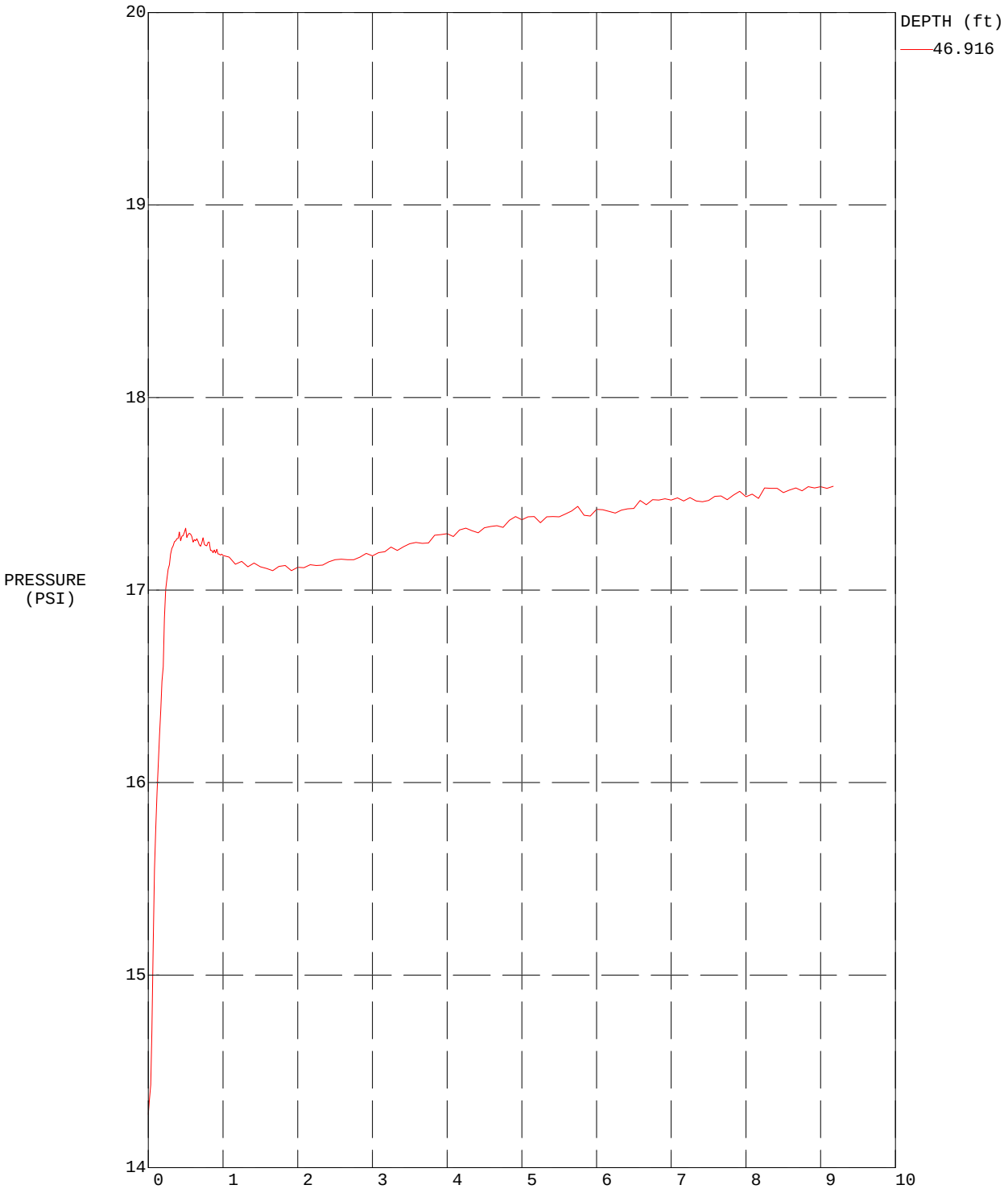


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: GRI / CPT-19 / PDX Runway Evaluation

TEST DATE: 4/26/2017 12:14:09 PM
OPERATOR: OGE TAJ



MAXIMUM PRESSURE = 17.539 (PSI)ME: (MINUTES)
HYDROSTATIC PRESSURE = 17.52 (PSI), WATER TABLE: 6.49 ft

GRI / CPT-19 / PDX Runway Evaluation

OPERATOR: OGE TAJ
TEST DATE: 4/26/2017 12:14:09 PM
COMMENT: GRI / CPT-19 / PDX Runway Evaluation
FILENAME: 17058 CPT-19.cpt
TOTAL DEPTH: 100.886 ft

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
0.164	15.27	0.2808	1.839	0.255	7	5	clayey silt to silty clay
0.328	15.84	0.4326	2.730	0.238	8	5	clayey silt to silty clay
0.492	34.06	0.4442	1.304	0.275	11	7	silty sand to sandy silt
0.656	29.71	0.6171	2.077	0.264	11	6	sandy silt to clayey silt
0.820	53.78	0.7336	1.364	0.277	17	7	silty sand to sandy silt
0.984	64.58	1.0225	1.583	0.028	21	7	silty sand to sandy silt
1.148	38.31	0.9118	2.380	0.137	15	6	sandy silt to clayey silt
1.312	23.99	0.6849	2.855	0.667	11	5	clayey silt to silty clay
1.476	34.50	0.7590	2.200	1.801	13	6	sandy silt to clayey silt
1.640	35.48	1.1961	3.371	1.681	17	5	clayey silt to silty clay
1.804	44.13	1.6755	3.797	1.918	21	5	clayey silt to silty clay
1.969	47.57	1.8276	3.842	0.288	23	5	clayey silt to silty clay
2.133	55.39	1.7837	3.220	-1.703	21	6	sandy silt to clayey silt
2.297	45.47	1.7388	3.824	-1.761	22	5	clayey silt to silty clay
2.461	39.45	1.7744	4.498	-1.724	25	4	silty clay to clay
2.625	33.77	1.8277	5.412	-1.698	32	3	clay
2.789	30.71	1.8430	6.002	-1.720	29	3	clay
2.953	28.14	1.6520	5.870	-1.729	27	3	clay
3.117	23.38	1.4378	6.149	-1.792	22	3	clay
3.281	23.03	1.3724	5.960	-1.873	22	3	clay
3.445	21.88	1.1741	5.366	-1.851	21	3	clay
3.609	20.21	1.0289	5.090	-1.836	19	3	clay
3.773	19.46	0.9375	4.818	-1.323	19	3	clay
3.937	18.46	0.8824	4.780	-1.236	18	3	clay
4.101	17.64	0.8800	4.989	-0.955	17	3	clay
4.265	17.25	0.8105	4.699	-0.626	17	3	clay
4.429	14.80	0.8390	5.671	-0.490	14	3	clay
4.593	13.60	0.8397	6.175	-0.364	13	3	clay
4.757	13.94	0.8443	6.057	-0.279	13	3	clay
4.921	13.89	0.7816	5.627	-0.266	13	3	clay
5.085	13.44	0.7200	5.358	-0.177	13	3	clay
5.249	12.09	0.7600	6.284	0.026	12	3	clay
5.413	11.67	0.7678	6.580	0.031	11	3	clay
5.577	11.48	0.7733	6.735	0.013	11	3	clay
5.741	11.58	0.7373	6.368	0.004	11	3	clay
5.906	11.63	0.7134	6.134	0.009	11	3	clay
6.070	11.13	0.4717	4.239	0.076	11	3	clay
6.234	11.81	0.5677	4.805	0.194	11	3	clay
6.398	12.43	0.5515	4.438	0.872	12	3	clay
6.562	12.51	0.5750	4.597	0.961	12	3	clay
6.726	13.45	0.6198	4.610	0.966	13	3	clay
6.890	12.65	0.5976	4.723	1.005	12	3	clay
7.054	12.23	0.6088	4.979	0.970	12	3	clay
7.218	13.49	0.6537	4.845	1.059	13	3	clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
7.382	12.65	0.6405	5.064	1.112	12	3	clay
7.546	12.14	0.5453	4.491	1.127	12	3	clay
7.710	10.98	0.4526	4.121	1.315	11	3	clay
7.874	11.38	0.4218	3.705	1.450	11	3	clay
8.038	10.72	0.4003	3.734	1.567	10	3	clay
8.202	10.45	0.3294	3.152	1.711	7	4	silty clay to clay
8.366	10.08	0.2459	2.439	1.857	6	4	silty clay to clay
8.530	8.55	0.2233	2.611	2.030	5	4	silty clay to clay
8.694	7.56	0.1073	1.420	2.160	4	5	clayey silt to silty clay
8.858	6.85	0.1051	1.535	2.285	4	4	silty clay to clay
9.022	7.22	0.0896	1.240	2.649	3	1	sensitive fine grained
9.186	7.42	0.0676	0.911	2.729	4	1	sensitive fine grained
9.350	6.69	0.0609	0.910	2.821	3	1	sensitive fine grained
9.514	6.65	0.0511	0.768	2.965	3	1	sensitive fine grained
9.678	6.27	0.0535	0.853	3.128	3	1	sensitive fine grained
9.843	6.11	0.0316	0.518	3.283	3	1	sensitive fine grained
10.007	5.27	0.0292	0.554	3.453	3	1	sensitive fine grained
10.171	4.89	0.0226	0.461	3.815	2	1	sensitive fine grained
10.335	5.39	0.0177	0.328	3.968	3	1	sensitive fine grained
10.499	4.72	0.0119	0.252	4.127	2	1	sensitive fine grained
10.663	5.47	0.0228	0.418	4.271	3	1	sensitive fine grained
10.827	5.59	0.0197	0.352	4.497	3	1	sensitive fine grained
10.991	5.31	0.0092	0.173	4.735	3	1	sensitive fine grained
11.155	5.32	0.0133	0.250	4.996	3	1	sensitive fine grained
11.319	7.09	0.0100	0.141	5.201	3	1	sensitive fine grained
11.483	5.64	0.0098	0.173	5.485	3	1	sensitive fine grained
11.647	7.06	0.0457	0.647	5.803	3	1	sensitive fine grained
11.811	7.60	0.1174	1.544	5.969	4	5	clayey silt to silty clay
11.975	8.83	0.1882	2.131	6.108	6	4	silty clay to clay
12.139	8.55	0.1358	1.589	6.110	4	5	clayey silt to silty clay
12.303	8.81	0.0920	1.044	6.224	4	5	clayey silt to silty clay
12.467	10.07	0.0410	0.407	6.747	4	6	sandy silt to clayey silt
12.631	7.52	0.0194	0.259	6.926	4	1	sensitive fine grained
12.795	6.88	0.0670	0.975	7.414	3	1	sensitive fine grained
12.959	7.96	0.0362	0.455	7.979	4	1	sensitive fine grained
13.123	13.09	0.0225	0.172	7.839	5	6	sandy silt to clayey silt
13.287	7.53	0.0131	0.174	8.035	4	1	sensitive fine grained
13.451	7.47	0.0121	0.162	8.831	4	1	sensitive fine grained
13.615	7.37	0.0366	0.497	9.404	4	1	sensitive fine grained
13.780	7.14	0.0229	0.321	10.061	3	1	sensitive fine grained
13.944	8.10	0.0301	0.371	10.455	4	1	sensitive fine grained
14.108	7.80	0.0238	0.305	11.181	4	1	sensitive fine grained
14.272	8.03	0.0281	0.350	11.848	4	1	sensitive fine grained
14.436	7.47	0.0363	0.486	12.393	4	1	sensitive fine grained
14.600	6.93	0.0416	0.600	12.973	3	1	sensitive fine grained
14.764	7.75	0.0496	0.641	13.372	4	1	sensitive fine grained
14.928	7.69	0.0614	0.799	13.666	4	1	sensitive fine grained
15.092	9.07	0.0269	0.296	14.032	4	1	sensitive fine grained
15.256	9.83	0.0216	0.219	14.244	5	1	sensitive fine grained
15.420	8.74	0.0288	0.329	14.907	4	1	sensitive fine grained
15.584	7.86	0.0351	0.447	15.615	4	1	sensitive fine grained
15.748	9.60	0.0239	0.249	18.347	5	1	sensitive fine grained
15.912	8.92	0.0160	0.179	18.715	4	1	sensitive fine grained

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.076	8.27	0.0158	0.191	19.539	4	1	sensitive fine grained
16.240	8.55	0.0065	0.076	20.751	4	1	sensitive fine grained
16.404	9.38	0.0170	0.181	22.018	4	1	sensitive fine grained
16.568	9.16	0.0891	0.973	23.278	4	5	clayey silt to silty clay
16.732	8.95	0.0577	0.645	24.422	4	5	clayey silt to silty clay
16.896	10.97	0.1009	0.920	11.761	4	6	sandy silt to clayey silt
17.060	11.54	0.0436	0.378	13.274	4	6	sandy silt to clayey silt
17.224	16.09	0.0900	0.559	13.461	6	6	sandy silt to clayey silt
17.388	12.24	0.1520	1.242	14.198	6	5	clayey silt to silty clay
17.552	13.31	0.2392	1.796	15.694	6	5	clayey silt to silty clay
17.717	18.48	0.2057	1.113	16.816	7	6	sandy silt to clayey silt
17.881	26.58	0.0914	0.344	15.384	8	7	silty sand to sandy silt
18.045	26.35	0.1925	0.730	11.839	8	7	silty sand to sandy silt
18.209	17.94	0.1764	0.983	12.360	7	6	sandy silt to clayey silt
18.373	18.89	0.1930	1.021	13.030	7	6	sandy silt to clayey silt
18.537	17.08	0.1986	1.162	13.463	7	6	sandy silt to clayey silt
18.701	13.87	0.1941	1.399	14.144	7	5	clayey silt to silty clay
18.865	17.07	0.1107	0.649	15.022	7	6	sandy silt to clayey silt
19.029	19.11	0.1547	0.810	14.246	7	6	sandy silt to clayey silt
19.193	18.11	0.2050	1.132	14.146	7	6	sandy silt to clayey silt
19.357	19.79	0.1225	0.619	14.822	8	6	sandy silt to clayey silt
19.521	32.86	0.1156	0.352	8.966	10	7	silty sand to sandy silt
19.685	31.05	0.1377	0.444	5.707	10	7	silty sand to sandy silt
19.849	29.35	0.1305	0.445	5.820	9	7	silty sand to sandy silt
20.013	30.97	0.1758	0.568	5.818	10	7	silty sand to sandy silt
20.177	27.09	0.3159	1.166	5.999	10	6	sandy silt to clayey silt
20.341	18.29	0.1327	0.725	6.254	7	6	sandy silt to clayey silt
20.505	21.37	0.2290	1.071	6.812	8	6	sandy silt to clayey silt
20.669	15.80	0.2111	1.337	6.289	6	6	sandy silt to clayey silt
20.833	15.42	0.1620	1.050	7.628	6	6	sandy silt to clayey silt
20.997	18.03	0.2217	1.230	7.464	7	6	sandy silt to clayey silt
21.161	13.95	0.1714	1.229	8.271	5	6	sandy silt to clayey silt
21.325	24.24	0.1322	0.545	7.545	8	7	silty sand to sandy silt
21.490	28.51	0.1067	0.374	5.127	9	7	silty sand to sandy silt
21.654	26.54	0.1365	0.514	5.262	8	7	silty sand to sandy silt
21.818	23.39	0.1796	0.768	5.507	9	6	sandy silt to clayey silt
21.982	19.04	0.2078	1.091	5.851	7	6	sandy silt to clayey silt
22.146	14.10	0.2745	1.946	6.230	7	5	clayey silt to silty clay
22.310	13.45	0.1793	1.334	9.324	6	5	clayey silt to silty clay
22.474	19.11	0.1802	0.943	10.477	7	6	sandy silt to clayey silt
22.638	20.37	0.1283	0.630	8.088	8	6	sandy silt to clayey silt
22.802	19.76	0.1391	0.704	8.439	8	6	sandy silt to clayey silt
22.966	12.83	0.1251	0.975	9.622	5	6	sandy silt to clayey silt
23.130	10.11	0.1034	1.023	11.733	5	5	clayey silt to silty clay
23.294	10.51	0.0453	0.430	12.663	4	6	sandy silt to clayey silt
23.458	11.06	0.0480	0.434	13.640	4	6	sandy silt to clayey silt
23.622	8.98	0.0854	0.952	14.856	4	5	clayey silt to silty clay
23.786	20.33	0.1158	0.569	17.039	8	6	sandy silt to clayey silt
23.950	26.19	0.1663	0.635	12.923	8	7	silty sand to sandy silt
24.114	25.91	0.1645	0.635	11.837	8	7	silty sand to sandy silt
24.278	24.84	0.1540	0.620	10.577	8	7	silty sand to sandy silt
24.442	19.14	0.2102	1.098	10.047	7	6	sandy silt to clayey silt
24.606	17.90	0.3309	1.849	10.167	9	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
24.770	16.42	0.2115	1.288	11.427	6	6	sandy silt to clayey silt
24.934	23.82	0.2099	0.881	11.212	9	6	sandy silt to clayey silt
25.098	20.60	0.2189	1.063	9.073	8	6	sandy silt to clayey silt
25.262	15.63	0.2720	1.741	9.788	7	5	clayey silt to silty clay
25.427	11.03	0.1741	1.579	11.691	5	5	clayey silt to silty clay
25.591	40.03	0.2809	0.702	9.230	13	7	silty sand to sandy silt
25.755	28.31	0.3256	1.150	7.301	11	6	sandy silt to clayey silt
25.919	42.36	0.2856	0.674	7.678	14	7	silty sand to sandy silt
26.083	60.54	0.3386	0.559	5.709	14	8	sand to silty sand
26.247	47.19	0.3735	0.791	5.034	15	7	silty sand to sandy silt
26.411	30.35	0.3093	1.019	5.690	10	7	silty sand to sandy silt
26.575	28.78	0.3030	1.053	6.154	9	7	silty sand to sandy silt
26.739	25.39	0.2853	1.123	6.529	10	6	sandy silt to clayey silt
26.903	26.10	0.2805	1.075	7.211	10	6	sandy silt to clayey silt
27.067	25.30	0.2063	0.815	7.471	8	7	silty sand to sandy silt
27.231	26.21	0.3162	1.207	7.172	10	6	sandy silt to clayey silt
27.395	18.27	0.2186	1.197	7.717	7	6	sandy silt to clayey silt
27.559	18.49	0.2520	1.363	9.533	7	6	sandy silt to clayey silt
27.723	27.62	0.2299	0.832	9.897	9	7	silty sand to sandy silt
27.887	28.05	0.2299	0.819	10.329	9	7	silty sand to sandy silt
28.051	25.91	0.2784	1.075	11.094	10	6	sandy silt to clayey silt
28.215	26.64	0.2897	1.088	11.185	10	6	sandy silt to clayey silt
28.379	39.24	0.2161	0.551	10.342	13	7	silty sand to sandy silt
28.543	41.13	0.1884	0.458	5.827	13	7	silty sand to sandy silt
28.707	39.81	0.3205	0.805	6.152	13	7	silty sand to sandy silt
28.871	38.85	0.3387	0.872	7.421	12	7	silty sand to sandy silt
29.035	70.19	0.3008	0.429	4.844	17	8	sand to silty sand
29.199	69.74	0.3170	0.455	3.946	17	8	sand to silty sand
29.364	67.65	0.4180	0.618	4.055	16	8	sand to silty sand
29.528	65.07	0.4249	0.653	4.393	16	8	sand to silty sand
29.692	56.21	0.4944	0.880	5.042	18	7	silty sand to sandy silt
29.856	41.03	0.5591	1.363	5.557	13	7	silty sand to sandy silt
30.020	26.74	0.4759	1.780	6.139	10	6	sandy silt to clayey silt
30.184	22.72	0.4495	1.979	7.046	9	6	sandy silt to clayey silt
30.348	20.33	0.3097	1.524	8.443	8	6	sandy silt to clayey silt
30.512	37.30	0.2682	0.719	9.601	12	7	silty sand to sandy silt
30.676	42.68	0.4307	1.009	5.404	14	7	silty sand to sandy silt
30.840	27.77	0.4140	1.491	5.973	11	6	sandy silt to clayey silt
31.004	26.55	0.2723	1.026	7.373	10	6	sandy silt to clayey silt
31.168	33.95	0.3882	1.143	7.534	11	7	silty sand to sandy silt
31.332	25.86	0.3514	1.359	8.269	10	6	sandy silt to clayey silt
31.496	30.89	0.2583	0.836	8.816	10	7	silty sand to sandy silt
31.660	24.40	0.3169	1.299	7.547	9	6	sandy silt to clayey silt
31.824	23.36	0.2411	1.032	8.334	9	6	sandy silt to clayey silt
31.988	26.86	0.1974	0.735	8.650	9	7	silty sand to sandy silt
32.152	25.60	0.3237	1.264	9.376	10	6	sandy silt to clayey silt
32.316	23.09	0.3529	1.529	10.172	9	6	sandy silt to clayey silt
32.480	38.73	0.3022	0.780	10.994	12	7	silty sand to sandy silt
32.644	42.10	0.3636	0.864	10.856	13	7	silty sand to sandy silt
32.808	53.65	0.4529	0.844	4.602	17	7	silty sand to sandy silt
32.972	36.37	0.4962	1.364	5.406	12	7	silty sand to sandy silt
33.136	21.69	0.2703	1.246	6.481	8	6	sandy silt to clayey silt
33.301	13.65	0.1687	1.235	9.143	5	6	sandy silt to clayey silt

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33.465	13.01	0.1486	1.142	19.151	5	6	sandy silt to clayey silt
33.629	12.12	0.1445	1.192	30.533	6	5	clayey silt to silty clay
33.793	11.71	0.1398	1.194	35.008	6	5	clayey silt to silty clay
33.957	11.53	0.1717	1.490	39.220	6	5	clayey silt to silty clay
34.121	11.35	0.1752	1.544	42.653	5	5	clayey silt to silty clay
34.285	11.23	0.1684	1.499	45.415	5	5	clayey silt to silty clay
34.449	10.75	0.1598	1.487	47.392	5	5	clayey silt to silty clay
34.613	11.01	0.1554	1.411	48.757	5	5	clayey silt to silty clay
34.777	11.43	0.1635	1.431	49.851	5	5	clayey silt to silty clay
34.941	11.70	0.1643	1.405	50.571	6	5	clayey silt to silty clay
35.105	11.85	0.0758	0.640	51.456	5	6	sandy silt to clayey silt
35.269	12.14	0.0752	0.619	51.260	5	6	sandy silt to clayey silt
35.433	8.19	0.0713	0.871	58.741	4	5	clayey silt to silty clay
35.597	8.74	0.0741	0.848	59.400	4	5	clayey silt to silty clay
35.761	9.64	0.0743	0.771	58.865	5	5	clayey silt to silty clay
35.925	9.48	0.0752	0.793	57.298	5	5	clayey silt to silty clay
36.089	9.03	0.0904	1.002	57.433	4	5	clayey silt to silty clay
36.253	9.87	0.0974	0.987	57.200	5	5	clayey silt to silty clay
36.417	8.90	0.1086	1.221	59.836	4	5	clayey silt to silty clay
36.581	9.42	0.1022	1.084	60.762	5	5	clayey silt to silty clay
36.745	9.24	0.0957	1.036	62.497	4	5	clayey silt to silty clay
36.909	8.70	0.0914	1.050	61.852	4	5	clayey silt to silty clay
37.073	7.78	0.0835	1.074	60.716	4	5	clayey silt to silty clay
37.238	7.80	0.0733	0.940	61.593	4	1	sensitive fine grained
37.402	8.05	0.0730	0.907	61.769	4	1	sensitive fine grained
37.566	7.40	0.0764	1.033	60.121	4	1	sensitive fine grained
37.730	8.06	0.0892	1.107	63.060	4	5	clayey silt to silty clay
37.894	8.83	0.1162	1.316	59.175	4	5	clayey silt to silty clay
38.058	9.82	0.1203	1.225	61.669	5	5	clayey silt to silty clay
38.222	9.47	0.1334	1.409	62.765	5	5	clayey silt to silty clay
38.386	9.06	0.1481	1.635	60.494	4	5	clayey silt to silty clay
38.550	8.85	0.1544	1.745	56.989	4	5	clayey silt to silty clay
38.714	9.19	0.0965	1.049	55.449	4	5	clayey silt to silty clay
38.878	10.08	0.0807	0.801	54.449	4	6	sandy silt to clayey silt
39.042	9.13	0.0687	0.752	58.379	4	5	clayey silt to silty clay
39.206	14.81	0.0660	0.446	63.542	6	6	sandy silt to clayey silt
39.370	17.76	0.0902	0.508	29.412	7	6	sandy silt to clayey silt
39.534	11.78	0.0833	0.707	35.893	5	6	sandy silt to clayey silt
39.698	10.34	0.0523	0.505	42.788	4	6	sandy silt to clayey silt
39.862	10.92	0.0210	0.192	43.464	4	6	sandy silt to clayey silt
40.026	8.41	0.0117	0.140	47.209	4	1	sensitive fine grained
40.190	8.32	0.0193	0.232	53.047	4	1	sensitive fine grained
40.354	8.04	0.0387	0.481	53.389	4	1	sensitive fine grained
40.518	10.33	0.0577	0.559	47.327	4	6	sandy silt to clayey silt
40.682	10.31	0.0892	0.865	42.991	5	5	clayey silt to silty clay
40.846	16.39	0.0897	0.547	41.572	6	6	sandy silt to clayey silt
41.011	19.36	0.1510	0.780	30.434	7	6	sandy silt to clayey silt
41.175	14.96	0.1054	0.705	30.685	6	6	sandy silt to clayey silt
41.339	15.68	0.1157	0.738	30.203	6	6	sandy silt to clayey silt
41.503	13.79	0.1142	0.828	28.483	5	6	sandy silt to clayey silt
41.667	13.73	0.1046	0.762	28.285	5	6	sandy silt to clayey silt
41.831	13.74	0.0629	0.458	28.117	5	6	sandy silt to clayey silt
41.995	12.37	0.0513	0.415	22.395	5	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
42.159	9.03	0.0320	0.354	26.295	4	1	sensitive fine grained
42.323	9.39	0.0389	0.414	31.823	4	6	sandy silt to clayey silt
42.487	9.49	0.0439	0.463	37.181	4	6	sandy silt to clayey silt
42.651	9.18	0.0372	0.405	38.043	4	1	sensitive fine grained
42.815	8.64	0.0532	0.616	43.109	4	1	sensitive fine grained
42.979	9.71	0.0308	0.318	48.692	4	6	sandy silt to clayey silt
43.143	8.10	0.0465	0.573	54.963	4	1	sensitive fine grained
43.307	9.73	0.0512	0.526	60.069	4	6	sandy silt to clayey silt
43.471	10.07	0.0665	0.661	63.361	4	6	sandy silt to clayey silt
43.635	10.03	0.0755	0.753	62.478	4	6	sandy silt to clayey silt
43.799	10.10	0.0712	0.705	63.044	4	6	sandy silt to clayey silt
43.963	9.50	0.0569	0.598	63.611	4	6	sandy silt to clayey silt
44.127	9.51	0.0842	0.886	61.954	5	5	clayey silt to silty clay
44.291	13.03	0.0942	0.723	60.662	5	6	sandy silt to clayey silt
44.455	18.18	0.0906	0.498	33.264	7	6	sandy silt to clayey silt
44.619	10.32	0.0861	0.835	40.696	4	6	sandy silt to clayey silt
44.783	8.96	0.0709	0.792	51.534	4	5	clayey silt to silty clay
44.948	9.27	0.0660	0.713	53.971	4	5	clayey silt to silty clay
45.112	11.02	0.0573	0.520	50.137	4	6	sandy silt to clayey silt
45.276	10.43	0.0411	0.394	52.358	4	6	sandy silt to clayey silt
45.440	10.39	0.1149	1.106	56.032	5	5	clayey silt to silty clay
45.604	15.33	0.2064	1.347	66.245	6	6	sandy silt to clayey silt
45.768	70.34	0.3596	0.511	18.118	17	8	sand to silty sand
45.932	77.46	0.7152	0.923	17.132	19	8	sand to silty sand
46.096	62.98	0.8011	1.272	17.494	20	7	silty sand to sandy silt
46.260	40.29	0.5664	1.406	17.948	13	7	silty sand to sandy silt
46.424	104.91	0.6902	0.658	15.735	25	8	sand to silty sand
46.588	132.46	0.8511	0.643	11.811	25	9	sand
46.752	141.44	0.9026	0.638	13.352	27	9	sand
46.916	145.82	0.9552	0.655	14.303	28	9	sand
47.080	143.52	0.8788	0.612	16.433	27	9	sand
47.244	121.67	0.8073	0.664	16.561	23	9	sand
47.408	113.81	0.7660	0.673	16.696	27	8	sand to silty sand
47.572	112.58	0.7275	0.646	17.021	27	8	sand to silty sand
47.736	114.81	0.7141	0.622	17.132	27	8	sand to silty sand
47.900	116.17	0.7220	0.621	17.196	22	9	sand
48.064	115.98	0.7135	0.615	17.315	22	9	sand
48.228	116.97	0.5193	0.444	17.507	22	9	sand
48.392	116.77	0.5035	0.431	17.590	22	9	sand
48.556	110.21	0.5002	0.454	16.616	21	9	sand
48.720	110.74	0.5166	0.467	17.124	21	9	sand
48.885	101.14	0.4727	0.467	17.128	24	8	sand to silty sand
49.049	107.37	0.4986	0.464	17.339	21	9	sand
49.213	124.75	0.5565	0.446	17.682	24	9	sand
49.377	124.42	0.5972	0.480	17.690	24	9	sand
49.541	117.96	0.6419	0.544	17.874	23	9	sand
49.705	112.36	0.6467	0.576	17.758	22	9	sand
49.869	102.80	0.5821	0.566	17.730	25	8	sand to silty sand
50.033	112.01	0.5651	0.504	17.701	21	9	sand
50.197	113.51	0.5494	0.484	17.880	22	9	sand
50.361	103.85	0.5524	0.532	17.865	25	8	sand to silty sand
50.525	89.29	0.5223	0.585	17.850	21	8	sand to silty sand
50.689	80.76	0.4845	0.600	17.780	19	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
50.853	75.70	0.4454	0.588	17.749	18	8	sand to silty sand
51.017	75.88	0.4331	0.571	17.847	18	8	sand to silty sand
51.181	81.15	0.4364	0.538	18.024	19	8	sand to silty sand
51.345	83.47	0.4303	0.515	18.224	20	8	sand to silty sand
51.509	81.93	0.2920	0.356	18.307	20	8	sand to silty sand
51.673	79.18	0.3119	0.394	18.307	19	8	sand to silty sand
51.837	77.39	0.3425	0.443	17.974	19	8	sand to silty sand
52.001	82.30	0.3824	0.465	18.142	20	8	sand to silty sand
52.165	100.15	0.4969	0.496	18.379	24	8	sand to silty sand
52.329	112.21	0.6254	0.557	18.458	21	9	sand
52.493	134.61	0.8529	0.634	18.514	26	9	sand
52.657	178.82	1.1813	0.661	19.175	34	9	sand
52.822	191.79	1.4106	0.735	18.676	37	9	sand
52.986	183.44	1.4471	0.789	18.299	35	9	sand
53.150	166.34	1.4274	0.858	18.030	32	9	sand
53.314	152.19	1.3095	0.860	18.076	29	9	sand
53.478	148.67	1.2237	0.823	18.061	28	9	sand
53.642	142.67	1.2157	0.852	18.078	27	9	sand
53.806	130.63	1.1235	0.860	18.255	31	8	sand to silty sand
53.970	128.06	0.9988	0.780	18.222	31	8	sand to silty sand
54.134	107.82	0.9260	0.859	18.288	26	8	sand to silty sand
54.298	98.43	0.8682	0.882	18.294	24	8	sand to silty sand
54.462	90.68	0.8505	0.938	18.357	22	8	sand to silty sand
54.626	86.49	0.8326	0.963	18.425	21	8	sand to silty sand
54.790	86.60	0.5060	0.584	18.732	21	8	sand to silty sand
54.954	87.49	0.5048	0.577	18.726	21	8	sand to silty sand
55.118	85.54	0.5160	0.603	18.026	20	8	sand to silty sand
55.282	91.10	0.5905	0.648	18.615	22	8	sand to silty sand
55.446	95.37	0.5873	0.616	18.820	23	8	sand to silty sand
55.610	109.08	0.6486	0.595	18.924	26	8	sand to silty sand
55.774	106.34	0.6670	0.627	19.016	25	8	sand to silty sand
55.938	100.50	0.6456	0.642	19.062	24	8	sand to silty sand
56.102	98.78	0.6378	0.646	19.070	24	8	sand to silty sand
56.266	92.11	0.6302	0.684	19.149	22	8	sand to silty sand
56.430	89.85	0.6306	0.702	19.297	22	8	sand to silty sand
56.594	85.31	0.6253	0.733	19.253	20	8	sand to silty sand
56.759	82.59	0.6208	0.752	19.415	20	8	sand to silty sand
56.923	82.52	0.6196	0.751	19.456	20	8	sand to silty sand
57.087	81.76	0.6178	0.756	19.550	20	8	sand to silty sand
57.251	80.79	0.6170	0.764	19.546	19	8	sand to silty sand
57.415	81.07	0.6056	0.747	19.637	19	8	sand to silty sand
57.579	80.19	0.5995	0.748	19.702	19	8	sand to silty sand
57.743	77.62	0.5999	0.773	19.785	19	8	sand to silty sand
57.907	75.90	0.5962	0.785	19.803	18	8	sand to silty sand
58.071	76.35	0.3804	0.498	19.936	18	8	sand to silty sand
58.235	75.65	0.3988	0.527	19.964	18	8	sand to silty sand
58.399	70.63	0.4235	0.600	19.352	17	8	sand to silty sand
58.563	71.24	0.4686	0.658	20.256	17	8	sand to silty sand
58.727	73.15	0.4905	0.671	20.574	18	8	sand to silty sand
58.891	75.19	0.5028	0.669	20.540	18	8	sand to silty sand
59.055	76.46	0.5143	0.673	20.679	18	8	sand to silty sand
59.219	80.06	0.5357	0.669	20.701	19	8	sand to silty sand
59.383	82.78	0.5675	0.686	20.777	20	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
59.547	82.76	0.5761	0.696	20.856	20	8	sand to silty sand
59.711	84.30	0.5884	0.698	20.952	20	8	sand to silty sand
59.875	87.08	0.6077	0.698	20.963	21	8	sand to silty sand
60.039	86.41	0.6168	0.714	20.978	21	8	sand to silty sand
60.203	83.74	0.6179	0.738	21.130	20	8	sand to silty sand
60.367	82.27	0.6117	0.743	21.248	20	8	sand to silty sand
60.532	82.51	0.6083	0.737	21.305	20	8	sand to silty sand
60.696	83.82	0.6023	0.719	21.335	20	8	sand to silty sand
60.860	83.61	0.6004	0.718	21.429	20	8	sand to silty sand
61.024	81.64	0.5930	0.726	21.531	20	8	sand to silty sand
61.188	81.51	0.5905	0.724	21.534	20	8	sand to silty sand
61.352	79.44	0.6100	0.768	21.468	19	8	sand to silty sand
61.516	76.87	0.5989	0.779	21.610	18	8	sand to silty sand
61.680	72.05	0.5902	0.819	21.224	17	8	sand to silty sand
61.844	70.99	0.5784	0.815	21.549	17	8	sand to silty sand
62.008	71.21	0.5652	0.794	21.658	17	8	sand to silty sand
62.172	69.02	0.5644	0.818	21.749	17	8	sand to silty sand
62.336	66.21	0.5638	0.852	21.845	16	8	sand to silty sand
62.500	68.56	0.5675	0.828	22.009	16	8	sand to silty sand
62.664	69.36	0.7658	1.104	22.146	22	7	silty sand to sandy silt
62.828	49.60	0.6385	1.287	22.190	16	7	silty sand to sandy silt
62.992	65.35	0.6589	1.008	23.489	21	7	silty sand to sandy silt
63.156	49.39	0.6091	1.233	15.724	16	7	silty sand to sandy silt
63.320	80.02	0.5463	0.683	14.878	19	8	sand to silty sand
63.484	114.73	0.5428	0.473	9.598	22	9	sand
63.648	107.46	0.6404	0.596	8.275	26	8	sand to silty sand
63.812	90.63	0.6512	0.719	9.797	22	8	sand to silty sand
63.976	72.74	0.6540	0.899	11.600	17	8	sand to silty sand
64.140	69.01	0.7048	1.021	13.189	17	8	sand to silty sand
64.304	92.53	0.4630	0.500	11.789	22	8	sand to silty sand
64.469	103.09	0.4678	0.454	4.785	20	9	sand
64.633	96.65	0.3771	0.390	4.933	19	9	sand
64.797	86.44	0.4052	0.469	6.021	21	8	sand to silty sand
64.961	80.05	0.4195	0.524	12.615	19	8	sand to silty sand
65.125	77.71	0.4302	0.554	14.041	19	8	sand to silty sand
65.289	75.60	0.4341	0.574	15.268	18	8	sand to silty sand
65.453	86.75	0.4870	0.561	19.870	21	8	sand to silty sand
65.617	94.38	0.5074	0.538	20.622	23	8	sand to silty sand
65.781	99.81	0.5485	0.550	21.965	24	8	sand to silty sand
65.945	98.08	0.5528	0.564	22.397	23	8	sand to silty sand
66.109	88.87	0.5211	0.586	22.783	21	8	sand to silty sand
66.273	77.13	0.4581	0.594	22.970	18	8	sand to silty sand
66.437	76.42	0.4414	0.578	23.443	18	8	sand to silty sand
66.601	88.73	0.4464	0.503	22.794	21	8	sand to silty sand
66.765	93.15	0.4635	0.498	20.265	22	8	sand to silty sand
66.929	98.03	0.4902	0.500	21.922	23	8	sand to silty sand
67.093	98.31	0.5031	0.512	22.334	24	8	sand to silty sand
67.257	86.26	0.4864	0.564	23.184	21	8	sand to silty sand
67.421	77.26	0.4733	0.613	23.380	18	8	sand to silty sand
67.585	72.53	0.4394	0.606	23.757	17	8	sand to silty sand
67.749	69.82	0.4259	0.610	24.012	17	8	sand to silty sand
67.913	68.31	0.2329	0.341	24.304	16	8	sand to silty sand
68.077	66.99	0.2406	0.359	24.668	16	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
68.241	63.60	0.2476	0.389	25.067	15	8	sand to silty sand
68.406	62.75	0.2535	0.404	25.277	15	8	sand to silty sand
68.570	62.41	0.2597	0.416	25.383	15	8	sand to silty sand
68.734	63.28	0.2657	0.420	25.455	15	8	sand to silty sand
68.898	64.37	0.2744	0.426	25.601	15	8	sand to silty sand
69.062	65.29	0.2918	0.447	25.632	16	8	sand to silty sand
69.226	67.60	0.3174	0.469	25.673	16	8	sand to silty sand
69.390	74.39	0.3563	0.479	25.824	18	8	sand to silty sand
69.554	85.51	0.4050	0.474	25.881	20	8	sand to silty sand
69.718	100.04	0.4561	0.456	25.815	24	8	sand to silty sand
69.882	108.24	0.5313	0.491	25.902	21	9	sand
70.046	101.58	0.5324	0.524	25.804	24	8	sand to silty sand
70.210	94.16	0.4962	0.527	25.628	23	8	sand to silty sand
70.374	86.56	0.4712	0.544	25.817	21	8	sand to silty sand
70.538	80.63	0.4633	0.575	25.998	19	8	sand to silty sand
70.702	78.15	0.4648	0.595	26.175	19	8	sand to silty sand
70.866	82.28	0.4685	0.569	26.362	20	8	sand to silty sand
71.030	92.32	0.4759	0.515	26.515	22	8	sand to silty sand
71.194	102.86	0.3725	0.362	26.561	20	9	sand
71.358	113.73	0.4253	0.374	26.567	22	9	sand
71.522	117.02	0.5100	0.436	25.889	22	9	sand
71.686	121.31	0.6013	0.496	26.406	23	9	sand
71.850	117.70	0.6277	0.533	26.277	23	9	sand
72.014	123.77	0.6252	0.505	26.293	24	9	sand
72.178	127.40	0.6259	0.491	26.386	24	9	sand
72.343	127.11	0.6018	0.473	26.371	24	9	sand
72.507	105.92	0.5691	0.537	26.519	25	8	sand to silty sand
72.671	109.13	0.6123	0.561	26.768	26	8	sand to silty sand
72.835	132.92	0.6664	0.501	27.197	25	9	sand
72.999	148.10	0.7525	0.508	26.818	28	9	sand
73.163	144.13	0.7706	0.535	26.672	28	9	sand
73.327	119.28	0.7262	0.609	26.491	23	9	sand
73.491	111.92	0.6834	0.611	26.606	27	8	sand to silty sand
73.655	112.27	0.6433	0.573	26.820	22	9	sand
73.819	107.30	0.6183	0.576	27.289	26	8	sand to silty sand
73.983	98.27	0.5911	0.602	27.021	24	8	sand to silty sand
74.147	95.45	0.5807	0.608	27.103	23	8	sand to silty sand
74.311	97.06	0.5803	0.598	27.389	23	8	sand to silty sand
74.475	100.47	0.4238	0.422	27.524	19	9	sand
74.639	108.97	0.4361	0.400	27.642	21	9	sand
74.803	121.67	0.4586	0.377	27.326	23	9	sand
74.967	134.13	0.5429	0.405	27.502	26	9	sand
75.131	131.69	0.5535	0.420	27.319	25	9	sand
75.295	111.62	0.5288	0.474	27.614	21	9	sand
75.459	96.87	0.5289	0.546	27.221	23	8	sand to silty sand
75.623	92.20	0.5337	0.579	27.555	22	8	sand to silty sand
75.787	102.24	0.5608	0.548	27.858	24	8	sand to silty sand
75.951	128.49	0.6899	0.537	28.259	25	9	sand
76.115	147.59	0.7647	0.518	28.296	28	9	sand
76.280	166.44	0.8571	0.515	27.956	32	9	sand
76.444	156.06	0.8785	0.563	27.847	30	9	sand
76.608	132.18	0.7988	0.604	27.481	25	9	sand
76.772	114.39	0.7144	0.625	27.197	27	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
76.936	106.02	0.6822	0.643	27.583	25	8	sand to silty sand
77.100	104.06	0.6711	0.645	28.017	25	8	sand to silty sand
77.264	104.93	0.6750	0.643	28.239	25	8	sand to silty sand
77.428	106.07	0.6843	0.645	28.425	25	8	sand to silty sand
77.592	110.09	0.6975	0.634	28.564	26	8	sand to silty sand
77.756	116.67	0.4950	0.424	28.645	22	9	sand
77.920	129.70	0.5101	0.393	28.791	25	9	sand
78.084	148.71	0.6066	0.408	28.368	28	9	sand
78.248	163.87	0.7595	0.463	28.695	31	9	sand
78.412	169.26	0.8062	0.476	28.163	32	9	sand
78.576	130.87	0.7119	0.544	28.071	25	9	sand
78.740	112.65	0.6508	0.578	27.890	22	9	sand
78.904	104.98	0.6221	0.593	28.324	25	8	sand to silty sand
79.068	112.39	0.6294	0.560	28.826	22	9	sand
79.232	136.55	0.6430	0.471	29.255	26	9	sand
79.396	158.40	0.7139	0.451	29.194	30	9	sand
79.560	155.03	0.7649	0.493	29.004	30	9	sand
79.724	144.03	0.7388	0.513	28.680	28	9	sand
79.888	140.69	0.7144	0.508	28.773	27	9	sand
80.052	133.00	0.6424	0.483	28.819	25	9	sand
80.217	125.90	0.5503	0.437	28.950	24	9	sand
80.381	116.42	0.5159	0.443	29.116	22	9	sand
80.545	110.17	0.5137	0.466	29.360	21	9	sand
80.709	92.61	0.5134	0.554	29.316	22	8	sand to silty sand
80.873	93.72	0.5050	0.539	29.647	22	8	sand to silty sand
81.037	100.46	0.4303	0.428	30.223	19	9	sand
81.201	102.82	0.4350	0.423	29.543	20	9	sand
81.365	95.81	0.4270	0.446	28.516	23	8	sand to silty sand
81.529	88.53	0.4370	0.494	29.305	21	8	sand to silty sand
81.693	85.63	0.3768	0.440	29.547	21	8	sand to silty sand
81.857	107.50	0.3454	0.321	30.232	21	9	sand
82.021	97.58	0.3615	0.370	29.026	19	9	sand
82.185	91.39	0.3908	0.428	30.234	22	8	sand to silty sand
82.349	90.20	0.4082	0.452	30.352	22	8	sand to silty sand
82.513	102.18	0.4579	0.448	30.692	20	9	sand
82.677	120.58	0.4817	0.399	30.670	23	9	sand
82.841	137.38	0.4915	0.358	30.618	26	9	sand
83.005	127.88	0.4816	0.377	30.642	24	9	sand
83.169	124.14	0.4876	0.393	30.639	24	9	sand
83.333	120.11	0.5115	0.426	30.652	23	9	sand
83.497	117.60	0.5009	0.426	30.650	23	9	sand
83.661	109.07	0.4917	0.451	30.742	21	9	sand
83.825	107.46	0.4825	0.449	30.993	21	9	sand
83.990	107.40	0.4906	0.457	31.049	21	9	sand
84.154	105.24	0.4909	0.466	31.184	20	9	sand
84.318	103.62	0.4932	0.476	31.219	20	9	sand
84.482	104.08	0.4902	0.471	31.282	20	9	sand
84.646	106.49	0.4873	0.458	31.357	20	9	sand
84.810	107.91	0.4673	0.433	31.459	21	9	sand
84.974	111.42	0.5794	0.520	31.494	21	9	sand
85.138	147.06	0.6862	0.467	31.636	28	9	sand
85.302	149.47	0.7175	0.480	31.374	29	9	sand
85.466	149.91	0.7179	0.479	31.400	29	9	sand

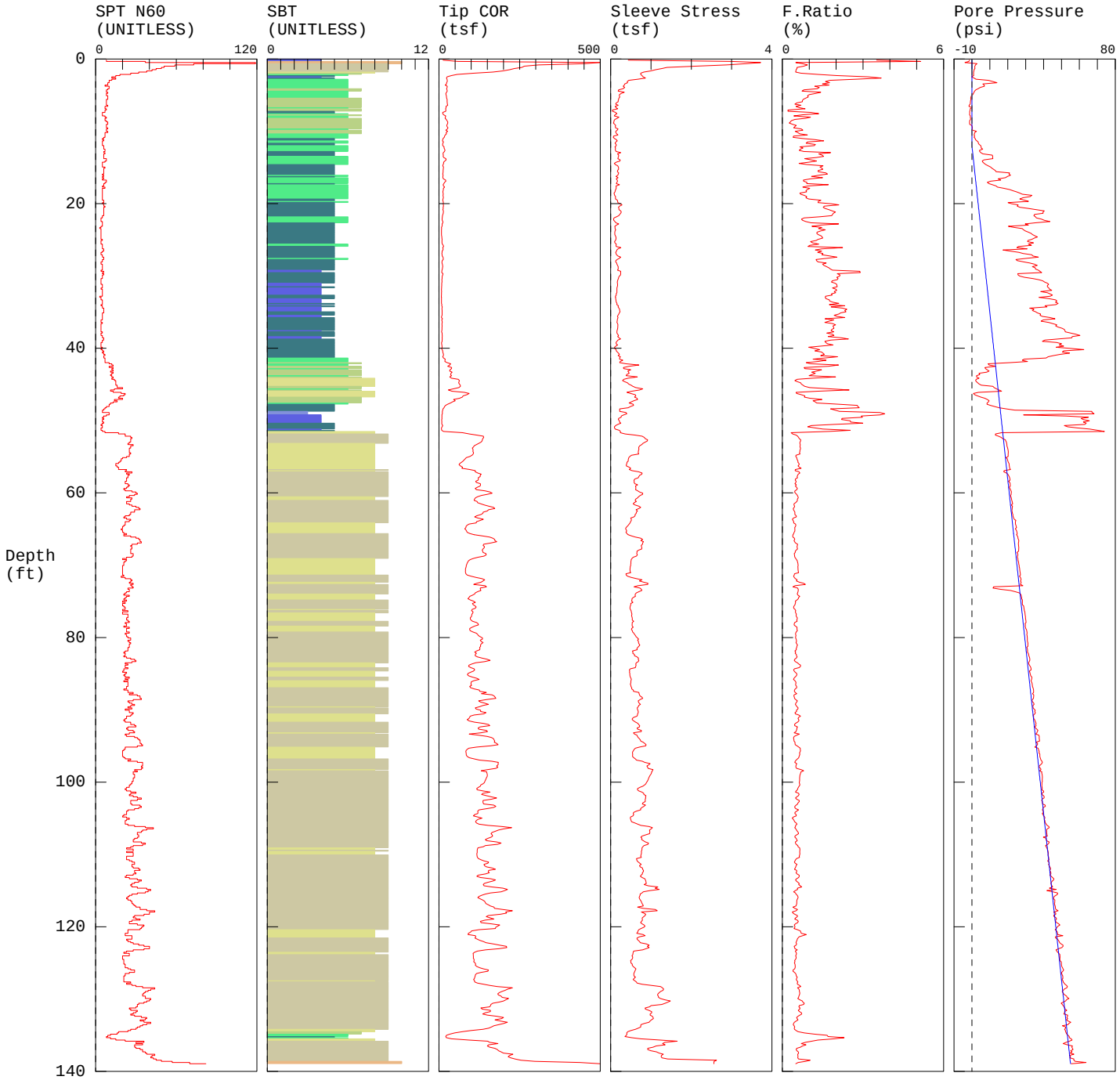
Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
85.630	155.87	0.7490	0.481	31.599	30	9	sand
85.794	171.27	0.7981	0.466	32.120	33	9	sand
85.958	176.70	0.8478	0.480	31.952	34	9	sand
86.122	178.48	0.8555	0.479	31.677	34	9	sand
86.286	179.43	0.8631	0.481	31.960	34	9	sand
86.450	177.76	0.8547	0.481	31.721	34	9	sand
86.614	176.98	0.8474	0.479	31.915	34	9	sand
86.778	170.70	0.8471	0.496	31.871	33	9	sand
86.942	161.23	0.8421	0.522	31.801	31	9	sand
87.106	160.13	0.8290	0.518	31.873	31	9	sand
87.270	163.24	0.7932	0.486	32.069	31	9	sand
87.434	160.75	0.7745	0.482	31.958	31	9	sand
87.598	146.65	0.6706	0.457	31.943	28	9	sand
87.762	143.47	0.5850	0.408	32.159	27	9	sand
87.927	144.20	0.5819	0.404	31.396	28	9	sand
88.091	162.85	0.6289	0.386	32.329	31	9	sand
88.255	177.24	0.6712	0.379	32.728	34	9	sand
88.419	182.85	0.7328	0.401	32.477	35	9	sand
88.583	180.97	0.7362	0.407	32.444	35	9	sand
88.747	178.49	0.7614	0.427	32.503	34	9	sand
88.911	176.08	0.7834	0.445	32.542	34	9	sand
89.075	173.53	0.8046	0.464	32.619	33	9	sand
89.239	169.27	0.7935	0.469	32.632	32	9	sand
89.403	171.74	0.7776	0.453	32.621	33	9	sand
89.567	161.14	0.7696	0.478	32.590	31	9	sand
89.731	158.28	0.7716	0.487	32.708	30	9	sand
89.895	151.87	0.7707	0.507	32.878	29	9	sand
90.059	149.80	0.7659	0.511	32.917	29	9	sand
90.223	146.48	0.7546	0.515	33.018	28	9	sand
90.387	150.61	0.7437	0.494	33.286	29	9	sand
90.551	156.96	0.7622	0.486	33.414	30	9	sand
90.715	171.49	0.7593	0.443	33.576	33	9	sand
90.879	173.15	0.8091	0.467	33.628	33	9	sand
91.043	170.92	0.7354	0.430	33.436	33	9	sand
91.207	172.60	0.7250	0.420	31.810	33	9	sand
91.371	179.85	0.7418	0.412	33.275	34	9	sand
91.535	170.88	0.7184	0.420	33.135	33	9	sand
91.699	167.56	0.7297	0.435	33.096	32	9	sand
91.864	155.95	0.7298	0.468	33.292	30	9	sand
92.028	151.62	0.6958	0.459	33.220	29	9	sand
92.192	152.77	0.7019	0.459	33.650	29	9	sand
92.356	143.07	0.7429	0.519	33.473	27	9	sand
92.520	143.45	0.7490	0.522	33.608	27	9	sand
92.684	149.19	0.7414	0.497	33.813	29	9	sand
92.848	161.05	0.7417	0.461	34.153	31	9	sand
93.012	156.88	0.7443	0.474	34.197	30	9	sand
93.176	148.29	0.7112	0.480	33.844	28	9	sand
93.340	129.74	0.6791	0.523	33.558	25	9	sand
93.504	120.65	0.6484	0.537	33.783	23	9	sand
93.668	115.51	0.6018	0.521	33.957	22	9	sand
93.832	112.28	0.5970	0.532	34.254	22	9	sand
93.996	111.39	0.5991	0.538	34.618	21	9	sand
94.160	116.95	0.4934	0.422	34.716	22	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
94.324	122.87	0.5115	0.416	34.964	24	9	sand
94.488	121.17	0.5130	0.423	34.417	23	9	sand
94.652	121.09	0.5002	0.413	34.666	23	9	sand
94.816	122.30	0.5098	0.417	34.797	23	9	sand
94.980	120.83	0.5185	0.429	34.901	23	9	sand
95.144	122.63	0.5656	0.461	35.139	23	9	sand
95.308	157.59	0.6644	0.422	35.701	30	9	sand
95.472	186.98	0.7698	0.412	35.832	36	9	sand
95.636	177.25	0.7992	0.451	35.243	34	9	sand
95.801	163.42	0.7678	0.470	34.962	31	9	sand
95.965	150.19	0.6925	0.461	34.953	29	9	sand
96.129	138.20	0.6441	0.466	35.167	26	9	sand
96.293	126.70	0.6232	0.492	35.398	24	9	sand
96.457	125.01	0.6318	0.505	35.793	24	9	sand
96.621	143.77	0.6723	0.468	36.268	28	9	sand
96.785	179.57	0.7414	0.413	36.612	34	9	sand
96.949	185.78	0.7822	0.421	36.501	36	9	sand
97.113	193.87	0.8265	0.426	36.255	37	9	sand
97.277	179.32	0.8380	0.467	35.915	34	9	sand
97.441	155.46	0.8847	0.569	35.522	30	9	sand
97.605	149.49	0.8134	0.544	35.505	29	9	sand
97.769	142.30	0.7708	0.542	35.590	27	9	sand
97.933	144.74	0.7537	0.521	36.209	28	9	sand
98.097	161.94	0.7597	0.469	36.425	31	9	sand
98.261	182.13	0.7934	0.436	36.830	35	9	sand
98.425	176.99	0.7962	0.450	36.532	34	9	sand
98.589	157.97	0.7844	0.497	36.043	30	9	sand
98.753	162.69	0.8511	0.523	36.386	31	9	sand
98.917	179.35	0.8941	0.499	37.070	34	9	sand
99.081	158.41	0.8503	0.537	36.778	30	9	sand
99.245	143.20	0.7980	0.557	35.976	27	9	sand
99.409	143.15	0.7780	0.543	36.619	27	9	sand
99.573	137.60	0.7608	0.553	36.817	26	9	sand
99.738	133.21	0.7582	0.569	36.887	26	9	sand
99.902	141.43	0.7424	0.525	37.236	27	9	sand
100.066	158.17	0.7617	0.482	37.689	30	9	sand
100.230	157.28	0.7645	0.486	37.672	30	9	sand
100.394	155.26	0.7189	0.463	37.452	30	9	sand
100.558	157.14	0.7197	0.458	37.914	30	9	sand
100.722	153.85	0.7202	0.468	37.559	29	9	sand
100.886	154.16	0.7202	0.467	37.602	30	9	sand

GRI / CPT-20 / PDX Runway Evaluation

TEST DATE: 4/26/2017 8:25:42 AM
HOLE NUMBER: CPT-20
CUSTOMER: 17058 GRI CPT-20 PDX Runway Evalu
OPERATOR: OGE TAJ

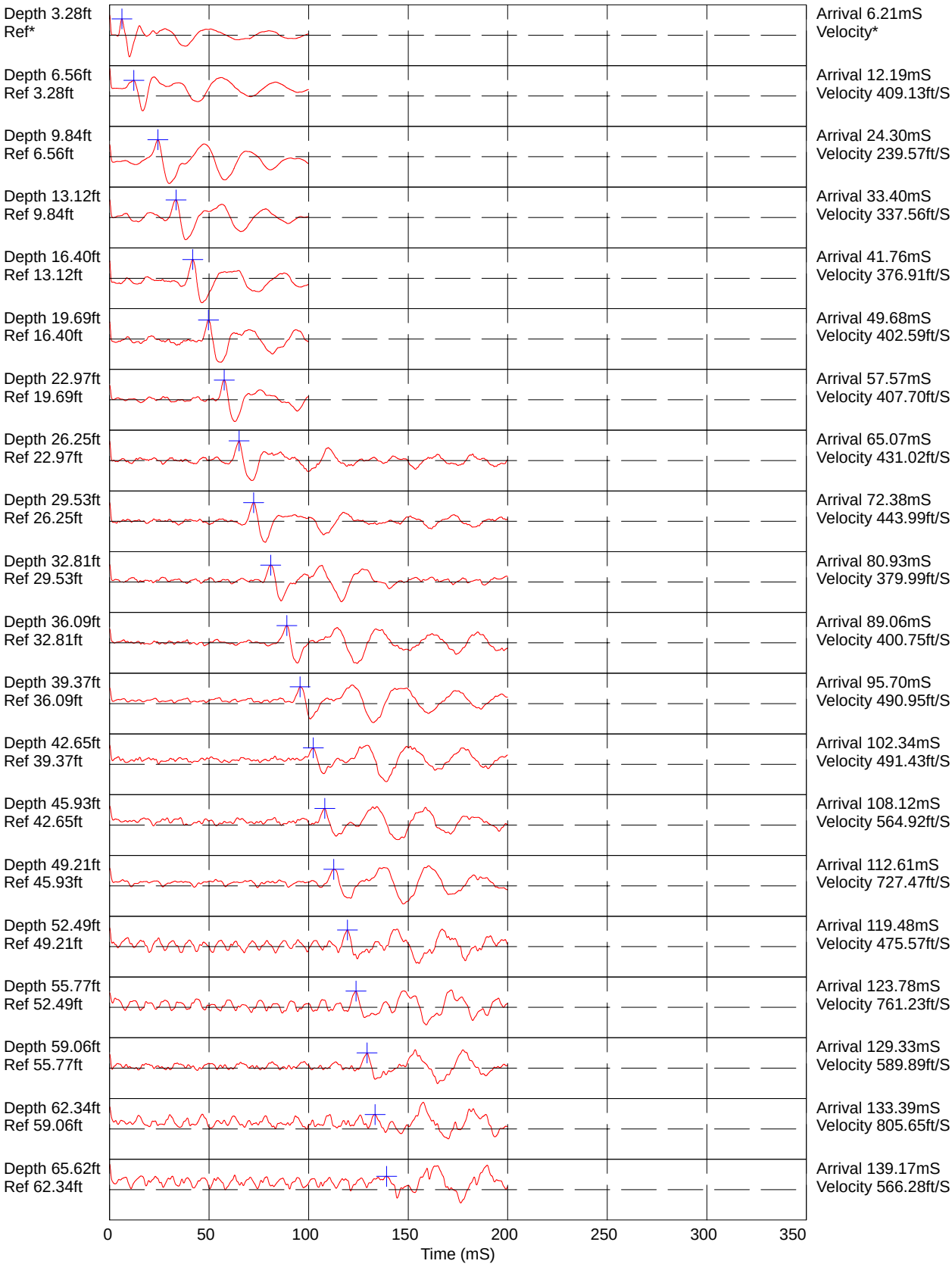
CONE ID: DPG1323
LOCATION: 17058/ GRI / CPT-20 / PDX Runway Evaluation
JOB NUMBER: 17058 / GRI / CPT-20 / PDX Runway Evaluation
TEST DATE: 4/26/2017 8:25:42 AM
TOTAL DEPTH: 138.944 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

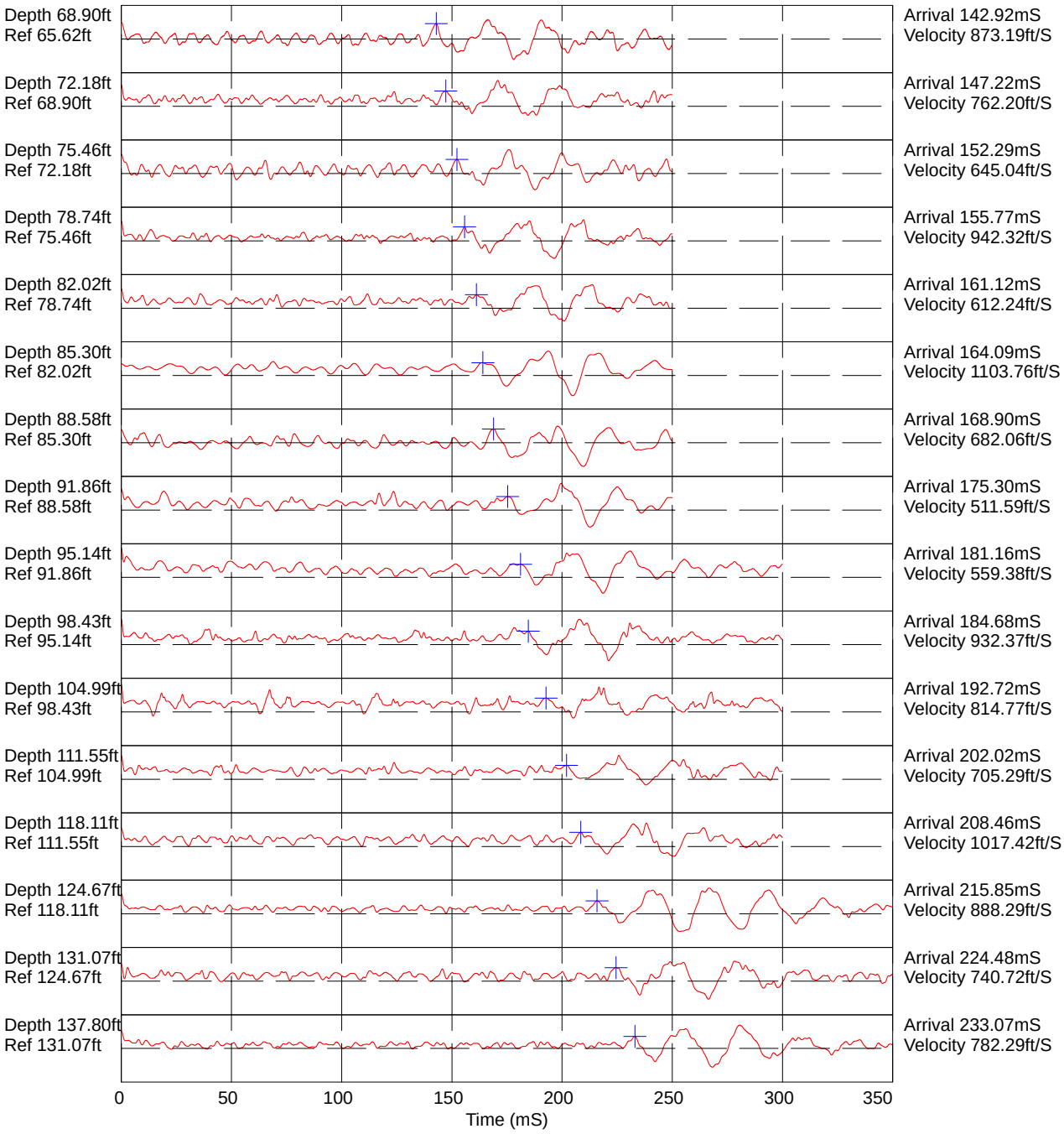
*SBT/SPT CORRELATION: UBC-1983

COMMENT: GRI / CPT-20 / PDX Runway Evaluation



Hammer to Rod String Distance (ft): 4.27
* = Not Determined

COMMENT: GRI / CPT-20 / PDX Runway Evaluation

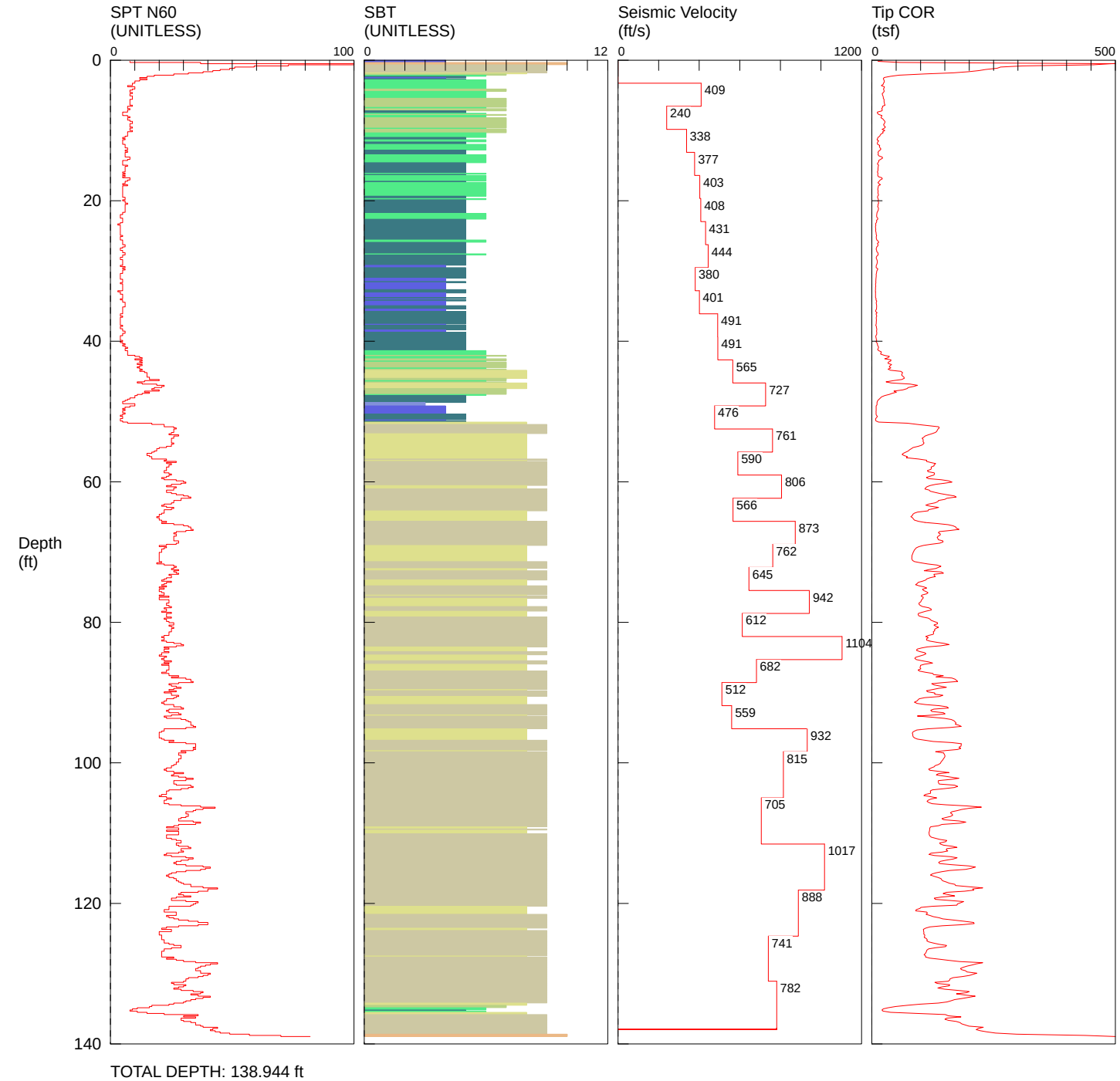


Hammer to Rod String Distance (ft): 4.27
* = Not Determined

GRI / CPT-20 / PDX Runway Evaluation

TEST DATE: 4/26/2017 8:25:42 AM
HOLE NUMBER: CPT-20
CUSTOMER: 17058 GRI CPT-20 PDX Runway Evaluatior
OPERATOR: OGE TAJ

CONE ID: DPG1323
LOCATION: 17058/ GRI / CPT-20 / PDX Runway Evaluation
JOB NUMBER: 17058 / GRI / CPT-20 / PDX Runway Evaluation
TEST DATE: 4/26/2017 8:25:42 AM
TOTAL DEPTH: 138.944 ft

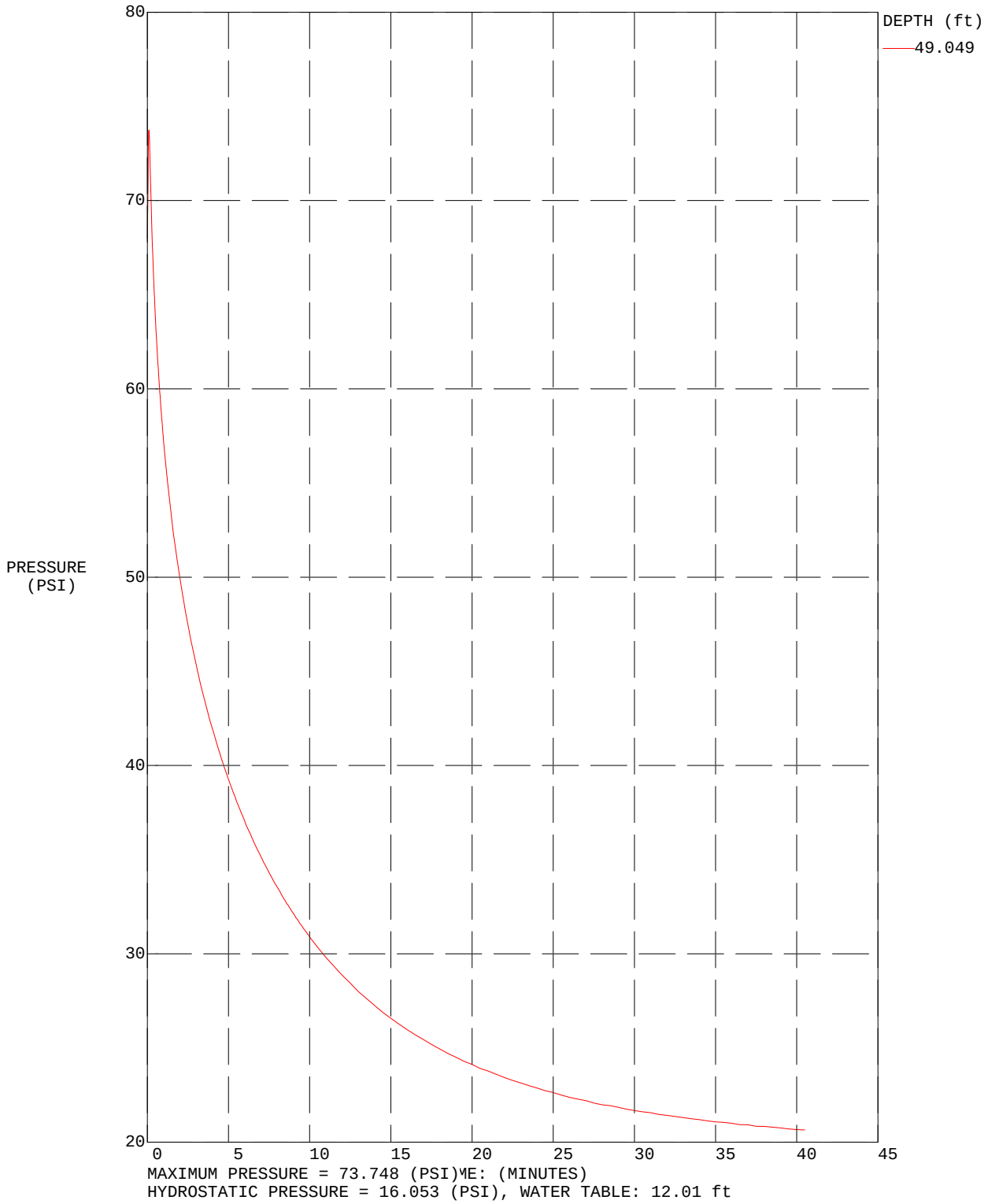


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: GRI / CPT-20 / PDX Runway Evaluation

TEST DATE: 4/26/2017 8:25:42 AM
OPERATOR: OGE TAJ



GRI / CPT-20 / PDX Runway Evaluation

OPERATOR: OGE TAJ
TEST DATE: 4/26/2017 8:25:42 AM
COMMENT: GRI / CPT-20 / PDX Runway Evaluation
FILENAME: 17058 CPT-20.cpt
TOTAL DEPTH: 138.944 ft

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
0.164	12.43	0.4355	3.505	-1.445	8	4	silty clay to clay
0.328	58.16	2.9910	5.143	-1.700	37	4	silty clay to clay
0.492	746.42	3.7213	0.499	-3.933	119	10	gravelly sand to sand
0.656	454.49	3.3698	0.741	2.740	73	10	gravelly sand to sand
0.820	308.85	2.8700	0.929	2.032	59	9	sand
0.984	264.42	2.1036	0.796	1.604	51	9	sand
1.148	256.91	1.3931	0.542	1.583	49	9	sand
1.312	233.58	1.2697	0.544	1.646	45	9	sand
1.476	219.66	1.1194	0.510	1.171	42	9	sand
1.640	198.11	0.9945	0.502	1.059	38	9	sand
1.804	167.23	0.8238	0.493	0.872	32	9	sand
1.969	108.29	0.7464	0.689	0.889	26	8	sand to silty sand
2.133	55.88	0.7445	1.332	0.913	18	7	silty sand to sandy silt
2.297	38.44	0.7749	2.016	0.944	15	6	sandy silt to clayey silt
2.461	25.23	0.8035	3.185	-0.179	12	5	clayey silt to silty clay
2.625	23.47	0.8628	3.676	1.206	15	4	silty clay to clay
2.789	24.49	0.6756	2.759	2.230	12	5	clayey silt to silty clay
2.953	25.52	0.4516	1.770	9.104	10	6	sandy silt to clayey silt
3.117	25.61	0.4101	1.601	11.724	10	6	sandy silt to clayey silt
3.281	23.75	0.4171	1.756	13.954	9	6	sandy silt to clayey silt
3.445	23.29	0.3477	1.493	6.030	9	6	sandy silt to clayey silt
3.609	19.40	0.3365	1.734	6.760	7	6	sandy silt to clayey silt
3.773	25.69	0.3093	1.204	6.961	10	6	sandy silt to clayey silt
3.937	25.36	0.3474	1.370	4.569	10	6	sandy silt to clayey silt
4.101	23.59	0.3062	1.298	3.401	9	6	sandy silt to clayey silt
4.265	24.66	0.1976	0.801	2.117	8	7	silty sand to sandy silt
4.429	25.43	0.1858	0.730	1.397	8	7	silty sand to sandy silt
4.593	23.61	0.3377	1.430	1.138	9	6	sandy silt to clayey silt
4.757	21.07	0.2633	1.250	0.844	8	6	sandy silt to clayey silt
4.921	21.66	0.2162	0.998	0.497	8	6	sandy silt to clayey silt
5.085	22.79	0.2135	0.937	-0.338	9	6	sandy silt to clayey silt
5.249	23.40	0.2256	0.964	-0.582	9	6	sandy silt to clayey silt
5.413	23.50	0.2046	0.871	-0.750	9	6	sandy silt to clayey silt
5.577	24.83	0.1935	0.779	-0.628	8	7	silty sand to sandy silt
5.741	24.98	0.1858	0.744	-0.796	8	7	silty sand to sandy silt
5.906	25.04	0.1853	0.740	-0.826	8	7	silty sand to sandy silt
6.070	25.48	0.1372	0.538	-0.983	8	7	silty sand to sandy silt
6.234	26.05	0.1213	0.466	-1.044	8	7	silty sand to sandy silt
6.398	27.07	0.1870	0.691	-1.526	9	7	silty sand to sandy silt
6.562	21.83	0.1107	0.507	-1.724	7	7	silty sand to sandy silt
6.726	21.89	0.1360	0.621	-0.013	7	7	silty sand to sandy silt
6.890	20.34	0.1725	0.848	-1.046	8	6	sandy silt to clayey silt
7.054	21.27	0.0440	0.207	-1.007	7	7	silty sand to sandy silt
7.218	20.67	0.0431	0.208	-1.328	7	7	silty sand to sandy silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
7.382	11.27	0.1197	1.063	-1.304	5	5	clayey silt to silty clay
7.546	11.28	0.1527	1.354	-1.297	5	5	clayey silt to silty clay
7.710	14.10	0.1064	0.754	-1.360	5	6	sandy silt to clayey silt
7.874	20.81	0.0892	0.429	-0.833	7	7	silty sand to sandy silt
8.038	19.70	0.2058	1.045	-0.903	8	6	sandy silt to clayey silt
8.202	18.70	0.1607	0.860	-0.772	7	6	sandy silt to clayey silt
8.366	22.35	0.1036	0.464	-0.807	7	7	silty sand to sandy silt
8.530	24.58	0.0822	0.335	-1.247	8	7	silty sand to sandy silt
8.694	26.88	0.0793	0.295	-1.376	9	7	silty sand to sandy silt
8.858	26.77	0.0676	0.253	-1.349	9	7	silty sand to sandy silt
9.022	25.67	0.0977	0.381	-1.291	8	7	silty sand to sandy silt
9.186	24.06	0.1248	0.519	-0.083	8	7	silty sand to sandy silt
9.350	25.07	0.1151	0.459	0.126	8	7	silty sand to sandy silt
9.514	27.77	0.1179	0.424	0.233	9	7	silty sand to sandy silt
9.678	25.75	0.1812	0.704	0.057	8	7	silty sand to sandy silt
9.843	21.02	0.1598	0.760	0.320	8	6	sandy silt to clayey silt
10.007	26.67	0.1277	0.479	2.479	9	7	silty sand to sandy silt
10.171	22.13	0.1264	0.571	1.526	7	7	silty sand to sandy silt
10.335	23.16	0.1515	0.654	1.380	7	7	silty sand to sandy silt
10.499	19.12	0.1775	0.928	1.151	7	6	sandy silt to clayey silt
10.663	17.14	0.0719	0.420	1.511	7	6	sandy silt to clayey silt
10.827	16.10	0.0647	0.402	1.216	6	6	sandy silt to clayey silt
10.991	12.61	0.0929	0.737	1.751	5	6	sandy silt to clayey silt
11.155	11.63	0.1396	1.200	1.975	6	5	clayey silt to silty clay
11.319	10.62	0.1629	1.534	2.699	5	5	clayey silt to silty clay
11.483	13.81	0.1284	0.930	3.479	5	6	sandy silt to clayey silt
11.647	12.07	0.1066	0.884	3.542	5	6	sandy silt to clayey silt
11.811	10.93	0.1344	1.229	4.059	5	5	clayey silt to silty clay
11.975	11.77	0.1400	1.190	4.885	6	5	clayey silt to silty clay
12.139	15.96	0.1033	0.647	5.123	6	6	sandy silt to clayey silt
12.303	15.49	0.1189	0.768	5.132	6	6	sandy silt to clayey silt
12.467	17.01	0.1145	0.673	5.967	7	6	sandy silt to clayey silt
12.631	18.61	0.1172	0.630	4.153	7	6	sandy silt to clayey silt
12.795	16.96	0.1348	0.795	4.336	6	6	sandy silt to clayey silt
12.959	13.67	0.2452	1.793	4.929	7	5	clayey silt to silty clay
13.123	12.42	0.1681	1.354	6.082	6	5	clayey silt to silty clay
13.287	13.28	0.1959	1.475	11.255	6	5	clayey silt to silty clay
13.451	12.64	0.1935	1.531	11.547	6	5	clayey silt to silty clay
13.615	14.68	0.1868	1.272	11.504	6	6	sandy silt to clayey silt
13.780	21.18	0.1754	0.828	11.608	8	6	sandy silt to clayey silt
13.944	21.99	0.2349	1.068	6.651	8	6	sandy silt to clayey silt
14.108	17.99	0.2285	1.270	5.742	7	6	sandy silt to clayey silt
14.272	14.14	0.1406	0.994	6.073	5	6	sandy silt to clayey silt
14.436	14.13	0.0870	0.616	6.830	5	6	sandy silt to clayey silt
14.600	12.51	0.1136	0.908	7.645	5	6	sandy silt to clayey silt
14.764	11.43	0.1732	1.516	8.975	5	5	clayey silt to silty clay
14.928	13.78	0.1928	1.399	10.420	7	5	clayey silt to silty clay
15.092	13.20	0.1936	1.466	11.098	6	5	clayey silt to silty clay
15.256	12.84	0.1932	1.505	12.055	6	5	clayey silt to silty clay
15.420	12.59	0.1677	1.333	13.017	6	5	clayey silt to silty clay
15.584	12.52	0.1668	1.332	13.455	6	5	clayey silt to silty clay
15.748	12.16	0.1973	1.622	20.930	6	5	clayey silt to silty clay
15.912	11.36	0.1901	1.673	20.603	5	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.076	12.77	0.1750	1.371	21.514	6	5	clayey silt to silty clay
16.240	12.13	0.1313	1.083	19.820	5	6	sandy silt to clayey silt
16.404	12.07	0.1804	1.495	18.652	6	5	clayey silt to silty clay
16.568	13.36	0.1403	1.050	14.632	5	6	sandy silt to clayey silt
16.732	20.44	0.1600	0.783	16.036	8	6	sandy silt to clayey silt
16.896	21.44	0.1703	0.794	10.422	8	6	sandy silt to clayey silt
17.060	17.15	0.1565	0.913	8.591	7	6	sandy silt to clayey silt
17.224	14.94	0.1361	0.910	9.433	6	6	sandy silt to clayey silt
17.388	12.74	0.2179	1.711	11.421	6	5	clayey silt to silty clay
17.552	13.96	0.1323	0.948	13.485	5	6	sandy silt to clayey silt
17.717	17.64	0.1338	0.758	14.196	7	6	sandy silt to clayey silt
17.881	13.31	0.1356	1.018	17.876	5	6	sandy silt to clayey silt
18.045	13.15	0.1214	0.923	21.048	5	6	sandy silt to clayey silt
18.209	12.69	0.1110	0.875	22.839	5	6	sandy silt to clayey silt
18.373	12.12	0.1092	0.901	24.869	5	6	sandy silt to clayey silt
18.537	12.61	0.0818	0.649	26.722	5	6	sandy silt to clayey silt
18.701	12.79	0.0870	0.680	28.137	5	6	sandy silt to clayey silt
18.865	12.23	0.0996	0.815	33.417	5	6	sandy silt to clayey silt
19.029	13.11	0.1185	0.904	32.431	5	6	sandy silt to clayey silt
19.193	13.42	0.1172	0.873	28.396	5	6	sandy silt to clayey silt
19.357	12.15	0.1187	0.977	26.641	5	6	sandy silt to clayey silt
19.521	11.63	0.1666	1.432	29.419	6	5	clayey silt to silty clay
19.685	12.73	0.1703	1.338	31.507	6	5	clayey silt to silty clay
19.849	13.46	0.1784	1.325	20.121	5	6	sandy silt to clayey silt
20.013	12.67	0.2300	1.816	22.177	6	5	clayey silt to silty clay
20.177	13.39	0.2813	2.101	25.780	6	5	clayey silt to silty clay
20.341	14.07	0.2203	1.566	25.227	7	5	clayey silt to silty clay
20.505	12.56	0.1907	1.518	26.746	6	5	clayey silt to silty clay
20.669	12.88	0.2037	1.582	31.280	6	5	clayey silt to silty clay
20.833	11.84	0.2046	1.728	35.780	6	5	clayey silt to silty clay
20.997	13.27	0.2457	1.852	40.279	6	5	clayey silt to silty clay
21.161	13.43	0.2650	1.972	39.684	6	5	clayey silt to silty clay
21.325	13.07	0.2480	1.898	39.734	6	5	clayey silt to silty clay
21.490	11.97	0.2236	1.869	34.925	6	5	clayey silt to silty clay
21.654	10.82	0.1984	1.833	34.509	5	5	clayey silt to silty clay
21.818	10.36	0.1443	1.393	35.398	5	5	clayey silt to silty clay
21.982	10.16	0.0818	0.805	35.919	4	6	sandy silt to clayey silt
22.146	9.81	0.0698	0.711	38.860	4	6	sandy silt to clayey silt
22.310	10.15	0.0760	0.749	40.351	4	6	sandy silt to clayey silt
22.474	12.04	0.1048	0.870	43.477	5	6	sandy silt to clayey silt
22.638	12.14	0.1290	1.063	35.427	5	6	sandy silt to clayey silt
22.802	9.44	0.1974	2.091	29.700	5	5	clayey silt to silty clay
22.966	10.18	0.1461	1.436	31.487	5	5	clayey silt to silty clay
23.130	9.10	0.1001	1.100	20.291	4	5	clayey silt to silty clay
23.294	7.30	0.1068	1.464	23.502	3	5	clayey silt to silty clay
23.458	8.17	0.1100	1.346	28.021	4	5	clayey silt to silty clay
23.622	7.61	0.1216	1.599	28.830	4	5	clayey silt to silty clay
23.786	7.67	0.1093	1.425	29.741	4	5	clayey silt to silty clay
23.950	7.91	0.1020	1.290	31.483	4	5	clayey silt to silty clay
24.114	7.93	0.1016	1.282	33.055	4	5	clayey silt to silty clay
24.278	7.53	0.1005	1.335	33.776	4	5	clayey silt to silty clay
24.442	8.14	0.1172	1.439	35.165	4	5	clayey silt to silty clay
24.606	8.77	0.1299	1.481	36.543	4	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
24.770	8.81	0.1322	1.502	34.842	4	5	clayey silt to silty clay
24.934	9.76	0.1299	1.332	33.406	5	5	clayey silt to silty clay
25.098	9.16	0.1155	1.261	31.265	4	5	clayey silt to silty clay
25.262	9.12	0.0953	1.045	31.008	4	5	clayey silt to silty clay
25.427	9.22	0.1034	1.121	34.313	4	5	clayey silt to silty clay
25.591	10.34	0.1399	1.353	31.431	5	5	clayey silt to silty clay
25.755	12.92	0.1317	1.019	33.218	5	6	sandy silt to clayey silt
25.919	14.20	0.1350	0.951	25.961	5	6	sandy silt to clayey silt
26.083	11.26	0.2524	2.242	25.070	5	5	clayey silt to silty clay
26.247	12.47	0.1822	1.461	30.737	6	5	clayey silt to silty clay
26.411	12.20	0.1492	1.223	17.346	6	5	clayey silt to silty clay
26.575	9.85	0.1438	1.461	21.429	5	5	clayey silt to silty clay
26.739	9.28	0.1219	1.313	26.216	4	5	clayey silt to silty clay
26.903	8.70	0.1311	1.507	28.555	4	5	clayey silt to silty clay
27.067	9.79	0.1444	1.475	33.329	5	5	clayey silt to silty clay
27.231	10.17	0.1793	1.763	34.051	5	5	clayey silt to silty clay
27.395	12.18	0.2464	2.024	37.018	6	5	clayey silt to silty clay
27.559	12.92	0.2169	1.680	30.879	6	5	clayey silt to silty clay
27.723	12.90	0.1617	1.253	24.492	5	6	sandy silt to clayey silt
27.887	9.97	0.1266	1.271	25.270	5	5	clayey silt to silty clay
28.051	9.10	0.1209	1.329	28.856	4	5	clayey silt to silty clay
28.215	9.11	0.1484	1.629	32.311	4	5	clayey silt to silty clay
28.379	10.28	0.1537	1.496	34.812	5	5	clayey silt to silty clay
28.543	10.95	0.1692	1.546	36.410	5	5	clayey silt to silty clay
28.707	11.28	0.1854	1.644	33.717	5	5	clayey silt to silty clay
28.871	10.81	0.1868	1.728	35.294	5	5	clayey silt to silty clay
29.035	10.28	0.1837	1.788	35.479	5	5	clayey silt to silty clay
29.199	9.17	0.1706	1.860	37.059	4	5	clayey silt to silty clay
29.364	8.63	0.2485	2.879	37.853	6	4	silty clay to clay
29.528	8.58	0.2487	2.899	38.965	5	4	silty clay to clay
29.692	12.17	0.2482	2.040	25.536	6	5	clayey silt to silty clay
29.856	11.39	0.2438	2.140	25.728	5	5	clayey silt to silty clay
30.020	10.14	0.2165	2.135	26.615	5	5	clayey silt to silty clay
30.184	9.77	0.1981	2.027	29.283	5	5	clayey silt to silty clay
30.348	9.28	0.1921	2.071	34.016	4	5	clayey silt to silty clay
30.512	8.81	0.1797	2.040	37.290	4	5	clayey silt to silty clay
30.676	9.06	0.1679	1.853	39.486	4	5	clayey silt to silty clay
30.840	8.95	0.1633	1.825	40.549	4	5	clayey silt to silty clay
31.004	8.45	0.1654	1.958	42.065	4	5	clayey silt to silty clay
31.168	8.30	0.1678	2.021	42.758	5	4	silty clay to clay
31.332	8.27	0.1681	2.033	42.139	5	4	silty clay to clay
31.496	7.94	0.1619	2.040	42.112	5	4	silty clay to clay
31.660	8.17	0.1525	1.867	42.849	4	5	clayey silt to silty clay
31.824	7.73	0.1542	1.995	43.316	5	4	silty clay to clay
31.988	7.57	0.1530	2.021	44.558	5	4	silty clay to clay
32.152	7.94	0.1530	1.928	38.402	5	4	silty clay to clay
32.316	7.65	0.1519	1.984	42.102	5	4	silty clay to clay
32.480	7.44	0.1358	1.825	43.584	5	4	silty clay to clay
32.644	7.56	0.1398	1.849	44.929	5	4	silty clay to clay
32.808	7.21	0.1160	1.608	43.641	3	5	clayey silt to silty clay
32.972	7.53	0.1202	1.595	37.469	4	5	clayey silt to silty clay
33.136	7.54	0.1218	1.617	42.897	4	5	clayey silt to silty clay
33.301	7.37	0.1287	1.746	46.590	5	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
33.465	7.52	0.1322	1.758	47.429	5	4	silty clay to clay
33.629	7.52	0.1410	1.876	46.577	5	4	silty clay to clay
33.793	7.49	0.1575	2.103	48.120	5	4	silty clay to clay
33.957	8.66	0.1510	1.744	46.852	4	5	clayey silt to silty clay
34.121	8.28	0.1919	2.319	40.783	5	4	silty clay to clay
34.285	10.03	0.1815	1.810	41.868	5	5	clayey silt to silty clay
34.449	9.18	0.2057	2.240	32.196	6	4	silty clay to clay
34.613	9.16	0.2198	2.401	34.596	6	4	silty clay to clay
34.777	9.59	0.2226	2.321	33.728	6	4	silty clay to clay
34.941	9.76	0.2309	2.365	35.525	6	4	silty clay to clay
35.105	9.78	0.2121	2.170	36.503	5	5	clayey silt to silty clay
35.269	9.61	0.2020	2.103	38.306	5	5	clayey silt to silty clay
35.433	9.45	0.1818	1.924	37.957	5	5	clayey silt to silty clay
35.597	8.09	0.1648	2.038	39.303	5	4	silty clay to clay
35.761	7.87	0.1826	2.320	43.505	5	4	silty clay to clay
35.925	10.72	0.1702	1.588	46.379	5	5	clayey silt to silty clay
36.089	8.56	0.1636	1.911	39.806	4	5	clayey silt to silty clay
36.253	9.30	0.1615	1.736	38.550	4	5	clayey silt to silty clay
36.417	9.90	0.1563	1.578	42.823	5	5	clayey silt to silty clay
36.581	8.99	0.1673	1.861	44.973	4	5	clayey silt to silty clay
36.745	9.08	0.1799	1.981	47.283	4	5	clayey silt to silty clay
36.909	9.34	0.1755	1.880	46.699	4	5	clayey silt to silty clay
37.073	9.22	0.1751	1.900	48.009	4	5	clayey silt to silty clay
37.238	9.10	0.1747	1.920	50.320	4	5	clayey silt to silty clay
37.402	9.06	0.1668	1.841	51.502	4	5	clayey silt to silty clay
37.566	8.70	0.1575	1.810	51.829	4	5	clayey silt to silty clay
37.730	8.03	0.1536	1.913	52.075	5	4	silty clay to clay
37.894	9.34	0.1545	1.654	55.107	4	5	clayey silt to silty clay
38.058	9.34	0.1740	1.863	57.915	4	5	clayey silt to silty clay
38.222	10.19	0.1955	1.918	60.239	5	5	clayey silt to silty clay
38.386	10.18	0.1735	1.705	55.931	5	5	clayey silt to silty clay
38.550	9.41	0.2069	2.198	55.724	6	4	silty clay to clay
38.714	9.93	0.2440	2.457	48.214	6	4	silty clay to clay
38.878	9.84	0.1776	1.805	40.735	5	5	clayey silt to silty clay
39.042	9.63	0.1523	1.582	39.318	5	5	clayey silt to silty clay
39.206	8.15	0.1316	1.614	47.203	4	5	clayey silt to silty clay
39.370	7.99	0.1337	1.674	49.952	4	5	clayey silt to silty clay
39.534	8.88	0.1677	1.889	48.652	4	5	clayey silt to silty clay
39.698	9.09	0.1303	1.432	51.194	4	5	clayey silt to silty clay
39.862	9.84	0.0965	0.981	47.017	5	5	clayey silt to silty clay
40.026	8.16	0.0975	1.195	55.471	4	5	clayey silt to silty clay
40.190	9.78	0.1354	1.385	62.460	5	5	clayey silt to silty clay
40.354	11.59	0.1401	1.209	51.140	6	5	clayey silt to silty clay
40.518	11.30	0.1643	1.454	50.418	5	5	clayey silt to silty clay
40.682	12.68	0.1913	1.509	54.482	6	5	clayey silt to silty clay
40.846	13.83	0.2155	1.558	49.239	7	5	clayey silt to silty clay
41.011	13.15	0.1874	1.425	45.396	6	5	clayey silt to silty clay
41.175	11.74	0.2407	2.051	42.496	6	5	clayey silt to silty clay
41.339	13.92	0.2196	1.577	41.339	7	5	clayey silt to silty clay
41.503	19.41	0.2210	1.139	29.183	7	6	sandy silt to clayey silt
41.667	18.51	0.3005	1.624	28.100	7	6	sandy silt to clayey silt
41.831	18.00	0.2370	1.317	31.049	7	6	sandy silt to clayey silt
41.995	25.09	0.2237	0.891	21.078	10	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
42.159	36.03	0.3784	1.050	8.988	12	7	silty sand to sandy silt
42.323	33.31	0.6957	2.089	9.529	13	6	sandy silt to clayey silt
42.487	26.72	0.4594	1.719	13.180	10	6	sandy silt to clayey silt
42.651	39.25	0.3166	0.807	7.227	13	7	silty sand to sandy silt
42.815	38.64	0.3220	0.834	7.536	12	7	silty sand to sandy silt
42.979	33.86	0.4939	1.459	8.445	13	6	sandy silt to clayey silt
43.143	33.14	0.4246	1.281	9.592	11	7	silty sand to sandy silt
43.307	40.48	0.4420	1.092	8.232	13	7	silty sand to sandy silt
43.471	37.38	0.4579	1.225	3.889	12	7	silty sand to sandy silt
43.635	35.82	0.3959	1.105	4.425	11	7	silty sand to sandy silt
43.799	38.78	0.3841	0.990	2.566	12	7	silty sand to sandy silt
43.963	33.44	0.6617	1.979	2.546	13	6	sandy silt to clayey silt
44.127	38.29	0.4330	1.131	3.928	12	7	silty sand to sandy silt
44.291	59.60	0.3269	0.548	2.343	14	8	sand to silty sand
44.455	63.01	0.2943	0.467	2.027	15	8	sand to silty sand
44.619	62.23	0.3459	0.556	2.452	15	8	sand to silty sand
44.783	60.99	0.4146	0.680	3.200	15	8	sand to silty sand
44.948	63.00	0.4449	0.706	4.063	15	8	sand to silty sand
45.112	66.00	0.5050	0.765	5.193	16	8	sand to silty sand
45.276	66.49	0.5498	0.827	11.637	16	8	sand to silty sand
45.440	61.45	0.6223	1.013	12.406	20	7	silty sand to sandy silt
45.604	44.69	0.7962	1.782	13.596	14	7	silty sand to sandy silt
45.768	28.86	0.7167	2.484	14.987	11	6	sandy silt to clayey silt
45.932	39.73	0.5233	1.317	16.515	13	7	silty sand to sandy silt
46.096	78.34	0.4032	0.515	3.597	19	8	sand to silty sand
46.260	93.43	0.4944	0.529	0.802	22	8	sand to silty sand
46.424	86.24	0.6085	0.706	1.524	21	8	sand to silty sand
46.588	74.73	0.6243	0.835	3.063	18	8	sand to silty sand
46.752	72.25	0.5936	0.822	4.916	17	8	sand to silty sand
46.916	63.77	0.6501	1.019	7.072	20	7	silty sand to sandy silt
47.080	45.19	0.6656	1.473	8.611	14	7	silty sand to sandy silt
47.244	50.37	0.5733	1.138	9.611	16	7	silty sand to sandy silt
47.408	41.76	0.5091	1.219	9.241	13	7	silty sand to sandy silt
47.572	35.75	0.4556	1.275	8.426	11	7	silty sand to sandy silt
47.736	26.45	0.5563	2.103	8.369	10	6	sandy silt to clayey silt
47.900	20.39	0.5679	2.785	10.250	10	5	clayey silt to silty clay
48.064	17.56	0.4934	2.810	12.539	8	5	clayey silt to silty clay
48.228	15.07	0.4314	2.862	15.179	7	5	clayey silt to silty clay
48.392	12.44	0.2229	1.792	19.129	6	5	clayey silt to silty clay
48.556	11.42	0.2241	1.962	23.932	5	5	clayey silt to silty clay
48.720	10.50	0.2232	2.125	66.914	5	5	clayey silt to silty clay
48.885	10.46	0.3794	3.625	67.053	10	3	clay
49.049	10.50	0.4000	3.808	68.141	10	3	clay
49.213	8.82	0.3204	3.635	28.845	8	3	clay
49.377	8.94	0.2622	2.934	52.596	6	4	silty clay to clay
49.541	8.59	0.2555	2.976	64.965	5	4	silty clay to clay
49.705	8.91	0.1976	2.217	60.950	6	4	silty clay to clay
49.869	8.56	0.1885	2.202	62.133	5	4	silty clay to clay
50.033	8.54	0.2160	2.527	65.469	5	4	silty clay to clay
50.197	8.66	0.2197	2.537	62.181	6	4	silty clay to clay
50.361	8.39	0.2510	2.991	63.786	5	4	silty clay to clay
50.525	9.20	0.1761	1.915	62.949	4	5	clayey silt to silty clay
50.689	11.22	0.1213	1.080	51.473	5	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
50.853	9.78	0.0924	0.945	53.424	5	5	clayey silt to silty clay
51.017	7.82	0.0952	1.217	58.763	4	5	clayey silt to silty clay
51.181	7.49	0.1125	1.503	65.643	4	5	clayey silt to silty clay
51.345	8.45	0.2134	2.526	70.097	5	4	silty clay to clay
51.509	13.92	0.2413	1.734	73.892	7	5	clayey silt to silty clay
51.673	72.90	0.2384	0.327	16.507	17	8	sand to silty sand
51.837	93.79	0.3556	0.379	13.141	22	8	sand to silty sand
52.001	116.38	0.5975	0.513	13.099	22	9	sand
52.165	137.22	0.7806	0.569	14.787	26	9	sand
52.329	138.51	0.8337	0.602	16.332	27	9	sand
52.493	135.80	0.8515	0.627	17.108	26	9	sand
52.657	134.33	0.9163	0.682	18.660	26	9	sand
52.822	133.43	0.9091	0.681	18.870	26	9	sand
52.986	130.46	0.8565	0.657	19.179	25	9	sand
53.150	123.39	0.7998	0.648	19.306	24	9	sand
53.314	115.97	0.7689	0.663	19.498	28	8	sand to silty sand
53.478	109.33	0.7238	0.662	19.511	26	8	sand to silty sand
53.642	106.78	0.7002	0.656	19.722	26	8	sand to silty sand
53.806	103.15	0.6936	0.672	19.883	25	8	sand to silty sand
53.970	105.13	0.7020	0.668	20.001	25	8	sand to silty sand
54.134	105.54	0.6902	0.654	20.176	25	8	sand to silty sand
54.298	105.17	0.6868	0.653	20.232	25	8	sand to silty sand
54.462	107.11	0.6839	0.639	20.250	26	8	sand to silty sand
54.626	105.77	0.6935	0.656	20.195	25	8	sand to silty sand
54.790	102.34	0.5152	0.503	20.184	25	8	sand to silty sand
54.954	95.51	0.4746	0.497	20.167	23	8	sand to silty sand
55.118	84.63	0.4507	0.533	18.977	20	8	sand to silty sand
55.282	81.26	0.4404	0.542	19.652	19	8	sand to silty sand
55.446	77.54	0.4334	0.559	19.855	19	8	sand to silty sand
55.610	74.53	0.4346	0.583	20.049	18	8	sand to silty sand
55.774	70.03	0.4036	0.576	20.247	17	8	sand to silty sand
55.938	64.41	0.3985	0.619	20.651	15	8	sand to silty sand
56.102	62.20	0.3870	0.622	20.753	15	8	sand to silty sand
56.266	66.24	0.3864	0.583	20.860	16	8	sand to silty sand
56.430	72.88	0.4559	0.626	20.947	17	8	sand to silty sand
56.594	70.99	0.4941	0.696	21.004	17	8	sand to silty sand
56.759	95.53	0.4598	0.481	21.553	23	8	sand to silty sand
56.923	112.67	0.5323	0.472	17.948	22	9	sand
57.087	111.96	0.6910	0.617	17.738	27	8	sand to silty sand
57.251	120.23	0.7804	0.649	19.229	23	9	sand
57.415	130.99	0.7725	0.590	19.968	25	9	sand
57.579	127.58	0.7215	0.565	20.396	24	9	sand
57.743	127.64	0.7000	0.548	20.777	24	9	sand
57.907	121.55	0.6846	0.563	20.989	23	9	sand
58.071	122.18	0.6003	0.491	21.194	23	9	sand
58.235	121.09	0.5782	0.477	21.246	23	9	sand
58.399	113.80	0.5829	0.512	20.420	22	9	sand
58.563	115.67	0.5796	0.501	21.048	22	9	sand
58.727	127.86	0.5982	0.468	21.305	24	9	sand
58.891	128.79	0.6694	0.520	21.296	25	9	sand
59.055	127.28	0.6144	0.483	21.359	24	9	sand
59.219	119.26	0.6243	0.524	20.843	23	9	sand
59.383	111.99	0.6242	0.557	21.213	21	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
59.547	115.94	0.6177	0.533	21.521	22	9	sand
59.711	142.47	0.6705	0.471	21.845	27	9	sand
59.875	157.71	0.7149	0.453	21.996	30	9	sand
60.039	164.40	0.7960	0.484	21.909	31	9	sand
60.203	149.67	0.7935	0.530	21.889	29	9	sand
60.367	131.18	0.7341	0.560	21.549	25	9	sand
60.532	119.38	0.6915	0.579	21.691	23	9	sand
60.696	112.97	0.6669	0.590	21.917	27	8	sand to silty sand
60.860	110.13	0.6182	0.561	22.061	26	8	sand to silty sand
61.024	108.90	0.6059	0.556	22.225	26	8	sand to silty sand
61.188	117.98	0.6358	0.539	22.421	23	9	sand
61.352	119.86	0.5806	0.484	22.591	23	9	sand
61.516	130.10	0.5605	0.431	22.680	25	9	sand
61.680	140.42	0.6039	0.430	21.950	27	9	sand
61.844	154.95	0.7027	0.454	22.628	30	9	sand
62.008	169.36	0.7472	0.441	22.467	32	9	sand
62.172	173.08	0.6990	0.404	22.386	33	9	sand
62.336	153.84	0.6308	0.410	22.340	29	9	sand
62.500	149.75	0.6630	0.443	22.268	29	9	sand
62.664	136.93	0.6361	0.465	22.465	26	9	sand
62.828	135.60	0.6330	0.467	22.569	26	9	sand
62.992	129.78	0.6025	0.464	22.870	25	9	sand
63.156	116.91	0.6027	0.516	22.863	22	9	sand
63.320	110.87	0.5789	0.522	23.027	21	9	sand
63.484	120.30	0.4968	0.413	23.269	23	9	sand
63.648	137.23	0.5119	0.373	23.626	26	9	sand
63.812	128.15	0.5103	0.398	24.494	25	9	sand
63.976	116.32	0.4934	0.424	24.254	22	9	sand
64.140	115.27	0.4792	0.416	24.291	22	9	sand
64.304	93.63	0.4584	0.490	24.270	22	8	sand to silty sand
64.469	87.05	0.4379	0.503	24.507	21	8	sand to silty sand
64.633	84.01	0.4087	0.486	24.703	20	8	sand to silty sand
64.797	83.13	0.3809	0.458	24.832	20	8	sand to silty sand
64.961	80.01	0.3686	0.461	24.178	19	8	sand to silty sand
65.125	83.44	0.3859	0.462	24.664	20	8	sand to silty sand
65.289	85.21	0.3971	0.466	24.919	20	8	sand to silty sand
65.453	87.47	0.3791	0.433	25.083	21	8	sand to silty sand
65.617	95.73	0.4054	0.423	25.213	23	8	sand to silty sand
65.781	108.80	0.4297	0.395	24.941	21	9	sand
65.945	135.10	0.5188	0.384	25.240	26	9	sand
66.109	156.62	0.6106	0.390	25.639	30	9	sand
66.273	166.68	0.7428	0.446	25.660	32	9	sand
66.437	172.47	0.7893	0.458	25.926	33	9	sand
66.601	173.33	0.7498	0.433	26.168	33	9	sand
66.765	178.93	0.8125	0.454	26.053	34	9	sand
66.929	161.07	0.7907	0.491	25.928	31	9	sand
67.093	138.61	0.7883	0.569	25.911	27	9	sand
67.257	136.59	0.7570	0.554	25.948	26	9	sand
67.421	140.80	0.7649	0.543	26.057	27	9	sand
67.585	140.17	0.7713	0.550	26.160	27	9	sand
67.749	136.21	0.7694	0.565	26.092	26	9	sand
67.913	133.95	0.6944	0.518	26.090	26	9	sand
68.077	135.50	0.6492	0.479	26.040	26	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
68.241	136.53	0.6530	0.478	25.083	26	9	sand
68.406	145.80	0.6452	0.443	25.501	28	9	sand
68.570	146.33	0.6619	0.452	25.634	28	9	sand
68.734	139.12	0.6349	0.456	25.460	27	9	sand
68.898	120.90	0.5608	0.464	25.248	23	9	sand
69.062	105.88	0.5265	0.497	25.593	20	9	sand
69.226	96.50	0.5074	0.526	25.621	23	8	sand to silty sand
69.390	91.61	0.5057	0.552	25.793	22	8	sand to silty sand
69.554	89.19	0.5010	0.562	25.944	21	8	sand to silty sand
69.718	87.17	0.5017	0.576	26.090	21	8	sand to silty sand
69.882	86.02	0.4967	0.577	26.164	21	8	sand to silty sand
70.046	84.68	0.4965	0.586	26.295	20	8	sand to silty sand
70.210	84.06	0.4839	0.576	26.367	20	8	sand to silty sand
70.374	83.05	0.4848	0.584	26.539	20	8	sand to silty sand
70.538	82.09	0.4766	0.581	26.604	20	8	sand to silty sand
70.702	82.33	0.4831	0.587	26.698	20	8	sand to silty sand
70.866	81.84	0.4829	0.590	26.772	20	8	sand to silty sand
71.030	82.28	0.4976	0.605	26.925	20	8	sand to silty sand
71.194	83.60	0.3770	0.451	26.949	20	8	sand to silty sand
71.358	87.56	0.3829	0.437	27.088	21	8	sand to silty sand
71.522	99.15	0.4148	0.418	26.463	19	9	sand
71.686	114.59	0.5069	0.442	27.051	22	9	sand
71.850	133.56	0.6425	0.481	27.326	26	9	sand
72.014	142.00	0.7765	0.547	27.420	27	9	sand
72.178	136.64	0.7097	0.519	27.090	26	9	sand
72.343	130.94	0.8171	0.624	27.465	25	9	sand
72.507	116.76	0.9256	0.793	27.228	28	8	sand to silty sand
72.671	107.42	0.9198	0.856	27.064	26	8	sand to silty sand
72.835	142.91	0.6755	0.473	28.488	27	9	sand
72.999	146.89	0.5802	0.395	12.070	28	9	sand
73.163	127.48	0.7243	0.568	11.741	24	9	sand
73.327	128.01	0.7578	0.592	15.986	25	9	sand
73.491	130.28	0.7720	0.593	21.494	25	9	sand
73.655	119.49	0.6960	0.582	24.147	23	9	sand
73.819	112.82	0.6402	0.567	26.327	22	9	sand
73.983	110.65	0.6110	0.552	27.084	21	9	sand
74.147	103.66	0.6049	0.584	27.457	25	8	sand to silty sand
74.311	95.40	0.6145	0.644	27.561	23	8	sand to silty sand
74.475	92.96	0.5596	0.602	27.753	22	8	sand to silty sand
74.639	89.55	0.5284	0.590	27.768	21	8	sand to silty sand
74.803	96.71	0.5263	0.544	28.165	23	8	sand to silty sand
74.967	107.02	0.5175	0.484	28.196	20	9	sand
75.131	112.33	0.5529	0.492	28.161	22	9	sand
75.295	103.68	0.4951	0.477	28.102	20	9	sand
75.459	106.01	0.4989	0.471	28.198	20	9	sand
75.623	111.61	0.4875	0.437	28.828	21	9	sand
75.787	115.16	0.4780	0.415	28.952	22	9	sand
75.951	112.36	0.4778	0.425	28.983	22	9	sand
76.115	102.92	0.4859	0.472	29.129	20	9	sand
76.280	101.14	0.5049	0.499	29.251	24	8	sand to silty sand
76.444	105.59	0.5103	0.483	29.467	20	9	sand
76.608	104.77	0.5192	0.496	29.554	20	9	sand
76.772	102.00	0.5296	0.519	29.643	24	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
76.936	101.28	0.5192	0.513	29.711	24	8	sand to silty sand
77.100	100.25	0.5234	0.522	29.813	24	8	sand to silty sand
77.264	96.75	0.5348	0.553	29.857	23	8	sand to silty sand
77.428	96.86	0.5362	0.554	29.909	23	8	sand to silty sand
77.592	99.23	0.5339	0.538	30.022	24	8	sand to silty sand
77.756	103.81	0.5704	0.550	30.127	25	8	sand to silty sand
77.920	116.43	0.5326	0.457	30.210	22	9	sand
78.084	121.20	0.5331	0.440	29.606	23	9	sand
78.248	122.14	0.5301	0.434	29.818	23	9	sand
78.412	110.77	0.5325	0.481	29.693	21	9	sand
78.576	102.95	0.5599	0.544	29.868	25	8	sand to silty sand
78.740	95.56	0.5210	0.545	30.016	23	8	sand to silty sand
78.904	95.00	0.5156	0.543	30.380	23	8	sand to silty sand
79.068	96.34	0.5370	0.557	30.493	23	8	sand to silty sand
79.232	104.58	0.5407	0.517	30.661	25	8	sand to silty sand
79.396	115.74	0.5726	0.495	30.764	22	9	sand
79.560	119.69	0.5924	0.495	30.646	23	9	sand
79.724	121.83	0.6144	0.504	30.733	23	9	sand
79.888	127.56	0.6306	0.494	30.816	24	9	sand
80.052	134.86	0.6631	0.492	30.918	26	9	sand
80.217	134.70	0.6911	0.513	30.857	26	9	sand
80.381	127.52	0.6649	0.521	30.833	24	9	sand
80.545	130.93	0.6885	0.526	30.958	25	9	sand
80.709	136.76	0.6892	0.504	31.163	26	9	sand
80.873	131.15	0.7030	0.536	31.269	25	9	sand
81.037	128.47	0.7229	0.563	31.173	25	9	sand
81.201	129.29	0.6980	0.540	31.265	25	9	sand
81.365	125.96	0.6708	0.533	30.589	24	9	sand
81.529	126.99	0.6477	0.510	30.912	24	9	sand
81.693	126.01	0.6577	0.522	30.966	24	9	sand
81.857	116.57	0.5388	0.462	31.008	22	9	sand
82.021	110.69	0.5527	0.499	31.001	21	9	sand
82.185	115.82	0.5478	0.473	31.378	22	9	sand
82.349	112.52	0.5880	0.523	31.649	22	9	sand
82.513	112.13	0.5885	0.525	31.736	21	9	sand
82.677	118.75	0.6496	0.547	32.039	23	9	sand
82.841	133.47	0.6885	0.516	32.215	26	9	sand
83.005	148.96	0.6803	0.457	32.300	29	9	sand
83.169	158.23	0.6995	0.442	32.327	30	9	sand
83.333	141.67	0.6852	0.484	31.971	27	9	sand
83.497	113.77	0.6356	0.559	31.566	22	9	sand
83.661	101.73	0.6217	0.611	31.718	24	8	sand to silty sand
83.825	93.07	0.6292	0.676	32.109	22	8	sand to silty sand
83.990	91.64	0.6184	0.675	32.490	22	8	sand to silty sand
84.154	98.31	0.6123	0.623	32.817	24	8	sand to silty sand
84.318	108.61	0.4901	0.451	32.954	21	9	sand
84.482	110.91	0.4613	0.416	32.961	21	9	sand
84.646	106.06	0.4717	0.445	32.028	20	9	sand
84.810	97.82	0.4666	0.477	32.281	23	8	sand to silty sand
84.974	89.96	0.4743	0.527	32.425	22	8	sand to silty sand
85.138	88.11	0.4744	0.538	32.584	21	8	sand to silty sand
85.302	91.54	0.4762	0.520	32.808	22	8	sand to silty sand
85.466	102.54	0.4866	0.475	33.404	25	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
85.630	117.04	0.5035	0.430	33.425	22	9	sand
85.794	124.58	0.5117	0.411	33.273	24	9	sand
85.958	108.22	0.5038	0.465	33.033	21	9	sand
86.122	100.03	0.4989	0.499	33.186	24	8	sand to silty sand
86.286	99.54	0.5010	0.503	33.480	24	8	sand to silty sand
86.450	98.94	0.4879	0.493	33.598	24	8	sand to silty sand
86.614	100.56	0.5013	0.498	33.702	24	8	sand to silty sand
86.778	94.89	0.5021	0.529	33.757	23	8	sand to silty sand
86.942	97.86	0.5202	0.532	33.983	23	8	sand to silty sand
87.106	109.44	0.5211	0.476	34.262	21	9	sand
87.270	125.13	0.5620	0.449	34.382	24	9	sand
87.434	126.36	0.5661	0.448	34.393	24	9	sand
87.598	146.67	0.6983	0.476	34.437	28	9	sand
87.762	131.55	0.7059	0.537	33.796	25	9	sand
87.927	164.27	0.7151	0.435	34.504	31	9	sand
88.091	170.86	0.7288	0.427	34.467	33	9	sand
88.255	173.78	0.7769	0.447	34.343	33	9	sand
88.419	176.04	0.7950	0.452	34.284	34	9	sand
88.583	146.66	0.7276	0.496	33.789	28	9	sand
88.747	123.04	0.6848	0.557	33.399	24	9	sand
88.911	128.03	0.6882	0.538	33.903	25	9	sand
89.075	141.12	0.7059	0.500	34.494	27	9	sand
89.239	153.03	0.7384	0.483	34.622	29	9	sand
89.403	136.42	0.6941	0.509	34.051	26	9	sand
89.567	125.37	0.6816	0.544	33.996	24	9	sand
89.731	112.28	0.6579	0.586	34.108	27	8	sand to silty sand
89.895	114.84	0.6594	0.574	34.635	22	9	sand
90.059	129.22	0.6725	0.520	35.283	25	9	sand
90.223	128.89	0.6825	0.529	35.023	25	9	sand
90.387	145.59	0.6828	0.469	35.361	28	9	sand
90.551	138.54	0.6695	0.483	35.067	27	9	sand
90.715	108.60	0.6621	0.610	34.328	26	8	sand to silty sand
90.879	97.18	0.6537	0.673	34.424	23	8	sand to silty sand
91.043	94.60	0.5701	0.603	34.422	23	8	sand to silty sand
91.207	92.70	0.5364	0.579	34.498	22	8	sand to silty sand
91.371	87.55	0.5340	0.610	34.923	21	8	sand to silty sand
91.535	93.01	0.5712	0.614	35.228	22	8	sand to silty sand
91.699	109.73	0.6178	0.563	35.527	26	8	sand to silty sand
91.864	137.81	0.6757	0.490	35.841	26	9	sand
92.028	153.83	0.6914	0.449	35.566	29	9	sand
92.192	157.42	0.7212	0.458	35.799	30	9	sand
92.356	127.23	0.7151	0.562	35.082	24	9	sand
92.520	120.97	0.6546	0.541	35.551	23	9	sand
92.684	123.12	0.6660	0.541	36.233	24	9	sand
92.848	146.65	0.7617	0.519	36.809	28	9	sand
93.012	150.35	0.7606	0.506	36.503	29	9	sand
93.176	129.90	0.5644	0.435	36.248	25	9	sand
93.340	93.43	0.5888	0.630	35.616	22	8	sand to silty sand
93.504	122.23	0.6530	0.534	37.312	23	9	sand
93.668	149.14	0.6624	0.444	37.563	29	9	sand
93.832	162.98	0.6839	0.420	37.559	31	9	sand
93.996	168.66	0.7111	0.422	37.508	32	9	sand
94.160	170.80	0.7366	0.431	37.692	33	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
94.324	172.83	0.7443	0.431	37.729	33	9	sand
94.488	171.33	0.8034	0.469	35.716	33	9	sand
94.652	179.02	0.8434	0.471	36.628	34	9	sand
94.816	183.43	0.8773	0.478	36.562	35	9	sand
94.980	159.58	0.8712	0.546	35.956	31	9	sand
95.144	116.72	0.7126	0.611	35.089	22	9	sand
95.308	92.40	0.6122	0.663	36.920	22	8	sand to silty sand
95.472	87.46	0.5823	0.666	37.103	21	8	sand to silty sand
95.636	83.90	0.5658	0.674	37.330	20	8	sand to silty sand
95.801	83.00	0.5469	0.659	37.517	20	8	sand to silty sand
95.965	84.21	0.5383	0.639	37.382	20	8	sand to silty sand
96.129	84.04	0.5458	0.649	37.903	20	8	sand to silty sand
96.293	84.84	0.5404	0.637	37.870	20	8	sand to silty sand
96.457	87.99	0.5446	0.619	37.829	21	8	sand to silty sand
96.621	93.83	0.5714	0.609	38.073	22	8	sand to silty sand
96.785	108.91	0.6120	0.562	38.298	26	8	sand to silty sand
96.949	125.79	0.6390	0.508	38.485	24	9	sand
97.113	163.82	0.7848	0.479	39.076	31	9	sand
97.277	183.90	0.8445	0.459	39.255	35	9	sand
97.441	183.29	0.9773	0.533	38.978	35	9	sand
97.605	183.32	0.9485	0.517	38.313	35	9	sand
97.769	178.57	0.8966	0.502	37.478	34	9	sand
97.933	182.40	0.9169	0.503	37.465	35	9	sand
98.097	175.82	0.9284	0.528	38.308	34	9	sand
98.261	150.39	1.0483	0.697	38.472	29	9	sand
98.425	130.79	1.0328	0.790	37.811	31	8	sand to silty sand
98.589	147.24	1.0185	0.692	38.962	28	9	sand
98.753	148.58	1.0097	0.680	38.980	28	9	sand
98.917	149.76	0.9964	0.665	39.130	29	9	sand
99.081	149.95	0.9749	0.650	39.189	29	9	sand
99.245	148.89	0.9596	0.644	39.248	29	9	sand
99.409	146.85	0.9432	0.642	39.287	28	9	sand
99.573	145.57	0.9354	0.643	39.202	28	9	sand
99.738	143.68	0.9222	0.642	39.194	28	9	sand
99.902	142.07	0.9065	0.638	39.326	27	9	sand
100.066	140.54	0.8841	0.629	39.030	27	9	sand
100.230	136.43	0.8726	0.640	39.106	26	9	sand
100.394	129.67	0.8425	0.650	38.993	25	9	sand
100.558	127.97	0.7970	0.623	39.050	25	9	sand
100.722	122.11	0.7259	0.594	39.163	23	9	sand
100.886	116.77	0.6668	0.571	39.215	22	9	sand
101.050	118.55	0.6637	0.560	39.030	23	9	sand
101.214	136.76	0.7006	0.512	39.871	26	9	sand
101.378	158.18	0.7709	0.487	40.079	30	9	sand
101.542	136.36	0.8191	0.601	39.002	26	9	sand
101.706	132.22	0.8228	0.622	39.098	25	9	sand
101.870	147.41	0.8760	0.594	39.933	28	9	sand
102.034	162.26	0.8638	0.532	40.323	31	9	sand
102.198	178.58	0.8669	0.485	40.179	34	9	sand
102.362	162.63	0.8564	0.527	39.115	31	9	sand
102.526	136.59	0.8564	0.627	38.823	26	9	sand
102.690	136.23	0.8578	0.630	39.316	26	9	sand
102.854	136.66	0.7986	0.584	39.322	26	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
103.018	138.49	0.7845	0.566	39.512	27	9	sand
103.182	169.79	0.8616	0.507	40.857	33	9	sand
103.347	176.27	0.8219	0.466	40.924	34	9	sand
103.511	169.41	0.7784	0.459	39.782	32	9	sand
103.675	149.01	0.7411	0.497	39.630	29	9	sand
103.839	124.11	0.7435	0.599	39.331	24	9	sand
104.003	119.76	0.6412	0.535	39.695	23	9	sand
104.167	120.75	0.5694	0.472	39.871	23	9	sand
104.331	120.27	0.5599	0.466	39.220	23	9	sand
104.495	110.18	0.5702	0.518	39.623	21	9	sand
104.659	106.82	0.5506	0.515	39.985	20	9	sand
104.823	120.19	0.4919	0.409	40.580	23	9	sand
104.987	133.06	0.4862	0.365	40.741	25	9	sand
105.151	120.89	0.4952	0.410	40.318	23	9	sand
105.315	115.51	0.5046	0.437	40.687	22	9	sand
105.479	113.35	0.5175	0.457	40.796	22	9	sand
105.643	116.43	0.6011	0.516	41.090	22	9	sand
105.807	123.59	0.6704	0.542	41.443	24	9	sand
105.971	152.07	0.7478	0.492	41.918	29	9	sand
106.135	195.32	0.9501	0.486	42.910	37	9	sand
106.299	224.92	1.0338	0.460	43.172	43	9	sand
106.463	200.12	1.0015	0.500	41.969	38	9	sand
106.627	184.11	0.9645	0.524	41.515	35	9	sand
106.791	175.47	0.9687	0.552	41.753	34	9	sand
106.955	164.47	0.9710	0.590	41.620	31	9	sand
107.119	161.33	0.9647	0.598	41.814	31	9	sand
107.284	164.48	0.8739	0.531	41.877	32	9	sand
107.448	166.11	0.7807	0.470	42.102	32	9	sand
107.612	161.62	0.7494	0.464	39.841	31	9	sand
107.776	151.80	0.7733	0.509	41.343	29	9	sand
107.940	143.89	0.7670	0.533	41.297	28	9	sand
108.104	147.29	0.8110	0.551	41.648	28	9	sand
108.268	178.89	0.8596	0.481	43.019	34	9	sand
108.432	192.84	0.9383	0.487	42.904	37	9	sand
108.596	181.29	0.9252	0.510	42.280	35	9	sand
108.760	143.93	0.8275	0.575	41.007	28	9	sand
108.924	137.20	0.7973	0.581	41.419	26	9	sand
109.088	120.88	0.7752	0.641	41.685	23	9	sand
109.252	119.02	0.7764	0.652	42.065	28	8	sand to silty sand
109.416	118.60	0.7725	0.651	42.300	28	8	sand to silty sand
109.580	118.48	0.7629	0.644	42.442	23	9	sand
109.744	118.06	0.7633	0.647	42.581	28	8	sand to silty sand
109.908	117.38	0.7599	0.647	42.570	28	8	sand to silty sand
110.072	117.48	0.7520	0.640	42.542	28	8	sand to silty sand
110.236	117.96	0.7428	0.630	42.638	23	9	sand
110.400	119.24	0.7584	0.636	42.769	23	9	sand
110.564	121.98	0.6411	0.526	42.854	23	9	sand
110.728	130.12	0.6446	0.495	43.004	25	9	sand
110.892	139.07	0.6555	0.471	42.217	27	9	sand
111.056	153.84	0.6853	0.445	42.923	29	9	sand
111.221	151.57	0.7235	0.477	43.124	29	9	sand
111.385	139.12	0.7578	0.545	42.666	27	9	sand
111.549	140.76	0.7143	0.507	43.050	27	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
111.713	147.14	0.7344	0.499	43.414	28	9	sand
111.877	165.22	0.7866	0.476	43.885	32	9	sand
112.041	174.70	0.7899	0.452	43.789	33	9	sand
112.205	154.02	0.8131	0.528	43.388	29	9	sand
112.369	152.61	0.8097	0.531	43.798	29	9	sand
112.533	155.82	0.7859	0.504	44.011	30	9	sand
112.697	144.45	0.7863	0.544	44.064	28	9	sand
112.861	121.33	0.7532	0.621	43.373	23	9	sand
113.025	117.29	0.7348	0.626	44.266	22	9	sand
113.189	128.59	0.7809	0.607	44.981	25	9	sand
113.353	161.00	0.8463	0.526	45.740	31	9	sand
113.517	175.18	0.8593	0.491	45.542	34	9	sand
113.681	167.10	0.8726	0.522	44.781	32	9	sand
113.845	151.97	0.8749	0.576	44.345	29	9	sand
114.009	140.65	0.8858	0.630	44.016	27	9	sand
114.173	137.08	0.8285	0.604	44.247	26	9	sand
114.337	139.52	0.9305	0.667	44.657	27	9	sand
114.501	163.51	1.1701	0.716	45.031	31	9	sand
114.665	198.65	1.1035	0.555	43.194	38	9	sand
114.829	212.51	1.2018	0.566	46.961	41	9	sand
114.993	204.02	0.9804	0.481	41.812	39	9	sand
115.158	192.67	0.8045	0.418	45.084	37	9	sand
115.322	159.62	0.7759	0.486	47.772	31	9	sand
115.486	143.50	0.7273	0.507	47.848	27	9	sand
115.650	131.85	0.7291	0.553	46.887	25	9	sand
115.814	123.81	0.7112	0.574	45.840	24	9	sand
115.978	120.20	0.7037	0.585	45.661	23	9	sand
116.142	127.68	0.7171	0.562	45.522	24	9	sand
116.306	136.11	0.7351	0.540	46.239	26	9	sand
116.470	141.95	0.7572	0.533	46.163	27	9	sand
116.634	143.20	0.7662	0.535	46.215	27	9	sand
116.798	145.61	0.7786	0.535	46.030	28	9	sand
116.962	153.18	0.8001	0.522	46.213	29	9	sand
117.126	158.95	0.8056	0.507	46.411	30	9	sand
117.290	170.27	0.6694	0.393	46.518	33	9	sand
117.454	171.89	0.8030	0.467	46.571	33	9	sand
117.618	197.43	1.1101	0.562	46.880	38	9	sand
117.782	227.63	1.1555	0.508	48.136	44	9	sand
117.946	206.86	0.7610	0.368	45.609	40	9	sand
118.110	209.32	0.8204	0.392	46.804	40	9	sand
118.274	190.37	0.8699	0.457	46.749	36	9	sand
118.438	152.82	0.8529	0.558	45.598	29	9	sand
118.602	146.27	0.8182	0.559	45.825	28	9	sand
118.766	158.74	0.7828	0.493	46.980	30	9	sand
118.931	170.05	0.7825	0.460	47.172	33	9	sand
119.095	142.78	0.7870	0.551	46.612	27	9	sand
119.259	128.28	0.7633	0.595	46.723	25	9	sand
119.423	130.47	0.7407	0.568	47.246	25	9	sand
119.587	160.37	0.7780	0.485	48.428	31	9	sand
119.751	188.20	0.8300	0.441	49.047	36	9	sand
119.915	181.69	0.8496	0.468	48.059	35	9	sand
120.079	175.70	0.8222	0.468	47.484	34	9	sand
120.243	174.51	0.7506	0.430	47.094	33	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
120.407	124.40	0.6972	0.560	46.448	24	9	sand
120.571	100.88	0.6750	0.669	47.187	24	8	sand to silty sand
120.735	98.27	0.6714	0.683	47.569	24	8	sand to silty sand
120.899	91.34	0.6440	0.705	47.754	22	8	sand to silty sand
121.063	89.97	0.8019	0.891	47.811	22	8	sand to silty sand
121.227	112.73	0.8555	0.759	50.763	27	8	sand to silty sand
121.391	114.08	0.7114	0.624	46.564	27	8	sand to silty sand
121.555	111.24	0.6491	0.583	46.736	27	8	sand to silty sand
121.719	118.79	0.6549	0.551	47.839	23	9	sand
121.883	126.19	0.6843	0.542	48.205	24	9	sand
122.047	138.08	0.7167	0.519	48.635	26	9	sand
122.211	145.33	0.7324	0.504	48.923	28	9	sand
122.375	168.53	0.8881	0.527	49.821	32	9	sand
122.539	188.82	0.9546	0.506	50.819	36	9	sand
122.703	208.76	0.9104	0.436	50.843	40	9	sand
122.868	210.08	0.9531	0.454	50.176	40	9	sand
123.032	185.95	0.8744	0.470	48.347	36	9	sand
123.196	144.65	0.7962	0.550	46.917	28	9	sand
123.360	119.05	0.5701	0.479	47.310	23	9	sand
123.524	110.60	0.5606	0.507	47.813	21	9	sand
123.688	105.57	0.5529	0.524	48.487	25	8	sand to silty sand
123.852	106.14	0.5485	0.517	49.071	25	8	sand to silty sand
124.016	106.19	0.5253	0.495	49.097	20	9	sand
124.180	106.85	0.5470	0.512	49.152	20	9	sand
124.344	106.29	0.5443	0.512	49.053	20	9	sand
124.508	108.63	0.5258	0.484	49.067	21	9	sand
124.672	108.51	0.4915	0.453	49.093	21	9	sand
124.836	107.44	0.5036	0.469	49.736	21	9	sand
125.000	111.79	0.4987	0.446	49.923	21	9	sand
125.164	113.59	0.5352	0.471	49.945	22	9	sand
125.328	112.60	0.5347	0.475	49.989	22	9	sand
125.492	117.30	0.5605	0.478	50.174	22	9	sand
125.656	126.35	0.5970	0.472	50.577	24	9	sand
125.820	138.12	0.6259	0.453	50.852	26	9	sand
125.984	153.25	0.6115	0.399	51.175	29	9	sand
126.148	151.27	0.5991	0.396	50.678	29	9	sand
126.312	130.60	0.5865	0.449	50.063	25	9	sand
126.476	116.44	0.5755	0.494	50.013	22	9	sand
126.640	112.99	0.5731	0.507	50.333	22	9	sand
126.805	112.13	0.5779	0.515	50.662	21	9	sand
126.969	111.11	0.6137	0.552	50.688	21	9	sand
127.133	109.92	0.5809	0.528	50.749	21	9	sand
127.297	107.09	0.5550	0.518	50.154	21	9	sand
127.461	110.09	0.5972	0.543	50.824	21	9	sand
127.625	110.38	0.6342	0.575	50.917	26	8	sand to silty sand
127.789	118.79	0.6538	0.550	51.380	23	9	sand
127.953	139.02	0.7819	0.562	51.975	27	9	sand
128.117	157.80	1.0133	0.642	52.792	30	9	sand
128.281	180.72	1.2348	0.683	53.235	35	9	sand
128.445	227.62	1.2817	0.563	52.936	44	9	sand
128.609	213.78	1.3145	0.615	51.567	41	9	sand
128.773	205.11	1.2967	0.632	50.981	39	9	sand
128.937	195.25	1.2393	0.635	50.329	37	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
129.101	187.12	1.2059	0.644	50.669	36	9	sand
129.265	181.95	1.1726	0.644	51.162	35	9	sand
129.429	183.79	1.1615	0.632	51.783	35	9	sand
129.593	192.10	1.1815	0.615	52.796	37	9	sand
129.757	195.47	1.1859	0.607	53.062	37	9	sand
129.921	215.62	1.2303	0.571	54.142	41	9	sand
130.085	207.99	1.3326	0.641	52.786	40	9	sand
130.249	200.51	1.4783	0.737	52.304	38	9	sand
130.413	186.09	1.4201	0.763	50.991	36	9	sand
130.577	166.97	1.3559	0.812	49.742	32	9	sand
130.742	160.50	1.2663	0.789	50.418	31	9	sand
130.906	159.97	1.0027	0.627	50.806	31	9	sand
131.070	156.78	0.9629	0.614	51.502	30	9	sand
131.234	129.44	0.8516	0.658	51.715	25	9	sand
131.398	134.45	0.8624	0.641	52.014	26	9	sand
131.562	159.57	0.9450	0.592	52.901	31	9	sand
131.726	159.07	1.0143	0.638	51.648	30	9	sand
131.890	143.98	1.0187	0.708	51.698	28	9	sand
132.054	135.22	0.9759	0.722	51.277	26	9	sand
132.218	150.00	0.9761	0.651	53.420	29	9	sand
132.382	178.29	1.0306	0.578	53.357	34	9	sand
132.546	199.76	1.0519	0.527	52.973	38	9	sand
132.710	193.76	1.0589	0.546	53.433	37	9	sand
132.874	173.66	1.0089	0.581	52.727	33	9	sand
133.038	189.59	0.9801	0.517	53.590	36	9	sand
133.202	212.10	0.9504	0.448	55.190	41	9	sand
133.366	199.72	0.8297	0.415	54.033	38	9	sand
133.530	185.18	0.7506	0.405	53.509	35	9	sand
133.694	170.01	0.7431	0.437	50.420	33	9	sand
133.858	162.24	0.7464	0.460	52.334	31	9	sand
134.022	154.10	0.6813	0.442	52.249	30	9	sand
134.186	136.62	0.6141	0.450	51.643	26	9	sand
134.350	98.98	0.5030	0.508	52.149	24	8	sand to silty sand
134.514	72.83	0.4246	0.583	52.210	17	8	sand to silty sand
134.679	48.65	0.3954	0.813	52.524	16	7	silty sand to sandy silt
134.843	33.37	0.4022	1.205	52.895	11	7	silty sand to sandy silt
135.007	23.39	0.3891	1.664	53.649	9	6	sandy silt to clayey silt
135.171	20.69	0.3513	1.698	54.381	8	6	sandy silt to clayey silt
135.335	22.57	0.5186	2.298	54.338	11	5	clayey silt to silty clay
135.499	38.51	0.7455	1.936	55.373	15	6	sandy silt to clayey silt
135.663	93.28	1.2307	1.319	55.857	22	8	sand to silty sand
135.827	150.78	1.6449	1.091	54.436	36	8	sand to silty sand
135.991	156.72	1.3446	0.858	52.581	30	9	sand
136.155	183.07	1.2861	0.703	50.889	35	9	sand
136.319	153.74	1.3512	0.879	53.311	29	9	sand
136.483	149.98	1.1264	0.751	56.051	29	9	sand
136.647	157.19	1.0480	0.667	55.687	30	9	sand
136.811	173.32	0.9201	0.531	56.086	33	9	sand
136.975	180.95	0.9208	0.509	56.374	35	9	sand
137.139	184.32	0.9935	0.539	55.092	35	9	sand
137.303	191.99	1.1349	0.591	55.875	37	9	sand
137.467	199.56	1.2018	0.602	54.798	38	9	sand
137.631	228.81	1.3063	0.571	56.914	44	9	sand

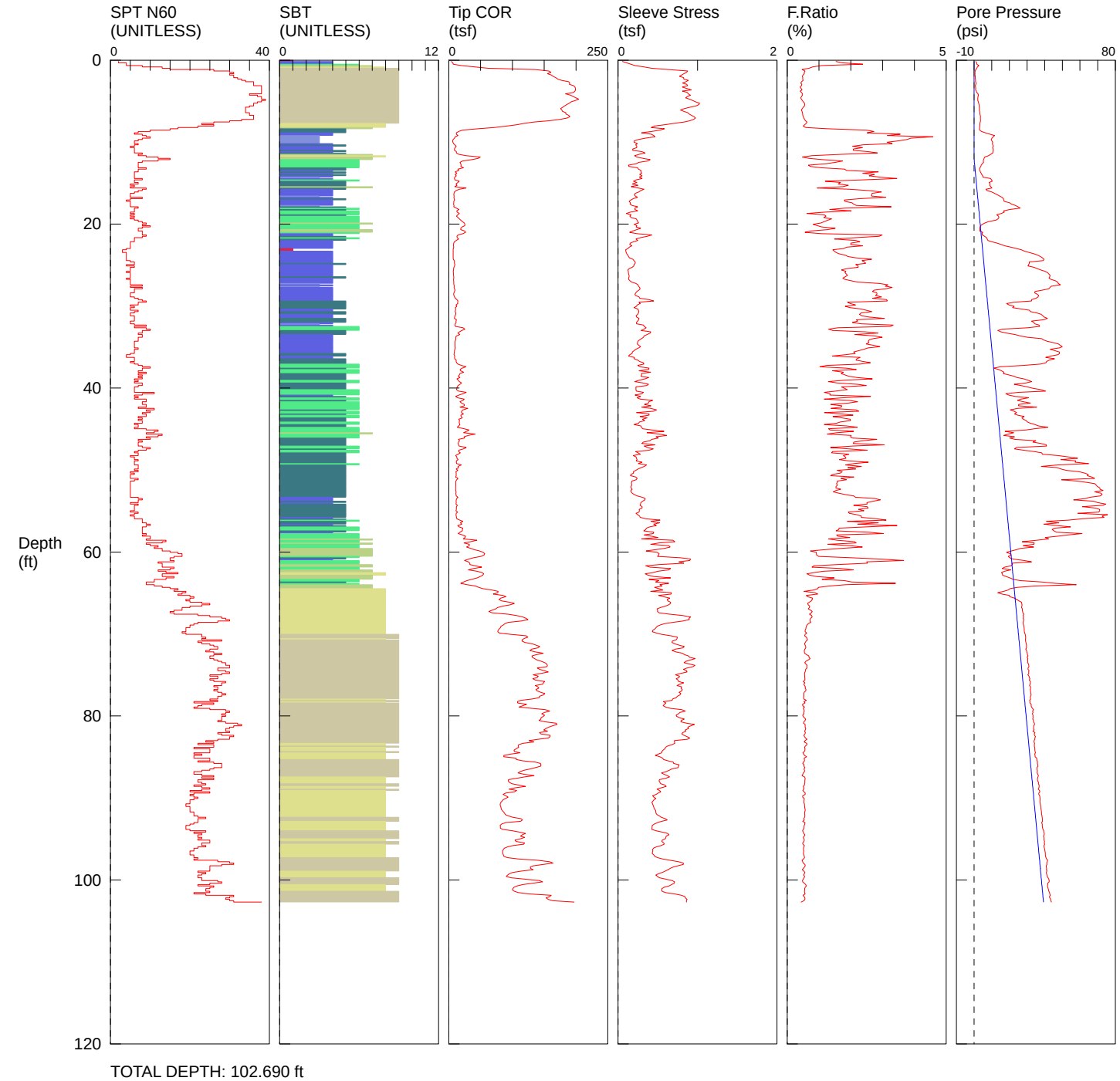
Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
137.795	218.99	1.2563	0.574	54.399	42	9	sand
137.959	214.30	1.2525	0.584	54.966	41	9	sand
138.123	222.54	1.2743	0.573	54.580	43	9	sand
138.287	235.72	1.4119	0.599	56.904	45	9	sand
138.451	253.96	2.6233	1.033	56.860	49	9	sand
138.616	297.12	2.5641	0.863	57.599	57	9	sand
138.780	437.53	2.5607	0.585	63.624	70	10	gravelly sand to sand
138.944	513.99	2.5607	0.498	55.421	82	10	gravelly sand to sand

GRI / CPT-21 / PDX Runway Evaluation

TEST DATE: 4/26/2017 8:44:07 AM
HOLE NUMBER: CPT-21

CUSTOMER: 17058/ GRI / CPT-21/ PDX
OPERATOR: OGE BJB

CONE ID: DPG1386
LOCATION: 17058/ GRI/ CPT-21/ PDX
JOB NUMBER: 17058/ GRI/ CPT-21/ PDX
TEST DATE: 4/26/2017 8:44:07 AM
TOTAL DEPTH: 102.690 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

GRI / CPT-21 / PDX Runway Evaluation

OPERATOR: OGE BJB
TEST DATE: 4/26/2017 8:44:07 AM
COMMENT: GRI / CPT-21 / PDX Runway Evaluation
FILENAME: 17058 CPT-21.cpt
TOTAL DEPTH: 102.690 ft

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
0.164	3.65	0.0558	1.531	0.899	2	1	sensitive fine grained
0.328	6.34	0.1101	1.738	1.446	4	4	silty clay to clay
0.492	6.72	0.1596	2.374	1.501	4	4	silty clay to clay
0.656	19.59	0.2130	1.087	2.687	8	6	sandy silt to clayey silt
0.820	40.79	0.3256	0.798	1.877	13	7	silty sand to sandy silt
0.984	61.96	0.4230	0.683	1.505	15	8	sand to silty sand
1.148	134.97	0.6290	0.466	0.976	26	9	sand
1.312	157.08	0.8751	0.557	0.635	30	9	sand
1.476	160.68	0.8611	0.536	0.511	31	9	sand
1.640	154.91	0.8274	0.534	0.554	30	9	sand
1.804	161.51	0.8001	0.495	0.439	31	9	sand
1.969	163.87	0.7727	0.472	0.678	31	9	sand
2.133	168.25	0.8249	0.490	0.657	32	9	sand
2.297	171.12	0.8259	0.483	0.707	33	9	sand
2.461	177.23	0.8828	0.498	0.772	34	9	sand
2.625	188.71	0.8519	0.451	0.858	36	9	sand
2.789	190.07	0.8135	0.428	1.050	36	9	sand
2.953	189.59	0.8652	0.456	0.933	36	9	sand
3.117	196.14	0.8743	0.446	0.686	38	9	sand
3.281	198.31	0.8089	0.408	0.798	38	9	sand
3.445	198.95	0.8607	0.433	0.918	38	9	sand
3.609	199.39	0.9206	0.462	0.822	38	9	sand
3.773	198.37	0.8106	0.409	1.259	38	9	sand
3.937	196.12	0.8732	0.445	1.467	38	9	sand
4.101	183.44	0.8818	0.481	2.165	35	9	sand
4.265	191.59	0.9109	0.475	2.419	37	9	sand
4.429	195.83	0.8724	0.445	2.265	38	9	sand
4.593	200.03	0.8509	0.425	2.057	38	9	sand
4.757	204.40	0.8978	0.439	2.076	39	9	sand
4.921	198.76	0.9382	0.472	2.074	38	9	sand
5.085	192.29	0.9772	0.508	2.431	37	9	sand
5.249	189.23	1.0258	0.542	2.531	36	9	sand
5.413	185.56	1.0171	0.548	2.745	36	9	sand
5.577	181.94	0.9818	0.540	2.850	35	9	sand
5.741	179.17	0.9079	0.507	2.920	34	9	sand
5.906	175.91	0.8333	0.474	2.970	34	9	sand
6.070	177.87	0.7861	0.442	2.963	34	9	sand
6.234	178.55	0.8271	0.463	3.097	34	9	sand
6.398	184.12	0.8782	0.477	3.272	35	9	sand
6.562	183.89	0.8930	0.486	3.231	35	9	sand
6.726	188.29	0.9225	0.490	3.438	36	9	sand
6.890	190.35	0.9541	0.501	3.579	36	9	sand
7.054	185.96	0.9736	0.524	3.529	36	9	sand
7.218	174.71	0.9504	0.544	3.553	33	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
7.382	157.85	0.9031	0.572	3.581	30	9	sand
7.546	134.63	0.8354	0.620	3.469	26	9	sand
7.710	118.63	0.7072	0.596	3.212	23	9	sand
7.874	107.39	0.5918	0.551	3.222	26	8	sand to silty sand
8.038	90.97	0.4571	0.502	3.188	22	8	sand to silty sand
8.202	71.32	0.4166	0.584	3.136	17	8	sand to silty sand
8.366	45.64	0.5814	1.274	3.009	15	7	silty sand to sandy silt
8.530	21.16	0.5269	2.490	3.174	10	5	clayey silt to silty clay
8.694	15.42	0.4207	2.728	4.150	7	5	clayey silt to silty clay
8.858	11.76	0.2955	2.513	6.353	6	5	clayey silt to silty clay
9.022	11.75	0.4176	3.554	8.961	8	4	silty clay to clay
9.186	14.26	0.4496	3.152	11.550	9	4	silty clay to clay
9.350	10.12	0.4639	4.584	10.783	10	3	clay
9.514	8.86	0.3450	3.892	10.114	8	3	clay
9.678	6.81	0.2563	3.765	9.663	7	3	clay
9.843	5.86	0.2046	3.493	10.049	6	3	clay
10.007	6.39	0.2006	3.140	10.502	6	3	clay
10.171	7.32	0.2418	3.304	10.349	7	3	clay
10.335	9.31	0.2217	2.382	10.500	6	4	silty clay to clay
10.499	11.42	0.2352	2.060	10.816	5	5	clayey silt to silty clay
10.663	9.90	0.2341	2.364	10.442	6	4	silty clay to clay
10.827	8.82	0.1836	2.082	10.778	6	4	silty clay to clay
10.991	8.86	0.1841	2.078	10.814	6	4	silty clay to clay
11.155	11.77	0.2982	2.535	10.663	6	5	clayey silt to silty clay
11.319	12.00	0.3399	2.833	10.641	8	4	silty clay to clay
11.483	15.58	0.2669	1.713	9.402	7	5	clayey silt to silty clay
11.647	27.10	0.2089	0.771	8.151	9	7	silty sand to sandy silt
11.811	49.29	0.2352	0.477	6.082	12	8	sand to silty sand
11.975	46.06	0.3165	0.687	5.610	15	7	silty sand to sandy silt
12.139	36.21	0.4022	1.111	5.365	12	7	silty sand to sandy silt
12.303	21.52	0.3742	1.739	5.178	8	6	sandy silt to clayey silt
12.467	17.29	0.2613	1.511	5.394	7	6	sandy silt to clayey silt
12.631	18.64	0.2285	1.226	4.718	7	6	sandy silt to clayey silt
12.795	19.47	0.1298	0.667	4.018	7	6	sandy silt to clayey silt
12.959	18.79	0.1355	0.721	3.838	7	6	sandy silt to clayey silt
13.123	22.82	0.2451	1.074	3.217	9	6	sandy silt to clayey silt
13.287	14.27	0.2574	1.803	3.068	7	5	clayey silt to silty clay
13.451	15.48	0.2884	1.863	3.255	7	5	clayey silt to silty clay
13.615	9.98	0.2856	2.862	3.514	6	4	silty clay to clay
13.780	12.56	0.2985	2.378	3.946	6	5	clayey silt to silty clay
13.944	9.93	0.2720	2.740	4.255	6	4	silty clay to clay
14.108	11.78	0.3035	2.575	4.893	6	5	clayey silt to silty clay
14.272	9.27	0.2695	2.909	4.972	6	4	silty clay to clay
14.436	8.78	0.3028	3.450	9.292	8	3	clay
14.600	9.57	0.2275	2.376	9.917	6	4	silty clay to clay
14.764	16.12	0.1925	1.194	10.299	6	6	sandy silt to clayey silt
14.928	14.15	0.2372	1.676	8.479	7	5	clayey silt to silty clay
15.092	11.25	0.1804	1.604	8.999	5	5	clayey silt to silty clay
15.256	13.03	0.2502	1.920	8.760	6	5	clayey silt to silty clay
15.420	9.46	0.1657	1.752	9.395	5	5	clayey silt to silty clay
15.584	27.26	0.2571	0.943	10.037	9	7	silty sand to sandy silt
15.748	16.52	0.3246	1.965	6.686	8	5	clayey silt to silty clay
15.912	11.13	0.2875	2.583	7.367	7	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.076	8.81	0.2609	2.960	10.013	6	4	silty clay to clay
16.240	8.10	0.2165	2.672	11.591	5	4	silty clay to clay
16.404	7.73	0.2051	2.653	12.998	5	4	silty clay to clay
16.568	8.24	0.2183	2.649	14.431	5	4	silty clay to clay
16.732	7.91	0.2453	3.100	15.700	8	3	clay
16.896	8.28	0.1902	2.298	16.627	5	4	silty clay to clay
17.060	8.96	0.1609	1.797	16.740	4	5	clayey silt to silty clay
17.224	7.61	0.1380	1.814	17.035	5	4	silty clay to clay
17.388	7.57	0.1545	2.040	20.137	5	4	silty clay to clay
17.552	7.23	0.1507	2.085	21.096	5	4	silty clay to clay
17.717	8.03	0.1742	2.169	23.318	5	4	silty clay to clay
17.881	7.54	0.2467	3.270	24.831	7	3	clay
18.045	11.75	0.2118	1.803	25.955	6	5	clayey silt to silty clay
18.209	15.91	0.2121	1.333	20.204	6	6	sandy silt to clayey silt
18.373	12.25	0.2464	2.012	16.699	6	5	clayey silt to silty clay
18.537	12.95	0.1561	1.206	17.131	5	6	sandy silt to clayey silt
18.701	16.59	0.1033	0.623	15.424	6	6	sandy silt to clayey silt
18.865	13.85	0.1613	1.165	12.775	5	6	sandy silt to clayey silt
19.029	11.99	0.1458	1.216	13.863	6	5	clayey silt to silty clay
19.193	14.27	0.1644	1.153	14.017	5	6	sandy silt to clayey silt
19.357	16.41	0.2282	1.391	13.573	6	6	sandy silt to clayey silt
19.521	18.67	0.2390	1.280	12.408	7	6	sandy silt to clayey silt
19.685	21.20	0.2471	1.165	8.131	8	6	sandy silt to clayey silt
19.849	24.31	0.2580	1.061	6.171	9	6	sandy silt to clayey silt
20.013	25.11	0.2040	0.812	4.641	8	7	silty sand to sandy silt
20.177	24.90	0.2369	0.951	3.778	10	6	sandy silt to clayey silt
20.341	20.91	0.2262	1.082	3.397	8	6	sandy silt to clayey silt
20.505	18.83	0.2842	1.509	3.109	7	6	sandy silt to clayey silt
20.669	18.61	0.2355	1.265	3.291	7	6	sandy silt to clayey silt
20.833	24.83	0.1847	0.744	3.133	8	7	silty sand to sandy silt
20.997	26.06	0.1449	0.556	4.869	8	7	silty sand to sandy silt
21.161	22.04	0.2405	1.091	4.483	8	6	sandy silt to clayey silt
21.325	14.21	0.4240	2.984	4.667	9	4	silty clay to clay
21.490	12.71	0.3669	2.888	5.907	8	4	silty clay to clay
21.654	13.15	0.2828	2.150	7.014	6	5	clayey silt to silty clay
21.818	15.16	0.2256	1.488	7.355	6	6	sandy silt to clayey silt
21.982	11.53	0.2489	2.160	7.813	6	5	clayey silt to silty clay
22.146	8.56	0.1955	2.283	9.937	5	4	silty clay to clay
22.310	7.74	0.1552	2.004	12.912	5	4	silty clay to clay
22.474	7.29	0.1454	1.995	15.242	5	4	silty clay to clay
22.638	7.33	0.1739	2.372	17.330	5	4	silty clay to clay
22.802	7.57	0.1415	1.869	20.827	5	4	silty clay to clay
22.966	7.01	0.1246	1.777	24.008	4	4	silty clay to clay
23.130	6.67	0.0955	1.433	26.648	3	1	sensitive fine grained
23.294	6.59	0.0975	1.478	28.467	3	1	sensitive fine grained
23.458	6.64	0.1017	1.531	31.152	4	4	silty clay to clay
23.622	6.70	0.1095	1.634	33.878	4	4	silty clay to clay
23.786	6.75	0.1231	1.824	36.023	4	4	silty clay to clay
23.950	6.82	0.1303	1.912	37.495	4	4	silty clay to clay
24.114	6.67	0.1428	2.141	38.660	4	4	silty clay to clay
24.278	7.03	0.1863	2.652	39.559	4	4	silty clay to clay
24.442	8.46	0.1991	2.354	39.161	5	4	silty clay to clay
24.606	8.85	0.2155	2.433	31.286	6	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
24.770	8.73	0.2150	2.463	31.241	6	4	silty clay to clay
24.934	9.37	0.2017	2.153	30.838	4	5	clayey silt to silty clay
25.098	8.89	0.1979	2.227	30.464	6	4	silty clay to clay
25.262	7.95	0.1774	2.231	33.854	5	4	silty clay to clay
25.427	7.48	0.1392	1.862	35.868	5	4	silty clay to clay
25.591	7.24	0.1236	1.707	37.805	5	4	silty clay to clay
25.755	6.94	0.1280	1.844	40.168	4	4	silty clay to clay
25.919	7.12	0.1292	1.813	41.595	5	4	silty clay to clay
26.083	7.12	0.1321	1.855	42.295	5	4	silty clay to clay
26.247	7.21	0.1367	1.896	42.971	5	4	silty clay to clay
26.411	7.57	0.1385	1.829	42.884	5	4	silty clay to clay
26.575	7.58	0.1325	1.748	42.484	4	5	clayey silt to silty clay
26.739	7.34	0.1332	1.815	43.505	5	4	silty clay to clay
26.903	7.43	0.1492	2.008	46.032	5	4	silty clay to clay
27.067	7.72	0.1712	2.219	47.293	5	4	silty clay to clay
27.231	7.79	0.2260	2.901	47.674	5	4	silty clay to clay
27.395	7.88	0.2496	3.168	48.801	8	3	clay
27.559	8.36	0.2578	3.084	43.819	5	4	silty clay to clay
27.723	8.15	0.2693	3.304	43.014	8	3	clay
27.887	8.95	0.2775	3.101	42.311	6	4	silty clay to clay
28.051	9.55	0.2613	2.736	38.742	6	4	silty clay to clay
28.215	8.86	0.2375	2.680	34.554	6	4	silty clay to clay
28.379	7.91	0.2225	2.813	34.257	5	4	silty clay to clay
28.543	7.52	0.2124	2.824	35.683	5	4	silty clay to clay
28.707	7.87	0.2185	2.777	36.553	5	4	silty clay to clay
28.871	8.87	0.2628	2.962	36.230	6	4	silty clay to clay
29.035	10.22	0.2735	2.677	35.084	7	4	silty clay to clay
29.199	12.48	0.3901	3.125	32.552	8	4	silty clay to clay
29.364	14.20	0.4470	3.149	32.490	9	4	silty clay to clay
29.528	13.82	0.2618	1.894	22.604	7	5	clayey silt to silty clay
29.692	14.06	0.2789	1.984	18.387	7	5	clayey silt to silty clay
29.856	11.15	0.2394	2.147	19.758	5	5	clayey silt to silty clay
30.020	12.61	0.2299	1.824	22.656	6	5	clayey silt to silty clay
30.184	10.28	0.2026	1.971	21.791	5	5	clayey silt to silty clay
30.348	10.61	0.2475	2.332	26.837	5	5	clayey silt to silty clay
30.512	10.34	0.2566	2.482	31.325	7	4	silty clay to clay
30.676	9.88	0.2622	2.655	31.838	6	4	silty clay to clay
30.840	10.99	0.2553	2.323	35.510	5	5	clayey silt to silty clay
31.004	10.81	0.2458	2.273	37.982	5	5	clayey silt to silty clay
31.168	9.66	0.2265	2.345	38.984	6	4	silty clay to clay
31.332	9.07	0.2332	2.571	39.674	6	4	silty clay to clay
31.496	8.65	0.2638	3.048	41.511	6	4	silty clay to clay
31.660	11.98	0.2604	2.173	39.305	6	5	clayey silt to silty clay
31.824	11.14	0.2461	2.210	32.562	5	5	clayey silt to silty clay
31.988	11.27	0.2312	2.050	33.796	5	5	clayey silt to silty clay
32.152	10.01	0.2329	2.325	34.429	6	4	silty clay to clay
32.316	9.61	0.3201	3.332	36.755	9	3	clay
32.480	10.14	0.3290	3.243	37.066	6	4	silty clay to clay
32.644	22.26	0.3537	1.589	30.354	9	6	sandy silt to clayey silt
32.808	25.06	0.3269	1.305	16.021	10	6	sandy silt to clayey silt
32.972	20.26	0.2899	1.430	13.518	8	6	sandy silt to clayey silt
33.136	16.67	0.4114	2.467	15.131	8	5	clayey silt to silty clay
33.301	14.14	0.4030	2.851	18.370	7	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
33.465	17.13	0.3640	2.125	23.145	8	5	clayey silt to silty clay
33.629	11.97	0.3281	2.741	26.118	8	4	silty clay to clay
33.793	10.70	0.3194	2.985	30.244	7	4	silty clay to clay
33.957	10.90	0.2940	2.697	38.291	7	4	silty clay to clay
34.121	10.45	0.2694	2.577	39.238	7	4	silty clay to clay
34.285	9.82	0.2504	2.550	41.290	6	4	silty clay to clay
34.449	9.53	0.2450	2.571	44.697	6	4	silty clay to clay
34.613	9.79	0.2428	2.481	47.746	6	4	silty clay to clay
34.777	9.60	0.2603	2.711	48.702	6	4	silty clay to clay
34.941	9.75	0.2838	2.912	49.947	6	4	silty clay to clay
35.105	10.20	0.2595	2.543	48.319	7	4	silty clay to clay
35.269	9.36	0.2260	2.415	43.124	6	4	silty clay to clay
35.433	8.87	0.2003	2.259	45.627	6	4	silty clay to clay
35.597	8.62	0.1801	2.090	48.223	6	4	silty clay to clay
35.761	8.23	0.1762	2.141	48.333	5	4	silty clay to clay
35.925	8.06	0.1482	1.840	47.533	4	5	clayey silt to silty clay
36.089	9.30	0.1317	1.416	43.481	4	5	clayey silt to silty clay
36.253	8.94	0.2047	2.290	40.516	6	4	silty clay to clay
36.417	9.21	0.2015	2.188	45.514	6	4	silty clay to clay
36.581	11.50	0.2490	2.165	42.575	6	5	clayey silt to silty clay
36.745	11.33	0.2700	2.384	40.998	5	5	clayey silt to silty clay
36.909	12.18	0.3184	2.613	40.724	6	5	clayey silt to silty clay
37.073	14.06	0.3236	2.302	37.620	7	5	clayey silt to silty clay
37.238	19.99	0.2491	1.246	27.717	8	6	sandy silt to clayey silt
37.402	26.96	0.2760	1.024	14.753	10	6	sandy silt to clayey silt
37.566	20.96	0.3893	1.857	11.181	8	6	sandy silt to clayey silt
37.730	17.71	0.3845	2.171	13.815	8	5	clayey silt to silty clay
37.894	18.46	0.2633	1.426	15.426	7	6	sandy silt to clayey silt
38.058	23.18	0.4096	1.767	16.865	9	6	sandy silt to clayey silt
38.222	17.39	0.2952	1.697	16.587	7	6	sandy silt to clayey silt
38.386	16.32	0.2965	1.817	19.631	8	5	clayey silt to silty clay
38.550	14.91	0.2886	1.936	22.695	7	5	clayey silt to silty clay
38.714	17.51	0.3853	2.201	24.255	8	5	clayey silt to silty clay
38.878	12.61	0.3375	2.676	28.177	6	5	clayey silt to silty clay
39.042	14.82	0.2651	1.789	30.503	7	5	clayey silt to silty clay
39.206	16.31	0.2107	1.292	32.555	6	6	sandy silt to clayey silt
39.370	19.90	0.3134	1.575	29.364	8	6	sandy silt to clayey silt
39.534	17.30	0.3840	2.219	22.676	8	5	clayey silt to silty clay
39.698	14.49	0.3599	2.484	26.526	7	5	clayey silt to silty clay
39.862	13.19	0.2246	1.702	30.095	6	5	clayey silt to silty clay
40.026	12.44	0.2241	1.801	33.168	6	5	clayey silt to silty clay
40.190	11.93	0.2246	1.883	37.730	6	5	clayey silt to silty clay
40.354	15.10	0.2297	1.521	40.449	6	6	sandy silt to clayey silt
40.518	27.42	0.3188	1.163	25.173	11	6	sandy silt to clayey silt
40.682	22.16	0.2987	1.348	17.970	8	6	sandy silt to clayey silt
40.846	15.88	0.2134	1.344	19.583	6	6	sandy silt to clayey silt
41.011	10.80	0.2833	2.624	23.246	7	4	silty clay to clay
41.175	13.50	0.2378	1.762	30.848	6	5	clayey silt to silty clay
41.339	23.98	0.2791	1.164	26.569	9	6	sandy silt to clayey silt
41.503	22.27	0.4339	1.948	24.591	9	6	sandy silt to clayey silt
41.667	17.56	0.3885	2.212	27.846	8	5	clayey silt to silty clay
41.831	19.92	0.3820	1.918	31.835	8	6	sandy silt to clayey silt
41.995	24.23	0.3315	1.368	25.226	9	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
42.159	24.08	0.4131	1.716	25.126	9	6	sandy silt to clayey silt
42.323	17.53	0.2977	1.698	35.453	7	6	sandy silt to clayey silt
42.487	29.87	0.4110	1.376	24.689	11	6	sandy silt to clayey silt
42.651	22.31	0.4829	2.165	20.508	9	6	sandy silt to clayey silt
42.815	19.86	0.4461	2.247	22.628	10	5	clayey silt to silty clay
42.979	19.82	0.2319	1.170	24.023	8	6	sandy silt to clayey silt
43.143	22.88	0.3906	1.707	22.824	9	6	sandy silt to clayey silt
43.307	18.86	0.3901	2.068	24.706	9	5	clayey silt to silty clay
43.471	19.33	0.2775	1.436	28.295	7	6	sandy silt to clayey silt
43.635	21.10	0.3636	1.723	27.070	8	6	sandy silt to clayey silt
43.799	15.61	0.3089	1.979	27.890	7	5	clayey silt to silty clay
43.963	16.83	0.3344	1.987	29.443	8	5	clayey silt to silty clay
44.127	16.14	0.2691	1.667	30.143	8	5	clayey silt to silty clay
44.291	16.56	0.2573	1.554	31.773	6	6	sandy silt to clayey silt
44.455	17.34	0.2022	1.166	34.477	7	6	sandy silt to clayey silt
44.619	15.38	0.2865	1.863	36.424	7	5	clayey silt to silty clay
44.783	13.35	0.2945	2.206	41.717	6	5	clayey silt to silty clay
44.948	23.95	0.3112	1.300	34.178	9	6	sandy silt to clayey silt
45.112	31.67	0.4264	1.346	29.261	12	6	sandy silt to clayey silt
45.276	27.68	0.5774	2.086	17.500	11	6	sandy silt to clayey silt
45.440	23.36	0.3639	1.558	22.326	9	6	sandy silt to clayey silt
45.604	41.33	0.5196	1.257	19.363	13	7	silty sand to sandy silt
45.768	30.36	0.6108	2.012	16.771	12	6	sandy silt to clayey silt
45.932	23.99	0.4771	1.988	22.887	9	6	sandy silt to clayey silt
46.096	24.85	0.5076	2.043	20.149	10	6	sandy silt to clayey silt
46.260	15.01	0.4232	2.820	23.093	7	5	clayey silt to silty clay
46.424	16.85	0.4007	2.379	34.947	8	5	clayey silt to silty clay
46.588	15.23	0.3188	2.094	33.307	7	5	clayey silt to silty clay
46.752	14.48	0.2998	2.071	37.670	7	5	clayey silt to silty clay
46.916	15.25	0.4655	3.052	40.820	7	5	clayey silt to silty clay
47.080	16.03	0.3296	2.056	41.062	8	5	clayey silt to silty clay
47.244	27.36	0.3729	1.363	23.970	10	6	sandy silt to clayey silt
47.408	22.88	0.4430	1.936	22.834	9	6	sandy silt to clayey silt
47.572	15.52	0.3901	2.513	28.192	7	5	clayey silt to silty clay
47.736	15.56	0.2214	1.423	34.144	6	6	sandy silt to clayey silt
47.900	17.96	0.2509	1.397	38.349	7	6	sandy silt to clayey silt
48.064	14.39	0.2796	1.943	38.680	7	5	clayey silt to silty clay
48.228	10.76	0.1903	1.769	47.403	5	5	clayey silt to silty clay
48.392	12.44	0.2273	1.827	53.377	6	5	clayey silt to silty clay
48.556	12.45	0.2303	1.850	58.574	6	5	clayey silt to silty clay
48.720	14.56	0.2387	1.639	49.191	7	5	clayey silt to silty clay
48.885	11.87	0.2280	1.921	57.443	6	5	clayey silt to silty clay
49.049	11.79	0.3007	2.550	57.265	6	5	clayey silt to silty clay
49.213	12.14	0.2547	2.098	64.817	6	5	clayey silt to silty clay
49.377	19.54	0.3578	1.831	47.370	7	6	sandy silt to clayey silt
49.541	14.17	0.3308	2.334	38.028	7	5	clayey silt to silty clay
49.705	15.24	0.2904	1.906	47.063	7	5	clayey silt to silty clay
49.869	11.69	0.2512	2.149	49.237	6	5	clayey silt to silty clay
50.033	14.13	0.2226	1.575	52.255	7	5	clayey silt to silty clay
50.197	11.09	0.1915	1.727	59.495	5	5	clayey silt to silty clay
50.361	11.71	0.1962	1.676	62.563	6	5	clayey silt to silty clay
50.525	11.41	0.1628	1.427	64.630	5	5	clayey silt to silty clay
50.689	11.46	0.1563	1.363	64.112	5	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
50.853	10.67	0.2233	2.093	66.679	5	5	clayey silt to silty clay
51.017	14.20	0.2396	1.687	68.178	7	5	clayey silt to silty clay
51.181	12.29	0.2286	1.860	49.525	6	5	clayey silt to silty clay
51.345	11.07	0.1738	1.571	58.361	5	5	clayey silt to silty clay
51.509	10.75	0.1688	1.570	64.088	5	5	clayey silt to silty clay
51.673	10.85	0.1681	1.549	68.372	5	5	clayey silt to silty clay
51.837	10.92	0.1722	1.576	69.129	5	5	clayey silt to silty clay
52.001	10.57	0.1621	1.533	69.885	5	5	clayey silt to silty clay
52.165	10.76	0.1645	1.529	71.189	5	5	clayey silt to silty clay
52.329	10.60	0.1781	1.680	71.342	5	5	clayey silt to silty clay
52.493	10.48	0.1606	1.532	73.087	5	5	clayey silt to silty clay
52.657	11.35	0.1645	1.449	68.252	5	5	clayey silt to silty clay
52.822	10.93	0.1774	1.623	71.857	5	5	clayey silt to silty clay
52.986	11.25	0.2053	1.825	72.459	5	5	clayey silt to silty clay
53.150	11.46	0.2394	2.090	71.344	5	5	clayey silt to silty clay
53.314	14.25	0.3060	2.148	65.531	7	5	clayey silt to silty clay
53.478	12.38	0.3413	2.757	63.213	8	4	silty clay to clay
53.642	11.53	0.3375	2.928	56.354	7	4	silty clay to clay
53.806	11.40	0.3081	2.704	67.720	7	4	silty clay to clay
53.970	11.46	0.2868	2.502	69.899	5	5	clayey silt to silty clay
54.134	11.25	0.2825	2.511	74.526	7	4	silty clay to clay
54.298	13.23	0.2764	2.089	72.991	6	5	clayey silt to silty clay
54.462	12.06	0.3031	2.514	61.269	6	5	clayey silt to silty clay
54.626	11.87	0.3020	2.545	68.489	6	5	clayey silt to silty clay
54.790	11.83	0.2653	2.244	71.030	6	5	clayey silt to silty clay
54.954	11.12	0.2683	2.412	71.074	5	5	clayey silt to silty clay
55.118	13.70	0.2636	1.925	70.640	7	5	clayey silt to silty clay
55.282	11.52	0.2248	1.952	58.735	6	5	clayey silt to silty clay
55.446	11.25	0.2461	2.187	75.508	5	5	clayey silt to silty clay
55.610	11.58	0.2697	2.328	72.452	6	5	clayey silt to silty clay
55.774	12.04	0.2803	2.329	73.538	6	5	clayey silt to silty clay
55.938	12.48	0.3516	2.819	61.271	8	4	silty clay to clay
56.102	16.98	0.5285	3.112	53.559	8	5	clayey silt to silty clay
56.266	21.84	0.4128	1.890	40.955	8	6	sandy silt to clayey silt
56.430	18.21	0.5217	2.866	48.038	9	5	clayey silt to silty clay
56.594	20.26	0.4483	2.213	39.535	10	5	clayey silt to silty clay
56.759	13.91	0.4802	3.453	46.986	9	4	silty clay to clay
56.923	16.08	0.3975	2.472	54.513	8	5	clayey silt to silty clay
57.087	21.86	0.3563	1.630	45.704	8	6	sandy silt to clayey silt
57.251	21.44	0.3469	1.618	44.229	8	6	sandy silt to clayey silt
57.415	21.00	0.3231	1.539	45.222	8	6	sandy silt to clayey silt
57.579	17.42	0.4475	2.569	46.593	8	5	clayey silt to silty clay
57.743	14.67	0.4433	3.022	61.173	9	4	silty clay to clay
57.907	21.15	0.3286	1.554	53.236	8	6	sandy silt to clayey silt
58.071	26.24	0.4172	1.590	47.525	10	6	sandy silt to clayey silt
58.235	25.47	0.5014	1.969	40.262	10	6	sandy silt to clayey silt
58.399	22.73	0.2944	1.295	42.182	9	6	sandy silt to clayey silt
58.563	43.98	0.6890	1.567	35.594	14	7	silty sand to sandy silt
58.727	33.77	0.7136	2.113	27.276	13	6	sandy silt to clayey silt
58.891	23.75	0.5149	2.167	34.079	9	6	sandy silt to clayey silt
59.055	32.24	0.4114	1.276	33.825	10	7	silty sand to sandy silt
59.219	32.15	0.6381	1.985	27.854	12	6	sandy silt to clayey silt
59.383	27.77	0.6553	2.359	33.602	11	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
59.547	34.30	0.5812	1.695	26.396	13	6	sandy silt to clayey silt
59.711	40.33	0.4623	1.146	23.809	13	7	silty sand to sandy silt
59.875	48.46	0.3538	0.730	21.091	15	7	silty sand to sandy silt
60.039	53.98	0.4922	0.912	18.416	17	7	silty sand to sandy silt
60.203	56.45	0.5174	0.917	20.300	18	7	silty sand to sandy silt
60.367	55.23	0.5106	0.925	20.916	18	7	silty sand to sandy silt
60.532	50.32	0.4969	0.987	19.298	16	7	silty sand to sandy silt
60.696	38.64	0.7841	2.029	20.187	15	6	sandy silt to clayey silt
60.860	31.41	0.9116	2.902	21.863	15	5	clayey silt to silty clay
61.024	24.66	0.9031	3.662	28.225	16	4	silty clay to clay
61.188	30.65	0.7659	2.499	32.471	12	6	sandy silt to clayey silt
61.352	32.84	0.8271	2.518	21.424	13	6	sandy silt to clayey silt
61.516	32.79	0.5200	1.586	21.738	13	6	sandy silt to clayey silt
61.680	41.35	0.3480	0.842	20.899	13	7	silty sand to sandy silt
61.844	51.65	0.4022	0.779	17.282	16	7	silty sand to sandy silt
62.008	38.92	0.6598	1.695	15.946	15	6	sandy silt to clayey silt
62.172	30.56	0.6356	2.080	20.719	12	6	sandy silt to clayey silt
62.336	43.98	0.5025	1.142	17.279	14	7	silty sand to sandy silt
62.500	52.06	0.4388	0.843	15.551	17	7	silty sand to sandy silt
62.664	54.79	0.3401	0.621	16.002	13	8	sand to silty sand
62.828	53.44	0.3775	0.706	16.088	13	8	sand to silty sand
62.992	49.15	0.4518	0.919	18.157	16	7	silty sand to sandy silt
63.156	44.73	0.6588	1.473	20.274	14	7	silty sand to sandy silt
63.320	35.57	0.3897	1.096	22.246	11	7	silty sand to sandy silt
63.484	28.50	0.5123	1.797	26.072	11	6	sandy silt to clayey silt
63.648	23.31	0.4728	2.029	38.229	9	6	sandy silt to clayey silt
63.812	18.68	0.6367	3.408	45.946	9	5	clayey silt to silty clay
63.976	28.48	0.5263	1.848	57.812	11	6	sandy silt to clayey silt
64.140	42.18	0.5549	1.316	34.305	13	7	silty sand to sandy silt
64.304	47.15	0.4592	0.974	24.344	15	7	silty sand to sandy silt
64.469	53.10	0.5125	0.965	20.353	17	7	silty sand to sandy silt
64.633	67.55	0.5632	0.834	19.238	16	8	sand to silty sand
64.797	77.44	0.4091	0.528	16.702	19	8	sand to silty sand
64.961	77.12	0.6715	0.871	13.432	18	8	sand to silty sand
65.125	69.76	0.6678	0.957	15.714	17	8	sand to silty sand
65.289	84.93	0.5102	0.601	19.957	20	8	sand to silty sand
65.453	89.65	0.5688	0.635	20.113	21	8	sand to silty sand
65.617	81.57	0.6508	0.798	22.812	20	8	sand to silty sand
65.781	79.05	0.6184	0.782	24.186	19	8	sand to silty sand
65.945	82.72	0.6252	0.756	25.368	20	8	sand to silty sand
66.109	95.33	0.6609	0.693	26.818	23	8	sand to silty sand
66.273	102.85	0.6610	0.643	26.969	25	8	sand to silty sand
66.437	96.43	0.6358	0.659	27.122	23	8	sand to silty sand
66.601	84.36	0.5944	0.705	26.998	20	8	sand to silty sand
66.765	76.78	0.5327	0.694	26.844	18	8	sand to silty sand
66.929	73.73	0.4906	0.665	27.331	18	8	sand to silty sand
67.093	67.74	0.4982	0.735	27.238	16	8	sand to silty sand
67.257	62.84	0.4952	0.788	27.480	15	8	sand to silty sand
67.421	68.02	0.5165	0.759	27.578	16	8	sand to silty sand
67.585	92.72	0.6485	0.699	28.194	22	8	sand to silty sand
67.749	106.49	0.8160	0.766	27.772	25	8	sand to silty sand
67.913	116.43	0.9119	0.783	28.026	28	8	sand to silty sand
68.077	121.07	0.8929	0.738	27.751	29	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
68.241	124.50	0.8964	0.720	28.096	30	8	sand to silty sand
68.406	114.35	0.8188	0.716	27.921	27	8	sand to silty sand
68.570	93.58	0.6936	0.741	27.686	22	8	sand to silty sand
68.734	88.07	0.5815	0.660	27.825	21	8	sand to silty sand
68.898	85.28	0.5287	0.620	27.988	20	8	sand to silty sand
69.062	81.98	0.4928	0.601	28.194	20	8	sand to silty sand
69.226	81.06	0.4774	0.589	28.290	19	8	sand to silty sand
69.390	79.08	0.4620	0.584	28.347	19	8	sand to silty sand
69.554	77.37	0.4372	0.565	28.364	19	8	sand to silty sand
69.718	76.83	0.4314	0.561	28.474	18	8	sand to silty sand
69.882	79.46	0.4858	0.611	28.630	19	8	sand to silty sand
70.046	96.66	0.5450	0.564	28.966	23	8	sand to silty sand
70.210	121.60	0.6649	0.547	29.035	23	9	sand
70.374	124.40	0.7464	0.600	29.232	24	9	sand
70.538	118.58	0.7427	0.626	29.160	23	9	sand
70.702	115.05	0.7287	0.633	29.064	28	8	sand to silty sand
70.866	115.14	0.6821	0.592	29.146	22	9	sand
71.030	119.60	0.6793	0.568	29.364	23	9	sand
71.194	131.27	0.7118	0.542	29.515	25	9	sand
71.358	137.27	0.7705	0.561	29.690	26	9	sand
71.522	143.02	0.8334	0.583	29.640	27	9	sand
71.686	139.71	0.8152	0.584	29.680	27	9	sand
71.850	130.41	0.7228	0.554	29.254	25	9	sand
72.014	127.57	0.6796	0.533	29.714	24	9	sand
72.178	135.36	0.7259	0.536	29.848	26	9	sand
72.343	148.44	0.8076	0.544	30.033	28	9	sand
72.507	137.45	0.8370	0.609	30.229	26	9	sand
72.671	130.68	0.8859	0.678	30.594	25	9	sand
72.835	131.34	0.8993	0.685	29.997	25	9	sand
72.999	135.05	0.9721	0.720	30.469	26	9	sand
73.163	138.61	0.9103	0.657	30.299	27	9	sand
73.327	145.91	0.8514	0.583	30.383	28	9	sand
73.491	151.14	0.8308	0.550	30.272	29	9	sand
73.655	153.82	0.8921	0.580	30.783	29	9	sand
73.819	154.89	0.9676	0.625	30.963	30	9	sand
73.983	154.28	0.9436	0.612	31.037	30	9	sand
74.147	139.06	0.8662	0.623	30.546	27	9	sand
74.311	142.95	0.8236	0.576	30.553	27	9	sand
74.475	150.29	0.8610	0.573	31.119	29	9	sand
74.639	156.23	0.8681	0.556	30.872	30	9	sand
74.803	144.60	0.7857	0.543	30.953	28	9	sand
74.967	132.64	0.7234	0.545	30.419	25	9	sand
75.131	140.58	0.7732	0.550	31.102	27	9	sand
75.295	138.97	0.7670	0.552	31.289	27	9	sand
75.459	131.97	0.7325	0.555	31.589	25	9	sand
75.623	136.33	0.7550	0.554	31.234	26	9	sand
75.787	150.72	0.7600	0.504	31.850	29	9	sand
75.951	148.77	0.8250	0.555	31.790	28	9	sand
76.115	147.73	0.7757	0.525	31.692	28	9	sand
76.280	136.02	0.7408	0.545	31.366	26	9	sand
76.444	139.90	0.7973	0.570	31.962	27	9	sand
76.608	141.53	0.7920	0.560	32.037	27	9	sand
76.772	136.90	0.8069	0.589	31.725	26	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
76.936	138.64	0.8034	0.579	31.905	27	9	sand
77.100	144.58	0.7666	0.530	32.030	28	9	sand
77.264	150.85	0.7903	0.524	32.137	29	9	sand
77.428	148.40	0.7785	0.525	32.291	28	9	sand
77.592	142.56	0.7459	0.523	32.006	27	9	sand
77.756	142.37	0.7319	0.514	31.790	27	9	sand
77.920	130.86	0.6869	0.525	32.020	25	9	sand
78.084	113.00	0.6796	0.601	31.416	27	8	sand to silty sand
78.248	108.04	0.5698	0.527	31.581	21	9	sand
78.412	108.13	0.6016	0.556	31.632	26	8	sand to silty sand
78.576	122.04	0.5845	0.479	32.392	23	9	sand
78.740	116.34	0.5663	0.487	32.289	22	9	sand
78.904	110.47	0.5991	0.542	32.514	21	9	sand
79.068	130.78	0.6591	0.504	33.087	25	9	sand
79.232	151.32	0.7999	0.529	33.602	29	9	sand
79.396	158.72	0.8457	0.533	33.111	30	9	sand
79.560	150.33	0.7779	0.517	33.319	29	9	sand
79.724	145.98	0.7592	0.520	32.998	28	9	sand
79.888	150.48	0.7307	0.486	33.367	29	9	sand
80.052	148.44	0.7388	0.498	33.341	28	9	sand
80.217	144.90	0.7775	0.537	33.288	28	9	sand
80.381	144.79	0.8329	0.575	33.199	28	9	sand
80.545	141.87	0.7947	0.560	33.626	27	9	sand
80.709	151.65	0.7899	0.521	33.588	29	9	sand
80.873	168.57	0.8633	0.512	34.110	32	9	sand
81.037	170.20	0.9599	0.564	34.264	33	9	sand
81.201	163.07	0.9180	0.563	33.753	31	9	sand
81.365	157.01	0.8779	0.559	33.720	30	9	sand
81.529	152.74	0.8875	0.581	33.700	29	9	sand
81.693	149.27	0.8441	0.565	33.926	29	9	sand
81.857	155.19	0.8517	0.549	33.233	30	9	sand
82.021	142.45	0.8135	0.571	34.470	27	9	sand
82.185	144.94	0.8026	0.554	34.024	28	9	sand
82.349	159.38	0.8292	0.520	34.245	31	9	sand
82.513	158.96	0.8674	0.546	34.681	30	9	sand
82.677	156.56	0.8998	0.575	34.389	30	9	sand
82.841	140.94	0.8745	0.620	34.360	27	9	sand
83.005	126.25	0.7087	0.561	33.962	24	9	sand
83.169	133.64	0.7102	0.531	33.868	26	9	sand
83.333	116.59	0.7143	0.613	34.249	22	9	sand
83.497	109.66	0.6783	0.619	34.106	26	8	sand to silty sand
83.661	109.20	0.6230	0.571	34.120	26	8	sand to silty sand
83.825	109.97	0.5982	0.544	34.245	21	9	sand
83.990	105.88	0.5888	0.556	34.386	25	8	sand to silty sand
84.154	102.53	0.5665	0.552	34.353	25	8	sand to silty sand
84.318	102.84	0.5513	0.536	34.525	25	8	sand to silty sand
84.482	111.94	0.5477	0.489	34.794	21	9	sand
84.646	97.57	0.5062	0.519	34.285	23	8	sand to silty sand
84.810	86.44	0.4696	0.543	34.518	21	8	sand to silty sand
84.974	86.53	0.5259	0.608	34.559	21	8	sand to silty sand
85.138	105.88	0.5609	0.530	35.393	25	8	sand to silty sand
85.302	106.06	0.5714	0.539	35.501	25	8	sand to silty sand
85.466	116.47	0.6300	0.541	35.659	22	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
85.630	135.86	0.6941	0.511	35.906	26	9	sand
85.794	144.17	0.6991	0.485	35.827	28	9	sand
85.958	144.92	0.7688	0.531	36.035	28	9	sand
86.122	144.48	0.7601	0.526	36.095	28	9	sand
86.286	136.15	0.7546	0.554	35.609	26	9	sand
86.450	128.54	0.6776	0.527	35.609	25	9	sand
86.614	118.54	0.6437	0.543	35.798	23	9	sand
86.778	112.17	0.6055	0.540	35.791	21	9	sand
86.942	108.77	0.5467	0.503	35.709	21	9	sand
87.106	118.36	0.5785	0.489	36.059	23	9	sand
87.270	134.02	0.6231	0.465	36.405	26	9	sand
87.434	119.07	0.6478	0.544	36.136	23	9	sand
87.598	106.97	0.6005	0.561	35.940	26	8	sand to silty sand
87.762	93.82	0.5218	0.556	35.875	22	8	sand to silty sand
87.927	93.48	0.5157	0.552	36.004	22	8	sand to silty sand
88.091	95.13	0.5254	0.552	36.465	23	8	sand to silty sand
88.255	98.85	0.5356	0.542	36.412	24	8	sand to silty sand
88.419	108.49	0.5858	0.540	36.752	21	9	sand
88.583	120.54	0.6052	0.502	36.843	23	9	sand
88.747	104.70	0.5472	0.523	36.716	25	8	sand to silty sand
88.911	94.73	0.4906	0.518	36.313	23	8	sand to silty sand
89.075	106.48	0.5211	0.489	36.970	20	9	sand
89.239	103.31	0.5375	0.520	37.246	25	8	sand to silty sand
89.403	89.32	0.5050	0.565	36.644	21	8	sand to silty sand
89.567	85.11	0.4782	0.562	36.604	20	8	sand to silty sand
89.731	89.71	0.4349	0.485	37.114	21	8	sand to silty sand
89.895	93.30	0.4506	0.483	37.289	22	8	sand to silty sand
90.059	89.06	0.4749	0.533	37.337	21	8	sand to silty sand
90.223	85.32	0.4519	0.530	37.328	20	8	sand to silty sand
90.551	81.73	0.4250	0.520	37.246	20	8	sand to silty sand
90.715	80.78	0.4336	0.537	37.431	19	8	sand to silty sand
90.879	80.82	0.4407	0.545	37.613	19	8	sand to silty sand
91.043	81.66	0.4468	0.547	37.752	20	8	sand to silty sand
91.207	82.02	0.4526	0.552	37.776	20	8	sand to silty sand
91.371	82.47	0.4616	0.560	37.936	20	8	sand to silty sand
91.535	83.99	0.4723	0.562	38.023	20	8	sand to silty sand
91.699	86.14	0.4754	0.552	38.126	21	8	sand to silty sand
91.864	87.74	0.4783	0.545	38.159	21	8	sand to silty sand
92.028	88.81	0.4893	0.551	38.222	21	8	sand to silty sand
92.192	93.73	0.5202	0.555	38.454	22	8	sand to silty sand
92.356	100.39	0.5431	0.541	38.500	24	8	sand to silty sand
92.520	113.12	0.5920	0.523	38.687	22	9	sand
92.684	115.78	0.6181	0.534	38.675	22	9	sand
92.848	112.63	0.5461	0.485	38.708	22	9	sand
93.012	89.31	0.4977	0.557	38.282	21	8	sand to silty sand
93.176	82.97	0.4556	0.549	38.598	20	8	sand to silty sand
93.340	80.66	0.4299	0.533	38.553	19	8	sand to silty sand
93.504	81.06	0.4286	0.529	38.684	19	8	sand to silty sand
93.668	80.91	0.4273	0.528	38.768	19	8	sand to silty sand
93.832	84.58	0.4250	0.502	39.020	20	8	sand to silty sand
93.996	99.61	0.4766	0.479	39.416	24	8	sand to silty sand
94.160	110.93	0.5562	0.501	39.444	21	9	sand
94.324	120.44	0.6247	0.519	39.715	23	9	sand

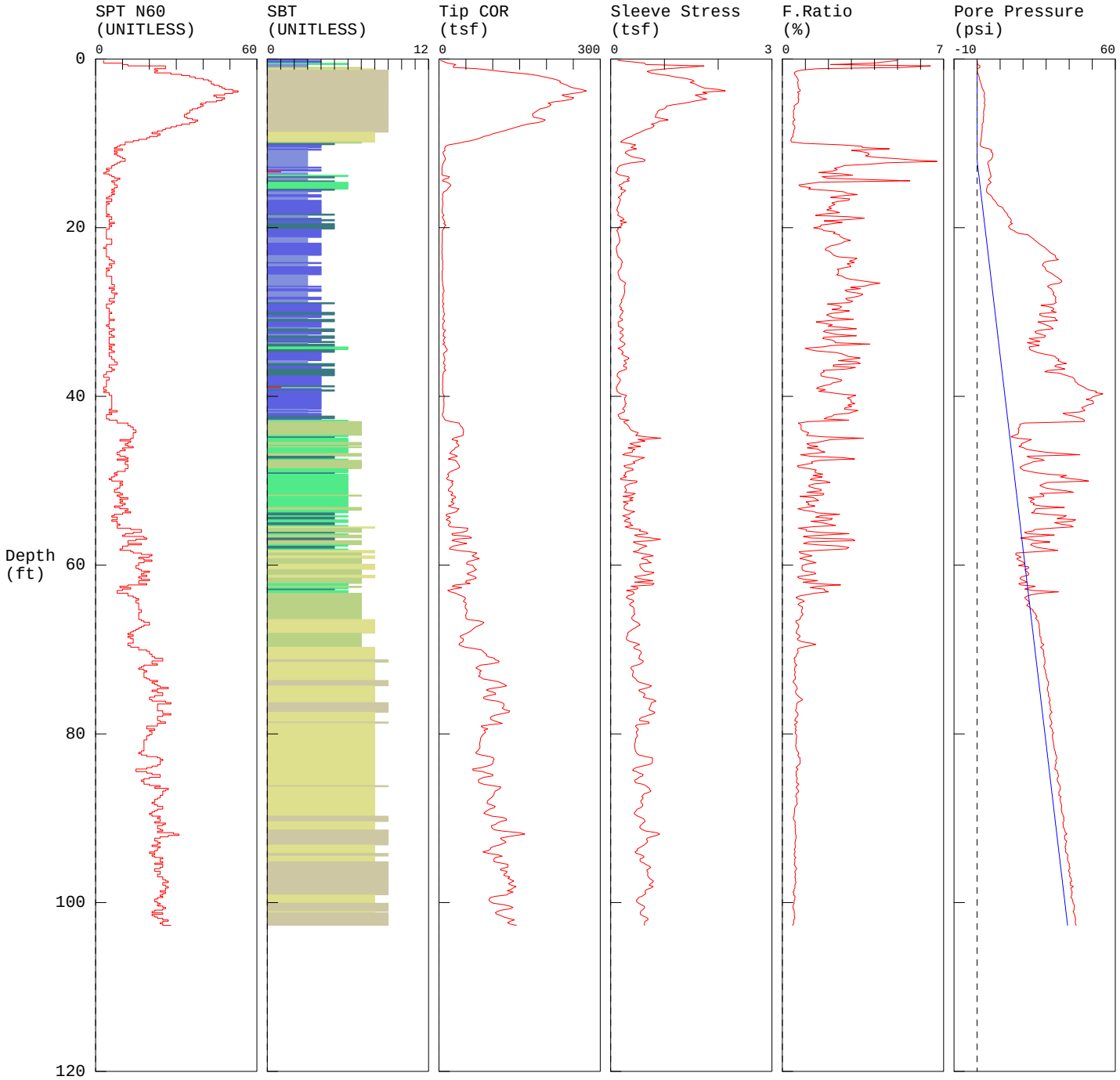
Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
94.488	115.63	0.6405	0.554	39.619	22	9	sand
94.652	112.93	0.6046	0.535	39.267	22	9	sand
94.816	118.94	0.6014	0.506	39.502	23	9	sand
94.980	112.78	0.5943	0.527	39.521	22	9	sand
95.144	104.19	0.5559	0.533	39.533	25	8	sand to silty sand
95.308	105.85	0.5517	0.521	39.878	25	8	sand to silty sand
95.472	119.08	0.5736	0.482	39.694	23	9	sand
95.636	117.88	0.5799	0.492	40.012	23	9	sand
95.801	100.86	0.5416	0.537	39.533	24	8	sand to silty sand
95.965	92.07	0.4814	0.523	39.543	22	8	sand to silty sand
96.129	87.08	0.4443	0.510	39.811	21	8	sand to silty sand
96.293	85.68	0.4359	0.509	40.041	21	8	sand to silty sand
96.457	84.64	0.4383	0.518	40.144	20	8	sand to silty sand
96.621	84.70	0.4322	0.510	40.245	20	8	sand to silty sand
96.785	84.87	0.4305	0.507	40.307	20	8	sand to silty sand
96.949	85.76	0.4506	0.525	40.370	21	8	sand to silty sand
97.113	86.23	0.4617	0.536	40.497	21	8	sand to silty sand
97.277	92.04	0.4971	0.540	40.705	22	8	sand to silty sand
97.441	109.72	0.5609	0.511	41.031	21	9	sand
97.605	139.32	0.6518	0.468	41.669	27	9	sand
97.769	158.13	0.7617	0.482	41.388	30	9	sand
97.933	163.77	0.8216	0.502	41.127	31	9	sand
98.097	148.42	0.8213	0.553	41.209	28	9	sand
98.261	132.92	0.7525	0.566	40.842	25	9	sand
98.425	128.23	0.6962	0.543	40.902	25	9	sand
98.589	128.59	0.6552	0.510	41.065	25	9	sand
98.753	132.52	0.6280	0.474	41.060	25	9	sand
98.917	113.76	0.5927	0.521	41.158	22	9	sand
99.081	100.34	0.5553	0.553	40.859	24	8	sand to silty sand
99.245	94.82	0.5061	0.534	41.019	23	8	sand to silty sand
99.409	92.39	0.4756	0.515	41.252	22	8	sand to silty sand
99.573	90.39	0.4943	0.547	41.386	22	8	sand to silty sand
99.738	97.66	0.5188	0.531	41.901	23	8	sand to silty sand
99.902	119.24	0.6004	0.504	42.314	23	9	sand
100.066	142.72	0.6807	0.477	42.491	27	9	sand
100.230	147.10	0.7113	0.484	42.508	28	9	sand
100.394	132.21	0.7061	0.534	41.652	25	9	sand
100.558	116.64	0.6730	0.577	41.717	22	9	sand
100.722	107.30	0.6427	0.599	41.523	26	8	sand to silty sand
100.886	102.48	0.5792	0.565	41.753	25	8	sand to silty sand
101.050	100.59	0.5518	0.549	41.964	24	8	sand to silty sand
101.214	99.89	0.5488	0.549	42.144	24	8	sand to silty sand
101.378	102.89	0.5526	0.537	42.309	25	8	sand to silty sand
101.542	109.13	0.5963	0.546	42.671	21	9	sand
101.706	126.59	0.7119	0.562	42.877	24	9	sand
101.870	160.94	0.7981	0.496	43.186	31	9	sand
102.034	158.20	0.8413	0.532	42.633	30	9	sand
102.198	153.09	0.8481	0.554	42.841	29	9	sand
102.362	156.42	0.8679	0.555	43.409	30	9	sand
102.526	163.49	0.8602	0.526	43.476	31	9	sand
102.690	196.96	0.8602	0.437	43.731	38	9	sand

GRI / CPT-22 / PDX Runway Evaluation

TEST DATE: 4/26/2017 10:19:28 AM
HOLE NUMBER: CPT-22

CUSTOMER: 17058/ GRI/ CPT-22/ PDX
OPERATOR: OGE BJB

CONE ID: DPG1386
LOCATION: 17058/ GRI/ CPT-22/ PDX
JOB NUMBER: 17058/ GRI/ CPT-22/ PDX
TEST DATE: 4/26/2017 10:19:28 AM
TOTAL DEPTH: 102.690 ft



TOTAL DEPTH: 102.690 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

GRI / CPT-22 / PDX Runway Evaluation

OPERATOR: OGE BJB
TEST DATE: 4/26/2017 10:19:28 AM
COMMENT: GRI / CPT-22 / PDX Runway Evaluation
FILENAME: 17058 CPT-22.cpt
TOTAL DEPTH: 102.690 ft

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
0.164	2.63	0.1313	4.999	0.014	3	3	clay
0.492	16.04	0.6327	3.944	0.137	10	4	silty clay to clay
0.656	31.18	0.6503	2.086	0.189	12	6	sandy silt to clayey silt
0.820	26.98	1.7344	6.427	1.230	26	3	clay
0.984	26.80	1.3995	5.222	1.189	26	3	clay
1.148	69.01	1.0769	1.561	0.127	22	7	silty sand to sandy silt
1.312	94.82	0.7867	0.830	0.153	23	8	sand to silty sand
1.476	114.79	0.6788	0.591	0.062	22	9	sand
1.640	144.76	0.7408	0.512	0.254	28	9	sand
1.804	168.99	0.8916	0.528	0.506	32	9	sand
1.969	184.15	1.0737	0.583	0.702	35	9	sand
2.133	195.61	1.1972	0.612	0.841	37	9	sand
2.297	209.83	1.3919	0.663	1.024	40	9	sand
2.461	219.08	1.5056	0.687	1.120	42	9	sand
2.625	225.68	1.5534	0.688	1.318	43	9	sand
2.789	224.84	1.4773	0.657	1.505	43	9	sand
2.953	231.80	1.5704	0.677	1.700	44	9	sand
3.117	238.93	1.6149	0.676	1.901	46	9	sand
3.281	242.84	1.6755	0.690	2.078	47	9	sand
3.445	251.33	1.7425	0.693	2.205	48	9	sand
3.609	265.53	2.0023	0.754	2.508	51	9	sand
3.773	274.18	2.1336	0.778	2.817	53	9	sand
3.937	265.10	1.7159	0.647	3.085	51	9	sand
4.101	248.69	1.7906	0.720	3.311	48	9	sand
4.265	228.81	1.5727	0.687	3.045	44	9	sand
4.429	234.48	1.6415	0.700	2.970	45	9	sand
4.593	250.50	1.6834	0.672	3.260	48	9	sand
4.757	247.44	1.7878	0.723	3.308	47	9	sand
4.921	233.22	1.6045	0.688	3.299	45	9	sand
5.085	213.06	1.4917	0.700	3.239	41	9	sand
5.249	203.16	1.3601	0.669	3.025	39	9	sand
5.413	208.31	1.1781	0.566	3.361	40	9	sand
5.577	205.53	1.0333	0.503	3.311	39	9	sand
5.741	199.67	1.0284	0.515	3.203	38	9	sand
5.906	188.39	0.9972	0.529	2.989	36	9	sand
6.070	184.23	0.9015	0.489	2.963	35	9	sand
6.234	180.24	0.8676	0.481	2.841	35	9	sand
6.398	176.33	0.8665	0.491	2.822	34	9	sand
6.562	173.76	0.8426	0.485	2.867	33	9	sand
6.726	174.88	0.8383	0.479	2.877	33	9	sand
6.890	175.72	0.8298	0.472	2.776	34	9	sand
7.054	189.14	0.9573	0.506	2.752	36	9	sand
7.218	197.68	1.0677	0.540	2.798	38	9	sand
7.382	193.90	0.8953	0.462	2.757	37	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
7.546	183.11	0.8665	0.473	2.594	35	9	sand
7.710	165.37	0.7552	0.457	2.170	32	9	sand
7.874	154.72	0.8095	0.523	2.225	30	9	sand
8.038	146.00	0.7915	0.542	2.203	28	9	sand
8.202	137.37	0.7457	0.543	2.193	26	9	sand
8.366	128.81	0.6566	0.510	2.167	25	9	sand
8.530	120.29	0.5921	0.492	2.158	23	9	sand
8.694	110.59	0.5505	0.498	2.040	21	9	sand
8.858	99.93	0.4713	0.472	1.978	24	8	sand to silty sand
9.022	94.10	0.4233	0.450	1.971	23	8	sand to silty sand
9.186	83.28	0.3883	0.466	1.896	20	8	sand to silty sand
9.350	77.49	0.3081	0.398	1.843	19	8	sand to silty sand
9.514	68.88	0.2580	0.374	1.745	16	8	sand to silty sand
9.678	59.10	0.2136	0.361	1.642	14	8	sand to silty sand
9.843	46.30	0.1866	0.403	1.522	11	8	sand to silty sand
10.007	34.75	0.3227	0.929	1.422	11	7	silty sand to sandy silt
10.171	18.13	0.4632	2.556	1.297	9	5	clayey silt to silty clay
10.335	12.12	0.4193	3.461	1.664	8	4	silty clay to clay
10.499	10.95	0.3797	3.469	2.841	7	4	silty clay to clay
10.663	10.32	0.4793	4.644	5.185	10	3	clay
10.827	11.21	0.3362	3.001	6.432	7	4	silty clay to clay
10.991	8.05	0.2801	3.480	6.070	8	3	clay
11.155	7.29	0.2724	3.738	6.712	7	3	clay
11.319	8.48	0.3193	3.764	6.878	8	3	clay
11.483	9.89	0.3569	3.608	6.765	9	3	clay
11.647	10.81	0.4348	4.022	6.612	10	3	clay
11.811	11.81	0.5838	4.943	6.381	11	3	clay
11.975	11.33	0.6427	5.671	5.859	11	3	clay
12.139	9.15	0.6151	6.720	4.965	9	3	clay
12.303	8.47	0.3829	4.521	4.598	8	3	clay
12.467	6.89	0.2648	3.846	4.629	7	3	clay
12.631	6.40	0.1730	2.703	5.017	6	3	clay
12.795	5.76	0.1437	2.494	5.099	6	3	clay
12.959	5.53	0.1253	2.265	5.252	4	4	silty clay to clay
13.123	5.37	0.1280	2.386	5.391	5	3	clay
13.287	5.53	0.1184	2.142	5.528	4	4	silty clay to clay
13.451	5.93	0.0938	1.582	5.626	3	1	sensitive fine grained
13.615	5.08	0.1329	2.616	5.751	5	3	clay
13.780	5.81	0.1770	3.044	5.972	6	3	clay
13.944	19.03	0.3283	1.725	6.077	7	6	sandy silt to clayey silt
14.108	17.90	0.3449	1.927	5.542	9	5	clayey silt to silty clay
14.272	8.52	0.3052	3.583	4.936	8	3	clay
14.436	6.20	0.3433	5.534	5.348	6	3	clay
14.600	14.84	0.2365	1.594	6.106	7	5	clayey silt to silty clay
14.764	18.98	0.2232	1.176	5.619	7	6	sandy silt to clayey silt
14.928	21.73	0.1552	0.714	4.596	8	6	sandy silt to clayey silt
15.092	21.24	0.1647	0.776	4.509	8	6	sandy silt to clayey silt
15.256	17.25	0.2114	1.226	4.238	7	6	sandy silt to clayey silt
15.420	16.36	0.1865	1.140	4.111	6	6	sandy silt to clayey silt
15.584	13.83	0.2791	2.019	4.037	7	5	clayey silt to silty clay
15.748	9.25	0.2463	2.662	4.138	6	4	silty clay to clay
15.912	6.92	0.1956	2.827	4.677	7	3	clay
16.076	6.33	0.2067	3.265	5.485	6	3	clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.240	7.18	0.1787	2.487	6.178	5	4	silty clay to clay
16.404	6.66	0.1400	2.101	6.609	4	4	silty clay to clay
16.568	6.13	0.1790	2.919	6.880	6	3	clay
16.732	6.26	0.1799	2.872	7.563	6	3	clay
16.896	6.96	0.1669	2.399	7.992	4	4	silty clay to clay
17.060	7.40	0.1593	2.152	8.429	5	4	silty clay to clay
17.224	6.81	0.1555	2.282	8.745	4	4	silty clay to clay
17.388	6.63	0.1421	2.143	9.217	4	4	silty clay to clay
17.552	6.37	0.1278	2.006	10.888	4	4	silty clay to clay
17.717	6.04	0.1284	2.127	11.243	4	4	silty clay to clay
17.881	5.76	0.1111	1.927	11.617	4	4	silty clay to clay
18.045	5.61	0.1277	2.279	11.986	4	4	silty clay to clay
18.209	5.76	0.1433	2.485	12.624	4	4	silty clay to clay
18.373	7.59	0.1355	1.786	13.096	5	4	silty clay to clay
18.537	9.22	0.1325	1.437	13.271	4	5	clayey silt to silty clay
18.701	6.25	0.1808	2.890	13.640	6	3	clay
18.865	6.33	0.2251	3.558	14.319	6	3	clay
19.029	8.46	0.2481	2.934	14.748	5	4	silty clay to clay
19.193	9.80	0.1778	1.815	14.887	5	5	clayey silt to silty clay
19.357	11.32	0.2942	2.599	14.487	7	4	silty clay to clay
19.521	8.57	0.1875	2.189	15.318	5	4	silty clay to clay
19.685	12.74	0.2132	1.673	14.134	6	5	clayey silt to silty clay
19.849	10.59	0.1756	1.659	13.609	5	5	clayey silt to silty clay
20.013	9.64	0.1305	1.354	14.012	5	5	clayey silt to silty clay
20.177	8.08	0.1393	1.724	14.503	4	5	clayey silt to silty clay
20.341	6.22	0.1108	1.783	15.968	4	4	silty clay to clay
20.505	5.93	0.1356	2.288	16.805	4	4	silty clay to clay
20.669	6.14	0.1365	2.223	18.154	4	4	silty clay to clay
20.833	5.86	0.1446	2.470	22.028	4	4	silty clay to clay
20.997	6.00	0.1497	2.493	22.843	4	4	silty clay to clay
21.161	6.19	0.1599	2.585	23.690	4	4	silty clay to clay
21.325	6.05	0.1655	2.737	24.469	6	3	clay
21.490	5.86	0.1737	2.966	25.027	6	3	clay
21.654	6.13	0.1648	2.686	25.821	6	3	clay
21.818	6.05	0.1565	2.586	26.593	6	3	clay
21.982	5.91	0.1411	2.386	27.348	4	4	silty clay to clay
22.146	5.53	0.1163	2.101	28.268	4	4	silty clay to clay
22.310	5.47	0.1082	1.978	29.302	3	4	silty clay to clay
22.474	5.61	0.1052	1.875	29.843	4	4	silty clay to clay
22.638	5.76	0.1073	1.864	30.620	4	4	silty clay to clay
22.802	5.51	0.1128	2.048	31.229	4	4	silty clay to clay
22.966	5.51	0.1168	2.120	31.859	4	4	silty clay to clay
23.130	5.64	0.1230	2.181	32.907	4	4	silty clay to clay
23.294	5.99	0.1345	2.245	33.935	4	4	silty clay to clay
23.458	5.57	0.1360	2.443	34.039	5	3	clay
23.622	5.40	0.1748	3.236	34.257	5	3	clay
23.786	6.20	0.1940	3.129	35.309	6	3	clay
23.950	7.20	0.2097	2.913	31.104	7	3	clay
24.114	7.04	0.2196	3.120	29.067	7	3	clay
24.278	7.08	0.1993	2.815	28.659	5	4	silty clay to clay
24.442	6.72	0.1972	2.933	28.273	6	3	clay
24.606	6.65	0.1977	2.974	29.045	6	3	clay
24.770	7.02	0.1865	2.657	29.721	4	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
24.934	7.17	0.1712	2.389	29.620	5	4	silty clay to clay
25.098	5.90	0.1441	2.443	30.148	4	4	silty clay to clay
25.262	5.57	0.1348	2.419	31.282	4	4	silty clay to clay
25.427	5.72	0.1391	2.430	32.492	4	4	silty clay to clay
25.591	6.11	0.1444	2.363	33.281	4	4	silty clay to clay
25.755	6.01	0.1582	2.632	34.007	6	3	clay
25.919	6.01	0.1617	2.692	35.124	6	3	clay
26.083	5.98	0.1742	2.914	35.748	6	3	clay
26.247	6.06	0.2026	3.342	36.652	6	3	clay
26.411	6.61	0.2475	3.744	36.680	6	3	clay
26.575	6.53	0.2773	4.244	35.748	6	3	clay
26.739	6.95	0.2657	3.825	32.073	7	3	clay
26.903	7.03	0.2527	3.595	30.642	7	3	clay
27.067	8.49	0.2517	2.965	30.884	5	4	silty clay to clay
27.231	7.48	0.2529	3.380	32.214	7	3	clay
27.395	9.52	0.2590	2.721	32.526	6	4	silty clay to clay
27.559	9.34	0.2620	2.805	32.955	6	4	silty clay to clay
27.723	7.84	0.2542	3.242	33.396	8	3	clay
27.887	7.17	0.2502	3.491	32.905	7	3	clay
28.051	7.19	0.2440	3.396	33.497	7	3	clay
28.215	7.29	0.2275	3.120	34.247	7	3	clay
28.379	8.20	0.2255	2.750	33.983	5	4	silty clay to clay
28.543	7.09	0.1991	2.809	34.146	5	4	silty clay to clay
28.707	6.88	0.2102	3.056	33.976	7	3	clay
28.871	6.78	0.1988	2.931	34.403	6	3	clay
29.035	9.32	0.1820	1.953	33.360	4	5	clayey silt to silty clay
29.199	7.00	0.1678	2.395	27.700	4	4	silty clay to clay
29.364	6.68	0.1714	2.565	31.135	4	4	silty clay to clay
29.528	8.14	0.2031	2.494	33.147	5	4	silty clay to clay
29.692	8.47	0.1823	2.153	33.295	5	4	silty clay to clay
29.856	8.05	0.2341	2.906	32.277	5	4	silty clay to clay
30.020	8.71	0.2215	2.541	34.384	6	4	silty clay to clay
30.184	10.17	0.2102	2.066	27.264	5	5	clayey silt to silty clay
30.348	9.71	0.1865	1.920	27.180	5	5	clayey silt to silty clay
30.512	8.37	0.1753	2.095	28.733	5	4	silty clay to clay
30.676	7.81	0.1715	2.196	33.907	5	4	silty clay to clay
30.840	7.18	0.2219	3.089	34.096	7	3	clay
31.004	10.34	0.2146	2.076	34.949	5	5	clayey silt to silty clay
31.168	9.51	0.1399	1.471	26.415	5	5	clayey silt to silty clay
31.332	7.50	0.1362	1.816	28.184	5	4	silty clay to clay
31.496	6.78	0.1469	2.165	29.812	4	4	silty clay to clay
31.660	7.10	0.1411	1.988	31.409	5	4	silty clay to clay
31.824	7.33	0.1914	2.610	32.236	5	4	silty clay to clay
31.988	7.18	0.2309	3.215	32.921	7	3	clay
32.152	11.96	0.2228	1.863	26.876	6	5	clayey silt to silty clay
32.316	10.04	0.1794	1.786	25.118	5	5	clayey silt to silty clay
32.480	8.51	0.1758	2.066	25.646	5	4	silty clay to clay
32.644	9.33	0.2167	2.322	27.921	6	4	silty clay to clay
32.808	7.31	0.2350	3.215	29.661	7	3	clay
32.972	11.34	0.2043	1.802	29.282	5	5	clayey silt to silty clay
33.136	9.86	0.1726	1.751	22.697	5	5	clayey silt to silty clay
33.301	8.10	0.1724	2.128	24.728	5	4	silty clay to clay
33.465	8.56	0.1955	2.284	27.230	5	4	silty clay to clay

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33.629	10.82	0.2478	2.290	21.827	5	5	clayey silt to silty clay
33.793	7.04	0.2670	3.794	24.608	7	3	clay
33.957	11.28	0.2421	2.146	26.988	5	5	clayey silt to silty clay
34.121	11.57	0.2046	1.769	22.616	6	5	clayey silt to silty clay
34.285	13.53	0.1339	0.990	22.800	5	6	sandy silt to clayey silt
34.449	15.46	0.1839	1.190	22.975	6	6	sandy silt to clayey silt
34.613	14.16	0.2130	1.504	24.426	7	5	clayey silt to silty clay
34.777	10.18	0.2353	2.310	26.084	5	5	clayey silt to silty clay
34.941	7.90	0.2033	2.572	28.427	5	4	silty clay to clay
35.105	8.45	0.2308	2.730	31.701	5	4	silty clay to clay
35.269	9.79	0.2821	2.882	33.914	6	4	silty clay to clay
35.433	10.10	0.3413	3.378	34.424	6	4	silty clay to clay
35.597	11.06	0.3194	2.887	35.551	7	4	silty clay to clay
35.761	10.25	0.2496	2.435	35.079	7	4	silty clay to clay
35.925	8.53	0.2770	3.246	36.529	8	3	clay
36.089	8.60	0.2904	3.378	38.773	8	3	clay
36.253	11.04	0.2452	2.222	34.465	5	5	clayey silt to silty clay
36.417	10.81	0.2389	2.209	33.693	5	5	clayey silt to silty clay
36.581	9.40	0.2977	3.168	35.820	6	4	silty clay to clay
36.745	10.41	0.2896	2.782	38.092	7	4	silty clay to clay
36.909	12.77	0.2264	1.772	30.922	6	5	clayey silt to silty clay
37.073	8.80	0.1601	1.818	29.347	4	5	clayey silt to silty clay
37.238	7.91	0.1323	1.673	35.788	4	5	clayey silt to silty clay
37.402	7.20	0.1201	1.668	37.534	3	5	clayey silt to silty clay
37.566	7.23	0.1214	1.680	39.437	3	5	clayey silt to silty clay
37.730	7.25	0.1423	1.964	41.475	5	4	silty clay to clay
37.894	7.09	0.1680	2.369	42.156	5	4	silty clay to clay
38.058	7.04	0.1821	2.586	42.566	4	4	silty clay to clay
38.222	6.81	0.1715	2.519	42.465	4	4	silty clay to clay
38.386	6.99	0.1530	2.190	43.289	4	4	silty clay to clay
38.550	6.49	0.1358	2.090	43.795	4	4	silty clay to clay
38.714	6.74	0.1216	1.803	45.140	4	4	silty clay to clay
38.878	6.95	0.1105	1.590	46.245	3	5	clayey silt to silty clay
39.042	6.75	0.1001	1.484	47.154	3	1	sensitive fine grained
39.206	6.49	0.1206	1.858	48.345	4	4	silty clay to clay
39.370	7.28	0.1150	1.579	51.749	3	5	clayey silt to silty clay
39.534	7.07	0.1478	2.090	51.526	5	4	silty clay to clay
39.698	7.39	0.1828	2.472	54.624	5	4	silty clay to clay
39.862	9.23	0.2942	3.188	52.334	6	4	silty clay to clay
40.026	9.32	0.2811	3.018	50.210	6	4	silty clay to clay
40.190	9.16	0.2580	2.816	49.518	6	4	silty clay to clay
40.354	8.73	0.2577	2.951	47.410	6	4	silty clay to clay
40.518	8.90	0.2663	2.992	50.265	6	4	silty clay to clay
40.682	8.93	0.2656	2.976	50.472	6	4	silty clay to clay
40.846	9.24	0.2907	3.147	50.460	6	4	silty clay to clay
41.011	9.31	0.2646	2.844	48.175	6	4	silty clay to clay
41.175	8.97	0.2697	3.006	46.866	6	4	silty clay to clay
41.339	8.71	0.2373	2.725	45.382	6	4	silty clay to clay
41.503	8.31	0.2236	2.691	46.073	5	4	silty clay to clay
41.667	8.01	0.2624	3.277	46.852	8	3	clay
41.831	8.24	0.2509	3.046	44.272	5	4	silty clay to clay
41.995	6.55	0.1884	2.879	37.256	6	3	clay
42.159	6.11	0.1371	2.246	38.624	4	4	silty clay to clay

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42.323	6.52	0.1420	2.176	41.774	4	4	silty clay to clay
42.487	8.95	0.1712	1.913	43.793	4	5	clayey silt to silty clay
42.651	9.74	0.1773	1.821	45.708	5	5	clayey silt to silty clay
42.815	11.80	0.3401	2.881	46.593	8	4	silty clay to clay
42.979	20.86	0.2416	1.159	46.509	8	6	sandy silt to clayey silt
43.143	37.61	0.2610	0.694	20.300	12	7	silty sand to sandy silt
43.307	38.70	0.3052	0.789	18.550	12	7	silty sand to sandy silt
43.471	39.75	0.3271	0.823	18.507	13	7	silty sand to sandy silt
43.635	42.71	0.3451	0.808	18.555	14	7	silty sand to sandy silt
43.799	44.13	0.3556	0.806	17.761	14	7	silty sand to sandy silt
43.963	45.71	0.3776	0.826	18.169	15	7	silty sand to sandy silt
44.127	45.66	0.4257	0.932	17.948	15	7	silty sand to sandy silt
44.291	44.99	0.5133	1.141	17.955	14	7	silty sand to sandy silt
44.455	44.92	0.4946	1.101	17.689	14	7	silty sand to sandy silt
44.619	44.69	0.4673	1.046	16.002	14	7	silty sand to sandy silt
44.783	36.17	0.6496	1.796	14.743	14	6	sandy silt to clayey silt
44.948	26.62	0.9359	3.516	17.404	13	5	clayey silt to silty clay
45.112	24.10	0.5095	2.115	23.627	9	6	sandy silt to clayey silt
45.276	35.21	0.6373	1.810	21.978	13	6	sandy silt to clayey silt
45.440	32.12	0.4899	1.525	20.679	12	6	sandy silt to clayey silt
45.604	33.67	0.3559	1.057	19.188	11	7	silty sand to sandy silt
45.768	37.28	0.4399	1.180	19.288	12	7	silty sand to sandy silt
45.932	36.18	0.5556	1.536	18.209	14	6	sandy silt to clayey silt
46.096	29.93	0.3232	1.080	20.278	10	7	silty sand to sandy silt
46.260	28.80	0.4529	1.573	21.388	11	6	sandy silt to clayey silt
46.424	24.53	0.4026	1.641	25.010	9	6	sandy silt to clayey silt
46.588	21.88	0.4050	1.851	29.388	8	6	sandy silt to clayey silt
46.752	19.86	0.2782	1.401	35.625	8	6	sandy silt to clayey silt
46.916	28.35	0.2224	0.784	44.627	9	7	silty sand to sandy silt
47.080	34.12	0.4147	1.216	21.717	11	7	silty sand to sandy silt
47.244	24.05	0.6324	2.630	22.822	12	5	clayey silt to silty clay
47.408	17.47	0.5485	3.139	27.448	8	5	clayey silt to silty clay
47.572	30.51	0.5040	1.652	29.115	12	6	sandy silt to clayey silt
47.736	33.26	0.4207	1.265	24.344	11	7	silty sand to sandy silt
47.900	34.30	0.4495	1.311	23.016	11	7	silty sand to sandy silt
48.064	36.47	0.3524	0.966	21.055	12	7	silty sand to sandy silt
48.228	37.88	0.2474	0.653	19.708	12	7	silty sand to sandy silt
48.392	38.26	0.2724	0.712	18.622	12	7	silty sand to sandy silt
48.556	35.04	0.4074	1.163	19.077	11	7	silty sand to sandy silt
48.720	28.44	0.4194	1.475	19.986	11	6	sandy silt to clayey silt
48.885	22.18	0.3135	1.413	22.731	8	6	sandy silt to clayey silt
49.049	18.63	0.2681	1.439	25.869	7	6	sandy silt to clayey silt
49.213	15.99	0.2797	1.749	30.759	8	5	clayey silt to silty clay
49.377	18.08	0.2401	1.328	38.728	7	6	sandy silt to clayey silt
49.541	16.84	0.2910	1.728	36.237	6	6	sandy silt to clayey silt
49.705	14.26	0.1833	1.286	39.926	5	6	sandy silt to clayey silt
49.869	15.81	0.1923	1.216	44.701	6	6	sandy silt to clayey silt
50.033	26.30	0.4905	1.865	48.436	10	6	sandy silt to clayey silt
50.197	23.39	0.4827	2.064	30.505	9	6	sandy silt to clayey silt
50.361	25.46	0.3487	1.370	28.904	10	6	sandy silt to clayey silt
50.525	24.77	0.2856	1.153	27.245	9	6	sandy silt to clayey silt
50.689	22.54	0.2605	1.156	28.163	9	6	sandy silt to clayey silt
50.853	19.77	0.2725	1.378	29.865	8	6	sandy silt to clayey silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
51.017	17.29	0.2909	1.682	33.461	7	6	sandy silt to clayey silt
51.181	17.46	0.2917	1.671	38.730	7	6	sandy silt to clayey silt
51.345	24.58	0.2610	1.062	41.849	9	6	sandy silt to clayey silt
51.509	25.28	0.4563	1.805	27.273	10	6	sandy silt to clayey silt
51.673	22.03	0.3898	1.770	28.860	8	6	sandy silt to clayey silt
51.837	29.73	0.2268	0.763	29.007	9	7	silty sand to sandy silt
52.001	30.82	0.4188	1.359	22.330	12	6	sandy silt to clayey silt
52.165	23.90	0.3511	1.469	24.847	9	6	sandy silt to clayey silt
52.329	26.21	0.4109	1.568	23.474	10	6	sandy silt to clayey silt
52.493	22.56	0.2337	1.036	23.083	9	6	sandy silt to clayey silt
52.657	28.26	0.3216	1.138	24.831	11	6	sandy silt to clayey silt
52.822	25.05	0.2777	1.109	24.368	10	6	sandy silt to clayey silt
52.986	17.70	0.2497	1.411	27.765	7	6	sandy silt to clayey silt
53.150	23.82	0.2497	1.048	37.936	9	6	sandy silt to clayey silt
53.314	37.03	0.2483	0.671	25.617	12	7	silty sand to sandy silt
53.478	33.52	0.3134	0.935	24.893	11	7	silty sand to sandy silt
53.642	32.76	0.4473	1.365	24.869	13	6	sandy silt to clayey silt
53.806	25.29	0.3797	1.501	23.584	10	6	sandy silt to clayey silt
53.970	13.82	0.3437	2.487	30.292	7	5	clayey silt to silty clay
54.134	13.40	0.2205	1.646	38.754	6	5	clayey silt to silty clay
54.298	20.78	0.3000	1.444	37.395	8	6	sandy silt to clayey silt
54.462	16.46	0.3575	2.171	34.760	8	5	clayey silt to silty clay
54.626	13.48	0.2833	2.101	42.705	6	5	clayey silt to silty clay
54.790	20.38	0.2529	1.241	41.273	8	6	sandy silt to clayey silt
54.954	21.53	0.3691	1.715	33.585	8	6	sandy silt to clayey silt
55.118	18.01	0.3582	1.989	36.227	9	5	clayey silt to silty clay
55.282	17.75	0.4098	2.309	40.317	8	5	clayey silt to silty clay
55.446	20.49	0.2666	1.301	41.741	8	6	sandy silt to clayey silt
55.610	53.49	0.3693	0.690	32.341	13	8	sand to silty sand
55.774	53.06	0.5536	1.043	24.917	17	7	silty sand to sandy silt
55.938	52.16	0.5361	1.028	24.476	17	7	silty sand to sandy silt
56.102	42.56	0.6689	1.572	20.602	14	7	silty sand to sandy silt
56.266	23.96	0.6924	2.890	21.832	11	5	clayey silt to silty clay
56.430	25.01	0.4450	1.779	33.456	10	6	sandy silt to clayey silt
56.594	55.77	0.5082	0.911	25.224	18	7	silty sand to sandy silt
56.759	60.78	0.7436	1.223	18.890	19	7	silty sand to sandy silt
56.923	30.40	0.9274	3.051	22.489	15	5	clayey silt to silty clay
57.087	24.38	0.7668	3.145	25.183	12	5	clayey silt to silty clay
57.251	37.40	0.4217	1.128	31.612	12	7	silty sand to sandy silt
57.415	51.78	0.4770	0.921	23.999	17	7	silty sand to sandy silt
57.579	38.45	0.5790	1.506	23.251	12	7	silty sand to sandy silt
57.743	27.04	0.6729	2.488	24.497	10	6	sandy silt to clayey silt
57.907	20.81	0.5999	2.883	26.226	10	5	clayey silt to silty clay
58.071	19.39	0.5376	2.772	30.467	9	5	clayey silt to silty clay
58.235	33.59	0.5220	1.554	35.005	13	6	sandy silt to clayey silt
58.399	57.17	0.4185	0.732	25.737	14	8	sand to silty sand
58.563	70.27	0.5383	0.766	17.001	17	8	sand to silty sand
58.727	66.81	0.7023	1.051	16.723	21	7	silty sand to sandy silt
58.891	61.53	0.7924	1.288	17.931	20	7	silty sand to sandy silt
59.055	67.48	0.6217	0.921	19.041	16	8	sand to silty sand
59.219	74.98	0.5728	0.764	17.138	18	8	sand to silty sand
59.383	65.70	0.6875	1.047	17.934	21	7	silty sand to sandy silt
59.547	55.19	0.6908	1.252	19.322	18	7	silty sand to sandy silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
59.711	51.54	0.7541	1.463	20.446	16	7	silty sand to sandy silt
59.875	51.51	0.5414	1.051	20.484	16	7	silty sand to sandy silt
60.039	62.83	0.5405	0.860	18.042	15	8	sand to silty sand
60.203	64.51	0.5521	0.856	22.414	15	8	sand to silty sand
60.367	66.52	0.5670	0.852	22.297	16	8	sand to silty sand
60.532	69.50	0.5956	0.857	20.739	17	8	sand to silty sand
60.696	64.01	0.6283	0.982	21.352	20	7	silty sand to sandy silt
60.860	57.63	0.8016	1.391	21.995	18	7	silty sand to sandy silt
61.024	52.04	0.7549	1.451	22.467	17	7	silty sand to sandy silt
61.188	58.07	0.6437	1.108	22.239	19	7	silty sand to sandy silt
61.352	66.84	0.4417	0.661	19.497	16	8	sand to silty sand
61.516	69.29	0.4964	0.716	18.624	17	8	sand to silty sand
61.680	63.46	0.6070	0.957	18.866	20	7	silty sand to sandy silt
61.844	51.12	0.7839	1.534	20.384	16	7	silty sand to sandy silt
62.008	49.42	0.4453	0.901	21.745	16	7	silty sand to sandy silt
62.172	57.98	0.8084	1.394	18.104	19	7	silty sand to sandy silt
62.336	30.59	0.7725	2.526	18.871	12	6	sandy silt to clayey silt
62.500	24.61	0.3793	1.541	25.303	9	6	sandy silt to clayey silt
62.664	42.28	0.5126	1.213	22.721	13	7	silty sand to sandy silt
62.828	26.67	0.4850	1.819	20.717	10	6	sandy silt to clayey silt
62.992	16.15	0.2955	1.830	24.332	8	5	clayey silt to silty clay
63.156	21.12	0.4225	2.001	35.295	8	6	sandy silt to clayey silt
63.320	31.15	0.4369	1.403	27.595	12	6	sandy silt to clayey silt
63.484	36.19	0.3955	1.093	23.881	12	7	silty sand to sandy silt
63.648	42.39	0.3161	0.746	21.822	14	7	silty sand to sandy silt
63.812	48.42	0.2906	0.600	20.760	15	7	silty sand to sandy silt
63.976	49.09	0.3252	0.663	20.899	16	7	silty sand to sandy silt
64.140	46.83	0.4139	0.884	21.765	15	7	silty sand to sandy silt
64.304	45.54	0.4309	0.946	22.493	15	7	silty sand to sandy silt
64.469	50.19	0.3769	0.751	22.743	16	7	silty sand to sandy silt
64.633	50.69	0.3475	0.686	21.918	16	7	silty sand to sandy silt
64.797	48.76	0.3653	0.749	21.549	16	7	silty sand to sandy silt
64.961	48.66	0.4204	0.864	22.688	16	7	silty sand to sandy silt
65.125	49.61	0.4346	0.876	23.244	16	7	silty sand to sandy silt
65.289	52.09	0.4346	0.834	24.272	17	7	silty sand to sandy silt
65.453	52.12	0.4374	0.839	24.210	17	7	silty sand to sandy silt
65.617	51.52	0.4303	0.835	24.886	16	7	silty sand to sandy silt
65.781	50.28	0.4479	0.891	25.466	16	7	silty sand to sandy silt
65.945	49.57	0.4245	0.856	25.619	16	7	silty sand to sandy silt
66.109	49.91	0.3995	0.801	26.010	16	7	silty sand to sandy silt
66.273	50.13	0.3877	0.773	25.358	16	7	silty sand to sandy silt
66.437	53.41	0.4025	0.754	25.900	17	7	silty sand to sandy silt
66.601	74.54	0.4345	0.583	26.401	18	8	sand to silty sand
66.765	83.52	0.4933	0.591	26.595	20	8	sand to silty sand
66.929	81.67	0.5290	0.648	26.842	20	8	sand to silty sand
67.093	76.62	0.5463	0.713	27.003	18	8	sand to silty sand
67.257	69.74	0.4911	0.704	26.916	17	8	sand to silty sand
67.421	66.10	0.4596	0.695	27.017	16	8	sand to silty sand
67.585	63.01	0.4077	0.647	27.091	15	8	sand to silty sand
67.749	59.98	0.3712	0.619	27.187	14	8	sand to silty sand
67.913	56.31	0.3402	0.604	27.180	13	8	sand to silty sand
68.077	51.61	0.3107	0.602	27.214	12	8	sand to silty sand
68.241	45.34	0.3203	0.706	27.204	14	7	silty sand to sandy silt

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
68.406	39.13	0.3015	0.770	27.206	12	7	silty sand to sandy silt
68.570	40.38	0.2927	0.725	27.765	13	7	silty sand to sandy silt
68.734	45.03	0.2889	0.642	27.683	14	7	silty sand to sandy silt
68.898	45.11	0.3086	0.684	27.715	14	7	silty sand to sandy silt
69.062	44.20	0.3732	0.844	27.878	14	7	silty sand to sandy silt
69.226	38.97	0.4785	1.228	27.990	12	7	silty sand to sandy silt
69.390	37.00	0.5364	1.450	28.988	12	7	silty sand to sandy silt
69.554	40.26	0.4774	1.186	28.479	13	7	silty sand to sandy silt
69.718	48.72	0.4273	0.877	27.580	16	7	silty sand to sandy silt
69.882	65.52	0.4399	0.671	28.160	16	8	sand to silty sand
70.046	79.10	0.5194	0.657	28.765	19	8	sand to silty sand
70.210	82.04	0.5617	0.685	28.858	20	8	sand to silty sand
70.374	84.30	0.5688	0.675	28.803	20	8	sand to silty sand
70.538	88.44	0.5583	0.631	29.004	21	8	sand to silty sand
70.702	87.91	0.5352	0.609	28.947	21	8	sand to silty sand
70.866	91.82	0.5315	0.579	29.100	22	8	sand to silty sand
71.030	103.14	0.5205	0.505	29.335	25	8	sand to silty sand
71.194	104.38	0.5537	0.530	29.364	25	8	sand to silty sand
71.358	111.49	0.6077	0.545	29.534	21	9	sand
71.522	111.40	0.5976	0.536	29.393	21	9	sand
71.686	96.82	0.5541	0.572	29.395	23	8	sand to silty sand
71.850	77.24	0.4852	0.628	29.031	18	8	sand to silty sand
72.014	72.01	0.3983	0.553	29.009	17	8	sand to silty sand
72.178	68.68	0.3744	0.545	29.163	16	8	sand to silty sand
72.343	73.34	0.3868	0.527	29.477	18	8	sand to silty sand
72.507	78.41	0.4207	0.537	29.738	19	8	sand to silty sand
72.671	75.74	0.4243	0.560	29.733	18	8	sand to silty sand
72.835	76.41	0.4118	0.539	29.743	18	8	sand to silty sand
72.999	76.28	0.4020	0.527	30.085	18	8	sand to silty sand
73.163	73.23	0.4073	0.556	30.016	18	8	sand to silty sand
73.327	78.84	0.4422	0.561	30.258	19	8	sand to silty sand
73.491	81.89	0.4650	0.568	30.347	20	8	sand to silty sand
73.655	98.06	0.4840	0.494	30.637	23	8	sand to silty sand
73.819	111.06	0.5101	0.459	30.932	21	9	sand
73.983	116.33	0.5956	0.512	30.984	22	9	sand
74.147	122.21	0.6851	0.561	30.989	23	9	sand
74.311	125.35	0.7580	0.605	30.766	24	9	sand
74.475	113.32	0.7156	0.632	30.642	27	8	sand to silty sand
74.639	94.47	0.6176	0.654	30.553	23	8	sand to silty sand
74.803	88.07	0.5220	0.593	30.493	21	8	sand to silty sand
74.967	95.37	0.5400	0.566	30.809	23	8	sand to silty sand
75.131	104.31	0.6047	0.580	30.946	25	8	sand to silty sand
75.295	105.46	0.6400	0.607	31.028	25	8	sand to silty sand
75.459	92.35	0.6254	0.677	30.896	22	8	sand to silty sand
75.623	83.14	0.6080	0.731	31.239	20	8	sand to silty sand
75.787	82.98	0.6809	0.821	31.512	20	8	sand to silty sand
75.951	89.80	0.7915	0.881	31.598	21	8	sand to silty sand
76.115	107.98	0.8408	0.779	31.684	26	8	sand to silty sand
76.280	117.29	0.7616	0.649	31.159	28	8	sand to silty sand
76.444	120.73	0.7508	0.622	31.634	23	9	sand
76.608	120.78	0.7447	0.617	31.665	23	9	sand
76.772	119.94	0.7346	0.612	31.785	23	9	sand
76.936	117.65	0.7223	0.614	31.795	23	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
77.100	121.53	0.7112	0.585	31.692	23	9	sand
77.264	131.14	0.7567	0.577	32.085	25	9	sand
77.428	130.26	0.8211	0.630	32.583	25	9	sand
77.592	118.06	0.8022	0.679	31.867	28	8	sand to silty sand
77.756	106.04	0.7143	0.674	31.569	25	8	sand to silty sand
77.920	97.81	0.6378	0.652	31.517	23	8	sand to silty sand
78.084	95.49	0.5642	0.591	31.617	23	8	sand to silty sand
78.248	95.99	0.5372	0.560	31.847	23	8	sand to silty sand
78.412	100.75	0.5389	0.535	32.171	24	8	sand to silty sand
78.576	108.97	0.7062	0.648	32.430	26	8	sand to silty sand
78.740	117.75	0.7148	0.607	32.459	23	9	sand
78.904	95.98	0.5022	0.523	32.126	23	8	sand to silty sand
79.068	78.47	0.4604	0.587	31.610	19	8	sand to silty sand
79.232	80.51	0.4766	0.592	31.994	19	8	sand to silty sand
79.396	90.84	0.5085	0.560	32.523	22	8	sand to silty sand
79.560	83.53	0.5093	0.610	32.727	20	8	sand to silty sand
79.724	85.89	0.4787	0.557	32.674	21	8	sand to silty sand
79.888	85.76	0.4790	0.559	33.221	21	8	sand to silty sand
80.052	81.78	0.4885	0.597	32.701	20	8	sand to silty sand
80.217	80.07	0.5005	0.625	32.619	19	8	sand to silty sand
80.381	78.29	0.4830	0.617	32.758	19	8	sand to silty sand
80.545	77.40	0.4658	0.602	32.761	19	8	sand to silty sand
80.709	77.15	0.4604	0.597	33.000	18	8	sand to silty sand
80.873	76.27	0.4599	0.603	33.092	18	8	sand to silty sand
81.037	76.01	0.4554	0.599	33.135	18	8	sand to silty sand
81.201	75.87	0.4468	0.589	33.245	18	8	sand to silty sand
81.365	76.03	0.4394	0.578	33.295	18	8	sand to silty sand
81.529	76.38	0.4487	0.587	33.401	18	8	sand to silty sand
81.693	75.81	0.4506	0.594	33.451	18	8	sand to silty sand
81.857	73.45	0.4526	0.616	33.559	18	8	sand to silty sand
82.021	71.98	0.4626	0.643	33.859	17	8	sand to silty sand
82.185	68.13	0.4734	0.695	33.964	16	8	sand to silty sand
82.349	69.71	0.4943	0.709	33.988	17	8	sand to silty sand
82.513	79.06	0.5298	0.670	34.290	19	8	sand to silty sand
82.677	94.60	0.6548	0.692	34.518	23	8	sand to silty sand
82.841	101.06	0.7748	0.767	34.573	24	8	sand to silty sand
83.005	102.40	0.7767	0.758	34.494	25	8	sand to silty sand
83.169	100.81	0.7773	0.771	34.074	24	8	sand to silty sand
83.333	100.68	0.7748	0.770	34.319	24	8	sand to silty sand
83.497	99.72	0.7627	0.765	34.329	24	8	sand to silty sand
83.661	97.07	0.7016	0.723	33.962	23	8	sand to silty sand
83.825	89.47	0.5822	0.651	33.943	21	8	sand to silty sand
83.990	78.78	0.4731	0.601	33.847	19	8	sand to silty sand
84.154	62.59	0.4248	0.679	33.782	15	8	sand to silty sand
84.318	63.63	0.4065	0.639	34.564	15	8	sand to silty sand
84.482	81.38	0.4778	0.587	34.940	19	8	sand to silty sand
84.646	89.36	0.5369	0.601	35.031	21	8	sand to silty sand
84.810	100.35	0.6023	0.600	35.180	24	8	sand to silty sand
84.974	99.73	0.5933	0.595	35.340	24	8	sand to silty sand
85.138	83.95	0.5260	0.627	35.100	20	8	sand to silty sand
85.302	76.82	0.5020	0.653	34.750	18	8	sand to silty sand
85.466	73.03	0.4493	0.615	34.837	17	8	sand to silty sand
85.630	73.44	0.4484	0.611	34.957	18	8	sand to silty sand

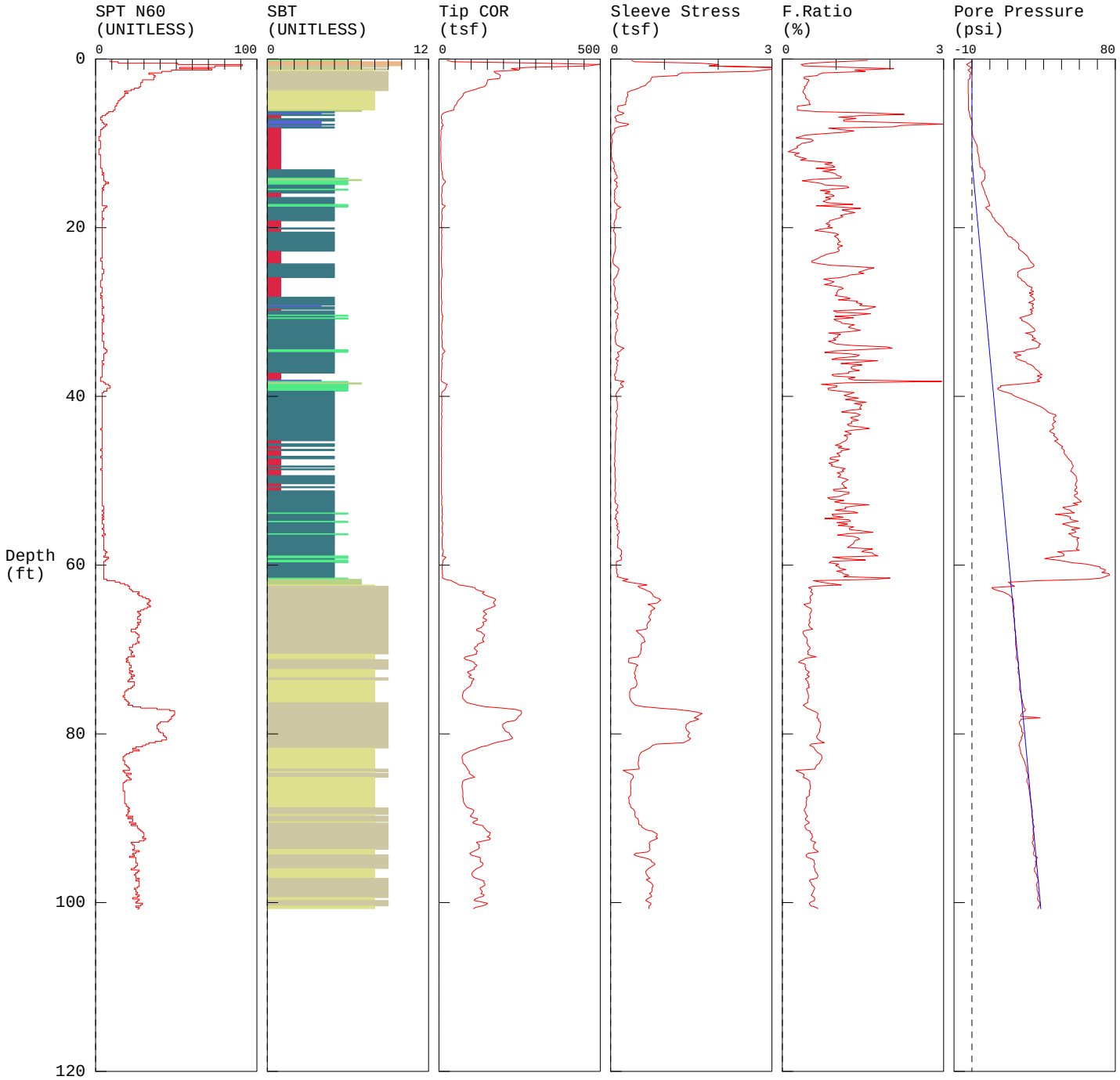
Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
85.794	74.95	0.4680	0.624	35.357	18	8	sand to silty sand
85.958	82.55	0.5895	0.714	35.544	20	8	sand to silty sand
86.122	98.26	0.6523	0.664	35.968	24	8	sand to silty sand
86.286	114.83	0.6821	0.594	36.117	22	9	sand
86.450	113.67	0.7181	0.632	36.059	27	8	sand to silty sand
86.614	109.57	0.7292	0.665	36.079	26	8	sand to silty sand
86.778	104.89	0.7486	0.714	35.671	25	8	sand to silty sand
86.942	102.81	0.7057	0.686	35.489	25	8	sand to silty sand
87.106	102.84	0.6236	0.606	35.549	25	8	sand to silty sand
87.270	100.95	0.5957	0.590	35.482	24	8	sand to silty sand
87.434	99.39	0.5786	0.582	36.512	24	8	sand to silty sand
87.598	96.51	0.6063	0.628	36.035	23	8	sand to silty sand
87.762	93.19	0.5893	0.632	36.016	22	8	sand to silty sand
87.927	90.37	0.5567	0.616	36.105	22	8	sand to silty sand
88.091	89.47	0.5632	0.629	36.256	21	8	sand to silty sand
88.255	89.91	0.5841	0.650	36.524	22	8	sand to silty sand
88.419	96.90	0.5994	0.619	36.699	23	8	sand to silty sand
88.583	104.47	0.5891	0.564	36.656	25	8	sand to silty sand
88.747	102.56	0.5535	0.540	36.803	25	8	sand to silty sand
88.911	94.12	0.4956	0.527	36.534	23	8	sand to silty sand
89.075	90.14	0.4742	0.526	36.711	22	8	sand to silty sand
89.239	86.13	0.4544	0.528	36.762	21	8	sand to silty sand
89.403	83.27	0.4355	0.523	36.872	20	8	sand to silty sand
89.567	89.76	0.4561	0.508	37.220	21	8	sand to silty sand
89.731	98.57	0.5027	0.510	37.383	24	8	sand to silty sand
89.895	118.28	0.5571	0.471	37.728	23	9	sand
90.059	125.21	0.6108	0.488	37.529	24	9	sand
90.223	125.66	0.6342	0.505	37.730	24	9	sand
90.387	113.98	0.6375	0.559	37.553	22	9	sand
90.551	108.41	0.5994	0.553	37.184	26	8	sand to silty sand
90.715	105.68	0.5795	0.548	37.409	25	8	sand to silty sand
90.879	97.95	0.5517	0.563	37.404	23	8	sand to silty sand
91.043	98.00	0.5385	0.550	37.426	23	8	sand to silty sand
91.207	99.46	0.5589	0.562	37.814	24	8	sand to silty sand
91.371	103.78	0.5984	0.577	37.960	25	8	sand to silty sand
91.535	119.66	0.6637	0.555	38.140	23	9	sand
91.699	150.04	0.8562	0.571	38.370	29	9	sand
91.864	159.72	0.9121	0.571	39.022	31	9	sand
92.028	143.17	0.8543	0.597	38.032	27	9	sand
92.192	126.90	0.7507	0.592	37.975	24	9	sand
92.356	114.01	0.6787	0.595	37.992	22	9	sand
92.520	116.55	0.6672	0.572	38.135	22	9	sand
92.684	121.73	0.6880	0.565	38.859	23	9	sand
92.848	124.58	0.6821	0.548	38.747	24	9	sand
93.012	118.99	0.6528	0.549	38.457	23	9	sand
93.176	111.77	0.6195	0.554	38.610	21	9	sand
93.340	101.59	0.5761	0.567	38.203	24	8	sand to silty sand
93.504	95.99	0.5305	0.553	38.306	23	8	sand to silty sand
93.668	95.24	0.4870	0.511	38.526	23	8	sand to silty sand
93.832	91.35	0.4969	0.544	38.368	22	8	sand to silty sand
93.996	81.82	0.4513	0.552	38.416	20	8	sand to silty sand
94.160	92.00	0.4744	0.516	38.986	22	8	sand to silty sand
94.324	109.94	0.5666	0.515	39.351	21	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
94.488	117.35	0.6166	0.525	39.377	22	9	sand
94.652	105.37	0.6141	0.583	39.320	25	8	sand to silty sand
94.816	102.23	0.5468	0.535	39.212	24	8	sand to silty sand
94.980	102.00	0.5442	0.534	39.341	24	8	sand to silty sand
95.144	102.84	0.5589	0.543	39.555	25	8	sand to silty sand
95.308	115.91	0.6206	0.535	39.888	22	9	sand
95.472	128.04	0.6482	0.506	40.118	25	9	sand
95.636	128.62	0.7106	0.552	39.931	25	9	sand
95.801	127.67	0.7471	0.585	40.240	24	9	sand
95.965	115.87	0.7136	0.616	40.219	22	9	sand
96.129	113.98	0.6710	0.589	39.746	22	9	sand
96.293	126.40	0.6824	0.540	39.792	24	9	sand
96.457	125.90	0.6930	0.550	40.288	24	9	sand
96.621	120.90	0.6869	0.568	40.226	23	9	sand
96.785	120.87	0.6876	0.569	40.154	23	9	sand
96.949	131.74	0.7029	0.534	40.331	25	9	sand
97.113	128.30	0.7236	0.564	40.835	25	9	sand
97.277	133.66	0.7560	0.566	40.813	26	9	sand
97.441	139.02	0.7943	0.571	41.130	27	9	sand
97.605	133.11	0.7817	0.587	40.322	25	9	sand
97.769	129.49	0.7411	0.572	40.662	25	9	sand
97.933	134.34	0.7169	0.534	40.442	26	9	sand
98.097	143.29	0.7891	0.551	41.777	27	9	sand
98.261	137.47	0.7457	0.542	40.631	26	9	sand
98.425	133.92	0.6740	0.503	40.967	26	9	sand
98.589	126.80	0.6439	0.508	40.969	24	9	sand
98.753	137.37	0.6430	0.468	41.271	26	9	sand
98.917	129.01	0.6509	0.505	41.161	25	9	sand
99.081	126.18	0.6201	0.491	41.175	24	9	sand
99.245	104.57	0.5783	0.553	40.923	25	8	sand to silty sand
99.409	95.66	0.5174	0.541	40.746	23	8	sand to silty sand
99.573	93.04	0.5009	0.538	41.305	22	8	sand to silty sand
99.738	93.04	0.4789	0.515	41.472	22	8	sand to silty sand
99.902	95.80	0.4842	0.505	41.578	23	8	sand to silty sand
100.066	100.84	0.5192	0.515	41.659	24	8	sand to silty sand
100.230	119.11	0.5632	0.473	42.096	23	9	sand
100.394	131.00	0.6206	0.474	42.223	25	9	sand
100.558	137.84	0.6315	0.458	42.163	26	9	sand
100.722	132.64	0.6171	0.465	42.072	25	9	sand
100.886	116.35	0.5847	0.503	42.038	22	9	sand
101.050	108.10	0.5572	0.515	41.748	21	9	sand
101.214	104.95	0.5493	0.523	42.000	25	8	sand to silty sand
101.378	107.92	0.5511	0.511	42.216	21	9	sand
101.542	115.76	0.5973	0.516	42.446	22	9	sand
101.706	120.56	0.6468	0.536	42.534	23	9	sand
101.870	129.88	0.6925	0.533	42.705	25	9	sand
102.034	140.32	0.6920	0.493	42.748	27	9	sand
102.198	132.43	0.6436	0.486	42.628	25	9	sand
102.362	127.59	0.6302	0.494	42.601	24	9	sand
102.526	131.39	0.6302	0.480	42.808	25	9	sand
102.690	143.75	0.6302	0.438	43.052	28	9	sand

GRI / CPT-23 / PDX Runway Evaluation

TEST DATE: 4/25/2017 1:35:42 PM
HOLE NUMBER: CPT-23
CUSTOMER: 17058 GRI CPT-23 PDX Runway Evalu
OPERATOR: OGE TAJ

CONE ID: DPG1323
LOCATION: 17058/ GRI / CPT-23/ PDX Runway Evaluation
JOB NUMBER: 17058 / GRI / CPT-23 / PDX Runway Evaluation
TEST DATE: 4/25/2017 1:35:42 PM
TOTAL DEPTH: 100.722 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

GRI / CPT-23 / PDX Runway Evaluation

OPERATOR: OGE TAJ
TEST DATE: 4/25/2017 1:35:42 PM
COMMENT: GRI / CPT-23 / PDX Runway Evaluation
FILENAME: 17058 CPT-23.cpt
TOTAL DEPTH: 100.722 ft

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
0.164	24.36	0.3859	1.584	-0.037	9	6	sandy silt to clayey silt
0.328	44.75	0.4579	1.023	-0.371	14	7	silty sand to sandy silt
0.492	322.39	1.6702	0.518	-1.866	51	10	gravelly sand to sand
0.656	573.25	2.0089	0.350	-3.050	91	10	gravelly sand to sand
0.820	463.03	1.8338	0.396	-1.936	74	10	gravelly sand to sand
0.984	272.38	3.5079	1.288	-0.497	52	9	sand
1.148	224.26	4.6449	2.071	-0.998	72	7	silty sand to sandy silt
1.312	247.51	3.3342	1.347	-2.208	47	9	sand
1.476	170.70	2.6366	1.545	-1.445	41	8	sand to silty sand
1.640	174.74	1.3206	0.756	-0.190	33	9	sand
1.804	186.15	1.2593	0.677	-1.105	36	9	sand
1.969	190.73	1.2412	0.651	-1.236	37	9	sand
2.133	189.23	0.7716	0.408	-1.018	36	9	sand
2.297	187.46	0.7536	0.402	-1.103	36	9	sand
2.461	150.82	0.7440	0.493	-2.136	29	9	sand
2.625	149.89	0.7303	0.487	-2.095	29	9	sand
2.789	148.75	0.6912	0.465	-2.130	28	9	sand
2.953	147.63	0.6692	0.453	-2.132	28	9	sand
3.117	144.69	0.6491	0.449	-2.119	28	9	sand
3.281	139.85	0.5704	0.408	-2.112	27	9	sand
3.445	123.15	0.5243	0.426	-2.132	24	9	sand
3.609	112.77	0.4503	0.399	-2.119	22	9	sand
3.773	96.04	0.3727	0.388	-2.091	18	9	sand
3.937	82.28	0.3130	0.380	-2.169	20	8	sand to silty sand
4.101	75.84	0.3089	0.407	-2.069	18	8	sand to silty sand
4.265	75.58	0.3208	0.424	-2.045	18	8	sand to silty sand
4.429	72.29	0.3167	0.438	-2.040	17	8	sand to silty sand
4.593	68.53	0.2940	0.429	-2.027	16	8	sand to silty sand
4.757	63.87	0.2906	0.455	-2.008	15	8	sand to silty sand
4.921	59.57	0.2945	0.494	-1.999	14	8	sand to silty sand
5.085	56.82	0.2824	0.497	-1.975	14	8	sand to silty sand
5.249	55.75	0.2796	0.502	-1.955	13	8	sand to silty sand
5.413	53.28	0.2761	0.518	-2.006	13	8	sand to silty sand
5.577	48.07	0.1333	0.277	-1.955	12	8	sand to silty sand
6.070	45.41	0.1257	0.277	-1.945	11	8	sand to silty sand
6.234	25.33	0.1606	0.634	-1.546	8	7	silty sand to sandy silt
6.398	14.16	0.2445	1.727	-1.456	7	5	clayey silt to silty clay
6.562	9.36	0.2122	2.268	-1.267	6	4	silty clay to clay
6.726	7.78	0.1132	1.456	-1.155	4	5	clayey silt to silty clay
6.890	7.20	0.0753	1.047	-1.016	3	1	sensitive fine grained
7.054	7.03	0.0965	1.372	-0.748	3	1	sensitive fine grained
7.218	9.24	0.1052	1.139	-0.366	4	5	clayey silt to silty clay
7.382	8.76	0.1003	1.146	-0.063	4	5	clayey silt to silty clay
7.546	7.72	0.1706	2.209	0.070	5	4	silty clay to clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
7.710	11.22	0.3345	2.980	0.296	7	4	silty clay to clay
7.874	13.47	0.2978	2.211	0.172	6	5	clayey silt to silty clay
8.038	7.62	0.1575	2.067	-0.216	5	4	silty clay to clay
8.202	9.28	0.0800	0.862	-0.129	4	5	clayey silt to silty clay
8.366	6.56	0.0706	1.076	-0.037	3	1	sensitive fine grained
8.530	5.78	0.0769	1.330	0.157	3	1	sensitive fine grained
8.694	6.37	0.0720	1.130	0.268	3	1	sensitive fine grained
8.858	6.15	0.0455	0.740	0.292	3	1	sensitive fine grained
9.022	5.54	0.0240	0.434	0.303	3	1	sensitive fine grained
9.186	5.09	0.0176	0.346	0.617	2	1	sensitive fine grained
9.350	5.09	0.0131	0.257	0.885	2	1	sensitive fine grained
9.514	4.68	0.0257	0.551	1.147	2	1	sensitive fine grained
9.678	5.27	0.0303	0.574	1.559	3	1	sensitive fine grained
9.843	6.13	0.0318	0.519	1.818	3	1	sensitive fine grained
10.007	5.47	0.0199	0.364	2.156	3	1	sensitive fine grained
10.171	5.40	0.0176	0.326	2.688	3	1	sensitive fine grained
10.335	5.37	0.0145	0.270	2.965	3	1	sensitive fine grained
10.499	5.26	0.0151	0.287	3.045	3	1	sensitive fine grained
10.663	5.18	0.0117	0.227	3.052	2	1	sensitive fine grained
10.991	5.19	0.0057	0.110	3.048	2	1	sensitive fine grained
11.155	4.76	0.0150	0.315	3.342	2	1	sensitive fine grained
11.319	5.58	0.0127	0.227	3.621	3	1	sensitive fine grained
11.483	5.81	0.0144	0.247	3.745	3	1	sensitive fine grained
11.647	5.57	0.0185	0.331	3.928	3	1	sensitive fine grained
11.811	5.46	0.0244	0.447	4.007	3	1	sensitive fine grained
11.975	5.39	0.0180	0.334	4.011	3	1	sensitive fine grained
12.139	5.46	0.0341	0.624	4.111	3	1	sensitive fine grained
12.303	6.74	0.0624	0.926	4.362	3	1	sensitive fine grained
12.467	7.27	0.0573	0.788	4.373	3	1	sensitive fine grained
12.631	7.25	0.0681	0.939	4.417	3	1	sensitive fine grained
12.795	6.85	0.0668	0.976	4.528	3	1	sensitive fine grained
12.959	7.70	0.0481	0.625	5.875	4	1	sensitive fine grained
13.123	7.63	0.0757	0.993	5.947	4	1	sensitive fine grained
13.287	8.77	0.0662	0.755	7.061	4	5	clayey silt to silty clay
13.451	10.61	0.0976	0.920	6.924	5	5	clayey silt to silty clay
13.615	9.10	0.0903	0.993	7.190	4	5	clayey silt to silty clay
13.780	10.97	0.1109	1.012	7.357	5	5	clayey silt to silty clay
13.944	10.94	0.1201	1.098	7.207	5	5	clayey silt to silty clay
14.108	11.21	0.1216	1.084	7.233	5	5	clayey silt to silty clay
14.272	13.72	0.0769	0.560	6.950	5	6	sandy silt to clayey silt
14.436	18.64	0.0690	0.370	6.368	6	7	silty sand to sandy silt
14.600	19.77	0.1138	0.576	5.265	8	6	sandy silt to clayey silt
14.764	15.07	0.1108	0.735	5.358	6	6	sandy silt to clayey silt
14.928	12.71	0.1006	0.791	5.605	5	6	sandy silt to clayey silt
15.092	10.49	0.1266	1.207	5.805	5	5	clayey silt to silty clay
15.256	8.65	0.1070	1.237	6.322	4	5	clayey silt to silty clay
15.420	9.48	0.0901	0.950	6.501	5	5	clayey silt to silty clay
15.584	9.74	0.0689	0.708	6.897	4	6	sandy silt to clayey silt
15.748	9.15	0.0810	0.886	7.074	4	5	clayey silt to silty clay
15.912	8.74	0.0692	0.791	7.299	4	5	clayey silt to silty clay
16.076	7.78	0.0723	0.929	7.508	4	1	sensitive fine grained
16.240	7.76	0.0746	0.961	7.990	4	1	sensitive fine grained
16.404	8.13	0.0654	0.805	8.225	4	1	sensitive fine grained

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
16.568	9.05	0.0810	0.895	8.515	4	5	clayey silt to silty clay
16.732	8.99	0.0728	0.809	8.796	4	5	clayey silt to silty clay
16.896	8.80	0.0668	0.759	9.151	4	5	clayey silt to silty clay
17.060	9.23	0.0798	0.865	9.385	4	5	clayey silt to silty clay
17.224	9.28	0.1217	1.311	9.720	4	5	clayey silt to silty clay
17.388	19.00	0.1193	0.628	9.989	7	6	sandy silt to clayey silt
17.552	16.89	0.1904	1.127	7.863	6	6	sandy silt to clayey silt
17.717	10.56	0.1538	1.456	7.863	5	5	clayey silt to silty clay
17.881	9.56	0.1062	1.111	9.084	5	5	clayey silt to silty clay
18.045	8.93	0.1092	1.223	9.764	4	5	clayey silt to silty clay
18.209	8.04	0.1083	1.348	10.457	4	5	clayey silt to silty clay
18.373	8.75	0.1047	1.196	10.909	4	5	clayey silt to silty clay
18.537	9.39	0.1016	1.082	11.212	4	5	clayey silt to silty clay
18.701	8.98	0.1011	1.126	11.375	4	5	clayey silt to silty clay
18.865	9.64	0.1015	1.053	12.434	5	5	clayey silt to silty clay
19.029	9.09	0.0863	0.949	12.650	4	5	clayey silt to silty clay
19.193	8.45	0.0738	0.873	13.080	4	5	clayey silt to silty clay
19.357	7.68	0.0670	0.873	13.884	4	1	sensitive fine grained
19.521	7.50	0.0608	0.811	14.850	4	1	sensitive fine grained
19.685	7.32	0.0651	0.889	15.556	4	1	sensitive fine grained
19.849	7.53	0.0638	0.847	16.467	4	1	sensitive fine grained
20.013	7.80	0.0725	0.929	17.056	4	1	sensitive fine grained
20.177	8.98	0.0626	0.697	17.693	4	5	clayey silt to silty clay
20.341	8.40	0.0511	0.608	17.878	4	1	sensitive fine grained
20.505	7.57	0.0640	0.846	18.456	4	1	sensitive fine grained
20.669	7.97	0.0799	1.003	19.147	4	5	clayey silt to silty clay
20.833	8.54	0.0891	1.043	19.687	4	5	clayey silt to silty clay
20.997	9.13	0.0884	0.968	20.162	4	5	clayey silt to silty clay
21.161	8.51	0.0856	1.006	22.395	4	5	clayey silt to silty clay
21.325	8.39	0.0874	1.042	22.680	4	5	clayey silt to silty clay
21.490	8.27	0.0861	1.041	24.167	4	5	clayey silt to silty clay
21.654	7.92	0.0856	1.081	24.699	4	5	clayey silt to silty clay
21.818	8.29	0.0861	1.038	25.710	4	5	clayey silt to silty clay
21.982	8.04	0.0821	1.022	26.096	4	5	clayey silt to silty clay
22.146	8.11	0.0907	1.118	26.199	4	5	clayey silt to silty clay
22.310	8.85	0.0923	1.043	25.998	4	5	clayey silt to silty clay
22.474	8.72	0.0896	1.027	26.007	4	5	clayey silt to silty clay
22.638	8.01	0.0846	1.056	26.807	4	5	clayey silt to silty clay
22.802	7.98	0.0836	1.048	27.893	4	5	clayey silt to silty clay
22.966	7.55	0.0727	0.962	28.830	4	1	sensitive fine grained
23.130	7.55	0.0623	0.826	29.617	4	1	sensitive fine grained
23.294	7.52	0.0583	0.776	30.522	4	1	sensitive fine grained
23.458	7.52	0.0531	0.707	31.132	4	1	sensitive fine grained
23.622	7.02	0.0468	0.667	31.570	3	1	sensitive fine grained
23.786	7.12	0.0433	0.609	31.987	3	1	sensitive fine grained
23.950	7.40	0.0404	0.546	32.575	4	1	sensitive fine grained
24.114	7.71	0.0425	0.551	33.024	4	1	sensitive fine grained
24.278	7.38	0.0513	0.696	34.003	4	1	sensitive fine grained
24.442	8.25	0.0745	0.903	34.655	4	5	clayey silt to silty clay
24.606	8.11	0.1140	1.405	34.282	4	5	clayey silt to silty clay
24.770	8.19	0.1398	1.707	32.599	4	5	clayey silt to silty clay
24.934	9.76	0.1546	1.585	28.063	5	5	clayey silt to silty clay
25.098	9.58	0.1435	1.499	26.550	5	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
25.262	9.47	0.1344	1.420	25.519	5	5	clayey silt to silty clay
25.427	8.92	0.1349	1.512	25.639	4	5	clayey silt to silty clay
25.591	9.26	0.1170	1.264	25.639	4	5	clayey silt to silty clay
25.755	9.09	0.1088	1.198	25.455	4	5	clayey silt to silty clay
25.919	8.27	0.0875	1.059	26.323	4	5	clayey silt to silty clay
26.083	7.84	0.0602	0.768	27.559	4	1	sensitive fine grained
26.247	6.67	0.0580	0.869	27.703	3	1	sensitive fine grained
26.411	6.63	0.0635	0.957	29.264	3	1	sensitive fine grained
26.575	6.95	0.0630	0.906	30.020	3	1	sensitive fine grained
26.739	6.83	0.0535	0.783	30.382	3	1	sensitive fine grained
26.903	7.00	0.0675	0.964	31.540	3	1	sensitive fine grained
27.067	7.39	0.0816	1.105	33.458	4	1	sensitive fine grained
27.231	7.32	0.0827	1.130	33.312	4	1	sensitive fine grained
27.395	7.43	0.0768	1.034	32.926	4	1	sensitive fine grained
27.559	7.36	0.0756	1.028	34.284	4	1	sensitive fine grained
27.723	7.15	0.0719	1.005	31.930	3	1	sensitive fine grained
27.887	7.15	0.0728	1.018	34.210	3	1	sensitive fine grained
28.051	7.74	0.0759	0.981	32.379	4	1	sensitive fine grained
28.215	7.12	0.0845	1.186	33.853	3	1	sensitive fine grained
28.379	7.81	0.0983	1.259	34.583	4	5	clayey silt to silty clay
28.543	7.97	0.0832	1.044	34.969	4	5	clayey silt to silty clay
28.707	8.36	0.1172	1.401	33.580	4	5	clayey silt to silty clay
28.871	9.14	0.1256	1.375	31.585	4	5	clayey silt to silty clay
29.035	8.53	0.1267	1.486	34.374	4	5	clayey silt to silty clay
29.199	8.09	0.1163	1.437	33.552	4	5	clayey silt to silty clay
29.364	7.43	0.1291	1.738	33.846	5	4	silty clay to clay
29.528	7.59	0.1251	1.648	34.395	4	5	clayey silt to silty clay
29.692	7.39	0.1125	1.522	32.510	4	5	clayey silt to silty clay
29.856	7.85	0.0750	0.955	33.807	4	1	sensitive fine grained
30.020	8.43	0.0861	1.020	32.922	4	5	clayey silt to silty clay
30.184	8.64	0.1415	1.637	33.735	4	5	clayey silt to silty clay
30.348	9.90	0.1384	1.398	31.993	5	5	clayey silt to silty clay
30.512	12.64	0.1233	0.975	29.366	5	6	sandy silt to clayey silt
30.676	10.14	0.1344	1.326	26.585	5	5	clayey silt to silty clay
30.840	11.13	0.1068	0.960	27.856	4	6	sandy silt to clayey silt
31.004	10.18	0.1014	0.997	27.738	5	5	clayey silt to silty clay
31.168	9.16	0.0998	1.089	29.831	4	5	clayey silt to silty clay
31.332	8.63	0.0955	1.107	31.093	4	5	clayey silt to silty clay
31.496	8.18	0.1095	1.339	32.314	4	5	clayey silt to silty clay
31.660	8.35	0.1052	1.259	33.105	4	5	clayey silt to silty clay
31.824	8.36	0.1029	1.231	33.757	4	5	clayey silt to silty clay
31.988	8.50	0.1134	1.334	34.814	4	5	clayey silt to silty clay
32.152	8.76	0.1270	1.449	35.169	4	5	clayey silt to silty clay
32.316	9.25	0.1151	1.244	34.509	4	5	clayey silt to silty clay
32.480	10.31	0.0892	0.865	29.955	5	5	clayey silt to silty clay
32.644	8.95	0.0967	1.080	32.468	4	5	clayey silt to silty clay
32.808	8.59	0.0883	1.028	33.962	4	5	clayey silt to silty clay
32.972	8.09	0.0829	1.025	33.805	4	5	clayey silt to silty clay
33.136	8.51	0.0808	0.948	35.494	4	5	clayey silt to silty clay
33.301	9.22	0.0919	0.997	33.510	4	5	clayey silt to silty clay
33.465	10.00	0.0858	0.859	35.858	5	5	clayey silt to silty clay
33.629	10.19	0.0955	0.938	36.804	5	5	clayey silt to silty clay
33.793	10.04	0.1010	1.006	38.215	5	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
33.957	9.63	0.1266	1.315	37.354	5	5	clayey silt to silty clay
34.121	9.46	0.1835	1.940	37.419	5	5	clayey silt to silty clay
34.285	12.09	0.2471	2.045	35.655	6	5	clayey silt to silty clay
34.449	13.73	0.2030	1.479	30.376	7	5	clayey silt to silty clay
34.613	18.66	0.1812	0.971	29.497	7	6	sandy silt to clayey silt
34.777	15.83	0.1247	0.788	23.363	6	6	sandy silt to clayey silt
34.941	10.97	0.1371	1.250	24.655	5	5	clayey silt to silty clay
35.105	10.39	0.1491	1.434	27.372	5	5	clayey silt to silty clay
35.269	11.24	0.1544	1.374	24.337	5	5	clayey silt to silty clay
35.433	10.52	0.1082	1.029	24.559	5	5	clayey silt to silty clay
35.597	9.70	0.0892	0.920	25.647	5	5	clayey silt to silty clay
35.761	7.97	0.1414	1.776	27.544	4	5	clayey silt to silty clay
35.925	8.39	0.1215	1.448	30.275	4	5	clayey silt to silty clay
36.089	10.19	0.1109	1.089	30.792	5	5	clayey silt to silty clay
36.253	8.53	0.1264	1.482	33.103	4	5	clayey silt to silty clay
36.417	9.09	0.1189	1.309	34.210	4	5	clayey silt to silty clay
36.581	8.50	0.1083	1.274	34.851	4	5	clayey silt to silty clay
36.745	8.57	0.1115	1.302	35.483	4	5	clayey silt to silty clay
36.909	7.74	0.1109	1.433	36.508	4	5	clayey silt to silty clay
37.073	7.89	0.0972	1.232	37.567	4	5	clayey silt to silty clay
37.238	7.67	0.0949	1.237	37.903	4	5	clayey silt to silty clay
37.402	7.45	0.0689	0.925	39.082	4	1	sensitive fine grained
37.566	7.85	0.0743	0.947	36.451	4	1	sensitive fine grained
37.730	6.77	0.0914	1.350	38.849	3	1	sensitive fine grained
37.894	6.51	0.0800	1.229	37.515	3	1	sensitive fine grained
38.058	6.43	0.0863	1.344	36.466	3	1	sensitive fine grained
38.222	8.30	0.2462	2.964	37.805	5	4	silty clay to clay
38.386	16.00	0.1901	1.188	33.774	6	6	sandy silt to clayey silt
38.550	25.56	0.1856	0.726	24.638	8	7	silty sand to sandy silt
38.714	22.42	0.2280	1.017	15.966	9	6	sandy silt to clayey silt
38.878	22.78	0.2302	1.010	16.079	9	6	sandy silt to clayey silt
39.042	19.05	0.1610	0.845	14.301	7	6	sandy silt to clayey silt
39.206	18.06	0.1554	0.860	14.952	7	6	sandy silt to clayey silt
39.370	12.03	0.1284	1.068	17.032	5	6	sandy silt to clayey silt
39.534	8.51	0.1135	1.333	19.755	4	5	clayey silt to silty clay
39.698	8.25	0.1035	1.255	22.068	4	5	clayey silt to silty clay
39.862	8.16	0.0937	1.148	23.031	4	5	clayey silt to silty clay
40.026	8.43	0.1040	1.234	24.557	4	5	clayey silt to silty clay
40.190	8.55	0.1211	1.417	26.739	4	5	clayey silt to silty clay
40.354	9.13	0.1071	1.174	28.643	4	5	clayey silt to silty clay
40.518	8.64	0.1164	1.347	30.500	4	5	clayey silt to silty clay
40.682	7.97	0.1245	1.562	32.523	4	5	clayey silt to silty clay
40.846	9.03	0.1211	1.340	34.415	4	5	clayey silt to silty clay
41.011	8.51	0.1259	1.479	36.070	4	5	clayey silt to silty clay
41.175	8.48	0.1234	1.455	38.093	4	5	clayey silt to silty clay
41.339	8.38	0.1205	1.437	39.392	4	5	clayey silt to silty clay
41.503	8.43	0.1240	1.470	40.523	4	5	clayey silt to silty clay
41.667	9.04	0.1107	1.225	41.585	4	5	clayey silt to silty clay
41.831	8.48	0.0935	1.102	42.361	4	5	clayey silt to silty clay
41.995	7.86	0.1077	1.370	43.743	4	5	clayey silt to silty clay
42.159	7.93	0.1148	1.447	46.588	4	5	clayey silt to silty clay
42.323	8.64	0.1220	1.412	46.911	4	5	clayey silt to silty clay
42.487	9.03	0.1144	1.267	45.598	4	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
42.651	8.06	0.1053	1.306	45.542	4	5	clayey silt to silty clay
42.815	7.81	0.1107	1.417	45.489	4	5	clayey silt to silty clay
42.979	8.11	0.1042	1.285	46.791	4	5	clayey silt to silty clay
43.143	8.10	0.1046	1.291	45.406	4	5	clayey silt to silty clay
43.307	8.15	0.0985	1.208	44.866	4	5	clayey silt to silty clay
43.471	7.95	0.0979	1.231	45.079	4	5	clayey silt to silty clay
43.635	7.38	0.1084	1.469	45.546	4	5	clayey silt to silty clay
43.799	7.25	0.1175	1.621	45.572	3	5	clayey silt to silty clay
43.963	7.83	0.1051	1.342	44.009	4	5	clayey silt to silty clay
44.127	7.94	0.0926	1.166	43.307	4	5	clayey silt to silty clay
44.291	7.80	0.0960	1.230	44.561	4	5	clayey silt to silty clay
44.455	7.31	0.0938	1.282	46.191	4	5	clayey silt to silty clay
44.619	8.09	0.0928	1.148	45.574	4	5	clayey silt to silty clay
44.783	7.74	0.0938	1.212	46.499	4	5	clayey silt to silty clay
44.948	7.72	0.0932	1.208	47.429	4	5	clayey silt to silty clay
45.112	7.93	0.0950	1.197	48.029	4	5	clayey silt to silty clay
45.276	7.62	0.0892	1.171	46.111	4	5	clayey silt to silty clay
45.440	7.54	0.0837	1.109	47.460	4	1	sensitive fine grained
45.604	7.61	0.0820	1.077	48.280	4	1	sensitive fine grained
45.768	8.28	0.0818	0.988	49.376	4	5	clayey silt to silty clay
45.932	7.81	0.0865	1.107	50.686	4	5	clayey silt to silty clay
46.096	7.73	0.0806	1.042	49.967	4	1	sensitive fine grained
46.260	6.87	0.0860	1.251	50.789	3	1	sensitive fine grained
46.424	7.73	0.0848	1.096	51.667	4	5	clayey silt to silty clay
46.588	7.34	0.0804	1.096	51.305	4	1	sensitive fine grained
46.752	7.82	0.0793	1.015	51.563	4	1	sensitive fine grained
46.916	7.64	0.0804	1.053	52.060	4	1	sensitive fine grained
47.080	7.18	0.0769	1.071	52.871	3	1	sensitive fine grained
47.244	8.27	0.0741	0.896	53.224	4	5	clayey silt to silty clay
47.408	8.16	0.0723	0.885	53.969	4	5	clayey silt to silty clay
47.572	7.72	0.0812	1.051	54.578	4	1	sensitive fine grained
47.736	7.91	0.0778	0.984	55.576	4	1	sensitive fine grained
47.900	8.16	0.0702	0.860	55.763	4	1	sensitive fine grained
48.064	7.63	0.0709	0.928	55.979	4	1	sensitive fine grained
48.228	7.72	0.0701	0.908	56.550	4	1	sensitive fine grained
48.392	7.92	0.0812	1.026	56.265	4	5	clayey silt to silty clay
48.556	7.31	0.0855	1.170	55.766	3	1	sensitive fine grained
48.720	7.67	0.0853	1.113	55.489	4	5	clayey silt to silty clay
48.885	7.51	0.0858	1.143	55.155	4	1	sensitive fine grained
49.049	7.47	0.0762	1.019	56.385	4	1	sensitive fine grained
49.213	7.54	0.0815	1.081	57.017	4	1	sensitive fine grained
49.377	7.65	0.0823	1.076	57.854	4	1	sensitive fine grained
49.541	7.83	0.0810	1.034	58.303	4	5	clayey silt to silty clay
49.705	7.81	0.0899	1.150	58.183	4	5	clayey silt to silty clay
49.869	7.69	0.0940	1.222	58.626	4	5	clayey silt to silty clay
50.033	7.67	0.0902	1.175	58.656	4	5	clayey silt to silty clay
50.197	7.75	0.0873	1.127	58.096	4	5	clayey silt to silty clay
50.361	7.65	0.0845	1.104	57.898	4	5	clayey silt to silty clay
50.525	7.48	0.0854	1.142	57.629	4	1	sensitive fine grained
50.689	7.54	0.0863	1.144	58.397	4	1	sensitive fine grained
50.853	7.53	0.0902	1.197	58.495	4	5	clayey silt to silty clay
51.017	7.93	0.0750	0.945	57.483	4	1	sensitive fine grained
51.181	7.78	0.0750	0.963	57.377	4	1	sensitive fine grained

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
51.345	7.43	0.0922	1.242	58.857	4	5	clayey silt to silty clay
51.509	7.88	0.0976	1.238	58.955	4	5	clayey silt to silty clay
51.673	8.21	0.0926	1.127	57.233	4	5	clayey silt to silty clay
51.837	8.69	0.0934	1.075	57.246	4	5	clayey silt to silty clay
52.001	8.97	0.0756	0.843	58.547	4	5	clayey silt to silty clay
52.165	8.54	0.0762	0.893	59.325	4	5	clayey silt to silty clay
52.329	7.96	0.0911	1.145	60.446	4	5	clayey silt to silty clay
52.493	7.98	0.0777	0.973	60.982	4	5	clayey silt to silty clay
52.657	8.48	0.0946	1.115	56.618	4	5	clayey silt to silty clay
52.822	7.83	0.1261	1.610	59.073	4	5	clayey silt to silty clay
52.986	10.03	0.1333	1.328	55.445	5	5	clayey silt to silty clay
53.150	10.66	0.1246	1.169	50.832	5	5	clayey silt to silty clay
53.314	9.84	0.1161	1.181	51.892	5	5	clayey silt to silty clay
53.478	9.36	0.0921	0.983	54.939	4	5	clayey silt to silty clay
53.642	9.89	0.1304	1.318	55.465	5	5	clayey silt to silty clay
53.806	9.66	0.1355	1.402	57.161	5	5	clayey silt to silty clay
53.970	11.13	0.1030	0.925	46.490	4	6	sandy silt to clayey silt
54.134	9.74	0.0916	0.941	52.895	5	5	clayey silt to silty clay
54.298	9.25	0.1046	1.130	55.005	4	5	clayey silt to silty clay
54.462	9.70	0.0763	0.786	54.673	5	5	clayey silt to silty clay
54.626	8.85	0.1098	1.241	55.576	4	5	clayey silt to silty clay
54.790	8.98	0.1138	1.268	59.197	4	5	clayey silt to silty clay
54.954	11.33	0.1151	1.015	53.566	4	6	sandy silt to clayey silt
55.118	11.36	0.1375	1.211	50.614	5	5	clayey silt to silty clay
55.282	10.59	0.1097	1.036	53.488	5	5	clayey silt to silty clay
55.446	10.07	0.1336	1.327	55.436	5	5	clayey silt to silty clay
55.610	9.37	0.1170	1.249	60.204	4	5	clayey silt to silty clay
55.774	10.27	0.1283	1.249	55.580	5	5	clayey silt to silty clay
55.938	10.55	0.1560	1.479	57.575	5	5	clayey silt to silty clay
56.102	9.79	0.1651	1.686	58.009	5	5	clayey silt to silty clay
56.266	11.86	0.1444	1.217	54.006	6	5	clayey silt to silty clay
56.430	11.60	0.1192	1.028	55.672	4	6	sandy silt to clayey silt
56.594	10.56	0.1397	1.322	56.025	5	5	clayey silt to silty clay
56.759	9.85	0.1394	1.415	59.742	5	5	clayey silt to silty clay
56.923	9.63	0.1385	1.438	58.501	5	5	clayey silt to silty clay
57.087	9.60	0.1298	1.352	58.837	5	5	clayey silt to silty clay
57.415	9.77	0.1293	1.324	59.221	5	5	clayey silt to silty clay
57.907	10.23	0.1242	1.215	58.861	5	5	clayey silt to silty clay
58.071	10.20	0.1711	1.677	58.207	5	5	clayey silt to silty clay
58.235	13.20	0.2010	1.523	59.916	6	5	clayey silt to silty clay
58.399	13.64	0.2016	1.478	47.756	7	5	clayey silt to silty clay
58.563	11.89	0.1997	1.680	50.385	6	5	clayey silt to silty clay
58.727	11.95	0.2029	1.698	51.358	6	5	clayey silt to silty clay
58.891	9.78	0.1740	1.778	51.124	5	5	clayey silt to silty clay
59.055	21.48	0.2011	0.936	44.465	8	6	sandy silt to clayey silt
59.219	17.71	0.2010	1.135	40.624	7	6	sandy silt to clayey silt
59.383	12.64	0.1952	1.544	47.290	6	5	clayey silt to silty clay
59.547	12.01	0.1086	0.905	51.957	5	6	sandy silt to clayey silt
59.711	12.20	0.1062	0.871	56.143	5	6	sandy silt to clayey silt
59.875	9.89	0.1035	1.046	64.226	5	5	clayey silt to silty clay
60.039	10.48	0.1038	0.990	67.692	5	5	clayey silt to silty clay
60.203	9.77	0.1032	1.056	71.531	5	5	clayey silt to silty clay
60.367	9.84	0.1047	1.065	71.649	5	5	clayey silt to silty clay

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
60.532	10.14	0.1200	1.184	74.463	5	5	clayey silt to silty clay
60.696	10.53	0.1062	1.008	74.212	5	5	clayey silt to silty clay
60.860	10.16	0.1127	1.110	72.567	5	5	clayey silt to silty clay
61.024	10.46	0.1186	1.134	76.482	5	5	clayey silt to silty clay
61.188	11.39	0.1405	1.234	76.796	5	5	clayey silt to silty clay
61.352	10.47	0.1190	1.136	74.365	5	5	clayey silt to silty clay
61.516	10.56	0.2115	2.004	72.076	5	5	clayey silt to silty clay
61.680	18.77	0.3244	1.728	65.100	7	6	sandy silt to clayey silt
61.844	38.41	0.2210	0.575	36.673	12	7	silty sand to sandy silt
62.008	46.77	0.3374	0.721	20.380	15	7	silty sand to sandy silt
62.172	56.40	0.5084	0.901	21.268	18	7	silty sand to sandy silt
62.336	61.24	0.6728	1.099	22.332	20	7	silty sand to sandy silt
62.500	88.46	0.5083	0.575	23.777	21	8	sand to silty sand
62.664	111.26	0.5415	0.487	11.035	21	9	sand
62.828	113.32	0.6195	0.547	11.992	22	9	sand
62.992	122.56	0.6668	0.544	14.200	23	9	sand
63.156	140.19	0.7339	0.523	17.257	27	9	sand
63.320	134.85	0.7559	0.561	18.850	26	9	sand
63.484	139.89	0.7822	0.559	20.356	27	9	sand
63.648	149.67	0.7863	0.525	21.303	29	9	sand
63.812	162.77	0.8328	0.512	22.109	31	9	sand
63.976	173.64	0.9007	0.519	22.809	33	9	sand
64.140	175.37	0.9297	0.530	23.044	34	9	sand
64.304	171.45	0.8937	0.521	22.791	33	9	sand
64.469	168.35	0.8682	0.516	23.097	32	9	sand
64.633	172.42	0.6941	0.403	23.105	33	9	sand
64.797	174.95	0.7541	0.431	23.254	34	9	sand
64.961	166.67	0.7841	0.470	23.520	32	9	sand
65.125	154.68	0.8246	0.533	23.452	30	9	sand
65.289	144.40	0.7817	0.541	23.145	28	9	sand
65.453	137.03	0.7417	0.541	22.979	26	9	sand
65.617	142.11	0.7521	0.529	23.308	27	9	sand
65.781	147.25	0.7482	0.508	23.539	28	9	sand
65.945	141.10	0.7212	0.511	23.245	27	9	sand
66.109	137.80	0.7117	0.517	23.234	26	9	sand
66.273	136.78	0.7175	0.525	23.709	26	9	sand
66.437	147.59	0.7425	0.503	23.803	28	9	sand
66.601	146.39	0.7279	0.497	23.740	28	9	sand
66.765	135.26	0.6996	0.517	23.698	26	9	sand
66.929	138.54	0.6867	0.496	23.731	27	9	sand
67.093	138.08	0.6716	0.486	23.786	26	9	sand
67.257	133.98	0.6755	0.504	23.768	26	9	sand
67.421	129.46	0.6821	0.527	23.792	25	9	sand
67.585	116.29	0.6575	0.565	23.683	22	9	sand
67.749	117.25	0.4770	0.407	23.748	22	9	sand
67.913	130.33	0.5013	0.385	24.464	25	9	sand
68.077	134.74	0.5187	0.385	24.089	26	9	sand
68.241	140.83	0.5627	0.400	24.352	27	9	sand
68.406	140.61	0.5820	0.414	24.311	27	9	sand
68.570	136.44	0.6156	0.451	24.339	26	9	sand
68.734	136.04	0.6164	0.453	24.213	26	9	sand
68.898	134.64	0.6246	0.464	24.383	26	9	sand
69.062	139.83	0.6423	0.459	24.346	27	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
69.226	128.28	0.5787	0.451	24.392	25	9	sand
69.390	119.12	0.5663	0.475	24.217	23	9	sand
69.554	119.07	0.5683	0.477	24.422	23	9	sand
69.718	110.91	0.5712	0.515	24.535	21	9	sand
69.882	109.37	0.5654	0.517	24.568	21	9	sand
70.046	114.15	0.5659	0.496	24.834	22	9	sand
70.210	118.74	0.5549	0.467	24.950	23	9	sand
70.374	115.49	0.5593	0.484	24.987	22	9	sand
70.538	116.27	0.5460	0.470	24.904	22	9	sand
70.702	99.14	0.5180	0.523	24.950	24	8	sand to silty sand
70.866	81.73	0.5160	0.631	24.664	20	8	sand to silty sand
71.030	78.16	0.3358	0.430	24.745	19	8	sand to silty sand
71.194	83.84	0.3337	0.398	25.009	20	8	sand to silty sand
71.358	100.30	0.3332	0.332	25.787	19	9	sand
71.522	108.60	0.3299	0.304	25.909	21	9	sand
71.686	110.88	0.4570	0.412	25.939	21	9	sand
71.850	117.43	0.5047	0.430	26.077	22	9	sand
72.014	114.37	0.4772	0.417	25.880	22	9	sand
72.178	108.11	0.4703	0.435	25.610	21	9	sand
72.343	109.02	0.4661	0.427	25.846	21	9	sand
72.507	97.93	0.4585	0.468	25.966	23	8	sand to silty sand
72.671	88.09	0.4402	0.500	25.702	21	8	sand to silty sand
72.835	92.17	0.4383	0.476	25.867	22	8	sand to silty sand
72.999	100.36	0.4548	0.453	26.288	24	8	sand to silty sand
73.163	92.21	0.4625	0.502	26.288	22	8	sand to silty sand
73.327	94.10	0.4457	0.474	26.262	23	8	sand to silty sand
73.491	108.52	0.4632	0.427	26.628	21	9	sand
73.655	105.23	0.4748	0.451	26.805	20	9	sand
73.819	100.83	0.4833	0.479	26.676	24	8	sand to silty sand
73.983	102.24	0.4848	0.474	26.639	24	8	sand to silty sand
74.147	98.30	0.4891	0.498	26.646	24	8	sand to silty sand
74.311	98.00	0.4749	0.485	26.652	23	8	sand to silty sand
74.475	90.91	0.4601	0.506	26.633	22	8	sand to silty sand
74.639	84.88	0.3818	0.450	26.548	20	8	sand to silty sand
74.803	81.42	0.3688	0.453	26.567	19	8	sand to silty sand
74.967	75.81	0.3553	0.469	27.021	18	8	sand to silty sand
75.131	74.91	0.3524	0.470	27.167	18	8	sand to silty sand
75.295	73.34	0.3527	0.481	27.284	18	8	sand to silty sand
75.459	72.80	0.3535	0.486	27.529	17	8	sand to silty sand
75.623	73.29	0.3541	0.483	27.568	18	8	sand to silty sand
75.787	73.94	0.3589	0.485	27.703	18	8	sand to silty sand
75.951	77.87	0.3669	0.471	27.949	19	8	sand to silty sand
76.115	81.47	0.3835	0.471	28.159	20	8	sand to silty sand
76.280	86.35	0.4072	0.472	28.252	21	8	sand to silty sand
76.444	102.44	0.4301	0.420	28.547	20	9	sand
76.608	119.50	0.4640	0.388	28.762	23	9	sand
76.772	143.71	0.6132	0.427	28.858	28	9	sand
76.936	197.24	0.9025	0.458	29.288	38	9	sand
77.100	238.92	1.2396	0.519	29.794	46	9	sand
77.264	254.20	1.4595	0.574	29.702	49	9	sand
77.428	255.96	1.6202	0.633	28.289	49	9	sand
77.592	255.38	1.7016	0.666	27.840	49	9	sand
77.756	252.32	1.6504	0.654	27.252	48	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
77.920	246.12	1.6089	0.654	27.317	47	9	sand
78.084	243.61	1.5564	0.639	38.071	47	9	sand
78.248	240.65	1.6377	0.681	27.337	46	9	sand
78.412	234.90	1.5747	0.670	27.184	45	9	sand
78.576	210.76	1.4766	0.701	26.391	40	9	sand
78.740	201.60	1.4379	0.713	26.532	39	9	sand
78.904	196.93	1.4037	0.713	26.696	38	9	sand
79.068	197.50	1.4054	0.712	27.162	38	9	sand
79.232	198.00	1.3952	0.705	27.494	38	9	sand
79.396	202.44	1.4045	0.694	27.705	39	9	sand
79.560	203.74	1.4144	0.694	27.686	39	9	sand
79.724	208.22	1.4428	0.693	27.648	40	9	sand
79.888	218.08	1.4695	0.674	28.623	42	9	sand
80.052	219.38	1.4523	0.662	28.224	42	9	sand
80.217	222.83	1.4343	0.644	28.174	43	9	sand
80.381	227.31	1.4463	0.636	27.413	44	9	sand
80.545	227.92	1.4856	0.652	27.801	44	9	sand
80.709	214.86	1.4614	0.680	27.352	41	9	sand
80.873	194.31	1.4023	0.722	27.097	37	9	sand
81.037	174.44	1.3592	0.779	26.465	33	9	sand
81.201	160.18	0.8523	0.532	26.591	31	9	sand
81.365	152.11	0.7745	0.509	26.155	29	9	sand
81.529	130.58	0.7503	0.575	26.674	25	9	sand
81.693	120.46	0.7188	0.597	26.718	23	9	sand
81.857	110.73	0.6683	0.604	26.912	27	8	sand to silty sand
82.021	97.12	0.6133	0.631	27.108	23	8	sand to silty sand
82.185	87.35	0.5661	0.648	27.171	21	8	sand to silty sand
82.349	79.63	0.5516	0.693	27.446	19	8	sand to silty sand
82.513	73.67	0.5369	0.729	27.686	18	8	sand to silty sand
82.677	71.77	0.5274	0.735	28.052	17	8	sand to silty sand
82.841	71.33	0.5254	0.737	28.427	17	8	sand to silty sand
83.005	71.68	0.5237	0.731	28.791	17	8	sand to silty sand
83.169	73.55	0.5209	0.708	29.079	18	8	sand to silty sand
83.333	73.69	0.5130	0.696	29.438	18	8	sand to silty sand
83.497	74.67	0.5134	0.688	29.615	18	8	sand to silty sand
83.661	79.29	0.5118	0.645	29.774	19	8	sand to silty sand
83.825	82.98	0.5202	0.627	30.216	20	8	sand to silty sand
83.990	86.27	0.5277	0.612	30.267	21	8	sand to silty sand
84.154	87.65	0.5296	0.604	30.408	21	8	sand to silty sand
84.318	90.93	0.2336	0.257	30.280	17	9	sand
84.482	94.30	0.2753	0.292	30.648	18	9	sand
84.646	93.08	0.3338	0.359	30.982	22	8	sand to silty sand
84.810	98.60	0.4020	0.408	31.324	19	9	sand
84.974	105.12	0.4205	0.400	31.224	20	9	sand
85.138	110.76	0.4238	0.383	31.145	21	9	sand
85.302	91.47	0.4088	0.447	30.975	22	8	sand to silty sand
85.466	78.67	0.3821	0.486	30.668	19	8	sand to silty sand
85.630	73.15	0.3723	0.509	30.657	18	8	sand to silty sand
85.794	72.83	0.3722	0.511	31.034	17	8	sand to silty sand
85.958	72.42	0.3681	0.508	31.272	17	8	sand to silty sand
86.122	70.90	0.3704	0.522	31.529	17	8	sand to silty sand
86.286	71.61	0.3710	0.518	31.751	17	8	sand to silty sand
86.450	71.99	0.3758	0.522	31.723	17	8	sand to silty sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
86.614	73.09	0.3725	0.510	31.956	17	8	sand to silty sand
86.778	73.76	0.3701	0.502	31.952	18	8	sand to silty sand
86.942	73.40	0.3746	0.510	32.113	18	8	sand to silty sand
87.106	74.48	0.3707	0.498	32.146	18	8	sand to silty sand
87.270	73.82	0.3739	0.507	32.233	18	8	sand to silty sand
87.434	73.27	0.3456	0.472	32.412	18	8	sand to silty sand
87.598	75.14	0.3326	0.443	32.521	18	8	sand to silty sand
87.762	74.91	0.3404	0.454	32.536	18	8	sand to silty sand
87.927	75.79	0.3412	0.450	32.808	18	8	sand to silty sand
88.091	76.55	0.3393	0.443	32.769	18	8	sand to silty sand
88.255	78.37	0.3475	0.443	32.878	19	8	sand to silty sand
88.419	80.99	0.3663	0.452	33.140	19	8	sand to silty sand
88.583	83.83	0.3676	0.438	33.162	20	8	sand to silty sand
88.747	88.71	0.3812	0.430	33.236	21	8	sand to silty sand
88.911	102.84	0.4214	0.410	33.539	20	9	sand
89.075	108.02	0.4373	0.405	33.709	21	9	sand
89.239	106.62	0.4530	0.425	33.632	20	9	sand
89.403	104.89	0.4500	0.429	33.484	20	9	sand
89.567	100.38	0.4484	0.447	33.460	19	9	sand
89.731	96.73	0.4526	0.468	33.521	23	8	sand to silty sand
89.895	103.36	0.4642	0.449	33.800	20	9	sand
90.059	119.09	0.5066	0.425	33.979	23	9	sand
90.223	118.18	0.5161	0.437	34.262	23	9	sand
90.387	107.06	0.5197	0.485	33.615	21	9	sand
90.551	104.46	0.5221	0.500	33.822	25	8	sand to silty sand
90.715	115.79	0.5209	0.450	34.164	22	9	sand
90.879	136.26	0.5729	0.420	34.548	26	9	sand
91.043	138.18	0.5827	0.422	34.757	26	9	sand
91.207	142.83	0.6228	0.436	33.979	27	9	sand
91.371	145.30	0.6612	0.455	34.182	28	9	sand
91.535	149.77	0.7763	0.518	34.121	29	9	sand
91.699	159.02	0.8222	0.517	34.271	30	9	sand
91.864	157.16	0.8669	0.552	34.550	30	9	sand
92.028	156.75	0.8643	0.551	33.979	30	9	sand
92.192	149.10	0.8387	0.563	34.112	29	9	sand
92.356	159.42	0.8707	0.546	33.953	31	9	sand
92.520	157.64	0.8232	0.522	34.579	30	9	sand
92.684	138.42	0.7602	0.549	34.042	27	9	sand
92.848	116.40	0.7231	0.621	33.558	22	9	sand
93.012	119.55	0.7158	0.599	33.787	23	9	sand
93.176	125.64	0.7281	0.579	34.308	24	9	sand
93.340	123.12	0.7192	0.584	34.310	24	9	sand
93.504	125.53	0.7245	0.577	34.640	24	9	sand
93.668	120.76	0.7329	0.607	34.862	23	9	sand
93.832	111.60	0.7177	0.643	34.718	27	8	sand to silty sand
93.996	103.06	0.6879	0.668	34.509	25	8	sand to silty sand
94.160	95.60	0.4621	0.483	34.345	23	8	sand to silty sand
94.324	99.08	0.4344	0.438	34.478	24	8	sand to silty sand
94.488	111.86	0.4976	0.445	35.289	21	9	sand
94.652	128.16	0.6013	0.469	36.558	25	9	sand
94.816	128.38	0.7003	0.545	35.963	25	9	sand
94.980	128.13	0.7538	0.588	36.054	25	9	sand
95.144	128.20	0.7607	0.593	35.267	25	9	sand

Depth ft	Tip COR (tsf)	Sleeve Stress (tsf)	F.Ratio (%)	Pore Pressure (psi)	SPT N60 (UNITLESS)	Zone	Soil Behavior Type UBC-1983
95.308	135.90	0.8094	0.596	35.958	26	9	sand
95.472	135.89	0.8247	0.607	35.372	26	9	sand
95.636	133.13	0.7810	0.587	35.688	25	9	sand
95.801	126.69	0.7431	0.587	35.304	24	9	sand
95.965	116.12	0.6994	0.602	34.683	22	9	sand
96.129	111.54	0.6776	0.607	34.962	27	8	sand to silty sand
96.293	106.62	0.6511	0.611	34.903	26	8	sand to silty sand
96.457	102.87	0.6560	0.638	35.431	25	8	sand to silty sand
96.621	102.13	0.6608	0.647	35.930	24	8	sand to silty sand
96.785	102.51	0.6821	0.665	36.222	25	8	sand to silty sand
96.949	106.24	0.6979	0.657	36.220	25	8	sand to silty sand
97.113	114.59	0.7336	0.640	36.735	27	8	sand to silty sand
97.277	128.06	0.6608	0.516	36.780	25	9	sand
97.441	139.66	0.7016	0.502	37.194	27	9	sand
97.605	138.87	0.7462	0.537	36.414	27	9	sand
97.769	142.01	0.7676	0.541	36.135	27	9	sand
97.933	142.33	0.7821	0.549	35.945	27	9	sand
98.097	135.47	0.7924	0.585	36.264	26	9	sand
98.261	126.85	0.7628	0.601	36.416	24	9	sand
98.425	128.60	0.7678	0.597	36.305	25	9	sand
98.589	132.66	0.7682	0.579	36.386	25	9	sand
98.753	134.05	0.7623	0.569	36.920	26	9	sand
98.917	129.80	0.7227	0.557	36.933	25	9	sand
99.081	140.37	0.7518	0.536	37.138	27	9	sand
99.245	136.60	0.7639	0.559	36.994	26	9	sand
99.409	121.29	0.7265	0.599	36.702	23	9	sand
99.573	112.38	0.6755	0.601	36.693	27	8	sand to silty sand
99.738	108.75	0.6516	0.599	36.835	26	8	sand to silty sand
99.902	129.69	0.6959	0.537	37.689	25	9	sand
100.066	150.23	0.7508	0.500	37.840	29	9	sand
100.230	146.81	0.7484	0.510	38.032	28	9	sand
100.394	132.91	0.7153	0.538	37.447	25	9	sand
100.558	113.61	0.7102	0.625	36.913	27	8	sand to silty sand
100.722	106.95	0.7102	0.664	36.870	26	8	sand to silty sand

Revised Report of Geotechnical Engineering Services

PDX Fuel Facility Improvements

Portland, Oregon

Prepared for

Burns & McDonnell

August 17, 2020

154-118-001

HARTCROWSER

0 1,000 2,000 4,000 Feet

Note: Feature locations are approximate.

N

PDX Fueling Facility Improvements
Portland, Oregon

Vicinity Map

154-118-001 9/19

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Figure 1

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Legend

- Boring
- Cone Penetrometer Test

N

0 30 60 120

Feet

Note: Feature locations are approximate.

PDX Fueling Facility Improvements
Portland, Oregon

Site Plan

154-118-001 9/19

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Figure 2

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APPENDIX A
Field Explorations

APPENDIX A

Field Explorations

General

This appendix documents the processes Hart Crowser used to determine the nature and quality of the soil and groundwater underlying the project site. We evaluated subsurface conditions at the site by advancing three CPT soundings and one geotechnical boring. The explorations were coordinated and overseen by geotechnical staff from Hart Crowser. A log of the geotechnical boring is included in this appendix. Data reports for the CPT soundings are included after the boring log.

The field explorations were coordinated by a geologist on our staff, who classified the various soil units encountered, obtained representative soil samples for geotechnical testing, and maintained a detailed log of the boring.

The exploration log within this appendix shows our interpretation of the drilling, sampling, and testing data. It indicates the depth where the soils change. Note that the change may be gradual. In the field, we classified the samples taken from the exploration according to the methods presented on Figure A-1 *Key to Exploration Logs* in this appendix. The key also provides a legend explaining the symbols and abbreviations used in the logs.

The approximate locations of the explorations are shown on Figure 2 of the report. Explorations were located in the field using a hand-held Garmin Trimble GPS unit.

Boring

We evaluated subsurface conditions at the site by completing one drilled boring on June 27, 2019. The boring was advanced using hollow stem auger methods in the top 16.5 feet bgs to observe groundwater levels and then mud rotary to depth using a truck-mounted drill rig operated by Western States Soil Conservation. The mud-rotary boring created a hole approximately 4 inches in diameter. The hole was backfilled with hydrated bentonite chips topped with site soils, which had been reserved during drilling. Figure 2 of the report shows the approximate location of the boring.

Soil Sampling Procedures

Materials encountered in the boring were classified in the field in general accordance with ASTM Test Method D 2488 “Standard Practice for the Classification of Soils (Visual Manual Procedure).” Soil classifications and sampling intervals are shown on the exploration logs included in this appendix.

Soil samples were obtained from the boring using the following methods.

- Samples were obtained from the boring using 1-1/2-inch inner-diameter split-spoon sampler (SPT sampler) in general accordance with guidelines presented in ASTM D 1586. The split-barrel sampler was driven into the soil with a 140-pound hammer free falling 30 inches. The sampler was driven a total distance of 18 inches or until refusal criteria was met (greater than 50 blows per 6 inches). The number of blows required to drive the samplers the final 12 inches (the N-value) is recorded on the exploration log, unless otherwise noted. All soil samples were placed into watertight bags and delivered to Hart Crowser's laboratory.

- Relatively undisturbed samples were collected at selected depths using thin-walled sampling methods, such as Shelby tubes.

CPT Soundings

Three CPT soundings were advanced on July 9, 2019, by Conetec Investigations of Auburn, Washington. They were completed in general accordance with ASTM D 5778 using a seismic electronic cone penetrometer. The CPT soundings are an *in situ* test that provides assistance in characterizing subsurface stratigraphy. The test includes advancing a 35.6-mm-diameter cone equipped with a load cell, friction sleeve, strain gages, porous stone, and geophone through the soil profile. The cone is advanced at a rate of approximately 2 centimeters per second. Tip resistance, sleeve friction, and pore pressure are typically recorded at 0.1-meter intervals. For seismic shear wave testing, the cone penetration is stopped at prescribed depth intervals (typically every 1 to 2 meters), and seismic profile readings are obtained at intervals of 5 seconds. Figure 2 of the report shows the approximate locations of the soundings. The logs of the CPT soundings are presented in this appendix.

Sample Description

Identification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. ASTM D 2488 visual-manual identification methods were used as a guide. Where laboratory testing confirmed visual-manual identifications, then ASTM D 2487 was used to classify the soils.

Relative Density/Consistency

Soil density/consistency in borings is related primarily to the standard penetration resistance (N). Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

SAND or GRAVEL Relative Density	N (Blows/Foot)	SILT or CLAY Consistency	N (Blows/Foot)
Very loose	0 to 4	Very soft	0 to 1
Loose	5 to 10	Soft	2 to 4
Medium dense	11 to 30	Medium stiff	5 to 8
Dense	31 to 50	Stiff	9 to 15
Very dense	>50	Very stiff	16 to 30
		Hard	>30

Moisture

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

USCS Soil Classification Chart (ASTM D 2487)

Major Divisions			Symbols: Graph	Symbols: USCS	Typical Descriptions
Coarse Grained Soils: More than 50% of Material Retained on No. 200 Sieve	Gravel and Gravelly Soils: More than 50% of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels (<5% fines)		GW	Well-Graded Gravel; Well-Graded Gravel with Sand
				GP	Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Gravels (5-12% fines)		GW-GM	Well-Graded Gravel with Silt; Well-Graded Gravel with Silt and Sand
				GW-GC	Well-Graded Gravel with Clay; Well-Graded Gravel with Clay and Sand
				GP-GM	Poorly Graded Gravel with Silt; Poorly Graded Gravel with Silt and Sand
				GP-GC	Poorly Graded Gravel with Clay; Poorly Graded Gravel with Clay and Sand
		Gravels with Fines (>12% fines)		GM	Silty Gravel; Silty Gravel with Sand
				GC	Clayey Gravel; Clayey Gravel with Sand
	Sand and Sandy Soils: More than 50% of Coarse Fraction Passing No. 4 Sieve	Sands with few Fines (<5% fines)		SW	Well-Graded Sand; Well-Graded Sand with Gravel
				SP	Poorly Graded Sand; Poorly Graded Sand with Gravel
		Sands (5-12% fines)		SW-SM	Well-Graded Sand with Silt Well-Graded Sand with Silt and Gravel
				SW-SC	Well-Graded Sand with Clay; Well-Graded Sand with Clay and Gravel
				SP-SM	Poorly Graded Sand with Silt; Poorly Graded Sand with Silt and Gravel
				SP-SC	Poorly Graded Sand with Clay; Poorly Graded Sand with Clay and Gravel
		Sands with Fines (>12% fines)		SM	Silty Sand; Silty Sand with Gravel
				SC	Clayey Sand; Clayey Sand with Gravel
Fine Grained Soils: More than 50% of Material Passing No. 200 Sieve	Silts			ML	Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
				MH	Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
	Silty Clay (based on Atterberg Limits)			CL-ML	Silty Clay; Silty Clay with Sand or Gravel; Gravelly or Sandy Silty Clay
	Clays			CL	Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
				CH	Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
	Organics			OL/OH	Organic Soil; Organic Soil with Sand or Gravel; Sandy or Gravelly Organic Soil
Highly Organic (>50% organic material)				PT	Peat - Decomposing Vegetation - Fibrous to Amorphous Texture

Minor Constituents

	Estimated Percentage
Sand, Gravel	
Trace	<5
Few	5 - 15
Cobbles, Boulders	
Trace	<5
Few	5 - 10
Little	15 - 25
Some	30 - 45

Soil Test Symbols

%F	Percent Passing No. 200 Sieve
AL	Atterberg Limits (%)
	Liquid Limit (LL)
	Water Content (WC)
	Plastic Limit (PL)
CA	Chemical Analysis
CAUC	Consolidated Anisotropic Undrained Compression
CAUE	Consolidated Anisotropic Undrained Extension
CBR	California Bearing Ratio
CIDC	Consolidated Drained Isotropic Triaxial Compression
CIUC	Consolidated Isotropic Undrained Compression
CK0DC	Consolidated Drained k0 Triaxial Compression
CK0DSS	Consolidated k0 Undrained Direct Simple Shear
CK0UC	Consolidated k0 Undrained Compression
CK0UE	Consolidated k0 Undrained Extension
CRSCN	Constant Rate of Strain Consolidation
DSS	Direct Simple Shear
DT	In Situ Density
GS	Grain Size Classification
HYD	Hydrometer
ILCN	Incremental Load Consolidation
K0CN	k0 Consolidation
kc	Constant Head Permeability
kf	Falling Head Permeability
MD	Moisture Density Relationship
OC	Organic Content
OT	Tests by Others
P	Pressuremeter
PID	Photoionization Detector Reading
PP	Pocket Penetrometer
SG	Specific Gravity
TRS	Torsional Ring Shear
TV	Torvane
UC	Unconfined Compression
UUC	Unconsolidated Undrained Triaxial Compression
VS	Vane Shear
WC	Water Content (%)

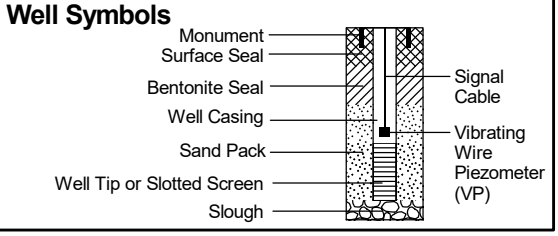
Groundwater Indicators

- Groundwater Level on Date or At Time of Drilling (ATD)
- Groundwater Level on Date Measured in Piezometer
- Groundwater Seepage (Test Pits)

Sample Symbols

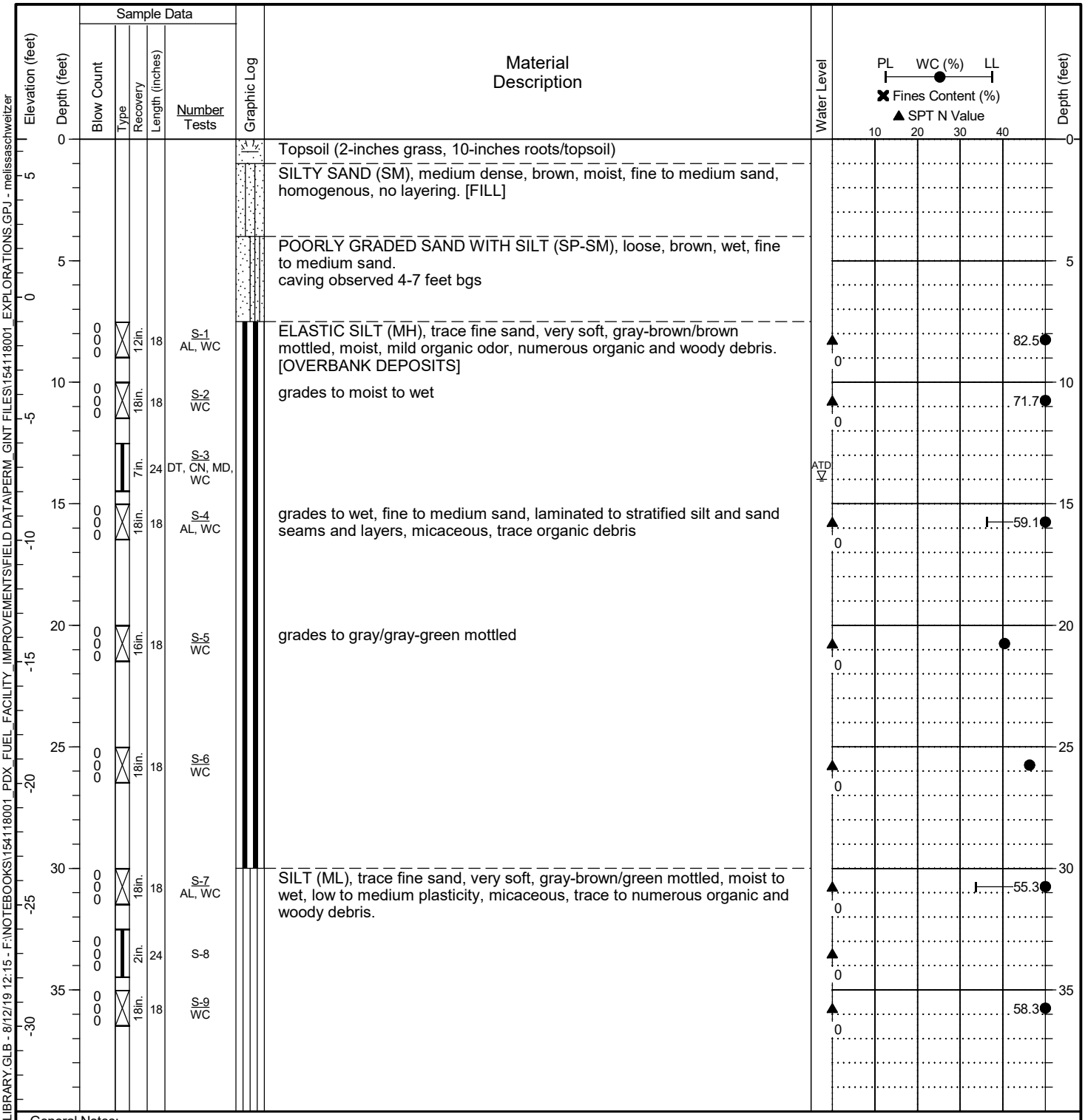
- 1.5" I.D. Split Spoon
- 3.25" O.D. Split Spoon
- Modified California Sampler
- Rock Core Run
- Sonic Core
- Shelby Tube/Push Probe/GeoProbe®
- Grab
- Cuttings

Well Symbols



KEY TO EXP LOGS (SOIL ONLY) - F:\GINT\HC_LIBRARY.GLB - 7/11/19 16:47 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Date Started: 6/27/19	Date Completed: 6/27/19	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Lucas	
Logged by: D. Knapp	Checked by: T. Anderson	Drilling Method: Mud Rotary/Hollow Stem Auger	
Location: Lat: 45.596739 Long: -122.612754		Rig Model/Type: GeoProbe® 7822DT / Track-mounted push-probe rig	
Ground Surface Elevation: 6.5 feet		Hammer Type: Auto-hammer	
Horizontal Datum: WGS 84		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
Vertical Datum: NAVD 88		Measured Hammer Efficiency (%): 91	
Comments: Location and ground surface elevations are approximate.		Hole Diameter:	Casing Diameter: NA
		Total Depth: 86.5 feet	Depth to Groundwater: 14 feet



General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material descriptions and stratum lines are interpretive and actual changes may be gradual. Solid stratum lines indicate distinct contact between material strata or geologic units. Dashed stratum lines indicate gradual or approximate change between material strata or geologic units.
3. USCS designations are based on visual-manual identification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

HARTCROWSER

Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Boring Log
B-1

Figure **A-2**
Sheet **1 of 3**

HC BORING LOG - F:\GINT\HC_LIBRARY.GLB - 8/12/19 12:15 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Date Started: 6/27/19	Date Completed: 6/27/19	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Lucas	
Logged by: D. Knapp	Checked by: T. Anderson	Drilling Method: Mud Rotary/Hollow Stem Auger	
Location: Lat: 45.596739 Long: -122.612754		Rig Model/Type: GeoProbe® 7822DT / Track-mounted push-probe rig	
Ground Surface Elevation: 6.5 feet		Hammer Type: Auto-hammer	
Horizontal Datum: WGS 84		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
Vertical Datum: NAVD 88		Measured Hammer Efficiency (%): 91	
Comments: Location and ground surface elevations are approximate.		Hole Diameter:	Casing Diameter: NA
		Total Depth: 86.5 feet	Depth to Groundwater: 14 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10 20 30 40)	Depth (feet)
-35	40	0 0 0		18in.	18	S-10 WC		SILT (ML), trace fine sand, very soft, gray-brown/green mottled, moist to wet, low to medium plasticity, micaceous, trace to numerous organic and woody debris. *(continued)* numerous fine to coarse sand lenses and layers, blocky, trace clay		▲ 0	40
-40	45	5 5 4		12in.	18	S-11 WC		POORLY GRADED SAND WITH SILT (SP-SM), loose, gray, wet, fine to medium sand, rapid dilatancy, micaceous, quartz-rich. [COLUMBIA RIVER SAND AQUIFER]		▲ 9	45
-45	50	8 9 10		11in.	18	S-12 GS, WC		grades to medium dense		✖ 6 ▲ 19 ●	50
-50	55	4 6 7		10in.	18	S-13 WC				▲ 13 ●	55
-55	60	5 6 8		12in.	18	S-14 WC				▲ 14 ●	60
-60	65	6 8 9		9in.	18	S-15 WC				▲ 17 ●	65
-65	70	5 8 9		10in.	18	S-16 WC				▲ 17 ●	70
-70	75	8 7 11		12in.	18	S-17 WC		increase in silt content		▲ 18 ●	75

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material descriptions and stratum lines are interpretive and actual changes may be gradual. Solid stratum lines indicate distinct contact between material strata or geologic units. Dashed stratum lines indicate gradual or approximate change between material strata or geologic units.
3. USCS designations are based on visual-manual identification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

HARTCROWSER

Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Boring Log **B-1**

Figure **A-2**
Sheet **2 of 3**

HC BORING LOG - F:\GINT\HC_LIBRARY.GLB - 8/12/19 12:15 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Date Started: 6/27/19	Date Completed: 6/27/19	Drilling Contractor/Crew: Western States Soil Conservation, Inc. / Lucas	
Logged by: D. Knapp	Checked by: T. Anderson	Drilling Method: Mud Rotary/Hollow Stem Auger	
Location: Lat: 45.596739 Long: -122.612754		Rig Model/Type: GeoProbe® 7822DT / Track-mounted push-probe rig	
Ground Surface Elevation: 6.5 feet		Hammer Type: Auto-hammer	
Horizontal Datum: WGS 84		Hammer Weight (pounds): 140	Hammer Drop Height (inches): 30
Vertical Datum: NAVD 88		Measured Hammer Efficiency (%): 91	
Comments: Location and ground surface elevations are approximate.		Hole Diameter:	Casing Diameter: NA
		Total Depth: 86.5 feet	Depth to Groundwater: 14 feet

Elevation (feet)	Depth (feet)	Sample Data: Blow Count	Type	Recovery	Length (inches)	Number / Tests	Graphic Log	Material Description	Water Level	PL WC (%) LL; ✖ Fines Content (%); ▲ SPT N Value (10 20 30 40)	Depth (feet)
-75	80	4 8 13		13in.	18	S-18		POORLY GRADED SAND WITH SILT (SP-SM), medium dense, gray, wet, fine to medium sand, rapid dilatancy, micaceous, quartz-rich. [COLUMBIA RIVER SAND AQUIFER]		▲ 21	80
-80	85	8 11 13		12in.	18	S-19 WC				▲ 24 ●	85
								Bottom of Borehole at 86.5 feet.			
-85	90										90
-90	95										95
-95	100										100
-100	105										105
-105	110										110
-110	115										115

General Notes:
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Material descriptions and stratum lines are interpretive and actual changes may be gradual. Solid stratum lines indicate distinct contact between material strata or geologic units. Dashed stratum lines indicate gradual or approximate change between material strata or geologic units.
3. USCS designations are based on visual-manual identification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling/excavation (ATD) or for date specified. Level may vary with time.

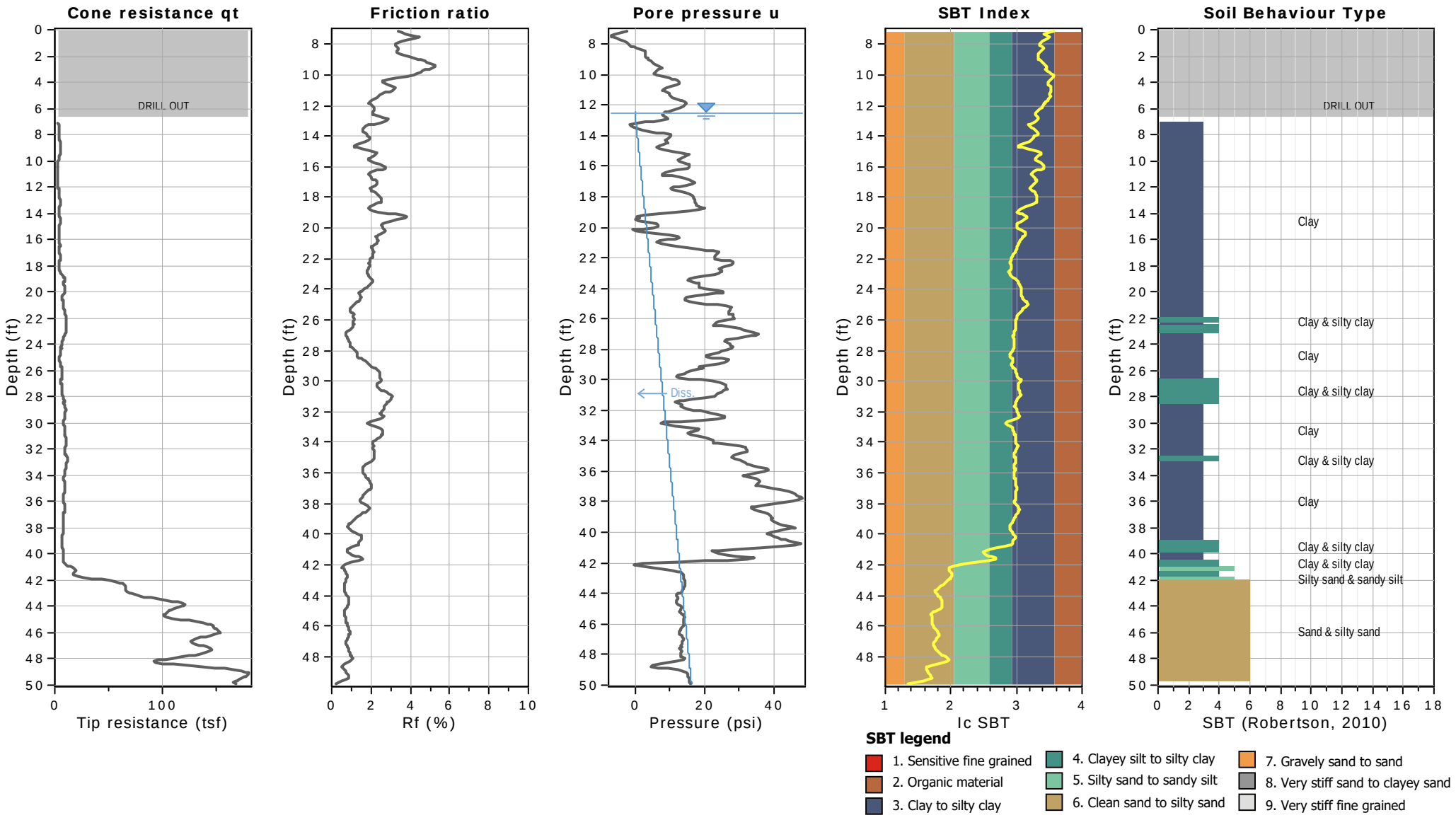
HARTCROWSER	Project: PDX Fueling Facility Improvements Location: Portland, Oregon Project No.: 154-118-001	Boring Log **B-1**	Figure **A-2** Sheet **3 of 3**

HC BORING LOG - F:\GINT\HC_LIBRARY.GLB - 8/12/19 12:15 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - melissaschweitzer

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

CPT: SCPT-01
Total depth: 101.11 ft, Date: 7/9/2019
Surface Elevation: 22.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location:



Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

CPT: SCPT-01
Total depth: 101.11 ft, Date: 7/9/2019
Surface Elevation: 22.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location:

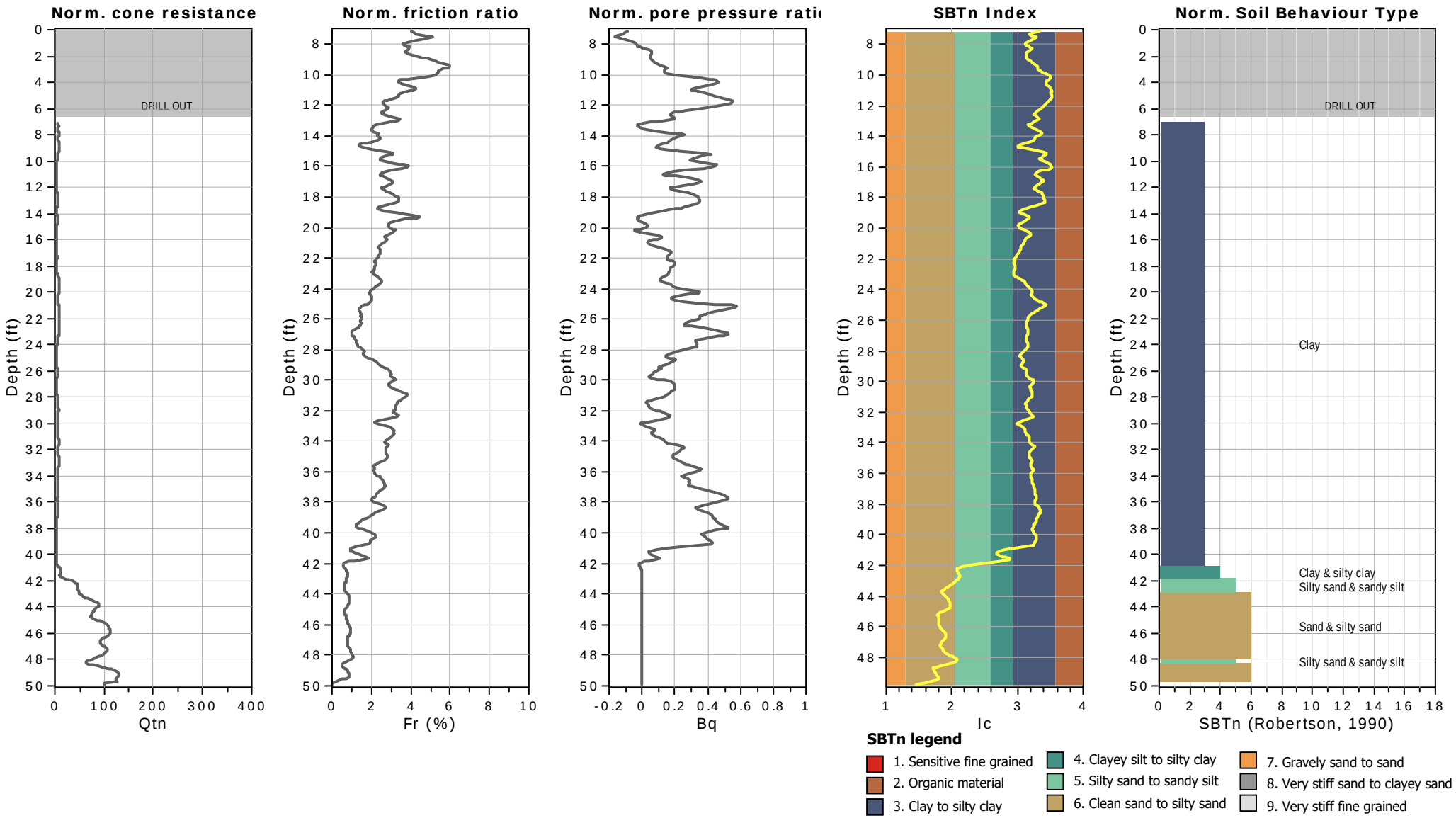


Figure A-3b

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

CPT: SCPT-01
Total depth: 101.11 ft, Date: 7/9/2019
Surface Elevation: 22.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location:

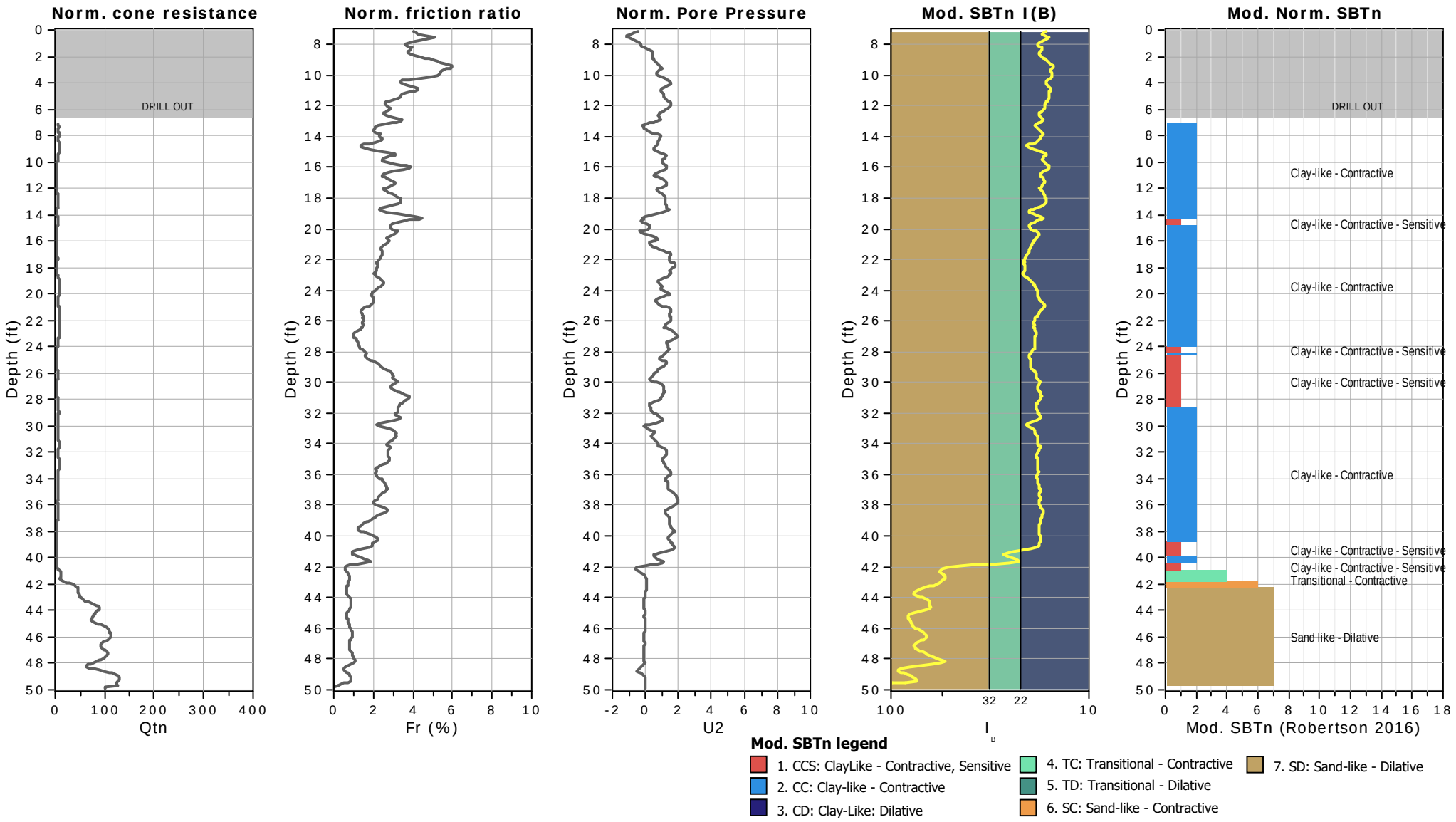


Figure A-3c

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

CPT: CPT-02
Total depth: 51.58 ft, Date: 7/9/2019
Surface Elevation: 22.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location:

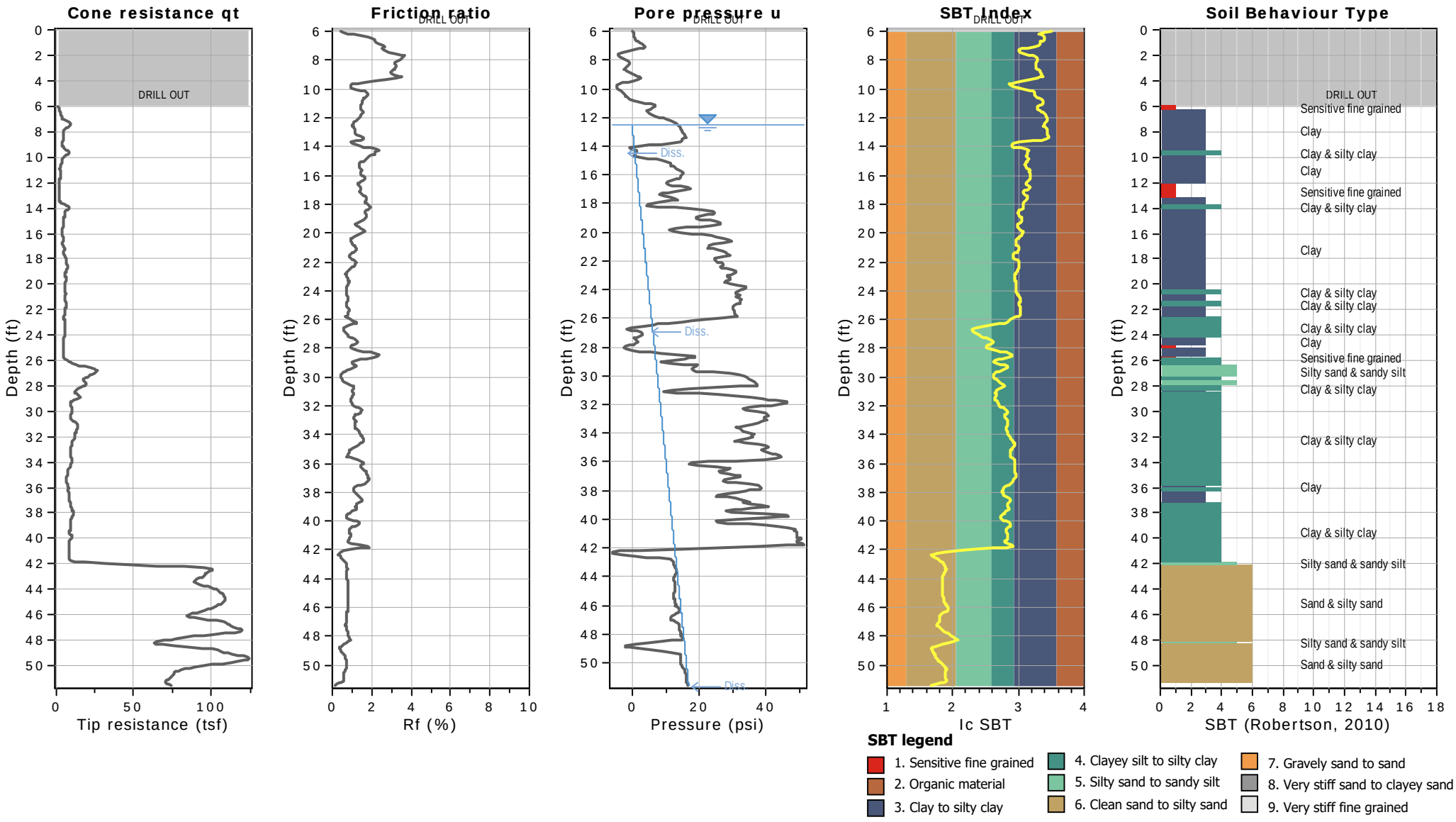


Figure A-4a

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

Project:
Location:

CPT: CPT-02
Total depth: 51.58 ft, Date: 7/9/2019
Surface Elevation: 22.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

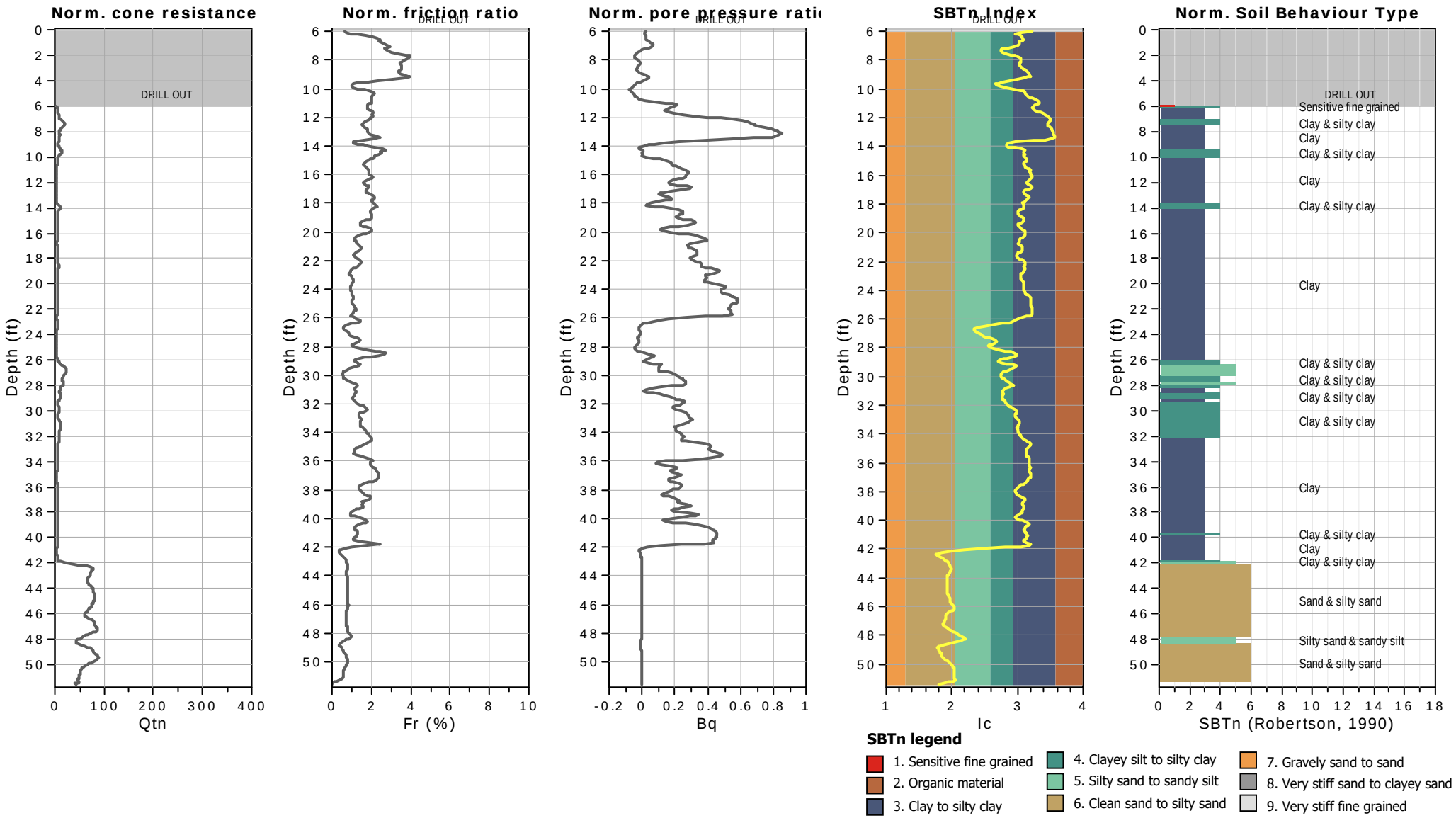
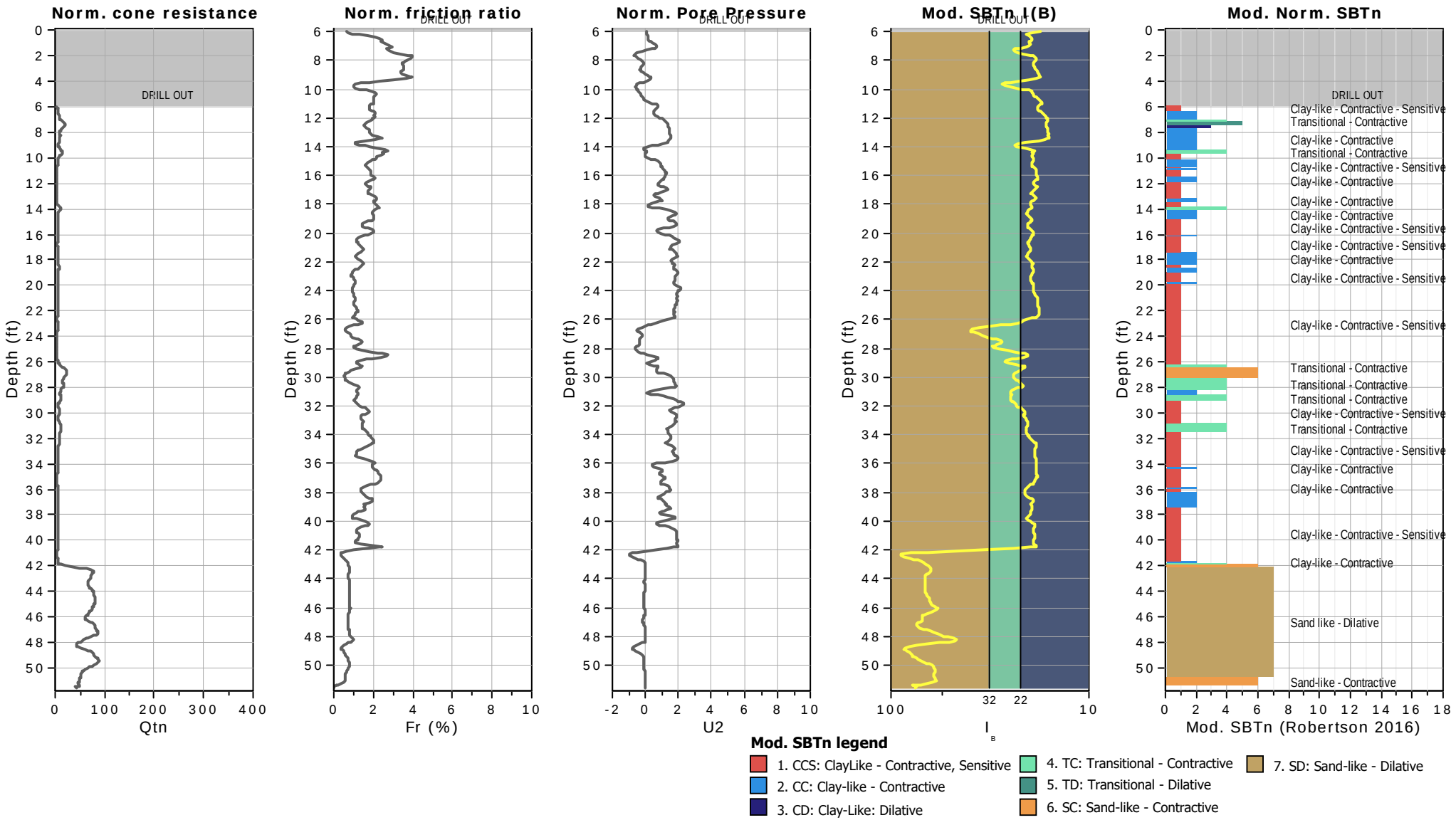


Figure A-4b

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

CPT: CPT-02
Total depth: 51.58 ft, Date: 7/9/2019
Surface Elevation: 22.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location:



Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

Project:
Location:

CPT: CPT-03
Total depth: 49.94 ft, Date: 7/9/2019
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

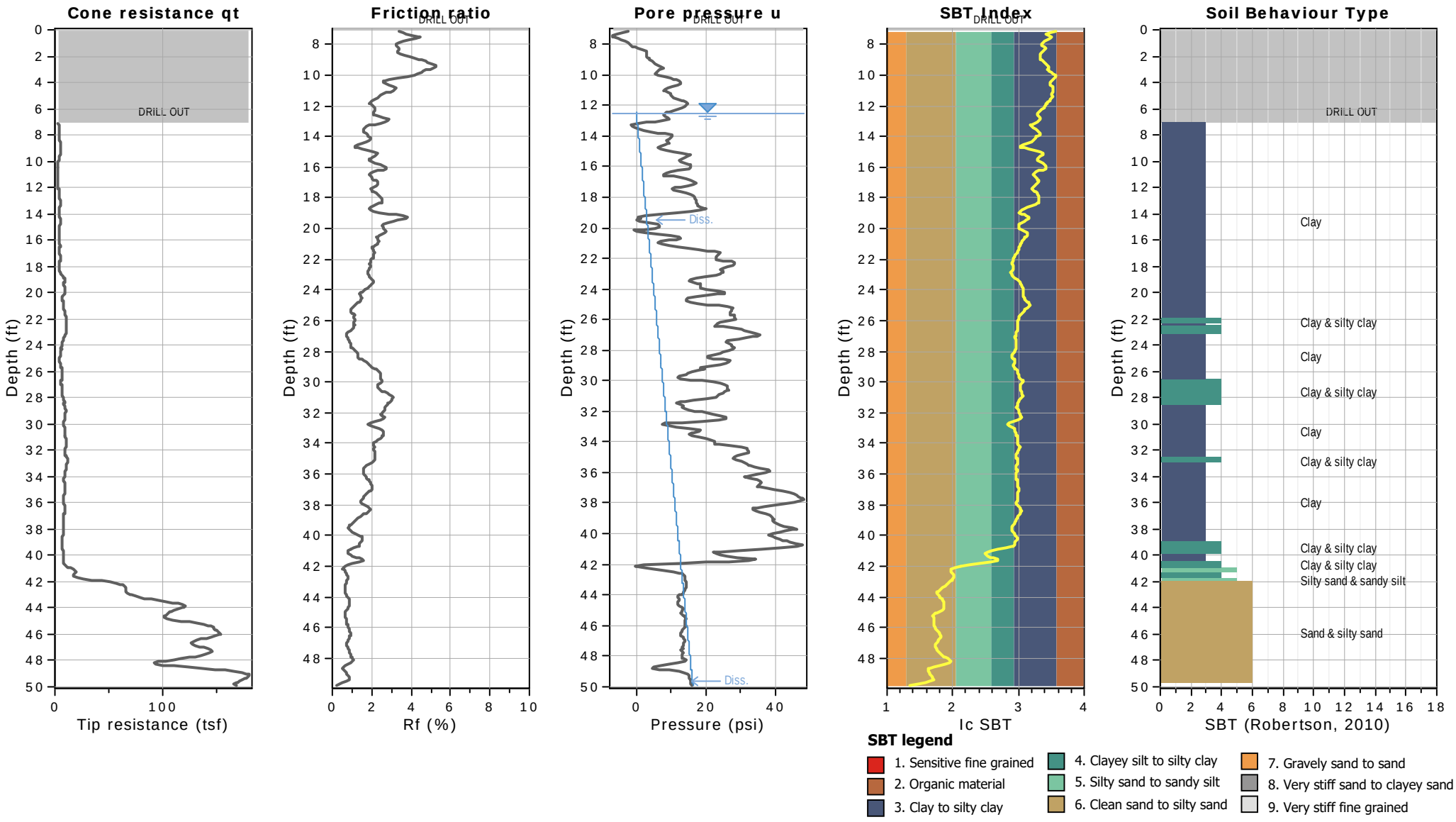


Figure A-5a

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

CPT: CPT-03
Total depth: 49.94 ft, Date: 7/9/2019
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location:

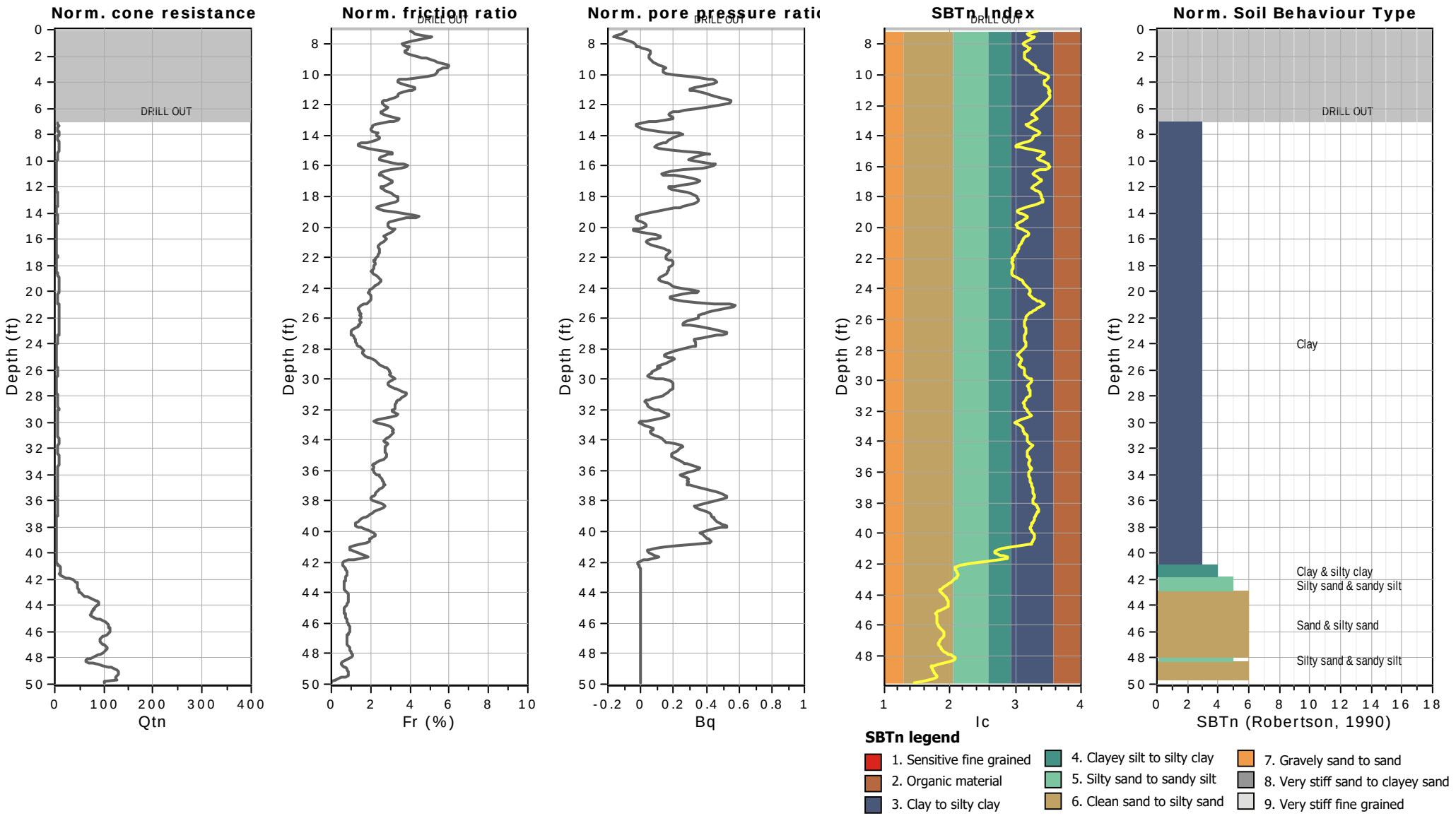
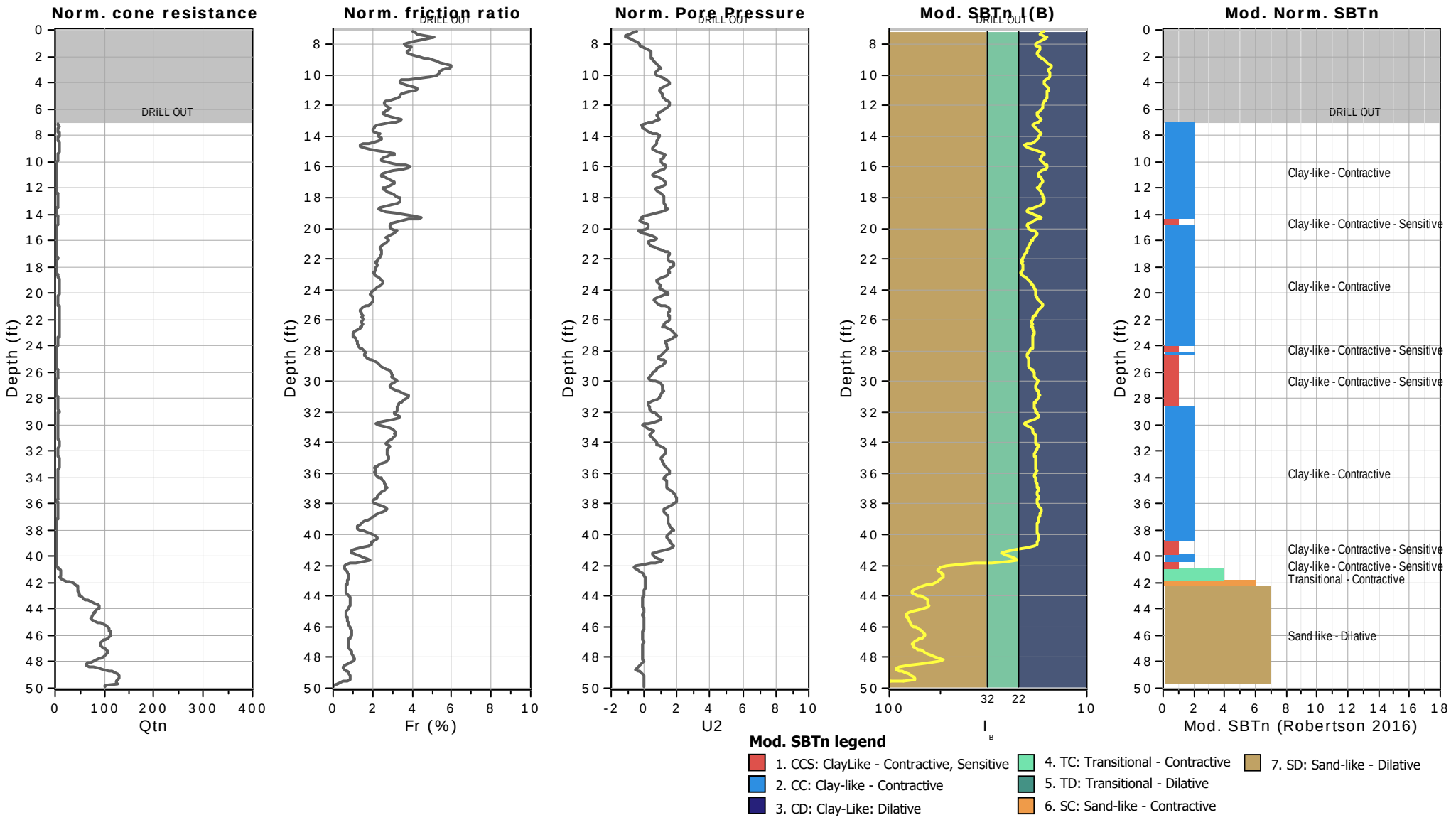


Figure A-5b

Hart Crowser
6420 SW Macadam Ave, Suite 100
Portland, OR 97239
www.hartcrowser.com

Project:
Location:

CPT: CPT-03
Total depth: 49.94 ft, Date: 7/9/2019
Surface Elevation: 0.00 ft
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:



Seismic Cone Penetration Test Plots

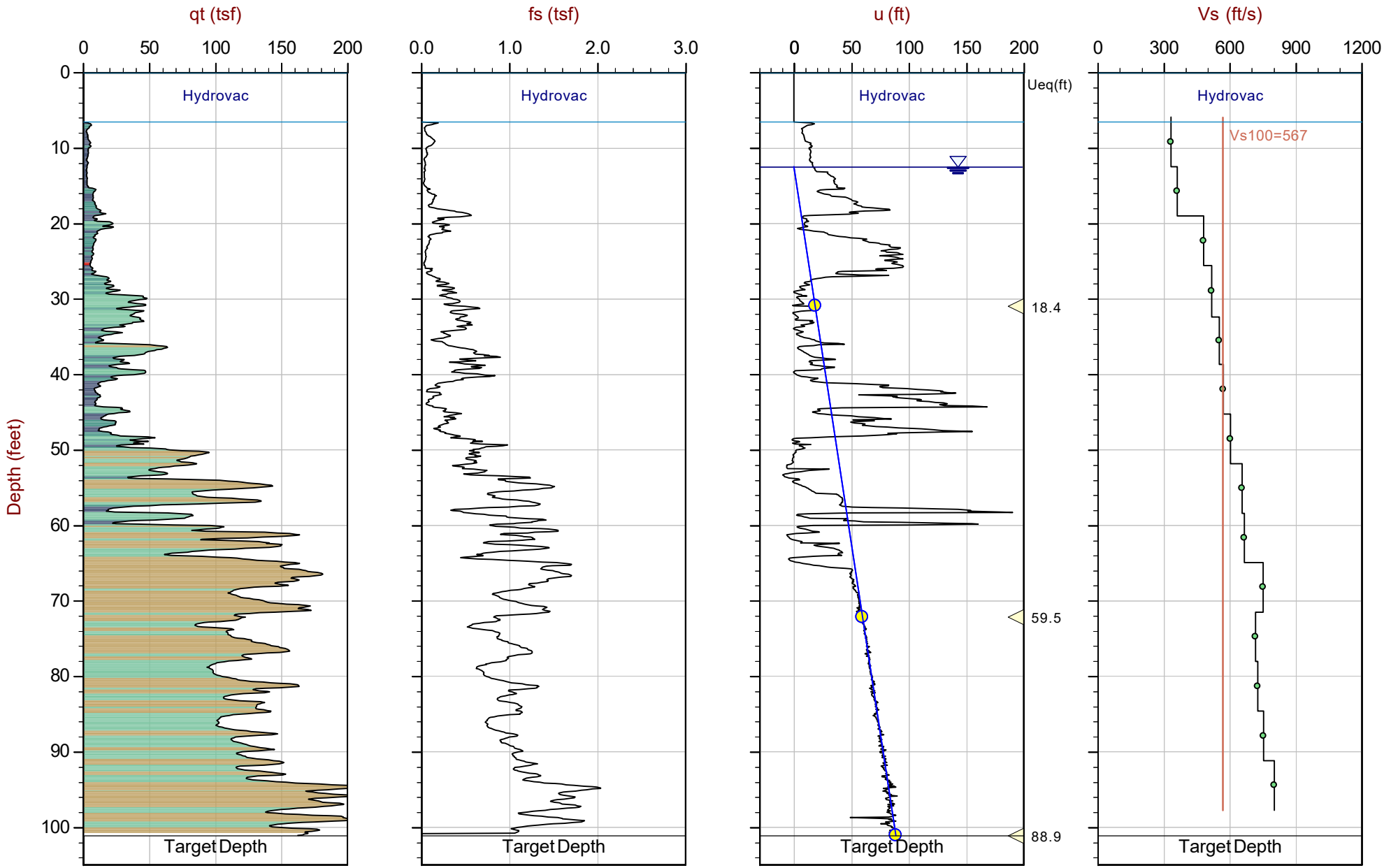
CONETEC

CONETEC

Hart Crowser

Job No: 19-59023
Date: 2019-07-09 12:13
Site: PDX

Sounding: SCPT01
Cone: 536:T1500F15U500



Max Depth: 30.825 m / 101.13 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-59023_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 45.59739 Long: -122.61306

△ Dissipation with estimated Ueq value △ Dissipation, equilibrium not achieved ○ Equilibrium Pore Pressure (Ueq) — Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Tabular Results

CONETEC

Job No:	19-59023
Client:	Hart Crowser
Project:	PDX
Sounding ID:	SCPT-01
Date:	09-Jul-2019

Seismic Source:	Beam
Source Offset (ft):	3.00
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

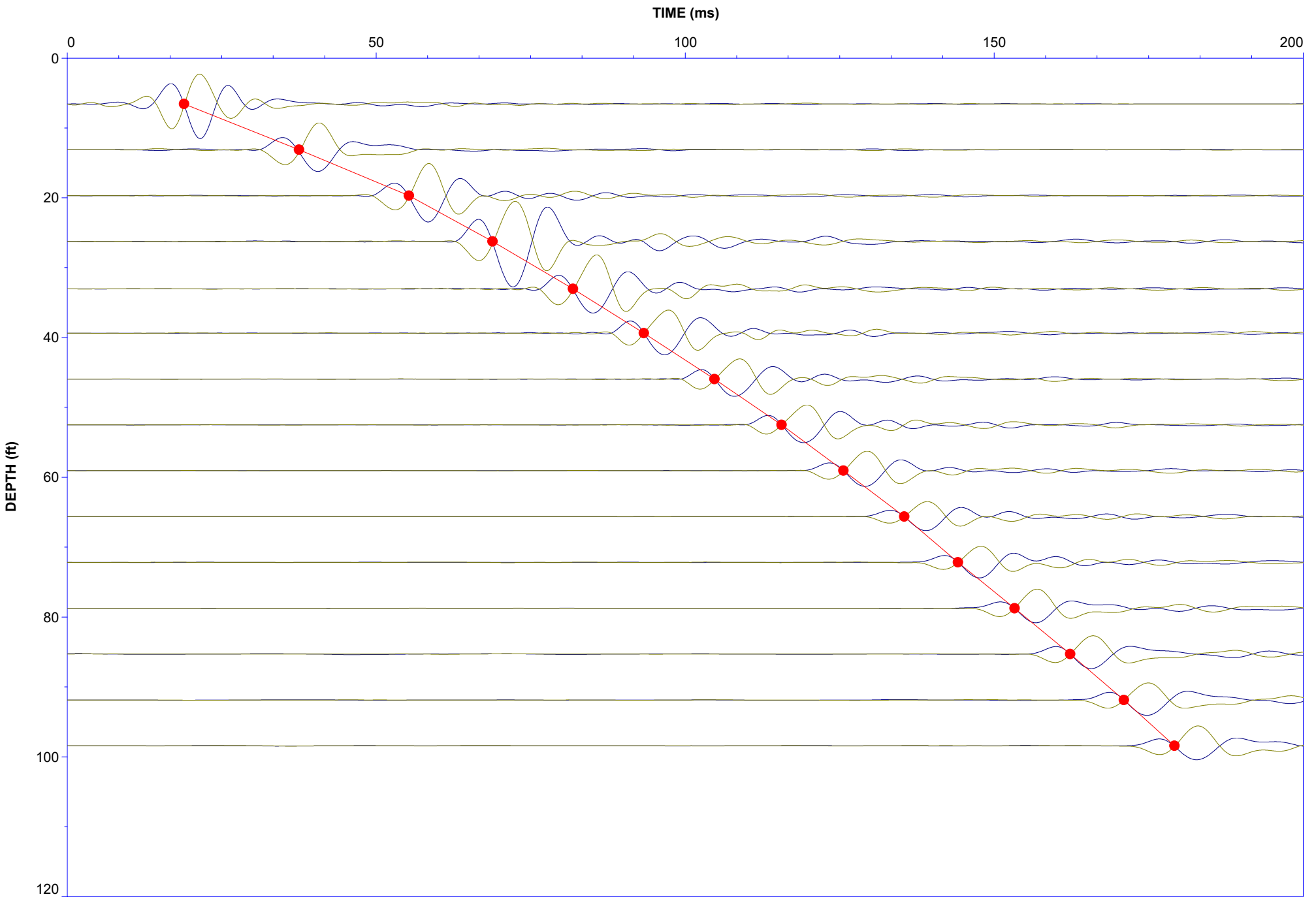
SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
6.56	5.91	6.62			
13.12	12.47	12.82	6.20	18.60	333
19.69	19.03	19.26	6.44	17.79	362
26.25	25.59	25.77	6.50	13.53	481
33.04	32.38	32.52	6.75	13.04	518
39.37	38.71	38.83	6.31	11.44	552
45.93	45.28	45.37	6.54	11.45	571
52.49	51.84	51.92	6.55	10.86	603
59.06	58.40	58.48	6.55	10.00	655
65.62	64.96	65.03	6.55	9.82	667
72.18	71.52	71.59	6.56	8.71	752
78.74	78.08	78.14	6.56	9.14	717
85.30	84.65	84.70	6.56	9.00	728
91.86	91.21	91.26	6.56	8.70	753
98.43	97.77	97.82	6.56	8.16	803

Seismic Cone Penetration Wave Traces

CONETEC

Job No: 19-59023 | Client: Hart Crowser | Project Title: PDX | Operator: SJAN | Sounding ID: SCPT-01 | Site: PDX | Date: July 9, 2019



Pore Pressure Dissipation Summary and

Pore Pressure Dissipation Plots

CONETEC

Job No:	19-59023
Client:	Hart Crowser
Project:	PDX
Start Date:	9-Jul-19
End Date:	9-Jul-19

CPTu PORE PRESSURE DISSIPATION SUMMARY

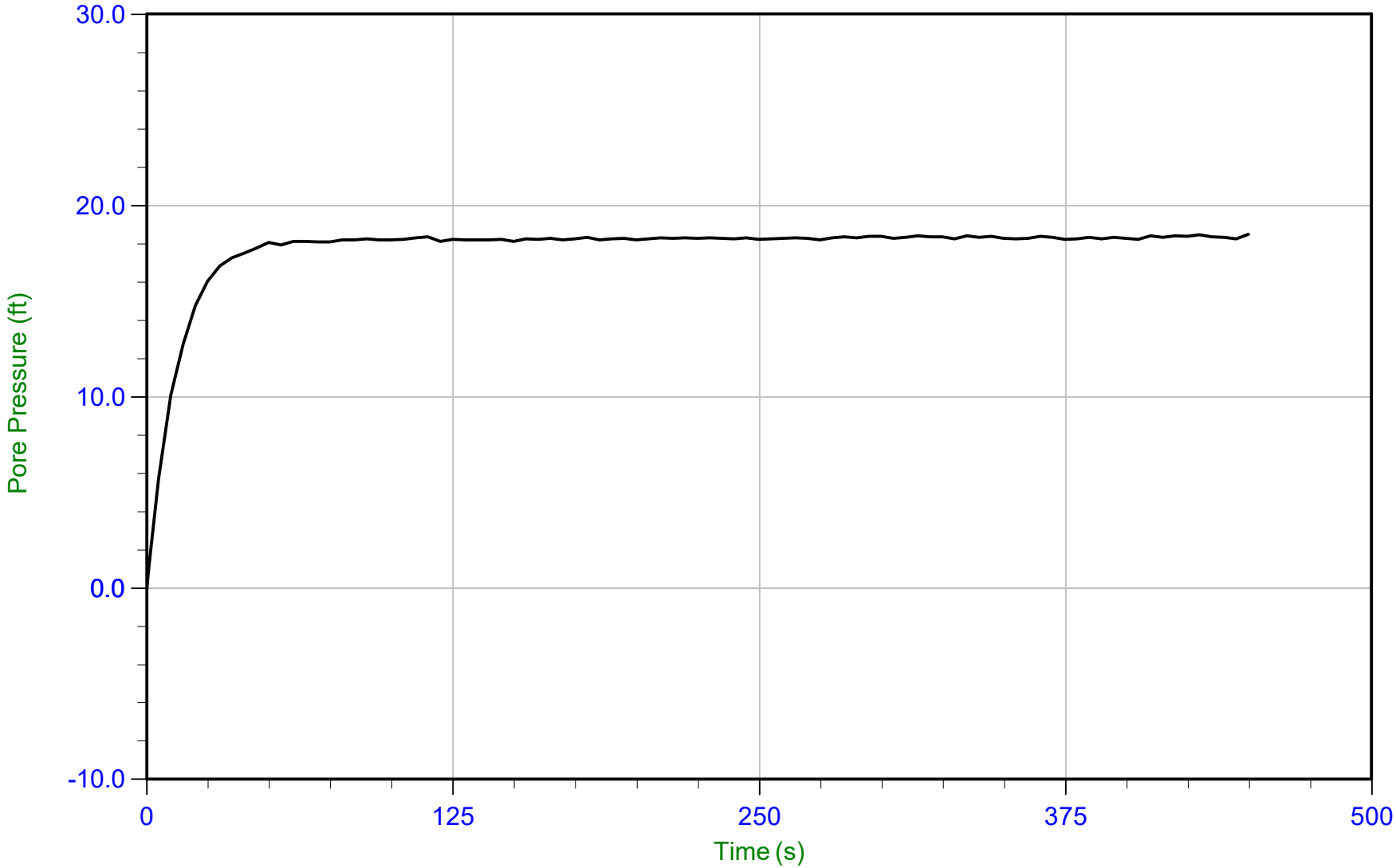
Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)
SCPT01	19-59023_SP01.PPD	15.0	450	30.9	18.4	12.5
SCPT01	19-59023_SP01.PPD	15.0	900	72.2	59.5	12.6
SCPT01	19-59023_SP01.PPD	15.0	850	101.1	89.0	12.2
CPT02	19-59023_CP02.PPD	15.0	450	14.5	6.5	8.0
CPT02	19-59023_CP02.PPD	15.0	250	27.0	17.0	10.0
CPT02	19-59023_CP02.PPD	15.0	300	51.7	38.8	12.8
CPT03	19-59023_CP03.PPD	15.0	190	19.5		
CPT03	19-59023_CP03.PPD	15.0	600	49.7	38.1	11.6
Totals			66.5			

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 12:43
Site: PDX

Sounding: SCPT01
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_SP01.PPD
Depth: 9.425 m / 30.922 ft
Duration: 450.0 s

U Min: -0.0 ft
U Max: 18.5 ft

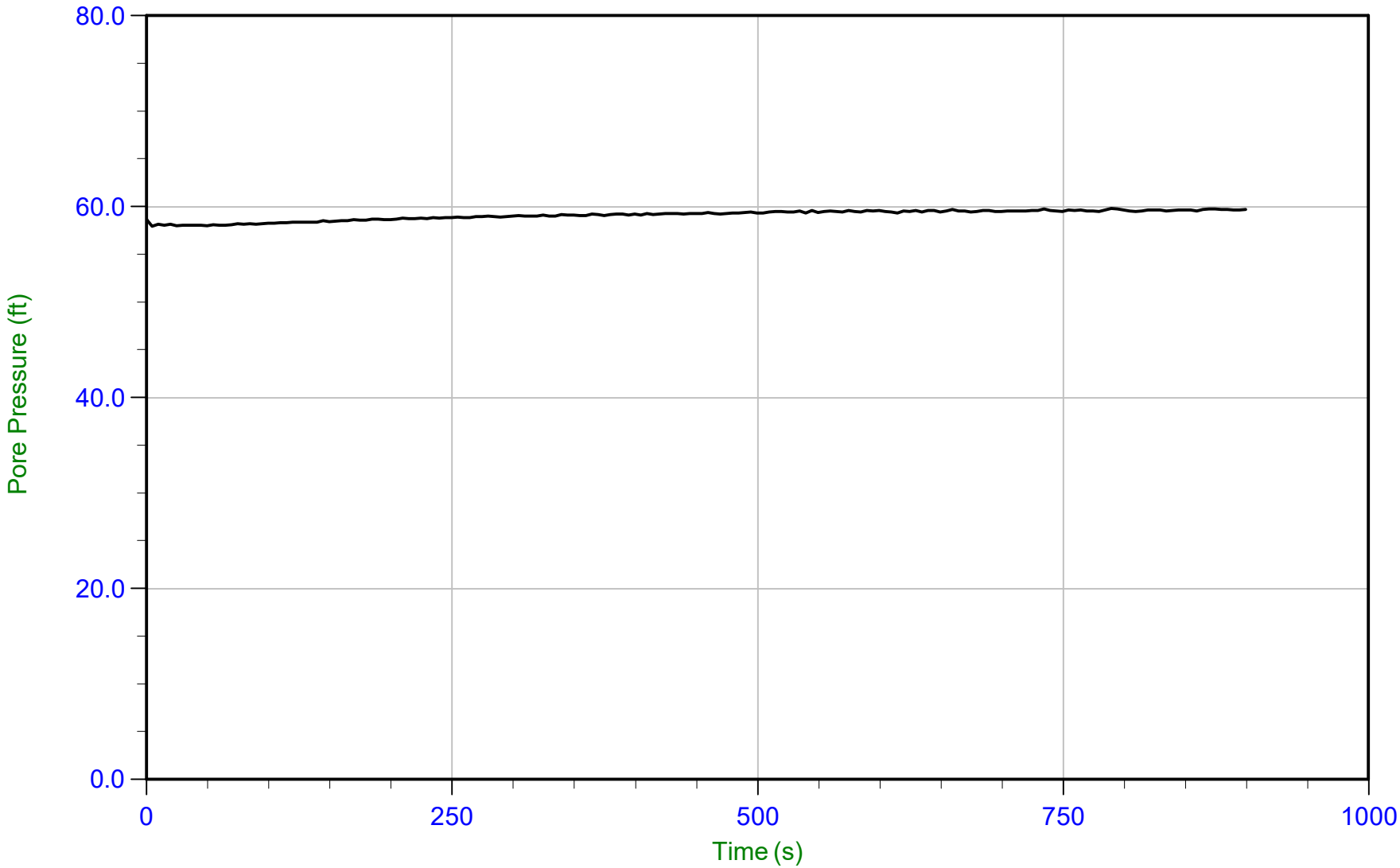
WT: 3.816 m / 12.520 ft
Ueq: 18.4 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 12:43
Site: PDX

Sounding: SCPT01
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_SP01.PPD
Depth: 22.000 m / 72.178 ft
Duration: 900.0 s

U Min: 57.9 ft
U Max: 59.8 ft

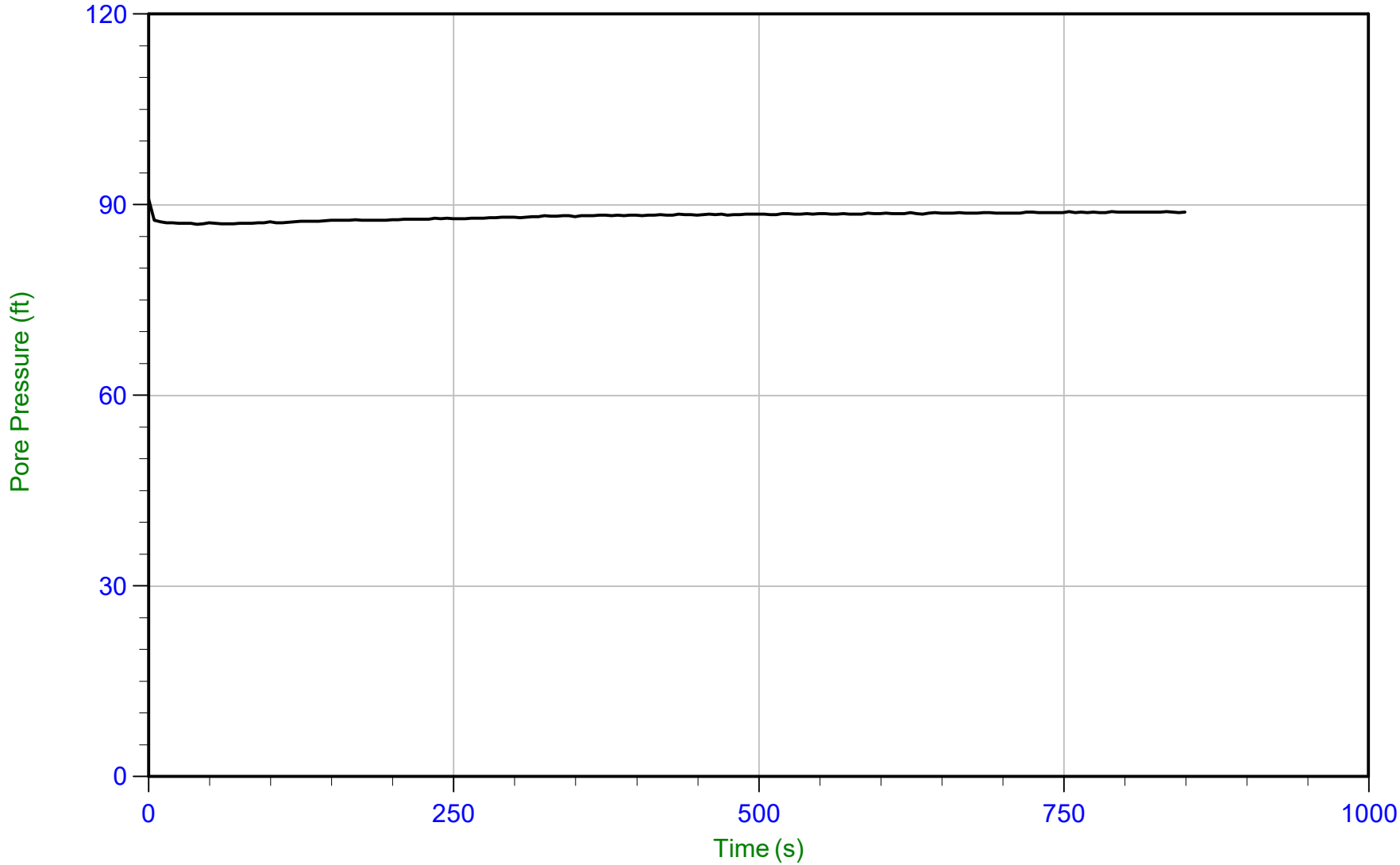
WT: 3.854 m / 12.644 ft
Ueq: 59.5 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 12:43
Site: PDX

Sounding: SCPT01
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_SP01.PPD
Depth: 30.825 m / 101.131 ft
Duration: 850.0 s

U Min: 87.0 ft
U Max: 90.9 ft

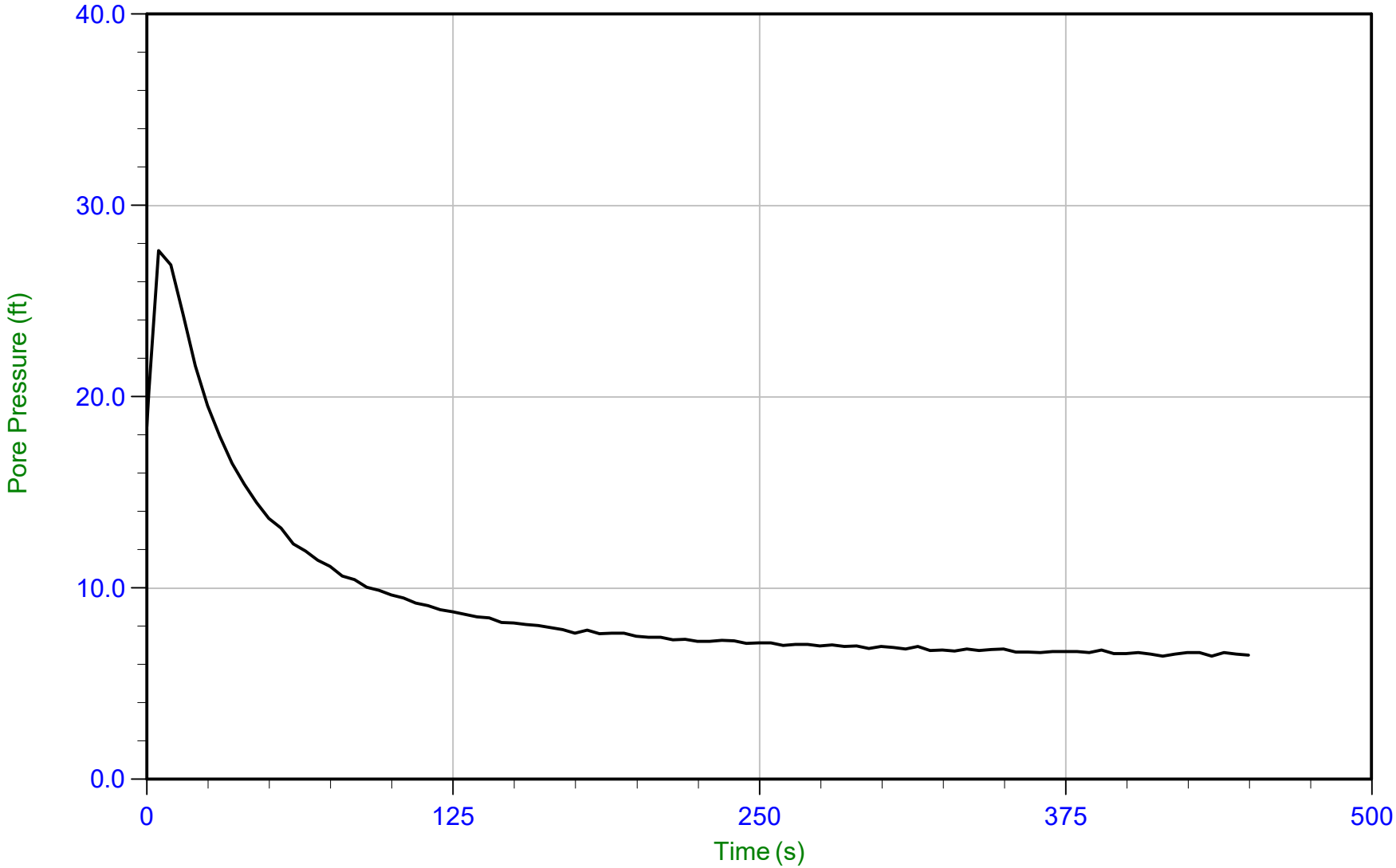
WT: 3.712 m / 12.178 ft
Ueq: 89.0 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 08:43
Site: PDX

Sounding: CPT02
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_CP02.PPD
Depth: 4.425 m / 14.518 ft
Duration: 450.0 s

U Min: 6.4 ft
U Max: 27.6 ft

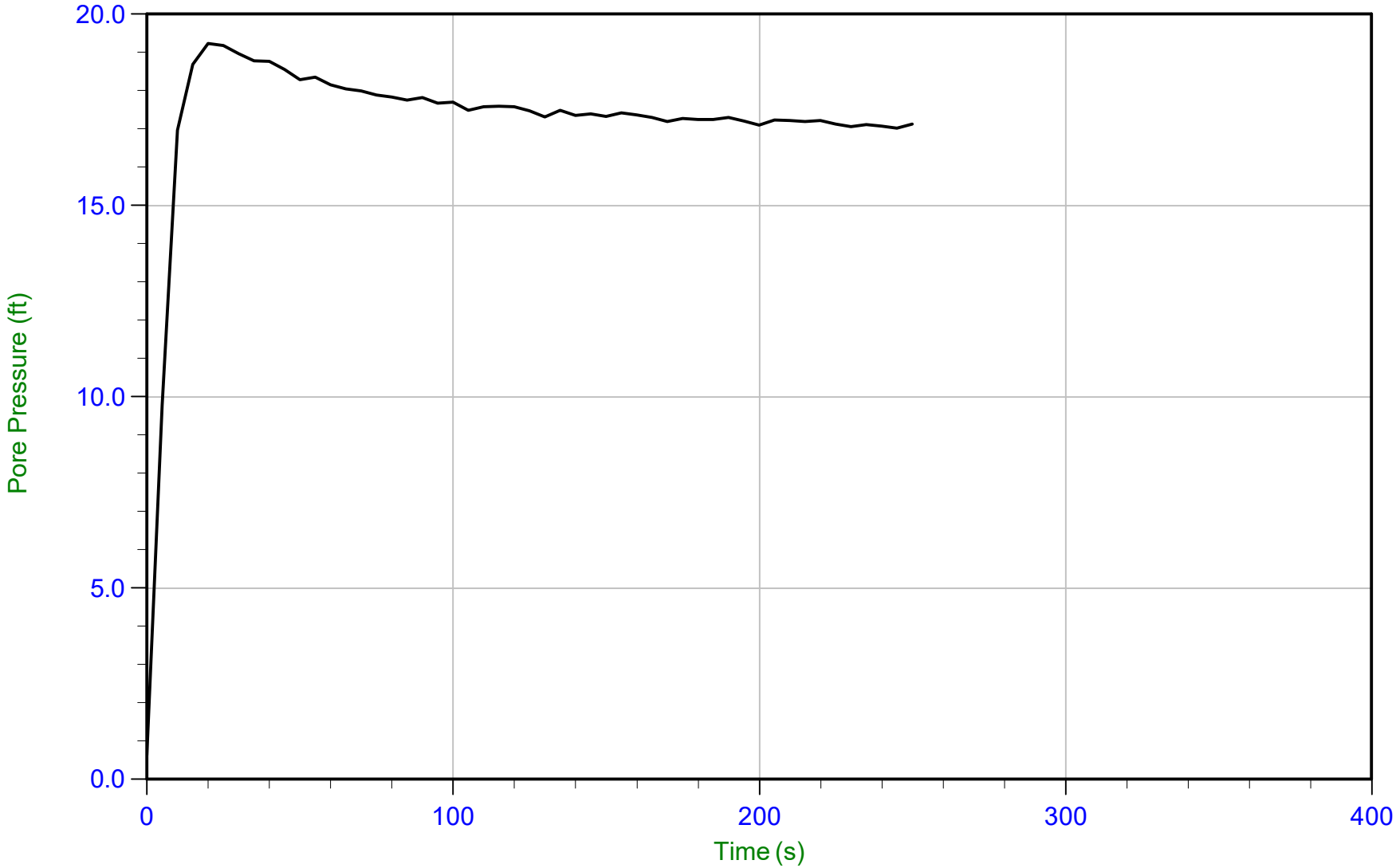
WT: 2.440 m / 8.005 ft
Ueq: 6.5 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 08:43
Site: PDX

Sounding: CPT02
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_CP02.PPD
Depth: 8.225 m / 26.985 ft
Duration: 250.0 s

U Min: 0.6 ft
U Max: 19.2 ft

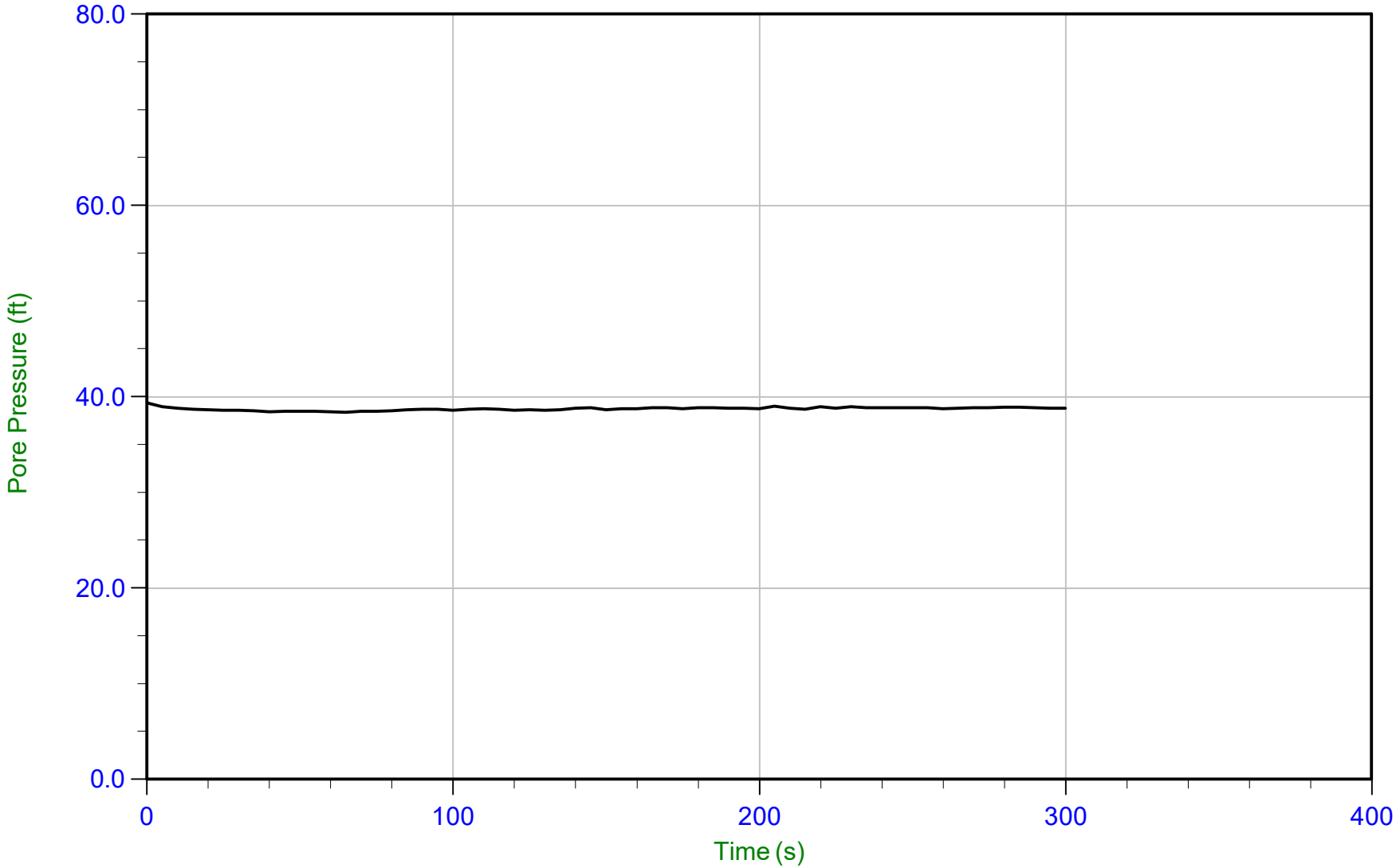
WT: 3.050 m / 10.006 ft
Ueq: 17.0 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 08:43
Site: PDX

Sounding: CPT02
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_CP02.PPD
Depth: 15.750 m / 51.673 ft
Duration: 300.0 s

U Min: 38.3 ft
U Max: 39.4 ft

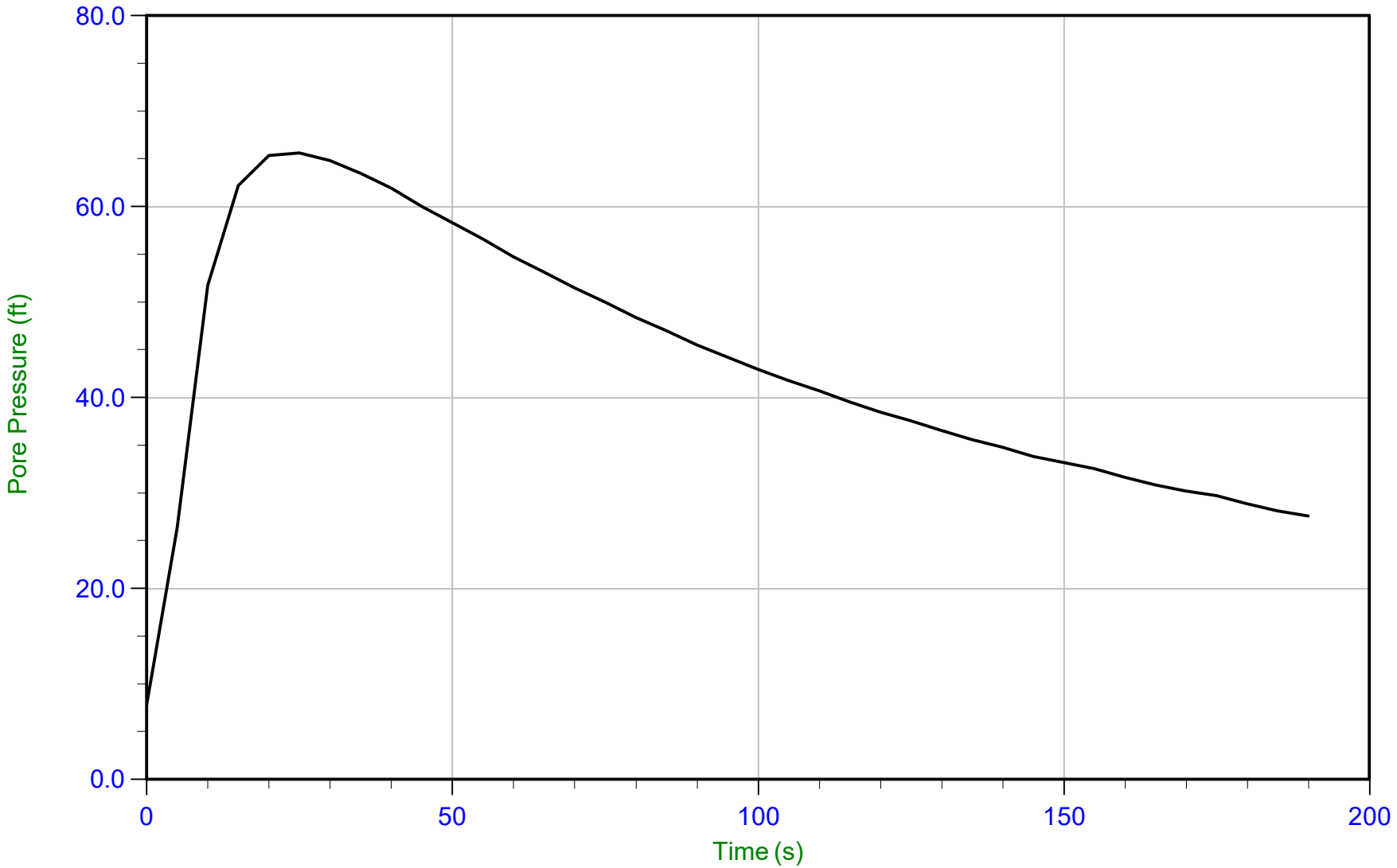
WT: 3.912 m / 12.834 ft
Ueq: 38.8 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 10:24
Site: PDX

Sounding: CPT03
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_CP03.PPD
Depth: 5.950 m / 19.521 ft
Duration: 190.0 s

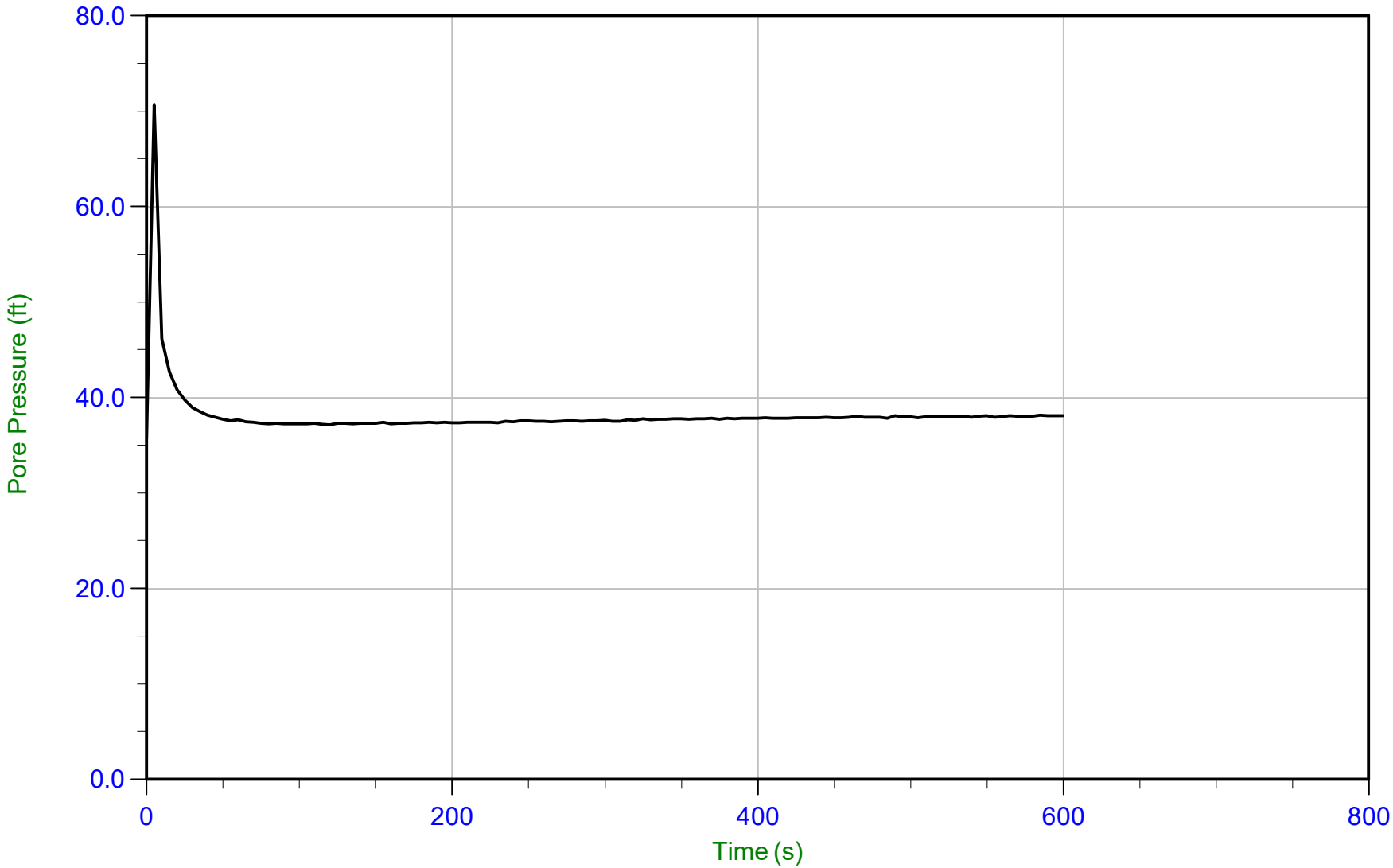
U Min: 7.8 ft
U Max: 65.6 ft

CONETEC

Hart Crowser

Job No: 19-59023
Date: 07/09/2019 10:24
Site: PDX

Sounding: CPT03
Cone: 536:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 19-59023_CP03.PPD
Depth: 15.150 m / 49.704 ft
Duration: 600.0 s

U Min: 35.7 ft
U Max: 70.6 ft

WT: 3.525 m / 11.565 ft
Ueq: 38.1 ft

APPENDIX B
Laboratory Testing

APPENDIX B

Laboratory Testing

General

This appendix documents the laboratory testing that Hart Crowser completed on selected soil samples collected from the explorations. This appendix includes information on the following subjects:

- Laboratories
- Visual Classification
- Hart Crowser Laboratory Testing
- External Laboratory Testing

Laboratories

Soil samples obtained from the explorations were transported to our laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering properties of the soils encountered. Representative samples were selected for laboratory testing. Selected samples were sent to Benchmark Geolabs of McMinnville, Oregon to evaluate the one-dimensional consolidation, corrosivity, and organic content properties of the soils encountered. The results of the organic content tests are presented on Figure B-1 in this appendix. While one-dimensional consolidation testing and organic content testing were performed by Benchmark Geolabs, the processing of the laboratory results was performed by Hart Crowser. The results of consolidation testing and corrosion suite testing are presented on Figures B-5 and B-6, respectively.

Visual Classifications

Soil samples obtained from the explorations were visually classified in the field and in our geotechnical laboratory based on the Unified Soil Classification System (USCS) and ASTM classification methods. ASTM Test Method D 2488 “Standard Practice for the Classification of Soils (Visual-Manual Procedure)” was used to classify soils using visual and manual methods. ASTM Test Method D 2487 “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)” was used to classify soils based on laboratory test results.

Hart Crowser Laboratory Testing

Moisture Content

Moisture contents of samples were obtained in general accordance with ASTM Test Method D 2216. The results of the moisture content tests are presented on the exploration logs included in Appendix A and on Figure B-1 in this appendix.

Atterberg Limits Testing

Atterberg limits (liquid limit, plastic limit and plasticity index) of fine-grained soil samples were obtained from three samples in general accordance with ASTM Test Method D 4318-02. The results of the Atterberg limits tests are presented on the exploration logs included in Appendix A and on Figure B-2 in this appendix.

Grain Size Distribution

One grain size analysis was performed to determine the quantitative distribution of particle sizes in the sample. The test was performed in general accordance with ASTM D 6913. The "percent fines" portion of the test results are presented on the exploration logs included in Appendix A and on Figure B-3 in this appendix.

Moisture Density Relationship

One bulk sample of surface sample was collected for the purposes of moisture density relationship testing. The test was performed in general accordance with ASTM D 1557. The test results are presented on Figure B-4 in the appendix.

External Laboratory Testing

One-Dimensional Consolidation

One-dimensional consolidation testing was performed by Benchmark Geolabs in general accordance with ASTM Test Method D 2435. The results from the laboratory are in included on Figure B-5a in this appendix. We processed the data using Taylor's Root of Time Method to determine the time and deflection at 100 percent of primary consolidation. The processed results of consolidation testing are included on Figure B-5b in this appendix.

Organic Content

The organic contents of selected soil samples were determined by Benchmark Geolabs in accordance with guidelines presented in ASTM D 2974. The moisture contents of the samples were determined by drying the samples in a standard drying oven and then expressed as a percentage of the total sample weight. The organic content is determined by igniting the oven-dried sample in a muffle furnace. The resulting substance is ash, which is expressed as a percentage of the oven-dried sample. The organic content is included on Figure B-1 of this appendix.

Corrosion Testing

A suite of tests was completed to evaluate corrosion potential, including pH, sulfate and sulfide content, chlorides, conductivity, redox and resistivity. The testing was performed by Benchmark Geolabs in general accordance with ASTM test methods G 200, G 51, and G 57; as well as EPA methods EPA300.0, as noted on Figure B-6 in this appendix.

Exploration	Sample ID	Depth	Water Content (%)	Dry Density (pcf)	Fines (%)	Sand (%)	Gravel (%)	Liquid Limit	Plastic Limit	Plasticity Index	Organic Content (%)	Pocket Pen (tsf)	Torvane (tsf)	
B-1	S-1	7.5	82.5					103	51	52				
B-1	S-2	10.0	71.7								5.8			
B-1	S-3	12.5	56.4	64.8										
B-1	S-4	15.0	59.1					55	36	19				
B-1	S-5	20.0	40.4								1.7			
B-1	S-6	25.0	46.3											
B-1	S-7	30.0	55.3					48	34	14				
B-1	S-9	35.0	58.3											
B-1	S-10	40.0	47.3											
B-1	S-11	45.0	38.5											
B-1	S-12	50.0	28.5		6	94	0							
B-1	S-13	55.0	31.9											
B-1	S-14	60.0	31.8											
B-1	S-15	65.0	29.3											
B-1	S-16	70.0	29.9											
B-1	S-17	75.0	32.5											
B-1	S-19	85.0	31.5											

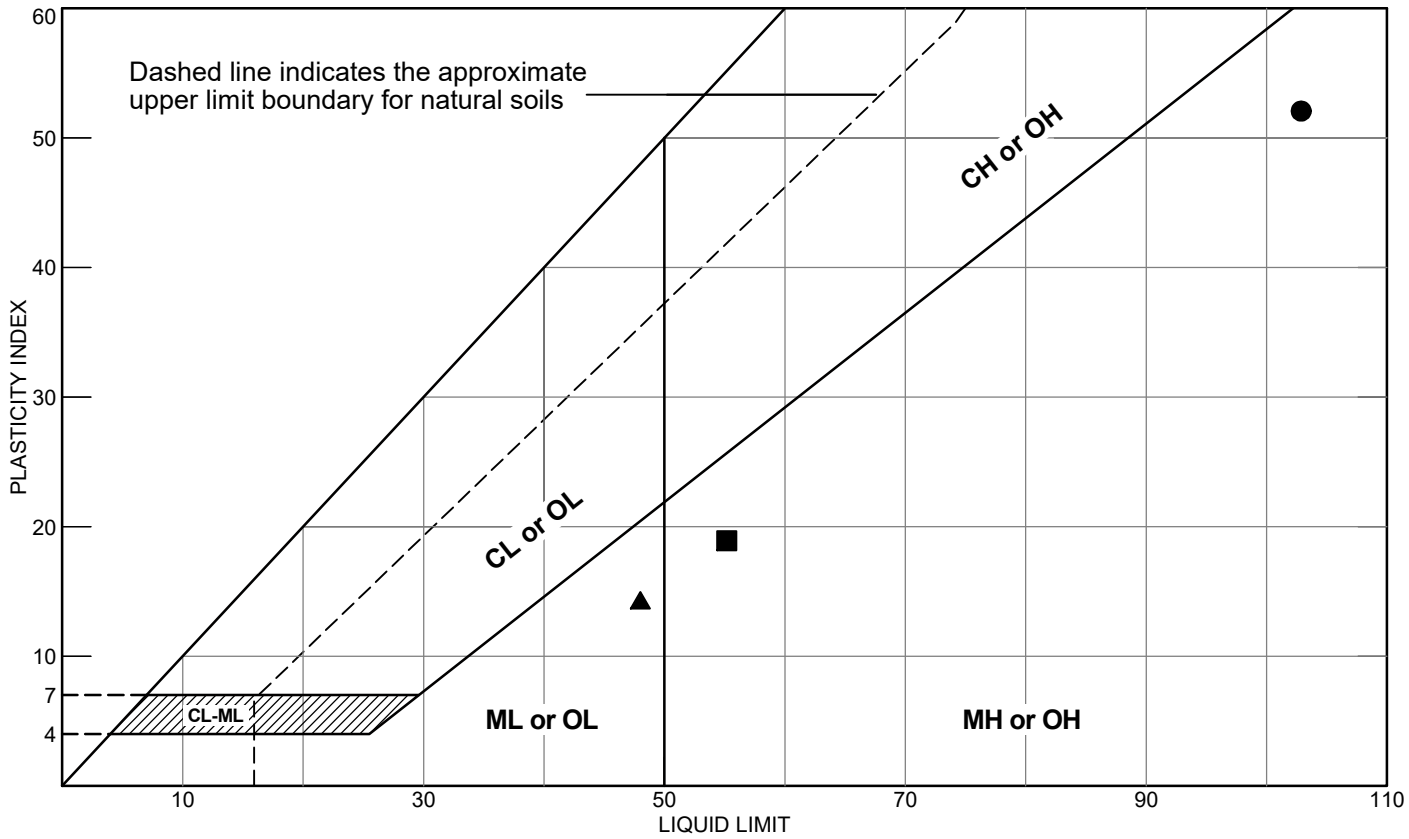
HC LAB SUMMARY (FOR REPORTS) - F:\GINT\HC_LIBRARY.GLB - 8/12/19 09:31 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - tristananderson

HARTCROWSER

Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Summary of Laboratory Results

Figure **B-1**
Sheet **1 of 1**



Location and Description			LL	PL	PI	#200	MC%	USCS
● **Source:** B-1 ELASTIC SILT	**Sample No.:** S-1	**Depth:** 7.5 to 9.0 feet	103	51	52	NT	83	MH
■ **Source:** B-1 ELASTIC SILT	**Sample No.:** S-4	**Depth:** 15.0 to 16.5 feet	55	36	19	NT	59	MH
▲ **Source:** B-1 SILT	**Sample No.:** S-7	**Depth:** 30.0 to 31.5 feet	48	34	14	NT	55	ML

Remarks:

●

■

▲

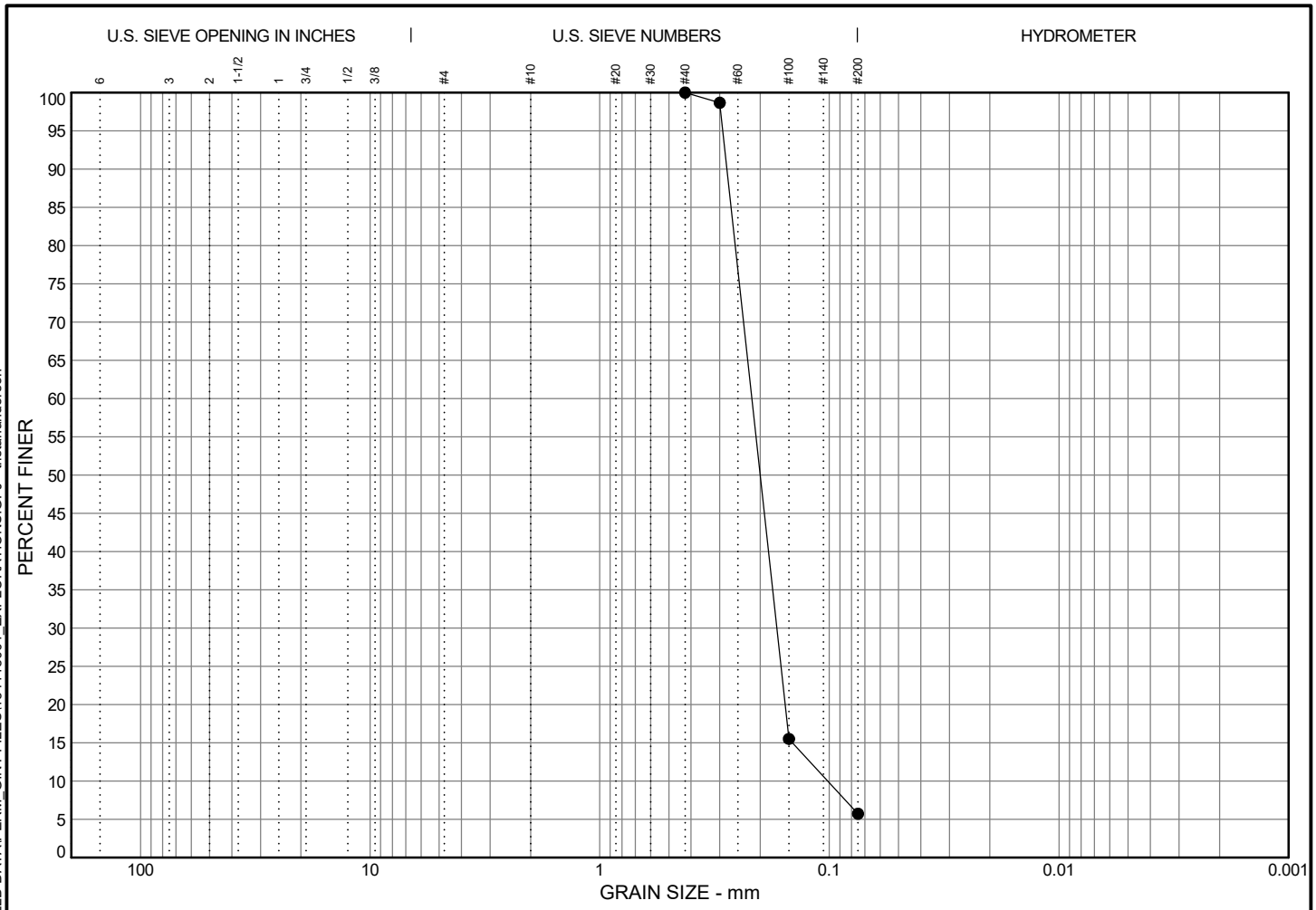
HARTCROWSER

Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Liquid Limit, Plastic Limit, and Plasticity Index

Figure **B-2**
Sheet **1 of 1**

HC ATTERBERG LIMITS - F:\GINT\HC_LIBRARY.GLB - 7/29/19 12:26 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - tristananderson



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Location and Description	% Cobbles	% Gravel	% Sand	% Silt	% Clay	MC%	USCS
● **Source:** B-1 **Sample No.:** S-12 **Depth:** 50.0 to 51.5 POORLY GRADED SAND WITH SILT	0.0	0.0	94.3	5.7		29	SP

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●			0.268	0.217	0.200	0.169	0.145	0.102	1.30	2.14

Remarks:

●

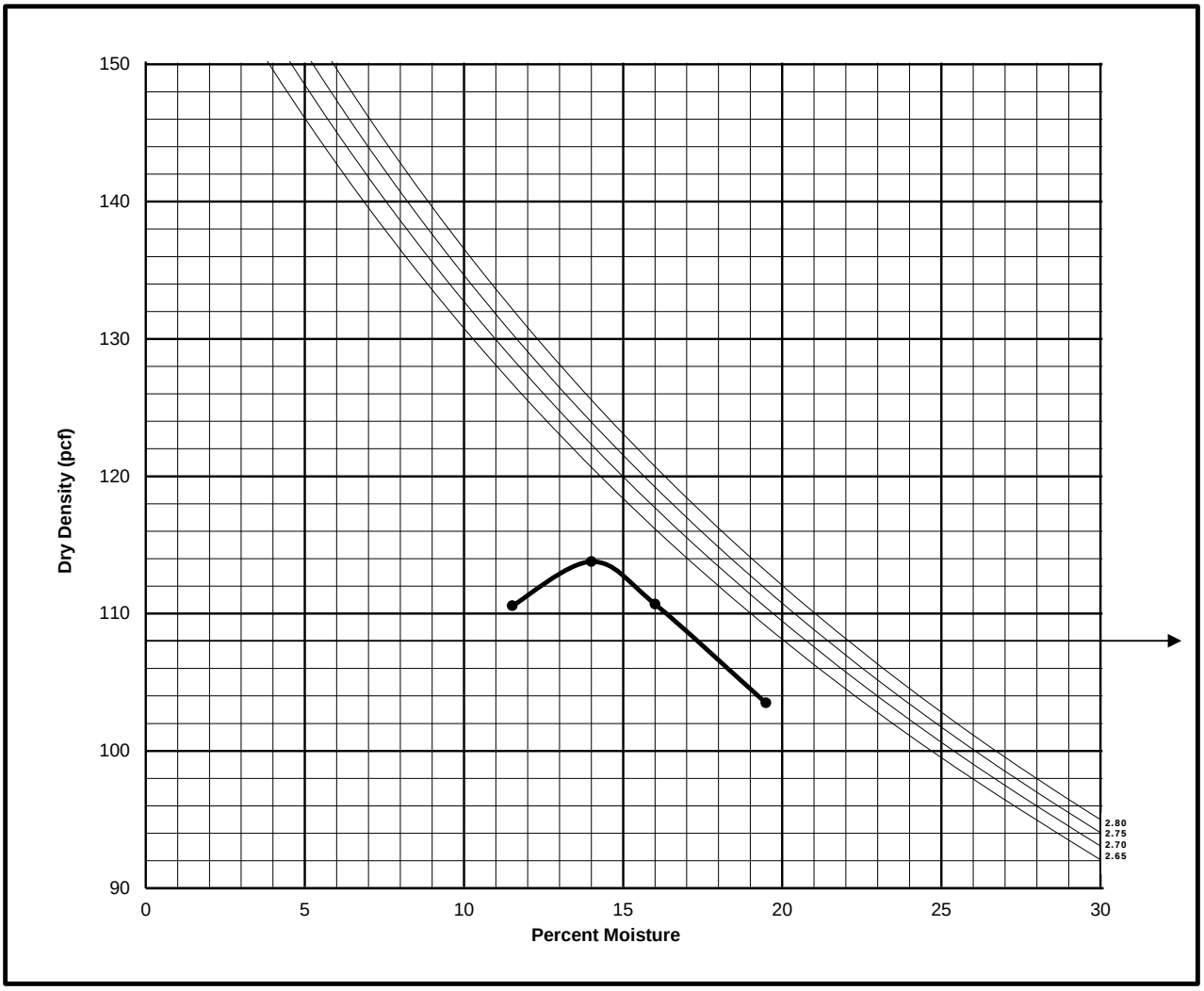
HARTCROWSER

Project: PDX Fueling Facility Improvements
Location: Portland, Oregon
Project No.: 154-118-001

Particle-Size Analysis

Figure **B-3**
Sheet **1 of 1**

HC GRAIN SIZE - F:\GINT\HC_LIBRARY.GLB - 7/29/19 12:27 - F:\NOTEBOOKS\154118001_PDX_FUEL_FACILITY_IMPROVEMENTS\FIELD DATA\PERM_GINT FILES\154118001_EXPLORATIONS.GPJ - tristananderson



Maximum Dry Density:	**113.8**	**Rock Corr. Maximum:**	**113.8**
Optimum % Moisture:	**14.0**	**Rock Corr. Opt. % Moisture:**	**14.0**
Test Standard:	**D 1557**	**Percent +3/4":**	**0.0**
Method:	**A**	**Correction Method:**	**D4718**

Sample I.D.	Existing Surface Fill
Sample Description:	Brown, fine silty sand
Sample Date	July 9, 2019

Project:	PDX Fuel Facility	**Date:**	July 23, 2019
File No.:	154-118-001	**Tested By:**	DLK
Client:	Burns & McDonnel	**Checked By:**	TTA
Comments:	Slightly Cemented		

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MOISTURE DENSITY RELATIONSHIP

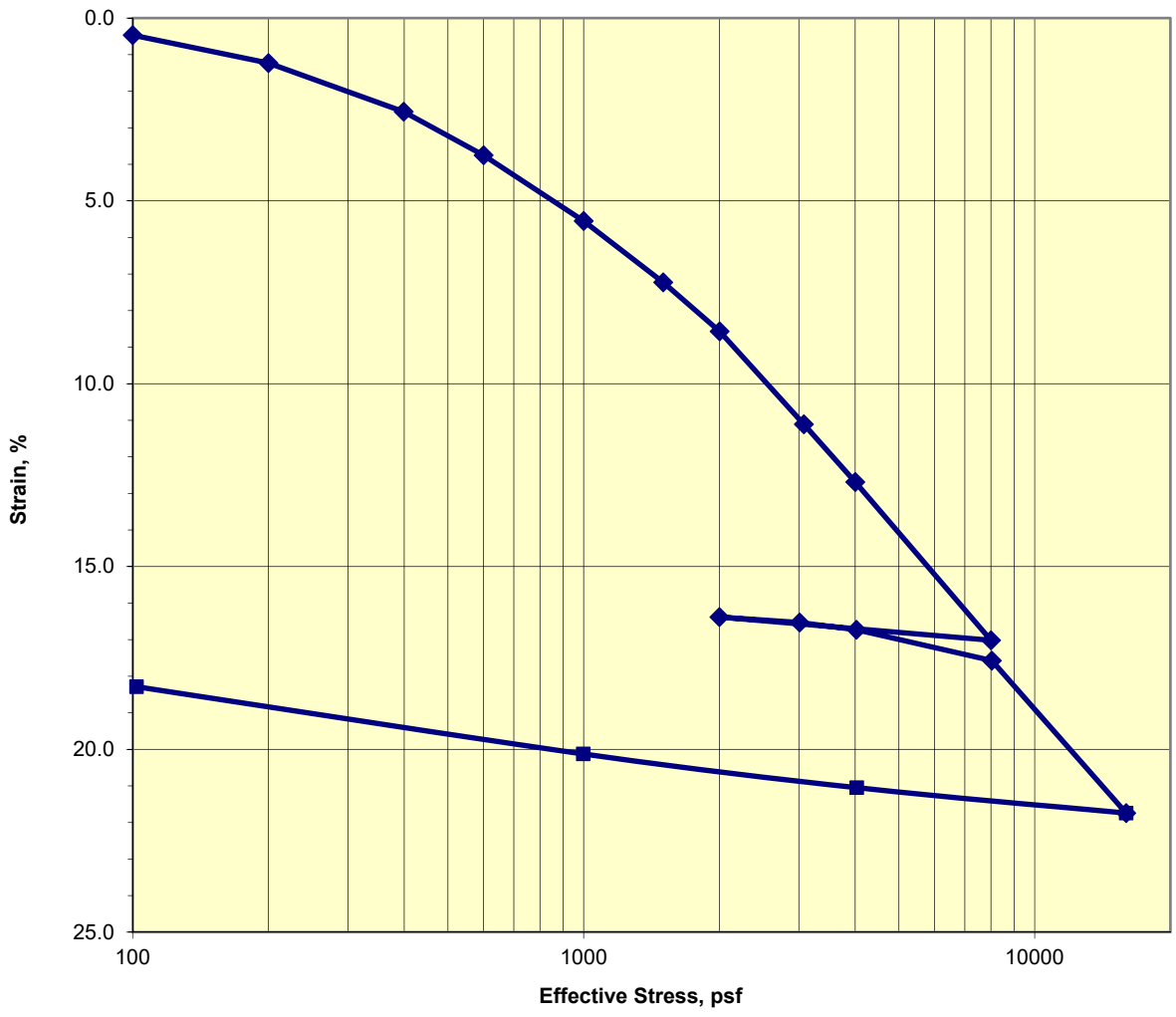
FIGURE B-4

BENCHMARK GEOLABS

Consolidation Test
ASTM D2435

BGL No.:	041-007	**Boring:**	B-1	**Run By:**	PJ
Client:	Hart Crowser	**Sample:**	S-3	**Checked:**	PJ
Project:	PDX Fueling Facility Improvements	**Depth, ft.:**	12.5-14.5	**Date:**	8/1/2019
Project No.	154-118-001	**Soil Type:**	Dark Gray SILT		

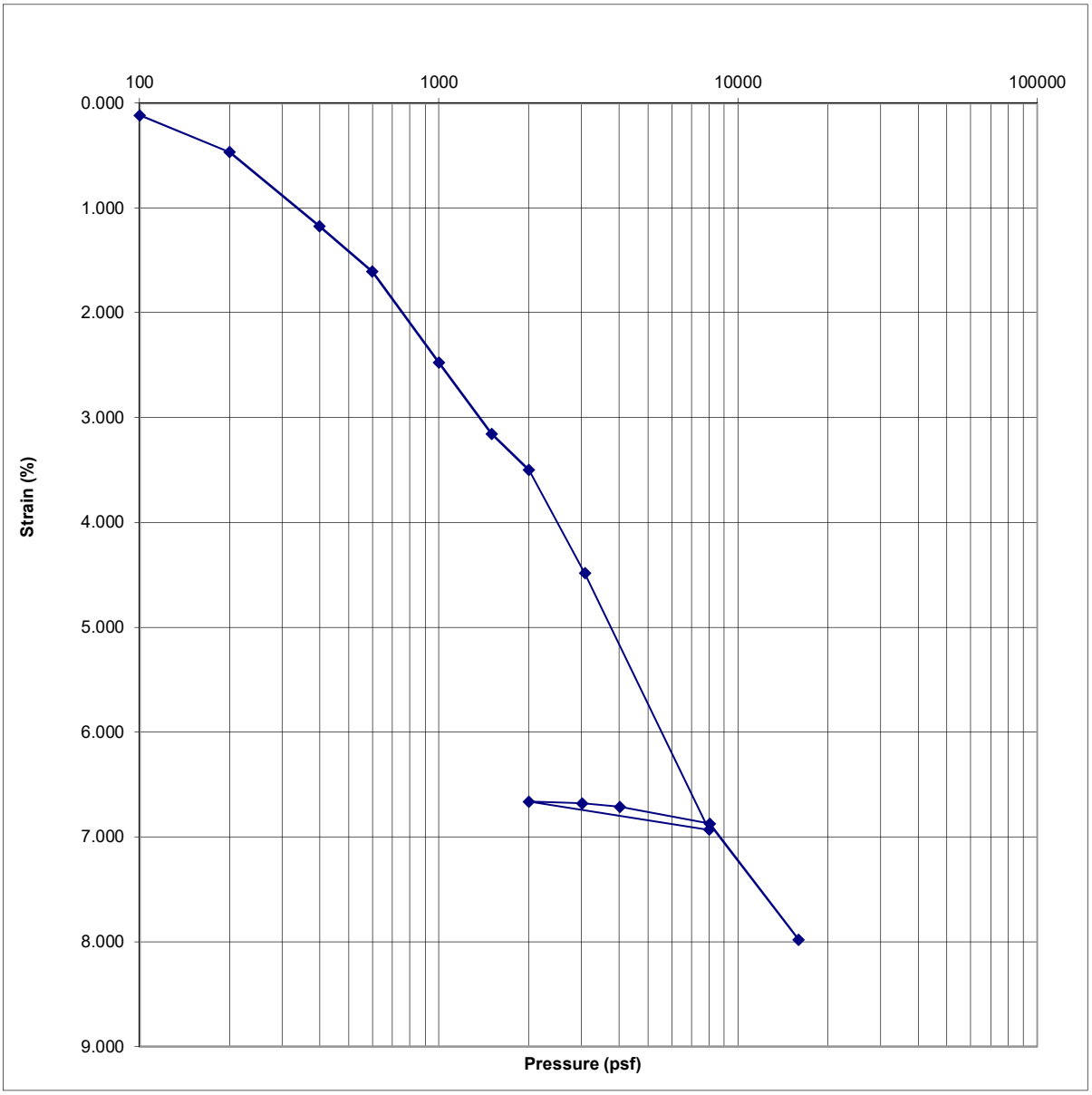
Strain-Log-P Curve



Assumed Gs 2.7	Initial	Final
Moisture %:	56.4	39.7
Dry Density, pcf:	66.3	81.2
Void Ratio:	1.540	1.076
% Saturation:	98.8	99.7

Remarks: This material was soft.

FIGURE B-5a



	Initial	Final
Moisture (%)	56.5%	39.7%
Dry Density (pcf)	66.3	81.2
Void Ratio	1.543	1.078
Per Cent Saturation	98.8	99.4

Sample Height (in)	1.0072
Sample Diam (in)	2.4210
Area (in^2)	4.603

Boring #:	B-1	**Depth:**	12.5 ft
Sample #:	S-3	**Soil Description:**	Dark Gray Silt

Project:	PDX Fueling Facility	**Date:**	08/01/19
File No.:	154-118-001	**Tested By:**	Benchmark Geolabs
Client:	Burns & McDonnell	**Checked By:**	TA
Comments:			

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Consolidation Test ASTM D2435

FIGURE B-5b

BENCHMARK GEOLABS

Corrosivity Tests Summary

BGL # 041-007 **Date:** 7/19/2019 **Tested By:** PJ **Checked:** PJ

Client: Hart Crowser **Project:** PDX Fuleing Facility Improvements **Proj. No:** 154-118-001

Remarks: The difference in pH between the two samples was noted and verified.

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP (Redox)		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		E_H (mv)	At Test	Qualitative by Lead	At Test %	
						Dry Wt.	Dry Wt.	Dry Wt.						
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	EPA 300.0	EPA 300.0	EPA 300.0	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
B-1	S-6	25-26.5	-	-	4,411	2	41	0.0041	4.8	260	20	Negative	46.3	Very Dark Gray SILT
B-1	S-14	60-61.5	-	-	6,111	2	24	0.0024	7.0	239	20	Negative	31.8	Gray SAND

Figure B-6

APPENDIX C
Field Resistivity Testing

Report on
Geophysical Explorations at the
Portland International Airport Fuel Depot
Portland, Oregon

Report Date: July 1, 2019

Prepared for:

Hart Crowser, Inc.
6420 SW Macadam Ave.
Portland, OR 97239

Prepared by:

EARTH DYNAMICS LLC
2284 N.W. Thurman St.
Portland, OR 97210
(503) 227-7659
Project No. 19404

1.0 INTRODUCTION

The Portland Fueling Facilities Corporation is planning to perform upgrades at the Portland International Airport (PDX) Facility in Portland Oregon. This report presents the results of electrical resistivity explorations at the proposed fuel facility upgrades. The explorations consist of Wenner four-point method electrical resistivity soundings at one location near the PDX fueling facility. The work was requested and authorized by Ms. Allison Pyrch of Hart Crowser, Inc. The field work was conducted on June 25, 2019 by Mr. Daniel Lauer of Earth Dynamics LLC. This report describes the methodology and results of the investigation.

2.0 SCOPE OF WORK

The goals of this study are to determine the site specific electrical properties of the soil. The exploration consists of one Wenner four-point method electrical resistivity soundings. The provided scope of work documents requested that *"The survey shall be conducted along two (2) perpendicular lines (N-S and E-W) centered at the locations noted. For each line, readings shall be taken with "a" spacings of 2.5, 5, 10, 20 and 50 feet. The values reported for each 'a'-spacing shall include current potential, and apparent resistivity reported in Ohm-cm."* The locations of the geophysical lines are shown in Figure 1.

3.0 METHOD

3.1 Wenner four-point method

Resistivity measurements are obtained using the Wenner four-point method in accordance with ANSI/IEEE Standard 81-1983 and *ASTM G 57–95a, Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method*. An Advanced Geosciences, Inc. SuperSting R8 Earth Resistivity Meter and a Wenner electrode array are used for the electrical resistivity sounding. The SuperSting R8 Meter was factory calibrated in October of 2017, and calibration is field verified before each use. For each measurement, the instrument applies a current (I), reverses polarity and applies the current again and then reverses polarity back to the original and applies current a third time. The reversed polarity technique is used to reduce electrode polarization. The voltage (V) at the potential electrodes is measured for each current injection, and the values are averaged. The average resistance (V/I), resistivity and standard deviation between two full measurement cycles are displayed on a screen and stored in the internal memory. The memory also stores the date and time of the measurement, and the electrode configuration. The system does not require scale multipliers that are common on older analog resistivity meters.

The Wenner soundings were completed on June 25, 2019. During the survey, the air temperature was approximately 55-60 °F. The weather was overcast and calm. Data

were acquired on two perpendicular arrays using “a”-spacings of 2.5, 5, 10, 20, 30 and 50 feet. Care was taken in all electrode placements for all profiles to ensure that the electrodes were installed into soil in a manner to provide adequate electrical contact. No water or electrolyte solution was added to any of the electrode placements. No overhead powerlines or apparent underground utilities are present in the vicinity of the data acquisition location.

3.2 Location Survey

Horizontal and vertical position data were obtained with a Trimble GEOXH 6000 GPS receiver. The position data were post-processed to increase the accuracy of the GPS positions. The reported accuracy of the post-processed position data is better than plus or minus one foot.

4.0 RESULTS

The locations of the geophysical profiles are shown in Figures 1 and 2. Positioning information for the profiles is summarized in Table 1. The acquired Wenner sounding data are summarized in Tables 2 and 3. The data from the north-south and east-west profiles are similar. Therefore, it is expected that the electrical resistivity of the soils in the vicinity of the test is laterally homogeneous.

Table 1. GPS Position Data for Geophysical Profiles.

Profile Location	Latitude	Longitude
R1-Center	45° 35.8386’N	123° 36.7408’W
R1-East	45° 35.8343’N	123° 36.7245’W
R1-West	45° 35.8431’N	123° 36.7572’W
R1-North	45° 35.8502’N	123° 36.7346’W
R1-South	45° 35.8272’N	123° 36.7472’W

Figure 1. Site image with geophysical profile locations.

Table 2. Summary of measured data for N/S Wenner Sounding.

Wenner A spacing (ft)	Wenner A spacing (cm)	Approximate Electrode insertion depth (in)	Current (mA)	Measured Resistance (Ω)	Apparent Resistivity (Ω-ft)	Apparent Resistivity (Ω-cm)
2.5	76.2	1	26.15	44.88	705.0	21488.4
5	152.4	1	20.52	40.41	1270.0	38709.6
10	304.8	2	46.34	22.39	1407.0	42885.4
20	609.6	3	9.576	9.523	1197.0	36484.6
30	914.4	4	58.8	3.917	728.4	22201.6
50	1524	4	77.19	1.044	328.1	10000.5

Table 3. Summary of measured data for E/W Wenner Sounding.

Wenner A spacing (ft)	Wenner A spacing (cm)	Approximate Electrode insertion depth (in)	Current (mA)	Measured Resistance (Ω)	Apparent Resistivity (Ω-ft)	Apparent Resistivity (Ω-cm)
2.5	76.2	1	20.49	47.4	744.0	22677.1
5	152.4	1	18.46	38.34	1205.0	36728.4
10	304.8	2	84.98	29.14	1831.0	55808.9
20	609.6	3	92.2	11.74	1476.0	44988.5
30	914.4	4	60.43	3.373	635.8	19379.2
50	1524	4	40.26	0.675	212.1	6464.8

5.0 LIMITATIONS

The data presented in this study were collected in accordance with standard procedures by experienced personnel using state of the art equipment. However, no warranty is made or intended by this report or by oral or written presentation of this work. Earth Dynamics accepts no responsibility for damages as a result of decisions made or actions taken based upon this report.

6.0 REFERENCES

ANSI/IEEE Std 81-1983, IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System. The Institute of Electrical and Electronics Engineers, Inc., New York, NY

ASTM G 57-95a (Reapproved 2001), Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method. ASTM, 100 Bar Harbor Drive, West Conshohocken, PA

RESPECTFULLY SUBMITTED
EARTH DYNAMICS

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