

ENGINEERING DESIGN REPORT

LAKESIDE INDUSTRIES ABERDEEN SITE 2400 SARGENT BOULEVARD ABERDEEN, WASHINGTON


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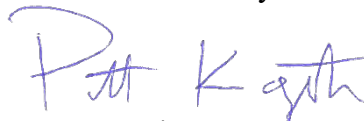
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ACRONYMS AND ABBREVIATIONS

1984 Hydrogeologic Report	<i>Report of Hydrogeologic Services, Existing Bulk Storage Facility, Aberdeen, Washington</i> dated July 9, 1984 prepared by GeoEngineers, Inc.
2019 RI/FS Report	<i>Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington</i> revised August 2019, prepared by Farallon Consulting, L.L.C.
2021 CAP	<i>Cleanup Action Plan, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington</i> revised September 14 2021, prepared by Farallon Consulting, L.L.C.
AST	aboveground storage tank
bgs	below ground surface
Chevron	Chevron USA Inc.
COC	constituents of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
DRO	total petroleum hydrocarbons as diesel-range organics
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
Farallon	Farallon Consulting, L.L.C.
FS	Feasibility Study
GeoEngineers	GeoEngineers, Inc.
GRO	total petroleum hydrocarbons as gasoline-range organics
HASP	Health and Safety Plan
JARPA	Joint Aquatic Resources Permit Application
Lakeside Industries	Lakeside Industries, Inc.
MTCA	Washington State Model Toxics Control Act Cleanup Regulation
NAVD88	North American Vertical Datum of 1988
ORO	total petroleum hydrocarbons as oil-range organics
PVC	polyvinyl chloride
RI	Remedial Investigation
SEPA	State Environmental Policy Act
Site	property at 2400 Sargent Boulevard in Aberdeen, Washington
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation



1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Engineering Design Report (EDR) on behalf of Lakeside Industries, Inc. (Lakeside Industries) to provide the design of the cleanup action alternative approved by the Washington State Department of Ecology (Ecology) for the property at 2400 Sargent Boulevard in Aberdeen, Washington (herein referred to as the Site) (Figures 1 and 2). This EDR was prepared in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Chapter 173-340 Section 400 of the Washington Administrative Code (WAC 173-340-400). The Site is enrolled in the Ecology Voluntary Cleanup Program and assigned Voluntary Cleanup Program Project Identification No. SW1161.

The Site, as defined under MTCA, comprises the area where hazardous substances at concentrations exceeding applicable MTCA Method A cleanup levels have come to be located. The results from the Remedial Investigation (RI) and Feasibility Study (FS) completed for the Site by Farallon in 2019 are documented in the *Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington* revised August 2019, prepared by Farallon (2019 RI/FS Report). Based on the results from the 2019 RI, the constituents of concern (COCs) for the Site are total petroleum hydrocarbons as gasoline-range organics (GRO), as diesel-range organics (DRO), and as oil-range organics (ORO); and associated petroleum compounds, including benzene, ethylbenzene, naphthalene compounds, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and the metals arsenic, cadmium, lead, and mercury. The RI confirmed that soil and groundwater are the affected media at the Site.

In 2021, Farallon prepared the *Cleanup Action Plan, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington* revised September 14, 2021, prepared by Farallon (2021 CAP). The 2021 CAP provided details on the selected cleanup action alternative, which is source area excavation, containment, monitored natural attenuation, and institutional and engineered controls. Ecology reviewed the 2021 CAP and issued a determination that upon completion of the proposed permanent cleanup action alternative, no further remedial action likely will be necessary to clean up contamination at the Site, documented in the letter regarding Opinion on Proposed Cleanup dated October 5, 2021.

The cleanup action being conducted by Lakeside Industries will be in accordance with the requirements of MTCA. The purpose of the cleanup action is to protect human health and the environment by eliminating risks posed by COCs identified at the Site. The remedial action will comply with the requirements for a cleanup action as defined in WAC 173-340-350 through 173-340-380, and the requirements of substantial equivalence under WAC 173-340-515 and 173-340-545.

1.1 PURPOSE

The purpose of the EDR is to document the design, construction, and operations of the permanent cleanup action selected for the Site. This EDR was prepared in accordance with WAC 173-340-400. The objective of the selected permanent cleanup action is to protect human health and the



environment, and meet MTCA requirements for Ecology to issue a No Further Action determination for the Site.

1.2 REPORT ORGANIZATION

This EDR has been organized into the following sections:

- **Section 2, Site Description and Background**, presents the Site description and operational history; a summary of the Site geology and hydrogeology; a summary of a subsurface investigation conducted at the Site by GeoEngineers, Inc. (GeoEngineers) in 1984; and a summary of the RI completed at the Site by Farallon in 2019.
- **Section 3, Conceptual Site Model Summary**, provides a summary of the COCs, media of concern, and potential exposure pathways.
- **Section 4, Cleanup Action Overview**, provides a summary of the selected cleanup action alternative and key work elements of the cleanup action.
- **Section 5, Design and Implementation**, provides a summary of the main engineering design elements; applicable local, state, and federal laws; and describes implementation of the main cleanup action work elements.
- **Section 6, Compliance Monitoring**, describes the protection, performance, and confirmational monitoring that will be conducted as part of the cleanup action.
- **Section 7, Bibliography**, provides a list of the documents used in preparing this EDR.
- **Section 8, Limitations**, presents Farallon's standard limitations associated with conducting the work reported herein and preparing this EDR.



2.0 SITE DESCRIPTION

The Lakeside Industries facility is located at 2400 Sargent Boulevard in Aberdeen, Washington (Figure 1). The Site is bounded by a frontage road and State Route 12 to the north, Elliott Slough to the east, and the Chehalis River to the south and west (Figure 2). The Site is approximately 3.5 miles upstream of the Chehalis River confluence with Grays Harbor, which is an estuarine bay of the Pacific Ocean on the western coast of Washington.

2.1 SITE DESCRIPTION AND OPERATIONAL HISTORY

The Site totals 8.6 acres in Section 10, Township 17, Range 9, in Aberdeen, Grays Harbor County, Washington (Figure 1). The Site has been owned by Lakeside Industries since 1985 and has been operated as a hot-mix asphalt batch plant since that time. Prior to Lakeside Industries' ownership, the Site was owned by Chevron USA Inc. (Chevron) and operated as a bulk fuel facility between 1922 and 1985. Locations of significant historical features at the Site prior to the Site's acquisition by Lakeside Industries are depicted on Figure 2.

Subsurface investigations have been conducted at the Site since 1984. Based on the results of these subsurface investigations, the former operation as a bulk fuel facility resulted in releases of petroleum hydrocarbons to the ground during past operations of Site facilities by Chevron. Additional details pertaining to Chevron operations are provided in the 2019 RI/FS Report.

Lakeside Industries' current operations at the Site include operation of a hot-mix asphalt batch plant, maintenance garage, and office facility (Figure 3). The aboveground storage tanks (ASTs), underground storage tanks, and associated petroleum products stored and used by Lakeside Industries at the Site are summarized below:

- A series of ASTs on the central portion of the Site, identified as the Asphalt Tank Farm, are used primarily to store asphalt cement for the hot-mix asphalt batch plant. The Asphalt Tank Farm area is paved and includes a concrete secondary spill-containment berm. One of the ASTs was removed from the Site in 2018.
- A series of ASTs on the western side of the Site, identified as the Diesel Tank Farm, are used primarily to store diesel fuel for vehicle refueling and, to a lesser extent, used oil and antifreeze. The Diesel Tank Farm area is underlain by a concrete slab and includes a concrete secondary spill-containment berm. Four of the ASTs were removed from the Site in 2017 and 2018.
- A series of ASTs in the shop building, identified as the Mechanics Shop, are used to store small volumes of engine oil, hydraulic oil, heat transfer oil, and used oil. Three of the ASTs were removed from the Site in 2017.

A minor spill of diesel fuel occurred on the western side of the Site on October 3, 1989 as a result of overfilling an AST within the Diesel Tank Farm containment area (Figure 3). The spill report filed for the incident stated that a quantity of diesel fuel ranging from 50 to 100 gallons was released to the ground surface and affected surface soil in a localized area on and adjacent to the



property. According to Ecology records, the cleanup of the diesel fuel and excavation of affected shallow surface soil were completed on the same day that the spill occurred, including backfilling the excavated area with clean fill.

2.2 GEOLOGY

According to geologic mapping conducted by the Washington Division of Geology and Earth Resources, the Site is underlain by Quaternary alluvium and undifferentiated glacial outwash deposits (Washington State Department of Natural Resources 1987). The alluvium consists of sand, silt, and gravel deposited in streambeds and fans. The undifferentiated outwash deposits consist of recessional and pro-glacial stratified sand and gravel, locally containing silt and clay.

Subsurface stratigraphy at the Site includes a shallow fill layer of sand with varying amounts of silt and gravel encountered from the ground surface to depths ranging from approximately 3.5 to 10 feet below ground surface (bgs). The fill layer is underlain primarily by silt, and to a lesser extent silty sand, with minor peat interbeds in localized areas to the total depth explored of 20 feet bgs at boring B3. Figure 3 provides a geological cross section that depicts the stratigraphic relationships of the identified subsurface materials.

2.3 HYDROGEOLOGY

An unconfined shallow groundwater-bearing zone is present in the fill layer at the Site at depths ranging from 1 to 9 feet bgs (Table 1). Based on the groundwater elevation data, groundwater in the shallow groundwater-bearing zone is interpreted to flow predominantly from the upland areas of the Site toward the Chehalis River to the south. The hydraulic gradient at the Site is interpreted to be between approximately 0.025 and 0.035 foot/foot. Slug testing performed in August 2016 estimated a geometric mean hydraulic conductivity for the Site of 5.89×10^{-5} centimeters per second in the shallow groundwater-bearing zone.

Field observations during drilling and installation of monitoring wells MW-18 through MW-21 indicated that the monitoring wells constructed in this area yielded only nominal volumes of groundwater before being purged dry, and required extended periods of time to recharge. The estimated rate of recharge was less than 0.01 gallon per minute based on field measurements, which is consistent with the relatively low transmissivity of the silt and silty sand encountered in the shallow groundwater-bearing zone.

Surface water elevations for the Chehalis River recorded at the National Oceanic and Atmospheric Administration Aberdeen Tidal Station No. 9441187 during the 25-hour period of a 2011 tidal study fluctuated by a maximum of approximately 10 feet. The largest changes in groundwater elevation recorded during the tidal study ranged from approximately 0.15 foot in monitoring well MW-9 to approximately 0.23 foot in monitoring well MW-10. The groundwater elevation recorded in monitoring well MW-6 displayed approximately 0.06 foot fluctuation. Water level data recorded in monitoring wells MW-7 and MW-8 indicated no response. Based on the tidal study, there appears to be no connection between the shallow groundwater-bearing zone at the Site and surface water of the Chehalis River.



3.0 CONCEPTUAL SITE MODEL SUMMARY

This section provides a summary of the conceptual site model derived from the results from the remedial investigation activities completed by Farallon and others from 1984 to 2019. The conceptual site model was used as a basis for selecting a permanent cleanup action alternative in accordance with applicable MTCA regulations.

Based on the results of the 2019 RI, the COCs for the Site are GRO, DRO, ORO, and associated petroleum compounds, including benzene, ethylbenzene, naphthalene compounds, cPAHs, and the metals arsenic, cadmium, lead, and mercury. The RI confirmed that soil and groundwater are the affected media at the Site.

The RI confirmed source areas in shallow soil and localized areas of shallow groundwater at the Site. The vast majority of source areas of petroleum products identified at the Site are associated with historical bulk fuel facility operations conducted by Chevron from 1922 through 1985, during which the Site was operated as a bulk fuel facility. The presence of petroleum products in soil was noted at the Site during a subsurface investigation conducted by GeoEngineers on behalf of Chevron in May and June of 1984, the results of which were documented in the *Report of Hydrogeologic Services, Existing Bulk Storage Facility, Aberdeen, Washington* dated July 9, 1984 prepared by GeoEngineers, Inc. (1984 Hydrogeologic Report). The 1984 Hydrogeologic Report concluded that the investigation results indicated that petroleum hydrocarbons had leaked into the ground during past operations of the Site facilities by Chevron prior to Lakeside Industries' acquisition of the Site in 1985. According to Lakeside Industries, a review of historical aerial photographs, and the 1984 Hydrogeologic Report, during Chevron's operation of the Site from 1922 through 1985, the Site was largely unpaved, with the exception of foundation concrete pads for bulk fuel ASTs and several structures. Upon purchase of the Site in 1985, Lakeside Industries capped the entire Site with asphalt pavement, and has operated the Site as a hot-mix asphalt plant from 1985 to the present.

Potential routes of migration of the COCs that also may have contributed to the observed distribution of contamination include leaching from soil to groundwater, and lateral and vertical transport in the shallow groundwater-bearing zone. The vertical retaining wall present along approximately half of the southern Site boundary and the presence of native silt underlying the entire Site provide physical barriers mitigating potential migration and discharge of contaminated soil and/or groundwater to surface water or sediments in the adjacent Chehalis River (Figure 2). Based on the results from the RI, migration of contaminated soil to surface water and/or sediment in the Chehalis River along the southern Site boundary has not occurred because of the concrete retaining wall and underlying native silt. However, the current concrete retaining wall is limited to the western half of the southern Site boundary, and does not provide full coverage of the confirmed source areas on the eastern portion of the Site where COCs exceed MTCA Method A cleanup levels. Indoor air and surface water were eliminated in the RI as media of concern.



4.0 CLEANUP ACTION OVERVIEW

The cleanup action includes limited source removal to the maximum extent practicable at confirmed source areas where COCs in soil and groundwater exceed MTCA Method A cleanup levels, implementation of institutional and engineering controls, installation and operation of a hydraulic pressure relief system, and monitored natural attenuation. Source removal excavations will be conducted at three confirmed source areas where concentrations of COCs in soil and groundwater exceed MTCA Method A cleanup levels, referred to as the West, Southeast, and Central Excavation Areas. Approximately 2,700 tons of petroleum-contaminated soil will be excavated and disposed of at a licensed disposal facility. Engineering controls include the installation of an approximately 700-foot sealed sheet pile wall to contain contaminated soil that will remain in-place and prevent potential migration and exposure to contaminated media while monitored natural attenuation takes place. Specifically, the 700-foot sheet pile wall will provide an active measure to permanently contain and prevent or minimize potential future releases to surface water via contaminated groundwater discharges and/or migration of soil with contamination exceeding MTCA Method A cleanup levels that will remain in-place proximate to the southern Site boundary adjacent to the Chehalis River. The sheet pile barrier wall includes installation of a hydraulic pressure relief system along the northern (up-gradient) face of the barrier wall at the interface of the fill layer and underlying silt to reduce potential hydrostatic pressure buildup behind the sheet pile barrier wall, if needed.

The selected cleanup action satisfies MTCA threshold criteria to protect human health and environment as specified in WAC 173-340-360(2)(a); meets additional requirements specified in WAC 173-340-360(2)(b); meets expectations for cleanup action alternatives as specified in WAC 173-340-370 for facilities adjacent to surface water requiring active measures to remediate, contain, and prevent or minimize releases to surface water of contaminated media in excess of cleanup levels to the maximum extent practicable; and provides the greatest degree of permanence and protectiveness.



5.0 DESIGN AND IMPLEMENTATION

The cleanup action described in this EDR consists of three source removal excavation areas, installation of a sheet pile wall, and installation and operation of a hydraulic pressure relief system. The objective of the cleanup action is to eliminate the threat to human health and environment by removing soil with high concentrations of petroleum hydrocarbons to support monitored natural attenuation of groundwater and installation of sheet pile wall as an engineered control to permanently contain and prevent or minimize potential future releases to surface water via contaminated groundwater discharges and/or migration of soil to the Chehalis River.

There are three remedial source excavation areas, West Excavation Area (75 tons), Central Excavation Area (450 tons) and Southeast Excavation Area (2,150 tons) (Figure 4). Approximately 2,700 tons of petroleum-contaminated soil that exceeds MTCA Method A cleanup levels will be excavated and disposed of off property at a licensed facility. The excavation areas will be backfilled with clean imported fill meeting the geotechnical engineer's criteria.

The polyvinyl chloride (PVC) sheet pile barrier wall will be installed along the upland face of the existing retaining wall to a total depth of approximately 25 feet bgs (elevation -5 to -10 feet North American Vertical Datum of 1988 [NAVD88]) and 770 lineal feet (Figure 4). The interlocking synthetic vinyl sheet piling will be installed and driven into underlying silt using excavation equipment or vibratory hammers in 30-inch-wide segments. The sheet pile barrier wall will provide a more-permanent measure of protection as sheet piles will be driven deeper into underlying silt, and can be extended along the entire length of the shoreline past the existing retaining wall with minimal disturbance to the Site.

The sheet pile barrier wall includes installation of a hydraulic pressure relief system along the northern (up-gradient) face of the barrier wall at the interface of the fill layer and underlying silt to reduce potential hydrostatic pressure buildup behind the sheet pile barrier wall, if needed. A series of four extraction wells with electric pumps will be installed along the barrier wall at approximate 100- to 200-foot lateral intervals to collect shallow groundwater mounding behind the sheet pile barrier wall and relieve potential hydrostatic pressure and prevent potential migration of petroleum-contaminated groundwater around the sheet pile barrier wall (Figure 4). Horizontal slotted well screens will be placed at elevations ranging from 9 to 10.5 feet NAVD88 to intercept groundwater and connected to a 6-inch-diameter schedule 40 PVC well casing that houses an electrical submersible pump activated based on groundwater elevations in the well casing. A 2-inch-diameter schedule 80 PVC water recovery line will convey groundwater recovered by the extraction wells to a vault, then discharge recovered groundwater via a gravity fed line to the existing side sewer system, and then discharge to the sanitary sewer system in accordance with a City of Aberdeen permit.

5.1 PERMITTING

Before the permanent cleanup action is initiated, the necessary permits and authorizations associated with cleanup action construction activities will be obtained by Lakeside Industries. In



June 2022, Berglund, Schmidt & Associates, Inc. submitted, on behalf of Lakeside Industries, a Washington State Joint Aquatic Resources Permit Application (JARPA) and completed a SEPA checklist for the JARPA submittal. Farallon is currently working with the City of Aberdeen to obtain a sewer discharge permit associated with the hydraulic pressure relief system. Final determination of permit requirements will be based on consultation with the permit-issuing entities.

5.2 MOBILIZATION AND SITE PREPARATION

Preparation for implementation of the cleanup action includes installation of security and erosion controls per permitted construction plans. Work related to re-routing underground utilities out of the cleanup action areas will be completed before implementing cleanup action scope of work.

Monitoring wells MW-1, MW-17, MW-18, MW-20, and MW-21 are located in the planned source removal excavation areas and will be decommissioned in accordance with WAC 173-160 (Figure 4). Source removal excavations will not begin until the monitoring wells have been decommissioned.

5.3 TEMPORARY DEWATERING FOR EXCAVATION ACTIVITIES

Temporary groundwater dewatering may be required for source area excavations and the installation of the hydraulic pressure relief system, which may extend below the surface of the shallow groundwater-bearing zone. Depth to groundwater varies seasonally between the ground surface and 10 feet bgs. Excavation wastewater may require treatment prior to discharge or disposal off the Site. If necessary, groundwater will be extracted from the excavations into temporary ASTs, sampled, and profiled to evaluate disposal options.

5.4 CONTAMINATED SOIL MANAGEMENT

Petroleum-contaminated soil generated during source excavations, preparation of the sheet pile wall installation, or trenching for the hydraulic pressure relief system will require special handling and disposal measures beyond those needed for handling and disposing of clean soil. Petroleum-contaminated soil will be excavated, segregated, stored temporarily, and disposed of off the Site in accordance with Washington State Solid Waste Management Laws and Regulations (Chapter 70.95 of the Revised Code of Washington; WAC 173-351 and 173-304) and the *Guidance for Remediation of Petroleum Contaminated Sites* revised June 2016, Publication No. 10-09-057, prepared by Ecology (Ecology Guidance).

Construction workers encountering petroleum-contaminated soil will have completed 40-Hour Hazardous Waste Operations and Emergency Response training in accordance with Part 1910.120 of Title 29 of the Code of Federal Regulations and will have completed Annual 8-Hour Hazardous Waste Operations and Emergency Response refresher training, as needed.

Excavated soil that will be transported off the property for disposal will be segregated by acceptance criteria of the disposal facility. Only petroleum-contaminated soil that exceeds MTCA



Method A cleanup levels is planned for excavation. However, petroleum-contaminated soil that is less than MTCA Method A cleanup levels may need to be generated to access the soil that exceeds MTCA Method A cleanup levels. Petroleum-contaminated soil that is less than MTCA Method A cleanup levels is not planned to be reused as backfill. In accordance with the Ecology Guidance, Category 2 soil with residual petroleum contamination should not be reused for backfill at sites where it may come into contact with shallow groundwater and/or should not be placed adjacent to surface water where contact with water is possible. Petroleum-contaminated soil that is less than MTCA Method A cleanup levels may be transported to an alternative facility, if available.

Farallon will conduct field screening during remedial excavations and trenching activities in accordance with the Ecology Guidance, which may consist of visual observation for evidence of soil staining or discoloration, and/or notation of noticeable odors, and may include use of field instrumentation such as a photoionization detector for detection of volatile vapors. Performance and confirmation soil sampling will be collected per Section 6, Compliance Monitoring.

If direct loading of excavated soil into trucks is not feasible, temporary stockpiles will be maintained by the excavation contractor as needed to segregate soil by disposal category until it can be loaded into trucks. At its own discretion, the excavation contractor will determine the best means and methods to construct and maintain stockpiles and to prevent intermixing of soil segregated by disposal category to the maximum extent practicable given the constraints of the construction project. The excavation contractor may consider use of physical barriers such as traffic plates beneath stockpiles to protect clean underlying soil, and/or concrete blocks between stockpiles to prevent commingling of segregated soil. Plastic sheeting should be placed on top of inactive stockpiles to prevent wind or runoff transport of petroleum-contaminated soil, and to prevent stockpile cross-contamination pending load-out. Plastic sheeting is not suitable for use beneath stockpiles of petroleum-contaminated soil placed on clean soil.

Farallon will assist Lakeside Industries with manifesting trucks loaded with petroleum-contaminated soil, and tracking quantities of soil delivered to the disposal facility. Documentation of soil disposal will be maintained in the project file and used for regulatory closure purposes under MTCA. Excavations will be backfilled with suitable imported material, and compacted according to the geotechnical specifications required for pavement resurfacing in accordance with future Site use plans.

5.5 SOURCE AREA EXCAVATIONS

Source removal excavations will be conducted at three confirmed source areas where concentrations of COCs in soil and groundwater exceed MTCA Method A cleanup levels, referred to as the West, Southeast, and Central Excavation Areas (Figure 4). Soil with concentrations of COCs exceeding MTCA Method A cleanup levels will be excavated to the maximum extent practicable from the three confirmed source areas using standard excavation means and methods. Based on the available data, an estimated combined total of approximately 2,700 tons of petroleum-contaminated soil will be excavated from the three source areas and transported off the Site to a licensed and permitted treatment, storage, and disposal facility.



The estimated area, depth, and volume of the West, Southeast, and Central Excavation Areas are:

- West Excavation: 40 cubic yards;
- Southeast Excavation: 1,200 cubic yards; and
- Central Excavation: 260 cubic yards.

The estimated soil volumes assume a 4-foot vertical cut along the excavation perimeter and then a 1-to-1 slope to the base of the excavation. A trench box will be used for the West Excavation to support limited soil removal adjacent to the shoreline riprap of the Chehalis River. Structural and geotechnical engineering considerations will determine the final extent of each excavation area. A geotechnical engineering field representative will be responsible for evaluating and determining appropriate measures to maintain soil stability issues during excavation, as necessary. Appendix A, Engineering Drawing Set for the Source Excavation, Containment, and Hydraulic Pressure Relief System, provides details for each remedial excavation area.

5.5.1 West Excavation Area

The West Excavation Area is designed to remove a confirmed DRO/ORO source area in the western portion of the Site. Based on the existing data the excavation is expected to extend to a depth of 10 feet bgs and excavation methods will include the use of a trench box. Approximately 75 tons of petroleum-contaminated soil will be excavated and disposed of as nonhazardous waste at a Subtitle D landfill. Soil samples will be collected from the base and sidewalls of the remedial excavation and analyzed for DRO/ORO as described in Section 6.2, Performance Monitoring.

5.5.2 Southeast Excavation Area

The Southeast Excavation Area is designed to remove a confirmed GRO/benzene source area in the southeastern portion of the Site comprised of a localized area of soil and groundwater contamination centered approximately on monitoring well MW-18. Based on the existing data the excavation is expected to extend to a depth of 12 feet bgs, which will be achieved by sloping the sidewalls of the excavation. Approximately 2,150 tons of petroleum-contaminated soil will be excavated and disposed of as nonhazardous waste at a Subtitle D landfill. Soil samples will be collected from the base and sidewalls of the remedial excavation and analyzed for GRO/benzene as described in Section 6.2, Performance Monitoring.

5.5.3 Central Excavation Area

The Central Excavation Area is designed to remove a confirmed DRO/ORO source area in the central portion of the Site comprised of a broad area of shallow soil contamination. Based on the existing data the excavation is expected to extend to a depth of 8 feet bgs, which will be achieved by sloping the sidewalls of the excavation. Approximately 450 tons of petroleum-contaminated soil will be excavated and disposed of as nonhazardous waste at a Subtitle D landfill. Soil samples will be collected from the base and sidewalls of the remedial excavation and analyzed for DRO/ORO as described in Section 6.2, Performance Monitoring.



5.5.4 Backfilling Source Excavation Areas

A geotechnical engineer will provide specifications on structural backfill to be used. Structural backfill will be used for the excavation and shall consist of imported, well-graded, granular material such as Seattle Type 17 Mineral Aggregate (City of Seattle Standards and Specifications, 2022, 9-03.14), Washington State Department of Transportation's (WSDOT) Gravel Borrow (WSDOT Standards and Specifications, 2022, 9-03.14(1)), or an approved equivalent.

Direct loading/unloading shall be used where possible to minimize impacts to facility operations. If needed to complete the work, stockpiles shall be established and maintained in keeping with all federal, state, and local erosion control requirements.

5.6 SHEET PILE WALL

A sheet pile barrier wall will be installed along the entire length of the portion of the Site with concentrations of COCs exceeding MTCA Method A cleanup levels in soil and/or shallow groundwater without disturbing the existing retaining wall. The location of the sheet pile barrier wall is shown on Figure 4. The sheet pile barrier wall will provide a more-permanent measure of protection as sheet piles will be driven deeper into underlying silt, and can be extended along the entire length of the shoreline past the existing retaining wall with minimal disturbance to the Site and active facility operations (Figure 4). Extending the sheet pile barrier wall east of the existing retaining wall will provide the barrier necessary to contain the entire portion of the southern Site boundary where COCs remain at concentrations exceeding MTCA Method A cleanup levels, including the confirmed source area in the southeastern portion of the Site proximate to monitoring well MW-18 attributed to releases from former Chevron operations (Figure 4).

The sheet pile barrier wall will address current exposure pathways and future potential exposure scenarios, including flooding and mass erosion during a 100-year storm event, and liquefaction and mobilization of shallow contaminated soil during an earthquake. Installation of the sheet pile wall meets the expectations specified in WAC 173-34-370 requiring an active measure to permanently contain and prevent or minimize potential future releases to surface water via contaminated groundwater discharges and/or migration of contaminated soil exceeding MTCA Method A cleanup levels that will remain in-place proximate to the southern Site boundary adjacent to the Chehalis River to the maximum extent practicable.

The sheet pile barrier wall was designed by Berglund, Schmidt & Associates, Inc., and will be installed along the upland face of the existing retaining wall to a total depth of approximately 25 feet bgs (elevation -5 to -10 feet NAVD88). The interlocking synthetic vinyl sheet piling will be installed and driven into underlying silt using excavation equipment or vibratory hammers in 30-inch-wide segments. The sheet pile barrier wall design incorporates the existing retaining wall footing and tiebacks on 25-foot centers. Berglund, Schmidt & Associates, Inc.'s engineering design plan set is provided in Appendix B.

Periodic inspections will be implemented in accordance with an Operation, Maintenance, and Inspection Plan, which will be prepared following installation of the sheet pile barrier wall.



5.7 HYDRAULIC PRESSURE RELIEF SYSTEM

The sheet pile barrier wall includes installation of a hydraulic pressure relief system along the northern (up-gradient) face of the barrier wall to reduce potential hydrostatic pressure buildup behind the sheet pile barrier wall, if needed. A series of four extraction wells with electric pumps will be installed along the barrier wall at approximate 100-foot to 200-foot lateral intervals to collect shallow groundwater and relieve potential hydrostatic pressure behind the sheet pile barrier wall (Figure 4). Each electric pump will be connected to horizontal well screen that will extend laterally 75 to 100 feet to the west and east of the pump, and will intercept and collect shallow groundwater if mounding occurs. A total of 725 feet of 4-inch-diameter 0.020 slotted well screen will extend horizontally at an approximate depth of 2 to 4 feet bgs (pipe invert elevations ranging from 9 to 10.5 feet NAVD88) to intercept groundwater if mounding occurs. The slotted well screen will connect to a 6-inch-diameter schedule 40 PVC well casing that houses an electrical submersible pump that will be activated based on groundwater elevations in the well casing. Approximately 670 feet of 2-inch-diameter schedule 80 PVC water recovery line will convey groundwater recovered by the extraction wells to a vault, then discharge recovered groundwater via an 8-inch-diameter gravity fed line to the existing side sewer system, and then discharge to the sanitary sewer system in accordance with a City of Aberdeen permit. Appendix A, Engineering Drawing Set for the Source Excavation, Containment, and Hydraulic Pressure Relief System, provides details for the installation of the hydraulic pressure relief system.

Periodic monitoring and maintenance will be implemented in accordance with an Operation, Maintenance, and Inspection Plan, which will be prepared following installation of the hydraulic pressure relief system.

5.7.1 Below Ground Installation

A portion of the piping for the hydraulic pressure relief system will be installed in a trench along the northern (up-gradient) face of the sheet pile barrier wall. The 4-inch-diameter slotted well screen will be installed to an approximate depth of 2 to 4 feet bgs (pipe invert elevations ranging from 9 to 10.5 feet NAVD88) and the electronic pump well casing to a depth of 8 to 10 feet bgs (approximate elevation 4 feet NAVD88) using a trench box shoring method. Approximately 1,100 tons of soil will be excavated from the trench. Excavated soil containing petroleum hydrocarbons will be managed and disposed of in accordance with Section 5.5, Contaminated Soil Management.

The 8-inch-diameter water discharge line will be trenched in from the concrete vault to the existing side sewer connection. If trench depths extend beyond 3 to 4 feet bgs, a trench box will be used to support trenching and excavation activities.

5.7.2 Aboveground Installation

The groundwater recovered by the hydraulic pressure relief system will be conveyed via an aboveground 2-inch-diameter schedule 80 PVC conveyance line anchored to the upland face of the sheet pile wall with steel Unistrut. An aboveground electrical conduit will also be secured to the upland face of the sheet pile wall to provide power to the four electrical pumps. The location



of the electrical meter box and control panel associated with the hydraulic pressure relief system will be field verified with contractors prior to mobilization to the Site.

5.7.3 System Startup, Operations, and Maintenance

Prior to backfilling below grade piping, all water recovery and conveyance lines will be pressure tested and inspected to hold 20 pounds per square for 10 minutes. Once all lines have passed a pressure test, the system interlocks and controls will be tested prior to full time operation.

The groundwater infiltration line will intercept any groundwater mounding behind the sheet pile wall and fill up the well casing that houses the electrical submersible pump. A pressure transducer will control the start and stop cycles for the electrical pump based on the elevation of water present in the well casing. It is estimated that the hydraulic pressure relief system may generate up to 7 gallons per minute. A sample monitoring point will be accessible to monitor the quality of the recovered groundwater and ensure compliance with the City of Aberdeen sanitary sewer discharge permit criteria. Power to the system will be monitored remotely via telemetry and quarterly operations and maintenance visits will be conducted to monitor and maintenance equipment.

5.8 CAPPING

Capping will be required to mitigate the direct contact exposure pathway, and to reduce rainwater infiltration that could mobilize soil contamination from soil to groundwater. Capping at the Site will include a combination of pavement and existing building foundations. The environmental covenant will reference and require implementation of an Operation, Maintenance, and Inspection Plan, which will include periodic inspections and maintenance to ensure that the integrity of the cap is maintained. The Operation, Maintenance, and Inspection Plan will be prepared for the Site following installation of the cap.

5.9 ENVIRONMENTAL COVENANT

An environmental covenant will be recorded for the Site because COCs will remain in soil and groundwater at concentrations exceeding applicable MTCA Method A cleanup levels following completion of the cleanup action. The environmental covenant will be prepared consistent with WAC 173-340-440, and will provide restrictions and obligations for the Site to ensure that the cleanup action protects future users of the Site, the environment, and the integrity of the cleanup action. The environmental covenant will be prepared following completion of the source area excavations and the installation of a sheet pile barrier wall and associated hydraulic pressure relief system. The environmental covenant will be implemented following approval by Ecology and completion of administrative and recording requirements in accordance with Chapter 64.70 of the Revised Code of Washington.



The environmental covenant for the Site will consist of:

- Periodic monitoring and maintenance of the impermeable cap, the sheet pile barrier wall, and the hydraulic pressure relief system. Monitoring and maintenance will be implemented in accordance with the Operation, Maintenance, and Inspection Plan prepared for the Site.
- Long-term groundwater monitoring, which will be implemented in accordance with the Compliance Monitoring Plan that will be prepared for the Site.
- Restriction of Site leases to uses and activities consistent with the environmental covenant.
- Requirements for worker safety during subsurface work such as utility line maintenance, new construction, and building and facility improvements and maintenance.
- Advance notification to Ecology concerning proposed sale or conveyance of the Site, or proposed use of the Site that may be inconsistent with the terms of the environmental covenant.
- Restrictions on groundwater use for any purpose, with the exceptions of groundwater monitoring and operation of the hydraulic pressure relief system.
- Access by Ecology personnel for inspection and review of records, and to determine compliance with the required monitoring and maintenance.

5.10 CLEANUP ACTION COMPLETION REPORT

Following completion of the cleanup action elements described in this EDR, a Cleanup Action Completion Report will be prepared documenting the Cleanup Action, per WAC 173-340-400. The Cleanup Action Completion Report will provide the technical basis to support a request for a No Further Action determination from Ecology, and a summary of the Cleanup Action, including the limits of the remedial source excavations, quantities of contaminated soil disposed of off the property, operations and maintenance plan for the hydraulic pressure relief system, and results from compliance monitoring. An environmental covenant will be recorded on the Site within approximately 6 months of completing cleanup action construction activities.



6.0 COMPLIANCE MONITORING

Compliance monitoring is required to ensure the protectiveness of the cleanup action in accordance with WAC 173-340-410. These regulations identify three types of compliance monitoring: protection, performance, and confirmational monitoring. This section documents the compliance soil, groundwater, and system monitoring to be conducted by the Farallon for the cleanup action described in the EDR.

6.1 PROTECTION MONITORING

Protection monitoring will be in accordance with the HASP and confirm that human health and environment are adequately protected during the Cleanup Action. A Site-specific HASP will be prepared prior to implementation of the permanent cleanup action. The HASP will include protection monitoring requirements to minimize potential short-term exposure to hazardous materials, and to protect personnel during cleanup action activities.

Construction workers encountering potentially impacted soil and/or groundwater will have completed 40-Hour Hazardous Waste Operations and Emergency Response training (and annual 8-Hour refresher training, as needed) in accordance with 29 CFR 1910.120. Perimeter and/or personal air monitoring will be completed during the implementation of the Cleanup Action. Best management practices will be used in accordance with the existing Stormwater Pollution Prevention Plan and temporary erosion and a temporary sedimentation control plan will be implemented during the Cleanup Action activities.

6.2 PERFORMANCE MONITORING

Performance monitoring will confirm that the cleanup action has attained the cleanup standards, and to demonstrate compliance with applicable permits. Performance monitoring will consist of soil sampling, groundwater monitoring, and wastewater discharge sampling. A description of the performance monitoring is provided below. Details pertaining to frequency, scope, duration, and analysis are provided in the Sampling and Analysis Plan (Appendix C).

6.2.1 Soil Sampling

The limits of source area excavations and trenching for the hydraulic pressure relief system are constrained by active Site operation as a hot-mix asphalt batch plant, and the presence of subsurface utility lines and substructures. The cleanup action focuses on removal of contaminated soil to the maximum extent practicable, and does not include removal of soil from beneath substructures or utility lines, or removal of soil that would affect the structural integrity of any structures in or near the excavation areas. During cleanup activities, performance soil samples will be collected to:

- Identify and confirm locations where the MTCA Method A cleanup levels for the Site have been achieved;



- Identify and quantify concentrations of COCs in soil that may be located in portions of the excavation areas that may be expanded and are accessible for additional soil removal;
- Identify and quantify concentrations of residual COCs in soil that cannot practicably be removed, and will remain in the subsurface at the completion of the excavations; and
- Identify and classify soil for disposal based on the Ecology Guidance.

Performance soil sampling will entail collecting discrete in-situ soil samples from the base and sidewalls at the excavation limits for laboratory analysis to quantify concentrations of COCs. Composite sampling may be conducted to identify and classify soil for disposal purposes. A Sampling and Analysis Plan is provided in Appendix C to present the specific requirements for field monitoring and sample collection and analysis during excavation activities.

6.2.2 Groundwater Monitoring

Compliance groundwater monitoring will be conducted as part of the permanent cleanup action. At a minimum, groundwater will be monitored every 6 months for 2 years, followed by once a year for 3 years using the proposed compliance monitoring well network shown on Figure 5. The procedures for groundwater sample collection (e.g., frequency, location) and sample handling are described in the Sampling and Analysis Plan (Appendix C).

Following completion of the source area excavations and installation of the sheet pile barrier wall, a compliance groundwater monitoring program will be initiated to evaluate the effectiveness of the source area excavations, to confirm that the cleanup standards for the Site have been achieved, and to demonstrate monitored natural attenuation of the COCs.

As areas of the Site meet the cleanup standards, monitoring in those areas will transition to confirmational monitoring, as described in Section 6.3.

6.2.3 Wastewater Discharge Sampling

Wastewater will be generated from temporary dewatering during source area excavations, and from long-term dewatering, as needed, during operation of the hydraulic pressure relief system. The procedures for wastewater discharge sample collection (e.g., frequency, location) and sample handling are described in the Sampling and Analysis Plan (Appendix C).

6.3 CONFIRMATIONAL MONITORING

The cleanup action will include soil and groundwater confirmational monitoring to confirm the long-term effectiveness of the cleanup action once cleanup standards have been attained. A brief description of the soil and groundwater confirmational monitoring planned for the cleanup action is provided below.



6.3.1 Soil Sampling

Confirmational monitoring for soil will be conducted once performance soil sampling results indicate that the source area excavations are approaching the lateral and vertical limits of soil containing COCs at concentrations exceeding MTCA Method A cleanup levels or practicable limits of the excavation, whichever occurs first. Confirmation soil samples will be collected from the final lateral and vertical limits of each excavation area using the sampling methodology described in the Sampling and Analysis Plan (Appendix C).

6.3.2 Groundwater Monitoring

Compliance groundwater monitoring will be conducted as part of the permanent cleanup action using the proposed compliance monitoring well network shown on Figure 5. Confirmational groundwater sampling will commence once performance monitoring demonstrates that the cleanup standards for groundwater have been achieved. The procedures for groundwater sample collection (e.g., frequency, location) and sample handling are described in the Sampling and Analysis Plan (Appendix C).



7.0 BIBLIOGRAPHY

- Farallon Consulting, L.L.C. (Farallon). 2019. *Remedial Investigation and Feasibility Study Report, Lakeside Industries Aberdeen Site, 2400 Sargent Boulevard, Aberdeen, Washington*. Revised August.
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8.0 LIMITATIONS

8.1 GENERAL LIMITATIONS

The conclusions contained in this report/assessment are based on professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location. The conclusions contained herein are subject to the following inherent limitations:

- **Accuracy of Information.** Farallon obtained, reviewed, and evaluated certain information used in this report/assessment from sources that were believed to be reliable. Farallon's conclusions, opinions, and recommendations are based in part on such information. Farallon's services did not include verification of its accuracy or authenticity. Should the information upon which Farallon relied prove to be inaccurate or unreliable, Farallon reserves the right to amend or revise its conclusions, opinions, and/or recommendations.
- **Reconnaissance and/or Characterization.** Farallon performed a reconnaissance and/or characterization of the Site that is the subject of this report/assessment to document current conditions. Farallon focused on areas deemed more likely to exhibit hazardous materials conditions. Contamination may exist in other areas of the Site that were not investigated or were inaccessible. Site activities beyond Farallon's control could change at any time after the completion of this report/assessment.

For the foregoing reasons, Farallon cannot and does not warrant or guarantee that the Site is free of hazardous or potentially hazardous substances or conditions, or that latent or undiscovered conditions will not become evident in the future. Farallon's observations, findings, and opinions can be considered valid only as of the date of the report.

This report/assessment has been prepared in accordance with the contract for services between Farallon and Lakeside Industries, Inc., and currently accepted industry standards. No other warranties, representations, or certifications are made.

8.2 LIMITATION ON RELIANCE BY THIRD PARTIES

Reliance by third parties is prohibited. This report/assessment has been prepared for the exclusive use of Lakeside Industries, Inc. to address the unique needs of Lakeside Industries, Inc. at the Lakeside Industries Aberdeen Site at a specific point in time.

This is not a general grant of reliance. No one other than Lakeside Industries, Inc. may rely on this report unless Farallon agrees in advance to such reliance in writing. Any unauthorized use, interpretation, or reliance on this report/assessment is at the sole risk of that party and Farallon will have no liability for such unauthorized use, interpretation, or reliance.

FIGURES

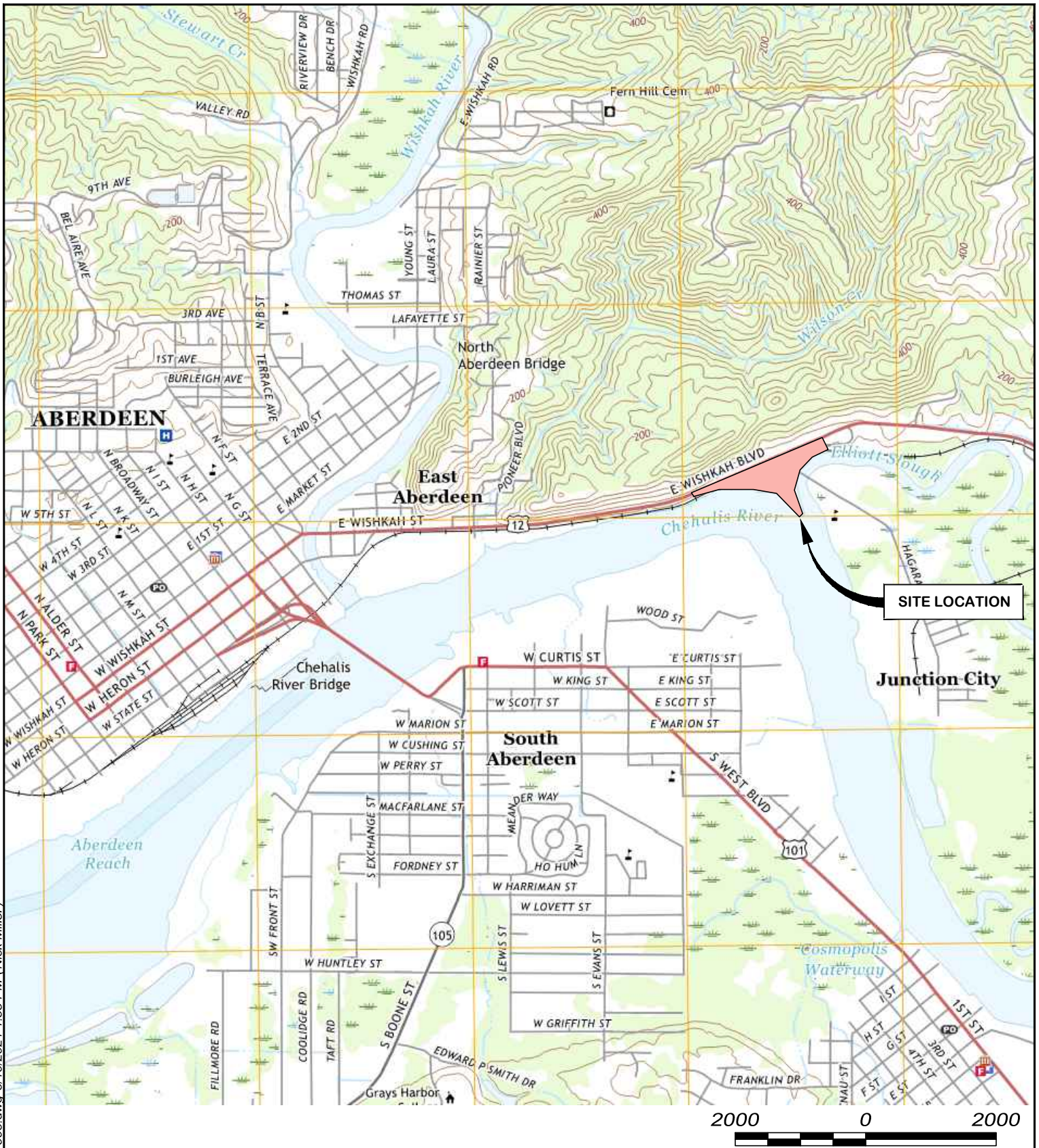
ENGINEERING DESIGN REPORT

Lakeside Industries Aberdeen Site

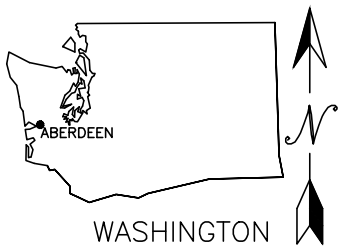
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Aberdeen, Washington

Farallon PN: 525-006



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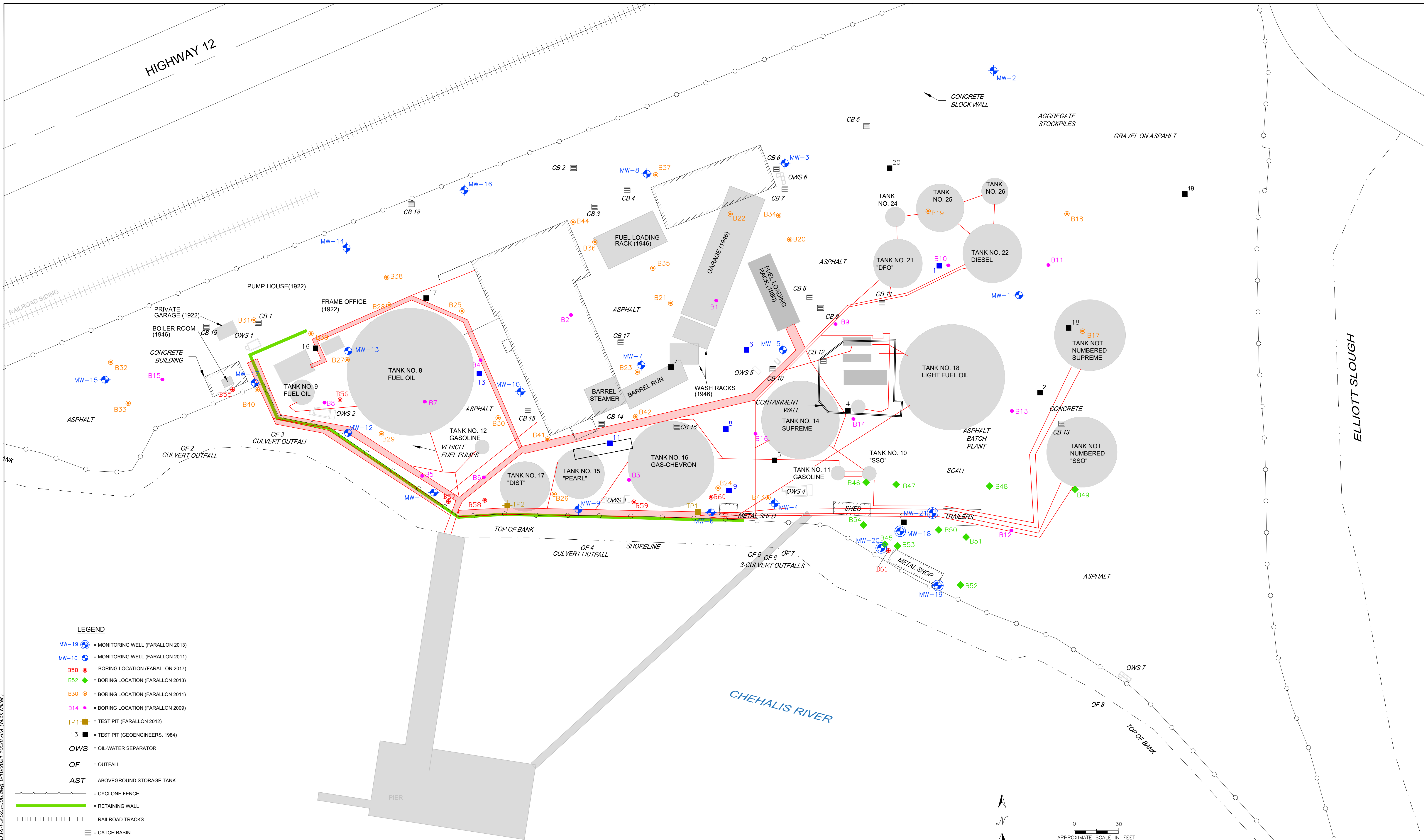
FIGURE 1

SITE VICINITY MAP
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN:525-006

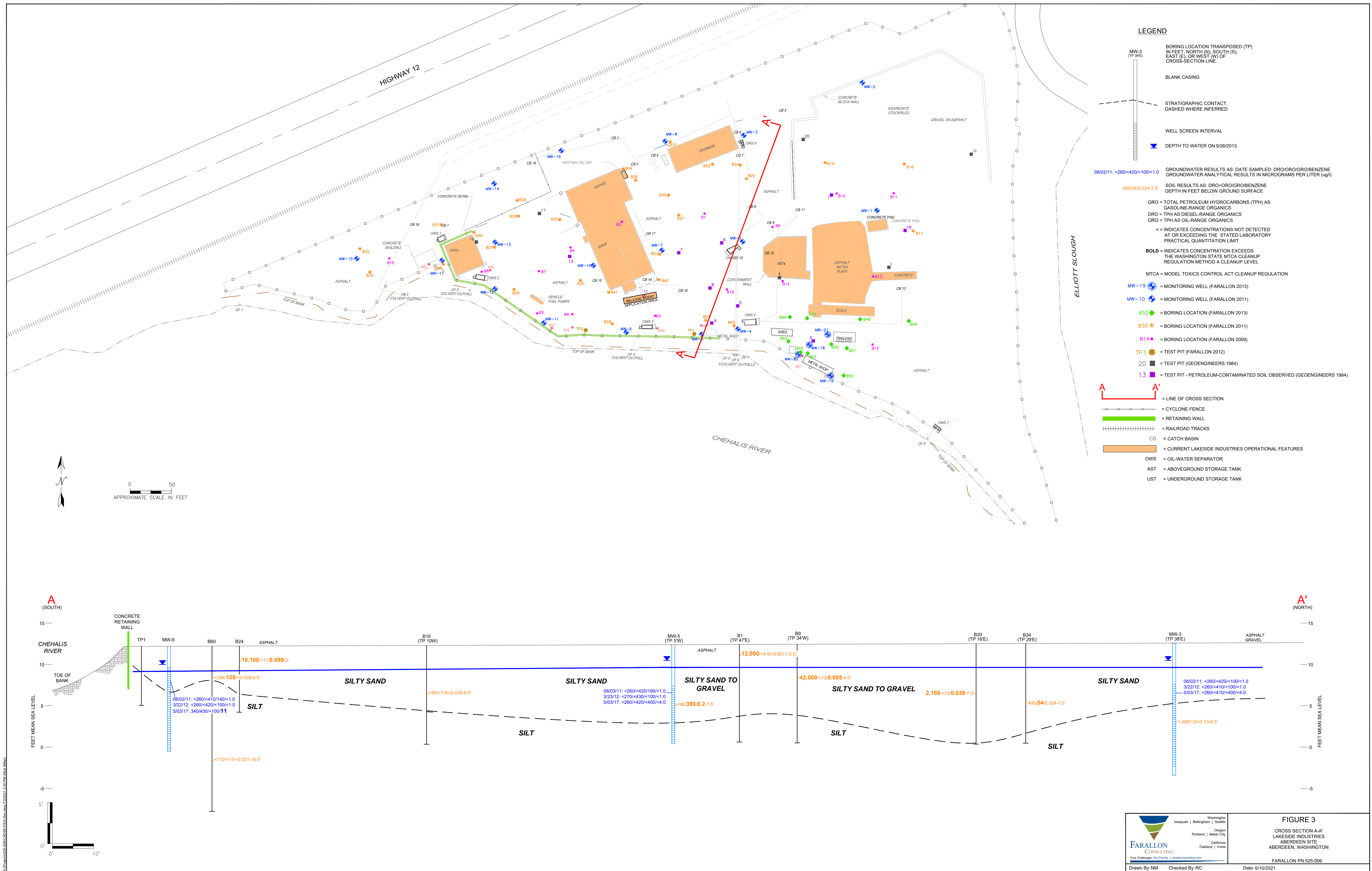
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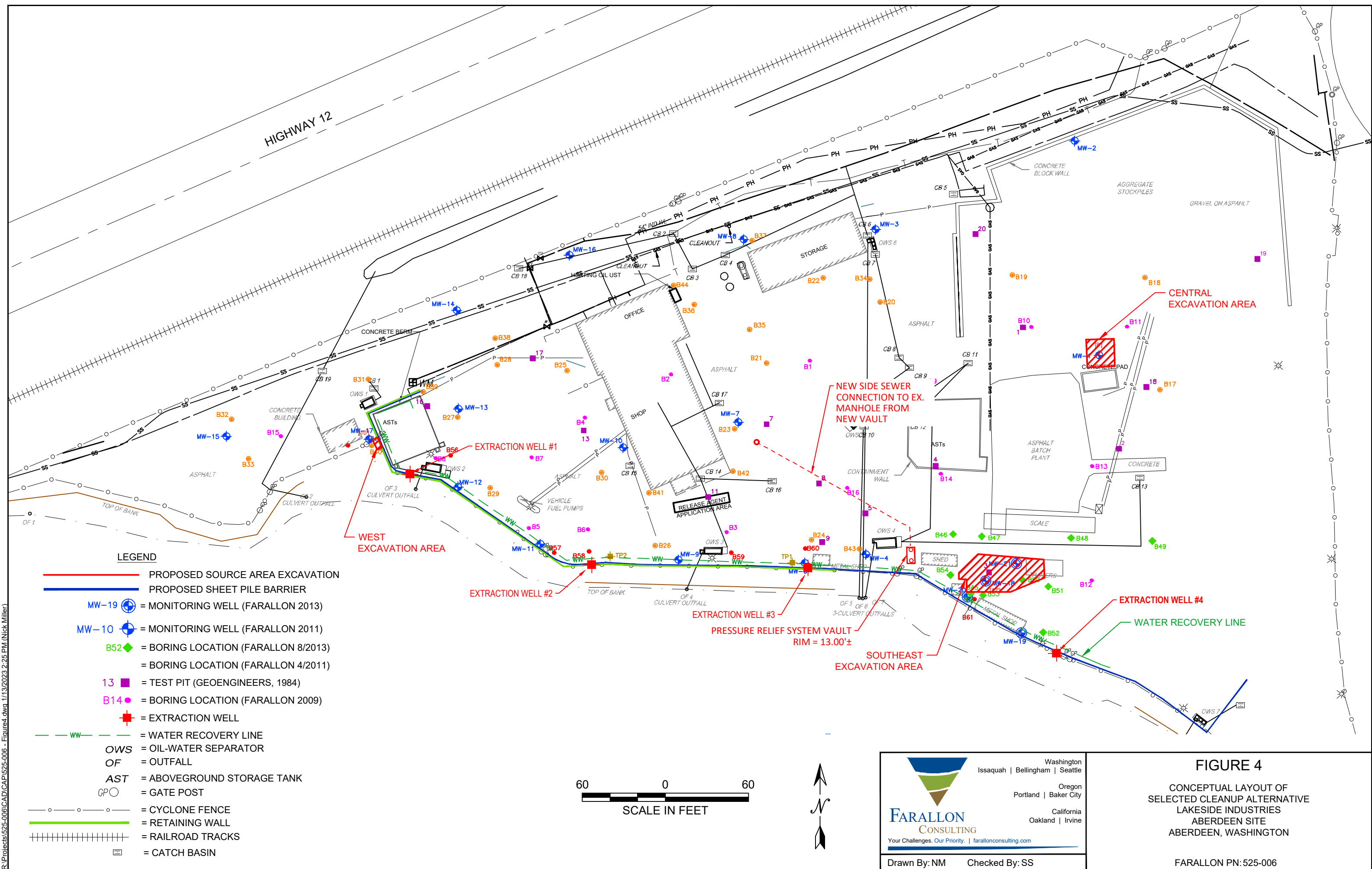
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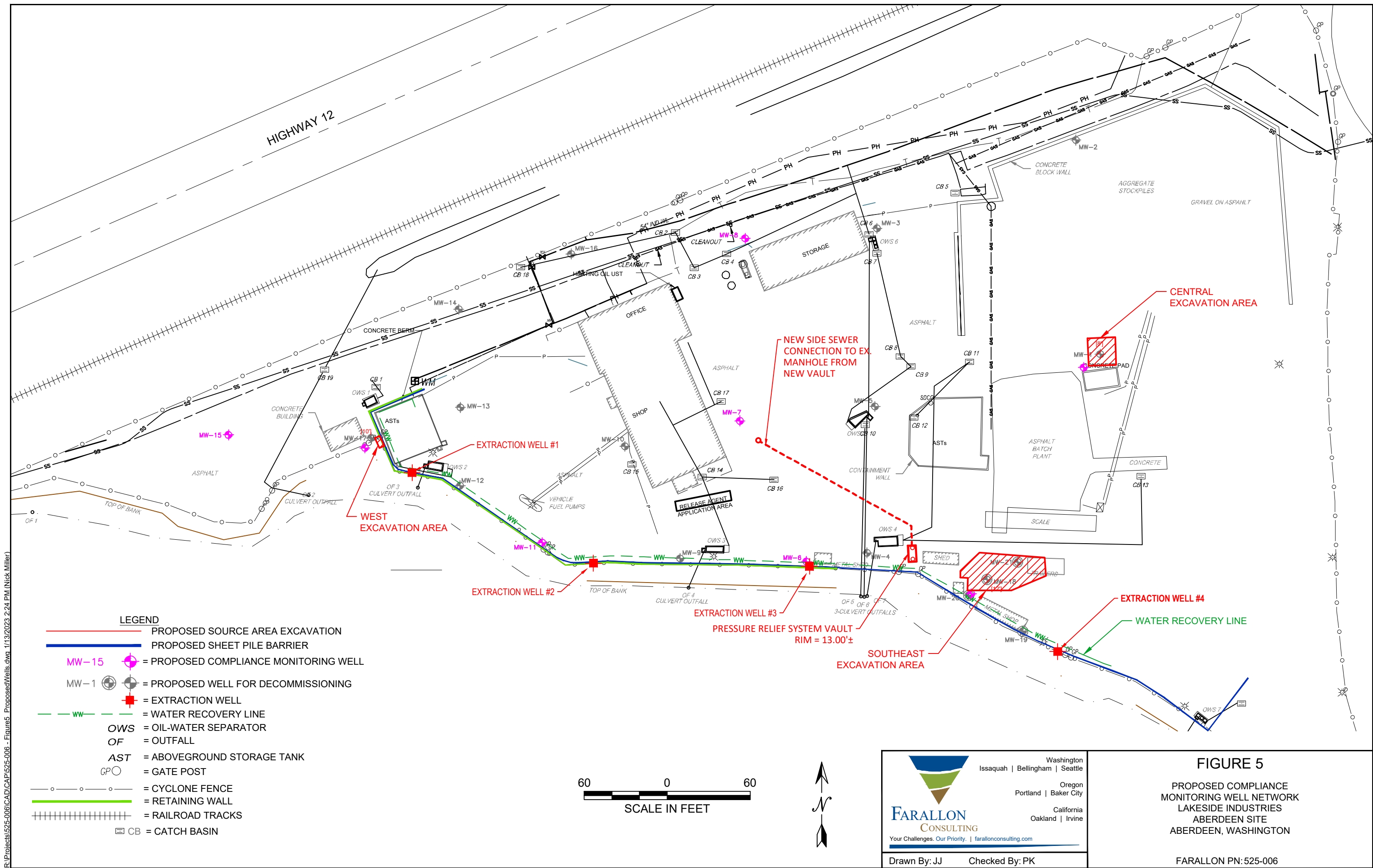
LEGEND

- MW-19 = MONITORING WELL (FARALLON 2013)
- MW-10 = MONITORING WELL (FARALLON 2011)
- B58 = BORING LOCATION (FARALLON 2017)
- B52 = BORING LOCATION (FARALLON 2013)
- B30 = BORING LOCATION (FARALLON 2011)
- B14 = BORING LOCATION (FARALLON 2009)
- TP1 = TEST PIT (FARALLON 2012)
- 1.3 = TEST PIT (GEOENGINEERS, 1984)
- OWS = OIL-WATER SEPARATOR
- OF = OUTFALL
- AST = ABOVEGROUND STORAGE TANK
- = CYCLONE FENCE
- = RETAINING WALL
- ++++ = RAILROAD TRACKS
- == = CATCH BASIN
- = APPROXIMATE LOCATION HISTORICAL ABOVEGROUND PRODUCT PIPING CORRIDOR
- = APPROXIMATE LOCATION HISTORICAL ABOVEGROUND PRODUCT PIPING
- = HISTORICAL FEATURES-FORMER CHEVRON BULK FUEL FACILITY 1922-1985





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TABLE

ENGINEERING DESIGN REPORT

Lakeside Industries Aberdeen Site

2400 Sargent Boulevard

Aberdeen, Washington

Farallon PN: 525-006

Table 1
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet) ¹	Depth to Water (feet) ²	Elevation of Groundwater (feet) ¹
MW-1	8/2/2011	13.23	3.50	9.73
	12/7/2011		3.24	9.99
	12/8/2011		3.27	9.96
	3/22/2012		2.75	10.48
	4/11/2013		2.74	10.49
	9/26/2013		3.90	9.33
	12/1/2016		NM	NM
	5/2/2017		2.33	10.90
MW-2	8/2/2011	20.62	9.97	10.65
	12/7/2011		8.22	12.40
	12/8/2011		8.30	12.32
	3/22/2012		8.09	12.53
	4/11/2013		7.47	13.15
	9/26/2013		8.45	12.17
	12/1/2016		6.71	13.91
	5/2/2017		7.03	13.59
MW-3	8/2/2011	11.08	0.97	10.11
	12/7/2011		2.56	8.52
	12/8/2011		1.36	9.72
	3/22/2012		1.79	9.29
	4/11/2013		2.14	8.94
	9/26/2013		2.69	8.39
	12/1/2016		2.45	8.63
	5/2/2017		0.87	10.21
MW-4	8/2/2011	11.50	4.12	7.38
	12/7/2011		4.20	7.30
	12/8/2011		3.46	8.04
	3/22/2012		4.20	7.30
	4/11/2013		4.19	7.31
	9/26/2013		4.03	7.47
	12/1/2016		2.61	8.89
	5/2/2017		4.16	7.34
MW-5	8/2/2011	10.87	2.83	8.04
	12/7/2011		2.33	8.54
	12/8/2011		2.76	8.11
	3/22/2012		3.13	7.74
	4/11/2013		3.45	7.42
	9/26/2013		1.97	8.90
	12/1/2016		3.95	6.92
	5/2/2017		3.41	7.46
MW-6	8/2/2011	10.64	2.59	8.05
	12/7/2011		2.64	8.00
	12/8/2011		2.70	7.94
	3/22/2012		2.19	8.45
	4/11/2013		2.18	8.46
	9/26/2013		2.24	8.40
	12/1/2016		1.90	8.74
	5/2/2017		2.05	8.59

Table 1
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet) ¹	Depth to Water (feet) ²	Elevation of Groundwater (feet) ¹
MW-7	8/2/2011	11.03	2.01	9.02
	12/7/2011		1.83	9.20
	12/8/2011		1.88	9.15
	3/22/2012		1.63	9.40
	4/11/2013		1.64	9.39
	9/26/2013		1.80	9.23
	12/1/2016		1.54	9.49
	5/2/2017		1.83	9.20
MW-8	8/2/2011	12.06	2.10	9.96
	12/7/2011		2.20	9.86
	12/8/2011		2.31	9.75
	3/22/2012		1.95	10.11
	4/11/2013		1.92	10.14
	9/26/2013		2.06	10.00
	12/1/2016		2.10	9.96
	5/2/2017		2.12	9.94
MW-9	8/2/2011	10.68	5.49	5.19
	12/7/2011		2.65	8.03
	12/8/2011		2.66	8.02
	3/22/2012		2.05	8.63
	4/11/2013		1.73	8.95
	9/26/2013		1.49	9.19
	12/1/2016		1.66	9.02
	5/2/2017		1.94	8.74
MW-10	8/2/2011	11.06	2.30	8.76
	12/7/2011		1.39	9.67
	12/8/2011		1.34	9.72
	3/22/2012		1.13	9.93
	4/11/2013		1.15	9.91
	9/26/2013		2.19	8.87
	12/1/2016		0.90	10.16
	5/2/2017		1.00	10.06
MW-11	8/2/2011	12.41	7.21	5.20
	12/7/2011		7.27	5.14
	12/8/2011		4.57	7.84
	3/22/2012		6.54	5.87
	4/11/2013		6.71	5.70
	9/26/2013		6.76	5.65
	12/1/2016		3.64	8.77
	5/2/2017		6.21	6.20
MW-12	8/2/2011	11.60	5.51	6.09
	12/7/2011		2.94	8.66
	12/8/2011		2.93	8.67
	3/22/2012		2.60	9.00
	4/11/2013		2.50	9.10
	9/26/2013		2.70	8.90
	12/1/2016		2.43	9.17
	5/2/2017		2.51	9.09

Table 1
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet) ¹	Depth to Water (feet) ²	Elevation of Groundwater (feet) ¹
MW-13	8/2/2011	12.83	2.81	10.02
	12/7/2011		2.25	10.58
	12/8/2011		2.30	10.53
	3/22/2012		1.80	11.03
	4/11/2013		1.74	11.09
	9/26/2013		2.42	10.41
	12/1/2016		1.53	11.30
MW-14	5/2/2017	12.50	2.05	10.78
	8/2/2011		1.10	11.40
	12/7/2011		0.69	11.81
	12/8/2011		0.69	11.81
	3/22/2012		0.00 ³	12.50
	4/11/2013		0.00 ³	12.50
	9/26/2013		0.16	12.34
MW-15	12/1/2016	14.41	0.00 ³	12.50
	5/2/2017		0.00 ³	12.50
	8/2/2011		7.35	7.06
	12/7/2011		6.95	7.46
	12/8/2011		7.00	7.41
	3/22/2012		6.33	8.08
	4/11/2013		6.55	7.86
MW-16	9/26/2013	13.55	7.08	7.33
	12/1/2016		6.23	8.18
	5/2/2017		6.45	7.96
	8/2/2011		1.10	12.45
	12/7/2011		0.49	13.06
	12/8/2011		0.51	13.04
	3/22/2012		0.00 ³	13.55
MW-17	4/11/2013	12.67	0.00 ³	13.55
	9/26/2013		0.11	13.44
	12/1/2016		0.00 ³	13.55
	5/2/2017		0.00 ³	13.55
	8/2/2011		3.79	8.88
	12/7/2011		3.45	9.22
	12/8/2011		3.45	9.22
MW-18	3/22/2012	14.65	3.21	9.46
	4/11/2013		3.35	9.32
	9/26/2013		3.63	9.04
	12/1/2016		3.03	9.64
MW-19	5/2/2017	13.92	3.26	9.41
	4/11/2013		4.40	10.25
	9/26/2013		5.48	9.17
	12/1/2016		3.82	10.83
MW-19	5/2/2017	13.92	4.11	10.54
	9/26/2013		4.73	9.19
	12/1/2016		NM	NM
MW-19	5/2/2017	13.92	4.78	9.14
	9/26/2013		NM	NM

Table 1
Groundwater Elevations
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Monitoring Well Number	Water Level Measurement Date	Well Head Elevation (feet) ¹	Depth to Water (feet) ²	Elevation of Groundwater (feet) ¹
MW-20	9/26/2013	14.32	4.89	9.43
	12/1/2016		3.92	10.40
	5/2/2017		4.08	10.24
MW-21	9/26/2013	13.47	4.36	9.11
	12/1/2016		2.54	10.93
	5/2/2017		2.95	10.52

NOTES:

¹Site surveys by Berglund, Schmidt and Associates, Inc. on August 11, 2011 and May 1 and October 1, 2013.
Elevations in feet above mean sea level based on NAVD88 datum.

²In feet below top of polyvinyl chloride well casing.

³Artesian conditions were observed at the time of measurement.

NM = not measured due to access issue

APPENDIX A
ENGINEERING DRAWING SET, SOURCE EXCAVATION,
CONTAINMENT, AND HYDRAULIC PRESSURE RELIEF SYSTEM

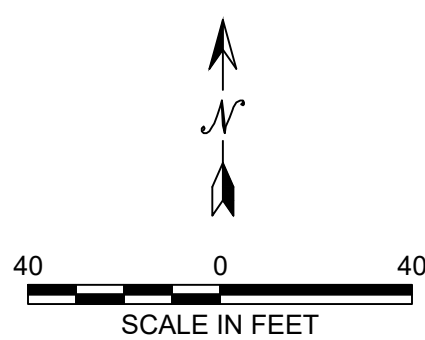
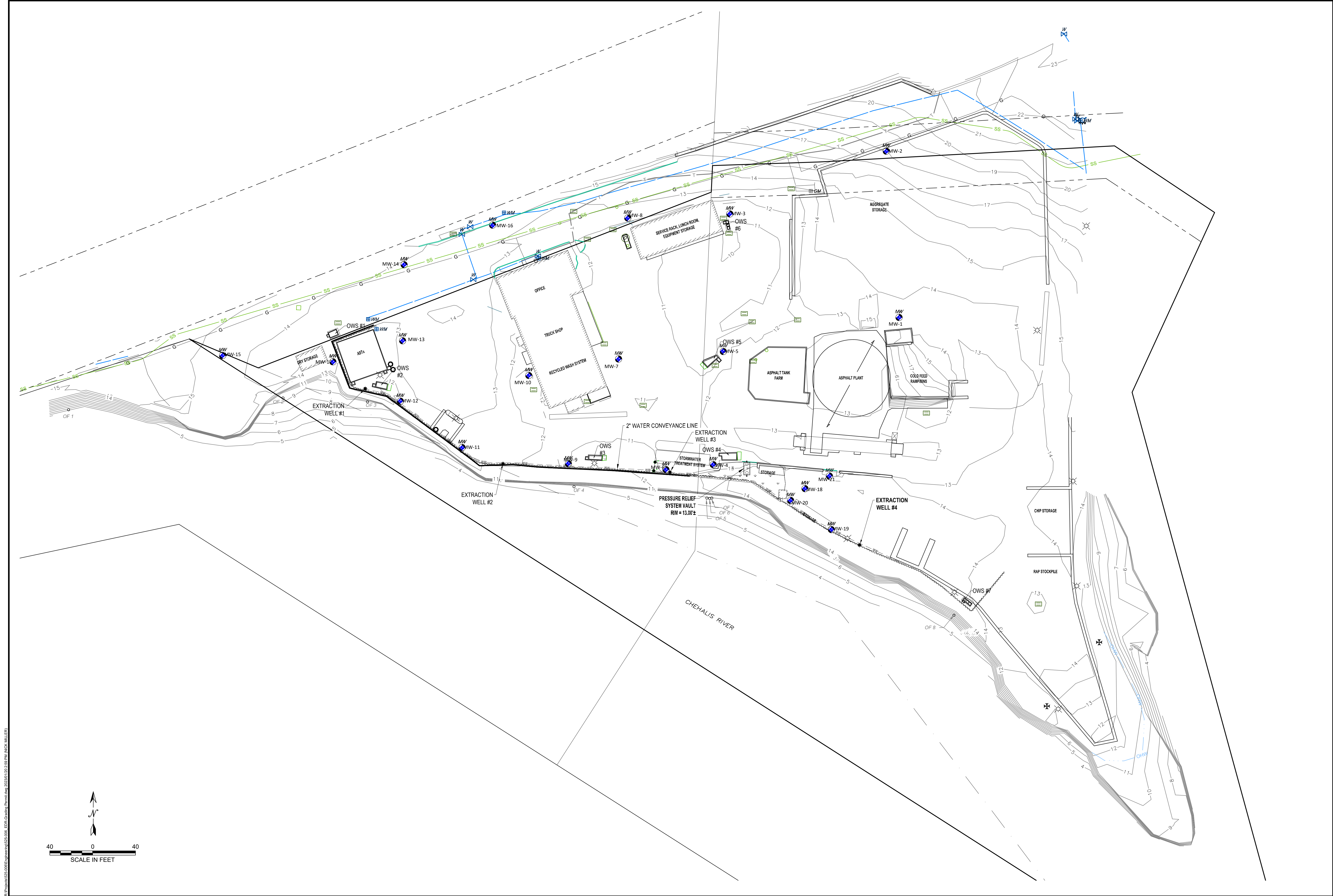
ENGINEERING DESIGN REPORT
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

ELECTRICAL ABBREVIATIONS		STANDARD ABBREVIATIONS		PIPING, ELECTRICAL AND EQUIPMENT SYMBOLS																																																																																																																							
A/AMP AC BD C CB CLG DC DIS DP DT EG E(OH) E(UG) EMER EPO EMT EXP FBO FLEX FRN GEN GFIC GND GRC HOA IRD HP HZ JB LFMC M MCC MCP NC NEC NEMA NF NO OL PBS PFB PL PLC RC RCPT SN SP ST SW TF/TRAN UF UG V VFD VP WHT WP XP	AMP ALTERNATING CURRENT BUS DUCT CURRENT CIRCUIT BREAKER CEILING DIRECT CURRENT DISCONNECT DOUBLE POLE DOUBLE THROW ENCLOSED AND GASKETED ELECTRICAL (OVERHEAD) ELECTRICAL (UNDERGROUND) EMERGENCY EMERGENCY POWER OFF ELECTRICAL METALLIC TUBING EXPOSED FURNISHED BY OTHERS FLEXIBLE METAL CONDUIT DUAL ELEMENT FUSE GENERATOR GROUND FAULT INTERRUPTER GROUND GALVANIZED RIGID CONDUIT HAND-OFF-AUTO SWITCH INFRARED DETECTOR HORSE POWER CYCLES PER SECOND JUNCTION BOX LIQUID TIGHT FLEXIBLE METAL CONDUIT MOTOR/MOTOR STARTER COIL MOTOR CONTROL CENTER MOTOR CIRCUIT PROTECTOR NORMALLY CLOSED NATIONAL ELECTRIC CODE NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION NON-FUSED NORMALLY OPEN OVERLOADS PUSHBUTTON POWER FACTOR PILOT LIGHT PROGRAMMABLE LOGIC CONTROLLER RIGID CONDUIT RECEPTACLE SOLID NEUTRAL SINGLE POLE SINGLE THROW SWITCH TRANSFORMER UNDERFLOOR UNDERGROUND VOLTS VARIABLE FREQUENCY DRIVE VAPOR PROOF WHITE WEATHER PROOF EXPLOSION PROOF	AF AB AC APPROX AF AS AST BF B.G.S. BLDG BOP BV CAS CONC CPLG C.J. CSVE DC Ø/DIA DWG DP DPI EF EL/ELEV ELEC ELB EPDM EXIST(IE) EXP EW EA FC FO FLXC FM FL FT FUT FINER FNPT GA GAC GALV GI GPM GR GND GSKT GW GV HDPE HORIZ HP HR HS HYD HOA ID IN INV IPS JT JB KO LSHH M MAX MH MJ MIN MISC MNPT MP MON.PORT MW NC NIC NO NO. N NTS NPDES OC OD OSHA OVHD #/LB PB PBF PC PCC PG PGLT PO P PRV PSI PSIA PSIG PTW PVC PV PR PUE R RC REQ REF SCH SDR SECT SHT SPEC SQ STA STD STL SBO ST STR SS STL SVE SW TYP TOC TOS TOW UBC UGPS UST UTIL V VAC VAR VERT VP VRV W/ W/O WS	HIGH DENSITY POLYETHYLENE HORIZONTAL HORSEPOWER/HIGH PRESSURE HOUR HOSE HYDRANT HAND OFF AUTOMATIC INSIDE DIAMETER INCHES INVERT IRON PIPE SIZE JOINT JUNCTION BOX KNOCK OUT LEVEL SWITCH MOTOR MAXIMUM MANHOLE MECHANICAL JOINT MINUTE/MINIMUM MISCELLANEOUS MALE NATIONAL PIPE THREAD METER PUMP MONITORING PORT MONITORING WELL NORMALLY CLOSED NOT IN CONTRACT NORMALLY OPEN NUMBER NEW NOT TO SCALE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM ON CENTER OUTSIDE DIAMETER OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION OVERHEAD POUND PULL BOX PROVIDED BY FARALLON PORTLAND CEMENT PORTLAND CEMENT CONCRETE PRESSURE GAS PROPERTY LINE/PIPE LINE PUMP OUT PRESSURE PRESSURE RELEASE VALVE POUNDS PER SQUARE INCH POUNDS PER SQUARE INCH, ABSOLUTE POUNDS PER SQUARE INCH, GAUGE PRESSURE TREATMENT POLYVINYL CHLORIDE PROCESS VARIABLE PAIR PUBLIC UTILITY EASEMENT RADIUS/RISER REINFORCED CONCRETE REQUIRED REFERENCE SCHEDULE STANDARD DIMENSION RATIO SECTION SHEET SPECIFICATION SQUARE STATION STANDARD STEEL SUPPLIED BY OWNER SAMPLE TAP STRAINER STAINLESS STEEL STEEL SOIL VAPOR EXTRACTION SWITCH TYPICAL TOP OF CASING/CURB TOP OF STEEL TOP OF WALL UNIFORM BUILDING CODE UNDERGROUND PULL SECTION UNDERGROUND STORAGE TANK UTILITY VALVE/VENT/VOLTS VACUUM VARIES/VARIABLE VERTICAL VAPOR VACUUM RELIEF VALVE WITH WITHOUT WATER SURFACE/WATER STOP	GATE VALVE GLOBE VALVE BALL VALVE BUTTERFLY VALVE CHECK VALVE DIAPHRAM OPERATED VALVE SOLENOID VALVE MOTOR OPERATED VALVE PRESSURE REGULATING VALVE DRAIN WELD CAP SCREWED CAP SCREWED PLUG FLANGE BLIND FLANGE REDUCER/INCREASER DIRECTION OF FLOW UNION FLEXIBLE PIPE COUPLING BLOWER OR FAN CENTRIFUGAL PUMP PITOT TUBE STRAINER TRAP FILTER Ø DIAMETER FEMALE ADAPTER SILENCER NEEDLE VALVE FLOW METER HOSE BIB SAMPLE TAP/MONITORING PORT HEAT EXCHANGER PRESSURE RELIEF OR AIR RELIEF VACUUM RELIEF NORMALLY OPEN NORMALLY CLOSED CONDUIT RUN EXPOSED CONDUIT RUN UNDERGROUND EXIST CONDUIT RUN UNDERGROUND MAGNETIC STARTER DUPLEX RECEPTICAL, 15A: WP-WEATHER PROOF ELAPSED TIME METER FUSE FUSED DISCONNECT CAMLOCK CONNECTION VERTICAL PIPERUN GROUND 																																																																																																																							
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AREA DRAIN ASPHALT (ASPH) BOLLARD BUILDING LINE BUILDING CORNER BUILDING ENTRANCE BIKE RACK CANOPY CATCH BASIN (CB) CONCRETE SURFACE CONCRETE/BRICK WALK CONCRETE/WOOD RETAINING WALL CONCRETE/EXTRUDED CURB CONCRETE/IRON PIPE CHAIN LINK FENCE (CLF) CABLE TV COLUMN CENTERLINE/MONUMENT LINE CONCRETE/WOOD STAIRS CORRUGATED METAL PIPE CENTER OF CHANNEL DRIVEWAY ELECTRICAL CONDUIT ELECTRICAL DUCT ELECTRICAL HANDHOLE ELECTRICAL MANHOLE ELECTRICAL METER ELECTRICAL VAULT/TRANSFORMER FOUND SURVEY MONUMENT (AS NOTED) FIRE HYDRANT FIRE DEPT. CONNECTION (FDC) FIBER OPTICS FIBER OPTIC MANHOLE FINISH FLOOR ELEVATION GRADE BREAK GAS MAIN GAS METER GAS VALVE GAS VAULT GUY ANCHOR HANDRAIL GUY POLE STRAIN POLE IRRIGATION CONTROL BOX IRRIGATION VALVE IRON FENCE (WIF) INVERT ELEVATION LIGHT POLE (METAL) LIGHT POLE (WOOD) LIGHT POLE (DECORATIVE) MANHOLE MONITOR WELL OVERHEAD POWER/TELEPHONE OVERHEAD GUYWIRE/BUS (TROLLEY) PARKING SPACE(S) PILING PROPERTY LINE (PL) PAINTED UTILITY LOCATION PIPE FLOW DIRECTION POLYETHYLENE PARKING PAY STATION POST INDICATOR VALVE COMBINED/SANITARY SEWER STORM DRAIN PRIVATE CATCH BASIN RECORD DATA GRAVEL SURFACE SEATTLE CITY LIGHT HANDHOLE SERVICE DRAIN (STORM) CLEANOUT STEAM LINE/VAULT SANITARY SIDE SEWER (RECORD) SIGN/STREET NAME SIGN TRAFFIC CONTROL/STREET LIGHT HANDHOLE TRAFFIC CONTROL CABINET (TRSC) TRENCH DRAIN TELEPHONE CONDUIT (BURIED) TELEPHONE DUCT TELEPHONE VAULT TELEPHONE MANHOLE TELEPHONE SENTRY TRAFFIC FLOW DIRECTION WATER VAULT WATER MAIN WATER METER WATER VALVE ALUMINUM PANEL FENCE		<ol style="list-style-type: none">1. READ ALL NOTES AND REVIEW ENTIRE PLAN SET PRIOR TO COMMENCEMENT OF WORK ACTIVITIES.2. ESTABLISH EXACT PROJECT BOUNDARIES PRIOR TO COMMENCEMENT OF WORK, AND RECONFIRM BOUNDARY LINES WHEN COORDINATING WITH NEIGHBORING PROPERTY OWNERS.3. VERIFY SITE CONTROL POINTS PROVIDED ON PLANS. VERIFY DIMENSIONS AND ORIENTATION PRIOR TO STAKING OF SITE POINTS.4. A COPY OF THE PROJECT DESIGN DRAWINGS AND SPECIFICATIONS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES.5. COPIES OF ALL PERMITS SHALL BE MAINTAINED ON THE JOB SITE AT ALL TIMES. THE CONTRACTOR SHALL COMPLY WITH ALL PERMIT REQUIREMENTS.6. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL LOCATIONS, DIMENSIONS AND QUANTITIES.7. UTILITIES SHOWN IN THIS DRAWING SET ARE BASED ON INFORMATION PROVIDED BY OTHERS. INFORMATION SHOWN SHALL BE CONSIDERED APPROXIMATE AND INCOMPLETE. CONTRACTOR SHALL VERIFY ALL UTILITY LOCATIONS PRIOR TO COMMENCEMENT OF WORK ACTIVITIES.8. THE CONTRACTOR SHALL HAVE A PRIVATE UTILITY LOCATE SERVICE VERIFY ALL UTILITIES AND/OR OTHERWISE FIELD VERIFY EXACT LOCATIONS AND MARK THEIR LOCATIONS ON THE GROUND PRIOR TO STARTING CONSTRUCTION. FARALLON SHALL BE CONTACTED IMMEDIATELY IF A CONFLICT IS FOUND BETWEEN EXISTING UTILITIES AND THE PROJECT DESIGN.9. ENGINEER SHALL BE NOTIFIED OF DISCREPANCIES BETWEEN CONTRACT DRAWINGS AND ACTUAL SITE CONDITIONS.10. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR THE JOB SITE CONDITIONS AND ENSURE THE SAFETY OF ALL PERSONS AND PROPERTY FOR THE DURATION OF ON-SITE PROJECT WORK. THE CONTRACTOR SHALL PROTECT STRUCTURES, UTILITIES, AND PAVING FROM DAMAGE, DIRECT OR INDIRECT, RESULTING FROM THE WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY OVER THE DURATION OF ON-SITE ACTIVITIES AND NOT BE LIMITED TO NORMAL WORKING HOURS.11. MAINTAIN FULL OPERATION OF PUBLIC ROADWAYS. KEEP CLEAN AND FREE OF DEBRIS, DIRT, AND OTHER PROJECT RELATED ITEMS. SWEEP AS NEEDED TO MEET PROJECT REQUIREMENTS. COORDINATE WITH OWNER AND PIERCE COUNTY ALL DISRUPTIONS TO SERVICES. REPAIR ALL DAMAGE TO MATCH EXISTING CONDITIONS.12. GENERAL CONTRACTOR AND, IF SUBCONTRACTED, THE EARTHWORK SUBCONTRACTOR ARE RESPONSIBLE FOR ANY EARTHWORK QUANTITY ESTIMATES.13. ON-SITE SOILS MAY ONLY BE USED IN ACCORDANCE WITH PROJECT REQUIREMENTS AND SUBJECT TO APPROVAL OF PROPER COMPLIANCE BY THE PROJECT ENGINEER.14. REVIEW AND PROPERLY COORDINATE ALL WORK OF ALL DISCIPLINES PRIOR TO CONSTRUCTION, INCLUDING, BUT NOT LIMITED TO, IRRIGATION LINES, SLEEVES, AND UTILITY CONDUITS.15. ALL EXCAVATIONS SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPLICABLE U.S. DEPARTMENT OF LABOR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE WASHINGTON INDUSTRIAL SAFETY AND HEALTH ACT (WISHA) REGULATIONS. THE CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR THE SAFETY OF ALL CONSTRUCTION OPERATIONS.16. NO TRENCHES SHALL BE LEFT OPEN WHEN WORK IS NOT IN PROGRESS. ALL OPEN EXCAVATIONS SHALL BE SECURELY FENCED AND COVERED IF SO REQUIRED.17. THE CONTRACTOR SHALL DISPOSE OF MATERIALS REMOVED FROM THIS SITE AT APPROPRIATE AND PERMITTED RECEIVING FACILITIES.18. CONFIRM ALL UTILITY ALIGNMENTS AND CROSSINGS PRIOR TO ORDERING MATERIALS AND PRIOR TO STAKING.19. UPON COMPLETION OF SITE WORK, CLEAN ALL SITE SURFACES (PAVEMENTS, CURBS, STAIRS, WALKS, ETC.).		<p>INSTRUMENT LEGEND</p> <table><thead><tr><th>FIRST LETTER INITIATING VARIABLE</th><th>SUCCEEDING LETTERS OUTPUT FUNCTIONS</th><th>SYMBOL</th><th>DESCRIPTION</th></tr></thead><tbody><tr><td>A</td><td>ANALYSIS</td><td></td><td></td></tr><tr><td>B</td><td>BURNER</td><td></td><td></td></tr><tr><td>C</td><td>CONDUCTIVITY</td><td></td><td></td></tr><tr><td>D</td><td>DENSITY</td><td></td><td></td></tr><tr><td>E</td><td>POTENTIAL (VOLTS)</td><td></td><td></td></tr><tr><td>F</td><td>FLOW RATE</td><td></td><td></td></tr><tr><td>G</td><td>FIRE ALARM</td><td></td><td></td></tr><tr><td>H</td><td>HAND (MANUALLY)</td><td></td><td></td></tr><tr><td>I</td><td>CURRENT (AMPERES)</td><td></td><td></td></tr><tr><td>J</td><td>POWER</td><td></td><td></td></tr><tr><td>K</td><td>TIME</td><td></td><td></td></tr><tr><td>L</td><td>LEVEL</td><td></td><td></td></tr><tr><td>M</td><td>MOISTURE/HUMIDITY</td><td></td><td></td></tr><tr><td>N</td><td>EQUIPMENT STATUS</td><td></td><td></td></tr><tr><td>P</td><td>PRESSURE/VACUUM</td><td></td><td></td></tr><tr><td>Q</td><td>QUANTITY</td><td></td><td></td></tr><tr><td>R</td><td></td><td></td><td></td></tr><tr><td>S</td><td>SPEED</td><td></td><td></td></tr><tr><td>T</td><td>TEMPERATURE</td><td></td><td></td></tr><tr><td>U</td><td>MULTIVARIABLE</td><td></td><td></td></tr><tr><td>V</td><td>VIBRATION/VOLUME</td><td></td><td></td></tr><tr><td>W</td><td>WEIGHT/FORCE/TORQUE</td><td></td><td></td></tr><tr><td>X</td><td>UNCLASSIFIED</td><td></td><td></td></tr><tr><td>Y</td><td></td><td></td><td></td></tr><tr><td>Z</td><td>POSITION</td><td></td><td></td></tr></tbody></table> <p>INSTRUMENT SYMBOLS</p> <table><thead><tr><th>SYMBOL</th><th>DESCRIPTION</th></tr></thead><tbody><tr><td></td><td>MOTOR</td></tr><tr><td></td><td>HAND-OFF-AUTO SELECTOR SWITCH</td></tr><tr><td></td><td>LOCALLY MOUNTED INSTRUMENT</td></tr><tr><td></td><td>CONTROL PANEL MOUNTED INSTRUMENT</td></tr><tr><td></td><td>INTERLOCK</td></tr><tr><td></td><td>PLC SHUTDOWN ALARM</td></tr></tbody></table>		FIRST LETTER INITIATING VARIABLE	SUCCEEDING LETTERS OUTPUT FUNCTIONS	SYMBOL	DESCRIPTION	A	ANALYSIS			B	BURNER			C	CONDUCTIVITY			D	DENSITY			E	POTENTIAL (VOLTS)			F	FLOW RATE			G	FIRE ALARM			H	HAND (MANUALLY)			I	CURRENT (AMPERES)			J	POWER			K	TIME			L	LEVEL			M	MOISTURE/HUMIDITY			N	EQUIPMENT STATUS			P	PRESSURE/VACUUM			Q	QUANTITY			R				S	SPEED			T	TEMPERATURE			U	MULTIVARIABLE			V	VIBRATION/VOLUME			W	WEIGHT/FORCE/TORQUE			X	UNCLASSIFIED			Y				Z	POSITION			SYMBOL	DESCRIPTION		MOTOR		HAND-OFF-AUTO SELECTOR SWITCH		LOCALLY MOUNTED INSTRUMENT		CONTROL PANEL MOUNTED INSTRUMENT		INTERLOCK		PLC SHUTDOWN ALARM
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PREPARED BY: FARALLON CONSULTING <small>www.farallonconsulting.com</small> 975 5th Avenue Northwest Issaquah, Washington 98027 (206) 295-0800 farallonconsulting.com		PREPARED FOR: LAKESIDE INDUSTRIES		SITE PLAN - PROPOSED SITE IMPROVEMENTS		 PROJECT LOCATION (S,T,R): PORTIONS OF THE ### 1/4 OF SEC. ###, TWP. ###N, RNG. ###E, W.M. JURISDICTION FILE NO.: ### FARALLON PROJECT NO.: 525-006 SHEET	
DATE 11/02/2023		REVISION DESCRIPTION		WORKING PLAN SET FOR ENGINEERING DESIGN		PK SS VPB BY CHK. APP.	

EN 2.00

THE IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL FACILITIES IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR ON A DAILY BASIS AND UNTIL ALL CONSTRUCTION IS APPROVED.

TEMPORARY EROSION AND SEDIMENT CONTROL (TESC) FACILITIES MUST BE CONSTRUCTED PRIOR TO AND IN CONJUNCTION WITH ALL GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT-LADEN WATER DOES NOT ENTER THE DRAINAGE SYSTEM DURING THE CONSTRUCTION PERIOD. THESE TESC FACILITIES SHALL BE UPGRADED TO INCLUDE ADDITIONAL CONTROL MEASURES AS NEEDED FOR UNEXPECTED STORM EVENTS.

THE BEST MANAGEMENT PRACTICES SHOWN ON THE TESC ARE MINIMUM REQUIREMENTS. FIELD ADJUSTMENTS SHALL BE MADE TO ENSURE THE TESC PERFORMS IN ACCORDANCE WITH THE 2012 DEPARTMENT OF ECOLOGY STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON, VOLUME II.

ANY SIGNIFICANT CHANGES REQUIRED TO MEET SITE OBJECTIVES THAT ARE OUTSIDE OF THE PERMITTED REQUIREMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE PROJECT ENGINEER.

THE CONTRACTOR SHALL PERFORM PRIVATE AND PUBLIC UTILITY LOCATES PRIOR TO PERFORMING ANY UNDERGROUND WORK. CALL 1-800-424-5555.

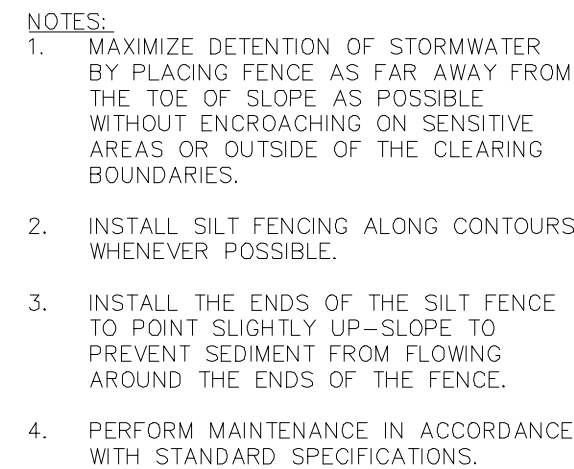
CONTRACTOR TO ATTEND PRE-CONSTRUCTION MEETING PRIOR TO BEGINNING WORK.

ALL PERSONNEL ARE TO PERFORM WORK ACCORDING TO THEIR SITE-SPECIFIC HEALTH AND SAFETY PLANS (HASP) PER OSHA REGULATIONS; TITLE 29 CFR 1910, AND MUST KEEP A COPY OF THE HASP ON-SITE AT ALL TIMES.

WORK HOURS ARE RESTRICTED TO THE CITY'S PERMITTED WORK HOURS.

ALL WORK SHALL BE PERFORMED PER APPROVED PERMITS, PLANS AND SPECIFICATIONS. THE CONTRACTOR SHALL MAINTAIN THESE DOCUMENTS ON-SITE.

0. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL LAWS.

[illegible]

PRELIMINARY PLANS
"NOT FOR CONSTRUCTION"

PREPARED BY:

FARALLON
CONSULTING

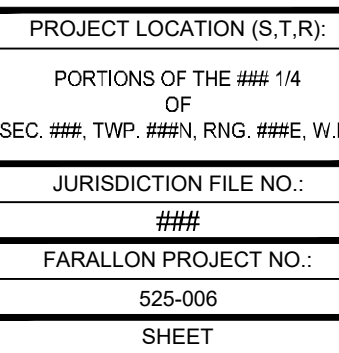
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Issaquah, Washington 98027
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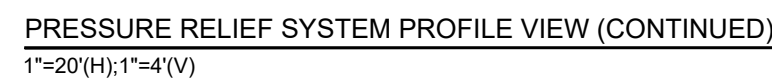
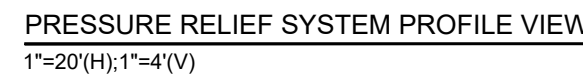
PREPARED FOR:

LAKESIDE INDUSTRIES

FORMER CHEVRON BULK FUEL FACILITY
LAKESIDE INDUSTRIES
ABERDEEN SITE, ABERDEEN, WA



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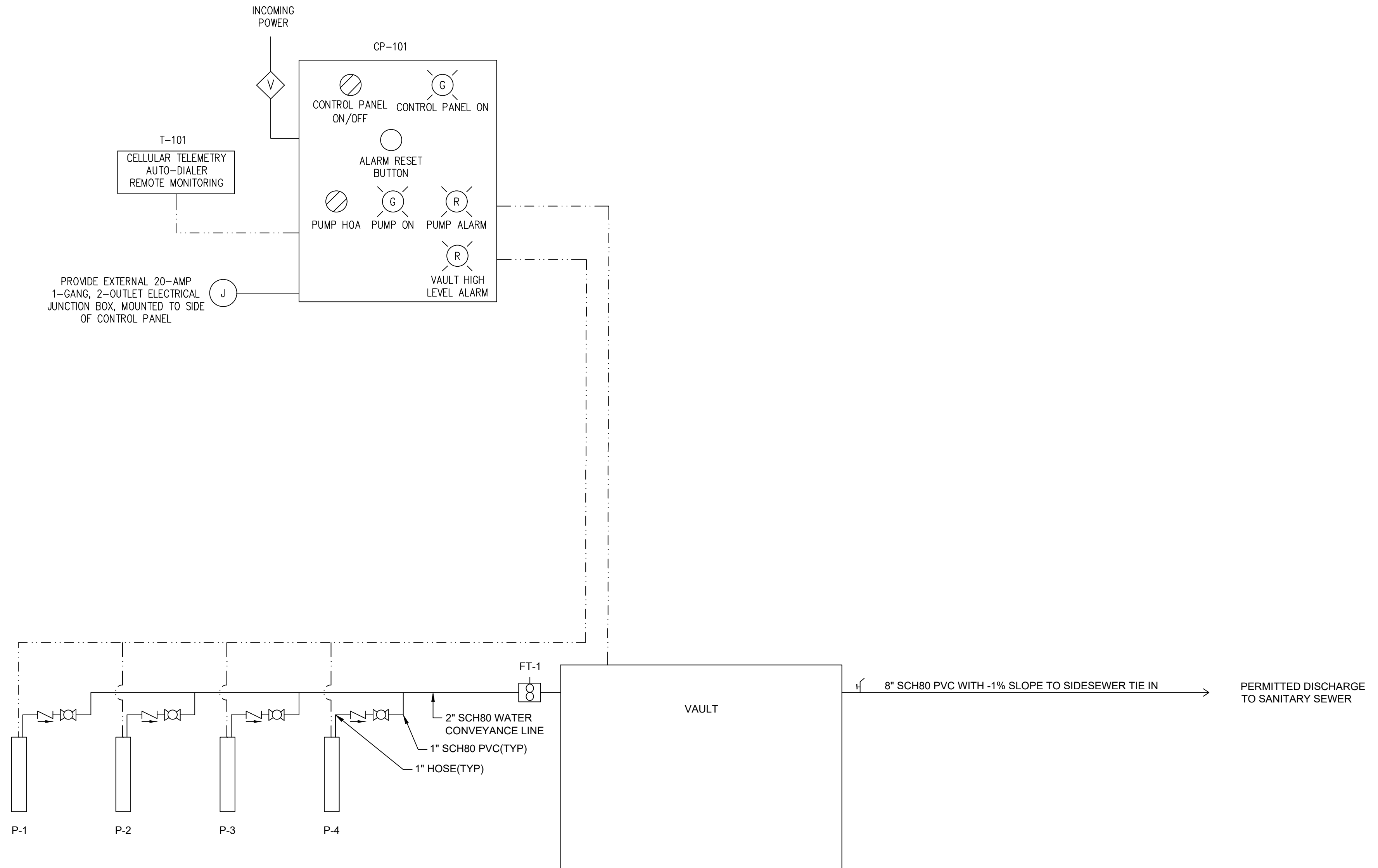
NOTES:

1. A SOLID 6-INCH DIAMETER SCH 40 PVC EXTRACTION WELL CASING WILL CONNECT THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE AND 2-INCH DIAMETER SOLID SCH 80 PVC PIPE WATER RECOVERY LINE.
2. THE CONTRACTOR WILL INSTALL THE WATER RECOVERY LINE TO SLOPE TOWARDS EXTRACTION WELLS. SLOPE WILL VARY TO ALLOW FOR A TOP OF PIPE MAXIMUM DEPTH OF 14-INCHES BELOW WELLS SURFACE.
3. THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE WILL EXTEND FROM THE WELL CASING APPROXIMATELY HALF THE DISTANCE BETWEEN EXTRACTION WELLS AS SHOWN IN THE EXTRACTION WELL SCHEDULE. THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE WILL BE CAPTURED AT THE END.
4. A 6X4-INCH SCH 40 PVC REDUCING CROSS WILL CONNECT THE 4-INCH DIAMETER SLOTTED PIPE TO THE 6-INCH DIAMETER EXTRACTION WELL CASING.
5. A 4-INCH WATER TIGHT GATE VALVE WILL BE INSTALLED AT A CHECK VALVE AND THEN BALL VALVE PRIOR TO TIEING INTO THE 2-INCH DIAMETER SCHEDULE 80 PVC WATER RECOVERY LINE.
6. WELLS ARE NUMBERED FROM WEST TO EAST IN THE EXTRACTION WELL SCHEDULE.



VAULT
BASE
OLDCASTLE 687-2-LA
8" DIAMETER KNOCKOUT FOR INLET AND OUTLET
TOP
OLDCASTLE 687-T-2-332P

1. EXTRACTION WELL PUMPS
 - 1.1. HIGH WATER LEVEL IN VAULT
 - 1.1.1. SHUTDOWN PUMPS, INDICATED RED HIGH LEVEL ALARM LED LIGHT,
 - 1.1.2. AUTO-DIALER NOTIFICATION,
 - 1.1.3. MANUAL RESTART BY ALARM RESET BUTTON.
 - 1.2. PUMP POWER OVERLOAD
 - 1.2.1. SHUTDOWN PUMPS, INDICATE RED ALARM LED LIGHT,
 - 1.2.2. AUTO-DIALER NOTIFICATION
 - 1.2.3. MANUAL RESTART BY ALARM RESET BUTTON.
2. GENERAL
 - 2.1. SHUTDOWN DUE TO POWER OUTAGE
 - 2.1.1. SHUTDOWN PUMPS, INDICATE RED ALARM LED LIGHT WHEN POWER RESTORED.
 - 2.1.2. AUTO-DIALER NOTIFICATION.
 - 2.1.3. MANUAL RESTART BY ALARM RESET BUTTON.

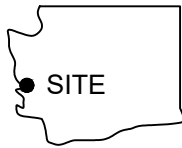


APPENDIX B
BERGLUND, SCHMIDT & ASSOCIATES, INC.'S
ENGINEERING DESIGN

ENGINEERING DESIGN REPORT
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

WASHINGTON



46.9782° N Latitude
123.7820° W Longitude

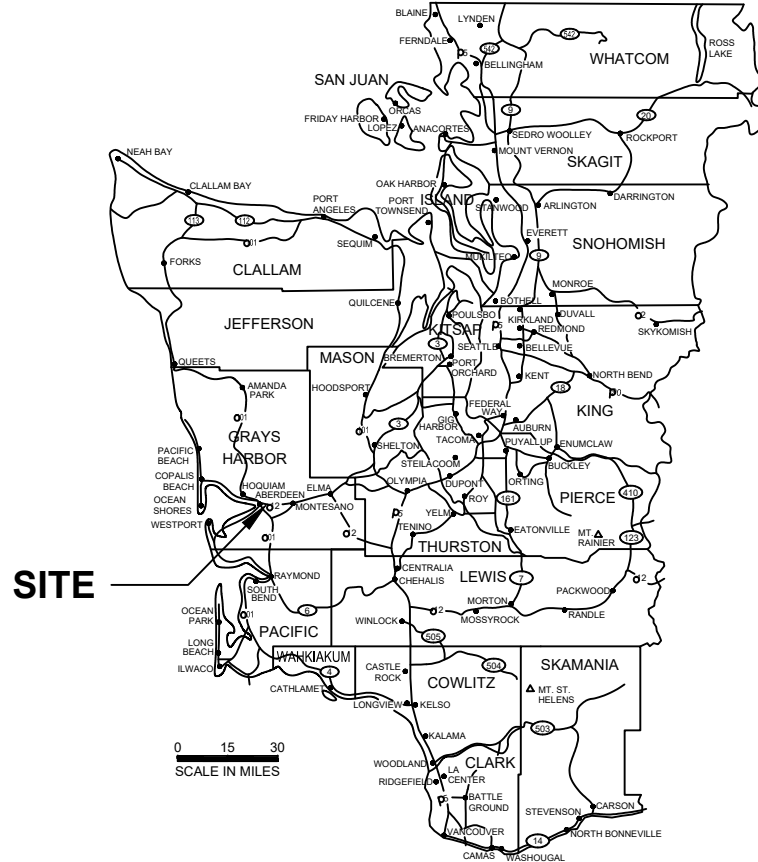
R 9 W

6				1
31				36

T
17
N

THE PROJECT SITE IS AT 2400 SARGENT BLVD, ABERDEEN, GRAYS HARBOR COUNTY, WASHINGTON.
THE SITE CONSISTS OF THE FOLLOWING TAX PARCEL: 317091011005-AB AC LOT 2 S OF JUNCTION CITY RD; LOT 3 LY S OF CO RD LS NP RR IN SECTION 10, TOWNSHIP 17 AND RANGE 9 WEST OF THE WILLAMETTE MERIDIAN.

LOCATION MAP



PROJECT LOCATION



PROJECT LOCATION

**BERGLUND, SCHMIDT
& ASSOCIATES, INC.**
professional engineers and land surveyors
2323 BAY AVENUE TEL.: (360)532-7630
HOQUIAM, WA 98550 FAX: (360)532-9682

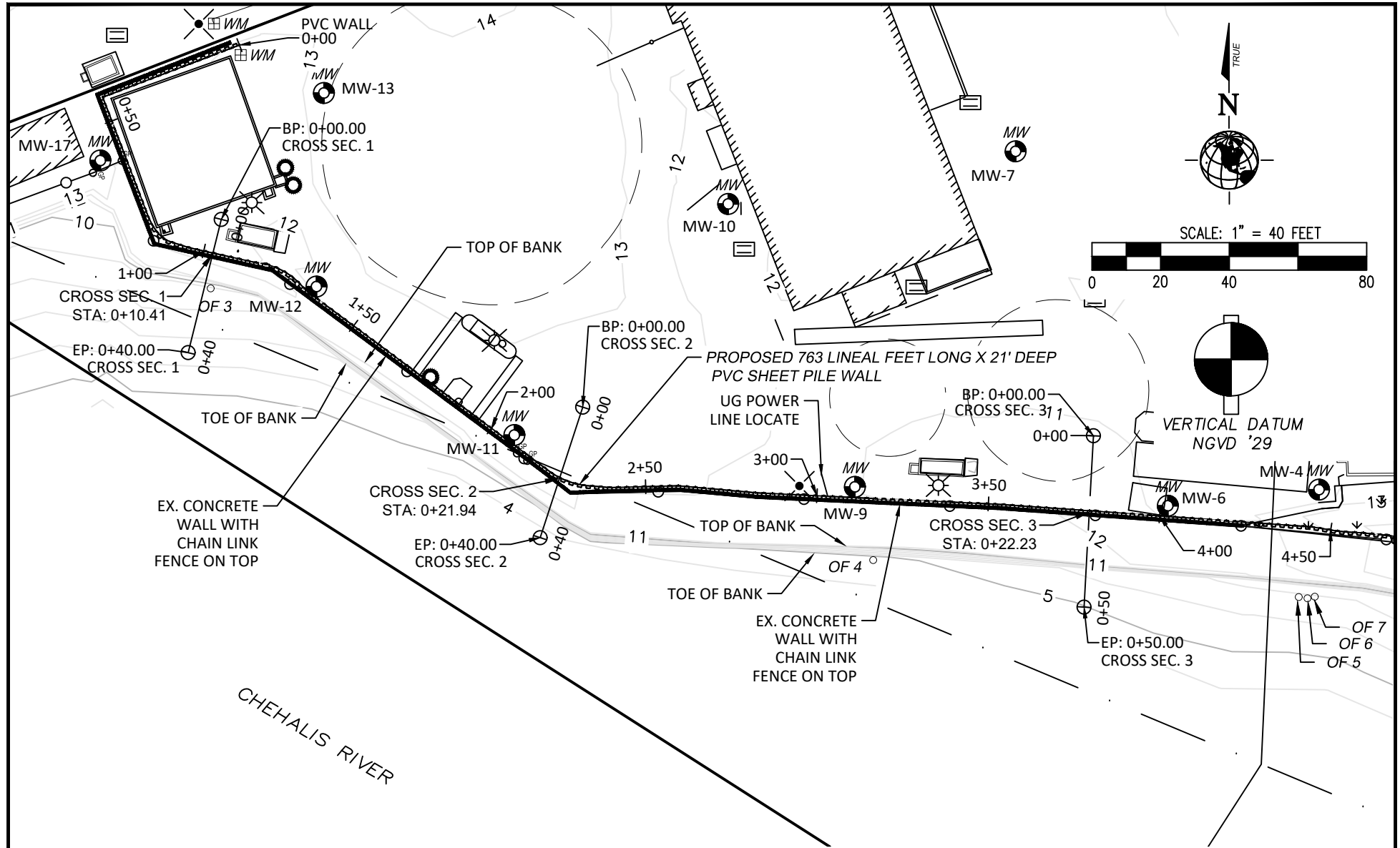
PURPOSE:
JARPA Drawings

DATUM: NAVD '88
ADJACENT PROPERTY OWNERS:
WASHINGTON STATE ROW
CITY OF ABERDEEN

VICINITY MAPS

APPLICANT: LAKESIDE INDUSTRIES, INC.
PROJECT NAME: PVC CUTOFF WALL
REFERENCE #: 22.001
SITE LOCATION ADDRESS:
2400 SARGEANT BLVD
ABERDEEN, WA 98520

PROPOSED:
POLLUTION CONTAINMENT
IN ABERDEEN
NEAR: CHEHALIS RIVER
COUNTY: Grays Harbor **STATE:** WA
SHEET 1 OF 9
DATE: 8/18/22



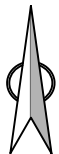
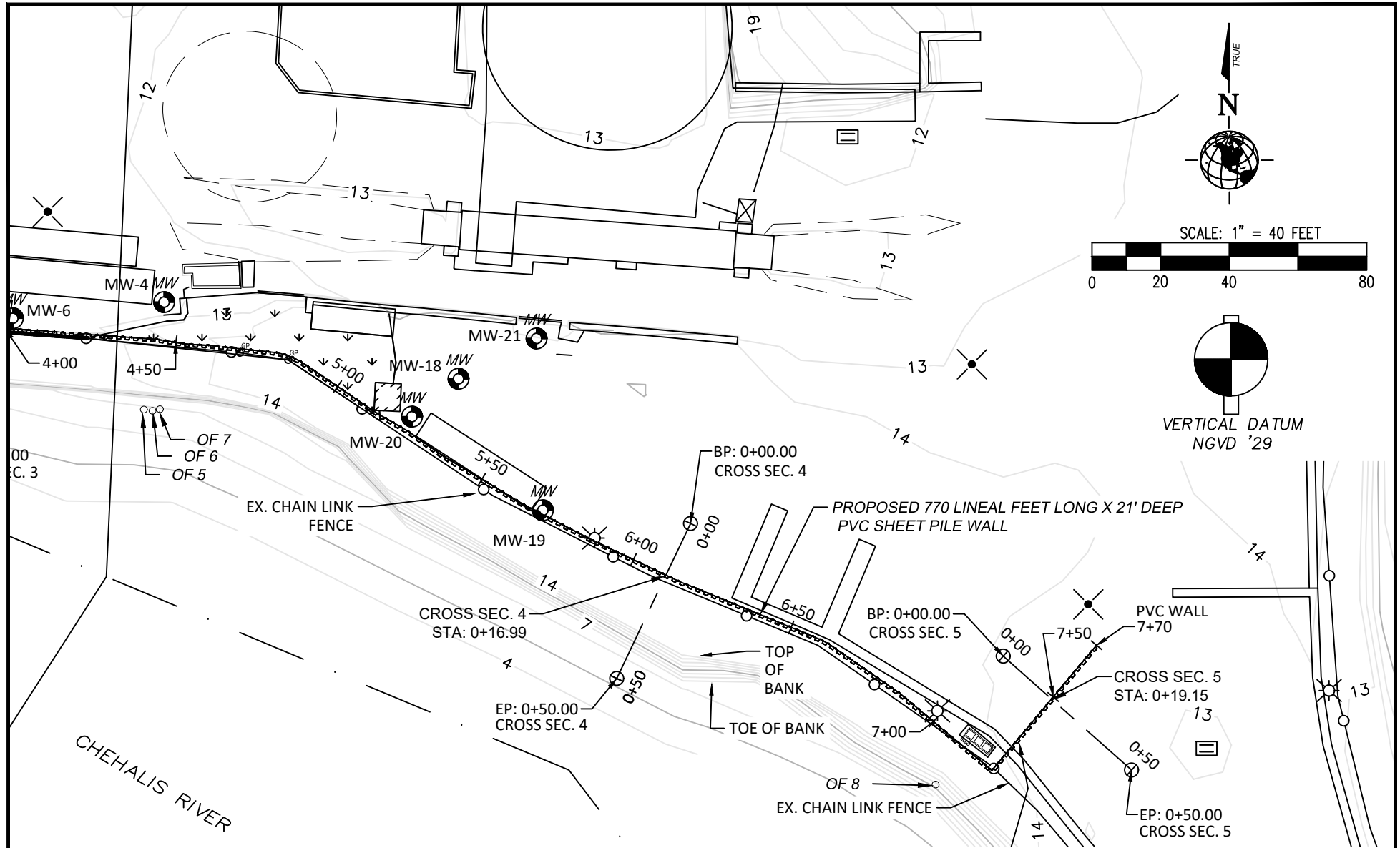
BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

PURPOSE:
JARPA Drawings

DATUM: NAVD '88
ADJACENT PROPERTY OWNERS:
WASHINGTON STATE ROW
CITY OF ABERDEEN

PLAN VIEW
APPLICANT: LAKESIDE INDUSTRIES, INC.
PROJECT NAME: PVC CUTOFF WALL
REFERENCE #: 22.001
SITE LOCATION ADDRESS:
2400 SARGEANT BLVD
ABERDEEN, WA 98520

PROPOSED:
POLLUTION CONTAINMENT
IN ABERDEEN
NEAR: CHEHALIS RIVER
COUNTY: Grays Harbor **STATE:** WA
SHEET 2 OF 9
DATE: 8/18/22



**BERGLUND, SCHMIDT
& ASSOCIATES, INC.**

professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

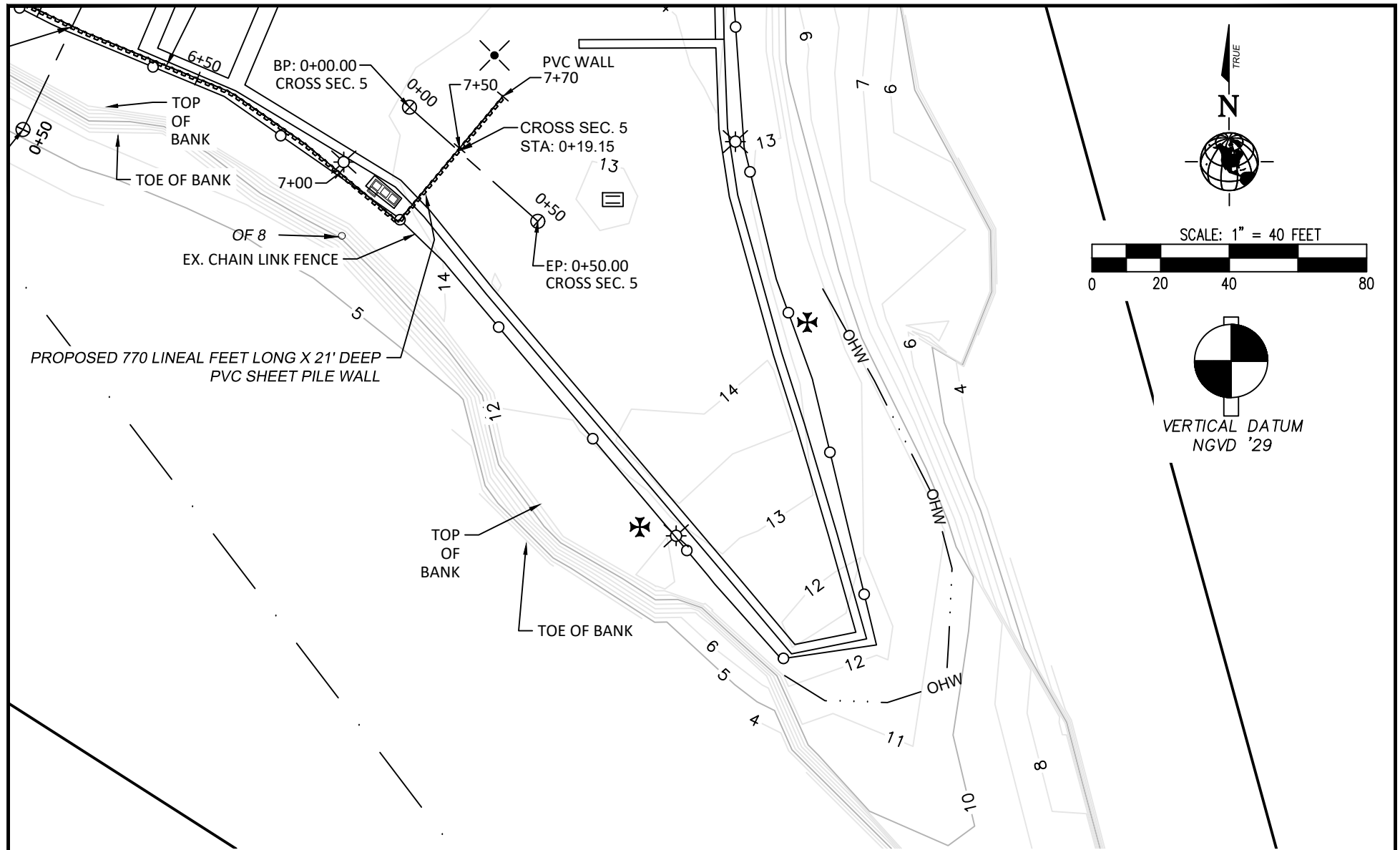
PURPOSE:
JARPA Drawings

DATUM: NAVD '88
ADJACENT PROPERTY OWNERS:
WASHINGTON STATE ROW
CITY OF ABERDEEN

PLAN VIEW

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PROJECT NAME: PVC CUTOFF WALL
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POLLUTION CONTAINMENT
IN ABERDEEN
NEAR: CHEHALIS RIVER
COUNTY: Grays Harbor **STATE:** WA
SHEET 3 OF 9
DATE: 8/18/22



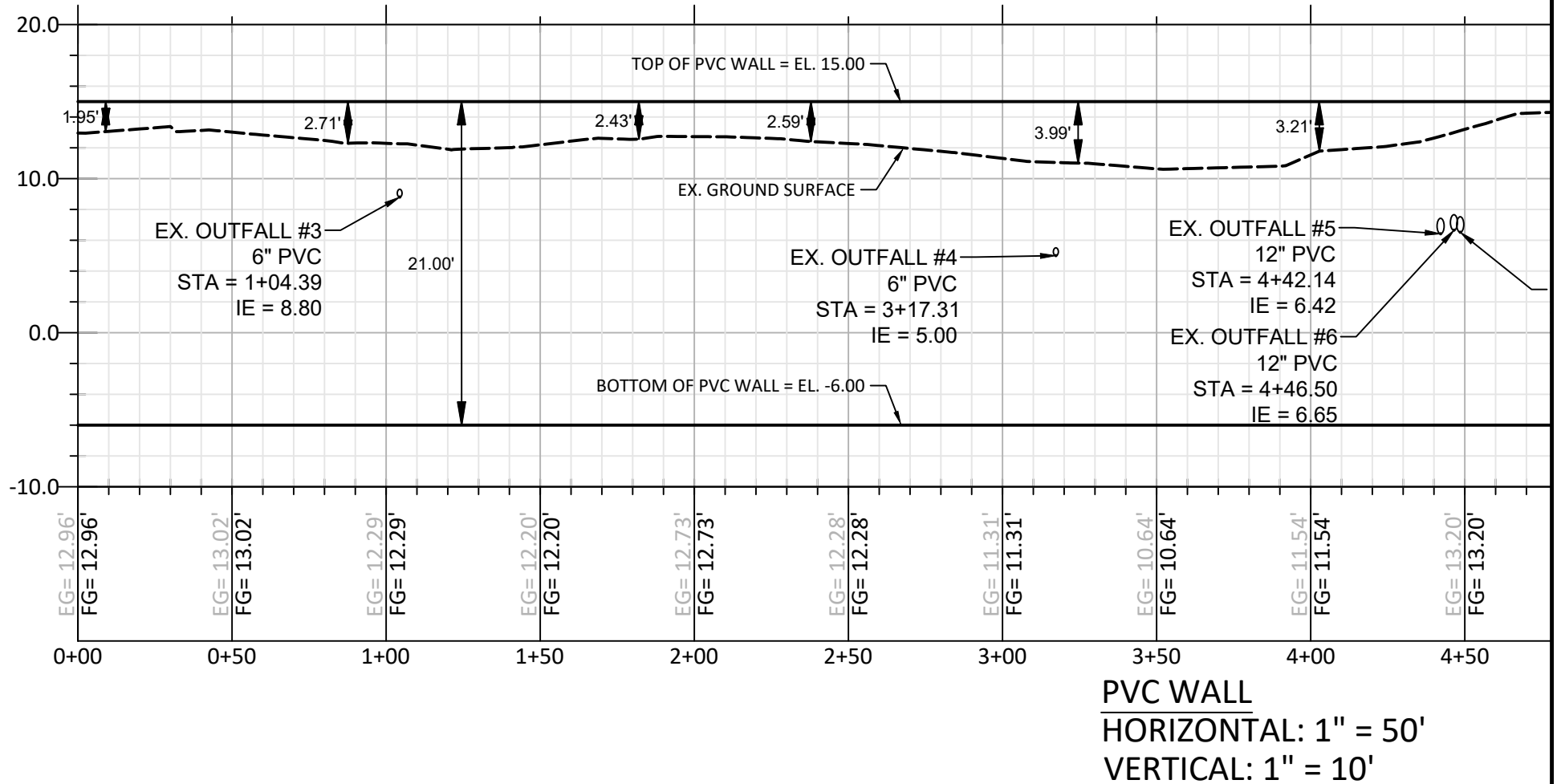
**BERGLUND, SCHMIDT
& ASSOCIATES, INC.**
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

PURPOSE:
JARPA Drawings

DATUM: NAVD '88
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CITY OF ABERDEEN

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PROPOSED:
POLLUTION CONTAINMENT
IN ABERDEEN
NEAR: CHEHALIS RIVER
COUNTY: Grays Harbor **STATE:** WA
SHEET 4 OF 9
DATE: 8/18/22



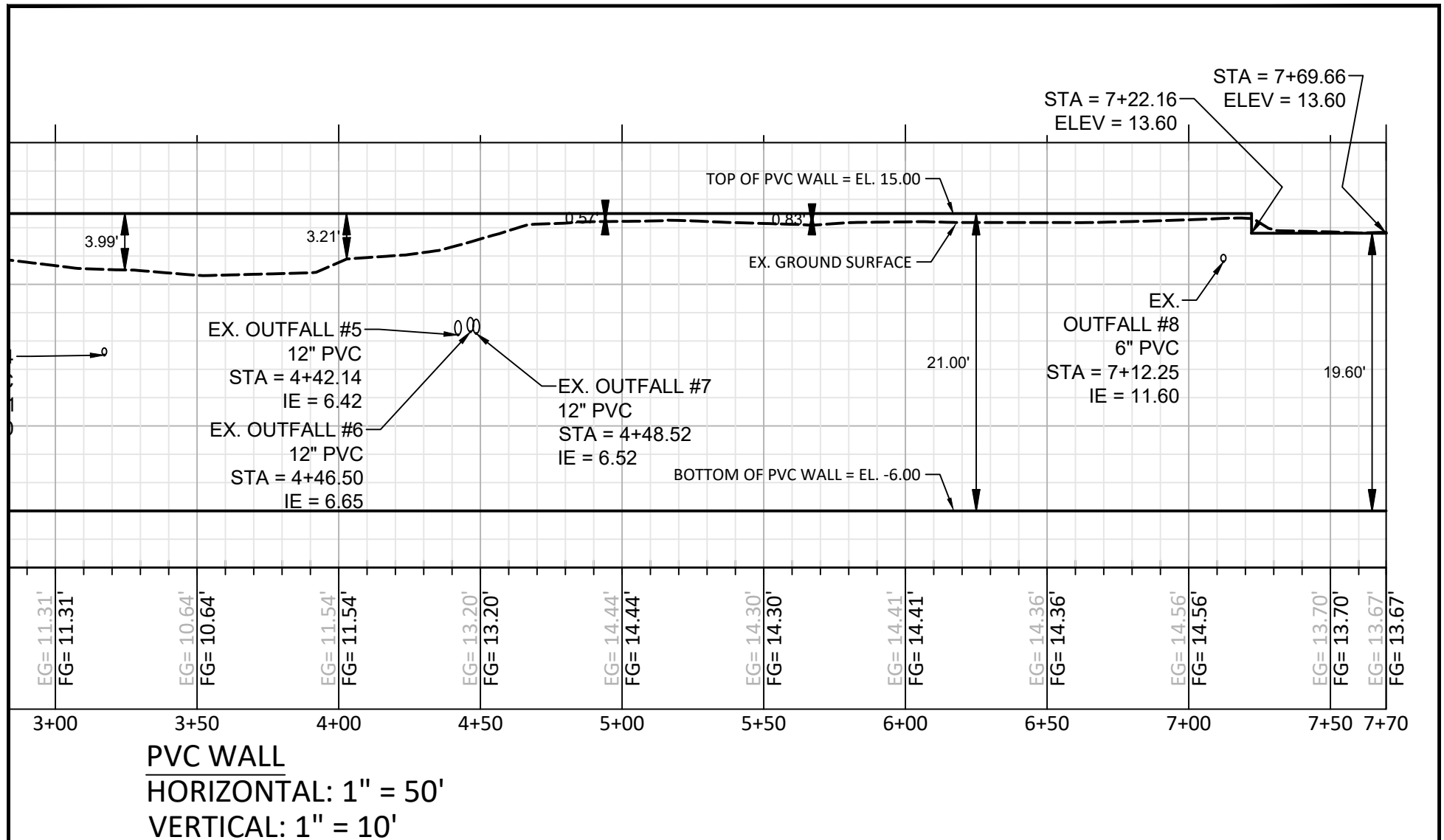
BERGLUND, SCHMIDT & ASSOCIATES, INC.
professional engineers and land surveyors
2323 BAY AVENUE
HOQUIAM, WA 98550
TEL.: (360)532-7630
FAX: (360)532-9682

PURPOSE:
JARPA Drawings

DATUM: NAVD '88
ADJACENT PROPERTY OWNERS:
WASHINGTON STATE ROW
CITY OF ABERDEEN

PROFILE VIEW
APPLICANT: LAKESIDE INDUSTRIES, INC.
PROJECT NAME: PVC CUTOFF WALL
REFERENCE #: 22.001
SITE LOCATION ADDRESS:
2400 SARGEANT BLVD
ABERDEEN, WA 98520

PROPOSED:
POLLUTION CONTAINMENT
IN ABERDEEN
NEAR: CHEHALIS RIVER
COUNTY: Grays Harbor **STATE:** WA
SHEET 5 OF 9
DATE: 8/18/22

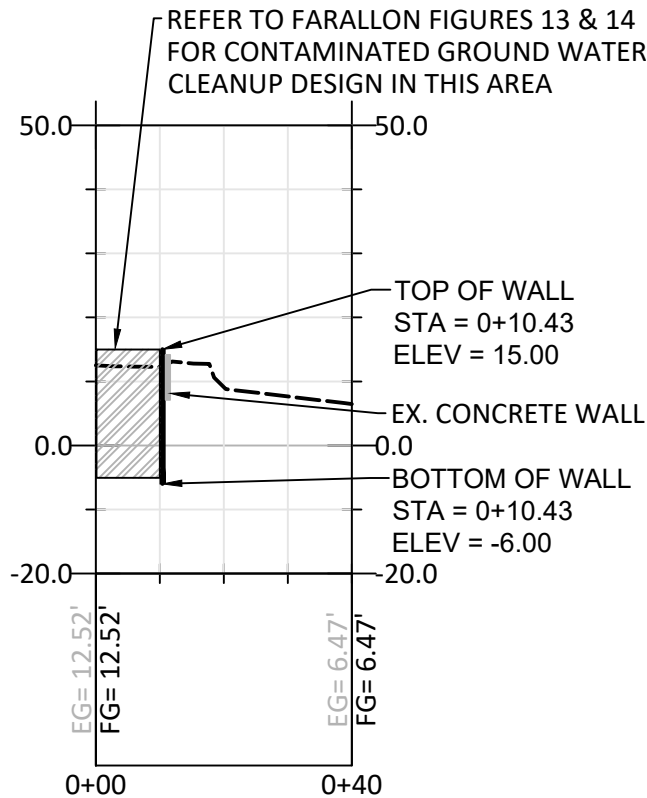


PURPOSE:
 JARPA Drawings

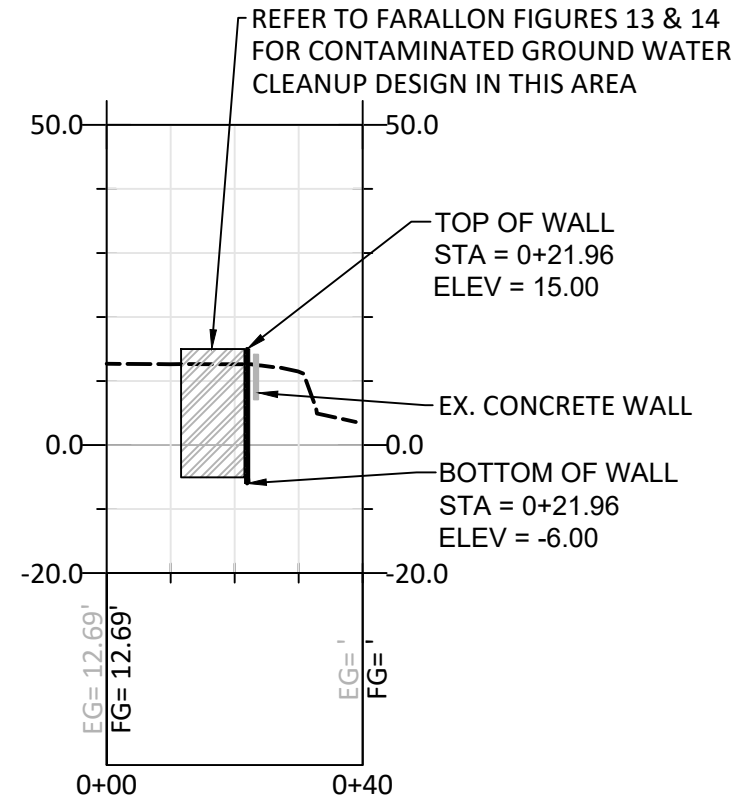
DATUM: NAVD '88
ADJACENT PROPERTY OWNERS:
 WASHINGTON STATE ROW
 CITY OF ABERDEEN

PROFILE VIEW
APPLICANT: LAKESIDE INDUSTRIES, INC.
PROJECT NAME: PVC CUTOFF WALL
REFERENCE #: 22.001
SITE LOCATION ADDRESS:
 2400 SARGEANT BLVD
 ABERDEEN, WA 98520

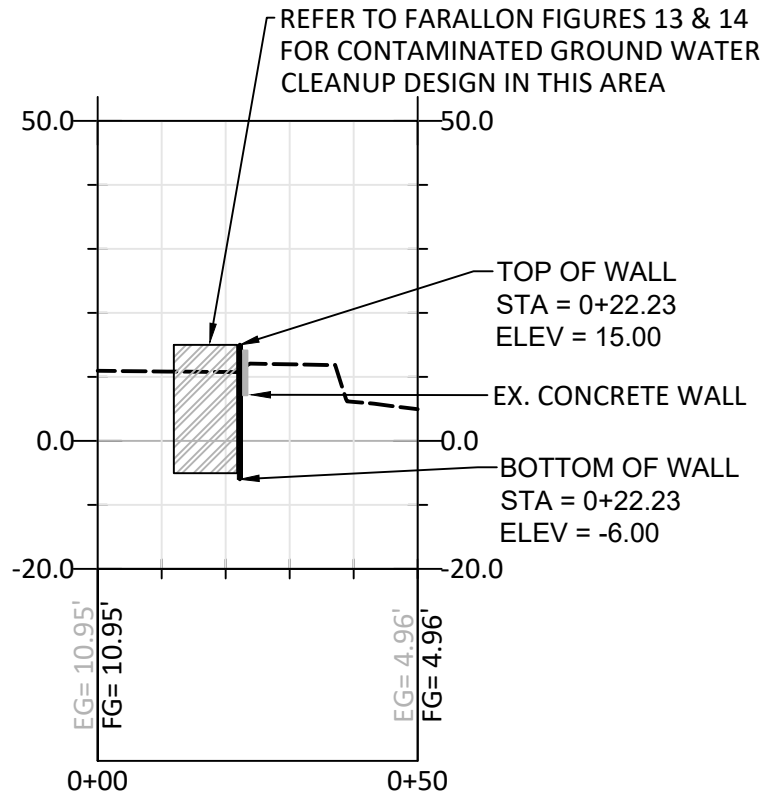
PROPOSED:
 POLLUTION CONTAINMENT
 IN ABERDEEN
NEAR: CHEHALIS RIVER
COUNTY: Grays Harbor **STATE:** WA
SHEET 6 OF 9
DATE: 8/18/22



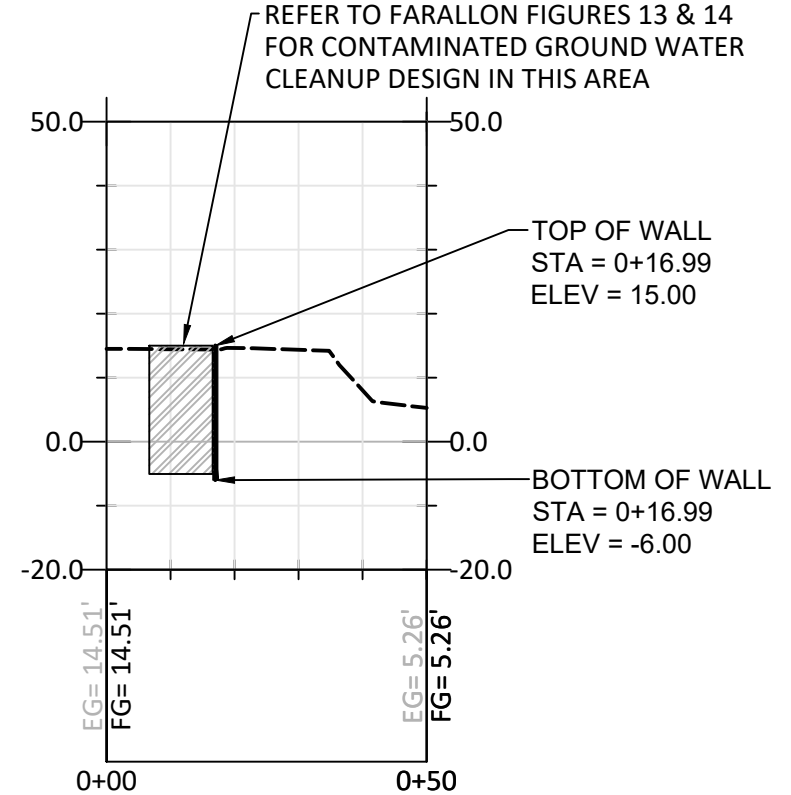
CROSS-SECTION 1
HORIZONTAL: 1" = 30'
VERTICAL: 1" = 30'



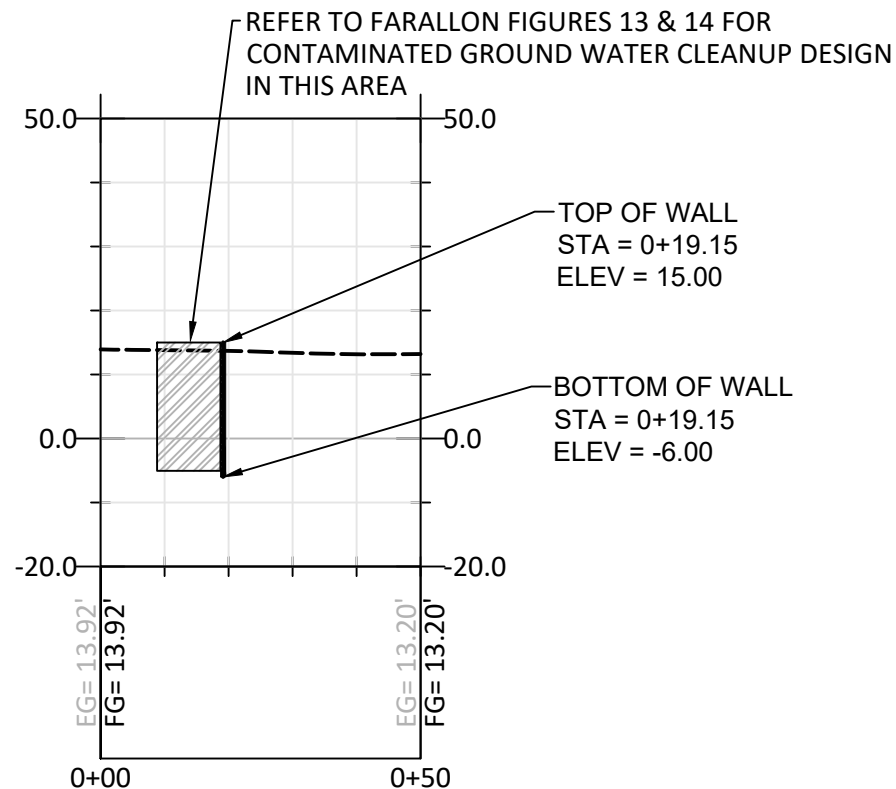
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HORIZONTAL: 1" = 30'
VERTICAL: 1" = 30'



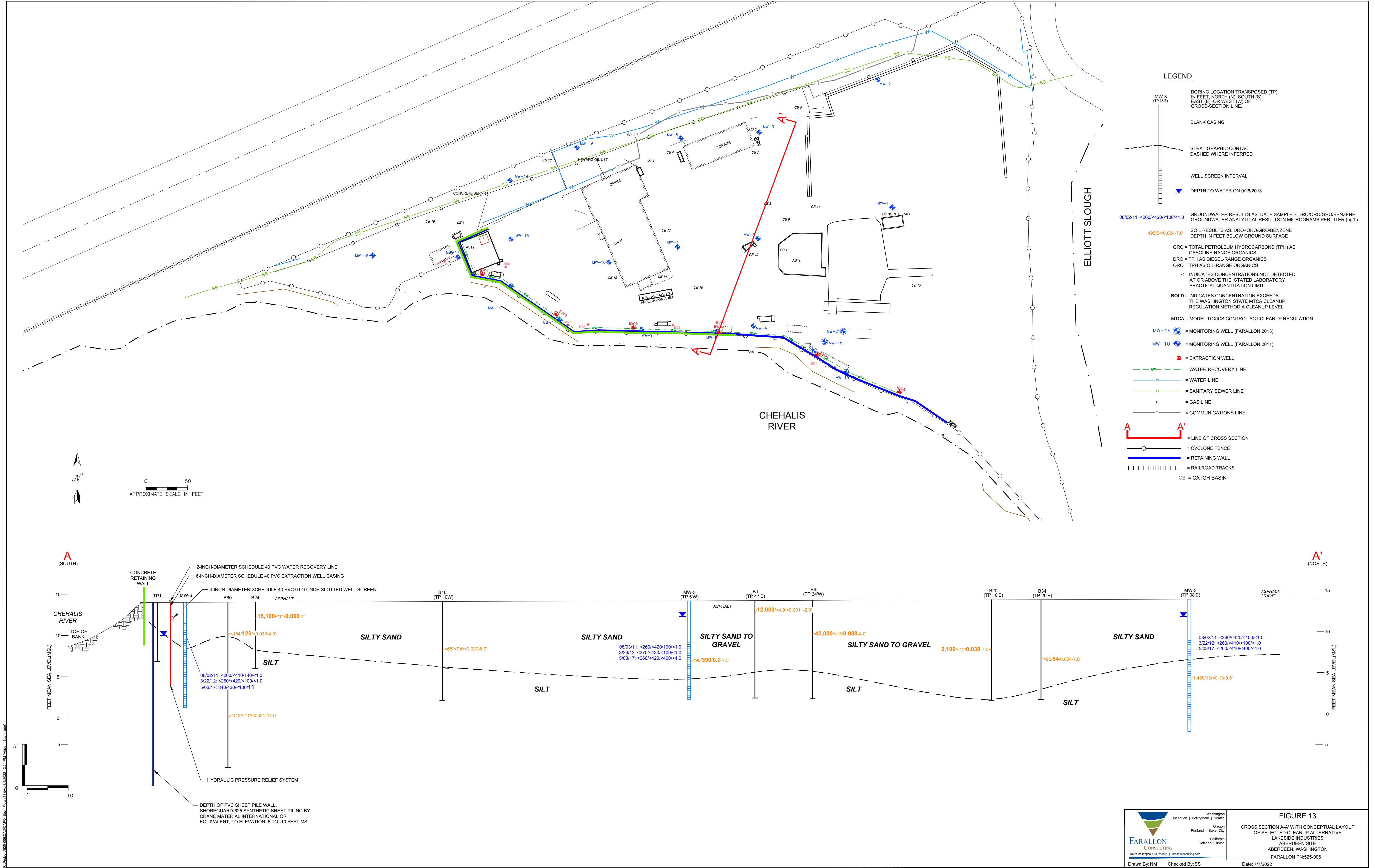
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HORIZONTAL: 1" = 30'
VERTICAL: 1" = 30'



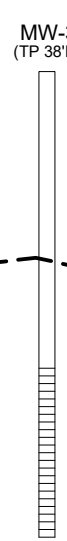
CROSS-SECTION 4
HORIZONTAL: 1" = 30'
VERTICAL: 1" = 30'



CROSS-SECTION 5
HORIZONTAL: 1" = 30'
VERTICAL: 1" = 30'



LEGEND



BORING LOCATION TRANSPOSED (TP)
IN FEET: NORTH (N), SOUTH (S),
EAST (E), OR WEST (W) OF
CROSS-SECTION LINE.

BLANK CASING



STRATIGRAPHIC CONTACT,
DASHED WHERE INFERRED

WELL SCREEN INTERVAL



DEPTH TO WATER ON 9/26/2013

08/02/11: <260/<420/<100/<1.0

GROUNDWATER RESULTS AS: DATE SAMPLED: DRO/ORO/GRO/BENZENE
GROUNDWATER ANALYTICAL RESULTS IN MICROGRAMS PER LITER (ug/L)

495/54/0.024-7.0'

SOIL RESULTS AS: DRO+ORO/GRO/BENZENE
DEPTH IN FEET BELOW GROUND SURFACE

GRO = TOTAL PETROLEUM HYDROCARBONS (TPH) AS
GASOLINE-RANGE ORGANICS
DRO = TPH AS DIESEL-RANGE ORGANICS
ORO = TPH AS OIL-RANGE ORGANICS

< = INDICATES CONCENTRATIONS NOT DETECTED
AT OR ABOVE THE STATED LABORATORY
PRACTICAL QUANTITATION LIMIT

BOLD = INDICATES CONCENTRATION EXCEEDS
THE WASHINGTON STATE MTCA CLEANUP
REGULATION METHOD A CLEANUP LEVEL

MTCA = MODEL TOXICS CONTROL ACT CLEANUP REGULATION

MW-19

= MONITORING WELL (FARALLON 2013)

MW-10

= MONITORING WELL (FARALLON 2011)

= EXTRACTION WELL

= WATER RECOVERY LINE

= WATER LINE

= SANITARY SEWER LINE

= GAS LINE

= COMMUNICATIONS LINE



= LINE OF CROSS SECTION



= CYCLONE FENCE



= RETAINING WALL



= RAILROAD TRACKS

CB = CATCH BASIN

FIGURE 13

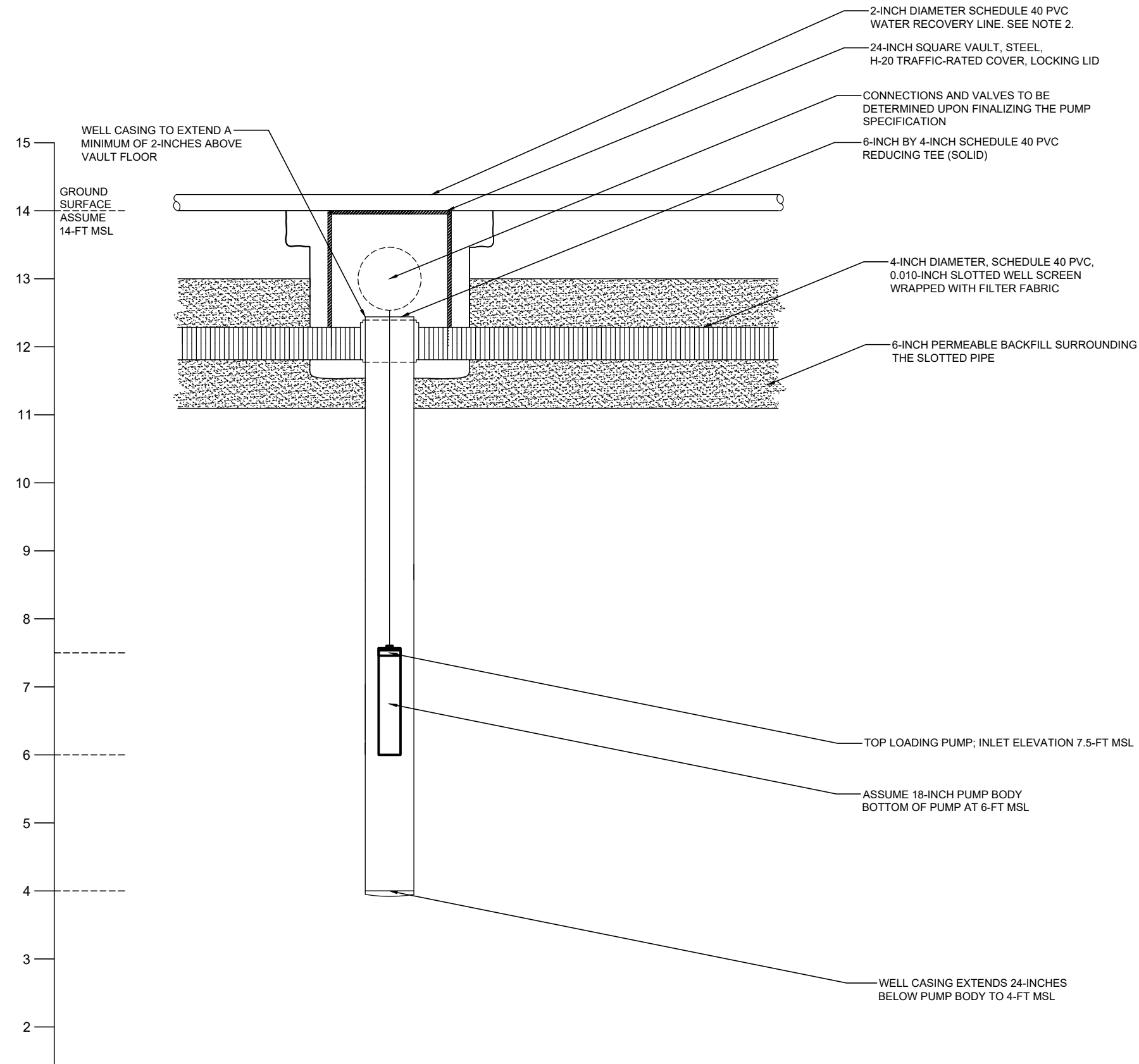
CROSS SECTION A-A' WITH CONCEPTUAL LAYOUT
OF SELECTED CLEANUP ALTERNATIVE
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON
FARALLON PN:525-006



Drawn By: NM Checked By: SS

Date: 7/7/2022

R:\Projects\525-006\CAD\Well Detail\525-006 WELL-DETAILS.dwg 8/5/2022 12:27 PM (Vincent Bachmann)



EXTRACTION WELL DETAIL

NOT TO SCALE

EXTRACTION WELL SCHEDULE		
EXTRACTION WELL NUMBER	APPROXIMATE SURFACE ELEVATION (FEET MSL*)	DISTANCE OF 4-INCH DIAMETER SLOTTED PIPE FROM EXTRACTION WELL (FEET)
COMPOUND	11.2	N/A
EW-1	12.1	75 (WEST) 50 (EAST)
EW-2	12.9	50 (WEST) 50 (EAST)
EW-3	11.2	50 (WEST) 60 (EAST)
EW-4	11.1	55 (WEST) 60 (EAST)
EW-5	14.8	60 (WEST) 55 (EAST)
EW-6	14.4	50 (WEST) 70 (EAST)

* ELEVATION IN FEET RELATIVE TO NORTH AMERICAN VERTICAL DATUM OF 1988.

NOTES:

1. A SOLID 6-INCH DIAMETER SCH 40 PVC EXTRACTION WELL CASING WILL CONNECT THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE AND 2-INCH DIAMETER SOLID SCH PVC PIPE WATER RECOVERY LINE.
2. THE CONTRACTOR WILL INSTALL THE WATER RECOVERY LINE TO SLOPE TOWARDS EXTRACTION WELLS. SLOPE WILL VARY TO ALLOW FOR A TOP OF PIPE MAXIMUM DEPTH OF 14-INCHES BELOW VAULT SURFACE.
3. THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE WILL EXTEND FROM THE WELL CASING APPROXIMATELY HALF THE DISTANCE BETWEEN EXTRACTION WELLS AS SHOWN IN THE EXTRACTION WELL SCHEDULE. THE 4-INCH DIAMETER SLOTTED SCH 40 PVC PIPE WILL BE CAPPED AT THE ENDS.
4. A 6X4-INCH SCH 40 PVC REDUCING TEE WILL CONNECT THE 4-INCH DIAMETER SLOTTED PIPE TO THE 6-INCH DIAMETER EXTRACTION WELL CASING.
5. THE CONNECTIONS AND VALVES FOR THE 2-INCH DIAMETER WATER RECOVERY LINE WILL BE DETERMINED UPON FINALIZING THE PUMP SPECIFICATION
6. WELLS ARE NUMBERED FROM WEST TO EAST IN THE EXTRACTION WELL SCHEDULE.

DRAFT



Washington
Issaquah | Bellingham | Seattle

Oregon
Portland | Baker City

California
Oakland | Irvine

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CONSULTING

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Drawn By: LT Checked By: SS

FIGURE 14
EXTRACTION WELL DETAIL
LAKESIDE INDUSTRIES
ABERDEEN SITE
ABERDEEN, WASHINGTON

FARALLON PN: 525-006

APPENDIX C
SAMPLING AND ANALYSIS PLAN

ENGINEERING DESIGN REPORT
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

**SAMPLING AND ANALYSIS PLAN
APPENDIX C OF THE ENGINEERING DESIGN REPORT**

**LAKESIDE INDUSTRIES ABERDEEN SITE
2400 SARGENT BOULEVARD
ABERDEEN, WASHINGTON**

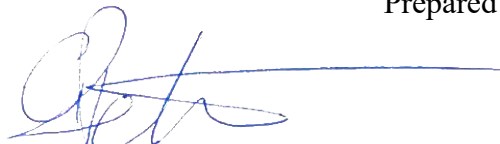
**Submitted by:
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027**

Farallon PN: 525-006

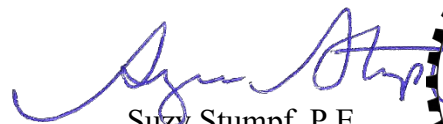
**For:
Lakeside Industries, Inc.
6505 226th Place Southeast, Suite 200
Issaquah, Washington 98027**

May 1, 2023

Prepared by:



Greg Peters
Project Environmental Scientist



Suzy Stumpf, P.E.
Principal Engineer



Reviewed by:



Peter Kingston, L.G.
Principal Geologist



Peter J. Kingston



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APPENDICES

- Appendix A *Farallon Standard Operating Procedures*
Appendix B *Farallon Field Forms and Records*



1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Sampling and Analysis Plan (SAP) on behalf of Lakeside Industries, Inc. (Lakeside Industries) to present specific methodologies for the collection, handling, and analysis of samples that will be collected during the cleanup action for the property at 2400 Sargent Boulevard in Aberdeen, Washington (herein referred to as the Site).

This SAP has been prepared in accordance with the Washington State Model Toxics Control Act Cleanup Regulation (MTCA), as established in Section 820 of Chapter 173-340 of the Washington Administrative Code (WAC 173-340-820), and the *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* revised December 2016, prepared by the Washington State Department of Ecology (Ecology) (2004).

1.1 PURPOSES

The purposes of this SAP are to:

- Identify key personnel and responsibilities for the cleanup action;
- Identify sample locations and media, sample quantities, analytical methods, and documentation protocols for the sampling program;
- Describe standard operating procedures (SOPs) for field-sampling of soil and groundwater; and
- Provide quality assurance (QA) and quality control (QC) protocols for field activities and laboratory analysis to ensure collection of representative and usable data.

1.2 SCOPE OF WORK

A detailed description of the scope of work for the cleanup action is provided in the Engineering Design Report. The main components of the cleanup action are shown on Figure 1. The source area excavation areas are shown on Figure 1. The proposed compliance monitoring well network is shown on Figure 2. The MTCA cleanup levels for soil and groundwater are shown on Table 1. The scope of work for the cleanup action, as detailed in the Cleanup Action Plan, includes:

- Source Area Excavations
 - Excavation and disposal of approximately 2,700 tons of soil from the three source area excavations
 - Collection of soil samples for performance and confirmational monitoring
- Installation of Sheet Pile Barrier Wall and Hydraulic Pressure Relief System
 - Installation of sheet pile barrier wall using excavation equipment or vibratory hammers



- Excavation of a trench and installation of dewatering wells for the hydraulic pressure relief system
 - Treatment and discharge of wastewater from the hydraulic pressure relief system
 - Wastewater discharge sampling
- Compliance Groundwater Monitoring
 - Decommissioning of five monitoring wells located in the source area excavations
 - Installation of three monitoring wells to replace the decommissioned wells
 - Groundwater monitoring.



2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project organization for conducting the cleanup action and identification of key personnel and their responsibilities are provided below.

Regulatory Agency: Ecology is the lead regulatory agency for the Site. The Ecology Site Manager for the Lakeside Industries Aberdeen Site is:

Christopher Maurer
Washington State Department of Ecology
Southwest Regional Office
300 Desmond Drive Southeast
Lacey, Washington 98503
Telephone: (360) 407-7223
cm461@ecy.wa.gov

Project Contact: Farallon has been contracted by Lakeside Industries to plan and implement the SAP. The Project Contact for Lakeside Industries is:

Karen Deal
Lakeside Industries, Inc.
6505 226th Place Southeast, Suite 200
Issaquah, Washington 98027
Telephone: (425) 313-2600
karen.deal@lakesideindustries.com

Project Principal: The Project Principal provides support for all project activities and reviews data and deliverables prior to their submittal to the Project Contact or the Regulatory Agency.

Pete Kingston, L.G.
Farallon Consulting, L.L.C.
1809 7th Avenue, Suite 1111
Seattle, Washington 98101
Telephone: (425) 295-0800
pkingston@farallonconsulting.com

Project Manager: The Project Manager has day-to-day responsibility for project implementation. The Project Manager will be responsible for monitoring the quality of the technical and managerial aspects of the project, and implementing the SAP and corresponding corrective actions, if necessary. The Project Manager for Farallon is:

Sarah Snyder, L.G.
Farallon Consulting, L.L.C.
1809 7th Avenue, Suite 1111
Seattle, Washington 98101



Telephone: (425) 295-0800
ssnyder@farallonconsulting.com

Project Data Manager: The Project Data Manager manages data as they are received from the laboratory, and is responsible for data validation. Data validation responsibilities include reviewing laboratory reports, advising on data corrective-action procedures, and performing QA/QC on analytical data reports. The Project Data Manager also will directly transfer laboratory data into an EQuIS environmental data management system database (EQuIS database) and the Ecology Environmental Information Management System. The Data Manager for Farallon is:

Jeanette Mullin
Farallon Consulting, L.L.C.
975 5th Avenue Northwest
Issaquah, Washington 98027
Telephone: (425) 295-0800
jmullin@farallonconsulting.com

Field Staff: Members of the field staff supervise contractor procedures, manage collection of samples, coordinate sample deliveries to the laboratory, and document field-sampling activities. Field staff also will communicate progress updates, including deviations from the SAP, to the Project Manager.

Laboratory: APEX Laboratories of Tigard, Oregon will perform analytical services in support of the cleanup action, and will be responsible for implementing specific QA/QC requirements.

2.1 PROJECT SCHEDULE

Implementation of the cleanup action is expected to occur over the next several years. Following receipt of the permits required for the cleanup action, construction activities for the cleanup action components will commence. Excavation of the source removal areas and installation of the sheet pile barrier wall are expected to take approximately 3 months. An environmental covenant will be recorded on relevant portions of the Site within approximately 6 months of completing construction activities. Compliance monitoring, inspections, and maintenance activities will be conducted every 6 months for the first 2 years, followed by once a year for 3 years, at which point, compliance with the cleanup standards is expected to be achieved.



3.0 FIELD PROCEDURES

This section summarizes the protocols and procedures that will be followed for field data collection. Farallon SOPs for fieldwork, including detailed step-by-step protocols, are provided in Appendix A.

3.1 SOIL SAMPLING

Soil samples will be collected during excavation of soil to refine, classify, and/or identify the presence of constituents of concern (COCs) exceeding MTCA cleanup levels.

Soil samples will be collected directly from the excavator bucket or by hand. Soil samples will be observed for lithologic description, visual and olfactory evidence of contamination, and volatile organic vapor concentrations as measured using a photoionization detector.

Confirmation soil samples will be collected from the sidewalls and floor of each excavation area. Samples generally will be collected on 20-foot centers from the sidewalls and floor of each excavation area, with a minimum of one sample collected from each sidewall and floor. When groundwater is encountered during excavation, the lowermost sidewall sample will be assumed to represent conditions at the water table.

Soil samples will be collected and handled in accordance with the requirements of SOP SL-02 (Appendix A), and as described in Section 4, Sample Handling, and Section 7, Field Documentation. Soil samples to be analyzed for volatile organic compounds will be collected in accordance with U.S. Environmental Protection Agency (EPA) Method 5035A as described in SOP SL-02 (Appendix A).

3.2 MONITORING WELL INSTALLATION

Three new monitoring wells will be installed to replace the five monitoring wells that will be decommissioned in the source area excavations. Farallon field staff will observe the monitoring well drilling and installation, and will document observations.

Monitoring wells will be constructed in accordance with WAC 173-160-400. Monitoring well screen intervals will be set across the top of first-encountered groundwater, which is anticipated at a depth of approximately 8 feet below ground surface. Each monitoring well will extend a minimum of 5 feet into the water-bearing unit. Monitoring well construction will be performed in accordance with SOP GW-01 (Appendix A).

The new monitoring wells will be developed using a submersible pump. Each monitoring well will be developed until the majority of fine-grained sediment has been removed from the well screen and adjacent sand pack. Monitoring well development will be performed in accordance with SOP GW-02 (Appendix A).



The new wells will be surveyed using the Washington State Plane North coordinates system, and measuring the top of casing elevations in North American Vertical Datum of 1988 by a Washington State Professionally Licensed Land Surveyor.

3.3 COMPLIANCE GROUNDWATER MONITORING

Following completion of the source area excavations and installation of the sheet pile barrier wall, a compliance groundwater monitoring program will be initiated to: evaluate the effectiveness of the source area excavations; confirm that the cleanup standards for the Site have been achieved; and demonstrate monitored natural attenuation of the COCs.

The groundwater compliance monitoring well network will consist of the three newly installed monitoring wells proximate to the source area excavations, and existing monitoring wells MW-6, MW-7, MW-8, MW-11, and MW-15.

Groundwater will be monitored every 6 months for the first 2 years, followed by once a year for 3 years, at a minimum. Groundwater monitoring events will include measuring the depth to groundwater, and collecting groundwater samples from each monitoring well. Procedures for measuring the depth to groundwater and for low-flow groundwater sampling are described in SOPs GW-03 and GW-04 (Appendix A).

3.4 WASTEWATER DISCHARGE SAMPLING

Wastewater will be generated from temporary dewatering during source area excavations, and from permanent dewatering during operation of the hydraulic pressure relief system.

3.4.1 Excavation Temporary Dewatering

Excavation wastewater may require treatment prior to discharge or disposal off the Site. If necessary, groundwater will be extracted from the excavations into temporary ASTs, sampled, and profiled to evaluate disposal options. Additional sampling may be required, depending on the selected disposal option.

3.4.2 Hydraulic Pressure Relief System

Influent and effluent samples will be collected to evaluate the performance of the wastewater treatment system. The wastewater will be sampled prior to discharge in accordance with a City of Aberdeen permit.

3.5 DECONTAMINATION PROCEDURES

Reusable equipment will be decontaminated in accordance with SOP EQ-01 (Appendix A).



4.0 SAMPLE HANDLING

This section discusses the sample designation, labeling, and handling methods to be used during the cleanup action. The protocols for sample documentation; sample designation; containers, preservation and hold times; collection of QA/QC samples; and sample packaging and shipment are described below.

4.1 SAMPLE DOCUMENTATION

Sample documentation includes sample labels, Field Report forms, Soil Sample Data Log forms, and Chain of Custody forms. Examples of these forms and other sample documentation to be maintained by field personnel are provided in Appendix B.

Each sample container will be marked with a durable adhesive label, and labeled with a unique identifier. The sample identifier for each sample will be assigned as described in Section 4.2, Sample Designation, and recorded on the Field Report forms and on the sample Chain of Custody form (Appendix B). Sample labels will contain the client name, project name and number, date and time sampled, sample identifier, sampler's initials, requested sample analysis, and analyte preservative(s), if any. The Chain of Custody form will contain the sample identifier, date and time of sample collection, sampler's initials, number of containers, and requested sample analysis. Entries for all samples will be made on the Chain of Custody form prior to transport of the samples.

4.2 SAMPLE DESIGNATION

Sample designation and labeling procedures for soil samples are described below.

4.2.1 Soil Sample Identifiers

Soil samples will be assigned a unique sample identifier that will contain the sample location (e.g., excavation grid), the number of the sample collected from the excavation grid, and the depth of the sample in feet below ground surface. Soil samples collected from interior portions of the excavation will be assigned a unique sample identifier that will contain the components listed below:

- Source area excavation or trench designation, as appropriate:
 - Southwest excavation (EX01);
 - West Excavation (EX02);
 - Central excavation (EX03);
 - Trench (EX04);
- Sampling grid designation, as appropriate:
 - North sidewall (NSW);
 - East sidewall (ESW);



- West sidewall (WSW);
 - South sidewall (SSW);
 - Floor/bottom (B); and
- Elevation of the surface soil sample in feet below ground surface.

For example, a soil sample collected from the north sidewall of the central source area excavation at a depth of 5 feet bgs would be assigned the sample identifier EX03-NSW-05

Soil samples collected from the 700-foot trench also will be assigned a grid number (e.g., A1). For example, a soil sample collected from the north sidewall of the trench in sampling grid A1 at a depth of 5 feet bgs would be assigned the sample identifier EX04-A1-NSW-05.

The sample identifier will be recorded on the sample label, the Field Report form, the Soil Sample Data Log, and the Chain of Custody form.

4.2.2 Groundwater Sample Identifiers

Groundwater samples will be assigned a unique sample identifier that will contain the well identifier, and the sample date in the format YYMMDD (e.g., 210201).

For example, a groundwater sample collected from monitoring well MW-07 on March 18, 2021 would be assigned the sample identifier MW-07-210318. The sample identifier will be recorded on the sample label, the Field Report form, and the Chain of Custody form.

4.2.3 Wastewater Sample Identifiers

Sample designation and labeling procedures for wastewater samples are described below.

4.2.3.1 Excavation Temporary Dewatering

If necessary, groundwater will be extracted from the excavations into temporary ASTs. Wastewater samples will be collected from the AST and assigned a unique sample identifier that will include the source area excavation, and the sample date in the format YYMMDD (e.g., 210201).

For example, a wastewater sample collected from wastewater generated from the southwest excavation on March 18, 2021 would be assigned the sample identifier EX01-Wastewater-210318. The sample identifier will be recorded on the sample label, the Field Report form, and the Chain of Custody form.

Additional sampling may be required, depending on the selected disposal option.



4.2.3.2 Hydraulic Pressure Relief System

Wastewater samples from the hydraulic pressure relief system will be assigned a unique sample identifier that will include the sample type (i.e., Influent or Effluent), and the sample date in the format YYMMDD (e.g., 210201).

For example, a wastewater sample collected from the treatment system's effluent discharge on March 18, 2021 would be assigned the sample identifier Effluent-210318. The sample identifier will be recorded on the sample label, the Field Report form, and the Chain of Custody form.

4.3 SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND HOLD TIMES

Sample container requirements for soil and groundwater sampling are based on the medium to be sampled and the type(s) of analysis to be performed. The containers, preservation procedures, and hold times for soil are shown in Table 2, and follow standard laboratory protocols.

4.4 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field duplicate samples will not be collected during soil sampling activities. Soil sampling is subject to potentially wide ranges of variability due to the heterogeneity of the sample and the limited mass of soil sampled. Conversely, a medium such as groundwater is not as susceptible to the effects of heterogeneity, and is a more-reliable medium for establishing measures of precision and/or accuracy. One field duplicate will be collected during each groundwater sampling event.

4.5 SAMPLE PACKAGING AND SHIPMENT

The samples shipped for laboratory analysis will be packaged according to applicable regulations and the recommendations of the laboratory performing the analysis. Samples will be shipped in accordance with SOP GN-03 (Appendix A).



5.0 LABORATORY ANALYSIS

This section presents the details for the laboratory analysis associated with the soil and groundwater samples that will be collected during the cleanup action. Laboratory analyses will be conducted by Apex Laboratories, who is accredited by Ecology, and meets the QA/QC requirements of Ecology and EPA.

5.1 LABORATORY ANALYSES

Soil samples will be analyzed for one or more the following analytes, depending on sample location:

- Total petroleum hydrocarbons as gasoline-range organics (GRO) by Northwest Method NWTPH-Gx;
- Total petroleum hydrocarbons as diesel-range (DRO) and as oil-range organics (ORO) by Northwest Method NWPTH-Dx;
- Benzene, toluene, ethylbenzene, and xylenes by EPA Method 8260D;
- Polycyclic aromatic hydrocarbons, including naphthalenes and carcinogenic polycyclic aromatic hydrocarbons, by EPA Method 8270D; and
- Resource Conservation and Recovery Act metals, including arsenic, cadmium lead and mercury, by EPA Methods 6010D and 7471B.

Groundwater samples will be analyzed for the following analytes:

- GRO by Northwest Method NWTPH-Gx;
- DRO and ORO by Northwest Method NWTPH-Dx; and
- Benzene, toluene, ethylbenzene, and xylenes by EPA Method 8260D.

Select groundwater samples will be analyzed for one or more of the following geochemical parameters to evaluate the performance of natural attenuation:

- Sulfate by EPA Method 300.0;
- Nitrate by EPA Method 300.0;
- Manganese by EPA Method 200.8;
- Methane, ethane, and ethene by Method RSK-175; and
- Alkalinity by Standard Method 2320B.

Ferrous iron, another geochemical parameter used to assess natural attenuation, will be measured in the field at select locations using a field test kit (e.g., Hach field test kit).



5.2 REPORTING LIMITS

The analytical methods identified above result in the reporting limits (or practical quantitation limits) that are shown in Table 3. The laboratory reporting limits are based on current laboratory data, and may be modified during the cleanup action as methodology is refined. Instances may arise where high sample concentration, non-homogeneity of samples, or matrix interferences preclude achieving laboratory reporting limits.



6.0 OFF-SITE SOIL DISPOSAL AND WASTE MANAGEMENT

Waste profiles will be used to manage off-Site soil disposal and waste generated during the cleanup action, including extracted groundwater from temporary dewatering associated with excavation activities, and wastewater from decontamination of equipment and disposable sampling supplies. Soil samples collected during excavation activities will be used to confirm that excavated soil meets current waste profiles. Excavated soil will be managed under existing soil waste profiles for the Site.

6.1 OFF-SITE DISPOSAL OF SOIL

Petroleum-impacted soil excavated from the source area excavations will require special handling and disposal off the Site at the Republic Services facility in Klickitat County, Washington, a licensed and permitted treatment, storage, and disposal facility. Farallon will assist Lakeside Industries with manifesting trucks loaded with petroleum-impacted soil and tracking quantities of soil delivered to disposal facilities. Documentation of soil disposal will be maintained in the project file and used for regulatory closure purposes under MTCA.

Excavated soil containing petroleum hydrocarbons at concentrations exceeding MTCA cleanup levels (Table 1) or at concentrations less than MTCA cleanup levels but exceeding laboratory PQLs, and/or with obvious olfactory or visual signs of contamination will be classified for disposal based on the Ecology (2016) *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology Guidance).

6.2 WASTEWATER

Wastewater will be generated from temporary dewatering during source area excavations and permanent dewatering during operation of the hydraulic pressure relief system. Excavation wastewater may require treatment prior to discharge or disposal off the Site. If necessary, groundwater will be extracted from the excavations into temporary ASTs, sampled, and profiled to evaluate disposal options. The wastewater from the hydraulic pressure relief system will be pretreated on the Site and discharged to the sanitary sewer system in accordance with a City of Aberdeen permit.

Wastewater generated by equipment decontamination and well development and purging will be placed into U.S. Department of Transportation-approved 55-gallon drums and stored at the Site. Wastewater generated during the cleanup action will be tracked using a Waste Inventory Tracking Sheet. Groundwater analytical data from groundwater monitoring and sampling will be used to develop wastewater profiles. Farallon will provide bids for disposal to Lakeside Industries based on the laboratory analytical data.



6.3 DISPOSABLES

Disposable personal protective clothing (e.g., Tyvek suits, rubber gloves, boot covers) and disposable sampling devices (e.g., plastic soil sample plungers) will be cleaned, placed into plastic garbage bags, and disposed of as nonhazardous waste.



7.0 FIELD DOCUMENTATION

Documentation of field activities will be provided on Field Report forms, Soil Sample Data Logs, Truck Tracking logs, boring logs, purging and sampling data forms, sample and waste material labels, Waste Inventory forms, and Chain of Custody forms, all described in this section. Documentation generated during the field program will be retained in the project files, and included in reports generated, as applicable. Completed forms and records will be maintained in Farallon project files. Examples of the forms and labels are provided in Appendix B.

7.1 FIELD REPORT FORM

Field personnel will be required to keep a daily field log on a Field Report form. Field notes will be as descriptive and inclusive as possible, enabling independent parties to reconstruct the sampling situation from the recorded information. Language will be objective, factual, and free of inappropriate or ambiguous terms and/or opinions.

A summary of each day's events will be provided on the Field Report form. Field documentation will contain at a minimum: the date, job number, project identification and location, weather conditions, sample collection data, personnel present and responsibilities, field equipment used, and any activities performed in a manner other than as specified in this SAP. In addition, if other forms or documents such as boring location surveys or maps are completed or used, they will be cited on and attached to the Field Report form. Field personnel will sign the completed Field Report form.

7.2 SOIL SAMPLE DATA LOG

A Soil Sample Data Log will be used to record information pertaining to soil samples collected. This log contains entries for the sample location, identification, and depth; the time sampled; field-screening results; the types and number of containers collected; and a brief lithologic description.

7.3 TRUCK TRACKING LOG

Truck Tracking logs will be used to record each truckload of soil from the source area excavations that is exported off the Site. Truck tracking logs will contain the time a truck left the Site, the transporter company name and truck number, if available, the destination facility, the soil classification, and any pertinent comments. The excavation grid and approximate soil elevation also may be recorded if readily available.

7.4 BORING LOGS

Boring logs will be prepared by a Farallon Scientist for each boring and/or monitoring well drilled. The log will contain hydrologic conditions, lithologic descriptions using the Unified Soil Classification System, and information on the potential presence of contamination.



7.5 LOW-FLOW WELL PURGING AND SAMPLING DATA FORM

A Low-Flow Well Purging and Sampling Data form will be used to record the depth to groundwater, well purging information, and other pertinent hydrologic measurements and supplementary information collected during groundwater sampling at each monitoring well. The form will be completed by a Field Scientist at the time of sample collection.

7.6 SAMPLE LABELS

Sample labels will be filled out with indelible ink and affixed to sample containers immediately prior to sample collection. The labels will contain the medium, date, time sampled, sample identifier (described in Section 4.2, Sample Designation), project name, project number, sampler's initials, and analyte preservative(s) if any.

7.7 WASTE MATERIAL LABELS

A waste material label will be filled out with indelible ink and affixed to the waste container immediately upon filling. The label will contain the job number and name, address where the waste was generated, container contents, date, consultant's name and phone number, and sampler's initials.

7.8 WASTE INVENTORY FORM

A Waste Inventory form will be used to document and track the drummed wastes generated during excavation activities, if necessary. The form will contain information on the waste container, origin of the waste, type of waste, date generated, date removed from the Site, transporter, and disposal location.

7.9 CHAIN OF CUSTODY FORM

The Chain of Custody form provides an accurate written record that can be used to trace the possession and handling of a sample from the moment of collection through analysis and reporting of analytical values. The Chain of Custody form will be updated whenever samples are collected, transferred, stored, analyzed, or destroyed. The Chain of Custody form contains the client name, project name and number, date and time sampled, sample identifier, sampler's initials, and requested sample analysis.



8.0 QUALITY ASSURANCE PROJECT PLAN

This section describes the analytical program to be conducted for each sample selected for chemical analysis, and the laboratory QA objectives and QC protocols required to be met to ensure collection of representative and usable data.

8.1 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) for this project will be used to develop and implement procedures to ensure that the data collected are of sufficient quality to adequately address the Site cleanup action excavation objectives. Observations and measurements will be made and recorded in a manner so as to yield results representative of the media and conditions observed and/or measured. Goals for representativeness will be met by ensuring that sampling locations are selected properly, a sufficient number of samples are collected, and field-screening and laboratory analyses are conducted properly.

The DQOs for this project are to:

- Collect confirmation soil samples at the limits of the excavations to evaluate soil conditions at the excavations limits;
- Collect performance soil samples from the limits of the excavations to evaluate the effectiveness of the excavations;
- Achieve a practical quantitation limit sufficient for direct comparison against MTCA screening levels; and
- Implement QA/QC protocols described in this SAP so data collected are scientifically defensible.

The quality of the field sampling methods and the laboratory data will be assessed using the parameters: precision; accuracy; representativeness; comparability; completeness; and sensitivity. The QC procedures for each of these parameters are described in the following sections. Quantitative DQOs for applicable parameters (i.e., precision, accuracy, and completeness) are provided following their definition. Laboratory DQOs have been established by the analytical laboratory, and are specified in the analytical laboratory Quality Assurance Manual. The applicable analytical laboratory Quality Assurance Manual will be kept on file at the Farallon corporate office in Issaquah, Washington.

8.1.1 Precision

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures, and is expressed in terms of analytical variability. For this project, analytical variability will be measured as the relative percent difference (RPD) or coefficient of variation between analytical laboratory duplicates, and between the matrix spike (MS) and matrix spike duplicate



(MSD) analyses. Monitoring and sampling variability will be measured by analysis of blind field-replicate samples.

The tolerance limit for percent differences between laboratory duplicates will be ± 20 percent; deviations from these criteria will be reported. If the criteria are not met, the laboratory will provide an explanation of why the limits were exceeded, and will implement appropriate corrective actions for laboratory control samples/laboratory control sample duplicates only. RPDs will be evaluated during data review and validation. If precision limit exceedances are linked to field sampling, those field sampling procedures will be reviewed, and any problems will be identified. Re-sampling and analysis may be required.

8.1.2 Accuracy

Accuracy (bias) is a statistical measurement of correctness and includes components of random error (i.e., variability due to imprecision) and systematic error. It therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ excessively from the known concentration of the spike or standard.

Accuracy measures the bias in a measurement system and is difficult to measure for the entire data collection activity. Sources of error include the sampling process, field contamination, preservative handling, sample matrix effects, and sample preparation and analysis techniques. To confirm that the samples collected are not contaminated during handling and transport, laboratory method blank samples will be analyzed.

Laboratory MSs and surrogates will be carried out at the analytical laboratory in accordance with EPA SW-846 requirements for organic chemical analyses. The frequency for both MS and MSD analysis will be 1 per batch of 20 or fewer samples. Quantitative percent recovery criteria for organic analyses will be based on laboratory-derived control limits for surrogate recovery and MS results.

The resultant percent recovery will be compared to the acceptance criteria defined in the SAP, and deviations from specified limits will be reported. If the objective criteria are not met, the laboratory will provide an explanation of why acceptability limits were exceeded, and will implement appropriate corrective actions. Percent recoveries will be reviewed during data validation, and deviations from the specified limits will be noted. The data reviewer will comment on the effect of the deviations on reported data.

8.1.3 Representativeness

Representativeness is a qualitative assessment of how closely the measured results reflect the actual concentration or distribution of the constituent concentrations in the matrix sampled. The sampling plan design, sample collection techniques, sample handling protocols, sample analysis methods, and data review procedures have been developed to ensure that the results obtained are representative of Site conditions. Representativeness also will be determined by evaluating hold



times, sample preservation, and blank contamination. Samples with expired hold times, improper preservation, or blank contamination may not be representative.

8.1.4 Completeness

Completeness, defined as the number of acceptable data points relative to the total number of data points, will be assessed for all samples within a given media (i.e., soil). The QA/QC objective for completeness for all components of this project is 95 percent. Data that were qualified as estimated because the QA/QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as estimated will be further reviewed for usability. For this scope of work, the primary use of the data is to evaluate the vertical and lateral extent of soil at the Site impacted with petroleum, carcinogenic polycyclic aromatic hydrocarbons, and/or metals. Data that were qualified as rejected will not be considered valid for the purpose of assessing completeness. If a sample medium has an unacceptable completeness percentage after comparison to the individual data quality objectives described above, original samples will be re-analyzed if sufficient sample volume is available, or archived samples will be analyzed, if appropriate.

8.1.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. To ensure that results are comparable, samples will be analyzed using standard EPA or Ecology methods and protocols. Calibration and reference standards will be traceable to certified standards, and standard data reporting formats will be employed. Data also will be reviewed to verify that precision and accuracy criteria were achieved and, if not, that data were appropriately qualified.

8.2 DATA QUALITY CONTROL

Data will undergo two levels of QA/QC evaluation: one by the laboratory; and one by Farallon. Initial data reduction, evaluation, and reporting will be performed by the laboratory, as specified in the laboratory Quality Assurance Manual. The analytical data will then be validated by Farallon under the supervision of the Project Data Manager. The following types of QC information will be reviewed, as appropriate:

- Method deviations;
- Sample extraction and hold times;
- Method reporting limits;
- Blank samples (e.g., equipment rinsate, trip, and laboratory method);
- RPD (for precision);
- MS/MSD samples (for accuracy);
- Surrogate recoveries; and
- Percent completeness.



Farallon will review field records and the results of field observations and measurements to ensure that procedures were properly performed and documented. Field procedures will be reviewed for the following elements:

- Completeness and legibility of field logs;
- Preparation and frequency of field QC samples;
- Field equipment calibration and maintenance; and
- Chain of Custody forms.

8.3 LABORATORY DATA PACKAGE REQUIREMENTS

Laboratory data packages will consist of a laboratory report and an electronic data deliverable. Laboratory reports will include the following elements:

- Case narrative;
- Analytical notes;
- QC narrative;
- Sample inventory report;
- Analytical results; and
- Data qualifiers and abbreviations.

The electronic data deliverable will include at a minimum:

- Sample identification information;
- Sample media;
- Sampling, laboratory receiving, extraction, and analysis dates;
- Analyte and Chemical Abstracts Service Reference No.;
- Reported concentrations and reporting units;
- Analytical method detection limits;
- Machine reporting limits and reporting units; and
- QA/QC results, including identification of MS/MSD and surrogate samples.

8.4 CORRECTIVE ACTION

Corrective action will be the joint responsibility of the Project Manager and the Project Data Manager. Corrective procedures may include:

- Identifying the source of deviation from the quality standards set forth in the SAP and its supporting documents;



- Re-analyzing soil samples if hold-time criteria permit;
- Re-sampling and analyzing soil, if necessary to meet the quality standards set forth in this SAP;
- Evaluating and amending sampling, analytical, and/or data transfer procedures; and/or
- Qualifying data to indicate the level of uncertainty.

During field operations and sampling procedures, field team members will be responsible for identifying and correcting equipment malfunctions and documenting sampling procedures in a manner that will enable the Project Manager or the Project Data Manager to evaluate whether corrective action is warranted.

Equipment malfunctions, variances in sampling protocols, and corrective actions taken by field team members will be documented in the field notes. The Project Manager or the Project Data Manager will evaluate the field notes upon submittal to determine whether the corrective action taken was adequate to meet project quality standards, or whether additional corrective action is required.

8.5 DATA MANAGEMENT

The final repository for sample analytical information will be the EQuIS database. The electronic data deliverables received from the laboratory will be directly transferred into the EQuIS database, reducing the likelihood of data entry errors. The Project Data Manager will manage and maintain the EQuIS database.

Farallon will directly transfer the analytical data provided by the laboratory into the Ecology Environmental Information Management System, thus eliminating the likelihood of data entry errors inherent with manual data entry.

Field measurements and other data requiring manual entry will be reviewed by Farallon personnel other than the data entry staff prior to submission to the Environmental Information Management System. Ecology's confirmation of receipt of the data will be maintained in Farallon project files.

8.6 DATA VALIDATION

Farallon will conduct a Level I Compliance Screening on all the analytical data.

All chemical data will be reviewed with regard to the following:

- Chain-of-custody/documentation;
- Sample preservation and hold times;
- Method blanks;
- Reporting limits;



- Surrogate recoveries;
- MS/MSD recoveries;
- Laboratory control sample recoveries; and
- Laboratory RPDs.

Data validation will be based on the QA/QC criteria as recommended in the methods identified in this SAP and in the *National Functional Guidelines for Organic Superfund Methods Data Review* and the *National Functional Guidelines for Organic and/or Inorganic Methods Data Review* (EPA 2017a, 2017b).

Data usability, conformance with the QA/QC objectives, any deviations that may have affected the quality of the data, and the basis of application of qualifiers will be included in the final reporting of the data. Any required corrective actions based on the evaluation of the analytical data will be determined by the laboratory in consultation with the Farallon Project Manager, and may include qualification or rejection of the data.



9.0 REFERENCES

- U.S. Environmental Protection Agency (EPA). 2017a. *National Functional Guidelines for Organic Superfund Methods Data Review*. EPA Administrative Record EPA-540-R-2017-002. January.
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- . 2005. *Guidance on Remediation of Petroleum-Contaminated Ground Water by Natural Attenuation*. Publication No. 05-090-091 (Version 1.0). July.
- . 2016. *Guidance for Remediation of Petroleum Contaminated Sites*. Publication No. 10-09-057. June.

FIGURES

SAMPLING AND ANALYSIS PLAN

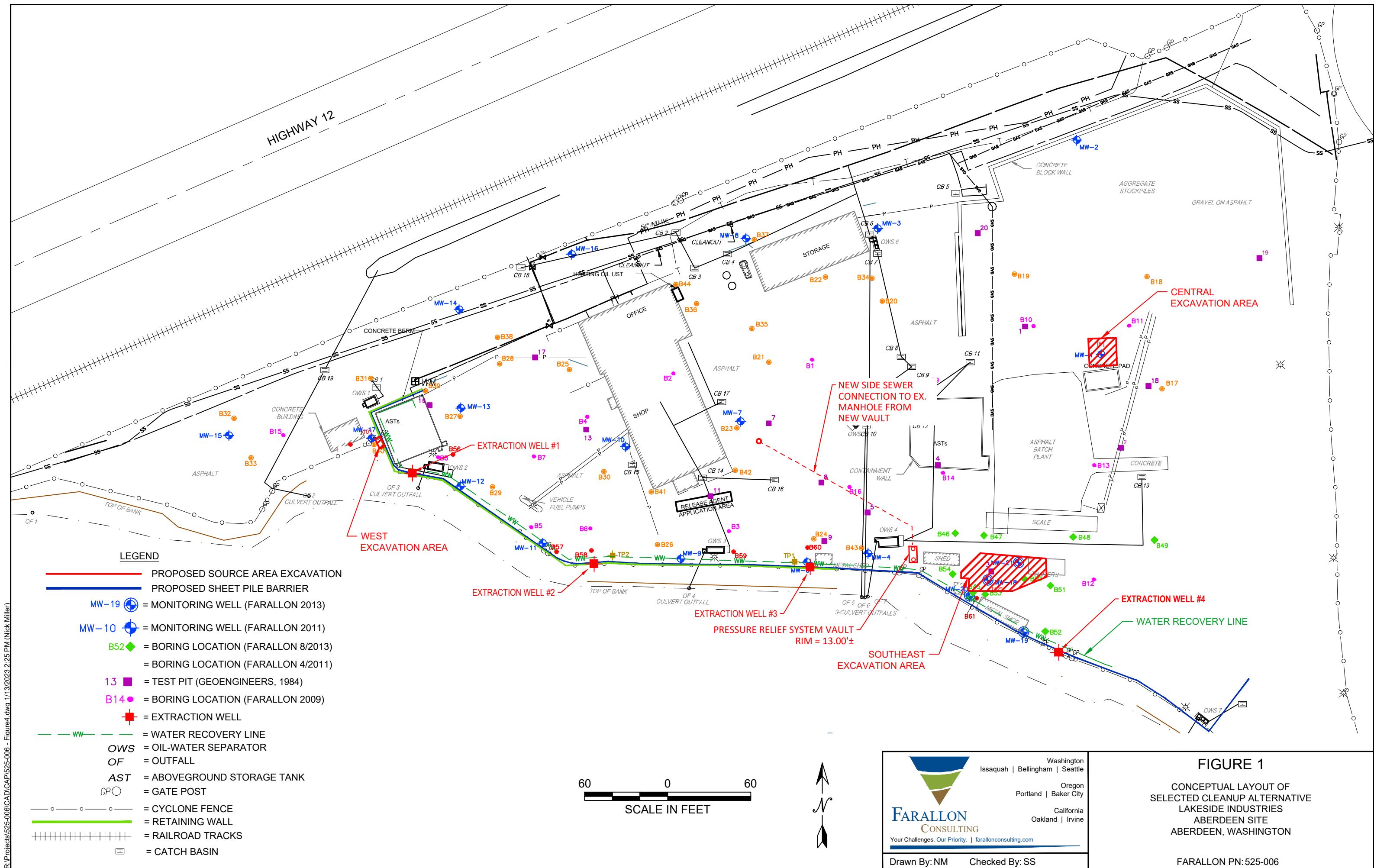
Lakeside Industries Aberdeen Site

2400 Sargent Boulevard

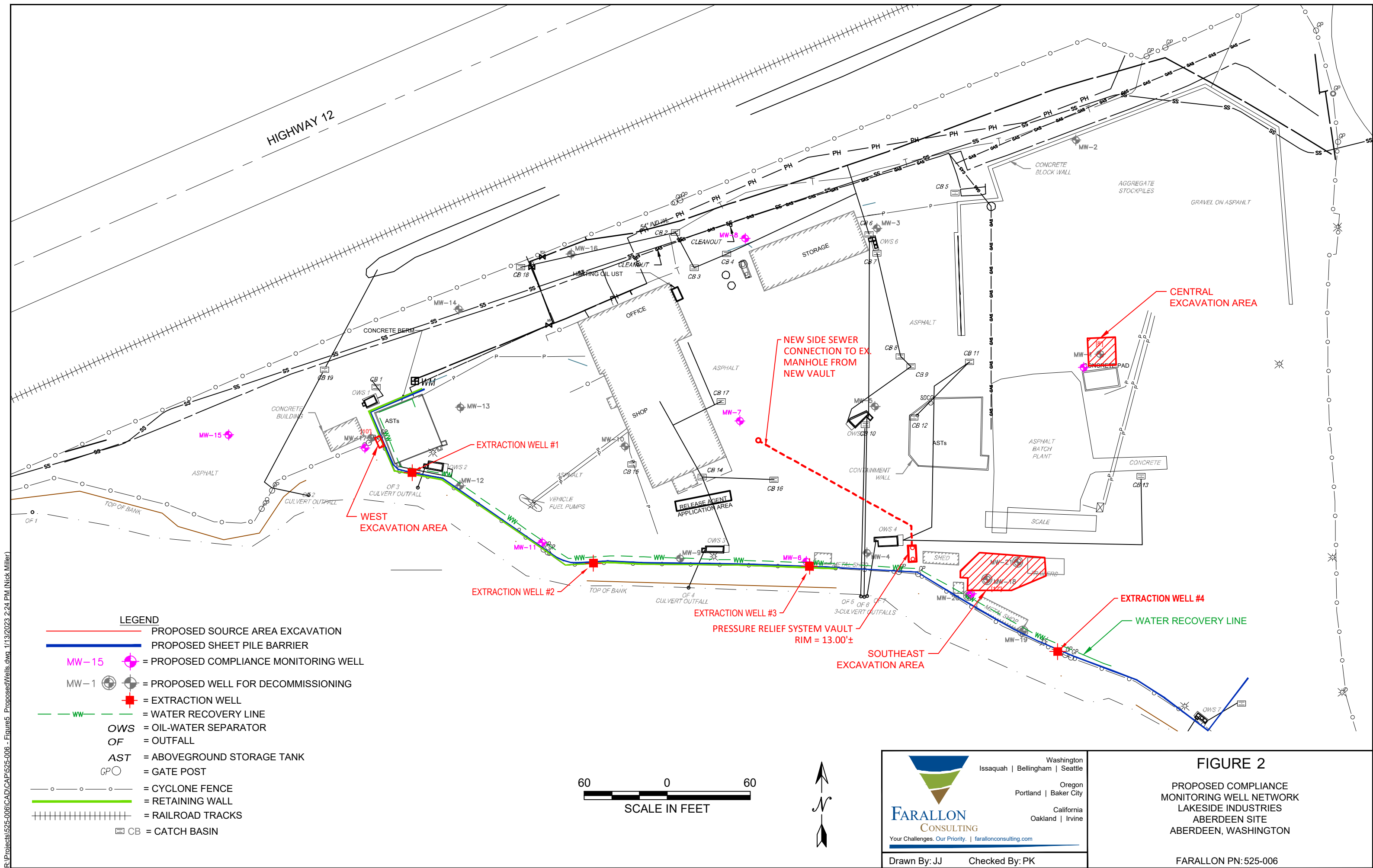
Aberdeen, Washington

Farallon PN: 525-006

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TABLES

SAMPLING AND ANALYSIS PLAN

Lakeside Industries Aberdeen Site

2400 Sargent Boulevard

Aberdeen, Washington

Farallon PN: 525-006

Table 1
Soil and Groundwater Cleanup Levels
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Constituents of Concern	Soil Cleanup Levels ¹ (milligrams per kilogram)	Groundwater Cleanup Levels ¹ (micrograms per liter)
Total Petroleum Hydrocarbons		
Gasoline-range Organics	30	800
Diesel-range Organics	2,000 ²	500 ²
Oil-range Organics		
Volatile Organic Compounds		
Benzene	0.03	5
Ethylbenzene	6.0	---
Polycyclic Aromatic Hydrocarbons		
Naphthalene	5.0 ³	---
1-Methylnaphthalene		
2-Methylnaphthalene		
Benzo(a)Pyrene	0.1 ⁴	---
Benzo(a)Anthracene		
Benzo(b)Fluoranthene		
Benzo(j,k)Fluoranthene		
Chrysene		
Dibenzo(a,h)Anthracene		
Indeno(1,2,3-cd)Pyrene		
Metals		
Arsenic	20	---
Cadmium	2	---
Lead	250	---
Mercury	2	---

NOTES:

— indicates chemical is not a constituent of concern in this media for the Site.

¹Washington State Model Toxics Control Act Cleanup Regulation (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Uses, Table 740-1 of Section 900 of Chapter 173-340 of the Washington Administrative Code (WAC), as revised 2013.

²Screening level based on the sum of diesel-range organics and oil-range organics.

³Screening level based on sum of naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

⁴Screening level based on total carcinogenic polycyclic aromatic hydrocarbons derived using the total toxicity equivalency method

Table 2
Sample Containers, Preservatives, and Hold Times
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Analytical Method	Soil Sample Container(s)/ Preservation ¹	Soil Sample Hold Time ¹	Water Sample Container(s)/ Preservation ¹	Water Sample Hold Time ¹
NWTPH-Dx	(1) 4-oz CWM Jar Cool to 4°C ±2°C	14 days to extract; 40 days to analyze after extraction	(2) 500-ml amber Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to extract; 40 days to analyze after extraction
NWTPH-Gx	(1) 40-ml glass pre-weighed VOA vial without a stir bar (5 gram soil sample) Cool to 4°C ±2°C in field; freeze ≤ 0°C in laboratory	48 hours to freeze; 14 days to analyze	(3) 40-ml glass VOA vials with Teflon septum Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to analyze
EPA 8260D	(2) 40-ml glass pre-weighed VOA vials with stir bar (5 gram soil sample), and (1) 40-ml glass pre-weighed VOA vial without a stir bar (5 gram soil sample) Cool to 4°C ±2°C in field; freeze ≤ 0°C in laboratory	48 hours to freeze; 14 days to analyze	(3) 40-ml glass VOA vials with Teflon septum Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to analyze
EPA 8270E/SIM	(1) 4-oz CWM jar Cool to 4°C ±2°C	14 days to extract; 40 days to analyze after extraction	NA	NA
EPA 6010D/7471B	(1) 4-oz CWM jar Cool to 4°C ±2°C	28 days to analyze for mercury; 6 months to analyze for other metals	NA	NA
Geochemical Parameters				
EPA 300.0 (Sulfate and Nitrate)	NA	NA	(1) 250-ml polyethylene bottle Cool to 4°C ±2°C	Sulfate-28 days to analyze; Nitrate-48 hours to analyze
EPA 200.8 (Manganese)	NA	NA	(1) 250-ml polyethylene bottle Preserve with HNO ₃ to pH <2; Cool to 4°C ±2°C	6 months to analyze
RSK-175 (Methane, Ethane, Ethene)	NA	NA	(2) 40-ml glass VOA vials with Teflon septum Preserve with HCl to pH <2; Cool to 4°C ±2°C	14 days to analyze
SM 2320B (Alkalinity)	NA	NA	(1) 250-ml polyethylene bottle Cool to 4°C ±2°C	14 days to analyze

NOTES:

¹Information from OnSite Environmental Inc. of Redmond, Washington.
°C = degrees Celsius

CWM = clear wide-mouth
EPA = U.S. Environmental Protection Agency
HCl = hydrochloric acid
HNO₃ = nitric acid
ml = milliliter

NA = not applicable
oz = ounce
VOA = volatile organic analysis

Table 3
Soil and Groundwater Laboratory Reporting Limits
Lakeside Industries Aberdeen Site
Aberdeen, Washington
Farallon PN: 525-006

Analyte	Analytical Method	Soil PQL ^{1,2} (mg/kg)	Groundwater PQL ¹ (µg/l)
Total Petroleum Hydrocarbons			
Gasoline-range Organics	NWTPH-Gx	5.0	100
Diesel-range Organics	NWTPH-Dx	25	100
Oil-range Organics	NWTPH-Dx	50	200
Volatile Organic Compounds			
Benzene	EPA 8260D	0.001	0.20
Ethylbenzene	EPA 8260D	0.001	NA
Polycyclic Aromatic Hydrocarbons			
Naphthalene	EPA 8270E/SIM	0.0067	NA
1-Methylnaphthalene	EPA 8270E/SIM	0.0067	NA
2-Methylnaphthalene	EPA 8270E/SIM	0.0067	NA
Benzo(a)Pyrene	EPA 8270E/SIM	0.0067	NA
Benzo(a)Anthracene	EPA 8270E/SIM	0.0067	NA
Benzo(b)Fluoranthene	EPA 8270E/SIM	0.0067	NA
Benzo(j,k)Fluoranthene	EPA 8270E/SIM	0.0067	NA
Chrysene	EPA 8270E/SIM	0.0067	NA
Dibenzo(a,h)Anthracene	EPA 8270E/SIM	0.0067	NA
Indeno(1,2,3-cd)Pyrene	EPA 8270E/SIM	0.0067	NA
Metals			
Arsenic	EPA 6010D	10	NA
Cadmium	EPA 6010D	0.50	NA
Lead	EPA 6010D	5.0	NA
Mercury	EPA 7471B	0.25	NA
Geochemical Parameters			
Sulfate	EPA 300.0	NA	1,000
Nitrate	EPA 300.0	NA	250
Manganese	EPA 200.8	NA	1.0
Methane	RSK-175	NA	1.0
Alkalinity	SM 2320B	NA	20 mg/l CaCO ₃

NOTES:

¹ Laboratory reporting limits are based on current APEX Laboratories, LLC. laboratory data, and may be modified during the cleanup action as methodology is refined. Instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving laboratory reporting limits.

² The actual PQL for each project soil sample will vary with the moisture content of the sample.

EPA = U.S. Environmental Protection Agency

mg/kg = milligrams per kilogram

µg/l = micrograms per liter

mg/l CaCO₃ = milligrams per liter as calcium carbonate

NA = not applicable

PQL = practical quantitation limit

SM = Standard Method

APPENDIX A
FARALLON STANDARD OPERATING PROCEDURES

SAMPLING AND ANALYSIS PLAN

Lakeside Industries Aberdeen Site

2400 Sargent Boulevard

Aberdeen, Washington

Farallon PN: 525-006

STANDARD OPERATING PROCEDURE EQ-01

EQUIPMENT DECONTAMINATION PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for decontaminating sampling equipment during various field activities. The step-by-step guidelines provided in this SOP are to be followed by the field crew during all site visits, as applicable.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly decontaminate field equipment during various field tasks:

- Rinse water or distilled water.
- Deionized water.
- Liquinox or other phosphate-free detergent.
- Paper towels.
- Labeled squirt bottles.
- Long-handled hard-bristle brushes (for sediment and soil).
- Cotton swabs.
- Plastic sheeting, garbage bags, and aluminum foil (for sediment and soil).
- Core liner caps or plastic wrap and rubber bands (for sediment and soil).
- Extension arm for cleaning core liners (for sediment and soil).
- Plastic 5-gallon bucket.
- U.S. Department of Transportation-approved drum(s) for decontamination water unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (see Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

Dilute Liquinox with distilled water in a squirt bottle in accordance with the instructions on the Liquinox package, and label the bottle. Fill another squirt bottle with distilled water, and label the bottle.



FIELD EQUIPMENT TO BE DECONTAMINATED AFTER USE

Decontaminate the following field equipment at the conclusion of field work each day, in accordance with the procedures outlined in this SOP:

- Water-level meter.
- Horiba/YSI multiparameter probe.
- Bladder pump.
- Submersible pump.
- Sediment and soil collection and processing equipment.

WATER-LEVEL METER DECONTAMINATION

Decontaminate the water-level meter after measuring the water level at a monitoring well before moving to a new monitoring well, using the following procedures:

- Spray the bottom half of a paper towel with the diluted Liquinox solution, and the upper half with deionized water.
- Grip the measuring tape of the water-level meter with the paper towel in one hand with the Liquinox side down toward the monitoring well casing.
- Begin slowly reeling up the water-level meter while maintaining firm contact between the measuring tape and the paper towel.
- Ensure that no debris or contamination remains on the measuring tape of the water-level meter once it has been reeled up.
- Use a clean new paper towel for each successive decontamination of the measuring tape of the water-level meter.

HORIBA/YSI MULTIPARAMETER PROBE DECONTAMINATION

Decontaminate the Horiba/YSI multiparameter probe at the end of each workday or after sampling a monitoring well with high concentrations of contamination, using the following procedures:

- Remove the multiparameter probe from the flow-through cell, and thoroughly spray each component with deionized water.
- Use a cotton swab to gently clean around each sensor probe, ensuring that all contaminated water and material has been washed away.
- Refill the protective dissolved oxygen and pH probe caps with deionized water, and replace prior to storage.
- Once the multiparameter probe has been adequately cleaned, replace the protective shield, and return the probe to the case. If the device appears to be overly wet, allow it to air-dry with the case open.



- Do not use Liquinox to clean any probes on the Horiba multiparameter probe, as it may damage the device.

BLADDER PUMP DECONTAMINATION

Decontaminate the bladder pump after sampling a well and at the end of each workday, using the following procedures:

- After extracting the bladder pump from the well, break down the pump, remove and dispose of the used bladder, and spray each component with the diluted Liquinox solution, followed by deionized water.
- Wipe away any visible contamination or debris with a paper towel.
- Capture cleaning water in a liquid waste drum for proper disposal in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.
- Ensure that all contamination and Liquinox solution is washed off all components before reassembling the device, installing a new bladder, and moving to sample a new well.

SUBMERSIBLE PUMP DECONTAMINATION

Decontaminate the submersible pump after purging water from any well, using the following procedures:

- After extracting the submersible pump from the well, thoroughly spray down the pump with the diluted Liquinox solution, followed by deionized water.
- Wipe away any visible contamination or debris with a paper towel.
- Purge clean water through the pump and tubing to ensure that contaminated water has been cleared from all lines.
- Capture cleaning water in a liquid waste drum for proper disposal in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.

SEDIMENT AND SOIL SAMPLING AND PROCESSING EQUIPMENT DECONTAMINATION

Decontaminate sampling equipment used to collect and process sediment and soil samples, using the following procedures:

- Place contaminated equipment and decontamination tools on plastic sheeting.
- Thoroughly rinse all used equipment with distilled water in a 5-gallon bucket to remove excess sediment or soil.
- Pour one capful of Liquinox solution into a 5-gallon bucket filled with tap water or distilled water.
- Using a long-handled hard-bristle brush, thoroughly scrub the equipment with the Liquinox solution until no sediment or soil particles remain.



- Holding the equipment over a 5-gallon bucket, double-rinse the equipment with distilled water until no Liquinox solution remains. Do not allow clean equipment to come into contact with a contaminated surface.
- Drain the equipment and place it in a clean, dry place to prevent recontamination.
- If decontaminated equipment will not be re-used immediately, wrap stainless steel equipment (e.g., bowls, spoons) in aluminum foil with the dull side facing the equipment. Seal polycarbonate core liners with core caps or cellophane plastic. Rubber-band ends to ensure a proper seal.
- After decontamination has been completed, place disposable items into a garbage bag, and store decontamination water in a drum in accordance with Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste.

STANDARD OPERATING PROCEDURE (SOP) GENERAL-02

UTILITY LOCATE

PURPOSE AND APPLICATION

The purpose of this SOP is to provide Farallon Consulting, L.L.C. (Farallon) personnel with the specific information needed to identify and locate utilities on sites where drilling or excavation activities will occur. Excavation is defined by Section 20 of Chapter 19.122 of the Revised Code of Washington (RCW 19.122.020) as “any operation, including the installation of signs, in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means.” For the purposes of this SOP, the excavation area refers to the area of an excavation or a perimeter around all proposed borings, test pits, soil gas sampling locations, and subslab soil gas sampling locations. Identifying utilities within the boundaries of a proposed excavation area prior to any digging is required by law and is necessary for the safety of Farallon personnel and contractors.

The guidelines provided in this SOP are to be followed by Farallon personnel who coordinate utility locating, mark locate boundaries, and/or observe field work that involves any type of excavation.

EQUIPMENT AND SUPPLIES

The following equipment and supplies are necessary to arrange and conduct utility locating:

- A map of the site with the proposed excavation area(s);
- Readable side sewer card figures, if applicable;
- Geographic information system (GIS) utility figures, if applicable;
- Readable American Land Title Association (ALTA) survey figures, if applicable;
- Any previous utility figures associated with the site;
- White marking products (e.g., paint, flags, stakes, grease marking pen, tape, chalk);
- Materials necessary to provide required documentation (e.g., Field Report form, camera, measuring wheel, global positioning system); and
- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan, or Level D PPE at a minimum.

PROCEDURES

The following utility locating procedures have been developed for use before excavation occurs on a site. The procedures are divided into the following four parts:

- Call Before You Dig System;
- Private Utility Locating Services;
- Hand-Clearing Proposed Excavation Areas; and
- Maintaining Public Utility Locate Marks.

The Project Manager should discuss the scope of work, details of the project location, and any essential information with the project field team before any of the procedures described below commence. When practicable, an on-site kickoff meeting involving a member of the field team and the Project Manager should be conducted to discuss the work to be performed, mark the boundaries of the excavation area, and mark potential boring locations, if applicable.

Call Before You Dig System

According to RCW 19.122.030, excavators are required to mark the boundary of a proposed excavation area using white marking products. Marking products include paint, flags, and stakes. Boundary marks should conform to the following guidelines:

- A continuous line, hashed line, dots, or corner marks with arrows are acceptable ways to mark the boundary.
- Flags and stakes can be used if paint is not adequate.

The location(s) of the proposed excavation area(s) must be reviewed to verify that no visible utilities that would interfere with the proposed excavation area(s) are present. If utilities are present, the Project Manager and field personnel should communicate the changes to the excavation that are area necessary before the boundaries are marked with white paint.

After marking the boundaries of the proposed excavation area, Farallon personnel must provide notice of the scheduled excavation to the owner/operators of buried utilities at least 2 but no more than 10 business days in advance by calling 811 or 1-800-424-5555, or using the online tool at www.callbeforeyoudig.org. Use of the online tool is preferred.

A map with the excavation area boundaries depicted and/or photos of the white paint marks is helpful in conveying the scope of work to the Call Before You Dig service.

The following information should be available to provide the Call Before You Dig service at the time of initial contact:

- Scope of work, including the start date and time.
- Contact information for the Project Manager and a field person able to answer questions from public utility locators regarding project details.
- Site address, township/range/section quarter, and name of property owner.

Once the Call Before You Dig system has been notified of the upcoming work, the system provides a ticket number, which

- Should be referenced whenever the Call Before You Dig service is contacted about the job.
- Provides proof that the Call Before You Dig system was notified prior to excavation. Public utility locators, inspectors, and law enforcement personnel may ask for the ticket number.
- Should be supplied to any subcontractors doing work on the site for reference when contacting the system for their own ticket number.

Call Before You Dig personnel will provide a list of public utilities present on the site, and will notify public utility operators of the planned work.

Public utility operators have 2 full business days after the day notification was received to locate and mark their lines, or to provide reasonable information on lines that they are not able to locate. The day notice is given is not included as 1 of these 2 days. Therefore, if excavation work is planned to start on a Monday, for example, the Call Before You Dig system must be notified by Wednesday the week before.

Two full business days must elapse between Call Before You Dig notification and the start of excavation. No excavation is to take place until all known utilities are marked or otherwise accounted for with information provided by the facility operator.

Locators mark their lines with colored hash marks. The American Public Works Association determines the colors to be used to denote different kinds of lines:

Red: Power Lines and Cable	Yellow: Gas, Oil, Petroleum
Orange: Telephone and Cable	Blue: Drinking Water
Green: Sewer (Storm and Sanitary)	Purple: Non-Potable Water
Pink: Survey Marks	White: Excavator Marks

Public utility operators are required to mark their lines only to the meter. Utility lines located beyond the meter are the responsibility of the property owner. Public utility operators should indicate by marking if no public utilities are present.

Public utility locators are required to mark their lines with reasonable accuracy. According to RCW 19.122.020, “reasonable accuracy means location within twenty-four inches of the outside dimensions of both sides of an underground facility.”

At this time, public utility companies are not required to mark abandoned or deactivated lines in Washington.

An individual not following the protocols established by the Call Before You Dig system can be held liable for up to three times the cost to repair a utility line damaged during excavation.

Records of ticket numbers and communications with the Call Before You Dig service should be stored in the project folder and supplied to on-site project personnel.

Before any excavation work is started, Farallon personnel should verify that all public utility marks are present on the site. The public utility company (companies) listed on the Call Before You Dig system ticket should be contacted if marks for that utility (utilities) are not present.

Private Utility Locating Services

After the public utility companies have marked their lines and before excavation begins, it is standard practice to have a private utility locating service clear areas that will be excavated.

Private locates generally are scheduled for the day before or the morning of the start of excavation.

Areas where excavation will occur must be cleared for conductible utilities by a private locator. Depending on the nature of the site and the proximity of utility lines, the private locator may also mark non-conductible utilities.

If possible, the excavation contractor should be on the site during the private utility locating to verify with the private locator that all proposed excavation areas are accessible.

When working with private utility locators, Farallon personnel should:

- Study existing figures of the site, noting the locations of known utilities.
- Use available side sewer cards or geographic information system utility figures to verify utility locations at the site.
- Verify that all public utilities have been marked by physically verifying that colored paint marks are present for all of the public utility companies listed on the One Call Before You Dig ticket. If any public utilities have not been marked, the utility company must be contacted and requested to mark the area, or to provide confirmation that the area is clear of their utility.
- Discuss the scope of work/excavation areas with the private locator.
- Document the name of the locating company and the name of the locator.
- Observe the locator clear the excavation area(s).
- Document the locate marks with photos, and note any uncertainties in the Field Report form.
- Identify the locations of shut-off valves for utilities such as water and natural gas.
- Contact the Project Manager or Principal to discuss relocating the excavation area if a proposed excavation area is in conflict with a utility identified by the private locator.
- Sign the locator's paperwork, if necessary, and depart the site if no additional field work is to be performed that day.

Private location of conductible utilities should sweep the excavation area in two perpendicular directions.

Private location of non-conductible utilities (typically storm and sanitary sewer) can use either a probe or a camera for accessible lines. Appropriately colored paint marks are applied by the private locator based on a signal sent from the probe or camera. For inaccessible lines, a ground-penetrating radar or magnetometer can be used to approximate the line locations. Marks based on this method should be considered approximate.

Hand-Clearing Excavation Areas

Prior to conducting certain excavation activities, excavators will clear the proposed excavation area to verify that no utilities are present. This can be accomplished through use of an air knife/vacuum truck, post-hole digging, hand-augering, or use of other hand tools that allow the excavation location be explored sufficiently to verify that no utilities are present. Farallon Project Managers will confirm the method of clearing and depths with the field team before the excavation work is performed. Farallon Project Managers also need to discuss shallow soil sampling needs with the field team if clearing activities are being performed. Clearing activities should be conducted according to the following guidelines:

- Hollow-Stem Auger Drilling: Hand-clear to a minimum depth of 5 feet below ground surface (bgs) using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Sonic Drilling: Hand-clear to a minimum depth of 5 feet bgs using an air knife/vacuum truck whenever possible. Alternative methods such as post-hole digging or hand-augering also may be used.
- Geoprobe Drilling: Clearing activity requirements are dependent on known utilities and results of the public and private utility location procedures completed above. Hand-clear using a post-hole digger or hand-auger to a maximum depth of 5 feet bgs is necessary. An air knife/vacuum truck may be used to hand clear each boring location to a maximum depth of 5 feet bgs, if available.
- Test Pit Excavation: No hand-clearing is necessary. Excavation contractors should be directed to dig cautiously in the upper 5 feet bgs in the event an unknown utility is present. A test pit excavation or regular excavation using machinery (e.g., track hoe, backhoe) should include using a spotter to watch for unidentified utility lines. Ideally, the spotter should be provided by the excavation contractor.
- Rotary Hammer for Soil Gas Sampling: No hand-clearing is necessary.
- Rotary Hammer for Subslab Soil Gas Sampling: No-hand clearing is necessary.

Some drilling contractors require that a utility line be exposed prior to drilling if the proposed drilling location is within a certain distance of the utility line. Farallon personnel should confirm drilling contractor requirements prior to conducting drilling activities.

If a utility line is encountered during clearing, excavators should verify that the utility has not been damaged, and Farallon personnel should document the encounter on the Field Report form with photos and details. RCW 19.122.020 states that “damage” includes the substantial weakening of structural or lateral support of an underground facility, penetration, impairment, or destruction of any underground protective coating, housing, or other protective device, or the severance, partial

or complete, of any underground facility to the extent that the owner of the affected facility determines that repairs are required. The Project Manager or Principal should be notified immediately if a utility line is encountered during hand-clearing, and an alternate location will be proposed. A hand-cleared area having an exposed utility line should be backfilled with a bentonite seal and finished to match existing grade.

Maintaining Public Utility Locate Marks

According to RCW 19.122.030, “public utility locate marks expire 45 days from the date the excavator provides notice,” and “it is the responsibility of the excavator to maintain the public utility marks for 45 days, or for the length of the project—whichever is shortest. In any case, the public utility locate marks expire after 45 days.”

Locate marks can be maintained digitally through both photos and figures drawn to scale.

Locate marks can be maintained in the field using white paint. White paint can be applied between original hash marks, on either side of the hash marks, or on both ends. Offset paint or staking can be used if placed a uniform distance from the original marks with a clear indication of the direction and distance from the original marks. The original marks should not be painted over, and white paint should never be applied over colored paint. White marks should include a letter identifying the type of buried line.

UTILITY LINE DAMAGE

A utility line does not need to be ruptured or severed to be considered damaged. Scratching or denting a utility line or its protective tape also is considered damage, as the integrity of the line may have been damaged even if the damage does not appear to be significant. Before excavation work begins, shut-off valve locations for applicable utilities should be documented. If a utility is believed to be damaged, the utility should be shut down if practicable and safe to do so. According to RCW 19.122.053, “all facility operators and excavators who observe or cause damage to an underground facility must report the damage event to the Washington State Utilities and Transportation Commission.”

If a utility line is hit and public safety is a concern, 911 should be the first call made after the immediate area has been evacuated. If a utility line is hit and the public is not at risk, the field team should notify the Project Manager, who will notify the Principal and the corporate Health and Safety Coordinator immediately. The Project Manager should then contact the utility that owns the damaged line, and report to the field team any instructions issued by the utility owner, and an expected timeframe for arrival of a utility owner representative at the site. Repairs to a utility line will not be attempted by Farallon personnel or contractors.

Damage must be reported through the Common Ground Alliance Damage Information Reporting Tool website, hosted by the Washington State Utilities and Transportation Commission: <http://www.utc.wa.gov/publicSafety/pipelineSafety/Pages/Damagereportingrequirements.aspx>

Access to damaged utility lines should be maintained to allow inspection by the utility company. An exposed utility should not be backfilled or patched until instruction to do so has been provided by the Project Manager or Principal.

DOCUMENTATION

Farallon personnel should document in the Field Report form the work performed and methods used by private utility locators, and photos from multiple angles with good reference points for each utility line in the excavation area(s).

REFERENCES

Washington Utilities Coordinating Council. 2014. *Guide to Safe Digging, Washington State Law and Industry Best Practices*.

STANDARD OPERATING PROCEDURE GW-01

MONITORING WELL CONSTRUCTION

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for monitoring well construction and installation. Monitoring well construction ultimately is at the discretion of the Project Manager, and is based on the geology at the site and the use of the monitoring well. Groundwater monitoring wells in the Puget Sound region, for example, typically are constructed using 2-inch-diameter Schedule 40 polyvinyl chloride well casing with 0.010-inch slotted screens because of the finer-grained materials prevalent in the region. Slot and sand sizes may be increased at the discretion of the Project Manager, depending on local geology. Monitoring wells must be installed and decommissioned by a licensed well driller, and constructed in general accordance with Chapter 173-360, Minimum Standards for Construction and Maintenance of Wells, of the Washington Administrative Code in Washington; with Rule 0410 of Division 240 of Chapter 690, Well Construction Standards – General, of the Oregon Administrative Rules in Oregon; with Bulletins 74-81 and 74-90, California Well Standards, from the California Department of Water Resources in California; and with the federal and/or state standards established for well construction specified in the project-specific field sampling plan in other states.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary for the construction and installation of monitoring wells:

- Monitoring well construction equipment (e.g., water-level meter, photoionization detector, tape measure, camera, plastic sheeting), as applicable.
- Monitoring well construction materials (e.g., well casing [screened and blank], filter pack sand, bentonite and/or Volclay Grout annular seal material, concrete, locking casing cap, well-head monument [flush-mounted or stove-pipe monument, as appropriate] complete with locking top, bollards for placement around well-head monument as applicable), provided by the driller.
- Materials necessary to provide required documentation, including Boring Log, Monitoring Well Construction Data form, and Field Report form.
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater and excess soil cuttings. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.



DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with potentially contaminated soil and groundwater, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Follow the instructions below for monitoring well construction and installation:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Before installing the casing, discuss the geology and groundwater conditions at the site with the Project Manager to confirm the depth the monitoring well screen should be placed at, and the length of screen to be used.
- Measure the depth to the bottom of the borehole to calculate the appropriate placement and length of the screened interval, filter pack, annular seal, and concrete surface seal. Calculate the approximate volumes of the filter pack and the seal material required for the specific monitoring well bore annulus and monitoring well casing diameter. Ensure that the filter pack extends from the bottom of the monitoring well intake to approximately 2 to 5 feet above the top of the monitoring well intake, and is approximately 2 to 4 inches thick. The monitoring well casing should be centered in the borehole. Ensure that the annular seal is a minimum of 2 feet thick above the top of the filter pack, and that the concrete seal is a minimum of 2 feet in depth from the surface.
- Prior to installation, measure and check the lengths of the monitoring well screen and the blank casing, and confirm the slot size and the sand filter pack size, the type of bentonite seal and/or Volclay Grout seal, and the monitoring well-head monument. For boreholes completed to depths deeper than the planned installation depth of the monitoring well casing, backfill the borehole with bentonite, sand, or pea gravel. Record the type and brand of the monitoring well construction materials used on a Monitoring Well Construction Data form.
- Record on a Field Report form the start and completion times for the various stages of monitoring well construction such as installation of the monitoring well casing into the borehole, filter pack and seal emplacement, and well-head monument placement.
- Record on a Monitoring Well Construction Data form the volumes of filter pack, the bentonite seal, and the concrete used to construct the monitoring well, and check against calculated volumes to confirm proper placement and amount. During the construction process, record any irregularities such as bridging of the filter pack or seal material that could indicate construction problems.
- Upon completion of monitoring well installation, measure the total monitoring well depth and the depth to groundwater, and record the measurements on the Monitoring Well Construction Data form.



- Place a mark or notch on the northern side of the top of the monitoring well casing to provide a monument for the measurement of water levels.

DOCUMENTATION

Document monitoring well construction activities on the Monitoring Well Construction Data form and the Field Report form.

REFERENCES

U.S. Environmental Protection Agency. 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. EPA160014-891034. March.

———. 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. April.

STANDARD OPERATING PROCEDURE GW-02

MONITORING WELL DEVELOPMENT

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for monitoring well development. All monitoring wells should be developed to create an effective filter pack around the monitoring well screen, rectify damage to the formation caused by drilling, remove fine particulates from the formation near the borehole, and assist in restoring the natural water quality of the aquifer in the vicinity of the monitoring well. The step-by-step guidelines provided in this SOP are to be followed by the field crew performing or overseeing monitoring well development.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly develop a groundwater monitoring well:

- Monitoring well key, socket wrench or speed wrench, socket set, padlock key, or other monitoring well-access equipment.
- Electric water-level meter long enough to reach the bottom of the monitoring well, calibrated to 0.01 foot.
- Two-inch-diameter (or appropriately sized) surge block.
- Monitoring well-purging equipment (e.g., silicone line, polyvinyl chloride pipe, plug, submersible or non-submersible pump, tubing, power supply, extension cord), as applicable.
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (see Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Materials necessary to provide required documentation (e.g., Field Report form, Monitoring Well Construction Data form, and Waste Inventory Tracking Sheet).
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with groundwater, in accordance with SOP EQ-01, Equipment Decontamination Procedures.



PROCEDURES

Follow the instructions below for each monitoring well:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Brush away soil and vegetation, and pump standing water away from the monitoring well opening.
- Open the monitoring well cap.
- Measure the depth to water and the total depth of the monitoring well to the nearest 0.01 foot using a decontaminated water-level meter in accordance with Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells. Record the measurements on the Monitoring Well Construction Data form.
- Calculate the unit purge volume using the formula and the input values from the table below:

$$V = [X(\text{monitoring well depth} - \text{water level})] + [Y(\text{monitoring well depth} - \text{bottom of seal or water level, whichever is lowest in depth})]$$

Where:

V = monitoring well volume, including annular space

X = internal casing volume per unit length (gallons per linear foot)

Y = annular volume per unit length (gallons per linear foot)

Borehole Diameter (inches)	Casing Diameter (inches)	Volume _{casing} (X) (gallons per linear foot)	Volume _{annulus} (Y) (gallons per linear foot)
7	2	0.17	0.68
8	2	0.17	0.98
10	4	0.65	1.34
12	4	0.65	2.07
12	6	1.47	1.70
14	8	2.61	1.98

Development Procedures – Existing and New Monitoring Wells

Existing wells in a monitoring well network may require redevelopment if an excessive amount of fines are present in the monitoring well casing that could interfere with stabilization of water-quality parameters or collection of representative water-quality samples.



The instructions below are to be followed for development of existing and new monitoring wells:

For existing monitoring wells only:

- Remove the pump and/or any dedicated tubing from the monitoring well.

For existing and new monitoring wells:

- Attach one length of twine to the decontaminated surge block (or use a drill rig or tripod) and lower the surge block to within 0.25 foot of the bottom of the monitoring well.
- Surge the monitoring well by vigorously moving the surge block up and down from 0.25 foot from the bottom of the monitoring well to 1 foot above the top of the screened interval for a minimum of 5 minutes to create a surging action across the screened interval, which will bring finer-grained material into suspension. Move the surge block up and down in 3-foot sections until the entire monitoring well screen length has been surged. Record on the Monitoring Well Construction Data form the number of times the surge block is raised and lowered, and total surge time.
- Remove the surge block.
- If a submersible pump is to be used for monitoring well development, gently lower the pump into the monitoring well to within 1 foot of the bottom of the screened interval. If a non-submersible pump is to be used, lower the tubing to within 1 foot of the bottom of the screened interval.
- Begin purging the monitoring well at a rate sufficient to remove fines without pumping the monitoring well dry. Record on the Monitoring Well Construction Data form the volume of water pumped from the monitoring well.
- Surge and pump the monitoring well, including saturated annular space, a minimum of three and a maximum of five monitoring well volumes. If the monitoring well runs dry, let the monitoring well recharge. Then commence purging until a minimum of three monitoring well volumes have been purged. If this event is the first time the monitoring well has been developed and water was added during the drilling process, remove the volume of water introduced during drilling and monitoring well construction. Purging has been completed when *one* of the following has occurred:
 - The minimum purge volume has been removed; OR
 - Five purge volumes and the drilling process water volume have been removed.
- Measure the total depth of the monitoring well after development, and record on the Monitoring Well Construction Data form the total volume of water pumped from the monitoring well.
- Record on the Monitoring Well Construction Data form a description of the suspended particle content, and additional information such as unique odor or water color.



- Containerize the purge water in a U.S. Department of Transportation-approved drum(s) unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field-Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Upon completion of monitoring well development, properly seal, secure, and label the drums in accordance with Farallon SOP WM-01, , Field-Handling of Investigation-Derived Waste. Record the number and contents of the drums on a Waste Inventory Tracking Sheet. At a minimum, the drum label(s) should include:
 - Boring/monitoring well ID.
 - Facility name.
 - Drum contents.
 - Date.
 - Drum number.
- Close the monitoring well and record any monitoring well-integrity concerns on the Field Report form and the Monitoring Well Construction Data form.
- Decontaminate all equipment in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

DOCUMENTATION

Document monitoring well development activities on the Monitoring Well Construction Data form. Record the number and contents of the drums on a Waste Inventory Tracking Sheet.

REFERENCE

U.S. Environmental Protection Agency. 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*. Document No. 160014-891034. March.

STANDARD OPERATING PROCEDURE GW-03

GROUNDWATER LEVEL MEASUREMENT IN MONITORING WELLS

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for measuring and documenting the depth to groundwater in monitoring wells. The step-by-step guidelines provided in this SOP are to be followed by the field crew to ensure consistent and representative measurements of depth to groundwater in monitoring wells. When multiple wells are present at a site, all water-level measurements typically are taken as quickly as possible to aid in the creation of potentiometric surface maps that are representative of a “single” point in time.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly measure the depth to groundwater in monitoring wells:

- Monitoring well key, hand drill, socket set, Allen wrench, speed handle, padlock key, or other monitoring well-access equipment specific to the monitoring well monument cover plate.
- Electronic water-level meter (Solinst or equivalent) narrow enough to fit in the monitoring well, calibrated to 0.01 foot, with sufficient line to reach the bottom of the monitoring well.
- Oil-water interface probe, if light nonaqueous-phase liquid (LNAPL) is known or suspected to be present.
- Disposable bailer if LNAPL is known or suspected to be present, and the Project Manager requests that LNAPL be bailed from the well.
- Tape measure.
- Materials necessary to provide required documentation, including Groundwater Level Measurement Summary Forms and Field Report forms.
- Personal protective equipment as described in the site-specific Health and Safety Plan.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate equipment that will come into contact with groundwater, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.



PROCEDURES

Follow the instructions below for measuring water levels at each monitoring well:

- Don appropriate personal protective equipment as described in the site-specific Health and Safety Plan.
- Check the operation of the water-level meter by turning on the indicator switch and pressing the test button.
- Remove soil or vegetation from the monitoring well site.
- Open the monitoring well-head enclosure, and use a bilge pump or cup to remove standing water inside the monitoring well monument before opening the monitoring well cap. Dispose of standing water to the ground surface.
- Open the monitoring well cap.
- Monitor air quality at the monitoring well-head if volatile contaminants are suspected to be present, or if it is unknown whether volatile contaminants are present.
- Repeat above procedure until all monitoring wells are open.
- Allow the water level to equilibrate with ambient atmospheric pressure for approximately 15 minutes before measuring.
- Before taking any measurements, carefully measure the length of the sonde to the nearest 0.01 foot. The additional 2 to 3 inches from the zero point of the sonde to the tip of the sonde **must be discounted** for **all** total depth measurements.
- Measure and record the depth to water using a water-level meter that has been decontaminated in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. With the water-level meter turned on to a medium level of sensitivity, slowly lower the meter into the monitoring well casing until it reaches the groundwater table. The probe will beep when it reaches the interface of the groundwater table (when the electronic circuit is first completed). Stop lowering the probe, hold the graduated water-level cable to the notch or mark on the northern side of the top of the monitoring well casing, and note the length measurement. Repeat this process to collect a second water-level measurement. If the two readings differ by more than 0.01 foot, repeat the measurements until the readings stabilize. Repeat the process until three consecutive stabilized readings have been measured. Record the water-level measurement **only** in relation to the probe being lowered into the monitoring well, *not* as it is raised out of the monitoring well. If you cannot see the top of the monitoring well casing when the water level beeps, grasp the tape with your thumb and index finger exactly at the measuring point corresponding with the notch or mark at the top of the monitoring well casing. Slowly pull the cable out of the monitoring well and read the measurement. Repeat until readings stabilize.
- Remove the cable from the monitoring well, and record the stabilized depth-to-water measurement on the Groundwater Level Measurement Summary Form to the nearest 0.01 foot.



- Measure the total monitoring well depth. **NOTE:** If groundwater samples are to be collected, measure the total monitoring well depth **after** all groundwater samples have been collected, to avoid resuspension of settled solids in the monitoring well, impacting the samples. If the monitoring well does not have a dedicated pump, lower the water-level indicator probe to the bottom of the monitoring well to measure the total depth of the monitoring well. Gently bounce the probe on the monitoring well bottom, and pull the slack in the cord to read the total monitoring well depth. Repeat three times to ensure that the monitoring well depth measurement is reproducible, and is representative of the true depth. Note on the Groundwater Level Measurement Summary Form whether the bottom of the monitoring well is hard or soft.
- Remove the cable from the monitoring well, and record the monitoring well depth measurement on the Groundwater Level Measurement Summary Form to the nearest 0.01 foot.
- Decontaminate the water-level meter in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.
- If the presence of LNAPL is suspected or if site conditions are unknown, check for the presence of LNAPL by one of two methods:
 - Use of a bailer: Use a new 3-foot-long disposable bailer attached to a nylon rope. Slowly lower the bailer until the bottom of the bailer is approximately 2 feet below the water surface. Slowly retrieve the bailer, and measure the product thickness using a tape measure. Record the information on the Groundwater Level Measurement Summary Form. Dispose of the bailer and product or wastewater in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste.
 - Use of an oil-water interface probe: Decontaminate the oil-water interface probe in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. With the oil-water interface probe meter turned on to a medium level of sensitivity, slowly lower the probe into the monitoring well casing until it reaches the top of the LNAPL. The probe will have a steady beep when it reaches the interface of the LNAPL (when the electronic circuit is first completed). Stop lowering the probe, hold the graduated oil-water interface cable to the notch or mark on the northern side of the top of the monitoring well casing, and note the length measurement. Repeat this process to collect a second LNAPL measurement. If the two readings differ by more than 0.01 foot, repeat the measurements until the readings stabilize. Repeat the process until three consecutive stabilized readings have been measured. Record the depth to LNAPL measurement **only** in relation to the probe being lowered into the monitoring well, *not* as it is raised out of the monitoring well. If you cannot see the top of the monitoring well casing when the oil-water interface probe beeps, grasp the tape with your thumb and index finger exactly at the measuring point corresponding with the notch or mark at the top of the monitoring well casing. Slowly pull the cable out of the monitoring well and read the



measurement. Repeat until readings stabilize. Once the depth to LNAPL has been recorded, collect the water-level measurement as described above using the oil-water interface probe. Once the depth to LNAPL and the depth to the groundwater table have been determined, subtract the depth to LNAPL from the depth to the groundwater table to determine LNAPL thickness.

- Close the monitoring well as appropriate based on monitoring well-head construction. Record any concerns about monitoring well integrity on the Groundwater Level Measurement Summary Form and on the Field Report form.

DOCUMENTATION

Document monitoring well water-level measurements on the Groundwater Level Measurement Summary Form. Document any additional information on the Field Report form.

REFERENCE

U.S. Environmental Protection Agency. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*. Office of Solid Waste. November.

STANDARD OPERATING PROCEDURE GW-04

LOW-FLOW GROUNDWATER SAMPLING PROCEDURES

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for collecting and documenting groundwater samples from monitoring wells using U.S. Environmental Protection Agency (EPA) low-flow groundwater sampling procedures (EPA 1996, 2017) for chemical analysis to ensure consistent and representative sampling. The step-by-step guidelines provided in this SOP are to be followed by the field crew conducting groundwater sampling.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly purge and sample a monitoring well:

- Monitoring well key, hand drill, socket set, padlock key, or other monitoring well-access equipment.
- Electronic water-level meter long enough to reach the bottom of the monitoring well, calibrated to 0.01 foot. Alternatively, to measure for light nonaqueous-phase liquid thickness in addition to groundwater, use an oil-water interface probe.
- Monitoring well purging and sampling equipment:
 - Submersible pump (bladder or Grundfos): the pump, control box, and power source (typically a portable generator or a 12-volt battery); or
 - Peristaltic pump: the pump with pump head, silicone tubing, tubing connectors (as needed), and power source (typically a 12-volt battery).
- Sample tubing of project- and site-specific type and length.
- Bailer, if a pump is not used, or if light nonaqueous-phase liquid requires removal.
- Sufficient number of 55-gallon drums, including lids, gaskets, and fasteners, to contain all purge water, unless other water-handling arrangements have been made.
- Flow-through water-quality meter(s) to measure temperature, pH, specific conductivity, dissolved oxygen, oxidation-reduction potential (ORP), and turbidity.
- Air-space monitoring equipment if required (photoionization detector or multi-gas meter).
- Decontamination equipment and supplies (e.g., buckets, scrub brushes, deionized or distilled water, potable water, Liquinox detergent).
- Materials necessary to provide required documentation, (e.g., sample labels, Field Report forms, Low-Flow Well Purging and Sampling Data form, Chain of Custody form, Waste Inventory Tracking Sheet).



- Sample containers with the chemical preservatives appropriate for the samples, as described in project-specific plans, or as required by the analytical laboratory at a minimum.
- Personal protective equipment as described in the site-specific Health and Safety Plan (HASP).
- Sampling-support equipment (e.g., sample coolers, ice, bubble wrap, clear tape, duct tape, resealable plastic bags, garbage bags, paper towels, distilled water, nitrile gloves, shipping supplies).
- U.S. Department of Transportation-approved drum(s) for purge water, unless other water-handling arrangements have been made. Separate drums are needed for liquid and solid wastes (Refer to Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.

DECONTAMINATION

Before arrival at the site, upon relocation at the site, and upon demobilization from the site, decontaminate reusable equipment that will come into contact with the monitoring well(s) and/or be used to acquire samples, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES FOR LOW-FLOW GROUNDWATER SAMPLING

Low-flow groundwater sampling procedures have been developed for monitoring wells with a dedicated pump (dedicated monitoring wells) and for monitoring wells without a dedicated pump (non-dedicated monitoring wells). Setup, purging, sample collection, and post-sampling procedures for dedicated and non-dedicated monitoring wells are presented below.

Setup

Setup procedures differ slightly for dedicated versus non-dedicated monitoring wells. Follow the instructions below for the monitoring wells as indicated:

- Calibrate the water-quality meter for the field parameters specified in the project-specific plans. At a minimum, collect temperature, pH, and specific conductivity during purging and prior to sampling. Record on the Field Report form the equipment calibration and maintenance performed. Decontaminate the water-quality meter between monitoring wells by rinsing with distilled or deionized water. Manage the rinsate water used in collecting these measurements in the same manner as for purge water, as defined in project-specific plans, and in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste.
- Don appropriate personal protective equipment as described in the site-specific HASP, including nitrile gloves for activities that might involve contact with groundwater or equipment. Change gloves between each monitoring well at a minimum, or when



contaminants could be introduced into a monitoring well or onto decontaminated equipment.

- Brush away soil and/or vegetation, and pump standing water away from the monitoring well opening. If necessary, place a plastic drop cloth around the monitoring well-head to prevent sampling equipment from contacting the ground surface.
- Inspect the condition of the monitoring well (e.g., locked monitoring well cap, tightness of monitoring well cap, well-marked measuring point on casing, disturbance of surface casing, straightness of monitoring well casing, condition of concrete pad). Indicate the monitoring well condition on the Low-Flow Well Purging and Sampling Data form.
- Open the monitoring well cap. If the site-specific HASP identifies organic compounds as potential contaminants of concern, screen the monitoring well headspace and the breathing zone headspace (if specified in the HASP) for organic vapors using the appropriate field monitoring instrument (e.g., photoionization detector, multi-gas meter).
- Measure and record the depth to water using a decontaminated water-level meter in accordance with Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells.
- If light nonaqueous-phase liquid may be present (see site-specific plans), obtain a sample from the monitoring well using a bailer (if a dedicated pump is not in use), as specified in Farallon SOP GW-03, Groundwater Level Measurements in Monitoring Wells. Alternatively, measure free-floating product thickness using an oil-water interface probe.
- Calculate the monitoring well casing volume as follows:

Monitoring well casing volume in gallons = $(\pi * r^2) * h (7.48 \text{ gallons/cubic foot})$

Where:

r = radius of the inside of the monitoring well casing in feet

h = length of the water column in the monitoring well casing (i.e., the depth to the bottom of the monitoring well minus the depth to water, both measured from the mark at the top of the monitoring well casing), in feet

- **For monitoring wells with dedicated pumps and tubing:** Set up a flow-through cell in preparation for purging. Connect dedicated tubing from the monitoring well to the flow-through cell. Set tubing and/or pump to the correct water depth in accordance with the constituents being sampled for, as described in project-specific plans. **DO NOT IMMERSE water-quality probes or meters in purge water containing nonaqueous-phase liquids, which could damage the probes.** Turn the pump controller to its lowest setting, set the memory in the flow-through cell to record readings every 3 minutes, and turn on the pump. Begin purging slowly (i.e., less than 500 milliliters per minute [ml/min]) to prevent drawing down the water table.



- **For monitoring wells with non-dedicated pumps:** Connect dedicated silicon tubing to the peristaltic pump. Place the tubing intake at the midpoint of the screen, or at the depth pre-determined in the project-specific plans. If using a bladder pump, insert the bladder pump and attach the dedicated polyethylene tubing so the pump intake is at the approximate midpoint of the screened interval, or set the pump intake to the depth pre-determined in the project-specific plans.

Purging Procedures

The purging instructions below are to be followed for dedicated and non-dedicated monitoring wells:

- Begin purging, and initiate water-quality testing for temperature, pH, specific conductivity, dissolved oxygen, ORP, and turbidity. Purge monitoring wells using a peristaltic or bladder pump, and dedicated polyethylene and silicon tubing. Record water-quality parameters every 3 minutes.
- Record water levels every 3 minutes, as possible. It is imperative that the water level not drop by more than 0.33 foot during the low-flow purging process. If the water level drops more than 0.33 foot during purging, reduce the flow rate on the pump. Recommended purge rates generally are less than 500 ml/min. Actual purge rates will vary based on aquifer material and monitoring well construction. If the water level continues to drop by more than 0.33 foot during the low-flow purging at a rate less than 100 ml/min, notify and consult with the Project Manager on how to proceed.
- Record flow rates every 3 minutes. Ensure that the flow rate does not exceed 500 ml/min during the low-flow purging process.

Purging Requirements

Continue purging at a constant rate until the water-quality parameters have stabilized for three successive measurements according to the stability criteria provided in the table below. Before samples can be collected from each monitoring well, the groundwater must stabilize according to following criteria:

- Drawdown is no greater than 0.33 foot for low-flow sampling, and
- The water-quality parameters should stabilize according to the criteria specified below:



Water-Quality Parameter	Stability Criterion
Turbidity (if required)	10% for values greater than 5 NTU or three consecutive values < 5 NTU
Dissolved oxygen	10% for values greater than 0.5 mg/l, or three consecutive values <0.5 mg/l
Specific conductivity	3%
Oxidation-reduction potential	+/- 10 millivolts
pH	+/- 0.1 unit
Temperature	3%

Notes:

mg/l = milligrams per liter

NTU = nephelometric turbidity unit

Although under some circumstances, a monitoring well may not stabilize according to the above criteria, the monitoring well can still be sampled if the monitoring well does not meet stability criteria due to the instrument accuracy, or the water level drops below the minimum value using low-flow sampling procedures. For example, a fluctuation in ORP greater than 10 millivolts does not meet the stability criterion. However, because the accuracy range of the ORP instrument is ± 20 millivolt, the stability criterion would be considered satisfied and within the range of instrument accuracy. Consult the manual for the instrument to determine the accuracy range.

Also, if the water level drops below the minimum value using low-flow sampling procedures (i.e., the pump intake, or the top of the screen if the aquifer is confined) during purging and one monitoring well volume of groundwater has been removed from the monitoring well, or the monitoring well runs dry during the purging procedure, sample the monitoring well as soon as the water level has recovered sufficiently to allow collection of the volume of groundwater necessary for all samples. Use the following equation to determine the minimum volume of groundwater to remove before sampling:

Minimum purge volume = $2 \times [500 \text{ milliliters} + M \times (\text{length of tubing in feet})]$

Where: M = volume (in milliliters) contained in a 1-foot length of tubing

The value of M is provided below for the inner diameters of tubing listed:

Inner Diameter (inches)	M (milliliters)
0.125	2.4
0.25	9.7
0.5	39

Record on the Field Report form and the Low-Flow Well Purging and Sampling Data form if any monitoring well did not meet the drawdown and stability criteria and explain the rationale for sampling the monitoring well at the time it was sampled. If stability criteria have not been achieved following completion of all entries in the Low-Flow Well Purging and Sampling Data form, notify



and consult with the Project Manager whether to continue purging until stability criteria have been achieved or begin sample collection.

Sample Collection

During low-flow sampling, do not stop pumping once the purging requirements have been met. Turn down the flow rate on the pump so the water flow is minimal, but maintain sufficient pressure in the system to prevent water from the tubing or flow-through cell from flowing back into the monitoring well. Disconnect the pump discharge hose from the flow-through cell, or cut the tubing just before the connection to the flow-through cell. It is imperative not to lower the water table or disturb the water column. Fill pre-cleaned laboratory-supplied sample containers directly from the pump discharge tube into the proper sample container, and fill to capacity. Place a bucket beneath the sampling tube to catch any unsampled water between filling the sample jars. When collecting groundwater samples for multiple analyses, collect the samples in the order listed below per the EPA (1992) groundwater sampling technical guidance:

- Volatile organic compounds (VOCs);
- Dissolved gases and total organic carbon;
- Semivolatile organic compounds;
- Metals and cyanide;
- Major water quality cations and anions;
- Radionuclides; and
- Dissolved (filtered) inorganics (if required).

When collecting samples for VOCs, adjust the flow rate as low as possible without introducing air bubbles into the system. When filling the VOC containers, hold the cap in hand to minimize contamination, and direct the flow from the pump discharge tubing down the side of the sample container to minimize aeration. Fill all VOC sample containers to the top, ensuring a positive meniscus when the cap is screwed down on the container. Tap the filled VOC container, and invert several times to ensure no air bubbles are present in the sample container. If an air bubble is present, the VOC sample must be recollected using a fresh VOC sample container. If sampling for other analytes, the flow rate may be increased.

If dissolved inorganics are required, attach a new disposable 0.45-micrometer filter cartridge to the discharge line. Collect filtered samples last. Pre-rinse the disposable filter cartridges by running a minimum of 0.25 gallon of groundwater through them (collecting the groundwater into a waste bucket) prior to collecting the samples directly into the sample container. Alternate field filtration methods may be specified in the project-specific plans. Remove the pump and/or tubing from the monitoring well.



Post-Sampling

- Record the depth to water of well to determine whether the water level changed from the original reading.
- Close and lock the monitoring well or tap and record any monitoring well integrity concerns on the Field Report form and the Low-Flow Well Purging and Sampling Data form.
- Transfer purge, wash, and rinse water into a U.S. Department of Transportation-approved drum(s) and label. Separate drums are needed for liquid and solid wastes, in accordance with SOP WM-01, Field Handling of Investigation-Derived Waste. Do not add liquid wastes to drums containing solid wastes.

PROCEDURES FOR RECONNAISSANCE GROUNDWATER SAMPLING

Collect reconnaissance groundwater samples from borings using direct-push or hollow-stem auger drilling methods and 0.75- or 2-inch-inside-diameter temporary monitoring well casing and 0.010-inch slotted screen. In some cases, alternate well casing diameters or screen slot sizes may be appropriate based on the drilling equipment or project-specific requirements. Follow the instructions below for reconnaissance groundwater sample collection:

- Withdraw the drill casing when the desired sampling depth has been reached, so the temporary monitoring well screen is exposed to water-bearing material.
- Insert disposable polyethylene tubing to the approximate midpoint of the temporary monitoring well screen. Attach the appropriate length of pre-cleaned disposable silicon tubing from the polyethylene tubing to connect with the peristaltic or bladder pump.
- Set up the peristaltic or bladder pump in preparation for purging. Turn the pump to its lowest setting and turn on the pump. Begin purging slowly to prevent drawing down the water table.
- Purge each temporary monitoring well point using a peristaltic or bladder pump until visual turbidity is as low as possible, or until the temporary monitoring well is purged dry of water.
- Purge a minimum of 1 to 2 liters before sample collection, if possible. If the temporary monitoring well is completely dewatered during purging, collect samples when sufficient recharge has occurred to allow filling of the sample containers.
- Slow the pumping rate to less than 500 ml/min to reduce the potential for volatilization of chemicals during sample collection.
- Collect the sample as described above.
- If insufficient groundwater is available to collect a sample using a peristaltic or bladder pump (i.e., the boring pumps dry or cannot maintain a sufficient flow of less than 100 ml/min) or if the depth to groundwater exceeds the maximum practicable limit for sampling using a peristaltic or bladder pump, use a disposable polyethylene bailer lowered



into the monitoring well screen to collect a groundwater sample from the screened interval, if possible.

DOCUMENTATION

Document the monitoring well purging and sampling activities on the Low-Flow Well Purging and Sampling Data form and on the Field Report form. Track samples on a Chain of Custody form. Track waste generated during groundwater sampling on a Waste Inventory Tracking Sheet.

REFERENCES

- U.S. Environmental Protection Agency. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*. Office of Solid Waste. November.
- . 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*. EPA/540/S-95/504. April.
- . 2017. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells*. EQASOP-GW4. September.

STANDARD OPERATING PROCEDURE SL-01

SOIL CORE SAMPLING

PURPOSE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to provide field personnel with the methodology for collecting and documenting soil core samples using a hollow-stem-auger drill rig, a direct-push drill rig, and a sonic drill rig. All drilling operations will be conducted by a licensed drilling subcontractor in accordance with subcontractor SOPs. This SOP presents the procedures that will be performed by Farallon field staff once the soil core has been collected by the drilling subcontractor. The step-by-step guidelines provided in this SOP are to be followed by the field crew conducting subsurface soil sampling.

EQUIPMENT AND SUPPLIES/REAGENTS

The following equipment is necessary to properly collect soil samples from borings:

- Personal protective equipment (PPE) as described in the site-specific Health and Safety Plan.
- Differential global positioning system, if required in project-specific plans. Discuss the methodology for recording the location of the sample point with the Project Manager before conducting the field work.
- Photoionization detector (PID) to monitor and record soil headspace readings.
- Applicable soil sampling equipment, including:
 - Stainless steel hand-auger.
 - Wooden or steel stakes to stabilize cores on table while sampling.
 - Folding table.
 - Utility knife.
 - Stainless steel spoons or scoops.
 - Six-mil plastic sheeting.
 - Resealable plastic bags.
 - Duct tape.
 - Aluminum foil.
 - Tape measure.
 - Five-gallon buckets, and scrub brushes.
 - Alconox phosphate-free cleanser.
 - Laboratory-provided certified pre-cleaned sample containers.



- Soil sample plunger and syringes for sampling volatile organic compounds (VOCs) using U.S. Environmental Protection Agency (EPA) Method 5035A.
- Materials necessary to provide required documentation, including:
 - Camera.
 - White board and dry-erase markers, if specified in project-specific plan.
 - Sample labels.
 - Field Report forms.
 - Boring Log forms.
 - Chain of Custody forms.
 - Chain-of-custody seals for the sample cooler(s).
- U.S. Department of Transportation-approved drum(s) for decontamination wastewater and excess soil cuttings. Separate drums are needed for liquid and solid wastes (refer to Farallon SOP WM-01, Field Handling of Investigation-Derived Waste). Liquid wastes should not be added to drums containing solid wastes.
- Decontamination equipment as specified in Farallon SOP EQ-01, Equipment Decontamination Procedures.
- Sampling support equipment (e.g., sample coolers, ice, bubble wrap, clear packing tape, heavy resealable plastic bags, razor knives, garbage bags, paper towels, distilled water, nitrile gloves).

DECONTAMINATION

Reusable equipment that will come into contact with soil boring samples or will be used to acquire soil samples is to be decontaminated before arrival at the site, between soil samples collected, upon relocation at the site, and upon demobilization from the site, in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures.

PROCEDURES

Prior to drilling, all underground utilities must be located, and cleared with an air-knife or other method approved by the Farallon Health and Safety Coordinator.

Collect soil samples from areas known or suspected to have the lowest concentrations of constituents of concern first, with areas of higher concentrations of constituents of concern sampled last, unless the Project Manager indicates a different project-specific sampling protocol. The procedures listed below may be modified, with approval from the field team lead and the Project Manager. Any modifications must be identified in the project-specific sampling plans or, at a minimum, details must be noted on the Field Report form.



Soil core collection methods differ for hollow-stem-auger, direct-push, and sonic drilling techniques, each summarized below:

- Hollow-stem-auger: Collect soil core samples using a standard 18-inch-length (6-inch waste barrel) Dames & Moore split-spoon sampler with a 2.5-inch inner diameter that can be used with or without brass or stainless steel liners.
- Direct-push: Collect soil core samples using 5-foot macrocore samplers with acetate sample liners.
- Sonic: Collect soil core samples using a standard 6-inch-diameter stainless steel sampling rod. Use a 2.5-, 5.0-, or 10-foot polyethylene liner inside the sampling rod for soil sample collection.

Record the specific drilling and soil sampling equipment used on the Boring Log form and on the Field Report form.

Setup

The instructions below are to be followed at each boring site:

- Don appropriate PPE as described in the site-specific Health and Safety Plan.
- Ensure that each borehole has been cleared to a minimum depth of 5 feet below ground surface using an air knife, per the Farallon health and safety policy.
- Set up a temporary sampling table adjacent to the drill rig to log and collect soil samples from the soil cores as they are recovered during drilling. During sunny conditions, consider using a portable canopy for protection from the sun. Lay plastic sheeting over the table to keep the surface clean and to prevent potential cross-contamination between borings and soil samples. Designate clean areas for decontaminated sampling equipment and laboratory-provided certified pre-cleaned soil sample containers.
- Set up 5-gallon buckets for decontaminating soil sampling equipment between samples. These decontamination buckets are separate from the buckets provided by the drillers for their split spoons and core barrels. (Refer to Farallon SOP EQ-01, Equipment Decontamination Procedures.)
- Calibrate the PID to monitor headspace for selected soil core samples in accordance with the equipment manual.

Sample Collection and Processing

The instructions listed below are to be followed for collecting samples using lined and unlined split-spoon and tube samplers:

- Don a new pair of nitrile sampling gloves for each individual soil sample collected, and prior to decontaminating sampling equipment to avoid potential cross-contamination.



- Ensure that the drillers have properly decontaminated all drill shoes and caps prior to initiating drilling operations. Drill shoes and caps must be decontaminated between sampling intervals and stations in accordance with Farallon SOP EQ-01, Equipment Decontamination Procedures. Replace dirty or ineffective decontamination water as needed throughout the workday.
- Ensure that the drillers position the sampling rig over the sample station and remove any surface material or debris that would interfere with sampling. Note on the Field Report form any surface material removed.
- Note on the Field Report form and the Boring Log forms any difficulties encountered during drilling operations. Include the number of blow counts (if applicable) or any resistance encountered during drilling operations.
- Place the core tube, core liner, or split spoon on a new piece of aluminum foil on the sample logging/processing table. If necessary, use wood or metal stakes as shims to stabilize the tube, liner, or split spoon on the sample logging/processing table.
- If a core liner is used, split the liner open with a decontaminated utility knife, taking care not to penetrate the soil in the liner with the blade or knife.
- Briefly examine the soil sample visually for obvious signs of contamination, and take PID readings.
- Take care to:
 - **Not** collect soil in contact with the sidewalls of the sampler or liner.
 - **Always** use decontaminated stainless-steel spoons or scoops to handle the soil within a given sample interval.
 - **Always** don a new pair of nitrile gloves before processing each sample interval in each soil core to prevent cross-contamination in the soil core.
- When sampling for VOCs, collect them as soon as possible after opening the core tube, split spoon, or core liner. Use a decontaminated stainless steel spoon to collect the VOC samples with minimal disturbance to soil by placing a representative amount of soil from the length and depth of the desired sample interval directly into the laboratory-provided VOC sample container with no headspace, and seal it tightly. Follow the sample collection guidelines provided by the manufacturer or the analytical laboratory when using a plunger-type sampling device in accordance with EPA Method 5035A.
- Retain approximately 100 grams of the soil sample in a heavy resealable plastic bag or glass sample container, shake the sealed bag to volatilize the contaminants in the soil, and wait approximately 5 minutes before measuring for headspace analysis using the PID (Washington State Department of Ecology 2011). Insert the PID probe tip into a small opening in the top of the bag, and record the PID units on the Boring Log form. Reseal the bag after taking the headspace reading in case further assessment of the sample is needed. Do not puncture the resealable plastic bag to obtain headspace readings.



- If specified in the project-specific plans, photograph each section of the boring, including in the photograph notations on a white board documenting sample location identifier, date, orientation, depth, and site markers.
- Describe the soil samples in accordance with ASTM International Standard D-2488-00, *Standard Practice for Description and Identification of Soils*.
- Record on the Field Report form any deviations from the project-specified sampling procedures or from this SOP, or any obstacle encountered.
- Examine the remaining soil core sample for lithology using the Unified Soil Classification System, and record the lithology on the Boring Log form.
- Discard excess soil cuttings in a labeled waste drum or a soil bin in accordance with Farallon SOP WM-01, Field Handling of Investigation-Derived Waste. Do not add soil to a liquid waste drum.
- Backfill the borehole, as appropriate.
- Upon completion of sampling at a boring, measure the boring's location to an on-site permanent datum, collect the location using the differential global positioning system, or have the sample location surveyed by a licensed surveyor.
- Decontaminate the soil sampling equipment, and don a new pair of sampling gloves before collecting each new soil sample.

DOCUMENTATION

Document the soil sampling activities on the Boring Log form, the Chain of Custody form, and the Field Report form.

REFERENCE

American Society for Testing Materials. 1989. *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D-1586-11.

U.S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operation Methods*. EPA Document No. 540-P-87-001. December 1.

Washington State Department of Ecology. 2011. *Guidance for Remediation of Petroleum Contaminated Sites*. Ecology Publication No. 10-09-057. Toxics Cleanup Program. September.

APPENDIX B
FARALLON FIELD FORMS AND RECORDS

SAMPLING AND ANALYSIS PLAN
Lakeside Industries Aberdeen Site
2400 Sargent Boulevard
Aberdeen, Washington

Farallon PN: 525-006

Page of

Comments:

FIELD REPORT (continued)

Page of

Project: _____ **Date:** _____ **Project #:** _____ **Task #:** _____

[illegible]



Log of Boring:

Page __ of __

Client:	Date/Time Started:	Sampler Type:
Project:	Date/Time Completed:	Drive Hammer (lbs.):
Location:	Equipment:	Depth of Water ATD (feet bgs):
Farallon PN:	Drilling Company:	Total Boring Depth (feet bgs):
Logged By:	Drilling Foreman:	Total Well Depth (feet bgs):
	Drilling Method:	

[illegible]

Well Construction Information

Monument Type:	Filter Pack:	Ground Surface Elevation (ft):
Casing Diameter (inches):	Surface Seal:	Top of Casing Elevation (ft):
Screen Slot Size (inches):		Boring Abandonment:
Screened Interval (ft bgs):	Annular Seal:	Surveyed Location: X: Y:

MONITORING WELL CONSTRUCTION DATA

WELL/BORING NO:

PROJECT NO:

PROJECT NAME:

PERMIT NO:

DATE:

SITE ADDRESS:

WELL SITE LOCATION PLAN:

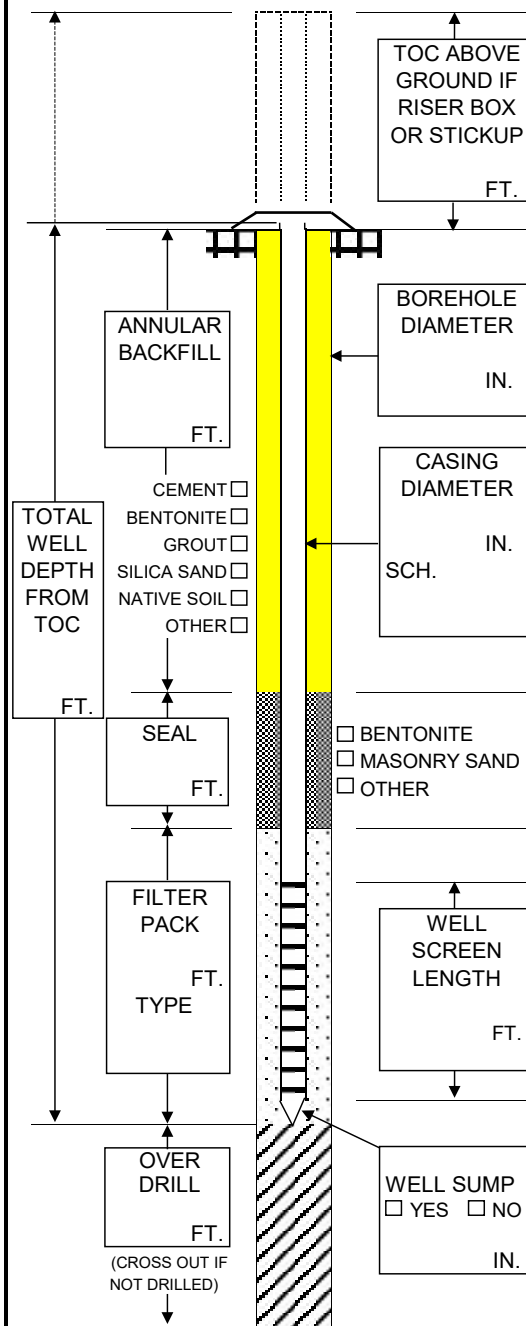
SEC: TWN: RGE: LAT: LONG:

DRILLING CO:

DRILL CREW:

WELL TYPE: ☐ SHALLOW ☐ SINGLE CASED ☐ MONITORING
☐ PERMANENT ☐ INTERMEDIATE ☐ DOUBLE CASED ☐ RECOVERY
☐ TEMPORARY ☐ DEEP ☐ OTHER ☐ OTHER

WELL SCHEMATIC



INSTALLATION DATA

DECON. ☐ STEAM CLEAN ☐ HIGH PRESSURE WASH
☐ SOAP WASH ☐ OTHER

CASING TYPE: ☐ PVC ☐ STAINLESS ☐ TEFLON ☐ OTHER
 JOINTS: ☐ THREADED ☐ WELDED ☐ COUPLED
☐ SCREWED ☐ OTHER

PIT CASING: ☐ YES ☐ NO ☐ DESCRIBE

WELL SCREEN: ☐ PVC ☐ STAINLESS ☐ TEFLON ☐ OTHER
 DIAMETER: ☐ 2" ☐ 4" ☐ 6" ☐ OTHER IN
 SLOT: ☐ 0.010 ☐ 0.020 ☐ OTHER IN

DRILLING METHOD: ☐ SOLID STEM ☐ HOLLOW STEM ☐ MUD ROTARY
☐ AIR ROTARY ☐ DIRECT PUSH ☐ HAND AUGER
☐ OTHER

BIT SIZE: ☐ 2" ☐ 4" ☐ 6" ☐ 8" ☐ 12" ☐ OTHER IN

DRILLING MUD: ☐ NONE ☐ WATER ☐ BENTONITE
☐ OTHER

CENTRALIZER: ☐ YES ☐ NO

COMPLETION: ☐ FLUSH MOUNT ☐ STICKUP ☐ RISER BOX
 LOCK TYPE: ☐ DOLPHIN ☐ MASTER KEY NO.
☐ OTHER

PAD: ☐ 2'X2' ☐ 4'X4' ☐ OTHER

CUTTINGS: ☐ DRUMMED ☐ SPREAD ☐ OTHER

DEVELOPMENT METHOD: ☐ NONE ☐ BAILING ☐ PUMPING ☐ AIR LIFT
☐ SURGE & BLOCK ☐ OTHER

TIME: ☐ 10 MIN ☐ 20 MIN ☐ OTHER MIN
 AMOUNT: ☐ 5 GAL ☐ 10 GAL ☐ OTHER GAL

WATER BEFORE: ☐ SILTY ☐ TURBID ☐ OPAQUE ☐ CLEAR
 WATER AFTER: ☐ SILTY ☐ TURBID ☐ OPAQUE ☐ CLEAR
 EVIDENT ODOR: ☐ YES ☐ NO TYPE

DEVELOPMENT WATER: ☐ DRUMMED ☐ SPREAD ☐ TREATED ☐ POTW ☐ OTHER

WATER LEVEL: INITIAL FT. ☐ BTOC ☐ BLS

DATE: FT BELOW TOC
 DATE: FT BELOW TOC

NOTES: (DESCRIBE ALL NON-STANDARD METHODS & MATERIALS)

PREPARED BY:

Page _____ of _____

LOW-FLOW WELL PURGING AND SAMPLING DATA

							WELL NO:								
DATE:		PROJECT NAME:					PROJECT NO:								
WEATHER CONDITIONS:															
WELL DIAMETER (IN.)		<input type="checkbox"/> 1		<input type="checkbox"/> 2		<input type="checkbox"/> 4		<input type="checkbox"/> 6		<input type="checkbox"/> OTHER _____					
SAMPLE TYPE:		<input type="checkbox"/> GROUNDWATER		<input type="checkbox"/> WASTEWATER		<input type="checkbox"/> SURFACE WATER		<input type="checkbox"/> OTHER							
WELL DEPTH (TOC)				FT.		DEPTH TO WATER BEFORE PURGING (TOC)				FT.					
LENGTH OF WATER				FT.		CALCULATED ONE WELL VOLUME ¹ :				GAL.					
DEPTH OF SAMPLE POINT				FT.		ESTIMATED VOLUME PURGED				GAL.					
EQUIP. DECON.		<input type="checkbox"/> ALCONOX WASH		<input type="checkbox"/> LIQUINOX WASH		<input type="checkbox"/> DIST/DEION 1 RINSE		<input type="checkbox"/> DIST/DEION 2 RINSE		<input type="checkbox"/> OTHER					
CONTAINER PRESERVATION:										<input type="checkbox"/> LAB PRESERVED <input type="checkbox"/> FIELD PRESERVED					
WATER ANALYZER:				PUMP TYPE:				TUBING:							
ACTUAL TIME (min)	FLOW RATE (ml/min)	DEPTH TO WATER (feet)	TEMP	SPECIFIC CONDUCT. (mS/cm)	pH	DISS. OXYGEN (mg/l)	TURBIDITY (NTU)	ORP (mV)	REMARKS						
			<input type="checkbox"/> °F <input type="checkbox"/> °C												
			(3%)	(3%)	(+/- 0.1)	(<0.5 mg/L or 10% for > 0.5 mg/L)	(<5 NTU or 10% for > 5 NTU)	(+/- 10 mV)	(EVIDENT ODOR, COLOR, PID)						
	INITIAL		--	--	--	--	--	--							
DEPTH TO WATER AFTER PURGING (TOC)						FT.		SAMPLE FILTERED			<input type="checkbox"/> YES <input type="checkbox"/> NO SIZE _____				
NOTES:						SAMPLE TIME:						ID#			
						DUPLICATE <input type="checkbox"/>						TIME:		ID#:	
						EQUIP. BLANK: <input type="checkbox"/>						TIME:		ID#:	
						PREPARED BY:									

¹ A 1 FOOT LENGTH OF WATER = 0.05 GAL IN 1" DIA. PIPE 0.17 GAL IN 2" DIA PIPE 0.65 GAL IN 4" DIA PIPE 1.5 GAL IN 6" DIA PIPE



Soil Sample Data Log

Date: _____ **Project Name:** _____ **Farallon P/N:** _____

PID Model & Serial No: _____ **Calibration Date/Standard:** _____

Headspace Container: ☐ 16 oz glass ☐ 8 oz glass ☐ Zip-loc ☐ Other

Sample Method: ☐ Hand auger ☐ Direct push ☐ Split spoon ☐ Corer ☐ Other

Equip Decon: ☐ Tap water wash ☐ DIST/DEION 1 Rinse ☐ Isopropanol ☐ Analyte-free final rinse ☐ Tap water final rinse

☐ Alconox wash ☐ Liquinox Wash ☐ DIST/DEION 2 rinse ☐ Other solvent ☐ DIST/DEION final rinse ☐ Air Dry[illegible]

2 oz = two-ounce jars

4 oz = four-ounce jars

WASTE INVENTORY TRACKING SHEET

Project Number:		Page:	of
Project Name:		Generation Date:	
Project Address:		Prepared By:	
Field Work Description:		Date Waste Removed:	
Project Manager:		Waste Transporter:	
		Waste Disposal Location:	

[illegible]

NOTES: Contents should be specified and include identification of well/boring, media, source, depth of soil (if applicable), and any other helpful information.

Container ID should be unique when compared against other nearby containers. Special waste labels may include flammable, corrosive, dangerous when wet, and/or oxidizer.

Location of Drums (sketch or describe):



