INTERIM ACTION WORK PLAN

Dawn Foods Site
6901 Fox Ave South

Prepared for:
Bridge Point Seattle 130, LLC

BRIDGE

June 10, 2024

Prepared by:

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CONSULTING, INC.

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Dawn Foods Site
6901 Fox Ave South

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Reviewed by:

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Acronyms and Abbreviations

AMP	Archaeological Monitoring Plan
bgs	below ground surface
Bridge	Bridge Point Seattle 130, LLC
CAP	Cleanup Action Plan
COC	contaminant of concern
cVOC	chlorinated volatile organic compound
cis-1,2-DCE	cis-1,2-dichloroethene
DAHP	Washington State Department of Archaeology & Historic Preservation
Ecology	Washington Department of Ecology
EPA	United States Environmental Protection Agency
ERD	Enhanced in-situ reductive dechlorination
FBI	Friedman & Bruya, Inc
ft	foot
GWCC	Great Western Chemical/Cascade Columbia Distribution Company
IAWP	Interim Action Work Plan
IDP	Inadvertent Discovery Protocol
LDW	Lower Duwamish Waterway
mg/kg	milligram per kilogram
MTCA	Model Toxics Control Act
PCE	perchloroethylene (tetrachloroethene)
PCUL	Preliminary Cleanup Level
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
RIWP	Remedial Investigation Work Plan
Property	Dawn Foods facility
SL	Screening level
TEA	Terminal electronic acceptors
TCE	trichloroethene
TOC	Total organic carbon
TPH	total petroleum hydrocarbons
VC	Vinyl Chloride
VOC	volatile organic compound
WAC	Washington Administrative Code
ZVI	Zero-valent iron

Engineer's Certification

I certify that the Interim Action Work Plan for the Former Dawn Foods Site located at 6901 Fox Ave South in Seattle, Washington was completed by me or by a person under my direct supervision.

Work for this project was performed in accordance with generally accepted professional practices for the nature and condition of work completed in the same or similar localities, at the time the work was performed.

No other warranty, express or implied, is made.

GRANT HAINSWORTH
33192

6/10/2024

Grant Hainsworth P.E., Principal
Washington State PE Number: 33192
Expiration Date: 6/5/2025

1 Introduction

This Interim Action Work Plan (IAWP) describes proposed cleanup actions at the Dawn Foods Site (Site). The former Dawn Foods facility is located at 6901 Fox Ave South in Seattle, Washington (Property – see Figure 1; King County Parcel Number 000180-0113). This IAWP was prepared on behalf of Bridge Point Seattle 130, LLC (Bridge) for review by the Washington State Department of Ecology (Ecology) under Agreed Order DE 21602.

This IAWP was developed based on data presented in the January 31, 2024 Remedial Investigation Work Plan (RIWP; CRETE 2024) and additional data collected in 2024. This interim action addresses contaminated groundwater in the southwestern portion of the Property where zinc has been detected in groundwater and where chlorinated volatile organic compounds (cVOCs; Tetrachloroethylene [PCE], Trichloroethylene [TCE], and vinyl chloride [VC]) have also been detected.

Parallel to these interim actions, Remedial Investigation (RI) data collection will continue, followed by preparation of a Remedial Investigation and Feasibility Study (RI/FS) report and a draft Cleanup Action Plan (CAP) to determine the final cleanup action for the Site.

2 Project Background

2.1 Current Site Use

The Property covers 5.4-acres and is located in the Georgetown neighborhood of Seattle adjacent to the Duwamish Waterway. The Property includes a warehouse building built in 1977 that is approximately 128,800 square feet (2.96 acres).

In 2020 Bridge purchased the Property from Guimont Fox Avenue LLC. The Property, including the warehouse building, was leased to Dawn Food Products, Inc. to mix and package dry commercial baking mixes through the end of 2023. Dawn Food Products, Inc. used the Property to store, produce, and ship dry food products, such as cake and brownie mixes. Bulk oils such as canola oil were received by truck and were previously received by rail. Currently the building is vacant.

There are several stormwater drain lines along the southern portion of the Property (Figure 2). Discharge from the Property occurs via a single outfall to the Duwamish Waterway. The outfall is located on the west end of the Property and crosses the northwest corner of the adjacent property to the south, known as the Seattle Boiler Works property (500 South Myrtle Street, Seattle), prior to discharge.

Stormwater associated with operations on the Property is managed in compliance with Industrial Stormwater General Permit No. WAR011560.

2.2 Site History/Past Land Use

The history of the Property is presented in detail in the RIWP and is summarized below:

- The Property is located in the Duwamish River Valley and is adjacent to the Duwamish Waterway. The river formerly meandered throughout the area until the 1913 to 1916 dredging program provided a channelized Duwamish Waterway.
- Ship building activities, such as ship repair, painting, and fabrication, likely occurred between 1929 and 1966 after which time the Property was leased and used by Emerson GM Diesel, a sheet metal fabrication and generator manufacturing company, to the mid 1970's (Hart Crowser 1996a).
- Tax records from the Emerson GM Diesel operations indicate that the existing warehouse was constructed in 1977 with all previously existing buildings demolished at that time.
- Records indicate that the current warehouse was used by various food companies, such as Dawn Foods (1988 to 2003), Ener-G Foods, Oroweat Foods Company, and Sam Wylde Flour Company (EPA 2008) up until 2023, when the Dawn Foods lease expired.

2.3 Future Planned Land Use

Bridge is scheduled to upgrade the existing warehouse in 2024 and maintain its use as an industrial warehouse. A future tenant will likely use the warehouse for distribution.

2.4 Site Conditions

Below is a summary of site conditions presented in the RIWP. Figure 3 shows sampling locations from the numerous environmental investigations which have occurred on the Property. Previous sampling events are detailed in the RIWP.

2.4.1 Physical Habitat Features

The Property is covered in pavement/concrete surfaces except for two small landscape areas along the shoreline and the rail spur north of the building. The shoreline is heavily armored from the top of bank and down the steep embankment into the Duwamish Waterway to an elevation of about -1 ft mean low lower water.

2.4.2 Site Geology

Site geologic cross sections are provided on Figures 4 through 7. The geological units encountered beginning at the surface and progressing deeper are discussed in the following subsections.

Fill Material

Near-surface soil predominately consists of fill material. Fill is present from ground surface (below pavement and structures) to a depth of 4 to 12 feet below ground surface (ft bgs). Fill material is predominately composed of poorly graded silty fine sand to gravelly sand or sandy silt to gravelly sandy silt. Locally, fill includes some organic matter, wood, and debris, including concrete rubble.

Recent Alluvial Deposits

The first native soils encountered beneath the fill are interpreted to represent recent (i.e., predevelopment) alluvial deposits of the lower Duwamish Valley. These deposits range in composition from fine to medium sand to slightly silty to very silty fine to medium sand. Locally, within these deposits, fine sandy silt lenses are intercepted. Where fill is not present, these alluvial deposits range in depth from near-surface to the total depth investigated. These deposits have been interpreted to represent channel and floodplain deposits laid down by the modern Duwamish Waterway (Booth and Herman 1998). These younger alluvial deposits are where the water table is encountered.

Silt Horizon

The upgradient Great Western Chemical Company site (GWCC Site; also referred to as the Fox Avenue Site) identified a thin layer of silt occasionally at 11 to 14 ft bgs. This silt horizon was used to define the base of an upper shallow groundwater unit. Except for direct push location GP-SB-2 located on the eastern edge of the property near the GWCC Site, this silt horizon was not encountered on the Property. A separate shallow silt (above 6 ft bgs) was observed in limited areas on the eastern portion of the Property that was also observed in the northwest corner of the GWCC Site.

2.4.3 Groundwater

The shallow unconfined aquifer in the Duwamish River Valley is generally located within the native alluvium unit. Shallow groundwater can also occur locally within fill material. In general, the valley alluvium is believed to comprise a single, large aquifer system (Booth and Herman 1998). Groundwater recharge to the valley occurs from infiltration and from upland aquifers that discharge into the alluvial valley both along subsurface pathways and through visible seeps along valley walls. Groundwater discharge is primarily to the channel of the Duwamish Waterway.

During previous field investigation, groundwater was generally encountered at between 8 and 10 ft bgs although tidal influence significantly increases that range near the Duwamish Waterway. Regional groundwater flow direction is generally to the west-southwest with groundwater discharging to the Duwamish Waterway. A groundwater contour map is included on Figure 8.

Data from the GWCC site indicate that the alluvium has an average hydraulic conductivity of $5.3\text{x}10^{-3}$ centimeter/second (cm/s) with a range from $3\text{x}10^{-3}$ to $1\text{x}10^{-2}$ cm/s.

Groundwater and surface water interactions also affect the salinity of the groundwater at the Property. Specific conductance, a proxy for salinity, is elevated in shoreline wells. This is due to mixing with brackish surface water from the Duwamish Waterway.

To determine the extent of the surface water interactions, two tidal studies have been conducted at the site. The first was performed from January 4 to 10, 2022 and a second from October 28 to 31, 2023; both were conducted during a time period including negative and non-negative low tides, allowing for observation of the tidal response. During the first tidal study (2022), the 6 nearshore monitoring wells and the nearest NOAA-monitored tidal station (ID# 9447130 in Seattle, WA) were used to measure tidal variations. During the second tidal study (2023), all site wells and the NOAA-monitored tidal station were used. The results of the 2022 tidal study are included in Appendix C of the RIWP and results from the 2023 tidal study are discussed briefly in Section 2.5.1.

2.5 2024 RIWP Data Collection Summary

In January and February 2024, CRETE performed additional soil and groundwater sampling in accordance with the RIWP. The remedial work included the following activities:

- Collected quarterly groundwater samples from nine (9) site monitoring wells and one (1) well point on January 9 through January 22, 2024.
- Completed soil borings and collected temporary groundwater grab samples from twelve (12) locations on February 27 through February 29, 2024.

A second tidal study was also completed on October 28 through October 31, 2023. This work was conducted to address data gaps identified in the RIWP.

Field efforts in January and February focused on data gaps associated with:

- Groundwater discharge to surface water (including point of discharge sampling);
- Extent of chlorinated volatile organic compound (cVOCs);
- Additional groundwater data analysis (including for compounds with elevated reporting limits; tributyltin, polychlorinated biphenyl aroclors, dioxins and furans, and chromium speciation); and
- Groundwater flow direction and gradient.

Additional work was performed in late April and May of 2024 to refine the understanding of potential vapor intrusion into the existing building.

2.5.1 Results

A complete summary of the RIWP field efforts will be included in the RI/FS. Current results are summarized in Tables 1 through 5. Appendix A includes borehole logs and Appendix B includes laboratory data reports.

Groundwater Discharge to Surface Water

Three existing monitoring wells (MW-1, MW-2 and MW-3) are located along the shoreline, representing the most downgradient locations before discharge to the Lower Duwamish Waterway (LDW). A well point, PD-1, was installed downgradient of MW-1 in the sediment to evaluate groundwater quality immediately prior to discharge to the LDW.

Samples collected from these four locations followed the protocols specified in the RIWP. Groundwater samples from PD-1 were collected at low tide, once there was no surface water covering that area. Best attempts were made to sample groundwater as it discharged to the Duwamish Waterway without collecting any surface water.

- All groundwater results from MW-2 and MW-3 were below screening levels for metals and cVOCs (Table 3).
- Dissolved zinc was detected in the groundwater sample collected from MW-1 above screening levels. Zinc was not detected above laboratory reporting limits in PD-1. No other compounds were detected at MW-1 or PD-1 above screening levels.

- cVOCs were either not detected or were detected below screening levels at MW-1 through MW-3 and PD-1 (Table 3).

Extent of cVOCs

cVOCs (specifically PCE, TCE and VC) are present in groundwater beneath the Property in three separate locations: (1) in the vicinity of MW-5 in the southwestern portion of the Property; (2) at RI-SB-13 in the southcentral portion of the Property; and (3) along the eastern boundary of the Property. cVOCs at the eastern boundary are connected to groundwater contamination at the upgradient GWCC Site. cVOCs in the vicinity of MW-5 and RI-SB-13 appear to be associated with minor releases from on-property sources.

PCE was detected in soil sampled from RI-SB-09, RI-SB-11 and RI-SB-13 above the screening level and TCE was detected in soil sampled from RI-SB-09 and RI-SB-11 above the screening level. PCE, TCE, and VC were detected in groundwater above screening levels at RI-SB-11 and PCE was detected in groundwater above the screening level at RI-SB-13. VC was also detected in groundwater grab samples from RI-SB-15, RI-SB-16, and RI-SB-17. All other cVOCs were below the laboratory detection limits at these locations.

Additional Zinc Data

Groundwater grab and soil samples from RI-SB-08 through RI-SB-11 were analyzed for zinc. Zinc was detected in the groundwater grab sample RI-SB-11 and the associated soil sample (from 5-7.5 ft bgs) above the screening level. Zinc was also detected above the soil screening level in RI-SB-08 and RI-SB-10.

Groundwater Flow Direction and Gradient Data

On October 28 through October 31, 2023 a tidal study was performed for all permanent monitoring wells on site (MW-1 through MW-9). The tidal study was conducted to determine the net groundwater flow direction and to establish the appropriate lag time at which to sample each well such that the groundwater in the well at the time of sampling is close to its lowest elevation during the tidal cycle (thus representing groundwater discharge). Previous tidal studies had excluded wells further than 200 feet away from the shoreline.

A pressure transducer was installed in each monitoring well to observe water level response to tidal variation over 48 hours. This data will be included in the RI/FS.

3 Nature and Extent of Contamination

This section presents the nature and extent of contamination related to the interim action:

- Soil and groundwater – cVOCs
- Soil and groundwater – zinc.

The RI/FS will provide a comprehensive and updated nature and extent section.

3.1 Extent of cVOC Impacts

cVOC contamination includes PCE, TCE, and vinyl chloride (Figure 9). As stated above, the Property is downgradient of known chlorinated solvent releases from the GWCC Site.

For the southwestern portion of the Property, PCE at MW-4 and TCE at MW-5 exceeded the groundwater screening levels (Table 3). During the 2024 field investigation work, PCE was detected above the screening level in groundwater at RI-SB-11 and RI-SB-13, and TCE was detected above the screening level in groundwater at RI-SB-09 and RI-SB-11 (Table 2). In soil, PCE and TCE were detected above screening levels at RI-SB-09 and RI-SB-11 (Table 5).

In the southcentral portion of the Property, PCE was detected in soil and groundwater above screening levels at RI-SB-13. This location was investigated in 2024 due to detected PCE at RI-SB-01. Both the southwestern and the southcentral area appear to be the result of localized historical spill/releases.

PCE and TCE have both exceeded groundwater screening levels in the southeastern corner of the Property at MW-8. PCE, TCE, and VC in the eastern portion of the Property are likely associated with the groundwater plume originating from the GWCC Site.

Vinyl chloride is the result of anaerobic degradation of chlorinated solvents such as PCE and TCE. The presence of cis-1,2-dichloroethene (cis-1,2-DCE) in most of these samples (Tables 2 and 3) supports the biodegradation pathway source.

3.2 Metals Impacts - Zinc

Groundwater samples from monitoring wells and temporary grab samples were analyzed for both total and dissolved metals (Tables 2 and 3). Zinc exceeds groundwater screening levels primarily in the southwestern corner of the Property (Figure 10). Soil data also indicate that zinc exceeds the screening level in the southwestern corner of the Property (Figure 10). These exceedances are located in the same area as the cVOC impacts in the southwestern corner. Figure 11 illustrates the areas where the zinc and cVOC groundwater impacts overlap in the southwestern corner of the Property.

4 Remedial Technologies Evaluated

Based on the data presented in Section 3, groundwater contaminated with cVOCs and zinc has the potential to migrate off of the Property and impact the LDW. In an effort to address this pathway, an interim action is proposed to address groundwater. This section briefly reviews a set of technologies that are potentially applicable based on the site conditions and the nature and extent of contamination. These include:

1. Excavation and disposal
2. Permeable reactive barrier
3. Enhanced in-situ reductive dechlorination

4.1 Excavation and Disposal

Excavation and disposal is commonly employed to permanently remove contaminated soil. Long term risks are immediately reduced by the removal of contaminated soils and the potential for this soil to act as a continuing source of groundwater contamination.

Short term risks are increased during excavation and transportation of impacted soils. The potential for workers to be exposed to contaminants by fugitive dust emissions and the potential for off-site migration of contaminated soils by stormwater runoff requires management.

While excavation eliminates all possible future exposure pathways, the soil data does not indicate a clear significant source and there is no documented spill or release area. Furthermore, the area available for excavation is in the parking lot which contains extensive utilities (Figure 2). Based on the low-level contamination in soil and the extensive utilities that would affect the ability to fully excavate without removing and re-routing utilities, the cost and short-term risk of the excavation are prohibitive and this option was therefore not retained as a remedial technology.

4.2 Permeable Reactive Barriers

A permeable reactive barrier (PRB) is a subsurface trench containing reactive materials through which groundwater flows. This in-situ method for remediating dissolved-phase contaminants in groundwater combines a passive chemical or biological treatment zone with subsurface fluid flow management. The most commonly used PRB configuration is a continuous trench in which the treatment material is placed as backfill into the ground surface. The trench is perpendicular to and intersects the groundwater plume.

The majority of installed trench style PRBs use zero-valent iron (ZVI)[1] as the reactive media for converting contaminants to non-toxic or immobile species. ZVI has the ability to reductively dehalogenate cVOCs and reduce the mobility of zinc. EnviroBlend is another reactive media that stabilizes metals by regulating pH and forming insoluble compounds which become trapped in the PRB.

A PRB requires installation along the entire width of the groundwater plume or the installation of a funnel and gate system. These would include a physical barrier that intercepts the groundwater plume and directs the water into the PRB. Due of the extensive trenching, a PRB is not feasible at this facility because of the extensive subsurface utilities (Figure 2) and the limited space between the groundwater plume and the shoreline. Furthermore, these reactive media will weather and become inactive over time. This weathering may be more rapid than normal due to the nearshore tidal fluctuations. Additionally, some of the immobilized chemicals may remobilize after the media is exhausted. Due to the construction constraints and concerns regarding the long-term reactivity of the media, a PRB was not retained as a remedial technology.

4.3 Enhanced In-Situ Reductive Dechlorination

Enhanced in-situ reductive dechlorination (ERD) is the process of modifying chemical, physical, and biological conditions in the aquifer to stimulate the microbial degradation of contaminants under anaerobic conditions to harmless end products (e.g., carbon dioxide [CO2] or ethene). In-situ treatment is conducted in place, without having to pump out groundwater for aboveground cleanup. ERD is the process through which chlorine atoms attached to an organic compound are sequentially removed under anoxic (no oxygen) conditions. The degradation process for PCE is generally PCE → TCE → cis-1,2-dichloroethylene (with the possibility of minor amounts of trans-1,2-dichloroethylene and 1,1- dichloroethylene) → vinyl chloride → ethene. Figure 9 shows that site groundwater has PCE and TCE in select locations, with vinyl chloride present in a larger area. The presence of vinyl chloride suggests incomplete degradation, which could be supplemented with ERD.

ERD is used frequently to remediate cVOC contamination in groundwater. Application of ERD is comprised of the introduction of an electron donor and sometimes bioaugmentation to modify existing geochemical and biological conditions in an aquifer to facilitate degradation of contaminants. The electron donor (which is a carbon source) is used as food by native microbes, which in turn, produce hydrogen through fermentation reactions. This process depletes the aquifer of dissolved oxygen and other electron accepters including nitrate, sulfate, and ferric iron, which lowers the oxidation-reduction potential, thereby creating the conditions for reductive dechlorination to occur[2].

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[1] https://clu-in.org/techfocus/default.focus/sec/permeable_reactive_barriers,_permeable_treatment_zones,_and_application_of_zero-valent_iron/cat/overview/

[2] https://clu-in.org/techfocus/default.focus/sec/Bioremediation/cat/Anaerobic_Bioremediation_(Direct)/

An electron donor is added to the impacted area to overcome the terminal electronic acceptors (TEA) sinks (i.e. dissolved oxygen, nitrate, sulfate, etc.) and create sulfate-reducing and/or methanogenic conditions throughout the target treatment zone. Either one or both conditions will promote the transfer of electrons to the chlorinated solvents, which will reduce their concentrations and remediate the target area. Desirable electron donor qualities include high water solubility, no particulate matter, low viscosity, and a low retardation factor in order to ensure mobility within the target treatment zone. If the substrate has a low solubility or significant retardation factor, then delivery via induced hydraulic gradients would require multiple pore volumes of recirculation prior to achieving site-wide delivery.

Anaerobic sulfate-reducing conditions, resulting from the ERD, can also stabilize zinc contamination by chemically reducing zinc sulfate to zinc sulfide, thereby reducing the solubility of the zinc that is present in soil and groundwater (Suthersan et al 2009; EPA 1987). Sufficient sulfate is expected to be present to support this process, particularly since sea water contains sulfate. Studies have also shown that metal sulfides remain stable even when the sulfate-reducing conditions no longer remain (Thomson et al. 2001; SERDP 2009). One study indicated that 1 to 2% of the metals would remobilize within 16 years after sulfate-reducing conditions no longer remained (SERDP 2009).

ERD via substrate injection, was selected as the interim remedial technology for the Property as it will be applied via injection points and will irreversibly transform contaminants into less harmful or mobile chemicals. ERD is both practicable and implementable, and will address the groundwater contamination in a cost-effective manner and in a reasonable restoration timeframe.

ERD and anaerobic sulfate-reducing conditions will also treat other site contamination, including TPH and arsenic. These compounds are co-located with cVOCs or zinc, as discussed in the RIWP. Concentrations of these compounds will be monitored during routine groundwater sampling conducted at the site.

5 Selected Interim Action

The interim action will address cVOCs and zinc in groundwater. The extent of the proposed interim action is shown on Figure 12 and includes in-situ ERD for cVOCs and anaerobic sulfate-reduction for zinc via substrate injection in the vicinity of MW-5/MW-4, RI-SB-13, and MW-8. The proposed interim action will prevent off-site migration of zinc, PCE, and TCE. All work will be performed in accordance with WAC 173-340-430 and permit requirements.

Injection locations focus on areas with PCE and TCE detected, as vinyl chloride is a degradation by product of PCE. The presence of vinyl chloride is evidence of incomplete degradation.

This section includes a summary of the interim action selected. Appendix A includes details on the Enhanced In-Situ Reductive Dechlorination product recommendations, Appendix B includes a project Health and Safety Plan (HASP), and Appendix C includes the Quality Assurance Project Plan (QAPP).

5.1 ERD Implementation

cVOCs and zinc are present in groundwater in the vicinity of MW-5 and MW-4, nearest to the adjacent property boundaries and shoreline. cVOCs are not present in shoreline wells, but zinc is present above screening levels. cVOCs are also present at RI-SB-13 and MW-8 (Figure 9).

To address both the cVOCs and zinc in groundwater, CarBstrate™, a nutrient-amended carbohydrate electron donor, will be added to the impacted area (Appendix A). Delivery of the substrate throughout the saturated zone will be optimized using several well points as injection locations. Figure 12 shows the proposed injection footprint. Temporary well points will be installed using direct push drilling methods with screens installed approximately 5-15 feet bgs and placed on 20 foot centers (approximate). The substrate will be mixed with potable water to make a solution which is then injected under pressure to each temporary well point, approximately 1,100 gallons of solution will be injected into each well point. The exact volume of solution injected and pressure for injection will vary based on subsurface conditions (geological layers) and will be adjusted in the field during injection.

The desired substrate concentration was calculated using stoichiometric ratios of carbohydrate to TEAs and chlorinated solvents at the Property. TEAs are estimated and the mass of substrate is calculated to overcome this estimate (Appendix A). Vendor experience, system capacity, and ongoing data will be used for substrate dosing.

The application of the electron donor to the subsurface will create the reductive conditions necessary for the reductive dechlorination of cVOCs and the sulfate reduction of zinc sulfate to zinc sulfide. A high solubility electron donor solution allows the solution to inject like water, allowing for efficient distribution even in tight formations. The electron donor solution also contains a pH buffer to mitigate pH shifts that may be produced by an active microbial community. In addition to its solubility and low-retardation factor, it is a non-toxic, food-grade product that includes the macro-nutrients that will be necessary for effective microbial growth (i.e. nitrogen and phosphate) as well as a specific suite of trace metals that have been shown to be critical for active anaerobic microbial activity.

For cVOCs, the goal is to not only fully dechlorinate the minor mass of chlorinated solvents dissolved in groundwater, but also fully dechlorinate the majority of the chlorinated solvent mass sorbed onto the organic fraction in the soil as it partitions into the groundwater. For zinc, the goal is to transform adequate zinc in soil and groundwater to zinc sulfide to reduce groundwater concentrations to below the zinc screening level prior to discharge to surface water.

The interim action will include the installation of 2 additional permanent monitoring wells, MW-10 and MW-11, shown on Figure 12. These wells will be constructed similar to other site wells (i.e., flush mount, 2-inch diameter well) and screened approximately 5 to 20 feet bgs. Well installation will be completed by a Washington State License driller and in accordance with Washington Administrative Code (WAC) 173-160 and 173-162. Well construction will follow the procedures included in Section 4.1 of the QAPP (Appendix C).

The estimated treatment timeframe is 3 to 6 months to allow for the reductive dechlorination process to occur. The intent is to achieve groundwater remediation levels with a single injection event although future injections may be needed.

5.2 Remediation Levels

The screening levels presented in the RIWP are used as remediation levels in this IAWP. The RI/FS report will develop contaminant of concern (COC)s and Indicator Hazardous Substances consistent with MTCA. Table 6 summarizes the groundwater remediation levels selected for the interim action. Groundwater remediation levels are based on the Preliminary Cleanup Level (PCUL) workbook for the LDW based on groundwater non-potability (see RIWP).

5.3 Schedule for Implementation

The interim action is expected to be implemented in the fall of 2024 depending on the timing of regulatory approvals.

5.4 Permits and Notifications

The interim action will be conducted with oversight from Ecology and will need to satisfy the permit requirements of the State of Washington and Ecology. For in-situ treatment, injection notifications will be required through the Underground Injection Control Program, and all temporary and permanent wells will require a notice of intent from Ecology.

A Washington State Department of Archaeology & Historic Preservation (DAHP) Archaeological Site Alteration and Excavation Permit is required for the IAWP and an application has been prepared and submitted to DAHP. As part of the permit application, an Archaeological Monitoring Plan and an Inadvertent Discovery Protocol (AMP/IDP) were developed. Archaeological monitoring will follow the findings and recommendations of the AMP/IDP and DAHP permit requirements.

Limited groundwater disturbance will be required for this interim action and no dewatering will be required. As a result, a construction stormwater permit will not be required for this interim action.

The Contractor will be responsible for complying with all local, state, and federal laws. Additional permits or notifications may be required if conditions change during construction from what is listed in this work plan.

5.5 Hazardous Substances to be Contained on Property

The selected remedy relies on in-situ treatment of waste materials present in groundwater to remediation levels. The RIWP and Section 3 provide a full description of the extent of impacted groundwater at the Property.

5.6 Health and Safety and Site Access

All work associated with this interim action will require workers that come into direct contact with contaminated waste and soil to be trained in accordance with OSHA HAZWOPER and Washington State Department of Labor and Industries training requirements. Appendix B includes a site-specific Health and Safety Plan (HASP) developed by CRETE and prepared in accordance with all applicable regulations, including, but not limited to, the Occupational Safety and Health Act (OSHA), the National Institute for Occupational Safety and Health (NIOSH), the American Conference of Governmental Industrial Hygienists, and the United States Environmental Protection Agency (USEPA). The Contractor will be responsible for developing a HASP that complies with the attached HASP and all state and federal standards.

Workers involved in soil handling activities shall be trained and monitored in accordance with Hazardous Waste Operations and Emergency Response (HAZWOPER) requirements, OSHA standard 29 CFR Part 1910.120 (OSHA 40-hour trained). The appropriate level of personnel training and equipment for personnel shall consider OSHA Section 1910.120(e)(3)(i) in making such a determination.

5.7 Stormwater Pollution Prevention Plan

This work will have minimal ground disturbance (less than 1 acre) and all work will be completed on paved surfaces or inside a covered building. An Ecology Construction Stormwater Pollution Prevention Plan is not required. All stormwater will continue to be treated through the onsite treatment system and discharged per the existing stormwater discharge permit (Stormwater General Permit No. No. WAR01156). All work shall comply with Washington Water Pollution Control Law (RCW 90.48; WAC 173-216, WAC 173-220) and the National Pollution Discharge Elimination System (CWA Part 402).

5.8 Waste Removal

The interim action will result in minimal ground disturbance and waste generation. Soil cuttings and purge water will require off-site disposal. All waste will be properly disposed at a permitted landfill.

5.9 Backfill and Property Development

No backfill will be required; all temporary wells will be abandoned in placed using bentonite chips. Property development will include resurfacing of the pavement and internal updates to the building.

5.10 Post Construction Documentation

The interim actions and performance monitoring results will be summarized in the RI/FS report and will include:

- A description of the interim action work completed;
- A description of the samples collected, including sample locations and methods; sample analyses performed; analytical results; how the results compare to remediation levels; and chain of custody records.
- Drawings showing post-interim action conditions.
- Progress photos collected during the interim action.

6 Compliance Monitoring Plan

Compliance monitoring is one of the threshold requirements for cleanup actions under MTCA (WAC 173-340-360(2)(a)) and confirms the long-term effectiveness of the cleanup action. This compliance monitoring plan is designed in accordance with WAC 173-340-410(1). The major aspects of a compliance monitoring plan are protection monitoring, performance monitoring, and conformational monitoring, as described below:

- **Protection Monitoring -** Monitoring during implementation of the remedy will ensure that human health and the environment are protected during construction. This monitoring will be performed in compliance with a health and safety plan and local permits. Protection monitoring will include monitoring the construction workers during soil disturbance activities (drilling).
- **Performance Monitoring -** Performance monitoring is used to confirm that the cleanup action has attained the cleanup standard. For the selected remedy, performance monitoring would verify that groundwater concentrations of metals (zinc) and cVOCs have been reduced and that groundwater concentrations are below screening levels (Table 6).
- **Confirmation Monitoring -** Confirmation monitoring is designed to monitor the long-term effectiveness of the remedy. This is an interim action that will be part of a larger action detailed in the RI/FS. The RI/FS will include confirmation monitoring details.

6.1 Sampling and Analysis Plan

Performance monitoring for in-situ ERD will include monitoring groundwater conditions at MW-1, MW-4, MW-5 and MW-8 and new monitoring wells MW-10 and MW-11 (Figure 12). This will include:

- Baseline event (prior to injection) – cVOCs (at all wells referenced above), zinc (at MW-1, MW-4, MW-5, and MW-11 only), inorganic analysis (e.g., ammonia, nitrate/nitrite, sulfate, phosphate, dissolved iron, dissolved manganese, and chloride), ethene, ethane, methane, and total organic carbon (TOC). In addition, groundwater quality parameters (i.e. ORP and pH) will be collected during sampling events.
- During injections – groundwater quality parameters (i.e. ORP and pH) will be collected during injection.
- Quarterly sampling (for a minimum of 3 quarters) – cVOCs (at all wells referenced above) and zinc (at MW-1, MW-4, MW-5, and MW-11 [pending baseline results] only). Inorganic analysis (e.g., ammonia, nitrate/nitrite, sulfate, phosphate, dissolved iron, dissolved manganese, and chloride), ethene, ethane, methane, and TOC will be monitored during select events at select wells based on cVOC and zinc

concentration trends. In addition, groundwater quality parameters (i.e. ORP and pH) will be collected during all sampling events.

Performance groundwater sampling will conform with the sampling, analysis, and statistical guidelines in WAC 173-340-740(7). A QAPP is included in Appendix C.

6.2 Reporting

Results of the groundwater sampling will be included in quarterly progress reports and will be incorporated into the final RI/FS. Performance monitoring data will not be available for the Agency Review Draft RI/FS that is anticipated to be submitted to Ecology by about August 31, 2024.

7 References

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Tables

Table 1 Groundwater Field Parameters
Bridge - Former Dawn Foods

Location ID	Date	Time	Depth to Water (ft BTOC)	Flow Rate (mL/min)	Temperature (°C)	Specific Conductance (mS/cm)	ORP (mV)	DO (mg/L)	pH	Turbidity (NTU)
MW-1	1/10/2024	22:45	15.26	350	13.9	12.523	95.9	7.82	6.74	3.0
MW-2	1/22/2024	22:54	11.77	250	9.8	19.964	78.3	7.86	7.39	1.8
MW-3	1/12/2024	0:24	nm	225	9.8	32.115	110.3	5.41	6.78	19.7
MW-4	1/11/2024	23:52	14.75	200	13.4	2.376	23.7	0.21	5.98	6.7
MW-5	1/22/2024	21:58	11.59	225	14.3	1.297	-109.1	0.11	6.81	20.5
MW-6	1/10/2024	23:53	12.7	250	12.5	23.477	118.0	2.81	6.24	26.5
MW-7	1/12/2024	12:00	7.04	175	7.8	0.1282	201.6	6.05	5.78	65.5
MW-8	1/10/2024	20:41	8.24	275	14.8	0.853	-102.9	0.16	6.35	0.4
MW-9	1/9/2024	19:52	8.41	350	13.5	0.831	-120.9	0.13	6.16	0.8
PD-1	1/10/2024	21:46	nm - saturated at ground surface	300	12.7	2.337	-64.3	0.16	6.59	0.4

°C - degrees Celsius
DO - dissolved oxygen
ft bgs - feet below ground surface
mg/L - milligrams per liter
mS/cm - milliSiemen per centimeter
mL/min - milliliters per minute
mV - millivolt
NTU - nephelometric turbidly unit
ORP - oxidation-reduction potential

Table 2 Summary of 2000-2024 Direct Push Borehole Groundwater Samples - Select Compounds
Bridge - Former Dawn Foods

Sample ID		GP-SB-1	GP-SB-2	GP-SB-3	GP-SB-5	GP-SB-6	GP-SB-7	GP-SB-08	GP-SB-09	Dup (GP-SB-09)	GP-SB-10	GP-SB-11	GP-SB-12	GP-SB-13	GP-SB-14	GP-SB-15	GP-SB-16	GP-SB-17	GP-SB-18	GP-SB-19	GP-SB-20	GP-SB-21	GP-SB-22	GP-SB-23	GP-SB-24	GP-SB-25	GP-SB-27	GP-SB-28
Date Sampled	Screening Level (ug/L)	1/2/2020	1/2/2020	1/2/2020	1/2/2020	1/2/2020	1/2/2020	6/9/2020	6/9/2020	6/9/2020	6/9/2020	6/9/2020	6/9/2020	6/9/2020	6/9/2020	6/9/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/5/2020	12/5/2020	12/5/2020
																								Sample results are in ug/L				
Metals Total/Dissolved																												
Zinc - total	See dissolved	NA	NA	25 U	**1,070**	**3770**	**22,800**	**562**	**342**	**502**	**104**	**32.2**	**17.9 J**	NA	NA	NA	NA	NA	50 U	50 U	50 U	50 U	50 U	**52.7**	50 U	**95.5**	50 U	**91.9**
Zinc - dissolved	81	NA	NA	25 U	25 U	**3,110**	**22,300**	**574**	**378**	**317**	5 U	**18.8**	**16.5 J**	NA	NA	NA	NA	NA	**7.01**	50U	5 U	50U	5 U	50U	50U	**14.6**	5 U	**6.36**
VOCs																												
Benzene	1.6	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	NA	NA	0.35 U	0.35 U	NA	NA	NA	1 U	1 U	1U	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	15000	1U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	180	**16**	**400**	1 U	1 U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane (EDC)	3.5	1U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane	11	1U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	130	1U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	77	1U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	21	1 U	1 U	1 U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	NA	1 U	**3.1**	**5.1**	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	No Criteria	NA	NA	NA	NA	0.04 U	NA	NA	0.02 U	**0.039**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl t-butyl ether	800	**1.1**	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	100	5U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	5U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	2.9	1 U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	**2.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	5400	1U	10 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.7	1 U	1 U	1U	1U	1 U	NA	1 U	1 U	1 U	NA	NA	1 U	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	100	1 U	1 U	1U	1 U	1 U	NA	1 U	1 U	1 U	NA	NA	NA	NA	NA	**8.1**	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.18	**44**	**72**	**0.31**	0.2 U	0.2 U	NA	0.1 U	1 U	1 U	NA	NA	**0.21**	NA	NA	**1.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes, Total	110	2 U	2 U	2 U	2 U	2 U	NA	2 U	2 U	2 U	NA	NA	NA	1 U	**5.6**	**8.3**	3 U	3 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2 Summary of 2000-2024 Direct Push Borehole Groundwater Samples - Select Compounds
Bridge - Former Dawn Foods

Sample ID		**GP-SB-29**	**GP-SB-30**	**GP-SB-31**	**GP-SB-32**	**RI-SB-01**	**RI-SB-02 / Duplicate**	**RI-SB-04**	**RI-SB-05**	**RI-SB-06**	**RI-SB-07 DUP05-0224**	**RI-SB-08 DUP04-0224**	**RI-SB-09 DUP02-0224**	**RI-SB-10**	**RI-SB-11**	**RI-SB-12**	**RI-SB-13**	**RI-SB-14**	**RI-SB-15**	**RI-SB-16**	**RI-SB-17**	**RI-SB-18**
Date Sampled	**Screening Level (ug/L)**	**12/5/2020**	**12/12/2020**	**12/12/2020**	**12/12/2020**	**12/18/2021**	**12/18/2021**	**2/28/2023**	**2/28/2023**	**2/28/2023**	**2/29/2024**	**2/29/2024**	**2/29/2024**	**2/27/2024**	**2/27/2024**	**2/27/2024**	**2/27/2024**	**2/27/2024**	**2/28/2024**	**2/28/2024**	**2/28/2024**	**2/28/2024**
Metals Total/Dissolved																						
Zinc - total	See dissolved	**210**	**67.6**	**17.4**	NA	**38.9**	**31.1 / 77.4**	**65.7**	**138**	**19.0 J**	NA	**31.0**	17.7 U / **9.93 J**	**38.9**	**114**	NA	NA	NA	NA	NA	NA	NA
Zinc - dissolved	81	**209**	**33.0**	**12.3**	NA	**5.49**	**10.7 / 9.96**	7.07 U	**123**	**8.80 J**	NA	**21.7 J**	17.7 U / 7.07 U	**7.29 J**	**102**	NA	NA	NA	NA	NA	NA	NA
VOCs																						
Benzene	1.6	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane	15000	NA	NA	NA	NA	1 U	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	180	NA	NA	NA	NA	1 U	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	**1.4**	**1.2**	**11**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane (EDC)	3.5	NA	NA	NA	NA	0.2 U	0.2 U / 0.2 U	0.2 U	0.2 U	0.2 U	0.2 U / 0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethane	11	NA	NA	NA	NA	1 U	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	130	NA	NA	NA	NA	1 U	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	77	NA	NA	NA	NA	1 U	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	21	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	No Criteria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl t-butyl ether	800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	100	NA	NA	NA	NA	**5.2 ca lc**	**11 ca lc / 9.3 ca lc**	5 U	5 U	5 U	5 U / 5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	2.9	NA	NA	NA	NA	**1.6**	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	**2.9**	1 U	**21**	1 U	**4.1**	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5400	NA	NA	NA	NA	1 U	1 U / 1 U	1 U	1 U	1 U	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	0.7	NA	NA	NA	NA	0.5 U	0.5 U / 0.5 U	0.5 U	0.5 U	0.5 U	0.5 U / 0.5 U	0.5 U	**0.76**	1 U	**2.1**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	100	NA	NA	1 U	1 U	NA	NA	NA	NA	NA	0.5 U / 0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.18	NA	NA	NA	NA	**0.21**	**0.30 / 0.28**	**0.50**	**0.55**	**0.40**	0.02 U / 0.02 U	**0.10**	**0.022**	**0.11**	**0.70**	**0.14**	**0.13**	0.02 U	**0.57**	**0.90**	**0.44**	0.02 U
Xylenes, Total	110	NA	NA	3 U	3 U	NA	NA	NA	NA	NA	0.02 U / 0.02 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2 Summary of 2000-2024 Direct Push Borehole Groundwater Samples - Select Compounds
Bridge - Former Dawn Foods

Notes:
Bold = detection
Shading denotes an exceedance of a screening level
MTCA screening levels are from Preliminary Cleanup Levels (pCUL) for Lower Duwamish Waterway workbook, these have been developed by Ecology specifically for the LDW. Source: https://apps.ecology.wa.gov/cleanupsearch/site/1643#site-documents.
Ca lc= The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.
x = Sample chromatographic pattern does not resemble the fuel standard used for quantitation.
ug/L = micrograms per liters
U = laboratory detection limit
J = reported concentration is an estimate.
VOCs -Volatile Organic Compounds

Table 3 Summary of Monitoring Well Groundwater Samples - Zinc and VOCs
Bridge - Former Dawn Foods

Sample ID		**MW-1**								
							MW-1 / DUP01-0623 (duplicate)	MW-1 / DUP03-0823 (duplicate)		
Date Sampled	**Screening Level (ug/L)**	2/1/2022	4/19/2022	8/8/2022	12/21/2022	3/25/2023	6/21/2023	8/29/2023	10/19/2023	1/10/2024
Sample results are in ug/L										
Metals Total/Dissolved										
Laboratory - Analytical Method for Metals Only		F&B - 6020B	BAL-1638 Mod							
Zinc - total	See dissolved	**234**	**292**	**225**	**652**	**388**	**235 / 237**	**390 / 398**	**949**	**496**
Zinc - dissolved	81	**217**	**282**	**209**	**637**	**380**	**226 / 235**	**386 / 379**	**956**	**528**
VOCs										
Benzene	1.6	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Ethylbenzene	21	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Xylenes, Total	110	NA	NA	NA	NA	NA	NA	NA	NA	3 U
m, p-Xylene	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	100	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Chloroethane	15000	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
1,2-Dichloroethane (EDC)	3.5	0.2 U	0.2 U	NA	0.2 U	0.2 U	0.2 U / 0.2 U	0.2 U	NA	0.2 U
1,1-Dichloroethane	11	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
1,1-Dichloroethene	130	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
trans-1,2-Dichloroethene	77	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
Phenanthrene	No critiera	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U
Methyl t-butyl ether	800	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	100	5 U	5 U	NA	5 U	5 U	5 U / 5 U	5 U	NA	5 U
cis-1,2-Dichloroethene	180	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
Trichloroethane	No critiera	1 U	1 U	NA	1 U	1 U	1 U / 1 U	0.5 U	NA	1 U
1,1,1-Trichloroethane	5400	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
Tetrachloroethene	2.9	1 U	1 U	NA	1 U	1 U	1 U / 1 U	1 U	NA	1 U
Trichloroethene	0.70	0.5 U	0.5 U	NA	0.5 U	0.5 U	0.5 U / 0.5 U	0.5 U	NA	0.5 U
Vinyl chloride	0.18	0.02 U	**0.021**	NA	0.02 U	0.02 U	0.2 U / 0.2 U	0.02 U	NA	0.02 U

Sample ID		**MW-2**								
Date Sampled	**Screening Level (ug/L)**	1/31/2022	1/31/2022	4/19/2022	8/9/2022	12/22/2022	3/26/2023	6/19/2023	8/29/2023	1/22/2024
Sample results are in ug/L										
Metals Total/Dissolved										
Laboratory - Analytical Method for Metals Only		F&B - 6020B	BAL - 1638 Mod.							
Zinc - total	See dissolved	5 U	7.07 U	7.07 U	7.07 U	**11.0 J**	17.7 U	7.07 U	**14.3 J**	7.07 U
Zinc - dissolved	81	50 U	7.07 U	7.07 U	7.07 U	7.07 U	17.7 U	7.07 U	**0.089 J**	7.07 U
VOCs										
Benzene	1.6	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Ethylbenzene	21	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Xylenes, Total	110	NA	NA	NA	NA	NA	NA	NA	NA	3 U
m, p-Xylene	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	100	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Chloroethane	15000	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
1,2-Dichloroethane (EDC)	3.5	NA	NA	NA	0.2 U	NA	0.2 U	NA	NA	0.2 U
1,1-Dichloroethane	11	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
1,1-Dichloroethene	130	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
trans-1,2-Dichloroethene	77	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
Phenanthrene	No critiera	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl t-butyl ether	800	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	100	NA	NA	NA	5 U	NA	5 U	NA	NA	5 U
cis-1,2-Dichloroethene	180	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
Trichloroethane	No critiera	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
1,1,1-Trichloroethane	5400	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
Tetrachloroethene	2.9	NA	NA	NA	1 U	NA	1 U	NA	NA	1 U
Trichloroethene	0.70	NA	NA	NA	0.5 U	NA	0.5 U	NA	NA	0.5 U
Vinyl chloride	0.18	NA	NA	NA	0.02 U	NA	0.02 U	NA	NA	0.02 U

Sample ID		**MW-3**								
Date Sampled	**Screening Level (ug/L)**	1/30/2022	1/30/2022	4/20/2022	8/8/2022	12/22/2022	3/26/2023	6/21/2023	8/29/2023	1/12/2024
Sample results are in ug/L										
Metals Total/Dissolved										
Laboratory - Analytical Method for Metals Only		F&B - 6020B	BAL - 1638 Mod.							
Zinc - total	See dissolved	50 U	17.7 U	17.7 U	17.7 U	7.07 U	17.7 U	7.07 U	**17.0 J**	17.7 U
Zinc - dissolved	81	50 U	17.7 U	17.7 U	17.7 U	7.07 U	17.7 U	7.07 U	**11.5 J**	17.7 U
VOCs										
Benzene	1.6	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Ethylbenzene	21	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Xylenes, Total	110	NA	NA	NA	NA	NA	NA	NA	NA	3 U
m, p-Xylene	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	100	NA	NA	NA	NA	NA	NA	NA	NA	1 U
Chloroethane	15000	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
1,2-Dichloroethane (EDC)	3.5	NA	NA	NA	NA	NA	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethane	11	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
1,1-Dichloroethene	130	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	77	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
Phenanthrene	No critiera	NA	NA	NA	NA	NA	NA	NA	NA	**0.023**
Methyl t-butyl ether	800	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	100	NA	NA	NA	NA	NA	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	180	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
Trichloroethane	No critiera	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	5400	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
Tetrachloroethene	2.9	NA	NA	NA	NA	NA	1 U	1 U	1 U	1 U
Trichloroethene	0.70	NA	NA	NA	NA	NA	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	0.18	NA	NA	NA	NA	NA	0.02 U	0.02 U	0.02 U	0.02 U

Sample ID		**MW-4**								
										MW-4 / DUP-0124 (duplicate)
Date Sampled	**Screening Level (ug/L)**	2/2/2022	2/2/2022	4/20/2022	8/9/2022	12/22/2022	3/26/2023	6/19/2023	8/30/2023	1/11/2024
Sample results are in ug/L										
Metals Total/Dissolved										
Laboratory - Analytical Method for Metals Only		F&B - 6020B	BAL - 1638 Mod.							
Zinc - total	See dissolved	**522 / 537**	**535**	**446**	**106**	**534**	**1,380**	**285**	**212**	**687 / 764**
Zinc - dissolved	81	**500 / 509**	**515 / 516**	**399**	**99.4**	**533**	**1310**	**278**	**167**	**627 / 664**
VOCs										
Benzene	1.6	NA	NA	NA	NA	NA	NA	NA	NA	1 U / 1 U
Ethylbenzene	21	NA	NA	NA	NA	NA	NA	NA	NA	1 U / 1 U
Xylenes, Total	110	NA	NA	NA	NA	NA	NA	NA	NA	3 U / 3 U
m, p-Xylene	2.9		NA		NA	NA	NA	NA	NA	NA
Toluene	100	NA	NA	NA	NA	NA	NA	NA	NA	1 U / 1 U
Chloroethane	15000	1 U / 1 U	NA	1 U	NA	1 U	1 U	1 U	1 U	1 U / 1 U
1,2-Dichloroethane (EDC)	3.5	0.2 U/ 0.2 U	NA	0.2 U	NA	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U / 0.2 U
1,1-Dichloroethane	11	1 U / 1 U	NA	1 U	NA	1 U	1 U	1 U	1 U	1 U / 1 U
1,1-Dichloroethene	130	1 U / 1 U	NA	1 U	NA	1 U	1 U	1 U	1 U	1 U / 1 U
trans-1,2-Dichloroethene	77	1 U / 1 U	NA	1 U	NA	1 U	1 U	1 U	1 U	1 U / 1 U
Phenanthrene	No critiera	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U / 0.02 U
Methyl t-butyl ether	800	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	100	5 U / 5 U	NA	5 U	NA	5 U	5 U	5 U	5 U	5 U / 5 U
cis-1,2-Dichloroethene	180	**1.2 / 1.2**	NA	**2.5**	NA	**1.8**	1 U	**1.5**	**1.5**	1 U / 1 U
Trichloroethane	No critiera	1 U / 1 U	NA	0.5 U	NA	1 U	1 U	1 U	1 U	1 U / 1 U
1,1,1-Trichloroethane	5400	1 U / 1 U	NA	1 U	NA	1 U	1 U	1 U	1 U	1 U / 1 U
Tetrachloroethene	2.9	1 U / 1 U	NA	1 U	NA	**1.2**	**1.9**	**2.4**	**4.8**	1 U / 1 U
Trichloroethene	0.70	0.5 U/ 0.5 U	NA	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U / 0.5 U
Vinyl chloride	0.18	**0.43 / 0.41**	NA	**0.59**	NA	**0.53**	**0.11**	**0.35**	**0.41**	**0.30 / 0.28**

Table 3 Summary of Monitoring Well Groundwater Samples - Zinc and VOCs
Bridge - Former Dawn Foods

Sample ID		MW-5									MW-6									MW-7				MW-8				MW-9				PD/PD1	
				MW-5 / DUP-0422 (duplicate)	MW-5 / DUP-0822 (duplicate)										DUP02-1222 (duplicate)					DUP03-0323 (duplicate)		DUP01-0823		DUP01-0323 (duplicate)				DUP02-0323 (duplicate)					
Date Sampled	**Screening Level (ug/L)**	1/31/2022	1/31/2022	4/21/2022	8/9/2022	12/21/2022	3/25/2023	6/19/2023	8/28/2023	1/22/2024	1/30/2022	1/30/2022	4/21/2022	8/8/2022	12/21/2022	3/25/2023	6/21/20203	8/30/2023	1/10/2024	3/28/2023	6/21/2023	8/28/2023	1/12/2024	3/25/2023	6/19/2023	8/28/2023	1/10/2024	3/28/2023	6/19/2023	8/28/2023	1/9/2024	10/19/2023	1/10/2024
Sample results are in ug/L																																	
Metals Total/Dissolved																																	
Laboratory - Analytical Method for Metals Only		F&B - 6020B	BAL - 1638 Mod.								F&B - 6020B	BAL - 1638 Mod.								BAL - 1638 Mod.				BAL-1638 Mod.				BAL-1638 Mod.				BAL-1638 Mod.	
Zinc - total	See dissolved	**2,020**	**1,930**	**268 / 195**	**32.8 J / 36.9**	**240**	**684**	**638**	**286**	**108**	5 U	17.7 U	17.7 U	7.07 U	7.07 U / 7.07 U	17.7 U	17.7 U	7.07 U	7.07 U	7.07 U	7.07 U	**9.39 J**	7.07 U	7.07 U / 7.07 U *	7.07 U	**10.8 J**	7.07 U	7.07 U	**9.03 J**	**8.84 J**	7.07 U	7.07 U	7.07 U
Zinc - dissolved	81	**1,900**	**1,880**	**122 / 103**	**34.9 J / 33.6**	**241**	**700**	**633**	**202**	**76.0**	50 U	17.7 U	17.7 U	7.07 U	7.07 U / 7.07 U	17.7 U	17.7 U	7.07 U	7.07 U	7.07 U	7.07 U	**10.6 J**	7.07 U	7.07 U / 7.07 U *	7.07 U	**10.1**	7.07 U	7.07 U	7.07 U	**9.71 J**	7.07 U	7.07 U	7.07 U
VOCs																																	
Benzene	1.6	NA	NA	1 U	NA	NA	NA	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	NA	NA	NA	1 U	NA	NA	NA	1 U	NA	NA	NA	1 U	NA	1 U
Ethylbenzene	21	NA	NA	1 U / 1 U	NA	NA	NA	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	NA	NA	NA	1 U	NA	NA	NA	**2.5**	NA	NA	NA	1 U	NA	1 U
Xylenes, Total	110	NA	NA	3 U	NA	NA	NA	NA	NA	3 U	NA	NA	NA	NA	NA	NA	NA	NA	3 U	NA	NA	NA	3 U	NA	NA	NA	**6.1**	NA	NA	NA	3 U	NA	3 U
m, p-Xylene	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	100	NA	NA	1 U	NA	NA	NA	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	1 U	NA	NA	NA	1 U	NA	NA	NA	**6.5**	NA	NA	NA	1 U	NA	1 U
Chloroethane	15000	1 U	NA	1 U / 1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
1,2-Dichloroethane (EDC)	3.5	0.2 U	NA	0.2 U / 0.2 U	NA	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	0.2 U	0.2 U / 0.2 U	0.2 U	NA	0.2 U	0.2 U	0.2 U / 0.2 U	NA	0.2 U / 0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	NA	0.2 U
1,1-Dichloroethane	11	1 U	NA	1 U / 1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U	NA	1 U
1,1-Dichloroethene	130	1 U	NA	1 U / 1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
trans-1,2-Dichloroethene	77	1 U	NA	**1.9 / 1.8**	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	1 U	**1.5**	1 U	**1.4**	1 U	1 U	1 U	1 U	NA	1 U
Phenanthrene	No critiera	NA	NA	0.02 U	NA	NA	NA	NA	NA	**0.024**	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U	NA	NA	NA	0.02 U	NA	NA	NA	0.02 U	NA	NA	NA	0.02 U	NA	0.02 U
Methyl t-butyl ether	800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	NA	NA	NA	NA	NA	NA
Methylene chloride	100	5 U	NA	5 U / 5 U	NA	5 U	5 U	5 U	5 U	5 U	NA	NA	NA	**7.1 lc**	5 U / 5 U *	5 U	NA	5 U	5 U	5 U / 5 U *	NA	5 U / 5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA	5 U
cis-1,2-Dichloroethene	180	**2.5**	NA	**5.0 / 4.7**	NA	**10**	**6.3**	**4.1**	**2.8**	**1.6**	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	**9.0**	**14**	**4.4**	**30**	**6.1**	**12**	**6.1**	**11**	NA	1 U
Trichloroethane	No critiera	1 U	NA	1 U / 1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	NA	NA	1 U / 1 U *	NA	1 U / 1 U	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
1,1,1-Trichloroethane	5400	1 U	NA	1 U / 1 U	NA	1 U	1 U	1 U	1 U	1 U	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA	1 U
Tetrachloroethene	2.9	**3.2**	NA	**6.1 / 6.0**	NA	**5.9**	**9.8**	**9.1**	**20**	**1.0**	NA	NA	NA	1 U	1 U / 1 U *	1 U	NA	1 U	1 U	1 U / 1 U *	NA	1 U / 1 U	1 U	**2.6**	**2.2**	**5.6**	1 U	1 U	1 U	1 U	1 U	NA	1 U
Trichloroethene	0.70	**2.1**	NA	**1.7 / 1.7**	NA	0.5 U	**0.53**	0.5 U	**0.58**	0.5 U	NA	NA	NA	0.5 U	0.5 U / 0.5 U *	0.5 U	NA	0.5 U	0.5 U	0.5 U / 0.5 U *	NA	0.5 U / 0.5 U	0.5 U	**0.98**	**1.8**	**1.1**	**1.2**	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U
Vinyl chloride	0.18	**1.4**	NA	**2.1 / 1.4**	NA	**6.9**	**5.0**	**6.8**	**8.2**	**4.9**	NA	NA	NA	**0.12**	**0.057/0.051***	0.02 U	NA	**0.094**	0.02 U	**0.14 / 0.15**	NA	**0.61 / 0.59**	0.02 U	**1.5**	**5.0**	**1.4**	**22**	**12**	**26**	**19**	**19**	NA	**0.037**

Table 3 Summary of Monitoring Well Groundwater Samples - Zinc and VOCs
Bridge - Former Dawn Foods

Notes:
All results in ug/L.
Bold = detection
Shading denotes an exceedance of a screening level
* Indicates duplicate value with associated normal sample.
MTCA screening levels are from Preliminary Cleanup Levels (pCUL) for Lower Duwamish Waterway workbook, these have been developed by Ecology specifically for the LDW. Source: https://apps.ecology.wa.gov/cleanupsearch/site/1643#site-documents.
MTCA - Model Toxics Control Act
ug/L = micrograms per liters
U = laboratory detection limit
J = reported concentration is an estimate.
NA = Not analyzed
ND = Not detected
VOCs -Volatile Organic Compounds
lc - The presence of the analyte is likely due to laboratory contamination.
ht - The re-run analysis was performed outside the method holding time requirement.

Table 4 Summary 2000-2024 Soil Data -Zinc
Bridge - Former Dawn Foods

Sample ID	Date Sampled	Sample Depth (feet bgs)	Vadose or Saturated	Units	Zinc
GP-SB-5-7	1/2/2020	7	Saturated	mg/kg	**180**
GP-SB-5-12	1/2/2020	12	Saturated	mg/kg	**24.9**
GP-SB-6-4	1/2/2020	4	Vadose	mg/kg	**78.7**
GP-SB-6-10	1/2/2020	10	Saturated	mg/kg	**26.7**
GP-SB-08	6/9/2020	9 to 10	Saturated	mg/kg	**7110**
GP-SB-09	6/9/2020	9 to 10	Saturated	mg/kg	**71.9**
GP-SB-10	6/9/2020	8 to 10	Saturated	mg/kg	**57.6**
GP-SB-11	6/9/2020	4 to 5	Vadose	mg/kg	**459**
GP-SB-12	6/9/2020	8.5 to 9.5	Saturated	mg/kg	**34.5**
GP-SB-18-03	12/1/2020	2 to 3	Vadose	mg/kg	**46.3 J / 55.3**
GP-SB-18-09.5	12/1/2020	9 to 9.5	Saturated	mg/kg	**24.2**
GP-SB-19-03.5	12/1/2020	3 to 3.5	Vadose	mg/kg	**40.1**
GP-SB-19-08.5	12/1/2020	8 to 8.5	Saturated	mg/kg	**57.1**
GP-SB-20-04.5	12/1/2020	3.5 to 4.5	Vadose	mg/kg	**29.7**
GP-SB-20-09	12/1/2020	7 to 9	Saturated	mg/kg	**26.8**
GP-SB-21-05	12/1/2020	3 to 5	Vadose	mg/kg	**19.3**
GP-SB-21-10	12/1/2020	7.5 to 10	Saturated	mg/kg	**27.7**
GP-SB-22-07	12/1/2020	5 to 7	Saturated	mg/kg	**30.2**
GP-SB-22-09	12/1/2020	9 to 10	Saturated	mg/kg	**19.4**
GP-SB-23-05	12/1/2020	3 to 5	Saturated	mg/kg	**67.1 J / 77.5**
GP-SB-23-11	12/1/2020	10 to 11	Saturated	mg/kg	**55.4**
GP-SB-24-10	12/1/2020	7.5 to 10	Saturated	mg/kg	**51.7**
GP-SB-24-12	12/1/2020	10 to 12	Saturated	mg/kg	**43.3**
GP-SB-25-08	12/5/2020	6 to 8	Vadose	mg/kg	**140**
GP-SB-25-13.5	12/5/2020	12 to 13.5	Saturated	mg/kg	**29.2**
GP-SB-26-06	12/5/2020	4 to 6	Vadose	mg/kg	**39.8**
GP-SB-26-12	12/5/2020	10 to 12	Saturated	mg/kg	**22.8**
GP-SB-27-08	12/5/2020	6 to 8	Vadose	mg/kg	**18.5**
GP-SB-27-12	12/5/2020	11 to 12	Saturated	mg/kg	**32.3**
GP-SB-27-14.5	12/5/2020	12 to 14.5	Saturated	mg/kg	**20.7**
GP-SB-28-04	12/5/2020	2 to 4	Vadose	mg/kg	**36.9**
GP-SB-28-08	12/5/2020	6 to 8	Vadose	mg/kg	**17.5**
GP-SB-28-12	12/5/2020	11.2 to 12	Saturated	mg/kg	**39.5**
GP-SB-28-13	12/5/2020	12 to 13	Saturated	mg/kg	**16.5**
GP-SB-29-06.5	12/5/2020	5.2 to 6.5	Vadose	mg/kg	**19.9**
GP-SB-29-10.5	12/5/2020	9.5 to 10.5	Saturated	mg/kg	**28.1**
GP-SB-29-12	12/5/2020	11 to 12	Saturated	mg/kg	**18.4**
GP-SB-30-05.5	12/12/2020	4 to 5.5	Vadose	mg/kg	**58.6**
GP-SB-30-08	12/12/2020	7 to 8	Vadose	mg/kg	**12.1**
GP-SB-30-13.3	12/12/2020	12.5 to 13.3	Saturated	mg/kg	**54.6**
GP-SB-31-06	12/12/2020	4.5 to 6	Vadose	mg/kg	**99.8**
GP-SB-31-08	12/12/2020	7 to 8	Vadose	mg/kg	**22.8**
GP-SB-31-14	12/12/2020	12.5 to 14	Saturated	mg/kg	**23.2**
MW-1 13-14'	12/16/2021	13 to 14	Saturated	mg/kg	**17.8**
MW-2 7.5-9'	12/15/2021	7.5 to 9	Saturated	mg/kg	25 U
MW-2 12.5-14'	12/15/2021	12.5 to 14	Saturated	mg/kg	41.7
MW-3 7.5-9'	12/16/2021	7.5 to 9	Saturated	mg/kg	25 U
MW-3 12.5-14'	12/16/2021	12.5 to 14	Saturated	mg/kg	**38.3**
MW-4 7.5-9'	12/16/2021	7.5 to 9	Saturated	mg/kg	**138**
MW-4 11-11.5'	12/16/2021	11 to 11.5	Saturated	mg/kg	**89.2**
MW-5 12.5-14'	12/15/2021	12.5 to 14	Saturated	mg/kg	**7,000**
MW-6 7.5-9'	12/15/2021	7.5 to 9	Saturated	mg/kg	**36.1**
RI-SB-01-10	12/18/2021	8 to 10	Saturated	mg/kg	**49.2**
RI-SB-01-14	12/18/2021	12.5 to 14	Saturated	mg/kg	**16.9**
RI-SB-02-08	12/18/2021	6 to 8	Vadose	mg/kg	**64.9**
RI-SB-02-12	12/18/2021	10 to 12	Saturated	mg/kg	**25.1**
-SB-04 2-4' / DUP-02282	2/28/2023	2 to 4	Vadose	mg/kg	**694 / 627**
RI-SB-04 11-12'	2/28/2023	11 to 12	Saturated	mg/kg	**116**
RI-SB-05 9-10'	2/28/2023	9 to 10	Saturated	mg/kg	**58.3**
RI-SB-05 12.5-14'	2/28/2023	12.5 to 14	Saturated	mg/kg	**26.0**
RI-SB-06 6-8'	2/28/2023	6 to 8	Saturated	mg/kg	**24.1**
RI-SB-06 12.5-13.5'	2/28/2023	12.5 to 13.5	Saturated	mg/kg	**23.8**
MW-7 8-10'	2/28/2023	8 to 10	Saturated	mg/kg	**21.3**
MW-7 16-18'	2/28/2023	16 to 18	Saturated	mg/kg	**25.9**
MW-8 11-13'	2/28/2023	11 to 13	Saturated	mg/kg	**15.3**
RI-SB-07 10-15'	2/29/2024	10 to 15	Saturated	mg/kg	NA
RI-SB-08 5-10'	2/29/2024	5-10	Vadose	mg/kg	**107**
RI-SB-08 10.6-12.5'	2/29/2024	10.6-12.5	Saturated	mg/kg	**45.3**
RI-SB-09 10-12.5' DUP01-0224	2/29/2024	10-12.5	Saturated	mg/kg	**45.5** **47.9**
RI-SB-10 5-8'	2/27/2024	5-8	Vadose/Saturated	mg/kg	**412**
RI-SB-11 5-7.5'	2/27/2024	5-7.5	Vadose	mg/kg	**335**
Screening Level MTCA Soil Method A/B					24,000
Screening Level MTCA Soil Protective of Groundwater Vadose (based on protection of surface water)					100
Screening Level MTCA Soil Protective of Groundwater Saturated (based on protection of surface water)					85

Notes:

Bold = detection

Shading indicates an exceedance of a screening level

MTCA screening levels are from Preliminary Cleanup Levels (pCUL) for Lower Duwamish Waterway workbook, these have been developed by Ecology specifically for the LDW. Source: https://apps.ecology.wa.gov/cleanupsearch/site/1643#site-documents.

feet bgs = feet below ground surface

mg/kg = milligrams per kilograms

U = laboratory detection limit

J = reported concentration is an estimate.

MTCA - Model Toxics Control Act

Table 5 Summary of 2000-2024 Soil Data - VOCs
Bridge - Former Dawn Foods

Sample ID	Screening Level (mg/kg)	GP-SB-15	GP-SB-1510 (Duplicate)	GP-SB-16-07	GP-SB-16-11	GP-SB-17-05	GP-SB-17-10	GP-SB-31-06	GP-SB-31-14	GP-SB-32-04	GP-SB-32-12	MW-4 11-11.5'	MW-5 12.5-14'	MW-6 7.5-9'	RI-SB-01-10	RI-SB-01-14
Date Sample		6/9/2020	6/9/2020	12/1/2020	12/1/2020	12/1/2020	12/1/2020	12/12/2020	12/12/2020	12/12/2020	12/12/2020	12/16/2021	12/15/2021	12/15/2021	12/18/2021	12/18/2021
Depth ft. bgs		10 to 11	10 to 11	6 to 7	10 to 11	4 to 5	9 to 10	4.5 to 6	12.5 to 14	2 to 4	10.3 to 12	11 to 11.5	12.5 to 14	7.5 to 9	8 to 10	12.5 to 14
Zone		Saturated	Saturated	Saturated	Saturated	Vadose	Saturated	Vadose	Saturated	Vadose	Saturated	Saturated	Saturated	Saturated	Saturated	Saturated
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
CVOCs					CVOCs											
Vinyl chloride	0.0011/0.000056	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
Chloroethane	No Criteria	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	0.5 U	0.5 U	NA	NA
1,1-Dichloroethene	260/1.4	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
Methylene chloride	0.43/0.03	0.5 U	0.5 U	NA	NA	NA	NA	NA	NA	NA	NA	0.5 U	0.5 U	0.5 U	NA	NA
trans-1,2-Dichloroethene	5.2/0.32	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
1,1-Dichloroethane	180/110	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
cis-1,2-Dichloroethene	160/120	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
1,2-Dichloroethane (EDC)	0.35/0.024	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
1,1,1-Trichloroethane	3700/210	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
Trichloroethene	0.0044/0.0027	0.05 U	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	NA	NA
Tetrachloroethene	0.029/0.0016	0.025 U	0.025 U	NA	NA	NA	NA	NA	NA	NA	NA	0.025 U	0.025 U	0.025 U	NA	NA

Notes:
Bold = detection
Shading denotes an exceedance of a screening level
MTCA screening levels are from Preliminary Cleanup Levels (pCUL) for LDW workbook.
feet bgs = feet below ground surface
mg/kg = milligrams per kilograms
U = laboratory detection limit
J = reported concentration is an estimate.
ND = Not detected
MTCA - Model Toxics Control Act
CVOCs - Chlorinated Volatile Organic Compounds

Table 5 Summary of 2000-2024 Soil Data - VOCs
Bridge - Former Dawn Foods

Sample ID	Screening Level (mg/kg)	RI-SB-02-08	RI-SB-02-12 / Duplicate	RI-SB-04 2-4' / DUP-022823	MW-8 11-13'	RI-SB-09 10-12.5'	RI-SB-10 8-10'	RI-SB-11 0.5-2'	RI-SB-11 5-7.5'	RI-SB-13 7.9-9'	RI-SB-13 13.3-15'
Date Sample		12/18/2021	12/18/2021	2/28/2023	2/28/2023	2/29/2024	2/27/2024	2/27/2024	2/27/2024	2/27/2024	2/27/2024
Depth ft. bgs		6 to 8	10 to 12	2 to 4	11 to 13	10 to 12.5	8 to 10	0.5 to 2	5 to 7.5	7.9 to 9	13.3 to 15
Zone		Vadose	Saturated	Vadose	Saturated	Saturated	Saturated	Vadose	Vadose	Saturated	Saturated
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
CVOCs											
Vinyl chloride	0.0011/0.000056	NA	NA	NA	NA	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Chloroethane	No Criteria	NA	NA	NA	NA	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	260/1.4	NA	NA	NA	NA	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Methylene chloride	0.43/0.03	NA	NA	NA	NA	1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	5.2/0.32	NA	NA	NA	NA	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
1,1-Dichloroethane	180/110	NA	NA	NA	NA	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
cis-1,2-Dichloroethene	160/120	NA	NA	NA	NA	0.1 U	0.05 U	**0.34**	**0.061**	0.05 U	0.05 U
1,2-Dichloroethane (EDC)	0.35/0.024	NA	NA	NA	NA	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
1,1,1-Trichloroethane	3700/210	NA	NA	NA	NA	0.1 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Trichloroethene	0.0044/0.0027	NA	NA	NA	NA	**0.088**	0.02 U	**0.29**	**0.092**	0.02 U	0.02 U
Tetrachloroethene	0.029/0.0016	NA	NA	NA	NA	**3.6**	0.025 U	**4.7**	**2.7**	**0.14**	0.025 U

Notes:

Bold = detection

Shading denotes an exceedance of a screening level

MTCA screening levels are from Preliminary Cleanup Levels (pCUL) for LDW workbook.

feet bgs = feet below ground surface

mg/kg = milligrams per kilograms

U = laboratory detection limit

J = reported concentration is an estimate.

ND = Not detected

MTCA - Model Toxics Control Act

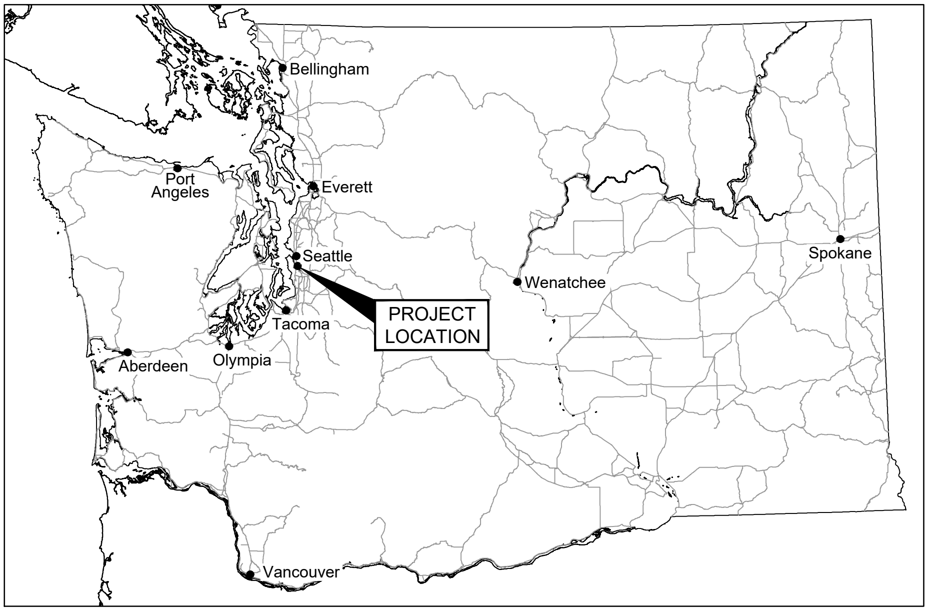
CVOCs - Chlorinated Volatile Organic Compounds

Table 6 Groundwater Remediation Levels
Bridge - Former Dawn Foods

Chemical	Groundwater COI (ug/L)	Source
Zinc	81.0	Protect SW PCUL
Tetrachloroethylene (PCE)	2.90	Protect SW PCUL
Trichloroethylene (TCE)	0.70	Protect SW PCUL
Vinyl chloride	0.18	Protect SW PCUL

Notes:
ug/L = micrograms per liters

Figures



WASHINGTON LOCATION MAP

VICINITY MAP

0 800 1600
SCALE IN FEET

Source: Google Earth. Image date 8/22/2022

File: Dawn Foods Vicmap.dwg Layout: Vicmap

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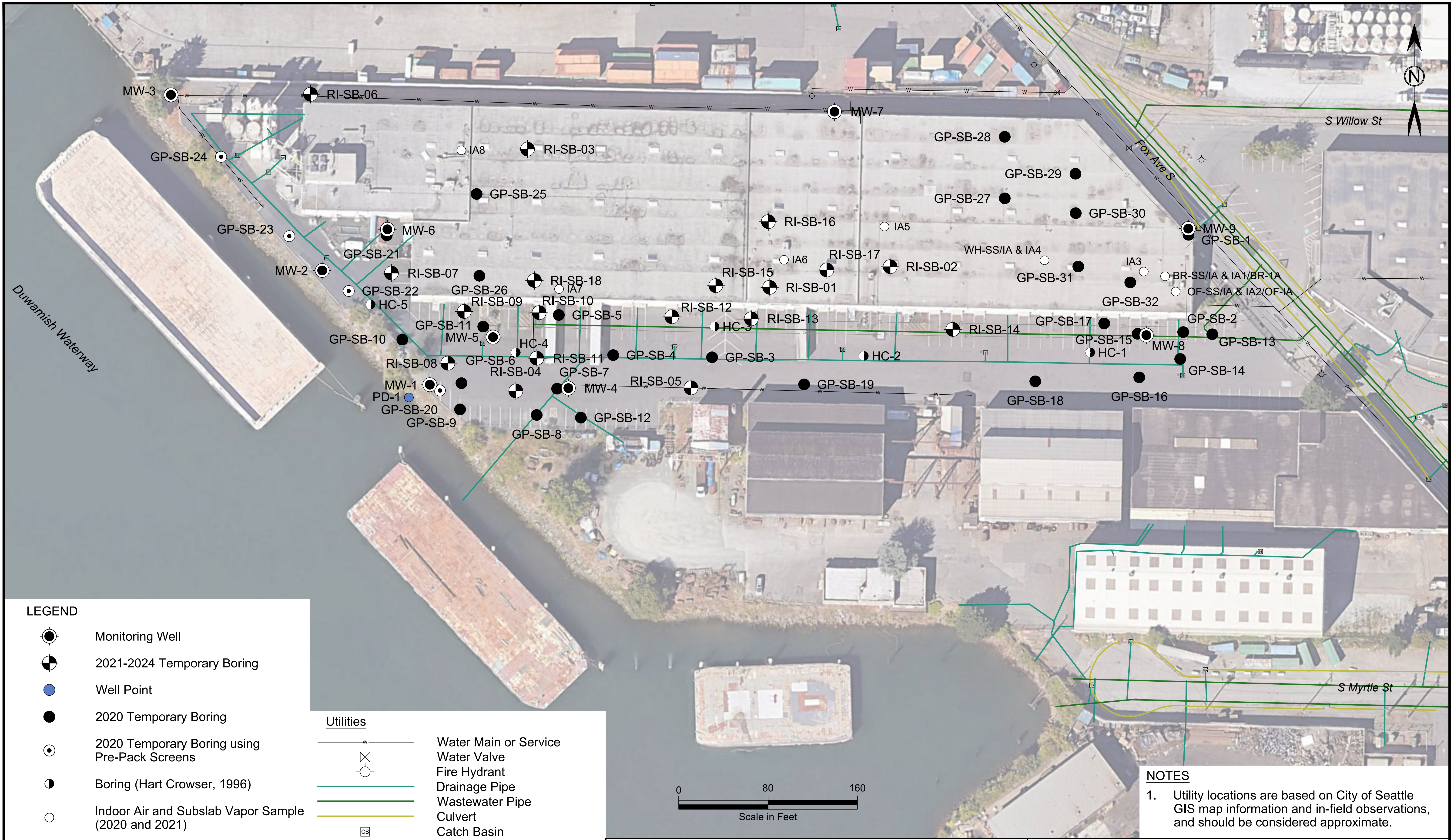
Former Dawn Foods Site
Bridge Point Seattle 130, LLC
1/22/2024

Figure 1
Vicinity Map



LEGEND

◉	Monitoring Well
⊕	2021-2024 Temporary Boring
●	Well Point
●	2020 Temporary Boring
⊙	2020 Temporary Boring using Pre-Pack Screens
◐	Boring (Hart Crowser, 1996)
○	Indoor Air and Subslab Vapor Sample (2020 and 2021)

Utilities

—w—	Water Main or Service
⋈	Water Valve
○	Fire Hydrant
—	Drainage Pipe
—	Wastewater Pipe
—	Culvert
CB	Catch Basin
S	Manhole
—OHP—	Powerline - Overhead
—P—	Powerline - Underground
○	Power Pole
—G—	Gasline

NOTES

1. Utility locations are based on City of Seattle GIS map information and in-field observations, and should be considered approximate.

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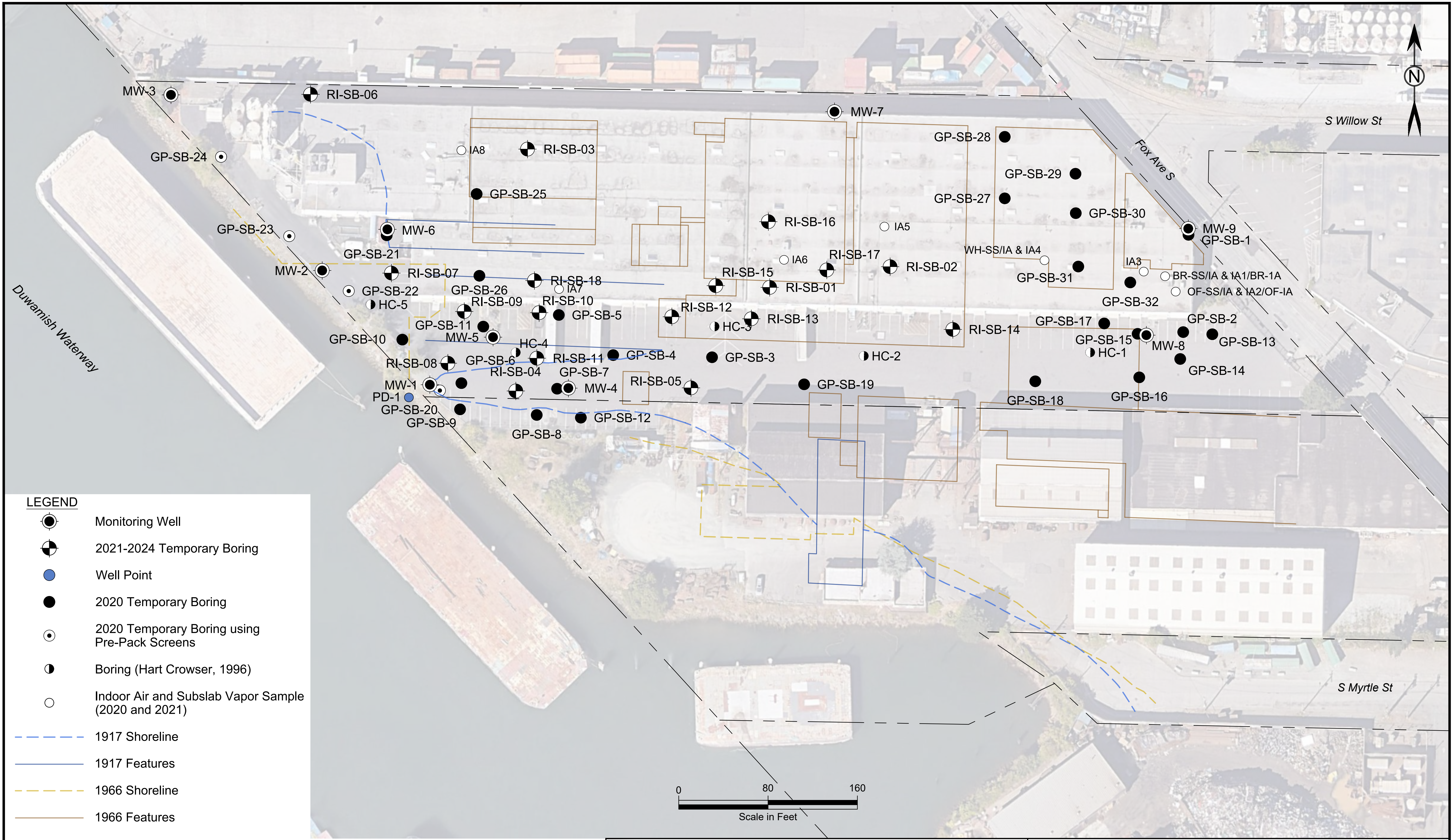
Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 2
Utility Map

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2024.dwg Date: 4/18/2024 | Cabry



File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2024.dwg Date: 4/18/2024 | Cabry

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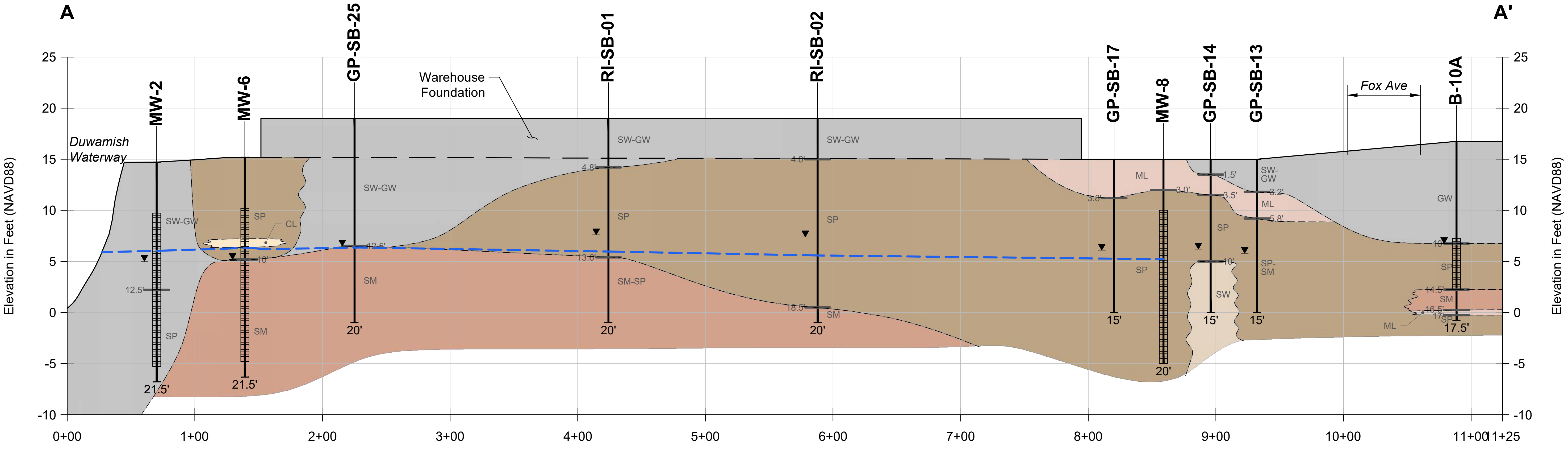
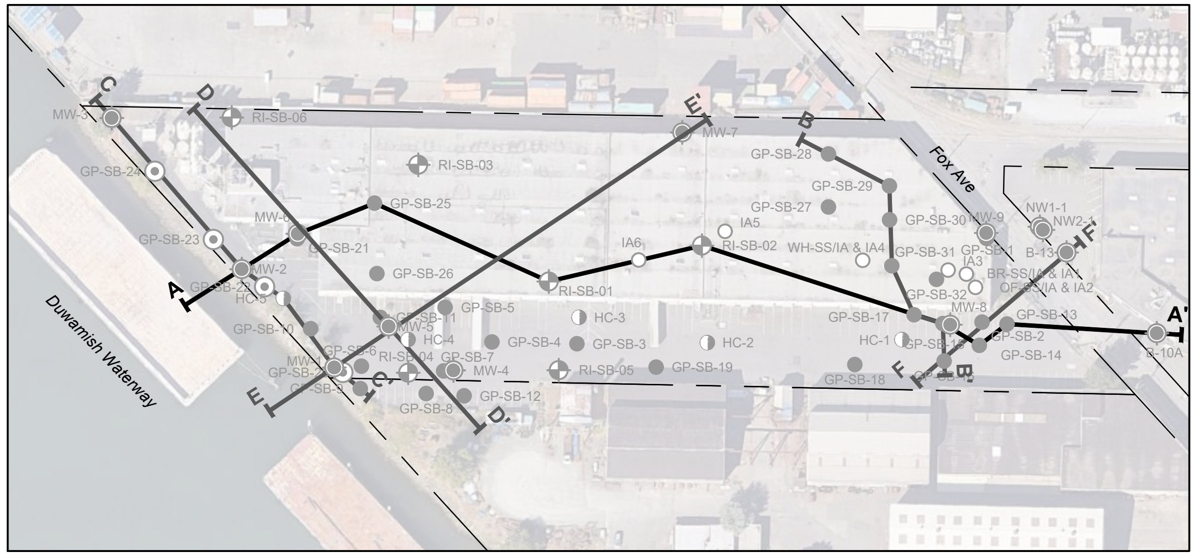
Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 3
Previous Investigation Locations





KEY MAP

LEGEND

B-1 Exploration Designation

2' Noted Lithologic Contact Depth Below Ground Surface (in Feet)

SM Unified Soil Classification System

▼ Water Level Observed at Time of Drilling

– – – Approximate Distinct Lithologic Contact

– – – Approximate Groundwater Surface

▥ Screen Interval

15' Depth of Exploration (in Feet)

LITHOLOGY LEGEND

▨	GW, SW-GW, SW (FILL) - Gravelly Sand or Sand with Gravel, Sometimes with Concrete Rubble, Occasional Wood Debris
▨	SW - SAND - Variable Fine to Fine to Coarse-Grained, often with Gravel or Concrete Rubble, Sometimes Wood
▨	SP - SAND - Variable Fine to Fine to Coarse-Grained, Sometimes Wood/Roots
▨	SM - SILTY SAND, Variable Fine to Fine to Coarse-Grained, Sometimes Wood/Roots, Occasional Clay Seams
▨	ML - SILT or SANDY SILT, often with very fine to fine grained sand
▨	CL - SANDY CLAY, SILTY CLAY

0 10 20
Vertical Scale in Feet

0 80 160
Scale in Feet
Vertical Exaggeration = 8X

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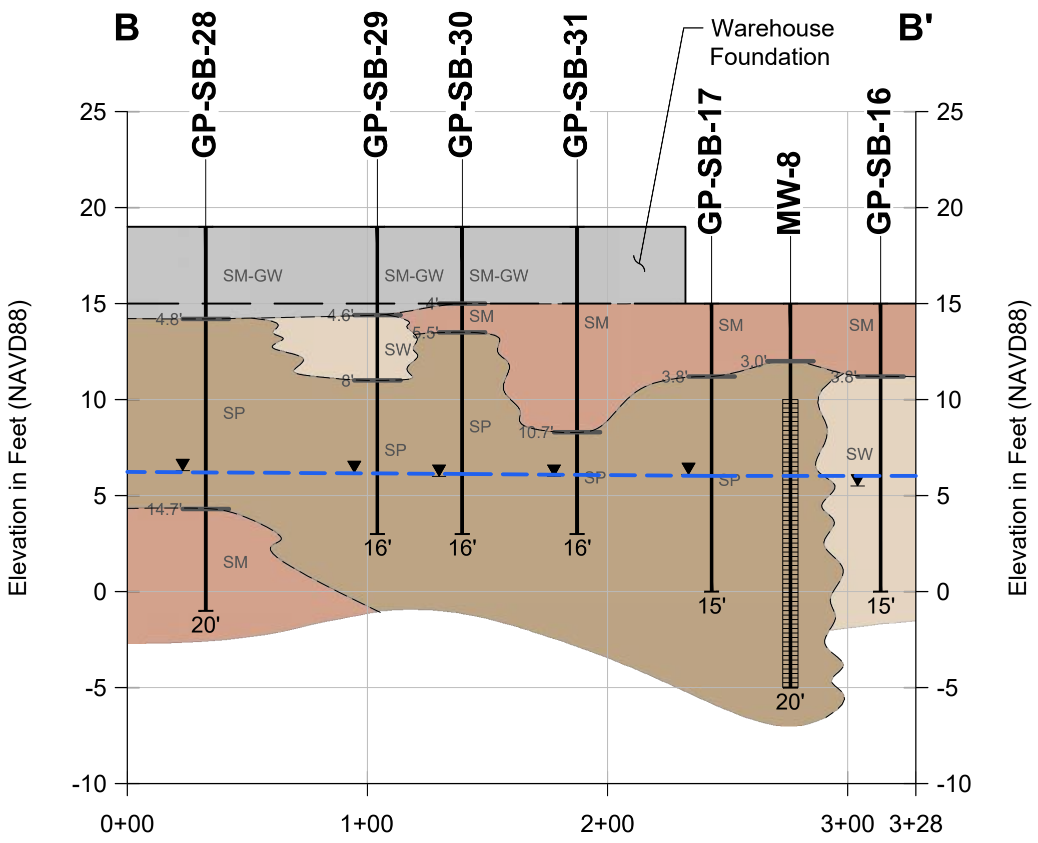
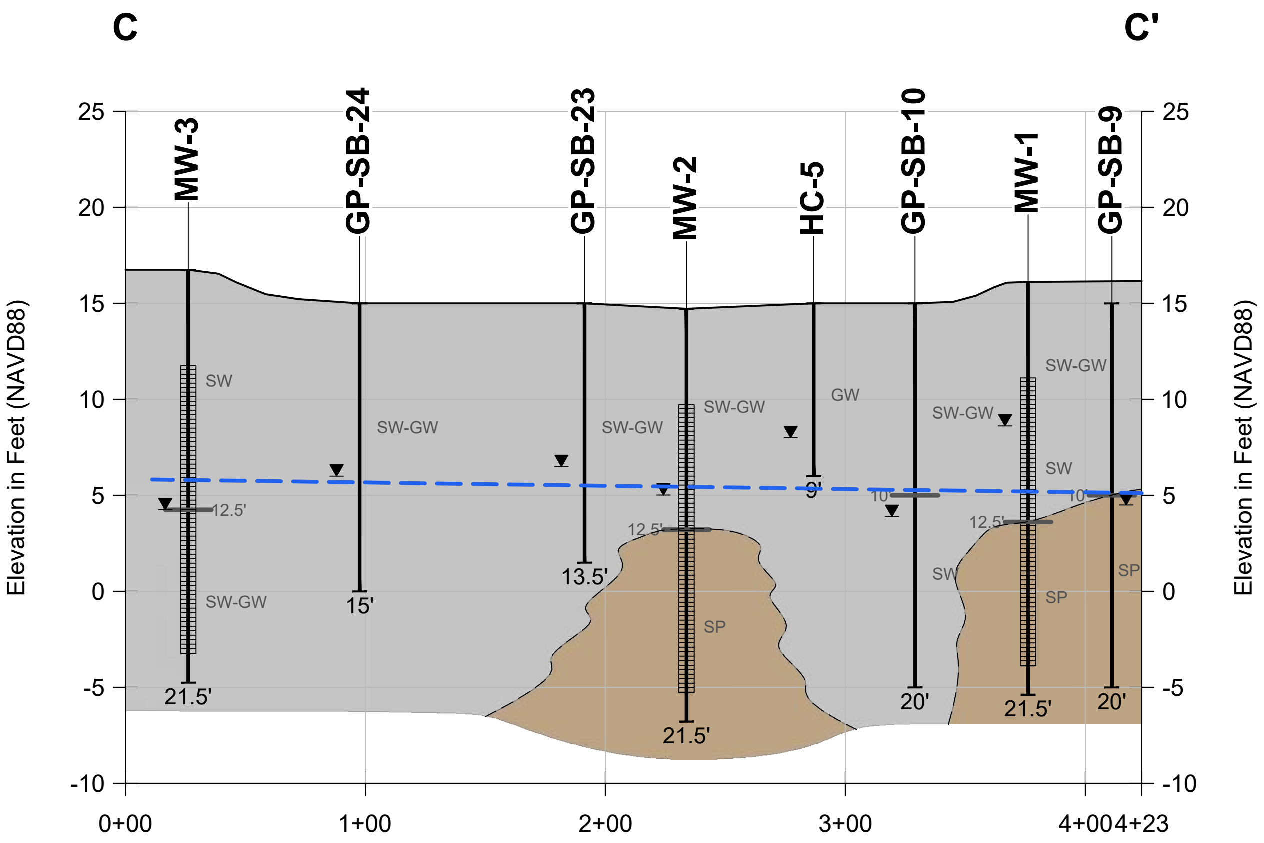
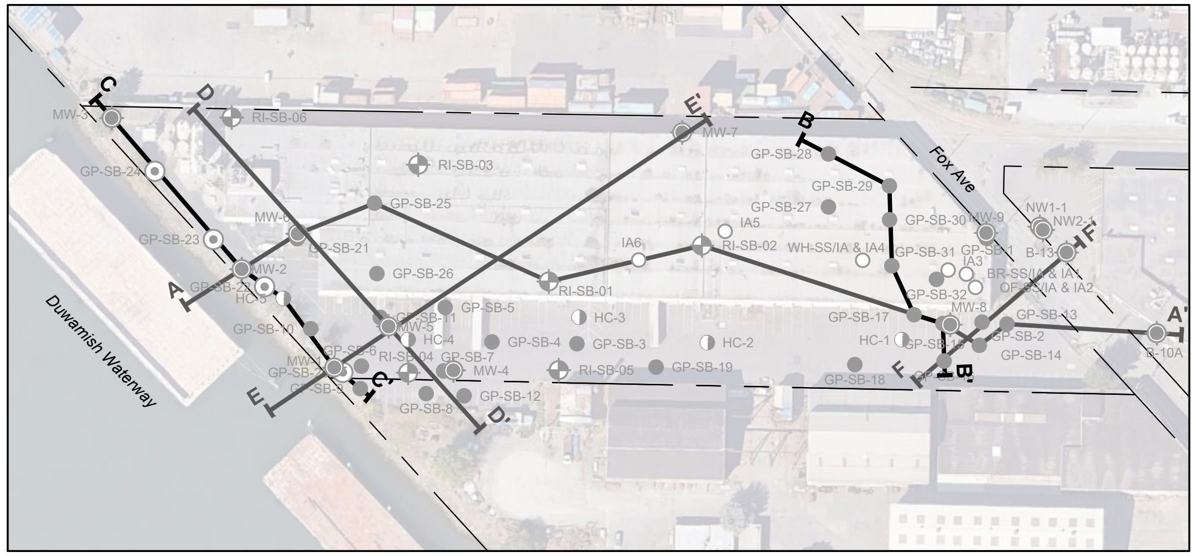
NOTE
Ground surface elevations based on monitoring well survey data and warehouse as-built drawings. Bathymetric data from GIS data for LDW FS posted to LDWG website (https://ldwg.org/project-library/).

Former Dawn Foods Site
Bridge Point Seattle 130, LLC
1/22/2024

Figure 4
Cross Section A-A'







KEY MAP

LEGEND

B-1	Exploration Designation
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SM	Unified Soil Classification System
▼	Water Level Observed at Time of Drilling
- - -	Approximate Distinct Lithologic Contact
- - -	Approximate Groundwater Surface
▥	Screen Interval
15'	Depth of Exploration (in Feet)

LITHOLOGY LEGEND

▨	GW, SW-GW, SW (FILL) - Gravelly Sand or Sand with Gravel, Sometimes with Concrete Rubble, Occasional Wood Debris
▨	SW - SAND - Variable Fine to Fine to Coarse-Grained, often with Gravel or Concrete Rubble, Sometimes Wood
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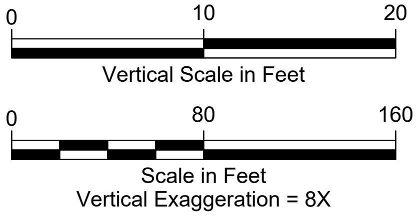
▨	SM - SILTY SAND, Variable Fine to Fine to Coarse-Grained, Sometimes Wood/Roots, Occasional Clay Seams
▨	ML - SILT or SANDY SILT, often with very fine to fine grained sand
▨	CL - SANDY CLAY, SILTY CLAY



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NOTE
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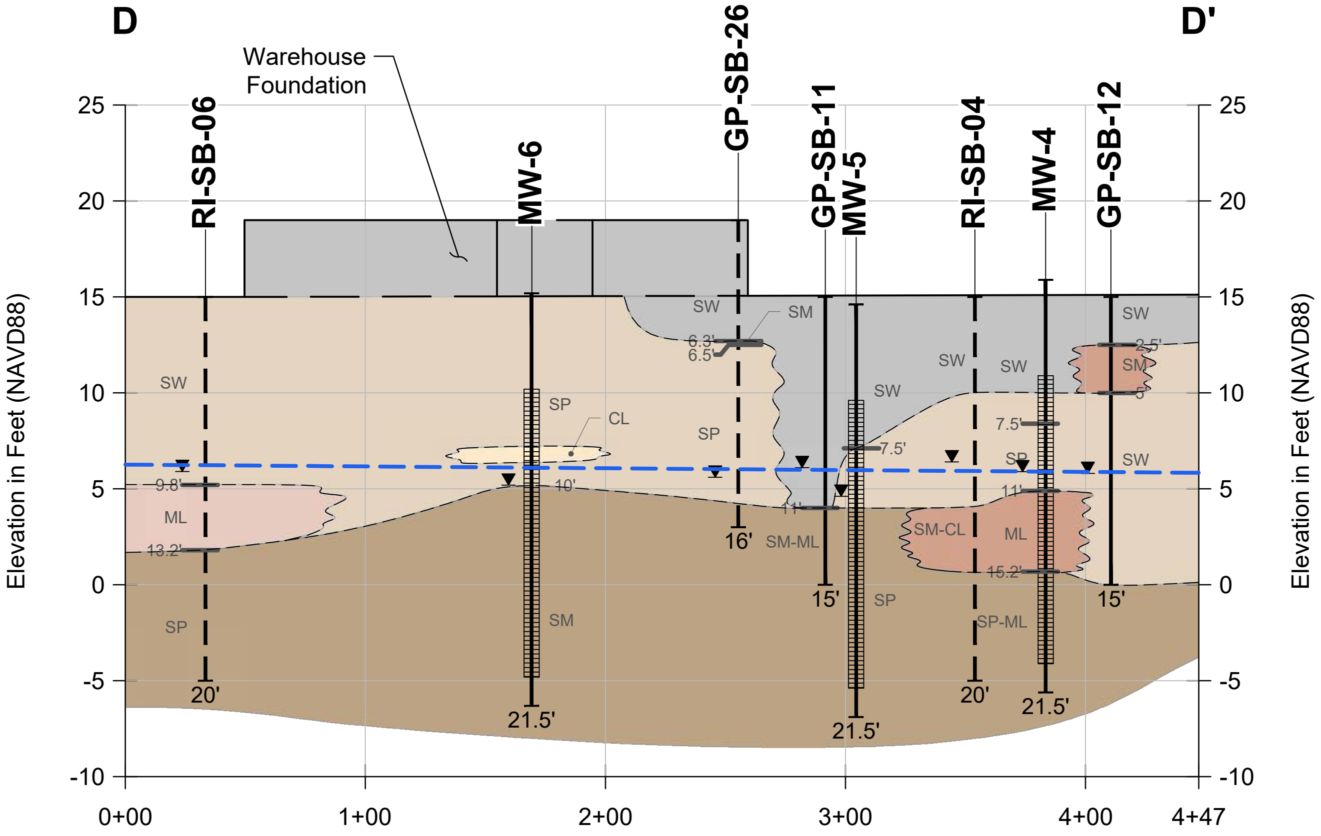
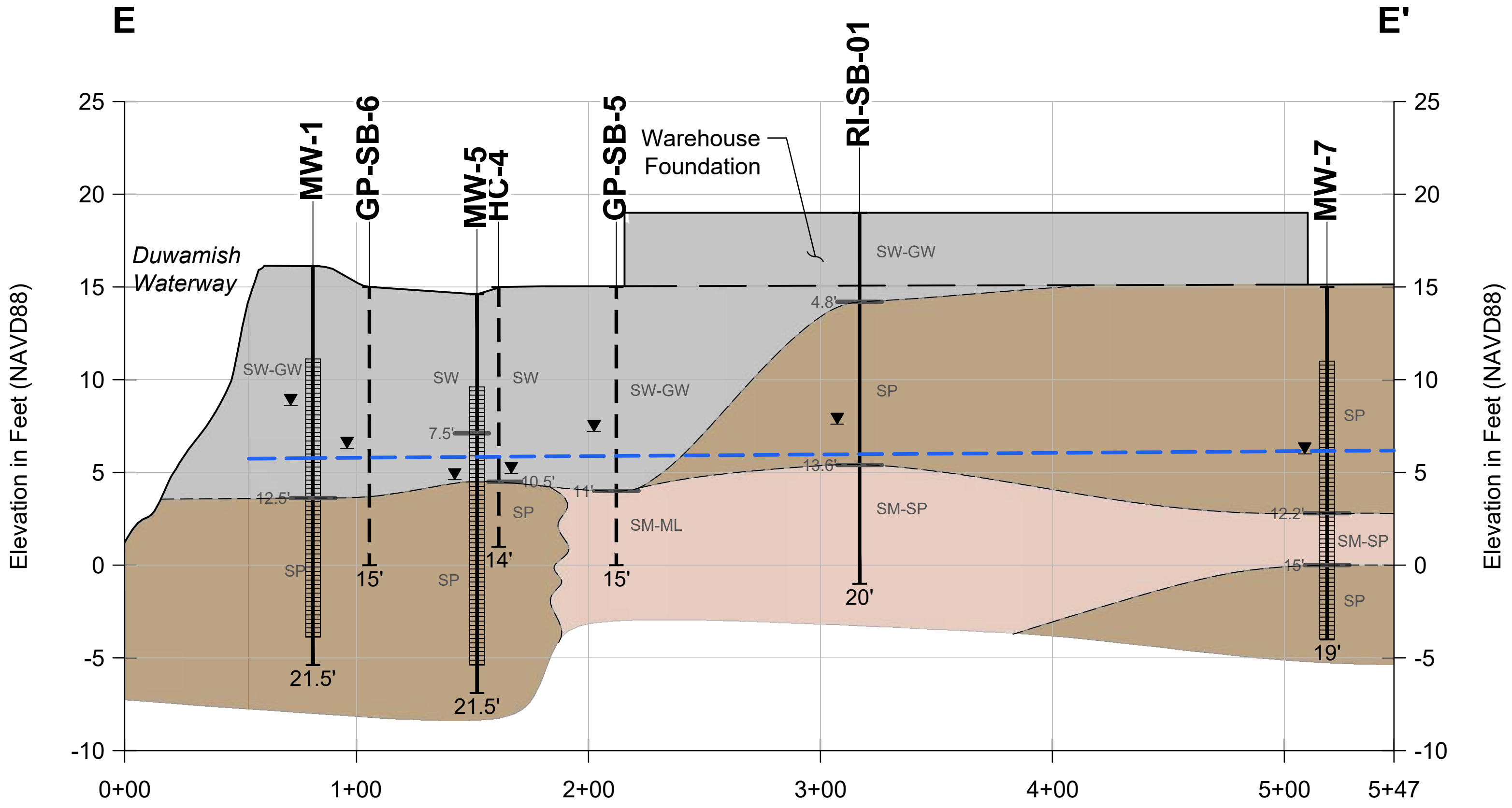
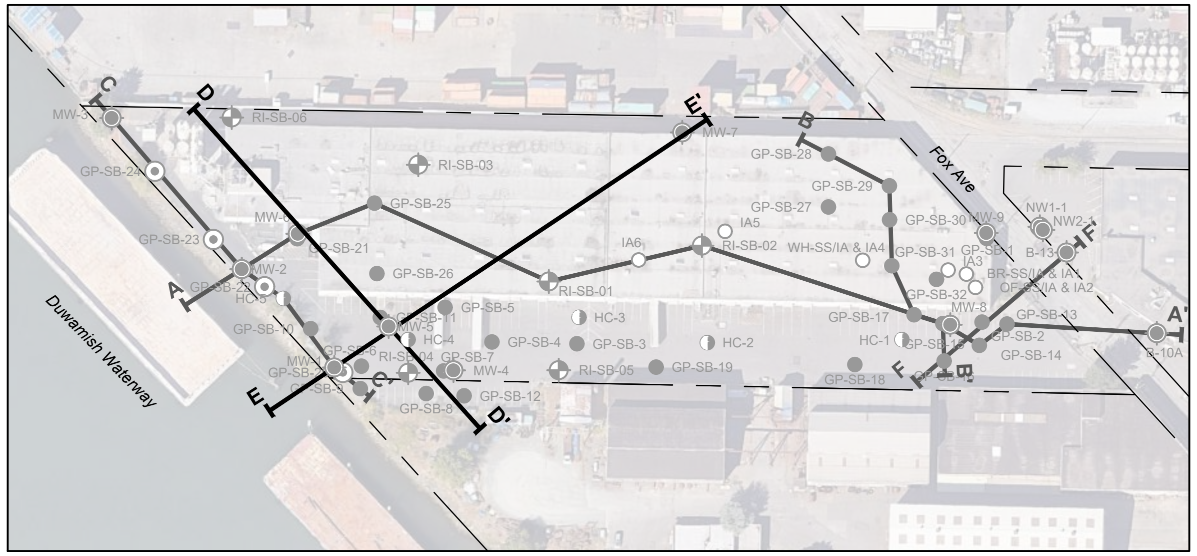
Former Dawn Foods Site
Bridge Point Seattle 130, LLC
1/22/2024

Figure 5
Cross Sections B-B' and C-C'







KEY MAP

LEGEND

B-1	Exploration Designation
2'	Noted Lithologic Contact Depth Below Ground Surface (in Feet)
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▼	Water Level Observed at Time of Drilling
- - -	Approximate Distinct Lithologic Contact
- - -	Approximate Groundwater Surface
▥	Screen Interval
15'	Depth of Exploration (in Feet)

LITHOLOGY LEGEND

■	GW, SW-GW, SW (FILL) - Gravelly Sand or Sand with Gravel, Sometimes with Concrete Rubble, Occasional Wood Debris
■	SW - SAND - Variable Fine to Fine to Coarse-Grained, often with Gravel or Concrete Rubble, Sometimes Wood
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■	CL - SANDY CLAY, SILTY CLAY

0 10 20
Vertical Scale in Feet

0 80 160
Scale in Feet
Vertical Exaggeration = 8X

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NOTE
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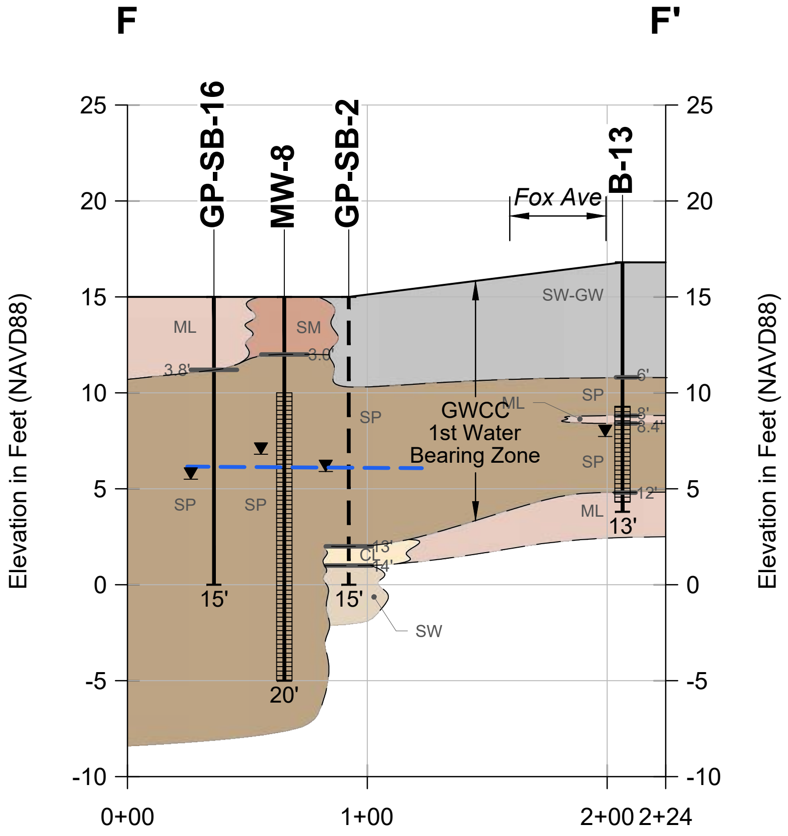
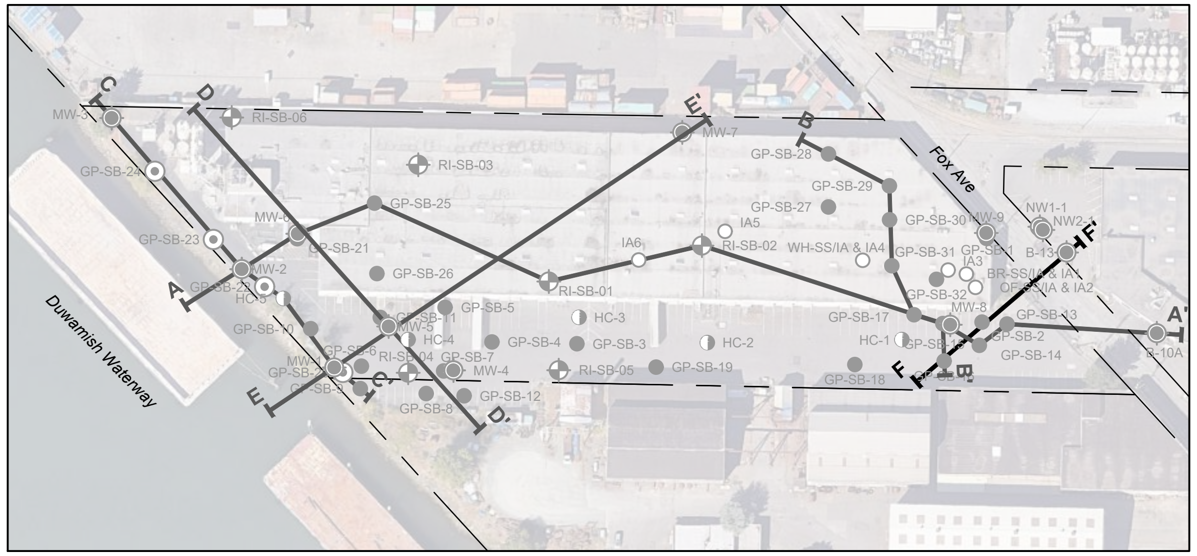
Former Dawn Foods Site
Bridge Point Seattle 130, LLC
1/22/2024

Figure 6
Cross Sections D-D' and E-E'





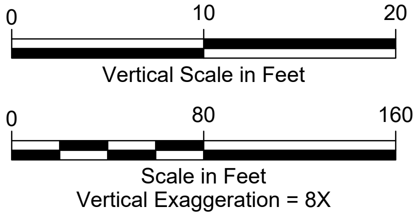
KEY MAP

LEGEND

B-1	Exploration Designation
2'	Noted Lithologic Contact Depth Below Ground Surface (in Feet)
SM	Unified Soil Classification System
▼	Water Level Observed at Time of Drilling
- - -	Approximate Distinct Lithologic Contact
- - -	Approximate Groundwater Surface
▥	Screen Interval
15'	Depth of Exploration (in Feet)

LITHOLOGY LEGEND

⬜	GW, SW-GW, SW (FILL) - Gravelly Sand or Sand with Gravel, Sometimes with Concrete Rubble, Occasional Wood Debris
⬜	SW - SAND - Variable Fine to Fine to Coarse-Grained, often with Gravel or Concrete Rubble, Sometimes Wood
🟫	SP - SAND - Variable Fine to Fine to Coarse-Grained, Sometimes Wood/Roots
🟫	SM - SILTY SAND, Variable Fine to Fine to Coarse-Grained, Sometimes Wood/Roots, Occasional Clay Seams
⬜	ML - SILT or SANDY SILT, often with very fine to fine grained sand
🟨	CL - SANDY CLAY, SILTY CLAY



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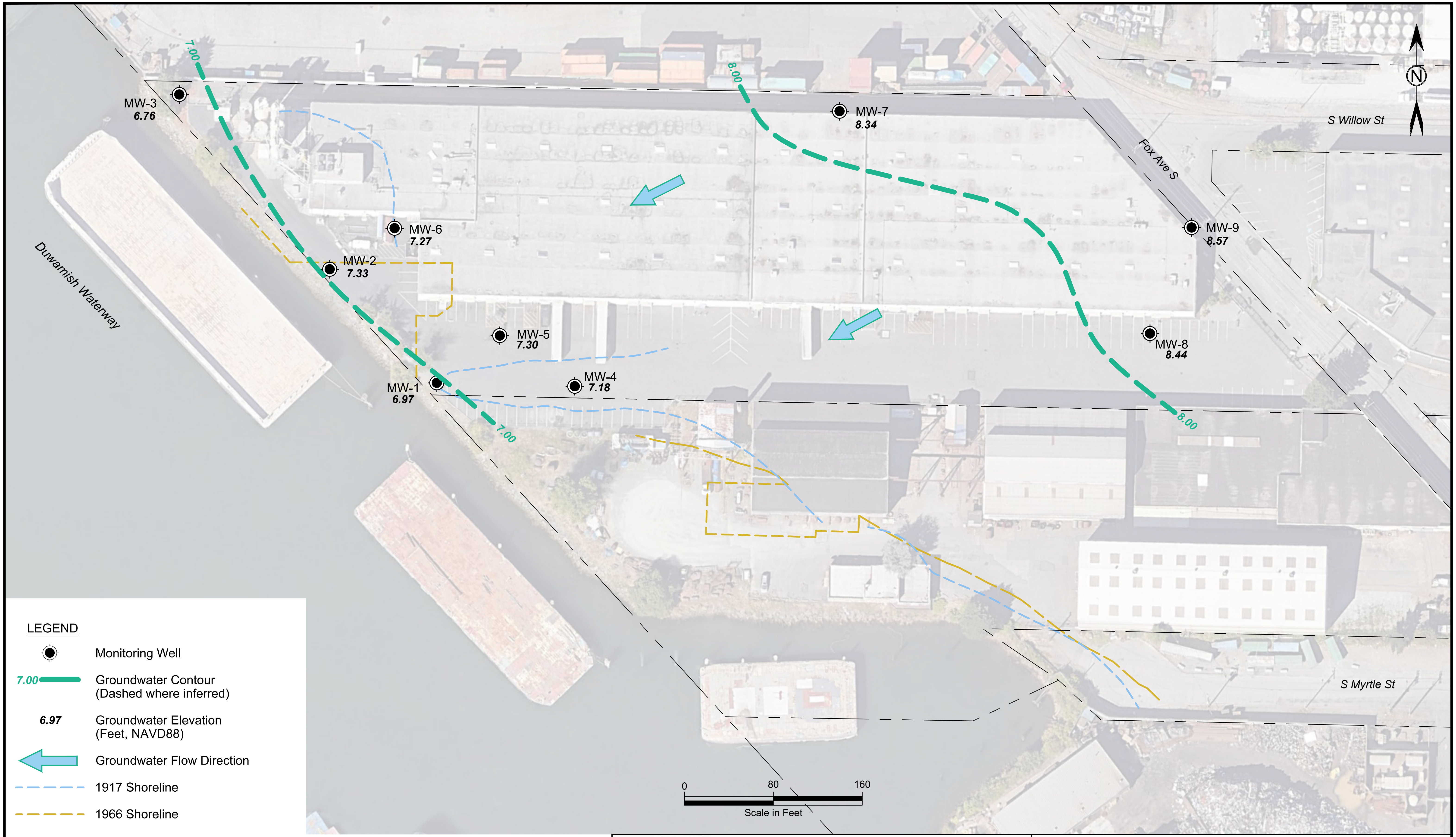
NOTE
Ground surface elevations based on monitoring well survey data and warehouse as-built drawings. Bathymetric data from GIS data for LDW FS posted to LDWG website (https://ldwg.org/project-library/).

Former Dawn Foods Site
Bridge Point Seattle 130, LLC
1/22/2024

Figure 7
Cross Section F-F'



LEGEND

●	Monitoring Well
7.00 ▬	Groundwater Contour (Dashed where inferred)
6.97	Groundwater Elevation (Feet, NAVD88)
←	Groundwater Flow Direction
- - -	1917 Shoreline
- - -	1966 Shoreline

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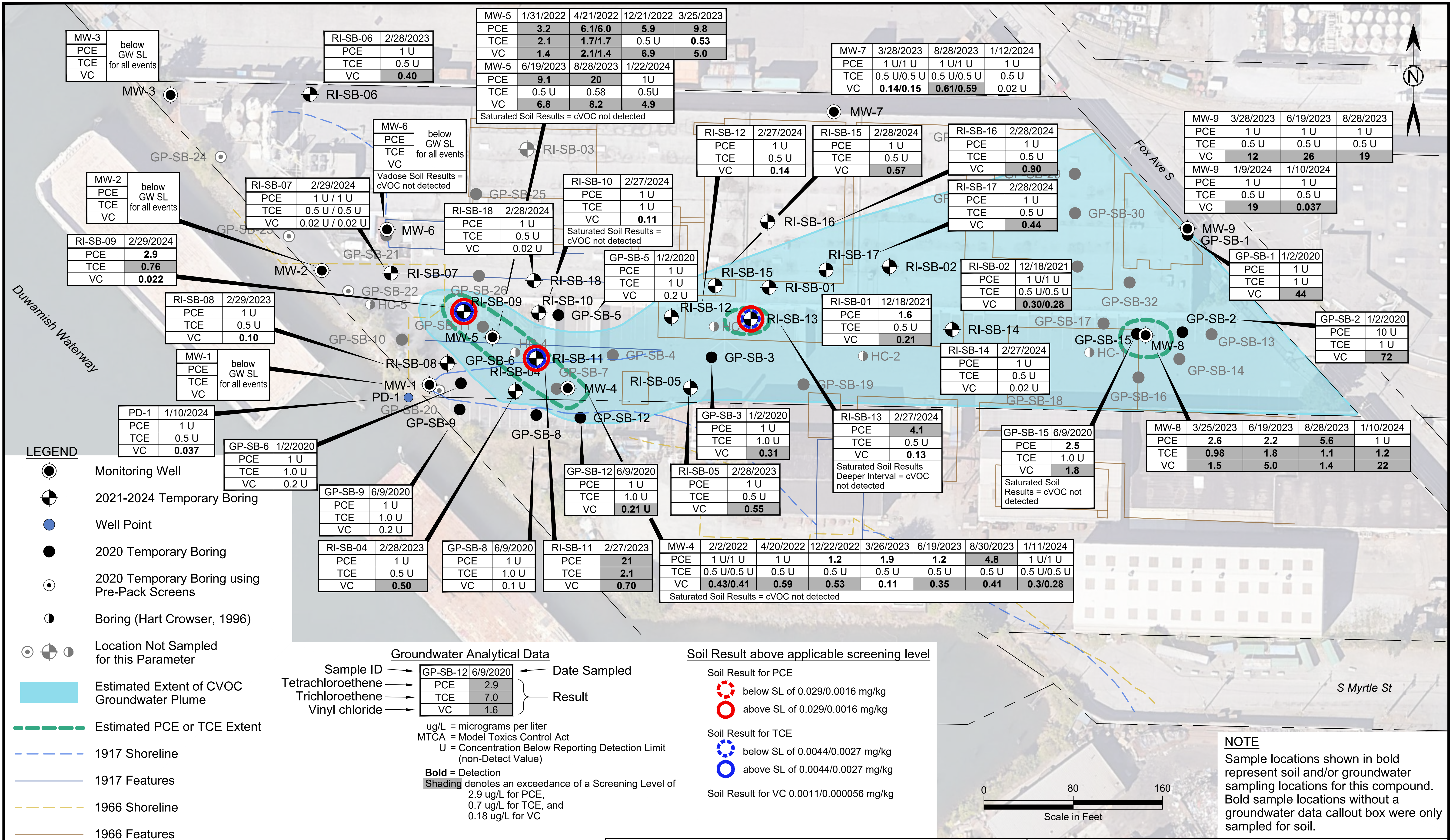
NOTE
All groundwater elevations averaged using Serfes (1991) method from 10/28/2023 05:00 to 10/31/2023 04:59.

Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 8
Groundwater Flow Map



MW-3	below GW SL for all events
PCE	
TCE	
VC	

RI-SB-06	2/28/2023
PCE	1 U
TCE	0.5 U
VC	**0.40**

MW-5	1/31/2022	4/21/2022	12/21/2022	3/25/2023
PCE	**3.2**	**6.1/6.0**	**5.9**	**9.8**
TCE	**2.1**	**1.7/1.7**	0.5 U	**0.53**
VC	**1.4**	**2.1/1.4**	**6.9**	**5.0**

MW-5	6/19/2023	8/28/2023	1/22/2024
PCE	**9.1**	**20**	1U
TCE	0.5 U	0.58	0.5U
VC	**6.8**	**8.2**	**4.9**

Saturated Soil Results = cVOC not detected

MW-7	3/28/2023	8/28/2023	1/12/2024
PCE	1 U/1 U	1 U/1 U	1 U
TCE	0.5 U/0.5 U	0.5 U/0.5 U	0.5 U
VC	**0.14/0.15**	**0.61/0.59**	0.02 U

MW-6	below GW SL for all events
PCE	
TCE	
VC	

Vadose Soil Results = cVOC not detected

MW-2	below GW SL for all events
PCE	
TCE	
VC	

RI-SB-07	2/29/2024
PCE	1 U / 1 U
TCE	0.5 U / 0.5 U
VC	0.02 U / 0.02 U

RI-SB-18	2/28/2024
PCE	1 U
TCE	0.5 U
VC	0.02 U

RI-SB-10	2/27/2024
PCE	1 U
TCE	1 U
VC	**0.11**

Saturated Soil Results = cVOC not detected

RI-SB-12	2/27/2024
PCE	1 U
TCE	0.5 U
VC	**0.14**

RI-SB-15	2/28/2024
PCE	1 U
TCE	0.5 U
VC	**0.57**

RI-SB-16	2/28/2024
PCE	1 U
TCE	0.5 U
VC	**0.90**

RI-SB-17	2/28/2024
PCE	1 U
TCE	0.5 U
VC	**0.44**

MW-9	3/28/2023	6/19/2023	8/28/2023
PCE	1 U	1 U	1 U
TCE	0.5 U	0.5 U	0.5 U
VC	**12**	**26**	**19**

MW-9	1/9/2024	1/10/2024
PCE	1 U	1 U
TCE	0.5 U	0.5 U
VC	**19**	**0.037**

RI-SB-09	2/29/2024
PCE	**2.9**
TCE	**0.76**
VC	**0.022**

GP-SB-5	1/2/2020
PCE	1 U
TCE	1 U
VC	0.2 U

GP-SB-1	1/2/2020
PCE	1 U
TCE	1 U
VC	**44**

RI-SB-02	12/18/2021
PCE	1 U/1 U
TCE	0.5 U/0.5 U
VC	**0.30/0.28**

RI-SB-08	2/29/2023
PCE	1 U
TCE	0.5 U
VC	**0.10**

RI-SB-01	12/18/2021
PCE	**1.6**
TCE	0.5 U
VC	**0.21**

GP-SB-2	1/2/2020
PCE	10 U
TCE	1 U
VC	**72**

MW-1	below GW SL for all events
PCE	
TCE	
VC	

RI-SB-14	2/27/2024
PCE	1 U
TCE	0.5 U
VC	0.02 U

PD-1	1/10/2024
PCE	1 U
TCE	0.5 U
VC	**0.037**

GP-SB-3	1/2/2020
PCE	1 U
TCE	1.0 U
VC	**0.31**

RI-SB-13	2/27/2024
PCE	**4.1**
TCE	0.5 U
VC	**0.13**

Saturated Soil Results Deeper Interval = cVOC not detected

MW-8	3/25/2023	6/19/2023	8/28/2023	1/10/2024
PCE	**2.6**	**2.2**	**5.6**	1 U
TCE	**0.98**	**1.8**	**1.1**	**1.2**
VC	**1.5**	**5.0**	**1.4**	**22**

GP-SB-6	1/2/2020
PCE	1 U
TCE	1.0 U
VC	0.2 U

GP-SB-15	6/9/2020
PCE	**2.5**
TCE	1.0 U
VC	**1.8**

Saturated Soil Results = cVOC not detected

GP-SB-12	6/9/2020
PCE	1 U
TCE	1.0 U
VC	**0.21 U**

RI-SB-05	2/28/2023
PCE	1 U
TCE	0.5 U
VC	**0.55**

GP-SB-9	6/9/2020
PCE	1 U
TCE	1.0 U
VC	0.2 U

RI-SB-04	2/28/2023
PCE	1 U
TCE	0.5 U
VC	**0.50**

GP-SB-8	6/9/2020
PCE	1 U
TCE	1.0 U
VC	0.1 U

RI-SB-11	2/27/2023
PCE	**21**
TCE	**2.1**
VC	**0.70**

MW-4	2/2/2022	4/20/2022	12/22/2022	3/26/2023	6/19/2023	8/30/2023	1/11/2024
PCE	1 U/1 U	1 U	**1.2**	**1.9**	**1.2**	**4.8**	1 U/1 U
TCE	0.5 U/0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U/0.5 U
VC	**0.43/0.41**	**0.59**	**0.53**	**0.11**	**0.35**	**0.41**	**0.3/0.28**

Saturated Soil Results = cVOC not detected

LEGEND

◉	Monitoring Well
⊕	2021-2024 Temporary Boring
●	Well Point
●	2020 Temporary Boring
⊙	2020 Temporary Boring using Pre-Pack Screens
◑	Boring (Hart Crowser, 1996)
⊙ ⊕ ◑	Location Not Sampled for this Parameter
🟦	Estimated Extent of CVOC Groundwater Plume
▬ ▬	Estimated PCE or TCE Extent
– – –	1917 Shoreline
——	1917 Features
– – –	1966 Shoreline
——	1966 Features

Groundwater Analytical Data

Sample ID →
Tetrachloroethene →
Trichloroethene →
Vinyl chloride →

GP-SB-12	6/9/2020
PCE	2.9
TCE	7.0
VC	1.6

← Date Sampled
} Result

ug/L = micrograms per liter
MTCA = Model Toxics Control Act
U = Concentration Below Reporting Detection Limit (non-Detect Value)

Bold = Detection
Shading denotes an exceedance of a Screening Level of 2.9 ug/L for PCE, 0.7 ug/L for TCE, and 0.18 ug/L for VC

Soil Result above applicable screening level

Soil Result for PCE
◌ below SL of 0.029/0.0016 mg/kg
○ above SL of 0.029/0.0016 mg/kg

Soil Result for TCE
◌ below SL of 0.0044/0.0027 mg/kg
○ above SL of 0.0044/0.0027 mg/kg

Soil Result for VC 0.0011/0.000056 mg/kg

NOTE
Sample locations shown in bold represent soil and/or groundwater sampling locations for this compound. Bold sample locations without a groundwater data callout box were only sampled for soil.

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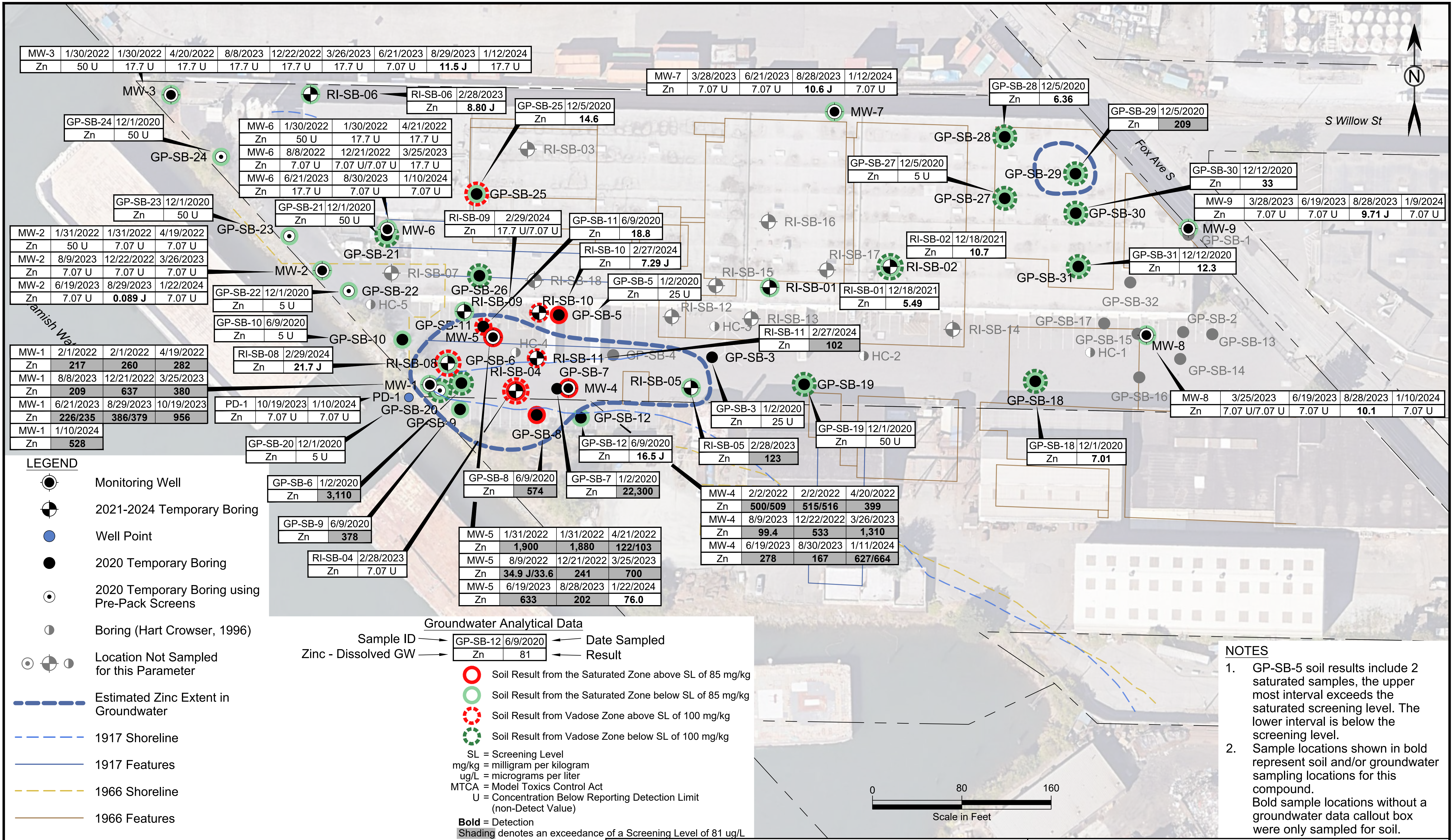
Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 9
Estimated Extent of VOCs
in Soil and Groundwater

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2024.dwg   Date: 5/23/2024 | Cabry



MW-3	1/30/2022	1/30/2022	4/20/2022	8/8/2023	12/22/2022	3/26/2023	6/21/2023	8/29/2023	1/12/2024
Zn	50 U	17.7 U	17.7 U	17.7 U	17.7 U	17.7 U	7.07 U	**11.5 J**	17.7 U

RI-SB-06	2/28/2023
Zn	**8.80 J**

GP-SB-25	12/5/2020
Zn	**14.6**

GP-SB-24	12/1/2020
Zn	50 U

MW-6	1/30/2022	1/30/2022	4/21/2022
Zn	50 U	17.7 U	17.7 U
MW-6	8/8/2022	12/21/2022	3/25/2023
Zn	7.07 U	7.07 U/7.07 U	17.7 U
MW-6	6/21/2023	8/30/2023	1/10/2024
Zn	17.7 U	7.07 U	7.07 U

MW-7	3/28/2023	6/21/2023	8/28/2023	1/12/2024
Zn	7.07 U	7.07 U	**10.6 J**	7.07 U

GP-SB-28	12/5/2020
Zn	**6.36**

GP-SB-29	12/5/2020
Zn	**209**

GP-SB-27	12/5/2020
Zn	5 U

GP-SB-30	12/12/2020
Zn	**33**

MW-9	3/28/2023	6/19/2023	8/28/2023	1/9/2024
Zn	7.07 U	7.07 U	**9.71 J**	7.07 U

GP-SB-23	12/1/2020
Zn	50 U

GP-SB-21	12/1/2020
Zn	50 U

RI-SB-09	2/29/2024
Zn	17.7 U/7.07 U

GP-SB-11	6/9/2020
Zn	**18.8**

RI-SB-02	12/18/2021
Zn	**10.7**

MW-2	1/31/2022	1/31/2022	4/19/2022
Zn	50 U	7.07 U	7.07 U
MW-2	8/9/2023	12/22/2022	3/26/2023
Zn	7.07 U	7.07 U	7.07 U
MW-2	6/19/2023	8/29/2023	1/22/2024
Zn	7.07 U	**0.089 J**	7.07 U

RI-SB-10	2/27/2024
Zn	**7.29 J**

GP-SB-31	12/12/2020
Zn	**12.3**

GP-SB-5	1/2/2020
Zn	25 U

GP-SB-22	12/1/2020
Zn	5 U

RI-SB-01	12/18/2021
Zn	**5.49**

GP-SB-10	6/9/2020
Zn	5 U

RI-SB-11	2/27/2024
Zn	**102**

MW-1	2/1/2022	2/1/2022	4/19/2022
Zn	**217**	**260**	**282**
MW-1	8/8/2023	12/21/2022	3/25/2023
Zn	**209**	**637**	**380**
MW-1	6/21/2023	8/29/2023	10/19/2023
Zn	**226/235**	**386/379**	**956**
MW-1	1/10/2024		
Zn	**528**		

RI-SB-08	2/29/2024
Zn	**21.7 J**

PD-1	10/19/2023	1/10/2024
Zn	7.07 U	7.07 U

MW-8	3/25/2023	6/19/2023	8/28/2023	1/10/2024
Zn	7.07 U/7.07 U	7.07 U	**10.1**	7.07 U

GP-SB-3	1/2/2020
Zn	25 U

GP-SB-19	12/1/2020
Zn	50 U

GP-SB-20	12/1/2020
Zn	5 U

GP-SB-12	6/9/2020
Zn	**16.5 J**

RI-SB-05	2/28/2023
Zn	**123**

GP-SB-18	12/1/2020
Zn	**7.01**

GP-SB-8	6/9/2020
Zn	**574**

GP-SB-7	1/2/2020
Zn	**22,300**

GP-SB-6	1/2/2020
Zn	**3,110**

MW-4	2/2/2022	2/2/2022	4/20/2022
Zn	**500/509**	**515/516**	**399**
MW-4	8/9/2023	12/22/2022	3/26/2023
Zn	**99.4**	**533**	**1,310**
MW-4	6/19/2023	8/30/2023	1/11/2024
Zn	**278**	**167**	**627/664**

GP-SB-9	6/9/2020
Zn	**378**

MW-5	1/31/2022	1/31/2022	4/21/2022
Zn	**1,900**	**1,880**	**122/103**
MW-5	8/9/2022	12/21/2022	3/25/2023
Zn	**34.9 J/33.6**	**241**	**700**
MW-5	6/19/2023	8/28/2023	1/22/2024
Zn	**633**	**202**	**76.0**

RI-SB-04	2/28/2023
Zn	7.07 U

LEGEND

- Monitoring Well
- 2021-2024 Temporary Boring
- Well Point
- 2020 Temporary Boring
- 2020 Temporary Boring using Pre-Pack Screens
- Boring (Hart Crowser, 1996)
- Location Not Sampled for this Parameter
- Estimated Zinc Extent in Groundwater
- 1917 Shoreline
- 1917 Features
- 1966 Shoreline
- 1966 Features

Groundwater Analytical Data

Sample ID → GP-SB-12 | 6/9/2020 ← Date Sampled
Zinc - Dissolved GW → Zn | 81 ← Result

- Soil Result from the Saturated Zone above SL of 85 mg/kg
- Soil Result from the Saturated Zone below SL of 85 mg/kg
- Soil Result from Vadose Zone above SL of 100 mg/kg
- Soil Result from Vadose Zone below SL of 100 mg/kg

SL = Screening Level
mg/kg = milligram per kilogram
ug/L = micrograms per liter
MTCA = Model Toxics Control Act
U = Concentration Below Reporting Detection Limit (non-Detect Value)
Bold = Detection
Shading denotes an exceedance of a Screening Level of 81 ug/L

NOTES

1. GP-SB-5 soil results include 2 saturated samples, the upper most interval exceeds the saturated screening level. The lower interval is below the screening level.
2. Sample locations shown in bold represent soil and/or groundwater sampling locations for this compound.
   Bold sample locations without a groundwater data callout box were only sampled for soil.

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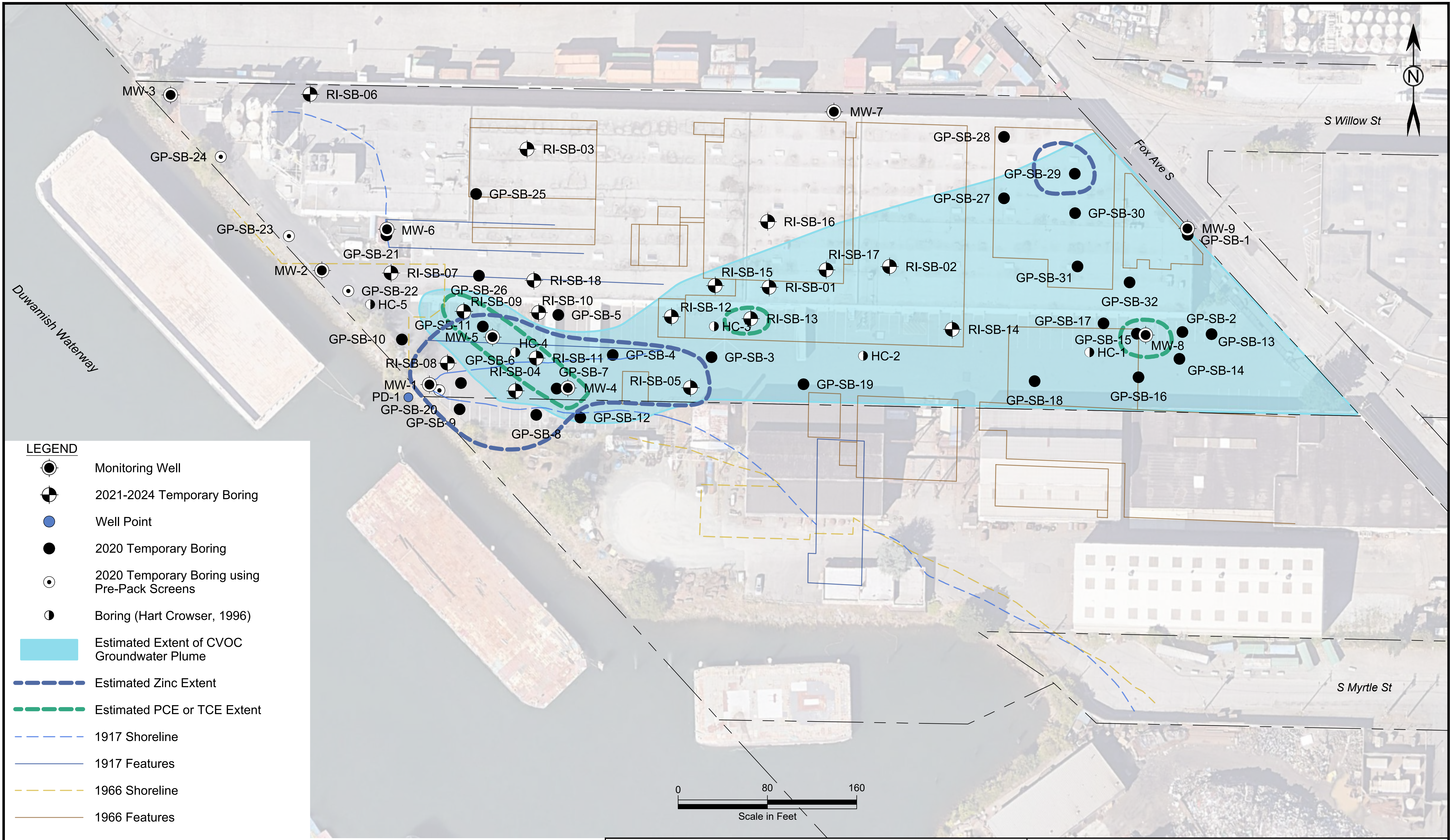
Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 10
Estimated Extent of Zinc
in Soil and Groundwater

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2024.dwg Date: 4/18/2024 | Cabry

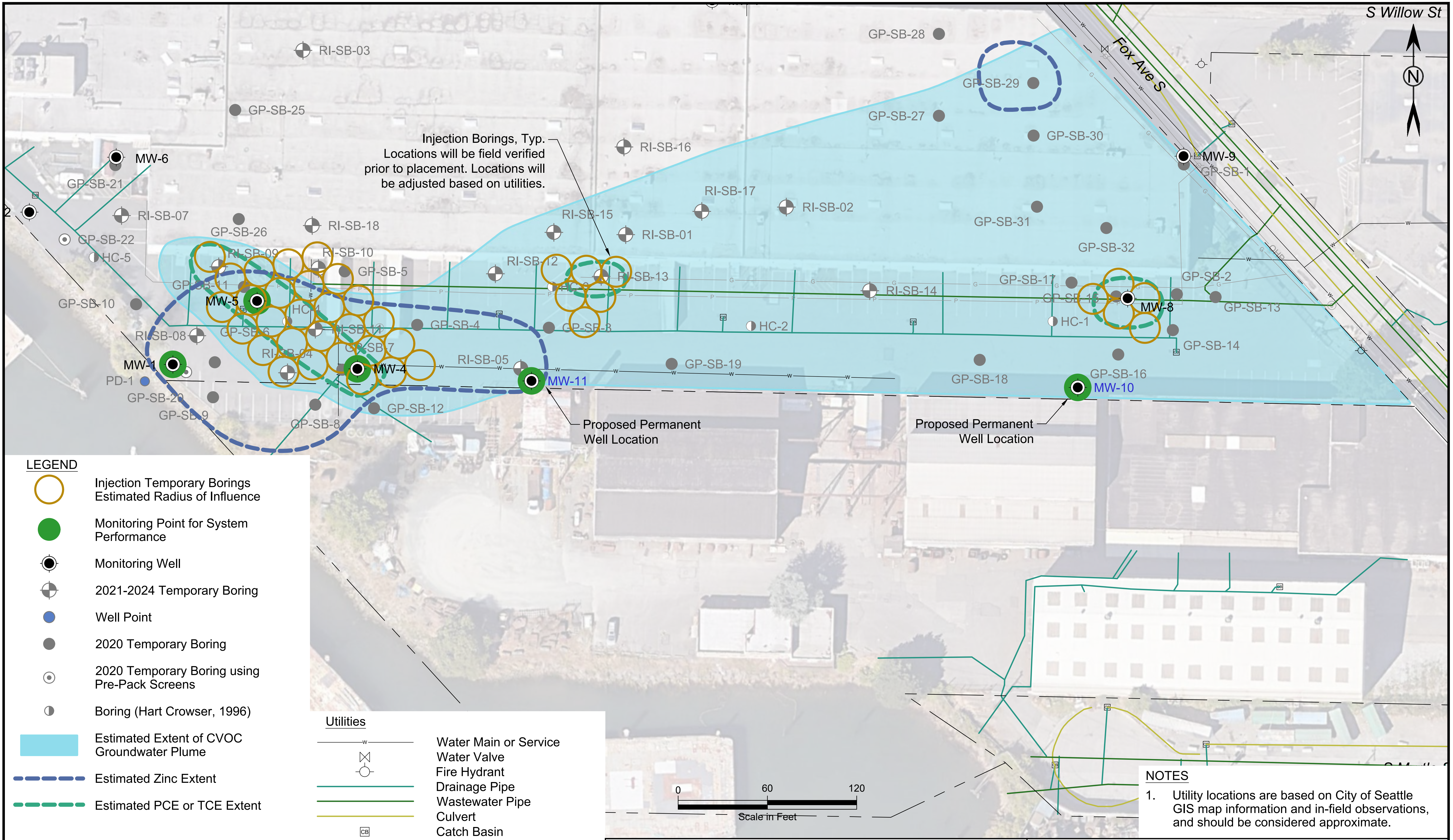


File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2024.dwg Date: 5/23/2024 | Cabry

CRETE
CONSULTING, INC.

Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 11
Estimated Extent of Groundwater Exceeding Screening Levels



LEGEND

○	Injection Temporary Borings Estimated Radius of Influence
●	Monitoring Point for System Performance
⊙	Monitoring Well
⊕	2021-2024 Temporary Boring
●	Well Point
●	2020 Temporary Boring
⊙	2020 Temporary Boring using Pre-Pack Screens
◐	Boring (Hart Crowser, 1996)
🟦	Estimated Extent of CVOC Groundwater Plume
- - -	Estimated Zinc Extent
- - -	Estimated PCE or TCE Extent

Utilities

—W—	Water Main or Service
⋈	Water Valve
-○-	Fire Hydrant
—	Drainage Pipe
—	Wastewater Pipe
—	Culvert
CB	Catch Basin
Ⓢ	Manhole
—OHP—	Powerline - Overhead
—P—	Powerline - Underground
-○-	Power Pole
—G—	Gasline

NOTES

1. Utility locations are based on City of Seattle GIS map information and in-field observations, and should be considered approximate.

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Former Dawn Foods Facility
Bridge Point Seattle 130, LLC
April 19, 2024

Figure 12
Proposed Interim Action - Groundwater

File: D:_Projects\Crete\Dawn Foods\Dawn Foods Sample_2024.dwg Date: 5/23/2024 | Cabry

Appendix A

Enhanced In-Situ Reductive Dechlorination Details

ETEC Advanced Bioremediation Solutions

PMB 133, 3307 Evergreen Way, Ste. 707
Washougal, WA 98671
(971) 222-3580 • (971) 222-3903 Fax
www.etec.bio

April 10, 2024

Ms. Jamie Stevens
Crete Consulting, Inc.
16300 Christensen Road, Suite 214
Tukwila, WA 98188

RE: PROPOSAL FOR IN-SITU REMEDIATION OF CHLORINATED ETHENES USING CARBSTRATE, DAWN FOODS FACILITY, SEATTLE, WASHINGTON

Ms. Stevens:

This proposal provides information and recommendations for the implementation of our specialized CarBstrate™ product to reductively dechlorinate chlorinated solvent compounds. ETEC has successfully demonstrated the use of our CarBstrate™ substrate to the subsurface to promote site-wide and complete reductive dechlorination of chlorinated solvents.

This site is an excellent candidate to implement our aggressive reductive approach, considering the concentrations of chlorinated solvents in the subsurface and the existing groundwater and soil data. The available data indicates that the injection of our CarBstrate™ product will support accelerated, aggressive reductive treatment within a reasonable timeframe (i.e. months).

SITE INFORMATION

General information provided by Crete about the impacted site is as follows:

- A release of chlorinated solvents has occurred and has impacted both soil and groundwater.
- The main contaminants of concern are CVOCs including PCE, TCE, cis-1,2-DCE and vinyl chloride in soil and groundwater.
- Groundwater concentrations range from 1 to 14 µg/L.
- Soil at the site is sand mixed with silt. Peat and wood seams are present below 11 feet bgs.
- MW-05 contains 9.8 µg/L PCE and 5.0 µg/L vinyl chloride.
- MW-04 contains 1.9 µg/L PCE and 0.11 µg/L vinyl chloride.
- Shallow wells are screened from 5 to 20 feet bgs.
- pH is assumed to be neutral
- Bio-parameter data (i.e. DO, ORP, pH, sulfate, and methane) was not available for the site.
- CarBstrate™ will be applied to direct-push injection points

This information was used to specify the CarBstrate™ mass and volume of the injectate.

DESCRIPTION OF BIOREMEDIATION PROCESSES AND PRODUCTS

ETEC's proposed approach is to add a nutrient-amended carbohydrate to the impacted area to overcome the TEA sinks (i.e. dissolved oxygen, nitrate, sulfate, etc.) and create sulfate-reducing and/or methanogenic conditions throughout the target treatment zone. Either one or both conditions will promote the transfer of electrons to the chlorinated solvents, which will reduce their concentrations and remediate the target area.

ETEC estimates substrate quantities/concentrations using stoichiometric ratios of carbohydrate to TEAs and chlorinated solvents, which will then be multiplied by a factor that is based on ETEC's field experience. The intent of this action is to not only fully dechlorinate the minor mass of chlorinated solvents dissolved in groundwater, but also fully dechlorinate most of the chlorinated solvent mass adsorbed onto the organic fraction in the soil matrix as it partitions into the groundwater.

ETEC's soluble nutrient-amended carbohydrate substrate (CarBstrate™) has been utilized throughout the United States with excellent results. In addition to its high solubility and low-retardation factor, CarBstrate™ is a non-toxic product that includes the macro-nutrients that will be necessary for effective microbial growth (i.e., N and P) as well as a specific suite of trace elements that have been shown to be critical for active anaerobic microbial activity. The application of CarBstrate to the subsurface at the site will create the reductive conditions necessary for the reductive dechlorination process to occur. CarBstrate's high solubility allows the injection solution to inject like water, which allows for efficient product distribution even in tight formations. Finally, CarBstrate™ contains a pH buffer to mitigate pH shifts that may be produced by an extremely active microbial community.

CarBstrate™ is provided in 50 pound bags and has no handling restrictions, allowing it to be easily mixed/applied in the field.

APPLICATION DESIGN

The following paragraphs provide specific information on the mass/volume of CarBstrate™ to be delivered to the subsurface.

DESIGN OBJECTIVES: The primary objective of the application includes the reduction of the total solvent mass via reductive dechlorination in groundwater and soil within a reasonable timeframe.

LOCATION: Infrastructure for the remedial action will be designed to influence the plume area that was identified in the figure provided.

- ***INJECTION SPECIFICATIONS:*** ETEC recommends injecting 7,500 lbs. of CarBstrate™ with enough water to make between 20,000 to 40,000 gallons of solution into direct-push injection points. This volume will be split between the injection wells and evenly distributed over the 9-20 ft. thick target zone. Approximately 35 injection points should be placed on 20-foot overlapping centers. Injection can be conducted under pressure and exact pressures and volume will be determined by the Crete and drilling personnel during the injection activities.
- ***TIMEFRAME:*** ETEC and contractor quotes estimate the application timeframe to be 4 to 5 days onsite to inject up to 40,000 gallons of solution based on supplying 1,100 gallons of solution to 35 application points. The time needed for application is based on the achievable injection rate for the site.

MONITORING AND DATA COLLECTION: For baseline and system performance monitoring data, we recommend that groundwater collected from the available wells be analyzed for cVOCs, inorganic analysis (e.g., ammonia, nitrate/nitrite, sulfate, phosphate, dissolved iron, dissolved manganese, and chloride), ethene, ethane, methane, and total organic carbon (TOC). In addition, groundwater quality parameters (i.e. ORP and pH) should be taken during sampling events. ETEC recommends these parameters be sampled and analyzed quarterly, at a minimum. Collection of these parameters will be the responsibility of CRETE, or its subcontractors.

ESTIMATED TREATMENT TIMEFRAME: ETEC estimates a required treatment timeframe of 3-6 months to allow for the reductive dechlorination process to initiate. At least 3 rounds of post-injection data will be required to effectively assess the remedial action. Additional applications may be necessary to reach low MTCA closure goals.

BIOREMEDIATION PRODUCT COSTS

Based on the information summarized above, our costs to supply the substrate are summarized below.

Item	Cost
Substrate	
CarBstrate™ – Initial Supply (7,500 lbs.)	
Shipping (Estimated)	
Sales Tax 10.35%	
SUBSTRATE TO	Not Included

Pricing valid for 180 days.

CLOSURE

ETEC appreciates the opportunity to propose our services for this chlorinated solvent impacted site. We are confident that the summarized approach to reduce contaminant concentrations in groundwater and soil at this site will yield favorable results. Additional applications may be necessary to reach closure goals for the site. Please contact me at 971-222-3616 x102 with questions and comments. We look forward to further discussion on this project.

Respectfully,

ETEC, LLC

____
Jeff Jordan
Northwest Operations Manager

Appendix B

Health and Safety Plan

HEALTH AND SAFETY PLAN
6901 Fox Avenue South, Seattle WA
Former Dawn Foods

Updated April 25, 2024

Prepared for:

Bridge Point Seattle 130, LLC

Prepared by:

CRETE
CONSULTING, INC.

HEALTH AND SAFETY PLAN

6901 Fox Avenue South, Seattle WA

Former Dawn Foods

April 24, 2024

Prepared by:

Rusty Jones

Rusty Jones, Project Geologist

Reviewed by:

Jamie C. Stevens

Jamie Stevens, P.E.

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Acronyms and Abbreviations

ACM	asbestos-containing material
APR	air purifying respirator
CDC	The Centers for Disease Control and Prevention
CIH	Certified Industrial Hygienist
CO_2	carbon dioxide
COC	chemicals of concern
CRETE	CRETE Consulting, Inc.
dB	decibels
DOSH	Washington State Division of Occupational Safety and Health
DOT	United States Department of Transportation
EPA	United States Environmental Protection Agency
HASP	Health and Safety Plan
IDLH	Immediately Dangerous to Life and Health
IDW	investigation-derived waste
JHA	job hazard analysis
MSDS	material safety data sheet
NIOSH	National Institute for Occupational Safety and Health
PEL	permissible exposure limit
PPE	personal protective equipment
SDS	safety data sheet
Site	6901 Fox Ave South, Washington
STEL	short-term exposure limit
TWA	time weighted average
WAC	Washington Administrative Code
WHO	World Health Organization

1 Introduction

This Health and Safety Plan (HASP) describes the health and safety protocols to be used during the 6901 Fox Ave South, Seattle Washington WA (Site) Environmental Site Assessment. The field investigation will include the following site activities:

- Grab groundwater samples from existing monitoring well,
- Installation of groundwater monitoring wells, and
- Injection of fluids into temporary groundwater monitoring points.

CRETE Consulting, Inc. (CRETE) will oversee all field work and collect all soil and groundwater samples from the Site. This plan was written by CRETE. All subcontractors will be contracted through CRETE and be supervised by a CRETE employee. Any further mention of CRETE in this HASP refers to field work performed by CRETE. Subcontractors involved in this work will follow the requirements of this HASP in addition to following their own HASPs. This HASP will address potential chemical hazards and general site safety, but will not address subcontractor-specific hazards related to their equipment or work practices.

General site information is summarized in Table 1-1. Background information pertaining to site history and general hazards is listed in Table 1-2.

In addition to the requirements set forth in this HASP, CRETE personnel shall comply with the HASPs and related protocols of all onsite Contractors and any health and safety protocols required by the Access Agreement.

1.1 Site Safety Plan Acknowledgment and Acceptance

The Field Manager (the CRETE staff onsite leading field activities) shall be responsible for informing all individuals assigned to work on the site of the contents of this HASP and for ensuring that each person signs the Site Safety Plan Acknowledgment Form (Appendix A). By signing the Site Safety Plan Acknowledgment Form, individuals recognize the site health and safety hazards, known or suspected, and will adhere to the protocols required to minimize exposure to such hazards. Subcontractors will also adhere to their own HASPs related to the work they are performing.

Visitors to the site who will not conduct work or enter active work areas will be required to sign the Visitor Sign-In Log in Appendix B.

1.2 Site Health and Safety Meetings

A pre-work meeting addressing site-specific health and safety issues shall be held on the first day of mobilization to the site and prior to the commencement of any work activities. Mandatory attendance is required for all personnel assigned to the particular tasks for which the equipment and crew was mobilized. The intent of these meetings is to discuss the site-specific health and safety issues (such as known or suspected contaminants), not to discuss activity-specific (such as sand blasting) health and safety issues.

At the conclusion of the meeting, personnel are to sign the Site Safety Plan Acknowledgment Form in Appendix A, indicating their attendance and understanding of the health and safety protocols. As additional personnel are assigned to the site, it is the responsibility of the Field Manager to ensure that new personnel are briefed on site-specific health and safety information and that they also have signed the Site Safety Plan Acknowledgment Form (Appendix A).

Daily tailgate meetings will be held by the Field Manager or field staff in charge of the day's activities, and attendance will be documented in the tailgate meeting form in Appendix C.

1.3 Training Requirements

All personnel assigned to work on this site must have successfully completed 40 hours of Training for Hazardous Waste Site Work in accordance with the Washington State Division of Occupational Safety and Health (DOSH) WAC 296-843 or PCB awareness training.

1.4 Medical Monitoring Requirements

All personnel, including subcontractors, assigned to work on this site must be enrolled in a medical surveillance program meeting the requirements of WAC 296-841. Personnel must have successfully passed an occupational physical within the past 12 months and be medically cleared to wear appropriate personal protective equipment (PPE), including the respiratory protection prescribed in this Plan.

1.5 Fit Testing Requirements

All CRETE personnel and subcontractors assigned to work on this site must be familiar with the requirements of the DOSH respiratory standard (WAC 296-841). All personnel who are required to wear respiratory protection must have successfully passed a respirator fit test within the past 12 months. Personnel who do not have a current fit test are prohibited from working in areas where any potential exists for exceeding DOSH Permissible Exposure Limits (PELs). Documentation of a successful respirator fit test for the appropriate type of respirator needed for this work must be maintained by each contractor performing onsite work.

1.6 Project Staff Responsibilities

The Field Manager is responsible for overall project administration and for coordinating health and safety protocols and procedures for all onsite CRETE personnel at all times. All applicable United States Environmental Protection Agency (EPA), DOSH, state, and local health and safety requirements shall be followed throughout the course of the project. Any person who observes health and safety problems or infractions should immediately report the problem or infraction to appropriate personnel.

1.7 Hazard Communication

The Field Manager will advise all CRETE personnel assigned to this site of the hazards associated with working onsite and of the methods to mitigate those hazards and prevent exposures. This information will be presented to personnel prior to initiation of any field activities. The following information regarding site contaminants or any chemicals brought to the site to conduct the work will be presented to site personnel prior to conducting any field work:

- Material Safety Data Sheets or Safety Data Sheets (MSDS/SDS; Appendix D)
- Chemical/physical hazards
- Appropriate PPE for protection from exposure
- Labeling.

Table 1-1 General Information

Client: Bridge	
Site Name: 6901 Fox Ave South- Former Bunge Foods	
Site Location: 6901 Fox Ave South, Seattle WA	
Description of Field Activities: Site groundwater and soil sampling, drilling, and sub surface injection	
Dates of Field Activities: 2024	
Project Manager: Grant Hainsworth, CRETE	**Project Manager Telephone Number:** 253-797-6323
QA Officer: Jamie Stevens, CRETE	**Office:** Seattle
Field Manager: Jamie Stevens, CRETE	
The following requirements have been fulfilled for each employee to work onsite: ☒**Completed OSHA 40-Hour HAZWOPER Training or PCB Awareness Training** ☒**Current Medical Surveillance Examination (within last 12 months)** ☒**Current Respirator Fit Test (within last 12 months)** **Note:** CRETE employees and subcontractors may not enter a site unless the training/qualifications listed above are current.	

Table 1-2 Site Background

Overall Hazard Is:			
High: ☐	**Low:** ☐	**Moderate:** ☒	**Unknown:** ☐
Facility Description: The Property is currently vacant. Past investigations at the site have indicated the soil and groundwater may be contaminated with petroleum products, chlorinated solvents, metals and products associated with historical boat building operations. The source of contamination is from leaks or spills over the operational history of the property.			
Status: This is an active commercial whole sale production facility. Considerable truck traffic is possible. Currently, deliveries are not made via rail, but existing lines are in close proximity to the site.			
Unusual Features (containers, dikes, buildings, power lines, terrain, etc.): None			
Site History (worker injury, complaints, regulatory agency action): None within the last 10 years.			
Potential Waste Types: The site has known contamination in the soil and groundwater. Building materials likely contain contamination.			
Liquid: ☒	**Solid:** ☒	**Sludge:** ☐	**Debris:** ☒
Characteristics:			
Corrosive: ☒	**Ignitable:** ☐	**Volatile:** ☒	**Toxic:** ☒
Reactive: ☐	**Unknown:** ☒	**Radioactive:** ☐	**Other (name):** ☐
Hazards posed by site activities (Job Hazard Analysis in Appendix E): Potential injury during sample collection and possible exposure to contaminated materials.			
Unusual Hazards: None			

2 Health & Safety Risk Analysis

This section identifies the specific hazards associated with the building material field investigation work and presents an analysis of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate exposure to these hazards. Hazards that cannot be eliminated must be abated by use of engineering controls and/or PPE.

2.1 Hazard Analysis Requirements

2.1.1 Job Hazard Analysis

A Job Hazard Analysis (JHA) Form (Appendix E) is a basic tool that allows personnel to think through the steps involved in each job and discuss how to complete the job safely prior to mobilizing to the field. Each JHA accomplishes the following:

- Breaks a job down into individual steps
- Lists the safety hazards in each step
- Lists appropriate precautions to be followed for each hazard and safety resources (engineering controls, PPE, equipment, permits, etc.) to be obtained and coordinated.

Completion of a JHA requires thoroughness and attention to detail, as well as input of all those who participate in the job. As part of this HASP and prior to commencement of work, initial JHA forms (Appendix E) for sample collection and the PCB paint removal pilot study have been completed and reviewed by the project Certified Industrial Hygienist (CIH). Each JHA will be modified if job scope or conditions change. If additional tasks are added to the scope of work in the field, a new JHA will be completed and approved by the CIH prior to the commencement of those additional tasks.

2.2 General Site Hazards

2.2.1 Lighting

Work areas must have adequate lighting for employees to see to work and identify hazards. The building has no electricity and many of the windows have been covered. The interior is dimly lit and all personnel should have flashlights available and auxiliary portable lighting for all indoor activities, or if working outdoors after daylight hours.

2.2.2 Fall Protection

Work site slip, trip, and fall accidents can result in serious injuries or fatalities. Procedures to help prevent these types of incidents will be implemented. Elevated work (above 4 feet) where a fall potential exists will be performed using appropriate ladders and/or fall protection. Applicable DOSH standards for fall protection shall apply (WAC 296-155-246).

2.2.3 Temperature Extremes

The site is in Tacoma, Washington and extreme cold or heat events are unlikely. However, cold or heat stress can occur over prolonged exposures and can be intensified by PPE.

Cold Stress

Site personnel will be instructed on the signs, symptoms, and the prevention of cold-related disorders prior to performing specific work tasks. The two major effects of cold stress are frostbite and hypothermia.

- Frostbite: Sudden blanching of the skin progressing to skin with a waxy or white appearance, which is firm to the touch, but the tissue beneath the skin is resilient to the touch.
- Hypothermia: The symptoms of systematic hypothermia are exhibited as follows: (1) shivering, (2) apathy, listlessness, and (sometimes) rapid cooling of the body to less than 90F, (3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate, (4) freezing of the extremities, and (5) death.

Personnel will monitor themselves and other team members for signs of frostbite and hypothermia. If temperatures fall below 20°F, thermal clothing may be required. Field activities will be curtailed if equivalent wind chill temperatures are less than 0°F, unless operations are of an emergency nature or are conducted indoors.

Heat-Related Illness

Work will be performed in accordance with WAC 296-62-095 with regard to heat-related illness. Site personnel may be required to perform their work tasks in ambient temperatures of 70°F or above or while wearing impervious clothing. All personnel must be instructed on the symptoms of the primary heat-related disorders and how to minimize their chances of becoming affected by them. These disorders, their symptoms, and first-aid measures are outlined below:

- Heat Rash: Decreased ability to tolerate heat, raised red vesicle on affected areas, and clothes that chafe. Maintain good personnel hygiene and use drying powders or lotions.
- Heat Cramps: Muscle spasms and pain in the extremities and abdomen. Rest in cool area and drink plenty of fluids. If pain persists, seek medical attention.
- Heat Exhaustion: Shallow breathing; pale, cool, moist, clammy skin, profuse sweating, dizziness, lassitude, and fainting. Rest in a cool area and drink plenty of fluids. Get medical attention prior to returning to work.
- Heat Stroke: Red, hot, dry skin, no perspiration, nausea, dizziness, confusion, strong rapid pulse, coma. Cool victim immediately with cool or cold water. Seek immediate medical attention.

At a minimum, personnel wearing non-breathable clothing at temperatures greater than 70°F should take a break every one to two hours and drink plenty of fluids. The intake of an average of one quart of fluids per hour is recommended. CRETE is required to provide enough water on site for each employee to drink one quart per hour on site. A cool or shaded rest area should be used.

2.2.4 Eye Wash

All operations involving the potential for eye injury, splash, etc., must have approved eye wash units locally available WAC 296-800-15030.

2.2.5 Hearing Protection

When the noise level of any operation exceeds the 8-hour Time Weighted Average (TWA) of 85 decibels (dB), a hearing protection program meeting the requirements of WAC 296-155-145 will be implemented. Noise monitoring will not be conducted during this project. If it you must raise your voice to be heard when talking to someone three feet away, that noise level is typically around 85 dB.

2.2.6 Fire Prevention

Operations involving the potential for fire hazards shall be conducted in a manner that minimizes the risk. Fire extinguishers shall be used or available as required. Sources of ignition shall be removed.

2.2.7 Confined Space Entry

If any operation is conducted in an area classified as a permit-required confined space by DOSH, a “Confined Space Entry Permit” will be completed and all applicable procedures meeting the requirements of WAC 296-155-203 will be implemented. No confined spacy entry is expected under this scope of work.

2.2.8 Severe Weather and Lightning

The Field Manager will monitor local media resources to identify possible severe weather situations at the project site. Site work may be delayed, postponed, or cancelled due to severe weather based on the Field Manager’s discretion. In the event of a weather emergency, the site will be evacuated in accordance with Section 6 of this document.

Lightning can strike up to a distance of 10 miles, but thunder can only be heard at a distance of 8 miles. Therefore, if site personnel working outdoors hear thunder and/or see lightning, work will be stopped and personnel will move to an indoor location. If indoor facilities are not available, personnel will move inside of passenger vehicles such as cars and pickups. During a thunderstorm with thunder/lightning, avoid trees/poles, standing water, high areas, and metal structures (fences, scaffolding, etc.). Work will resume 30 minutes following the final observance of thunder and/or lightning.

2.2.9 Drum Handling

Accidents may occur during handling of drums and other IDW containers. Hazards include vapor generation and/or physical injury resulting from moving heavy containers by hand and working around drums and heavy equipment. DOSH regulations (WAC 296-155) include general requirements and standards for storing, containing, and handling chemicals and containers, and for maintaining equipment used for handling materials. EPA regulation 40 CFR Part 265 stipulate requirements for types of containers, maintenance of containers and containment structures, and design and maintenance of storage areas. Department of Transportation (DOT) regulations (49 CFR Parts 171 through 178) also stipulate requirements for containers and procedures for shipment of hazardous waste.

- Have a dry chemical fire extinguisher on hand to control small fires.
- Check for labels, markings, etc., and note conditions of containers.
- Before moving any drum or container, determine the most appropriate sequence in which the various containers should be moved.
- Exercise extreme caution in handling drums that are not intact or tightly sealed.
- Use the following types of equipment to move drums and/or containers: 1) drum grappler attached to a hydraulic excavator, 2) small front-end loader with a bucket sling, 3) rough terrain fork lift, or 4) drum cart.
- Train personnel in proper lifting and moving techniques to prevent back injuries.
- Have over packs ready before any attempt is made to move drums.
- Pressurized drums are extremely hazardous. If possible, do not move drums that may be under internal pressure as evidenced by bulging or swelling. This is not expected because the only drums to be handled during the Field Investigation are those storing IDW (PPE, blasting media, decontamination fluid).
- If a drum containing liquid cannot be moved without rupture, immediately transfer its contents to a sound drum using a pump designed for transferring the liquid.
- DO NOT use picks, chisels, or firearms to open drums.
- If pressure must be released manually, place a barrier such as explosion-resistant plastic sheeting between the worker and bung to deflect any gas, liquid, or solid that may be expelled as the bung is loosened.
- Reseal open bungs and drill holes with new bungs or plugs to avoid explosions and/or vapor generation. If an open drum cannot be resealed, place the drum into an over pack. Plug any opening in pressurizing drums with pressure venting caps set for 5 psi.
- Cover drum tops with plastic sheeting or other suitable non-chlorinated material to avoid excessive contact with drum tops.
- Never stand on drum tops.

2.2.10 Ladder Safety

Site activities that include ladder will follow these steps:

- Read and follow all labels/markings on the ladder.

- Avoid electrical hazards– Look for overhead power lines before handling a ladder. Avoid using a metal ladder near power lines or exposed energized electrical equipment.
- Always inspect the ladder prior to using it. If the ladder is damaged, it must be removed from service and tagged until repaired or discarded.
- Always maintain a 3-point (two hands and a foot, or two feet and a hand) contact on the ladder when climbing. Keep your body near the middle of the step and always face the ladder while climbing.
- Only use ladders and appropriate accessories (ladder levelers, jacks or hooks) for their designed purposes.
- Ladders must be free of any slippery material on the rungs, steps or feet.
- Do not use a self-supporting ladder (e.g., step ladder) as a single ladder or in a partially closed position.
- Do not use the top step/rung of a ladder as a step/rung unless it was designed for that purpose.
- Use a ladder only on a stable and level surface, unless it has been secured (top or bottom) to prevent displacement.
- Do not place a ladder on boxes, barrels or other unstable bases to obtain additional height.
- Do not move or shift a ladder while a person or equipment is on the ladder.
- An extension or straight ladder used to access an elevated surface must extend at least 3 feet above the point of support. Do not stand on the three top rungs of a straight, single or extension ladder.
- The proper angle for setting up a ladder is to place its base a quarter of the working length of the ladder from the wall or other vertical surface.
- A ladder placed in any location where it can be displaced by other work activities must be secured to prevent displacement or a barricade must be erected to keep traffic away from the ladder.
- Be sure that all locks on an extension ladder are properly engaged.
- Do not exceed the maximum load rating of a ladder. Be aware of the ladder’s load rating and of the weight it is supporting, including the weight of any tools or equipment.

2.3 Chemical Hazards

Available historical environmental reports for the site indicate that there are no known chemicals of concern (COCs) for this scope of work. Asbestos and lead may be present in building materials. Because the unknown nature of the soil and groundwater COCs, workers should assume that soil and groundwater may have chemicals.

The COCs and applicable occupational exposure limits are listed in Table 2-1. Mold is also present in the building due to deteriorated building condition and water intrusion. There are currently no occupational exposure limits for mold. Workers will use appropriate PPE if exposure to a known or suspected contaminated medium is likely.

The primary routes of exposure for all chemicals on site are the inhalation of building debris particulate, inhalation of fibers, direct skin contact with contaminated media, or the accidental ingestion of contaminated building debris. The hazards are minimized by limiting dust generating activities, the use of vacuums and dust control systems during paint removal, segregating work areas from other non-work areas, the use of wet methods, and PPE.

The hazards discussed in this section represent those known to exist on site. Given the nature of the work on this project, it is of course possible to encounter hazardous materials that had not been previously identified, particularly during sampling activities. It is difficult to predict where unknown contaminants might be present; therefore workers involved in sampling activities must be alert to potentially contaminated media. Sensory cues such as discoloration or unusual odor provide some indication of the presence of contamination. If unanticipated contamination is encountered, all work in the area must cease immediately. If contamination is confirmed, the CIH will be notified and this plan will be amended accordingly.

All work with chemicals and contaminated media, whether previously identified or discovered during the course of work on the site, will be performed in accordance with the requirements of this Health and Safety Plan.

2.4 Potential Exposure Routes

2.4.1 Inhalation

It is assumed that some of the compounds identified in the site assessment will be released during site work in the form of dust. The use of mechanized dust collection systems and segregation of work areas will minimize worker exposure. Other workers in the vicinity of the site work should stage themselves at a safe distance upwind during paint removal or sampling activities, if possible.

Air monitoring will be conducted to ensure workers' airborne exposures are less than the Permissible Exposure Limits (PELs) and project action limits.

2.4.2 Skin and Eye Contact

Skin and eye contact with contaminated media presents a potential for worker exposure. For this reason, sturdy construction clothing, boots, and safety glasses shall be worn at all times by workers on-site to prevent potential exposure. Workers conducting PCB paint removal will be required to use chemical-resistant clothing, goggles, gloves, respirators, and follow decontamination procedures to further minimize the potential for skin contact with contaminated materials.

2.4.3 Ingestion

The inadvertent transfer of site contaminants from hands or other objects to the mouth could occur if site workers engage in eating, drinking, smoking, chewing gum or tobacco, or applying cosmetics in contaminated areas. This could result in accidental ingestion of site contaminants, potentially leading to illness. For this reason, eating, drinking, smoking, chewing gum or tobacco, applying cosmetics or similar activities are not allowed in the work area.

2.5 Chemical Hazard Information and Assessment

Table 2-1 lists the COCs known to be present in building materials on site and DOSH PELs and project action limits for site contaminants in air. The primary contaminants identified on the site are PCBs, lead, and asbestos.

This section discusses the hazards associated with the contaminants remaining on site. Employees may inhale contaminated dusts or come into direct contact with contaminated media while performing building material field investigations or otherwise handling the building materials.

Table 2-1 Chemical Hazards

Contaminant	Unit	PEL[a]	TLV[b]	REL[c]	STEL[d]	IDLH[e]	Odor Threshold	IP[f] (in eV)
Benzene	ppm	1	0.1	0.1	1	500	34-119	9.24
Toluene	ppm	200	50	100	150	500	0.16-37	8.82
Ethylbenzene	ppm	100	100	100	125	800	0.092-0.06	8.76
Xylene	ppm	100	100	100	150	900	20	8.44 - 8.56
Benzo(a)pyrene	mg/m^3	0.2 (soluble aerosol, as coal tar pitches		0.1	10 (mineral mist)	Ca	None Reported	NA
Diesel (as mist)	mg/m^3	5	5	5	10	Ca	None Reported	NA
Gasoline	ppm	None	300	LOQ 15	C, 500	Ca	None Reported	9.24
Phenol	mg/m^3	19	19	19	NA	962.5	0.04	NA
Naphthalene	ppm	10	10	10	15	250	0.084	8.12
Trichloroethylene (TCE)	ppm	100	50	25	NA	1000	1.36	9.45
Tetrachloroethylene (perc; PCE)	ppm	100	100	Ca	100	150 Ca	1	9.32
Dichloroethane	ppm	50	10	1	2	50	11.2	11.05
Dichlorobenzene	ppm	75	25	75	NA	150	0.72	8.98
Vinyl Chloride	ppm	1	1	1	5	NA	0.253	9.80

Note:

[a] OSHA Permissible Exposure Limit (PEL) (8-hour time weighted average [TWA])

[b] American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (8-hour TWA)

[c] National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) (8-hour TWA)

[d] Short-Term Exposure Limit (15-minute TWA that should not be exceeded at any time during the work day)

[e] Immediately Dangerous to Life & Health

[f] Ionization Potential

C = Ceiling Limit (Concentration that should not be exceeded during any part of the working exposure)

CA = Carcinogenic

mg/m^3: milligrams per cubic meter

2.5.1 Other Chemical Hazards

Other hazards may be posed by chemicals brought on site by CRETE or their subcontractors. In accordance with DOSH requirements for hazard communication, MSDS/SDSs are available for all products brought on site. In order to facilitate the accessibility by site workers, all MSDS/SDSs will be maintained in a separate binder and kept on site.

- CRETE employees and subcontractors will bring on site only those materials required to perform work on site. The following procedures will be followed to optimize use of the MSDS/SDSs.
- All CRETE employees will be briefed on material safety procedures, use of MSDS/SDSs for employee health information, and use of MSDS/SDSs for mishap response during safety meetings.
- In the event of a spill or other emergency event involving a material brought on site by CRETE employees, the MSDS binder will be brought to the mishap location for use by the Field Manager.

3 Personal Protective Equipment

PPE is required for all field work. The level of PPE required varies by the type and duration of potential exposures. The EPA terminology for protective equipment (Levels A, B, C, and D) provides guidance on typical work levels and required PPE. Requirements for Level C or Level D PPE are described below. Level A and B PPE are not anticipated for this project and are not described here.

Table 3-1 PPE for Project Activities

Activity	Level of PPE	Special Requirements
Groundwater and soil, sampling	Level D	None
Monitoring well installation	Level D	None
Subsurface injection	Level D	None

3.1 Level D

Level D protection will be used when:

- The atmosphere contains no known hazard.
- Work functions preclude splashes, immersions, or the potential for unexpected inhalation of, or contact with, hazardous concentrations of chemicals.
- Atmospheric concentrations of contaminants are less than one half of the PEL.

Table 3-2 Level D PPE

☒	Standard construction clothing
☒	Work boots with safety toe
☒	Work gloves
☐	Safety goggles
☒	Safety glasses
☒	Hearing protectors (**REQUIRED** if site noise levels are greater than 85 dB based on an 8-hour TWA)
☒	Hard hat (**REQUIRED** if overhead or bump hazards exist)
☐	Hard hat with face shield
☐	**Modifications:**

4 Air Monitoring and Action Levels

According to WAC 296-841, air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection required for personnel working on site.

5 Decontamination

In general, everything that enters the PCB paint removal pilot test area must either be decontaminated or properly discarded upon exit from the containment. Material that is generated by decontamination procedures will be drummed and properly disposed of.

5.1 Personnel Decontamination

Personnel may become contaminated in a number of ways including, not limited to:

- Contacting particulates in the air
- Being splashed by materials during sampling or paint removal tests
- Walking through puddles or on contaminated soil
- Using contaminated instruments or equipment.

Even with safeguards, personnel contamination may occur. Harmful materials can be transferred into the clean area, exposing unprotected personnel. In removing contaminated clothing, personnel may contact contaminants on clothing or inhale them. To prevent such occurrences, decontamination procedures must be developed and established before anyone enters the site and must continue throughout site operations.

Personnel decontamination procedures will be based on the contaminants of concern and the level of protection being worn by site personnel.

5.2 Equipment Decontamination

All equipment will be decontaminated by the operator/subcontractor.

5.3 Disposal of Contaminated Materials

All materials and equipment used for decontamination must be disposed of properly (Table 6-1).

5.4 Emergency Decontamination

Personnel with medical problems or injuries may also require decontamination. There is the possibility that the decontamination may aggravate or cause more serious health effects. If prompt lifesaving, first aid, and medical treatment are required, decontamination procedures will be omitted. In either case, a member of the site management team will accompany contaminated personnel to the medical facility to advise on matters involving decontamination.

5.5 Sanitizing of Personal Protective Equipment

Respirators, reusable protective clothing, and other personal articles not only must be decontaminated before being reused, but also sanitized. The insides of masks and clothing become soiled due to exhalation, body oils, and perspiration. Manufacturer's instructions should be used to sanitize the respirator masks.

Table 5-1 Decontamination Procedures

☒	**Level D:** Wash hands before eating, drinking, smoking, or applying cosmetics. **Modifications:**

6 Emergency Response/Contingency Plan

It is essential that site personnel be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, earthquake, tsunami, or sudden changes in weather. Table 6-1 outlines the contact information for emergencies. The first two numbers should be called in the order listed for all emergencies requiring immediate assistance. The other numbers are specific to emergency type (e.g., spill, poisoning). The Project Manager and the client contact are to be notified of the incident after the emergency situation is addressed.

Table 6-1 Emergency Contacts/Telephone Numbers

1. Fire, Police, Ambulance	911 or
Capable of Transporting Contaminated Personnel?	**Yes:** ☒ **No:** ☐
Hospital:	**Virginia Mason Hospital and Seattle Medical Center** **1100 9th Ave, Seattle, WA 98101** **(206) 223-6600**
Note: See map for route to hospital at the end of this section. ***The route to the hospital was verified by:*** Jamie Stevens. Distance from the Site to the hospital is: 5.7 miles. The approximate driving time is: 11 minutes.	
National Response Center (for spill reporting)	(800) 424-8802
Washington Emergency Management Division (for spill reporting)	(800) 258-5990 or (800) OILS-911
CRETE Consulting Office and Project Manager	Grant Hainsworth (253) 797 -6323 – cell/office
CRETE Consulting Personnel Medical Consultant	Valley Medical Center Occupation Health and Safety
CRETE QA Officer	Jamie Stevens (206) 799-2744 – cell/office
CRETE Field Manager	Jamie Stevens (206) 799-2744 – cell/office
Client Contact	Matt Gladney 425.749.4324

6.1 Incident Reporting and Management

In the event of any type of health or safety incident, including but not limited to, near misses, injury/illness, environmental release or impact, property damage, or a potential exposure the onsite Field Manager is responsible for providing a verbal notification to Port of Tacoma security as well as to Mike Byers, the Crete Project Manager, as soon as possible following the incident. Written follow-up and an evaluation of procedures leading up to the incident may be conducted depending on the severity of the incident.

The following steps should be followed if an injury or illness case occurs:

1) Check the scene of the injury or illness and; either provide first aid, if trained and the conditions are safe to do so, or call 911 to obtain emergency care for the victim.

2) Ensure that appropriate decontamination treatment for exposed or injured personnel is obtained.

3) Once the victim is stabilized, place the following calls in the following order :

Grant Hainsworth (Crete)	**(253) 797-6323 (cell)**

4) Mike Byers will then call the following individuals:

Matt Gladney (Bridge)	**(425) 749-4324 (cell)**

5) If the incident results in one or more fatalities or hospitalization of one or more personnel, notify the Washington State Department of Labor and Industries within 8 hours.

6) The Project Manager or his designee will follow up with the victim after receiving medical attention to find out about the nature of the injury or illness, medical care given, and whether there are any work restrictions or modifications.

Any person transporting an injured/exposed person to a hospital for treatment should take directions to the hospital (Figure 7-1) and information on the chemicals involved with him. Any vehicle used to transport contaminated personnel will be cleaned or decontaminated as necessary.

In order to be prepared for an emergency, field staff should add key phone numbers to their cell phone contact lists, such as Port Security. If using a smart phone onsite, staff should also save hospital directions into the Google Maps or similar application.

6.2 Environmental or Property Damage Incident Response

The Field Manager or designee has primary responsibility for responding to environmental and property damage incidents. The Field Manager will:

1) Take appropriate measures to protect the public and the environment including isolating and securing the site, preventing run-off to surface waters, and ending and/or controlling the emergency to the extent possible.

2) Ensure that the appropriate federal, state, and local agencies are informed and emergency response plans are coordinated. In the event of an air release of toxic materials, 911 and Port Security should be informed in order to assess the need for evacuation.

3) Notify the Project Manager.

6.3 Fire or Explosion

Although unlikely for the anticipated scope of work, in the event of a fire or explosion, the local fire department must be summoned immediately. Upon their arrival, the Field Manager and any additional personnel with firsthand knowledge of the nature of the fire will advise the fire commander of the location and nature of the fire and identification of all hazardous materials on site.

If it is safe to do so and personnel have been properly trained, site personnel may use fire-fighting equipment available on site, or remove or isolate flammable or other hazardous materials, which may contribute to the fire (i.e., incipient stage fire-fighting only).

6.4 Evacuation Routes and Resources

The site is at the head of the Sitcum Waterway. The evacuation route is to the northwest or northeast, toward 11th Avenue. In extreme emergencies, evacuation should be conducted immediately, without regard for equipment or property.

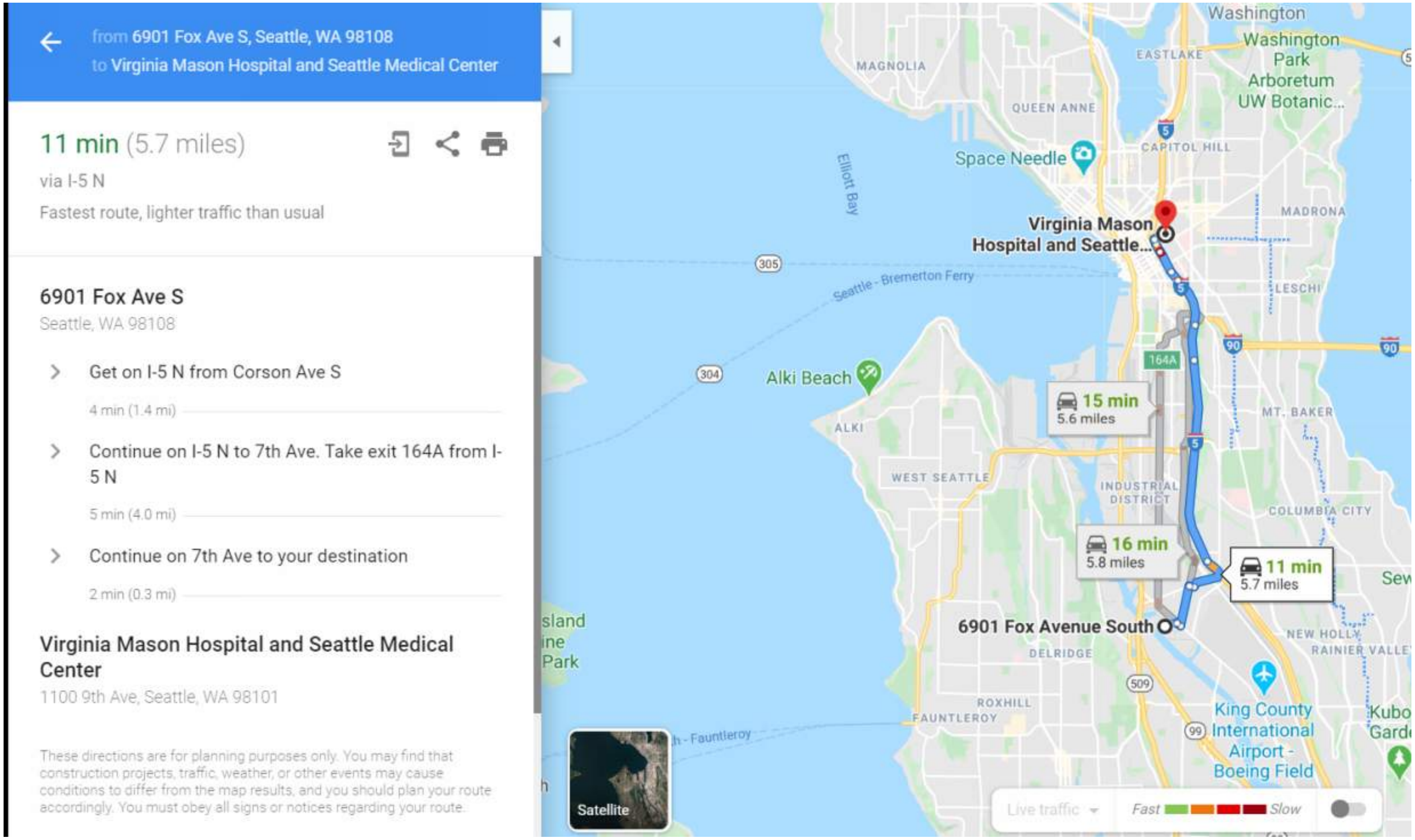
In the event a site evacuation is necessary, all personnel are to:

- Escape the emergency situation
- Decontaminate to the maximum extent practical
- Meet at Port of Tacoma office or some other pre-arranged location
- Notification may be verbal or by a continuous blast on an air horn or vehicle horn.
- Keep upwind of smoke, vapors, or spill location.

Figure 6-1 Route to Hospital

Virginia Mason Hospital and Seattle Medical Center - 1100 9th Ave, Seattle, WA 98101

<u>911 Emergency</u> - (206) 223-6600 Non-Emergency



from 6901 Fox Ave S, Seattle, WA 98108
to Virginia Mason Hospital and Seattle Medical Center

11 min (5.7 miles)
via I-5 N
Fastest route, lighter traffic than usual

6901 Fox Ave S
Seattle, WA 98108

- Get on I-5 N from Corson Ave S
  4 min (1.4 mi)
- Continue on I-5 N to 7th Ave. Take exit 164A from I-5 N
  5 min (4.0 mi)
- Continue on 7th Ave to your destination
  2 min (0.3 mi)

Virginia Mason Hospital and Seattle Medical Center
1100 9th Ave, Seattle, WA 98101

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix A
Site Safety Plan Acknowledgment Form

Site Safety Plan
Acknowledgment Form

I have been informed, understand, and will abide by all the procedures and protocols set forth in this Site Health and Safety Plan for the 6901 Fox Avenue South, Seattle WA Project.

Name (Print)	Signature	Affiliation	Date

Appendix B
Visitor Sign-In Log

Visitor Sign-In Log

Client:____

Project Name:______________________________________

Location:____

Field Activity:_______________________________________

Project Mgr.:_______________________________________

Field Manager:_____________________________________

Date	Name	Affiliation	Purpose of Visit	Site EHS Training		Do you have Level D PPE?		Time In	Time Out
				Yes	No	Yes	No		

Appendix C
Site Safety/Tailgate Meeting Form

Site Safety/Tailgate Meeting Form

Project Name:______________________________ **Location**:______________________________

Date:______________________________ **Time**:______________________________

Project Number:______________________________ **Instructor**:______________________________

Safety Topics Presented

JHA:______________________________

Lessons Learned:______________________________

General Safety Topics:______________________________

Name	Attendee’s Signature

Appendix D
Material Safety Data Sheets/Safety Data Sheets

Appendix E
Job Hazard Analysis Forms

Job Hazard Analysis

JHA Type: ☒ Investigation ☐ O&M ☐Office ☐ Construction	☐ New ☒ Revised	Date: 4/25/24
Work Type: Groundwater Sampling	Work Activity: Groundwater Sampling	

Personal Protective Equipment (PPE): Personal Protective Equipment (PPE): Minimum PPE is Level D including: Hard hat, safety glasses or goggles, steel-toed boots, high visibility safety vest, hearing protection as needed, and gloves as needed (type dependent on job-specific requirements).

Additional PPE may be required in the Health & Safety Plan (HASP). Also refer to the HASP for air monitoring, and emergency procedures.

❶ Job Steps	❷ Potential Hazard	❸ Critical Actions
1. Fluid Level Gauging	Exposure to site contaminants and decontamination chemicals	• Review MSDSs prior to engaging in field activities • Wear appropriate PPE for the task at hand • Review site specific chemical (contaminants present) data prior to work in each area • Wear splash protection especially for exposed skin and eyes. Nitrile gloves and safety glasses are required • Handle decon chemicals carefully • Keep portable eyewash stations nearby in case of splashing of fluids into eyes or on skin
2. Work Area Conditions	Slip, Trip and Fall	• Establish and maintain clean work area • Use of approved lighting units if work after dusk is to be performed • Inspect boots and terrain where sampling will take place. Terrain includes steep riverbank slopes. • Be aware of heavy machinery traffic in area • Alert operators to your presence while in the area sampling • Be aware of icy conditions
	Lifting/Tool Usage	• Use proper lifting methods – use legs to lift, not the back • Training, use of protective (leather) gloves and eye protection • Wear proper hearing protection while in areas of high ambient noise levels • Use leather gloves while working with well covers to minimize pinch and impact hazards from well covers
	Cold Stress	• Wear clothing appropriate for weather conditions • Change clothing in the event it becomes wet • Monitor self and other workers • Leave no skin surface exposed at temperatures/wind chills of 40^{o}F or less

3. Collecting Groundwater Samples and Equipment Decontamination	Cross-contamination, chemical exposure, back strain	• Use Alconox or liquid-nox to decontaminate all equipment with potential to contact groundwater • Use dedicated tubing or replace tubing between each sample location • Ask for help when moving heavy or awkward equipment. • Wear all appropriate PPE
4. Debris and Waste Mgmt.	Spills, chemical exposure, regulatory infractions, back strain, pinch points	• Ensure that all decon water and purge water are properly contained and labeled • Use a drum dolly or lift to move any drums onsite. • Clear a path before moving drums • Prepare a bill of lading for all waste to be moved from site. Complete Port of Tacoma forms for drum handling/disposal.
5. Demobilization	Chemical exposure, back strain, pinch points	• Avoid lifting heavy or awkward objects without help. • Wear all appropriate PPE • Ensure that all equipment has been decontaminated prior to repacking. • Ensure that all equipment is securely put away and tied down.

Job Hazard Analysis

JHA Type: ☒ Investigation ☐ O&M ☐Office ☐ Construction	☐ New ☒ Revised	Date: 4/25/24

Work Type: Direct Push Drilling (Geoprobe)	Work Activity: Boring and Monitoring Well Installation

Personal Protective Equipment (PPE): Minimum PPE is Level D including: Hard hat, safety glasses or goggles, steel-toed boots, high visibility safety vest, hearing protection as needed, and gloves as needed (type dependent on job-specific requirements).

Additional PPE may be required in the Health & Safety Plan (HASP). Also refer to the HASP for air monitoring and emergency procedures.

❶ Job Steps	❷ Potential Hazard	❸ Critical Actions
1. All Onsite Activities	Slips/Trips/Falls Heat/Cold Stress Biological Hazards	• Keep all areas free of excess materials and debris and clear all walking paths. • Monitor onsite workers for signs of heat/cold stress and ensure that necessary breaks are taken. • Use insect repellant and check areas for signs of snakes, spiders, poisonous plants, ticks and mosquitoes • Maintain a clear line of sight.
2. Utility Locate	Explosion, electrocution, injury, death or property damage	• Contact public utility locate and have utilities marked out around the site. • Oversee a private onsite utility locate. • Review locations against construction drawings and known utilities • If necessary, clear upper eight feet of intended drilling location with an air/knife/vacuum truck
3. Equipment Inspections	Leaks, defective or damaged parts, slip/trip/fall hazards, fuel/oil spills, fire hazards, pinch points	• Conduct thorough inspections of all equipment at the beginning of each day and throughout the day, as appropriate. • Check for leaking hoses or fittings, loose connections, functional controls, functional emergency shutoff and damaged equipment • Identify pinch points • Check that a spill kit is available for use on site in the event of a spill or that secondary containment is provided. • Clear working areas of all unnecessary equipment.
4. Equipment Set Up	Flying debris, pinch points	• Identify pinch points • Use a spotter to locate drill rig • Delineate work area with delineators or equivalent • Establish a support zone and set up sampling equipment outside of drill rig work zone • Use designated hand signals to approach drill crew • Engage outriggers • Lower drill rig derrick prior to moving the rig

5.Drilling Operation	Flying debris, pinch points, back strain, cross-contamination, struck by drill rig derrick, chemical exposure, clothing caught in rotating equipment, hearing loss	• Keep hands and feet away from the drill stem while in motion • Wear all appropriate PPE (incl. hearing protection) • Decontaminate all equipment prior to use. • Avoid lifting heavy equipment and use the buddy system for heavy objects • Assure that the drill rig derrick is secured • Make sure all guards are in place while drilling operations are underway. • Do not wear loose fitting clothes or jewelry
6. Collecting soil samples	Pinch points, back strain, knee strain, chemical exposure	• Identify pinch points • Wear all appropriate PPE • Place soil core samples on an elevated surface (portable table) to avoid bending. • Keep hands clear while core samples are removed from the drill stem
7. Monitoring well construction	Back strain, pinch points, chemical exposure, hearing loss	• Identify pinch points • Wear all appropriate PPE • Use proper lifting technique and avoid lifting more than one bag of sand or bentonite at a time • Avoid bending while pouring sand pack or bentonite seal • Keep hands and feet clear as drill stem is raised out of the borehole
8. Well Box Construction	Back strain, knee strain, vehicle hazards	• Delineate work area with delineators or equivalent so you can be seen when vehicles or equipment are being moved. • Avoid lifting heavy objects without assistance • Avoid bending while laying the concrete • Wear knee pads when kneeling.
9. Backfilling soil borings	Back strain	• When soil borings are not completed as monitoring wells, borings must be backfilled with bentonite. • Avoid lifting more than one bag of bentonite at a time • Take breaks as necessary.
10. Equipment Decontamination	Cross-contamination, chemical exposure, back strain	• Use Alconox or liquid-nox to decontaminate all equipment with potential to contact soil or groundwater • Ask for help when moving heavy or awkward equipment. • Wear all appropriate PPE
11. Debris and Waste Mgmt.	Spills, chemical exposure, regulatory infractions, back strain, pinch points	• Ensure that all soil cuttings, decon water and purge water are properly contained and labeled • Use a drum dolly or lift to move any drums onsite. • Clear a path before moving drums • Prepare a bill of lading for all waste to be moved from site.

12. Demobilization	Chemical exposure, back strain, pinch points	- Avoid lifting heavy or awkward objects without help. - Wear all appropriate PPE - Ensure that all equipment has been decontaminated prior to repacking. - Ensure that all equipment is securely put away and tied down.

Job Hazard Analysis

JHA Type: ☒ Investigation ☐ O&M ☐ Office ☒ Construction | ☐ New ☒ Revised | Date: 4/25/24

Work Type: Drilling, well development | Work Activity: Drilling, well development

<u>Personal Protective Equipment (PPE):</u> Minimum PPE is Level D including: Hard hat, safety glasses or goggles, steel-toed boots, high visibility safety vest, hearing protection, and gloves as needed. PPE has Level C contingency.

Additional PPE may be required in the Health & Safety Plan (HASP). Also refer to the HASP for emergency procedures.

❶ Job Steps	❷ Potential Hazard	❸ Critical Actions
1. All Onsite Activities	Slips/Trips/Falls, Heat/Cold Stress, Biological Hazards	• Keep all areas free of excess materials and debris and clear all walking paths. • Monitor onsite workers for signs of heat/cold stress and ensure that necessary breaks are taken. • Use insect repellant and check areas for signs of snakes, spiders, poisonous plants, ticks and mosquitoes • Maintain a clear line of site.
1. All Onsite Activities	High noise levels	• Wear hearing protection when excavators are operating.
1. All Onsite Activities	Fire/Explosion	• Maintain fully charged fire extinguisher onsite • Monitor volatile organic vapor levels in work zone • Remove or protect ignitable fuel sources • Properly ground all electrical equipment • Use non-sparking tools
2. Drilling/Well Development	Contact with heavy equipment and debris	• Heavy equipment will have operable backup alarms and will use spotters when necessary. • Ensure that drill rig inspection form has been completed and all concerns addressed before the start of work • Ensure that the rear 'kill' switch is work with a demonstration by the driller rig operator • Do not approach equipment unless eye contact has been made with operator.
3. Collecting soil samples	Contact with contaminated soil	• Wash hands at end of work shift and before breaks • Wear all appropriate PPE.
3. Collecting soil samples	Pinch points, back strain	• Place containers, clipboards, and equipment on an elevated surface (portable table) to avoid bending • Maintain correct hand position when opening/closing containers or when handling heavy equipment. • Use proper lifting technique
4. Equipment Decontamination	Cross-contamination, chemical exposure, back strain	• Use Alconox or liquid-nox to decontaminate all equipment with potential to contact soil or groundwater • Ask for help when moving heavy or awkward equipment. • Wear all appropriate PPE

5. Debris and Waste Management	Spills, chemical exposure, regulatory infractions, back strain, pinch points	• Ensure that all decontamination water is properly contained and labeled • Use a drum dolly or lift to move any drums onsite. • Clear a path before moving drums • Prepare a bill of lading for all waste to be moved from site.

Appendix C

QAPP

INTERIM ACTION WORK PLAN
APPENDIX C: QUALITY ASSURANCE PROJECT PLAN

Former Dawn Foods Site
6901 Fox Ave South

June 10, 2024

Prepared for:

BRIDGE

INTERIM ACTION WORK PLAN
APPENDIX C: QUALITY ASSURANCE PROJECT PLAN

Former Dawn Foods Site
6901 Fox Ave South

June 10, 2024

Prepared by:

CRETE
CONSULTING, INC.

Title Page with Approvals

Interim Action Work Plan
Attachment C: Quality Assurance Project Plan
Bridge Point 130, LLC (Bridge)
Dawn Foods Site – 6901 Fox Ave South, Seattle WA
June 10, 2024

Project Manager____
Grant Hainsworth, CRETE Date

Quality
Assurance Officer____
Jamie C. Stevens, CRETE Date

Ecology
Project Manager____
David Butler, Ecology Date

Bridge Project
Manager____
Matt Gladney, Bridge Point 130, LLC Date

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List of Tables

Attachments

Acronyms and Abbreviations

BAL	Brooks Applied Labs
COI	contaminant of interest
CLP	Contract Laboratory Program
CTD	conductivity, temperature, and depth
DQO	data quality objective
EDD	electronic data deliverable
EIM	Environmental Information Management
EPA	United States Environmental Protection Agency
IAWP	Interim Action Work Plan
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
MDL	method detection limit
MRL	method reporting limit
MS/MSD	matrix spike/matrix spike duplicate
PARCC	precision, accuracy, representativeness, comparability, and completeness
Property	Former Dawn Foods Site
PDF	portable document format

PQL	practical quantitation limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
SL	screening level
SOP	standard operating procedure
VOC	volatile organic compound
WAC	Washington Administrative Code

1 Introduction

1.1 Background

This Quality Assurance Project Plan accompanies the Interim Action Work Plan for the former Dawn Foods site (Property), located at 6901 Fox Ave South in Seattle, Washington (King County Parcel Number 000180-0113).

This QAPP describes quality assurance/quality control (QA/QC) procedures associated with collecting, analyzing, validating, and using groundwater data to fill data gaps identified in the Interim Action Work Plan (IAWP). This QAPP uses Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology 2016).

The history, contaminants of interest (COIs), screening levels (SLs), and other background information for the site are described in the IAWP.

1.2 Project Description

This QAPP pertains to the following tasks that are part of the larger RI to be conducted, as described in the IAWP (where the goals and objectives of this work are defined):

- Fieldwork
- Laboratory analyses
- Data validation and management
- Data analysis and report preparation.

<u>Fieldwork</u>

Groundwater sampling and testing will include collection of groundwater samples for analysis of COIs. Groundwater field measurements will be taken for pH, specific conductance, temperature, oxidation-reduction potential, and dissolved oxygen during well purging and as an indicator that samples are collected under stable conditions. Groundwater samples will be analyzed for the analytes in Table 2. This table also includes reporting limits and analysis methods.

<u>Laboratory Analyses</u>

Analyses will be completed using the laboratory methods listed in Table 2. Unique analytical procedures are described in Section 5.

Level 2B laboratory data reports will be provided in portable document format (PDF), and electronic data deliverables (EDDs) will be provided in a text or Excel file format.

<u>Data Validation and Management</u>

Data verification will be completed by the Quality Assurance Officer. The accuracy and completeness of the data will be verified by the Quality Assurance Officer. Following verification, data collected during the RI will be uploaded to Ecology's Environmental Information Management (EIM) system.

Data Analysis and Report Preparation

The data collected under the IAWP will inform the Remedial Investigation/Feasibility Study (RI/FS). The results of those efforts will be documented in the RI/FS Report or in Quarterly Progress Reports, depending on the schedule of the RI/FS Report.

1.3 Organization and Schedule

1.3.1 Roles and Responsibilities

Roles and responsibilities are defined in Table 1.

Friedman & Bruya and Brooks Applied Labs (BAL) will perform the majority of chemical analyses of the groundwater samples collected by CRETE Consulting, Inc. Other laboratories may be added should specialized testing be required.

1.3.2 Schedule

Field work will follow the schedule in the IAWP.

Samples will be delivered to the laboratory within applicable holding times and within 24 hours of collection time, when possible, with schedule constraints. Samples will be delivered to the laboratory by field personnel or arranged for pickup by laboratory couriers. Chain-of-custody procedures will be maintained during transit to the laboratory.

Data will be uploaded to the Ecology EIM System and uploaded quarterly, after submittal of the Quarterly Progress Reports.

2 Quality Objectives

The overall data quality objective for this project is the collection of representative data of known and acceptable quality. The QA procedures and measurements that will be used for this project are based on EPA guidance (EPA 2020a/2020b). Parameters related to precision, accuracy or bias, representativeness, completeness, and comparability (PARCC) will be used to assess the quality of RI data (Table 3).

2.1 Precision

Precision is a measure of how closely one result matches another result expected to have the same value. Field precision will be assessed by collecting one duplicate sample for every ten field samples of each medium. Field precision is determined by the relative percent difference (RPD) between a sample and its duplicate. However, results from the analysis of a duplicate sample also test laboratory precision. Therefore, the RPD between the sample and the field replicate provides an indication of both the field and laboratory precision. The tolerance limit for percent differences between field duplicates will be ± 35 percent for groundwater. If the RPDs exceed these limits, a replicate sample may be run to verify laboratory precision. If any RPD exceedance is linked to field sampling, the Field Manager will recheck field sampling procedures and identify the problem. Resampling and analysis may be required.

Laboratory precision can be measured through the evaluation of laboratory control samples/duplicates (LCS/LCSD). The laboratory will perform the analysis of one set of LCS/LCSD samples for every 20 samples. Laboratory precision will be evaluated by the RPD for each analyte between LCS/LCSD samples.

$$\text{RPD} = \frac{\text{ABS(R1-R2)}}{\text{(R1+R2)/2}} \text{ X } 100$$

Where:
ABS = absolute value
R1 = Sample result
R2 = Duplicate sample result.

The tolerance limit for percent differences between laboratory duplicates will be ± 20 percent for groundwater samples. If the precision values are outside this limit, the laboratory will recheck the calculations and/or identify the problem. Reanalysis may be required.

2.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Accuracy may be expressed as a percentage of the true or reference value for reference material or as spike recovery from matrix spike/matrix spike duplicate (MS/MSD) samples. The RPD between the MS and MSD is used to evaluate laboratory precision. The following equations are used to express accuracy:

- For reference materials:
  - Percent of true value = (measured value/true value) x 100
- For spiked samples:
  - Percent recovery = ([SQ – NQ]/S) x 100

SQ = quantity of spike or surrogate found in sample
NQ = quantity found in native (unspiked) sample
S = quantity of spike or surrogate added to native sample

The performance of the method will be monitored using surrogate compounds or elements. Surrogate standards are added to all samples, method blanks, matrix spikes, and calibration standards.

Laboratory method reporting limits (MRL) are listed in Table 2. All MRLs are below SLs; otherwise, SLs derived in the IAWP were set to the practical quantitation limit, which is identical to the MRL for this project.

3 Sampling Process Design

The adequacy of the sampling design is evaluated by representativeness, comparability, and completeness of the data produced. The data must also be adequate to characterize nature and extent of contamination and to evaluate the completeness of pathways.

3.1 Representativeness

Representativeness is the degree to which data from the project accurately represent a particular characteristic of the environmental matrix which is being tested. Representativeness of samples is achieved by adherence to standard field sampling protocols and standard laboratory protocols. Representativeness is achieved through following of the sampling plan design, sampling techniques, and sample handling protocols.

3.2 Comparability

Comparability is the qualitative similarity of one dataset to another (i.e., the extent to which different datasets can be combined for use). Comparability will be addressed through the use of field and laboratory methods that are consistent with methods and procedures recommended by Ecology and that are commonly used for groundwater studies.

3.3 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

Completeness =
(number of valid measurements/ total number of data points planned) x 100

The data quality objective (DQO) for completeness for all analytes is 95%. Data that have been qualified as estimated (J qualified) will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness. Results will be considered valid if all the precision and accuracy targets are met. Resampling or re-analysis of remaining sample aliquots may be required if the completeness DQO is not met.

4 Sampling Procedures

The sampling program addressed in this QAPP is to:

- Monitoring well installation (4.1)
- Collect water samples from permanent monitoring wells (4.2)
- Collect water samples from temporary well points (4.3)

Standard Operating Procedures and Field forms are included in Attachment A.

4.1 Monitoring Well Installation

Wells will be installed in accordance with Washington Administrative Code (WAC) 173-160. As the soil cuttings are removed, field staff will log visual observations, similar to those for soil sampling, on a well log/well construction diagram.

Monitoring well construction and installation will involve drilling a borehole using either a sonic or a hollow-stem auger drill rig, installing a 2-inch diameter 0.010-inch slot Schedule 40 PVC well, filling the annular space with 10-20 (sieve size) Colorado silica sand below bentonite, and developing the well prior to sampling.

Upon reaching the target depth below ground (15 feet [ft]), the 10-ft long well screen and riser pipe are inserted into the borehole. The full length of the slotted portion of the well screen as well as the unslotted portion of the bottom of the screen should be measured with the measuring tape, and these measurements should be recorded on the well construction diagram. The well screen will be placed such that it intercepts the water table. The water table depth below ground is determined after the borehole depth has been achieved by placing a water level meter inside the borehole. Moisture observations are also made on the soil cuttings removed from the borehole.

After the static water level measurement has been taken, the drilling subcontractor will begin assembling the well in conformance with any modifications to the well design made by the geologist based on field conditions. As the assembled well is lowered, extra attention will be given to centering it in the hole if centralizers are not used. The well should be temporarily capped before filter sand and other annular materials are installed. The drilling subcontractor should fill the annular space surrounding the screened section of the monitoring well to at least one foot above the top of the screen with a clean sand or fine gravel. In general, the filter pack should not extend more than three feet above the top of the screen to limit the thickness of the monitoring zone. A minimum 2-foot thick layer of bentonite pellets or slurry seal will be installed by the drilling subcontractor immediately above the well screen filter pack in all monitoring wells.

The borehole annulus will be grouted with seal materials to within three feet of the ground surface. Drill cuttings, even those known not to be contaminated, will not be used as backfill material. The grout seal should consist of a bentonite/cement mix with a ratio of bentonite to cement of between 1:5 and 1:20. The drilling subcontractor will cut the top of the well casing to a height that will allow installation of a locking cap with the monument closed. Wells completed in the sloping shipways ramp will be completed with a water tight monument.

All newly installed monitoring wells will be surveyed to the nearest 0.01-ft vertical at the top of casing and less than 1-ft horizontal accuracy. All other sampling locations will be located to 1-ft horizontal and vertical accuracy.

4.2 Sampling from Monitoring Wells

Groundwater sampling will include measurement of field parameters to evaluate stability of groundwater collected from wells and in support of fate and transport analyses. Field water quality instruments will be calibrated at the beginning (prior to sampling) and middle of each day. Calibration data will be recorded on a field form or log book.

New, disposable, polyethylene tubing will be used to draw water from each monitoring well. The following tasks will be performed at each well:

- Measure and record static water level (distance from top of casing) to the nearest 0.01 foot using an electric well sounder and measuring tape.
- Use the EPA Low-Flow Groundwater Sampling Procedure (EPA 2017). This procedure includes several steps and can be summarized as follows. First, purge groundwater at a low rate (~100-200 milliliters/minute). Second, monitor the discharge water for temperature, pH, and specific conductance at least three times during the purging period. Third, measure the purge volume using a calibrated bucket. Fourth, record purge water volume, time, and field parameter values in the field notes.
- Sampling may begin after three consecutive field parameter measurements (temperature, specific conductance, and pH) are stable. Continue purging water until three consecutive stable measurements are recorded. Sampling may be conducted without stabilization if the parameter trends are reasonably attributed to in-aquifer variability such as tidal flux.
- Collect samples of water for laboratory analysis in a manner that minimizes volatilization of constituents. Hands and clothing will be clean when handling sampling equipment and during sampling. Clean, disposable, latex gloves will be worn when filling bottles for analyses. Gloves will be changed when dirty and between samples. All water samples will be collected from the pump discharge lines directly into the appropriate sample containers. Samples submitted for dissolved metals analyses only will be filtered in the field prior to filling the sample container.

Collect samples in the following manner:

- Volatile organic compounds (VOCs): For each sample, fill three 40-ml vials preserved with hydrochloric acid. Slowly fill each vial until all air is removed and sample water bulges slightly over the top of the vial. Wet cap with sample water and screw onto top of vial. Invert vial and tap with finger. The properly filled vial has NO visible air bubbles.

- Metals: Samples will be collected directly into lab-supplied bottles with acid preservative. For dissolved samples, water will be collected directly into lab-supplied bottles with acid preservative after passing through an in-line, disposable, 0.45-micron filter such as the Sample Filter Plus or equivalent installed in the discharge line of the pump. A new filter will be used for each sample. Sample bottles will be filled almost to the top but not overfilled.
- Other Parameters: There are no headspace or filtering concerns related to the other water quality parameters. Fill the laboratory prepared sample bottles almost to the top, taking care not to overfill.
- Record sample identification data on each sample container, in the field notes, and on the chain-of-custody. Sample identification will be the same as the well name/number and the sample collection date.

Stable is defined as:

- Specific conductance and temperature that do not indicate a trend (continuously increase or decrease between readings) and do not vary by more than 10 percent between readings.
- pH measurements that do not vary by more than 0.1 pH units between readings.

The container and preservative requirements are listed in Table 2.

4.3 Groundwater Sampling from Geoprobe Locations

Groundwater samples collected from Geoprobe borings will be collected with a temporary screen, placed to intercept the water table, and peristaltic pump as follows:

- Lower the new, clean polyethylene tubing into the well until the tubing intake is in the middle of the screened interval, or slightly above the middle of the screened interval. Secure the tubing to the top of the well and leave approximately 5 feet of tubing outside the well. Attach a 1-foot length of silicon tubing that is appropriate for a peristaltic pump to the polyethylene tubing.
- Attach the silicon tubing to the peristaltic pump. Purge (remove with pump) water from the well into a calibrated 5-gallon pail or similar and monitor flow rate.
- Purge at approximately 100-300 milliliters (0.03-0.09 gallons) per minute until turbidity has decreased. The goal is to create minimal screen velocities during purging such that fines, which may bias sampling results, are not captured. This goal may be difficult to achieve under some circumstances and may require adjustment based on site-specific conditions and professional judgment.
- Sampling may begin when turbidity has stabilized. Other field parameters at the time of sampling will be recorded. Field instruments are to be calibrated prior to use, according to the manufacturer’s instructions.

- Collect samples of water for laboratory analysis in a manner that minimizes volatilization of potential contaminants from the water into the air. Hands and clothing will be clean when handling sampling equipment and during sampling.
- Clean, disposable, latex, nitrile, or equivalent–material gloves will be worn when filling bottles for analyses. Gloves will be changed when dirty and between samples.
- All water samples will be collected from the pump discharge lines directly into the appropriate sample containers following the procedures described for filling sampling containers from monitoring wells.

The container and preservative requirements are listed in Table 2.

4.4 Sampling Equipment

Field equipment and supplies include sampling equipment (e.g., bowls, tape measures), utensils (e.g., spoons), decontamination supplies, sample containers, coolers, log books and forms, personal protection equipment, and personal gear. Protective wear (e.g., hard hats, gloves) are described in the Health and Safety Plan. Sample containers, coolers, and packaging material will be supplied by the analytical laboratory.

4.5 Decontamination

If used, stainless-steel sampling equipment will be washed with Liquinox^{TM} detergent (or a similar phosphate-free detergent) and rinsed with distilled water prior to use and between sampling stations. The following decontamination steps will be performed on stainless-steel bowls and spoons using for compositing prior to use at each station:

- Wash with detergent
- Double rinse with distilled/deionized water
- Final rinse with distilled/deionized water.

If a residual material remains on the sampling equipment or is difficult to remove using the standard decontaminations procedures above, a hexane rinse may be added, followed by a final rinse with distilled/deionized water. Sample equipment will be kept wrapped in aluminum foil until time for use. To minimize sample cross-contamination, disposable gloves will be replaced between samples. If any equipment decontamination occurs, an equipment blank will be collected by pouring distilled water over the equipment and collecting in a set of the same sample containers as those used for the environmental samples the equipment is used to collect.

Gloves will be changed between each sample. Tubing used to collect groundwater samples is also disposable. Water level and field parameter meters will require decontamination between sample collection locations.

4.6 Sample Nomenclature

The sample nomenclature will be consistent with previous samples collected at the project. The following rules shall apply:

- Monitoring Wells – all samples collected from monitoring wells shall have the monitoring well ID and the date. The date format shall be month/year unless multiply samples are collected in the same month, in which case the date shall be added. Example: MW-04-0624 or MW-04-061024.

- Groundwater Grab Samples from temporary well borings or well points - all samples collected from temporary points are considered grab samples. These samples shall have the boring location ID and the date. Boring locations shall include "IAWP" to clarify that borings are associated with the IAWP. The date format shall be month/year unless multiply samples are collected in the same month, in which case the date shall be added. Example: IAWP-SB-04-0624 or IAWP-SB-04-061024.

- If multiple samples are collected from the same location at the same day, add a numerical ID to the end of the sample ID. Example: MW-04-0624-01.

- Duplicates shall not include information linking the parent sample to the duplicate. Example: Dup-01-0624.

- Equipment Reinstate Blanks are not expected because dedicated sampling equipment will be used, but if other blanks are collected, they shall include an identification acronym followed by the date. Example: Blank-01-0624 or MSD-01-0624.

4.7 Sampling Containers

Requirements for sample containers and storage conditions are provided in Table 2. Samples analyzed for VOCs and dissolved metals (groundwater only) will require chemical preservation, which will be present in the laboratory-supplied containers. All sample containers will have screw-type lids so that they are adequately sealed. Lids of the glass containers will have Teflon™ inserts to prevent sample reaction with the plastic lid and to improve the quality of the seal. Commercially available, pre-cleaned jars will be used, and the laboratory will maintain a record of certification from the suppliers. The container shipment documentation will record batch numbers for the bottles. With this documentation, containers can be traced to the supplier, and bottle rinse blank results can be reviewed.

Sampling containers will be filled to minimize head space, and will be appropriately labeled and stored prior to shipment or delivery to the laboratory. Samples must be packed to prevent damage to the sample containers and labeled to allow sample identification. All samples must be packaged so that they do not leak, break, vaporize or cause cross-contamination of other samples. Each individual sample must be properly labeled and identified. When refrigeration is required for sample preservation, samples must be kept cool, by means of ice packs or double-bagged ice in coolers, during the time between collection and final packaging.

4.8 Field Logs

All field activities and observations will be noted on weatherproof paper at the time they occur. The field logs will be compiled in a binder in the chronological order they were completed. Information will include personnel, date, time, station designation, sampler, types and number of samples collected, photographs taken, weather conditions, health and safety meetings conducted (tailgate meeting), and general observations. Any changes that occur at the site (e.g., personnel, responsibilities, deviations from the IAWP) and the reasons for these changes will be documented in the field log. It will also identify onsite visitors observing the sampling. The Site is an actively used property, therefore only those specifically visiting/observing sampling activities will be documented. The Field Manager is responsible for ensuring that the field logs are correct.

All field activities and observations will be noted during fieldwork. The descriptions will be clearly written with enough detail so that participants can reconstruct events later, if necessary. Requirements for entries include:

- Field logs will be compiled in chronological order in a 3-ring binder, with the date and observer clearly marked on all field forms and note sheets.
- Entries will be made legibly with black (or dark) waterproof ink or pencil.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made should be noted, as well as the time of the observation itself).
- Each consecutive day's first entry will be made on a new, blank page.
- The date and time, based on a 24-hour (military) clock (e.g., 0900 for 9 a.m. and 2100 for 9 p.m.), will appear on each page.
- When the field activity is complete, the field binder will be physically entered into the project file and the pages will be scanned to a PDF file and saved in the electronic project library. Scanning of sheets may also occur after each day’s field activities.
- The person recording the information must initial and date each sheet. If more than one individual makes entries on the same sheet, each recorder must initial and date each entry. The bottom of the page must be signed and dated by the individual who makes the last entry.
- The Field Manager, after reading the day’s entries, also must sign and date the last page of each daily entry.
- Corrections will be made by drawing a single line through the original entry allowing the original entry to be read. The corrected entry will be written alongside the original. Corrections will be initialed, dated, and explained.

4.9 Chain-of-Custody Procedures

All samples must be clearly identified immediately upon collection. Each sample container label will list:

- Client and project name
- A unique sample description/sample ID
- Sample collection date and time.

Additionally, the container's label may include:

- Sampler's name or initials
- Preservative, if applicable
- Analyses to be performed.

Chain-of-custody procedures will be used to document sample possession from the time of collection, through analysis, to disposal. Chain-of-custody forms will document transfers of sample custody. A sample is considered to be under custody if it is in one's possession, view, or in a designated secure area. One set of chain-of-custody forms will be used per laboratory shipment. The chain-of-custody record will include, at a minimum, the following information:

- Client and project name
- Sample collector's name
- Sampler's company mailing address and telephone number
- Designated recipient of data (name, email, and telephone number)
- Analytical laboratory's name and city
- Description of each sample (i.e., unique identifier and matrix)
- Date and time of collection
- Quantity of each sample or number of containers
- Type of analysis required
- Any unique features of analysis, such as lower reporting limits
- Any requests to hold/archive samples
- Addition of preservative, if applicable
- Requested turn-around times
- Date and method of shipment.

When transferring custody, both the staff relinquishing custody of samples and the staff receiving custody of samples will sign, date, and note the time on the form. Samples to be analyzed by Friedman & Bruya Laboratory will not be shipped, but will be delivered by project personnel to the laboratory at the end of each sampling day. If samples are to be analyzed by other laboratories, they will either be delivered or shipped, depending on the location. All samples will be stored appropriately by the laboratory.

5 Measurement Procedures

Groundwater samples will be analyzed by the methods and to the reporting limits identified in Table 2. The number of samples and the sample nomenclature are described in the IAWP.

6 Quality Control

6.1 Laboratory Quality Control

Only laboratories accredited in accordance with WAC 173-50, Accreditation of Environmental Laboratories will be used for this project. EPA Contract Laboratory Program (CLP) QA/QC procedures or similar efforts will be used for the analyses. Internal quality control procedures are used to produce consistently high-quality data. A routine QC protocol is an essential part of the analytical process. The minimum requirements for each analytical run are described here. Additional description of laboratory QA/QC procedures can be found in the laboratory's QA manual. A project narrative detailing analytical results must accompany all data packages submitted by the laboratory.

Preparation batches have a maximum of 20 field samples of the same matrix. QA/QC samples processed with each batch are:

- **One method blank**. The method blank is used to assess the preparation batch for possible contamination during the preparation and processing steps. It is processed along with and under the same conditions as the environmental samples. Concentrations of compounds detected in the blank will be compared to the samples. Any concentration of common laboratory contaminants (i.e., phthalates, acetone, methylene chloride, or 2-butanone) in a sample lower than 10 times that found in the blank will be considered a laboratory contaminant and will be so qualified. For other contaminants, any compounds detected at concentrations lower than five times that found in the blank will be considered laboratory contamination (EPA 2020a/b). Values reported for the method blanks are expected to be below the Method Detection Limits (MDLs) for all analytes, except the common laboratory contaminants. Deviations from this must be explained in the laboratory project narrative(s).
- **One LCS**. The LCS is used to evaluate the performance of the total analytical system, including all preparation and analysis steps.
- **One MS**. Matrix specific QA/QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and is not normally used to determine the validity of the entire batch.
- **At least one duplicate**. Duplicates are replicate aliquots of the same sample taken through the entire analytical procedure. The results from this analysis indicate the precision of the results for the specific sample using the selected method. One duplicate sample is analyzed with each preparation batch. If sufficient sample is provided, this will be either an MSD. If not, an LCSD will be analyzed.
- **Initial and continuing calibration:** A calibration standard will be analyzed each time an instrument is calibrated. The instruments used to perform the analyses will be calibrated, and the calibrations will be verified as required by EPA methodologies. For example, a standard five-point initial calibration will be utilized to determine the linearity of response with the gas chromatograph/electron capture detection. Once calibrated, the system must be

verified every 12 hours. All relative response factors, as specified by the analytical method, must be greater than or equal to 0.05. All relative standard deviations, as specified by the analytical method, must be less than or equal to 30 percent for the initial calibration and less than or equal to 25 percent for the continuing calibration.

- **Surrogate evaluations:** Surrogate recovery is a QC measure used in organics analyses. Surrogates are compounds added to every sample at the initiation of preparation to monitor the success of the sample preparation on an individual sample basis (accuracy). Although some methods have established surrogate recovery acceptance criteria that are part of the method or contract compliance, for the most part, acceptable surrogate recoveries need to be determined by the laboratory. Recoveries of surrogates will be calculated for all samples, blanks, and QC samples. Acceptance limits will be listed for each surrogate and sample type and will be compared against the actual result.
- **Laboratory management review:** The Laboratory Project Manager will review all analytical results prior to final external distribution (preliminary results will be reported before this review). If the QA Officer finds that the data meet project quality requirements, the data will be released as "final" information. Data which are not acceptable will be held until the problems are resolved, or the data will be flagged appropriately.

6.2 Field Quality Control

QA/QC samples will be collected during all sampling activities. Trip blank, field duplicate, and matrix spike/matrix spike duplicate samples will be collected as follows:

One water trip blank per sampling day will be prepared by the laboratory and will travel with the sample containers from and to the lab for analysis. This sample will be handled in the same manner as the groundwater samples. The blank will be submitted to the lab and will be analyzed for the EPA Method 8260 VOCs.

Field duplicate samples will be called 'Dup' but no identification to the parent sample will be included in the name or on documents to the laboratory so that they are submitted "blind" to the laboratory. Field duplicates are useful in identifying problems with sample collection or sample processing. One duplicate sample will be collected for every 10 field samples of the same matrix. Each field duplicate will be analyzed for the same parameters as the samples to evaluate heterogeneity attributable to sample handling.

One matrix spike/matrix spike duplicate sample (MS/MSD) will be collected for every 20 field samples. Extra sample containers (the same as those for the environmental sample) collected for MS/MSD analyses will be noted in field notes and on chain-of-custody forms submitted to the analytical laboratory. Extra sample bottles for MS/MSD will be labeled with a "-MS/MSD" suffix for clarity in sample processing.

Rinsate and equipment blanks will not be collected for groundwater samples because samples will be collected using either disposable or dedicated sample tubing, which prevents cross-contamination.

6.3 Instrument and Equipment Testing, Inspection, and Maintenance

The primary objective of an instrument/equipment testing, inspection, and maintenance program is to aid in the timely and effective completion of a measurement effort by minimizing the downtime due to component failure.

Testing, inspection, and maintenance will be carried out on all field and laboratory equipment in accordance with manufacturer's recommendations and professional judgment. Hand-held field monitors will be used to monitor groundwater for field parameters. They will be calibrated and maintained according to the manufacturer's recommendations.

Analytical laboratory equipment preventative testing, inspection, and maintenance will be addressed in the laboratory QA manual, which will be kept on file at the contracted laboratory.

As appropriate, schedules and records of calibration and maintenance of field equipment will be maintained in the field notebook. Equipment that is out of calibration or is malfunctioning will be removed from operation until it is recalibrated or repaired.

6.4 Instrument and Equipment Calibration and Frequency

Field equipment and laboratory instrumentation used for monitoring and sample analysis will be subject to the following calibration requirements:

- **Identification**. Either the manufacturer's serial number or the calibration system identification number will be used to uniquely identify equipment. This identification, along with a label indicating when the next calibration is due, will be attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference.
- **Standards**. Equipment will be calibrated, whenever possible, against reference standards having known valid relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of natural physical constraints. If national standards do not exist, the basis for calibration will be described and documented.
- **Frequency.** Equipment will be calibrated at prescribed intervals and/or prior to use. Frequency will be based on the type of equipment, inherent stability, manufacturers' recommendations, intended use, and observation of equipment

  readings over the course of the field work. All sensitive equipment to be used in the field or laboratory will be calibrated or checked prior to use.
- **Records**. Calibration records (certifications, logs, etc.) will be maintained for all measuring and test equipment used.

If field or laboratory equipment is found to be out of calibration, the validity of previous measurements will be investigated, and/or corrective action will be implemented. The Field Manager or the Laboratory Manager, respectively, will lead the evaluation process, which will be document in the field forms or laboratory log book, respectively.

All laboratory calibration requirements must be met before sample analysis may begin. The laboratory will follow the calibration procedures dictated by the analytical methods to be performed. If calibration non-conformances are noted, samples will be reanalyzed under compliant calibration conditions within method-specified hold times.

6.5 Inspection and Acceptance of Supplies and Consumables

The Field Manager will be responsible for material procurement and control. The Field Manager will verify upon receipt that materials meet the required specifications and that, as applicable, material or standard certification documents are provided, maintained, and properly stored with the project files. The Field Manager will also verify that material storage is properly maintained and that contamination of materials is not allowed.

The laboratory must document and follow procedures related to:

- Checking purity standards, reagent grade water, and other chemicals relative to intended use
- Preparing and storing chemicals
- Handling disposable glassware (including appropriate grade).

The Field Manager will be responsible for procuring and transporting the appropriate sample containers, equipment, and consumables (e.g., soap) to the Site. The containers will be pre-cleaned and certified by lot. If needed, reagents provided will be of the appropriate grade for the analysis. Records of these certifications and grades of material will be maintained on file at the laboratory.

7 Corrective Actions

Upon receipt of data, the QA Officer will evaluate field and laboratory precision by the RPDs between the field duplicate and sample data. Non-conforming items and activities are those which do not meet the project requirements or approved work procedures. Non-conformance may be identified by any of the following groups:

- **Field staff/Manager**: during the performance of field activities, supervision of subcontractors, performance of audits
- **Laboratory staff**: during the preparation for and performance of laboratory testing, calibration of equipment, and QC activities
- **QA Staff**: during the performance of audits and during data validation, through the use of data to make decisions (i.e., do the data make sense?).

If possible, the Field Manager will identify any action that can be taken in the field to correct any non-conformance observed during field activities. If necessary and appropriate, corrective action may consist of a modification of methods or a re-collection of samples. If implementation of corrective action in the field is not possible, the non-conformance and its potential impact on data quality will be discussed in the data quality section the summary report.

Corrective action to be taken as a result of non-conformance during field activities will be situation-dependent. The laboratory will be contacted regarding any deviations from the QAPP, will be asked to provide written justification for such deviations, and in some instances, will be asked to reanalyze the sample(s) in question. All corrective actions must be documented. The person identifying the nonconformance will be responsible for its documentation.

Documentation will include the following information:

- Name(s) of the individual(s) identifying or originating the nonconformance
- Description of the nonconformance
- Any required approval signatures
- Method(s) for correcting the nonconformance or description of the variance granted.

Documentation will be made available to project, laboratory, and/or QA management. Appropriate personnel will be notified by the management of any significant nonconformance detected by the project, laboratory, or QA staff. Implementation of corrective actions will be the responsibility of the Field Manager or the QA Officer. Any significant recurring nonconformance will be evaluated by project or laboratory personnel to determine its cause. Appropriate changes will then be instituted in project requirements and procedures to prevent future recurrence. When such an evaluation is performed, the results will be documented. If there are unavoidable deviations from this QAPP, the Project Manager will document the alteration and track the change in the subsequent deliverables.

8 Data Management Procedures

The project database will only have one result per constituent in a given sample. Where duplicate analyses of the same constituent are present in the data for the same sample due to reanalysis or inclusion in multiple analytical methods, only one value will be preserved in the primary database tables; this does not apply to duplicate samples which are maintained as separate samples in the database. The preserved value will be selected as follows: for non-detects, the result with the lower reporting limit; values without QA flags are preserved over flagged values; detections are selected over non-detects; where all other conditions are equal, the result with the higher concentration is preserved in the database.

For accepted data, concentrations will be averaged between the parent and field duplicate, using one-half the reporting limit if any values are undetected. The database will store both the parent and field duplicate data.

All hard copies of field forms or log book pages will be filed in the project library as scanned PDFs. Well installation logs and boring logs will be transcribed from hand-written field notes into formal electronic logs using LogPlot or a similar software program.

9 Audits and Reports

Field investigators will maintain field notes in a bound notebook or on field forms, and all documents, records, and data collected will be kept in a case file in a secure records filing area. All laboratory deliverables with verifiable supporting documentation shall be submitted by the laboratory to the QA Officer. The following documents will be archived at the laboratory: 1) signed hard copies of sampling and chain-of-custody records; and 2) electronic files of analytical data including extraction and sample preparation bench sheets, raw data, and reduced analytical data. The laboratory will store all laboratory documentation of sample receipt and login; sample extraction, cleanup, and analysis; and instrument output in accordance with the laboratory Standard Operating Procedure (SOP) or QA manual.

PDFs of all analytical reports will be retained in the laboratory files, and at the discretion of laboratory management, the data will be stored electronically for a minimum of 1 year. After 1 year, or whenever the data become inactive, the files will be transferred to archives in accordance with standard laboratory procedure. Data may be retrieved from archives upon request.

No audits, other than the identified data verification will be conducted.

10 Data Verification and Validation

Analytes detected at concentrations between the MRL and the MDL will be reported with a J qualifier to indicate that the value is an estimate (i.e., the analyte concentration is below the calibration range). J-qualified data are considered valid when completeness is calculated. Undetected data will be reported at the MRL. The MRL will be adjusted by the laboratory as necessary to reflect sample dilution or matrix interference.

Verification of completeness and method compliance, as well as raw data entry and calculations by analysts will be reviewed by the Laboratory Project Manager. The Laboratory Project Manager will be responsible for checking each group or test data package for precision, accuracy, method compliance, compliance to special client requirements, and completeness. The Laboratory Project Manager will also be responsible certifying that data in PDFs and EDDs are identical prior to release from the laboratory.

Data validation will be completed by a third-party data validator. Data validation will be completed within two weeks after receipt of the complete laboratory data package.

The laboratory will generate Level 2B data package for all analytes. Validation of the analytical data will comply with criteria set forth in the CLP National Functional Guidelines for Superfund Organic Methods Data Review (EPA 2020b).

11 Data Quality (Usability) Assessment

The QA Officer will review the field notebooks, laboratory reports, and the data validation report to determine if the data quality objectives have been met. Instances where the data quality objectives were not met will be documented. The usability of the data will depend on the magnitude of the data quality objective exceedance. Data that has been rejected will be flagged as “R” and will not be included in the database. The QA Officer will determine if rejected data trigger additional sample collection.

The achieved MRLs will be compared to the SL in order to determine if the produced laboratory data can answer the study questions. In some cases, the SL was set to the practical quantitation limit (PQL, also the MRL), and therefore those MRLs need to be achieved in order for the data to be usable.

12 References

Ecology 2016. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication No. 04-03-030. July 2004, revised December 2016.

EPA 2020b. Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. EPA 540-R-20-005. November 2020.

EPA 2020a. Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review. OSWER 9240.1-51. EPA 542-R-20-006. November 2020.

EPA 2017. Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Revision 4, September 19, 2017. EQASOP-GW-001

Tables

Table 1 Project Roles and Responsibilities

Role	Person	Responsibilities
Ecology Project Manager	David Butler (206-518-3513)	• Direct other Ecology staff and their consultants to review and comment on materials • Grant final approval on this QAPP/IAWP, on data use, and on further data collection.
The Property Representative	Matt Gladney (425-749-4324)	• Represents the PLP (Bridge Point Seattle 130, LLC [Bridge]) • Monitor all aspects of the project to verify that work follows Owner's goals and decisions
Consultant Team Project Manager	Grant Hainsworth (253-797-6323)	• Primary point of contact on behalf of Bridge. • Review all technical documents associated with the project for technical accuracy and feasibility, as well as adherence to budget and schedule.
Quality Assurance Officer	Jamie Stevens (206-799-2744)	• Monitor all aspects of the project to verify that work follows project plans • Review laboratory analytical data • Serve as liaison between the laboratory and Field Manager • Maintain a complete set of laboratory data • Evaluate conformance of the analyses with the specifications of this QAPP • Verify the reported results with the raw data • Check that EDDs match the analytical reports • Review compliance with field methods and procedures.
Field Manager	Rusty Jones (832-330-1359)	• Collect or direct collection of groundwater samples • Maintain a log (field log book) for all sampling-related activities • Coordinate the sampling operations to verify that the this QAPP is followed • Identify any deviations from this QAPP • Prepare the field data and information for reporting • Maintain the integrity of samples throughout sample collection and transport to the laboratory.
Laboratory Project Manager	Eric Young – Friedman and Bruya Lab (206-285-8282) Amy Goodall – Brooks Applied Lab (206-632-6206)	• Conduct analysis of water samples • Practice quality assurance methods per internal laboratory SOPs and this QAPP, and document such practices • Verify quality of samples (e.g., cooler temperature) as they're received at the laboratory • Verify accuracy and completeness of laboratory reports and EDDs.

Table 2 Sample Analytes

Analyte	Preparation Method	Analytical Method	Method Reporting Limit	Lowest Initial Screening Level	Holding Time	Sample Container/ Preservation/ Storage
Groundwater Samples						
Dissolved/Total Metals (µg/L)	200.8/ EPA Method 1638 ICP-DRC-MS *	200.8 with reductive precipitation/ Method 1638	0.0068 – 0.18 (CAS-calculated MDLs)	Copper = 2.4	6 months	Field filter into 500-mL plastic bottle with HNO_3 preservative to pH <2; Dark, 4°C
VOCs (µg/L)	5030	EPA 8260C; potentially with SIM for groundwater	0.2 – 2	Vinyl chloride = 2.4	14 days (if preserved)	Three 40-ml vials preserved with hydrochloric acid; Dark, 4°C; freeze VOCs with 48 hours if not analyzed.
Ammonia, nitrate, nitrite, phosphate, sulfate, and chloride(mg/L)	SM 4500 NH3 B/C (EPA 350.2)	SM 4500 NH3 B/C (EPA 350.2)	varies	NA	48 hours	500-mL plastic bottle; Dark, 4°C
ethene, ethane, and methane(mg/L)	RSK 175(M)	RSK 175(M)	varies	NA	48 hours	500-mL plastic bottle; Dark, 4°C
total organic carbon (mg/L)	SM 5310 D(M) (EPA 415.1)	SM 5310 D(M) (EPA 415.1)	varies	NA	48 hours	500-mL plastic bottle; Dark, 4°C

Notes:

VOCs - volatile organic compound
SIM – Selective Ion Mode mg/L- milligram per liter
PQL – practical Quantified limit
VOA – volatile organic analysis

µg/L - micrograms per liter
EPA – Environmental Protection Agency

Table 3 Measurement Quality Objectives

Parameter	Precision (RPD; lab/field)	Accuracy	Completeness
Metals	Water: 20%/35%	70-130%	100%
VOCs			

Notes:
VOCs - volatile organic compound

Attachment A

Standard Operating Procedures and Field Forms

1 INTRODUCTION

1.1 Purpose and Applicability

This standard operating procedure (SOP) is concerned with the collection of valid and representative samples of groundwater from monitoring wells. The scope of this document is limited to field operations and protocols applicable during groundwater sample collection.

This SOP is written in a broad-based manner and considers the application of a variety of sampling equipment in the collection of representative groundwater samples. Respective state and/or federal agency regulations may require specific types of equipment to be used when applying this SOP to a particular project. The project manager should review the applicable regulatory requirements, if any, prior to the start of the field sampling program. Deviations from this SOP to accommodate regulatory requirements should be reviewed in advance of the field program and documented in the project work plan.

This SOP has been developed based on the Washington State Department of Ecology (Ecology) Standard Operating Procedure for Purging and Sampling Monitoring Wells plus Guidance on Collecting Samples for Volatiles and other Organic Compounds (Ecology 2014) and the Environmental Protection Agency Low Stress Purging and Sampling Procedures for Collection of Groundwater Samples from Monitoring Wells (EPA 2017).

1.2 Quality Assurance Planning

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific QAPP. Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements typically suggest the collection of a sufficient quantity of quality control (QC) samples such as field duplicate, equipment and/or field blanks and matrix spike/matrix spike duplicate (MS/MSD) samples. These requirements should be outlined in the QAPP. Additional information regarding quality assurance sample collection relevant to groundwater sampling is contained in Section 5.0 of this SOP.

1.3 Health and Safety Considerations

Groundwater sampling may involve chemical hazards associated with the materials being sampled. Adequate health and safety measures must be taken to protect project sampling personnel from potential chemical exposures or other hazards.

These measures must be addressed in the project Health and Safety Plan (HASP). This plan must be approved by the project Health and Safety Officer before work commences, must be distributed to all personnel performing sampling, and must be adhered to as field activities are performed.

2 RESPONSIBILITIES

2.1 Project Manager

The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the measurements in accordance with this SOP and the project-specific work plan.

2.2 Sampling Technician

It is the responsibility of the sampling technician to be familiar with the sampling procedures outlined within this SOP and with specific sampling, quality assurance, and health and safety requirements outlined within project-specific work plans (Sampling Plan, HASP, and QAPP). The sampling technician is responsible for collection of groundwater samples and for proper documentation of sampling activities as samples are being collected.

3 REQUIRED MATERIALS

Groundwater sampling objectives may vary significantly between projects. Project objectives should be defined within the project-specific work plans. The list of required materials below identifies the types of equipment which may be used for a range of groundwater sampling applications. From this list, a project-specific equipment list should be selected based upon project objectives and other factors such as the depth to groundwater, well construction, required purge volumes, and analytical parameters, among others. The various types of sampling equipment which may be used include:

<u>Well Purging Equipment</u>

- Bailers
- Bladder pumps
- Submersible pumps
- Peristaltic pumps
- Centrifugal Pumps
- WaterraTM pumps

Field Instruments

- Individual or multi-parameter meter(s) to measure temperature, pH, specific conductance, dissolved oxygen (DO) oxidation reduction potential (ORP), and/or turbidity

- Water level measuring device

- Interface probe or product detection paste

Sampling Equipment

- Reusable or disposable bailers

- Peristaltic pump

- Bladder pump

Sample Preparation Equipment

- Filtration equipment

- Intermediate containers

- Sample kit (i.e., bottles, labels, preservatives, custody records, cooler)

General Equipment

- Project-specific sampling plans (SAP, QAPP, HASP)

- Sample collection records

- Field notebook/pen

- Waterproof marker pens

- Deionized water dispenser bottler

- Sample cup

- Buckets

- Coolers, or sample shuttles

- Instrument calibration solutions
- Power source (generator of 12V marine battery)
- Equipment decontamination supplies
- Health and safety supplies
- First-Aid kit
- Tool box

Expendable Materials

- Deionized water supply
- Disposable bailer string (nylon or polypropylene)
- 0.45 micron filters
- Paper towels
- Plastic sheeting
- Ice/blue ice for sample preservation
- Disposable latex powder-free glove liners
- Disposable nitrile gloves
- Plastic trash bags
- Ziplock® bags

This equipment list was developed to aid in field organization and should be used in preparation for each sampling event. Depending on the site-specific sampling plan, additional material and equipment may be necessary and should be determined before the scheduled sampling event. Similarly, not all of the items shown in this list may be necessary for any one sampling event.

4 Method

4.1 Free Product Determination

Wells that may potentially contain free product should be assessed for product with an interface probe or product detection paste. Interface probes generally operate on the same principle as a water level tape although they are designed to register water and product levels usually with different audible tones. Product paste generally is used in combination with some type of measuring tape which is lowered into the well with a coating of paste applied to it. Wells containing free product are generally not used for groundwater sampling, since the concentration of contaminants present in the free product can adversely affect the quality of the water sample, lending to a non-representative water sample.

4.2 Water Level Measurement

To obtain a water level measurement, lower the probe of a water level measuring device into the well until the audible sound of the unit is detected or the light on an electronic sounder illuminates. At this time the precise measurement should be determined (to nearest 0.01 feet) by repeatedly raising and lowering the tape to converge on the exact measurement. Obtain the reading of the TOC measuring point. The water level measurement should be entered on the Groundwater Sample Collection Record or in the field records.

The measurement device shall be decontaminated immediately after use with a non-phosphatic detergent and rinsed with distilled water. Generally, only that portion of the tape which enters the water table should be cleaned. It is important that the measuring tape is never placed directly on the ground surface or allowed to become kinked. Measuring devices, including interface probes, which come into contact with free product will likely require more thorough decontamination.

4.3 Purge Volume Calculation

Wells designated for sampling require purging to remove stagnant water in the well. A single casing volume of groundwater will be calculated after measuring the length of the water column and checking the well casing diameter.

The amount of standing water can be calculated using a variety of methods. One equation is:

Well volume: V = 0.041 x HD2 = ____ gallons, where

- V is volume of water in the well, in gallons,
- H is height of water column in well (i.e. total well depth – measured depth to water), in feet, and
- D is the inside diameter of the well casing, in inches

4.4 Well Purging Methods and Procedures

4.4.1 Objectives

Prior to sample collection, purging must be performed for all groundwater monitoring wells to remove stagnant water from within the casing and gravel pack and to ensure that a representative groundwater sample is obtained.

There are three general types of non-dedicated equipment used for well purging and include: bailers, surface pumps and down-well pumps. The purge method and equipment selected should be specified in the project-specific work plans.

NOTE: This SOP only describes the most common equipment and methods used for purging. Other purging equipment, as well as dedicated equipment, can be used provided that the method employed does not have an adverse effect on the overall quality of the groundwater.

Regardless of the purge method, purge water temperature, pH, and specific conductance will be monitored at predetermined purge volumes and recorded on the Groundwater Sample Collection Record. Additional water quality parameters may be required by the project-specific sampling plan. In general, purging will be considered complete following the withdrawal of at least 3 to 5 well volumes of groundwater and when all field parameters have stabilized.

Purging a well to dryness may occur under some low-yield conditions or tidal conditions. When the well recovers, a cascading effect may occur within the screened zone which can volatilize some organic compounds. This may be considered inappropriate by regulatory agencies when volatile organic compounds (VOC) are the target analyte of interest. Purging a well to dryness, then sampling after it has recovered may be acceptable for other target analytes, however. Under low yield conditions, low-flow sampling pumps such as bladder pumps may be required for VOC sample collection.

4.4.2 Bailing

General

Bailing is often the most convenient method for well purging especially if only a small volume of purge water is required during the purge routine. Bailers are constructed using a variety of materials including PVC, polyethylene, stainless steel, and Teflon®. Teflon® bailers are generally most "inert" and are available in reusable and disposable form. Disposable polyethylene bailers are relatively inert and inexpensive. Reusable stainless steel and PVC bailers must be decontaminated between uses. Most commercially available bailers are constructed to fit into a 2-inch diameter well, although other bailer diameters are available.

Waterra™ foot valves are essentially bailer check valves which manually thread onto the bottom of standard pump tubing (polyethylene, teflon). The foot valves are commercially available in a variety of diameters in stainless steel, Teflon®, and high-density plastic (Delrin). The foot valves operate by manually or mechanically raising and lowering the valve assembly within the water column which raises the water level within the discharge tube. Flow rates usually in the vicinity of 1 gallon per minute can be achieved with these devices.

Measurements of the pumping rate, temperature, pH, and specific conductance (and/or other parameters as required) should be made after each purge volume is removed and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been withdrawn and the field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

Bailing presents two potential problems with well purging. First, increased suspended solids may be present in samples as a result of the turbulence caused by raising and lowering the bailer through the water column. High solids concentrations may affect sample representativeness. Second, bailing may be less feasible for deep wells or wells which require a large volume of water to be removed during purging because of the time involved with continuous insertion and removal/emptying of the bailer.

Bailing Procedure

Obtain a clean bailer and a spool of clean polypropylene or nylon bailer cord. Uncover the top end of the bailer and tie a bowline knot, or equivalent, through the bailer loop. Test the knot and the bailer itself to ensure that all knots and parts are secure prior to inserting the bailer into the well.

Remove the protective wrapping from the bailer, and lower the bailer to the bottom of the monitoring well and cut the cord at a proper length. Bailer rope should never touch the ground surface at any time during the purge routine. Tie a hand loop at the end of the bailer cord.

Raise the bailer by grasping a section of cord using each hand alternatively in a "rocking" action. This method requires that the sampler's hands be kept approximately 2-3 feet apart and that the bailer rope is alternately looped onto or off each hand as the bailer is raised and lowered.

Grab the bailer with one hand as it emerges from the well. Pour the bailed groundwater from the bailer into a graduated bucket to measure the purged water volume. Repeat this procedure until one complete purge volume of water is removed from the well.

At the end of one complete well purge volume, place a small of purged water into a sample cup. Measure temperature, pH and specific conductance (and for other assigned parameters) and record the results on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been withdrawn and the specific field parameters have stabilized to within 10% of their preceding measurement.

4.4.3 Surface Pumps

General

Well purging using pumps located at the ground surface can be performed with peristaltic or centrifugal pumps if the water level in the well is within approximately 20 feet of the top of the well.

Peristaltic pumps provide a low rate of flow typically in the range of 0.02-0.2 gallons/minute (75-750 ml/min). For this reason, peristaltic pumps are not particularly effective for well purging. Peristaltic pumps are suitable for purging situations where disturbance of the water column must be kept minimal for particularly sensitive analyses.

Centrifugal pumps are designed to provide a high rate of pumping, in the range of 5 to 40 gallons/minute (gpm), depending on pump capacity. Discharge rates can also be regulated somewhat, provided the pump has an adjustable throttle. These pumps also require polyethylene or teflon-lined polyethylene tubing as suction line. The pump may also require priming to initiate flow.

Peristaltic Pump Procedure

Attach a new suction and discharge line to the peristaltic pump. Silicon tubing must be used through the pump head and must meet the pump head specifications. A second type of tubing may be attached to the silicon tubing for use as the suction and discharge continuous discharge. If drawdown causes the discharge to stop, the suction line will be lowered very slowly further down into the well until pumping restarts.

Measurements of temperature, pH and specific conductance (and/or other assigned parameters) should be made after each well purge volume and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been removed and the specific field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

Measure the length of the suction line and lower it down the monitoring well until the end is in the upper foot or more of the water column. Start the pump and direct the discharge into a graduated bucket. Adjust the pumping rate with the speed control knob so that a smooth flowing discharge is attained.

Centrifugal Pump Procedure

Attach a new suction and discharge line to the centrifugal pump. Start the pump and record the stabilized rate of discharge. As with other well purging systems, measurement of temperature, pH, and specific conductance (or other parameters as required) will be made after each well purge volume has been removed. These measurements shall be recorded on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been removed and the field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

4.4.4 Down-Well Pumps

Groundwater withdrawal using non-dedicated down-well pumps may be performed with a submersible pump or a bladder pump.

Electric submersible pumps provide an effective means for well purging and in some cases sample collection. Submersible pumps are particularly useful for situations where the depth to water table is greater than 20 feet and where the depth or diameter of the well requires that a large purge volume be removed before sample collection.

Commonly available submersible pumps include the Johnson-Keck pump model SP-82, the Grunfos Ready-Flow 2 pump, and disposable marine galley pumps, all of which are suited for operation in 2-inch or larger internal diameter wells.

Recently, the use of bladder pumps (positive gas-displacement pumps) has been promoted by the EPA for use in well purging and sampling primarily because the pumps can be operated at low flow rates (less than 1 liter per minute). Bladder pumps generally reduce the potential turbidity of the sample and theoretically reduce the potential for loss of VOC constituents, ultimately providing a more representative groundwater sample. Use of bladder pumps may require additional time for purging and sampling because of the low flow rate. Please note, however, that when using bladder pumps, it may not be necessary to purge an entire well volume of water prior to each check of the water quality parameters. Well purging is accomplished at such a low rate that, theoretically, the influent flow into the pump represents groundwater flow through the well screen, thereby eliminating the requirement for purging several entire well volumes of water before sample collection.

Bladder pumps usually consist of a stainless steel pump housing with an internal teflon or polyethylene bladder. Discharge tubing is generally made from teflon, polyethylene, or teflon-lined polyethylene. The pump is operated by lowering it into the water column within the well screen, then pulsing air into the bladder with an air compressor and pump controller unit. Pumps and controllers are often not interchangeable between manufacturers; therefore, it is usually necessary to have both items provided by the same manufacturer. Pump bladders are generally field-serviceable and replaceable.

A check of well condition may be required prior to inserting any down-well pump if the well has not been sampled for some time or if groundwater quality conditions are not known. The well condition check should include a check of casing plumbness as a bent well casing could cause a pump to get stuck. Casing plumbness can be checked by lowering a clean cylindrical tube with the approximate pump dimensions into the well. If the well casing is not plumb then an alternative purging method should be used.

The well inspection should also include a check of air quality or headspace conditions within the well for potentially explosive gasses and a check for free product which could foul the pump. Well casing headspace conditions can be monitored with a photoionization detector (PID) and/or an explosimeter for the presence of potentially explosive gasses. If potentially hazardous conditions exist, then an alternative purging method should be used. In general, it is rare for explosive conditions to be present.

The presence of free product should be determined before inserting the submersible pump into the well because free product may contaminate the pump's internal mechanisms making it extremely difficult to decontaminate. An interface probe should be used to check for free product.

Electric Submersible Pump Procedure

Once the above well conditions have been assessed, and assuming it's safe to precede, slowly lower the submersible pump with attached discharge line into the monitoring well taking notice of any roughness or restriction within the well riser pipe. The pump should be placed in the uppermost section of the static water column of the monitoring well. The power cord should be attached to the discharge line with an inert material (i.e., zip-ties) to prevent the power cord from getting stuck between the pump, discharge line, and the well casing. Secure the discharge line and power cord to the well casing, using tape or a clamp, taking care not to crimp or cut either the discharge line or power cord.

Connect the power cord to the power source (i.e., rechargeable battery pack, auto battery, or generator) and turn the pump on. Voltage and amperage meter readings on the pump controller (if provided) should be monitored closely during purging. The operations manual for the specific pump used should be reviewed regarding changes in voltage/amperage and the potential impacts on pump integrity. Pumping should be discontinued if warning conditions occur and/or if the well is pumped to where drawdown falls below the pump's intake level.

If drawdown continues to the extent that the well is pumped dry, the pump should be shut off and the well allowed to recharge. This on/off cycle may be necessary in order to purge the well properly.

Measurements of the pumping rate, temperature, pH, and specific conductance (and/or other required parameters) should be made after each purge volume is removed and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required purge volume has been withdrawn and the field parameters have stabilized to within 10% of their preceding measurement. Project-specific sampling objectives may require that the sample be collected with a bailer.

Bladder Pump Procedure

To operate the bladder pump system, the pump and discharge line should be lowered into the well close to the bottom of the well screen, and then secured to the well casing with a clamp. The air compressor should then be turned on to activate pumping. The pump controller is used to vary the discharge rate to the required flow.

Measurements of the pumping rate, temperature, pH, and specific conductance (and/or other required parameters) should be made at periodic intervals while water is removed and documented on the Groundwater Sample Collection Record or in the field logbook. Samples may be collected after the required field parameters have stabilized to within 10% of their preceding measurement. Generally, because of the low flow rate, samples are usually obtained from the bladder pump discharge line.

4.5 Sample Collection Methods and Procedures

4.5.1 Objectives

Groundwater samples can be collected using similar methods employed for purging, provided these methods do not adversely affect the quality of the groundwater. These methods include bailing, surface pumping and down-well pumping.

In most cases during sampling, groundwater will be transferred to the appropriate containers directly for the discharge source. During transfer, discharge tubing and other equipment shall not contact the inside of the sample containers. In addition, a clean pair of nitrile or latex gloves will be worn during sample collection and handling.

As a general rule of thumb, samples should be collected in order of decreasing volatilization of the target parameters. The preferred order of sample collection is as follows: volatile organic compounds, extractable organic compounds (e.g., semivolatile organic compounds, PCBs, pesticides), metals, and general water chemistry (ions and turbidity).

4.5.2 Bailers

The methods and procedures described in this section also apply to collecting groundwater samples with a bailer. If a bailer was used to purge the well, the same bailer may be used for sampling. If other well purging equipment was used, a decontaminated or new disposable bailer should be used for sampling.

When volatile organic compounds are the target sampling parameter, a bottom discharge tip should be used during sample transfer. A discharge tip restricts the outflow of the sample from the bailer and diminishes the potential for volatilization. Reusable bailers may require a special screw-on tip fitted with a bottom discharge top. Disposable bottom discharge tips are usually supplied with disposable bailers.

Bailer cord shall be discarded after sampling is completed. Disposable bailers should only be used in one well. Reusable bailers should be appropriately decontaminated between uses.

4.5.3 Surface Pumps

The methods and procedures described in this section for peristaltic and centrifugal pumps also apply to groundwater sample collection.

Peristaltic Pumps

Peristaltic pumps equipped with the appropriate type tubing will be used to collect groundwater from wells in which the water resides at a depth less than 20 feet. Sample bottles shall be filled directly from the pump's discharge line and care shall be taken to keep the discharge tube from contacting the sample container.

Groundwater samples requiring filtration prior to placement in sample containers can be placed in intermediate containers for subsequent filtration, or may be filtered directly with in-line disposable 0.45-micron filters.

After sampling is complete, all used tubing and filters shall be disposed of appropriately.

Centrifugal Pumps

Centrifugal pumps are generally not recommended for use in sample collection, especially when volatile organic compounds are the target analyte of interest. Samples for other analytes, however, may be obtained with use of an in-line sample trap. It is suggested that if samples cannot be obtained before going through the pump, that samples be obtained by using a bailer once purging is complete and pumping has ceased. Collecting samples from the pump discharge is not recommended.

After sampling is complete, all suction line tubing should be disposed of properly.

4.5.4 Down-Well Pumps

Electric Submersible Pump

Using the pump methods described in Section 4.9.4, groundwater samples can be collected directly from the pump discharge line, provided the discharge line is composed of inert material. Sample bottles will be filled directly from the discharge line of the pump. This method is generally not recommended for collection of volatile organic samples.

Bladder Pumps

Groundwater samples, including those collected for VOC analysis may be collected directly from the pump discharge tubing under active pumping conditions. Sample bottles will be filled directly from the discharge line of the pump.

After sampling is complete, the pump, discharge line and power cord shall be decontaminated and/or disposed of as required by the project-specific work plan.

Low Volume and Poor Recovery Wells - Purging and Sampling Procedures

Even with a low pumping rate, some wells experience significant drawdown or in extreme cases may even purge dry. Slow recovering wells or wells that purge dry require extra care in order to be purged and sampled with minimal disturbance to the water column and fine materials in and around the well screen.

For low volume and poor recovery wells, review past field data sheets if available for previous purge rates, amounts of drawdown, and purge volume prior to sample collection. Measure the well's water level. If you suspect the well may be low yielding, calculate the amount of standing water in one well volume as described in step 4.3.

If the well is not equipped with a dedicated sampling system, install a decontaminated pump or pump tubing. Slowly lower the equipment through the water column to avoid stirring up particulates. The final pump intake depth should be near the bottom of the screened interval. To prevent stirring up particulates it is important not to touch the well bottom. Record the intake depth on the field data sheet.

Once the pump or pump tubing is in place, slowly lower the water level probe back into the well. It is important to frequently measure the water level throughout purging in low volume or poor recovery wells to enable the pump rate to be adjusted downward if necessary.

Start purging at a rate less than 0.5 liter per minute if the pump capacity allows. Record the pump rate on the field data sheet. At regular intervals record field parameter values, water level, time of measurement, and amount of purge water discharged. Allow at least one complete exchange of water in the flow cell between measurements. Note and provide qualifying remarks if parameter readings are anomalous, the water level is dropping or if at some point the water level stabilizes. Record observations on the pumped waters appearance (e.g. clarity, odor, etc.) during purging and sampling. Continue purging until field parameters stabilize.

Attempts should be made to avoid purging low yielding wells dry. However, if this is not possible shut the pump off and allow the well to recover at least once before collecting samples. This generally constitutes an adequate purge, and the well can be sampled as soon as it has recovered sufficiently to produce an adequate volume of water to fill the sample containers. If time permits, purge the well a second time and allow it to recover before sampling. Samples should be collected within 24 hours of the final purge/recovery cycle.

It should be noted that there can be significant alterations in groundwater chemistry when a well is purged dry and allowed to recover before sampling. Groundwater chemistry can change as formation water surrounding or entering the screened interval of the well is exposed to air which can affect volatile organics and redox sensitive analytes. Increased turbidity can also be an issue when sampling metals and some general chemistry parameters (Ecology 2014). Collect samples once field parameters stabilize and any end of purge analysis has been conducted.

If the well has been purged dry and allowed to recover, field parameters should be measured after sample collection if there is an adequate volume of water. Sample containers should be filled in the order specified in the project QAPP. However, when sampling low-yielding wells which may not have a sufficient volume of water to fill all the sample containers, the relative importance of each analyte should be evaluated. Samples for analytes of most interest should be collected first.

4.6 Sample Filtration

Groundwater samples collected for total dissolved metals analyses will be filtered prior to being placed in sample containers and properly preserved. Groundwater filtration will be performed using a peristaltic pump and a 0.45-micron in-line water filter. Disposable filters are commonly available in 0.45-micron size. Low-capacity or high-capacity cartridges are available and may be selectively used based on sample turbidity.

The filtration of groundwater samples shall be performed either directly from the pump discharge line or from laboratory-supplied intermediate containers. In either case, well purging shall be performed first. Fresh groundwater shall then be filtered directly into sample containers.

4.7 Sample Handling

All samples collected should be packaged and handled according to ensure no breakage during shipping. Preservatives should be used where analytical methods require preservation. The QAPP will indicate the type of sample preservation necessary.

5 QUALITY CONTROL

5.1 Field Blank/Equipment Blank Sample Collection

Field blank samples serve as a quality assurance check of equipment and field conditions at the time of sampling. Field blank samples are usually prepared by transferring analyte-free water into a clean set of sample containers, then analyzing it as a sample. Sometimes, the analyte-free water is transferred over or through the sampling device before it is placed into the sample containers. This type of field blank sample is known as an equipment blank. The QAPP contains specific information regarding the type and number of field blanks or equipment blanks required for collection.

5.2 Field Duplicate Sample Collection

Field duplicate samples are collected for the purpose of providing two sets of results for comparison. These samples are used to assess precision. Duplicate samples are usually prepared by splitting the sample into two sets of sample containers, then analyzing each set as a separate sample. The QAPP contains specific information regarding the type and number of duplicate samples for collection.

5.3 MS/MSD Sample Collection

MS/MSDs provide information about the effect of the sample matrix on digestion and measurement methodology. For samples submitted for MS/MSD analysis, triple sample volume is generally required (contact the analytical laboratory for information specific to the project analytical parameters). The QAPP contains specific information regarding the frequency of MS/MSD samples.

6 DOCUMENTATION

Specific information regarding sample collection should be documented in several areas: the sample chain-of-custody record, sample collection record, field notebook, and sample labels, tags. Additional information regarding each form of documentation is presented in the following paragraphs:

6.1 Sample Chain-of-Custody Record

This ENSR standard form requires input of specific information regarding each collected sample for laboratory analytical purposes. The information requested includes site name and location, project number, field notebook reference, collection date and type of analysis requested. Each sample submitted for analysis is also listed individually using its field identification number, number and type of container, and requested analyses.

6.2 Groundwater Sample Collection Record

This form (Attachment 1 or 2) requires input of specific information regarding the collection of each individual sample including sample identification, water quality parameters, collection method, and containers/preservation requirements.

6.3 Field Logbook

This logbook should be dedicated to the project and should be used by field personnel to maintain a general log of activities throughout the sampling program. This logbook should be used in support of, and in combination with, the sample collection record. Documentation within the logbook should be thorough and sufficiently detailed to present a concise, descriptive history of the sample collection process.

6.4 Sample Labels/Tags

Sample labels shall be completed at the time each sample is collected and attached to each sample container. Labels will include the information listed below.

- Client or project name/project number
- Sample number
- Sample designation
- Analysis type
- Preservative
- Sample collection date
- Sample collection time
- Sampler's name

7 TRAINING/QUALIFICATIONS

Groundwater sample collection is a relatively involved procedure requiring formal training and a variety of equipment. It is recommended that initial sampling attempts be supervised by more experienced personnel. Sampling technicians should be health and safety certified as specified by OSHA (29 CFR 1910.120(e)(3)(i)) to work on sites where hazardous waste materials are considered to be present.

8 REFERENCES

Washington State Department of Ecology (Ecology) Standard Operating Procedure for Purging and Sampling Monitoring Wells plus Guidance on Collecting Samples for Volatiles and other Organic Compounds. Version 2.0. January 27, 2014.

EPA, Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, EQASOP-GW4. Revised September 19, 2017.

EPA, Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA-600/4-82-029, September 1982.

EPA, RCRA Groundwater Monitoring Technical Enforcement Guidance, November 1992.

Geotrans, Inc., RCRA Permit Writer's Manual, Groundwater Protection, prepared for the U.S. EPA, Contract No. 68-01-6464, October 1983.

Code of Federal Regulations, Chapter 40 (Section 261.4(d)).

Low Flow Groundwater Sample Collection Record

Date:	**Well ID:**
Project Name:	**Location:**
Project Number:	**Collector(s):**
Start Time:	**End Time:**

Water Level Data

Total Well Depth:		Water Table Depth:	
Screen Interval:		Tubing Placement Depth:	
Well Volume		**Well Volume = 3.14*(R^2*H*(CF)** R= Radius (feet), 2 inch = 0.17 feet H = Height of the water column CF = conversion factor = 7.48 gal/ft3	
Purge Method:		Purge Rate:	

Water Quality Parameters

Time (24 hr)	Vol. Purged (L)	Temp (C)	pH	Spec. Cond (uS/cm)	DO (mg/L)	ORP (mv)	Turbidity (NTU)	Flow Rate (ml/min)	DTW	Color/ Odor

Acceptance Criteria defined:

Temp 3%	pH +/- 1.0 unit	Spec. Cond 3%	DO 10%		
Turbidity <5 NTU*	ORP +/- 10 MV	Drawdown <0.3'*			
Sample Collection:			Duplicate Details:		

*Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. If after 2 hours of purging indicator field parameters have not stabilized, discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization.

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Low Flow Groundwater Sample Collection Record

Date:	**Well ID:**
Project Name:	**Location:**
Project Number:	**Collector(s):**
Start Time:	**End Time:**

Water Level Data

Total Well Depth (ft BTOC):		Initial Water Level (ft BTOC): Product Level (if applicable):	
Screen Interval:		Tubing/Pump Intake Depth:	
Well Volume:		Equipment and Additional Details:	
Purge Method:			

Water Quality Parameters

Time (24 hr)	Vol. Purged (L)	Temp (C)	pH	Spec. Cond	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (mL/min)	DTW (ft BTOC)	Color/ Odor

Stabilization guidelines:

Temp 3%	pH +/- 1.0 unit	Spec. Cond 3%	DO 10%	
Turbidity <10 NTU*	ORP +/- 10 MV	Drawdown <0.3'*		

*Achievement of turbidity levels of less than 10 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. If after 1 hour of purging indicator field parameters have not stabilized, discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization.

Decontamination of Field Equipment	May 2020	**CRETE SOP No. 1014**
	Rev. # 2	
	Jamie Stevens	

1 INTRODUCTION

1.1 Purpose and Applicability

This Standard Operating Procedure (SOP) describes the methods used for decontamination of field equipment used in the collection of environmental samples which may have contacted investigated media (including soil, groundwater, surface water, sediment, and other media). It is important to follow these procedures from a quality control (QC) perspective to ensure that environmental data generated in the field are of the highest quality and are not misrepresented or misinterpreted due to cross-contamination. Also, improperly decontaminated sampling equipment can lead to cross contamination and could expose field personnel to hazardous materials.

This SOP discusses the decontamination procedures to be used with reusable field equipment. Respective state or federal agency regulations may require specific types of equipment or procedures used in the decontamination of field equipment. The Project Manager should review applicable state/federal regulations (if any) prior to the start of field work and update this SOP per those regulations.

1.2 General Principles

Potential hazards associated with the planned tasks should be thoroughly evaluated prior to conducting field activities. The site-specific Health and Safety Plan (HASP) provides a description of potential hazards and associated safety and control measures.

Decontamination is accomplished by manually scrubbing, washing, or spraying equipment with detergent solutions, tap water, distilled/deionized water, steam and/or high pressure water or solvents. Generally this is conducted between each sampling site or collection points, unless sufficient sampling collecting tools are available. Waste decontamination materials, such as spent liquids and solids, are collected and managed as investigation-derived waste for later disposal.

Sampling personnel must wear powder-free nitrile gloves while performing the procedures described in this SOP. Specifically, nitrile gloves must be worn while preparing sample bottleware, preparing and decontaminating sampling equipment, collecting and processing samples, and packing samples. At a minimum, nitrile gloves must be changed prior to the collection of each sample or as necessary to prevent the possibility of cross-contamination with the sample, the sample bottleware, or the sampling equipment.

Consideration should be given to the order in which the samples are collected. In general, samples should be collected from areas suspected to be least impacted by contamination followed by areas suspected to be most impacted by contamination, thereby minimizing the potential for cross-contamination Prior to field activities, the field team should consider how investigation-derived waste (such as decontamination fluids) is to be handled.

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will allow for collection of equipment blank samples in order to determine the effectiveness of the decontamination procedures.

Solvent selection is an important consideration and should be evaluated for each scope of work, at each site. There are several factors which shall be considered. The solvent should not be an analyte of interest, the sampling equipment should be resistant to the solvent, and the solvent must evaporate or be water soluble or preferably both.

Pesticide-grade methanol is the solvent of choice for general organic analysis. Hexane, acetone, and isopropanol are also good choices for organic analysis. A 10% nitric acid in deionized water solution is the solvent of choice for general metals analysis. Nitric acid can be used on Teflon, plastics and glass. If used on metal equipment, the nitric acid will eventually corrode the metal and could introduce metals from the sampling equipment into the environmental samples. Dilute hydrochloric acid can also be used for metal analysis.

All Decontamination should be performed a safe distance away from the sampling area as to not interfere with sampling activities.

1.4 Health and Safety Considerations

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). All field activities will be conducted in conformance to this HASP.

At a minimum, the following precautions should be taken in the field during these cleaning operations:

- When conducting field cleaning or decontamination using laboratory detergent, safety glasses with splash shields or goggles, and latex gloves will be worn.

• No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations

2 RESPONSIBILITIES

2.1 Sampling Technician

It will be the responsibility of the sampling technician to be familiar with the decontamination procedures outlined within this SOP, the HASP, the QAPP, and the Sampling Plan. The sampling technician is responsible for the proper decontamination of all field equipment and proper documentation. The sampling technician is also responsible for ensuring that all decontamination producers are following by all subcontractors. Decontamination may be required on heavy equipment; it is the responsible of the sampling technician to ensure all equipment has been properly decontaminated.

2.2 Field Project Manager

It will be the responsibility of the field project manager to ensure that the sampling technician understands the decontamination producers and has access to all materials required for decontamination. The field project manager is also responsible for all waste generated during decontamination producers.

3 REQUIRED MATERIALS

In addition to those materials provided by the subcontractor, the project geologist/sampling engineer may require:

- Decontamination agents
- Chemical free paper towels
- Waste storage containers
- Cleaning storage containers
- Cleaning brushes
- Pressure sprayers (if required)
- Squeeze bottles
- Plastic sheeting
- Aluminum foil
- Health and safety equipment (as required by HASP)
- Project notebook/field sheets/pen

Sampling equipment which comes in direct contact with environmental samples during the sample collection process should be constructed of stainless steel, teflon, or glass, unless specified otherwise in the Project Sampling Plan or QAPP.

4 METHOD

4.1 General Method Description

It should be assumed that all sampling equipment, even new items, are contaminated until the proper decontamination procedures have been performed, unless, certificate of analysis is available and demonstrates the items are clean.

It is important to set up a decontamination cleaning station. This will vary depending on site acitivites and site access. Generally speaking, an decontamination area for small/hand held equipment cleaning should include a barrier (e.g. plastic sheeting) to work on, should decontamination tubs and/or buckets and rinse bottles in order of use on top of the barrier. Decontamination solution containing solutions and water should be gathered and put into accessible containers within easy reach of the decontamination tubs). Record the source of the water in the field logbook.

For decontamination of drilling rigs or backhoes/excavators, establish an area for decontamination that will meet the program and site-specific requirements for collection of decontamination fluids. If necessary, set up a decontamination pad. If containerization of decontamination fluids associated with decontaminating large equipment (such as drilling rigs and backhoes/excavators) is required, it is imperative to ensure that the subcontractor will have appropriate equipment onsite. This equipment may include a portable electric generator and a high-pressure steam-cleaner or steam-jenny. In addition, a decontamination pad or portable containment system should be used to collect fluids. The contractor shall conduct gross decontamination (such as removing general mud from large equipment) prior to arriving at site.

All equipment used for sampling, testing, or measuring, including excavating and drilling equipment, that comes in contact with potentially sampled media will be decontaminated prior to use unless the equipment is prepackaged and sealed by a manufacturer of environmental sampling equipment. Reusable sampling equipment will also be decontaminated between sampling locations. If disposable sampling equipment (clean prepackaged materials) is used, this equipment will not be decontaminated before use and will be disposed of properly after one use. Disposable equipment will not be used at more than one sampling location.

The following presents decontamination procedures for manual sampling equipment and heavy equipment.

4.2 Equipment Decontamination – Small Hand Held Equipment

The following general decontamination steps should be applied to all equipment prior to initial use (unless using clean prepackaged environmental sampling equipment) or that have been utilized to collect sample media for analytical purposes. Site-specific project control documents may specify modifications to these procedures and should be followed when applicable. It is important to note that no acids or solvents will be used to decontaminate any electrical or electronic instrumentation unless specified by the manufacturer.

a. Physically remove visible material from the sampling equipment to the extent practical before decontaminating the equipment with decontamination fluids. If this material appears to be impacted based on visual observation, instrument readings, or other credible indication, collect and manage this material in accordance proper procedures.
b. Immerse (to the extent practicable) the equipment in the cleaning solution and scrub the equipment thoroughly with a stiff brush until visible residual material is removed and the equipment is visibly clean. Circulate detergent solution through equipment that cannot be disassembled such as submersible pumps (ASTM, 1990).
c. Rinse the equipment thoroughly with potable water.
d. Rinse the equipment with organic desorbing agent (e.g., isopropyl alcohol). If samples are not being collected for analysis of organic compounds, omit this step (ASTM, 1990).
e. Rinse the equipment thoroughly with potable or DI water.
f. To the extent practicable, allow the equipment to air dry in a clean area (equipment does not need to be completely dry before reuse; under certain weather conditions, complete air drying is not possible).
g. Change the initial decontamination solution daily and/or between sites at a minimum and more frequently as needed. Collect decontamination solvents in a separate container from water/detergent solutions and properly containerize, store, and dispose of decontamination solutions.

If decontaminated equipment will not be used immediately, the equipment may be wrapped in aluminum foil (if used for organics only) or sealed in a plastic bag for storage. Decontamination activities, including date, time, and reagents used, should be documented in the field logbook and decontaminated sampling equipment should be labeled with this information as appropriate.

4.3 Equipment Decontamination – Decontamination of Heavy Equipment

The following steps for decontamination can be applied to heavy equipment.

a. Physically remove as much of the visible material as possible from the heavy equipment after use and prior to steam cleaning. If contaminated material is suspected as determined by visual observations, instrument readings, or other means, collect material in an appropriate container. Otherwise, return the material to the area where it originated.
b. Place the heavy equipment on the decontamination pad in the decontamination area. If wash water is to be collected, ensure that the collection mechanism functions properly and that the decontamination pad has no leaks.
c. Steam clean parts of the heavy machinery that come into contact with visible material (such as tires, bulldozer bucket, augers, and back of drill rig).
d. For any portion of the heavy equipment that comes into contact with the sampling media, decontaminate by following listed in Section 4.2.
e. Containerize fluids, if appropriate. Place solids in a drum or other appropriate container.

5 QUALITY CONTROL

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

Equipment blanks and Field blanks are generally made by pouring laboratory-supplied deionized water into, over, or through the freshly decontaminated sampling equipment. Blanks should be labeled as a sample and submitted to the laboratory to be analyzed for the same parameters as the associated sample.

6 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms include:

- Boring logs
- Field log books
- Sample collection records
- Chain-of-custody records
- Shipping labels

The field team should document and log all field sampling decontamination methods. Repetitive decontamination of small items of equipment does not need to be logged each time the item is cleaned.

7 REFERENCES

ASTM. Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites: D 5088-90, 1990.

sample is removed from the tool. The soil sample is then cut from or extracted from the liner. This sampling tool is most often used for soil profiling and collection of larger volume soil samples (1,300 ml).

The Large Bore Sampler consists of a 22-inch long by a slightly over 1-inch diameter steel sampling tool and may be used for sampling to depths of approximately 30-50 feet. Various liner types are available for use with this sampler, and include: plastic, brass, stainless steel, and Teflon®. The metal liners are available in segmented 6-inch lengths. The sampler is designed for discrete interval sampling and is not affected significantly by borehole wall collapse. This sampler is similar to a piston sampler where a retractable drive (piston) point is withdrawn when the targeted sampling interval is achieved and the soil sample enters the sampler. Once the sampler is removed from the ground, the inserted liner containing the soil sample is extracted from the sampler and the soil sample is then cut from or extracted from the liner. The segmented liner materials and discrete interval sampling capability gives this device greater suitability for collection of smaller volume soil samples (320 ml).

1.2.2 Split Spoon Sampling

Split-spoon subsurface sampling methods require the use of a drilling rig (e.g. hollow-stem auger) to drill a borehole in which a split spoon sampling device is inserted and then driven to collect soil at the desired depth. The sampling device is driven using a weighted hammer and retrieved and opened to remove the recovered soil sample. Soil samples can be collected at continuous intervals or at pre-selected intervals. Typical split spoon samplers are used on a 2 inch diameter auger, though sampling devices come in a variety of sizes to fit difference auger diameters.

1.3 Quality Assurance Planning Considerations

Sampling personnel should follow specific quality assurance guidelines as outlined in the site-specific Quality Assurance Project Plan (QAPP). Proper quality assurance requirements should be provided which will allow for collection of representative samples from representative sampling points. Quality assurance requirements outlined in the QAPP typically suggest the collection of a sufficient quantity of field duplicate, field blank, and other samples.

1.4 Health and Safety Considerations

All utilities (electric, water, sewer, etc.) or property owners who may have equipment or transmission lines buried in the vicinity of proposed investigation area should be notified. Sufficient time should be allowed after notification (typically 3 working days) for the utilities to respond and mark locations of any equipment that may be buried on site. The estimated location of utility installations, such as sewer, telephone, electric, water lines and other underground installations that may reasonably be expected to be encountered during excavation work, shall be verified by the site owner prior to opening an excavation and may require a private utility locate to verify location and or material present.

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). All field activities will be conducted in conformance to this HASP.

2 RESPONSIBILITIES

2.1 Project Geologist/Engineer

It will be the responsibility of the project geologist/sampling engineer to conduct subsurface soil sampling in a manner which is consistent with this SOP. The project geologist/sampling engineer will observe all activities pertaining to subsurface soil sampling to ensure that the SOP is followed, and to record all pertinent data onto a boring log. It is also the project geologist/sampling engineer's responsibility to indicate the specific targeted sampling depth or sampling interval to the drilling subcontractor. The project geologist/sampling engineer is also responsible for the collection of representative environmental or stratigraphic characterization samples once the sampling device has been retrieved and opened. Additional sample collection responsibilities include labeling, handling, and storage of samples until further chain-of-custody procedures are implemented.

2.2 Drilling Subcontractor

It will be the responsibility of the drilling subcontractor to provide the necessary Geoprobe™ or auger drilling equipment for obtaining subsurface soil samples. For Geoprobe™ equipment this generally includes the truck or ATV-mounted percussion/probing machine and one or more Macro-Core and Large Bore samplers in good operating condition, appropriate liners, and other necessary equipment for borehole preparation and sampling. For split spoon sampling a drill rig – such as a hollow-stem auger drill rig – and one or more split spoon sampling devices which fit with the drill rig augers, all of which should be in good operating condition.

It is the drilling subcontractor's responsibility to provide and maintain their own boring logs if desired. Equipment decontamination materials should also be provided by the subcontractor and should meet project specifications.

3 REQUIRED MATERIALS

In addition to those materials provided by the subcontractor, the project geologist/sampling engineer will require:

- Project Sampling Plan, QAPP, and HASP

- Field records/logbook (boring logs)
- Sampling spoons and sample collection bowl
- Stakes and/or fluorescent flagging for marking locations
- Sample kit (bottles, labels, custody records and tape, cooler)
- Folding rule or tape measure
- Equipment decontamination materials (as required by QAPP)
- Health and safety equipment (as required by HASP)
- Sheet plastic
- Decontamination materials and solutions

Sampling equipment which comes in direct contact with environmental samples during the sample collection process should be constructed of stainless steel, Teflon®, or glass, unless specified otherwise in the Project Sampling Plan or QAPP.

4 METHOD

4.1 General Method Description – Geoprobe

Geoprobe™ soil sampling methods generally involve collection of soil samples by driving the sampling tool directly into the ground using the percussion/probing machine and without the aid of hollow-stem augers or other casing-installed drilling methods. Both the Macro-Core and Large Bore soil samplers consist of metal tubes of seamless construction which cannot be split apart like split-spoons. Liner/sleeve inserts are required in order to extract an intact soil core/sample from the sampling device.

Both sampling devices operate by being directly pushed/hammered into the ground by the percussion/probing machine. The borehole is created as the sampling device is advanced downward. The Macro-Core Sampler collects samples continuously and requires that an open borehole be maintained for efficient sample recovery. The Large Bore Sampler contains a piston tip/drive point which allows for advancing the sampler to a designated depth for discrete interval sampling. The piston tip is retracted when the desired sampling interval is reached. When the soil sampling device is retrieved from the borehole, the drive head, cutting shoe and/or piston assembly is removed, and the liner insert with sample is removed from the sampling device. The project geologist/sampling engineer is then given access to the sample for whatever purpose is required.

4.2 General Method Description – Split Spoon Sampling

Split spoon sampling devices are typical construction of steel and most commonly available in lengths of 18 and 24 inches. Sampling device diameters are typical 1.5 to 3 inches. The sampling device includes a long tubular column with two halves that split apart lengthwise, a drive head is located on the upper end with a ball-check valve for venting and a hardened steel cutting shoe is located at the bottom. Soil enters the sampling device through the hardened steel cutting shoe as the sampler is driven into the ground to the required depth. Inside the cutting shoe is often a plastic or metal basket that prevents the soil sample from falling out of the shoe as the sample is retrieved.

Soil borings completed with a hollow-stem auger (typical for completing soil borings for the collection of soil samples) must have casing/augers of sufficient diameter to allow for the collection of the minimum soil sample volume required in the Sampling Plan. The casing/augers are advanced to the required sampling depth per the Sampling Plan. If hollow-stem augers are used, a temporary plug shall be used in the lead auger to prevent the auger from becoming filled with drill cuttings while drilling is in progress.

Use of added or recirculated water during drilling is permitted when necessary but should be minimized to avoid any possible impacts to the sample quality. Water usage shall be documented in the field notebook and should follow the QAPP or Sampling Plan.

4.3 Equipment Decontamination

Each sampling device must be decontaminated prior to its initial use and following collection of each soil sample. If sampling for soil logging only is conducted, thorough sampler decontamination between samples may not be necessary although sufficient cleansing is necessary for the sampler to operate properly. Site-specific requirements for equipment decontamination should be outlined in the Project Sampling Plan.

4.4 Sampling Procedures - Macro-Core Sampler

These procedures are excerpted from Geoprobe™ Systems literature. This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample acquisition are not provided.

4.4.1 Sampler Preparation

- Decontaminate the sampler parts (cutting shoe, sample tube, liners) before assembly.
- Assemble the sampler by first placing the liner over the inside end of the cutting shoe, then inserting the liner/shoe assembly into the sample tube, and then finally threading the cutting shoe into the sample tube. Tighten the cutting shoe with the shoe wrench.
- Thread the sampler onto the drive head.

4.4.2 Sampling

- Using the percussion/probing machine, drive the sampler into the ground until the drive head reaches the ground surface.
- For deeper samples, the borehole walls must remain stable. The cutting shoe is designed with a tapered surface to limit sidewall scraping. Add additional probe rods until the sampler reaches the targeted sample interval, then drive the sampler through the desired sample interval.
- Use the machine hydraulics to pull the sampler from the borehole.

4.4.3 Sample Recovery

- Once the sampler has been removed from the borehole, the sampler must be unthreaded from the drive head, the cutting shoe unthreaded from the sampler, and the liner/shoe assembly removed from the sample tube.
- Disconnect the cutting shoe from the liner which contains the soil sample. The recovered soil sample may now be viewed, logged, and extracted from the liner for analysis (refer to Section 4.5 for sample containment procedures).

4.5 Sampling Procedures - Large Bore Sampler

These procedures are excerpted from Geoprobe™ Systems literature. This SOP assumes that the subcontractor will perform sampling; therefore, detailed procedures regarding sample acquisition are not provided. Additional detailed sampling procedures for this specific item of equipment is presented in Geoprobe™ Technical Bulletin No.93-660, appended to this SOP.

4.5.1 Sampler Preparation

- Decontaminate the sampler parts (cutting shoe, piston rod/tip, sample tube, liners) before assembly.
- Assemble the sampler by first placing the liner on the cutting shoe, then threading the liner/shoe assembly into the sample tube, then connecting the piston tip to the piston rod, and then finally inserting the piston tip/rod assembly into the sample tube. Tighten the cutting shoe with the shoe wrench.
- Thread the sampler onto the drive head. Thread the stop-pin onto the drive head (stop-pin holds the piston tip/rod in place while driving the sampler to the desired sample interval).

4.5.2 Sampling

- Using the percussion/probing machine, drive the sampler into the ground until the upper portion of the targeted sampling interval is achieved.

- Unthread and remove the stop-pin from the drive head using extension rods. This will activate the piston tip/rod.
- Drive the sampler through the targeted sampling interval to collect the sample. The piston tip/rod will retract as the sample enters the sample tube.
- Use the machine hydraulics to pull the sampler from the ground.

4.5.3 Sample Recovery

- Once the sampler has been removed from the ground, the sampler must be unthreaded from the drive head, then the cutting shoe unthreaded from the sample tube, and the liner/shoe assembly removed from the sample tube.
- Disconnect the cutting shoe from the liner which contains the soil sample. The recovered soil sample may now be viewed, logged, and extracted from the liner for analysis (below).

4.6 Sampling Procedures – Split Spoon Sampler

- Decontaminate the sampler parts (cutting shoe, piston rod/tip, sample tube, baskets) before assembly.
- Assemble the sampler by placing the 2 split halves together, thread the cutting shoe (with the basket inserted, if used) and then place the top ball check valve. Tighten the cutting shoe with the shoe wrench.
- Thread the sampling device to the drilling auger.

4.6.1 Sampling

- The driller will lower the split spoon into the borehole. The sampler will be driven, using Standard Penetration Test in ASTM Standards (ASTM D 1586-84) with a 140-pound hammer with a vertical free drop of 30 inches using two turns of rope on the cathead. The number of hammer blows required for every 6 inches of penetration will be recorded on the boring log.
- Once the split spoon is driven to depth, or to refusal, it will be removed, buy the driller, from the borehole.

4.6.2 Sample Recovery

- Once the sampler has been removed from the ground, the sampler must be unthreaded from the drive head, then the cutting shoe unthreaded from the sample tube, and the liner/shoe assembly removed from the sample tube.
- Disconnect the cutting shoe from the liner which contains the soil sample. The recovered soil sample may now be viewed, logged, and extracted for analysis (below).

4.7 Sample Containment

4.7.1 General

- The soil sample can be removed from the liner/split spoon device following viewing and/or logging. Non-segmented plastic or Teflon® liners should be cut with a utility knife into approximate 6-inch lengths to facilitate sample extraction or to isolate specific sample zones targeted for analysis. Segmented metal liners can be manually separated.
- Once the liner has been separated, the soil sample may be extracted from the individual liner segments with a spoon or spatula. Except for volatile organic samples (see below), the soil sample should be placed into a sample collection pan and homogenized. Place the sample directly into the required sample container.
- Once filled, the sample container should be properly capped, cleaned and labeled. Sample chain-of-custody and preservation procedures should then be initiated.
- Perform equipment decontamination following containment of the sample.

4.7.2 Volatile Organic Samples

- Using Geoprobe methods, the use of Teflon® liners is preferred when sampling for analysis of volatile organic compounds (VOC) because these liners are more inert. In order to limit the potential for loss of volatiles, the soil sample should be removed from the liner as soon as possible after sample recovery. VOC soil samples should be selected from a central point within the liner unless another specific sample zone has been targeted. The liner should be cut with a knife and the sample immediately extracted and containerized. Clean and label the container and place it into a cooler immediately. Residual sample may then be used to fill other sample or logging requirements.
- Using a split spoon sampling methods, to limit the potential loss of volatiles during sample collection, the soil sample needs to be obtained as quickly and as directly (from the sampler) as possible. This generally means the VOC sample is collected and placed in the sample container as soon as the split spoon is opened, prior to inspection of the soil or the collection of other samples. The VOC sample should be collected from a discrete portion of the entire sample interval and not composited or homogenized in the field, as this can cause VOC to volatize with the air.

5 QUALITY CONTROL

Quality control requirements are dependent on project-specific sampling objectives. The QAPP will provide requirements for equipment decontamination (frequency and materials), sample preservation and holding times, sample container types, sample packaging and shipment, as well as requirements for the collection of various quality assurance samples such as trip blanks, field blanks, equipment blanks, and field duplicate samples.

6 DOCUMENTATION

Various forms are required to ensure that adequate documentation is made of sample collection activities. These forms include:

- Boring logs
- Field log books
- Sample collection records
- Chain-of-custody records
- Shipping labels

Boring logs will provide visual and descriptive information for each sample collected and are often the most critical form of documentation generated during a soil sampling program. The field log book is kept as a general log of activities and should not be used in place of the boring log. Occasionally, sample collection records are used to supplement boring logs, especially for environmental samples which have been collected for laboratory analysis. Chain-of-custody forms are transmitted with the samples to the laboratory for sample tracking purposes. Shipping labels are required if sample coolers are to be transported to the laboratory by a third party (courier service). Original copies of these records should be maintained in the appropriate project files.

7 REFERENCES

ASTM D1586 / D1586M-18, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils, ASTM International, West Conshohocken, PA, 2018, www.astm.org

ASTM D6282 / D6282M-14, Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations, ASTM International, West Conshohocken, PA, 2014, www.astm.org

Geoprobe™ Systems, August 1993, "1993-94 Equipment and Tools Catalog".

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FIELD ACTIVITY LOG

PROJECT__________________

JOB NO.______________________________

DAY & DATE__________________________

COMPLETED BY_______________________

APPROVED BY________________________

SHEET OF

FIELD ACTIVITY SUBJECT:
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:

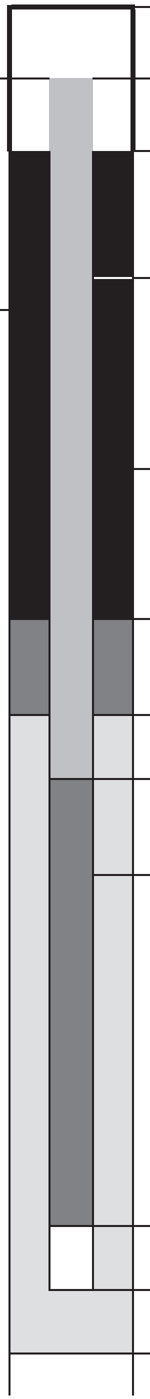
TIME	

VISITORS ON SITE:	CHANGES FROM PLANS OR IMPORTANT DECISIONS
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
PERSONNEL ON SITE:	

Monitoring Well Construction Detail

CRETE CONSULTING, INC.	*Client:*	WELL ID:
	Project Number:	
	Site Location:	*Date installed:*
	Well Location:	*Inspector:*
	Method:	*Contractor:*

MONITORING WELL CONSTRUCTION DETAIL



Measuring Point for Surveying & Water Levels

Cement, Bentonite, Bentonite Slurry Grout, or Native Materials

% Cement

% Bentonite

% Native Materials

	Depth from G.S. (feet)	Elevation(feet) Datum
Top of Steel Guard Pipe		
Top of Riser Pipe		
Ground Surface (G.S.)		

Riser Pipe:
Length
Inside Diameter (ID)
Type of Material

Bottom of Steel Guard Pipe

	Depth from G.S. (feet)	Elevation(feet)
Top of Bentonite		

Bentonite Seal Thickness

	Depth from G.S. (feet)	Elevation(feet)
Top of Sand		
Top of Screen		
▼ Stabilized Water Level		

Screen:
Length
Inside Diameter (ID)
Slot Size
Type of Material

Type/Size of sand
Sand Pack Thickness

	Depth from G.S. (feet)	Elevation(feet)
Bottom of Screen		
Bottom of Tail Pipe:		
Bottom of Borehole		

Length

Borehole Diameter

Describe Measuring Point:

Signature

Date

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Low Flow Groundwater Sample Collection Record

Date:	**Well ID:**
Project Name:	**Location:**
Project Number:	**Collector(s):**
Start Time:	**End Time:**

Water Level Data

Total Well Depth:		Water Table Depth:	
Screen Interval:		Tubing Placement Depth:	
Well Volume		**Well Volume (gallons) = 0.041xH(D^2)** D= is in the inside diameter of the well casing, in inches H = Height of the water column (in feet)	
Purge Method:		Purge Rate:	

Water Quality Parameters

Time (24 hr)	Vol. Purged (L)	Temp (C)	pH	Spec. Cond (uS/cm)	DO (mg/L)	ORP (mv)	Turbidity (NTU)	Flow Rate (ml/min)	DTW	Color/ Odor

Acceptance Criteria defined:

Temp	3%	pH	+/- 1.0 unit	Spec. Cond	3%	DO	10%		
Turbidity	<5 NTU*	ORP	+/- 10 MV	Drawdown	<0.3'*				

Sample Collection:		Duplicate Details:	

*Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. If after 2 hours of purging indicator field parameters have not stabilized, discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization.

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Indoor Air/Ambient Air Sampling - Field Form

Project	
Sampler	
Date and Start Time	
Date and End Time	
Weather (attach copies of detailed weather reports)	
Sample Port Type	
Indoor or Ambient Location	

Location ID							
Location Details							
Sample Canister LAB ID			Flow Controller LAB ID			Sample Canister Size	
Start Sample Time		Start Pressure (“ Hg)		End Sample Time		End Pressure (“ Hg)	
Analysis							

Sample Collection Notes/General Observations

Date	Time	Canister Vacuum (in Hg)	Weather Conditions/Barometric Pressure (in Hg)

Observations/VOC product inventory around sample location

List any potential VOC containing products observed around sample location:	

Was HVAC Fan On?	
Was Heat on?	